BIDDING REQUIREMENTS, CONTRACT FORMS
CONDITIONS, SPECIFICATIONS AND RELATED DOCUMENTS FOR

JACKSON OWRE MILLARD LYON COMPLEX REMODELING
CONTRACT B (JOML-B)
MINNEAPOLIS CAMPUS
UNIVERSITY OF MINNESOTA
COMMISSION NUMBER 280.02
PROJECT NUMBER MINN. BHRD-HP-5C-070

Donald P. Brown — University of Minnesota
Acting Vice President for Finance and Development

Clinton N. Hewitt — University of Minnesota
Assistant Vice President for Physical Planning

THE ARCHITECTS COLLABORATIVE, INC. — Cambridge, Massachusetts

HEALTH SCIENCES ARCHITECTS & ENGINEERS, INC.
University Park Plaza - Suite 704
2829 University Avenue South East — Minneapolis, Minnesota
(612) 378-3833 — 55414

The Cerny Associates, Inc. — Minneapolis, Minnesota
Hammel Green and Abrahamson, Inc. — Saint Paul, Minnesota
Setter, Leach and Lindstrom, Inc. — Minneapolis, Minnesota

I hereby certify that these plans, specifications or reports were prepared by me or under my direct supervision, and that I am a duly Registered Architect under the laws of the State of Minnesota.

Duane E. Blanch

Date: May 2, 1977 — Reg. No. 8397

	Pages
PROJECT IDENTIFICATION	
Title Page	1 Page
Table of Contents	3 Pages
DIVISION A - BIDDING REQUIREMENTS	
A1 Advertisement for Bids	A1-1 thru A1-2
A2 Instructions to Bidders	A2-1 thru A2-13
A3 Bid Form	A3-1 thru A3-4
A4 Bid Bond	A4-1
DIVISION B - CONTRACT FORMS	
B1 Agreement	4 Pages
B2 Contractor's Bond	2 Pages
DIVISION C - CONDITIONS OF THE CONTRACT	
C1 General Conditions	C1-1 thru C1-54
C2 Wage Rate Determination	C2-1 thru C2-11
DIVISION 1 - GENERAL REQUIREMENTS	
01010 Summary of Work and Special Requirements	01010-1 thru 01010-8
01100 Description of Alternates	01100-1 thru 01100-3
01150 Payment	01150-1 thru 01150-2
01200 Contract Time and Construction Schedule	01200-1 thru 01200-4
01300 Submittals	01300-1 thru 01300-4
01400 Testing and Inspection	01400-1 thru 01400-2
01500 Temporary Facilities	01500-1 thru 01500-9
01600 Materials and Equipment	01600-1 thru 01600-5
01700 Project Close Out	01700-1 thru 01700-4
01910 Cutting, Removal and Patching	01910-1 thru 01910-4
DIVISION 2 - SITEWORK	
02200 Earthwork	02200-1 thru 02200-7
DIVISION 3 - CONCRETE	
03100 Concrete Formwork	03100-1 thru 03100-6
03200 Concrete Reinforcement	03200-1 thru 03200-3
03300 Cast-in-Place Concrete	03300-1 thru 03300-16
DIVISION 4 - MASONRY	
04100 Mortar	04100-1 thru 04100-3
04200 Unit Masonry	04200-1 thru 04200-9
04400 Cut Stone	04400-1 thru 04400-3
DIVISION 5 - METALS	
05300 Metal Decking	05300-1 thru 05300-3
05500 Metal Fabrications and Structural Steel	05500-1 thru 05500-10
05750 Special Formed Metal	05750-1 thru 05750-3
DIVISION 6 - CARPENTRY	
06100 Carpentry	06100-1 thru 06100-6
06400 Architectural Woodwork	06400-1 thru 06400-6

	Pages
DIVISION 7 - THERMAL AND MOISTURE PROTECTION	
07111 Elastomeric Membrane Water Proofing	07111-1 thru 07111-6
07150 Dampproofing	07150-1 thru 07150-2
07510 Built-up Bituminous Roofing	07510-1 thru 07510-5
07600 Sheet Metal Work	07600-1 thru 07600-4
07900 Caulking and Sealants	07900-1 thru 07900-5
DIVISION 8 - DOORS AND WINDOWS	
08110 Hollow Metal	08110-1 thru 08110-3
08113 Acoustical Hollow Metal	08113-1 thru 08113-3
08200 Wood Doors	08200-1 thru 08200-3
08700 Finish Hardware	08700-1 thru 08700-11
08800 Glass and Glazing	08800-1 thru 08800-3
DIVISION 9 - FINISHES	
09100 Lath, Plaster and Gypsum Drywall	09100-1 thru 09100-16
09300 Tile Work	09300-1 thru 09300-6
09400 Terrazzo	09400-1 thru 09400-2
09500 Acoustical Treatment	09500-1 thru 09500-4
09541 Preformed Metal Soffits and Ceilings	09541-1 thru 09541-3
09650 Resilient Flooring	09650-1 thru 09650-3
09750 Composition Seamless Flooring	09750-1 thru 09750-3
09820 Epoxy-Polyester Coatings (S.G.-1)	09820-1 thru 09820-4
09830 Glazed Wall Coatings (S.G. -2)	09830-1 thru 09830-4
09840 Elastomeric Coatings (S.G. -3)	09840-1 thru 09840-3
09900 Painting	09900-1 thru 09900-9
DIVISION 10 - SPECIALTIES	
10180 Toilet Compartments	10180-1 thru 10180-3
10200 Louvers and Vents	10200-1 thru 10200-2
10250 Firefighting Devices	10250-1
10260 Wall & Corner Guards	10260-1
10640 Operable Walls, Panel Type	10640-1 thru 10640-3
10800 Toilet and Bath Accessories	10800-1 thru 10800-2
DIVISION 11 - EQUIPMENT	
11180 Darkroom Equipment	11180-1
11600 Laboratory Equipment	11600-1 thru 11600-3
11611 Metal Laboratory Casework	11611-1 thru 11611-28
11613 Reconditioning Existing Metal Casework	11613-1 thru 11613-2
11614 Reconditioning Stone Countertops	11614-1
DIVISION 12 - FURNISHINGS	
NONE	
DIVISION 13 - SPECIAL CONSTRUCTION	
13451 Insulated Doors	13451-1 thru 13451-3
DIVISION 14 - CONVEYING SYSTEMS	
NONE	
DIVISION 15 - MECHANICAL	
15010 General Provisions	15010-1 thru 15010-12
15100 Basic Materials and Methods	15100-1 thru 15100-6

	Pages
DIVISION 15 - MECHANICAL (continued)	
15110 Pipe and Pipe Fittings	15110-1 thru 15110-6
15120 Valves	15120-1 thru 15120-5
15130 Piping Specialties	15130-1 thru 15130-7
15140 Mechanical Supporting Devices	15140-1 thru 15140-4
15150 Vibration Isolation	15150-1 thru 15150-4
15160 Mechanical Systems Insulation	15160-1 thru 15160-5
15200 Water Service	15200-1
15260 Soil and Waste System	15260-1 thru 15260-4
15300 Plumbing Fixtures and Trim	15300-1 thru 15300-7
15310 Laboratory Fixtures and Trim	15310-1 thru 15310-12
15350 Gas Piping System	15350-1
15410 Compressed Air System	15410-1
15420 Laboratory Vacuum Systems	15420-1 thru 15420-2
15430 Special Gases	15430-1
15460 Deionized Water System	15460-1
15500 Fire Protection System	15500-1 thru 15500-2
15600 Steam Heating System	15600-1 thru 15600-5
15650 Hot Water Heating System	15650-1 thru 15650-4
15800 Ventilation and Air Conditioning	15800-1 thru 15800-13
15830 Air Filtration Equipment	15830-1 thru 15830-3
15900 Chilled Water System	15900-1 thru 15900-3
15950 Automatic Temperature Controls and Instruments	15950-1 thru 15950-14
DIVISION 16 - ELECTRICAL	
16010 General Provisions - Electrical	16010-1 thru 16010-10
16100 Electrical Basic Systems	16100-1 thru 16100-6
16110 Basic Systems and Methods	16110-1 thru 16110-4
16200 Electric Service System	16200-1 thru 16200-12
16210 Emergency Standby Systems	16210-1 thru 16210-2
16220 Service Grounding System	16220-1
16300 Electrical Distribution System	16300-1 thru 16300-8
16310 Electrical Secondary Devices	16310-1 thru 16310-3
16400 Lighting Fixtures	16400-1 thru 16400-8
16500 Communications and Signal Systems	16500-1 thru 16500-11
16700 Electrical Power Equipment	16700-1 thru 16700-6

ADVERTISEMENT FOR BIDS

JACKSON OWRE MILLARD LYON COMPLEX REMODELING

CONTRACT B (JOML-B)

UNIVERSITY OF MINNESOTA - MINNEAPOLIS CAMPUS

BIDS CLOSE: 2:00 P.M. CDT, June 16, 1977
BIDS RECEIVED AT: ST. PAUL, MINNESOTA

CONTRACT B (JOML-B)
COMMISSION NUMBER 280.02
DOCUMENTS DATED: May 2, 1977

THE ARCHITECTS COLLABORATIVE, INC., AND
HEALTH SCIENCES ARCHITECTS AND ENGINEERS, INC
UNIVERSITY PARK PLAZA - SUITE 704
2829 UNIVERSITY AVENUE S.E.
MINNEAPOLIS, MINNESOTA 55414

Sealed lump sum Bids will be received on behalf of the University of Minnesota Board of Regents, at the office of Robert James, Director of Purchasing and Stores, in the Administrative Services Building, 2610 University Avenue, St. Paul, Minnesota 55114 until the time and date bids close, specified above. Bids received after this time will not be accepted nor opened. Immediately after closing time, Bids will be opened publicly and read aloud.

The Project consists of furnishing all labor, material, equipment and incidentals for construction of building alterations at Jackson-Owre Hall, Millard Hall and Lyon Laboratory on the Minneapolis Campus of the University of Minnesota. This project is a part of the Jackson Owre Millard Lyon Complex Remodeling.

Bids will be received for a single lump sum contract for all work required by Contract Documents.

No bidder may withdraw his bid until 45 days after the date of opening of Bids.

Bidding requirements, bid and contract forms, drawings and specifications may be examined at:

Office of the Architect/Engineer, listed above.

Office of the Engineering and Construction Division, Folwell Hall, University of Minnesota, Minneapolis, Minnesota.

The Builders Exchanges of Minneapolis and Saint Paul, Minnesota

F. W. Dodge Corporation Plan Room, Minneapolis, Minnesota.

One complete set of the documents for this Work may be obtained from the office of Health Sciences Architects and Engineers, Suite 704 University Park Plaza, 2829 University Avenue S. E., Minneapolis, Minnesota, 55414, in accordance with the Instructions to Bidders, upon making a deposit in the form of a check in the amount of $225.00 payable to Health Sciences Architects and Engineers, Inc. Sets requested to be mailed will be forwarded C.O.D.

The full deposit will be returned to bidders who submit a bona fide prime contract bid to the University, upon the return of the complete set of documents in good condition to the Health Sciences Architects and Engineers, Suite 704 University Park Plaza, 2829 University Avenue S.E., Minneapolis, Minnesota 55414, within 10 days after bid date. Deposits will be returned to others in accordance with the Instructions to Bidders, upon return of the complete set of documents under the same time and conditions.

A bid security in the amount of five percent (5%) of the maximum amount of the Bid, shall be submitted with each Bid in such form and subject to the conditions stated in the Instructions to Bidders.

The attention of all bidders is called to the Equal Employment Opportunity requirements for contractors, subcontractors and suppliers, as stated in the Contract Documents.

The University reserves the right to reject any and all bids, accept any bid it deems to be in its best interest, to waive any informalities in bids submitted and waive minor discrepancies in bidding procedures.

REGENTS OF THE UNIVERSITY OF MINNESOTA
By: Robert James
Director of Purchasing and Stores for the
Regents of the University of Minnesota

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - INVITATION FOR BIDS

1.1 Invitation

1.1.1 The Regents of the University of Minnesota, referred to as the University, invite qualified bidders to submit lump sum bids for the Project identified as:

JACKSON OWRE MILLARD LYON COMPLEX REMODELING
CONTRACT B (JOML-B)
MINNEAPOLIS CAMPUS
UNIVERSITY OF MINNESOTA

as prepared by:

THE ARCHITECTS COLLABORATIVE, INC., CAMBRIDGE, MASS.
and
HEALTH SCIENCES ARCHITECTS & ENGINEERS, INC.
University Park Plaza - Suite 704
2829 University Avenue S.E.
Minneapolis, Minnesota 55414

1.2 Types of Bids

1.2.1 Bids will be received for a single lump sum Contract for the entire construction described in the Contract Documents for this Contract B.

ARTICLE 2 - BIDDING PROCEDURES

2.1 Bid Time and Place

2.1.1 Bids shall be submitted to the designated location indicated in the Advertisement for Bids, by the designated time or any extension thereof made by Addendum. Bids received after the time and date for receipt of bids will not be opened.

2.1.2 Bidder shall assume full responsibility for timely delivery at location designated for receipt of bids.

2.2 Preparation of Bid

2.2.1 One copy of the bid shall be submitted in the form included in the specification. Forms are available from the Architect/Engineer.

2.2.2 All blank spaces on the Bid Form shall be filled in by typewriter or manually in ink, expressing the sums both in words and figures. In all cases the written and numerical figures must agree, otherwise it may be cause for rejection of the Bid.

2.2.3 Any interlineation, alteration or erasure must be initialed by the signer of the Bid.

2.2.5 In the event unit prices are called for, a Bid for each unit price shall be submitted.

2.2.6 The Bidder shall not make any additional stipulations or alternates, nor qualify his Bid in any other manner.

2.2.7 Bidder shall state all addenda received or considered in preparing his Bid.

2.2.8 Each copy of the Bid shall include the legal name of Bidder and a statement whether Bidder is a sole proprietor, a partnership, a corporation, or any other legal entity, and each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. If the Bidder is a partnership, the names of all partners shall be stated. A Bid by a corporation shall further give the State of incorporation and have the corporate seal affixed.

2.2.9 The signature on the Bid shall be in longhand, in ink.

2.3 Submission of Bids

2.3.1 The Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope.

2.3.2 The envelope shall be addressed to the party receiving the bids and shall be identified with the Project name, the Bidder's name and address, and the portion of the project or category of work for which the Bid is submitted. If the Bid is sent by mail the sealed envelope shall be enclosed in a separate mailing envelope with the notation "BID ENCLOSED" on the face thereof.

2.4 Modification or Withdrawal of Bid

2.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of bids, and Bidder so agrees in submitting his Bid.

2.4.2 Prior to the time and date designated for receipt of bids, bids submitted early may be modified only by notice to the party receiving bids at the place and prior to the time designated for receipt of bids.

.1 Such notice shall be in writing over the signature of the Bidder or be by telegram; if by telegram, written confirmation over the signature of the Bidder must have been mailed and postmarked on or before the date and time set for receipt of Bids; it shall be so worded as not to reveal the amount of the original Bid. If the written confirmation is not received by the party receiving bids within 24 hours after bid closing time, no consideration will be given the telegraphic modification.

2.4.3 Withdrawn bids may be resubmitted up to the time designated for the receipt of bids provided that they are then fully in conformance with these instructions to Bidders.

2.4.4 Bid security, shall be in an amount sufficient for the bid as modified or resubmitted.

ARTICLE 3 - BID SECURITY

3.1 Form of Security

3.1.1 The Bid shall be accompanied by a bid security in accordance with these requirements. The bid security shall pledge that the Bidder will enter into a contract with the University on the terms stated on his Bid, in accordance with the Contract Documents, and will furnish the required Performance Bond.

3.1.2 The bid security shall be in the form of a certified or cashier's check drawn on a solvent bank, or a bid bond, drawn to the order of the "Regents of the University of Minnesota".

3.1.3 Bid bonds shall be duly executed by the bidder as principal, issued by a corporate surety company authorized to do business in the State of Minnesota, with a current copy of Power of Attorney of the Attorney-in-Fact who executes the bond on behalf of the surety attached, as well as proper acknowledgements.

3.1.4 The amount of the bid security shall be as stated in the Advertisement for Bids, but in no event less than 5% of the maximum amount of the Bid, including additive alternates, if any.

3.2 Retention of Bid Security

3.2.1 The University shall have the right to retain the bid security of all bidders until either (a) the Contract has been executed and bonds required, have been furnished or (b) the specified time has elapsed so that bids may be withdrawn, or (c) all bids have been rejected. Thereafter, bid security in the form of checks will be returned to bidders and bid bonds returned upon request of the Bidder.

3.3 Forfeiture of Bid Security

3.3.1 Should the Bidder be awarded a contract and fail or refuse to execute and deliver the Contract and performance bonds required within 10 days after he has received notice of the acceptance of his bid, he shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid. In the event the Contract has not been prepared for signature within 10 days after notice of award, the bidders shall have three days after it is prepared and offered to execute the Contract and provide the performance bond.

ARTICLE 4 - CONSIDERATION OF BIDS

4.1 Opening of Bids

4.1.1 Bids will be opened publicly and read aloud immediately after the time for receipt of bids.

4.2 Informalities

4.2.1 The University reserves the right to consider informal any Bid not prepared in strict accordance with requirements herein and to waive said informalities and to waive minor discrepancies in bidding procedures.

4.3 Rejection of Bids

4 3.1 The University shall have the right to reject any or all bids and in particular to reject a Bid not accompanied by any data required by the Bidding Documents or a Bid in any way incomplete or irregular.

4.4 Acceptance of Bid (Award Procedures)

4.4.1 In consideration of alternates, it is the intent of the University, if it accepts any alternates, to accept them in the order in which they are listed on the Bid Form. However, the University reserves the right to accept alternates in any order if such acceptance out of order does not change the low Bidder.

4.4.2 The low Bidder will be determined on the basis of the sum of the Base Bid and any alternates accepted.

4.4.3 In evaluating alternates which affect more than one contract, the University reserves the right to consider the total value of the alternate under all contracts and accept such alternates of the Bidders the University may deem in its best interest. In some instances it may result in additive amounts to some contracts and deductive amounts to others.

4.4.4 The University reserves the right to reject unit prices of a low Bidder if the unit prices are significantly out of balance with other bids, indicating a hardship may be imposed on the University. In such instances, the University may negotiate reasonable unit prices prior to award of the Contract.

4.4.5 The University reserves the right to award a contract it deems in its best interest and consider all factors. Serviceability, maintenance costs, life cycle costs, energy conservation, interchangeability with other facilities, flexibility, uniformity of appearance and similar factors may be considered.

4.4.6 It is the intent of the University to award a contract to the lowest responsible Bidder, all factors considered, provided the Bid has been submitted in accordance with the requirements of the bidding requirements and Contract Documents, is judged to be reasonable, and does not exceed the funds available. However, the University shall not be obligated to award a contract in any event.

4.4.7 The University reserves the right to disqualify bids, before or after opening, upon evidence of collusion, intent to defraud or other illegal practices on the part of the Bidder.

4.5 Execution of Contract

4.5.1 Upon award of a Contract, the successful Bidder shall execute the Agreement within 10 days after it is offered to him, and provide the required performance bond. In the event the Agreement is not prepared, ready for execution, within 10 days after award, the Contractor shall execute the Agreement within 3 days after its preparation.

ARTICLE 5 - DOCUMENTS FOR BIDDING

5.1 Documents for Bidders for a Contract with the University

5.1.1 Prospective bidders may obtain one complete set of drawings, specifications and other Contract Documents from the Architect/Engineer by making a deposit in the form of a check in favor of the Architect/Engineer in the amount specified in the Advertisement for Bids.

5.1.2 Should Bidders wish to obtain additional sets of Contract Documents for their convenience in preparing their Bid, additional sets may be obtained from the Architect/Engineer in the same manner and amount as specified in Advertisement for Bids.

5.1.3 The full deposit for the first set of Contract Documents will be refunded to bidders who submit a bona fide bid to the University, upon the return of the complete set of documents in good condition to the Architect/Engineer, within 10 days after bid date. In the event of damaged or missing documents, the cost of replacement will be deducted from the deposit.

5.1.4 One half (1/2) the deposit for the second (and additional) sets issued to the Bidders will be returned to the Bidder, upon return of the documents as noted in 5.1.3.

5.1.5 In the event multiple sets are requested and issued to various firms for joint venture bids, the deposit on the second and additional sets will be returned in accordance with 5.1.4 above.

5.1.6 Any sets issued and subsequently returned prior to bid date shall have the deposit returned in the amount noted under 5.1.4 above.

5.1.7 Sets requested to be mailed to Bidders will be forwarded C.O.D.

5.2 Documents for Subcontract Bidders, Suppliers, Manufacturers and Quantity Surveyors

5.2.1 One set of drawings, specifications and other Contract Documents may be obtained from the Architect/Engineer for the amount noted in Advertisement for Bids.

5.2.2 One half (1/2) the deposit for the set will be returned upon return of the documents in good condition within 10 days after bid date.

5.3 Return of Documents

5.3.1 All documents remain the property of the Architect/Engineer and shall be returned to him promptly after bid date, except a Bidder receiving a

Contract with the University may retain his sets and his full deposit will be returned for the first full set and 1/2 deposit for the remaining sets.

5.4 Complete Sets Used in Preparing Bids

5.4.1 Complete sets of drawings, specifictions and other Contract Documents, shall be used in preparing bids. Neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents.

5.5 Partial Sets

5.5.1 Copies of individual drawings and pages of specifications may be purchased from the Architect/Engineer at the cost of $1.50 per drawing and $0.25 per page. The cost of these sheets will not be refunded.

5.5.2 Individual sheets or pages issued shall be used at the risk of the Bidder or subcontract bidders and shall not relieve the user from examining the complete set of drawings, specifications or other Contract Documents.

5.5.3 Partial sets, as grouped sets, may be obtained from the Architect/Engineer by Bidders for a contract with the University for use as second or additional sets, and by subcontract bidders, for the deposit amount scheduled below. Refunds for these partial sets will be made as scheduled, provided the full partial set is returned to the Architect/Engineer in good condition within 10 days after bid date. Any partial sets issued will be used at the Bidder's risk and shall not relieve the Bidder from thoroughly examining the complete set of drawings and specifications and all other Contract Documents.

	Deposit	Refund
Architectural and Structural drawings (set A)	90.00	45.00
Mechanical/Electrical drawings (set M/E)	120.00	60.00
Bidding Requirements, Contract Forms, Conditions, Specifications and Related Documents	30.00	15.00

5.6 Use of Documents for Bidding

5.6.1 The University and Architect/Engineer, in making copies of the drawings, specifications or other Contract Documents available on the above terms, do so only for the purpose of obtaining bids on the Project and do not confer a license or grant for any other purpose.

ARTICLE 6 - INTERPRETATION OR CORRECTION OF DOCUMENTS

6.1 Notice and Request for Interpretations and Clarifications

6.1.1 **Bidder** shall promptly notify the Architect/Engineer of any alleged ambiguity, inconsistency or error they may discover upon examination of the Contract Documents, Bidding Requirements, the site or local conditions.

6.1.2 Bidder requiring clarification or interpretation of the Documents shall make his request to the Architect/Engineer.

6.1.3 All notices of alleged ambiguities, inconsistencies or errors and requests for clarification or interpretation shall be made in writing and forwarded so it is received by the Architect/Engineer at least seven (7) days prior to bid date, unless longer periods are specified elsewhere for certain conditions.

6.2 Response to Notices and Requests

6.2.1 Corrections, interpretations and clarifications involving or providing information which is not already a part of the Bidding Requirements or Contract Documents will be made only by written addenda and supplemental or revised drawings, if required.

6.2.2 Corrections, interpretations and clarifications will not be made in any other manner than by addenda and unless they are included in addenda, bidders shall not rely on information provided or received in any other manner. Neither the Architect/Engineer nor the University will be responsible for, nor honor any claims resulting from, or alleged to be the result of, misunderstanding by the Bidder (and subsequently the Contractor) of any discussion of the Project conditions prior to receiving bids. Any verbal communications during the bidding period are subject to inclusion in addenda; otherwise, they shall not be binding on the University nor the Architect. Any item not clarified by addenda shall be subject to interpretation by the Architect or University in accordance with the provisions of the General Conditions of the Contract or other Contract Documents.

ARTICLE 7 - ADDENDA

7.1 Issuing Addenda

7.1.1 The Architect/Engineer will issue all required addenda, in writing, which may include supplemental or revised drawings.

7.1.2 Addenda will be mailed or delivered to all bidders for a contract directly with the University, who have been issued a completeset of Documents are on record at the Architect/Engineer's office as a bidder. Bidders shall furnish the proper address for mailing of addenda.

7.1.3 Addenda will also be issued to the locations noted in the Advertisement for Bids where Contract Documents are on file for examination.

7.1.4 It is the intent that written addenda will not be issued less than 3 days prior to bid date.

7.2 Incorporating and Acknowledging Addenda

7.2.1 All addenda issued, and the information included therein, shall become part of the Contract Documents and shall be incorporated in all bids submitted.

7.2.2 All bidders, including those submitting subcontract or supply bids, shall be responsible to ascertain the addenda that have been issued prior to bid date, examining all of the addenda and determining the effect of addenda provisions on their bids and their work. Failure of any bidder to receive any such addendum or interpretation shall not relieve him from any obligation to complete the Work in accordance with the Contract Documents if awarded a Contract.

7.2.3 All bidders shall state on the Bid Form the number of addenda received and incorporated in their Bid.

ARTICLE 8 - CONTRACTOR'S BOND

8.1 Bond for Performance and Payment

8.1.1 A bond for faithful performance and completion of the Project and for payment for all just claims in connection with the Project is required. The cost of said bond shall be included in all bids to the University.

8.1.2 The bond shall be in the form of the University's Contractor's Bond, as bound into the Documents or available from the University, and shall meet all requirements specified in the General Conditions of the Contract, paragraph 7.5. The properly executed Contractor's Bond shall be provided to the University at the time of execution of the Agreement with the University, and shall be accompanied by a certified and effectively dated copy of the Power of Attorney for the Attorney-in-Fact.

ARTICLE 9 - QUALIFICATIONS OF BIDDERS

9.1 Qualifications

9.1.1 The University reserves the right to consider the competency and responsibility of a Bidder in making an award, which may include, but not be limited to: (1) Proof of financial responsibility, (2) quality of similar work, (3) amount of experience with similar projects, (4) facilities, personnel and equipment, (5) reputation for performance, including service after Substantial Completion, (6) capability to complete the work on time, and (7) integrity of the Bidder.

9.1.2 The University reserves the right to make any investigations necessary to satisfy itself that the Bidder is properly qualified to execute the work of the Project under the Contract. The University may make such investigations as it deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the University all such information and data for this purpose as the University may request. The University reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the University that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

ARTICLE 10 - OBLIGATIONS OF BIDDER

10.1 Examination of Documents

10.1.1 Each bidder is obligated to thoroughly examine and study all Contract

Documents, Bid and Contract Forms and Bidding Requirements, if necessary, to fully inform himself as to all conditions, requirements and other factors which will affect his Bid or execution of the work under the Contract Documents. By submitting a Bid, the Bidder represents that he has made such examinations and study, that he understands the requirements of the Contract Documents and Bidding Requirements, that he is familiar with the site, site conditions and local conditions, and that his Bid is made in conformance with all requirements.

10.1.3 In examining the drawings, specifications and other Contract Documents, the Bidder shall study and examine the entire set of Contract Documents, including those drawings and specifications primarily intended to portray the work which may be under another Contract with the University or for trades not normally in the employ of the Bidder, so as to be totally familiar with the scope of the entire Project and all factors which will affect the Bid or accomplishment of the work under the Contract Documents.

10.1.4 The Bidder is obligated to obtain clarifications and interpretations, as well as to notify the Architect/Engineer of alleged errors, ambiguities or inconsistencies in accordance with Article 6 of the Instructions to Bidders.

10.1.5 No allowance or extras will be granted the Bidder who is awarded a Contract as a result of misunderstanding of the extent or scope of the work as a result of his failure to study all documents and conditions and record his own findings, or for neglecting any specified instructions in the preparation of his Bid.

10.2 Labor

10.2.1 Each Bidder shall investigate and fully inform himself as to the availability, local labor and union conditions and cost of the employment of labor for the Project, both skilled and unskilled, and shall consider such matters in the preparation of the Bid.

10.3 Materials, Equipment and Systems

10.3.1 By submitting a Bid, the Bidder represents that his Bid is based on the materials, equipment, systems and other similar items in full compliance with requirements and descriptions in the Contract Documents, without exception.

10.4 Sales Tax

10.4.1 Bidders shall include the cost of the Minnesota Excise and Use Tax, as applicable, in their Bids.

ARTICLE 11 - SUBCONTRACTORS

11.1 Acceptance of Subcontractors

11.1.1 Bidders are advised that any person, firm or organization to whom an award of a subcontract is proposed under the Contract must be acceptable to the University and the Architect/Engineer as specified under Article 5 of the General Conditions of the Contract.

ARTICLE 12 - PROPOSED ALTERNATE MATERIALS AND EQUIPMENT

12.1 Intent

12.1.1 The intent of this Article is to encourage and permit competition on qualified products by reputable and qualified contractors, subcontractors, suppliers and manufacturers, whose products, reputations and performance warrant acceptance for the conditions, intent of design and performance considerations required for this Project. For consideration of alternate products, the procedures, time requirements and other provisions of this Article must be complied with.

12.1.2 To avoid hardships resulting from non-acceptance of a proposed product that has been bid, and to provide the equitable condition for all bidders, subcontract bidders and suppliers by their having the same knowledge of which products, in the opinion of the Architect/Engineer, will be acceptable as meeting the Project requirements, the evaluation period for proposed products shall be prior to the bid date, instead of after receipt of bids.

12.1.3 The word "product" herein means any material, equipment, system, assembly, manufacturer, brand, trade name, element, item or similar description as applicable.

12.1.4 Wherever a product is named on the drawings or in the specifications the phrase "or acceptable equal in the opinion of the Architect/Engineer" shall be implied whether specifically noted or not.

12.2 Procedure

12.2.1 All requests for consideration of proposed alternate products in lieu of those specified shall be made in writing. Requests shall clearly define and describe the product for which acceptance is requested, and shall be accompanied by manufacturer's literature, specifications, drawings, cuts, performance data, list of references, model numbers, or other information necessary to completely describe and evaluate the item.

12.2.2 All requests shall be submitted to the Architect/Engineer so it is received a minimum of 7 days prior to bid date and hour, unless a longer period of time is specified in technical sections. Requests received after this time will not be reviewed nor evaluated.

12.2.3 Products which the Architect/Engineer deem basically acceptable for bidding purposes will be included in addenda. Information on acceptance will be provided in no other manner.

12.2.4 Acceptance of a product for bidding purposes shall not relieve the Bidder from complying with all requirements of the Contract Documents, including the criteria established in the Contract Documents and these Instructions to Bidders.

12.3 Criteria

12.3.1 Any product or manufacturer used as basis of the specifications shall generally set the basic criteria. It shall be expressly understood that any

other product or manufacturer listed in the specification, or any addenda, as an acceptable alternate, will be acceptable provided they fully comply with the requirements and match the basic and essential criteria of the product used for base specification, including the level of workmanship quality, as determined by the Architect/Engineer. For final acceptance for use in the work, the Architect/Engineer shall have right to accept or reject proposed deviations. Should a proposed product be unable to meet the necessary requirements, the product shall not be used.

12.3.2 The use of references to standards, manufacturers, brands and similar designations is intended to establish the measure of quality as to minimum standards of design, function, appearance, type, strength, durability, construction, efficiency, sound level, finish, availability, service and similar characteristics, which have been determined as requisite for this Project.

12.3.3 Proposed alternate products shall also: be available in the same range of colors, textures, dimensions, gauges, types, and finishes as the material or article specified; must equal the specified item in strength, durability, efficiency, serviceability, ease and cost of maintenance; must be compatible with the building design and not necessitate design modifications, nor impose additional work or require changes in the work of any Contractor, or any other Subcontractor, vendor, or materials supplier, nor result in any additional cost to the University. The supplier or manufacturer providing any acceptable product shall bear the cost of any required modifications to spaces, services, utilities and other features as the result of the use of his product, including but not limited to larger capacity mechanical or electrical service, devices or utilities resulting from acceptance of the product for bidding purposes, as well as to pipes, conduits, ducts, and controls for conveying, distributing, and controlling those services or utilities; as well as insulation, wrappings, coatings, or other integral features of the lines or items conveying those lines.

12.3.4 For any same or like product for this Project, only one brand, manufacturer, source or type shall be used, as approved by Architect/Engineer and the University.

12.4 Use of Products

12.4.1 Where two or more products are shown or specified, the Bidder (and Vendor) has his option of which to use, provided the product proposed will meet all requirements of the specifications and the design criteria. The The right is reserved by the Architect/Engineer to accept or reject proposed deviations in design, function, construction or similar differences that will affect design intent or quality.

12.4.2 For products specified or shown by describing proprietary items, model numbers, catalog numbers, manufacturers, trade names or similar reference, the Bidder obligates himself to submit proposals and accept award of a Contract based upon the use of such products as specified or accepted in addenda.

ARTICLE 13 - COMMENCEMENT AND COMPLETION OF THE WORK

13.1 Commencement of Work

13.1.1 By submitting a bid, and execution of the Agreement, the Bidder (and Vendor) agrees to commence work in accordance with the General Conditions of the Contract, or as otherwise specified in Division 1 of the specifications.

13.2 Completion of Work

13.2.1 By submitting a bid, and execution of the Agreement, the Bidder (and Contractor) agrees to complete the Project within the time specified, including any separate phases, elements or areas of the entire Project which may be specified, and that time for completion is an essential condition of the Contract.

13.2.2 By submitting a Bid, and execution of the Agreement, the Bidder (and Contractor) expressly agrees the time (or times for various phases) for completion is reasonable, considering all factors. The Bidder (and Contractor) further represent he has: analyzed the Project, including the equipment, materials and methods; considered his own capabilities and work load; determined availability of qualified mechanics and unskilled labor; considered the time of year for commencement of work; made a reasonable allowance for weather variations and other potential delays encountered in the construction process; the condition of the site; considered the constraints specified; evaluated the effects of other contractors who may be on the site; and has taken these and other relevant factors bearing on the progress of the work into account.

ARTICLE 14 - LAWS AND REGULATIONS

14.1 Compliance with Laws and Regulations

14.1.1 Applicable laws, rules, regulations and ordinances of the Federal Government, the State of Minnesota and municipalities, or other authorities, with jurisdiction over the construction of the Project shall be complied with.

ARTICLE 15 - WAGES

15.1 Minimum Wage Rates

15.1.1 The attention of bidders is drawn to the Regents' policy on minimum wages, as specified under Article 16 of the General Conditions of the Contract.

ARTICLE 16 - EQUAL EMPLOYMENT OPPORTUNITY

16.1 University Policy on Equal Employment Opportunities and Affirmative Action

16.1.1 It is the policy of the Regents of the University of Minnesota to promote equal opportunity of employment without discrimination based on race, creed, color, sex, or national origin. Henceforth, the Regents will require

that all Contractors with the University, including suppliers supplying goods or services to it, regardless of where located or the form of the contractual relationship, be equal opportunity employers, whose business is guided by the principle that there shall be no difference in the treatment of persons because of race, creed, color, sex, or national origin. The Regents will also require that the Contractor take affirmative action to ensure implementation of this policy, such action to include but not to be limited to the following: employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training including apprenticeship.

16.1.2 The attention of bidders is drawn to the Equal Employment Opportunity Requirements under Article 15 of the General Conditions of the Contract.

16.1.3 Monthly reports will be required of the Contractor from the start of the Project until completion.

16.2 Affirmative Action Plan

16.2.1 The Affirmative Action Plan is required of successful Contractors only and shall follow the specified requirements and the guidelines required by the University's Affirmative Action Officer, the State of Minnesota's Equal Employment Opportunity Officer and interested Federal Agenices. If a bidder has a question or needs assistance they may contact the University's Office of Equal Opportunity, Room 419, Morrill Hall, on the Minneapolis Campus, 373-7969.

ARTICLE 17 - EXAMINATION OF EXISTING CONDITIONS

17.1 Arrangements for Examination

17.1.1 Bidders may examine exterior areas and public spaces (ie: corridors and lobbies) in adjacent buildings at their convenience at any time from 8:30 A.M. to 4:30 P.M.

17.1.2 For all other interior areas of adjacent spaces, the Bidders shall make arrangements to examine the areas by appointment. Arrangements may be made to examine the areas each Monday and Wednesday, starting at 9:00 A.M. Arrangements shall be made with Mr. Paul Maupin at the University Health Sciences Planning Office, telephone 373-8590.

- - -

BID FORM

TO THE: REGENTS OF THE
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA

ATTENTION: ROBERT JAMES
DIRECTOR OF PURCHASING
AND STORES
2610 UNIVERSITY AVENUE
ST. PAUL, MINNESOTA 55114

PROPOSAL FOR: Complete Construction

PROJECT: JACKSON OWRE MILLARD LYON
CONTRACT B

LOCATION: MINNEAPOLIS, MINNESOTA

DATE: _____

- -

(1) Bid of _____
(Firm name - hereinafter referred to as the "Bidder")

(2) The Bidder, in compliance with Advertisement for Bids, hereby submits the Bid for the COMPLETE CONSTRUCTION OF JACKSON OWRE MILLARD LYON COMPLEX REMODELING - CONTRACT B, MINNEAPOLIS CAMPUS, UNIVERSITY OF MINNESOTA.

(3) The Bidder agrees to accomplish the Work in strict compliance with the drawings, specifications and Contract Documents, dated May 2, 1977, prepared by The Architects Collaborative, Inc., and Health Sciences Architects and Engineers, Inc., Commission Number 280.02

(4) The Bidder, having examined the drawings, specifications and related documents, and being familiar with all of the conditions of the proposed work, including the availability of materials and labor, hereby proposes to furnish all labor, materials, services, and supplies, and to accomplish the Work for which this Bid is submitted, in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. The prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this bid is a part.

(5) Addenda: The Bidder hereby acknowledges that Addendum instructions numbered _____ have been received and/or the requirements therein have been incorporated in this Bid.

(6) Completion of Work: The Bidder hereby agrees to commence work under this Contract on or before the time stipulated in the written "Notice to Proceed" in accordance with the General Conditions, and to complete all Work under this Contract in accordance with the requirements of Specification Section 01200 and other provisions of the Contract Documents.

(7) In completing this Bid, the Bidder shall complete the Bid in both words and figures.

(8) Base Bid: Bidder agrees to provide all work required by the Contract Documents for the lump sum of _____

_____ $ _____

(9) Alternates of Scope: Bidder agrees to deduct from the Base Bid the following amounts for omission of certain work. See Section 01100.

Deductive Alternate No. 1: Omit certain work on Second Floor - Jackson-Owre Hall. Deduct the lump sum of: _____

_____ $ _____

Deductive Alternate No. 2: Omit certain work in Rooms 19 through 19.8 of Owre Hall. Deduct the lump sum of _____

_____ $ _____

Deductive Alternate No. 3: Omit Certain Work on Second Floor of Millard Hall relating to Rooms 206, 206.1, 207, 2-13, 2-12, 218 and 221 through 221.4. Deduct the lump sum of _____

_____ $ _____

Deductive Alternate No. 4: Omit certain work in Millard Hall relating to Room 218, and 221 through 221.4. Deduct the lump sum of _____

_____ $ _____

Deductive Alternate No. 5: Omit certain work on Fourth Floor of Owre Hall relating to Rooms 436, 437, 438, 439 and 442. Deduct the lump sum of _____

_____ $ _____

Deductive Alernate No. 6: Omit certain work on Fourth Floor of Owre Hall relating to Rooms 401 through 401.1 and 403 and on First Floor of Owre Hall relating to Rooms 117 and 117.1. Deduct the lump sum of:

_____

_____ $ _____

(10) Materials Alternates: Bidder agrees to add to or deduct from the Base Bid as appropriate, the following amounts if the Owner elects to substitute products as described. See Section 01100.

Substitution Alternate A: Refer to Sections 11611 and 11613. Provide new epoxy resin countertops and cup sinks in lieu of existing troughs on all existing casework in Lyon Lab Rooms 464, 466, 467 and 468. (ADD) (DEDUCT) the lump sum of: _____

_____ $ _____

Substitution Alternate B: Refer to Section 15310. Provide Water Saver Faucet Co. equipment in lieu of the specified Chicago Faucet. (ADD) (DEDUCT) the lump sum of: _____

_____ $ _____

Substitution Alternate C: Refer to Section 15800. Provide centrifugal supply air fans in lieu of vane-axial fans specified for Supply Air Units #S-100, 101, 102, 104, 106 and 107.: (ADD) (DEDUCT) the lump sum of:

_____

_____ $ _____

Substitution Alternate D: Refer to Section 15600. Provide air operated steam pressure reducing valves in lieu of steam operated valves by Spence as specified. (ADD) (DEDUCT) the lump sum of: _____

_____ $ _____

(11) Bid Security: The Bidder submits the attached Bid Secuity in the form of a Certified Check, Cashier's Check or Bid Bond, in accordance with the Instructions to Bidders, drawn to the order of the Regents of the University of Minnesota. The Bidder acknowledges the Bid Security may be retained by the University as specified in the Instructions to Bidders and agrees if the Bidder defaults in executing the Contract within the time set forth, or in furnishing the Performance Bond as specified, the check will become the property of the University (or the Surety will pay the University in the amount of the bond) as liquidated damages for the delay and additional expense to the Owner caused thereby.

(12) Holding of Bids: The Bidder agrees this Bid shall be good and may not be withdrawn for forty-five (45) days after the scheduled time and date for receiving bids.

(13) Acceptance of Bids: The Bidder understands the University reserves the right to accept any Bid it determines in its best interest and to reject any and all Bids. Upon receipt of notice of award of a Contract (acceptance of this Bid) the Bidder will execute the Agreement, in the specified form, within 10 days thereafter and to deliver a Contractor's Performance Bond, in the stipulated form, in accordance with Article 8 of the Instructions to Bidders and Paragraph 7.5 of the General Conditions.

(14) Informalities: It is understood by the Bidder the University reserves the right to waive informalities in bids received and minor discrepancies in bidding procedure.

(15)

Certification for Equal Opportunity
and Affirmative Action:

(Must be Signed by Bidder)

The bidder hereby certifies that all of the specified requirements for Equal Opportunity and Affirmative Action, General Conditions Article 15, will be fully complied with, as stated, for this project.

_____

(Signed) Title

(16) Information about Bidder:

If a Corporation, Incorporated in the State of _____

Qualified to conduct business in the State of Minnesota? _____

If a Partnership, full names of all Partners are _____

_____

_____

(17) Respectfully submitted:

Correct and full name of bidder

Name _____

Address _____

By _____ Title _____

By _____ Title _____

(Affix Corporate Seal if bid is by a corporation)

Date _____

THE AMERICAN INSTITUTE OF ARCHITECTS

AIA Document A310

Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we

as Principal, hereinafter called the Principal, and

a corporation duly organized under the laws of the State of
as Surety, hereinafter called the Surety, are held and firmly bound unto

as Obligee, hereinafter called the Obligee, in the sum of

Dollars ($),
for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this day of 19

(Witness)	(Principal) (Seal) (Title)
(Witness)	(Surety) (Seal) (Title)

UNIVERSITY OF MINNESOTA
BUSINESS ADM. FORM 203
7-73 — 500

This Agreement, made this day of 19

by and between

(hereinafter designated the Contractor), and the Regents of the University of Minnesota (hereinafter designated the Owner),

Witnesseth, that the Contractor in consideration of the agreements herein made by the Owner, agrees with the said Owner as follows:

ARTICLE I. The Contractor shall and will provide all the materials and perform all the work for the

as shown on the drawings and described in the specifications prepared by the Architect, which drawings and specifications are a part of this contract.

ARTICLE II. It is understood and agreed by and between the parties hereto that the work included in this contract is to be done under the direction of the Owner's authorized representatives.

It is further understood and agreed by the parties hereto that any and all drawings and specifications prepared for the purposes of this contract by the said Architect, are and remain the property of the Owner, and that all charges for the same and for the services of said Architect are to be paid by the said Owner.

ARTICLE III. No changes shall be made in the work except upon written order of the Owner through its authorized representatives; the amount to be paid by the Owner or allowed by the Contractor by virtue of such changes to be stated in said order.

ARTICLE IV. The Contractor shall provide sufficient, safe and proper facilities at all times for the inspection of the work by the authorized representatives of the Owner and shall, after receiving written notice to that effect, proceed to remove from the grounds or buildings all materials condemned by them, whether worked or unworked, and to take down all portions of the work which, by like written notice, condemn as unsound or improper, or as in any way failing to conform to the drawings and specifications, and shall make good all work damaged or destroyed thereby.

Refer to the General Conditions of the Contract, Paragraphs 3.5 and 14.2

ARTICLE V. / ~~Should the Contractor at any time refuse or neglect to supply a sufficient number of skilled workmen, or~~ sufficient material of proper quality, or fail in any respect to prosecute the work with promptness and diligence; or fail in the performance of any of the agreements herein contained such refusal, neglect or failure being certified by the authorized representatives of the Owner, they shall be at liberty, after written notice to the Contractor, to provide any such labor or material, and to deduct the cost thereof from any money then due or thereafter to become due to the Contractor under this contract; and if the authorized representatives of the Owner shall certify that such refusal, neglect or failure is sufficient ground for such action, they shall also be at liberty to terminate the employment of the Contractor for the said work and to enter upon the premises and take possession for the purpose of completing the work included under this contract, of all material, tools, and appliances thereon, and to employ any other person or persons to finish the work, and to provide the material therefore; and in case of such discontinuance of the employment of the Contractor, he shall not be entitled to receive any further payment under this contract until the said work shall be wholly finished, at which time, if the unpaid balance of the amount to be paid under this contract shall exceed the expense incurred by the Owner in finishing the work, such excess shall be paid by the Owner to the Contractor; but if such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner, as herein provided, either for furnishing material or for finishing the work and any damage incurred through such default, shall be audited and certified by the authorized representatives of the Owner, whose certificate thereof shall be conclusive upon the parties.

ARTICLE VI. The Contractor shall complete the several portions, and the whole of the work comprehended in this agreement by and at the time or times hereinafter stated, to-wit:

time being of the essence of this contract. Should said contractor fail or neglect to prosecute said work as herein provided, and complete the same within the time above stated, he shall pay the Owner (1) the actual damages sustained by the delay, or (2) the sum specified in the specifications, plans and addenda, for each day said work shall remain uncompleted after said date, that amount being mutually agreed upon as liquidated damages in lieu of actual damages for such delay.

Subject to the conditions of Article 8 of the General Conditions

ARTICLE VII. / Should the Contractor be delayed in the prosecution or completion of the work by the act, neglect or default of the Owner, or of any other Contractor employed by the Owner upon the work, or by any damage caused by fire or other casualty for which the Contractor is not responsible, or by combined action of workmen in no wise caused by or resulting from default or collusion on the part of the Contractor, then the time herein fixed for the completion of the work shall be extended for a period equivalent to the time lost by reason of any or all the causes aforesaid, which extended period shall be determined and fixed by the authorized representatives of the Owner, but no such allowance shall be made unless a claim therefore is presented in writing to the authorized representatives of the Owner within the time specified of the occurrence of such delay as contained in the specifications and plans.

ARTICLE VIII. It is hereby mutually agreed between the parties hereto that the sum to be paid by the Owner to the Contractor for said work and material shall be

subject to additions and deductions as herein provided, and that such sum shall be paid by the Owner to the Contractor in current funds and only upon certificates of the authorized representatives of the Owner as follows:

Except as otherwise specified in the Contract Documents.

/ Ninety (90) percent of the actual cash value of all labor performed and material furnished in place each calendar month shall be paid on proper vouchers during the next succeeding calendar month, and the balance upon the full completion of the job.

If, at any time, there shall be evidence of any claim for which, if established, the Owner of the said premises might become liable, and which is an obligation chargeable to the Contractor, the Owner shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify it against such claim. Should there prove to be any such claim after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging any lien or claim on said premises in consequence of the Contractor's default.

It is further stipulated and agreed that out of any retained amounts, the Owner may at his option pay, in whole or in part, any just claim against the Contractor for labor or material furnished him by persons not parties hereto, where such labor or material has been expended in the carrying out of work covered by this agreement.

ARTICLE IX. It is further mutually agreed between the parties hereto that no certificate given or payment made under this contract, shall be conclusive evidence of the performance of this contract, either wholly or in part, and that no payment shall be construed to be an acceptance of defective work or improper materials.

ARTICLE X. The Owner, through its authorized representatives, has the power and duty to decide all questions as to the due performance of this contract.

The said parties, for themselves, their heirs, successors, executors, administrators and assigns, do hereby agree to the full performance of the covenants herein contained.

In Witness Whereof, the parties have hereunto set their hands and seals the day and year first above written, and caused these presents to be executed in their behalf by the Vice President, Finance, Planning and Operations of the University of Minnesota and the Contractor by its .....

.....

In the presence of:

..... Witness	..... Contractor
..... Witness	..... Contractor

REGENTS OF THE UNIVERSITY OF MINNESOTA

By.....
Vice President, Finance, Planning and Operations

Recommended by:

..... Assistant Vice President	..... Date
..... Purchasing Agent	..... Date
..... University Attorney	..... Date

UM HEALTH SCIENCES
JOML-B · B1-3

AGREEMENT

BETWEEN

_____
Contractor

AND

_____
Owner

FOR

_____

_____

_____

_____ 19____

AMOUNT OF CONTRACT

$_____

UNIVERSITY OF MINNESOTA
BUSINESS ADM. FORM 204
6-65—1M

CONTRACTOR'S BOND

KNOW ALL MEN BY THESE PRESENTS, That we, the undersigned _____

_____ of _____
(Corporate or firm name of contractor) (Address of contractor)

a corporation,* organized and existing under the laws of the State of _____, partnership,* individual,* duly authorized by law to do business as a construction contractor in the State of Minnesota, hereinafter called the "Principal," and _____

_____ of _____
(Corporate name of surety) (Address of surety)

a corporation organized and existing under the laws of the State of _____, and duly authorized to do a surety business under the laws of the State of Minnesota, hereinafter called the "Surety," are held and firmly bound unto *Regents of the University of Minnesota,* hereinafter called the "Obligee," in the penal sum of

_____ Dollars ($_____),
(Amount of contract price)

lawful money of the United States, for the payment of which well and truly to be made unto said Obligee, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents, as follows:

The conditions of this obligation are such that, whereas on the _____ day of _____, 19____, the said Principal entered into a written Contract with said Obligee for the construction of _____
(Brief description of work to be done)

_____

_____

located at _____, _____ as set forth in detail in the advertisement for bids, general conditions, information for bidders, proposal, plans and specifications, and other related contract documents referred to in said Contract, all of which are hereby made a part hereof, and by reference incorporated herein.

NOW, THEREFORE, If the said Principal shall well and truly perform and complete said project in strict accordance with said Contract, advertisement for bids, general conditions, information for bidders, proposal, plans, specifications and related documents; shall comply with all the requirements of the Laws of the State of Minnesota; shall pay as they become due all just claims for work, tools, machinery, skill materials, insurance premiums, equipment and supplies, for the completion of the Contract in accordance with its terms; and shall defend, indemnify and save harmless said Obligee against any and all liens, encumbrances, damages, claims, demands, expenses, costs and charges of every kind, including patent infringement claims, except as otherwise provided in said specifications and other contract documents, arising out of or in relation to the performance of said work and the provisions of said Contract, then this Bond shall be void, otherwise it shall remain in full force and effect.

This obligation is made for the use of the Obligee and of all persons doing work or furnishing skill, tools, machinery or materials, or insurance premiums, or equipment, or supplies for any camp maintained for the feeding or keeping of men or animals, or any combination thereof, engaged under or for the purpose of the execution of said Contract and may be sued on thereby.

The said Surety, for value received, hereby stipulates and agrees that no assignment, modification or change, extension of time for completion, alteration or addition to the terms of said Contract or to the work to be performed thereunder or the specifications accompanying the same, shall in any wise affect its obligations on this Bond or release the Surety, and it does hereby waive notice of any such change, extension of time for completion, alteration or addition to the terms of the Contract as to the work or to the specifications.

IN TESTIMONY WHEREOF, the parties hereunto have caused the execution hereof in _____ original counterparts as of the _____ day of _____, 19____.

(Seal, if any)
Attest (or countersigned):

_____
_____
(Title)

_____
(Name of contractor), Principal

By _____
_____
(Title)

(Seal)
Attest (or countersigned):

_____
_____
(Title)

_____
(Name of surety), Surety

By _____
_____
(Title)

* Omit inapplicable terms.

UM HEALTH SCIENCES
JOML-B B2-1

(Acknowledgment by Natural Person)

STATE OF MINNESOTA,
County of _____ } ss.

On this _____ day of _____, 19____, before me personally appeared _____ to me known to be the person—described in and who executed the foregoing instrument, and acknowledged that _____ executed the same as _____ free act and deed.

_____

_____

My Commission expires _____

(Acknowledgment by Corporation)

STATE OF MINNESOTA,
County of _____ } ss.

On this _____ day of _____, 19____, before me appeared _____ to me personally known, who, being by me duly sworn, did say that he is the _____ of _____ _____, corporation, and that the seal affixed to the foregoing bond is the corporate seal of said corporation, and that said bond was executed in behalf of said corporation by authority of its Board of Directors, and said _____ acknowledged said instrument to be the free act and deed of said corporation.

_____

_____

My Commission expires _____

(Justification by Sureties)

STATE OF MINNESOTA,
County of _____ } ss.

_____

being each duly sworn, did each for himself depose and say that he is a resident and freeholder of the State of Minnesota and one of the sureties on the foregoing bond, and that he is worth the sum hereinafter set opposite his name over and above his debts and liabilities, and property exempt from execution.

Sworn to and subscribed before me this _____ day of _____, 19____

_____ $_____
_____ $_____
_____ $_____
_____ $_____

BOND OF

Contractor,

FOR WORK AT

UM HEALTH SCIENCES
JOML-B B2-2

The within Bond and sureties thereon approved and Bond filed _____, 19____

Regents of the University of Minnesota

DIVISION C - GENERAL CONDITIONS OF THE CONTRACT

Where any Article, Paragraph, Subparagraph or Clause of the General Conditions is modified, supplemented or deleted by other provisions of the Contract Documents, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect. Where provisions of the General Conditions are modified elsewhere in the Contract Documents, any references to those General Conditions provisions shall be read as referring also to the same subject matter contained elsewhere in the Contract Documents.

ARTICLE 1 - THE CONTRACT DOCUMENTS

1.1 Definitions

1.1.1 The Contract Documents

The Contract Documents consist of the University-Contractor Agreement, the Performance Bond, the Instructions to Bidders, the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, the Specifications, all Addenda issued prior to execution of the Contract, and all Modifications thereto. A Modification is (1) a written order or amendment to the Contract signed by both parties, (2) a Change Order, (3) a written interpretation issued by the University or Architect pursuant to Subparagraph 1.2.5, or (4) a written order for a minor change in the Work issued by the University or Architect pursuant to Paragraph 12.4.

1.1.2 The Contract

The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification as defined in Subparagraph 1.1.1, except that changes to the Contract involving the Contract Sum or Contract Time, may be made only by Change Order.

1.1.3 The Work

The term Work includes all labor and services necessary to produce and fully complete the construction required by the Contract Documents, and all materials and equipment incorporated in such construction.

1.1.4 The Project

The Project is the total construction designed by the Architect, or designed by others in consultation or collaboration with the Architect and included in the Contract Documents, of which the Work performed under the Contract Documents may be the whole or a part.

1.1.5 The Specifications

The Specifications include all Sections of Division 1, General Requirements, and all Sections of the Technical Divisions for the Project.

1.2 Execution, Correlation, Intent and Interpretations

1.2.1 The Agreement shall be signed in not less than triplicate by the University and Contractor. To the extent necessary, the Architect shall identify the Drawings and Specifications of the Contract Documents.

1.2.2 By executing the Contract, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents and Bidding Requirements. However, he does not represent having examined conditions that are not exposed without demolition unless the necessary demolition is specified or authorized by the University. The Contractor also represents he has examined all Contract Documents for the Project, including those intended for work or trades not normally performed by the Contractor's own forces, and has become thoroughly familiar with all conditions which may pertain to or affect the Work, and its costs, under this Contract.

1.2.3 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. The intention of the Documents is to include all labor, materials, equipment and other items as provided in Subparagraph 4.4.1 necessary for the proper execution and satisfactory completion of the Work, including proper operating condition. For any of the Work that is shown, indicated, noted or referred to in any of the Contract Documents, or is reasonably inferable therefrom as being necessary to produce the intended results, and which is not covered under any heading, section, branch, class or trade of the specifications, shall be provided in accordance with the Architect's instructions without additional cost to the University or Architect. Should there be an inconsistency in the quality or quantity of Work required under the Contract Documents, it shall be interpreted that the greater quality or quantity of Work is required under the Contract, without increase in the Contract Sum. Words which have well-known technical or trade meanings are used herein in accordance with such recognized meanings. The Contract Documents generally do not set forth the basis and analysis of design and the Contractor shall obtain such information as may be necessary to satisfactorily perform and complete the Work.

1.2.4 The organization of the Specifications into Divisions, Sections and Articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade, unless it is specified that a subcontract include specific phases or elements to complete a certain part of the Work for reasons of coordination or responsibility. Where the Specification has been divided into Sections, it is for convenience in use. The Architect and the University assume no responsibility for the placement of materials, equipment or other phases of the Work into the proper Division or Section of the Specifications, nor for the arrangement of Work shown on the Drawings. Neither the Architect nor the University shall be obligated to enter into any jurisdictional or other dispute as a result of the organization, arrangement or location of parts of the Work in the Specifications or Drawings, nor serve as an arbitrator to establish subcontract limits between the Contractor and any Subcontractor.

1.2.5 Written interpretations necessary for the proper execution of the Work, in the form of drawings or otherwise, will be issued with reasonable promptness by the Architect or the University and in accordance with any schedule agreed upon. In general, requests for interpretation of design intent shall be directed to the Architect. Either party to the Contract may make written requests to the Architect for such interpretations. Other requests for interpretation shall be directed to the University, who may consult with the Architect at its discretion. Interpretations shall be consistent with and reasonably inferable from the Contract Documents. The Contractor is responsible to request interpretations and clarifications for those matters which appear to be inconsistencies, ambiguitities or omissions in the Contract Documents. The Contractor shall execute the Work in accordance with the decision, clarification or interpretation provided to him.

1.2.6 Where a reference in the Contract Documents to an American Society for Testing and Materials standard, American National Standards Institute standard, Federal Specification or other recognized standard does not include the date of the standard, the edition current as of the date of the Contract Documents shall apply.

1.2.7 The general character and scope of the Work is called for by the Contract Documents. Where a portion of the Work is fully drawn and the remainder is merely indicated, the portion fully drawn shall apply to all same parts of the Work. Drawings intended primarily as information for one trade may not necessarily show the work of other trades, but this shall not be construed as indicating there are no other related materials or adjacent work.

1.2.8 Figured dimensions shall be followed in preference to measurement by scale. In the event of discrepancies between dimensions, or between drawings, the intent shall be interpreted by the Architect, which shall be binding on the Contractor. Where a dimension may be missing, the Work shall be accomplished in accordance with the directions and dimensions provided by the University or the Architect. Dimensions on drawings, as well as detail drawings themselves are subject in every case to measurements of existing, adjacent, incorporated and completed work which shall be taken by the Contractor before undertaking any work depending upon such data. Dimensions pertaining to the Work or its installation shall be verified at site by the Contractor.

1.2.9 Where the Specifications are of the abbreviated or "streamlined" type, they shall be construed as complete sentences, as shall notes on the drawings. Omissions of words such as "the", "the Contractor shall", and "as shown on the drawings" is intentional. The words " shall" or "shall be" are to be supplied by inference. Imperative or directive instructions, directions or the Specifications apply to and refer to the Contractor. The words "symmetrical" and "similar" are used in the general sense and need not mean "identical." Where a number is specified (as for gauges, weights, temperatures, an amount of time, and similar references), and the specified number cannot be obtained, the number shall be interpreted as the next better, as available.

1.2.10 The Contractor shall examine all Contract Documents and use all specifications and drawings for the Project, including those that may

primarily pertain to other work the Contractor normally does not perform with his own forces. The Contractor shall use all of the Project drawings and specifications: for a complete understanding of the Project and his Work; to determine the type of construction and systems; for coordination; to determine what other work may be involved throughout; to anticipate and notify others when their coordinated efforts will be required; and all other relevant matters related to the Project and the Contractor's Work. The Contractor shall also be bound by all the requirements to complete his Work, that are applicable to, pertain to, or affect his Work, as may be shown or reasonably inferable from the entire set of drawings and specifications.

1.3 Copies Furnished and Ownership

1.3.1 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, a reasonable number of copies of Drawings and Specifications, as necessary for the execution of the Work.

1.3.2 The copies of all Drawings and Specifications furnished to the Contractor are and shall remain the property of the University. They are not to be used on any other project, and, with the exception of two contract sets, are to be returned to the University on request at the completion of the Work.

ARTICLE 2 - THE ARCHITECT/ENGINEER

2.1 Definition

2.1.1 The Architect or Engineer is the design professional or organization whose name appears on the Contract Documents and identified as such in the Agreement, referred to throughout the Contract Documents as singular in number and masculine in gender. The term Architect, or Engineer, means the Architect, or Engineer, and his authorized representatives.

2.1.2 For reference ease, the term Architect is used in the General Conditions. For Contract Documents developed by the engineering disciplines, the term Engineer shall be substituted for Architect.

2.1.3 A Consultant is any person or firm who has provided specialized design services for the Project, in consultation or collaboration with the Architect or the University and whose design services are represented in the Contract Documents. The Consultant, or his representative, shall have the authority to make decisions on his design to the extent authorized by the Architect or the University.

2.1.4 Nothing contained in the Contract Documents shall create any contractual relationship between the Architect and the Contractor.

2.2 Administration of the Contract

2.2.1 During construction the Architect will advise, and consult with, the University in the general administration of the Contract, to the extent required by the University, acting on behalf of the University to the extent provided by the Contract Documents or otherwise authorized by the University.

2.2.2 The Architect, and the University, shall at all times have access

to the Work wherever it is in preparation and progress. The Contractor shall provide safe and convenient facilities for such access.

2.2.3 Periodically the Architect will visit the site to assist the University in the administration of the Construction Contract, to generally familiarize himself with the progress and quality of Work and to consult and advise the University on questionable matters in need of interpretation or modification. The Architect will not be required to make continuous, detailed or exhaustive on-site observations to check the quality or quantity of the Work.

2.2.4 The Architect and the University will not be responsible for construction means, methods, techniques, progress, sequences or procedures, or for safety precautions and programs in connection with the Work, and they will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

2.2.5 The Architect does not approve the Contractor's Request for Payment, but upon request may advise the University regarding the sums requested.

2.2.6 The Architect will, in the first instance, interpret the requirements of the Contract Documents and judge the Contractor's performance thereunder, when required by the University or the Contractor. The Architect will, within a reasonable time, render such interpretations as he may deem necessary for the proper execution or progress of the Work.

2.2.7 Claims, disputes and other matters in question between the Contractor and the University relating to the execution or progress of the Work or the interpretation of the Contract Documents shall be referred to the Architect in writing for decision, which he will render within a reasonable time.

2.2.8 All interpretations and decision of the Architect shall be consistent with the intent of the Contract Documents. In his capacity as interpreter and judge, he will exercise his best efforts to insure faithful performance by both the University and the Contractor as required by the Contract Documents.

2.2.9 The Architect's decision in matters relating to artistic effect will be final if consistent with the intent of the Contract Documents.

2.2.10 Any written decision by the Architect on a claim, dispute or other matter covered by such decision shall become final and binding on the Contractor and the University, without further appeal or recourse, thirty days after the decision is received by the parties unless written notice is served within the thirty days to the Architect and other party of the intent of further appeal or action.

2.2.11 The Architect, as well as the University, will have authority to reject Work which does not conform to the Contract Documents. Rejected Work shall be immediately removed from production or the site. Whenever, in the reasonable opinion of the Architect or the University it is considered necessary or advisable to insure the proper implementation of the intent of the Contract Documents, they shall have authority to require special inspection or testing of the Work in accordance with Subparagraph 7.8.2 whether or not such Work be then fabricated, installed or completed.

However, neither the Architect's or University's authority to act under this Subparagraph 2.2.11, nor any decision made by them in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Architect or the University to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work.

2.2.12 The Architect will review Shop Drawings and Samples as required in Subparagraph 4.13.1. Additionally, certain shop drawings and samples, as determined by the University, are also reviewed by the University.

2.2.13 The Architect will prepare Change Orders in accordance with Article 12, and will have authority to order minor changes in the Work as provided in Subparagraph 12.4.1.

2.2.14 The duties and limitations of authority of the Architect during construction as set forth in these General Conditions will not be modified or extended without written consent of the University and the Architect.

2.2.15 The Architect will not be responsible for the acts, procedures, programs, or omissions of the Contractor, any Subcontractors, or any of their agents or employees, or any other persons performing any of the Work.

2.2.16 In case of the termination of the employment of the Architect, the University shall appoint an architect whose status under the Contract Documents shall be that of the former architect.

ARTICLE 3 - THE OWNER

3.1 Definition

3.1.1 The Owner is the Regents of the University of Minnesota, a State of Minnesota Constitutional and Educational Corporation, herein referred to as the University.

3.1.2 The University acts through Clinton Hewitt, Assistant Vice President for Physical Planning, or his authorized representatives, except for certain functions which are the responsibility of the University's Purchasing Agent. Unless otherwise indicated, all papers and formal written notice required to be delivered to the University shall be delivered to Clinton Hewitt, Assistant Vice President, Room 340, Morrill Hall, University of Minnesota, Minneapolis, Minnesota 55455.

3.1.3 The University Purchasing Agent functions to receive bids for construction contracts and issues the Notice to Proceed to the successful Contractor.

3.1.4 The administration of the construction contract is performed by the Assistant Director of Planning of the Engineering and Construction Division of the University of Minnesota, or his authorized representatives.

3.1.5 At the commencement of the Work, the representatives of the University will be identified to the Contractor by name, function and authority.

3.2 Information and Services Provided by the University

3.2.1 Except as may otherwise be required by the Contract Documents, the University shall furnish all surveys describing the physical characteristics, legal limits and utility locations for the site of the Project.

3.2.2 The University shall secure and pay for easements for permanent structures or permanent changes in existing facilities.

3.2.3 For building projects, the University will establish a point locating one corner of the building on the site and furnish the location and elevation of a bench mark, all of which shall be verified by the Contractor.

3.2.4 The University shall select the appropriate testing agencies for the required tests, unless otherwise specified.

3.2.5 Information or services under the University's control shall be furnished by the University with reasonable promptness to minimize delay in the orderly progress of the Work.

3.2.6 During progress of the Work, the University will generally issue instructions to the Contractor, except for those instructions the University delegates to the Architect.

3.2.7 The foregoing are in addition to other duties and responsibilities of the University enumerated in the Contract Documents and especially those in respect to Payment and Insurance in Articles 9 and 11 respectively.

3.3 Administration of the Construction Contract

3.3.1 The University through its authorized representative will provide the general administration of the Construction Contract, functioning through a general, routine review and examination of the work to (1) judge the Contractor's performance of the Work under the Contract; (2) assist in avoiding defects, deficiencies and omission in the Work; (3) assist the Contractor in interpreting the Contract Documents, when necessary; (4) make determinations on questionable or ambiguous matters relating to the Work; (5) determine amounts due the Contractor for periodic payments; (6) make other judgments and determinations as may be necessary for the satisfactory completion of the Work to fulfill the intent of the Contract Documents.

3.3.2 The University will consult with the Architect at its discretion for interpretations, decisions on the quality of materials and workmanship, intent of the Contract Documents, progress of the Work and similar Contract matters, when necessary.

3.3.3 The University will receive and review the Contractor's submittals of the Performance Bond and insurance evidence.

3.3.4 The University will review the Contractor's progress schedule and reserves the right to question the schedule, comment on the schedule and require changes in the schedule to help assure proper scheduling to complete

the Work on time or benefit the overall progress of the Project. The University will provide the general coordination of schedules of separate contractors to assist in resolving possible conflicts of activities or priorities, but will assume no responsibility for the progress and completion of the Work by the Contractor.

3.3.5 The University will review certain shop drawings submitted to the Architect by the Contractor, prior to their being returned to the Contractor and the Contractor's timing of shop drawing submissions shall allow for the University review.

3.3.6 The University shall at all times have access to the Work, as provided in Subparagraph 2.2.2.

3.3.7 The University will be continuously represented at the site or, at its option, will visit the site and review the Work at such times and frequency it deems necessary to be familiar with the general progress and to generally determine if the Work is in accordance with the Contract Documents. The University will not be responsible to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work, which shall be the Contractor's responsibility.

3.3.8 The University, in consultation with the Architect when appropriate, will decide on proposed Changes in the Work.

3.3.9 The University will review the Contractor's Request for Payment and determine the amounts due the Contractor, based on the Contract requirements and the University's evaluation of the progress of the Work.

3.3.10 Requests for required interpretations, clarifications and similar matters arising out of the Contract Documents, or the construction, shall first be made to the University, who will consult with the Architect when necessary or advisable. The University's interpretation and decisions shall be consistent with the intent of the Contract Documents.

3.3.11 The University shall have the right and authority to reject any of the Work and to order special inspections or testing, in accordance with Subparagraph 2.2.11.

3.3.12 The University will conduct inspections to determine the dates of Substantial Completion and final completion, will receive and review written guarantees and related documents required by the Contract and assembled by the Contractor.

3.3.13 The University shall not be responsible for the Contractor's activities as specified under Subparagraph 2.2.4. Neither the titles nor functions of the University, or the Architect, and their representatives shall be construed as (1) assuming or imposing any of the Contractor's responsibilities on the University or Architect; (2) supervising the Work under the Contract Documents; (3) being responsible in any way for the performance, acts, omissions or inaction of the Contractor, his Subcontractors, anyone employed directly or indirectly by any of them or any one for whose acts they may be liable.

3.4 University's Right to Stop the Work

3.4.1 If the Contractor fails to correct defective Work or persistently fails to supply materials or equipment in accordance with the Contract Documents, does not allow others sufficient time to perform their work or otherwise is in substantial violation of the Contract, the University may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated.

3.5 University's Right to Carry Out the Work

3.5.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents or fails to perform any provision of the Contract, the University may, after seven days' written notice to the Contractor and his Surety, require the Surety to assume the obligations of the Contractor to complete the Work under the terms of the Contract. Should the Surety fail to assume the obligations within ten days after receipt of the written notice, the University, without prejudice to any other remedy it may have, may make good such deficiencies. In such case an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor, or the Surety, the cost of correcting such deficiencies, including the cost of the Architect's additional services made necessary by such default, neglect or failure. The Architect shall approve both such action and the amount charged to the Contractor. If the payments then or thereafter due the Contractor, or the Surety, are not sufficient to cover such amount, the Contractor or his Surety shall pay the difference to the University.

ARTICLE 4 - THE CONTRACTOR

4.1 Definition

4.1.1 The Contractor is the person or organization identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Contractor means the Contractor or his authorized representative.

4.2 Review of Contract Documents

4.2.1 The Contractor shall carefully study and compare the Contract Documents and shall at once report to the University any error or alleged error, inconsistency or omission he may discover. The Contractor shall obtain necessary drawings, specifications or instructions when required to satisfactorily complete any of the Work which is questionable.

4.3 Supervision and Construction Procedures

4.3.1 The Contractor shall supervise and direct the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences, programs, safety and procedures and for coordinating all portions of the Work under the Contract.

4.4 Labor and Materials

4.4.1 Unless otherwise specifically noted, the Contractor shall provide all labor, material, equipment, facilities, systems, tools, temporary

facilities, services and related items to properly execute and satisfactorily complete the Work.

4.4.2 The Contractor shall employ and assign labor that is skilled and competent in the assigned tasks and shall maintain order and discipline among his employees

4.4.3 The Contractor shall provide and perform all Work to comply with the requirements of the Contract Documents.

4.5 Warranty

4.5.1 The Contractor warrants to the University and the Architect that all materials and equipment furnished under the Contract, as a permanent part of the Project, will be new unless otherwise specified, and that all Work will be of first quality as acceptable to the University and Architect, free from faults and defects and in conformance with the Contract Documents. All Work not so conforming to these standards may be considered defective. If required by the University or the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

4.6 Taxes

4.6.1 The Contractor shall pay all sales, excise, consumer, use and other similar taxes required by law.

4.7 Permits, Fees and Notices

4.7.1 The Contractor shall obtain and pay for all permits, fees, licenses or other charges required or bearing on the conduct of the Work, where property other than University property is involved (i.e. municipalities, other governmental units, utilities) including connections to water, sewer or other utilities, or where sidewalks, streets and alleys not on University property must be disturbed or used. Other required permits and licenses applicable to University property will be obtained or provided by the University without cost to the Contractor.

4.7.2 The Contractor shall give all notices and comply with all codes, laws, ordinances, rules and regulations of any public authority having jurisdiction which bears on the performance of the Work.

4.8 Cash Allowances

4.8.1 By executing the Agreement, the Contractor represents the Contract Sum includes all cash allowances stated in the Contract Documents.

4.9 Superintendent

4.9.1 The Contractor shall employ a competent Superintendent and necessary assistants who shall be in attendance at the Project site during the progress of the Work. The Superintendent shall be satisfactory to the University and Architect, and shall not be changed except with the consent of the University, unless the Superintendent proves to be unsatisfactory

to the Contractor and ceases to be in his employ. The Superintendent shall be the executive representative of the Contractor and all communications given to the Superintendent shall be as binding as if given to the Contractor. When requested by the Contractor, important communications will be confirmed in writing.

4.9.2 Unless specifically approved by the University, the Contractor's Superintendent shall be constantly present during all working hours from start to completion of the Work, including those times when only Subcontractors are performing work at the site or minor activity is in progress. During the final stages of completion of the Work, the Superintendent shall continue to be constantly present at the site during all working hours to expedite, coordinate and direct the Work to final completion.

4.10 Responsibility for Those Performing the Work

4.10.1 The Contractor shall be responsible to the University for the acts and omissions of all his employees and all Subcontractors, their agents and employees, and all other persons performing any of the Work under a contract with the Contractor.

4.11 Progress Schedule

4.11.1 The Contractor shall prepare and submit for University approval, the progress schedule required by the Contract Documents.

4.12 Drawings and Specifications at The Site

4.12.1 The Contractor shall maintain at the site for his use and that of the University one copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders and other Modifications, in good order and marked to record all changes made during construction. These shall be available to the University and the Architect.

4.13 Shop Drawings and Samples

4.13.1 The Contractor shall provide and submit all shop drawings and samples required by the Contract Documents.

4.14 Use of Site

4.14.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits, the Contract Documents or the University's directions and shall not unreasonably encumber the site with any materials, equipment or debris.

4.15 Cutting and Patching of Work

4.15.1 The Contractor shall do all cutting, fitting or patching of his Work that may be required to make its several parts fit together properly, and shall not endanger any work by cutting, excavating or otherwise altering the Work or any part of it.

4.16 Cleaning Up

4.16.1 The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work he shall remove all his waste materials and rubbish from and about the Project as well as all his tools, construction equipment, machinery and surplus materials.

4.16.2 At the completion of the Project, the Contractor shall perform all cleaning to leave the Work "thoroughly clean" as required by the Contract Documents, unless otherwise specified.

4.16.3 If the Contractor fails to maintain the premises or clean up as specified, the University may do so after two days notice, with the cost paid for by the Contractor.

4.17 Communications

4.17.1 The Contractor shall provide to the Architect a copy of all communications to the University.

4.18 Indemnification

4.18.1 The Contractor shall indemnify and hold harmless the University and the Architect and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

4.18.2 In any and all claims against the University or the Architect or any of their agents or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Paragraph 4.18 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

4.18.3 The obligations of the Contractor under this Paragraph 4.18 shall not extend to the liability of the Architect, his agents or employees arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the University or the Architect, their agents or employees provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 5 - SUBCONTRACTORS

5.1 Definition

5.1.1 A Subcontractor is a person or organization who has a direct contract with the Contractor to perform any of the Work at the site, or to furnish materials, equipment or systems specifically fabricated for the Work. The term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative.

5.1.2 A Sub-subcontractor is a person or organization who has a direct or indirect contract with a Subcontractor to perform any of the Work at the site or to furnish materials, equipment or systems specifically fabricated for the Work. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or an authorized representative thereof.

5.1.3 Nothing contained in the Contract Documents shall create any contractual relation between the University or the Architect and any Subcontractor or Sub-subcontractor.

5.2 Award of Subcontracts and Other Contracts for Portions of the Work

5.2.1 Unless another time is specified in the Contract Documents, within 14 days after notice of award of the Contract, letter of intent to award, Notice to Proceed, or execution of the Contract, whichever occurs first, the Contractor shall furnish to the Architect in writing, for acceptance by the University and the Architect, a list of the names of all Subcontractors, and their Sub-subcontractors where appropriate, he proposes to use for the Work. No subcontracts shall be finally executed until the list has been reviewed by the University and Architect and the Contractor notified of the acceptance or non-acceptance of those listed. The Architect shall, with reasonable promptness, notify the Contractor if either the University or the Architect does not accept any Subcontractor or Sub-subcontractor on the list. At the request of the University or the Architect, the Contractor shall submit the names of proposed Subcontractors or Sub-subcontractors for portions of the Work not on the list. The listed Subcontractors or Sub-subcontractors will be deemed acceptable unless the Contractor is notified of the University's or Architect's objection or non-acceptance within a reasonable time established by the Contractor and the Architect.

5.2.2 The proposed Subcontractors or Sub-subcontractors shall be established, reputable firms of recognized standing with a record of successful and satisfactory past performance with the type work and/or items proposed to be provided or furnished by them. Where specifically named Subcontractors may be specified for certain portions of the Work, only the specified Subcontractors will be acceptable for those parts of the Work.

5.2.3 The right to reject any Subcontractor or Sub-subcontractor will be exercised by the University or the Architect when, in their opinion, it is believed the proposed Subcontractor or Sub-subcontractor: (1) cannot provide, or proposes deviations in, materials, equipment, systems, methods,

facilities or other Work as required by the Contract Documents; (2) cannot provide labor and skill necessary to accomplish the part of the work for which he is proposed, including but not limited to quality of workmanship; (3) lacks experience appropriate to the proper execution and completion for that part of the Work for which he is proposed; (4) has previously failed to perform satisfactorily, including cooperation and necessary services after project completion; (5) cannot satisfactorily perform the part of the Work for which he is proposed within the time schedule, due to financial status, size of organization, existing work load, or other considerations; (6) cannot demonstrate his ability, through examples of representative work, to perform the part of the Work for which he is being considered; (7) is of questionable integrity; or (8) there are other considerations bearing on the probability of unsatisfactory performance.

5.2.4 The Contractor shall not contract with any Subcontractor, nor use any Sub-subcontractor or any person or any organization (including those who are to furnish materials, equipment, systems or other items fabricated specially for the Work) who has been rejected by the University or the Architect. Except whereby the submission of the bid by the Contractor under the conditions of the Contract Documents indicates or implies he has accepted the use of a particular specified Subcontractor, the Contractor will not be required to contract with any Subcontractor or person or organization against whom he has a reasonable objection.

5.2.5 If the University or Architect refuses to accept any Subcontractor or person or organization on a list submitted by the Contractor in response to the requirements of the Contract Documents or the Instructions to Bidders, the Contractor shall submit an acceptable alternative.

5.2.6 If the University or the Architect requires a change of any proposed Subcontractor, Sub-subcontractor or person or organization previously accepted by them, the Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. No increase in the Contract Sum will be allowed where the change is a result of subsequent evidence of any of the reasons for rejection under 5.2.3.

5.2.7 The Contractor shall not make any substitution for any Subcontractor, Sub-subcontractor or person or organization who has been accepted by the University and the Architect, except for just cause acceptable to the University and the Architect, and unless the substitute is acceptable to the University and the Architect. In the event of a proposed change, the Contractor shall submit, in writing, the reasons for the change and the proposed substitutions. No change will be allowed for the improvement of the schedule where the Contractor, or his Subcontractors, have failed to properly order or schedule delivery or installation of materials and equipment The proposed change is subject to all conditions of Paragraph 5.2.

5.3 Subcontractual Relations

5.3.1 All work performed for the Contractor by a Subcontractor shall be pursuant to an appropriate agreement between the Contractor and Subcontractor (and where appropriate between Subcontractors and Sub-subcontractors) which shall contain provisions that:

.1 Preserve and protect the rights of the University and the Architect under the Contract with respect to the Work to be performed under the subcontract so that the subcontracting thereof will not prejudice such rights;

.2 Require that such Work be performed and guaranteed in accordance with the requirements of the Contract Documents.

.3 Require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party, in reasonable time to enable the Contractor to apply for payment in accordance with Article 9;

.4 Require that all claims for additional costs, extensions of time, damages for delays or otherwise with respect to subcontracted portions of the Work shall be submitted in writing to the Contractor (via any Subcontractor or Sub-subcontractor where appropriate) in sufficient time so that the Contractor may comply in the manner provided in the Contract Documents for like claims by the Contractor upon the University;

.5 Waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance described in Paragraph 11.2, except such rights as they may have to the proceeds of such insurance held by the Trustee for the insurance proceeds, and

.6 Obligate each Subcontractor specifically to consent to the provisions of this Paragraph 5.3.

5.4 Payments to Subcontractors

5.4.1 The Contractor shall pay each Subcontractor, upon receipt of payment from the University an amount equal to the percentage of completion allowed to the Contractor on account of such Subcontractor's Work, less the percentage retained from payments to the Contractor. The Contractor shall also require each Subcontractor to make similar payments to his subcontractors.

5.4.2 If the University fails to make payment for any cause which is the fault of the Contractor and not the fault of a particular Subcontractor, the Contractor shall pay that Subcontractor on demand, made at any time after the payment should otherwise have been made, for his Work to the extent completed, less the retained percentage.

5.4.3 The Contractor shall pay each Subcontractor a just share of any insurance moneys received by the Contractor under Article 11, and he shall require each Subcontractor to make similar payments to his subcontractors.

5.4.4 The University may, on request and at its discretion, furnish to any Subcontractor, if practicable, information regarding percentages of completion certified to the Contractor on account of Work done by such Subcontractors.

5.4.5 Neither the University nor the Architect shall have any obligation to pay or to see to the payment of any moneys to any Subcontractor.

ARTICLE 6 - SEPARATE CONTRACTS

6.1 University's Right to Award Separate Contracts

6.1.1 The University reserves the right to award other contracts in

connection with other portions of the Project under these or similar Conditions of the Contract.

6.1.2 When separate contracts are awarded for different portions of the Project, "the Contractor" in the Contract Documents in each case shall be the Contractor who signed each separate contract.

6.2 Mutual Responsibility of Contractors

6.2.1 The Contractor, and his Subcontractors, shall cooperate with and coordinate their work with each other and all other contractors and the University to facilitate general progress of the Project and to prevent delaying the progress of other contractors. The Contractor shall give reasonable notice and afford other contractors reasonable opportunity for the introduction and storage of their materials and equipment and the installation or execution of their work, and shall properly connect and coordinate his Work with theirs. The Contractor, and his Subcontractors, shall obtain layout drawings, roughing-in detail sheets and other pertinent information directly from the other contractors to coordinate all phases of the Work, and all contractors shall within a reasonable time provide such necessary information. For coordination with the University's equipment or materials, information shall be obtained from the University. After timely notification by the Contractor of the need to accomplish a particular phase or element of the Work, the other contractors shall, within a reasonable time, perform their work so as not to delay or impede the Contractor.

6.2.2 If any part of the Contractor's Work depends for proper execution or results upon the work of any other separate contractor, the Contractor shall inspect, including measurements and inspection of work already in place, and shall promptly report to the University any apparent or alleged discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor so to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper to receive his Work, except as to defects which may develop in the other separate contractor's work after the execution of the Contractor's Work.

6.2.3 Should the Contractor cause delay or damage to the work or property of any separate contractor on the Project, the Contractor shall, upon due notice, settle with such other contractor by agreement or arbitration, if he will so settle. If such separate contractor sues the University on account of any delay or damage alleged to have been so sustained, the University shall notify the Contractor who shall defend such proceedings at the Contractor's expense, and if any judgment or award against the University arises therefrom the Contractor shall pay or satisfy it and shall reimburse the University for all attorney's fees and court costs which the University has incurred.

6.3 Cutting and Patching Under Separate Contracts

6.3.1 The Contractor shall be responsible for any cutting, fitting and patching that may be required to complete his Work except as otherwise

specifically provided in the Contract Documents. The Contractor shall not endanger any work of any other contractors by cutting, excavating or otherwise altering any work and shall not cut or alter the work of any other contractor except with the written consent of the Architect or the University.

6.3.2 Any costs caused by defective or ill-timed work shall be borne by the party responsible therefor.

6.4 University's Right to Clean Up

6.4.1 If a dispute arises between the separate contractors as to their responsibility for cleaning up as required by Paragraph 4.16, or elsewhere in the Contract Documents, the University may clean up and equitably charge the cost thereof to the several contractors.

ARTICLE 7 - MISCELLANEOUS PROVISIONS

7.1 Governing Law

7.1.1 The Contract shall be governed by the laws of the State of Minnesota.

7.2 Successors and Assigns

7.2.1 The University and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the University.

7.3 Written Notice

7.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or member of the firm or to an officer of the corporation for whom it was intended, or if delivered at or sent by registered mail to the last business address known to him who gives the notice. Written notice to the University shall be addressed as noted under Subparagraph 3.1.2.

7.4 Claims for Damages

7.4.1 Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the other party or of any of his employees, agents or others for whose acts he is legally liable, claim shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage.

7.5 Performance/Guaranty Bond

7.5.1 At the time of execution of the Agreement between the University and the Contractor, the Contractor shall furnish a Bond in the full amount of the Contract Sum, signed by the Contractor and a Corporate Surety authorized to provide bonds in the State of Minnesota and approved by the University. A valid and enforceable Bond shall be maintained by the Contractor throughout the life of the Contract and its Guarantee Periods.

7.5.2 The minimum requirement for University approval of the Surety shall be that the Surety is listed by the United States Treasury Department as acceptable for bonding Federal projects and that the bond amount is within the limit set by the Treasury Department as the net limit on any single risk. There shall be no affiliation between the Contractor and the Bonding Agent or Agency.

7.5.3 The Bond shall guarantee the Contractor will perform each and every part of the Contract, cover all guarantees called for and insure prompt payment to all persons furnishing material or labor required in prosecution of the Work under the Contract. In the event of additions to the Contract, the University reserves the right to require evidence of additional bond.

7.5.4 The Bond shall provide: (1) for additions or deductions from the Work in any amount; (2) that completion time shall not be extended by reason of such changes, unless agreed to at time of change; (3) that no notice of aforesaid alterations, additions or omissions need be given the Surety; and (4) permit occupancy by the University at any time.

7.5.5 Unless otherwise stipulated in the Contract Documents or Bidding Requirements, the form of bond shall be provided by the University. (Contractor's Bond, Business Administration Form 204).

7.5.6 If it shall at any time appear that Contractor has unlawfully, fraudulently or through collusion with any representative of University, supplied inferior materials or workmanship or has departed from the terms of the Contract, or should the University make a claim under the Guarantee provisions, the final inspection and acceptance of the Work shall not be binding on the University and the University shall have the right to cause the Work to be properly performed and satisfactory material supplied to the extent the University may deem necessary, all at expense of the Contractor or his Surety. The University shall have right to recover against the Contractor, or his Surety, such damages as may be incurred by the University therefrom.

7.5.7 Final acceptance of the Work shall not relieve the Contractor nor his Surety from their obligations under this Contract, including guarantees of materials, equipment, installation or service.

7.6 Rights and Remedies

7.6.1 The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

7.7 Royalties and Patents

7.7.1 The Contractor shall pay all royalties and license fees and shall secure to the University for all times the free and undisputed right to the use of any and all patented design, process, method or product used in performance of the Work. The Contractor shall defend all suits or claims for infringement of any patent rights and shall save the University harmless from loss on account thereof.

7.8 Tests

7.8.1 If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, or instructions of the University or Architect requires any of the Work to be inspected, tested or approved, the Contractor shall make all arrangements for the tests, inspections or approvals and notify all appropriate parties in ample time to make the inspections, tests or approvals. The Contractor shall give the University and Architect timely notice of readiness for testing and inspection and the dates set for tests, inspections and approvals by public authorities so they may observe such tests and inspections if they choose. The Contractor shall bear all costs of such inspections, tests or approvals except as otherwise specified in the Contract Documents. Any of the Work requiring testing, inspection or approval which is covered or otherwise made inaccessible without the consent of those requiring or making the inspection or test, shall be uncovered or made accessible by and at the expense of the Contractor.

7.8.2 If after the commencement of the Work the University or the Architect determines that any Work requires special inspection, testing, or approval which Subparagraph 7.8.1 does not include, the University may instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as in Subparagraph 7.8.1. If such special inspection or testing reveals a failure of the Work to comply (1) with the requirements of the Contract Documents, or (2) with respect to the performance of the Work, with laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, the Contractor shall bear all costs thereof, including the Architect's additional services made necessary by such failure; otherwise the University shall bear such costs, and an appropriate Change Order shall be issued.

7.8.3 Certificates of required inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the University and the Architect.

7.8.4 Neither the observations by the University or the Architect, nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from his obligations to perform the Work in accordance with the Contract Documents.

7.9 (Not Used)

7.10 Use of University Personnel and Property

7.10.1 Unless the Contract Documents call for University property to be supplied to the Contractor, or installed or connected by the Contractor under the Contract, no property, supplies, equipment or personnel of the University shall be used by the Contractor in the performance of the Contract.

7.11 University Use or Occupancy of the Premises

7.11.1 The University reserves the right to jointly use the premises with the Contractor in the performance of his duties and functions. The University reserves the right to: (1) enter into the Project and premises at all

times; (2) make installations of materials and equipment at appropriate times as the Work progresses; (3) store property in essentially completed areas; (4) install furniture and furnishings when spaces are at appropriate stages of completion; (5) and use the premises for other similar activities. The Contractor shall coordinate the Work with the work of the University or other contractors and shall cooperate with them, to minimize undue interferences. Such activities shall not be construed as occupancy.

7.11.2 If any part, unit or the entire Work or Project is Substantially Complete or ready for occupancy, the University may, upon notice to the Contractor, enter into and make use of the Work that is Substantially Complete or otherwise suitable for the University's purposes.

7.11.3 If the Work is not complete at the time included in the Contract, but the Work is to a state of readiness to permit partial or full use or occupancy by the University, the University reserves the right, upon notice to the Contractor, to enter into and make use of those parts that are suitable for his needs. The Contractor shall cooperate with and coordinate his operations in completing the Work with the University to minimize disturbance of the University's programs and functions.

7.11.4 The University's beneficial use or occupancy, as provided for in 7.11.1 through 7.11.3 shall not be construed as acceptance of the Work or any of its materials and equipment. Such use and occupancy shall be subject to any corrections or deficiencies, damage or omissions noted. Damage occurring after occupancy, not caused by the Contractor, will be the responsibility of the University or other contractors causing the damage.

7.11.5 To the extent applicable to the Work, as determined by the University, the Contractor shall conform to the provisions of this Subparagraph. Upon occupancy by the University, complete and usable facilities of light, power, exits, heat, ventilation, air conditioning, utilities, toilets and similar facilities necessary for safety, comfort and University's functions shall be available at all times, so the Work can be used without hazards, discomfort or inconvenience. After occupancy by the University, its program, functions or normal use shall not be unnecessarily interrupted nor interferred with and unnecessary inconvenience will not be permitted. The Contractor shall schedule and arrange the Work with the University to accomplish this objective. If the Work is not complete by the time in the Contract, and if necessary, work shall be scheduled on weekends, or other times when the Work is not in use, without additional cost to the University. The Contractor will be allowed reasonable access to the areas as necessary to complete the Work. All operations or activities relating to electrical, heating, air conditioning, ventilation, plumbing services and phases shall be accomplished in accordance with a sequence schedule planned with the University so that complete facilities are maintained.

7.12 Additional Definitions

7.12.1 The term "provide" shall mean to furnish and install complete, including as applicable all connections to utilities or service, complete anchorage and suspension, fastening or anchor devices, controls, trim, supports, standard accessories, finishes, adjustments for proper operation and other related items or labor, unless specifically specified otherwise.

7.12.2 The terms "Approved," "Satisfactory," "Equal to," "Proper," and similar terms shall mean the decision is vested in the Architect and the University, which shall be binding upon the Contractor and Subcontractors. For decisions relating to artistic effect or interpretation and intent of the Contract Documents, the Architect's decision will be final.

7.12.3 The terms "Project," "Work," "Job", as may be used in the technical sections of the Specifications or on the drawings, may be used interchangeably and are synonymous. They shall mean the facility, construction and/or improvement within the intent or scope of the Contract Documents. The terms shall mean the entire facility, or separable parts as appropriate to the use of the term.

7.12.4 The term "Notice to Proceed" shall mean written notice by the University to the Contractor to commence his work of the Contract, issued either before or after execution of the Contract. In issuing the Notice, stipulations may be included in the Notice, or in the Contract Documents, as to time and other requirements that may condition commencement of the Work at the site. In the absence of a specific Notice to Proceed, the execution of the Agreement shall be deemed as such Notice, conditional upon the submission of a proper Performance Bond and proper insurance evidence.

7.12.5 The term "Substantial Completion" shall mean the Work of the Contract (or separable units or phases as provided in the Contract Documents or otherwise determined by the University) is essentially and satisfactorily complete in accordance with the Contract Documents, as modified by approved Change Orders or other written orders, ready for full occupancy or use by the University in the manner intended without inconvenience or discomfort. The determination by the University on the status of Substantial Completion shall be final. As may be applicable to this Project and Work of this Contract, it is the intent that Substantial Completion shall generally mean: all materials, equipment, systems, controls, features, facilities, accessories and similar elements are installed in the proper manner and in operating condition; spaces and surfaces (except minor areas or spaces) have been painted or otherwise finished throughout; masonry and concrete cleaned with any sealer or other finish applied; casework installed, complete with tops, sinks, fittings and other related items installed and services connected; utilities and systems connected and functioning; sitework essentially complete; permanent heating, ventilating, air conditioning and other systems properly operating with proper controls; lighting and electrical systems installed, operable and controlled; and other work to a similar state of essential and satisfactory completion. A minor amount of work, as determined by and at the discretion of the University, such as installation of minor accessories or items, a minor amount of painting, minor replacements of defective work, minor adjustment of controls, completion or correction of minor exterior work that cannot be completed due to weather conditions, will not delay determination of Substantial Completion. For the purposes of Substantial Completion, specified areas of the entire Work or Project (or as otherwise determined by the University) may be individually judged as Substantially Complete.

7.12.6 The terms "Complete", "Completion" or "Final Completion" shall mean when all of the Work of the Contract fulfills all of the terms of the Contract Documents in all respects.

7.13 Or Equal

7.13.1 Wherever materials, products, articles, equipment, systems or similar items are identified by reference to proprietory terms, model numbers, catalog numbers, trade names, manufacturers or similar reference, it is intended to establish the minimum standard or measure of quality that has been determined as requisite or intended for the Work. During bidding competition is encouraged from contractors, subcontractors, suppliers, manufacturers and producers whose products, systems, reputation, performance and service warrant acceptance for the conditions, intent of design, requirements and other considerations of the Work under the conditions specified in the Instructions to Bidders. Where not specifically stated, the phrase "or acceptable equal as determined by the Architect" shall be implied throughout. The Architect consults with the University in the determination of products to be used and their acceptable equals.

7.13.2 The determination of products for use may be based on the construction, design, function, type, size, capacity, performance, strength, durability, efficiency, sound level, finish, aesthetic quality, service, matching existing work, the University's standards for repair, replacement and maintenance or other characterisitcs and criteria. Acceptance or rejection of proposed alternate or similar products, equipment or system may be based on any of the factors and criteria. The final decision on acceptance or rejection of proposed alternate or similar products, equipment or system shall be vested in the Architect and his determination may or may not express the reason for the decision, at his option.

7.13.3 The product, equipment, system or manufacturer used as the basis for the design or specification shall generally set the criteria. It shall be expressly understood that any product, equipment, system or manufacturer listed in the Contract Documents as acceptable shall meet and be in full compliance with the requirements and criteria, including those established by the product, equipment, system or manufacturer used as the basis for the specification. The Architect and the University shall have the right to reject any proposed deviations from specified criteria or characteristics, or deviations from the criteria and characteristics of the product, system or manufacturer used as the basis of the Contract Documents.

ARTICLE 8 - TIME

8.1 Definition

8.1.1 The Contract Time is the period of time alloted in the Contract Documents for completion of the Work.

8.1.2 The date of the commencement of the Contract Time is the date of the University's Notice to Proceed or the date of the Agreement, whichever is first. In the absence of a time or date established in the Notice to

Proceed or in the Contract Documents, work at the site shall commence within 21 days after the Notice to Proceed or Contract execution, whichever occurs first, unless a later time is agreed to or directed by the University.

8.1.3 The date of Substantial Completion of the Work or designated portion thereof is the date determined by the University when construction is sufficiently complete, in accordance with the Contract Documents, so the University may occupy the Work or designated portion thereof for the use for which it is intended and the Work meets the requirements of Subparagraph 7.12.5. The date of Final Completion shall be determined by the University when the Work meets the requirements of Subparagraph 7.12.6.

8.1.4 The term day as used in the Contract Documents shall mean calendar day.

8.2 Progress and Completion

8.2.1 All time limits or dates stated in the Contract Documents are essential conditions of the Contract. In executing the Contract, the Contractor agrees the Contract Time is reasonable for the Work.

8.2.2 The Contractor shall begin the Work in accordance with Subparagraph 8.1.2. No work at the site shall be commenced until proper evidence of the required insurance has been submitted to the University. The Contractor shall carry the Work forward expeditiously with adequate forces to maintain progress in accordance with the Progress Schedule and to complete the Work within the Contract Time.

8.2.3 Except for constraints which may be specified for certain part of the Work or otherwise imposed by the University, the Work shall not be suspended or shut down, but shall progress continuously and expeditiously, unless otherwise approved by the University. The Contractor shall assemble materials and equipment in advance of the need and, as may be appropriate to the progress, shall prefabricate assemblies which will comply with the Contract Documents, as may be specified, or if not specified as may be permitted by labor agreements, to expedite the Work and insure completion on time.

8.2.4 If completion dates or times are specified or otherwise included in the Contract, it shall mean the date of Final Completion as defined under Subparagraph 7.12.6, unless otherwise specified in the Contract Documents.

8.2.5 If the Contractor shall neglect, fail or refuse to complete the Work within the time specified, or any proper extensions thereof granted by the University, unless liquidated damages are specified, the Contractor will be subject to paying actual damages suffered by the University resulting from non-completion on time and default under the Contract.

8.3 Delays and Extensions of Time

8.3.1 If the Contractor is delayed at any time in the progress of the Work by any act or neglect of the University or the Architect, or by any employee of either, or by any separate contractor employed by the University,

or by changes ordered in the Work, or by labor disputes, fire, unusual delay in transportation, unavoidable casualties or any causes beyond the Contractor's control, or by any other cause which the University determines may justify a delay, the Contract Time may be extended by Change Order for such reasonable time as the University may determine. Claims for extensions of time will be considered valid only under the following conditions:

.1 Only those enumerated conditions over which the Contractor has no control will be considered. The burden of proof to substantiate the claim for an extension of time shall rest with the Contractor, including evidence that the cause was beyond his control. It shall be deemed the Contractor has control over the supply of labor, materials, equipment, methods, techniques and over his Subcontractors.

.2 A delay in the progress of the Work actually occurred as a result of one of the valid causes for time extension.

.3 Any unusual delay in transportation is solely due to transportation. An extension of time will not be granted for delays in deliveries where said delivery was not properly scheduled or when orders were not promptly and properly placed.

.4 With respect to a claim for an extension of time as result of climatic conditions, the Contractor shall consider the location of the site and recognize the existence, as normal, of variations from "average" conditions. Foul weather in itself will not be a valid reason for time extension. Requests for time extension because of delay resulting from weather extremes will not be considered unless a substantial variation from usual weather conditions occurs for a significant period of time and operations necessarily were suspended to a significant degree when they would otherwise have been in progress. In considering the time extension, the weather conditions both before and after the period in which the delay is claimed will be evaluated.

.5 For Changes in the Work which significantly affects the time and progress of the entire Work, any time extension shall be made no later than when the Change is authorized by the University. Any claim shall be made at the time the Change is requested. For Changes in the Work which do not affect the progress of the entire Work, the University reserves the right to grant a time extension only for the area, phase or element of the entire Work affected by the Change.

.6 Delays resulting from a labor dispute will result in a time extension no longer than the dispute period, in addition to a reasonable mobilization period that is unavoidable, and may be less depending on the actual affect the dispute had on the overall progress and the operations that were actually curtailed or suspended. Lockouts, over which the Contractor has control, will not be a valid reason for a time extension.

.7 No time extension will be granted as a result of improper scheduling or for failure to have shop drawings or samples submitted in ample time for review under a reasonable schedule.

.8 Delays caused by Subcontractors will be valid reasons for time extension only under the same conditions as Paragraph 8.3.

8.3.2 Except for Changes in the Work, all claims for extension of time shall be made in writing to the University no more than ten days after the beginning of the occurrence of the delay; otherwise they shall be waived. In the case of a continuing cause of delay only one claim is necessary.

8.3.3 If no schedule or agreement is made stating the dates upon which written interpretations as set forth in Subparagraph 1.2.5 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until fifteen days after demand stating a delay will result is made for them, and not then unless such claim is reasonable.

8.3.4 All extensions of time shall be determined by the University, in consultation with the Architect when necessary, and its decisions shall be final and binding.

8.3.5 In the event of separate contractors for the Work, if a time extension is granted to one or more contractors for a valid delay, a time extension may also be granted other contractors if, in the opinion of the University, their progress or work schedule is materially affected by the time extension granted. If no time extension is allowed to the Contractor, or should the Contractor decline a time extension offer, the Contractor shall make no claim against the University for damages alleged to be the result of any time extension granted to others.

8.3.6 This Paragraph 8.3 does not exclude the recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 Contract Sum

9.1.1 The Contract Sum is stated in the Agreement and is the total amount payable by the University to the Contractor for the performance of the Work under the Contract Documents.

9.2 Schedule of Values and Cash Flow Schedule

9.2.1 Unless otherwise specified, the Contractor shall submit a Schedule of Values (cost breakdown) at least 14 days prior to the first Request for Payment, in such form and detail as required by the Contract Documents and as directed by the University.

9.2.2 Upon request of the University, the Contractor shall prepare and provide a schedule of estimated periodic requests for payment for the University's guidance in its financial planning to have funds available.

The schedule shall indicate the anticipated amount that will be requested each month, taking into consideration the work schedule, expected deliveries and the retained amount. The Contractor will not be bound to the estimated amounts, but should the actual requested amounts tend to vary substantially from the estimates, the Contractor shall revise the schedule, at the request of the University.

9.3 Progress Payments

9.3.1 As the Work progresses, after a bona-fide start at the site, the Contractor may make periodic Requests for Payment, but no more often than monthly, for work satisfactorily completed or materials suitably stored and protected at Project site, or as otherwise provided under Subparagraph 9.3.5. With the Request for Payment, the Contractor shall provide such supporting data as may be required by the University to substantiate the Contractor's right to payment.

9.3.2 Requests for Payment shall be submitted to the University in five copies on forms provided by the University. Each periodic payment request shall be in itemized detail form, following the Schedule of Values accepted by the University and as directed by the University. The processing procedures and time for submitting Requests for Payment shall be as directed by the University.

9.3.3 Payment will be made only for the Work that has been satisfactorily executed or accomplished and, except as provided for under Subparagraph 9.3.5, only for materials and equipment that are on the job site and adequately protected from the elements, pilferage, vandals or other damage. Requests for Payment which are incorrect, incomplete or are based on anticipated progress and deliveries will be rejected.

9.3.4 For payments that are to be made on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the site, such payments shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the University to establish the University's title to such materials or equipment or otherwise protect the University's interest, including applicable insurance. No payment will be made for materials until a bona fide and substantial on-site start has actually been made.

9.3.5 Where there is limited storage area on the site of the Work of this Contract, and it will improve the schedule or benefit the progress of the Work, the University will consider making payment for certain materials and equipment which are stored off the site. The University shall be the sole judge as to the types of materials and equipment it will pay for while in off-site storage and the conditions for the payment. The University will not pay for items in off-site storage which are: (1) damaged or otherwise defective; (2) off-the-shelf type materials; (3) held at the producer's plant; (4) produced over a period of time and normally would be installed to a schedule over a period of time as they are delivered, unless the University has caused a significant change in the schedule. For consideration of payment for items stored off-site, at the start of the Work the Contractor shall submit a proposed list to the University for review and concurrence, provide the reasons for each, the proposed storage locations and the anticipated delivery time. The list shall include: (1) the item; (2) proposed storage location; (3) anticipated delivery time to the off-site storage. To qualify for consideration, the material or equipment shall be:

.1 A major item.

.2 Specially fabricated or produced for the Work of this Contract and shall be in accordance with the Contract Documents; or

.3 A critical material which is in short supply or which has an uncertain long lead time delivery schedule.

.4 Properly stored and protected as approved by the University, including marking with the Project name.

.5 Paid for in full by the Contractor (or by the Subcontractor purchasing the item) with the evidence of a paid receipt submitted with the Request for Payment. The Contractor (or Subcontractor) shall also certify the item is in storage and will be immediately available when required.

.6 Examined by the University at the place of storage.

.7 Properly insured, with insurance coverage (as a minimum) equal to the Property Insurance for the Project, as specified under Paragraph 11.2, and insurance evidence provided to the University. The Contractor shall also provide a Consent of the Surety to allowing payment for the item.

.8 Furnished at no additional cost or expense to the University except the time required to examine the items.

9.3.6 The Contractor warrants and guarantees that title to all Work, materials and equipment covered by a Request for Payment, whether incorporated in the Project or not, will pass to the Owner upon the receipt of such payment by the Contractor, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article 9 as "liens"; and that no Work, materials, or equipment covered by a Request for Payment will have been acquired by the Contractor, or by any other person performing the work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the Seller or otherwise imposed by the Contractor or such other person.

9.3.7 Unless otherwise specified in the Contract Documents, progress payments will be made for ninety percent (90%) of the value of the Work satisfactorily executed, or for materials and equipment furnished, installed or suitably stored in an approved manner, including all additions or deductions to the Contract Sum approved by Change Order, and less any previous payments made to Contractor or payments made for his account. No payment for engineering, shop drawings or other similar costs will be made until materials are delivered and satisfactorily stored or incorporated in the Work.

9.3.8 By submitting any Request for Payment the Contractor attests to the accuracy of the amounts requested, represents that the Work has been satisfactorily executed in compliance with the Contract Documents and he is entitled to the amount shown. By submitting the second or any subsequent

Request for Payment, the Contractor attests that he has paid all just claims for labor, materials, equipment, subcontracts or other expenses represented by all previous Requests for Payment.

9.3.9 No progress payment, nor partial or full use or occupancy of the Project, shall be construed as acceptance of any Work not in accordance with the Contract Documents. All Work is subject to an evaluation for conformance with the Contract Documents upon Completion, to the results of any subsequent tests required by the Contract Documents, to minor deviations from the Contract Documents correctable prior to Completion, and to any specific qualifications stated by the University or Architect. The making of a payment by the University shall not thereby be deemed to represent that it has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that it has reviewed the construction means, methods, techniques, sequences or procedures, or that it has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract Sum.

9.3.10 Full or partial payment on the Contract Sum, or in reducing the retained amount (percentage) shall not relieve the Contractor or his Surety from fulfilling all obligations of this Contract, including guarantee of the Work. Under the conditions of the Contract, the Contractor and his Surety agree that they waive any actual or alleged rights of subrogation or action against the University and Architect as a result of such payments being made. The Surety at any time may examine the status of the Work, as well as any payments and may request the University withhold additional sums as they consider appropriate to protect their interests.

9.3.11 In the event the University is unable to approve payment in the full amount requested, due to work not satisfactorily complete in the amount represented by the Request for Payment, it may revise the amount indicated as due, process for payment and advise the Contractor of the change.

9.3.12 At the time any request is made to make full payment on a periodic Request for Payment or to reduce the retained percentage, the Contractor shall submit a written "Consent of Surety" to said reduction, without invalidating any obligation under the Bond.

9.4 Payments Withheld

9.4.1 The University may decline to approve a Request for Payment in whole or in part, to the extent necessary to reasonably protect its interests. The University may also decline to approve any Request for Payment or, because of subsequently discovered evidence or subsequent inspections, it may nullify the whole or any part of any Request for Payment previously issued, to such extent as may be necessary in its opinion to protect the University from loss because of:

.1 Defective work not remedied,

.2 third party claims filed or reasonable evidence indicating probable filing of such claims,

.3 failure of the Contractor to make payments properly to Subcontractors for labor, materials or equipment,

.4 reasonable doubt that the Work can be completed for the unpaid balance of the Contract Sum,

.5 damage to another contractor,

.6 reasonable indication that the Work will not be completed within the Contract Time, or

.7 unsatisfactory prosecution of the Work by the Contractor.

9.5 Not Used

9.6 Substantial and Final Completion

9.6.1 As applicable to the Work of this Contract, Substantial and Final Completion shall be as defined under Subparagraph 7.12.5 and 7.12.6.

9.6.2 When the Contractor determines that the entire Work, or a specified or designated area or part thereof as established by the University, is Substantially Complete, the Contractor shall submit to the University and Architect a written statement that the Work meets the requirements for Substantial Completion. At the same time, the Contractor shall submit to the University and the Architect a list of all items and Work to be completed or corrected. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Based on observations at the site, if the University agrees to the status of the Work, it will schedule and make an inspection of the Work and provide the Contractor with a list of any additional items to be completed, replaced or corrected. If the Work is not Substantially Complete, in the University's opinion, the Contractor will be advised and a subsequent date set for the inspection. In the absence of any other date established by the University, the day on which the University completed its inspection of the Work, or part, and determined the Work, or part, as Substantially Complete, will be the Substantial Completion date.

9.6.3 When the entire Work, or specified or designated area or part thereof as established by the University, is determined as Substantially Complete, or upon the University's full occupancy of the entire Work or established area or part thereof, the Contractor and the University shall review and agree on necessary changes in responsibilities as may be provided in the Contract Documents which are related to the Work, such as insurance, cost of services and utilities, heating and air conditioning, maintenance and similar matters. In no case shall Substantial Completion or occupancy relieve the Contractor from his obligations under the Contract. Unless otherwise specified, the change in responsibilities shall be effective the day after the Work is determined as Substantially Complete, or if full occupancy occurs earlier, on the first day of full occupancy.

9.6.4 The Contractor shall recognize the need for proper procedures and diligence to complete the Work and shall continuously prosecute it to completion, including the period after Substantial Completion. The Contractor shall organize and methodically prosecute all phases of completing the Work according to a schedule acceptable to the University.

9.6.5 Upon receipt of written notice from the Contractor that the Work is complete, all corrections made, all reports and other data filed, all equipment and systems tested and there is no other unfinished Work, the University will make one final inspection on the items previously noted to be completed or remedied. Final payment will not be made until the University has been fully and properly instructed in use and operation of all of the Work, equipment and systems under the Contract and all manuals, bonds and similar items have been provided.

9.7 Final Payment

9.7.1 Final payment, including any retained amount on the Contract Sum, will not become due until the Contractor provides any submittals the University may require to substantiate the Contractor's right to payment, such as: (1) affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the University or his property might in any way be responsible, have been paid or otherwise satisfied; (2) consent of surety, if necessary to final payment and (3) other data establishing payment or satisfaction of all obligations, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designed by the University. If any Subcontractor refuses to furnish a release or waiver as may be required by the University, the Contractor may furnish a bond satisfactory to the University to indemnify it against any such lien. If any such lien remains unsatisfied after all payments are made, he Contractor shall refund to the University all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.7.2 Prior to final payment, the Contractor shall file with the University the certificate, Form 134, "Affidavit for Obtaining Final Settlement of Contract with the State of Minnesota", showing he has complied with M.S.A. 290.92 requiring withholding of income tax on wages at the source.

9.7.3 If after Substantial Completion of the Work, Final Completion thereof is materially delayed through causes not under the control of the Contractor, or a very minor amount of the Work remains incomplete or uncorrected due to weather, unsuitable conditions for testing or other circumstances, and the Architect so confirms, the University may, without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. In such case, the University will retain at least 3 times the value of the incomplete or uncorrected parts of the Work. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims, nor termination of the Contract.

9.7.4 The making of final payment shall constitute a waiver of all claims by the University except those arising from:

.1 Unsettled liens;

.2 faulty, defective, missing, substandard or improperly installed work previously noted or appearing or found after Substantial Completion;

.3 failure of any of the Work to comply with the requirements of the Contract Documents; or

.4 terms of any standard of special guarantees required by the Contract Documents.

9.7.5 The acceptance of final payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and still unsettled.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.1 Safety Precautions and Programs

10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. All of the Work shall be performed in a safe manner.

10.2 Safety of Persons and Property

10.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

.1 all employees on the Work and all other persons who may be affected thereby;

.2 the public, including University staff and employees;

.3 all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-Subcontractors;

.4 materials, equipment, supplies or construction of other contractors; and

.5 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other improvements and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall comply with all applicable codes, laws, ordinances, rules, regulations and lawful orders of any public authority, including the University's Environmental Health and Safety Division, having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

10.2.3 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents and

other safety or protection measures. This person shall be the Contractor's superintendent unless otherwise designated in writing by the Contractor to the University.

10.2.4 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel. No explosives shall be used without the permission of the University.

10.2.5 The Contractor shall provide and maintain adequate fire extinguishers or other fire fighting systems or devices in and around the construction area, available to all workmen, but shall not use extinguishers that are to be installed in the Work.

10.2.6 The Contractor shall not load or permit any loading which will endanger the safety of or in any way damage the Project, the Work, or any existing or adjacent facilities.

10.2.7 All damages or loss to any property referred to in Clauses 10.2.1.3 through 10.2.1.5, caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, shall be remedied and paid for by the Contractor, except damage or loss solely attributable to faulty Drawings or Specifications, or to the acts or omissions of the University, or Architect or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault, acts, operations, methods or negligence of the Contractor.

10.3 Emergencies

10.3.1 In any emergency at the site affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss and shall immediately notify the University. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Article 12 for Changes in the Work.

ARTICLE 11 INSURANCE

11.1 Contractor's Liability Insurance

11.1.1 The Contractor shall purchase and maintain such insurance as will protect him from claims which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by himself or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable; such insurance shall, as a minimum, cover:

.1 claims under workmen's compensation, disability benefit and other similar employee benefit acts;

.2 claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;

.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

.4 claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person; and

.5 claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

11.1.2 The insurance required by Paragraph 11.1 shall be written for not less than the limits of liability specified in Subparagraph 11.1.10, other requirements of the Contract Documents, or required by law, whichever is greater. The Contractor is solely responsible to purchase and provide adequate and additional insurance for work under the Contract, subject to the specified minimum requirements. The insurance shall be written on a Combination Comprehensive Liability Form with Broad Form Property Damage coverage.

11.1.3 Unless otherwise specified in the Contract Documents, as a minimum the liability coverage shall include:

.1 General Public Liability.

.2 Workmen's Compensation, with All States or Universal endorsement.

.3 Employee's Liability, with All States or Universal endorsement.

.4 Premises and Operations.

.5 Contractor's Protective Contingent Liability.

.6 Elevators (if any under this Contract).

.7 Personal Injury, Groups A, B, and C.

.8 Explosion, Collapse and Underground Property (The University will consider the exclusion of one or more of these hazards only if the Contractor provides a sworn statement which certifies no work involving these hazards will be performed under the Contract by the Contractor, any Subcontractor or anyone employed by them.)

.9 Contractural Liability.

.10 Completed Operations, which shall be maintained a minimum of one year after final completion.

.11 Automobile, including owned, non-owned and hired vehicle coverage.

11.1.4 The Contractor's Contractual Liability insurance shall cover the Contractor's obligations under Paragraph 4.18. Insurance for said agreement shall, as a minimum, provide limits as specified for any claim arising out of the hold harmless agreement and said limits shall not be reduced as the result of any claim made under the Public Liability Insurance.

11.1.5 If any insurance policy is written to cover more than one exposure, the minimum limit specified for each exposure shall be available for claims under each of the exposures.

11.1.6 The insurance companies for all policies shall waive the right to assert immunity of the University as a defense to any claim made, and endorsements to policies or the certificate shall indicate the waiver.

11.1.7 Within 14 days after receipt of the Notice to Proceed or Contract execution, whichever occurs first, and prior to commencing the Work at the site, the Contractor shall submit to the University three copies, with one copy to the Architect, of a certificate of Liability Insurance indicating all coverages. The certificates shall be one Minnesota CICC Form 701, latest edition.

11.1.8 The Contractor shall not allow insurance to be cancelled, lapse, change by decrease in limits or coverage during the life of the Contract, including guarantee periods. In event of any such change or termination, 15 days prior written notice shall be given the University, the Architect, and all insured parties. Certificates shall bear acknowledgement of the notice requirement.

11.1.9 The Contractor's Surety for the Bond specified under Paragraph 7.5 shall be held until all claims against the insurance (including claims under Paragraph 4.18) have been settled and suitable evidence of the settlement has been provided to the University.

11.1.10 Unless otherwise specified in the Contract Documents, the minimum limits for liability insurance shall be as follows, unless higher limits are required by law:

.1	Workmen's Compensation:	As required by law
.2	Employee's Liability:	$100,000
.3	Bodily Injury - For each of Public Liability and Automobile	$300,000 each person $500,000 each occurrence $500,000 aggregate
.4	Property Damage - Public Liability	$250,000 each occurrence $500,000 aggregate
.5	Property Damage - Automobile	$100,000 each occurrence
.6	Personal Injury	$300,000 each person $500,000 each occurrence
.7	Contractual Liability	Same limits as .3 and .4 above

.8 Umbrella Excess Liability: If such policy is used to supplement the underlying limits, it shall be written for not less than $1,000,000 and both the underlying policy and the umbrella policy shall provide for X-C-U coverage.

11.2 Property Insurance

11.2.1 Unless otherwise provided in the Contract Documents, the Contractor shall purchase and maintain Property Insurance in the amount of 100% of the insurable value of Work under the Contract plus 1/4 of 1% of the Contract Sum for architectural fees which may be required as a result of a loss. This insurance shall include the interests of, and name or designate as joint insureds, the University, the Architect, the Architect's Consultants, and all other agents, the Contractor, his Subcontractors and Sub-subcontractors on the Work and shall, as a minimum, insure against the perils of Fire, Extended Coverage, Vandalism, Malicious Mischief and Multiple Perils, and shall cover debris removal. (Builder's Risk with Multiple Peril Form, with coverage equal to an Inland Marine Form)

11.2.2 The Property Insurance shall be placed into effect and two copies of the policy provided to the University prior to starting any work at the site, the delivery of any materials to the site or exposure to any loss may occur. The policy shall provide that in the event of cancellation or expiration, a minimum of 15 days written notice shall be provided the University and the Architect. In addition to providing copies of the policy to the University, the Contractor shall submit one copy of the policy to the Architect.

11.2.3 Property Insurance shall be maintained by the Contractor until completion of the Work under the Contract, or full occupancy by the University, whichever occurs first, as determined by the University. Prior to termination of the insurance, at a time approved by the University, 15 days written notice of the proposed termination shall be provided to the University and Architect.

11.2.4 At the time the policy is issued, an endorsement shall be attached to the policy granting "permission for partial occupancy," to prevent the insurance from becoming invalid for partial occupancy by the University.

11.2.5 The University, the Architect, the Contractor, any other separate contractor on the Project performing work under these General Conditions, and all their Subcontractors, upon execution of construction agreements in connection with the Project automatically waive all rights, each against all others, for damages caused by fire or other perils to the extent covered by insurance under this Paragraph 11.2, except such rights as they may have to proceeds of such insurance held by the Trustee. Any policy issued with a clause negating this waiver shall have the clause voided by endorsement or the policy will be unacceptable. The Contractor shall arrange for, and require, similar waivers by Subcontractors and Sub-subcontractors in accordance with Clause 5.3.1.5., if necessary.

11.2.6 The Property Insurance policy may include a deductible amount as specified, but not to exceed $1,000 per occurrence, which shall not apply to the coverages of fire, windstorm, hail, lightning, smoke, explosion,

riot, civil commotion, aircraft, vehicles or the upset, overturning or collision of a transporting conveyance. The Contractor shall be responsible for any damage to his Work not covered (including damage subject to the deductible) by the insurance and he may selfinsure or obtain insurance to cover any losses, at his option.

11.2.7 Any other property not covered by insurance provided under this Paragraph 11.2 (such as Contractor's tools, machinery or equipment and property of similar nature not destined to become a part of the Project) shall be Contractor's responsibility and Contractor may self-insure or provide other insurance at his option.

11.2.8 Any insured loss is to be adjusted with the University and made payable to the Contractor as Trustee for the insureds, as their interests may appear. The Contractor as Trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within five days after the occurrence of loss to the exercise of this power. If such an objection is made, settlement with the insurers shall be made by the Contractor, the University and a third insured selected by them.

11.2.9 If required in writing by any party in interest, the Contractor as Trustee shall, upon the occurrence of an insured loss, give bond for the proper performance of his duties. He shall deposit in a separate account any money so received, and he shall distribute it in accordance with such agreement as the parties in interest may reach, or in accordance with an award by arbitration.

11.2.10 In the event of an insured loss, with University agreement, the Contractor shall immediately arrange with his insurance carrier to allow the Contractor to replace, repair, rebuild or remedy the loss so the work is accomplished as quickly as possible and to prevent (or minimize) any delay in job progress. Any claim for time extension as a result of a loss shall be approved by the University.

11.2.11 Upon termination of the Contractor's Property Insurance, the University hereby waives any claim against the Architect, Contractor and his Subcontractors and Sub-subcontractors for damage to its property from the perils covered under the terminated Contractor's Property Insurance which may occur during the completion of the Work and the guarantee period.

11.2.12 For work involving additions, remodeling or repair to existing property, the University hereby waives any claim for damage to his existing properties against the Architect, and any claim against the Contractor and his Subcontractors and Sub-subcontractors for damage to its existing properties from fire or other peril insured by the Contractor's property insurance or the cost of such damage which is in excess of the specified minimum limit for the Contractor's Public Liability Property Damage coverage.

11.3 Steam Boiler and Machinery Insurance

11.3.1 Should the Work under the Contract include such equipment as steam boilers, other pressure vessels, hot water boilers, fired storage water

heaters, fired coil water heaters and similar equipment or objects, the Contractor shall effect and maintain appropriate broad coverage steam boiler and machinery insurance as required by law or the Contract Documents. Such coverage shall, as a minimum insure against loss or damage, including death or bodily injury, from explosion, rupture or bursting of the equipment, piping and normally covered appurtenances.

11.3.2 The policy shall name, as insureds, the Contractor, the University, the Architect, other contractors for the Work, Subcontractors and Sub-subcontractors.

11.3.3 The insurance shall be placed into effect prior to the start up and testing of the equipment and have a policy period of at least one year but in any event shall be maintained until Final Completion of the Work.

11.3.4 The policy shall cover, as a minimum (1) loss to property of the insured, including extra costs of temporary repair, (2) death or bodily injury liability, including defense, settlement and supplementary payments, and (3) property damage liability including defense, settlement and supplementary payments.

11.3.5 Unless otherwise specified in the Contract Documents, the minimum limits shall be $500,000 per occurrence.

11.4 Loss of Use Insurance

11.4.1 The University at its option, may purchase and maintain such insurance as will insure it against loss of use of its property due to fire or other hazards, however caused, except delay caused by the Contractor.

11.5 Other Insurance

11.5.1 If other insurance is required by the University or the Contractor to insure against particular hazards not specified under Article 11 or elsewhere in the Contract Documents, they shall effect and pay for such special coverage as they may individually require or wish to carry.

11.5.2 If construction or any of the Work entails special hazards, the Contractor shall provide a rider or riders to be attached to the appropriate policies specified to cover such special hazards.

11.5.3 If any government agency requires special coverage for work on or adjacent to public streets or property, the Contractor shall comply with and provide such insurance, endorsements or extensions as may be required by the agency.

ARTICLE 12 CHANGES IN THE WORK

12.1 Change Orders

12.1.1 The University, without invalidating the Contract, may order Changes in the Work consisting of additions, omissions or other revisions, the Contract Sum and the Contract Time being adjusted accordingly. All such Changes in the Work shall be authorized by Change Order, or other

established written procedures, and shall be executed under the applicable conditions of the Contract Documents. Such Changes in the Work may be made without notice to the Surety on the Bond given under the Contract. The University reserves the right to require additional security when additions are made if, in its judgment, such security is necessary to protect its interests.

12.1.2 A Change Order is a written order to the Contractor signed by the University, issued after the execution of the Contract, authorizing a Change in the Work or an adjustment in the Contract Sum or the Contract Time. A Change Order may also be signed by the Contractor if he agrees to the adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order.

12.1.3 The cost or credit to the University shall be determined in one of the following ways and, unless otherwise approved or directed by the University, in the precedence of the order listed:

.1 By an accepted Unit Price proposed in the Contractor's original bid and incorporated in the Contract or a Unit Price comparable to unit costs in the Contractor's Schedule of Values.

.2 By a lump sum cost acceptable to the University, based on the Contractor's detailed, itemized breakdown of the actual basic cost, with allowance for the Contractor's profit and overhead, as provided for under Subparagraph 12.1.5.

.3 By mutually agreeable Unit Prices for the actual cost, with allowance for the Contractor's profit and overhead, computed in a similar manner as provided for in Subparagraph 12.1.5.

.4 On the actual basic cost of the Change, as determined by payroll records and paid receipts, plus allowance for the Contractor's profit and overhead as provided for in Subparagraph 12.1.5, subject to a predetermined maximum amount.

12.1.4 The Contractor shall provide or perform additional work, make other Changes in the Work and comply with the provisions of a Change Order, the same as though the Changes had been a part of the original Contract Documents, when and as ordered in writing by the University.

12.1.5 Except for Unit Prices included in the Contract, and unless otherwise approved by the University, for proposed Changes in the Work the Contractor shall submit an itemized list of quantities with the applicable unit cost and extended price for each, in such form and detail as required by the University or Architect.

.1 As a minimum the detailed breakdown shall include and indicate the items enumerated below. Items (a) and (b) constitute the cost of labor and items (a), (b), (c) and (d) constitute the actual "basic costs" referred to under this Article 12.

(a) Actual labor costs, itemized by each trade involved showing the hourly rates for each. Labor rates shall be the same for extra and credit computations.

(b) Burden on labor, which shall be the actual costs of mandatory fringe benefits, taxes on labor, workmen's compensation, insurance on labor as affected by payroll, unemployment taxes, including FICA and FUTA.

(c) Actual quantities of material and equipment, with their actual unit costs.

(d) The cost of subcontracted work, computed in the same way as provided for under this Subparagraph 12.1.5.

(e) Overhead, profit or commission.

(f) Applicable sales tax on materials.

.2 The maximum that will be allowed for overhead, profit or commission shall be as follows, expressed as a percentage of the actual basic cost of the change. The percentages for profit, overhead and commission allowed by the University may be less, depending on the nature, extent or complexity of the change, where the percentage is not commensurate with the responsibility and administration involved (such as the Contractor merely processing a substantial Change Order to a Subcontractor) but in no event shall they exceed the following:

	Overhead	Profit	Commission
(a) To the Contractor and/or his Subcontractor for work performed with his own forces	10%	10%	---
(b) To the Contractor for work performed by other than his own forces	---	---	10%

.3 The burden on labor may be indicated as a dollar/cents addition to the hourly rate or may be expressed as a percentage of the extended hourly rate costs. If required by the University or Architect, the Contractor shall provide a detailed breakdown to justify the labor burden. The University reserves the right to reject any labor burden which is inconsistent with other similar contractors.

.4 Material costs shall be at the actual cost to the Contractor, or Subcontractor. Upon request, the Contractor (or Subcontractor) shall submit evidence to substantiate the costs. Materials shall be quoted at trade discount prices, with quantity discounts also applied where the quantities warrant. Cash or prompt payment discounts need not be credited. In any proposal with material credits, the credit shall be based on the actual Contract cost of the material (including trade and quantity discounts) less any charges actually incurred for handling or returning a material which has been delivered. No "cancellation" charge will be allowed when material has not been shipped.

.5 The percentages allowed for overhead, profit or commission under Clause 12.1.5.2 shall be deemed to include: (1) field and office supervision and administration, including the field superintendent and administrative foremen; (2) general insurance, except that listed as the labor burden; (3) use of small tools; (4) shop burden; (5) equipment rental (other than required additional hoisting equipment or required excavating equipment necessary solely as a result of the Change); (6) engineering and estimating costs; (7) performance (guaranty) bond; (8) cost of safety measures (including those imposed by OSHA); (9) shipping, drayage and demurrage; (10) and all other costs except those enumerated under Clause 12.1.5.1.

.6 Except for changes based on Unit Prices included in the Contract, cost changes shall be computed by determining the actual basic costs enumerated under Clause 12.1.5.1, to which the overhead may be added, then the profit figure may be added and finally adding the sales tax on materials.

.7 Subcontractors shall compute their costs in the same way and are subject to the same maximum percentages for overhead and profit. To the Subcontractor's price, the Contractor may add up to 10% commission.

.8 Not more than three percentages for overhead, profit and commission will be allowed. The mark-up on any part of the Work a Subcontractor subcontracts will be limited to one overhead figure and one profit figure, in addition to the Contractor's commission. The Subcontractor and Sub-subcontractor may divide the overhead and profit amount as they agree upon.

.9 For Changes involving extra cost by a Subcontractor and the Contractor, the commission shall be applied directly to the Subcontractor's price, with the overhead and profit figure applied only to the Work the Contractor performs with his own forces.

.10 For Changes involving both extra and credit amounts, the overhead and profit, or commission, shall be applied only to net difference where the extra exceeds the credit.

.11 For Changes resulting in a credit in the basic costs, a reasonable allowance for overhead, profit or commission shall be credited the Owner, as determined by the University. In general no credit for overhead, profit or commission will be required where the net change credit is minor or where the Change in Work indicates it is reasonable for no credit be allowed to the University. In the event of substantial subcontract credits, or for Work performed by the Contractor, a reasonable overhead, profit or commission credit shall be allowed to the University, in an amount acceptable to the University.

12.1.6 On Changes where the value or extent of Work cannot be reasonably pre-determined or agreed upon, the University, at its sole discretion, may

authorize Work to proceed on an agreed upon cost plus basis, not to exceed a pre-determined maximum amount. In such cases, the basic costs and mark-up for overhead, profit and commission will be in accordance with this Paragraph 12.1.

12.1.7 Unit Prices proposed on the bid form and included in the Contract are not subject to further profit, overhead or commission adjustments, nor the conditions of Subparagraph 12.1.5. The Contract Sum will be adjusted by the direct extension of the number of units and the Unit Prices.

12.1.8 The University may, at its discretion, initiate procedures for Modifications for Changes in the Work involving the Contract Sum, prior to preparation of a formal Change Order. Such Modifications shall be signed by authorized representatives of the University, shall be subject to the same conditions and cost proposals as Change Orders, shall order and authorize the Contractor to proceed with the Changes in the Work and shall have the same effect as a Change Order, except the Contract Sum or Contract Time will not be changed until the Modification has been incorporated in a subsequent Change Order.

12.1.9 Except in an emergency endangering life or property, the Contractor shall make no Changes in the Work affecting the Contract Sum or Contract Time unless in pursuance of a Change Order or other written order from the University, or from the Architect and approved by the University, whereby the scope of the change and the cost, or basis of payment, is agreed upon.

12.1.10 Should Contractor find during progress of the work that, in his judgment, existing conditions or requirements make desirable, or beneficial, a Modification in the Contract requirements, he shall promptly report such matters to University and Architect, in writing, for decision and instruction.

12.1.11 If Unit Prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed that application of the agreed unit prices to the quantities of Work proposed will create a hardship on the University or the Contractor, the applicable unit prices shall be equitably adjusted to prevent such hardship.

12.1.12 Should concealed or subsurface conditions encountered in the performance of the Work be at significant variance with the conditions indicated by the Contract Documents, or in other information available to the Contractor including his own investigations, or should a significant variance from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, be encountered, the University and the Architect shall be notified immediately before the conditions are disturbed. Upon the determination that a significant difference exists, such changes shall be made as determined to be necessary and the Contract Sum shall be equitably adjusted by Change Order upon claim by either party made within fourteen days after the first observance of the conditions.

12.2 University's Right to Perform Changes in the Work

12.2.1 If the University does not accept proposals of the Contractor for additional Work or Changes in the Work and no agreement is reached, or if

it does not seem advisable or expedient to proceed on the basis of the Contractor's proposal, the University reserves the right to perform additional Work or Changes in the Work with its own personnel or to employ others for Changes in the Work.

12.3 Claims for Additional Cost

12.3.1 If the Contractor wishes to make a claim for an increase in the Contract Sum, he shall give the University and the Architect written notice thereof within fourteen days after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor and approval to proceed issued prior to the Contractor proceeding to execute the Work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Subparagraph 10.3.1. No such claim shall be valid unless so made. Any change in the Contract Sum resulting from such claim shall be authorized by Change Order.

12.3.2 If the Contractor claims that additional cost is involved because of (1) any written interpretation issued pursuant to Subparagraph 1.2.5, (2) any written order for a minor change in the Work issued pursuant to Paragraph 12.4, the Contractor shall make such claim as provided in Subparagraph 12.3.1.

12.4 Minor Changes in the Work

12.4.1 The Architect and the University shall have authority to order minor changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents. The University and Architect also reserve right to make minor changes in dimensions, locations, arrangements, or details to accommodate changes in other materials and equipment, improve the Work or prevent unforeseen interference with structural or other features. Such changes shall be made without change in the Contract Sum.

ARTICLE 13 - UNCOVERING AND CORRECTION OF WORK

13.1 Uncovering of Work

13.1.1 If any Work should be installed or covered contrary to the provisions of the Contract Documents or request of the University or Architect, it must, if required by the University or Architect, be removed or uncovered for observation and replaced at the Contractor's expense. The Contractor shall give timely notice to the University and Architect of the readiness of work for observation.

13.1.2 If any other Work has been covered which the Contract Documents, University or Architect has not specifically requested to observe prior to being covered, the University or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work be found in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be paid by the University. If such Work be found not in accordance with the Contract Documents, the Contractor shall pay such costs unless it be found that this condition was caused by a separate contractor employed as provided in Article 6, and in

that event the separate contractor shall be responsible for the payment of such costs.

13.2 Correction of Work

13.2.1 The Contractor, all Subcontractors, and Subsubcontractors shall be bound by the conditions of this Paragraph 13.2. The Contractor shall promptly correct all Work rejected by the Architect or the University as defective or as failing to conform to the Contract Documents whether observed before or after Completion and whether or not fabricated, installed or completed, unless the University elects to accept the Work as provided for under 13.3. The Contractor shall bear all costs of correcting such rejected Work, including the cost of the Architect's additional services thereby made necessary. Work rejected before Final Completion shall be corrected prior to final payment.

13.2.2 If, within one year after date of Substantial Completion, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any of the Work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the University to do so unless the University has previously given the Contractor a written acceptance of such condition. The University shall give such notice promptly after discovery of the condition.

13.2.3 Except as provided under Subparagraph 13.2.5 the commencement of the specified guaranty or correction of Work periods covered by this Article, or any other special specified period, shall be the date of the inspection for Substantial Completion of the last unit, part or phase of the Work, except for any work then noted as incomplete or unsatisfactory. The guarantee period for said incomplete or unsatisfactory work shall start on the date of final correction or remedy and the acceptance of these features by the University. In the absence of specifically noted dates of inspection for Substantial Completion (or of acceptance, in writing, by the University of corrected work), the date of the final payment on the entire Contract will be the start of the guarantee period. Occupancy or use of the Work shall not be construed as commencing guarantee periods at any earlier date.

13.2.4 The specified correction of Work or general guarantee periods, or other special guarantees specified for other periods of time, or by law, shall not be limited by any warranty of a manufacturer, producer, supplier or Subcontractor or other source. The specified guarantees shall be provided by the Contractor, who shall make his own arrangements with the manufacturer, producer, supplier, Subcontractor or other source as he may choose. Where a manufacturer, producer, supplier or Subcontractor guarantees or provides warranties in excess of the general guarantees, the extended guarantees and warranties shall be passed to the University, the same as though they were specified under this Article 13.

13.2.5 Should special circumstances indicate an earlier commencement of guarantee or correction of Work periods than on Substantial Completion is reasonable for certain parts of the Work, in the opinion of the Architect or University, the University may consider such earlier start provided suitable credit is given the University. An earlier start of the periods

shall be only with the University's written approval of the time and acceptance of the credit by Change Order.

13.2.6 The expiration of any guarantee or correction of Work period shall not relieve the Contractor of the obligation to correct, at his own expense, any latent defect in the Work or deficiencies which are not readily ascertained, including but not limited to defective materials and workmanship, defects attributable to substitutions for specified materials, substandard performance or any of the Work otherwise not in compliance with the Contract Documents. Such latent defects or deficiencies shall be corrected as provided in this Paragraph 13.2. Following the correction or replacement of any of the Work, as above specified, the Contractor shall correct any defects or deficiencies in the corrected or replaced materials and workmanship, which is found within one year after the date of correction or replacement.

13.2.7 All such defective or non-conforming Work under Subparagraphs 13.2.1 and 13.2.2 shall be removed from the site if necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the University or Architect.

13.2.8 The Contractor shall bear the cost of making good all work of separate contractors destroyed or damaged by such removal or correction.

13.2.9 If the Contractor does not remove such defective or non-conforming Work within a reasonable time fixed by written notice from the University or the Architect, the University may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten days thereafter, the University may upon ten additional days' written notice sell such Work at auction or at a private sale and shall account for the net proceeds thereof, after deducting all the costs that should have been borne by the Contractor, including compensation for additional architectural services. If such proceeds of sale do not cover all costs which the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the University.

13.2.10 If the Contractor fails to correct such defective or non-conforming Work, the University may correct it in accordance with Paragraph 3.5.

13.3 Acceptance of Defective or Non-Conforming Work

13.3.1 If, in the opinion of the University, it is expedient, or in its best interest, or should the University choose to accept defective or non-conforming Work for convenience, it may do so instead of requiring the removal and correction, in which case a Change Order will be issued to reflect an appropriate reduction in the Contract Sum for the difference in value together with an allowance for damage or loss of quality. If the amount is determined after final payment, it shall be paid by the Contractor or his Surety. The amount shall be determined by the University.

ARTICLE 14 TERMINATION OF THE CONTRACT

14.1 Termination by the Contractor

14.1.1 If the Work is stopped for a period of thirty days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, or if the Work should be stopped for a period of thirty days by the Contractor for University's failure to make payment within 30 days after payment is due then the Contractor may, upon ten days' written notice to the University and the Architect, terminate the Contract and recover from the University payment for all Work executed and for any proven loss sustained upon any materials, equipment, tools, construction equipment and machinery, including reasonable profit. Such right to termination, however, shall not extend to material shortages as a result of market conditions, diminishing resources or other causes except a formally declared emergency specifically restricting or preventing the use of materials.

14.2 Termination by the University

14.2.1 If the Contractor is adjudged a bankrupt, or if he makes a general assignment for the benefit of his creditors, or if a receiver is appointed on account of his insolvency, or if he refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials to satisfactorily prosecute and complete the Work according to schedule and within the Contract Time, or if he fails to make prompt payment to Subcontractors or for materials or labor, or disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a substantial violation of a provision of the Contract Documents, then the University, with the advice of the Architect, may, without prejudice to any right or remedy and after giving the Contractor and his Surety seven days' written notice, require the Surety to promptly take over and complete the Work under the terms of the Contract. Should the Surety fail to assume the obligations of completing the Work within ten days after receipt of the written notice, the University may, upon seven days' additional notice, terminate the Contract (except the obligations under the Bond) and take possession of the site and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever method it may deem expedient. In such case the Contractor or his Surety shall not be entitled to receive any further payment until the Work is finished.

14.2.2 If the University completes the Work and the unpaid balance of the Contract Sum exceeds the costs of finishing the Work, including the University's additional costs, attorneys' costs and compensation for the Architect's additional services, an amount shall be paid to the Contractor only to the extent as will compensate him for the Work the Contractor actually performed, based on the actual basic costs as defined under Clause 12.1.5.1. If such cost for the University to complete the Work exceeds such unpaid balance, the Contractor or his Surety shall pay the

difference to the University. The costs incurred by the University as herein provided shall be certified by the University.

ARTICLE 15 - EQUAL EMPLOYMENT OPPORTUNITY

15.1 Non-Discrimination, Equal Employment Opportunity

15.1.1 Unless other Equal Employment Opportunity provisions are included in the Contract Documents, the Contractor shall comply with the University of Minnesota Construction Contract Non-Discrimination requirements of Subparagraphs 15.1.2 through 15.1.12 throughout the life of the Contract.

15.1.2 The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, or sex. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, national origin, or sex. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

15.1.3 The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the University of Minnesota setting forth the provisions of this non-discrimination clause.

15.1.4 The Contractor shall designate an Equal Employment Opportunity Officer, who shall have authority and responsibility for the implementation of equal employment opportunity and affirmative action programs under this Contract. The Contractor shall submit for approval a written copy of its program within fifteen (15) days after receipt of notice from the University of Minnesota.

15.1.5 The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, national origin, or sex.

15.1.6 The Contractor shall send to each labor union or representative of workers with which he has a collective bargaining agreement or other contracts or understanding, a notice to be provided by the University of Minnesota advising the labor union or workers' representatives of the Contractor's commitments under this policy and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

15.1.7 The Contractor shall be required to give evidence of persistent and prolonged efforts to increase the number of minority group employees. The Contractor shall make maximum use of apprentices to develop qualified minority personnel. The Contractor shall seek to fill labor shortages for apprentices and skilled journeymen by upgrading present employees including qualified minority employees.

15.1.8 The Contractor shall furnish to the University of Minnesota information and periodic reports necessary to substantiate his compliance with the requirements of this policy during the duration of the Contract. These reports shall include an appraisal of the effectiveness of the Contractor's equal employment opportunity and affirmative action programs, and shall list any factors and conditions which impede, restrict, or account for less than complete success of the program. The Contractor shall permit access to his books, records, and accounts by the University of Minnesota for purposes of investigation to ascertain compliance with these provisions.

15.1.9 Non-compliance with any requirements of these provisions shall be a breech of a condition of the Contract and will afford the University any and all rights otherwise described under the terms of the contract as applying to the breach of condition.

15.1.10 The Contractor shall include the provisions of Subparagraphs 15.1.2 through 15.1.10 in every subcontract, unless exempted by the provisions of this policy, so that provisions will be binding on each Subcontractor. The Contractor shall take such action as may be required to enforce such provisions.

15.1.11 Contracts and subcontracts not exceeding $10,000 are exempt from the reporting requirements of this Article.

15.1.12 Except in the case of subcontracts for the performance of construction work at the site of construction, provisions of Subparagraphs 15.1.2 through 15.1.10 shall not be required to be inserted in subcontracts below the second tier.

ARTICLE 16 - WAGE RATES

16.1 Minimum Wage Rates

16.1.1 Unless other Wage Rates are included in the Contract Documents, the Contractor shall comply with the provisions of Subparagraph 16.1.2. If other Wage Rates are included in the Contract Documents, such other rates that are higher than required under Subparagraph 16.1.2 shall be paid by the Contractor for labor on the Work.

16.1.2 For any Contract for construction, alteration, or repair of University buildings or other major structures, financed in whole or in part by State appropriation and which exceeds $2,500 in total cost, the Contractor and his Subcontractors shall pay to their respective laborers and mechanics employed directly on the Work at the site at least the wage rate then prevailing in the area of the Project. The term "prevailing wage rate" shall mean the wage paid to the largest number of those employed in the same class of labor in the labor market area, as determined by the University.

16.1.3 By requiring the Contractor to pay the wages under Subparagraph 16.1.2, or to pay any other minimum wage rates, neither the University nor the Architect represent that labor may be employed at the minimum hourly wage called for. The Contractor shall investigate and verify the conditions at the location of the Work, to satisfy himself as to the availability and cost of labor required to perform the Work.

16.1.4 The Contractor shall examine any wage rate schedule included in the Contract Documents for completeness or accuracy. Should any trade which will be used for the Work be omitted, or any wage rate shown be incorrect from prevailing wages of the area, such omission and discrepancies shall be reported to the University for determination. If necessary, the Contractor shall assist in obtaining decisions on incorrect or missing rates.

ARTICLE 17 - DHEW REQUIREMENTS FOR FEDERALLY ASSISTED CONSTRUCTION CONTRACTS

17.1 Equal Opportunity

17.1.1 During the performance of this contract the Contractor agrees as follows:

.1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by an appropriate agency of the Federal Government setting forth the requirements of these non-discrimation provisions.

.2 The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

.3 The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided advising the labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

.4 The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965 and of the rules, regulations and relevant orders of the Secretary of Labor.

.5 The Contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books,records,

and accounts by an appropriate agency of the Federal Government and by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

.6 In the event of the contractor's noncompliance with the equal opportunity conditions of this contract or with any of such rules, regulations or orders, this contract may be cancelled, terminated or suspended in whole or in part, and the Contractor may be declared ineligible for further Government contracts, or Federally Assisted Contracts, in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

.7 The Contractor will include all of clauses of 17.1.1.1 through 17.1.1.7 inclusive in every subcontract or purchase order, unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontractor or vendor as the appropriate agency of the Federal Government may direct as a means of enforcing such provisions, including sanctions for noncompliance: provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the appropriate agency of the Federal Government, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

17.1.2 Exemptions to the requirements of the above Equal Opportunity conditions are contracts and subcontracts not exceeding $10,000, and contracts and subcontracts with regard to work performed outside the United States by employees who were not recruited in the United States.

17.1.3 Unless otherwise provided, the above Equal Opportunity provisions are not required to be inserted in subcontracts except for subcontracts involving the performance of construction work at the site of construction, in which case the provisions must be inserted in all such subcontracts.

17.2 Prevailing Wages

17.2.1 All mechanics and laborers employed or working directly upon the site of the work shall be paid unconditionally, and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Copeland Regulations [29 Code of Federal Regulations, Part 3]), the full amounts due at time of payment computed at wage rates not less than the aggregate of the basic hourly rates and the rates of payments, contributions, or costs for any fringe benefits contained in the wage determination decision of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor or Subcontractor and such laborers and mechanics, and the

wage determination decision shall be posted by the Contractor at the site of the work in a prominent place where it can easily be seen by the workers.

17.2.2 The Contractor may discharge his obligation under subparagraph 17.2.1 to workers in any classification for which the wage determination decision contains:

.1 Only a basic hourly rate of pay, by making payment not less than such basic hourly rate, except as otherwise provided in the Copeland Regulations (29 CFR, Part 3); or

.2 Both a basic hourly rate of pay and fringe benefit payments, by making payment in cash, by irrevocably making contributions pursuant to a fund, plan or program for and/or by assuming an enforceable commitment to bear the cost of bona fide fringe benefits contemplated by the Davis-Bacon Act, or by any combination thereof. These fringe benefit payments can be discharged only by making contributions to the same type or types of fringe benefits listed in the applicable determination. Contributions made, or costs assumed, on other than a weekly basis shall be considered as having been constructively made or assumed during a weekly period to the extent that they apply to such period. Where a fringe benefit is expressed in a wage determination in any manner other than as an hourly rate and the contractor pays a cash equivalent or provided an alternative fringe benefit, he shall furnish information with his payrolls showing how he determined that the cost incurred to make the cash payment or to provide the alternative fringe benefit is equal to the cost of the wage determination fringe benefit. In the event of disagreement between or among the interested parties as to an equivalent of any fringe benefit, the owner shall submit the question together with his recommendation through the appropriate Federal agency to the Secretary of Labor for final determination.

17.2.3 The assumption of an enforceable commitment to bear the cost of fringe benefits listed in the wage determination decision forming a part of the contract may be considered as payment of wages only with the approval of the Secretary of Labor pursuant to a written request by the Contractor. The Secretary of Labor may require the Contractor to set aside assets, in a separate account, to meet his obligations under any unfunded plan or program.

17.2.4 The owner shall require that any class of laborers or mechanics which is not listed in the wager determination and which is to be employed under the contract shall be classified or reclassifed conformably to the wage determination and a report of the action taken shall be sent to the appropriate Federal agency. If the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers or mechanics to be used, the owner shall submit the question together with his recommendations through the appropriate Federal agency to the Secretary of Labor for final determination.

17.2.5 In the event it is found by the owner that any laborer or mechanic employed by the Contractor or any Subcontractor directly on the site of the work has been or is being paid at a rate of wages less than the rate

of wages required by subparagraph 17.2.1, the owner may (a) by written notice to the prime contractor terminate his right to proceed with the work, or such part of the work as to which there has been a failure to pay said required wages, and (b) prosecute the work to completion by contract or otherwise, whereupon such Contractor and his sureties shall be liable to the owner for any excess costs occasioned the owner thereby.

17.3 Contract Work Hours and Safety Standards Act - Overtime Compensation (40 United States Code 327-330)

17.3.1 The Contractor shall not require or permit any laborer or mechanic in any work-week in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such work-week on work subject to the provisions of the Contract Work Hours and Safety Standards Act unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such work-week, whichever is the greater number of overtime hours. The "basic rate of pay" as used in this provision shall be the amount paid per hour, exclusive of the Contractor's contribution or cost for fringe benefits, and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

17.3.2 In the event of any violation of the provisions of subparagraph 17.3.1, the Contractor shall be liable to any affected employee for any amounts due and to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of subparagraph 17.3.1, in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard work-week of 40 hours without payment of the overtime wages required by subparagraph 17.3.1.

17.3.3 The Contractor shall not require or permit any laborer or mechanic employed in the performance of this contract to work in surroundings or under conditions which are unsanitary, hazardous, or dangerous to his health as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation (29 CFR Part 1518, 36 F.R. 7340, April 17, 1971) pursuant to Section 107 of the Contract Work Hours and Safety Standards Act.

17.4 Apprentices

17.4.1 Apprentices shall be permitted to work as such only when they are registered individually under a bona fide apprenticeship program registered with a State apprenticeship agency which is recognized by the Bureau of Apprenticeship and Training, U. S. Department of Labor or, if no such recognized agency exists in a State, under a program registered with the aforesaid Bureau of Apprenticeship and Training. The allowable ratio of apprentices to journeymen in any craft classification shall not be greater than the ratio permitted to the Contractor as to his entire work force under the registered program. Any employee listed on a payroll at any apprentice wage rate, who is not registered as above, shall be paid the wage rate determined by the Secretary of Labor for the classification of work he actually performed.

17.4.2 The Contractor shall furnish written evidence of the registration of his program and apprentices, the ratios allowed and the wage rates required to be paid thereunder for the area of construction prior to using any apprentice in the contract work.

17.5 Payrolls and Basic Records

17.5.1 The Contractor shall maintain payrolls and basic records relating thereto during the course of the work and shall preserve for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name and address of each employee, his correct classification, rate of pay (including rates of contributions for, or costs assumed to provide, fringe benefits), daily and weekly number of hours worked, deductions, made and actual wages paid. Whenever the Contractor has obtained approval from the Secretary of Labor as provided in subparagraph 17.2.3, he shall maintain records which show the commitment, its approval, written communication of the plan or program to the laborers or mechanics affected, and the costs anticipated or incurred under the plan or program.

17.5.2 The Contractor shall submit weekly a copy of all payrolls to the Owner. The Prime Contractor shall be responsible for the submission of copies of payrolls of all subcontractors. Each such copy shall be accompanied by a statement signed by the Contractor indicating that the payrolls are correct and complete, that the wage rates contained therein are not less than those determined by the Secretary of Labor, and that the classifications set forth for each laborer or mechanic conform with the work he performed. Submission of the "Weekly Statement of Compliance" required under this contract and the Copeland Regulations of the Secretary of Labor (29 CFR, Part 3) shall satisfy the requirement for submission of the above statement. The Contractor shall submit also a copy of any approval by the Secretary of Labor with respect to fringe benefits

17.5.3 The Contractor shall make the records required under subparagraphs 17.5.1 and 17.5.2 available for inspection by authorized representatives of the owner, the State, the appropriate Federal agency and the U. S. Department of Labor, and shall permit such representatives to interview employees during working hours on the job.

17.6 Compliance With Copeland Regulations

17.6.1 The Contractor shall comply with the Copeland Regulations of the Secretary of Labor (29 CFR, Part 3) which are incorporated herein by reference. In addition, the Weekly Statement of Compliance required by these regulations shall also contain a statement that the fringe benefits paid are equal to or greater than those set forth in the minimum wage decision.

17.7 Withholding of Funds

17.7.1 The Owner may withhold or cause to be withheld from the Prime Contractor so much of the accrued payments or advances as may be considered ecessary (a) to pay the laborers and mechanics employed by the Contractor or any Subcontractor on the work the full amount of wages required by the contract, and (b) to satisfy any liability of any Contractor for liquidated damages under paragraph 17.3 hereof entitled "Contract Work Hours and Safety Standards Act - Overtime Compensation (40 USC 327-330)".

17.7.2 If the Contractor or any Subcontractor fails to pay any laborer or mechanic employed or working on the site of the work, all or part of the wages required by the Contract, the owner may, after written notice to the Prime Contractor, take such action as may be necessary to cause suspension of any further payments or advances until such violations have ceased.

17.8 Subcontracts

17.8.1 The Contractor will insert in all subcontracts paragraph 17.2 through 17.9 inclusive, respectively entitled "Prevailing Wages", "Contract Work Hours and Safety Standards Act - Overtime Compensation (40 USC 327-330)", "Apprentices", "Payrolls and Basic Records", "Compliance with Copeland Regulations", "Withholding of Funds", "Subcontracts" and "Contract Termination - Debarment", and shall further require all subcontractors to incorporate physically these same paragraphs in all subcontracts.

17.8.2 The term "Contractor" as used in such paragraphs in any subcontract shall be deemed to refer to the subcontractor except when the phrase "Prime Contractor" is used.

17.9 Contract Termination - Debarment

17.9.1 A breach of paragraphs 17.2 through 17.8 inclusive, respectively entitled "Prevailing Wages", "Contract Work Hours and Safety Standards Act - Overtime Compensation (40 USC 327-330)", "Apprentices" "Payrolls and Basic Records", "Compliance with Copeland Regulations", "Withholding of Funds" and "Subcontracts", may be grounds for termination of the contract and for debarment as provided in 29 CFR 5.6.

17.10 Certification of Nonsegregated Facilities
(Applicable to contracts and subcontracts exceeding $10,000 which are not exempt from the provisions of Paragraph 17.1 "Equal Opportunity" of this Article.)

17.10.1 By entering an agreement related to the work described in the Contract Documents the Contractor or Subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The Contractor and Subcontractor further certifies that he will not maintain or provide for his employees any segregated facilities at any of his establishments and that he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The Contractor or Subcontractor agrees that a breach of this certification is a violation of paragraph 17.1 "Equal Opportunity". As used herein, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities, provided for employees on the basis of race, creed, color, or national origin, because of habit, local custom or otherwise. The Contractor further agrees that (except where he has obtained identical certifications from proposed subcontractors

for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from this provisions of paragraph 17.1 "Equal Opportunity"; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

"NOTICE TO PROSPECTIVE SUBCONTRACTORS
OF REQUIREMENT FOR CERTIFICATIONS OF
NONSEGREGATED FACILITIES"

A certification of nonsegregated facilities, as required by the May 9, 1967, order (32 Federal Register 7439, May 19, 1967) on elimination of segregated facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of paragraph 17.1 "Equal Opportunity". This certification may be submitted either for each subcontract or for all subcontracts during a period, i.e. quarterly, semi-annually or annually.

17.10.2 The penalty for making false statements in certifications required by subparagraph 17.10.1 is prescribed in 18 USC 1001.

17.11 Disqualified Subcontractors

17.11.1 The Contractor may utilize the services of only those Subcontractors who have not been disqualified under existing Federal laws and regulations from participating in Federally assisted construction projects.

17.12 Federal Inspection

17.12.1 The authorized representatives and agents of the Federal Government shall be permitted to inspect all Work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

- - -

SUPERSEDEAS DECISION

STATE: Minnesota COUNTIES: See Below
DECISION NUMBER: MN76-2001 DATE: Date of Publication
Supersedes Decision No. AR-3164, dated November 8, 1974 in 39 FR 39705.
DESCRIPTION OF WORK: Building (Including Residential), Construction.

COUNTIES: Anoka, Carver, Hennepin, Scott, Dakota, Ramsey & Washington

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
ASBESTOS WORKERS	$9.02	.51	.65		.02
BOILERMAKERS	9.45	.60	1.00		.02
BOILERMAKERS' HELPERS	9.20	.60	1.00		.02
BRICKLAYERS & STONEMASONS	9.62	.555	.33		
CARPENTERS:					
Building:					
S.W. Portion of Scott County	9.15	.40			.02
Remainder of Scott County	8.21	.40	.30	.50	.02
Carpenters; Millwrights and Piledrivermen:					
Remainder of Counties	8.21	.40	.30	.50	.02
Soft Floor Layers	8.25	.46	.34	.45	.02
Site Preparation, Excavation & Incidental Paving					
Carpenters & Piledrivermen	8.21	.40	.30	.50	.02
CEMENT MASONS:					
Building, Site Preparation, Excavation & Incidental Paving	9.28	.40	.40		
ELECTRICIANS:					
Building					
Twps. of Anoka & Fridley in Anoka County	9.60	6½%	4%	9%	1½%
Remainder of Anoka County & Remaining Counties	9.68	6½%	3%	10%	1%
Residential					
Carver, Hennepin & Scott Cos; Twps. of Anoka, Fridley, Grow & Ramsey in Anoka County: Construction of all new family dwellings up to & including 4-plexes; and to all residential remodeling, rewiring & repairing except that any single apartment project including a change of main service entrance shall not exceed 8 living units or 400 amps.	6.00	.36	1%	.27	1%

PAGE 2

DECISION NO. MN76-2001

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
ELECTRICIANS (CONT'D)					
Dakota, Ramsey, Washington Counties & Remainder of Anoka County: Construction of all new family dwellings up to & including 4-plexes, townhouses of 4 or less contiguous units; and to all residential remodeling, rewiring & repairing except that any single apartment project including a change of main service entrance shall not exceed 8 living units or 400 amps.	$6.00	.36	1%	.27	½ of 1%
ELEVATOR CONSTRUCTORS:					
Elevator Constructors	8.75	.445	.29	3%+a	.02
Helpers	70%JR	.445	.29	3%+a	.02
Helpers (Prob.)	50%JR				
IRONWORKERS	9.60	.55	.55		.02
LATHERS:					
Anoka; Carver & Hennepin Cos.	8.72	.31	.35		.01
Washington; Dakota & Ramsey Cos.	8.51	.50	.40	.81	.01
MARBLE SETTERS	8.535	.455	.23	.56	
TERRAZZO WORKERS	8.46	.30	.25		
TILE SETTERS	8.59	.37	.50		
MARBLE & TILE HELPERS	7.69	.37			
PAINTERS:					
Dakota, Ramsey & Washington Cos:					
Brush	8.43	.45	.25		.06
Structural Steel & Spray	8.93	.45	.25		.06
Remaining Counties:					
Brush	8.98	.35	.25		.04
Structural Steel & Spray	9.48	.35	.25		.04
PLASTERERS:					
Dakota, Ramsey & Washington Cos.	8.92	.50	.25	.65	.01
Remaining Counties	8.88	.45	.20		.01

DECISION NO. 1976-2001

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
PLUMBERS:					
Plumbers, Steamfitters & Pipefitters:					
Dakota, Ramsey & Washington Cos.	$8.67	.38	.50	1.52	.06
Plumbers & Steamfitters & P/F Remaining Counties:					
Plumbers	7.73	.38	.45	1.25	.03
Steamfitters & Pipefitters	8.13	.38	.50	1.25	.03
ROOFERS	9.19	.64	.25		.03
SHEET METAL WORKERS:					
Dakota, Ramsey & Washington Cos.	9.53	.47	.55		.02
Remaining Counties	9.63	.42	.50		.06
SPRINKLER FITTERS	8.79	.40	.60		.02
Welders - receive rate prescribed for craft performing operation to which welding is incidental.					

PAID HOLIDAYS:

A-New Years Day; B-Memorial Day; C-Independence Day; D-Labor Day; E-Thanksgiving Day; F-Christmas Day.

FOOTNOTE:

a-Employer contributes 4% Basic Hourly Rate for over 5 years service, 2% Basic Hourly Rate for 6 months, to 5 years as Vacation Pay Credit; 6 Paid Holidays A through F.

DECISION NO. 1976-2001

SITE PREPARATION, EXCAVATION & INCIDENTAL PAVING

LABORERS

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
CLASS 1	$ 7.30	.40	.45	.40	
CLASS 2	7.40	.40	.45	.40	
CLASS 3	7.45	.40	.45	.40	
CLASS 4	7.55	.40	.45	.40	
CLASS 5	7.60	.40	.45	.40	
CLASS 6	7.65	.40	.45	.40	
CLASS 7	7.70	.40	.45	.40	
CLASS 8	7.73	.40	.45	.40	
CLASS 9	7.75	.40	.45	.40	
CLASS 10	7.93	.40	.45	.40	
CLASS 11	7.98	.40	.45	.40	

CLASS 1 Unskilled Laborer; Drill Runner Helper; Landscape Gardener, Sod Layer & Nurseryman; Powder Monkey; Rein. Steel Lab., Rein. Steel Setter Salamander Heater & Blower Tender Carpenter Tender; Winch Handler

CLASS 2 Laborer, Wrecking & Demolition; Bit Batcherman (Stationary Plant); Bit Shoveler; Blacksmith Helper; Bottom Man (sewer, Water or Gas Trench); Bricklayer Tender; Cement Handler; Cement Coverman (Batch Trucks); Compaction Equip. Shoveler; Batchermen Conc., Conc. Vibrator Tamper & Puddler (Paving) Conc. Longitudinal Floatman; Conduit Layer (w.o. wiring); Chipping Hammer; Curb Setter (Stone or Precast Conc.) Kettleman (Bit. or Lead); Service connection maker; Power Buggy; Joint Sawer; Squeeze man (Bit. Brick or Block); Stabilizing batcherman (Stationary Plant); Stonemasons tender; Drill Runner (Heavy, including Churn Drill)

CLASS 3 Chainsaw Man; Conc. Mixer (1 bag); Jackhammer Man & Paving Buster; Mortar Mixer; Pipe Handler; Pipe Derrickman (Tripod, manual)

CLASS 4 Bottom Man (Sewer, Water or Gas Trench, more than 8' below starting level of manual work); Tunnel Laborer (Atmospheric pressure) Underpinning Work; Caisson Work; Other work more than 8' below level of manual work; Open Ditch Work

DECISION NO. MN76-2001

LABORERS (CONTD)

CLASS 5 Bituminous Tamper; Pipelayers; Sand Cushion & Bedmaker
CLASS 6 Cement Gun (1½ & over); Leadman
CLASS 7 Bricklayer (Concrete)
CLASS 8 Brick or Block Paving Setter
CLASS 9 Bituminous Raker, Plaster & Utility Man
CLASS 10 Tunnel Man (Air Pressure); Tunnel Miner
CLASS 11 Foreman

MINN-62-TD					
TRUCK DRIVERS: BUILDING, SITE PREPARATION, EXCAVATION & INDUSTRIAL, PAVING	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
GROUP 1	$ 8.25	.35	.45		
GROUP 2	7.95	.35	.45		
GROUP 3	7.85	.35	.45		
GROUP 4	7.65	.35	.45		

GROUP 1
Driver (Hauling machinery for employer's own use, including operation of hand & power operated winches); Truck train Mechanic; Welder; Tractor-Trailer; Off-Road Truck.

GROUP 2
Tri-Axle (including 4-Axles); Dump Dry Batch Hauler; Tank Truck (Gas, Oil, Road Oil & Water); Boom & "A" Frame; Ready Mix Concrete; Slurry Driver.

GROUP 3
Bituminous Distributor; Bituminous Distributor (1-Man Operation); Tandem Axle.

GROUP 4
Bituminous Distributor Spray (rear-end oiler); Dumpman; Greaser & Truck Servicemen; Tank Truck Helper (Gas, Oil, Road Oil & Water) Teamster and Stableman; Tractor Operator (Wheel Type used for any purpose) Pilot car driver; Self Propelled Packer; Slurry Operator; Single Axle Trucks.

DECISION NO. MN76-2001

MINN-1-PEO-1

POWER EQUIPMENT OPERATORS: BUILDING	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Appr. Tr.
CLASS 1	$12.85	.45	.35		
CLASS 2	10.45	.45	.35		
CLASS 3	10.10	.45	.35		
CLASS 4	10.00	.45	.35		
CLASS 5	9.90	.45	.35		
CLASS 6	9.65	.45	.35		
CLASS 7	9.53	.45	.35		
CLASS 8	9.45	.45	.35		
CLASS 9	9.18	.45	.35		
CLASS 10	8.90	.45	.35		
CLASS 11	8.45	.45	.35		

POWER EQUIPMENT OPERATORS: BUILDING

CLASS 1-Helicopter Operators (Hoisting Material)
CLASS 2-Truck & Crawler Cranes with 200' of Boom & over including Jib
CLASS 3-Truck & Crawler Cranes with 150' of Boom up to & not including 200' of Boom including jib.
CLASS 4-Traveling Tower Crane
CLASS 5-Master Mechanic
CLASS 6-Derrick (Guy & Stiff Leg); Hoist Engineer (3 drums or more); Locomotive Operator; Overhead Crane Operator, (Inside Building Perimeter); Truck & Crawler Cranes up to 150' of Boom including jib.
CLASS 7-Air Compressor Operator; Pump Operator & or Conveyor; 2 or more Mechanics; Hoist Engineer (2 drums); Mechanic or Welder; Pumperete or Complaco Type Machine Operator; Fork Lift Operator
CLASS 8-Boom Truck Operator; Concrete Mixer Operator; Drill Rigs (Heavy Duty Rotary or Churn Drill when used for caisson drillin or when drilling for elevator cylinder on Building Construction; Front End Loader Opr; Hoist Engineer (1 drum); Power Plant Engineer (100 KWH & over); Straddle carrier Operator; Tractor Operator (Over D-2); Well Point Pump Operator
CLASS 9-Concrete Batch Plant Operator; Gunnite Operator; Tractor Operator (D-2 or similar size & Front End Loader Operator-up to ½ cu. yd.)
CLASS 10-Air Compressor Operator; Pump & or Conveyor Operator; Fireman-Temporary Heat; Brakemen; Pick Up Sweeper (combustion engine operated); Truck Crane Oiler
CLASS 11-Mechanic Space Heater (Temporary Heat) Oiler or Greaser

DECISION NO MN76-2001

MIDL-TM-PEO-2-3

SITE PREPARATION, EXCAVATION & BITUMINOUS PAVING LAYER EQUIPMENT OPERATORS:	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
GROUP 1	$12.95	.45	.35		
GROUP 2	9.66	.45	.35		
GROUP 3	9.40	.45	.35		
GROUP 4	9.27	.45	.35		
GROUP 5	9.18	.45	.35		
GROUP 6	8.50	.45	.35		
GROUP 7	8.20	.45	.35		

GROUP 1 Helicopter Pilot
GROUP 2 Crane with over 135' Boom, excluding jib, Dragline and/or other similar equipment w/shovel type controls 3 cu. yds. & over Mfg. rated capacity
GROUP 3 Cableway op., Concrete Mixer, Stationary Plant over 34E, Derrick, Dragline and/or other similar equipment with shovel type controls up to 3 cu. yds. Mfg. rated capacity, Dredge Operator or Engineer, Dredge Oper. (power) & Engineer, Front End Loader Op., 5 cy. yds. & over, Grader or Motor Patrol, Finishing earthowrk & bituminous, Locomotive Crane Operator, Master Mechanic, Mixer (Paving) Concrete Paving Op., Road Mole., Op., incl. power supply, Mucking Mach., incl. mucking operations Conway or similar type, Refrigeration Plant Engineer, Tandem Scraper, Tractor Op. (Boom Type), Truck Crane Op., Tugboat Op. 100 HP & over
GROUP 4 Dual Tractor Op., Elevating Grader Op., Pumpcrete Op., Scraper, Struck Capacity 32 cu. yd. & over, Self-Propelled. Traveling Soil Stabilizer
GROUP 5 Air track Rock Drill, Asphalt Bituminous Stabilizer Plant Op., Crushing Plant Op., or Gravel Washing, Crushing and Screening Plant Op., Dope Machine Op., Drill Rigs, Heavy Rotary or Churn or Cable Drill, Engineer in charge of Plant requiring First Class License, Fork Lift or Straddle Carrier Op., Fork Lift or Lumber Stacker, Front End Loader Op., Loader Op., over 1 cu. yds., Hoist Engineer, Hydrualic Tree Planter, Launcherman, Locomotive, all types, Mechanic or welder, Multiple machines, such as air compressors, welding machines, generators, pumps or crane oilers, paving breaker or tamping machines op., (power-driven - Mighty might or similar type, Pick-up sweeper, 1 cu. yd. & over Hopper capacity, Pipeline wrapping, cleaning or bending machine actuated horizontal boring mach., over 6" op., pugmill op., roller, 8 tons & over, Rubber tired farm tractor, backhoe att., sheep foot op., tie tamper & ballast mach. Op., tractor op., over D2, TD6 or similar HP with power take-off, tractor Op., over 50 HP without power take-off, trenching machine Op., (sewer, water, gas) turnapull op., (or similar type) well point installation, dismatling or repair mechanic

DECISION NO MN76-2001

POWER EQUIPMENT OPERATORS: (CONT'D)

GROUP 6 Air compressor Op. 375 CFR or over, bituminous spreader and bituminous finishing machine op., concrete dist. and spreader op., finishing machine longitudinal float op., joint mach. op., spray op., concrete mixer op. 14S and under, concrete op. (Malt. Blade), curb mach. op., Fine grade Op., form trench digger, front end loader op. (up to & incl. 1 cu. yd.), grader op. (motar patrol), gunit op. gunall, lead greaser on truck or rack, leader op., power actuated Augers and boring mach. op. power actuated jacks op., pump op., toller op., self-propelled chip spreader, shouldering mach. Op., stump chipper op., tractor op. (D2, TD6 or similar HP with power take-off
GROUP 7 Brakeman, switchman, conveyor op., deckhand, Fireman, Tank Car Heater op., Gravel screening plant op., greaser leverman, mech. helper, mech. space heater, oiler, self-prop. vib. packer op., sheep foot roller, tractor op. 50 HP or less w/o power take-off, truck crane oiler

MIDL-27-LAB-1

LABORERS: BUILDING CONSTRUCTION	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
CLASS 1	$ 7.35	.40	.35	.40	
CLASS 2	7.40	.40	.35	.40	
CLASS 3	7.45	.40	.35	.40	
CLASS 4	7.50	.40	.35	.40	
CLASS 5	7.60	.40	.35	.40	
CLASS 6	7.65	.40	.35	.40	
CLASS 7	7.70	.40	.35	.40	
CLASS 8	7.75	.40	.35	.40	
CLASS 9	8.055	.40	.35	.40	

CLASS 1 - Common Laborer; Steel joist handler (erection); Power Buggy Operator; Carpenter Tender; Earth Dumpman; Flagman
CLASS 2 - Reinforced Steel Handler
CLASS 3 - Men handling cement 2 hours per day (Bulk or Sack; excluding Mortar Mixer; Mason Tender; Concrete Joint Saw Operator; Demolition & Wrecking Laborer.
CLASS 4 - Hot tar caulker & corker; Laborers on swing stage line scaffold (excl. "patent" scaffolding); Automatic Tamper Operator; Chipping Hammer Operator; Paving Buster; Mortar; Concrete Vibrator Operator; Sheeting Setter & Driver on Heavy Building; Excavation; Jackhammer Men.
CLASS 5 - Underground Work
CLASS 6 - Pipelayer
CLASS 7 - Caisson Work; Underpinning
CLASS 8 - Nozzlemen
CLASS 9 - Dynamite Men; Power for Blasting purposes

MODIFICATIONS P. 1

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
DECISION #AL75-1063 - Mod. #4 (40 FR 2494 - June 30, 1975) Madison County, Alabama					
CHANGE:					
Electricians; Linemen	$8.75	.40	1%		1%
DECISION # GA75-1005 - Mod. #6 (40 FR 3091 - January 17, 1975 Richmond County, Georgia					
Change:					
Sheet Metal Workers	7.14				.04
DECISION #MN76-2001- Mod. #1 (41 FR 2551 - January 16, 1976) Anoka, Carver, Hennepin, Scott Dakota, Ramsey & Washington Counties, Minnesota					
CHANGE:					
Electricians:					
Building					
Hennepin & Scott Cos; Anoka & Fridley Twps. in Anoka County	$9.60	6½%	4%	9%	1½%
Remainder of Anoka & Remaining Counties	9.68	5½%	3%	10½%	1%

MODIFICATIONS P. 2

	Basic Hourly Rates	Fringe Benefit Payments			
		H & W	Pensions	Vac. ion	Education and/or Appr. Tr.
DECISION NO. MT76-5006 - Mod. #1 (41 FR 2555 - January 16, 1976) Statewide, Montana					
Change:					
Plasterers: Carter, Custer, Dawson, Fallon, Powder River, Prairie, Richland, Rosebud and Wibaux Counties	$ 7.50				
Plumbers: Blaine, Cascade, Chouteau, Fergus, Glacier, Hill, Judith-Basin, Liberty, McCone, Meagher, Phillips, Pondera, Roosevelt, Teton, Toole and Valley Counties	9.60	.40	.70		1%

DECISION #MN76-2001 - Mod. #8
(41 FR 2551 - January 16, 1976)
Anoka, Carver, Hennepin, Scott, Dakota, Ramsey & Washington Counties, Minnesota

CHANGE:
Laborers:
Building Construction

MDRN-27-IAB-1

LABORERS: BUILDING CONSTRUCTION	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
CLASS 1	$ 7.35	.40	.45	.40	
CLASS 2	7.40	.40	.45	.40	
CLASS 3	7.45	.40	.45	.40	
CLASS 4	7.50	.40	.45	.40	
CLASS 5	7.60	.40	.45	.40	
CLASS 6	7.65	.40	.45	.40	
CLASS 7	7.70	.40	.45	.40	
CLASS 8	7.75	.40	.45	.40	
CLASS 9	8.055	.40	.45	.40	

CLASS 1 - Common Laborer; Steel joist handler (erection); Power Buggy Operator; Carpenter Tender; Earth Dumpman; Flagman
CLASS 2 - Reinforced Steel Handler
CLASS 3 - Men handling cement 2 hours per day (Bulk or Sack; excluding Mortar Mixer; Mason Tender; Concrete Joint Saw Operator; Demolition & Wrecking Laborer.
CLASS 4 - Hot tar caulker & corker; Laborers on swing stage line scaffold (excl. "patent" scaffolding); Automatic Tamper Operator; Chipping Hammer Operator; Paving Buster; Mortar, Concrete Vibrator Operator; Shooting Setter & Driver on Heavy Building; Excavation; Jackhammer Men.
CLASS 5 - Underground Work
CLASS 6 - Pipelayer.
CLASS 7 - Caisson Work; Underpinning
CLASS 8 - Nozzlemen
CLASS 9 - Dynamite Men; Power for Blasting purposes

DECISION #NJ75-3049 - Mod. #6
(40 FR 26219 - June 20, 1975)
Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Monmouth, Ocean & Salem Counties, New Jersey

Change:
Carpenters, Millwrights & Insulators:
Zone 2

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
Carpenters & Insulators	$10.22	7%	7%		.2 of 1%
Millwrights	10.47	7%	7%		.2 of 1%

DECISION #IL76-2048 - Mod. #1
(41 FR 15[illegible] - April 16, 1976)
Alexander, Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Johnson, Marion, Massac, Perry, Pope, Pulaski, Saline, Union, White & Williamson Counties, Illinois

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
ADD:					
Under Carpenters:					
Hamilton, Jefferson & White Counties:					
Carpenters, Piledrivermen & Soft Floor Layers	$8.66	.45	.50		.02
Millwrights	9.01	.45	.50		.02
Remainder of Counties:					
Carpenters, Piledrivermen, Millwrights & Soft Floor Layers	8.85	.35	.45		.02
CHANGE:					
Truck Drivers:					
Group I	9.60	.55	a14.00		
Group II	10.00	.55	a14.00		
Group III	10.20	.55	a14.00		

DECISION #IL76-2001 - Mod. #3
(41 FR 2551 - January 16, 1976)
Anoka, Carver, Hennepin, Scott, Dakota, Ramsey & Washington Counties, Minnesota

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
CHANGE:					
Bricklayers & Stonemasons	$9.66	.555	.33	.56	
Carpenters (Building):					
S.W. Portion of Scott County	9.75	.40			.02
Remainder of Scott County	9.51	.40	.30	.50	.02
Remainder of Counties					
Carpenters; Millwrights & Piledrivermen	9.51	.40	.30	.50	.02
Soft Floor Layers	8.95	.51	.34	.45	.02
Cement Masons:					
Building, Site Preparation, Excavating & Incidential Paving	9.68	.50	.50		
Electricians - Building:					
Hennepin & Scott Cos; Anoka & Fridley Twps. in Anoka Co.	9.60	6½%	4%	9%	1½%
Remainder of Anoka Co. & the Remainder of Counties	9.68	5½%	3%	10½%	1%
Elevator Constructors:					
Constructors	9.35	.495	.32	4%+a	.02
Helpers	70%JR	.495	.32	4%+a	.02
Helpers (Prob.)	50%JR				
Ironworkers	10.35	.55	.55		.02
Laborers - Building:					
Class 1	7.80	.45	.45	.40	
Class 2	7.85	.45	.45	.40	
Class 3	7.90	.45	.45	.40	
Class 4	7.95	.45	.45	.40	
Class 5	8.05	.45	.45	.40	
Class 6	8.10	.45	.45	.40	
Class 7	8.15	.45	.45	.40	
Class 8	8.20	.45	.45	.40	
Class 9	8.505	.45	.45	.40	
Laborers - Site Preparation, Excavation & Incidential Paving:					
Class 1	7.75	.45	.45	.40	
Class 2	7.85	.45	.45	.40	
Class 3	7.90	.45	.45	.40	
Class 4	8.00	.45	.45	.40	
Class 5	8.05	.45	.45	.40	
Class 6	8.10	.45	.45	.40	

MODIFICATIONS P.9

DECISION #MN76-2001 (Cont'd)

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
Plumbers, Steamfitters & PF					
Remaining Counties:					
Plumbers	$9.64	.38	.50	1.35	.05
Steamfitters & Pipefitters	9.64	.38	.50	1.25	.05
Sheet Metal Workers:					
Dakota, Ramsey & Washington Counties	10.76	.59	.65		.02
Remaining Counties	10.98	.52	.50		.06
Sprinkler Fitters	10.48	.60	.90		.02
DECISION #MN76-2002 - Mod. #2 (41 FR 3607 - January 23, 1976) Olmsted County, Minnesota					
CHANGE:					
Asbestos Workers	$10.48	.60	.65		.02
Carpenters-Building	8.95	.50	.50		
Glaziers	9.56			.30	
Painters:					
Brush	8.90	.37	.25		.08
Spray, Swing State & High Work	9.40	.37	.25		.08
Roofers	9.43	.42	.30		.02
Sheet Metal Workers	10.07	.52	.30		.02
DECISION #MN76-2003 - Mod. #2 (41 FR 3610 - January 23, 1976) Stearns County, Minnesota					
CHANGE:					
Asbestos Workers	$10.48	.60	.65		.02
Soft Floor Layers	7.50				
Painters:					
Brush	6.90				.02
Structural Steel	7.40				.02
Spray	7.90				.02
Plumbers & Steamfitters	10.35	.48	.50		.08
Roofers	8.50	.64	.25		
Helpers	5.95	.64	.25		
Sheet Metal Workers	10.38	.42	.20		.02

MODIFICATIONS P. 10

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
DECISION #MN76-2064 - Mod. #1 (41 FR 21025 - May 21, 1976) Blue Earth, Fairbault, Freeborn & Mower Counties, Minnesota.					
CHANGE:					
Asbestos Workers	$10.48	.60	.65		.02
Electricians:					
Blue Earth & Fairbault Cos:					
Jobs outside the Mankato City Area less than 50,000	8.45	7%	4%	10%	1%
Jobs within a 5 mile radius of Mankato 50,000 & over	9.21	7%	4%	10%	1%
Elevator Constructors:					
Blue Earth County					
Constructors	10.345	.545	.35	4%+a	.02
Helpers	70%JR	.545	.35	4%+a	.02
Helpers (Prob.)	50%JR				
Glaziers:					
Remainder of Counties	9.50				
Painters:					
Mower County					
Brush	8.90	.37	.25		.08
Spray	9.40	.37	.25		.08
Roofers:					
Mower County	8.62		.20		
Remainder of Counties	8.65	.55			

DECISION #0176-2137 - Mod. #1 (Cont'd)

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
Bricklayers & S/B: (Cont'd)					
Calhoun County; Bellevue, Carmel, Eaton & Kalton Twps. in Barry County	$10.30	.55	.35		
Finishers:					
Clinton, Ionia & Ingham Counties:					
Brush & Tapers	10.35	.42	.40		.005
Structural Steel	10.75	.42	.40		.005
Spray	11.10	.42	.40		.005
Calhoun County:					
Brush	8.30		.25		
Spray	9.13		.25		
DECISION #0176-2138 - Mod. #2 (41 FR 48930 - November 5, 1976) Bay, Genesee, Huron, Iosco, Lapeer, Saginaw, St. Clair, Sanilac, Shiawassee & Tuscola Counties, Michigan					
CHANGE:					
Plasterers:					
Bay, Huron, Iosco, Saginaw & Tuscola Counties	9.82	.50			
Plumbers & Steamfitters:					
Saginaw & S. ½ of Tuscola (including Caro, Washington & south to the Lapeer County Line) counties	9.83	.66	.85	1.25	.01
DECISION #0176-2139 - Mod. #5 (41 FR 51313 - November 19, 1976) Macomb, Monroe, Oakland, Washtenaw & Wayne Counties, Michigan					
CHANGE:					
Plasterers:					
Monroe County	10.53	.75	.70		.07
Washtenaw County	10.16	.75+.15	.75		.10

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
DECISION #0176-2001 - Mod. #5 (41 FR 2551 - January 16, 1976) Anoka, Carver, Hennepin, Scott, Dakota, Ramsey & Washington Counties, Minnesota					
CHANGE:					
Carpenters: (Building)					
Remainder of Counties:					
Carpenters; Millwrights & Pileidrivermen	$9.21	.50	.50	.50	.02
Plumbers:					
Dakota, Ramsey & Washington Counties	9.17	.48	.50	1.52	.06
DECISION #0176-2002 - Mod. #3 (41 FR 3607 - January 23, 1976) Olmsted County, Minnesota					
CHANGE:					
Sheet Metal Workers	$10.06	.52	.33		.07
Tile Setters	10.72				
Plumbers & Steamfitters	9.41	.30	.70		.02
Roofers	9.40	.42	.33		
DECISION #0176-2003 - Mod. #3 (41 FR 3610 - January 23, 1976) Stearns County, Minnesota					
CHANGE:					
Electricians:					
Jobs under $50,000	8.45	7%	4%	10%	1½%
Jobs over $50,000	9.63	7%	4%	10%	1½%

MODIFICATIONS P. 15

DECISION NO. MA76-2105-Mod. 74 (41 FR 35977 - September 13, 1976) Suffolk County, Massachusetts	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
Change:					
Glaziers	10.40	.57	.64		.03
Marble setters & terrazzo worker	9.60	.85	.80		
Plumbers	11.20	1.02	1.70		.05
Steamfitters	11.96	.94	1.00		.07
Tile setters	9.60	.85	.80		
DECISION NO. MA76-2105-Mod. 75 (41 FR 37633 - September 3, 1976) Worcester County, Massachusetts					
Change:					
Carpenters & soft floor layers: Blackstone & Millville	9.40	.65	.90		.05
Glaziers:					
Remainder of County	10.40	.57	.64		.03
Ironworkers: Blackstone	9.43	.70	1.50		.03
Laborers: Remainder of County	10.12	1.45	.25		.01
Pipefitters: Longmeadow	11.96	.94	1.00		.07
Sheet metal workers	10.70	.85	.75		.05
DECISION # MD77-3017 - Mod. 14 (42 FR 2142 - January 14, 1977) Counties of Anne Arundel (excluding the D.C. Training School), Baltimore, Baltimore City, Harford, and Howard, Maryland					
Change:					
Glaziers:					
Inside work	7.90	.25	.40		
Outside work	9.77	.80	1.53		.06

MODIFICATIONS P. 16

DECISION MI76-2139 - Mod. 67 (41 FR 51313 - November 19, 1976) Macomb, Monroe, Oakland, Washtenaw & Wayne Counties, Michigan	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
Change:					
Plumbers & Steamfitters: Remainder of Counties					
Plumbers	$10.12	1.40	1.20	1.25	.05
Pipefitters	10.25	1.38	1.20	1.35	.05
DECISION MN76-2001 - Mod. 06 (41 FR 2551 - January 16, 1976) Anoka, Carver, Hennepin, Scott, Dakota, Ramsey & Washington Counties, Minnesota					
Change:					
Lathers: Anoka, Carver & Hennepin Counties	$9.08	.45	.35	.70	.01
Plasterers: Remainder of Counties	9.50	.45	.20	.70	.01
DECISION MO77-4059 - Mod. 01 (42 FR 13762 - March 11, 1977) Franklin, Jefferson, Lincoln, St. Charles and Warren Counties and St. Louis City and County, Missouri					
Change:					
Laborers: Zone 2	$6.05	.45	1.00		

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
DECISION 076-2031 - Mod. #7 (41 FR 2551 - January 16, 1976) Anoka, Carver, Hennepin, Scott, Dakota, Ramsey & Washington Counties, Minnesota					
CHANGE:					
Electricians:					
Residential					
Carver, Hennepin & Scott Cos; Twps. of Anoka, Fridley, Grow & Ramsey in Anoka County:					
Construction of all new family dwellings up to and including four-plexes. Old work shall apply to all residential remodeling, rewiring & repairing, in apartment buildings up to & including a 400 ampere service. This is limited to 3 floors occupied as living quarters floors & non-elevator apartment buildings	$6.73	.48	1%	.27	1%

	Basic Hourly Rates	Fringe Benefits Payments			
		H & W	Pensions	Vacation	Education and/or Appr. Tr.
DECISION 077-4051 - Mod. #1 (42 FR 12616 - March 4, 1977) Description of Work and Locations: Heavy and Highway Construction, Missouri					
Change:					
CARPENTERS & PILEDRIVERMEN:					
Zone 3	$11.00	.50	.30		.05
LINE CONSTRUCTION:					
Zone 4					
Lineman	10.58	.45	1%		.25%
Groundman - Class I	9.02	.45	1%		.25%
Groundman - Class II	7.38	.45	1%		.25%
Groundman - Class A	6.72	.45	1%		.25%
Groundman - 1st. 6 mos.	6.42	.45	1%		.25%
PAINTERS:					
Zone 1					
Brush & roller	10.19	.55	.70		.08
Spray	11.19	.55	.70		.08
Bridge	10.94	.55	.70		.08
Zone 2					
Brush	8.15		.25		
Spray	8.90		.25		
Zone 3					
Brush	7.05				
Spray	7.45				
Zone 11					
Brush	9.05		.50		
Spray, bridgemen, steelman	9.55		.50		
OMIT:					
Zone 13	10.15	1.00	.95		
Zone 12	8.30		.50		

AREAS COVERED BY CEMENT MASON'S ZONES

Zone 12 - Clark, Knox, Lewis and Scotland Counties.

Zone 13 - St. Louis City and County, Jefferson and St. Charles Counties; and Counties of Crawford, Franklin, Iron, Lincoln, Madison, Reynolds, Shannon, St. Francois, Ste. Genevieve, Warren and Washington on projects $100,000.00 and over.

PART I: SUMMARY OF WORK

1.01 DIVISION I

A. The requirements of all sections of Division I apply to and govern the Contract and the Work of each Contractor and all (sub)contractors and vendors of material for this Project. Where the provisions of Division I or the technical specifications assign a specific requirements or responsibility to a particular (sub)contractor he shall have the responsibility to provide, accomplish, assume or enforce, but the Contractor and all (sub)contractors shall be governed by the requirement and shall cooperate in its fulfillment.

1.02 WORK COVERED BY THE CONTRACT DOCUMENTS

A. Work under this Contract consists of furnishing and installing all materials, labor, equipment and machinery, incidentals, and other facilities and services necessary for the proper execution and completion of University of Minnesota Jackson Owre Millard Lyon Complex Remodeling - Contract B (JOML-B).

B. The Project Site is located on the Minneapolis Campus of the University of Minnesota, south and east of the intersection of Church Street S.E. and Washington Avenue S.E. in Jackson Hall, Jackson-Owre Hall, Owre Hall, Millard Hall and Lyon Laboratory, the Complex identified for purposes of this Contract as the Jackson Owre Millard Lyon (JOML) Complex.

C. Related Requirements Specified Elsewhere:

1. Alternates: Section 01100
2. Construction Schedule: Section 01200

D. The drawings applicable to the Work of this Contract are entitled Jackson Owre Millard Lyon Complex Remodeling-Contract B, dated May 2, 1977 and enumerated on drawing number A-1.

1.03 CONTRACTS

A. Work shall be accomplished under a single lump-sum Contract.

1.04 WORK BY OTHERS

A. Unit B/C Contracts: Work is underway and will be completed during the life of this JOML-B Contract, on the Unit B/C Project on the site adjacent to the east and south sides of the JOML site. The projects interface only through the JOML-A work.

B. JOML-A Contract: Work is underway and will be completed prior to start of this JOML-B Contract, on the JOML-A Contract. JOML-A construction relates directly to this JOML-B Work and consists primarily of the construction of two towers for mechanical duct work and equipment to interface as shown on the drawings.

C. Surgical Pathology Renovation: Work is underway and will be completed during the life of this JOML-B Contract on the Surgical Pathology Renovation.

The two projects interface at the ceiling constructed under this JOML-B Contract in the corridor adjacent to the Surgical Pathology Project (First Floor of Jackson Hall).

D. Contractor's Superintendent shall have authority from Contractor to provide all necessary field coordination of Work of this Contract with that of other Contracts.

E. The Contractor shall cooperate and coordinate all of his work with the University and all other contractors, and shall schedule all of his Work with the other contractors and the University.

1.05 UNIVERSITY-FURNISHED EQUIPMENT

A. Refer to drawings and equipment schedules. Certain equipment is to be furnished by the University and is indicated in schedules as "Group II by Owner" and on drawings as "by Owner", "N.I.C." (Not in Contract) or indicated by broken line.

B. As the work progresses, areas mutually agreed upon by the Contractors and University shall be made available to the University to receive and assemble equipment prior to its being located in the room of installation.

C. University shall furnish, in a timely manner, all information pertinent to the roughing-in and installation of its equipment for the information of the Contractor.

D. The University will deliver (or receive) at the Project, uncrate or unpack, assemble, clean and/or otherwise make the equipment ready for installation and connection.

E. University will then deliver the equipment to the room of installation.

F. University shall assume responsibility for damage found during unpacking or which may occur during moving to the room of installation. University shall be responsible for the care of accessories or other loose items.

G. The University will remove and dispose of any packing or crating materials.

H. N.I.C. Equipment installation is assigned to the University, and it shall move the equipment to its final location and it shall make final connections.

I. The University and Contractor shall jointly prepare a schedule for delivery of each item of equipment, thereby establishing priorities for deliveries. In general, the schedule shall indicate the earliest date the equipment can be installed, depending upon the completion of preceding work in the space, as well as the latest time for delivery which will avoid delaying the work.

1.06 FUTURE WORK

A. Future contracts: The University may award future contracts for other remodeling projects in the Jackson Owre Millard Lyon Complex, and reserves the right to demand the cooperation of this JOML-B Contractor with all others on and about the JOML Complex.

1.07 WORK SEQUENCE AND COORDINATION

A. Related Contracts: Completion of the General Construction portion of the Southeast, and Southwest Mechanical Equipment Towers constitutes the scope of Contract A. The Towers will house air handling units provided as part of Contract B. It is intended that construction of the Northwest and Northeast Mechanical Equipment Towers will occur as part of future construction projects. Contract A construction work has begun and will be completed in May 1977.

B. General: Construction of all interior remodeling work and the equipping of the Mechanical Equipment Towers, (provided under Contract A described above) will constitute the work of Contract B. Construction under Contract B shall be accomplished within 560 calendar days from the start of construction. See Section 01200.

C. Work within the buildings shall be performed according to a schedule agreed between the Contractor and the University. See Section 01200.

D. Except for constraints listed herein, Contractor may proceed with work in any space according to his own schedule but once entering a space for remodeling shall pursue the work to the earliest possible conclusion (and according to the agreed schedule).

E. Refer to Section 01200 for procedures for scheduling and updating and progress reporting.

F. The following list are schedule constraints which shall be maintained:

1. Jackson Hall Rooms 88.1 and 88.2 - entire remodeling must be completed in thirty days.

2. Jackson Owre Halls Rooms 54.2, 54.3, 54.6, 1, 1.4, 2, 6 and 6.1 - entire remodeling must be completed from June to September 1978.

3. Jackson Hall rooms 297 through 297.3 and 298 through 298.3 - remodeling must not be started until after item 2 is substantially completed. Relocated casework to item 2 may occur during that phase.

4. Millard Hall rooms 206, 207, 221 through 221.4, 218, 212 through 212.4, 213 through 213.3 - remodeling must not be started until after Owre Hall 3rd floor is completed.

5. Owre Hall rooms 458 through 458.2, 426, 242, 432, 411 through 411.2, 412 and Lyon Lab rooms 464, 466, 467, 468 and 475 - remodeling must not be started until after Owre hall room 461 through 461.3 and Millard rooms 310, 312 are completed.

6. Owre hall rooms 435, through 466 - remodeling must not be started until after Jackson Hall rooms 496 through 496.11 are completed.

7. Millard Hall rooms 24 through 24.2, 2, 3, 101 through 101.2, 130 through 136.1, 124 through 128 and Lyon Laboratories rooms 262, 274, 280, 282, 277 - remodeling must not be started until Millard hall rooms 20-22.1, 118 through 123 and Owre halls rooms 111 through 136.5, 216 through 221.1, 227 through 228.8 are completed.

8. Lyon Laboratory rooms 263, 269, 275 - remodeling must not be started until rooms in item 7 are all completed.

G. In addition to the commencement and completion of work at various areas being scheduled in the Contractor's Construction Schedule, the Contractor shall verify the timing and advise the University 2 weeks in advance of work in all existing and occupied spaces, to permit the spaces to be vacated and related arrangement to be made.

1.08 CONTRACTOR USE OF PREMISES

A. It is imperative and mandatory to schedule and coordinate all activities with the Unit B/C and other contractors, all sub-contractors and the University.

B. Should field dimensions be required, the Contractor and sub-contractors shall cooperate to obtain or provide them. Each Contractor shall cooperate in obtaining dimensions to prevent fabrication delay. In the event it is impractical to have work in place to permit field dimensions, the Contractor shall guarantee necessary dimensions, to the various fabricators and be responsible to insure the dimensions.

C. Storage areas and work spaces at the project site are very limited. The Contractor shall utilize offsite storage until deliveries can be made directly to the proper locations, for installation immediately after delivery. The Contractor shall alert and advise subcontractors and suppliers of the need to hold deliveries until they are notified the materials are required.

1. Refer to drawings for limitations of construction site relating to storage.

D. The only access to the South East Tower site is through the existing B/C construction site or by temporary access road into Mayo Court. Contractor shall be responsible for scheduling his work in coordination and cooperation with the Unit B/C Contractor so as to obtain proper access for deliveries and erection without interfering with Unit B/C work or in any way obstructing traffic on access roads to the hospital.

E. The Contractor shall confine his unloading and storage at the site to areas as directed by the University. In general, assembly and similar installation activities shall be confined to the particular location or space for the installation, unless specifically approved by the University.

F. The Contractor shall cooperate with other contractors, with due respect for the methods and schedules of the others, and shall work in close coordinated effort to the benefit of the completion of the Project and so as not to delay or impede the work of other contractors. In the event of conflict or need to establish priority, the University shall make the determination of the precedence or other required decision to the benefit of the overall Project and its progress, which shall be binding on all contractors.

G. With respect to mechanical and electrical features of equipment, complete data must be exchanged directly between Contractors as the progress of the

Project requires. The person requesting the information shall advise when it will be required.

H. All work shall be accomplished to cause a minimum of disruption of the University's activities, uses, functions and programs in/and around the building, as approved by the University.

I. Elevators: Use of one elevator will be allowed by the University as shown on drawings. The Contractor may provide additonal vertical transportation by means of cranes, hoists, chutes and/or lifts for materials and debris, and stairs for personnel.

J. Refer to Article 4.14 of General Conditions. From the time the Contractor and subcontractors for this Project commence work at the site until their Contracts are completed, Contractor (and/or subcontractor) is responsible for the care of the site and Project to the extent his work, acts, operatons or use of the site affects the siteand Project, subject to the rights of the University and the University's workmen thereon.

K. The Contractor shall confine his apparatus, materials, equipment, shacks and operations of workmen to the site limits indicated on drawings or otherwise imposed by law or ordinance. The site and Project shall not be unreasonably encumbered with materials and equipment. Neat and orderly stockpiling and other operations shall be maintained and debris shall be regularly removed from the building. Before any work is started, Contractors shall meet with the University and agree to the use of available areas for storage. The Contractors shall then confine their storage and operations to said agreed limits and to University directions.

L. All improvements in or about the building which are not shown to be altered, removed or otherwise changed shall be restored to the conditions which existed previous to starting work. All existing buildings, structures, or other features shall be protected from damage by any operation in connection with the Project. Each Contractor shall replace or repair, at his own expense (and to the satisfaction of the University), all damage to existing buildings, sidewalks, curbs, drives, lawns, platns, trees, shrubbery and other property, resulting from work of his Contract, from whatever cause.

M. The General Contractor shall install and maintain temporary board or plank protection at all sides of openings in finished or exposed construction where materials may be moved, including (but not limited to) sills and jambs of door, window or similar openings through which material may be passed. Any damaged surfaces shall be removed and replaced as directed.

N. Utilities or other services which are shown, or not shown but encountered or otherwise found, shall be protected by the Contractor from any damage from excavation or other work and operations of this Contract, unless or until they are abandoned. If the utilities or services are not abandoned, or to be abandoned, the Contractor shall immediately restore any damage from his work or operations to place the utilities and service in an equal or better condition to that which existed. Where utilities or services are shown to be abandoned or moved, they shall remain in service, and be protected by the Contractor, until new utilities and services have been provided, tested and are ready for use.

O. Insofar as practicable, the drawings indicate all existing systems which must be removed and/or relocated to provide proper clearances for new work. If, however, the Contractor finds existing work, not noted for removal, which interferes with the new work, he shall immediately notify the University and request instructions. In no case will additional compensation be allowed for removal or relocation work pursued without instruction nor for correction of errors resulting from such work without instruction.

P. The normal functions of the University and Campus shall not be disturbed, except within the construction areas of this Contract. Except when work is in progress at areas indicated for Work to be performed, or as otherwise necessary to complete the Contract, all walks, driveways, parking areas, and entrances shall be kept clear and free of all Contractor's equipment, material and debris at all times. Remove debris promptly.

Q. The University will continue to occupy the surrounding areas and buildings and continue the normal functions, including parking and delivery. The University's employees and staff shall have full access to surrounding areas and shall be allowed to perform their duties therein without any restriction. See Article 1.13 herein.

R. The University reserves the right to let other contracts in connection with this Project, the JOML Complex, or in connection with adjacent existing buildings. This Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and execution of their work, and shall properly connect and coordinate his work with theirs.

S. Materials and equipment shall be assembled, including that of subcontracts, and subcontractors committed to a firm schedule, prior to commencing work to accomplish the work as expeditiously as possible. After work commences in any existing space it shall be continued without interruption to completion, except where work phases required otherwise.

T. All work shall be accomplished to cause a minimum of disruption of the University's activities, uses, functions and programs in the building, as approved by the University.

U. Material deliveries are to be scheduled appropriately so that trucks are promptly unloaded upon arrival at the site.

PART 2: SPECIAL REQUIREMENTS

2.01 SPECIAL CONSTRAINTS

A. Refer to Sections 01200 - Contract Time, 01300 - Submittals, 01500 - Temporary Facilities, 01910 - Cutting, Removal and Patching, other articles of this Section and technical sections for other special requirements.

B. In deference to the welfare of patients in adjacent hospital buildings, no operations creating loud noises will be allowed between the hours of 8:00 P.M. and 7:00 A.M. This shall include such operations as jack hammering and other noisy operations and equipment.

C. Any work required outside the normal working hours (8:00 A.M. to 5:00 P.M.) shall be specifically scheduled with and approved by the University, who will coordinate with University Hospitals.

D. At no time shall Contractor's vehicles be allowed to obstruct traffic on the streets or sidewalks adjacent to the site nor to drive over any sidewalk unless it has first been planked to protect from overloading.

E. Contractor shall provide, in addition to the schedule updating required by Section 01200, weekly notice to the University of all work contemplated which will cause noise or vibration so that users are able to adjust to any adverse effect to the University's use of the premises caused by the construction work.

2.02 LAYING OUT THE WORK

A. The General Contractor shall locate and layout the work with relation to reference points. The General Contractor shall consult with the University and demonstrate to the University's satisfaction that significant points and elevations are correctly established.

B. Contractor shall correctly locate his work in relation to the existing building features, to all requirements imposed by the drawings and good construction practice. Contractor shall verify the locations of all existing work to which his Work must fit and all lines, levels and dimensions shown on the drawings and report any errors or inconsistencies in above to University before commencing work.

C. As the Work progresses, the General Contractor shall lay out the exact location of partitions and similar features, as guide to all trades.

D. The Contractor shall recognize that the drawings necessarily are diagrammatic, in many instances. All work and in particular exposed piping, ducts, conduit and similar items shall be neatly and carefully laid out to provide the most useful space utiliziation and the most orderly appearance. Piping and similar work shall be installed as close to ceilings and walls as conditions permit, located to prevent interference with other work or with the use of the spaces in the manner required by the functions of the room and staff. Valves shall be located in inconspicuous places. Before proceeding with any work, particularly where exposed, the Contractor shall carefully plan the layout and review it with the University for acceptability of location.

2.03 CONTRACT DOCUMENTS FOR THE CONTRACTOR

A. The Contractor will be provided, free of charge, twenty-five (25) complete sets of drawings and specifications and five (5) sets of General Construction drawings. Additional sets may be obtained at the cost listed in the Instructions to Bidders as the "Deposit" amount. (No refunds will be given). Subcontractors shall obtain sets from the Contractor; free sets will not be issued to Subcontractors, by the Architect/Engineer or University.

2.04 ADDITIONAL DEFINITIONS

A. Owner: Where used, the term is synonymous with the University. Refer to Article 3 of the General Conditions.

B. Site: In general, the term refers to the actual site within the construction limits indicated, adjacent areas outside the construction limits where work must be performed to complete the Contract and nearby adjacent areas indicated as staging/storage areas and the access to these areas.

C. Quantity: Singular notations and specifications shall be considered plural where plural application is reasonably inferrable. Mention or indication of extent of work under any work Division of specification Section is done only for the convenience of Contractor and shall not be construed as describing all work required under that Division or Section.

D. James F. Brinkerhoff, whose name appears on the drawings, is no longer in the employ of the University. Any reference to Mr. Brinkerhoff found in the Contract Documents shall instead refer to Donald P. Brown, Acting Vice President for Finance and Development.

2.05 PERMITS AND FEES

A. Refer to Paragraph 4.7 of the General Conditions. The University will obtain and pay for all permits and connection charges of the State, City of Minneapolis and utility companies, at no cost to the Contractors, except as noted in C. following.

B. The University will pay all fees to the State, as may be required for review and inspection services.

C. The Contractors shall make their own arrangements, and pay any charges including parking costs and bonds, for use of public streets or roads in transporting, loading/unloading or use of construction equipment on the streets.

D. The entire installation shall comply with all codes and regulations, including the State of Minnesota and the University.

- - -

PART 1: GENERAL

A. This section describes the limits of the requested alternates to the basic contract work. Refer also to the technical specifications and drawings for the various trades for information pertaining to the work of each alternate.

B. The Owner may, at his option, vary the scope of the Work by ordering alternates which either add to or deduct from the work, or he may substitute materials, equipment or methods by ordering materials alternates.

1.2 GENERAL REQUIREMENTS

A. Each proposal under an Alternate shall include work of all trades as they may be affected and all adjustments to accommodate the changes shall be made. All work shall meet the requirements of drawings and specifications. In submitting the Proposal and in accomplishing the Work, provisions for future work or future completion shall be made, unless otherwise stated. All work shall be provided in accordance with appropriate details and specification sections, and provided (or omitted as appropriate) by the subcontractor for that section.

B. Each alternate proposal shall be submitted as an individual cost for the particular Alternate (not accumlative) and shall be proposed under the premise no other Alternates have been accepted. Should the work of an Alternate called for by the Bid Form not affect the cost of the work, "No Change" shall be stated.

C. Materials Alternates may be accepted by the Owner in any order and will not be used to determine the low bidder.

D. Each bidder shall submit a proposal for each Alternate.

E. Alternates of Scope are numbered and listed for the entire project in the order in which they will be accepted, whether or not they affect each separate trades. Each numbered Alternate as a whole, will be deductive, resulting in a reduction of the Project cost, even though the work for one of the separate trades involved may be additivie.

F. Each Bid under an Alternate shall include the work of all trades as they may be affected and all adjustments to accommodate the changes shall be made. All work shall meet all the requirements of the Contract Documents, including drawings and specifications.

G. In submitting the Bid and in accomplishing the Work, provisions for future work or future completion shall be made, unless otherwise stated. All work shall be provided in accordance with appropriate details and specification Sections, and provided (or omitted as appropriate) by the subcontractor for that Section.

H. Alternates of Scope accepted by the Owner will be used to determine the low bidder. Materials Alternates are to provide Owner's options and will not be used to determine low bidder.

1. The University reserves the right to selectively reinstate the work of any accepted deductive alternate by written order at the deductive price at any time up to one hundred twenty (120) days after receipt of bids.

PART 2: DESCRIPTION OF ALTERNATES OF SCOPE

2.1 DEDUCTIVE ALTERNATE NO. 1

A. Omit all acoustical ceilings, perimeter plaster soffits, gypsum board ceilings, light fixtures, ductwork, diffusers, mixing boxes, wiring up to the panelboards from rooms on 2nd Floor Jackson Owre Hall.

B. Omit all diffusers, ductwork, mixing boxes for A/C in 2nd Floor Owre Hall Rooms 210 - 210.8 and 239, 242 - 242.2. Existing mechanical system and supply duct from sub-basement and exhaust duct to roof are to remain in Jackson-Owre Hall.

C. Omit all metal ceilings, lights, wiring up to the panelboards, ducts, painting, plaster surface on tile walls from Corridors 2-05 to a line west of 2-08 at corridor widening in 2nd Floor Owre and Jackson Owre.

D. Delete mechanical units S-106, GE-106 and RE-106 and associated ductwork, piping, and wiring from 2nd Floor southwest tower.

E. Provide air supply to rooms 250, 254 and 256 from third floor supply air unit no. S-107. Supply duct shall be installed in tower similarly to Basement-First Floor system.

2.2 DEDUCTIVE ALTERNATE NO. 2

A. Delete all demolition and remodeling work (General, Mechanical, Electrical wiring up to panelboard) from Rooms 19 through 19.8 in Basement Owre Hall and S15.1 in Sub-basement; delete Door 19 and adjacent wall; delete vertical ductwork from Room 19 up to 3rd Floor and roof and all louver work indicated on Detail 6/A20 including exhaust fan GE-120.

B. Existing concrete stair back of elevator from Basement to First Floor will be removed.

C. Erect new north-south wall between Rooms 19.2 and Lobby B-8.1 north of elevator #8 and east-west wall between Rooms 19 and Lobby B-8.1 west of elevator #8.

2.3 DEDUCTIVE ALTERNATE NO. 3

A. Delete all demolition and remodeling work (General, Mechanical, Electrical wiring up to panelboard) from Rooms 206, 206.1 and 207 in 2nd floor Millard Hall.

B. Delete metal ceilings, light fixtures, wiring (up to panelboard), painting and A/C ductwork from Corridor 2-13 and 2-12 Millard Hall.

C. Delete all A/C and flexible ductwork, mixing boxes, dampers, from Rooms 218 and 221 through 221.4, Millard Hall.

2.4 DEDUCTIVE ALTERNATE NO. 4

A. Delete all demolition and remodeling work (General, Mechanical, Electrical) from Rooms 218, 221 through 221.4, Millard Hall, including exhaust fans FE-101 and 102 and connecting ductwork.

B. Doors 218.1 and 213.3B will be installed, and work on chase wall separating Room 218 from Stair J will be performed.

2.5 DEDUCTIVE ALTERNATE NO. 5

A. Delete all demolition and remodeling work (General, Mechanical, Electrical) from Rooms 436, 437, 438, 439 and 442 in 4th Floor Owre Hall including exhaust fan FE-114 and connecting ductwork.

2.6 DEDUCTIVE ALTERNATE NO. 6

A. Delete all demolition and remodeling work (General, Mechanical, Electrical) from Rooms 401 through 401.1 and Room 403 in 4th Floor Owre Hall.

B. Wall erection and other work in Stair D will be performed and required demolition to accomplish this stair plan. Supply and return duct rerouting must remain.

C. Delete all demolition and remodeling work (General, Mechanical, Electrical) from Rooms 117 and 117.1 in First Floor Owre Hall.

D. Wall will be erected to separate Rooms 114.1 and 115 Owre and required demolition to accomplish these walls.

PART 3: DESCRIPTION OF MATERIALS ALTERNATES

3.1 SUBSTITUTION ALTERNATE A

Refer to Sections 11611 and 11613. Provide new epoxy resin countertops and cup sinks in lieu of existing troughs on all existing casework in Lyon Lab Rooms 464, 466, 467 and 468.

3.2 SUBSTITUTION ALTERNATE B

A. Refer to Section 15310. Provide Water Saver Faucet Co. equipment in lieu of the specified Chicago Faucet equipment.

3.3 SUBSTITUTION ALTERNATE C

A. Refer to Section 15800. Provide centrifugal supply air fans in lieu of vane axial fans specified for Supply Air Units #S-100, 101, 102, 104, 106 and 107.

3.4 SUBSTITUTION ALTERNATE D

A. Refer to Section 15600. Provide air operated steam pressure reducing valves in lieu of steam operated valves by Spence as specified.

- - -

PART 1: GENERAL

1.01 BASIS FOR PAYMENT

A. Refer to the Bid Form and General Conditions Article 9.

B. The basis for payment is a lump sum for all work under the Contract, to be paid in increments as the progress of the Work permits. Adjustments in the lump Contract Sum will be made only pursuant to, and upon approval of Change Orders in accordance with Article 12 of the General Conditions.

C. The University will make payment directly to the Contractor in accordance with the General Conditions and the conditions specified herein.

1.02 SCHEDULE OF VALUES

A. Refer to the General Conditions, Paragraph 9.2.

B. The form and detail of the Schedule of Values (cost breakdown) shall be acceptable to the University and shall provide the means for simple and ready monitoring of the Work satisfactorily completed and elegible for payment. The Schedule shall provide the means for evaluating the extent of completion of each line item and the quantities of products, equipment or materials, as well as determining the state of completion of other costs incorporated into the Contract Sum.

C. The Contractor shall develop a Schedule of Values for review and acceptance by the University and revise as may be required by the University. The Schedule of Values shall bear a sworn, notarized statement by an officer of the contracting firm that the Schedule of Values represents a true and accurate allocation of costs of the Contract Sum and that each item includes its proper share of overhead and profit.

D. The costs of General Conditions and Division 1 items (i.e.: bond, insurance, temporary facilities, etc.) and similar non-material costs shall be listed individually, with unit or increment quantities and their prices where applicable.

1.03 PROGRESS PAYMENTS

A. Refer to General Conditions, Paragraph 9.3.

B. On the first Request for Payment, the University will make payment for the value of the Performance Bond and similar lump sum cost items which must be paid in full by the Contractor at the start of the Work. Thereafter, no further payments will be made until a bona-fide and substantial on-site start has been made.

C. Progress billings (Requests for Payment) shall indicate the detailed and itemized costs of the Work for which the current Request for Payment is made and a summary total of costs previously billed and payments made.

1.04 RETAINAGE

A. Refer to General Conditions Subparagraphs 9.3.7 through 9.3.12.

B. Ten percent (10%) of the satisfactorily completed work of the Schedule of Values, as approved by the University on Requests for Payment, will be retained until 75% of the work is satisfactorily completed. Thereafter, no additional sums will be retained.

C. If at any time after the reduction in any retained percentage, there appears reasonable evidence that the work is not proceeding satisfactorily, including the appearance of defective materials and workmanship, or the work is not on schedule, the University may again retain such amounts as it deems necessary to protect its interest until such time as all requirements for reducing the retainage are again satisfied.

D. Final payment of retained amounts will be made after final completion of the Work of the Contract except as provided in Paragraph 9.7.5 of the General Conditions.

1.05 UNIVERSITY EXAMINATION

A. Refer to General Conditions, Subparagraph 9.3.5. Any materials or equipment the University agrees to pay for in off-site storage, shall be stored in the Metropolitan Twin City Area. Upon submittal of a Request for Payment for materials in the Contractor's off-site storage, the University will examine the materials, with travel cost, any subsistence and time of University personnel paid by the University. The Contractor shall provide access, facilities and assistance to verify the accuracy of the materials claimed as complete, relating to the Schedule of Values.

- - -

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

A. Refer to General Conditions, Article 8, for general conditions relating to the Contract Time, commencement of the Work, progress, completion and delays. Refer to Sections 01010 - Scope of Work and Special Requirements, Section 01300 - Submittals, Section 01500 - Temporary Facilities, Section 01700 - Project Closeout and Articles of this Section which relate to the commencement, schedule, progress and completion of the Work.

B. The Work shall be prosecuted regularly, diligently, without interruption or shutdown at such rate of progress as will insure Substantial and Final Completion within the Contract Time. By execution of the Contract, the Contractor represents he has analyzed the Project, the materials and methods involved, the systems of the building, availability of qualified mechanics and unskilled labor, restrictions of the site, constraints imposed, his own work load and capacity to perform the Work and indicates his agreement that the specified completion times are reasonable considering the Project conditions, usual industrial conditions, climatic conditions prevailing in the locality of the Project, and other factors, with reasonable allowance for variations from average, typical or ideal conditions.

C. It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that each date of commencement of work, Substantial Completion and Final Completion as specified in Section 01200 is an Essential Condition of this Contract.

PART 2: COMMENCEMENT OF WORK

A. The date on the Owner's written notice to proceed or letter of intent shall be the official starting date of the Project, which shall also be the date of the Contract.

B. The Contractor shall commence the Work at the site as soon as possible after required and proper insurance evidence has been submitted to the University. All submittals shall be prepared and submitted by the specified times and temporary heat, light and power shall be installed where required, without delay.

C. The Contractor may assume site management and commence work within 14 days after the University's Notice to Proceed or execution of the Contract, whichever occurs first. However, he shall not commence work until he has confirmed his delivery dates for critical materilas and equipment so that the wWork can be pursued in an orderly and continuous manner with the minimum of disruption. It is intended that maximum care be exercised in protecting the water integrity of the existing structures throughout the construction period. University approval of commencement day shall be required as an essential condition of the Construction Schedule. See Article 3.02 herein.

D. It shall be noted that access to the portion of the site continguous to the Unit B/C Contract Limits is under the site management of the previous

Contractor. Because of the relative scope of work on the Southeast Tower and this project, site management of that area must remain with the other (Unit B/C) Contractor and this JOML-B Contractor must submit to the scheduling and instruction of the other Contractor, pertaining to access through and use of the Unit B/C Site.

E. Once work on the site has commenced, the Contractor shall pursue the work continuously and diligently to completion within the specified time.

2.02 PRECONSTRUCTION CONFERENCE AND SITE MEETINGS

A. After award of contracts, at time designated by the University, the Contractor and key sub-contractors shall attend a Pre-construction Conference at a location in the Metropolitan Twin City area. Government requirements, procedures to be followed, coordination efforts and similar matters will be reviewed.

B. During Construction, periodic site meetings will be held under the supervision of the University at times directed by the University. These meetings will be held bi-weekly (unless job conditions warrant differently) and may be held more frequently if job progress and needs indicate. Except when excused as being not necessary due to the status of work, Contractor and all key sub-contractors shall have one or more responsible representatives in attendance. The General Contractor shall be responsible for recording "minutes" of the meeting and distributing them to all interested parties.

2.03 COMPLETION SCHEDULE

A. Refer to General Conditions Subparagraphs 7.1.5 and 7.1.6 for definitions of Substantial Completion and Completion. Within the framework of the general definitions, the University shall be the judge of the status of completion. The definitions shall apply to the Project as a whole as well as separable spaces or areas where the University may assume beneficial occupancy or use of the facilities.

B. The definition of beneficial occupancy or use shall include the allowing the work of another contractor within the Contract Limits of this JOML-B Contract.

C. During the period in which other contractors are on the site and the JOML-B Contract is not yet complete, the JOML-B Contractor shall be responsible for site management until such time as he is released at final completion of his work.

D. Certain areas and phases of the Project are required by the University to be substantially completed before the entire Project is complete, and have more critical requirements for occupancy by the University, to accommodate other phases of Work, and other Contacts and to coordinate with other construction. The commencement dates and sub-completion dates for various areas or phases, as specified or as later developed in the Construction Schedule of the Contractor, shall be essential conditions of the Contract, as well as completion of the entire Project.

E. At any space or area specified, or later scheduled, to be occupied or used by the University before the entire Project is complete, all elements and systems of the Work shall be substantially complete in these areas by the scheduled time.

F. Substantial Completion of the entire Project shall be accomplished on or before 560 calendar days after Notice to Proceed or execution of Contract whichever is earlier.

G. Final Completion of the entire Project shall be accomplished within 28 days after Substantial Completion. Final Completion of any area or space occupied or used by the University or accepted for other work to commence prior to completion of the entire Project, shall be accomplished within 14 days after the specified or scheduled substantial completion, unless otherwise approved by the University.

H. In addition to the time of commencement, substantial completion and final completion dates, other events, factors, and constraints shall be carefully considered in establishing the work progress for the Project. The contractors and subcontractors shall work closely in timing of operations and shall have materials, equipment and other elements ready (in off-site storage, where necessary) to be able to immediately fulfill their obligations in the overall schedule. Consideration shall be given the time required for the Owner to move in the Project, as well as the work that follows various installations.

2.04 EXTENSION OF TIME

A. Refer to General Conditions, Paragraph 8.3, for requirements for time extensions. Time extensions will be allowed only for the portions, phases or elements of the Work affected by the enumerated conditions for valid delay. Extension of the time for completion of the entire Project will be allowed only for such valid delays as will affect all Work of the Contract.

PART 3: TIMING OF WORK

3.01 UNIVERSITY ESTABLISHED CONSTRUCTION CONSTRAINTS AND COMPLETION TIMES

A. Work at the site shall be carefully coordinated among the various subcontractors and vendors of this Contract and with any separate Contractor, as well as the University and its agencies, and the Unit B/C Contractor. All periods stated shall be in consecutive calendar days.

B. The affected areas of the adjacent existing buildings will be made available to the contractor at the time of the Notice to Proceed. The Contractor shall immediately prepare dust-tight temporary partitions as close as possible to the cutting and removal work so as to allow occupancy and use of these existing spaces by the University within 21 calendar days after Notice to Proceed.

C. After temporary partitions are placed the Contractor may proceed with the demolition and removal work required to accommodate the new construction.

3.02 CONSTRUCTION SCHEDULE

A. Initial Schedule:

1. Within 10 days after issuance of Notice to Proceed or execution of the Contract, whichever comes first, the General Contractor shall prepare the Construction Schedule for scheduling and management of the Project.

2. Within thirty days from the Notice to Proceed, the General Contractor shall provide the Architect, the Owner, and all sub-contractors with copies of the Schedule.

3. The Construction Schedule shall contain detailed representation of all significant aspects of the construction plan, including, but not restricted to, site preparation, structural work, exterior finishing, electrical and mechanical work, shop drawings submittal, review and revision, materials delivery, and acquisition and installation of fabricated equipment and materials. A weekly time period shall be followed for all activities.

4. Remodeling construction within the building shall be performed according to a schedule agreed upon by the Contractor and the University. With the Construction Schedule the contractor shall submit a detailed listing by room number of when the proposed start and completion of each remodeling is scheduled. The University may then elect to make certain minor changes in the Schedule to accommodate his scheduling and/or occupancy. Every effort shall be made by the Contractor to finish individual areas of the project to allow occupancy by the Owner. Various areas of the project will have phased substantial and final completion dates.

5. The Construction Schedule shall generally conform to the Schedule of Values required under the General Conditions and Section 01150 so that progress can be monitored and compared with application for payment.

B. Updating Schedule:

On a set date each momth, established by Contractor in cooperation with Univeristy, Contractor shall revise his schedule, as necessary to reflect actual progress and correct for critical delays in the work and return the work to a satisfactory schedule. Each schedule revision shall be submitted to the University for his use in monitoring progress.

- - -

PART 1: GENERAL

1.01 SCOPE

A. This section defines procedures for the following submittals required of the Contractor.

PART 2: REQUIRED SUBMITTALS

2.01 SHOP DRAWINGS, EQUIPMENT BROCHURES AND PRODUCT DATA

A. Required submittals of shop, fabrication, or erection drawings, equipment brochures and/or product data, composite systems (including those by one or more Subcontractors or suppliers) and similar information shall be submitted in accord with this Article.

B. "Shop Drawings" shall mean all similar types of product data, including specially prepared drawings, standard prints, brochures and other descriptive data.

C. Drawings submitted, including transparencies, shall be marked with name of project, Contractor, Architect, whether "preliminary" or "final" in nature, and shall bear stamp of approval of the Contractor, as evidence that drawings have been checked (including field dimensions) by the Contractor. The Contractor shall field verify or otherwise determine interferences or conflicts between various materials and resolve dimensions or methods resulting therefrom as approved by the Architect and University. Any drawings submitted without the Contractor's approval will not be considered or reviewed and will be returned to the Contractor.

D. The Contractor shall submit shop drawings to the Architect with such promptness as to cause no delay in his work or the work of any other contractor or subcontractor on the project. Adequate time shall be allowed for checking by the Architect and University. Contractor shall submit shcedule of submittals within 21 days after Notice to Proceed.

E. Prepared shop drawings shall be submitted in the form of clear, sharp reproducible transparencies until acceptable to the Architect. Each drawing shall have a clear space of not less than 20 square inches for Architect's stamps and be transmitted, rolled, in mailing tubes. After the drawings have been checked, the Architect will obtain prints of the transparency for his records and the University's records and return the transparency to the Contractor. Transparencies returned "Accepted" or "Accepted as Noted" shall be printed by the Contractor in quantity required for his use. When drawing transparencies are returned "Not Accepted" or "Resubmit", the Contractor shall correct the drawing and resubmit a new transparency of the corrected original until final acceptance is obtained. The final shop drawings shall show field verified dimensions.

F. It is not intended that field verified dimensions are required prior to the Architect's acceptance of shop drawings. If however, field dimensions require changes in the shop drawings in size, detail and similar considerations, a revised shop drawing shall be submitted for review and acceptance.

G. Transparencies will not be required for catalog cuts, equipment brochures or similar items; however, layout drawings shall be prepared where necessary or required by the Architect. Such items shall be submitted in a minimum of 7 copies unless otherwise specified. If acceptable, the copies will be so stamped and 3 copies returned to the Contractor. If notations indicate revision of data is required, resubmit as directed. The Contractor shall not furnish, fabricate, proceed with, or install work until shop drawings receive final acceptance.

H. Checking and acceptance of shop drawings by the Architect is for general conformance with design intent and Contract requirements and does not relieve the Contractor of responsibility to verify accuracy of dimensions, obtain field dimensions, coordinate dimensions with work of others, and prevent interference with other equipment and other features of the Work. If a drawing as submitted is in accordance with Contract requirements, or specifically indicated deviation from Contract requirements which Architect finds to be in interest of University and to be so minor as not to involve a change in contract price or time for performance, Architect will accept drawings.

I. Acceptance of shop drawings and setting drawings will be general and, except as otherwise provided in preceding paragraph, shall not be construed as: (1) permitting any departure from contract requirements, (2) relieving Contractor of responsibility from errors in details, dimensions or otherwise that may exist, (3) accepting departures from additional details or instructions previously furnished by Architect and, (4) confirming clearances or lack of interference.

J. Checking and acceptance by Architect shall not relieve Contractor of responsibility for deviations from drawings and specifications unless such deviation is specifically called to Architect's attention by a specific indication of "note deviation" or similar clear and bold indication at time of submission, nor shall it relieve him of responsibility for errors or omissions in shop drawings.

K. Refer to Article 6 of General Conditions and to Article 1.8, of Section 01010 for coordination and cooperation of contractors. This Contractor shall cooperate with all other contractors as may be required to coordinate the work of all contractors and their subcontractors. Shop drawings shall be provided or exchanged as necessary or beneficial to the coordination effort, with the exchange directly by the contractors involved, not through the University or Architect.

2.02 SAMPLES

A. Deliver samples of materials, equipment, assemblies and components as required by specifications to Architect (or other designated location) with delivery costs prepaid. At Architect's direction, remove samples after approval. Samples shall be of like kind to the product to be provided for building and shall have finish and other characteristics required by work. Samples shall indicate type of construction and quality proposed for installation in the Project.

B. Where the Contractor requires approved samples to be returned, submit the number of samples required by the Contractor plus two which shall be retained by the Architect and University. Submit all other samples in duplicate.

2.03 LIST OF MATERIALS

A. Within 14 days after the award of the Contract (notice to proceed or letter of intent), the Contractor shall submit 5 copies of a complete list of all materials, products, and equipment proposed to be used in construction to the Architect for acceptance. Materials shall not be ordered until the proposed listed materials are accepted.

B. Where two or more makes or kinds of items are named in the specifications (or additional names are called for in an addendum), the Contractor shall state which particular make or kind of each item he proposed to provide. If the Contractor fails to state a preference, the University shall have the right to select any of the makes or kinds named without change in price.

C. This list shall be submitted on the form prescribed by the Architect and arranged in order of specification sections. The items listed shall fully conform to project requirements and specifications. All materials are subject to the Architect's and University's acceptance. After acceptance, there shall be no changes or substitutions, except as provided in Article 7 of the General Conditions and Article 1.18 of Section 01010.

D. The list shall clearly identify the material, product or equipment by manufacturer and brand by listing the names for all items, including those where only one material or product is specified. Each and all materials, products and equipment shall be specifically named, not listed "as specified".

2.04 LIST OF SUBCONTRACTORS

A. Within 14 days after the award of the Contract (notice to proceed or letter of intent), the Contractor shall submit 5 copies of a complete list of all subcontractors (and major material suppliers) he proposes to use in performance of the Contract to the Architect for review and acceptance by the Architect and University. The list shall be in the form prescribed by the Architect. When appropriate, or when requested by the Architect, the list shall include proposed Sub-subcontractors. No subcontracts shall be executed until the proposed list subcontractors are accepted.

B. The proposed subcontractors or sub-subcontractors shall be established, reputable firms of recognized standing with a record of successful and satisfactory past performance with the type work and/or items proposed to be provided or installed by them. Only those subcontractors (and sub-subcontractors when appropriate) who are acceptable to the Architect and the University shall be used on the Work.

C. The right to reject any subcontractor or sub-subcontractor, is reserved by the Architect and University. The right to reject will be exercised by the Architect or University as specified under sub-paragraph 5.2.3 of the General Conditions.

2.05 RECORD SET OF DRAWINGS

A. Contractor shall provide a record set of drawings to the University at the completion of Contract.

B. During construction, Contractor shall maintain a clean set of drawings for the sole purpose of recording changes and actual "as installed" information.

C. Marking of the record set shall be done methodically as work progresses, clearly and neatly, in color.

D. As a general guide, the type of information to be recorded on the record set includes: (1) revisions made except minor or non-critical dimensions; (2) omissions, including work omitted by accepted alternates; (3) dimensioned locations of major or main utility lines, such as main conduit runs, piping mains and similar work; (4) locations of control valves; (5) additions to the work; (6) changes in significant details (i.e.: for water protection); and (7) other similar data.

2.06 OTHER SUBMITTALS

A. Provide other required submittals as specified. In particular, refer to:

Progress Schedule	Paragraph 4.11 of General Conditions, and Section 01200.
Performance Bond	Paragraph 7.5 of General Conditions
Schedule of Values	Paragraph 9.2 of General Conditions and Article 1.02 of Section 01150
Payment Requests	Paragraph 9.3 of General Conditions and Articles 1.03 and 1.04 of Section 01150
Liability Insurance	Paragraph 11.1 of General Conditions
Property Insurance	Paragraph 11.2 of General Conditions
Equal Employment and Prevailing Wages	Articles 15 and 16 of General Conditions
Testing and Inspection	Section 01400 and Technical Sections
Form 134 Affidavit	Subparagraph 9.7.2 of General Conditions
Project Closeout Requirements	Section 01700
Reports Certificates Samples Guarantees (including roof maintenance and Guarantee)	Technical Sections

- - -

PART 1: GENERAL

1.01 TESTING

A. Refer to technical specifications for specific testing requirements and methods.

B. Unless otherwise provided in the specifications, the Contractor shall provide all materials, samples, mock-ups or assemblies for all tests specified in various sections of specifications or as directed by Architect or University and pay shipping costs of such samples to laboratory or other testing location and facility. Unless specifically specified otherwise, all tests shall be made by an approved independent testing laboratory and reports shall be provided to Architect and University.

C. Tests shall be provided and accomplished in accordance with the standard used as the reference for the particular material or product, unless other test methods or criterion are specified. In the absence of a referenced standard, tests shall be accomplished in accordance with applicable ASTM Standards or Test Methods as determined by the Architect and the University.

1.02 QUALIFICATIONS OF TESTING AGENCY

A. "Approved independent testing laboratory" shall mean an independent testing agency acceptable to the University and the Architect and possessing the professional qualifications and equipment to perform the specified tests and to evaluate and report the results.

1.03 PAYMENT FOR TESTS

A. Where specifically specified, the University will pay for the costs of tests (field or laboratory), directly to the laboratory. The University will also select the testing agency and advise the Contractor.

B. The cost of all other tests shall be paid by the Contractor, including any retesting required when initial tests indicate non-compliance.

1.04 TESTS TO DEMONSTRATE QUALIFICATION

A. In addition to tests specified, should the Contractor propose a product, material, method or assembly that is of unknown or questionable quality to Architect, the Architect or the University, may require and order suitable tests to establish a basis for acceptance or rejection. Such tests will be paid for by the Contractor, or by the Subcontractor requesting approval. "Standard" test reports on "similar" material will not be acceptable.

B. The University and Architect reserve the right to require certification or other proof that the material, assembly, equipment or other product furnished or proposed to be furnished, for this Project is in compliance with any test or standard called for. The certificate shall be signed by a representative of the independent testing laboratory.

C. Any tests required to qualify the Contractor or any of his workmen for any phase of the work, and any test of a method, system or equipment that may be required by specification or law to qualify the item for use, shall be made or taken without cost to the University or Architect.

1.05 INSPECTIONS

A. Should the specifications, Architect's instruction, laws, ordinances or any public authority require any work to be inspected or approved, the Contractor shall give timely notice of its readiness for inspection and a reasonable date fixed for such inspection. If any work requiring inspection should be covered up without approval or consent of the approving agency or the University's representatives, it must be uncovered for examination at Contractor's expense.

1.06 OWNER'S INSPECTION OF FABRICATION

A. The University reserves the right to inspect the fabrication facilities and the fabrication of products for this Project. The producer shall permit such inspections and cooperate with the University to facilitate the inspections. At least 10 days prior to commencing fabrication on the following products, or others the University advises the Contractor of, the University shall be notified of the scheduled date for commencing production:

1. Miscellaneous and structural metals, as designated by the Owner
2. Casework of all types.
3. Architectural woodwork, doors, trim, etc.
4. Hollow metal.

B. The University's right to inspect the fabrication facilities and fabrication of products for the Project shall not be limited to the products listed. After notice, the University may inspect any and all facilities and product fabrication.

C. For such inspections of fabrication and fabrication facilities, the University will pay for its own travel and subsistence. The Contractor and producer shall cooperate in such inspections and make the facilities and products available on time so the University does not incur any other costs.

1.07 CERTIFICATES

A. Except for test reports provided and signed by approved independent testing laboratories, all certificates required by the specification shall be signed by an authorized official of the firm providing the certificate, with the signature notarized, when such certificates by the producer are acceptable to the University.

1.08 FEDERAL INSPECTION

A. The authorized representatives and agents of the Federal Government shall be permitted to inspect all Work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

- - -

PART 1: CONSTRUCTION HEAT, LIGHT AND POWER, WATER, TELEPHONE

1.01 TEMPORARY (CONSTRUCTION) HEAT

A. Temporary Heat: As used in this specification, temporary heat shall mean all heat required and provided during construction, whether by temporary heating units and devices, or the permanent existing or new heating system and devices, until the Project is occupied or accepted by the Owner.

B. Existing Heating System:

1. The existing heating systems shall be kept operative throughout the entire construction. Contractor shall cooperate with University personnel to effect any required modifications to systems with minimum interruption to building services.

2. In existing spaces, the University will make no charge for temporary heat. Contractor and subcontractors, however, shall not waste University furnished heat. Openings cut and windows removed during remodeling shall be provided with insulated and secure temporary closures until permanent closure is installed and sealed.

C. Temporary steam heating units may be used for short periods when the permanent new units are being installed and weather conditions demand.

D. Electrical Energy: Cost of energy for using temporary systems will be paid as specified under Article 1.2 of this Section. Electric heaters will not be permitted for temporary heat. Electrical lines furnishing temporary current to pumps and other equipment of heating system shall be adequately sized to deliver the required rate voltages and amperage to equipment.

E. Steam from University's Plant: When steam is used from the University's plant for temporary systems, it will be provided free of charge during the construction period. The Mechanical Subcontractor shall make the connections to the steam source. When steam from plant is being used, enclosure of building shall be such that steam is conserved, with consideration for adequate ventilation, as approved by the University.

F. Condensate: When steam from the plant is being used, all condensate must be piped back to the plant with none wasted. Installations by the Mechanical Subcontractor shall be made to achieve the condensate return.

G. Temporary Heating Units or Devices: All units or devices used in or adjacent to new construction, or existing buildings, are subject to approval of the University. Only steam fired units will be acceptable.

H. Ventilation: During construction and particularly during painting work, and similar finishing operations, adequate ventilation shall be provided, including spaces without windows. Use power exhausts where necessary. Frosting or sweating of walls or roof will be an indication of excess humidity to be corrected. Give special attention to adequate ventilation immediately after building enclosure as well as during roofing operations

(particularly in or after cold weather) to remove moisture from building. Prevent condensation in building and prevent moisture from being driven up to roofing. General Contractor shall be responsible for the ventilation.

I. Miscellaneous Requirements: Provide temporary heat such that no damage results to building, materials or installed work as may be caused by dampness, cold, thermal shock, smoke or similar damage related to heat. Maintain adequate and continuous temperatures to prevent any such damage. Keep workmen or watchmen present constantly when open fires are burning. After roof deck has been placed, or an area otherwise covered in a manner which will generally prevent snowfall in the area, the General Contractor shall immediately remove snow or ice which has accumulated within the building or unit and take closure measures to prevent further snow accumulation. Except for minor quantities and with University's approval, haul (not melt) snow and ice out of spaces.

1.02 CONSTRUCTION LIGHT AND POWER

A. Reference: Refer to Section 16010 for additional details.

B. Energy Costs and Objectives: Except as otherwise specified, the University will furnish electrical energy free to Contractor and Subcontractors throughout the construction of the Project, which is provided within the capacity of the existing and new services described in Sections 16010 and 16300, provided the privilege is not abused. However, the University will assume no responsibility or liability for power outages, or damages resulting from outages, and the Contractor shall hold the University harmless from all claims and costs from outages. Not only the conservation of energy but minimum expense to the University are objectives, within the intent to provide good lighting conditions and adequate working conditions for high quality workmanship, as well as safety and security measures. The Contractor shall comply with University directions on the temporary installations, lighting conditions and use of energy.

C. General:

1. Except as otherwise specified, throughout construction Contractor and Subcontractors shall provide their own temporary wiring, cords, outlets, lamps, devices and connections as required. Installation, service, wiring and devices shall be safe, substantially supported and adequately connected and meet all codes. Demand shall not exceed the service and any damage resulting from misuse, faulty equipment or overloading shall be paid for by responsible persons.

2. Electric heaters shall not be used for heating unless approved by the University as the only reasonable solution.

3. Energy costs and services for cranes, hoists, large welders and similar heavy loads shall be provided and paid for by Contractor and Subcontractors requiring such service and they shall arrange for their own service and meters. Limited use of energy and service, when being paid for by the University will be permitted for loads of others for such equipment as grinders and pipe threaders provided their use does not limit the service for normal lighting and power tool loads. In the event such equipment use indicates the available service may reach capacity the Contractor and Subcontractors requiring such service shall provide their own service after being advised by the University when such condition is likely to exist.

D. Existing Service: During "down" time in any area, procedures for temporary building service specified in paragraph E, below, shall be used.

E. Temporary Building Service: As work progresses, the Electrical Subcontractor shall install the permanent service and energize the permanent secondary electrical system as soon as practicable and when approved by the University. Permanent service characteristics are specified in Section 16300.

1. The Electrical subcontractor shall provide temporary wiring, sockets and outlets for lighting and hand tools, as specified herein and in Section 16010.

2. Permanent convenience outlets shall not be used, and permanent fixtures shall not be installed until finish operations are in process but fixtures shall be installed prior to equipment installation. Other temporary wiring and devices shall be provided by each contractor as required, safe, substantially supported and adequately connected. Electrical Subcontractor shall install the permanent convenience outlets when approved by the University, just prior to occupancy.

3. For use of the temporary heating plant, and its equipment, the Electrical Subcontractor shall install all services, panels, devices and connections necessary to use the plant and system.

G. Lamps, Incandescent Bulbs and Fluorsecent Tubes: Throughout the construction period, lamps in temporary lighting systems shall be provided, including replacements, by the General Contractor and installed by the Electrical Subcontractor. In general, lamps shall not be over 200 watts, except where necessary. The Electrical Contractor shall also remove and replace burned out lamps as they occur.

1. As work progresses and permanent incandescent light fixtures are used for lighting, the General Contractor shall provide the lamps and the Electrical Subcontractor shall install as specified in preceding paragraph. Just prior to final inspection the Electrical subcontractor shall remove all construction bulbs and install proper new bulbs. The University shall be advised when this replacement is being made so they may verify the installation of new bulbs.

2. In permanent fluorescent fixtures, the Electrical Subcontractor shall install new lamps as the fixtures are installed. The Electrical Subcontractor shall replace tubes as they burn out during construction and replace all burned out lamps just prior to final inspection so all lamps are good at the time of inspection.

1.03 SAFETY LIGHTING

A. The Contractor shall provide lighting at temporary walkways or temporary lighting at permanent walkways, constructed under this Project, until permanent lighting is installed.

B. When temporary lighting is no longer required, the Contractor shall remove the temporary facilities, at a time approved by the Owner.

1.04 CONSTRUCTION WATER

A. General: Contractor, and subcontractors where appropriate, shall provide their own hoses (or piping), connections and other equipment to use water, and protect their own equipment. Needless and wasteful running of water, when provided through the General Contractor's or the University's service, will not be permitted. When water is being used, the service shall be protected from freezing and damage at all times.

B. Temporary Service: During periods when water service in the existing building is shut down or is otherwise not available to accommodate the remodeling work, the General Contractor shall arrange for a source of water from hydrants or other municipal services, arrange for meter, have all connections made to provide water for use of all trades. The University will pay for water used (but not cost of meter) and the General Contractor shall consult with the University, and follow its direction, on arrangements for payment, whether directly to the City or through the Contractor. The General Contractor shall provide all connections and valves to utilize the water service, which shall include outlet connections to which other contractors may connect piping or hoses. General Contractor shall be responsible for preventing any damage to water service, including damage from freezing.

C. There is no permanent water service under this Contract.

D. The Owner will allow free use of water, provided the privilege is not abused and unnecessary running of water is prevented.

PART 2 FIRE SAFETY

2.01 FIRE SAFETY DEVICES AND SYSTEM

A. General: Contractor shall be alert to fire hazards and remove or protect against hazards and shall comply with directions of the University on hazards and fire safety.

B. Fire Extinguishers: Except for units in individual Contractors offices, the General Contractor shall provide and maintain adequate and proper fire extinguishing devices in and about the construction area, available for use by all workmen. The devices shall not be the units to be later installed in the Project. Appropriate devices shall be provided for the class of the potential hazard (ie. oil, electrical) at those areas where unusual hazards may exist, including in mechanical rooms. Fire hoses shall be connected to adequate sized water lines. As construction proceeds, or materials which create a hazard are moved onto various floors, extinguishing devices shall be available on each floor. The number and distribution of devices shall be adequate for effective fire control, to the satisfaction of the University.

C. Fire Hydrants: The area fire hydrants must be accessible at all times. Fences and construction work must be arranged and accomplished to provide immediate access to hydrants.

PART 3 OFFICE, TOILETS, STORAGE ENCLOSURES

3.01 CONSTRUCTION OFFICES AND CONFERENCE SPACE

A. Contractor shall maintain an office at a designated location suitable for

storing of records and for conferences. Maintain copy of Contract Documents, shop drawings, correspondence, Architect's directions. Maintain neat housekeeping. Keep separate bound files, kept neat and up-to-date. Only shop drawings accepted by Architect/Engineer shall be kept on file.

B. Contractor shall meet with University before work begins to locate office, storage areas, etc., and to coordinate work.

C. Rooms designated for offices for the entire life of the Contract are Rooms 214 and 215 Owre Hall. Contractor will have exclusive use of these rooms throughout construction.

3.02 SANITARY FACILITIES

D. At completion of project Contractor shall remove his material and equipment from the construction office, return the space to its original condition and turn it over to the University.

3.02 SANITARY FACILITIES

A. The University will designate toilet rooms in the existing buildings for the use of Contractor and his employees. Contractor shall require proper use and care of these facilities.

3.03 STORAGE

A. General: Refer to drawings for areas of storage. The Contractor (and each subcontractor) shall provide adequate enclosures and coverings to protect and preserve all materials stored at the site. Materials such as wood, finished metal, cement, masonry materials, equipment of any type, conduit and similar materials, shall not be piled directly on ground. Any material subject to damage, deterioration or weathering when exposed shall be covered or in protective enclosures. The University reserves the right to direct such protection, which shall be complied with by the Contractor. Coverings shall be durable, watertight, fully cover sides as well as top, substantial and well anchored to prevent blowing away. Shed type of enclosures shall be provided for easily damaged and small items, shall be neatly constructed, well maintained and subject to University approval. Any protection which becomes damaged shall be replaced immediately.

1. When no longer required, the Contractor shall remove the storage enclosures, except fences.

B. Limited Area: With the extremely limited storage area, the Contractor shall carefully schedule material deliveries for immediate installation to minimize the need for storage area. Any storage structures required shall be located on the Contractor's allocation of site space. Inside existing buildings, storage shall be restricted to the areas being remodeled only.

C. Another contractor will provide construction fence around South West Tower area as shown on drawings. Fence will become property of University and be left in place for use of JOML-A, JOML-B, and future Contractors. Removal of this fence will be by JOML-B Contractor.

D. A section of fencing exists near the South East Tower area (installed by B/C Contractor and JOML-A Contractor) as shown on drawings. This shall remain the property of the University and will be removed by the B/C Contractor.

E. A section of fencing exists near Washington Avenue and Church Street. This fencing will be turned over to the JOML-B Contractor for his use.

F. Contractor shall extend fenced areas in JOML Courtyard and along Church Street as shown on Drawing A-1.

3.04 CONSTRUCTION FENCE

A. Provide new fencing, complete, with gates, as shown on drawings.

B. Maintain new and existing fences until removed by the Contractor at completion of the Work.

C. Quality and detail shall be equivalent to U. S. Steel (Cyclone) or Page, Continental Steel or Crowley Fence Company.

D. Height shall be minimum six (6) feet.

E. Materials:

1. Fabric: ASTM A392 Diamond mesh, No. 9 gauge wire, 2" woven steel wire fencing fabric, with twisted and barbed bottom and knuckled top. Wire hot dipped galvanized after weaving, minimum zinc coating weight of 1.2 oz. per square foot (Class I coating).

2. Posts and fittings:

a. Galvanizing: Hot dipped galvanized after fabrication, minimum zinc coating in accordance with ASTM A123 and ASTM A153 as applicable.

b. Length: Provide posts of sufficient length to provide a minimum 36" setting in concrete footings, except where mounted on walls or over underground structures.

c. Intermediate or Line Posts: Provide pipe or "H" column of manufacturer's standard, minimum weight 2.70 lb. per foot, not over 10'-0" o.c.

d. Terminal Posts (ends and corners): Provide 2-1/2" or 3" pipe columns, minimum weight 3.65 lbs. per foot.

e. Gate Posts: Size and weight as per manufacturer's recommendations for gate width as indicated.

f. Post Tops: All posts shall be equipped with tops. Tubular post tops designed to exclude moisture from posts. Intermediate post tops designed to hold top rail.

g. Fittings: Cast iron or pressed steel.

3. Gates: Provide swinging hinged type of 1-1/2" (2.72 lbs. per foot weight) steel pipe frame, complete with welded fittings, torsion bars, hinges, truss rods, positive type latching device with provision for padlocking, center plunger rod, catch and semi-automatic outer catch to secure gate in opened position.

4. Top Rail: 1-5/8" o.d. steel pipe 1.8 lbs. per foot. Provide with couplings every 20 feet. Top rail to pass through intermediate post tops and form a continuous brace from end to end of each stretch of fence. Fasten to terminal posts with steel connections.

5. Braces: At terminal posts as per manufacturer's recommendations for secure, rigid installation.

6. Tension Wire: No. 7 gauge coated spring coil tension wire. Coating as specified for fabric.

F. Erection:

1. Erect in rigid, substantial manner, level and plumb in strict accordance with manufacturer's installation instruction. Set all posts in concrete footings.

2. Confirm locations of all underground structures and utilities before excavating post holes. Do not proceed if interference exists. Obtain University approval of any adjustments in location of fence or components.

3. Provide all bracing, guying and other incidentals to provide permanent fence.

PART 4: MISCELLANEOUS PROVISIONS

4.01 PARKING AND LOADING - UNLOADING

A. General: All campus regulations, signs and directions regarding parking and loading - unloading shall be followed. The Contractor is responsible to instruct his workmen. For unusual conditions, the Contractor shall consult with the University on proposed procedures and locations, should a temporary variance be required, and follow the instructions issued.

B. Absolute Zones: All zones which are marked NO PARKING - NO STOPPING ANY TIME, must be strictly adhered to. All deliveries and pickups by contractors, subcontractors and suppliers must be made on side streets, alleys, or on University driveways and loading zones.

C. Parking is available for cars of contractors' foreman and workmen working on campus in University parking lots at regular parking rates.

4.02 PROTECTION IN GENERAL

A. Refer to Article 10 of the General Conditions, other Articles of this Section 01500 and Section 01010 for more specific requirements. The University may require the Contractor to provide additional protection, where protective

measures appear inadequate, but assumes no obligation to do so nor accepts any responsibility of the Contractor to provide all protection required for persons or property.

B. When it is noted or specified for a particular Contractor to provide protection, it is the intent that Contractor provides the basic routine or normal protection, but shall not be construed to establish the total responsibility, as each Contractor shall have the protection responsibility as affected by his Work, labor, operations, materials, equipment spaces and similar conditions.

C. Each Contractor shall provide protection for all his own equipment, hoists, and other facilities used in the prosecution of the work, to prevent operation of unauthorized personnel.

D. Any work on the roof or other membranes, after membrane has been installed, shall be done over planking, plywood or other suitable protection, to spread loads under walkways and at all work areas, including around ventilating bases, with the protection provided by the Contractor whose work is being done over the membrane. There shall be no exceptions to this requirement and the General Contractor shall advise the University of any violations by other Contractors.

4.03 TEMPORARY CLOSURES AT EXISTING BUILDINGS

A. The General Contractor shall provide neat and approved temporary closures wherever work of this Project interfaces with existing buildings or spaces. In general, closures shall be partition types (not canvas or similar material), with doors or access between the spaces only as required. Surfaces facing adjacent finished or occupied spaces shall have equivalent of gypsum board surface, smooth and undamaged. Temporary closures shall be located as approved by the University, with minimum encroachment on the existing spaces. Closures shall not block required exits nor unduly restrict circulation or activities in the adjacent space. The Contractor shall provide a schedule to the University, on a floor-by-floor and location-by-location basis when areas need to be vacated to install closures, or when areas will be closed off.

B. Temporary closures shall provide security from passage between the spaces (new spaces and existing space remaining in use by University), as well as provide protection from weather and from the transfer of dust. When any closure will be exposed to weather from November to April, it shall be insulated with 3" minimum blanket insulation. Perimeters and penetrations shall be sealed with masking tape, caulk or other appropriate seal to eliminate passage of air and dust. Closures shall be well maintained to protect against weather, dust and to provide security.

C. Painting of surfaces facing adjacent finished or occupied spaces will be done by the University, if required.

D. At a time agreed upon by the University and Contractor, temporary closures shall be removed and all permanent surfaces cleaned and restored by the Contractor.

PART 1: GENERAL

1.01 CHARACTER OF WORK, MATERIALS AND INSTALLATION

A. The Work shall conform in all respects with requirements of all Contract Documents, and workmanship shall be first quality, the best obtainable at the present state of the crafts. Incompetent or careless workmanship shall not be permitted by the Contractor and will not be accepted by the University.

B. Except where reusing of existing materials or equipment is required by the Contract Documents, all equipment and material shall be new, undamaged, in proper operating condition, serviced and ready for full use of the University after installation.

C. If, in opinion of the Contractor (or any Subcontractor) any Work is indicated on drawings or specified in such manner as to make it impossible to produce Work of highest quality, within space shown, or which may be considered improper for use and conditions, including the effects of expansion and contraction, or should discrepancies appear between drawings, or drawings and specifications, the Contractor shall refer same to the University and the Architect before proceeding. If the Contractor does not request such interpretation, no excuse will be entertained thereafter for failure to carry out and guarantee the Work in a satisfactory manner. Elements of the Work intended to protect against weather shall be guaranteed weather and water tight.

D. Proper performance of the Contract shall imply, among other things, correct and proper placement, proper or published results for products and equipment, fitting and operation of fixed or movable and operating parts of the Work, including doors, windows, hardware and all systems and equipment. All materials and equipment shall be complete in every respect, with all parts, connections, anchors, devices, backing, fittings and other necessary items, and shall be completely installed, anchored, fitted and placed in operating condition. Before buying, constructing or installing work, the Contractor shall notify theUniversity and the Architect of any conditions which may exist in the Contract Documents which will affect proper operation or first quality installation.

E. Throughout project, various materials and pieces of equipment are fitted to others, various materials are applied to which other materials attach and similar installation relationship. Each manufacturer, Contractor and subcontractor shall take all reasonable precautions to insure his materials, devices, items, equipment or other products can be satisfactorily applied or installed to each other or work of others and he shall make necessary adjustment during preparation of shop drawings or in advance of field or shop work to accommodate other work to prevent unsatisfactory items or installation.

F. All materials or equipment shall be installed or applied according to directions of the manufacturer or recommendations of an association dealing primarily with materials, unless specifically designated otherwise. In no case shall the installation, including any temporary work necessary (i.e.

shoring), be below the standard recommended by the manufacturer. Where specified requirements exceed the manufacturer's standards, the specification shall govern. Fabrication (including reinforcing and accessories) and installation shall be provided to insure proper placement and use of the item or material under the location, use, condition and available space to serve intended function and to meet code requirements.

G. Equipment and devices shall be provided and installed to "fail safe" in all circumstances and it shall be Contractor's obligation to provide and install work in such manner.

1.02 PROPOSED MATERIALS AND EQUIPMENT

A. Refer to Article 12 of the Instructions to Bidders, Paragraph 7.13 of the General Conditions and Article 2.03 of Section 01300, Submittals. The Contractor shall provide materials, articles, equipment, systems and other items (products) that have been specified, or listed in addenda, under the specified conditions and criteria. Requests for the use of alternate products after bids have been received will not be considered, nor changes allowed in the accepted list of products, except when the specified or accepted product subsequently is determined as not meeting the requirements of the Cotract Documents or the product becomes unavailable, and then only under the following conditions:

1. The Contractor (or subcontractor) has placed ordersfor the specified materials and equipment (products) promptly upon award of contract and acceptance of list. No excuse or proposed substitution will be considered for products due to unavailability unless proof is submitted that firm orders were placed immediately.

2. The reason for unavailability is beyond the control of the Contractor. Unavailability will be construed as being due to prolonged strikes or lockouts which will seriously delay the entire Project to an extent the University finds unacceptable, bankruptcy, discontinuance of manufacture of a product or Acts of God.

3. The request for the use of an alternate product is submitted in writing within 10 days after the date the Contractor has ascertained the product does not comply with the specifications or has become unavailable, accompanied by supporting evidence.

4. The Contractor proposes to use an alternate product that was specified or listed in an addendum, along with complete data on the product.

5. There is no extra cost to the University.

6. The alternate product is acceptable to the University and Architect.

B. If, after acceptance of the Contractor's proposed list of materials, required under Section 01300, by subsequent evidence or investigation the University or Architect determines a product has been misrepresented and will not comply with, or perform in accordance with, the Contract Documents, they shall have the right to require a change to a complying product without increase in cost to the University.

1.03 REFERENCES TO STANDARDS AND CODES

A. If the Contractor observes that the drawings and specifications are at variance with any applicable code or regulation of a governmental unit having authority, he shall promptly notify the University and Architect in writing, and any necessary changes shall be adjusted as provided in the Contract for Changes in the Work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the University, he shall bear all costs and damages arising therefrom.

B. The standards referred to, such as ASTM, Federal Specifications and similar standards, shall have full force and effect as though printed in the specifications, except as modified in the specification. These standards are not furnished to bidders and the Contractor as it is assumed that manufacturers and trades involved are familiar with their requirements.

C. Any material specified by reference to the number, symbol or title of a specific standard, such as ASTM, Commercial Standard, a Federal Specification, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of The Contract Documents, unless otherwise noted.

D. For products specified in accordance with a Federal Specification, ASTM Standard, American National Standards Institute or similar association standards, upon request the Contractor shall provide an acceptable affidavit by independent testing laboratory, or other source approved by the University and Architect, certifying that product furnished for this Project complies with particular standard specifications. Where necessary, requested or specified, supporting test data shall be submitted to substantiate compliance. The manufacturer is subject ot Architect's acceptance.

1.04 GUARANTEES

A. In addition to the general one year guarantee on all Work under this Contract, any extended guarantee of the manufacturer on any item shall be provided to the University as a part of this Contract, and shall remain in force and effect for the University.

B. The Contractor shall complete all manufacturer's warranty registrations for all items, components and units so warranted, and shall file copies of the warranties with the University. Manufacturer's standard warranties for periods shorter than one year shall not limit the one year guarantee period by the Contractor as required under the Contract.

1.05 ANCHORAGE, SUPPORTS AND SLEEVING

A. The requirements of technical sections of the specifications or as shown on drawings, which are more specific or in excess of the general requirements herein, shall take precedence over these general requirements.

B. The Contractor and his subcontractors shall furnish and install proper anchorage devices to securely and in the best manner fasten, hang, mount,

anchor, support all work in a neat and substantial way. Unless otherwise specified, subcontractors shall furnish all devices for fastening their work together and for fastening to the structure.

C. The Contractor and each subcontractor shall furnish and install all their own sleeves, anchors, inserts and other devices as work progresses to accommodate their own materials or work. Methods and devices, as well as location, may be subject to the Architect's and University's approval and shall not impair, violate or alter structure, water integrity or aesthetic value of the Work.

D. In general, provide bolts and shields for anchorage to solid materials, toggle bolts into hollow construction or through bolts and washers where necessary, unless otherwise shown or specified. Wood plugs into solid materials, toggle bolting to vertical lath and plaster, or bolting into shields at hollow units, will not be acceptable. The Contractor shall provide adequate backing for all fastenings and supports to prevent pull-out, deflection or undue stresses. For concrete, anchorage devices shall generally be cast-in, not drilled in later, unless otherwise specified.

E. At concrete, shot or drilled-in anchor devices will be permitted where casting-in may be difficult to coordinate, provided they will not damage the concrete or cause any spalling around the anchor. Shot anchors will not be permitted in bottoms of joists, in the underside of slabs 4" or less in thickness nor where spalling may result. Any shot anchors at concrete joists shall be at the side of the joist, above centerline. A representative number of anchors shall be field loaded above anticipated loads to insure their adequacy. Drilled-in expansion anchors, which have the same hole size as the bolt size, such as "Kwik-Bolt" or "Wej-it" will be permitted provided there is no spalling around the holes, the holes are neatly drilled and approved test reports indicate adequate shear and pull-out strength with ample safety factor.

F. Sleeves shall be provided for all pipes, conduit and similar features that pass through walls, floors, roof slabs, concrete joists, concrete beams or girders, or concrete bridging, whether specifically indicated or not. (No sleeves permitted thru columns). Sleeves shall be provided by the Contractor or the Subcontractor requiring the hole for his work. At all concrete penetrations sleeves shall be uncoated or galvanized pipe, not less than Schedule 40 steel pipe. At exposed or concealed masonry walls, sleeves shall be same as for concrete penetrations. Unless otherwise called for, sleeves passing through walls, slabs, beams, bridging, shall be 1/2" greater in inside diameter thanexternal diameter of pipe (including insulation), or conduit passing through the sleeves. All sleeves shall be of new material, cut square, reamed. Sheet metal sleeves may be used only where specifically approved. Unless otherwise called for: sleeves through walls shall extend full thickness of wall and be cut flush with finished surface; sleeves through exterior building walls, above or below grade shall extend full thickness of wall and be cut flush with finished surface; sleeves through floor slabs for piping where piping or conduit will be exposed shall extend 1/2" above finished floor except at potentially "Wet areas" (all equipment rooms and similar spaces) the sleeves shall extend 1-1/2" above finished floor; where concealed, sleeves through floor shall be cut flush with floor. Where sleeves occur in rows or clusters, a minimum of 4" of

concrete shall be left between sleeves and if the normal spacing of reinforcing bars cannot be maintained, or are interrupted because of sleeve size or cluster locations, extra reinforcing shall be provided as directed by the Architect. In no case shall sleeves impair the structural capability of the Work, new or existing.

G. Sleeves at core drilled holes shall conform in dimension, material and height to the requirements of paragraph F above. The sleeves shall provide a good fit to core drilled hole and shall be set in place with a full coating of approved epoxy adhesive to insure remaining in place and a good seal between the hole and the sleeve.

H. As pipe, conduit or other feature is installed through a sleeve, it shall be wedged to keep in the center of the sleeve, with wedges held 1" back from end of sleeve. Pipe, conduit or other features through walls or other vertical surfaces, shall be caulked both sides of wall, exposed or concealed. Pipe, conduit or other features through floors and roofs shall be caulked at the top in all cases, and at the bottom where exposed in a finished space. An approved rod-stock backing for sealant shall be inserted around the pipe, conduit or other feature, held back 1/2 inch from end of sleeve. Sealant shall then be applied, sloped up about 20 degrees to the pipe to form a watershed. The sealant shall be G. E. Silpruf Sealant, or approved equal, with a Shore A hardness of 40 to 50, color as selected by Architect. All sealant work shall be provided by the Contractor installing the pipe or conduit and shall be installed in accordance with the workmanship provisions, including clean surfaces, of Section 07900 of these specifications. At all penetrations through roof and floor slabs, fire and smoke rated walls or partitions and shaft or core enclosing walls, the space between the sleeve and pipe shall be provided with an approved fire stop. Prior to placing the rod stock backing and sealant, insert Johns-Manville, Cerablanket-FS ceramic fiber blanket insulation filling the entire space between sleeve and pipe or conduit, a minimum of1-1/2" in depth. Hold back from edge of sleeve to allow for rod stock backing and sealant. Installation shall be made to maintain an effective fire stop. (Cerablanket material available from Tremco).

- - -

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

A. The nature of the Project, the schedule of substantial completion and final completion as specified in Section 01200, the time necessary for the University to complete future Projects of the Jackson Owre Millard Lyon Complex Remodeling requires careful and efficient planning to facilitate an orderly completion process within a short period of time. The Contractor shall organize and schedule a coordinated completion process and prosecute the work efficiently and diligently. The Contractor shall organize and schedule the work of subcontractors, as well as his own work, obtain firm commitments from subcontractors on completion of their work and coordinate his effort with all other Contractors and the University to achieve completion on time.

B. As applicable, the specified requirements shall apply to substantial completion specified in Section 01200. Where appropriate or possible, the specified requirements shall be accomplished on or before the date of substantial completion.

C. After substantial completion, the Contractor shall continue to diligently prosecute all remaining work in an organized, efficient manner.

D. As may be appropriate, the requirements of this section apply to, and shall be accomplished for any individual area, floors, spaces or other parts of the total Project which the University may take over and assume beneficial occupancy or use.

PART 2: PROJECT CLOSE OUT

2.01 REQUIREMENTS SPECIFIED ELSEWHERE

A. Insurance: Refer to General Conditions, Article 11.

1. Upon completion of last phase of the work and final payment, provide a certificate of insurance that indicates the specified Completed Operations Insurance will be provided a minimum of one year after the University's acceptance of the entire Project.

2. The specified Property Insurance (Multiple Peril Builder's Risk) may be cancelled at a time approved by the University after occupancy of the entire project by the University, or upon final completion and final acceptance by the University of the entire Project, whichever occurs first.

B. Change Orders: All Change Orders shall be resolved prior to final payment, including the adjustment of any allowances.

C. Consent of Surety: Refer to General Conditions, Sub-Paragraph 9.7.1. The consent of the Surety must be obtained prior to any reduction in retained percentage and prior to final payment.

D. State Income Tax Withholding Certificate: Refer to General Conditions, Sub-Paragraph 9.7.2.

E. Guarantees - Warranties: Refer to General Conditions, Sub-Paragraph 13.2.2 for the general guarantee requirements.

1. In addition to the general guarantee, provide all written guarantees specified in the technical Sections of the specifications. Where the guarantee terms are included in the specifications (i.e.: Section 07510) or a specific guarantee is referenced, submit guarantee in the specified form. Submit guarantees at substantial completion. The Contractor shall provide a check list of required guarantees, by Section numbers.

F. Test Reports and Certificates: Provide all test reports and certificates required in the technical Sections, prior to final payment. The Contractor shall provide a check list of required reports and certificates, by specification Sections.

G. Retention of Records: Retain all records as required by law and good business practice.

H. Record Set of Drawings: Refer to Section 01300, Article 2.5. Deliver the record set to the University upon final completion of the Project. Review the set with designated personnel of the University, to clarify or explain changes that may be necessary. Obtain a receipt for the set.

I. Temporary Utilities: Refer to Section 01500.

1. Remove all temporary facilities and utilities as the job progress permits. Read all meters at the times specified for the transfer of services cost from the Contractor to the University, as applicable.

2. The Contractor shall pay the University for all charges for utilities (except those paid directly to the utility company) he is responsible for, prior to final payment on the Contract to the University.

J. Sanitary Facilities: Refer to Section 01500, Article 3.2. Remove temporary toilets and restore the area as specified, prior to substantial completion of final phase.

K. Elevators: Refer to Section 01500, Article 4.4.

1. At a time approved by the University, the Contractor shall remove all protective linings provided by him in elevators that have been in temporary use and shall restore the elevators, as required to return them to existing condition. It is intended this work be accomplished just prior to final completion of the entire Project.

L. Temporary Facilities:

1. As the job progresses and facilities are no longer needed, they shall be removed by the Contractors, at a time approved by the University.

2. Prior to final payment, the Contractors shall remove all temporary sheds, offices, fences (except as specified in Section 01500), barricades, surplus materials, debris and other materials or items not part of the Project.

M. Extra Materials: Prior to final completion, deliver all extra materials specified in the various technical sections. These materials shall not be allowed to "collect" in various parts of the Project, but shall be delivered to the designated representatives of the University, as directed. Obtain receipt for the specified extra materials and without such evidence of delivery, no credit will be given for fulfilling the specified requirements. The Contractor shall provide a check list of the specified extra materials.

N. Construction Cores and Keys: At the time of substantial completion, just prior to occupancy, the University will replace the construction cores and install the permanent cores in the locks. Thereafter, access to the spaces will be by having the University open the doors.

O. Identification of Equipment: Prior to substantial completion, the Contractor shall provide the identification tags or plates, or other identification means, as specified under the technical Sections of the specifications, such as at valves, panelboards and similar items. Plates with directions, circuit data and similar information shall also be affixed.

2.02 SYSTEMS AND EQUIPMENT TESTING

A. The Contractors are responsible for testing all equipment and systems of their contract and demonstrating they are correctly installed and operating properly, in the intended and planned manner. The Contractors shall operate and test each system and provide a written record of the tests and the results.

2.03 CLEAN-UP

A. Refer to General Conditions, Article 4.16, and Section 01010, Article 1.25 for general requirements of cleaning during construction. Unless otherwise specified, each subcontractor shall be responsible for cleaning the materials and equipment of his subcontract, as well as the removal (hauling away) of all his own debris, cartons, crates, surplus materials and maintaining his work neat and orderly under the general direction of the General Contractor.

B. It is intended the general "final" cleaning of all areas affected by the work of the Project be accomplished just prior to the inspection for substantial completion and occupancy, typically within the week prior to the inspection. Cleaning shall be a planned, organized effort to avoid working in spaces after they have been cleaned. The General Contractor shall schedule the cleaning sequence, in cooperation with subcontractors and other Contractors and all shall schedule their operations to conform to the cleaning plan. In general, the mechanical and electrical subcontractors shall perform their cleaning and debris removal from the spaces first, with the General Contractor last.

C. The following requirements are a general guide to the required cleaning; do not construe as a complete description of all the cleaning required, as the work of the entire Project shall be thoroughly cleaned, including any specific cleaning required under other sections. As an area is cleaned, each Contractor shall remove the accumulated dust, dirt and debris.

D. The electrical subcontractor shall clean the interiors of cabinets, panelboards and other equipment provided under his Contract, and clean light fixtures which have become dusty and lenses which are dirty.

E. The mechanical subcontractor shall: clean any ductwork that has become dirty or dusty; clean all fixtures and fittings; clean any dirty or dusty radiation; dust and clean piping and equipment and clean other work.

F. Tunnels, shafts, air shafts, air plenums (not ductwork) and similar areas where work has taken place, shall be free of dust and dirt. General Contractor shall clean these areas to "broom clean" condition.

G. At all spaces of this contract the General Contractor shall clean the spaces to "broom clean" condition, except that floors shall be washed and new floors shall be given the final coat of seal specified under Section 03300.

H. At contiguous normally occupied areas, such as classrooms, laboratories, service areas, passages and corridors and similar spaces, the General Contractor shall: clean all his work to the "thoroughly clean" condition previously specified; provide floors (including concrete) that are free of stains and discoloration; adjust hardware and polish any that has become discolored; and perform such other cleaning as required to turn the Project and its spaces over to the University in a new, well maintained building condition, ready for full use and occupancy.

I. At spaces with bare concrete floors, the floors shall be washed and be given the final coat of seal, specified under Section 03300, just prior to final inspection or occupancy of the space.

J. After cleaning for inspection for substantial completion and occupancy, any subsequent work in any space shall likewise be cleaned upon the completion of the work by the Contractor or subcontractor, as above.

- - -

PART 1: GENERAL

1.01 SCOPE

A. Conditions of Contract and Division 1 General Requirements apply to all work of this Section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Refer to Sections 01010, 01200, and 01500 for special requirements, protection, constraints, timing of work, scheduling of work, enclosures and similar requirements relating to this Section.

C. This Section covers cutting, demolition, removal work, patching and restoration of work as necessary to accomplish and complete all work under the Contract, including removal and relocation or reuse of existing materials, equipment, systems or other work, as well as the disposition of salvaged materials or debris. This Section governs all Subcontracts and trades.

D. The University will disconnect and remove all non-fixed equipment in coordination with the Contractor's schedule.

E. It is the intent that, unless otherwise specifically shown on the drawings or specified, each subcontractor shall be responsible for all cutting, demolition, removal, patching or restoration as may be required to complete his work, under the general direction of the General Contractor.

F. Except for general demolition of entire areas it is the intent that at each area, or space, each subcontractor shall make the removals, perform demolition and accomplish relocations of work normal to his trade (ie: Mechanical subcontractor removes or relocates piping, ductwork and similar; Electrical subcontractor removes or relocates panelboards, conduit, lighting and similar). At areas of general demolition of the entire spaces, the Mechanical and Electrical shall make removals of work normal to their Contract or as may be called for, for reuse or relocation, make any necessary relocations and cut-off, terminate, cap or otherwise discontinue services that will be abandoned or removed in the space. The General Contractor shall then demolish or remove all abandoned or unwanted electrical or mechanical materials, items or elements in the area.

G. All work under this section shall be coordinated with the other Contractors and the University and shall be accomplished at times acceptable to the University.

PART 2: DISPOSITION OF MATERIALS

2.01 UNSALVABLE MATERIALS

A. All unsalvable materials shall be removed in a manner that will avoid damage to materials or equipment to remain and shall be completely removed and legally disposed away from the site.

2.02 SALVABLE MATERIALS TO BE RE-USED IN THE WORK

A. Salvable materials designated for re-use or relocation shall be removed

by the applicable trades, stored (off site if required), and protected from damage until they are incorporated into the new work.

B. Carefully remove, salvage, clean and preserve materials and equipment indicated to be reused or needed for reuse to match existing work. Exercise extreme care in removals to prevent damage or to make materials unsuitable for reuse. For materials shown or called for to be reused and which are damaged, replace with equivalent and matching work.

C. Exercise extreme care in removing brick or stone from existing building to preserve for reuse. Do not reuse broken brick. After removal clean all mortar from all sides of brick, carefully stockpile and protect to insure brick is available for reuse. Stockpile off site, if space is not available at site, and cover and otherwise protect from soil or damage. Stockpile on suitable platforms (not on earth).

2.03 SALVABLE MATERIALS TO BE STORED FOR THE UNIVERSITY

A. All salvable materials not designated for reuse in the work are hereby designated to remain the property of the University. These shall be carefully removed by the applicable trades, protected from damage and stored as directed on the site until removed by the University.

B. Consult the University for any salvage the University may wish to retain and the salvagability of all items. Carefully remove and salvage any materials the University wishes to retain. Remove finish hardware from the item or material taken out of the building and turn over to University. Cleaning or restoration of the University's salvage materials is not required.

C. Removal from the site storage to University storage will be by the University.

PART 3: EXECUTION

3.01 TEMPORARY PROTECTION

A. Provide temporary bracing, shoring, needling and support during demolition, cutting, remodeling and related new construction as necessary for the execution of the Work and the protection of persons and property. Perform all work with appropriate supports, protection and methods to prevent collapse, settling or damage to property or persons. Provide adequate supports for the loads to be carried, with loads properly distributed including to lower levels, if necessary.

B. Provide protective coverings and enclosures necessary to prevent damage to existing spaces and materials to remain. Protect openings in exterior walls and roofs (including removal of roofing and flashing) so as to prevent damage from water and the elements and prevent excessive heat loss from the existing buildings.

C. Refer to Article 4.02 of Section 01500. Provide dust-proof temporary enclosures separating areas under demolition and remodeling from the remainder of the building. Provide temporary hinged doors in temporary enclosures where necessary. Temporary and permanent doors shall be completely sealed with tape or other suitable material during demolition work and shall remain sealed until dust has settled.

3.02 GENERAL REQUIREMENTS

A. Accomplish all work of cutting, removal, demolition, patching or other restoration using only mechanics skilled in the trade. If necessary, sublet the work to skilled contractors or subcontractors.

3.03 DEMOLITION AND CUTTING

A. Demolish and remove existing construction as shown, indicated or required to be removed. Where new Work is to be installed in or adjacent to existing construction or existing work is to be replaced, remove or cut the existing construction as necessary to complete the Work of the Project.

B. Execute work with care. Existing construction that is to remain which is loosened, cracked, or otherwise damaged or defaced as a result of the Work and is unsuitable for use intended shall be removed and replaced at no additional cost to the University.

C. Clean demolition areas and remove debris, waste and rubbish from the building at the conclusion of each day's work. Transport debris and rubbish in such a manner so as to prevent spread of dust.

D. Debris from upper levels shall be transported to ground in covered chute or other approved means. No free-fall debris removal is permitted. Moisten debris with spray where practical. Take all precautions to minimize dust. Promptly remove debris from site as demolition progresses and debris accumulates. Do not store or permit debris storage at site. Do not burn debris, rubbish or waste at the site. Keep adjacent areas unencumbered and clean. Keep walks and similar areas broom clean.

3.04 PATCHING, REMODELING AND RESTORATION

A. Patch or otherwise restore disturbed existing construction as indicated on the drawings, or as otherwise required to restore the work and surfaces. Patching or restoration shall be carried to natural breaks (ie: corners) wherever reasonable. Where existing construction is removed, cut, exposed or otherwise disturbed by Work of the Project, patch defective and incomplete surfaces. Repair any damage to existing construction which is to remain.

B. Patching work shall be done by skilled mechanics experienced in the particular type of work involved. Patching work shall conform to the standards of the Specifications where applicable, and where not specified, work shall conform to the highest standards of the trade.

C. Patch existing construction to match existing work (unless otherwise called for) except provide new materials and accomplish as for new work. Examine existing surfaces to be patched before proceeding with the work. Report all conditions where existing materials, colors and finishes cannot be matched to the University, and do not proceed until the University has issued instructions.

D. Existing construction that has been damaged as a result of the Work shall be repaired to an extent and as required to match adjacent existing undamaged construction.

E. Thoroughly clean and prepare all surfaces to receive new finish or covering. Completely remove dirt, dust, grease, oil, paint, loose materials and soil. Clean, etch where necessary, and place surfaces in most suitable condition for the finish, as approved by University.

3.05 MECHANICAL AND ELECTRICAL WORK EXPOSED

A. Where unknown mechanical piping or electrical conduit is exposed during removal of partitions or walls, removal or rerouting shall be accomplished by the Mechanical or Electrical subcontractor as applicable. Rerouted piping shall be located where directed and shall be connected to maintain all functions in proper operation. Abandoned piping may be left in place where it is buried in floors or walls (not in chases or concealed spaces), providing that it is disconnected from its source. There shall be no "dead end" water, sewer, or vent piping existing in the completed work. Abandoned piping, duct work, conduit or other mechanical or electrical items in chases, vertical enclosures or concealed above ceilings shall be completely removed.

B. Removals, capping or otherwise terminating services which are abandoned shall be accomplished without additional cost to the University. Relocations and rerouting of services that were unknown shall be paid for as Changes in the Work.

3.06 WORK OF EACH CONTRACT

A. Each Subcontractor shall carefully review the Contract Documents including for other trades, with respect to the coordination of the demolition, removal and remodeling work and perform such removals normal to their Contract as may be shown, noted or otherwise required. Cutting and patching incidental to demolition, removal and or remodeling of general construction work shall be construed as the work of another trade when specifically noted or called for on documents primarily for another trade, or the cutting and patching is done solely to accomplish work of another trade. Mechanical and Electrical subcontractors shall perform their own cutting and patching to accomplish their work unless indicated on Architectural drawings as being done by the General Contractor.

3.08 PAINTING

A. Mechanical or Electrical Subcontractor shall be responsible for painting or repainting of patched or remodeled areas where he has performed work, except for those areas shown or required to be remodeled under the General Contract, in which case the new, patched and remodeled paintable surfaces shall be repainted by the General Contractor. It is the intent the Mechanical and Electrical Subcontractors paint or repaint surfaces at locations where demolition, cutting and patching is accomplished only for their work.

B. Painting, including preparation, materials, workmanship and number of coats shall comply with Section 09900. Painting of surfaces patched shall extend to natural breaks, such as corners, as approved by the University.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes all earthwork required by the Construction Documents within the defined construction limits as well as outside the construction limits as may be required to accomplish all phases of work under the Contract. The following broadly outlines the intent of work under this section; do not construe as describing all phases, operations, details, methods or requirements. Perform, provide and accomplish all similar and related items to complete the work.

1. Removal and disposal of excavated materials which are excess or not suitable for fill or backfill.

2. Earth excavation required for construction and site development including excavations for foundations and underpinnings, and vaults and manholes.

3. Installation of the concrete and non-shrink grout at underpinnings.

4. Backfilling and compacting against footings and walls.

5. Placing and compacting of fills, backfills and cushions.

6. Grading of excavations and site within the construction limits.

7. Grading of temporary drives for earthwork operations.

8. Protection of buildings, structures, streets, paving, curbs, manholes, walks, utilities and underground services and other new or existing items to remain from damage.

9. Provide to site all materials of kinds required to accomplish work shown and specified, unless available at the site.

10. Removal and disposal of underground sewers and appurtenances to be replaced.

C. Work excluded from this Section:

1. Work under this contract includes rough grading to levels that are 8 inches below final grades. Finish grading and landscaping above these levels will be provided and installed by the owner.

2. Exterior walks, curbs, curb and gutters, paving and other exterior surfacing materials required, unless noted otherwise, will be provided and installed by the Owner.

D. Related work specified elsewhere:

1. Demolition and Removal Work: 01910.
2. Cast-in-Place Concrete: Section 03300.

1.2 CONDITIONS AT THE SITE

A. Bidders shall completely familiarize themselves with the site, specifications and drawings. No extra compensation will be allowed for unforeseen conditions that can be determined from a careful examination of the site, drawings and specifications.

1.3 TESTING

A. The Owner will retain the services of qualified engineers employed by an independent testing laboratory to analyze the soils and to perform tests, report findings and determine whether the required soil values are obtained.

B. The Contractor shall extend full cooperation to these engineers in obtaining samples for field and laboratory use.

1.4 INSPECTIONS AND APPROVAL

A. The methods of excavation shall be subject to the approval of the Owner and Architect.

B. The final conditions at the bottoms of the excavations will be inspected by the Owner and testing laboratory. Tests shall be made where necessary. Approval of conditions found must be obtained from the Owner before forms, reinforcement and concrete are placed.

C. All protective measures provided to prevent disturbance of existing soil supported structures, to prevent bearing failure of soils under existing foundations and to support and protect the existing utilities shall be subject to review and approval by the Owner and Architect before proceeding and during the earthwork operations.

PART 2: MATERIALS

2.1 EARTHWORK MATERIALS

A. Granular fill and backfill. Reasonably well graded pit run granular materials, sand or sand-gravel, clean course and sharp in character, free of debris, cobbles and boulders, free of clay and silt, free of organic material or other material which will prevent compaction. Use material classified under ASTM D2487-69 and D2488-69 as SW, SP, GW, GP or GM-SM. Suitable material from site may be used after analysis and classification by soil laboratory. Use for:

1. General fill and backfill within buildings, including "bulk" fill.
2. Backfill at foundations interior and exterior.

B. Gravel Cushion: Use as a free draining cushion under slabs-on-grade.

Gravel cushion to be in accordance with the 1968 Minnesota Standard Specifications for Highway Construction, Section 2502.2, Subdrainage Backfill.

C. Site Fill: For general fill at site use best classes of materials available at the site, using coarse grained soils as far as possible and avoiding use of silty and other poor soils. Use fill material free from debris and organic matter. Use for general site fill at unsurfaced areas.

D. Laboratory tests on types of materials to be used for granular fill and backfill and gravel cushion will be provided by the Soils Engineer, retained by the Owner in accordance with Article 1.3 and 3.5. Two tests to be provided for each type of soil. Contractor shall consult with the Soils Engineer, who shall make a recommendation of optimum moisture content, method of providing this moisture and methods of compaction for each type of fill. Contractor shall moisten or dry out fill and provide and accomplish compaction as recommended by laboratory. Copies of tests shall be provided to Architect, University and Contractor.

2.2 THICKNESS OF MATERIAL

A. Gravel cushion under slabs on grade: 8".

PART 3: EXECUTION

3.1 SITE CLEARANCE

A. Remove all debris and legally dispose away from the site. Where debris is mixed with soil, both the soil and the debris shall be removed. Protect existing adjacent buildings, trees, shrubs, and areas, features, and property. Replace any sidewalks, curb, gutter and other structures broken as result of operations under this Contract which are to remain.

B. At the start of operations, strip topsoil at areas to be disturbed within the construction limits by approved methods and legally dispose away from the site. Topsoil outside the construction limits shall remain. Disturbed site areas outside of the construction limits shall be leveled and dressed to a finished grade appearance.

3.2 EXCAVATION

A. Soil Excavation:

1. Perform no excavation adjacent to existing features until proper precautions or protection have been provided or will be provided as excavations progress. Immediately replace any damage and restore services.

2. Excavate so that column and load-bearing wall footings bear on sound, undisturbed, natural soils. Excavate down through any fill, black colored topsoil and loose silty layers as required to provide proper bearing and prevent differential settlement.

3. No footings or similar loads are to bear on fill or soil with inadequate bearing capacity.

4. Excavate to lines, levels, dimensions shown and required with allowances for slabs, footings, cushions and other features. Hand excavate lower levels (at least 10") of footing and trench excavations and work adjacent to existing utilities, pipes, electrical duct, and buildings.

5. Keep footing trenches level and free of loose dirt, debris or water. Provide excavations for footings and walls wide enough to accommodate forms as all concrete shall be formed.

6. Remove all frost from ground such that no building feature is placed on frozen ground.

7. Overcut footing excavations shall require that the footing concrete be placed for the full depth of the overcut, at no additional cost to the Owner.

B. Excavated Material: Excavated material, if suitable as determined by Soil Testing Laboratory, shall be retained on the site for use as described under Article 2.1. All unsuitable material and other excess earthwork materials shall become the property of the Contractor and shall be disposed by him off the limits of the University at no further cost to the Owner. Conduct operations such that excavation material and material used for fill shall not be subject to erosion and the Contractor shall be responsible for any damage to adjacent properties, because of erosion, or diversion of surface water drainage.

C. Water:

1. All footing excavations must be kept free of surface water by grading the surface adjacent to the excavation to divert water.

2. Provide pumping of water to keep excavations free of water, including time of placing and curing concrete, during placing and compacting of soils or other work subject to water damage.

3.3 CONCRETE UNDERPINNING

The Contractor shall review with the Owner, for approval before starting the work, the materials to be used and the installation methods to be followed for placement of the concrete underpinnings shown on the drawings.

Materials and installation methods to be used and followed shall be those commonly employed for this type of work, based on proven engineering principles, and that will prevent any disturbances or damage to the existing soil supported structures and utilities.

The installation of the underpinnings shall be performed by qualified workmen experienced in this type of work.

Where cribbed pits are used for underpinning excavations, they shall be installed in alternating sections approximately 4'-0" in length, with no more than two (2) open pits permitted at any time, and the concrete placed in the pits for the underpinnings and the non-shrink grouting shall be allowed to cure as necessary to safely sustain the loads to be supported thereon before cribbing the adjacent pits.

All open underpinning excavations shall be covered when excavating work is not being performed.

Concrete and grout to be used for the underpinning is specified in Section 03300.

3.4 BACKFILLING

A. Backfilling Methods:

1. All excavated areas of the site shall be thoroughly cleaned of all debris before backfill operations are begun.

2. All backfill material shall be in accordance with Article 2.1.

3. Backfill shall be placed on subgrades in uniform, successive layers approximately 6" in compacted thickness. Each layer shall be level, smooth and thoroughly compacted by appropriate means over the entire surface before placing successive layers.

4. Embankments shall not be constructed during periods when the soil will freeze while being placed and compacted, nor shall any embankment material be placed on soil that is frozen. Frozen soil shall not be placed in embankments.

5. The Contractor shall provide the necessary vibratory or rolling equipment to obtain the required compaction.

6. Compaction by grading equipment shall not be considered adequate for uniform compaction.

7. Small vibratory or hand tamping compactors shall be required wherever fill or backfill is placed adjacent to walls or around footings and columns.

8. Where fill or backfill materials are placed on both sides of walls, they shall be placed in layers alternately on opposite sides of the walls to maintain levels that will avoid displacement of, or damage to, the walls.

9. Where fill or backfill materials are placed on one side of a wall the wall shall be adequately shored and braced or the material shall not be placed until the supporting slabs have been poured and set.

10. Any trenches dug in the compacted fill or backfill materials shall be backfilled firmly in uniform layers not exceeding eight inches in loose depth with each layer being compacted with a small vibratory or hand tamping compactor to the density specified in Article 3.5.

11. Fills and backfills shall be formed and maintained to provide proper drainage.

12. The completed subgrade surfaces shall be reasonably smooth, compacted and free from irregular surface changes.

13. Where excavation to proper subgrade exposes unstable soil, remove the unstable materials and replace with satisfactory materials as directed by the Supervising Engineer, except at soils located below footings. In the event unstable soils are found to exist below footing locations, the Testing Laboratory, Owner and Architect will direct the procedures to follow.

14. Earthwork operations shall be suspended at any time when satisfactory

results cannot be obtained due to rain, freezing weather or other unsatisfactory field conditions.

B. Drainage: As necessary during the progress of work, provide adequate temporary drainage facilities that will prevent erosion damage or unnecessary delay of the work, and shall restore original drainage as soon as the work will permit. Provide and maintain drainage away from any building or work area during the construction period.

C. Removal of Water: Dispose of any water entering the excavation and at all times maintain the excavation in a clean and dry condition. Provide sufficient storm water drainage, construct temporary sumps as required and pump to permanent drainage structures on or off the site. Water shall not be conducted onto adjacent property.

D. Inspections:

1. The Owner and Testing Laboratory will inspect all excavations.

2. The Testing Laboratory will perform any field and laboratory tests and inspections required on the natural soils at the bottoms of the footing excavations to verify the load bearing capacity of these soils as required and specified in Article 3.5 A2.

3. The Contractor shall not proceed with the construction of footing forms until the existing soils at the bottom of the excavations have been inspected and tested as necessary and permission to proceed has been given by the Owner.

4. Laboratory tests (sieve analysis, density tests, etc.) of the fill, backfill and gravel cushion materials and the methods of compaction must be accepted by the University before starting work.

E. Grading:

1. Rough grading to levels 8 inches below the final elevations is included under this Contract.

2. Final elevations shall be determined in the field to be uniformly level or uniformly sloped to match the existing finished adjacent undisturbed areas and provide natural drainage with the surrounding areas.

3. All grading shall be worked such that smooth contours will result and the subgrade shall be free of lumps, boulders, debris and water pockets.

3.5 FIELD AND LABORATORY TESTS

A. Laboratory and field testing of soils prior to and during excavation, filling, backfilling and compaction operations shall be done in accordance with the following:

1. The Owner shall retain an independent testing laboratory which shall provide inspection of excavations, soils evaluation tests and soil density tests.

2. All natural, undisturbed soils below the footings and foundations of the electrical vaults shown on drawing sheets numbered S3 and S4 shall be inspected and tested as necessary by the soil testing laboratory to verify that these soils have a minimum design bearing capacity of 5000 pounds per square foot as required to meet the design requirements. In the event that the natural, undisturbed soils do not have the required design bearing capacity the Testing Laboratory, Owner and Architect will determine the procedures to follow for the installation of the footings and foundations.

3. All material to be used for granular fill, backfill and gravel cushion shall be tested by mechanical analysis (AASHO) to determine conformance with these specifications.

4. No fill, backfill or gravel cushion materials shall be placed until the necessary tests have been made and approval obtained from the Owner.

5. Field Density Tests of the compacted fills, backfills and gravel cushions shall be performed in accordance with ASTM D1556.

6. Compaction shall meet or exceed the following percentages of Proctor Density (ASTM D698):

- 96% for: All fill and backfill within building; backfill against building foundations and other backfill and cushions under all concrete slabs (interior or exterior); all backfill within 25 feet of building.

- 92% for: General site fill which is more than 25 feet from building and not under slabs or paved areas.

7. Tests of compacted fills, backfills and gravel cushions shall be made every second layer at intervals as required to assure compliance with these specifications.

8. The testing laboratory shall submit to the Owner, in triplicate, plus a copy to the Contractor and Architect, complete written reports of all inspections and tests performed as soon as practicable after they are made.

B. If tests indicate that the materials specified have not been furnished, placed and compacted in compliance with these specifications, the materials shall be removed, replaced, recompacted and retested and the entire cost of this additional work, including the costs of the retests, shall be paid for by the Contractor.

3.6 PROSECUTION AND CLEAN-UP

A. Be aware of and comply with work priorities outlined in these specifications and other adjustments in work schedule, as may be required to properly coordinate the construction work with the Owner's requirements.

B. Leave the site in an orderly condition free of all debris. All areas outside the Contract limits which have been disturbed shall be restored to their original condition.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all formwork for cast-in-place concrete.

C. Related work specified elsewhere:

1. Concrete Reinforcements: Section 03200.
2. Cast-in-Place Concrete: Section 03300.
3. Metal Decking: Section 05300.
4. Metal Fabrications: Section 05500.

1.2 REFERENCE STANDARDS

A. American Concrete Institute, (ACI), ACI 347-68, "Recommended Practice for Concrete Formwork."

B. ACI 301-72, "Specifications for Structural Concrete for Buildings."

C. ACI 318-71, "Building Code Requirements for Reinforced Concrete".

PART 2: PRODUCTS

2.1 MATERIALS

A. Construct removable forms of wood, metal or other material to the following requirements.

1. For exposed concrete, use BB Plyform Class I or II Exterior, HD Overlay Plyform Class I or II Exterior, Exterior Plyron with smooth tempered hardboard faces or ¼" thick Tempered Presdwood Masonite form liners, free of torn grain, worn edges, hole patches or other defects.

2. Metal forms may be used, upon approval of the Owner and Architect, and shall produce surfaces equal to those of wood forms specified.

3. Sound boards, plank or metal forms may be used where concrete is not exposed, except structural slabs shall be formed with plywood.

4. Suitable moldings or chamfer strips shall be placed in the corners of column, beam and wall forms where the concrete will be exposed to view.

5. Positive means of adjustment (wedges or jacks) of shores and struts shall be provided.

B. Permanent metal forms used for the new concrete floor slabs replacing the existing removable floor panels on the third floor of Owre Hall and the existing removable trench covers on the third floor of Jackson-Owre Hall, as shown on Details 3/S4 and 4/S4, shall be galvanized and shall be Granco's Standard Corruform, Wheeling's Tensilform #50, or approved equal, furnished complete with welding washers.

C. Form Oil: Non-staining paraffin-based meeting Federal Specification P-O-361.

D. Form accessories to be partially or wholly embeded in the concrete, such as ties and hangers, shall be a commercially manufactured type. Nonfabricated wire is not acceptable. The portion remaining within the concrete shall leave no metal within one inch of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed one inch diameter. Ties for walls below grade shall be snap ties or have cones and shall incorporate a water-seal washer.

PART 3: EXECUTION

3.1 REMOVABLE FORMWORK

A. Construction: Construct forms to shapes, lines and dimensions called for on drawings, true to line, plumb and level, with joints mortar tight. Provide proper bracing and supports of sufficient strength to carry, without appreciable deflection and with absolute safety, the dead load of concrete as a liquid together with live loads of men, equipment and materials.

1. Provide sufficient forms so that work can be carried out without delay. Build forms of material of sufficient strength to hold concrete without bulging or sagging between supports. For concrete to be exposed to the weather, the edges shall be glued or otherwise sealed to prevent loss of any of the matrix. Edges of form panels in contact with concrete shall be flush within 1/16" and forms for plane surfaces shall be such that the concrete will be plane within 1/16" in four (4) feet.

2. Construct forms with proper camber resulting in level construction when the concrete has been placed in the forms.

3. Construct forms for exposed concrete with particular care to avoid appreciable deflection and to eliminate bulges, offsets or other unsightly features in the finished surfaces.

4. Design forms so they may be removed in the proper sequence and without damage to the concrete.

5. Provide side forms for beams and slabs which are removable without disturbing the bottom forms or the shoring beneath them.

6. Provide satisfactory foundations for formwork supported on the ground

to carry the loads imposed during and after construction, without appreciable settlement.

7. Adjust shores and struts to take up all settlement during concrete placing operations.

8. Forms for walls and columns shall have removable panels where required for cleaning, inspection and application of bonding paste.

9. Design and construct formwork to insure that concrete surfaces will conform to the following tolerances.

a. Variation from the plumb:
   1. In the lines and surfaces of columns, piers and walls:
      In any 10 feet of length - - - - - - - - - - - - - - - 1/4 in.
      In any story or 20 feet maximum - - - - - - - - - - - 3/8 in.
      Maximum for entire length - - - - - - - - - - - - - - - 1 in.
   2. For exposed corners, control-joint grooves and other conspicuous lines:
      In any bay or 20 foot length - - - - - - - - - - - - - 1/4 in.
      Maximum for entire length - - - - - - - - - - - - - - 1/2 in.

b. Variation from the level or from the grades indicated on the drawings:

   In slab and beam soffits:
      In any 10 feet - 1/4 in.
      In any bay or 20 foot length - - - - - - - - - - - - - 3/8 in.
      Maximum for entire length - - - - - - - - - - - - - - 3/4 in.

c. Variation of the linear building lines from established position in plan and related position of columns, walls & partitions.
   In any bay or 20 foot length -- - - - - - - - - - - - - - 1/2 in.
   Maximum for entire length - - - - - - - - - - - - - - - - - 1 in.

d. Variation in the size and locations of sleeves, floor openings and wall openings - - - - - - - - - - - - -+ or - 1/4 in.

e. Variation in cross-section dimensions of columns and beams and in the thickness of slabs and walls:
   Minus - 1/4 in.
   Plus - 1/2 in.

f. Footings:

   1. Variations in dimension in plan
      Minus - 1/2 in.
      Plus - 2 in.
   2. Misplacement or eccentricity
      2% of the footing width in the direction of misplacement but not more than - - - - - - - - - - - - - - - - - - - 2 in.

3. Reduction in thickness
   Minus - - - - - - - - - - - - - - - 5% of specified thickness

g. Variation in steps

1. In a flight of stairs
   Rise - + or -1/8 in.
   Tread - + or -1/4 in.
2. In consecutive steps
   Rise - + or -1/16in.
   Tread - + or -1/8 in.

B. Soil Supported Forms: If soil supporting forms is not suitable to carry loads imposed without compressing, provide trussed supports.

C. Openings: Form all openings, chases, recesses, etc. shown on the drawings.

D. Cleaning and Oiling: Sweep, clean and oil coat forms before reinforcing is placed.

E. Re-use: Before form material is re-used, all surfaces that are in contact with the concrete shall be thoroughly cleaned, all damaged places repaired, and all projecting nails withdrawn. Re-use of form material shall be subject to specific approval of the Architect and Supervising Engineer.

F. Joints: Provide expansion and contraction joints where shown on the drawings. Provide construction joints as detailed and where required. Construct joints in accordance with ACI 301-72.

G. Wetting Forms: In hot weather, wet down forms with hose immediately before placing concrete.

H. Built-in Items: Cooperate with all trades for the installation of reinforcement, inserts, anchors, sleeves, and other built-in items.

I. Edge Forms and Screeds: Set edge forms and screeds accurately to produce the designed elevations, slopes in the finished surfaces. Provide required slope to drains.

3.2 REMOVAL OF FORMS

A. Forms shall be removed in accordance with requirements of the ACI Building Code Requirements for Reinforced Concrete, No. 318-71, Chapter 6, and the ACI publication "Recommended Practice for Concrete Formwork," No. 347-68, except as modified below, without damage to concrete and in a manner to insure complete safety of the structure. Leave shoring in place until concrete member will safely support its own weight plus any live loads that may be placed upon it.

B. All shores under slabs having 16'-0" or less clear span shall remain for a minimum of 7 days providing the 7 day test cylinder shows at least 3/4 of the 28 day compressive strength requirement. Add ½ day shoring time per foot for each foot over 16'-0" span to maximum of 14 days.

C. In all weather, all concrete slabs having 16'-0" or less clear span shall have had 3 days of 70°F and 4 days of 50°F before shore removal. Spans over 16'-0" shall have had 3 days of 70°F and 50°F for the remaining days providing that the 7 day test cylinder shows at least 3/4 of the 28 day compressive strength requirement. In cold weather (below 40°F) an extra 7 day test cylinder shall be job cured under the same conditions as the concrete.

D. Shoring under beams shall remain a minimum of 28 days and the concrete must have achieved full 28 day strength prior to stripping. Forms shall be built so that column forms can be removed first, then the sides of beams where they occur, than the slab forms. Shoring for beams must be placed on the column center lines and the beam bottoms and their shoring shall be so constructed that they can be left in place after the rest of the forms have been removed.

E. Removal of Shores and Reshoring: After form removal at slabs, "back-post" within four hours after original shores are removed. Backposting shall remain in place a minimum of 28 days and longer when required to carry added loads on the slab.

F. Upon removal of forms, the Architect shall be notified by the Contractor in order that an inspection of the newly stripped surfaces may be made prior to patching.

G. Freshly stripped surfaces shall not be pointed up or touched in any manner before having been inspected by the Owner and Architect.

3.3 PERMANENT METAL FORMS

A. Erection.

1. Sheets shall be placed with edges up and flutes at right angles to supports.

2. Sheets shall be placed end-to-end beginning at one corner.

3. When one row has been placed end-to-end, begin another, making alignment adjustments if necessary.

4. Minimum end laps shall be 2 inches and shall always occur over steel supports.

5. All sheets shall be lapped one-half flute at side laps.

B. Welding.

1. Sheets shall be attached to the steel supports by welding through welding washers.

2. Minimum welding requirements are as follows:

a. Eng laps-each lap is fastened at each side lap plus one intermediate weld (3 welds per sheet).

b. Intermediate supports - weld sheet at side laps.

3.4 INSPECTIONS OF CONCRETE SURFACES

A. The Owner and Architect will inspect the completed concrete work after the forms have been removed. Work that does not conform to the shapes, lines and dimensions shown on the drawings, within the tolerances specified under Article 3.1.A.9 as determined by the Owner and Architect, shall be repaired and/or removed and replaced by the Contractor at his own expense.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing all concrete reinforcement for cast-in-place concrete including all accessories required. Cast-in-place concrete to be reinforced includes all footings, piers, walls, slabs, beams, curbs, and all other locations shown or noted on the drawings. Welded wire fabric reinforcement in slabs placed over metal decking, slabs placed over permanent metal forms, slabs or toppings placed over existing concrete surfaces and fabric reinforcement for wrappings of steel beams and columns shown encased in concrete are included under this section.

C. Related work specified elsewhere:

1. Concrete Formwork: Section 03100.
2. Cast-in-Place Concrete: Section 03300.
3. Masonry Reinforcement: Section 04200.

D. Furnished but not installed under this section:

1. Reinforcing for concrete filled lintels and bond beams: installed under Section 04200.

1.2 REFERENCE STANDARDS

A. The following specifications and standards are incorporated by reference:

1. American Concrete Institute, Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315-65.

2. American Concrete Institute, Building Code Requirements for Reinforced Concrete, ACI 318-71.

3. American Concrete Institute, Specifications for Structural Concrete for Buildings, ACI 301-72.

4. Concrete Reinforcing Steel Institute, Placing Reinforcing Bars, 2d Edition, 1975.

5. Concrete Reinforcing Steel Institute, Manual of Standard Practice, 1973.

1.3 SUBMITTALS

A. Shop Drawings: Submit fabrication and placing drawings in accordance with Section 01300.

PART 2: PRODUCTS

2.1 MATERIALS

A. Welded wire fabric: ASTM A185.

B. All reinforcing bars: ASTM A615, Grade 60.

C. Supports and Accessories: Conform to ACI 315-65. Where concrete surface is exposed to view or weather, use plastic supports, include all spacers, chairs ties, slab bolsters, clips, chair bars and other devices for properly assembling, placing, spacing, supporting and fastening the reinforcement. Metal supports shall be of such a type as not to penetrate the surface of the formwork and show through the surface of the concrete. Individual and continuous slab bolsters and chairs shall be of a type to complement the various conditions encountered and must be capable of supporting a 300-pound load without crushing.

2.2 DETAILING

A. Detail concrete reinforcement in accordance with ACI 315-65 and ACI 318-71.

2.3 FABRICATION

A. Shop fabricate to size, dimension and shape shown on approved shop drawings and within tolerances specified in ACI 301-72. After fabrication, sort, bundle, and metal tag reinforcement before delivery to the job site.

B. Concrete slabs on grade shall be reinforced as follows, unless noted or detailed otherwise on the drawings:

Slabs 4" or less in thickness - - - - - - 6 x 6 - 10/10 welded wire fabric.
Slabs 5" thick - - - - - - - - - - - - - - 6 x 6 - 8/8 welded wire fabric.
Slabs 6" thick - - - - - - - - - - - - - - 6 x 6 - 6/6 welded wire fabric.

C. Concrete toppings exceeding 2 inches in thickness placed over polyethylene slip sheets shall be reinforced with 6 x 6 - 10/10 welded wire fabric.

D. Cast-in-place concrete walls shall be reinforced in accordance with Chapter 14 of the American Concrete Institute Building Code (ACI 318-71), unless noted or detailed otherwise on the drawings.

PART 3: EXECUTION

3.1 PLACEMENT

A. Place concrete reinforcement in accordance with the approved placing drawings, CRSI recommendations and CRSI Manual of Standard Practice and in accordance with tolerances specified in ACI 301-72.

B. Place only reinforcement that is free of mill scale, excessive rust, or other coating that would prohibit proper bond with the concrete.

C. Support reinforcement and guard against displacement during concreting.

3.2 FIELD QUALITY CONTROL

A. Notify the Owner when all reinforcement is in place for each pour at least 24 hours in advance of placing concrete. Allow no placing of concrete until the Owner has inspected and approved concrete reinforcement in place in forms.

B. Corrections shall be made by the Contractor at his expense.

C. Exposed reinforcing steel in finished work, indicating the bars are not properly located, will be sufficient cause for the rejection, removal and replacement of the concrete section.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all cast-in-place concrete work.

C. Related work specified elsewhere:
   1. Concrete Formwork: Section 03100.
   2. Concrete Reinforcement: Section 03200.
   3. Metal Decking: Section 05300.
   4. Metal Fabrications: Section 05500.
   5. Earthwork: Section 02200 (Concrete Underpinnings).

D. Furnished by Owner:

   1. Retain and pay for testing agency for field quality control only. (Contractor shall retain and pay for testing agency for materials testing and mix design.)

E. Furnish but not installed under this section:

   1. Concrete bond beam and lintel fill: Installed under Section 04200.

F. Installed but not furnished under this Section:

   1. Certain imbedded items: See other sections.

1.2 REFERENCE STANDARDS

A. The following specifications and codes are incorporated by reference:

   1. American Concrete Institute Publications:
      a. ACI 301, "Specifications for Structural Concrete for Buildings".
      b. ACI 318-71, "Building Code Requirements for Reinforced Concrete".
      c. ACI SP-15, Field Reference Manual.
      d. ACI 613, "Recommended Practice for Selecting Proportions for Concrete".
      e. ACI 613A, "Recommended Practice for Selecting Proportions for Structural Lightweight Concrete".

   2. National Ready Mixed Concrete Association Publications: "Concrete Plant Standards and Truck Mixer and Agitator Standards".

   3. Portland Cement Association Publications:

a. "Design and Control of Concrete Mixtures", 11th edition
b. "Construction Joints" (AC 19.3)
c. "Curing Concrete" (ST 95)
d. "Specification for Vibrating Concrete" (ST 26)

B. The Contractor shall at all times keep available on the site for reference the above codes and standards.

1.3 QUALIFICATIONS

A. Mix design: Mix designs and aggregates testing shall be performed by an independent testing agency approved by the Owner and paid by the Contractor.

B. Testing Agency: Testing agency for field quality control will be selected and paid by the Owner.

1.4 SUBMITTALS

A. Mix Design: Submit reports in triplicate of all concrete mix designs and aggregate reports to the Architect for approval at least five (5) working days prior to pouring concrete.

PART 2: PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement:

1. Cement shall be American-made Portland Cement, free from water soluble salts or alkalies which will cause efflorescence on exposed surfaces. Portland Cement shall be an approved brand conforming to ASTM C150 - Type 1.

B. Regular Weight Concrete Aggregates:

1. Fine Aggregate: Washed inert, natural sand conforming to the requirements of ASTM C33.

2. Coarse Aggregate: Well graded crushed stone or washed gravel conforming to the requirements of ASTM C33 as follows:

a.

Location	Maximum Size
Footings and underpinning . . .	1½"
All other concrete	3/4"

C. Lightweight Concrete Aggregates:

1. Lightweight Aggregate: Well-graded expanded shale, clay or slate conforming to ASTM C330. The nominal maximum coarse aggregate size shall be 3/8".

2. Fine Aggregate: Washed inert, natural sand conforming to the requirements of ASTM C33.

D. Water: Clean, free of deleterious amounts of acids, alkalies or organic materials.

E. Admixtures:

1. Water Reducing Agent: ASTM C494, W.R. Grace WRDA, Master Builders Pozzolith 100N, or approved equal.

2. Air Entraining Agent: ASTM C260, W.R. Grace Darex AEA, Master Builders MB-VR, or approved equal.

3. Admixtures (e.g., calcium chloride) causing accelerated setting of cement in concrete shall not be used without written approval of the Architect and shall not be used in concrete placed over metal decking or permanent metal forms.

4. Admixtures shall be premixed in solution form and dispensed as recommended by the manufacturer. The water in the solution shall be included in the computation of water-cement ratio.

F. Grout: Pre-mixed, nonshrinking grout, Master Builders Embeco Grout, U.S. Grout Company Five Star Grout, Sonneborn Ferrolith G "D.S", or approved equal. Use below steel column base plates, steel beam bearing plates, between steel beam top flanges and existing concrete above, between the top of concrete underpinnings and the existing footing above and other locations where noted on the drawings.

G. Underlayments:

1. Latex Underlayment: Brock-White Latex Underlayment or approved equal. Use for skincoating and smoothing floors that require ¼" or less of underlayment. Before applying the existing concrete or terrazzo surfaces shall be sanded or mechanically abraded and cleaned to expose the original concrete or terrazzo.

2. Latex Liquid: Brock-White Latex Liquid or approved equal. Mix with Portland Cement and sand as recommended by the manufacturer and use for smoothing floors and for underlayments where the required thickness exceeds ¼" but is less than ½". Before applying the existing concrete or terrazzo surfaces shall be sanded or mechanically abraded and cleaned to expose the original concrete or terrazzo.

H. Epoxy Bonding Agent: Brock-White Uniweld Bonding Agent or approved equal. Use for bonding all concrete toppings 2" or less in thickness and at feathered edges of sloped toppings or ramped toppings wherever the thickness is reduced to 2" or less. Use epoxy bonding agent in other areas for bonding of concrete toppings that exceed 2" in thickness only where specifically noted on the drawings and details. Before applying the existing concrete or terrazzo, surfaces shall be sanded or mechanically abraded and cleaned to expose the original concrete or terrazzo surfaces.

I. Slip Sheets: 6 mil polyethylene plastic sheets and polyethylene tape. Use

over existing concrete surfaces prior to placing concrete toppings exceeding 2" in thickness except in areas where the toppings are specifically noted on the drawings and details to be bonded to the existing concrete.

J. Surface Treatments:

1. Curing Compounds and Floor Sealer: Brock-White Crete-Seal, A.C. Horn Clear Seal 150, Sonneborn Kure-N-Seal, Master Builders Company's Masterseal or Protex Triple Seal.

2. Non-slip Aggregate: Sonneborn Frictex NS, Grace Durafax, Norton Alundum or approved equal, graded to pass a 1/8" mesh and be retained on a 1/32" mesh.

2.2 CONCRETE RELATED MATERIALS

A. Expansion joint fillers: Preformed, non-extruding type.

1. Non-bituminous type, ASTM D1752 where used with a sealant.
2. Bituminous type, ASTM D1751, where sealant is not required.

B. Waterstops: New stock extruded polyvinyl chloride, 3-3/4" wide with center bulb; Electrovert, Meadows, Durajoint Type 2, B.H. Goodrich, W.R. Grace, or approved equal. Continuity in water stops shall be accomplished by making a fused butt splice using a heating element specifically designed for that purpose.

2.3 CONCRETE MIXING

A. Mix Design: Employ and pay for the services of an independent testing laboratory, acceptable to Owner, to test the proposed aggregate and design mixes for each type and strength of concrete required. Design mixes shall be proven by preliminary tests prior to concreting in accordance with ASTM C192. Such tests shall show 28 day average strengths at least 25% greater than strengths specified.

1. The Contractor shall make available to the Testing Agency all materials and mixtures for the concrete mix designs as well as sufficient samples of fine and coarse aggregates for qualitative acceptance tests. The materials acceptance tests, trial mix data, and recommended job mixtures shall be presented to the Architect for approval as soon as possible and at least five (5) working days prior to the proposed beginning of concreting. Materials shall not be delivered to the site or used until the mix designs shall have been approved.

3. Sample and test each type of aggregate in accordance with applicable ASTM procedures.

4. Design regular concrete mixes in accordance with ACI 301, except as modified herein.

5. Design Lightweight concrete mixes in accordance with the foregoing and ACI 613A.

B. Types, Strengths and Locations.

1. Unless otherwise noted on the plans, all concrete used for the construction of the underground vaults, all concrete used for underpinnings, footings, walls and slabs-on-grade and all exterior concrete used for stairs and slabs-on-grade shall be regular weight concrete having a minimum compressive strength of 4000 pounds per square inch at 28 days of age.

a. All exterior exposed concrete used for stairs and slabs-on-grade shall contain not less than 4½% nor more than 7½% entrained air.

2. Unless otherwise noted on the plans, all other concrete used for this construction that is not included in Article B1 above shall be lightweight concrete having a minimum compressive strength of 3000 pounds per square inch at 28 days of age. This shall include all concrete used over metal decking, and permanent metal forms, steel stair tread pan fill, interior stairs, raised floors, floor toppings, interior ramped floors and other locations where noted.

a. All lightweight concrete shall contain not less than 4% nor more than 7% entrainged air.

b. The air dry unit weight of the lightweight concrete shall not exceed 110 pounds per cubic foot at 28 days of age.

C. Minimum Cement Content:

1. The laboratory designed concrete mixes shall have minimum cement contents for each type and strength of concrete as follows:

<u>4,000 lbs. per sq. inch (regular weight) - without water reducing admixture</u>
6.25 sacks per cubic yard for the 3/4" maximum size aggregate.
6.00 sacks per cubic yard for the 1½" maximum size aggregate.

<u>4,000 lbs. per sq. inch (regular weight) - with water reducing admixture</u>
5.75 sacks per cubic yard for the 3/4" maximum size aggregate.
5.50 sacks per cubic yard for the 1½" maximum size aggregate.

<u>4,000 lbs. per sq. inch (regular weight) - with air-entraining admixture</u>
6.25 sacks per cubic yard for the 3/4" maximum size aggregate.

<u>4,000 lbs per sq inch (regular weight)-with air-entraining & water-reducing admixtures</u>
5.75 sacks per cubic yard for the 3/4" maximum size aggregate.

<u>3,000 lbs per sq inch (light weight) - with air-entraining admixture</u>
6.50 sacks per cubic yard for the 3/8" maximum size aggregate.

D. Slump and Workability:

1. Slump:

a. For regular weight concrete the slump shall be not less than 1" nor more than 4".

b. For light weight concrete the slump shall be not less than 3" nor more than 4".

c. The amount of slump shall be determined by the standard test method ASTM C143.

2. Workability.

a. Workability shall be such that when adequately vibrated with high cycle internal vibrators the concrete will consolidate completely without segregation.

E. Mixing and Delivery of Concrete:

1. All concrete shall be ready mixed concrete provided by a central mixing plant. All concrete shall be completely plant mixed in a stationary mixer and the mixed concrete shall be transported to the job in agitating type trucks in accordance with ASTM Specification C94.

2. Deliveries shall be timed to insure that all concrete can be placed within one (1) hour after initial mixing water is added.

3. Batching, mixing and delivery equipment, operation and procedures shall conform to the recommendations of the National Ready Mixed Concrete Association.

4. Attention is called to the importance of scheduling and dispatching trucks from the batching point so that they shall arrive at the site of the work just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

5. Partially hardened concrete shall not be retempered or used.

6. Concrete placed in air temperatures below 40°F shall have a temperature of 60°F. Temperature of individual materials, including mixing water, shall not exceed 140°F.

7. Adding water to mix: No water shall be added after the initial introduction of the mixing water for the batch, except under special conditions. When on arrival at the jobsite it is found that the slump of the concrete is less than specified under such conditions, additional water to bring the slump within limits may be added only with the approval of the University's representative. It shall be injected into the mixer under such pressure and direction of flow that the requirements for mix uniformity are met. The drum or blades shall be turned an additional 30 revolutions or more if necessary, at mixing speed, until uniformity of the concrete is within these limits. When water is added to the batch upon arrival at the jobsite, it must be noted on the delivery ticket and signed by the University's representative. Water shall not be added to the batch at any later time.

F. Changes in materials:

1. If, during the progress of the work, the Contractor desires to use materials other than those approved (originally) or if the materials from the source originally approved change in characteristics, additional tests shall be made with new materials which will produce concrete meeting with the stated requirements and not cause objectionable change in the color or appearance of the structure. These additional tests shall be made by the Testing Agency, at the expense of the Contractor. No concrete made from such different materials shall be used in the work until the Architect has given his approval.

2. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished by the Vendor, the Architect may order such changes in the proportions or materials, or both, as may be necessary to secure the desired properties, subject to the stated requirements. Any changes so ordered shall be made at the Contractor's expense, and no extra compensation will be allowed by reason of such changes.

PART 3: EXECUTION

3.1 CONCRETE PLACEMENT (Except Underlayments and toppings)

A. Inspection of Forms and Reinforcing: At least 24 hours prior to placing of concrete notify the University's representative so that he may inspect forms and reinforcing in place and give instructions for any corrections required.

B. Placing: Prepare, convey and deposit concrete in accordance with ACI 301, except as modified herein.

1. Unless otherwise permitted the work shall be so executed that a section begun on any one day shall be completed the same day.

2. Remove water and foreign matter from forms and excavations and, except in freezing weather or as otherwise directed, sprinkle porous subgrade and wood forms just prior to placing concrete to eliminate suction. Place no concrete on frozen soil and provide protection against frost action.

3. Deposit concrete continuously and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section.

4. Deposit concrete so as to maintain, until the completion of the unit, a plastic surface approximately horizontal. In thin sections (such as walls and columns) of considerable height, concrete shall be placed in such a manner as will prevent segregation, rehandling or flowing and accumulations or hardened concrete on the forms or reinforcement above the mass of concrete being placed. To achieve this end, suitable hoppers, spouts with restricted outlets, tremies, etc., shall be used as required. Openings in the side of the walls will not be permitted. Vertical free drops shall not exceed four feet. Place concrete in layers not exceeding 12" in depth, each layer compacted by mechanical vibrating equipment.

5. All concrete shall be thoroughly compacted and consolidated following procedures recommended by ACI 609, "Consolidation of Concrete".

6. After depositing concrete in columns or walls, at least 2 hours must elapse before depositing in beams, girders or slabs supported thereon.

7. Chutes, hoppers, spouts, adjacent work, etc., shall be approved type, thoroughly cleaned before and after each run and the water and debris shall not be discharged inside the form.

8. Contractor shall provide sufficient labor and equipment to thoroughly compact all freshly placed concrete by internal mechanical vibration. Before each concrete placing operation is started, the Contractor shall have on hand at the project two complete high cycle vibrator outfits in good operating condition of each size and type of vibrator needed to adequately consolidate the concrete scheduled to be placed. All concrete shall be compacted with the aid of high cycle internal electrical mechanical vibrators for a sufficient duration and intensity to fill all voids, thoroughly consolidate and compact the concrete in place, to produce a dense mass of smooth surface concrete without honeycomb and a minimum of bug holes.

C. Grouting: Install a full bed of non-shrinking mortar grout at all locations specified under Article 2.1 F. Proportion, mix and place in accordance with the manufacturer's instructions.

3.2 CONCRETE TOPPINGS

A. Concrete topping shall be defined to exist at all locations where the thickness of new concrete placed over existing concrete or terrazzo floors exceeds ½".

B. All concrete toppings 2" or less in thickness shall be bonded to the existing surface using the epoxy bonding agent specified. Toppings exceeding 2" in thickness shall be bonded to the existing concrete surface only where specifically noted on the drawings or details. Bonded toppings shall be installed in accordance with the following:

1. Before installing the topping the existing surface shall be thoroughly sanded or otherwise mechanically abraded, then cleaned to expose the original concrete or terrazzo surface.

2. The epoxy bonding agent and topping shall be applied to the cleaned surface in accordance with the manufacturer's recommended instructions.

3. Replace topping in any area which sounds hollow or otherwise indicate separation of the topping and base slab.

C. Toppings exceeding 2" in thickness shall be reinforced, unbonded toppings placed over slip sheets, except where bonded toppings are specifically noted on the plans or details. Unbonded toppings shall be installed as follows:

1. Before placing the slip sheets the existing surface shall be cleaned.

2. The slip sheets shall be laid flat over the existing cleaned surface with ends and edges of sheets lapped a minimum of 4" and taped.

3. For existing surfaces that are relatively smooth use a single slip sheet layer. For rough surfaces provide a double layer of slip sheets.

4. Place the topping concrete over the plastic sheets and reinforce the topping with 6 x 6 - 10/10 welded wire fabric.

3.3 UNDERLAYMENTS

A. Underlayments shall be used wherever an existing concrete or terrazzo floor, specified or noted to receive a new finish material, requires a skincoat ½" or less in thickness in order to raise the existing surface to the correct elevation and/or to provide a smooth surface.

B. The materials used shall be those specified under Articles 2.1 G1 and 2.1 G2.

C. Before applying the underlayments, the existing surface shall be thoroughly sanded or otherwise mechanically abraded and cleaned to expose the original concrete or terrazzo surface.

D. Underlayments shall be installed in accordance with the manufacturer's recommended instructions.

3.4 EMBEDDED ITEMS AND FASTENING DEVICES FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, and other fastening devices required for attachment of other work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete beams or columns except upon approval of the Architect.

B. Where concrete surfaces are veneered with masonry, install 22-gauge galvanized iron dovetail anchor slots in concrete set vertically 2'-0" on centers.

C. Install slab lift handles in removable concrete slabs noted on details.

3.5 MISCELLANEOUS CONCRETE ITEMS

A. Construct equipment foundations, pads, bases, trenches, pits and other miscellaneous concrete items noted and shown on the drawings as detailed. Obtain precise dimensions from manufacturers of equipment. Provide and install anchors and bolts in concrete where directed and required.

3.6 CONSTRUCTION JOINTS

A. Construction joints shall be located where noted on the drawings and constructed as detailed.

B. Install polyvinyl chloride waterstops in all vertical construction joints in exterior walls and in other joints where noted or detailed on the drawings.

C. Vertical construction joints, if required in continuous composite slabs over metal decking and slabs supported on steel framing, shall be located over the structural steel supports.

D. Vertical construction joints, if required, in other concrete slabs shall be located at the center of spans and shall be constructed as directed by the Architect with all reinforcing bars continued through the joint and additional dowels and keys provided as directed.

E. Construction joints in concrete slabs-on-grade shall be constructed as detailed.

F. Unless detailed otherwise, all reinforcing steel and welded wire fabric shall be continued across joints.

3.7 CONCRETE FINISHING

A. General:

1. The intent of this Specification is to secure for the job materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming materials specified. Surfaces which reveal, upon removal of forms, imperfections of such magnitude as to seriously impair the appearance or strength of the structure, in the opinion of the Architect, shall be deemed cause for rejection, and concrete members containing such imperfections shall be entirely removed and replaced without damage to adjacent material or extra expense to the Owner. Lesser imperfections of concrete surfaces shall be patched and finished in accordance with the procedures hereinafter specified.

2. Finish only properly set concrete. Under adverse weather conditions, finish only under proper protection.

3. The Contractor, at his own expense, shall do all leveling and grinding of depressed and high spots in concrete surfaces in excess of the tolerances specified herein. In areas where leveling materials are required to provide the proper surface, such materials shall be of a type approved by the Architect.

4. Protect all concrete work against injury from heat, cold and defacement of any nature during construction operations.

B. Repairing and finishing of formed surfaces:

1. It is the intent of this Specification to require forms, mixtures of concrete and workmanship so that concrete surfaces, when exposed, will require no patching except for plugging of tie holes. Repairable defective areas, as determined by the Architect, and all tie holes shall be repaired in accordance with the procedure outlined in the ACI 301, Chapter 9, except as modified herein.

2. As soon as the forms have been stripped, fins and projections shall be removed and the areas smoothed out with wet carborundum stones or power grinders to the extent directed, in areas where the concrete surfaces will be exposed.

3. Efflorescence, stains, oil, grease, or any unsightly accumulation of foreign materials visible on the exposed surface of finished concrete will require remedial action to remove these blemishes. Such action may cover all exposed concrete, or, when irregular lapping can be avoided, only such parts as are affected by the stains or other unsightly appearances.

4. Finishing of concealed concrete surfaces: At surfaces to receive waterproofing membranes or dampproofing coatings, chip off fins and other projections and trowel patch all voids, honeycombs and air pockets exceeding ½" in any dimension. Patch voids formed by tie-rod cones flush with adjacent surfaces. At other concealed surfaces, patching, if any, shall be as directed and shall, in general, be only such as is required to assure or protect the structural integrity of concrete or reinforcing.

5. Concrete surfaces to receive paint or plaster directly shall be scrubbed with washing soda and then thoroughly rinsed with water. Repeat this operation until all form oil and other foreign materials which would prevent proper adhesion of the above specified materials are removed.

C. Flatwork and flatwork finishes:

1. Flatwork placing and finishing shall comply with the procedures and requirements of ACI 301, Chapter 11, except as modified herein.

2. No dry cement or mixture of sand and cement shall be applied to surfaces of any concrete slab to absorb moisture.

3. Protect floors from damage until completion of job.

4. Finishes:

a. Troweled Finish:

1) Provide a troweled finish on the following surfaces:

a) Slabs to receive membrane waterproofing.
b) Top of exposed walls.
c) Interior slabs.
d) Interior stairs, landings and ramps.

b. Broom Finish:

1) Provide a broom finish on the following surfaces:

a) Exterior exposed slabs.

c. Non-Slip Finish:

1) Provide a non-slip finish on the following surfaces:

a) Exterior stairs.
b) Floors of rooms noted in Architectural Room Finish Schedule.

2) Procedure: Allow the concrete surface to harden until it bears the weight of workmen standing on boards. At this time, the specified non-slip aggregate, previously soaked in clean water for not less than 10 minutes, but free of excessive moisture, shall be broadcast and imbedded and the slabs trowel finished in accordance with ACI 301. Sand blast non-slip finished surfaces lightly. Apply non-slip aggregate at the rate of 20 pounds per 100 square feet of area.

3.8 CURING AND PROTECTION

A. Curing and protection shall be performed in accordance with ACI 301, Chapter 12 and the following additions:

1. Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.

2. Immediately after placing or finishing, all concrete surfaces not covered by forms shall be protected from loss of moisture by the use of one of the following materials or methods:

a. Covering with waterproof paper or polyethylene film conforming to ASTM C171.

b. Applying specified curing compound conforming to ASTM C309.

3. Sheets of waterproof paper or polyethylene film shall be lapped a minimum of six (6) inches at edges and ends and maintained in place by sealing laps with pressure-sensitive tape and weighting down as necessary.

4. Curing compounds shall be applied within two hours after the concrete has been finished.

5. Curing compounds shall be applied in accordance with the manufacturer's recommendations and shall not be used on any surface against with additional concrete or other cementitious materials are to be bonded, nor on concrete surfaces to receive hardening treatment or conductive flooring.

6. If forms are to be removed during the curing period, one of the curing materials or methods specified for concrete surfaces not covered by forms shall be employed immediately and continued for the remainder of the curing period.

7. The curing period shall continue until the accumulative number of days not necessarily consecutive, during which the temperature of the air in contact

with the concrete is above 50°F has totaled seven days.

8. Rapid drying at the end of the curing period shall be prevented.

B. Cold weather protection:

1. Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing weather and near freezing weather. Concrete materials and reinforcements, fillers, forms and ground with which the fresh concrete is to come in contact shall be free from frost.

2. Arrangements for heating, housing, covering, and insulation shall be made in advance of pouring concrete and shall be adequate to maintain the required temperature and moisture conditions without injury to the concrete due to concentration of heat or carbon dioxide flue gases. In general, except as herein specified, follow the recommendations of ACI 306 "Recommended Practice for Cold Weather Concreting".

3. When the temperature of the surrounding air is below 40°F fresh concrete, when placed, shall have a minimum temperature of 60°F and a maximum temperature of 80°F depending on the existing conditions.

4. Special precautions must be taken to protect concrete floor slabs and steps scheduled to receive a troweled finish, from cooling too rapidly or from surface freezing during the finishing operations. Slabs to be troweled shall not be cast during cold windy weather unless an enclosed heated shelter is provided above the area to be cast and finished.

5. Curing temperature for structural concrete shall be maintained as follows:

a. Regular concrete made with Type 1 regular Portland Cement shall be maintained at not less than 70°F for the first 72 hours and 50°F for the next 3 days.

b. High early strength concrete made with regular Portland Cement may be obtained by the addition of 25% more cement to the mix or by adding 1% calcium chloride in standard solution dissolved in a part of the mixing water, according to directions of the Calcium Chloride Institute. Sikacrete may be used as recommended by the manufacturer. Accelerators are not to be considered as a substitute for any type of protection from freezing. Calcium chloride shall not be used in concrete placed over metal decking or permanent metal forms or concrete that will be permanently exposed to the weather.

c. High early strength concrete made by adding 25% more cement as an accelerator shall be maintained at 70°F for the first 24 hours and 50°F for the next three days.

6. At the end of any curing period, the concrete shall be allowed to cool gradually (approximately 1°F per hour) by leaving the covering protection in place and intact for a minimum of 24 hours. In no case shall structural concrete be exposed to freezing for a full 6 days after it has been cast and has

developed strength required to support itself and any superimposed loads that may be placed on the concrete.

7. High early strength concrete shall not be used for casting thick sections of concrete. Specific approval must be obtained from the Architect and the University before using any high early strength concrete.

8. During freezing weather the Contractor shall take the temperature of the concrete at regular intervals during the curing period and maintain temperature records of the various concrete sections at locations as directed by the University to insure proper curing temperatures are being maintained.

C. Hot Weather Concreting:

1. Care shall be exercised during hot weather to keep concrete temperatures and mixing and placing time to a minimum.

2. Transport trucks shall be dispatched to avoid delays and the work shall be organized to use the concrete promptly to prevent unnecessary additional mixing at the jobsite.

3. When necessary, arrangements for installation of windbreaks, shading, spraying, sprinkling or wet covering of a light color shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

4. Production, delivery, placement and protection shall comply with the American Concrete Institute Standard entitled "Recommended Practice for Hot Weather Concreting" (ACI 605), except that concrete shall be placed within one hour after the initial mixing water is added.

D. Wet Weather: Unless adequate protection is provided do not place concrete in rain, sleet, or snow.

3.9 SEALING OF FLOORS, STAIRS AND LANDINGS

A. Partitions shall be laid out, as specified in Section 01010, as soon as possible after concrete floors have hardened and cured for 7 days.

B. All interior concrete floors, stairs and landings, with the exception of the areas receiving non-slip finish, shall be treated with specified sealer as follows, which shall be in addition to any curing compound coating previously used:

1. Surfaces receiving finish materials (carpet, V.A.T. composition). Note: CONFIRM COMPATIBILITY OF SEALER WITH FINISH:

a) Clean surfaces and apply one coat as soon as possible after partition layout is complete, but not less than 28 days after concrete is finished.

b) Clean surfaces and apply the second coat of sealer immediately in

advance of finish materials, allowing sufficient time for complete curing of sealer before applying covering.

2. All exposed concrete floors, stairs and landings which will not receive finish covering, including any areas where finish is omitted by alternate:

a) Clean surfaces and apply first coat sealer as soon as possible after partition layout is complete, but not less than 28 days after concrete is finished.

b) Clean surfaces thoroughly and apply two additional coats of sealer immediately before final inspection.

3.10 FIELD QUALITY CONTROL (TESTING)

A. Slump Tests: Make slump tests whenever concrete is being poured at the direction of the Owner in accordance with ASTM C143.

B. Compression Tests:

1. The casting of concrete test cylinders shall be performed by the Contractor at the times selected by the University and under his direct supervision. The Contractor shall arrange and pay for all transportation of concrete test cylinders to the testing laboratory at the proper time as specified.

2. The University will select the testing laboratory for delivery and compression testing of concrete cylinders and will pay for these tests.

3. Prepare standard test cylinders during the placing of concrete in accordance with ASTM C31 and ASTM C172 in sets of two. One set (two cylinders) is required for each day's pour. If the day's pour exceeds 25 cubic yards, prepare an additional set of cylinders for each additional 50 cubic yards or fraction thereof.

4. The test cylinders shall be laboratory tested and shall be stored at the site in 60-80°F temperature range, and so on injury to cylinders will occur, for 24 to 48 hours. After this time the Contractor shall deliver the two cylinders to the testing laboratory, taking care not to freeze, crack or damage the specimens. These cylinders shall be laboratory cured and tested at 7 and 28 days of age with tests indicating concrete strengths for compliance with the specifications.

5. During freezing, or near freezing, weather (or for special conditions where early removal of forms is requested by the Contractor, and approved by the Owner) concrete test cylinders shall be taken in sets of three. One of the three cylinders shall be a "field condition" cylinder to be placed as near as possible to the final location of the concrete from which the sample was taken and shall receive the same curing and protection as adjacent concrete. The Contractor shall deliver this "field condition" cylinder to the laboratory 28 days after casting or at an earlier age when an earlier field strength data is desired. The other two cylinders shall be stored at the site and delivered to the laboratory for curing and testing as outlined in paragraph 4.

6. Each cylinder shall be marked by the Contractor with the job name, location of pour, date of pour, slump, mix number and strength of concrete specified. In addition the air content shall be marked on the cylinder where an air-entraining admixture is specified.

C. Entrained Air Tests:

1. When air entrained concrete is used, the first batch of each pour shall be tested for air content at the Project by the Contractor as directed by the University and as often thereafter as required to insure that the air content is within the specified limits.

2. Testing shall be performed in accordance with ASTM C173 or ASTM C231.

D. Evaluation of Test Results and Failure to Meet Strength Requirements:

1. Test results shall be evaluated according to the "Recommended Practice for Evaluation of Compression Test Results of Field Concrete," ACI214.

2. Evaluations shall be valid only if the samples have been taken and tests have been conducted in accordance with ACI and ASTM specifications and methods as applicable.

3. If strength tests performed on concrete cylinders, cast at the time the concrete is placed, fail to meet the specified 28 day value, or if the samples have not been taken and tests conducted as specified, the concrete represented by such tests shall be considered questionable and shall be subject to further testing at the expense of the Contractor.

4. These additional tests of questionable concrete shall be preformed by an independent testing laboratory, approved by the Architect, and shall be conducted in accordance with ACI 301, Chapter 17 when concrete cores may be obtained in the field or by load tests conducted and results evaluated in accordance with ACI 318, Chapter 20.

5. If the additional tests fail to demonstrate strengths adequate for the intended purpose of the member, or members, in question, as determined by the University and the Architect, all the questionable concrete shall be removed and replaced with concrete meeting the specifications at the expense of the Contractor.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements of pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes mortar for all unit masonry and stone work.

C. Related work specified elsewhere:

1. Concrete for bond beams and/or lintels: Section 04200.

2. Unit masonry: Section 04200.

3. Cut Stone: Section 04400.

D. Furnished but not installed under this section:

1. Mortar is installed under Sections 04200 and 04400.

1.2 SUBMITTALS

A. Test Reports: Submit information copies of all test reports in duplicate to the Architect.

1.3 PRODUCT HANDLING

A. Handle, transport and store mortar materials in a manner that will prevent damage or deterioration from the elements.

PART 2: PRODUCTS

2.1 MATERIALS

A. Conform to ASTM standard specifications as follows:

1. Portland Cement: ASTM C150, Type I.

2. Quick Lime: ASTM C5.

3. Hydrated Lime: ASTM C207, Type S.

4. Aggregates: ASTM C144.

5. Water: Clean and free of deleterious amounts of acids, alkalies or organic materials.

6. Latex additive: Brock-White 9875 Latex Liquid. Use in lieu of water for setting mortar for stone.

B. Use of masonry cement is prohibited.

2.2 MEASURING AND MIXING

A. Measure and mix in accordance with ASTM C270 and the following:

1. Shovel measurement is prohibited.

2. Mix mortar as required for immediate use only and discard any mixed for a period exceeding 2½ hours.

3. MORTAR PROPORTIONS BY VOLUME:

Mortar Type	Parts by Volume of Portland Cement	Parts by Volume of Hydrated Lime or Lime Putty	Aggregate measured in a damp, loose condition
M	1	¼	Not less than 2¼ times and not more than 3 times the sum of the volumes of the cement and lime used.
S	1	over ¼ to ½	

4. Lime Putty: A stiff mixture of lime and water. Keep moist until used. Putty made from quick lime shall be slaked and allowed to soak at least 72 hours before using. Putty made from 92% hydrated lime may be used after mixing.

5. Plain grout: Type M mortar to which water is added to produce consistency for pouring without segregation of the constituents of the mortar. After adding water, stir and work all grout at frequent intervals.

6. Control and accurately maintain the specified proportions of mortar materials during the entire progress of the work.

7. Thoroughly mix cementitious materials and aggregates with the amount of water to produce workability. Machine mix all mortar.

8. Use latex liquid in lieu of water for mortar for stone.

2.3 MORTAR PROPERTIES

A. Conform to the property specifications of ASTM 270 and the following:

1. Compressive Strength: The average compressive strength of three 2" cubes of mortar shall not be less than the strength given in the following table for the mortar type specified:

Mortar Type	Average Compressive Strength at 28 days-psi
M	2500
S	1800

PART 3: EXECUTION

3.1 TYPE OF MORTAR REQUIRED

A. Type: Use Type M for masonry in contact with earth and in exterior walls and Type M or S for all other masonry.

B. Tempering: Adjust the consistency of the mortar to the satisfaction of the mason by adding only as much water as is necessary to obtain workability.

C. Use mortar within two and one half (2½) hours after mixing. Mortar that has stiffened within this time may be retempered with the minimum amount of water necessary to obtain desired workability.

3.2 TESTING MORTAR

A. Owner will select an independent testing laboratory to perform testing as follows:

B. Determine the water retentivity and compressive strength of mortar in accordance with the Test Procedures described in ASTM C91 with the exceptions noted in ASTM C270. Contractor shall pay for these tests.

C. Before starting masonry work make tests on trial mortar mix. Mix mortar for testing in the laboratory from representative samples of mortar materials and proportions to be used in the construction. Contractor shall pay for these tests.

D. Make compressive strength tests on one set of samples from first mortar batch and as the work progresses for each lot of 1,000 concrete block masonry units of each type of mortar or 5,000 brick masonry units or as directed by the University. Owner will pay for these tests.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing all unit masonry shown on the drawings and specified herein.

C. Related work specified elsewhere:

1. Mortar: Section 04100.
2. Insulation: Sections 07220 and 09100.
3. Sealants, Gaskets, etc: Section 07900.

D. Installed but not furnished under this section:

1. Bearing plates, anchors, etc. for work of other trades: Applicable Sections.

2. Steel lintels, jamb angles, etc: Section 05500.

1.2 SUBMITTALS

A. Test Reports: Submit test reports in duplicate indicating compliance with applicable specifications for compressive strength, absorption, weight, moisture content and dimensions for each type of masonry unit. Reports on manufacturer's normal quality control will be acceptable for all units for initial acceptance.

1.3 PRODUCT HANDLING

A. Handle, transport and store at the job site in a manner that will avoid damage.

B. Protect masonry units from wetting prior to use. Cube units on pallets at the time of manufacture and deliver to the job with waterproof coverings. Make sure that units remain covered on the job.

1.4 ENVIRONMENTAL CONDITIONS

A. In freezing weather, lay no masonry when the temperature of the outside air is below 40°F, or is anticipated to fall below 40°F, unless suitable means are provided to heat the masonry materials and protect the completed work from freezing.

B. Heat the masonry materials to at least 40°F and maintain an air temperature

above 40°F on both sides of masonry for at least 48 hours if Type M mortar is used, and 72 hours if Type S mortar is used.

C. In order to avoid "thermal shock" in concrete block walls, turn heat (either temporary or permanent) on or off at a rate not to exceed 2°F per hour or approximately 50°F per 24 hours.

PART 2: PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete masonry units shall be of modular dimensions and shall be high pressure steam cured in an Autoclave at a temperature of 350°F to 365°F and a pressure of 120 to 150 PSI and shall conform to the ASTM Specifications and the modifying and additional requirements as indicated below:

1. Hollow load-bearing units: ASTM C90, grade N-1. Use for all concrete masonry units unless otherwise indicated or specified.

2. Hollow non-loadbearing units: ASTM C129, type 1. Use only for 4" thick partitions.

3. Solid load-bearing units: ASTM C145, grade N-1. Use only where solid or filled block is indicated or specified.

4. Concrete building brick: ASTM C55, grade S-1.

5. Lightweight units shall be made of expanded clay or shale or other lightweight aggregates conforming to ASTM C331 and shall have an oven-dry weight of less than 105 lb. per cu. foot. Use wherever concrete block is indicated.

6. Face shell and web thicknesses shall conform to Table IV of ASTM C90 except that twelve (12) inch wide units shall have a face shell thickness of not less than one and one-half (1½) inches.

7. The lineal shrinkage tested by the modified British Method (ASTM C426) shall not exceed the following:

Normal weight units	0.020%
Lightweight units	0.030%

8. The moisture content of the units at the time of delivery shall not exceed 30% of the total absorption.

9. Fire-resistance rated units shall meet requirements of the Underwriters Laboratories, Inc. as to minimum face shell and web thickness to produce fire ratings as indicated on the drawings.

10. Provide special shapes of ordinarily available types such as bullnose units, header units, jamb units, cap blocks, etc.

11. General Appearance Requirements: Exposed units shall be light in color, with uniform fine texture, free of face smears. Broken units shall not be used, and chipped or other defective units will not be acceptable or used

where exposed. Not over 5% of units will be permitted to have chips and chips shall not exceed 3/8" in any dimension. Exposed concrete unit walls to have units uniform in size, texture and color, including all shapes. Architect reserves right to reject a unit masonry manufacturer, if in Architect's opinion, unit quality, color or texture is unacceptable with design intent. Appearance requirements may be waived by University (at its option) for concealed units.

12. Tentative Acceptance: For tentative acceptance of blocks (or brick), provide tests and reports on minimum of five units, from current stock, to provide proof of ability to conform to ASTM Standards. Texture, dimension, tolerance, appearance and test reports will be basis for tentative acceptance of supplier of blocks. Provide samples to Architect for appearance approval.

2.2 CLAY MASONRY MATERIALS

A. Structural glazed facing tile: ASTM C126, to match existing in color, size and laying pattern.

B. Structural Clay Tile: Conforming to ASTM C56, Grade NB. Surfaces of tile for plaster finish shall be scored, combed or roughened. Surfaces of tile with exposed surfaces shall be finished smooth. Where assembly requires fire proofing with tile, use ASTM C34, Grade B.

C. Clay Floor Tile: ASTM C57, Grade FT2.

2.3 ANCHORS, TIES, ACCESSORIES

A. Zinc coating of anchors and ties: ASTM A153, Class B-2.

B. Zinc coating of wires: ASTM A116, Class 3.

C. Corrugated metal ties: 22-gauge galvanized sheet steel, 7/8" wide, not less than 6" in length.

D. Wire mesh ties: Equivalent to 0.0625 in nominal diameter, no gauge steel wire, ½" mesh.

E. Concrete block wall reinforcing: galvanized, butt welded truss design, formed from #9 gauge wire with deformed side rods. Provide in widths of manufactured standards for each wall thickness. Dur-O-Wall or AA Wire Products.

F. Anchors in Concrete: Furnish galvanized dovetail anchors, bolt anchor fixtures, power driven fasteners, etc., as required for anchoring to concrete.

G. Wall anchorage: Brock-White #4211 Ankortite, or approved equal.

H. Adjustable wall ties: AA, Dur-O-Wal, Lox-all, or approved equal, rectangular type, galvanized.

I. Control joint gaskets: Williams Weatherite R, AA Titewall, Dur-O-Wal Rapid

Control Regular, Sonneborn-Contech, or approved equal.

J. Preformed fillers: W.R. Grace semi-rigid Rodofoam, or approved equal.

2.4 CONCRETE FILL

A. Concrete fill for bond beam lintels and/or piers shall be 4,000 psi concrete conforming to Section 03300.

2.5 CONCRETE REINFORCEMENT

A. Concrete reinforcement for bond beams, lintels, and/or piers shall conform to Section 03200.

PART 3: EXECUTION

3.1 PROTECTION OF EXTERIOR WORK

A. Protect all facing material, sills, ledges, etc., against staining and keep top of walls covered with non-staining waterproof coverings when work is not in progress.

B. During erection keep walls dry by covering at the end of each day or shut-down period. Protect partially completed walls not being worked on similarly at all times. Overhang coverings at least 2 feet down each side of wall, and securely anchor.

C. When work is resumed, clean off all loose mortar from top surface.

3.2 MORTAR

A. Mortar proportioning and mixing is specified in Section 04100.

B. Tempering: The consistency of mortar may be adjusted to the satisfaction of the mason, but only as much water shall be added as is necessary to obtain desired workability.

C. Mortar shall be used within two and one-half (2½) hours after mixing. Mortar that has stiffened within this time may be retempered with the minimum amount of water necessary to obtain desired workability.

D. Type: All masonry shall be laid in mortar of the type specified in the table below:

TYPE OF MORTAR REQUIRED

Kind of Masonry	Mortar Type
Masonry in contact with the ground and in exterior walls	M
Masonry above grade, interior	M or S

3.3 LAYING CONCRETE BLOCK

A. Lay concrete block in straight, uniform courses, plumb and true to line and plane in running bond pattern unless otherwise indicated on the drawing.

B. Use face shell bedding with full coverage of face shells for hollow units, full bed for solid units.

C. Cut flush all joints in block for tooling as specified in paragraph 3.9.

D. Cut flush all joints in concealed spaces. Fill solid with concrete, two courses under bearing plates, top course of all bearing walls and under beam and lintel bearings. Provide control joints as shown on the drawings.

E. Hollow masonry units shall be filled solid with mortar or concrete at following locations:

1. The first two cells of units abutting door frames (mortar).

2. All cells of units of course immediately above head of door frames (mortar).

3. All cells of units where called for on Drawings (concrete or mortar as indicated).

4. Where necessary for embedment of anchors, bolts, bearing of steel members, and where shown (concrete or mortar as indicated).

5. Bond beams, tintels and/or piers (concrete).

F. Wherever metal items, anchors, bolts, etc., are embedded in mortar or concrete within the concrete unit masonry, provide screen wire stops of galvanized steel insect screening to prevent mortar, or concrete from dropping through the voids below.

G. Reinforce all concrete block masonry work with wall reinforcing starting at second course and at every second course thereafter. Bond facing units to backing with tab tie reinforcing and metal ties. Wall reinforcing splices shall have 6" laps. Corners shall be formed by cutting and bending to fit or by use of prefabricated corner units. Place reinforcing in the first and second bed joint above and below openings or recesses where possible. Terminate reinforcing on each side of control joints.

H. Unless otherwise shown bond each course at corners and intersections, and break vertical joints at least 4". Fill in with concrete brick where units cannot be used. Provide recesses for built-in items.

I. Horizontal Control Joints: All full height non-loadbearing walls and partitions shall be finished 3/8" below concrete slab above for filler and caulking under Section 07900.

J. Vertical Control Joints: Construct as detailed.

K. Partitions that abut exterior walls and columns shall be bonded thereto at least once every two feet in height. Use rigid steel anchors where bonding is not possible.

L. Provide reinforced concrete block lintels over all square head openings unless otherwise noted on the drawings and as detailed. Use bond beam (8" high only) units to construct lintels at exposed locations. Fill lintels solid with 4,000 psi concrete conforming to Section 03300 and reinforce with steel rods as shown on the drawings conforming to Section 03200. Provide a minimum of 8" bearing at ends. Providing shoring for at least 7 days after setting, or precast at least 7 days before setting.

M. Construct bond beams as detailed. Concrete fill is furnished under Section 03300, installed under this section.

N. When flashing is to be laid on or against masonry, the surface of the masonry shall be smooth and free from projections which might puncture the flashing material. Weep holes spaced not more than 24" on center shall be provided in the bed joints under the first course immediately above all flashings.

O. Build in properly all anchors, ties, plates, joists, beams, lintels, flashings, inserts, etc., which come in contact with masonry work. Consult other trades in advance and make provisions for installation of their work in order to avoid cutting and patching. Build in work specified under other sections of these specifications as the work progresses. Grout hollow metal frames full of mortar.

P. Set steel lintels in full beds of mortar. Fill solid with mortar around jambs and heads of metal door bucks and frames as walls are laid.

Q. Provide all necessary openings and chases in walls or partitions to take the work of other trades and build in all sleeves, hangers, supports or forms furnished by and placed by them providing such openings are located and such necessary items are furnished and placed by the other subcontractors in advance of construction. No cutting or drilling shall be done without the permission and instruction of the General Contractor and the University.

R. Where new brickwork is laid in existing brick walls it shall be properly bonded or tied with metal ties and shall be toothed in as required to provide a plane surface. Bond, joint and pattern shall match existing.

S. Fill all vertical, longitudinal joints, with mortar by back parging the facing or by pouring full with grout.

T. Use solid units or fill hollow units with mortar or concrete wherever flashing reglets in new masonry are indicated.

3.4 WETTING CLAY MASONRY UNITS

A. All clay masonry units having absorption rates (determined in accordance with ASTM Specifications C67) in excess of 0.025 oz. per sq. in. per min. shall be wetted sufficiently so that the rate of absorption when laid does not exceed this amount.

B. The method of wetting shall be such as to insure that each unit is nearly saturated, surface dry when laid. During freezing weather, units that require wetting shall be sprinkled with warm water just before laying.

3.5 LAYING CLAY WALL TILE

A. Lay each course of tile plumb and true to line with each course breaking joint with course below. Lay tile in solid bed of mortar with vertical joints buttered their entire length.

B. Bond each course at corners and intersections and bond into adjacent masonry. Use ties and galvanized perforated steel anchors where necessary to reinforce the bonding of the tile and where tile cannot be otherwise adequately bonded.

C. Fill solid with mortar and masonry the space around all built-in items. Set all plates, beams, lintels, anchors, ties, etc., in a full bed of mortar.

D. Fill solid with mortar the space behind electric outlet boxes for a sound barrier.

3.6 MASONRY REINFORCING

A. Wall Installations: Provide reinforcing in every concrete block wythe including 4" walls, if any.

B. General Requirements: Provide proper width for all thickness to insure complete imbedment of side rods or tab ties in full mortar bed. Carry continuously along walls, lapping ends 6" minimum, except do not carry through control and expansion joints. As a minimum, all reinforcing as specified herein.

C. Types: Provide truss design for all types. Provide types as follows:

1. At concrete block walls and partitions, provide normal truss type with diagonal cross rods welded to side rods.

2. At brick adjacent to block where cavity does not occur, provide extended type reinforcing; full width (less 1" each side) of block and brick wythes.

D. Corners: At all corners and wall intersections, except intersections intending to act as control joint, provide prefabricated corner and intersection units.

E. Location and Spacing: Unless otherwise indicated, provide reinforcing as follows:

1. 16" o.c. vertical dimension, continuous full length of wall.

2. At bed joint at top course of wall or partition, continuous full length of wall.

3. In first and second courses below and above each wall opening, extending at least three feet beyond opening jamb, in addition to continuous reinforcing noted under "1" above.

4. Do not carry through control joints.

3.7 JOINTS

A. Where fresh masonry joins masonry that is partially set or totally set, the exposed surface of the set masonry shall be cleaned so as to obtain the best possible bond with the new work.

B. If it becomes necessary to "stop off" a horizontal run of masonry, this shall be done only by racking back one half unit length in each course and, if grout is used, stopping grout 4" back of the rack. Toothing will not be permitted, except upon written approval of the University.

C. Where cutting of exposed units is necessary, the cuts shall be made with a motor-driven masonry saw.

D. Exposed mortar head and bed joints in block walls shall have a thickness equal to the difference between the actual dimension and the nominal dimension of the unit either in height or in length, but in no case less than ¼" nor more than ½". Joints shall be as uniform as possible.

E. Where flashing reglets are indicated in new or existing masonry, cut such reglets using a motor driven masonry saw.

3.8 POINTING, TOOLING, CLEANING

A. Exposed joints in walls of concrete masonry units shall be, unless otherwise noted, tooled with a round or other approved jointer when thumb-print hard. The jointer shall be slightly larger than the width of the mortar joints so that complete contact is made along the edges of the units, compressing and sealing the surface at the joint. Wipe joint, if necessary, to remove all excess mortar, so no rough edges remain.

B. Joints in new brickwork in existing walls shall be tooled to match existing joints.

C. Point up mortar joints in vertical masonry (except brick pavers) with the specified colored mortar. Press colored mortar well into raked joint and when thumbprint hard, compress joint as for other masonry.

D. Cleaning:

1. Upon completion, cut out defective mortar joints, cut out cracked, broken, chipped or badly scratched brick or block and replace with matching units. Point up all exposed masonry.

2. Clean test panels to test cleaning method before actual cleaning is

begun. Test or protect all surrounding non-masonry surfaces from cleaning materials or fumes.

3. Remove all excess mortar spots, drips and smears from face brick, and exposed concrete block.

4. A minimum curing and drying period of twenty eight (28) days shall elapse between topping out of a masonry wall section and the start of the cleaning operation.

5. Following the curing period, all face brick, exterior and interior shall be cleaned with specified cleaning solution. Clean, potable water shall be readily available for cleaning operations.

6. Pre-soak prior to cleaning operations.

7. Saturate masonry with clean water and flush off loose mortar and dirt. Scrub down walls with a solution of ½ cup trisodium phosphate (Calgon) plus ½ cup household detergent dissolved in one gallon of clean water. Scrub with a stiff fiber brush only. Thoroughly wash off all cleaning solution, dirt and mortar crumbs using clean pressurized water. Sonneborn-Contech and Sure-Klean masonry cleaners will be acceptable.

8. Do not use muriatic acid or proprietary cleaning compounds without the prior written approval of the Architect. Do not use metal cleaning tools and brushes or abrasive powders.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1 - General Requirements apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing and installing all cut stone shown on drawings and required to furnish project complete and removal and resetting of existing cut stone.

C. Related work specified elsewhere:
   1. Mortar: Section 04100.
   2. Unit Masonry: Section 04200.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01300. Drawings shall show in detail the sizes, sections and dimensions of stone, the arrangements of joints and bonding, anchoring and other necessary details. Show joint construction, including dowel anchorage.

B. Samples: Provide three (3) samples, 12" x 12" x 1", for approval by the Architect. Samples shall be typical of the minimum, average and maximum range of color, texture and finish, and shall match existing limestone in vicinity of new work.

1.3 PRODUCT HANDLING

A. Stone shall be received and unloaded at the site with necessary care in handling to avoid damaging and soiling.

B. Stone shall be stored clear of the ground on non-staining skids and adequately protected by covering with non-staining waterproof paper or 4 mil polyethylene film.

PART 2: PRODUCTS

2.1 CUT STONE

A. Cut Stone: Indiana buff limestone matching color, texture and finish of adjacent limestone. Including facing panels and stone cap. Provide for expansion of cap stone. Provide new granite sills matching existing granite as shown on drawings.

B. A stockpile of existing limestone removed by others is available for inspection in Mayo Garage. Contractor shall assess usability for JOML-B project

and provide all required new stone to complete the work.

C. Cutting: Accurately cut to shape and dimensions as detailed to approved jointing layout. Provide all exposed faces true, without wind. Beds and joints shall be at right angles to the face; unless otherwise shown. Joints, unless otherwise shown or indicated on drawings, shall have a uniform thickness of ¼". Comply with the fabrication tolerances of the Indiana Limestone Institute.

C. Defects: No patching or hiding of defects will be allowed. No drilled holes on exposed face.

2.2 ACCESSORIES

A. Anchors, dowels, cramps and fastening: Furnish and set all anchors, cramps, and dowels and fasteners, shown or required to fasten and anchor the stone properly in place. All anchorage shall be stainless steel (Type 18-8, 302 or 317).

B. Weep Holes: Ropes of glass fiber or ¼" clear plastic tubing.

2.3 MORTAR

A. Mortar: Provide mortar type M with latex additive conforming to Section 04100.

B. General: Rake joint at cap stone, both sides, to a depth of 3/8" for sealant. Provide sealant conforming to Section 07900.

PART 3: EXECUTION

3.1 GENERAL

A. Do not use stone units with chips, cracks, voids, stains or other defects which might be visible in the finished work. All stone units that cannot be handled manually or set with a clamp, shall be provided with proper lewis holes. Lifting of stone with lewis pins shall be in the same plane that holes are drilled.

B. Provide expansion joints where shown or required. Do not fill with mortar. Install continuous strips of preformed joint and sealant conforming to Section 0790.

C. Set stone accurately, true to levels, lines and shop drawings. Set plumb, level, square with uniform joints, with full mortar bed and joints, strike joints slightly concave and tool to a dense hard surface. Use lead shims where required. Fill all sinkage, anchor and dowel holes solid with mortar.

D. Cut ropes or tubes at face of mortar or sealant.

3.2 PROTECTION AND CLEANING

A. Protect work from rain, mortar stains and soil. Where materials may be passed over stone, protect stone with non-staining covering to eliminate damage from construction.

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1 - General Requirements apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes the fabrication and erection of all metal decking shown and noted on the structural drawings numbered S1 through S4. The metal decking for steel stair landings shall be included under this Section.

C. Related work specified elsewhere:
   1. Metal Fabrications: Section 05500.

1.2 REFERENCE STANDARDS

A. The following standards or specifications are incorporated by reference:

   1. American Welding Society (AWS), Code for Welding in Building Construction D1.0-69.

   2. Specifications for the Design of Cold-Formed Steel Structural Members published by the American Iron and Steel Institute.

B. Where ASTM Standards of specifications or other recognized trade or industry standards or specifications are referenced in this specification, such standards or specifications shall be the latest editions effective at time of bidding.

1.3 SUBMITTALS

A. Submit fabrication and erection drawings for approval in accordance with Section 01300.

B. Fabrication and erection drawings shall show the layouts of the decks, field welding and/or bolting requirements at all ends, intermediate supports and side laps, installation details and all other required information necessary for the proper installation of the decks.

1.4 QUALIFICATIONS

A. Welding procedures, welders, welding operations and tackers shall be qualified in accordance with AWS Code. Inspection of such qualifications shall be in accordance with Article 604 of AWS Code.

1.5 PRODUCT HANDLING

A. Handle, transport and store metal decking in a manner that will avoid damage or deformation.

B. Storage of Materials:

1. Metal decking which is stored at the project site shall be above ground on platforms, skids or other supports with one end elevated for drainage, and protected from the elements with a waterproof covering.

2. Other materials shall be stored in a weathertight and dry place, until ready for use in the work.

3. Packaged materials shall be stored in their original unbroken package or container.

C. The decking shall not be used for storage of materials or as a working platform until the sheets have been securely fastened in position and shall not be damaged or overloaded during the entire construction period.

PART 2: PRODUCTS

2.1 MATERIALS

A. All composite cellular metal floor and stair decking and accessory items shall be formed from galvanized steel sheets conforming to ASTM A446 with a minimum yield strength of 33,000 psi. Galvanized coating shall be in accordance with ASTM A525 and Federal Specification QQ-S-775d Type I Class e.

B. All composite non-cellular metal floor decking and accessory items shall be formed from galvanized steel sheets as specified above for cellular metal decking or from carbon steel sheets conforming to ASTM A611 with a minimum yield strength of 33,000 psi. If carbon steel sheets are furnished, prior to forming, the sheets shall be given an iron phosphate treatment, and the exposed side of the deck (that side not covered by the concrete) shall be given two coats of factory baked-on enamel (phosphatized/painted).

2.2 DECK CONSTRUCTION

A. Approved Manufacturers: All metal deck shall be as manufactured by Inland-Ryerson Construction Products Company, H.H. Robertson Company, Bowman Construction Products, or approved equal.

B. Types: Deck types shall be as detailed and noted on the drawings and shall conform to the manufacturer's specifications for each type scheduled as to gauge, cell area, cell spacing and design.

C. When two or more sheets are assembled by welding to form a unit and the properties of that unit have been calculated in accordance with the above AISI Specifications, the welds integrating the sheets into the unit shall be sufficient to develop the full horizontal shear at the plane where sheets are jointed.

D. Deformations shall be provided in top sheets of all composite type deck adequate to structurally bond the overlying structural fill material. This action shall be demonstrated in tests approximating building requirements and such tests shall be made available to the Architect upon request.

2.3 DESIGN

A. Sections and calculations of their properties shall conform to the American Iron and Steel Institute's Specification for the Design of Light Gauge Cold-Formed Steel Structural Members.

2.4 ACCESSORIES

A. Provide sheet metal closures as noted on the drawing details.

B. Provide sheet steel cover plates (or closure tape) as required to prevent concrete from flowing into cells or through end and abutting joints of decking.

C. Provide expansion bolts for anchoring of decking to existing concrete at bearing ends as shown on details 18/S2, 21/S2 and 23/S2.

1. Expansion bolts shall be ¼" x 1-5/8" Wej-it or Kwik-bolts.

PART 3: EXECUTION

3.1 ERECTION

A. Erection of the metal decking shall be performed according to the manufacturer's standards and as noted on drawings.

B. Units shall be placed on the supports and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing. If the supports are not in proper alignment or at proper level, Contractor shall have corrections made.

C. Units shall be placed in straight alignment for the entire length of deck; and with minimum of space between ends of abutting units.

D. Panels shall be fastened to the steel supports or anchor plates at ends and at intermediate supports by welds. Where two units abut, each unit shall be so fastened. Weld deck to insure sound and permanent welds. Use methods which will insure welds occuring entirely over supporting steel; burn no holes off the supporting steel. Replace any panel where weld hole is visible from below. Reweld any unsound, inadequate, broken or otherwise defective weld.

E. Side laps of the panels are to be fastened by tack welding not more than 3'-0" on center. Sheet metal screws shall not be used.

F. All welding shall be done by competent experienced welding mechanics.

G. Where the end bearings of the decking are shown anchored to existing concrete by expansion bolts the bolt embedment depths into the concrete shall be at least 1-1/8".

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this Section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing and installing all structural steel and utilitarian miscellaneous metal and ornamental metal items manufactured, fabricated or otherwise specially modified to meet requirements of this Project and not specified under other sections of this specification or provided under other contracts. In general, this includes field applied (welded, embedded, bolted, anchored, etc.) metal items adjacent to other materials. "Field-weld" is the key term used to identify miscellaneous metal items in relation to main structural steel members indicated on architectural drawings. Use the following listing only as general guide to clarify the intent of work provided under this Section as to general type. Do not construe as listing or describing all required items. Exposed parts of all items indicated this (*) in all spaces (except tunnels, shafts, mechanical rooms) will be considered work where appearance is a prime consideration for acceptance. Miscellaneous and ornamental metal work of this Section includes, but is not necessarily limited to, the following:

*1. Stairs and ladders: All steel stairs and ladders throughout. Include complete framing, landings, checkered plate treads, metal supports, anchors and all other work to secure to structure and complete.

*2. Railings and rail brackets.

*3. Structural steel including all shapes and plates, connection bolts, expansion bolts and anchor studs.

4. Grating over exhaust areaways at electrical vaults, Sections 5/A12, 6/A12, 13/S3.

5. Pit cover.

6. Flush type lift handles for removable panels (4 per panel - 8 total) - Details 13/S2 and 2/S4.

7. Toilet Partition Suppotts 1/A17, 2/A17.

8. Hangers, angles and supports at fume hood duct fireproofing.

C. Related work specified elsewhere:

1. Caulking and Sealants: Section 07900.
2. Hollow metal doors and frames: Section 08110.
3. Louvers: Section 10200.

1.2 REFERENCE STANDARDS

A. The following specifications and standards are incorporated by reference:

1. American Institute of Steel Construction (AISC), Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, February 12, 1969 and Supplements 1 through 3.

2. AISC, Code of Standard Practice for Steel Buildings and Bridges, adopted effective July 1, 1970.

3. American Welding Society, Code for Welding in Building Construction D1.1-72.

4. Steel Structures Painting Council Manual, Volume 2, Systems and Specifications, Second edition, 1969.

B. Where ASTM standards or specifications or other recognized trade or industry standards or specifications are referenced in this specification, such standards or specifications shall be the latest editions effective at the time of bidding.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings of all items furnished under this Section in accordance with Section 01300. Show all gauges and weights of metals, type of metal, finish, fastening, welds, joinings, reinforcements, supports, anchors, relation to adjacent materials, accessories and other pertinent data.

1.4 QUALIFICATIONS

A. Welding procedures, welders, welding operations and tackers shall be qualified in accordance with AWS Building Code. Inspection of such qualifications shall be in accordance with Article 604 of AWS Code.

1.5 PRODUCT HANDLING

A. Handle, store and erect structural steel and related items in a manner that will avoid damage or deformation.

B. Storage of Materials:

1. Structural steel members which are stored at the project site shall be above ground on platforms, skids or other supports.

2. Other materials shall be stored in a weathertight and dry place, until ready for use in the work.

3. Packaged materials shall be stored in their original unbroken package or container.

1.6 PRODUCT HANDLING

A. Protect, handle, deliver and store in a manner that will avoid damage or deformation. Store metal off ground and provide covering for metal in storage.

1.7 COORDINATION

A. Coordinate work directly with Contractor and other Subcontractors. Provide and obtain necessary dimensions, clearances and similar data for work related to items provided under this Section. Where necessary to insure proper fitting and assembly work, ship fabricated metalwork to other Subcontractors with all shipping charges paid by metal fabrications subcontractor.

1.8 FIELD DIMENSIONS

A. Obtain and verify all necessary dimensions in field to accurately fit to conditions as constructed. The nature of the various other materials including concrete and masonry, makes it mandatory to obtain dimensions, elevations, squareness of openings and similar conditions affecting work of this Section. Included are conditions relating to stairs, railings, gratings and frames, opening frames and inserts cast in for threads.

1.9 QUALITY OF WORK

A. General: Miscellaneous and ornamental metals have been combined in one metal fabrications section as result of close relationship of various elements and since similar end products would be provided under separate sections. Do not construe the combining of two sections as relieving Contractor of furnishing and installing exposed work, where appearance is a prime consideration, in any other manner than to highest quality of work. Deliver, store and protect such items (where first and highest quality work is required for appearance) and any in unsatisfactory condition will be rejected.

B. Subcontractor: All work shall be fabricated and provided by a fully qualified, experienced firm with a history of providing satisfactory metal work of the types included herein, and which is acceptable to Architect.

C. Standards in General: Conform to standards of Architectural Metal Manufacturers Association in absence of project specification or drawing requirement.

D. Exposed Work: Appearance is a prime consideration for items similar to those designated above. For such exposed items, all aluminum shall have fine satin and uniform finish, all stainless steel shall have #4 finish, unless otherwise specified. Steel shall be smooth surfaces, cold formed, cold rolled or drawn steel that is free from blemishes. Where necessary to use structural steel shapes for "finished" items, exposed surfaces shall be finished to provide surfaces similar to cold formed work.

PART 2: PRODUCTS

2.1 METAL FABRICATION MATERIALS

A. General Metals: Metals shall be free from defects impairing strength or durability and be of best commercial quality for use. For exposed work, where appearance is a factor, provide smooth, unblemished metal, free of rust, scale, pitting, mill marks and similar markings.

B. Steel: Hot rolled mild steel 0.15% to 0.25% carbon range. For structural steel, provide ASTM A36-70. Where appearance is of prime consideration, provide cold rolled steel and non-structural shapes of mild steel which has been cleaned or pickled and rolled or drawn through dies producing a material free from scale and accurate to size or gauge, equal to samples in Architect's office. Structural shapes, where appearance is a prime consideration (and shapes noted or specified as cold rolled but not so made) shall be sand blasted as necessary to achieve unblemished smooth surface, essentially equivalent to cold rolled steel. Select steel for exposed work to eliminate dented, bent, crooked, warped or otherwise damaged steel and to provide best possible appearance. Provide full length pieces, no built-up lengths, crops or stubs. Provide tube and pipe steel that is straight, with proper wall thickness, free of dents, warps, twist or similar defects.

C. Tubing: Sizes as indicated, smooth, unpitted surfaces equivalent to cold rolled steel, seamless, straight and true to size.

D. Pipe: Smooth surfaces, unpitted, undamaged.

E. Galvanized Sheet Metal: ASTM 361-71, G-90 coating designation. No damaged or dented metal.

F. Checkered Plate: Inland's "4-way" or similar approved pattern of other manufacturers, ¼" thick unless noted.

G. Galvanizing:

1. Scope: Provide where noted or specified.

2. Galvanizing: Hot dipped galvanizing in accordance with ASTM A386-65, Class B, 2.0 oz. of pure zinc on thickness 3/16" and over, 1.5 oz. on thickness of metal under 3/16". (Metal thickness or gauges are before galvanizing.) Clean, degrease and pickle steel prior to galvanizing. Clean, remove drips or teats on exposed work. Galvanize after fabrication, no cutting or welding after galvanizing. Galvanize to prevent warping, distortion or similar defects and conform to ASTM A-384-59 and A-385-62 as applicable.

H. Paste Solder: Fill exposed non-welded field joints with hard setting paste solder of approved type. Apply smooth, flush, completely filling joint. File when hard to smooth surface free of file marks, flush with adjacent surfaces. Touch up with paint.

I. Fastenings: Best, most appropriate type for connections to be made, of sufficient number and strength for intended use. Provide all fastenings and holes for joining work of this section together and to other building components. Provide stainless steel screws at aluminum work and non-ferrous (not galvanized) screws or bolts at exterior work and at areas where moisture is present.

J. Caulking Tape (by Erector): Provide caulking tape where indicated and/or where steel abuts other materials. Furnish and install extruded ribbons of non-shrinking, non-staining, non-bleeding and paintable tape equal to Tremco's #440. Use proper size to fill and seal joint by compressing tape in joint.

K. Wall access doors: Milcor Style M, or approved equal.

L. Paint:

1. On ferrous metal: Approved rust inhibitive paint, Rust-Oleum #769 or Pratt and Lambert's Noxide Primer.

2. On galvanized metal: 80% metallic zinc dust primer, Federal Specification TT-P-641B, paint all galvanized work that is exposed unless noted herein.

M. Flush type lift handles: Hohmann and Barnard "Slablift", Style "O" maleable iron with steel handle, hot-galvanized.

N. Grating over exhaust areaway at electrical vault: Irving Type AA, 3/4" x 3/16" bearing bars, galvanized, or equivalent Reliance, Borden, Kerrigan, Gary, or Dravo gratings.

2.2 METAL FABRICATION IN GENERAL

A. General: Fit and assemble in shop, ready for erection so far as possible. Fabricate and erect square, plumb, level, straight and true. Fit accurately with tight joints and intersections. Make substantial and securely fasten. Meet highest standards of trade.

B. Exposed Work: Give particular attention to work where appearance is a consideration to obtain smooth unblemished surface finish. Grind off all mill marks, burrs and similar rough edges. Fill flush and smooth out all holes, pits, joints and cracks. Grind smooth, flush with adjacent surfaces. At any reworked surfaces, such as welds or removed mill marks, smooth the surface by filing and buffing to provide finish matching remainder of surface, without grind marks, hollows, depressions or other noticeable surface variation.

C. Formed Metal: Bend metal without marking or rupture of metal. Unless otherwise indicated, make bends as sharp as possible.

D. Railing: At tube and pipe railings, provide flush end closure plates at exposed otherwise open ends. Provide accurately set sleeves for close, uniform fit to post, leaving proper amount of space for grout. Grout space solidly full of lead or sulphur.

E. Joints: Provide joints, connections, intersections in best miscellaneous or ornamental practice as appropriate. Provide splined, doweled, shouldered, pinned or similar positive joints as necessary and approved. Where necessary at exterior, provide permanently weathertight joints, connections and intersections exposed to weather. Provide continuous weld (by "skip" welding if necessary) where such weld will best exclude weather. Use paste solder, where required and specifically approved by Architect, to fill field joint cracks.

F. Edges: Ease sharp edges or corners, as approved, that might be source of injury. Ease all sharp edges of handrails.

2.3 WELDING METAL FABRICATIONS

A. General: Conform to American Welding Society's Code for Welding in Building Construction, latest edition as applicable, using skilled welders. For "structural" type welds, use care to provide welds which will develop proper stresses in welds, using licensed welders, inspected by qualified welding inspectors. Conform to other requirements specified elsewhere herein.

B. Exposed Work: Use plug welding including field joints, where required or where plug welds will provide best possible joints. Provide other exposed welding by cutting and grinding a suitable "vee" to receive weld and insure rigid connection flush with original surface. Provide full length welds, generally. Grind and finish as previously specified.

C. Field Welding: Welds made in field subject to same requirements. Field weld where indicated on drawings or as required to provide positive connections, weathertight joints and to provide neat joint connections.

2.4 PAINTING METAL FABRICATIONS

A. General: Apply, in shop, a uniform coat of paint to all ferrous and galvanized surfaces, as well as specified areas of aluminum work. Apply to clean degreased surfaces free of dirt, rust, oil, moisture, other foreign material that will interfere with coating functions. Apply paint carefully, smoothly finish and with full coverage including connections. Allow to fully dry before handling. Provide paint film suitable to protect work during building construction and suitable to receive painter's finish, with no runs on exposed surfaces.

B. Touch-Up: Apply coat of paint at scratched or abraded areas and field weld areas immediately after erection; erected work to show no bare metal or scratched paint.

C. Dissimilar Materials: Apply two coats of paint to aluminum surfaces in contact with masonry, concrete, steel or similar dissimilar materials.

2.5 STAIRS AND LADDERS

A. General: Construct to details indicated and where not otherwise shown, follow standards of Architectural Metals Handbook as approved. Include all stringers, fascia plates, treads, tread and riser pans for concrete finishes, landing beams and framing steel bracket supports, platforms, header channels, platform supports, supports for treads and risers, clips and other devices to secure to structure, temporary and permanent spreaders, cross bracing, channel tread supports, railing anchorage, spacers, and all other work required to complete stairs except for pan fill material.

B. Shop Assembly: Shop assembly as far as possible. Typically, steel stairs are designed to be shop fabricated and assembled for each run. Completely shop assemble each run, with treads, landings and railings welded to stringers, ready for installation as a "unit". Handle with care to prevent racking, twisting, straining of welds, or other damage.

C. Steel Plate Treads: Where treads are of exposed steel plate, provide "checkered" plate. Bend treads to form nosing and back lip as indicated. Fit

treads and risers neatly and tightly to stringers.

D. Exposed Work: Metal exposed after stair completion shall be subject to requirements previously specified. Exceptions are: ships ladders, but these shall be made of new, undamaged steel, free from excessive scale pits, dents, cuts or similar defects. Note: Face of stringer next to walls, within 12" of walls, are not considered exposed steel for purposes of quality of work.

2.6 RAILINGS, GUARDRAILS, AND WALL BRACKETS FOR RAILS

A. Scope: All metal railings, handrails, brackets and other necessary and related items at interior and exterior, including stairs, ramps, areaways, and elsewhere indicated or specified. Types as shown, of pipe, solid bars, channels and tubes. Fabricate to details indicated, including anchorage devices and sleeves.

B. Fabrication: Fabricate to highest quality, with metal free of scale, pits and similar imperfections, to provide smooth surfaces. Submit samples of tube, bar and channel rails for approval, with pickets attached. Where necessary to achieve neatly fabricated work, use plug welding. No paint runs. Sharp edges of handrails and railings shall be lightly eased. Plug welding or welds at "vee" joints shall be used to preserve shape of railing sections. Where pickets are welded to top of plate stringers or facias, level or vee cut pickets each side, for welding, and finish for exposed work and for appearance being a prime consideration.

C. Sleeves: Provide galvanized sleeves required at all posts set in concrete, galvanized. Anchor to slabs or weld to steel to accurate locations.

D. Removable Rails: Provide where indicated complete with fittings, necessary bolts, slip-snug sleeves.

E. Pipe Rails: Construct pipe railings and pipe handrails flush with smooth curves, without rupturing or deforming the pipe. Cap all exposed ends, weld and grind flush and smooth. Provide 1¼" I.D. pipe unless otherwise noted. Provide approved wall flanges where connecting to walls.

F. Pipe Rail Brackets: Unless otherwise shown, provide Julius Blum and Company, Inc. #378 malleable iron, flat black finish, complete with expansion shields and threaded studs. Equivalent brackets of other manufacturers may be used.

2.7 STRUCTURAL STEEL

A. Rolled Sections:
   1. Structural tubing and pipe, ASTM A501.
   2. All other shapes and plates, ASTM A36.

B. Unfinished Bolts: ASTM A307, Grade A.

C. Welding Electrodes: E70XX.

D. Expansion Bolts: McCullock Industries "Kwik-Bolts", Wej-it Expansion Pro-

ducts, Inc. "Wej-it bolts", or approved equal.

E. Shop Paint Primer: Hentzen Chemical Coatings, Inc, #4080 Red Oxide Zinc Chromate Primer, or the equivalent products of Tremec Company, SCM Glidden, Pratt & Lambert or Sherwin Williams.

F. Headed anchor studs: Nelson Stud Welding Company, or approved equal.

2.8 DETAILING STRUCTURAL STEEL

A. Prepare detailed fabrication and erection drawings in accordance with the AISC Code of Standard Practice for Steel Buildings and Bridges and the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Mark all items of structural steel showing sizes, lengths, locations, details, ASTM designations and painting or galvanizing where noted or specified.

2.9 FABRICATION OF STRUCTURAL STEEL

A. Fabricate structural steel in accordance with the Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings and the Code of Standard Practice for Steel Buildings and Bridges of the American Institute of Steel Construction.

B. Provide punching, drilling, studs, clips, connections, etc. as indicated on the structural drawings or specified herein.

C. Shop connections shall be welded in accordance with the American Welding Society Code for Welding in Building Construction unless otherwise shown or noted.

D. Provide loose angles for miscellaneous supports for metal decking and/or concrete slabs as noted and detailed on the drawings.

E. Galvanizing: The grating support angle shown and noted on Detail 16/S4 shall be galvanized in accordance with ASTM A123.

F. Painting:

1. The structural steel angle noted above to be furnished galvanized shall not be painted.

2. Structural steel items shown to be encased in concrete shall not be painted.

3. Structural steel items that will not be exposed to the weather and will not be visible, shall not be painted.

4. Structural steel items that will be exposed to the weather any/or will be visible shall be shop painted.

5. Items to be shop painted shall be thoroughly cleaned of all mill

scale, loose rust, dirt, grease and other foreign matter in accordance with Steel Structures Painting Council SSPC-SP 1-63 and SP 2-63 and apply one coat of specified primer in accordance with the applicable SSPC specifications.

2.10 STEEL FABRICATION TOLERANCES

A. Structural steel shall be fabricated so that straightness and length are in accordance with the tolerances specified in Article 1.23.8 of the AISC Specification.

PART 3: EXECUTION

3.1 ERECTING METAL FABRICATIONS

A. Install to provide substantial, well anchored and rigid stairs, with: straight stringers; vertical rails and facias; level treads; uniform stringer spacing from walls; smooth, undamaged metal; workmanship of highest quality.

B. Set to proper height, level where appropriate, straight true, perfectly plumb. Fasten by welding or bolting as indicated, for form rigid and permanently anchored units. Neatly field weld to provide concealed or non-visible welds. Where set into sleeves, sleeves shall form tight fit, be accurately set.

3.2 STRUCTURAL STEEL ERECTION

A. Erect structural steel as shown on approved erection drawings and in accordance with the AISC Specification and AISC Code of Standard Practice.

B. Steel to steel bolted connections: Use ASTM A307 bolts as shown or noted on the drawings.

C. Expansion bolted connections: Bolts shall be installed in accordance with the manufacturer's instructions. Unless noted otherwise, the lengths of the bolts provided and installed shall give imbedment depths into the concrete that are at least the minimum recommended by the manufacturer.

D. Welded connections: Make welded connections as shown on the structural drawings and in accordance with AWS Code for Welding in Building Construction.

E. Touch-Up Painting: Where steel is shop painted touch-up connections and abraded spots with specified primer after erection.

F. Field Assembly:

1. Field connections shall be as specified on the drawings.

2. Do not cut openings in the field through structural steel members for the passage of conduit, pipes, ducts, etc., without obtaining prior approval of the Architect. Whenever approval to cut openings in the field is obtained, provide openings and additionally reinforce the member as directed by and under the supervision of the Architect.

G. Grouting: Install a full bed of the specified mortar grout under all steel base plates and bearing plates and between the steel beam top flanges and the existing concrete above where noted and detailed on the drawings. Proportion, mix and place in accordance with manufacturer's instructions. Use grout specified in Section 03300, Article 2.1.F.

3.3 TOUCH-UP

A. Touch up coat of paint at scratched or abraded areas and field weld areas. Clean these areas and touch up immediately upon erection. Finish erected work to show no bare metal or scratched paint.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing and installing custom fabricated special formed metal (S.F.M.) items including the following:

1. Radiation enclosures including baffles, primary and secondary supports, framing and facings and all other components except gypsum board facings.

2. Accessories for radiation enclosures including aluminum bar grilles.

3. Fastenings for work of this section.

4. Shop finishing of items furnished under this section.

C. Related work specified elsewhere:

1. Metal Fabrications: Section 05500.
2. Plastic Laminate Window Stools: Section 06400.
3. Sheet metal work: Section 07600.
4. Hollow metal: Section 08110.
5. Insulation, gypsum wallboard & plaster at wall: Sections 09100, 09250.
6. Metal Laboratory Casework: Section 11611.
7. Service piping, brackets and supports: Division 15.

1.2 SUBMITTALS

A. Shop Drawings: Submit fabrication and installation drawings of special formed metal items in accordance with Section 01300. Show all features of construction, dimensions, gauges, fastening, welds, mechanical joinings, reinforcements, supports, cutouts, anchorage to adjacent construction, accessories, finishes and other pertinent data.

B. Samples: Submit to Architect as follows:

1. Fabrication: Provide one full size sample of each fabricated metal item at a joint condition. Sample to be approximately a 10" wide section, indicating joint construction as fabricated, complete with fastenings and all accessories.

2. Finish and Color: Provide three (3) 8" x 8" samples of finish and color as selected, applied on typical Project metal. Provide for steel and aluminum.

1.3 QUALITY ASSURANCE

A. The following manufacturers are acceptable as special formed metal fabricators subject to complying with the design requirements of drawings and conforming to the specifications herein:

1. Hofmeister Company
2. Mark Hot, Inc.

1.4 PRODUCT HANDLING

A. Package, handle, deliver and store in a manner that will avoid damage or deformation.

1.5 COORDINATION

A. Coordinate work directly with Contractor and other Subcontractors. Provide and obtain necessary dimensions, clearances and similar data for work related to items provided under this section.

PART 2: PRODUCTS

2.1 MATERIALS

A. Steel: Cold formed, prime quality, pickled, annealed stretcher leveled steel, free from scale, pitting or other surface defects. Unless otherwise indicated on drawings, provide not lighter than 16-gauge steel.

B. Fastenings: As indicated. Provide Phillips head screws where screws are indicated. Fabricate steel clips of spring steel.

C. Aluminum Grilles: Hofco Bar Grille Type HA, consisting of H-82 linear bars at 5/8" on centers with H-52 crossbars one inch from each end and equally spaced intermediate cross bars at maximum 6" o.c. Notch cross bars to fit around primary and secondary bracket. Provide turn catch (CAM) to secure grilles to primary bracket. Provide without border. Provide proper alloy required to produce integral intergral "hardcoat" colors of architectural class 1, AA-A42 designation, color as selected by Architect. Provide grilles within a single unit in one-piece.

2.2 STEEL FINISHING

A. Material: M&T Coating B-65, vinyl organosol, by M&T Chemicals Inc., Subsidiary of American Can Company, Rahway, New Jersey, or as approved equal.

B. Finish and Color: Satin finish, custom color as selected by Architect. Only one color will be selected for all finished metal, unless noted otherwise.

C. Metal Preparation: Phosphate treatment, providing surface free from grease, soil or residual salts.

D. Coating Procedure: In accordance with manufacturers instructions. Coat clean, phosphated surface with approximately 5 mils of spray applied coating;

air-dry 1 to 5 minutes and bake 12 to 15 minutes at 250-300°F to obtain desired satin finish.

2.3 FABRICATION

A. General: Fabricate to profiles and dimensions as indicated. Consider and provide for erection procedures. Shop assemble to greatest extent possible, considering shipping and erection. Completely shop assemble and disassemble prior to shipment, marking pieces for proper field assembly. Provide all supports, anchoring devices, anchor bolts, screws, clips, seals and gaskets and other accessories.

B. Formed Corners: Neat, sharp, continuous, free of break marks. Corner radius shall be twice the metal thickness.

C. Flat Surfaces: Free of waves, buckles, dents, hollows, oil-canning.

D. Welding: In accordance with appropriate recommendations of American Welding Society using proper procedures. Welds behind finished surfaces shall be accomplished so as to minimize distortion and discoloration from finished side. Remove weld spatter and welding oxides from finished surfaces by descaling and grinding. Grind and polish weld beads on exposed surfaces to match and blend with finish on adjacent parent metal.

PART 3: EXECUTION

3.1 INSTALLATION

A. General: Erect in accordance with approved erection drawings by workmen skilled and experienced with this type of metal installation.

B. Installation: Erect plumb, level, rigid and in proper alignment complete with all fastenings secured. Use concealed anchorages. Form tight joints with gasket material in firm, uniform contact with adjacent surfaces to form effective sound barrier.

C. Touch-Up: Field touch-up all scratches and abrasions with specified finish to match finish of adjacent surface. Return items which cannot be refinished in the field to the shop, replace or make the required alternations and refinish the entire unit.

D. Protection: General Contractor shall provide protection from damage until building is occupied or accepted by Owner.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this Section: The following outline is a general listing of the type and character of work required under this Section. Do not construe as listing all work, materials or areas, nor describing each part of the work.

1. Wood framing, fire blocking, plates, nailers, blocking, bucks, stripping, furring, backing, grounds, including: nailers, blocking, cant strips and at roof; roof curbs; control joints, nailers and blocking for casework wood grounds (permanent and temporary) and similar wood and carpentry items.

2. Plywood and particle board not provided under other sections.

3. Miscellaneous thermal insulation (batt and blanket).

4. All other wood items shown or required and not provided under other sections.

5. Install wood doors furnished, ready-to-hang, under Section 08200 and hollow metal doors furnished ready-to-hang, under Section 08110.

6. Install architectural woodwork furnished under Section 06400.

7. Fireproofing and preservative treatment of wood as specified herein.

8. Furnish and install rough hardware, including framing anchors, nails, spikes, bolts, carriage bolts, nuts, washers, screws, toggle bolts, recessed grommets, etc., as required for work of this section. Bolts, nuts, washers for connecting wood framing to steel and concrete. Anchors for securing wood to masonry, steel or concrete.

9. Temporary enclosures required to protect work and public, temporary wood self-closing doors opening into heated spaces.

10. All other carpentry and miscellaneous work required.

C. Related work specified elsewhere:

1. Concrete Formwork: Section 03100.
2. Hollow Metal: Section 08110.
3. Sizing wood doors and preparing wood doors to receive hardware: Section 08200.

4. Lath plaster and gypsum drywall: Section 09100.

1.2 GENERAL INFORMATION

A. Wood Doors: Wood doors (Section 08200) are specified to be factory pre-fit to opening size, factory machined to receive applied hardware, factory marked for specific opening. Hardware location tolerances are specified to be ± 1/64".

1.3 PRODUCT HANDLING

A. Protect all lumber and millwork at job site from exposure to moisture and weather. Protect millwork from damage, dust and dirt. Stack doors in flat position, with spacers as recommended by manufacturer.

B. Protect millwork material. General Contractor and Millwork supplier shall jointly be responsible to make certain that ceiling is not delivered until the building area is sufficiently dry so that the material will not be damaged by excessive changes in moisture content. Maximum allowable, as outlined in "Forest Products Laboratory Handbook."

PART 2: MATERIALS

2.1 GENERAL LUMBER

A. Dimension and Framing Lumber: Douglas Fir, "Construction" and "Select Structural" as applicable. Where any piece may be exposed, it shall be clean and smooth (sand if necessary), sound and straight.

B. Other Non-Finish and Non-Framing Board Lumber: Douglas Fir, "Construction". Equivalent grades of Ponderosa Pine, Sitka Spruce or White Pine acceptable.

C. Grounds, Stripping and Furring: #1 Common Ponderosa Pine, or equivalent Idaho White Pine, Northern White Pine, KD, surfaced.

D. Exposed Wood indicated "Paint Black": Prior to installation, apply one coat of wood primer and at least one coat of flat black enamel to provide uniform well coated black finish. Apply to all surfaces.

E. Grading: All lumber graded according to WCLIB Standard 16, "Dry". Where part of a member may be exposed (i.e. at reveals), provide clean, sanded, smooth and sound members.

F. General: All lumber shall be dry material, surfaced 4 sides (unless otherwise indicated), each piece grade marked (except boards). Provide new wood for all lumber used at permanent part of the work (unused during construction).

2.2 PLYWOOD AND PARTICLE BOARD

A. Exposed Plywood for Paint: Douglas Fir Plywood with Medium Density Overlay manufactured under APA quality control program Product Standards PS 1-66, DFPA quality MDO-EXT-DFPA Overlay, with grade mark each piece. Under plies shall cause no defects to be visible through paint. Provide MDO at face of all ex-

posed plywood unless otherwise indicated.

B. Concealed Plywood: Douglas Fir, manufactured under APA quality control program, Product Standard PS 1-66, DFPA quality. Provide Exterior Type.

C. Particle Board: Particle board, with Medium Density Overlay on exposed face, manufactured under APA quality control program. Thickness as called for, interior grade.

2.3 MISCELLANEOUS INSULATION

A. Batt or blanket glass fiber insulation full thickness for void; Owens-Corning, Carney, W.R. Grace, or approved equal.

2.4 EXPANSION MATERIALS

A. Expansion Materials: "Ethafoam", or approved equal. Use where expansion joint material is noted and not installed under other sections.

2.5 TAPES, SEALANT, ADHESIVES AND MISCELLANEOUS

A. General Adhesive: All as recommended by manufacturer of the product to be applied for the surface material to which it is applied, guaranteed to give permanent adhesion, with material remaining flat to back surface.

B. Insulation Adhesive: Dow's insulation Mastic #7 or other adhesive recommended by insulation manufacturer. Adhesive shall dry (or set) rapidly and not attack or soften the insulation.

C. Sealant: As specified under Section 07900, for application.

D. Sealing Tape: Tremco's tape 440, or approved equal polyisobutylene-butyl, reinforced.

E. Caulking Compound: Tremco's Curtain Wall Sealant, or approved equal, polybutene sealant for hidden or concealed applications.

2.6 FIREPROOFING TREATMENT

A. General: Pressure impregnated with Koppers Company, Inc.'s "Non-Com" chemicals to comply with requirements of Underwriter's Laboratories, so marked or branded when delivered to site. Store indoors, completely protected from weather, moisture. Treat after cutting to shape.

B. Moisture Content: All material furnished fireproofed shall be kiln dried to an average of 18% or less.

C. Appearance: Fireproofed material used shall be without twist, warp, split, check or other defects resulting from fireproofing and re-drying process which would adversely affect work or function of any member. Discoloration will not be regarded as a defect.

D. Extent of Work: Fireproof treat all wood used for furring strips and blocking and for wood board ceiling.

2.7 PRESERVATIVE TREATMENT OF WOOD

A. General: Treat by vacuum or pressure method, using approved preservative that will not stain or bleed, is paintable and will not cause softening or deterioration of roofing where wood member is built into roof. Subcontractor performing treatment shall: Review all conditions; confirm applicability of treatment and advise Architect if change in treatment is recommended; submit a proposed list of treatments for approval; dry thoroughly before installation; treat after cutting to shape, ends of preservative treated wood that are job cut shall be given two swab coats of Penta-WR.

B. Preservative Treatment, Exposed Wood: "Penta-WR" water repellent preservative meeting Federal Specification TT-W-572, accomplished by vacuum process, treated to refusal (approximately 2 lbs of solvent per cubic foot).

C. Preservative Treatment Concealed Wood: For wood at roof, exterior and interior concealed wood, treat by pressure process using Wolman Salts, dried after treatment, retention about 3.5 lbs. dry chemical per cubic foot. Retention as recommended by manufacturer and treating plant for condition.

D. Extent of Preservative Treating: Treat all wood at (1) cant strips, nailers, curbs, blocking and other wood a permanent part of structure at roof (2) all permanent wood at exterior of building, (3) other wood subject to damp or humid conditions.

2.8 ROUGH HARDWARE, FASTENERS, ANCHORAGE DEVICES AND STEEL STUDS

A. Extent: Provide all rough hardware required, including nails, screws, bolts, lag screws, grommets, cinch anchors, joist hangers, toggle bolts, shot anchors, and similar items.

B. General: Provide proper size and type for use intended and for materials to be fastened. Install adequate hardware to insure substantial and positive anchorage. Use hot dip galvanized nails at exterior work. Anchor wood ground with toggle bolts or similar approved device. Nailing into wood plugs is not acceptable for any work. Where shot anchors are noted or specified or used, use Ramset of type and size recommended by manufacturer for conditions of use.

PART 3: WORKMANSHIP AND INSTALLATION

3.1 FRAMING, NAILERS, BUCKS, CANT STRIPS

A. General: Install plumb, level, true and square to dimensions shown and required. Allow for finishes and proper clearances where necessary. Provide sound bearing, square cuts, full bearing surfaces. Framing to be 16" o.c. unless specifically noted otherwise. Set crown up for horizontal members. Provide double top plates and single bottom plates at stud partitions. Locate studs, horizontal members or backing behind all joists. Provide solid support under end joints. Shim and block where required. Eliminate crooked, twisted,

cupped or bowed framing where such defects will interfere with or prevent highest finishing with other materials. Anchor in substantial, accurate manner to hold dimensions required. Shim and block where required. Accurately rip cant strips and other special shapes as shown and required. Provide blocking above ceiling for ceiling mounted items.

B. Anchorage: Adequately anchor, fasten and support all members in best, trade practice to form secure, substantial and accurate anchorage and to hold required dimensions and prevent twist. Exercise care at all hangers, ceiling frames and similar work to provide permanent support. Use bolts and screws to eliminate loosening up of joints, sagging or similar movement.

3.2 FURRING, STRIPPING, GROUNDS AND BACKING

A. Install plumb, level, true and square. Anchor substiantially for permanent installation. Install stripping or furring for paneling 16" o.c. unless otherwise specified. Set and shim to a straight edge so finish wall is true and straight. Provide grounds and backing as shown or required. Allow for finishes and shim out to form level surfaces. Verify ground sizes and locations before installation. Firestop 8' o.c. each way.

3.3 PLYWOOD AND PARTICLE BOARD

A. Install according to applicable DFPA published recommendations including nailing. Use annular ringed nails generally. Miter at corners where exposed unless finish edge is called for. Securely nail with casing nails, set, cut and install so all pieces have clean edges and are free of hammer marks, other disfigurement that will show through paint. Edges (including at end joints) of all plywood shall be provided with and nailed to solid support.

3.4 INSULATION

A. General: Install all insulation in accordance with manufacturer's recommendations (including adhesives), unless otherwise specified herein, to full thickness throughout spaces to form well insulated spaces. Carefully cut and fit. Install with large headed nails or staples at wood and with mastic and anchors at concrete or masonry to form secure anchorage. Install with tight butt joints. Replace any insulation that has holes, becomes torn or is damaged. Do not use small pieces. Cut neat holes around obstructions.

B. Acoustical: Install as indicated to result in continuous "blanket" without openings. Cut for snug fit to all penetrating elements and snugly butt joints. At acoustical insulation nail or staple to adjacent wood framing or furring members to retain insulation in place.

3.5 FINISH HARDWARE

A. General: Refer to Article 1.1.C and Article 1.2, this section, for information relative to hardware. Carefully install hardware, using skilled finish carpenters. Fit before painter's finish is applied, remove and install after finish is complete. Install hardware so that all operating parts operate smoothly, close tightly and do not rattle. At all screw holes install proper

screws, install hardware firmly anchored.

B. Doors: Hang doors so they will stand in any open position. At each door, install bumper, stop or holder. Set door stops so bumpers occur at reinforced areas of doors. Verify condition for stops prior to installation. Where conditions permit, doors shall swing over 90° and install for 180° swing wherever possible. Stops shall be securely anchored to guarantee permanent installation.

C. Closers: Adhere to manufacturer's directions for closers, including location at opening (as well as distance from door edge), closer size, anchorage and other factors affecting proper installation. Verify any questionable installations with hardware supplier prior to installing closers. All closer installations shall be done by thoroughly skilled and trained workmen. One trained workman shall adjust (and re-adjust) all closers after installation.

D. Thresholds: Set metal thresholds in full bed of specified caulking compound, forming tight seal between threshold and surface to which set. Securely, permanently anchor thresholds using countersunk non-ferrous screws to match color of threshold (stainless steel screws at aluminum thresholds).

3.6 MILLWORK AND CASEWORK

A. Workmanship: Install millwork and casework in neat and workmanlike manner, free from hammer or tool marks, open joints, slivers and to best quality workmanship. Architect's and Owner's decision on quality of work will be final.

B. General: Set plumb, level, square and true. Scribe to abutting surfaces as required. Miter corners, (including at trim), countersink nails, drill holes for nails in hardwood. Install millwork after plaster is dry and building humidity is at acceptable level. Anchor securely. Permanently and substantially anchor all work. Install to eliminate all exposed end grain. Set millwork to provide uniform and equal spaces and reveals, as indicated by details. Back primed or sealed under Section 09900.

C. Clearances and Coordination: Coordinate work with all other materials and verify clearances, hardware items and other related work prior to installation.

3.7 GENERAL WORKMANSHIP

A. Provide all workmanship to meet highest standards, accomplished by skilled mechanics. For finished millwork use experienced finished carpenters only. All exposed wood shall be free of hammer marks, abrasions, slivers, gouges, etc. Set all nails at exposed wood surfaces.

3.8 WORK OF OTHERS

A. Examine all sections of Specifications and drawings so as to properly anticipate work which must be built into, attached to, butted against, concealed by, etc. work of others and furnish and install such bucks, backing, supports, openings and other items as may be required.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes providing all millmade wood items not provided under other sections. In general, provide the following but do not construe this listing to be complete in all detail:

1. Plastic laminate: Adjustable shelving and standards and brackets for same.
2. Wood door and window frames - 1/A23.
3. Staff mail unit - 1/A19.
4. Standing and running trim.
5. Shelves and rods - 13/A49.
6. All hardware required to be built into woodwork.
7. Plastic Laminate window stools - 12/A48.
8. Plastic Laminate Coat Hook Shelf - 38/A54.

C. Related work specified elsewhere:

1. Wood, lumber, plywood, acoustical insulation, grille cloth and installation of all millmade items: Section 06100.
2. Wood doors: Section 08200.
3. Hardware and accessories: Section 08700.
4. Metal Laboratory casework: Section 11611.

D. Furnished but not installed under this section:

1. All work of this section is installed under Section 06100.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all work in accordance with Section 01300. Show work in related and/or dimensional position with sections shown in not less than 3/4" or 1½" scale except detail sections shall generally be shown in full size. Note species and quality grade of all wood and similarly identify other materials. Competent personnel shall neatly organize and produce

drawings. Tracing of Architect's details will not be accepted as adequate shop drawings.

B. Samples: Ship to Painting Subcontractor samples of Project millwork woods to receive transparent and/or stain finish. Samples shall be uniform in size, approximately one square foot. Identify Project in ink directly on back surface of sample. Provide sample pieces which will be representative of each species and from both solid and veneered wood. Provide up to six pieces (if requested) for each species.

1.3 DELIVERY, HANDLING AND STORAGE

A. Deliver woodwork under cover. General Contractor shall not permit delivery until job conditions, including humidity, are suitable. Except as otherwise required by relationships detailed on drawings, do not deliver interior millwork until building is sufficiently dry to insure no damage to millwork will result; as a minimum, plaster and similar moisture shall have been out of entire building for at least ten days, relative humidity shall be less than 50% and in cold weather, heat shall have been provided for at least ten days prior to delivery.

B. Doors: Package, handle, deliver and store at the jobsite in a manner that will avoid damage. Damaged doors will be cause for rejection. Store doors flat and support in such a way as to prevent marring, crushing and warping. Store doors in unopened containers until ready to hang.

1.4 COORDINATION

A. Coordinate work directly with Contractor and other Subcontractors as necessary to insure proper fitting, joining to or clearance of other work. Obtain templates as required to insure proper fitting. If necessary for proper fitting, or assembly of work, General Contractor shall ship to mill metal work provided under other sections, at mill's request. All miscellaneous metal items for anchorage of millwork to millwork shall be shipped to mill.

1.5 GENERAL REQUIREMENTS

A. Quality Standards: Except as otherwise shown on drawings or specified herein, comply with Quality Standards of Architectural Woodwork Industry (illustrated, copyrighted 1970) and by reference they are made a part of this specification.

B. Joinery details shown on drawings take precedence over AWI Standards and these specifications. AWI Section 600 shall not have any application unless specifically incorporated hereinafter.

C. Competence: Millwork shall be manufactured by a well established and experienced firm, acceptable to Owner and Architect, with satisfactory record of similar size and quality installations. Architect reserves right to reject any millwork Subcontractor if it is Architect's opinion that (1) shop capacity, experience of workmen, equipment or supply of material will not result in the required quality within time required for completion, or (2) previous performance

by manufacturer has been unsatisfactory.

D. Cutouts and Holes: Provide cutouts and holes for items such as sinks, fittings, risers, ducts, and other features furnished into work of this section. Holes and openings for electrical features will be cut by Electrical Contractor under Division 16.

E. Millwork Assembly: Assembly work in mill so far as possible. If necessary to insure best results, complete units shall be assembled in mill and then partially disassembled into workable sections for shipping and job installation. Necessary joints for shipping shall be approved types. Mill assembly shall include, but not be limited to: laminated items, shelving assemblies, benches, and similar items. Prime Contractor, when installing items not shop assembled shall distribute, to best overall advantage, defects allowed by specifications.

F. Deviations: No deviations below quality grade, species and finish specified below under "Interior Woodwork for Transparent Finish" and "Interior Woodwork for Paint Finish" will be accepted for individual items or components unless explicity so detailed on drawings or explicitly so specified under the separate headings covering such items. Provide higher quality grade and finish or other species when so specified under the separate headings covering such items.

PART 2: MATERIAL

2.1 QUALITY GRADE AND MATERIALS GENERAL REQUIREMENTS FOR INTERIOR WOODWORK

A. Interior Woodwork for Transparent Finish:

1. All interior woodwork, unless explicity indicated for paint finish, shall be for transparent finish.

2. Material and workmanship of all woodwork for transparent finish shall conform to the premium grade requirements of AWI Quality Standards.

3. Wood species, all interior "solid" wood for transparent finish shall be plain sawn Red Oak.

4. Wood species for all laminated hardwood, plain sawn Red Oak.

5. All interior veneered work for transparent finish shall be plain sliced Red Oak.

B. Interior Woodwork for Paint Finish:

1. All interior woodwork, so indicated on drawings, shall be for paint finish.

2. Quality Grade: Material and workmanship of all interior woodwork for paint finish shall conform to Custom grade requirements of AWI Quality Standards.

3. Wood Species: All interior "solid" wood for paint finish shall be natural birch or natural gum.

2.2 PLYWOOD

A. Exposed plywood for paint: Douglas Fir plywood with Medium Density Overlay (MDO), manufactured under APA quality control program, Product Standards PS 1-66, DFPA quality MDO-EXT-DFPA overlay, with grade mark each piece. Under plies shall cause no defects to be visible through paint. Provide MDO at face of all exposed plywood unless otherwise indicated.

2.3 HARDBOARD

A. Provide where noted, thickness as indicated, smooth face both sides. Tempered board shall be manufactured by Masonite, Insulite, Weyerhauser or approved equal.

2.4 SHELVING

A. Fixed shelving (including anchorage) and adjustable shelving (including related brackets and standards) as follows:

1. Plastic laminate shelving in all rooms.

2. Wood shelving, hardwood and softwood, in all rooms to be furnished by Section 06400 and installed by Section 06100.

3, Unless noted otherwise, adjustable and 3/4" thick up to 36" span, 1" thick on 36"-42" span, minimum 1-1/8" thick over 52" span. Plywood or particle board, as shown, that are to receive paint, provide hardwood edge band with tongue groove joint to shelf and miter at exposed ends. Provide plastic laminate on all sides of shelves where plastic laminate shelves are indicated.

4. Shelf standards to be extra heavy duty type - KV 87, or equal, and extra heavy duty type adjustable bracket - KV 187, or equal, complete with end rests - KV 212 (or 210 and 211).

5. Fixed shelf brackets and anchorages as detailed or required.

2.5 PLASTIC LAMINATE AND CORE

A. Quality Grade: Material and workmanship of plastic laminate work shall conform to Section 500, Premium Grade requirements of AWI Quality Standards.

B. Provide where shown on drawings and as specified herein.

C. Components:

1. Plastic Laminate: General purpose, 1/16" thick, General Purpose Grade, high pressure laminate plastic for all exposed surfaces, both horizontal and vertical.

2. Core: Thickness as noted on drawings, particle board (40-45 pound density), or hardwood faced, 5 ply core plywood.

3. Balancing Sheet: .025" Cabinet Liner Grade (white) as made by laminate manufacturer. Apply to surfaces as outlined under Article 2.1-C.

4. Backing Sheet: .030" thick, Backing Sheet Grade as made by laminate manufacturer. Apply to concealed side of all laminate work.

D. Plastic laminate: As manufactured by Formica, Micarta and Textolite or approved equal. Selected from full range of colors (including white), plain or other patterns. satin finish.

E. Fabrication: By experienced fabricator, approved by Architect. Eliminate joints where possible. Machine pressure bonded using waterproof adhesive, shear strength shall not be less than 200 pounds per square inch. Unless specifically shown otherwise, apply matching laminate to all exposed edges (including back edge not tight to wall) and provide approved bevel at edge. Seal all core surfaces not laminate-faced with clear synethetic resin sealer recommended by laminate manufacturer.

2.6 MISCELLANEOUS ACCESSORIES

A. Provide all angles, anchors and accessories as indicated or required to provide all millwork items complete.

2.7 GENERAL FABRICATION REQUIREMENTS

A. Intent: It is intent of drawings and specifications to provide durable, serviceable millwork meeting highest standards and materials, methods, construction and assembly shall meet these standards. Millwork shall be equal to quality of millwork of AWI Standards (Premium Grade) unless more restrictive or rigid requirements are specified herein.

B. Strength: Join and assemble work to provide durable, strong, rigid units that will not warp or rack including during shipping, installation. Where conditions of service and usage indicates need for heavier construction than is indicated on drawings, make adjustments as approved by Owner and Architect.

C. Thickness: Dimensions shown are to dressed, finished surfaces.

D. Laminating and Edge Gluing: Provide solid members from single piece of stock unless otherwise shown or approved. Where laminated work is shown, use laminations of thickness indicated, glue under pressure and provide concealed steel tie rods as shown on drawings or required.

E. Edge Banding: Build-in or plow-in band matching veneer full width of core at exposed edges of veneered work (including plywood) so band is covered by and does not read through veneer. Make band at least 3/4" deep except ½" deep acceptable at panels 3/4" thick or less. Fit band so snug, firm contact is made

with panel on all surfaces and glue all contact surfaces. If detailed, miter corner intersections of edge bands to eliminate end grain showing when intersection is exposed to normal view.

F. Gluing: Glue all joints on all surfaces. Use highest grade glue in strict accordance with manufacturer's recommendations. Use Type I waterproof glue for all work exposed in any part to exterior, around sinks and at other locations where work is exposed to moisture, dampness that might affect glue bond. Use water-resistant glue equal to urea-formaldehyde resin glue at all other locations.

G. Provision for Work of Others: Make cutouts of proper size to accommodate other work as required by drawings and/or furnished by others. Provide, where not otherwise indicated or concealed, mouldings to cover exposed core of veneered work. Provide proper mountings for hardware including snuggers, catches. Closure panels at all openings.

H. Corners: Ease lightly with sandpaper (do not round or bevel) all corners not shown or specified rounded.

2.8 MISCELLANEOUS MILLWORK

A. Grade: Unless otherwise noted or specified, all millwork shall conform to the Custom Grade requirements of the AWI Standards, Section 400, for transparent finish.

B. Species: All wood exposed to view, including exposed backs and ends and shelves and inside of open cases, shall be hardwood for paint finish unless noted "finish natural."

C. Hardboard: Tempered board equal to manufacture of Masonite or Insulite, smooth both sides, or approved equal.

2.9 OPENING FRAMES, STANDING, RUNNING TRIM, ETC.

A. Provide without warp or twist which cannot be easily straightened as installed. Furnish in single lengths as shown, or in long enough lengths to allow for job mitering of corners, etc. Rout to receive accessories where indicated.

2.10 LAMINATED MEMBERS

A. Laminate into one single piece, provide steel dowels, conceal ends with hardwood dowels, ease edges and corners.

2.11 GUARANTY

A. For All Work: Guarantee all work against warping, racking, shrinkage, opening of joints, cracking, delamination and other defects for a period of one year.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all elastomeric membrane waterproofing.

C. Related work specified elsewhere:

1. Cast-In-Place Concrete: Section 03300.
2. Bituminous Dampproofing: Section 07150.
3. Building Insulation: Section 07210.
4. Built-Up Bituminous Roofing: Section 07510.
5. Flashing and Sheet Metal: Section 07600.
6. Sealants: Section 07900.

1.2 GENERAL INFORMATION

A. General: Following information is intended to complement and clarify the intent of the drawings but do not construe as outlining all required work. Provide all materials and installation to complete the work. Provide all work, flashing and related materials to complete the entire installation and to provide complete water barrier integrity to the building spaces.

B. Elastomeric Waterproof Membrane: Provide membrane at: (1) All exterior slabs, tunnels, and similar locations which have a space below, where the membrane typically is built into construction (not the roof areas where the built-up membrane and gravel is the surface); (2) Other exterior areas where shown on drawings; (3) Vertical surfaces of all foundation walls in contact with earth or backfill, including tunnels, where a space occurs on the interior side of the wall, minimum of 3'-0" above footing and carried a minimum of 1'-0" out onto footing (Note: this foundation wall membrane generally is not indicated on the drawings). Use heavy duty membrane at locations where bituminous paving is laid directly on membrane.

C. Flashing: Provide all flashing and base flashing in conjunction with waterproofing including: up all walls, curbs and similar abutting surfaces, at joints and intersections, and elsewhere required to insure water integrity. Where flashing height requires the flashing to extend above the concrete topping slab or other wearing course, flashing is to be covered with metal counter flashing (with metal under Section 07600) as indicated (details may not fully indicate metal counter flashing thus, but all locations where flashing becomes exposed to the weather are to be so covered).

D. Compatibility: Where any flashing, membrane or other material, new or existing, (including sealants and gaskets) are to be built into, or be in

contact with each other, verify the compatibility of the materials prior to commencing work. Do not use materials that are incompatible, will soften or cause deterioration to plastic or cold applied membranes or other materials. If necessary, provide and use alternate materials as approved, without additional cost.

E. Installation of insulation and other covering materials: Coordinate and schedule all work with insulating subcontractor so that membrane is protected and cover provided without delay.

F. Notice: Give notice to University when materials are delivered to permit examination and testing. Give at least 7 days notice before starting any work to permit inspections to be scheduled.

G. Certificate: Provide manufacturer's certificates, prior to starting work, certifying all materials are in accordance with specified requirements.

H. Instructions: Conform to the material manufacturer's directions, instructions or specifications, unless these project specifications are in excess of (but not in conflict with) the manufacturer's directions, in which case these specifications shall govern.

1.3 GUARANTEE AND INSURANCE

A. Guarantee: Provide 5 year written guarantee for work of this Section, in the same form and generally the same conditions (as applicable) specified under Article 1.4 of Section 07510, except: annual inspections shall be limited to examining spaces below membrane work with a representative of the Owner to check for evidence of leaks; and the work to repair any leaks shall include the removal and replacement of the surface (and other) materials above the membrane.

B. Insurance: The manufacturer of the cold applied waterproof membrane materials shall effect, and maintain throughout the life of this guarantee, such product liability insurance to cover bodily injury, cost of repairs and damage to property, under a comprehensive liability policy, with the following minimum amounts:

Bodily Injury, each person	$ 250,000
Bodily Injury, each occurrence	$1,000,000
Prop. Damage & Cost of Repairs, each occurrence	$1,000,000

1. This insurance shall be renewable at Owner's option and cost for additional three-year periods.

1.4 SUBMITTALS

A. Guarantee: Submit specified membrane guarantee in duplicate to the Architect.

B. Certificates: Submit certificates specified in 1.2.N, herein, in duplicate to the Architect. Prior to starting work at the site, submit copies of certificates of insurance for the insurance specified under 1.3.B, above, to the Architect and Owner.

1.5 DELIVERY, STORAGE, HANDLING

A. Package, handle, deliver and store all materials at the jobsite in a manner which will avoid damage, contamination or spoilage.

B. Storage: Store all materials off the ground and keep under waterproof covering. Do not allow covering to be torn, displaced or otherwise damaged. Store rolls by stacking on end, with adequate platform and clearance to prevent penetration of moisture from grade. Do not pile materials to such weights as will damage deck or insulation.

PART 2: PRODUCTS

2.1 ACCEPTABLE SYSTEMS

A. The system of W.R. Grace Construction Products Division (Bituthene) is specified to establish standards of quality and performance. Any of the following systems are acceptable subject to approval of deviations in details by the Architect and University:

1. Bituthene by W.R. Grace.
2. HLM 1000/1300 by Sonneborn.
3. Jiffy Seal by Protecto Wrap.
4. Tremproof 50 by Tremco.

2.2 WATERPROOFING MEMBRANE

A. Membrane: Rubberized asphalt, integrally bonded to polyethylene film .064" thickness, W.R. Grace & Co's. Bituthene. Use heavy duty Bituthene where bituminious pavement will be laid directly on membrane.

B. Primer: Bituthene Primer.

C. Mastic: Bituthene Mastic.

PART 3: EXECUTION

3.1 GENERAL WORKMANSHIP REQUIREMENTS

A. Workmanship: Conform to best practice and accomplish by using only skilled mechanics. SPILL NO MEMBRANE MATERIALS ON BUILDING OR OTHER MATERIALS. Spilled materials on exposed surface will result in applicator repairing, resurfacing or replacing the stained work. Requirements for installing membrane applies to similar operations for vapor barrier work. See Section 01010 for conditions for working on and over membranes, and Section 01500 for Temporary Heat requirements.

B. General Responsibility: Perform no work in conflict with, contrary to, or below the standards established by membrane materials manufacturer. After starting work, applicator is responsible for complete water integrity of the membrane, and for providing properly applied membranes which will insure a satisfactory life of not less than 20 years. Therefore, applicator shall:

1. Not apply membranes or other work under any conditions which are not

proper and in best recommended practices, including surfaces or weather.

2. Examine decks and other surfaces with prime contractor for suitability of surfaces and not proceed until corrections have been made where necessary. Start of work means acceptance of the deck and conditions by this Subcontractor.

3. Review all drawing and specification requirements and establish control and test procedures to insure compliance.

4. Exercise care to insure adequate quantities of materials are used.

5. Maintain competent foremen continuously supervising the work, with authority to discard unsuitable materials or remove unsatisfactory workmen.

6. Supervise installation of, and be responsible for seeing that drains, curbs, and other work is properly set and membrane is not damaged, make membrane and flashing repairs as necessary; advise Supervising Engineer and Prime Contractor of any potential leaks due to work of others.

7. Resolve questionable installation work prior to proceeding.

8. Inspect deck with Owner representative prior to starting work.

3.2 PREPARATION IN GENERAL

A. Surfaces: Properly prepare all surfaces to provide and insure best installation. Decks and other surfaces must be clean and dry. Sweep and clean areas thoroughly before starting work. Do not start work during threatening weather. Notify General Contractor of any areas unsuitable for applying membrane. Do not proceed over frosty or damp surfaces nor until deck is proper. Remove snow from decks and dry thoroughly before starting.

B. Deck Smoothness: Check deck for smoothness and for suitability to receive vapor barrier and insulation. Refer to Section 03300 for required concrete finish. Install no barrier over deck with ridges and/or depressions that will result in unsatisfactory base for work under this section. Have all corrections made to provide deck that meets project requirements and applicator's approval. Start of work is placed immediately after the insulating fill or insulation and immediately covered with insulating fill or insulation.

3.3 INSTALLING WATERPROOFING MEMBANE

A. General: Install membrane waterproofing and flashing (including base flashing of membrane) in accordance with manufacturer's instructions and requirements of this section. Coordinate all work. Provide extra plies of membrane as called for by the manufacturer or as otherwise indicated in the Contract Documents, whichever is the greater requirements.

B. Preparation of Substrate:

1. Concrete Finish: Horizontal concrete surfaces will have a troweled finish as a minimum, or as otherwise called for under Section 03300.

2. Wearing surfaces will be regular weight concrete block with joints cut flush.

3. Surface Condition: Concrete and masonry surfaces shall be surface-dry and must be cured for seven days before application of membrane or primer. Surfaces shall be broom-cleaned and free of voids, loose stones and sharp protrusions prior to priming or applying membrane.

4. Priming: Membrane is generally applied directly to concrete or masonry; all surfaces must be primed with specified or approved primer. Apply by brush, roller or spray at the rate of 200 to 400 square feet per gallon until the surface is black, using more than one pass if necessary. Membrane must be applied only after the primer solvents have flashed off and the primer has become tack-free (at least 60 minutes after priming, but not over 36 hours). After 36 hours, surface must be reprimed. Metal, plastics and other dense surfaces need not be primed, but must be clean, dry and free of grease, oil and dust.

5. Temperature: Ambient surface and materials temperatures shall be over 40°F. and under 100°F. during application of membrane primer and mastic to ensure a good bond. At temperatures below 40°F, special techniques may be used for certain applications on recommendation of membrane manufacturer.

C. Application:

1. Joints: Lay membrane from the low point to the high point across the fall line so that the laps shed water. Apply membrane in double thickness over control and construction joints. Provide a loop of excess material across joints as shown and as necessary to relieve the strain.

2. Sealing Edges: Membrane shall be finished off by sealing it into a reglet joint, or by drawing the membrane down over the edge of a slab or over the top of a foundation or parapet wall, setting and pressing or rolling it down firmly and completely in two parallel ¼" beads of mastic, then trowelling a liberal bead over edge of membrane. Where these installations are not possible, the top edge of the membrane on the vertical surface must be set and pressed or rolled down firmly and completely in two parallel ¼" beads of mastic and finished with a troweled bead of mastic. If nails are used, use large head nails and cover with a 6" strip of membrane. Where the membrane is carried over the edge of the slab, carry down wall face a minimum of 18", but in all cases, cover the joint in concrete between the wall and the slab.

3. Sealing Seams: All seams shall be overlapped at least 2½", and pressed or rolled firmly in place. The succeeding strip shall be laid with a minimum 2½" overlapping and rolled down firmly and completey. Misaligned or inadequately lapped seams shall be covered with a minimum 6" wide strip of membrane.

4. Corner Details: All inside and outside corners (vertical or horizontal) including where a cant strip occurs, shall be double-covered with membrane by applying an initial strip of 11" minimum width, centered along the axis of the corner. This strip shall be completely covered by the regular application of membrane. Outside corners shall be rounded and inside corners filled with an

inorganic cant strip or mortar fillet prior to application. Seams must be carefully sealed in corners. Where details indicate, the base flashing shall be the additional ply of membrane. Any exposed edge of membrane shall have troweled bead of mastic over these edges.

5. Drains and Protrusions: Areas around drains, posts or other protrusions shall have two plies of membrane, set in full beds of mastic, set in clamping ring and edges and ring covered with trowelled bead of mastic. (Drains, connected to sewer, are provided and set under Division 15, built-in under this section). Build-in drains, plumbing vents and similar items as recommended by manufacturer.

6. Membrane Protection, Vertical Surfaces: Within 5 days, cover the membrane. Temporarily hold in place, if necessary until backfilling or other cover is placed. Shield from sunlight.

7. Membrane Protection, Interior and Exterior Horizontal Areas: Immediately after testing the membrane, it shall be covered and protected. Also cover areas at cant strips of flashing to protect the membrane. Promptly advis other sections so the membrane areas are promptly covered and protected by the final finishes.

D. Precautions:

1. Punctures and Tears: Care shall be taken not to puncture or tear the membrane prior to covering it. Topping, backfill, insulation or protection board shall be placed immediately to protect membrane. Careful inspection shall be made prior to covering membrane, and any ruptures shall be patched with membrane and mastic.

2. Exposed Edges: If the work must be left partially complete, the exposed edges of the outside strips shall be set and pressed or rolled down in two parallel ¼" beads of mastic and the edge sealed with a trowelled bead of mastic.

3.4 TESTS

A. Flood Tests: Perform flood tests upon completion of the horizontal membrane areas, prior to placing protection board or any subsequent fill or finishes. Construct watertight dams, using membrane materials, and temporarily close drains. Flood area to depth of 1" minimum, maintaining flooded condition for at least 24 hours. Thoroughly test intersections and flashings by flooding or hose testing. Notify the University in advance of testing and inspect the work with the Owner's representative. Repair any leaks and repeat flood test until there is no evidence of leaks.

3.5 FOLLOW-UP INSPECTIONS AND SERVICE

A. Project Completion: Just prior to acceptance of entire Project, or covering with finish surfaces, membrane applicator shall inspect entire membrane, remove all nails, wire, cut metal and other debris. Remove any drips of bitumen. Any "ridging", blisters and similar defects shall be cut open and repaired.

B. Annual Inspection: Provide the inspection and services for three years, in connected with specified guarantee.

- - -

Part 1: General

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all dampproofing of exterior foundation walls.

C. Related work specified elsehwere:

1. Earthwork: Section 02200.
2. Membrane Waterproofing: Section 07110.
3. Built-up Bituminous Roofing: Section 07510.
4. Gaskets, caulking and sealant: Section 07900.

1.2 DELIVERY, STORAGE, HANDLING

A. Package, handle, deliver and store at the jobsite in a manner that will avoid damage.

B. Deliver all materials in their original, unopened containers, seals intact.

PART 2: PRODUCTS

2.1 MATERIALS

A. Mastic Coating: Trowelled on pitch base material. Celotex Pitch Base Plastic Cement or similar product of Koppers, or approved equal.

PART 3: EXECUTION

3.1 APPLICATION, WALLS

A. Extent: Provide dampproofing on outside (earth side) face of all below-grade building foundation walls from top of waterproof membrane (or top of footing if no membrane) to 6" below finish grade. Dampproofing is not required where membrane waterproofing is indicated.

B. Trowel on as recommended by manufacturer to a coat 1/16" to 1/8" thick.

C. Apply to clean, dry surfaces, free of loose particles, projections and similar defects. Remove all such obstructions before proceeding.

D. Accurately establish finish grade lines, or levels of paving or concrete, prior to coating walls to prevent dampproofing above grade. Where concrete, brick pavers, or bituminous surfacing occurs, carry up to underside of the top paving slab.

E. Carry coatings from 6" below grade to footings and carry 6" out on footings to completely seal wall to footing joints. Accurately establish finish grade lines, or levels of paving or concrete, prior to coating walls, to prevent dampproofing above grade. At Plaza area, carry up to underside of the top concrete slab. Apply coating prior to installation of foundation wall insulation and coat walls where insulation will also be placed. Where coated walls intersect non-coated walls, run bead in corner and carry coating minimum 3 feet onto non-coated walls or 3 feet onto walls of non-excavated spaces.

F. Provide workmanship in best practice, accomplished by skilled mechanics trained in their trade and in strict accordance with manufacturer's instructions. Provide finished work free of damage, blisters, cracks, open joints, pin holes, skips, holidays, thin spots, etc.

G. Where dampproofing is contiguous with asphaltic waterproofing, provide mask of minimum 6 mil aluminum foil. Cement foil to asphaltic membrane with asphaltic plastic cement for top 6" of aluminum foil then apply pitch-base dampproofing to entire outside face of foil, then fold foil back (up) on itself to produce pocket to retain pitch base material. If the detail calls for asphaltic material <u>above</u> the campproofing, reverse this foil procedure, folding foil back over asphaltic material.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes patching existing roofs and related rigid roof insulation at new roof openings.

C. Related work specified elsewhere:

1. Carpentry: Section 06100.

D. Not furnished under this section, but built-in under this section:

1. Metal Roof Flashing and Trim which is built into plies of roofing membrane: Section 07600.

1.2 GENERAL INFORMATION AND REQUIREMENTS

A. Information in this Article is intended to complement and clarify the intent of the drawings, but do not construe as outlining all required work. Provide all materials and installation to complete the work. P & G used herein means pitch and gravel construction or asphalt and gravel construction as applicable.

B. Flashing:

1. In cooperation with sheet metal subcontractor (or others, as appropriate), build-in any metal flashing (furnished under other Sections) which is inserted into plies of roofing.

2. Provide and install all plastic sheet under metal copings, roof edges and similar locations.

C. Compatibility: Where any "plastic" flashing or membrane is to be built-into, or be in contact with, built-up membranes, verify the compatibility of the proposed "plastic" flashing with the built-up membrane materials. Do not use any "plastic" flashing that is incompatible, will soften or cause deterioration to plastic or built-up membrane.

D. Notice: Give notice to University when materials are delivered to permit examination and testing. Give at least 7 days notice before starting any work to permit inspections to be scheduled.

E. Certificate: Prior to starting work, provide certificates from the manufacturers that the materials being provided to the job are in accordance with the specified requirements.

1.3 FOLLOW-UP INSPECTIONS AND SERVICE

A. Project Completion: Just prior to acceptance of entire project, roofer shall inspect patched roof, remove all debris, nails, wire, cut metal and re-spread gravel over thin or bare spots. Provide additional gravel and bitumen as required. Remove any drips of bitumen. Send written confirmation to Owner and Architect when such services have been performed. Any "ridging", blisters and similar defects shall be cut open and repaired.

1.4 DELIVERY, STORAGE, HANDLING

A. Package, deliver and store materials in a manner that will avoid damage.

B. Store all materials off the ground and keep under waterproof covering, approved by University. Do not allow covering to be torn, displaced or otherwise damaged. Store rolls by stacking on end, with adequate platform and clearance to prevent penetration of moisture from grade. Do not pile roof materials to such weights as will damage deck or insulation.

1.5 SUBMITTALS

A. Certificate: Submit 2 copies of certificates specified in Article 1.2.E herein.

PART 2: PRODUCTS

2.1 MANUFACTURERS OF ROOFING MATERIALS

A. Provide materials of best grades of Barrett, Koppers, or approved equal. Strictly adhere to manufacturer's requirements for twenty years roofing and flashing for type of deck and other conditions, or as specified herein, whichever requirement is the most rigid or demanding. Note that certain requirements herein may be in excess of normal bonded roof specifications and such additional requirements shall be provided. As reference, Barrett may be named. For all built-up membrane materials, provide products of one manufacturer.

2.2 ROOFING AND PLASTIC FLASHING MATERIALS

A. Provide materials conforming to ASTM standards, where they apply, as minimum requirements, as well as equal to Barrett's materials.

1. Base Sheet: 40-45 lb. coated base felt equal to Barrett.

2. 15 lb. Asphalt Felt: ASTM-226, with Underwriter's label, 15 lb/100 sq ft.

3. 15 lb Tarred Felt: ASTM D227, with Underwriter's label, 15 lb/100 sq ft.

4. Asbestos Finishing Felt: ASTM D250, 15 lb/100 sq ft.

5. Reinforced Asbestos Base Flashing: Barrett AB-20, or approved equal.

6. Steep Roofing Asphalt: ASTM D312, Types II, III or IV as appropriate for slopes.

7. Coal Tar Pitch: ASTM D450, Type A, straight run, high bitumen coal tar pitch.

8. Plastic Cement: As recommended by roofing manufacturer, minimum standards Federal Specification SS-C-153, Type I or II as compatible with roofing.

9. Sealant: G.E. silicone Construction Sealant, or Dow-Corning Silicone Sealant.

10. Gravel: Water worn gravel, ½" to 5/8" in size, washed, clean, dry, generally rounded aggregate and suitable for use on roofing, ASTM D1863 (no slag).

PART 3: EXECUTION

3.1 STANDARDS FOR INSTALLATION

A. Workmanship: Conform to best practice and accomplish by using only skilled mechanics. Exercise special care at openings through roof and at roof edges. SPILL NO ROOFING MATERIALS ON BUILDING OR OTHER MATERIALS. Spilled materials on exposed surface will result in roofer repairing, resurfacing or replacing the stained work. Requirements for installing roofing applies to similar operations for vapor barrier and insulation work. See Section 01010 for conditions for working on roof and over membranes, and Section 01500 for Temporary Heat requirements.

B. General Responsibility: Perform no work in conflict with, contrary to, or below the standards established by roofing materials manufacturer. After starting work, roofer is responsible for complete water integrity of the membranes which will insure a satisfactory roof life of not less than 20 years. Therefore, roofer shall:

1. Not apply membranes or other work under any conditions which are not proper and in best recommended practices, including surfaces or weather.

2. Examine roof decks and other surfaces with prime contractor for suitability of surfaces and not proceed until corrections have been made where necessary (start of work means acceptance of deck and conditions by the roofer).

3. Not overheat bitumens and in event of accidental high temperatures, discard entire batch.

4. Review all drawing and specification requirements and establish control and test procedures to insure compliance.

5. Exercise care to insure adequate quantities of materials are used.

6. Maintain competent foremen continuously supervising the work, with

authority to discard unsuitable materials or remove unsatisfactory workmen.

7. Supervise installation of, and be responsible for seeing that ventilators, drains, curbs and other work is properly set and roof is not damaged; make roof and flashing repairs as necessary; advise University and Prime Contractor of any potential leaks in work of others.

8. Resolve questionable installation work prior to proceeding.

9. Inspect deck with University Representative prior to starting work.

3.2 PATCHING BUILT-UP P & G ROOFING

A. General: Coordinate schedule and work with other operations to apply membrane over insulation immediately. Use only dry, undamaged felts and properly heated bitumen. For first ply of all built-up membranes, use 15 lb. tarred felt. Complete membrane in one operation, without phases. Lay all plies "Shingle fashion" at one time (no "combination" laying), except for first ply if specifically recommended by manufacturer. Spread bitumen by mopping to full coverage of surfaces.

B. Cut and rewire existing roofing and patch and reflash as for new work.

C. Protection: Keep all felts covered, clean and dry. Perform all work, including use of equipment to transport materials, to prevent damage to fill, insulation or deck. Roofer shall do all preparation work, take all precautions and be responsible for preventing any bitumen dripping onto or into building.

D. Heating: DO NOT OVERHEAT BITUMEN: Discard any overheated material. Do not use on project. Do not heat pitch over 400° and apply to surface above 350°. Do not heat asphalt over 450° and apply to surface above 400°. (If manufacturer recommends lower heat temperature, follow manufacturer's recommendations). Temperatures apply to membrane, vapor barrier and insulation work. Roofer shall keep accurate thermometers at site for use of workmen and Owner's representative. (Thermometers shall not be built-in kettle thermometers.)

E. Membrane Plies: Install at least 4 plies of saturated tarred felt, lapping each 27½" over preceeding felt and mopping each felt uniformly and fully so in no place does felt touch felt. Use minimum 30 lbs of pitch per ply per 100 sq ft. Lay all felts without buckles and wrinkles and broom in each ply to form intimate contact over entire surface so plies are completely bonded together with bitumen.

F. Flood Coat: Over entire surface pour uniform coating of bitumen, using 75 lbs of pitch per square. Apply within two days of completion of membrane but not until cut tests have been taken.

G. Gravel Surface: At all built-up membranes, while flood coat bitumen is still hot, uniformly spread and imbed gravel. At roofs use not less than 400 lbs per 100 sq ft.

H. Vertical Surfaces: Where membranes are continuous over a vertical or steep sloped surface, install all plies in full uniform trowelled coating of plastic

cement and apply plastic cement top surface approximately 1/8" thick. At these areas, in lieu of built-up membrane, the 55-60 mil plastic sheet membrane may be provided instead, built into membrane a minimum of 8".

J. Obstructions and Roof Penetrations: Perform and install all work around openings with plastic cement, including drains, vents and similar items. Double felt strip flanges into membrane. At pipes, conduits and similar round items (without flanges) which penetrate roof, install plastic flashing sealed to obstruction and carried out onto membrane at least 8", built into membrane. Construct all work to insure no pitch drips into building.

K. Determine existing materials and do not use asphalt with coal tar pitch.

3.3 INSTALLING FLASHING

A. General: Examine all drawings, including mechanical and electrical work for general indication of curbs, openings, skylights, vents, joints and similar work, as well as types of flashing work. Drawings are not represented as indicating all obstructions or features that may occur nor do details indicate all requirements or methods of flashing work. Metal flashings are provided under Section 07600.

B. Vertical Surfaces, Built-up Membranes: At intersections of horizontal surfaces to walls, curbs and similar vertical surfaces with cant strip, carry all felts of built-up membrane up cant and cut off evenly. Either full height of curb or up 8" minimum apply specified composition flashing system. Cover entire surface with plastic cement and imbed surfaced cap sheet. Nail tops of flashing plies to backup with tin discs. Seal entire top edge of flashing plies with liberal application of plastic cement. When flashing must be installed in cold weather, with the specific approval of the Architect, hot steep asphalt may be substituted for plastic cement to imbed the cap sheet (final ply) by using a heavy hot mopping on the surface of the ply under the cap sheet and also over the surface of the cap sheet.

C. Equipment Curbs: Construct as detailed. Seal all penetrations through flashing at supports. Flash as for vertical surfaces.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 10101, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all sheet metal work.

C. Related work specified elsewhere:

1. Special Formed Metal: Section 05750.
2. Built-up Bituminous Roofing: Section 07510.
3. Field Painting: Section 09900.

D. Furnished under this Section, built-in under other Sections:

1. Sheet metal for roof flashing and trim: Built-in under Section 07510.

1.2 GENERAL LOCATION OF TYPES OF SHEET METAL WORK

A. Provide all required sheet metal work, of the general types and character outlined herein. Provide the following sheet metal work.

1. 0.012" stainless steel cover - counter flashing at roof curbs.
2. 0.012" stainless steel, flashing at and below grade.

B. Provide all other sheet metal work and related materials of similar nature, for flashing, counterflashing, curbs, enclosures, caps and all other sheet metal except as may be provided under other sections.

1.3 SUBMITTALS

A. Samples: Submit full size samples of each type of typical counter flashing, prior to fabricating metal for the Project. Show joints for each type.

B. Shop Drawings: Submit fabrication and erection drawings of all sheet metal work including full size details, prior to fabrication. Show locations of proposed joints at exposed metal work. Submit in accord with Section 01300.

1.4 DELIVERY, STORAGE, HANDLING

A. Deliver, handle and store at the jobsite in a manner that will avoid damage. Scratched, dented, or deformed metal items will be rejected.

PART 2: PRODUCTS

2.1 MATERIALS

A. Galvanized Sheet Metal: ASTM A525 and ASTM A361, 1.25 oz. class (G90) by Armco, US Steel, Wheeling or Toncan Metal, or approved equal. Prime on both sides. Gauges of metal as specified, shown on drawings and required to provide highest quality installation.

B. Stainless Steel: "Soft" Chrome-nickel stainless steel, "Micro Flex," of Washington Steel Corporation, or approved equal, dull matte finish, thickness as specified. Prime exposed metal prior to furnishing to the job, for final field painting.

C. Painting:

1. Asphaltic coating: Coat metal built into roof type membranes, or under insulation, with bituminous paint on parts to be built in.

2. Galvanized metal: For all other G.I. flashing (not built into roofing) thoroughly clean metal of all dirt, grease, oil, or other residue, properly treat surface to insure adhesion, then apply one full coat of zinc dust primer on both sides of metal before installation. Primer to be Type 1, in accordance with Federal Specification TT-P-641-D with 80% metallic zinc dust. No substitutions. See Article 2.2 below.

3. Stainless Steel: Paint all exposed parts of S.Stl. with primer recommended by manufacturer, after thoroughly cleaning metal. Apply in shop prior to delivery to job. See Article 2.2 below.

D. Fastenings:

1. General: Provide appropriate and recommended type and size of non-rusting fastenings for all metal to insure: proper and permanent alignment; metal remaining permanently in place; restricted movement; permanently tight joints. Provide screws or rivets at all soldered joints to take the stresses. No nails to be used where exposed. Where exposed fastenings are required, provide screws. Fastenings shall penetrate wood a minimum of 3/4".

2. Galvanized metal: Hot dip zinc coated steel nails and screws, except screws holding removable counter flashing shall be stainless steel.

3. Stainless steel: Stainless Steel Screws and Nails.

4. Watertight washers: For screws at coping caps, tops of curbs and similar locations, provide neoprene washers under the head to insure watertight hole.

E. Solder:

1. Galvanized Iron work: 50-50 tin-lead alloy.

2. Stainless steel work: 50-50 tin and lead alloy for general work, except use 60-40 or 80-20 at exposed unpainted work. Use strong acid type flux as recommended by metal manufacturer.

F. Joint Sealer, Mastic and Miscellaneous:

1. Roofer's Mastic: Plastic cement as specified for roofing, Section 07510.

2. Concealed sealant (bedding sealant): Tremco Curtainwall Sealant, Polyisobutylene-butyl type, or approved equal.

3. Caulking compound-sealant: As specified for sealant under Section 07900.

2.2 FABRICATION WORKMANSHIP

A. General: Provide metal free from holes, waves, buckles, pinch marks and other defects. Imperfect metal will be rejected and shall be replaced. Coping covers and roof edge covers will be rejected if not straight and level.

B. Peeling Paint: Thoroughly cleaned metal is a requirement prior to priming to insure proper provide adhesion. Paint that peels or blisters from metal work (primed under this section) at the line of primer and metal, within two years after acceptance by Owner, shall be basis for rejection of painting and this subcontractor shall brush, reclean and repaint such work as directed at the expense of this subcontractor. If repainting is required, two coats of paint shall be provided and entire metal will be cleaned and repainted.

PART 3: EXECUTION

3.1 WORKMANSHIP

A. General: Conform to best practice, accomplish by using skilled mechanics, in accordance with Sheet Metal Contractor's Association Handbook and Recommendations and to details shown. Provide metal work that is substantial, securely fastened, neatly installed, with clean sharp breaks, water and weatherproof at exterior and below plaza locations. At roof locations, provide metal work to meet roofer's requirements and approval for twenty year bonded type roof. Insulate between dissimilar material with asphalt paint or other approved insulator, such as plastic sheet.

B. Verify conditions: Prior to starting work, verify that all nailers, etc., are true to size and line and securely anchored. Notify General Contractor of unsatisfactory work and do not proceed until corrections are made so straight, level, plumb and properly sized work results. Verify dimensions in field to provide proper and accurate fit.

C. Dimensions: Carefully form and install metal work, including at masonry, to conform to dimensions indicated and to field confirmed dimensions.

D. Joints: Construct all joints with laps in direction of flow. At butt and locked joints, construct joints watertight.

E. Hemmed edges: Turn back metal to form hemmed edges wherever the edge creates a hazard or where it may cut into membranes. Provide hemmed edges at lower edges of flashing, counter flashing.

F. Soldering: Screw, spot weld or rivet all soldered joints to take stress, with solder acting only as sealant between metal. Keep solder work neat, smooth, with no greater spread than required to seal the joint. For stainless steel solder work, carefully follow manufacturer's directions. Thoroughly clean all flux from surfaces and for acid type flux scrub residue, neutralize with ammonia or washing soda and rinse with clean water.

G. Keepers and wedges: Where shown, or required to firmly hold metal in place, provide continuous keepers, screeds or cleats of same metal as metalwork. Provide lead wedges where noted or where required to hold metal work firmly in place.

H. Built-in work: Furnish metal to proper trades for installation when other work is in progress. Sheet metal fabricator is responsible to be aware of job progress and to provide built-in metal at proper time to prevent delays at jobsite.

3.2 TYPES OF JOINTS

A. Counterflashing: Lapped joint.

3.3 JOINT CONSTRUCTION

A. Lapped Joints: Lap 2" in direction of water flow. At counter flashings and similar work, lock bottom edges together.

B. General: At all corners, inside or outside type, provide sections built up in shop, with soldered joints. Corner units to be neat and follow profile of adjacent metal. No nails permitted at exposed surfaces of exposed roof metal, use only screws. Form metal as indicated to field verified dimensions.

3.4 COUNTER AND CURB FLASHING

A. General: Install metal counterflashing after composition flashing and cap sheets are installed. Lap joints and lock lower edges together. Counterflashing to provide watertight closure over top of composition flashing. At corners, curbs and similar intersections, solder watertight. Carry counterflashing down 45° cant strip to about 1" above roofing membrane.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all caulking, sealing, and gasket work except that specifically required under other sections.

C. Related work specified elsewhere:

1. Caulking and sealants related to membrane waterproofing: Section 07110.

2. Caulking and sealants related to roofing: Section 07510.

3. Caulking and sealants related to sheet metal flashing & roofing: Sections 07600 and 07610.

4. Caulking, sealants and gaskts related to glazing: Sections 08800, 08900.

5. Caulking, sealants and gaskets related to acoustical sealing of partitions: Section 09100.

6. Caulking and sealants related to tile work: Section 09300.

1.2 GENERAL INFORMATION

A. Following outline is intended to indicate the locations and general types of work under this Section as well as to complement and clarify drawing requirements. Do not construe as indicating all work required by this Section, describing all operations or mentioning each type of sealing requirement. Refer to drawings and other Sections for additional requirements.

1. Joint Sealant: This is the primary sealant for use at all exterior vertical joints, including interior joints of window sash where indicated to be sealed.

2. Exterior Slab Sealant: This is the primary sealant for use at all caulked joints at Plaza areas, including expansion joints, slab control joints, feature joints to maintain pattern, joints where slabs abut buildings, areaways, columns, shafts, and similar feature and expansion joints in areaways, including at perimeters where slabs abut buildings or walls, installed under this contract, and all similar locations. Refer to drawings for general indications as well as to Section 03300 for joint locations which may not be indicated.

3. Interior Slab Sealant: Provide at joints around perimeters of all

equipment bases and pads at locations on earth, as at basement equipment rooms, floor expansion and cut control joints, as indicated on drawings and specified under Section 03300, isolation joint at perimeter of laboratory (and similar) spaces at basement floor, interior slab control joints where joint is not covered with finish floor material, other interior joints of the same type where joint filler or cut slab joint is provided or indicated.

4. Interior vertical surface joint sealer (caulking): This is the primary interior sealant for all uses in joints in vertical surfaces except acoustical sealant.

5. Acoustical Sealant: This is sealant for use at perimeter of all partitions where they abut floors and other partitions as shown on drawings.

1.3 SUBMITTALS

A. Color Samples: Submit actual samples of full color pallette of each material for Architect's selection.

B. Manufacturer's Recommendation: Submit technical data including performance requirements, recommendations and application instructions to the Architect for approval of materials used.

PART 2: PRODUCTS

2.1 SEALANTS

A. Primary Vertical Surface Joint Sealant: Sealant shall be a gun-grade class B, non-sag two-part polysulfide sealant licensed by Thiokol Chemical Corp. as conforming to Thiokol Building Trade Performance Specification, such as Tremco "Lasto-Meric", W.R. Grade Hornflex, Pecora Synthacalk GC-5, Sonneborm Sonolastic (two-part), or approved equal. Special sealant color may be required, to blend with precast and to be similar or match Health Sciences Unit A sealant, as selected by Architect. Provide in-place samples, after preliminary selection, for final approval.

B. Exterior Slab Sealant: Heel resistant, self-leveling, high strength, one part polyurethane rubber sealant, Dupont Imron, Vulkem 45, or approved equal.

C. Interior Slab Sealant: Polysulphide-base sealant conforming to ASA A-116.1 Class A, self-leveling, guaranteed non-staining without the use of primer. Acceptable products and manufacturers, subject to suitable colors, are those listed by Thiokol Chemical Corp under "Approved Sealant Products" and conforming to Thiokol's Building Trade Performance Specification, current at the date of this specification. Submit name of proposed product, with approved independent testing laboratory evidence that material (formula) conforms to ASA and Thiokol's specifications. Provide manufacturer's certificate that material (formula) conforms to specifications. Thiokol's "Tested and Approved" seal shall appear on all containers of the product in addition to the supplier's name.

D. Interior Vertical Surface Joint Sealant: Same as 2.2.A, above.

E. Primer: Provide primer type as supplied or as recommended by manufacturer of sealant or gasket material, including "conditioner" for exterior slab sealant.

F. Bidding Sealant: Acrylic Latex Caulk, Tremco, or approved equal. Use for bidding thresholds.

2.2 BACKING AND BOND BREAKERS

A. Backing and Rod Stock Backstops: Refer to other Sections (including Sections 03300, 04200) for backstop provided under other sections. Where appropriate backing for proper joint configuration is not supplied by others, or where backing is too deep in joint, provide "Ethafoam" rod stock (or other similar recommended rod type backing) oversize for joint. At all locations, provide approved backstop that will prevent sealant adhesion at backside and use as separator between non-compatible sealant materials.

B. Bond Breaker: Aluminum foil or other sheet goods, compatible with sealants.

PART 3: EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. DILUTION: DO NOT DILUTE, CUT, GAS, ADULTERATE OR OTHERWISE CHANGE ANY SEALANT. SUCH PRACTICE WILL RESULT IN AUTOMATIC REJECTION OF CAULKING SUBCONTRACTOR. IN ADDITION, ALL CAULKING DONE WILL BE REJECTED, REMOVED AND REPLACED BY OTHERS AT EXPENSE OF OFFENDING SUBCONTRACTOR, TO EXTENT DIRECTED BY ARCHITECT OR UNIVERSITY.

B. Joint Condition: Do not work until joints are in proper condition for best results. Caulking subcontractor shall perform all work to insure joints that are clean, dry, and free from frost, dust, oil (including form oil) or other residue that will prevent or reduce adhesion. Joint defects, including lack of adequate depth or size shall be corrected by prime contractor.

C. Primer: At porous surfaces and elsewhere recommended by sealant manufacturer, prime joints with clear primer made for that purpose, as recommended by manufacturer. Surface to show gloss. Primer is required at stone, porous masonry and porous concrete. Provide primer (conditioner) at <u>all</u> joints to receive exterior slab sealant.

D. Clean Sealant: Keep surface of all sealant clean until "skinning" has taken place. Do not caulk under conditions which will permit dust to adhere to surface.

E. Joint Design and Configurations: Details provide only general indications as to where sealants occur. Provide proper depth of material in relation to width, with proper configuration to insure proper adhesion, without exceeding adhesion abilities of the sealant. Obtain manufacturer's recommendations and keep copy at jobsite to permit reference. Joint size and configuration shall be as recommended by manufacturer for location, proportion, type of stress and shape, including joints in shear. In all cases, provide backstop or bond backer

at backup to prevent sealant from adhering to backup.

F. Instructing Mechanics: Prior to commencing work, thoroughly instruct all mechanics in the proper methods and techniques required to insure best possible end result. In addition to reviewing instruction of each of the manufacturers involved, review requirements of temperature, surface of sealant with relation to surrounding materials, cleaning joints, priming joints, backstops and joint configurations.

3.2 CAULKING

A. General: Do not caulk during period of precipitation nor immediately thereafter. Provide proper backing at all joints. Provide rod stock typically at all joints, including raked back mortar, except where gaskets are provided. Use oversize rod stock to insure proper shape and to hold rod stock backing firmly in place. Follow manufacturer's recommendations on joint proportions. Caulking depth generally shall be two-thirds of joint width, but not less than ¼" depth. Fill joints over 3/8" in width by at least 3 passes, running a bead in each corner and finish by a bead down center.

B. Preparation: Before caulking, take only measures to insure clean, dry joints. Brush, degrease, dry and clean all grooves. Use solvents recommended by manufacturer.

C. Temperatures: Caulk under ideal temperatures, above 40°. If necessary, provide heated enclosures to accomplish work under ideal temperatures.

D. Caulking: Use proper and approved guns, with proper size nozzles, including offset nozzles at limited clearance spaces. Mask adjacent surfaces as required to prevent surplus or misplaced sealant. If caulking operations indicate careless workmanship, misplaced sealant or sealant smeared (or overlapping) adjacent surfaces, masking will be required (and provided without extra cost) at all locations. Finish joints by neatly pointing with beading tool. Apply surface coating to surface of sealant before tooling only if recommended by manufacturer and if coating will not discolor caulking.

E. Cleanup: Immediately clean adjacent materials which have been soiled; leave work in a neat, clean condition; finish work to be smooth, clean, even surfaces, neat, free from holes, pits and absolutely watertight.

F. Rope Wicks: When wicks for weeping masonry or in-wall flashing occur, cut wick flush with caulking face and do not seal wick ends.

G. Recessed Caulking: Where shown, caulk so surface of caulking is uniformly back from adjacent surface. Where not otherwise indicated at recessed caulking, hold surface back about ¼".

H. Seal joints of precast concrete prior to application of thermal insulation at interior side.

3.3 SLAB SEALANT

A. General: Conform to applicable provisions of caulking requirements above,

such as cleaning, preparation, temperatures, caulking, primer and cleanup. Expansion joint filler is typically provided under Section 03300, but provide bond breaker on top of any joint filler material which is not of the Ethafoam type. Prime (or "condition") all exterior joints.

B. Level of Sealant: At all interior joints, install sealant so top face is flush and level with surrounding surfaces. At exterior joints of Plaza where edges of joint are slightly rounded, keep top face of sealant down a uniform ¼" from surrounding surfaces. At joints located in areaways, where slabs abut building or other features, install so sealant face is flush and level with surrounding surfaces.

C. Sealant Depth: Also refer to Section 03300. Provide uniform depth sealant for each type of joint and verify uniform backing depth prior to starting. Depth of sealant noted herein is from face of sealant to high (rounded) point of backing. At interior joints, provide 3/8" deep sealant. At exterior expansion joints and slab control joints (as at Plaza) and all joints subject to heel traffic, provide sealant depth equal to width of joint, but not less than 3/8" nor more than 5/8". At other exterior joints, as at areaways and where slabs abut building, walls or similar features, provide depth 1/8" less than joint width, but not less than 3/8".

D. Application: Install backing or bond breaker as required and to regulate joint depth. Apply primer or conditioner of type recommended by manufacturer. Apply sealant by gun, using proper nozzle size, filling all voids and to insure proper level and thickness. Tool sealant to smooth, even finish, free from ridges, wrinkles or similar surface marks.

3.4 WORKMANSHIP

A. Conform to best practice and accomplish by using mechanics skilled in their trade. Caulking shall accomplish its purpose to prevent admittance of air and water. Remove and replace defective caulking. Requirements herein specified are minimum requirements as to materials and methods and perform work and use all means as necessary to insure best results. Assume responsibility for defective work. Following types of failure will be adjudged defective work: Leakage of air or water; hardening, cracking, pulling away from adjacent surfaces; loss of bond; crumbling; sagging; shrinking; running of compound; staining of adjacent work by compound; improper levels; surfaces which are not smooth.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all hollow metal shown on drawings and specified herein which includes the following but not limited to: Exterior and interior hollow metal doors, and frames including UL labeled and nonlabeled openings. Provide standard and special anchors, clip angles, etc, required for installation. Miscellaneous metal frames are not included.

C. Related work specified elsewhere:

1. Grouting of frames: Sections 04200, 09100.
2. Metal Fabrications: Section 05500.
3. Carpentry: Section 06100.
4. Metal Siding: Section 07411.
5. Finish hardware: Section 08700.
6. Field painting: Section 09900.
7. Louvers: Section 10200.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings of hollow metal items in accordance with Section 01300. Show all features of construction, dimensions, gauges, reinforcements, cutouts anchorage to adjacent construction and other pertinent data.

1.3 PRODUCT HANDLING

A. Handle, transport and store hollow metal work in a manner that will prevent damage and deterioration. Provide proper packaging to protect all items. Store at the project site in an upright position under cover and on wood sills.

PART 2: PRODUCTS

2.1 MATERIALS AND MANUFACTURERS

A. This specification is based on Trussbilt Stockline Hollow Metal Doors and Frames.

B. Equivalent products manufactured by Overly Mfg Co., Pioneer, Steelcraft or Curries Manufacturing, Inc, or approved equal which conform to these specifications will be acceptable.

2.2 FABRICATION

A. Construct all work in a first class manner in accordance with details and approved shop drawings. All joints and mortises shall be to hairline accuracy, with all welds continuous and ground smooth and with all items square and true.

B. Factory assemble frames in the largest size units permitted by shipping restrictions for minimum assembly of related parts at the job site.

C. Frames:

1. Provide one piece welded unit type construction formed to the profiles shown on details. Construct frames of hot-rolled pickled and annealed steel. Use 16-gauge for all frames. Label frames, 16 gauge or heavier if required by label.

2. Miter all corners, including stops, to hairline accuracy continuously arc welded on the back side. Grind frame faces smooth for invisible joint. At mullion intersections of special frames, arc weld faces of frames and stops. Welding and grinding to flush, smooth surfaces shall be done to preserve the original profile of the frame and to maintain crisp square corners. Spot welding of reinforcement shall be invisible on exposed surfaces.

3. Provide at least three anchors at each jamb for anchoring frame to adjacent construction. Type of anchor shall be determined by the type of construction and as recommended by the frame manufacturer. Provide 2" x 3½" x 12-gauge floor clip angles. Where no separate structural lintel is indicated for frames in 4" walls, provide a 12-gauge channel head reinforcement, welded to frame head.

D. Doors:

1. Provide hollow metal doors of size and type shown. Construct of cold rolled, stretcher-leveled furniture steel. Use 16 gauge face sheets for exterior doors and 18 gauge face sheets for interior doors, or heavier as required by Underwriter's label. No seams on face sheets. Provide an 18 gauge steel channel on top and bottom of doors. Provide watertight flush plate at top to prevent water pockets. Door edges shall be flush and smooth, without visible seam or joint.

2. Provide continuous true truss inner core, full height and width, spot welded to face sheets 3" on center both vertically and horizontally

or

2. Provide an inner core consisting of vertical stiffeners of 16-gauge channel or zee members spaced 6" on center and spot welded to face sheet 3" on center.

3. Insulate doors and panels with 6-pound density mineral rock wool.

4. Provide glass light and louver openings as required complete with removable molding hand fitted to each opening with joints true and tightly fitted. Fasten with #6 Jackson-head screws. Moldings shall not overlap door face

sheets. Install door louvers at the factory.

5. Construct stile and rail doors with equivalent reinforcing to flush doors. Reinforce intersections of stiles and rails to form rigid unit, capable of severe abuse without racking or sagging. Weld intersections of stiles and cause no defects to be visible through paint. Provide MDO at face of all exposed plywood unless otherwise indicated.

E. Hardware Preparation:

1. Mortise, reinforce, drill and tap doors and frames for hardware using templates furnished by the hardware supplier. Provide the minimum reinforcements and components required by the Steel Door Institute STandards for template doors and frames.

2. Provide three Glynn-Johnson GJ64 moulded, non-staining rubber mutes for all interior door frames.

G. Underwriters Construction:

1. Provide Underwriter's construction and labels of the classifications required by the drawings. Label requirements shall take precedence over any conflicting portions of the drawings and specifications. Hollow metal shall be capable of the required label with the specified hardware, including single point locks.

2.3 PAINTING

A. After fabrication, thoroughly clean all items of rust, oil, grease or other impurities, spot glaze where necessary to correct defects and apply the following coats of red oxide primer, each coat baked-on.

1. Frames - 1 coat.
2. Doors - 2 coats.
3. Interior of exterior doors and label doors - 1 coat.

PART 3: ERECTION

3.1 ERECTION

A. Erect frames in position plumb, rigid and in true alignment. Provide the necessary bracing and spreaders to prevent displacement or distortion until adjacent construction is completed. Securely attach frames to floor and adjacent construction. Frames in masonry walls shall be grouted full of mortar at jambs and anchors built into joints by the mason as the walls are laid up.

B. Drill and tap for field splices and connections after erection. Caulk splices and connections and leave finished work smooth and free from warps and buckles.

C. Install doors with uniform margin at jambs and head.

D. After erection, touch up field splices, connections, welds and abrasions with specified primer.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all acoustical hollow metal door units shown on drawings and specified herein which includes the following but not necessarily limited to: interior acoustical hollow metal doors and frames. Rough bucks and frame reinforcing shown, specified or required. Standard and special anchors, clip angles, etc., required for installation. Jamb, head and floor anchorage. Extensions of frames (channels or similar) to secure frames and mullions to structure above, as shown or required.

C. Related work specified elsewhere:

1. Grouting of frames: Section 09100
2. Metal Fabrication: Section 05500.
3. Hollow Metal: Section 08110.
4. Wood Doors: Section 08200.
5. Finish Hardware: Section 08700.
6. Field Painting: Section 09900.

D. Installed but not furnished under this section: Finish Hardware, Section 08700.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings of acoustical hollow metal items in accordance with Section 01300. Show all features of construction, dimensions, gauges, reinforcements, cutouts anchorage to adjacent construction and other pertinent data.

B. If requested by Architect, prior to fabrication submit samples to job site of ¼ of a door and a frame showing reinforcing, construction and workmanship. If approved, samples will be retained as a comparison with delivered hollow metal.

C. Drawings and Guarantees: Before work is started, contractor shall furnish for Architect's approval, complete shop drawings and the following certificates and guarantees:

1. Certification by an independent acoustical laboratory meeting the requirements of the specified ASTM procedure in all respects that the Sound Transmission Class of the door, based on tests at the series of 16 third octave band frequencies from 125 to 4000 Hz (cycles per second) is no less than 45 STC per ASTM E9070, doors tested with threshold conditions as detailed.

2. Written guarantee that doors are constructed in accordance with laboratory tested door and free of defects in material and workmanship for a period of one year after installation.

1.3 PRODUCT HANDLING

A. Handle, transport and store hollow metal work in a manner that will prevent damage and deterioration. Provide proper packaging to protect all items. Store at the project site in an upright position under cover and on wood sills.

PART 2: PRODUCTS

2.1 MATERIALS AND MANUFACTURERS

A. General: Door openings marked "soundproof" on the plans to be Sonicbar units furnished by Sonicbar Division, Rysdon Products Company, Chicago, Illinois, or approved equal. Units shall include laboratory certified sound insulating doors of 45 STC rating, formed frames, and adjustable clearance crack sealing devices. Unit assemblies shall be flush threshold Model DS2-45F.

B. Door and Frame Construction: Soundproof doors to be 1 3/4" flush design, 16 gauge cold rolled stretcher leveled sheet steel, of incombustible construction and free of visible joints at seams of door faces. Doors to have interior formed stiffening reinforcement shop welded full height so that faces shall not be connected except at edges. Fireproof non-coupling filler shall be interlaced between reinforcements throughout door interior. Doors with half lights or vision panels, to have provision for glazing 1/4" double lights with resilient self-sealing and locking, mechanically unconnected glazing frames. Door frames shall be 14 ga. HRPO steel. Head and jamb intersections to be fitted hairline joints, reinforced, welded, and ground smooth. Doors and frames to be factory mortised, reinforced and fitted for heavy duty locksets, strikes and template hinges. Door and frames to be factory prime finished with a red oxide rust inhibiting primer.

C. Perimeter Sealing Devices: Clearances between frame and door shall not exceed 1/8". Side and head jambs to be sealed by means of Sonicbar Adjustable Sound Stops. Concealed position locking screws 8" o.c. shall provide a minimum of 3/8" adjustment of closed cell neoprene gasket assemblies installed in anodized aluminum (US28) housings with snap-on decorative cover attached to frame. Where flush thresholds are detailed, sill operating clearance shall not exceed 1/4" and be sealed by means of a Soncibar Tri-Seal Automatic Threshold Closer providing instantaneous 1/4" retraction of the neoprene gasket when door is opened. (Flush Sill Only)

2.2 FABRICATION

A. Construct all work in a first class manner in accordance with details and approved shop drawings. All joints and mortises shall be to hairline accuracy, with all welds continuous and ground smooth and with all items square and true.

B. Factory assemble frames in the largest size units permitted by shipping restrictions for minimum assembly of related parts at the job site.

C. Frames:

1. Provide welded unit type construction formed to the profiles shown on details.

2. Miter all corners, including stops, to hairline accuracy continuously arc welded on the back side. Grind frame faces smooth for invisible joint. At mullion

intersections of special frames, arc weld faces of frames and stops. Welding and grinding to flush, smooth surfaces shall be done to preserve the original profile of the frame and to maintain crisp square corners. Spot welding of reinforcement shall be invisible on exposed surfaces.

3. Provide at least three anchors at each jamb for anchoring frame to adjacent construction. Type of anchor shall be determined by the type of construction and as recommended by the frame manufacturer. Provide minimum 2" x 3½" x 12-gauge floor clip angles. Where no separate structural lintel is indicated for frames in 4" walls, provide a 12-gauge channel head reinforcement, welded to frame head.

4. Reinforce frames for acoustical doors as required to adequately support the door.

2.3 PAINTING

A. After fabrication, thoroughly clean all items of rust, oil, grease or other impurities, spot glaze where necessary to correct defects and apply the following coats of red oxide primer, each coat baked-on.

1. Frames - 1 coat.
2. Doors - 2 coats.

PART 3: EXECUTION

3.1 ERECTION

A. Erect frames in position plumb, rigid and in true alignment. Provide the necessary bracing and spreaders to prevent displacement or distortion until adjacent construction is completed. Securely attach frames to floor and adjacent construction and in strict accordance with manufacturer's specifications. Frames in masonry walls shall be grouted full of mortar at jambs and anchors built into joints by the mason as the walls are laid up.

B. Drill and tap for field splices and connections after erection. Caulk splices and connections and leave finished work smooth and free from warps and buckles.

C. Install doors with uniform margin at jambs and head.

D. After erection, touch up field splices, connections, welds and abrasions with specified primer.

3.2 TEST

A. After installation, manufacturer or his authorized representative, shall check installation and test to illustrate conformance with specification requirements.

B. The Owner reserves the right to make tests of the complete installation. Contractor shall correct any deficiencies.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods. and other conditions.

B. Work under this section includes furnishing all wood doors, shown on the drawings, (with door number indication).

C. Related work specified elsewhere:

1. Installation of doors: Section 06100.
2. Architectural Woodwork: Section 06400.
3. Hollow Metal: Section 08110.
4. Finish Hardware: Section 08700.
5. Glass and Glazing: Section 08800.
6. Field Finishing: Section 09900.

1.2 GENERAL INFORMATION

A. Field Dimensions: Field measure building features as required to insure proper fitting of work.

B. Samples: Provide Painting Subcontractor with four unfinished samples (two of each) of Project veneers. Samples shall be uniform in size, approximately one square foot. Identify Project in ink directly on one surface of sample. Provide sample pieces which will be representative for each species.

1.3 JOB CONDITIONS

A. General Contractor shall not permit delivery until job conditions, including humidity, are suitable. Do not deliver until building is sufficiently dry to insure no damage to doors will result; as a minimum, plastering and similar moisture shall have been out of entire building for at least ten days, relative humidity shall be less than 50% and in cold weather, heat shall have been provided for at least ten days prior to delivery, with frames and construction conditions ready to finish and hang doors.

1.4 DELIVERY, HANDLING AND STORAGE

A. Package, handle, deliver and store at the jobsite in a manner that will avoid damage. Damaged doors will be cause for rejection.

B. Store doors flat and support in such a way as to prevent marring or crushing.

C. Store doors in unopened containers until ready to hang.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings of all wood door items in accordance with Section 01300. Show all features of construction, dimensions; and all other pertinent data.

1.6 GUARANTEE

Guarantee interior doors for five years. Guaranty shall cover faulty workmanship, materials, delamination or splitting of veneer or warp in excess of ¼" for doors up to 7'-0" and warp in excess of 3/8" for doors over 8'-0". Replace doors complete including fitting, hanging and finishing.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Wood Door Manufacturers: Doors by Eggers Hardwood Products Corp., Algoma Hardwoods, Inc., Weyerhaeuser, Aaron Carlson Company, or approved equal, conforming to the below specifications will be acceptable.

2.2 WOOD DOORS

A. Quality Grade: Except as otherwise specified herein, provide Premium Grade, as defined in AWI Quality Standards, Section 1300.

B. Flush Door Construction: Solid core, wood flake board core, 28 to 32 lb. per cubic foot density; or single thickness slab of 3-ply particle board; conforming to Commercial Standards CS236-66, Type 1, Density C, Class I. Stile edges 1-3/8" to 1½", top and bottom edges 1¼" thick, overlays as specified under 2.3 herein.

C. All wood doors shall bear a minimum 20 minute UL label.

2.3 FACE VENEER

A. Veneers for Paint Finish: Medium density overlay on hardwood face veneer. Face veneers with open joints, face depressions, glue or other stains, or telegraphing core variances will be cause for rejection and replacement of doors. Unless otherwise noted all new wood veneer doors are for paint finish.

2.4 FABRICATION AND PACKAGING

A. Openings: Manufacturer shall cut for glass where required if any, as shown. Openings shall have mouldings tacked in place for field glazing. Seal all cutout openings at mill prior to tacking in mouldings. Prevent any stains on face of door. Fire-rated doors shall have metal framed openings as at detail 4/46.

B. Numbering: Provide door opening number on either top or bottom edge of door. Location of numbers shall be consistent.

C. Packaging: Pack doors individually in heavy cardboard cartons; paper bag

packaging not acceptable. Provide door opening number on shipping carton.

PART 3: EXECUTION

3.1 INSTALLING AND FINISHING

A. All doors are fitted and installed under Section 06100 and finished under Section 09900.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing of all finish hardware shown on drawings and specified herein except for that specified under other sections.

C. Related work specified elsewhere:

1. Hardware Built-in to Millwork: Section 06400.
2. Hollow Metal - Section 08110.
3. Wood Doors: Section 08200.
4. Hardware for Toilet Partitions: Section 10161.
5. Hardware for Metal Laboratory Casework: Section 11611.
6. Other Finishing Hardware Specifically included with manufactured items or under specific fabrication or erection specifications: Applicable Sections.
7. Rough Hardware: Applicable Sections.

D. Furnished but not installed under this section:

1. Finish hardware is installed under Section 06100.

E. Outline and schedules contained herein have been listed to indicate scope of work. Under this Section provide all work reasonably required by the general scope as outlined herein, and all work shown on drawings. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete the project. Provide hardware which functions properly and advise Architect of any items that will not operate properly and are improper for conditions or will not remain permanently anchored before hardware is furnished.

1.2 SUBMITTALS

A. Schedule: Submit in accordance with Section 01300 and the following:

1. After award of contract, prior to preparation of schedule, successful bidder is required to deliver an outline of products of all proposed items to the Architect for acceptance. For proposed substitutions provide samples in specified finishes, identified as to manufacturer and catalog number. Accompany samples of substitute items with samples of specified item for comparison.

2. Submit three copies of a complete vertical type detailed hardware schedule with doors listed in numerical order and sequentially identified by specification hardware group.

3. Resubmit six correct copies.

4. Submit a brochure of all approved items to facilitate Architect's checking of catalog items.

5. Include schedule of mounting heights of hardware. Verify that no conflicts exist in mounting heights specified. If discrepancies are uncovered call to architects attention for direction about how to proceed.

B. Templates: Furnish a final hardware schedule and accurate templates to the door and frame supplier. If required, furnish physical hardware to the door and frame manufacturer for application. All reinforcements required to adapt hardware to metal doors or frames are specified in door and/or frame specifications.

C. Operating and maintenance manuals, three ring loose leaf, hard cover binders in five copies.

D. Letter certifying to final hardware adjustments.

1.3 DELIVERY, STORAGE, HANDLING

A. Properly and carefully pack items to guard against damage in transit. Pack each group separately and mark clearly to show its contents and place in building for which it is intended. Do not deliver hardware until General Contractor has suitable locked storage space.

1.4 GUARANTEE AND ADJUSTMENTS

A. The hardware distributor shall guarantee all workmanship and material against defective manufacture, and he shall replace and make good all defective workmanship and material appearing within a period of one year. Hardware distributor shall not be responsible for faulty application.

B. Where hardware indicates improper operation, hardware supplier or manufacturer shall visit job and make necessary adjustments and corrections. Where hardware is inadequate for required function, exposure or use, replace with suitable hardware as directed.

C. Shortages and/or incorrect items (based on the plans and specifications and approved schedules) shall be furnished and/or replaced with correct material by the hardware distributor, at no additional cost to the Owner.

D. At completion of project, General Contractor shall notify hardware subcontractor, who shall have a qualified factory representative make inspection of closer installations. Final adjustments of closers shall be made by representative and a letter sent to Architect reporting conditions and that final adjustments have been made.

PART 2: PRODUCTS

2.1 GENERAL QUALITY

A. Furnish new hardware, free from defects, scratches, mars, etc. Furnish hardware complete with necessary screws, shields, grommets, etc., for correct installation onto door, frame or other supporting surface for which each item is intended.

B. Unless specifically called for herein, furnish no hardware with aluminum components.

C. All like items of hardware shall be of the same manufacturer.

2.2 FINISH AND MATERIALS

A. Unless otherwise indicated in the specification groups, all finishes shall be as follows:

Hinges	Exterior US32D
	Interior US26D
Locksets	US32D
Closers	Sprayed USP
Push, Pulls, Kickplates & Armorplates	US32D
Overhead Stops and Holders	US26D
Door Stops and Holders	US26D
Miscellaneous Items	US26D

2.3 LOCKS AND KEYING

A. Provide locks and latch sets of "heavy duty" mortise locks, equal to Sargent 8200 series with lever handles and escutcheons and 7800 series with knobs and escutcheons. Locks shall have adjustable armored fronts and anti-friction latch bolts with minimum 3/4" throw. Provide wrought boxes and curved lip strikes with proper lip length to protect trim but not to project more than 1/8" beyond trim, frame or inactive leaf. All locks and latchsets shall be UL listed for labeled fire doors. See Alternates, Section 01100.

B. Unless otherwise specified, provide Sargent lever handle trim, 1446F special (all edges eased), stainless steel. Escutcheons to be 7-5/8" x 1-5/8" cast stainless steel, through bolted top and bottom (concealed outside), Sargent LE1. Trim on knob locks to be Sargent MRL, wrought stainless steel x 1673 screwless knobs. Where not otherwise specified, all doors to have same lock trim each side of door. See Alternates, Section 01100.

C. For all key operated locksets provide Best Universal Lock Company 7 pin cylinder with Best's interchangeable cores, typically 1E74, US26D.

D. Keying will be determined by owner in conjunction with representative of Best Universal Lock Company. Ship permanent cores directly to University of Minnesota, for installation by Owner. If contractor desires temporary construction cores for certain locksets during construction, Owner will, upon application, furnish and install a reasonable number of such cores without charge.

2.4 HINGES

A. Each door leaf shall be supplied with hinges fabricated of planished and plates contract grade materials and shall have:

1. Flat button tips.
2. Non-rising loose pins.
3. Steel pins.
4. Inner edge of hinge need not be beveled.

B. Hinges shall be fabricated to template for use with metal doors or frames.

C. Non-removable loose pins are required on all locked outswinging doors.

D. Hinge material shall be as follows:

1. Outswinging exterior doors - stainless steel.
2. All other hinges shall be steel.

E. Weight and bearing of hinges shall be determined by door width and type as follows:

1. Interior hollow core doors 1-3/8" thick - standard weight plain bearing hinges.

2. Interior doors less than 44 inches wide - standard weight ball-bearing hinges.

3. Interior doors wider than 44 inches - extra heavy hinges with four ball-bearing races.

4. Exterior and vestibule doors - extra heavy hinges with four ball-bearing races.

F. Size of hinges shall be determined by door thickness as follows:

1. Doors 1-3/8" thick - 3½" x 3½"
2. Doors 1-3/4" thick - 4½" x 4½"

G. Number of hinges per door, shall be determined by door opening height, width and location as follows:

1.	60 inches and under	2 hinges
2.	61 through 90 inches	3 hinges
3.	91 through 120 inches	4 hinges
4.	Exterior and Vestibule Doors	4 hinges
5.	Doors 40 inches or more in width	4 hinges

H. Acceptable Hinges:

Type	Lawrence	Stanley	McKinney	Hager
Plain Bearing-steel	4181	F179	T2714	1279
Standard Weight BB Steel	BB4101	FBB179	TB2714	BB1279
Extra Heavy 4-BB Steel	BB5151	FBB168	T4B3786	BB1168
Extra Heavy 4-BB, stainless steel	BB5151-32D	FBB199-32D	T4B3386	BB1199

2.5 CLOSERS

A. Door closers shall be cast of iron or aluminum and arms shall be forged. Closers shall be complete with all accessories to correctly mount closer.

B. Closers shall be of a surface type with full cover and narrow projection, 2-1/8" or less. Closers shall have full rack and pinion mechanism with back-check, 50% adjustable spring power and separately adjustable controls on 'sweep,' 'latch' and 'backcheck' speeds.

C. Locate closers as follows unless details or special conditions require otherwise:

1. Room side of corridor doors.
2. Parallel arm or top jamb on exterior doors.
3. Stair side of stairways.
4. Do not mount closers to limit door swing.

D. Hardware schedule shall show the manufacturer, type, size, finish, accessories and degree of opening for each closer. Final closer mounting position may be determined during review of the hardware schedule.

E. Attach closers with through-bolts on mineral and hollow core doors.

F. Size of door closer shall be as recommended by manufacturer. Schedule closer of larger size if required by special conditions such as weatherseal, latching resistance, internal building pressure and wind conditions.

G. Guarantee successful operation of each door supplied with door closer and provide, if necessary, and at no additional cost to the Owner, a larger size closer for any door which will not operate properly.

H. Acceptable Closers:

LCN	Norton	Sargent	Yale
4020	J7730	150I	400
4010	7700	150	400
4110	7700	150P	400

2.6 ELECTRO-MAGNETIC HOLDER-CLOSERS

A. Door controls shall have a fail-safe electronic single-point hold open feature capable of holding the door open at the maximum degree of opening.

B. One unit at each opening shall incorporate an ionization type detector with a matching satellite unit at paired doors.

C. All units shall have full systems compatibility with the specified fire alarm system.

D. Hold open shall release upon detecting particles of combustion, remote signal or by a normal manual pull on the door without interruption of current.

E. Unit to have self-resetting detector, detector-on indication and remote indicating capability.

F. Closing force to be manufacturers recommended size and hydraulically adjustable as per 2.5.B.

G. 24 VDC detectors and hold-open are voltage compatible with the specified fire alarm system, however, the successful bidder is to coordinate and verify with the Electrical Contractor.

H. Acceptable Electro-Magnetic Holder Closers

LCN	Norton	Firemark	Yale
4330-MED	4870-04	FM6631	4840-04
4330-MEC	4820-04	FM5631	4820-04
Concealed wiring and hold-open bypass as required.			

I. Coordinate locations of detector units at each opening with Electrical Contractor.

2.7 KICK PLATES AND ARMOR PLATES

A. Kick Plates: 14" high generally, stainless steel, .050 thickness with countersunk screw holes. Width shall be 1½" less than door width on stop side of doors and ½" less than door width on hinge side of doors. Where one kick plate is specified, install on stop side of door. Packaging, workmanship and quality equal to Hiawatha hardware. Height ½" less than bottom rail where limiting mounting conditions occur.

B. Armor plates to be 42" high, otherwise as kick plates.

2.8 PULLS

A. Unless otherwise specified furnish 564G 10" c.c. with through bolt mounting.

B. Acceptable manufacturers - Hiawatha, Brookline, Cipco, or equal.

2.9 PUSH PLATES

A. Where specified, furnish push plates of .050 material, beveled all sides, size 8" x 16", equal to Hiawatha. Furnish 4" x 16" on doors with 5" stiles. Install push plates to cover through bolt mounting of pulls.

2.10 STOPS AND HOLDERS

A. Provide a stop or holder for all doors, whether noted in schedule or not. Provide door holders for doors where listed in hardware groups. Provide a stop type WB50X or GJ300 series, as required for all doors not equipped with holders or other specified stop. Furnish WB50X wherever possible. Furnish GJ300 series for all doors shown not to swing against walls. Stops by Ives, Glynn Johnson, Baldwin or Quality. Secure stop or holder to wood blocking within all steel stud partition locations. Use surface type stops at labeled doors, roller bumpers for interfering doors and projection type stops at doors with flush pulls or where knob or lever does not contact the wall.

2.11 EXIT DEVICES

A. All exit devices shall be UL listed for safety requirements as well as listed for labeled doors. Provide cross bars with metal reinforcement for all doors.

B. Exit devices are based on Von Duprin 55 series with function and trim as scheduled.

C. Mount exit devices at mineral core doors with through-bolts.

D. Exit devices by Corbin, Russwin, or Sargent will be considered in lieu of VonDuprin, providing that similar design and construction available and all functions and UL labeling available as specified and required. To be considered, samples of Corbin, Russwin or Sargent must be submitted to Architect during bidding period, and prior approval obtained by Addendum. All exit devices shall be by the same manufacturer.

2.12 THRESHOLDS

A. For all exterior doors provide Wooster Type 115 Cast aluminum, unless specified or detailed otherwise. Thresholds shall be continuous for the entire door opening. Type 110 on all tower doors.

B. Other acceptable manufacturers - Safe-T-Metal, American Abrasive or American Mason.

2.13 WEATHER, LIGHT AND SOUND STRIPPING

A. Unless otherwise indicated, head and jambs shall have co-polymer plastic, Schlegel PF114T black.

B. Unless otherwise indicated, door bottom seals shall be Zero 22 spring bronze.

C. Acceptable manufacturers Reese, Zero, Pemko or Schlegel.

2.14 PAIRS OF DOORS

A. Unless otherwise specified, furnish two bolts Corbin 2846 - or equal, Ives, Russwin, or Sargent for all pairs of non-labeled doors with locks or latch sets. Furnish dustproof strike plates for bottom bolt. Unless otherwise specified, trim each leaf of a pair of doors identically. Bottom bolt 12" size, top bolt size required to mount approximately 6' up from floor.

B. On the inactive leaf of pairs of labeled doors not required for exit purposes, it shall be provided with labeled self latching top and bottom bolts or labeled two point latches. No manual flush bolts shall be used on fire doors. Provide dust proof strikes, coordinators and closers for a complete UL approved installation.

C. Self-latching bolts by Precision; automatic flush bolts by Door Controls; non-projecting coordinators with filler pieces for a complete installation jamb to jamb by Door Controls are acceptable.

2.15 MOUNTING HEIGHTS

A. All dimensions up from finished floor:

Knob, lever or flush cup pull	40 inches to C/L
Push Plate	54 inches to top
Pull (to bottom post)	40 inches
Exit device crossbar	Manufacturer's Std.
Kick & Armor Plates	Bottom within 1/8" of door bottom
Wall Holders W20	66" backset (same as for locks)
Deadlocks	C/L of cylinder at 60 inches.
Hinges	Hollow Metal Standard Locations.

PART 3: HARDWARE GROUPS

NOTE: Hardware Group Nos. omitted from this Schedule are not used and are not required.

Group 1

1 Latchset 8215
1 Stop
1 Set Airseal, Schlegel PF114T Black at doors 496, 496.3B
1 Automatic Door bottom, Reese 320N at doors 496, 496.3B
1 Automatic door bottom, Reese 370N at door 437. 1

Group 3

1 Lockset 8237
1 Stop

Closer at door 496, 496.3B

Group 4

1 Lockset 8204
1 Stop
1 Set lightseal, Schlegel PF114T black at door 226.1
1 Automatic door bottom, Reese 320N at door 226.1

Group 5

1 Lockset 8205
1 Stop

Group 6

1 Privacy Set 8265
1 Stop

Group 7

1 Push Plate
1 Pull
1 Closer
1 Kickplate
1 Stop - Holder

Group 8

1 Deadlock 4876
1 Pull, Stanley 4486x4487 base pads (none at telephone closets)
1 Stop

Group 9

1 Lockset 7804 less trim
1 Flush cup pull, Hiawatha 1459 (outside)
1 Surface flush cup handle, Builders Brass 166SM (inside)
1 Stop

Group 9 (continued)

1 Auto. door bottom, Reese 320N
1 Set Sound Seal, Schlegel PF114T black.

Group K10

1 Lockset 7804 Less outside trim
1 Flush cup pull, Hiawatha 1459 (outside)
1 Stop

Group 11

1 Latchset 8215 (7815 at doors "K" Prefix)
1 Closer
1 Kickplate
1 Stop
1 Set Airseal, Schlegel PF114T black at doors 210.4, 310.1
1 Automatic door bottom, Reese 320N at doors 210.4, 310.1

Group 12

1 Lockset 8216
1 Closer (delayed action at door 19)
1 Kickplate
1 Stop

Group 13

1 Lockset 8237(7815 at doors w/'K' prefix)
1 Closer
1 Kickplate
1 Stop

Group 14

1 Lockset 8204
1 Closer
1 Kickplate
1 Stop
1 Threshold

Group 15

1 Lockset 8205
1 Closer
1 Kickplate
1 Stop

Group 18

1 Lockset 8213
1 Closer
1 Kickplate(none at door 336)
1 Stop

Group 19

1 Lockset 8204 less outside trim
1 Flush Cup Pull, Hiawatha 1459 (outside)
1 Closer (delayed action at doors 25.1A, 25.1B)
1 Kickplate
1 Stop

Group K20

1 Lockset 7804 less outside trim
1 Flush Cup Pull, Hiawatha 1459 (outside)
1 Closer
1 Stop

Group 22

1 Lockset 8216
2 Closers (delayed action at doors 25, 25.2)
2 Automatic Flush bolts
1 Dustproof Strike
1 Coordinator
2 Kickplates (Armorplates at doors 25, 25.2)
2 Stops

Group 23

1 Lockset 8237
2 Closers
2 Automatic Flush Bolts
1 Dust proof Strike
1 Coordinator
2 Kickplates
2 Stops

Group K24

1 Lockset 7804 less outside trim
1 Flush Cup Pull, Hiawatha 1459 (outside)
2 Closers
2 Automatic Flush Bolts
1 Dustproof Strike
1 Coordinator
2 Stops

Group 28

1 Deadlock 4876
2 Manual Flush Bolts
2 Pulls, Stanley 4486 x 4487 base pads (none at tank storage and electrical closets)
2 Stops

Group 31

1 Latchset 8215
1 Single Point Detector-Holder-Closer
1 Single Point Holder Closer
2 Automatic Flushbolts
1 Dustproof Strike
1 Coordinator
2 Kickplates
2 Stops

Group 32

1 Latchset 8215
1 Single Point Detector-Holder-Closer
1 Kickplate
1 Stop

Group 33

1 Lockset 8216
1 Single Point Detector-Holder-Closer
1 Kickplate
1 Stop

Group 41

1 Exit Device BE5534 x 63L lever
1 Closer
1 Kickplate
1 Stop

Group 43

1 Exit Device 5534 x 63L lever control
1 Closer
1 Kickplate
1 Stop

Group 44

1 Exit Device 5534NL less outside pull
1 Closer - Stop
1 Kickplate
1 Threshold
1 Set Weatherstripping
1 Door Bottom Seal

Group 50

Hardware by Door Supplier.

Group 51

Reuse balance of existing hardware

Group 52

1 Latchset 8215
Reuse balance of existing hardware.

Group 53

1 Latchset 7815 less trim (coordinate mounting height with door elevation)
2 Surface flush cup handles, Builders Brass 166SM.

UM HEALTH SCIENCES
JOML-B 08700-10

Group 61

Track, Lawrence 505
Hangers, Lawrence 451/551
Floor Guides, Lawrence 460
Flush Pulls, Lawrence 405-DSS
Stops, Lawrence 565

Group 62

Track, Lawrence 580
Hardware Sets, Lawrence HD620
Pulls, Stanley 4486 x 4487 Base Pads
Bottom Guide Channel, Lawrence 589
Bottom Guide, Lawrence 589

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all glass unless specifically called for other sections and related glazing and setting materials and accessories.

C. Related work specified elsewhere:

1. Wood Doors: Section 08200.

PART 2: PRODUCTS

2.1 GLASS

A. Provide glass of type and thickness indicated on drawings and of manufacture and quality specified. Provide ¼" plate glass if type and thickness are not otherwise indicated.

1. Wire Glass: Polished wire, plate glass, ¼" thick; set so wires run vertical and horizontal. Mississippi Glass, Polished Baroque; L.O.F., equivalent Polished Wired, or approved equal, which conforms to these specifications will be acceptable. All wire glass shall be UL approved.

2. Obscure Wire Glass: Factrolite Misco, or approved equal.

3. Polished Plate Glass: Glazing quality polished plate or float glass, ¼" thick, unless otherwise indicated, by PPG Industries, L.O.F., or approved equal, which conforms to these specifications will be acceptable.

2.2 SHIMS AND BLOCKS, ACCESSORIES

A. Pure vinyl or neoprene, minimum 1" long. Setting block portion under glass about 70-80 durometer hardness, shims between glass and stops 40-50 durometer hardness. Sizes as recommended by a glass manufacturer.

2.3 GLAZING COMPOUNDS AND SEALANTS

A. Glazing Compound: (For use at interior glass) Tremco's Tremglaze or equivalent mastic compound of DAP PRC or Presstite.

B. Glazing Tape: Tremco 440 Tape or equivalent by Protective Treatments, Inc, or approved equal, size as required to provide minimum 1/8" tape after depression, width as required.

PART 3: EXECUTION

3.1 GENERAL

A. Accomplish work in accordance with project specifications. In absence of project specification requirements, follow recommendations of glass manufacturer, glazing material manufacturer and Glazing Manual of Flat Glass Jobbers Association. Obtain Architect's written direction, before proceeding with work, in the event project specifications are at variance with manufacturer's recommendations. In no case shall installation be below standard recommended by manufacturer.

B. Obtain shop drawings directly from frame, door or window unit fabricator, determine conditions and dimensions. Architect will not furnish such data.

C. Check stop lengths and locations and advise fabricator, in writing, of any missing stops, improper or ill-fitting stops, improper clearance - prior to starting work. Do not set glass until corrections are made. Replace stops lost, damaged, misplaced or misapplied subsequent to check.

D. Glaze only into rabbets providing proper clearance between glass and stops, i.e. 1/8" at interior openings.

E. Clean, just prior to glazing, rabbets, stops and glass free of dirt, rust, oil, grease, moisture, frost, temporary protective films or other foreign matter. Notify Contractor of any unsuitable conditions. Glaze when all surfaces are clean, dry.

F. Follow manufacturer's recommendations for protection of edges. Examine each piece of glass for nicked or otherwise damaged edges and install only glass free of such damage.

G. Set glass with factory attached labels in place.

H. Set glass with reams (waves) running horizontally.

I. Glaze only with proper sized glass i.e.: with edge clearance as recommended by manufacturer and with glass lapping stops not less than 2/3 of stop depth.

J. Off set shims and setting blocks so no "through-joint" occurs in glazing material.

K. Place setting blocks at locations recommended by glass manufacturer, generally between ¼ points and 6" from corner. Use blocks of length required to properly support glass. Offset approximately 1" from shims.

3.2 INTERIOR GLAZING

A. Use glazing compound, sealant or tape both sides of glass for entire perimeter of interior openings.

B. Center glass in opening and in rabbet, using shims both sides.

C. Use sealant at sound retardent glass, fill all spaces around glass solid with sealant.

D. Apply full bed of compound to rabbet and apply loose stop in compound so that rabbet is completely filled, without voids. Remove surplus compound so flush with daylight edge of stops. Strip to straight, unpitted smooth surface meeting at corners with sharp intersection.

3.3 CLEANING

A. Remove all surplus materials. Final cleaning of glass shall be done by General Contractor.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements apply to all work of this section. Refer to Article 12 of the Instructions to Bidder, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing all metal stud partition systems (including for gypsum drywall), metal furring, gypsum lath and plaster, accessories, plaster work and gypsum drywall work indicated or specified.

1.2 REFERENCE STANDARDS

A. Lathing and furring work shall conform to the Specifications for Interior Lathing and Furring, ANSI A42.4-1967, unless otherwise specified herein.

B. Gypsum plastering work shall conform to the Specifications for Gypsum Plastering, ANSI A42.1-1964, unless otherwise specified herein.

C. Gypsum drywall work shall conform to the Specifications for the application and finishing of wallboard, ANSI A97.1-1965, unless otherwise specified herein.

D. Gypsum drywall partition and ceiling systems shall be constructed strictly according to the gypsum manufacturer's current printed specifications.

E. Where a fire resistance rating is required, the partitions or ceilings shall be constructed strictly according to the rated design so that the completed installation will achieve the required fire resistance rating.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in their original, unopened packages, containers or bundles with labels intact. Deliver, store and handle materials to prevent damage. Protect from water and the elements. Store gypsum lath and gypsum indoors in dry locations, neatly stacked flat on wooden pallets. Protect metal items from rusting and damage to painted finishes. Do not unwrap gypsum board until ready for actual use.

B. Protect plaster, lime and cement from water, the elements and other damage during delivery, storage and handling. Store cementitious materials in watertight sheds with elevated floors or indoors in dry location on wooden pallets.

1.4 JOB CONDITIONS

A. No gypsum lath, plaster, stucco, nor gypsum drywall shall be applied when the temperature is below 55°F and a minimum temperature of 55°F shall be maintained throughout the curing period.

B. Protect wood, glass, metal and other finished surfaces by placing adequate coverings over such surfaces before starting work. Damaged, stained or soiled surfaces shall be replaced or restored.

C. Provide adequate ventilation during and after installation throughout curing period avoid uneven drying.

PART 2: PRODUCTS

2.1 LATHING AND FURRING MATERIALS

A. Metal studs shall be screw type, channel studs formed from 20 gauge galvanized steel with knockouts for pipe and conduit. Runners shall be channel shaped with 1" minimum legs formed from 20-gauge galvanized steel. Studs and accessories shall be manufactured by National Gypsum, U.S. Gypsum, Milcor Inland Ryerson, Wheeling, Penn Metal, or approved equal. Furnish studs in widths indicated on the drawings.

B. Drywall furring channels shall be 7/8" deep, hat-shaped sections with a 2-3/4" wide back and a 1-3/8" face formed from 25 gauge galvanized steel or resilient channels (furring). Provide appropriate channels or clips for condition.

C. Furring channels and runners shall be 3/4", 1½" or 2" cold rolled steel channels. Minimum weight per lineal foot shall be 0.300 pounds for 3/4" channels, 0.475 pounds for 1½" channels and 0.590 pounds for 2" channels. Channels shall be coated with rust inhibitive paint after forming.

D. Metal lath shall be flat or self-furring lath manufactured from copper bearing steel and conforming to Federal Specification QQ-L-101a. Lath shall be coated with rust inhibitive paint after fabrication. Minimum weight of lath (painted) shall be 3.4 pounds per square yard. Lath for Portland cement plaster shall be galvanized.

E. Cornerite and strip lath shall be 2.5 pound flat expanded metal lath. Cornerite shall be bent at right angles with 3" wide legs each side. Strip lath shall be 6" wide.

F. Accessories for stucco work shall be formed from zinc sheets; other accessories shall be formed from galvanized sheet. Accessories shall be manufactured by Inland-Ryerson (Milcor), National Gypsum, US Gypsum, or approved equal, and shall be as follows:

1. Corner bead - Milcor No. 1, 26 gauge.
2. Casing bead - Milcor No. 66 Expansion, 24 gauge.
3. Control joint - USG N. 50, 75 or 100.
4. Corner control joint - Milcor No. 30, 26 gauge.
5. Custom shapes, plates as detailed, 24 gauge.

G. Tie wire and clips shall be galvanized, soft annealed steel. Hanger wire shall be galvanized steel wire, #9 gauge except in fire rated ceilings where #8 gauge shall be used.

H. Gypsum lath and accessories shall be manufactured by National Gypsum, U.S. Gypsum, or approved equal.

1. Gypsum lath for veneer plaster shall comply with ASTM C588 of thickness noted on the drawings. Use as large panels as is practicable to minimize joints. Fire retardant gypsum lath for veneer plaster shall be Type 'X'.

2. Accessories for gypsum lath for veneer plaster shall be formed from galvanized sheet and shall be manufactured by Inland-Ryerson (Milcor), National Gypsum, U.S. Gypsum, or approved equal as follows:

a. Joint reinforcement: USG Imperial tape, type S.
b. Corner bead: USG 900.
c. Casing bead: USG 701-A or 701-B.
d. Control joint: USG 093.

I. Clips, screws and other accessories for the attachment of metal studs, runners and drywall furring channels shall be manufacturer's standard type for intended use.

J. Ceiling Inserts: Brock-White 3308 drive-in type or shell type inserts or powder driven eye pins at the subcontractor's option capable of supporting 150 pounds without pulling out.

K. Acoustical insulation: USG Thermafiber Sound Attenuation Blankets.

L. Sound Attenuation Blankets: USG Thermafiber Blankets, or Owens Corning Sonobatts.

M. Insulation Filler: Owens-Corning No. 703 unfaced semi-rigid glass fiber board of thickness required to fill the void with slight compression.

2.2 PLASTER MATERIALS

A. Plaster materials shall conform to ASTM standard specifications as follows:

1. Gypsum Plaster: Gypsum neat plaster conforming to ASTM C28.
2. Gauging Plaster: ASTM C28.
3. Keene's Cement: ASTM C61.
4. Hydrated Lime: ASTM C206, Type S.
5. Sand: ASTM C36.

a. Sand for sand float finish coats shall be a white silica sand graded as follows:

Passing #16 sieve	100%
Passing #30 sieve	50-80%
Passing #50 sieve	30-50%
Passing #100 sieve	0-20%

6. Veneer plasters:

a. Basecoat: USG Imperial basecoat plaster or comparable product of National Gypsum Company Kal-Kote, Georgia-Pacific Denscote Systems or approved equal.

b. Finish: USG Quick Set Structo-Gauge - lime putty or Keenes-lime-sand float plaster or comparable products of National Gypsum Company,

Georgia Pacific or approved equal.

B. Stucco and Portland cement plaster materials shall conform to ASTM standard specifications as follows:

1. Portland Cement: ASTM C150. Cement for job mixed finish coat shall be non-staining, white Portland cement.

2. Hydrated Lime: ASTM C206, Type S.

3. Factory Prepared Finish Coat: US Gypsum Oriental Exterior Finish Coat or approved equal. Color shall be white.

4. Sand: ASTM C144, graded as follows:

Passing #4 sieve	100%
Passing #8 sieve	100%
Passing #16 sieve	60-90%
Passing #30 sieve	35-70%
Passing #50 sieve	10-30%
Passing #100 sieve	5% maximum

Not more than 50% shall be retained between any two consecutive sieves nor more than 25% between the #50 and #100 sieves.

a. Sand for job mixed finished coats shall be a white silica sand as specified in paragraph 5.a above.

C. Water shall be clean, potable and free of deleterious amounts of acids, alkalies or organic materials.

2.3 PLASTER MIXES

A. Base Coat Proportions:

1. Scratch coat for three-coat work over gypsum lath and metal lath shall be mixed in proportions of 100 pounds gypsum neat plaster to 200 pounds (2 cubic feet) damp, loose sand. Brown coat shall be mixed in proportions of 100 pounds gypsum neat plaster to 300 pounds (3 cubic feet) damp loose sand.

2. Base coat for two-coat work over gypsum lath shall be mixed in proportions to 100 pounds gypsum neat plaster to 250 pounds (2½ cubic feet) damp, loose sand.

3. Base coat for veneer plaster is mill mixed.

B. Finish Coat Proportions:

1. GypsumLime Putty Trowel Finish shall be mixed in proportions of 1 part gypsum gauging plaster to not more than 3 parts lime putty by volume.

2. Sand Float Finish shall be mixed in proportions of 1 part gypsum neat unfibered plaster to 2 parts white silica sand by weight.

3. Veneer finish plasters:

a. Trowel finish veneer plaster shall be mixed in proportions of 1 part gauging plaster to 2 parts lime putty by dry weight.

b. Sand float finish veneer plaster shall be mixed in proportions of 100 lb. Keenes cement to 50 lb. lime to 400 lb. sand by dry weight.

C. Mixing.

1. Accurately measure materials.

2. If mixing by hand, mix plaster and aggregate to a uniform color at one end of the box before adding water, hoe into water at the other end and thoroughly mix to the proper consistency. Clean tools and mixing box after each batch.

3. If using a power mixer, add approximate amount of water, approximately half the sand, all the plaster and the remainder of the sand, in that order, while the mixer is in continuous operation, and mix to proper consistency adding additional water as necessary. Clean mixer after discharging each batch.

4. Plaster shall be accelerated, if necessary to provide a setting time of not more than 4 hours after addition of mixing water.

5. Discard material which has partially set. No retempering will be permitted.

2.4 PORTLAND CEMENT PLASTER MIXES

A. Portland Cement Plaster Proportions. Scratch coat and brown coat shall be one part Portland cement to not less than 3 nor more than 5 parts damp, loose sand by volume. Hydrated lime may be added as a plasticizer, but the amount used shall not exceed 10% by weight or 25% by volume of the Portland cement. Use the smallest amount of lime necessary to obtain the desired plasticity.

B. Finish Coat Proportions. Finish coat shall either be a factory prepared finish coat mixed strictly according to manufacturer's instructions or a job mixed finish coat mixed in the proportions of one part white Portland cement to 3 parts silica sand by volume.

C. Mixing.

1. Accurately measure materials by volume. Use a power mixer. Mix cement, lime and sand to a uniform color before adding water. Mix for at least 5 minutes after adding water. Thoroughly clean mixer after discharging each batch.

2. Apply cement plaster within one hour after mixing. No retempering will be permitted.

2.5 GYPSUM WALLBOARD

A. Gypsum wallboard, accessories and related materials shall be manufactured by National Gypsum, U.S. Gypsum, or approved equal. Materials shall be as follows:

1. Gypsum wallboard shall be ½", 48" wide wallboard with tapered edges conforming to ASTM C36.

2. Fire-retardant gypsum wallboard shall be ½", 48" wide wallboard with tapered edges conforming to ASTM C36, Type X. Fire-retardant gypsum wallboard shall be listed by the Underwriters Laboratories, Inc. (Guide No. 40 U18.23).

3. Gypsum backing board shall be ½", 48" wide backing board with square edges conforming to ASTM C442. Fireretardant gypsum backing board shall conform to ASTM C442, Type X and shall be UL listed.

4. Accessories shall be as follows:
   a. Corner Bead - US Gypsum DUR-A-BEAD, No. 101 or No. 103.
   b. Casing Bead - U.S. Gypsum No. 200-A or 200-B Metal Trim.
   c. Control Joint - U.S. Gypsum No. 093.

5. Screws, nails, clips, ties and other accessories shall be as recommended by the gypsum board manufacturer.

6. Adhesives shall be Durabond of type recommended by the gypsum board manufacturer for application required.

7. Joint treatment system shall be a perforated tape and cement system, Durabond or equivalent recommended by the gypsum board manufacturer for the intended use.

8. Gypsum wallboard shown laminated to 1½" insulation and 1½" rigid insulation at exterior walls shall be Insul Wall panels as manufactured by Panel Era or approved equal system, using veneer plaster gypsum lath, laminated to urethane foam board with the following properties:

Form core tested without facers

Density, core, pcf	1.9
Compressive strength, psi @ yield parallel to rise	.21
Initial "K" factor (facers prevent loss of "K" factor w/aging)	0.12
Porosity, % closed cells	.88
Friability, loss in 10 minutes (%)	1.1
Moisture vapor transmission per-inches	1.5
Cold age, -20°F, % delta V, 7 days	1.2
Dry Heat Age, 230°F, Amb. R.H. % delta V, 28 days	.21
Humid Age, 158°F, 100% R.H., % delta V, 28 days	.15
Butler Chimney Test, % wt. retained	.24
N.B.S. Smoke Chamber, Dm (corrected), flaming	.59
Fire Rating Classification	Class II

Flammability Rating, ASTM E-84 (Steiner Tunnel)
- Flame Spread - 36
- Fuel Contributed - 19
- Smoke Developed - 6

9. In addition to the above requirements, wallboard shall be installed in contact with foam plastic insulation and in a manner that will assure they will remain in place for the entire 15 minutes of the finish rating test.

2.6 SHAFT WALL SYSTEM

A. Core Wall system, Cavity Shaft Wall system by US Gypsum is specified to establish standards of quality, performance, and construction. Comparable system of National Gypsum (Metaledge Corewall), or approved equal, are acceptable subject to approval of the Architect of minor deviations in detail and wall thickness dimension.

1. The core wall system shall have a fire resistance rating of 2 hours. The core wall system shall be capable of resisting the live loads specified in Article 3.18 herein.

2. Metal edged coreboard panels shall consist of two layers of 1" thick, homogeneous gypsum coreboard, 24" wide with 1" by 1" by 1" by 24-gauge hot dipped galvanized steel channel factory laiminated to the vertical edges of each 1" thick layer. Vertical edges of the two layers shall be offset 2½" from each other. Panels shall have water repellent paper both sides.

3. Metal components shall be as follows:

a. Ceiling Runners - 2¼" x 2" x 1" by 20-gauge hot dipped galvanized steel J-channels or two 2" by 2" by 20-gauge hot dipped galvanized steel angles.

b. Floor Runners - 2¼" by 2" by 1" by 20-gauge hot dipped galvanized J-Runners.

c. Edge Channels - 1" by 2" by 1" by 20-gauge hot dipped galvanized channels.

d. Steel Strapping - 3/4" by 24-gauge rust resistant steel strapping with 3/16" diameter holes spaced not over 6" on center.

e. Metal Studs - 2" x 2" by 20-gauge Steel H studs.

f. Metal Lath: 3.4 lb. diamond mesh expanded metal lath.

PART 3: EXECUTION

3.1 INSPECTION

A. Examine supporting materials and surfaces to receive work of this section before commencing work. Do not proceed until conditions which would result in a less than first class installation are satisfactorily corrected. Commencing work shall be construed as acceptance of the surface by this Contractor as satisfactory to receive furring, lath, plaster or gypsum wallboard.

3.2 INSTALLATION OF METAL STUDS

A. Install metal studs, runners and accessories strictly according to manufacturer's recommendations. Align partitions accurately. Coordinate with work of other trades.

B. Secure floor runners to concrete floor with concrete stub nails or powder driven anchors spaces not over 24" on center, except no powder driven anchors within 3" of any slab edge.

C. Anchor ceiling runners at approximately 24" on center. If through finished ceilings; securely attach ceiling runners to structure above.

D. Locating studs: Space studs 16" o.c. unless otherwise indicated. Install additional studs or adjust location of basic studs to accommodate the following:

1. Plumbing chases.

2. Wall supported architectural woodwork. Locate studs at each shelf standard or counter bracket.

3. Wall hung metal laboratory casework.

4. At all intersections of walls and partitions.

5. At all changes in partition and wall types.

6. Where any other equipment or shelf standard is to be mounted on the wall or partition.

7. At framing for fume hood duct fireproofing.

E. Studs shall be full height without splices. Securely attach all studs to floor and ceiling runners.

F. Place studs directly against jambs of hollow metal door frames, abutting partitions, internal partition corners, partition terminals and similar locations, and anchor such studs to runner channels with screws or other positive fasteners.

G. Securely anchor studs to jamb and head anchor clips at hollow metal door frames with screws of bolts. Install a runner track with web and flanges bent down at each end across head of hollow metal frames, and screw each flange to vertical studs. Install jack studs above frame.

H. Locate extra studs not more than 2" from jambs of hollow metal door frames, abutting partitions, internal partition corners, partition terminals and similar locations and anchor such studs to runner channels with screws or other positive fasteners.

I. Install sound insulation in partitions where indicated on the drawings.

J. Reinforce partitions as necessary to receive and support casework and other equipment mounted on the walls.

3.3 INSTALLATION OF WALL FURRING

A. Install drywall furring channels vertically. Attach to masonry and concrete surfaces with concrete stub nails or powder driven anchors spaced not over 24" on center and staggered on opposite flanges. Make splices by nesting at least 8", and securely anchor with 2 anchors in each flange.

3.4 SUSPENDED CEILING GRILLAGE

A. Securely attach hanger wires to structure above. Space hangers along direction of main runners not over 48" on center, and locate hangers not more than 6" from ends of runners. Use #8 gauge hanger wires where ceilings require fire rating.

B. Main runners shall be 1½" furring channels spaced not over 36" on center. Locate main runners within 6" of parallel walls. Keep ends of main runners at least 1" away from walls. Install main runners level, true to plane, at the required elevation with hangers saddle tied.

C. Where hanger spacing must exceed 48" on center, use #8 gauge hangers spaced not over 60" on center and 2" furring channels spaced not over 36" on center.

D. Where main runners are spliced, lap ends with channel flanges interlocked not less than 12", and tie each end of the lap with double loops of #16 gauge wire.

E. Cross runners shall be 3/4" furring channels or metal furring channels spaced 16" on center maximum and saddle tied to main runners with 16-gauge wire or a double strand of #18 gauge wire at each crossing. Locate cross runners about 1" from parallel walls, and keep ends at least 1" away from walls.

F. Where main runners or cross runners are interrupted by light fixtures, grilles and registers and other openings, install additional runners to frame openings. Reinforce grillage as necessary to support light fixtures, grilles and registers and other items mounted in the ceiling with a maximum allowable deflection of 1/360 of the span.

G. Grillage shall not be suspended from ductwork or piping. Where hanger spacing and spans exceed the specified spans, use hangers with a larger capacity, larger main runners or additional reinforcing members, hangers, stiffening or bracing as necessary to support the loads without exceeding the specified deflection.

H. Where suspended ceilings are to receive Portland cement plaster, install cross runners not over 13½" on center, and lath with 3.4 pound metal lath.

I. Where plenum sound barrier occurs above plaster ceiling, provide under this section 09100.

3.5 MISCELLANEOUS METAL FRAMING

A. Construct miscellaneous metal framing and furring as indicated on the drawings. Use metal studs, or use drywall furring channels screwed to 1½" fur-

ring channels. Space members not over 24" on center. Brace vertical members with diagonal bracing spaced not over 48" on center.

3.6 INSTALLATION OF GYPSUM LATH

A. Starting at the bottom, install gypsum lath at right angles to the supports with face out. Butt joints together. Locate end joints between studs with joints staggered in successive courses. Screw lath to studs and support ends of lath strictly according to manufacturer's instructions. Cut lath to fit neatly around electrical boxes, pipe, grilles and registers and similar items. Attach lath to each support with 2 screws, each located 2" from edge.

B. In ceilings, install gypsum lath at right angles to the 3/4" furring channel cross runners. Butt joints together. Locate end joints between runner channels with joints staggered in alternate courses. Attach lath to furring channels screws installed strictly according to manufacturer's instructions. Support end joints. Cut lath neatly around light fixtures, grilles and registers and other openings.

C. Reinforce corners of openings with not less than 12" long self-furring strip lath installed diagonally across corners.

3.7 LATHING OF GYPSUM COREWALL

A. Apply gypsum lath for veneer plaster to gypsum board corewalls where scheduled. Use as large panels as possible to minimize joints.

B. Apply lath by adhesive method using positive mechanical fastening to hold in place until adhesives cure. Apply in accordance with manufacturer's recommendations.

3.8 INSTALLATION OF METAL LATH

A. Install metal lath with long dimension of sheets perpendicular to supports. Attach lath to supports not over 6" on center. Tie lath to metal furring and other metal supports with 18 gauge wire.

B. Lap ends of 3.4 pound metal lath not less than 1" and sides not less than ½". Stagger end laps where possible. Lace or tie end laps occurring between supports not over 9" on center with 18-gauge wire. Tie side laps to supports, and tie side laps not over 9" on center between supports.

C. Reinforce corners of openings in metal lath with a 12" by 24" piece of 3.4 pound self-furring metal lath installed diagonally across corners.

D. Where partitions are to receive Portland Cement plaster, lath with 3.4 lb. self-furring metal lath screwed to studs 6" on center. Where partitions are to receive Portland cement plaster on one side only, cover studs with polyethylene vapor barrier before installing lath. Seal joints and edges of vapor barrier with polyethylene tape.

E. Anchor metal lath covering structural glazed tile at mortar joints, <u>not</u> tile faces.

3.9 INSTALLATION OF PLASTER ACCESSORIES

A. Install corner beads at all external corners. Securely anchor in place 8" on center.

B. Install casing beads where plaster surfaces abut dissimilar finish materials and elsewhere as indicated on the drawings. Accurately cut and miter ends. Position and securely attach to provide full plaster grounds.

C. Install control joints where indicated on the drawings. Where not indicated, install control joints in ceilings so that plaster panels are less than 2400 square feet and control joints are spaced not over 60 feet on center in either direction. Where not indicated, space control joints in walls and partitions not over 30' on center. Where length of wall or partition is unbroken for distances greater than 30', provide control joints dividing wall into approximately equal panels not longer than 30'. Provide corner control joint at inside corners of all abutting walls and partitions.

D. Veneer Accessory Application:

1. Joint reinforcement shall be applied over the full length of all lath joints but shall not overlap at intersections.

   a. Type S Tape shall be stapled not over 12" o.c. with 3/8" staples to insure a firm wrinkle-free attachment.

2. Corner Bead - All vertical and horizontal exterior corners shall be reinforced with corner bead fastened with staples not over 12" o.c. on both flanges along the entire length of the bead.

3. Casing Bead - When a plaster veneer wall or partition terminates against masonry or other dissimilar material, USG Metal Trim shall be applied over the Plaster Base and fastened on the perforated side with staples spaced 12" o.c.

4. Screws shall be power-driven with an electric screwdriver and set so that the screwhead is flush with the surface of the Plaster Base without tearing through the face paper.

5. Control joints shall be provided in the non-resilient face layer as required above and shall be fastened with staples not over 12" o.c. on both flanges along entire joint length.

3.10 MISCELLANEOUS LATHING AND FURRING

A. Install miscellaneous lathing and furring according to ANSI A42.4.

3.11 APPLICATION OF PLASTER

A. Thickness and number of coats.

1. Gypsum plaster on plain gypsum lath supported 16" on center maximum shall be applied in 2 coats, and gypsum plaster on perforated gypsum lath and gypsum lath supported more than 16" on center shall be 3 coats. Thickness of plaster including the finish coat shall be not less than ½".

2. Gypsum-perlite or gypsum-vermiculite plaster on metal lath shall be applied in three coats and total thickness of plaster shall be not less than 1" measured from face of lath. Use for ceilings wherever a room is scheduled for a fire resistance rating. Finish coat shall be as scheduled for the room.

B. Two Coat Work. Apply base (first coat with sufficient material and pressure to form a good bond and cover well. Do not scratch. Before the material has set, double back with material of the same proportions to bring plaster out to grounds. Straighten to a true surface without application of water, and cross rake or scratch to receive the finish (second) coat.

C. Three Coat Work. Apply scratch (first) coat with sufficient material and pressure to form full keys with the lath, cover well and have enough depth to allow for scratching. Before coat hardens, scratch to a rough surface. After scratch coat has set firm and hard, apply brown (second) coat. Bring out to grounds, straighten to a true surface without application of water and cross rake or scratch to receive the finish (third) coat.

D. Finish Coats. Dampen the surface of the base coat evenly by brushing or spraying as necessary to produce uniform suction before applying the finish coat. Avoid excessive use of water in applying finish coats.

1. Trowel Finishes. Apply finish coat approximately 1/16" to 1/8" thick. Scratch in thoroughly, double back and fill out to a true, even surface. Allow to draw a few minutes, and then trowel well with water to a smooth finish, free of cat-faces and other blemishes or irregularities.

3.12 APPLICATION OF VENEER PLASTERS

A. Basecoat:

1. Use as basecoat plaster for all veneer plaster.

2. Veneer basecoat plaster applied directly to veneer gypsum lath shall be used to embed tape and fill beads, and allow to set; then scratch and immediately double back to a thickness of 1/16" to 3/32" in accordance with manufacturer's directions.

B. Finish Coats:

1. Trowel finish coat shall be scratched in thoroughly to basecoat and immediately double back to fill out to a smooth, dense surface for decoration, free of surface blemishes and irregularities. Finish coat shall be applied as thin as possible preferably 1/16" to not more than 1/8".

3.13 APPLICATION OF PORTLAND CEMENT PLASTER

A. Thickness and Number of Coats. Portland cement plaster shall be applied in 3 coats, except omit finish coat where Portland cement plaster is backing for ceramic tile. Total thickness of stucco shall be not less than 1" measured from face of lath, and total thickness of Portland cement plaster shall be not less than 7/8".

B. Scratch Coat. Hair or fiber (not over one pound per sack of cement) may be added to the scratch coat mixture for application on horizontal surfaces only. Apply coat to approximately ½" thickness using sufficient pressure to form full keys and completely embed the lath. Before coating hardens, rough darby and scratch the surface with horizontal scratches to provide a good mechanical bond with the brown coat.

C. Brown Coat. After the scratch coat has set sufficiently to support an additional 3/8" of material (about 3 to 4 hours), apply the brown coat approximately 3/8" thick. Bring surface to a true even plane depressed about 1/8" below surface of grounds. Leave surface rough to receive finish coat. Moist cure for not less than 48 hours and then allow to dry at least 5 days before proceeding with finish coat.

D. Finish Coat. Dampen surface of brown coat sufficiently to produce uniform suction, and apply finish coat not less than 1/8" thick. Bring to true surface, flush with grounds, and wood float to a fine sand float finish. Protect finish coat from rapid drying but do not moist cure until the day after application. Then moist cure using a light fog spray for at least 24 hours.

3.14 PATCHING

A. After plaster is cured, rake out expansion joints and clean beads adjacent to other materials. Patch defects as required to produce a true unblemished surface.

3.15 EXISTING SURFACES

A. If more than 35% of an existing surface is required to be patched, panelize the surface to nearest panel break (such as corner, control joint or door jamb) remove the finish coat for the entire panel, patch the scratch and brown coat as required, and provide a new finish coat for the entire surface of panel.

3.16 INSTALLATION OF GYPSUM BOARD

A. Install gypsum board strictly according to ANSI A97.1 and manufacturer's recommendations.

B. Cut gypsum board by scoring and breaking neatly or by sawing, working from the face side. Cut or break back paper. Smooth cuts as necessary to form neat joints. Kerf where required for form curved surfaces.

C. Install gypsum board with true, even surfaces and straight, sharp corners. In general, install gypsum board on ceilings before installing on walls. Use full length boards where possible. End joints on the same side of wall shall be staggered, and end joints on ooopsite sides of wall shall not occur over the same support. Do not locate normal end joints at edge of openings. Form joints neatly. Butt boards together, but do not force into place. Do not place butt ends against tapered edges. No joint shall have a gap greater than ¼".

D. Use gypsum backing board for first layer of double layer construction. Stagger joints between layers.

E. Fasten gypsum board beginning at the center and work toward the outer edges. Hold the board firmly against the supports while fastening. Locate fasteners opposite each other on adjacent ends and edges. Fasteners at edges of boards shall be located from 3/8" to ½" from the edge.

F. Openings for electrical devices, piping and grilles and registers shall be accurately located and neatly made to closely fit the devices and be completely covered by plates and escutcheons.

G. Install corner reinforcing at external corners, and install casing beads at exposed perimeter joints to be sealed and where gypsum board abuts other materials. Install control joints where indicated on the drawings. Where not indicated, locate control joints not over 30' on center.

H. Seal partition perimeter joints where indicated on the drawings, and seal all perimeter joints (top, bottom and both ends) in partitions indicated to be round rated. Seal around pipes, ducts, conduit and other items extending through gypsum board partitions. Use acoustical sealant.

I. In sound rated partitions, completely cover the back and sides of electrical boxes and other cutouts with acoustical tape. Extend tape onto back of gypsum board to seal the joint. After box is taped, solidly fill the joint with joint compound.

3.17 INSTALLATION OF GYPSUM BOARD ON METAL FRAMING

A. Install gypsum board with long dimension on board parallel to metal studs or furring channels. Center joints over flanges of studs and furring channels, and stagger joints on opposite sides of stud partitions.

B. Screw gypsum board to studs and furring channels with manufacturer's standard screw of type recommended for this installation. For single layer construction, space screws 8" on center along edges and 12" on center in the field. For double layer construction, space screws 16" on center for both layers.

C. Where metal stud partitions have gypsum board one side only, brace the exposed stud side with 12" high, ½" thick gypsum board gussets, spaced not over 24" on centers, and screwed to each stud with minimum of two screws.

3.18 INSTALLATION OF COREWALL SYSTEM

A. Install corewall system strictly according to manufacturer's recommendations.

B. The completed installation shall have a fire resistance rating of not less than 2 hours, before application of gypsum baord face panels or gypsum lath and and plaster face.

C. The corewall system at utility cores, stairwells and all other locations shall be designed and installed to resist a live load (air pressure load) of 5.0 pounds per square foot with a maximum deflection of 1/240 of the unsupported height for installations with gypsum board face panels and 1/360 of the unsupported height for installations with gypsum lath and plaster facing.

D. Accurately locate floor and ceiling runners and edge channels. Install 2" by 2" by 1" J-channel ceiling runners, 2" by 2" angle floor runners and 1" by 2" by 1" edge channels with 1/8" minimum diameter power-driven fasteners or equivalent anchors spaced not over 24" on center. Locate vertical edge channels at columns and abutting walls.

E. Install metal stud stiffeners, where required, on shaft side of wall, and screw to floor and ceiling runners.

F. Install coreboard panels starting at vertical intersection. Cut one edge of first panel to form a square edge, and insert into vertical edge channel. Accurately plumb panel, and screw to top and bottom runners. Install following panels with ship-lap edges overlapping. Butt edges together, but do not force. Screw each panel to ceiling runner with one screw located at panel center, and screw through panel face to metal edge of preceeding panel not over 24" on center. Where panels are installed over metal stud stiffeners, screw to stiffeners not over 12" on center. Cut last panel ¼" less than opening width, and insert into edge panel. Install steel strapping at top and bottom, and screw each strap to each panel with 3 screws.

G. At corners, intersection partitions and partition ends, cut panel edges square and cover with 1" by 2" by 1" edge channels. Screw through channel flanges with screws spaced not over 24" on center and staggered between flanges. At corners and intersections, screw through panel into web of abutting channel not over 24" on center.

H. Install 1" by 2" by 1" edge channels at jambs of hollow metal frames, and screw to panel not over 12" on center. Install floor runner angle across head of frame and screw to each vertical channel. Securely anchor channels to hollow metal frame anchor clips.

I. Cut openings neatly for ducts, conduit and other items extending through corewall, and frame openings with 1" by 2" by 1" channels or 2" by 2" angles screwed to panels not over 24" on center.

J. Reinforce panels with 6" by 26" by 20-gauge galvanized steel plates to receive handrail brackets. Reinforce as necessary to receive other items to be mounted on corewalls.

K. Where corewalls are to be faced with gypsum board, use ½" thick, Type X gypsum board applied vertically. Install gypsum board with edges centered over coreboard metal channels, and screw to metal channels at center and vertical edges of board with screws spaced not over 12" on center. Stagger joints between layers of gypsum board. Cut and fit board neatly. Do not locate joints at edges of openings.

L. Install corner beads at external corners of gypsum board face panels. Install casing beads at exposed perimeter joints to be sealed and where gypsum board face panels abut dissimilar materials. Install control joints where indicated on the drawings. Where not indicated, locate control joints not over 30' on center.

M. Seal all corewall perimeter joints (top, bottom and both ends) and seal around pipes, ducts, conduit and other items extending through the corewalls with acoustical sealant.

N. Where intricate shapes of members penetrating corewall make it impossible to close shaft wall, provide rectangular opening in corewall, install metal lath at rear or front face of corewall and completely fill opening with fireproofing plaster to a minimum thickness of 1".

3.19 FINISHING GYPSUM BOARD

A. Tape and finish gypsum board surfaces including partitions above suspended ceiling. Apply materials strictly according to manufacturer's recommendations. Fill joints with joint compound, embed perforated tape, and apply a skim coat of joint compound over tape. Apply two additional coats of joint compound allowing at least 24 hours between each coat. Fill dimples and imperfections with three coats. Sand each coat. Finished surfaces shall be uniformly smooth, true and in satisfactory condition to receive paint.

3.20 CAULKING

A. Seal perimeter joints and other joints in gypsum board as indicated on the drawings or specified above.

B. Joints shall be clean and dry. Prime joints as recommended by the sealant manufacturer. Mask face of gypsum board and adjoining materials at exposed joints as necessary to keep exposed faces free of sealant. Apply sealant strictly according to manufacturer's instruction. Completely fill the joint with sealant. Clean sealant from adjacent surfaces, and remove masking.

3.21 GROUTING OF FRAMES

A. Partitions with plaster finish: At hollow metal frames, grout heads and jambs full.

B. Partitions with gypsumboard finish: Spot grout hollow metal frames at each anchor and at floor. At corewall, grout hollow metal frames at each anchor and at floor. At corewall, grout hollow metal frames and elevator frames in accordance with published requirements of manufacturer. Grout is not indicated on all details but shall be provided as specified.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all ceramic tile and quarry tile.

C. Related work specified elsewhere:

1. Demolition and Removal: Section 01910.
2. Cast-in-Place Concrete: Section 03300.
3. Drains: Division 15.

1.2 SUBMITTALS

A. Samples: Submit sample colors and panels in duplicate for Architect's selection and approval. Each panel shall have at least 8 tile representing the normal range of color, include the color of grout and be a minimum of 144 square inches.

B. Submit Master Grade Certificate.

1.3 REFERENCE SPECIFICATIONS

A. The following specifications and standards are incorporated by reference:

1. Specifications for Glazed Wall Tile Installed with Portland Cement Mortar, ANSI 108.1-1967.

2. Specifications for Ceramic Tile installed with Dry-Set Portland Cement Mortar ANSI A108.5-1967.

3. Specifications for Quarry Tile and Paver Tile installed with Portland Cement Mortar, ANSI A108.3-1967.

4. Tile Council of America, Inc. Handbook for Ceramic Tile Installation, 1976 edition.

1.4 HANDLING, DELIVERY, STORAGE

A. Tile and other materials shall be properly packaged and brought to the site in original, unopened containers with grade, type, and quality indicated on the labels.

B. Containers shall be stored and protected, raised above floor level and kept dry until ready for use.

1.5 EXTRA STOCK

A. Provide minimum 1% additional stock of each color and/or type of material for future maintenance and patching.

B. Deliver in standard containers, unopened to the University as directed.

C. If smallest standard container exceeds 1%, provide at least one full container.

PART 2: PRODUCTS

2.1 MATERIALS

A. Tile: TCA A137.1-1976, and Federal Specification SS-T-308c; Master Grade Certificate; United States Ceramic Tile Co., American Olean Tile Co., Inc., Florida Tile, or approved equal. Where indicated to patch; match existing, size, type and color.

1. Ceramic Floor Tile: Unglazed Ceramic Mosaic Tile Modular 2" x 2" x ¼", all purpose edge, to be laid with 1/16" joint.

2. Ceramic Base: Modular trim, C-853 cove, row 2" x 2".

3. Quarry Tile:
   a. No. 1: 9" x 9" x ½" standard grade quarry tile, conforming to TCA A137.1-1976. Canyon Red.
   b. No. 2: Same as No. 1, except abrasive surface.

4. Quarry Tile Base: Round top, cove base to match existing.

5. Provide special shapes as required by the details.

6. Extra tile: provide one carton of each pattern and color of tile to Owner for future patching.

B. Mortar Materials:

1. Portland Cement: Cement shall conform to ASTM C150-74, Type 1.

2. Aggregate: Sand shall be clean and graded in accordance with ASTM C144-70 for mortar or for grout as required. Fine sand shall pass a 16-mesh screen.

3. Hydrated Lime: Lime shall conform to ASTM C206-49 or ASTM C207-74, Type S.

4. Water: Water for mixing shall be clean and potable.

C. Wall Tile Grout: One part Portland Cement to one part clean, fine sand by volume. Grout color as selected by Architect, (gray or white as selected).

D. Grout for floors and bases: Hydroment as manufactured by Upco Company, the equipment product of Atlas Mineral and Chemical Division of ESB, Inc., or approved equal. Color as selected by the Architect. Any standard color or mixture of colors may be selected.

E. Sealant: Two-component, Federal Specification TT-S-227b, Type II for joints in vertical surfaces, Type I for joints in horizontal surfaces, colored to match grout; DAP Flexiseal, W.R. Grace Hornflex, Sonneborn Sonolastic, Tremco Lasto-Meric, or approved equal.

1. Backup: Flexible and compressible as recommended by the sealant manufacturer.

2. Bond Breaker: Polyethylene tape, wax paper, or aluminum foil same width as joint.

3. Preformed Filler (use for backup in quarry tile expansion and control joints): W.R. Grade semi-rigid Rodofoam, or approved equal.

F. Reinforcing Wire Fabric: ASTM A82-72, 2" x 2" - 16/16 welded wire fabric.

G. Metal divider strips at all junctions between quarry tile and dissimilar floor finish materials shall be aluminum angles or strips as detailed with 3/16" thick top as approved by the Architect. Strip shall have mortar anchors 8" o.c. Overall depth shall suit conditions of the job.

PART 3: EXECUTION

3.1 EXAMINATION OF SURFACES

A. Refer to Section 01910 and schedules for specified removal by General Contractor exposing existing structural slab. In general, concrete topping or quarry tile and mortar beds are being removed, exposing the rough slab. Work of this section begins at rough slab.

B. Inspect surfaces to which tile is to be applied with the Contractor and the University to determine the suitability of surfaces. Commencement of work implies acceptance of surface and assumption of responsibility.

C. Work shall commence only after grounds, anchors, plugs, hangers, bucks, and electrical and mechanical work to be in or behind tile have been installed. All surfaces shall be dry and clean before setting bed is applied.

3.2 SETTING

A. Set all tile work in accordance with the requirements of the Tile Council of America, Inc. Handbook for Installation, 1976 edition and as specified herein.

1. Set floor tile according to Method F112, cement mortar bonded at slabs on grade, except as follows:

2. Set tile base according to Method F-113, dry-set-mortar.

3. Set ceramic wall tile according to Method W213 or W243 as applicable.

4. Match existing tile patterns and joint sizes.

5. Provide expansion joints according to method EJ411, as applicable:

   a. At perimeter of all rooms over 12 feet in largest dimension.
   b. Not over 12'-0" in both directions in large rooms.
   c. Not over 12'-0" across narrow corridors (less than 12' wide).
   d. Where elsewhere shown on the drawings.

B. Do all necessary cutting, fitting and drilling of tile to accommodate the work of other trades.

C. Room temperatures at areas in which ceramic materials are being installed shall be maintained at not less than 40°F for a period of 24 hours prior to commencement of tile work, during tile work, and afterwards until completion of construction. Areas in which tile work is being done shall be closed to traffic until the installation has set.

D. As far as possible, lay out work so that no tile less than half size occurs. Align joints in wall tile vertically and horizontally except where other patterns are shown or specified. Align joints in floor tile at right angles to each other and straight with walls to conform to patterns selected. Verify locations of accessories before installing tile. Coordinate with plumbing and other trades. Fully tile surfaces behind all surface-mounted items.

E. Install cleavage planes over all structural floor slabs above grade where waterproofing membranes have not been provided by another trade. Use single layer lapped 2" at joints. Omit cleavage plane at non-structural slabson-grade.

F. Install all tile using lighting conditions that will closely approximate the proposed lighting required in the areas involved in order to achieve uniformity in finished work.

3.3 GROUTING

A. Tile Grouting: Grout ceramic tile in accordance with the applicable portions of ANSI A108.5-1967 and the following:

1. Allow a minimum of 24 hours after setting of tile before commencing of grouting.

2. Grout full depth of ceramic tile joints.

3. Compress joints to dense, smooth surface.

B. Quarry Tile Grouting: Grout quarry tile in accordance with the applicable portions of ANSI 108.6-1969 and the grout manufacturer's instructions.

3.4 FLOOR TILE INSTALLATION (PORTLAND CEMENT BED)

A. Set in Portland Cement setting beds in accordance with listed standards. Clean concrete and waterproofing or cleavage membrane surfaces, and thoroughly wet surface of concrete prior to placing setting bed mortar.

B. Setting bed mortar mix shall consist of one (1) part Portland Cement and six (6) parts dry sand, by volume, to which not more than 1/10 parts of hydrated lime may be added. Mix in approved waterproofing compound in accordance with manufacturer's instructions.

C. When mixed with water, the mortar mix shall be of such consistency and workability as to produce maximum density. Determine consistency by stroking the mortar surface with a trowel. When of correct consistency, the troweled surface readily assumes a smoothed, slickened appearance.

D. Spread setting bed mortar and screed to provide smooth, dense beds with true planes properly pitched to drains. Install reinforcing mesh in all setting beds over waterproof membranes. The thickness of bed shall be such that the floor tile will finish flush with top of division strips and adjacent finish flooring, but in any case, not less than 3/4" nor more than 1¼" thick. Where additional build-up is required, apply as separate layers.

E. Install metal dividing strips where tile floors abut other finish floor materials. Separate dividing strips a reasonable distance from control joints to assure firm anchorage of the strips. Where divider strips are located across door openings, locate strip on the door side, in line with the edge of door stop, terminating at the rabbet; set strip in place while under-bed is still semi-plastic.

F. After bed has set sufficiently to be worked over, trowel or brush a thin layer, 1-32" to 1/16" in thickness, of neat Portland cement paste over the bed or the back of tile or apply a thin layer of dry Portland cement over the setting bed worked in lightly with a trowel. Do not prepare larger setting bed than can be covered with tile before the mortar sets.

G. Press tile firmly into the bed tamping with wood blocks to obtain smooth surface. All tile shall be properly aligned, with straight joints in even widths. Joints width shall be determined by spacers on ceramic tile. Tamping shall be completed within one (1) hour after placing tile. Adjust work out of line within this period. See drawings for locations of expansion joints. All expansion joints shall be clear of grout to receive filler and sealant.

H. Fit tile closely around pipes running through walls and floors. Pitch floors to drain.

3.5 BASE INSTALLATION (Dry-Set Mortar)

A. Set in dry-set mortar, 1/8" to ¼" setting thickness, in accordance wih ANSI A108.5.

B. Press tile firmly into the bed tamping with wood blocks to obtain smooth surface. All tile shall be properly aligned, with straight joints in even

widths. Tamping shall be completed within one (1) hour after placing tile. Adjust work out of line within this period. See drawings for locations of expansion joints. All expansion joints shall be clear of grout to receive filler and sealant.

3.6 CONTROL JOINTS

A. Cut through setting beds at perimeter joints and at projections through the floor. Install neoprene or butyl rubber strip (Shore A hardness 70) full depth of setting bed. Provide specified joint sealant.

B. Provide control joints where floor tiles meet restraining surfaces such as perimeter walls, cove bases, curbs, columns, pipes, etc., and directly over control or expansion joints in sub-surfaces. Control joints shall be placed as specified in Article 3.2. Form control joints in neat, straight lines. Cut tile cleanly and to accurate radius at exposed junctions with pipes, etc. Tile control joints shall be full width of control joint in sub-surfaces and same width as grouted joints (but not less than ¼") at quarry tile.

C. Fill control joints that will be exposed in the finished work to full depth of setting beds from sub-surface to rear face of tile, with control joint backing. Keep remaining void clear of grout and debris. After completion of grouting operations, seal control joints with specified sealant of color to match adjoining grout.

3.7 CLEANING, PATCHING, PROTECTION

A. After completion, clean all work, point open joints and replace defective work. After cleaning, protect work with a suitable covering of paper before other trades have access to area.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1 - General Requirements apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes all terrazzo work required, generally the cutting and patching of existing terrazzo floors and base.

C. Related work specified elsewhere:

1. Concrete: Section 03300.
2. Tile Flooring: Section 09300.
3. Resilient Flooring: Section 09650.

1.2 SUBMITTALS

A. Sample Panels: Submit duplicate samples 4" x 4" x 1" to demonstrate match of aggregate and matrix with existing floors.

PART 2: PRODUCTS

2.1 MATCHING MATERIALS

A. All materials shall be selected to match existing flooring.

B. Portland Cement: ASTM C150, Type 1.

C. Sand: ASTM C33.

D. Marble Chips: ASTM C241.

E. Divider Strips: Full depth of terrazzo, match existing gauge.

F. Colarants: Alkali Resistant non-fading color pigments.

G. Reinforcement: ASTM A185, 2 x 2 / 16-16 galvanized welded wire fabric.

H. All other materials same as existing depending upon system.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install new or patching terrazzo to exactly match the existing adjacent terrazzo.

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this Section includes furnishing and installing all acoustic lay-in adhesive applied ceilings.

C. Related work specified elsewhere:

1. Lath and Plaster: Section 09100.
2. Gypsum Drywall: Section 09250.
3. Lighting Fixtures: Division 16.

1.2 SUBMITTALS

A. Samples: Submit three (3) samples of each tile proposed by the manufacturer. The Architect will select and approve the texture and pattern for the Project.

1.3 GENERAL INFORMATION AND REQUIREMENTS

A. General: Except as otherwise specified herein, recommendations of the Acoustical Materials Association and the manufacturer, whichever is most stringent, shall be followed.

B. Quantity, location: Refer to drawings, including Room Finish Schedules and notes, for extent of acoustical treatment.

C. Relationship to Features: Note the ceiling heights as they relate to masonry courses, frames, lintels and other features and maintain relationship shown.

1.4 PRODUCT HANDLING

A. Package, handle, transport and store materials at the jobsite in a manner that will avoid damage. Repair or replace all damaged material.

B. Ceiling materials shall be delivered in manufacturer's original labeled, unopened cartons, suitably stored within the building and protected from damage until ready for installation.

1.5 JOB CONDITIONS

A. Inspection: Before commencing ceiling work, inspect all surfaces to receive work of this Section to assure that conditions are suitable for installa-

tion of the work, including checks for form oil and other deleterious materials. Notify Architect in writing of unsatisfactory conditions and do not proceed with the work until Architect's instructions have been received. Commencement of work shall be construed as acceptance of conditions.

B. Environmental Conditions: The building shall be glazed and have a relative humidity not exceeding 50% plus or minus 15% before materials are delivered to the site or work is begun. Uniform temperature of at least 60°F shall be maintained during and after the installation.

C. Coordination: Coordinate ceiling work with that of related trades.

1.6 EXTRA STOCK

A. Provide minimum 1% additional stock of each color and/or type of material for future maintenance and patching.

B. Deliver in standard containers, unopened to the University as directed.

C. If smallest standard container exceeds 1%, provide at least one full container.

PART 2: MATERIAL

2.1 SUSPENSION SYSTEM

A. Suspension system for acoustical lay-in ceilings shall be Donn AB Exposed Grid System as manufactured by Donn Products, Inc., or equivalent System of Chicago Metallic Corporation Roper Eastern, Lok Products Co., or National Rolling Mills Co., or approved equal.

B. Components shall be formed from aluminum.

C. Exposed parts shall be finished satin white.

D. System shall support entire ceiling assembly including lighting fixtures, diffusers, grilles and registers, sprinkler heads (not system), speakers and acoustical material with a maximum deflection of 1/360 of the span.

E. Pattern shall be as shown on the drawings.

2.2 ACOUSTICAL UNITS, GENERAL

A. All acoustical units of each type shall be products of one manufacturer and shall have same appearance throughout. Submit samples of all tile prior to shipping to job as outlined under Article 1.2.

B. Criteria listed under each type acoustical units is considered as minimum requirements for type, performance and appearance.

C. Unless otherwise noted, units to be Class 25 in accordance with SS-S-118a with UL label; AMA Class I when tested under ASTM E84. Washable, white painted finish with minimum 75% light reflectivity or mylar film coated as indicated.

D. Entire work shall be accomplished by a Subcontractor approved by manufacturer of tile and qualified on installation.

2.3 ACOUSTICAL UNITS, PERFORMANCE CRITERIA

A. Acoustic Ceiling Board

1. Size: 24" x 48" x 5/8" Lay-in Board.
2. NRC: .50-.60 minimum
3. STC: 35-39 minimum (continuous ceiling test).
4. Light Reflectance: LR-1 (over 75%).
5. Flame Spread Classification: ASTM E84.

B. Finish: Plastic Coated

C. Acceptable Materials: Subject to satisfactorily meeting all criteria of physical properties, size, pattern, and appearance, as well as final approval of samples are:

1. Armstrong: Minaboard Panels, Fissured Design, Plastic Coated.

2. Celotex Corporation: Safetone Lay-in Panels, Fissurtone Design, Plastic Coated.

3. Conwed Corporation: Fissura Lay-in Panels, Plastic Coated.

4. Gold Bond Building Products, Division of National Gypsum Company. Solitude Lay-in Panels, Fissured Design, Plastic coated.

5. Johns-Manville: Spintone Lay-in Panels, DCF Design, Plastic Coated.

6. United States Gypsum: Auratone Lay-in Panels, Fissured Design, Plastic Coated.

7. Approved equal which conforms to these specifications will be acceptable.

D. Acoustical Tile: Provide units of dimension and pattern to match existing.

PART 3: EXECUTION

3.1 SUSPENSION SYSTEM

A. Install suspension system in strict accordance with system manufacturers installation instructions and the approved layout and erection drawings.

B. All suspension shall be from the structure and not from ductwork, piping or other requipment.

C. Where recommended hanger spacing is exceeded, provide such sub-framing and reinforcement as is necessary to reduce the span between hangers and maintain the specified structural properties.

3.2 ACOUSTICAL UNITS

A. Install acoustic panels in the finished grid system after all other work in and above ceiling has been completed.

B. Take care to avoid damaging or soiling acoustical units.

C. Where required, cut acoustical material to fit and accommodate the work of other trades.

D. Where edge member panel occuring would be less than 6" wide, cut 2'x 4' panels to the proper width (so that edge panels may be 2' x up to 2'-6").

3.3 WORKMANSHIP AND GUARANTEE

A. Workmanship shall be of the highest quality, using skilled mechanics thoroughly trained in their trade. Finished work shall be clean, free of mars or other defects. Clean or replace dirty and damaged units and panels that have sagged. Workmanship or material to be guaranteed for one year against faulty workmanship or materials. Replace all tile that falls off, joints that open up or tile that becomes loose or is sagging, at no cost to Owner.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes the furnishing and installing of all metal ceilings indicated "Metal Ceilings" as shown on drawings. All accessories required to furnish Project complete. Acoustical insulation.

C. Related work specified elsewhere:
   1. Acoustical Treatment: Section 09500.
   2. Fixed and Flexible Ductwork: Division 15.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings of all metal soffits and metal ceilings, suspension members, hold down members and accessories, in accordance with Section 01300.

B. Samples: Submit samples in 3'-0" x 3'-0" panels, of all soffit and metal ceiling material, including suspension members, closures and accessories. Submit samples at time of final approval of shop drawings.

1.4 GENERAL INFORMATION

A. Coordination: Coordinate work directly with appropriate contractors and subcontractors as necessary to insure proper fitting, opening sizes and clearances to other work. Metal soffit and ceiling manufacturer shall be responsible for coordination of information to insure proper fit of soffits and ceilings.

B. Field Dimensions: Field measure building features as required to insure proper fitting of work.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. The products specified herein are based on the Alcan Planar Ceiling System as manufactured by Alcan Building Products Division, to establish standards of quality, design profile and performance. Products manufactured by Hunter Douglas, Inc., will be acceptable subject to meeting the design profile and functional requirements of these specifications and the drawings.

2.2 METAL CEILINGS

A. Refer to "Room Finish Schedule" for location of metal ceilings and herein for description.

1. Metal panels, 3-3/8" wide by 5/8" deep ribs at 4" o.c., no reveal closures; panel face with 15% perforations. Acoustical Insulation, 1" thick over 80% of panel surface, where indicated.

B. Properties of Interior Panels:

1. Metal: .020" aluminum.
2. Width: 3-3/8".
3. Depth: 5/8".
4. Length: Maximum length, interior sleeve at splice.
5. Finish: Concealed side - prime coated. Exposed side - two coats baked enamel, matt finish, color as selected from manufacturer's standards.

C. Interior Panel Carriers: Formed and punched from prepainted strip and cut to maximum lengths, splice carriers. Carriers with prongs, panels clipped to prongs; prongs punched to maintain panel spacing of 4" o.c., providing reveal spacing on each side. Holes prepunched to receive hangers. Provide non-standard or adjustable spacing increment at certain locations indicated.

1. Metal: .040" aluminum.
2. Length: Maximum length.
3. Finish: 2 coats baked enamel (black).
4. Supports: No. 12-gauge wire hangers.

2.3 EXTERIOR METAL SOFFITS

A. At exterior soffits, called "metal soffit", refer herein for description.

1. Metal soffit: Metal panels; 3-5/16" wide x 5/8" deep, 4" o.c., with reveal closures between each panel. Thermal insulation, 3" thick over 100% of panel surface.

2.5 INSULATION; ACOUSTICAL

A. Acoustical: 1" thick, 3 pound density per cubic foot mineral wool or fiberglass insulation with black covered exposed face (2 oz. fabric lamination) NRC .70.

PART 3: EXECUTION

3.1 FIELD ERECTION

A. Field erection of all components, including acoustical and thermal insulation shall be performed by the manufacturer's erection division or by its Subcontractor in accord with approved assembly and erection drawings. Wherever metal ceilings are built into or occur within plaster, gypsumboard or integrated ceiling systems, provide resilient suspension system to same criteria as Section 13500.

B. Install all carriers on 4'-0" grid, securely fasten to structure above; Carriers and intermediates to be level to within 1/8" in 10'-0" span in all directions. Provide necessary carriers at interior fascias.

C. Install insulation to conform to Sound Absorption Test A70-142, at 100% coverage. Lay acoustical insulation with black side down. Perpendicular to panels.

D. Accessories and Trim: Furnish and install as required and detailed. Make necessary cut-outs for light fixtures and other features set in ceiling or soffit. Access panels where indicated, provide sleeves at end joints, securely fasten all panel members together, removable, by hinged and screw cam.

E. Touch-Up Painting: Touch up all ceilings and soffits, edges that have been field cut; all scratches and abrasions.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1 - General Requirements apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, etc.

B. Work under this section includes furnishing and installing all resilient floor and base materials as shown on the drawings and specified herein.

1.2 PRODUCT HANDLING

A. Deliver materials in their original unopened containers with manufacturer's labels intact.

B. Store and handle materials in a manner that will prevent damage and provide protection against moisture and the elements. Store materials at the job site for at least 24 hours prior to installation.

C. Store materials containing solvents in tightly sealed containers. Assume fire and safety protection.

PART 2: PRODUCTS

2.1 MATERIALS

A. Resilient Tile:

1. Vinyl Asbestos Tile (VAT): 12" x12"x1/8" thick, equivalent to Armstrong Imperial Modern, Fed spec SS-T-312, Type IV, color as selected by Architect. Acceptable manufacturers are Armstrong, Flint-Kote, GAF, Kentile.

2. Asphalt Tile (AT): 9"x 9"x 1/8" thick, equivalent to Kentile Marbelized Federal Spec. SS-T-312B, match existing color.

B. Resilient Base (in tile floor areas): Vinyl or rubber, cove type, dimensions shown, of colors selected by the Architect. Provide pre-formed internal and external corners. Acceptable manufacturers are the above and Johnson Rubber Co., VPI and Mercer.

C. Adhesive: Waterproof type as recommended by above material manufacturers.

D. Resilient sheet flooring and base (vinyl): Multiflor Granit as manufactured by Tarkett AB, or approved equal.

1. Composition and Materials: Thickness - .090" (2.0mm): Width - 6'-0" (72", 184cm): Length - 82 Lin. Ft. (25m). Chemical Composition: Polyvinyl

Chloride 80%; Color Pigments, stabilizers and plasticizers 20$. Pattern and color shall extend throughout total thickness of material.

2. Technical Data:

a. Chemical Resistance: (Surface immersed for 24 hours.) Resists most chemicals and miscellaneous foreign materials.

b. Wear Resistance: The Taber Abrasion resistance of using an H-18 abrasive wheel with a load of 500 grams shall be at least an average of 23,000 cycles.

c. Tensile Strength: PVC surface must be at least 2,750 psi.

d. Fire Resistance: material shall have been tested per ASTM E84-70 with a flame spread rate of 45 and fuel contribution of 0.

e. Flexibility: Material shall not crack, separate or fracture after repeated cycles of 360° bending and/or flexure.

3. Trim for base: Tarkett Standard Metal trim, cap, outside corner and end cap as detailed.

4. Cove form: Standard wood cove form or equivalent PVC, feather edge.

5. Adhesive: As approved by manufacturer.

6. Seam material: Tarkett Welding Rod.

PART 3: EXECUTION

3.1 EXAMINATION OF SURFACES

A. Examine surfaces to receive resilient flooring and base and notify the Contractor in writing if any condition exists that will prevent satisfactory results. Do not proceed with installation until unsatisfactory conditions are corrected. Commencement of work implies acceptance of surfaces and assumption of responsibility for satisfactory results.

3.2 INSTALLATION

A. Installing resilient tile: Apply adhesive and install resilient tile flooring and base in accordance with manufacturer's recommendations.

1. Vinyl Asbestos Tile and Asphalt Tile: Lay and fit tile with joints tight and in true alignment. At individual spaces lay tile symmetrical about center lines of rooms or spaces with no border tile less than one-half size. Lay tile to match pattern and arrangement existing, except where drawings may indicate otherwise. Cut tile to fit around permanent fixtures and fit accurately at joining with other materials. Install vinyl reducer strips where edge of tile is exposed.

2. Resilient Base: Install base on walls where shown and on built-in casework and other similar items in rooms scheduled to have base. Use cove type at all flooring. Firmly cement base to backing, straight and true with tight butt joints. Apply after floor tile is in place.

B. Install resilient sheet flooring in strict accordance with manufacturer's installation instructions using approved adhesive by an approved, qualified installer.

1. In all areas, side and end seams shall be mechanically welded with Tarkett Welding Rod.

2. Set cove form and roll floor material into base. Weld inside base corners. Use metal trim at outside corners and caps.

3.3 CLEANING AND FINISHING

A. Just prior to final inspection, thoroughly clean surfaces of above materials in accordance with manufacturer's instructions. Upon completion, leave clean, smooth and free of buckles and projecting edges.

3.4 PROTECTION

A. Protect finished work from damage until final acceptance. Replace any damaged work.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installation of composition seamless flooring and base (height as indicated). Waterproof membrane under finished surface. Provide to extent indicated on the drawings and room finish schedules as "Seamless."

C. Related work specified elsewhere:

1. Concrete sub-strate: Section 03300.
2. Ceramic Tile: Section 09300.
3. Metal Ceilings: Section 09541.
4. Floor Drains: Division 15.

D. Resilient base at floor mounted casework to be furnished and installed as follows:

1. At composition flooring, first install composition flooring and composition base at all areas and walls (including floor underneath and walls behind casework), and then install casework. The casework supplier shall apply a continuous toebead of sealant at juncture of casework base and composition flooring. Sealant by casework supplier to be Tremco, or equal, non-hardening type, compatible with composition flooring. The casework supplier shall furnish and install the resilient base, in compliance with requirements of Section 09650. Seal and embed the toe of the resilient base in sealant during installation. At completion, clean excess sealant and adhesive.

1.2 SUBMITTAL

A. Samples: Provide three 12" by 12" samples to Architect for color approval.

B. Submit report certifying that number of coats and thickness specified have been applied.

1.3 PRODUCT HANDLING

A. Deliver materials to project in original containers with seals unbroken, labels intact, containing manufacturers hallmark. Containers without labels will be cause for rejection. Use materials only in accordance with container label directions.

PART 2: PRODUCTS

2.1 MANUFACTURERS AND MATERIAL

A. This specification is based on Dex-O-Tex Neotex (Industrial-67 Formulation) Flooring and Dex-O-Tex Membrane Waterproofing as manufactured by Crossfield Products Corporation. Products as manufactured by Selby - Battersby & Company, Philadelphia, Pennsylvania, or approved equal which conform to these specifications will be acceptable. Todco Division of McNaughton-Brooks.

2.2 MEMBRANE WATERPROOFING

A. Dex-O-Tex Membrane Waterproofing (see Article 2.1 above), thin-section, troweled, neoprene-latex composition material reinforced with glass fabric, 1/16" thick, apply to concrete sub-floor and up onto concrete masonry base.

B. Physical Characteristics:

1. Waterproofness: 18" diameter sample, subjected to 50 pounds per inch water pressure for 60 minutes. Amount of water forced through in grams: none.

2. Tensile Strength & Elongation: Conform to ASTM D-1117-69.

3. Strip Adhesion: Strip adhesion measured in per linear inch force required to pull up membrane, 8.75 to 10.0 lbs. per inch.

2.3 COMPOSITION SEAMLESS FLOOR

A. Dex-O-Tex Neotex (see Article 2.1 above); troweled, jointless floor and base, water-phase resin material applied in a series of coats to a smooth finish. Total thickness ¼", color selected by Architect, slip-resistant final finish.

B. Physical Characteristics:

1. Resistance to Heavy Rolling Load: Standard #1-39T (2" wide cast iron wheel with 500 lb. load, 500 strokes; test run both on dry sample and sample immediately after immersion in water for 24 hours).
   Dry - .002" indent
   Wet - .006" indent

2. Surface Hardness: Conform to ASTM D-2240-68 (Scale "D" 62).

3. Indentation Characteristics: Conform to MIL-D-3134, Para. 4.7.4.2.1 - (2.74%) (Steadily applied load)

4. Adhesion: Conform to MIL-D-3134, Para. 4.7.14 - (395 psi).

5. Tensile Strength: Conform to ASTM C-190 (607 psi).

6. Flammability: Conform to ASTM E-162, flame spread index - 0.0, smoke deposited - less than 0.1 mg. Conform to ASTM E84, flame spread rate - 10, fuel contributed factor - 0, smoke density factor - 0.

PART 3: EXECUTION

3.1 INSTALLATION OF MEMBRANE WATERPROOFING

A. Prepare surfaces by removal of all laitence, grease and foreign matter.

B. Apply initial troweled adhesive waterproofing coating to floor and wall base surfaces.

C. Embed reinforcing fabric into adhesive-waterproofing coating.

D. Trowel or brush apply additional waterproofing coating as necessary to fill voids or pinholes.

E. Application shall be made by factory franchised or authorized installer only.

3.2 INSTALLATION OF COMPOSITION SEAMLESS FLOOR

A. Prepare surfaces by removal of all foreign matter.

B. Apply bonding coat by trowel or brush.

C. Trowel apply ¼" body coat.

D. Apply two grout coats to fill in and smooth off body coat.

E. Power sand to remove trowel marks.

F. Roller apply two coats of saturating final finish dressing in texture as selected.

G. Application shall be made by factory franchised or authorized installer only.

3.3 PROTECTION

A. Keep traffic off all surfaces for a minimum of 48 hours after application is complete.

B. General Contractor shall protect floor surface, with heavy duty paper, until building is accepted by Owner.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes providing all labor, materials, services, equipment, transportation and services necessary to complete all epoxy-polyester wall coating work as indicated by "S.G.-1" on the drawings. Refer to drawings for locations.

C. Related work specified elsewhere:

1. Concrete Masonry: Section 04200.
2. Lath, plaster and gypsum drywall: Section 09100.
3. Ceramic Tile: Section 09300.
4. Composition Seamless Flooring: Section 09750.
5. Elastomeric Coatings (S.G.-3): Section 09821.
6. Glazed Wall Coating (S.G.-2): Section 09830.
7. Painting: Section 09900.

1.2 SUBMITTAL

A. Submit full range of color samples to Architect for selection. After selection, but before commencement of work, prepare two (2) 8" by 16" samples of each color selected on concrete block or other approved surface for Architect's approval.

B. All colors shall be selected by Architect from manufacturer's standard range. Finishes shall be semi-gloss or satin, of solid, plain colors as required.

C. Samples shall be prepared and submitted in accordance with the requirements of Division 1, General Requirements, with all postage and transportation cost paid by this Subcontractor.

1.3 GUARANTEE

A. The Contractor shall obtain from the applicator a written guarantee to the Owner from both the applicator and the manufacturer of the glazed coating system materials covering replacement without charge of defective work caused by defects of materials or workmanship which appear within period of one (1) year from date of final completion of the Project.

1.4 PRODUCT HANDLING

A. Deliver materials to Project in original containers with seals unbroken,

labels intact, containing manufacturer's hallmark. Containers without labels will be cause for rejection. Use materials only in accordance with container label directions.

B. Punctured or damaged containers shall be removed from the site before application of materials is begun.

C. All materials shall be properly stored in spaces provided. Such spaces shall be kept under lock and shall be inaccessible to all except those employed under this section.

PART 2: PRODUCTS

2.1 MATERIAL

A. Glazed wall coating shall be a polyester-epoxy or polyester-polyurethane system providing a hard tile-like glazed finish, resistant to moisture, abrasion and staining. Glazed finish shall be one of the following products, or approved equal which conforms to these specifications will be acceptable.

1. "Descoglaze" by McNaughton Books, Buffalo, N.Y.
2. "Sanitile 550" by Master Mechanics Company, Cleveland, Ohio.
3. "Tru-Glaze" by Devoe Paint, Louisville, Kentucky.
4. "Pittglaze" by PPG Industries, Pittsburgh, Pennsylvania.

B. Materials installed under this Section shall have a Class A fire-rating and shall meet or exceed the following requirements when tested under ASTM E-84.

Flame Spread:	0 - 10
Fuel Contributed:	0 - 10
Smoke Developed:	0 - 15 (Smoke must be non-toxic)

C. All materials shall be freshly compounded, and supplied by coating manufacturer or his franchised representative. Except as otherwise indicated, coating shall comply with Federal Spec. TT-C-550a or TT-C-545b.

D. In addition to the above listed rating, materials shall meet the following minimum requirements:

1. Chemical Resistance: Unaffected by common industrial cleaning and maintenance compounds.

2. Stain Resistance: Following stains shall be easily removable: lipstick, fountain pen ink, ballpoint pen ink, grease pencil marks, rubber heel marks, petroleum oil, and crayon.

3. Scrubability Test: No harmful effects after 5000 cycles on a Gardner Straight Line Washability apparatus.

4. Alkali Resistance: Finish coat, not affected by seven day immersion in 5% sodium hydroxide held at 75 $\pm$ 2°F - ASTM D-1647.

5. Acid Resistance: Finish coat not affected by seven day immersion in: 50% alcohol, 20% caustic sodium hydroxide, 50% supfuric Acid, 15% hydrochloric

acid, 10% lactic acid, 20% calcium chloride, 5% urea and mineral spirits.

6. Fungus Resistance: Conforms to TT-C-550a, paragraph 3.3.7. Material does not contain any mercurial fungicide.

PART 3: EXECUTION

3.1 GENERAL

A. All surfaces to receive glazed coating shall be thoroughly cured, dry and clean. Moisture content shall not exceed 16%, as measured with a moisture meter, in the presence of the Architect and Owner. Wall temperature shall be maintained at a minimum of 50°F during the application of glazed coating and for two (2) weeks thereafter.

B. Carefully inspect all surfaces to which glazed coating is to be applied and report to the Architect in writing, surfaces which are not in satisfactory condition to receive work under this Section. Commencement of application of glazed coating to any surface will be construed as acceptance of that surface.

C. Mask all surfaces that are not to be coated.

3.2 COORDINATION OF WORK

A. Areas in which glazed wall coatings are to be applied shall be kept free of traffic, and no other trade shall be permitted to work in rooms during the application and curing of the coating.

B. Plumbing fixtures, accessories, grilles, radiation, etc, shall not be installed until after glazed coating work is complete.

C. Hard flooring (ceramic tile, concrete, etc.) shall be installed before glazed coating work is begun. Soft flooring (resilient flooring, composition flooring, etc.) shall not be installed until after glazed coating work is finished.

D. Installation of suspended ceilings, painting of surrounding areas and caulking shall be done after coating work if finished.

3.3 APPLICATION AND WORKMANSHIP

A. Application shall be by an applicator approved by the manufacturer and shall be in strict compliance with the manufacturer's written instructions.

B. Adjacent areas not to receive glazed wall coating shall be effectively masked or protected by drop-cloths.

C. Apply filler coat evenly to block by airless spray, building up 10 to 15 mils dry film thickness. Tint filler close to finish coat color. Allow 72 hours for base coat to cure before proceeding. Where concrete is required to be coated, use manufacturer's compatible first coat suitable for such surfaces to assure uniform finish results.

D. Apply colored finish glaze coat by airless spray to a minimum dry film thickness of 5 mils. Back roll with roller as required to remove pinholes and unevenness.

E. Allow 24-hours for finish coat to cure and protect from damage during curing periods.

F. Each coat applied shall be inspected and approved by the Architect and Owner before succeeding coat is applied. A progress schedule showing date of application of each coat for each room, space or area shall be made by the Contractor for inspection and approval of the Architect and Owner.

G. Glazed wall coating shall cover full height of wall where indicated, from floor to ceiling of each area.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes providing all labor, materials, services, equipment, transportation and services necessary to complete all glazed wall and ceiling coating work as indicated by "S.G.-2" on the drawings. Refer to drawings for locations.

C. Related work specified elsewhere:

1. Concrete Masonry: Section 04200.
2. Lath, Plaster and Gypsum Drywall: Section 09100.
3. Ceramic Tile: Section 09300.
4. Composition Seamless Floorings: Section 09750.
5. Conductive Composition Seamless Flooring: Section 09760.
6. Epoxy-Polyester Coatings: Section 09820.
7. Elastomeric Coating (S.G.-1): Section 09821.
8. Painting: Section 0990.

1.2 SUBMITTAL

A. Submit full range of color samples to Architect for selection. After selection, but before commencement of work, prepare two (2) 8" by 16" samples of each color selected on concrete block or other approved surface for Architect's approval.

B. All colors shall be as selected by Architect from manufacturer's standard range. Finishes shall be semi-gloss or satin, of solid, plain colors as required.

C. Samples shall be prepared and submitted in accordance with the requirements of Division 1, General Requirements, with all postage and transportation costs paid by this Subcontractor.

1.3 GUARANTEE

A. The Contractor shall obtain from the applicator a written guarantee to the Owner from both the applicator and the manufacturer of the glazed coating system materials covering replacement without charge of defective work caused by defects of materials or workmanship which appear within a period of one (1) year from date of final completion of the Project.

1.4 PRODUCT HANDLING

A. Deliver materials to Project in original containers with seals unbroken,

labels intact, containing manufacturer's hallmark. Containers without labels will be cause for rejection. Use materials only in accordance with container label directions. Punctured or damaged containers shall be removed from the site before application of materials is begun.

B. All materials of this Section shall be properly stored in spaces provided. When in use, such spaces shall be kept under lock and shall be inaccessible to all except those employed under this Section.

PART 2: PRODUCTS

2.1 MATERIAL

A. All materials shall be first quality and freshly compounded, and supplied by coating manufacturer or his franchised representative.

1. Color coat shall be at least 90% inorganic, and of a solvent blend. Thinning when necessary, shall be with mineral spirits only. No emulsions, epoxies, polyesters, vinyls, or other organic materials will be accepted.

2. Glaze coat shall be clear, non-yellowing, acrylic-type, spray applied coating, containing no epoxies, polyesters, emulsions, vinyls, or two-component glazes.

B. The materials installed under this Section must be listed by the Underwriters' Laboratories, Inc, in accordance with their standards for incombustible coatings. The results obtained by the U.L. tests (all coats) must meet or exceed the following standards:

Flame Spread:	0 - 5
Fuel Contrubuted:	0 - 5
Smoke Developed:	0 -10 (Any smoke developed must be non-toxic)

C. All materials must be shipped to the job site in containers bearing the UL labels listing the above ratings. All containers for all materials must arrive at the site unopened.

D. Glazed wall coating system shall be equal to "Glazetite Type II", specially formulated for use at wet areas, produced by Desco International, as approved by Architect. Manufacturers of other glazed coating systems must submit their request to Architect at least 10 days before bid opening, accompanied by the following listed items. Approval by Architect will be in the form of an addendum to the specifications issued to all bidders of record that the additional brand or brands are approved as equal to those specified so far as the requirements of the Project are concerned. Such approval, however, will not relieve any manufacturer, including the one named herein, from meeting all the requirements of this specification, and products failing under laboratory tests to meet said requirements, or inability or unwillingness to obtain the required UL label service, will cause rejection of the product even though prior approval has been given. Submissions for approval, as described above, are as follows:

1. A notarized affidavit on the bidder's company stationery stating that all requirements of this Specification will be met without exception and that he

has successfully applied the material submitted for at least five years, naming at least three projects five years old.

2. Submission of duplicate samples on concrete block, not less than 8" by 8" on the face, each clearly indicating the three steps required by this Specification.

3. Submission of 1 container of color mastic and 1 container of clear glaze, each to bear the UL label stating Flame Spread 0-5, Fuel Contrubuted 0-5, Smoke Developed 0-10.

4. Submission of the full UL Report stating that any smoke developed is not toxic.

E. In addition to the above listed UL ratings, the material installed under this Section must meet the following minimum requirements:

1. Will not support fungus or bacteria.

2. Chemical Resistance: Unaffected by industrial cleaning and maintenance compounds.

3. Stain Resistance: Following stains must be easily removed by use of mineral spirits: lipstick, fountain pen ink, ballpoint pen ink, grease, pencil marks, rubber heel marks, petroleum oil, and crayon.

4. Fade-ometer: No apparent fading after 48 hours exposure. ASTM E188-70.

5. Scrubability Test: No harmful effects after 5000 cycles on a Gardner Straight Line Washability apparatus.

6. Impact Resistance: Gardner Impact Tester 80 inch-lbs; no loss of adhesion.

PART 3: EXECUTION

3.1 GENERAL

A. All surfaces to receive glazed wall coatings shall be thoroughly cured, dry and clean. Moisture content shall not exceed 16%, as measured with a moisture meter in the presence of the Architect and Owner. Wall temperature must be maintained at a minimum of 50°F during the application of glazed coatings and for at least two weeks thereafter.

B. Before commencing this work, carefully inspect the surfaces to which the glazed coating is to be applied and report to the Architect in writing any surfaces not satisfactory to receive the material. Commencement of application of glazed coating to any surface will be construed as acceptance of that surface as proper to receive the finish materials.

C. Mask all surfaces that are not to be coated.

3.2 COORDINATION OF WORK

A. Areas in which glazed wall coatings are to be applied must be kept free of traffic, and no other trade will be permitted to work in rooms during the application and curing of the coating.

B. Fixtures, accessories, grilles, radiation, etc., will not be installed until after glazed coating work is complete.

C. Hard flooring (ceramic tile, concrete, etc.) shall be installed before glazed coating work is begun. Soft flooring (resilient flooring, composition flooring, etc.) shall not be installed until after glazed coating work is finished.

D. Painting of surrounding areas, and caulking, must be done after glazed coating work is finished. Oil-based or solvent-release caulking compound not permitted in contact with glazed coating material.

3.3 APPLICATION AND WORKMANSHIP

A. Application shall be by an applicator franchised by the manufacturer and shall be in strict compliance with the manufacturer's written instructions.

B. Adjacent areas not to receive glazed wall coating shall be effectively masked or protected by drop-cloths.

C. Apply color coat over all bases as called for, other than concrete, or concrete masonry. Apply 15 to 25 mils thick using airless spray head with a minimum 43 mil spray tip. At concrete and concrete masonry, apply in three to four coats, with build-up of a minimum 40 mil thickness. The first two coats shall be heavily filled; the first applied by brush and the second sprayed with undercoating equipment. The final coat or coats shall be applied by airless spray with a minimum 43 mil spray tip.

D. Apply glaze coat over color coat in 5 mils minimum additional thickness, also by power spray method. The final glazed wall coating installation shall be entirely free of "pin-holes."

D. Each coat applied must be inspected and approved by the Architect or Owner before application of succeeding coat. A progress schedule showing date of application of each coat for each room, space or area shall be kept by this subcontractor for inspection and approval of the Architect.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes providing all labor, materials, services, equipment, transportation and services necessary to complete all elastomeric wall coating work as indicated by "S.G.-1" on the drawings. Refer to drawings for locations.

C. Related work specified elsewhere:

1. Concrete Masonry: Section 04200.
2. Lath, Plaster and Gypsum Drywall: Section 09100.
3. Composition Seamless Flooring: Section 09750.
4. Epoxy-Polyester Coatings (S.G.1): Section 09820.
5. Glazed Wall Coatings (S.G.-2): Section 09830.
6. Painting: Section 09900.

1.2 SUBMITTAL

A. Submit full range of color samples to Architect for selection. After selection, but before commencement of work, prepare two (2) 8" by 16" samples of each color selected on concrete block or other approved surface for Architect's approval.

B. All colors shall be selected by Architect from manufacturer's standard range. Finishes shall be semi-gloss or satin, of solid, plain colors as required.

C. Samples shall be prepared and submitted in accordance with the requirements of Division 1, General Requirements, with all postage and transportation cost paid by this Subcontractor.

1.3 GUARANTEE

A. The Contractor shall obtain from the applicator a written guarantee to the Owner from both the applicator and the manufacturer of the coating system materials covering replacement without charge of defective work caused by defects of materials or workmanship which appear within period of one (1) year from date of final completion of the Project.

1.4 PRODUCT HANDLING

A. Deliver materials to Project in original containers with seals unbroken, labels intact, containing manufacturer's hallmark. Containers without labels will be cause for rejection. Use materials only in accordance with container label directions.

B. Punctured or damaged containers shall be removed from the site before application

of materials is begun.

C. All materials shall be properly stored in spaces provided. Such spaces shall be kept under lock and shall be inaccessible to all except those employed under this section.

PART 2: PRODUCTS

2.1 MATERIALS

A. Glazed wall coating shall be a catalyst-cured elastomeric thermoplastic system without vinyl resins, providing a hard, tile-like glazed finish, resistant to moisture, abrasion and staining. System shall be Desco Hylon or approved equal.

B. System shall have a Fire Hazard Classification (ASTM E84, Tunnel Test) not exceeding:

Flame Spread	25
Fuel Contributed	0
Smoke Developed	35

and shall be shipped in containers bearing Underwriters' Laboratories factory applied labels certifying the Fire Hazard Classification.

C. Primer: Type recommended by Coating Manufacturer, for applicable substrate.

PART 3: EXECUTION

3.1 GENERAL

A. All surfaces to receive coating shall be thoroughly cured, dry and clean. Moisture content shall not exceed 16%, as measured with a moisture meter, in the presence of the Architect and Owner. Wall temperature shall be maintained at a minimum of 50°F during the application of coating and for two (2) weeks therafter.

B. Carefully inspect all surfaces to which coating is to be applied and report to the Architect in writing, surfaces which are not in satisfactory condition to receive work under this Section. Commencement of application of glazed coating to any surface will be construed as acceptance of that surface.

C. Mask all surfaces that are not to be coated.

3.2 COORDINATION OF WORK

A. Areas in which coatings are to be applied shall be kept free of traffic, and no other trade shall be permitted to work in rooms during the application and curing of the coating.

B. Plumbing fixtures, accessories, grilles, radiation, etc, shall not be installed until after coating work is complete.

C. Hard flooring (ceramic tile, concrete, etc.) shall be installed before coating work is begun. Soft flooring (resilient flooring, composition flooring, etc.) shall not be installed until after coating work is finished.

D. Installation of suspended ceilings, painting of surrounding areas and caulking shall be done after coating work if finished.

3.3 APPLICATION AND WORKMANSHIP

A. Apply coatings in accordance with Coating Manufacturer's printed instructions, employing technically trained Desco Applicators, using equipment specifically designed for this purpose.

B. Apply Desco Foundation Coat or Desco Fill Coat over concrete, concrete masonry, and other coarse surfaces, as required to obtain coating finish equal to approved sample.

C. Prime surfaces according to directions. Allow to dry.

D. Apply Hylon Coating in 2 individual, uniform applications, permitting the first to cure at least 4 hours before applying the succeeding one.

E. Minimum dry film thickness shall be 8 to 10 mils.

F. Finished work shall match approved samples; be uniform in thickness, sheen, color and texture and be free from defects detrimental to appearance or performance.

G. Thickness Verficiation: Verify film thickness of completed coating system in the field, at random, using a Tooke Mark II Coating Inspection Gauge. Minimum thickness shall be as specified, excluding foundation or fills coats. Conduct tests in presence of Architect or his representative.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this Section includes field finishing of all materials scheduled and/or specified for paint, enamel, transparent finish and similar field painting not specified under other sections.

C. Related work specified elsewhere:

1. Metal Fabrications: Section 05500.
2. Carpentry: Section 06100.
3. Hollow Metal: Section 08110.
4. Wood Doors: Section 08200.
5. Lath, Plaster and Gypsum Drywall: Section 09100.

D. General Outline of Work: Following outline is intended to complement and clarify the drawings. Do not construe as listing all surfaces, materials or finishes.

1. Exterior:
   a. Exposed Sheet Metal at Roof.
   b. Ferrous Metal.
2. Interior:

a. All walls and ceilings at rooms and surfaces, where indicated. Where plaster ceilings occur in spaces with painted, enameled, stained and varnished or other finish on walls, such ceilings shall be painted unless otherwise noted. Paint interior surfaces of windows and trim in all spaces where scheduled.

b. Hollow metal, including frames and other hollow metal. Paint on all sides including at rooms or spaces not otherwise painted or finished.

c. Door Closers and metal vision light and door louver frames.

d. Wood shelves, hook strips, trim and other unfinished millwork (custom woodwork) throughout.

e. Bare or insulated piping, hangers, saddles, brackets, stands, supports, panel boards and similar metal throughout, including at: finished rooms, equipment rooms, vaults, utility cores, switch gear room, above metal ceilings and similar accessible spaces.

f. Rooms or spaces in existing building where general contractor does remodeling, demolition and cutting, walls and/or ceilings shall be entirely

repainted under Section 09900, except as specifically noted otherwise on drawings.

g. Metal Stairs and rails.

E. Work excluded from this section (areas or materials):

1. Exterior: No other exterior painting is required except that scheduled above.

2. Interior:

a. The walls and ceilings of any room or space not scheduled for paint in Room Finish Schedules.

b. Plastic laminate.

c. Piping, ducts and conduit concealed in shafts and above ceilings accessible and non-accessible and their supports and hangers.

d. Brass, bronze, stainless steel, hardware, except prime coated.

e. Prefinished equipment.

1.2 INTENT OF DOCUMENTS

A. The Subcontractor providing the work of this Section shall examine the specifications for the various other trades and other contractors and shall familiarize himself with all their provisions regarding their painting and it shall be clearly understood that all surfaces that are left unfinished or have prime coat only by the requirements of other specifications shall be field painted or finished as a part of this Section.

B. Painting under this Section includes and means all specified or required preparatory work and application of paint systems including primers, sealers, stains, fillers, varnishes, paints, clear silicone treatments, and other similar finishes not specified under other Sections.

C. It is the intent to paint the entire new work as well as adjacent spaces and surfaces in existing building affected by work of this Project, except for specifically omitted areas and items.

D. In painting new work of this Project, paint all paintable surfaces except those explicitly omitted herein under Article 1.1.E. Paintable surfaces are: concrete; concrete masonry (brick and block); plaster and stucco; hardboard; gypsum board; cement-asbestos board; wood and plywood; metal, insulated or bare, (including piping, hangers, supports, ducts, brackets and other miscellaneous metal): ducts, insulated or bare; piping and equipment insulation and insulation covering; other surfaces listed under Painting Outline above.

E. Except for factory finish coats and prime or finish coats on certain identified mechanical and electrical work, only patch painting of rooms having no general construction remodeling is required of Mechanical and Electrical Subcontractors; field painting of all other surfaces shall be done by Painting Subcontractor under this section. Refer to Mechanical and Electrical drawings and specifications for extent of piping, conduit, duct work and equipment.

F. The number of coats specified are field painted coats, in addition to prime or shop coats, after all touch up work has been done to restore shop coats to full coverage. Use only first line products of manufacturers specified, of types of paint specified.

1.3 SUBMITTALS

A. Painting Systems: Submit for Architect's approval descriptive data in duplicate for paint materials and systems to be furnished. In this submittal, indicate each specified system, locations of use and the substitute system proposed.

B. Colors: The Architect will select all colors. If color selections are made which are not in the color line of the paint to be furnished, submit in duplicate for approval, 8" x 10" color cards showing the selected color in the paint to be furnished.

1.4 JOB CONDITIONS

A. Paint under conditions best suited for first quality work, including dry surfaces, dust free spaces, minimum temperature of 40° or higher as recommended by manufacturer. Paint exterior surfaces only when not subject to damage from present or subsequent rain, frost or other inclement weather, or when base surface is thoroughly dry. Test materials such as plaster to insure the base surface is dry. Paint in spaces not subject to entrance of dust or moisture from adjacent areas. Work with adequate illumination. Avoid painting of surfaces while they are exposed to hot sun.

B. Protection:

1. Protect all surfaces subject to damage and misplaced paint by covering with drop cloths, by masking, by other suitable covering or by removing from area.

2. Take particular care in working over and around factory finished materials and casework, as well as other pre-finished work. Provide hardboard covering at tops to prevent accidental damage and adequately cover or mask equipment.

3. Make good any damage caused by painting operations.

4. General Contractor shall isolate, cover or protect as necessary to insure no damage, stains, abrasions, other disfigurement of finish painted surfaces immediately upon completion by painter of final application to such surfaces.

5. Maintain 10# CO extinguisher in paint storage, mixing rooms. Remove oily rags and other fire hazards at end of day's work. Keep cans tightly covered. Take every precaution to avoid danger of fire.

D. Cleanup:

1. Remove oily rags, waste, etc. from building every night.

2. Upon completion of work, remove all misplaced paint, stains, etc. and remove all debris, rubbish, materials and equipment, and excess materials from the premises.

1.5 PRODUCT HANDLING

A. Delivery: Deliver all materials in the original containers, with seals unbroken and labels intact.

B. Storage:

1. Store and mix materials in designated places only. Protect walls and floors of storage rooms.

2. Post storage and mixing areas "NO SMOKING" and strictly enforce.

1.6 GUARANTEE

A. Guarantee all work for one year against blistering, peeling, or other loss of adhesion, yellowing, excessive chalking, other defects in material or workmanship. Remove defective work, prepare and repaint surface without cost to Owner. Repaint all of surface (i.e. wall, ceiling, door, etc.) on which work is defective to exact match of other adjacent similar surface; if exact match cannot be provided, then repaint adjacent surfaces to extent required to insure exact match.

PART 2: PRODUCTS

2.1 MATERIALS

A. Use only materials of brand and quality specified, if brand and quality are not specified, use material approved by Architect and Owner.

B. Provide paint manufactured with lead-free pigments and colors. Verify with manufacturer.

C. Provide turpentine, alcohol, mineral spirits, bonding solution, sundries, etc., of highest quality, pure and with identifying label on container and in accordance with paint manufacturer's recommendations.

D. Use no material over paint product of another manufacturer except as otherwise specified or permitted by Architect, and only if recommended by manufacturers.

E. Before applying paint over any shop coat or other pre-primed surfaces, verify compatibility of coatings.

2.2 COLORS

A. General: Architect will select colors, which may be from University of Minnesota 1976 Standard Color Palette. Mix paint to match color chips where necessary. Prepare actual samples, including natural finish as directed.

B. Electrical Conduit: At finished spaces, paint all conduit to blend out as directed, different color each coat.

2.3 PAINTING SYSTEMS

A. Painting systems are specified using the products of Pratt and Lambert Company to establish standards of quality. Comparable systems of O'Brien Paint Company, Benjamin Moore & Company, Sherwin Williams, Martin Senour Company, Pittsburgh Plate Glass, The Glidden Company and Devoe & Reynolds, or approved equal, will be acceptable subject to approval by the Architect of the systems and specific products.

B. Use the materials of the same manufacturer for each system insofar as possible.

C. Exterior Systems:

1. Ferrous Metal:
   1 - Coat P&L Effecto Enamel Primer. (Spot prime if existing)
   2 - Coats P&L Effecto Enamel.

2. Galvanized Metal: Chemically treat bare (unprimed) surface with #46 Metal Pretreatment before painting to provide good bond followed within 8 hours by:
   1 - Coat 80% Zinc-Dust-Zinc Oxide Primer, Fed Spec TT-P-64 1b. (Omit if surface is shop primed).
   2 - Coats P&L Vapex House Paint.

D. Interior Systems:

1. Plaster or Gypsum Board Walls:

   2 - Coats P&L Pro-Hide Latex Satin Enamel

2. Plaster Ceilings:

   2 - Coats P&L Vapex Flat Wall Finish.

3. Wood Doors, Trim, Millwork, Casework and other Wood for Transparent Finish (S&V)

   1 - Coat P&L Paste Filler
   1 - Coat P&L Tonetic Wood Stain
   2 - Coats P&L "38" Pale Trim Varnish gloss
   1 - Coat P&L "38" Pale Trim Varnish Satin

4. Wood Doors, Trim, Millwork, Casework & Other Wood for Painted Finish
   1 - Coat P&L Pro-Hide Prime/Undercoating
   2 - Coats P&L Pro-Hide Latex Satin

5. Covered Pipe, and Ducts - canvas jacketed - painted spaces:
   1 - Coat Rubber base sizing
   1 - Coat H.B. Fuller Insco BC-716, White
   1 - Coat finish as for adjacent wall or ceiling.

6. Covered Pipe, unjacketed:

Finish as for 4 above, except omit sizing.

7. Bare Pipe - Ungalvanized -All bare ungalvanized pipe in painted areas:

1 - Coat P&L Noxide Metal Primer, then finish same as adjoining wall or ceiling.

1 - Coat P&L Noxide Metal Primer, then finish same as adjoining wall or ceiling.

8. Bare Pipe - Galvanized - all galvanized pipe in painted area:

1 - Coat 80% zinc dust - zinc oxide primer, Federal Specification TT-P -641b, then finish same as adjoining wall or ceiling.

9. Hollow Metal Doors and Frames
1 - Coat P&L Pro-Hide Primer/Undercoating
2 - Coats P&L Pro-Hide Latex Satin Enamel

10. Ferrous Metal
1 - Coat P&L Vitralite Enamel Undercoating
1 - Coat P&L Vitralite Enamel Gloss
1 - Coat P&L Vitralite Enamel Eggshell

PART 3: EXECUTION

3.1 EXAMINATION OF SURFACES

A. The Subcontractor shall examine the surfaces to be finished prior to commencing work. If woodwork, metal or any other surfaces to be finished cannot be put in proper condition for finishing by customary cleaning, sanding and puttying operations, notify the Contractor in writing or assume the responsibility for and rectify any unsatisfactory finish resulting. Test surfaces for dry condition to receive paint.

3.2 WORKMANSHIP

A. Job Site Sample Areas: Make sample application on Project surfaces to extent directed by Architect or Owner. Obtain acceptance of sample field application before making additional applications. Accomplish all work to equal or exceed standards established by approved samples. Protect and maintain approved field samples through completion of Project.

B. The workmanship shall be of the very best, employing only skilled mechanics. Spread the materials on in even, thorough coats without runs, sags or other blemishes. Meet standards and recommendations for "Type 1 - Recommended" type work of Painting and Decorating Contractors of America, as minimum requirements, in absence of more stringent Project specification requirements.

C. Consult with Architect and/or manufacturer's technical representative if in

doubt as to suitability of material to application. Verify that paint is compatible with shop coat of others.

D. Apply succeeding coats only after prior coat has been approved by Owner, otherwise no credit will be given for the coat.

E. Coordinate work with others to insure that work to be painted is given maximum possible protection by applying coatings at times as will best insure such work against deterioration of any kind. Apply back prime and prime coats to millwork as soon as practicable after delivery to job.

3.3 SURFACE PREPARATION

A. All surfaces to be painted shall be cleaned and free of dirt, grease, rust, and dust before painting is started. Knots, streaks and sappy spots shall be touched up with an approved primer or sealer after removing pitch.

B. All necessary puttying of nail holes, cracks, etc. shall be done after the first coat, with putty of color to match that of the finish. Fill countersunk screw heads metal anchorage (not stop screws) with paste metal "body putty". Sand smooth and flush.

C. Touch up metal where shop coats are abraded. Clean down to bare metal and touch up paint used for shop coat.

D. All metal surfaces shall first be washed with mineral spirits to remove any dirt or grease before applying materials. Where rust or scale is present, it shall be wire brushed or sandpapered clean before painting.

E. Remove and reset hardware as required to completely finish surfaces and prevent misplaced paint. Cooperate with other trades and schedule painting operations prior to final setting and adjustment of hardware.

F. All woodwork to be finished with varnish or enamel shall be sanded smooth and the surfaces cleaned before proceeding with the application of the first coat. Sand between coats with fine sandpaper to produce an even smooth finish, except do not sand stain.

G. All coats shall be thoroughly dry before applying succeeding coats.

H. Prime, seal or stain and seal all surfaces of all millwork and paneling immediately upon arrival at the job. All interior and exterior trim shall be back primed before installation.

I. General Contractor shall repair holes, cracks, fissures and other defects in concrete and concrete masonry and remove excess mortar before prime coat is applied by Painting Subcontractor.

J. Patch small holes, abrasions and similar defects in plaster with spackle after prime coat. Patch flush and smooth with adjacent surfaces. Large imperfections shall be patched by plasterer. Seal spackle or patch before succeeding coats.

3.4 PREPARATION OF EXISTING SURFACES

A. General: Wash all surfaces to be repainted. Remove all grease, oil, soil or other matter which will interfere with proper bond of new material. Scrape and wire brush all loose or flaking paint to clean down to sound surfaces, sand edges to feather out. Remove all rust, scrape and brush to provide bright clean metal. Surfaces shall be clean, smooth, free of cracks, alligatoring, loose material. Etch surface of paint by using chemical wash. Fill cracks, voids and similar defects. Above work shall be done in addition to any other required preparation. Do all work necessary to place in best possible condition for repainting.

B. Unless specifically indicated otherwise, painting in corridors and spaces adjacent to remodeled spaces is only required on patched or new surfaces. Paint out to nearest panel break (such as corner or control joint, door jamb).

3.5 APPLICATION

A. Apply all materials without reduction, unless reduction is explicity required by manufacturer's original container label or unless otherwise directed or approved by Architect. Adulterate no material.

B. Apply all coatings smoothly, evenly and free of runs, sags, crawling, impurities and skins.

C. Apply over only thoroughly dry preceeding coat. Follow manufacturer's printed directions for drying time of undercoats. (Generally 24-hour minimum will be required.)

D. Use roller or brush on plaster and concrete surfaces; thoroughly fill all pores, each coat.

E. Spray first coat on concrete ceilings as approved, to thickness and hiding equivalent to properly brushed or rolled coat of material. Coat voids in concrete. Brush or roll succeeding coats, unless spray coats (equal in hiding and thickness to sample areas of brushed coats) are applied for comparison in Owner's presence. Spray may be used at pan and joist ceilings which are exposed, subject to the "equal coat" provision specified.

F. Color each paint coat to approximate color, somewhat lighter, of succeeding coat.

G. Stain and seal wood paneling, including edges and tongue and groove, prior to erection.

H. Finish tops and bottoms of doors same as rest of door, as well as all faces and edges of shelves, with all coats of paint. Should painter fail to paint tops and bottoms of wood doors, including cabinet doors, with all specified coats, and any door warps, painter shall be held responsible for entire cost of door replacement, including new door, fitting, sanding and refinishing.

I. Lightly sand before applying each coat of stain, sealer, varnish, enamel at wood (except do not sand stain), and elsewhere that runs or uneven build-up

occurs, to insure smooth coats and adhesion.

J. At existing building, repaint walls and/or ceilings surface entirely that have been disturbed by work of the General Contractor. "Patch" or "Spot" painting is not acceptable.

K. When painting around glazed openings, paint exposed glazing compound or putty and slightly, uniformly lap paint onto glass.

L. Apply paint adjoining other materials or other colors with full, clean cut lines without overlapping and to straight line.

M. Apply all work so free of runs, holidays, dead spots, roller or brush marks, foreign materials and impurities, etc., and uniform in color and sheen. Apply additional coats at no expense to Owner to areas showing such deficiencies or thin spots or other lack of hiding.

N. At completion of work of other trades, touch up and restore all painted work where damaged or defaced, free of blemishes.

O. Discard all containers as they are emptied. Reuse will be prohibited.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, etc.

B. Work under this section includes furnishing and installing all toilet compartments, urinal screens, hardware and accessories as indicated on drawings and herein specified.

C. Related work specified elsewhere:

1. Support above finished ceiling: Section 05500.

2. Toilet and Bath Accessories: Section 10800.

1.2 GENERAL INFORMATION

A. Competence: Work under this section shall be manufactured by a well established and experienced firm, acceptable to the Architect, with satisfactory record of similar size and quality installations. Architect reserves the right to reject any subcontractor if it is Architect's opinion that (1) shop capacity, experience of workman, equipment or supply of material will not result in the required quality within time required for completion, or (2) previous performance by manufacturer has been unsatisfactory.

1.3 SUBMITTAL

A. Shop Drawings: Submit shop drawings and manufacturer's literature on all partitions and screens; showing partition sizes, door swings and screen sizes. Indicate all fastening devices, in accordance with Section 01300.

B. Samples: Prior to award of subcontract for toilet compartments, the successful proposed subcontractor shall submit samples of all hardware for approval. No subcontract shall be awarded until the samples are approved by the Architect and Owner.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. General and Manufacturers: Materials, panel and door thickness, accessories, hardware, hardware design, partition design, finishes and color selection must be fully equal and comparable to manufacturer specified. Provide at least 40 different colors and patterns of laminated plastic for selection by Architect, if selection is more limited, non-standard colors shall be provided. Acceptable manufacturers, subject to all criteria or requirements of specifica-

tions are Mid-South Manufacturing Company, the Sanymetal Products Co., Bobrick Washroom Equipment, Inc, Knickbocker Partition Co, Global, Weis, Metpar, Roberts, Accurate, Robart and American Standard, or approved equal.

2.2 TOILET COMPARTMENTS

A. Toilet Compartment Type: Ceiling supported or floor supported as indicated flush partitions with pilasters. Provide extended pilasters, where ceiling height dictates, to maintain 12" from bottom of partition to floor. At all compartments, where indicated, inswinging doors shall be 24" wide; outswinging doors shall be 34" wide. Panels of size to fit space and layout indicated. Compartments specified are based on Type A, floor supported or Type C, Ceiling Hung Style, as manufactured by Mid-South Manufacturing Co.

B. Material: Stiles, panels and doors shall have external surfaces; faces and all edges, covered with seamless high pressure laminated plastic, .062" thick, conforming to NEMA Standards LD-1-1971, as manufactured by Westinghouse Electric Corp, Formica Brand Laminates, Textolite General Electric Co, Pioneer Plastics Corp, and Enjay Fibers and Laminates Co; cores for stiles, panels and doors of chipboard.

C. Construction: Laminated plastic sheets shall be bonded to the cores with a plastic resin adhesive applied under continuous heat and pressure until cured to produce sections approximately 1" thick for doors and panels and 1¼" thick for stiles. Panels shall be hooked to stiles at three (3) points by means of galvanized tension cleats recessed in the panel. Stiles, panels, and doors to be predrilled for application of fittings and hardware.

D. Hardware: Doors shall be equipped with trouble proof hinge set. Each hinge set shall consist of cast-alloy, nonferrous-metal, chrome-plated hinge brackets. The top pivot shall be recessed into the edge of the door 2½" below the top. Heavy stainless steel pivot pin operating in a Zytel nylon bearing shall be anchored above and below the top hinge bracket. The operation of the door shall be controlled by the lower hinge unit which consists of a heavy stainless pintel and mating Zytel nylon cams which permit setting of door at desired position when door is not latched. Slide latch, bumper and keeper, coat hook and wall brackets shall be of cast brass alloy, nonferrous metal, chrome plated. Wall and pilaster brackets and other fittings may be minimum 14 gauge type 302 stainless steel or cast alloy, non-dweeoua Zamak Metal, chrome plated. Aluminum metal in hardware, brackets, or fittings is prohibited. Working hardware shall be brass alloy, chrome plated. All hardware, except coat hooks, shall be throughbolted with one-way type theftproof screws and fasteners. Stile cover bases shall be 3" high of .031 inch stainless steel 302 alloy, hemmed top and bottom, die formed to fit stile.

2.3 URINAL SCREENS

A. Urinal Screen Type: Wall hung, flush panel type, 18" x 42"; 12" from bottom to floor.

B. Material: Panel and high pressure laminated plastic as specified for toilet compartment under 2.2 B & C herein.

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes all wall louvers.

C. Related work specified elsewhere:

1. Field painting: Section 09900.

1.2 QUALITY ASSURANCE

A. Products of the Airolite Co. are specified to establish standards of quality and performance. Products of Construction Specialties; Ventilouvre Co., Inc.; Louvers and Dampers Inc.; Industrial Louvers, Inc.; American Warming and Ventilating Inc.; or approved equal which meet the following specifications, are acceptable.

1.3 SUBMITTALS

A. Shop Drawings: Submit fabrication and installation drawings in accord with Section 01300.

B. Performance Data: Submit certified data from an independent testing laboratory substantiating aerodynamic performance of all louvers and, in addition, acoustical performance of acoustical louvers.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver in sections as large as practicable for handling and installation.

B. Protect as required during handling to preclude damage. Replace any damaged units or parts.

PART 2: PRODUCTS

2.1 EXTERIOR LOUVERS - STEEL

A. Airolite Co., 4" thick, 16-gauge galvanized, bonderized steel, weatherproof profile type, model 638-C-100. Provide with vertical invisible mullions, flashing, sills, as required.

B. Bird screen shall be ½" square mesh, 14-gauge galvanized, bonderized steel, in standard frame, inside mounted.

C. Entire unit prime painted.

2.2 STEEL REINFORCING MEMBERS

A. Rolled steel shapes. Steel conforming to ASTM A-36, sized as detailed or required for installation.

2.3 FLASHING MATERIAL

A. 20-gauge, galvanized, bonderized, steel sheet for steel louvers, shop primed to match louver primer.

PART 3: EXECUTION

3.1 INSTALLATION

A. Erect in accordance with approved installation drawings.

B. Install flashings in conjunction with louvers. Coordinate with other trades and Mechanical Contractor for connections.

C. Install all supporting members as indicated.

D. Provide dissimilar metal protection where required.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installation of combination hose and fire extinguisher cabinets.

1.2 QUALITY ASSURANCE

A. Products specified are those of JL Industries to establish standards of quality. Products manufactured by Larsen's Manufacturing Co., Elkhart Brass Manufacturing Co., or approved equal and meeting the same requirements of performance and design, are acceptable.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings in accord with Section 01300. Submit brochures, schedules, installation details, etc. as required to provide for proper installation.

B. Samples: Submit the following samples in accord with Section 01300:

1. One of each type cabinet.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver cabinets required by Project sequencing, for installation.

PART 2: PRODUCTS

2.1 CABINET

A. Ambassador series, recessed, single extinguisher, Model 202A. Steel prime painted construction, full DSA door with pull handle, red baked enamel finish frame and inside. Verify exact color with Architect. No lettering.

PART 3: EXECUTION

3.1 INSTALLATION OF EXTINGUISHERS CABINETS

A. Install cabinets as construction progresses. Prepare opeings as detailed.

B. Install level and plumb, anchored securely and in accordance with details.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing all wall bumpers and corner guards indicated on the drawings or specified herein. See drawings for type, quantity and location.

C. Related work specified elsewhere:

1. Lath and Plaster: Section 09100.

1.2 SUBMITTALS

A. Shop Drawings. Submit layout and installation drawings in accordance with Section 01300.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in a manner that will prevent damage. Replace damaged material.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products manufactured by Intrad, Tepromark International, Inc., are specified to establish standards of quality and design intent. The equivalent products of Construction Specialties, Inc., Vinyl Plastics, Inc., Pawling Rubber Corp., Afco Rubber Co., Flexco Division of Textile Rubber Co., or approved equal.

2.2 WALL GUARDS (WALL BUMPERS)

A. Pawling WGR-1 Rubber Wall Guards, include all necessary brackets, end stops, outside corners, joint blocks and spacers. Color selected by Architect.

PART 3: EXECUTION

3.1 ERECTION

A. Erect wall guards plumb, true and square in a rigid and substantial manner in strict accordance with approved layout drawings.

B. After erection, clean surfaces with mild detergent and rinse with clear water.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instruction to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes all operable walls (panel type, track hung).

C. Related work specified elsewhere:

1. Support assemblies: Section 05500.
2. Carpentry: Section 06100.
3. Lath and Plaster: Section 09100.
4. Acoustical

1.2 SUBMITTALS

A. Shop Drawings: Submit fabrication and installation drawings of each partition in accordance with Section 01300.

B. Samples: Submit samples of complete color line of fabrics and finishes to the Architect for selection. One fabric and color will be selected.

C. Test Data: Submit reports by an approved independent testing laboratory certifying the operable wall proposed for use in this Project has been tested in a full size 14' x 9' test opening working assembly in accordance with ASTM E90-70 and the assembly meets or exceeds the specified STC requirements.

1.3 PRODUCT HANDLING

A. Package, handle, transport, store and erect at the jobsite in a manner that will avoid damage. Damaged, dented or torn material or panels will be cause for rejection.

1.4 QUALIFICATIONS

A. Manufacturer: The products of Modernfold, New Castle, Indiana are specified to establish standards of quality of appearance, performance and workmanship. The products of Richards-Wilcox Manufacturing Co., Holcomb & Hoke Manufacturing Co., Inc., or approved equal, are acceptable subject to the approval by the Architect of minor deviations from these specifications and the details of installation. The sound transmission class shall be as specified or greater.

PART 2: PRODUCTS

2.1 GENERAL SYSTEM

A. Operable walls as shown on the plans shall be Divisiflex Model 301 with Acoustical "A" Panels, as manufactured by Modernfold, New Castle, Indiana, and as furnished by an authorized representative or equivalent of other named manufacturers. See Article 1.4, herein.

2.2 SOUND TRANSMISSION CLASS (STC)

A. Partitions shall meet the requirement of an STC of 39 as determined in a full scale 14' x 9' opening in accordance with ASTM E90-70 (Geiger & Hamme Test NC-136ST). Single panel tests shall not be acceptable.

2.3 OPERATION

A. Operable partition shall consist of indicidual sliding panels, top supported and manually operated. Each panel shall be capable of negotiating any angular turn or intersection including 90° turns at L, T and X intersections of the supporting track. No floor track shall be required. Expandable panels shall be furnished as required, to effect final closure.

B. Expandable panels shall be complete with an internal telescoping mechanism, manually operated and not requiring a lever or separate tools, and shall not require add-on posts or sleeves for expansion.

2.3 SUSPENSION SYSTEM

A. Steel track shall accommodate angular turns and intersections including 90° L, T and X intersections and permit track layout in a grid pattern. Each panel shall be supported in the track by two adjustable hangers providing free, smooth movement.

B. Suspension shall have been tested by an independent laboratory through 10,000 operating cycles, equal to 12 years typical use, without failure.

C. Provide 3/8" diameter hanger rods as required to support the track without deflection. Suspend directly from reinforced concrete structure using expansion anchors suitable and adequate to the application.

2.4 PANELS

A. "A" panels shall be 2¼" thick, with wood stiles and rails and internal mineral wood sound insulation. Faces shall be ¼" hardboard with specified finishes.

B. Finish: Panels shall be factory finished with hardboard covered with Marking Pen/Projection Surface, equivalent to Illustra-Cote, as manufactured by Laminating Services, Inc., or vinyl wall covering Modernfold Glass-Mesh Jute as indicated.

C. Trim: Panels shall be framed in extruded aluminum trim. Finish shall be satin black. Vertical astragals shall be tongue and groove configuration interlocking ½" for panel stability plus light and sound seal; lead-in shall insure ease of panel alignment. Multi-finger black vinyl sweep seals shall close the

panel-track gaps.

D. Seals: Vertical astragals shall incorporate a flexible vinyl sound seal.

E. Operable floor seals: Each panel shall be equipped with an operable bottom seal, lowered and locked by an enclosed pressure type footbolt. This seal and footbolt combination shall be equipped with a rubber friction base.

2.5 PASS DOOR

A. Provide standard single pass door in one panel at location shown on drawings.

PART 3: EXECUTION

3.1 INSPECTION OF OPENINGS

A. Inspect openings and other work prepared under other sections which affect the first class installation of operable walls and perform no installation until all deficiencies have been corrected. Commencement of installation of operable walls shall be construed as acceptance of all conditions and responsibility for proper operation and performance of the installed partition.

3.2 INSTALLATION

A. Operable walls shall be installed by the manufacturer or his authorized representative.

B. Install operable walls strictly in accordance with manufacturer's recommendations and approved erection drawings. Erect hardware and partitions in a substantial manner complete with operators and all accessories. Upon completion, lubricate operating parts according to manufacturer's instructions, adust partitions and controls for ease of operation and leave installation clean, in good operating condition. Guarantee proper, smooth and easy operable installations. Make all adjustments to insure the performance, including prompt follow-up service during the guarantee period.

C. The operable wall subcontractor shall assume full responsibility for the field performance of the "in-place" partition assemblies. The entire assembly includes the entire sealing at perimeters and the tracks. At the discretion of the Owner or Architect, field tests on the completed assemblies may be performed in accordance with ASTM E336-71. The field performance shall not be greater than 4 to 6 STC below the laboratory STC value specified for the partition. Should the assembly fail the tests, corrections shall be made by this subcontractor and the cost of the test paid by the subcontractor. If the assembly passes, the Owner will pay for the tests.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirments, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing all accessories shown on drawings and specified herein.

C. Related work specified elsewhere:

1. Mirrors: Section 08800.

1.2 GENERAL INFORMATION

A. For recessed items of this Section; either furnish the item with attached anchors for building in as walls are laid or furnish appropriate anchors for building in as walls are laid for attachment of the items where it is to be installed in the recess later.

B. For non-recessed items; furnish appropriate hangers or other fastening devices for building in as walls are laid for later attachment of the item. Provide anchorage devices which will insure secure, permanent attachment.

C. Verify mounting, locations and heights.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings and/or manufacturer's literature on all accessories, showing all anchorage devices. In accordance with Section 01300.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed under each item specified herein.

2.2 TOILET PAPER HOLDER (T.P.H.)

A. Provide one holder for each water closet, whether in a toilet compartment or individual room, with proper mounting and fastening devices for the surface on which it is mounted. At masonry walls, furnish appropriate anchors for fastening devices to the mason to build in as masonry work progresses. Provide devices to insure secure permanent attachment.

B. Provide heavy duty, chrome plated brass tension spring type for roll type tissue, meeting Federal Type No. 129.

C. Acceptable manufacturers: Pocono Metal Products Company and Reliable Metal Products Company, Inc.

2.3 SANITARY NAPKIN RECEPTOR (S.N.R.)

A. Surface mounted on walls behind each water closet in women's toilets. Model 480 sanitary napkin disposal as manufactured by Bradley Washfountain Co. Fabricated of 22-gauge type 304, stainless steel. Piano hinge lid.

B. Acceptable Manufacturers: Units by Bradley Washfountain Co, Miami-Carey Company, Bobrick Washroom Equipment, Inc. and The Charles Parker Co, or approved equal, conforming to these specifications will be acceptable.

2.4 PAPER TOWEL DISPENSERS (P.T.D.)

A. Surface mounted, model 250, towel dispenser units as manufactured by Bradley Washfountain Co, type 304 stainless steel, satin finish exposed surfaces. Doors equipped with tumbler locks, all companion units keyed alike.

B. Acceptable Manufacturers: Units by Bradley Washfountain Co, Miami-Carey Company, Bobrick Washroom Equipment, Inc, or approved equal conforming to these specifications will be acceptable.

2.5 GRAB BARS

A. Mounted in all toilet partitions with "outswinging" doors, on both sides; and elsewhere as indicated on drawings. Series 817 SK-005 and 817 SK-006 (both sides) 1½" diameter with safety grip, 90° angle, type 304 stainless steel as manufactured by Bradley Washfountain Co. Fastenings as recommended by manufacturer to withstand 500 pound pull. Maximum projection of outside of grab bar from wall shall be 3 inches.

B. Acceptable Manufacturers: Units by Bradley Washfountain Co, Miami-Carey Company, Bobrick Washroom Equipment, Inc. and The Charles Parker Co, or approved equal, conforming to these specifications will be acceptable.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing the darkroom equipment indicated on the drawings and specified herein.

C. Related work specified elsewhere:

1. Carpentry

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings of all darkroom equipment in accordance with Section 01300.

B. Instructions: Submit complete operating instructions for each item.

1.3 PRODUCT HANDLING

A. Deliver, store and handle darkroom equipment in a manner that will prevent damage. Repair or replace damaged items.

PART 2: PRODUCTS

2.1 REVOLVING DARKROOM DOOR

A. Provide Model No. 2005 Slimline, 2 way revolving door for 36" doorway as manufactured by Consolidated International Corporation.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install revolving doors in finished opening(s) in strict accordance with the manufacturer's instructions and the approved installation drawings.

B. Adjust all operating parts to provide for smooth, proper operation.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing and installing all laboratory equipment indicated on the drawings or specified herein.

C. Related work specified elsewhere:

1. Connection of hot water, cold water, steam, distilled water and waste piping: Division 15.

2. Electrical connection: Division 16.

D. Furnished by Owner:

1. Refer to Equipment Schedules for Group II equipment furnished and installed by Owner.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings in accordance with Section 01300. Shop drawings shall include rough-in dimensions for utility services.

B. Operating and Maintenance Instructions: Submit written operating and maintenance instructions and instruct the Owner's personnel in the use and maintenance of all equipment furnished under this section (Refer to Section 01700).

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle laboratory equipment in a manner that will prevent damage. Repair or replace damaged items.

1.4 POWER CHARACTERISTICS

A. Electrical power shall be 120 volt, single phase, 60 Hz and 208 volt, 3 phase, 60 Hz alternating current. Heating loads larger than 1.8 KW shall be 208 volt, single phase. Motors larger than ½HP shall be 208 volt, 3 phase.

1.5 COORDINATION

A. The laboratory equipment subcontractor shall be responsible for coordination with the Mechanical Contractor, Electrical Contractor and other contractors and subcontractors having casework, piping, equipment, fixtures, outlet boxes or fittings connecting into or mounted on or adjacent to the laboratory equipment.

B. Contact other contractors directly and provide connection requirements, fixture and equipment sizes and locations, rough-in dimensions, holes and cutout sizes and locations, equipment weights and supports required, methods of attachment and space requirements to connect and service equipment.

C. At locations indicated on drawings, casework contractor (plastic laminate or metal laboratory) shall provide undercounter openings for undercounter refrigerators. Refrigerators are furnished and installed by laboratory equipment sub-contractor - Section 11600.

1.6 SCHEDULE OF LABORATORY EQUIPMENT

A. Refer to drawings and equipment schedule, sheet A-26, for reference, location and service requirements for all laboratory equipment.

PART 2: PRODUCTS

2.1 EQUIPMENT ITEM L-211, GLASSWARE DRYER

A. Radiant Heat Glassway Dryer.

B. Turbo Dryer Series 8000, as manufactured by Better Built Machinery Corporation.

2.2 EQUIPMENT ITEM L-326, GLASSWARE WASHER

A. Heavy Duty Automatic Glassware Washer.

B. Turbomatic Series 3,000 as manufactured by Better Built Machinery Corp.

2.3 EQUIPMENT ITEM L-327, GLASSWARE WASHER/DRYER

A. Existing undercounter unit to be relocated.

2.4 EQUIPMENT ITEM L-328, GLASSWARE WASHER

A. Compact Automatic Glassware Washer.

B. Turbomatic Jr. Series 7000 as manufactured by Better Built Machinery Corp.

2.5 EQUIPMENT ITEM L-329, GLASSWARE WASHER/DRYER

A. Undercounter Glassware Washer/Dryer.

B. Turbomite Model UC100 as manufactured by Better Built Machinery Corp.

2.6 EQUIPMENT ITEM L-338, GLASSWARE WASHER

A. Existing unit to be relocated.

2.7 EQUIPMENT ITEM L-570, FLAMMABLE LIQUID STORAGE CABINET

A. Wall hung ventilated flammable liquid storage cabinet.

B. Model No. 5530 as manufactured by Protectoseal Co.

2.8 EQUIPMENT ITEM M-855, CONFERENCE ROOM KITCHEN UNIT

A. Compact unit kitchen.

B. Model EB400S as manufactured by Dwyer Kitchens, Inc.

2.9 EQUIPMENT ITEM P-121, MORTICIANS WATER CONTROL SYSTEM

A. Compact water control unit.

B. Model No. C32B/7160 Pierce Water Control Unit as manufactured by Pierce Chemicals/Morticians Supply Co., 409 Zone Blvd, Dallas, TX 75208.

2.10 EQUIPMENT ITEM R-621, UNDERCOUNTER REFRIGERATOR

A. Compact undercounter laboratory refrigerator.

B. Model No. UC-5-BC as manufactured by Jewett Refrigerator Co., Inc.

2.11 EQUIPMENT ITEM R-625, UNDERCOUNTER FREEZER

A. Compact undercounter laboratory freezer.

B. Model No. UC-5-F-CW as manufactured by Jewett Refrigerator Co., Inc.

PART 3: EXECUTION

This part not used.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing all metal laboratory casework indicated on the drawings or specified herein. The work includes, but is not limited to, the following:

1. Metal laboratory casework including floor mounted base cabinets, full height storage cases, wall mounted storage cases, aprons, legs, back panels and filler panels.

2. Remodeling and reinstalling of existing metal laboratory casework, all work to be in accordance with the provisions for new casework specified herein.

3. Countertops for base units including curbs and backsplashes.

4. Reagent racks and box service turrets.

5. Integral stainless steel sinks and cup sinks occurring in stainless steel countertops. Sink outlets, strainers, plugs, overflows, and tailpieces for integral stainless steel sinks and cup sinks furnished under this section.

6. Supports for sinks and other built-in equipment occurring in casework.

7. Fume hoods and supporting cabinets and work tops, and asbestos lined volatile storage cabinets where indicated. Volatile storage cabinets to comply with NFPA No. 30 - Flammable and Combustible Liquids Code.

8. Light fixtures occurring in fume hoods with switch and connecting conduit and wire. Light bulbs for light fixtures. Electrical outlets, and pilot lights mounted in fume hood walls with connecting conduit and wire to a junction box.

9. Aluminum air by-pass grilles in fume hoods.

10. Stainless steel exhaust hoods or enclosures at ceiling.

11. Metal covers for service columns.

12. Laboratory pegboards.

13. All stainless steel work counters, with or without sinks, located in rooms with metal laboratory casework is to be provided.

14. All fixed and adjustable wall mounted metal shelving and shelving constructed of laboratory countertop materials, with support systems.

15. All wall mounted plastic laminate covered shelving, complete with standards and brackets, in rooms where metal laboratory casework is to be provided. See Article 1.3 herein.

16. Tests and samples as specified.

17. Metal narcotics lockers, including narcotics lockers set in plastic laminate casework. (See Article 1.3 herein.)

18. Support systems for all casework, shelving, sinks, counters and similar items.

19. Coordination of remodeling and reinstallation of existing casework only where it interfaces with new casework of this Section 11611 (other existing casework is coordinated under Section 11613).

20. Other related and miscellaneous work to complete the work of this section.

21. Chalkboard surface cabinet doors.

C. Related work specified elsewhere:

1. Fixed and adjustable wall mounted plastic laminate and wood shelving and support systems: Section 06400.

2. Resilient base against walls and base against toe space of floor mounted casework on resilient flooring: Section 09650 (see Article 1.3 herein).

3. Refinishing existing casework: Section 11613.

4. Undercounter Refrigerators set in openings in metal casework: Section 11600. (See Article 1.3 herein.)

5. Laboratory Equipment: Section 11600.

6. Removal, remodeling, refinishing and reinstalling existing metal laboratory casework and refinishing existing casework in place: Section 11613.

7. The following work is specified under Division 15:

a. Sinks, cup sinks, drains and drain fittings including outlets, sink plugs, strainers, overflows, tailpieces, traps and plaster traps, (except as specified in Article 1.1.B.4 above)

b. Installation of sink outlets, strainers, plugs overflows and tailpieces furnished under this Section 11611.

c. Plumbing service fixtures including oxygen, gas, air and vacuum cocks and turrets; hot, cold and distilled water faucets, cocks and stops, remote controls; and similar items.

d. Plumbing rough-in and piping including piping occurring within casework, fume hoods, pipe chases behind casework, box curbs, reagent racks and service columns. Pipe supports, brackets, bolts, clips and similar accessories for piping.

e. Ductwork (from fume hood outlet) and blowers for fume hoods. Absolute filters for isotape hoods.

f. Canopy hoods and exhaust hoods (except as specified under Article 1.1.B.9).

8. The following work is specified Under Division 16.

a. Electrical outlets, switches, plug mold, pilot lights, conduit, wiring, boxes and similar electrical work (except as specified in Article 1.1.B.7 above).

D. Furnished by Owner:

1. Refer to Equipment Schedules for Group II, Equipment Furnished and Installed by Owner.

1.2 QUALIFICATIONS

A. The metal laboratory casework manufacturer shall have an established organization and production facilities, specializing in this type equipment, shall be currently engaged in the manufacture of metal laboratory casework, shall have the demonstrated ability to produce the specified metal laboratory casework of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

B. The Casework Subcontractor (and Bidders) shall have an established resident local representative in the Minneapolis-St. Paul Metropolitan Area who is fully qualified in laboratory casework and has the authority to make decisions and act for the subcontractor.

C. All metal laboratory casework furnished under this Section shall be the product of one manufacturer, except for those elements (i.e. tops) which may be specified by naming another manufacturer or producer.

D. Casework shall be Pacemaker Steel Casework as manufactured by Hamilton Industries Division of American Hospital Supply Corporation. The equivalent products of Kewaunee Scientific Equipment Corporation, Jamestown Metal Products Co. and St. Charles Manufacturing Co. will be acceptable sugject to the approval of the Architect of minor deviations in detail from the products specified.

1.3 COORDINATION

A. The metal laboratory casework subcontractor shall be responsible for coordination with the Mechanical (sub)Contractor, Electrical (sub)Contractor and other contractors and subcontractors having equipment, fixtures, outlet boxes or fittings built into or mounted on or adjacent to the metal laboratory casework.

B. Contact other contractors directly and obtain fixture and equipment lists, fixture and equipment sizes and locations, rough-in dimensions, holes and cutout sizes and locations, equipment weights and supports required, methods of

attachment and space requirements to connect and service equipment.

C. At locations indicated on drawings, provide openings for other equipment. Provide filler panels required.

D. Fixed and adjustable shelving, including anchorage, related brackets and standards to be furnished as follows:

1. Plastic laminate shelving in all rooms to be furnished by Section 06400 and installed by Section 06100.

2. Wood shelving, hardwood and softwood, in all rooms to be furnished by Section 06400 and installed by Section 06100.

3. Shelving of countertop materials in all rooms, including animal areas, to be furnished and installed by Section 11611.

4. Shelf standards to be extra heavy duty type - K.V. 87, or equal, and extra heavy duty type adjustable bracket - K.V. 187, or equal, complete with end rests - K.V. 212 (or 210 and 211), to be furnished by section furnishing shelving.

5. Unistrut framing and shelf standards to be furnished and installed under Section 11611.

E. Resilient base at floor mounted casework to be furnished & installed as follows:

1. At resilient flooring, install casework prior to installation of flooring. Resilient flooring (V.A.T.) by Section 09650 will stop at the base of the casework and will not continue underneath. Resilient base will be applied to the casework base by Section 09650 (but not to walls concealed by casework).

2. At composition flooring, first install composition flooring and composition base at all areas and walls (including floor underneath and walls behind casework), and then install casework. The basework supplier shall apply a continuous toe bead of sealant at juncture of casework base and composition flooring. Sealant by casework supplier to be Tremco, or equal, non-hardening type, compatible with composition flooring. The casework supplier shall furnish and install the resilient base, in compliance with requirements of Section 09650. Seal and embed the toe of the resilieht base in sealant during installation. At completion, clean excess sealant and adhesive.

1.4 SUBMITTALS

A. Shop Drawings. Submit shop drawings in accordance with Section 01300.

1. Shop drawings shall be prepared specifically for this Project. Provide drawings for rough-in for building construction promptly to prevent construction delays and if necessary, furnish rough-in drawings prior to other shop drawings. Provide overall plans, details, sections and connections to adjacent work. Shop drawings shall indicate: method of attaching wall mounted cases to walls; field joints, fillers and scribe strips; size and location of equipment fixtures and fittings furnished by other contractors to be built into or mounted on or adjacent to the casework; rough-in dimensions and size and location of holes and cutouts. Manufacturer's "standard" shop drawings are acceptable for individual

pieces of casework provided, holes, cutouts, rough-in and similar data is indicated. Shop drawings shall include all plans, elevations, details and other information necessary to insure a complete installation.

2. Shop drawings shall locate all critical studs for mounting or anchoring casework items, including shelving and all wall mounted casework. A stud shall be located within 4" in from the end of a wall case.

3. Take field measurements and verify field conditions as necessary. Indicate field measurements and other field conditions on shop drawings.

4. Submit shop drawings and erection drawings to other contractors concerned.

B. Test Reports: Promptly after award of Contract, prior to commencing shop drawings and fabrication, submit certified reports of tests of the (1) bending properties, chemical resistance and moisture resistance of the metal casework finish, (2) physical properties chemical resistance and heat resistance of the solid epoxy resin tops and (3) performance capabilities of the fume hoods. Tests shall be conducted by a nationally recognized, independent testing laboratory, and reports shall indicate the testing procedures and certify the findings. Test procedures shall be as specified hereinafter.

C. Samples. Upon request of the Architect, submit the complete set of samples previously specified for qualifying bidders, under 1.2.F.4 above. (Note: These samples may be in addition to those specified for prequalification). Deliver samples to the location in the Minneapolis-St. Paul Metropolitan Area as directed by the Architect. Uncrate samples and assemble. Remove samples when directed by the Architect.

D. Fume Hood Demonstration. As soon as practicable after award of Contract, conduct a demonstration of fume hood performance at the specified face velocity maintaining the required exhaust rate. The demonstration may take place at the casework manufacturer's plant or at another location determined by the casework manufacturer. The test demonstration shall be conducted by, or witnessed by, an independent testing laboratory, with the report results certified by the laboratory. Conduct the test in general conformance with Article 3.2. Notify Owner and Architect in advance to permit their observing the test, if they choose. Submit certified reports to Owner and Architect.

E. Maintenance and Cleaning Instructions: Submit written maintenance and cleaning instructions and instruct the Owner's personnel in the care and maintenance of all casework and equipment furnished under this section (refer to Section 01300).

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle metal laboratory casework in a manner that will prevent damage. Repair or replace damaged material.

B. Deliver casework to insure completion in accordance with the Contractor's Construction Schedule and to meet the Project completion date. Coordinate delivery of casework with the actual status of work at the site. If items of case-

work are too large to be moved through permanent openings in the building, deliver casework to its approximate final location before access is restricted by surrounding construction and make arrangements with other contractors to provide temporary openings or ship casework in subassemblies which may be moved through permanent openings and then assembled. Protect casework from damage during storage.

C. To assist in assuring casework on hand when required for installation, casework may be delivered and stored by the casework subcontractor in shell spaces of the Project as determined by the University. The University will designate which spaces may be used for storage and the deliveries shall be scheduled with the University.

PART 2: PRODUCTS

2.1 MATERIALS

A. Sheet steel shall be prime grade, cold rolled stretcher or roller leveled mild steel free of scale, ragged edges, deep scratches and other injurious defects. Gauges shall be US Standard Gauge.

B. Stainless steel shall be chromium-nickel steel sheet conforming to ASTM A-167-70, Type 316. (Type 304 may be used for wall shelving and ceiling exhaust hoods only). Finish of exposed surfaces shall be AISI No. 4 mechanical finish. Gauges shall be U.S. Standard Gauge.

C. Glass for frame sliding doors shall be 1/8" double strength. Glass used in fume hoods or other hazardous locations, shall be combination laminated safety glass. Use tempered glass where specified or required.

D. Cement-asbestos board shall be asbestos fibers and Portland cement combined under extreme pressure into homogeneous integrally colored sheets of the thickness shown, specified or otherwise required, Transite, or approved equal.

E. Sheet lead shall be 99.9% pure virgin lead free from dross, oxide inclusions, laminations, scale, blisters or cracks.

F. Structural steel, if any, shall conform to ASTM A36. Any structural steel that is exposed to view shall have the same smooth surface as the sheet steel, free from pits, scale, depressions and other defects.

G. Provide all clips, support angles and brackets of hot-rolled mild steel, painted.

2.2 METAL CABINETRY - GENERAL

A. Metal cabinets shall be designed and constructed so that each case is a complete and integral, rigid, self-supporting unit that may be used by itself or

in an assembly of cabinets. Metal cabinetry shall be rigidly constructed and so assembled that it can be relocated at any time. No manufacturer's label shall be applied to the exterior of cabinetry, nor on inside faces of drawers and doors. Any proposed labels shall be approved by the Owner, in inconspicuous locations.

B. Metal cabinet parts shall be notched, keyed, tightly fitted and electrically welded to form rigid units. Cabinets shall have a smooth, cleanable interior. The channel shape at the front upright of cases shall be closed to provide a cleanable interior. Formed metal shapes for drawer and door stops shall be fully closed on the interior, including at top and bottom. Die-pierced slots and perforations required for the mounting of drawers channels, hinged or shelf brackets, shall not be visible from the exterior of the assembled cabinet. Cabinets shall be completely welded to present a finished, smooth exterior and shall have reinforced corner gussets behind intersecting members.

C. Cabinets shall have a finished, flush, smooth face at all exposed sides. Where members intersect, they shall be on the same plane (not overlapped) to provide the flush, smooth surface across the joint. Exposed finished ends of cabinets shall have no punched holes, nor fastenings which are not flush with the end panel.

D. Minimum gauges of steel for cabinet construction shall be as follows:

1. Drawer assembly, door assembly and adjustable shelves - 20 gauge.

2. Front horizontal rails, table legs and aprons - 16 gauge.

3. Hinge reinforcements, case and drawer support channels and corner gussets - 14 gauge.

4. All other parts not otherwise specified - 18 gauge.

E. Metal cabinetry shall be manufactured to the dimensions indicated on the drawings. Exact widths of 18", 24", 30", 36", 42", 48" and 54" are required; nominal dimensions differing from these exact widths will not be permitted. Vertical dimensions shown, but bottom edges of both low and high counter units shall align at the same height above the floor. Typical nominal base cabinet depth is 1'-10".

F. Full height cabinets may vary plus or minus ½" from the 7'-0" height indicated. Wall case heights may vary plus or minus 1" from dimensions indicated, but shall be mounted with the top at the same height as the full height cases.

G. Construct cabinets, frames, tops and other components to provide the full, clear pipe space dimensions called for, in a single pipe space chase.

H. All cabinets shall have bottoms. Bottoms shall be pan type with sides and backs turned up.

I. All cabinets shall have backs, except units with a full bank of drawers may

have the back omitted provided the unit is constructed to form a rigid, non-racking unit. Backs may be welded to the cabinet framing. At units in front of piping or other services, provide removable backs. At units 30" wide or less, provide the removable back in one piece, full height between top rail and cabinet bottom, full width between end panels or end panel and intermediate vertical back post, formed for rigidity. At cabinets over 30" wide, removable back may be two-piece, split vertically, with formed offset to insure positive snug fit. Removable backs may be pan construction or have other forming at the four edges to provide rigid panel. Removable backs and cabinets shall be constructed so the back is held snugly in place, without rattling, utilizing snap-in devices if necessary. Removable backs shall be removable without the use of tools. Provide finished backs on cabinets with backs exposed to view.

J. Hinged doors and drawer fronts may either overlap cabinet ends, top and bottom or may be recessed (inset) within the cabinet and be flush with the cabinet ends, top and bottom. If recessed doors and drawers are used, cabinet openings shall be rabbetted on four sides to receive the doors and drawers.

K. Cabinets shall be constructed to have shelf adjustment on approximately 1" centers by means of shelf adjustment holes.

L. Stainless steel cabinets shall be of the same construction as the metal casework described below, except that the metal shall be of the specified stainless steel and of the gauges indicated for other steel cabinets.

2.3 UNDERCOUNTER CABINETS - GENERAL

A. Intermediate horizontal rails shall be provided between door and drawer sections occurring in a single cabinet, concealed when door and drawers are closed. Intermediate rails shall be provided wherever required for locking of drawers. Wherever locked doors or locked drawers occur, provide horizontal rail above the locked drawer or door, with security panel above the cabinet space or drawer. Security panels may be locked-in type.

B. Intermediate vertical rails shall be furnished at cabinets only where required for a half-width bank of drawers and be removable. Vertical rails shall not be used at the center of double door cabinets.

C. Vented volatile storage cabinets, including ones below all fume hoods, shall be lined with cement-asbestos panels not less than ¼" thick and equipped with one 16 gauge, Type 316 stainless steel expanded metal shelf. Ventilation holes or slots shall be provided at top of cabinet doors covered with heavy copper screen on inside. Vented cabinets shall be vented to the fume hood superstructure above by means of two stainless steel vent pipes (one extending to near bottom of cabinet and one near top) extending up to 1" or more through the hood deck behind baffle. All cabinets below fume hoods shall be vented. Only one cabinet per standard laboratory shall be painted for flammable storage, as specified under Article 2.12, Paragraph E.

2.4 FLOOR MOUNTED BASE CABINETS

A. Floor mounted base cabinets shall be conventional floor mounted metal laboratory cabinets. Cabinets shall have an integral or removable metal base

with a toe space not less than 4" high and 3" deep.

B. Floor mounted base cabinets shall support the countertops directly in the conventional manner.

C. Provide table frames and legs for knee spaces. Legs shall be square steel tubing with a recessed leveling bolt with bottom flange. Each leg shall have a 2½" high, coved, molded, black rubber shoe. Provide removable back panels for knee spaces. Provide casters for movable tables.

D. Provide support struts for all floor mounted base cabinets as necessary to support plumbing and water piping and conduit occurring within pipe chases behind casework and elsewhere as indicated on the drawings. Support struts shall be spaced 8'-0" maximum on center. Support struts shall consist of two 16 gauge channel uprights fastened top and bottom with two U-shaped spreaders. Channels shall receive standard fittings.

E. All other details of construction shall be as specified above, in Articles 2.2 and 2.3.

2.5 WALL MOUNTED STORAGE CASES

A. Wall mounted stroage cases shall have a fixed back, solid top and flush finished bottom or flush soffit panel at bottom. Other details of construction shall be as specified in Article 2.2 above. Wall mounted casework shall also include wall type cabinets that are supported on reagent shelves, including back to back units as at details 12 and 31/A34.

B. Wall mounted storage cases shall be attached to walls and partitions using the casework manufacturer's standard method of attachment. (In general, partitions are steel stud partitions with either plaster or gypsum drywall.) Wall mounted storage cases shall be capable of supporting a load of 250 pounds per square foot evenly distributed over the bottom of the case without failure of the attachment to the wall. On shop drawings, locate critical stud locations for other trades, with a stud within 4" in from cabinet end.

2.6 FULL HEIGHT STORAGE CASES

A. Full height storage cases shall have a fixed back, a solid top and a toe space not less than 4" high and 3" deep. Other details of construction shall be as specified in Article 2.2 above. Full height cases shall be securely anchored to surrounding construction. Provide leveling devices and gussets at each corner.

2.7 HINGED SOLID DOORS

A. Hinged solid doors shall be approximately 3/4" thick, double wall construction and fully sound-deadened.

B. Hinged doors shall be readily removable from the cabinetry and easily interchangeable among cabinets of equal size. Hinged doors shall swing through a 180° arc.

C. A hinged solid door, mounted on a cabinet shall be capable of supporting without permanent distortion, a concentrated load of 200 pounds at its outer top edge, while door is being swung.

D. The outer door pan of all hinged solid doors shall be provided with a recessed door pull as specified in Article 2.13 below. A 14 gauge hinge reinforcement member shall be electro-welded to the inner pan at each hinge location. All four corners of outer door pan shall be welded and finished smooth before painting. All parts of the door assembly which will be concealed after the door is assembled shall be painted completely before assembly. Each door shall be equipped with rubber bumpers applied to the inner door face. Doors three feet high or less shall have two bumpers, and door greater than 3 feet high shall have three bumpers.

E. Where locks are required, the outer door pan shall be pierced for that purpose. Where locks are required on double door cabinets, the left hand door shall be furnished with up-and-down bolts and a concealed astragal. Alternate methods of locking pairs of small cabinet doors will be acceptable, subject to the method providing positive locking of both doors and it is not possible to spring doors open. Up and down bolts at full height case doors are required, as specified under Article 2.13.H.

F. Provide security panels between drawer space and cabinet behind doors wherever drawers occur above doors to be locked.

G. Hinged doors shall be fastened to the cabinet side by use of 2½", five knuckle institutional type, heavy duty chrome-plated steel hinges. Each hinged door shall be provided with a nylon roller-type friction catch assembly. For doors 36" or less in height, heavy duty knife type hinges (minimum 11 gauge) will be acceptable. No painted hinges permitted.

2.8 GLASS SLIDING DOORS

A. Glass sliding doors shall be frameless type, of ¼" plate or float glass. Glass edges shall be eased to lightly rounded edge with edge finished to straight line, smooth and free of hazards.

B. Glass panels shall be fitted into a metal bottom shoe with nylon rollers, rolling in a bottom track for easy operation. Track shall be concealed in a formed recess at the bottom of the track. Glass panels shall have formed guides at the top, with nylon or equivalent spacers to provide quiet, easy operation. For tall, full height doors, an equivalent approved top hung glass roller assembly may be used.

C. Provide rubber bumpers at jambs, top and bottom of opening. Provide solid pull at bottom shoe, each panel, for wall cases. At full height door panels, provide solid block-type pull at about mid-point of door panels.

2.9 DRAWERS

A. Drawers shall be manufactured to the heights as scheduled and/or indicated on the drawings. Where height of drawers have a specific dimension, drawers shall be manufactured to these exact dimensions. Where drawers are indicated to

be equal height, a combination of drawers of two different heights will be permitted, provided the height of the drawers does not vary more than 1", unless otherwise indicated on the drawings.

B. Drawer assembly shall consist of an inner drawer head, an outer drawer head, a drawer body and a drawer back. The drawer head shall be not less than 3/4" thick, square edges and sound-deadened. The drawer body shall be electro-welded to the drawer back and to the drawer head assembly. Drawer body may be one piece construction, with removable drawer head. The outer drawer head shall not present an exposed raw edge of metal along the top inside edge of the drawer. Where locks are required the outer drawer head shall be perforated for that purpose. Both the inner and the outer drawer heads shall be fully painted before assembly. Drawer heads shall be provided with pulls as specified in Article 2.13 below. As a minimum, the top corners of the outer drawer head shall be welded and finished smooth before painting; bottom corners may be welded or butted to a hairline seam. The assembly of drawer head shall provide the head securely held in place, to a true vertical face which cannot be displaced out of plane. 48" wide drawer bodies shall be reinforced on the bottom by a full length plug hat reinforcement.

C. Drawers shall operate quietly and smoothly on a nylon roller and channel suspension, with front rollers set into case channels and rear rollers set into drawer channels. Nylon rollers shall be large diameter, of the type with steel ball bearing races. Case channels shall maintain alignment of drawer and provide an integral drawer stop to prevent the inadvertent removal of the drawer, but drawers shall be removable without the use of tools. Drawers shall have not less than two rubber bumpers on the inside drawer head to cushion closing the drawer.

D. Shallow drawers at knee spaces which do not permit use of drawer suspension specified above shall have steel guide angles and nylon slides. Drawers shall be arranged for smooth operation and easy removal. Drawers shall have rubber bumpers as specified above.

E. Provide security panels above drawers to be locked.

F. Refer to detail 19/A34. In all drawers, provide the capability to locate divider panels as indicated. Provide removable, adjustable dividers at all drawers in the location of the top row of drawers (immediately under countertop).

2.10 ADJUSTABLE SHELVES

A. Adjustable shelves should be constructed with a double channel at the front and rear edges, full depth, and flanged down at the sides. Adjustable shelves over 38" in length shall be reinforced by a flanged channel welded to the underside of the shelf.

2.11 CLOSURE PANELS, FILLER PANELS AND SCRIBE STRIPS

A. Knee spaces shall have back panels, except where top is less than 25" deep or noted otherwise.

B. Provide closure panels to close exposed ends of pipe chases. Where back of pipe chases are exposed to view, provide closure panels to close back.

C. Provide filler panels where indicated on the drawings or as required for a flush front at banks of components.

D. Knee space panels, closure panels and filler panels, knee space and pipe space closure shall be removable and interchangeable between similar locations.

E. Where casework extends from wall to wall, provide equal width scribe strips at each end to close openings between casework and walls.

2.12 CASEWORK FINISH AND COLOR

A. After units have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of finish system to metal and to aid in prevention of corrosion. Physical and chemical cleaning of the metal shall be accomplished by washing with a hot alkaline cleaner followed by a thorough rinsing. The clean metal shall then be treated with metallic phosphate solution, followed by a thorough water rinse and a chromic acid rinse to set the phosphate surface. The resulting uniform, fine-grained, crystalline phosphate surface shall provide excellant bond for the finish coats and provide increased protection against humidity and corrosion.

B. Immediately following the phosphate treatment, a corrosion-resistant synthetic resin primer shall be applied to all surfaces and baked at a high temperature. Primed units shall then be cooled, inspected, and sanded where necessary prior to the application of the durable finish coat.

C. A high-bake, synthetic resin finish coat shall be applied over the primed surfaces and baked at the required high temperature to produce optimum coating properties.

D. Colors shall be as selected by the Architect. Colors may be selected to match or compliment those existing, and may include colors which are not standard with the casework manufacturer, requiring special colors. In general, doors, drawer fronts and cabinet bodies shall be the same color. Two-tone painting will not be required and all cabinets in a room will be the same color. Up to six colors for the entire Project may be selected.

E. Only one of the vented lower fume hood cabinets in each standard laboratory shall be painted for flammable storage, located where directed by the Architect. Paint the doors (not cabinet frame) with yellow fire retardant paint, color as selected by the Architect. Across the front, letter FLAMMABLE STORAGE - KEEP FIRE AWAY in red, Helvetica Medium lettering style. Letter size as selected or approved by the Architect.

F. The finish shall be able to withstand a 180° bend over a 3/8" diameter mandrel without chipping or flaking using a Gardener Conical Mandrel #1620 or equivalent, conforming to ASTM D522-41 procedure.

G. The finish shall be highly resistant to moisture and chemicals and shall meet the performance requirements of the casework manufacturer's current, pu-

blished moisture and chemical performance tests.

H. In scheduling the fabrications, finishing and delivery of casework, the fabricator shall recognize and take into consideration the multiple colors of finshing. To assure timely delivery of casework to meet the installation sequence and schedule, it may not be possible to finish all casework of a particular color at the same time, unless the fabricator is prepared to store later delivery casework and is able to finish all various colors to meet the required installation schedule.

2.13 HARDWARE AND ACCESSORIES

A. In general, it is desirable to match hardware with that existing, and as far as possible provide matching hardware. All chrome plated hardware shall have satin brushed chrome finish.

B. Door and Drawer Pulls: Drawer and hinged door pulls shall be anodized aluminum with No. 4 finish on all surfaces exposed to view. Pulls shall be nominal 4" wide by 1½" high. Pulls shall be recessed flush with drawer and hinged door fronts. Locate pulls as generally as shown on drawings. The locations of pulls may vary slightly, from drawings and specifications, subject to Architect's approval in appearance and function. Confirm final locations when final samples of casework are submitted.

1. Base Units: On base units pulls shall be positioned horizontally with the top of the pulls, approximately 3/4" below the top of the door or drawer.

2. Overcounter Units: On overcounter units pulls shall be positioned horizontally as indicated on drawings, approximately 3/4" from the bottom of the door.

3. Full Height Units: Pulls are to be positioned vertically, 3/4" from the edge and at door centerline. Full height units may have latch handle or knobs of approved design.

C. Hinges: Shall be 2½" five knuckle institutional type, heavy-duty chrome plated steel hinges. Hinges shall have hospital tips and full 180° opening. Hinged doors 36" or less in height shall have one pair of hinges per door, and hinged doors greater than 36" in height shall have 1½ pairs of hinges per door. Hinges shall not be welded to the cabinet or to the door. Hinges shall be applied with four 8-32 by 3/8" flathead screws. For doors 36" or less in height, heavy duty (minimum 11 gauge) stainless steel knife type hinges will be acceptabel, subject to meeting the load test. No painted hinges permitted.

D. Continuous Hinges: 0.045" thick wrought steel. Finish as specified for metal.

E. Locks: Provide locks for doors and drawers where indicated on the drawings. Locks for the purpose of coordinating keying systems, shall be Illinois "Duo", Type A, or approved equal, offering 2 sets of 5 primary tumblers and one set of 4 secondary tumblers. Locks shall be Grand Master keyed to Owner's existing GM Key System. Controlled key blanks and registered key plan shall be used to assure a complete security system. Use and installation of locks shall assure a

complete security system. Locks offering other than a non-duplicating system will not be accepted. Keying as directed by Owner. Casework contractor shall meet with Owner to establish keying schedule.

F. Friction Catches: Shall be spring actuated, adjustable nylon-roller type friction catches. Properly sized magnetic catches will be acceptable, provided they are of sufficient power to hold the door as firmly as the specified catches. Catches determined to be undersized by the Owner shall be replaced.

G. Elbow Catches: Cadmium-plated steel elbow catches and strike plates shall be used on left-hand doors of double door cases where locks are used.

H. Up and Down Bolts: Hinged full height storage cases shall have right-hand door provided with an active knob and up-and-down bolt assembly. Left-hand door shall have an astragal strip, allowing the door to be opened only when right-hand door is open. Left-hand door shall be provided with a dummy pull. Up-and-down bolts shall be concealed between pans of solid doors.

I. Sink Supports: Sink supports and reinforcing shall be adequate to support a fully loaded sink without causing deflection, distortion or sink movement. Where necessary on large sinks, provide an additional line of supports. Coordinate dimensions with Mechanical Contractor to propery locate the sink supports, with allowance for adjustment in the leveling devices. Sink supports shall be hanger type, suspended from top front and top rear horizontal rails of cabinet by four ¼" rods, threaded at bottom end and offset at top to hang from two full length reinforcements welded to the front and rear rails. Two 3/4" by 1½" by 12 gauge channels shall be hung on the threaded rods to provide an adjustable sink cradle for supporting sinks. In lieu of hanger type sink supports, the supports at base cabinets may be heavy cross channels securely fastened to cabinet framing, or reinforced back, to form a sturdy support system. All support systems shall have 4 point leveling. Submit sample of support system for final approval.

J. Shelf Supports and Shelf Adjustment Clips: Shall be provided on interior of cabinets to provide shelf adjustment on approximately 1" centers. Shelves longer than 4'-0" shall be supported at the center by an additional partition or a full width bracket.

K. Wall mounted shelving, counters and similar items; Provide the wall brackets as indicated on drawings for non-adjustable items, designed to adequately support the item under full loading. Where indicated, or otherwise required for heavy loaded items which require adjustment, provide proper sized Unistrut channels and brackets for the loads and conditions. For adjustable wall shelving, provide extra heavy-duty slotted standards equal to Knape and Vogt No. 87, with appropriate brackets, satin chrome finish.

L. Pegboard Panels: Shall be constructed of a combination of Portland cemnt and asbestos fibers impregnated with phenolic resin and pressure bonded into a solid sheet 1" thick and shall have a high bake, black chemical resistant enamel finish. Where pegboards are integral with box curb or backsplash (i.e.: detail 17/A34 they shall be epoxy resin, the same as the top and curb or backsplash.

M. Pegboard Pegs: Provide polypropylene pegs, except provide stainless steel rod pegs at locations of stainless steel work. Pegs shall be held in panel by mechanical design and easily removable from board.

N. Bumpers: All drawers and doors shall close against rubber bumpers, minimum of two with additional bumpers as specified elsewhere. Bumpers shall be type that are "locked-into" holes in casework by means of retaining collar. Stripable "tape" type rubber cushions are not acceptable.

2.14 SOLID MODIFIED EPOXY RESIN TOPS

A. Solid modified epoxy resin countertops and working surfaces shall be Duriron Company Durcon 2A 1¼" thick.

B. Solid modified epoxy resin countertops and working surfaces shall be molded from a modified epoxy resin that has been especially compounded and cured to provide the optimum physical and chemical resistance properties required of a heavy-duty laboratory table top. Tops and curbs shall be a uniform mixture throughout their full thickness, and shall not depend upon a surface coating that is readily removed by chemical or physical abuse. Tops and curb shall be non-glaring and black in color.

C. Tops shall have a level true surface and uniform thickness. Tops shall have drip grooves on the underside exposed edges. Exposed edges, except as indicated below, shall be rounded to approximately a ¼" radius at front top edge and at vertical corners. Provide 3/4" thick epoxy resin backsplash or 4" high curbs as indicated on drawings. A curb shall be provided against all walls (at back and ends) unless otherwise shown, set in chemically resistant adhesive. At fume hoods, the curb shall be integral with the top; coved to approximately 3/4" radius.

D. Sink cutouts shall be smooth and uniform without saw marks and the top edge shall have a uniform radius of approximately 1/8". The bottom edge of the sink opening shall be finished smooth with the edge eased to prevent sharpness. Corners of sink cutouts shall be radiused not less than 3/4".

E. Where indicated on the drawings (in fume hoods), table tops shall be indented not less than ¼" to provide a raised rim approximately 5/8" wide around all exposed edges. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded to not less than 1/8" radius. The junction between the raised rim and the top surface shall be coved to approximately a ¼" radius. See Article 2.18.E for front ledge at fume hoods.

F. Physical properties of modified epoxy resin tops shall include flexural strength (ASTM D790-49T), compressive strength (ASTM D695-54), Rockwell M hardness (ASTM D785-51); heat resistance and chemical resistance of solid epoxy resin top shall equal the Duriron Company's current published specifications. Prime Resin is acceptable.

1. Heat and chemical resistance performance tests shall be conducted according to the test procedures contained in the Duriron Company's current published specifications.

2.15 STAINLESS STEEL TOPS, COUNTERS, WORK SURFACES, SINKS, HOODS AND SHELVES

A. All stainless steel shall be as specified under Article 2.1.B, with the

specified finish at all exposed surfaces. Use Type 316 for all work, except as specifically noted under 2.1.B.

B. Except where a lighter gauge may be specifically noted on drawings for minor surfaces, provide minimum of 16 gauge stainless steel. Provide heavier gauge as may be necessary for the intended use and to maintain flat surfaces, free of distortion and oil-canning. Gauges are "after finishing".

C. In general, fabricate without framing as far as possible, with structural strength being achieved by the gauge of metal and integrally formed edges. However, reinforce tops, counters and similar surfaces on the back or underside with 16 gauge formed carbon steel channels or other appropriate shapes, spaced as necessary, where required to provide and maintain flat surfaces under heavy loading and to prevent twisting, warping, oil-canning or buckling. All metal work shall be free from pinch marks, buckles, creases or other defacing marks.

D. In general, detail and fabricate in accordance with National Sanitary Foundation (NSF) standards for food service equipment. NSF labels not required. Shop fabricate into complete units as far as possible. When manufacturing process or welding destroys original finish, regrind and polish to match adjoining surfaces. No bracing, support or other features shall show through finished tops. Provide rounded external (free) corners, as at tops. Construct to eliminate unsightly connections, free from sharp edges or corners, without fins, projections or other hazards. Fabricate to eliminate field joints as far as possible. Where field joints are required by the size of the unit, field weld, grind and polish the joint to match remainder of surface finish. Detail and fabricate to details indicated on drawings where they are not inconsistent with NSF standards.

E. Except as otherwise shown, form exposed edges of tops and similar surfaces into a channel shape, 1¼" high. Form special edges as indicated. Form edges, curbs, backsplashes and similar formed shapes of the same sheet as the top (or other surface) or welded and finished to form an integral and match part of the top. Form top of backsplashes and curbs into a channel shape. Provide curbs and backsplashes of heights indicated, but not less than 4". Provide suitable wood inserts at edges, or other appropriate fastening device for securing the tops to the supporting structure. At exposed ends of splashbacks, provide welded closures for the open ends.

F. Where stainless steel sinks are called for in stainless steel work surfaces, weld the sink bowl to the top, grind and polish to provide the sink as an integral part of the top and to simulate one-piece construction. For sinks, cove all corners on inside to provide smooth and sanitary construction, approximately 1" radius. Pitch bottoms to provide complete drainage. Grind corners smooth and polish, with vertical and horizontal corners coved to about 1" radius. Partitions between sinks to be double wall with round top edge. Weld sink integral with tops of drainboards to simulate one-piece construction.

G. Form all marine type edges and other integrally formed work as indicated on drawings. Pitch work surfaces adjacent to sinks to the sink to provide positive drainage.

H. Welded parts and work to be non-porous and free of imperfection, pits,

cracks, buckles, discolorations, or other distortions. At stainless steel, provide homogeneously heli-arc welds, ground, buffed and polished to original finish, smooth without pits or depressions. Maintain metal thickness, show no weld or grind marks and simulate one-piece construction. Weld and finish field joints to match rest of unit. Soldering of sinks, curbs, backsplashes or other items to tops will not be permitted.

I. Sound deaden the undersides of all tops, counters, other work surfaces and sink bowls (except where exposed), with a 1/8" thick smooth spray coat of Minnesota Mining and Manufacturing Company's Coating No. EC-549, or approved equal.

J. At stainless steel sinks, provide a stainless steel, stamped drain outlet fitting for 3½" opening top diameter with a 3" perforated grid strainer and 4" x 1¼" o.d. stainless steel tailpiece with connecting nut.

K. Stainless steel cup sinks to be built into stainless steel countertops and working surfaces shall be constructed of not less than 16 gauge, stainless steel. Cup sinks shall be welded to the top, as for other sinks. At stainless steel cup sinks provide a 4" x 4¼" o.d. stainless steel tailpiece with connecting nut.

2.16 AIR FOIL FUME HOODS - GENERAL

A. Provide fume hoods of the air foil type, designed with radiused foil sections at the top, bottom and sides of the hood opening to ensure maximum operating efficiency of the hoods. Sizes as indicated on drawings. All fume hoods shall extend to the ceiling, as indicated, with the grilles shown at the front and extensions of the side panels at all exposed sides.

B. Provide double wall end panels for fume hood super-structures, with the front of the panel at the hood opening radiused, providing a streamlined section and ensuring a smooth, even flow of air into the hood. The hood interior end panels shall be flush with the entrance shape to prevent eddy and backflow of air. The area between the double wall ends shall be closed to house the sash counterbalance weight and remote control valves as required.

C. Provide an air foil, similar to the sides, installed at the bottom of the hood opening. This foil shall be mounted with a minimum of 1" open space between the foil and the top front edge of the working surface to direct an air stream across the hood work top to prevent any backflow of air at this point. The air foil shall extend back under the sash, so that the sash closes on top of the foil, and thus does not close the 1" opening.

D. Provide an automatic air bypass for the hoods at the top of the sash opening. This air bypass shall limit the maximum air velocity through the face of the hood, and provide a relatively constant volume of air through the hood regardless of sash position) when hood exhaust blowers are in operation. By lowering the sash to a distance of 10" from the deck of the hood, the face velocity shall increase by not allowing the bypass to function. The bypass shall function for the last ten (10) inches of travel before complete closure only. The hood air bypass shall not be dependent on mechanical or electrical linkage, and shall be completely positive in operation.

E. Provide a removable baffle, with adjustable openings at top and bottom, at the rear of the hoods. Adjustable baffle openings shall be provided to allow the air through the hood to be adjusted to compensate for types of gases, apparatus or heat sources used in the hoods.

F. Hood working surface shall have a raised ledge along the front of the hood to confine spillage away from the hood face. For epoxy resin tops, the working surface shall be constructed not less than 1¼" thick solid modified epoxy resin formed into a ½" deep watertight pan. For stainless steel top, provide formed "marine edge".

G. Vertical sliding sash shall be composed of not less than 18 gauge painted steel rolled shape, 3/4" thick x 2½" wide, mitered, welded and ground smooth to provide a complete frame with no visible joints. Glass shall be ¼" thick, 3 ply safety glass, except hoods with steam baths shall have ¼" thick tempered plate glass. The internal glass retaining strips shall be of stainless steel, and the strips shall be attached to the sash frame with stainless steel screws. The sash shall be counterbalanced with a single sash weight and sash cable system to prevent tilting of the sash during operation. Double sash weight and cable counterbalance system may be provided. (Spring type counterbalances are not acceptable.) Sash cables shall be stainless steel and shall operate on ball-bearing sheaves. The sash frame shall be equipped with plastic glides which operate in stainless steel sash guides to ensure proper operation of the sash and prevent metal-to-metal contact.

H. Provide a two-tube fluorescent light fixture of the longest practical length at the top of the hoods, shielded from the hood interior by a tempered glass panel sealed into the hood body with chemical rubber channels. The seal of the glass panel separating the fluorescent tubes from the interior of the hood shall be vaportight. Furnish and install light bulbs.

I. Hood exterior shall be constructed of cold-rolled steel, with component parts screwed together to allow removal of the end panels, front end fascia pieces, top fascia or grille, and air foil strips, to allow replacements or to afford access to the plumbing lines and fixtures. Spacers or reinforcements shall be welded to these main parts. After fabrication and before final assembly, all cold rolled steel parts shall be cleaned, phosphate treated and finished as specified for metal casework finish.

J. Removable access panels to mechanical service fixtures shall be set flush with hood interior except in stainless steel hoods.

K. Standard hood interior shall be of cement-asbestos. Cement-asbestos panels and all surfaces in contact with fumes shall be coated with fire and acid-resistant finish. The end panels, back panel, baffle and top shall be not less than ¼" thick, screwed together, with cleats or steel angles to form a completely rigid assembly to which the exterior cold-rolled steel parts can be mounted. Joints shall be backed up with angles or cleats to eliminate gaps. Screws used to assemble the panels shall be stainless steel truss head screws, which are not countersunk, in order to provide maximum strength to the screwed joints. No metal, except stainless steel, shall be exposed on the interior of the hood.

L. The hood baffle shall be screwed to cleats at the rear of the hood with

stainless steel screws. Adjustment strips made of the lining materials, which are adjustable by means of plastic knobs, shall be provided in the top of the hood plenum chamber in back of the top sloping baffle. Provide a slot in baffle to create better flow.

M. The hood widths shall be the same dimension as, in line with, the base cabinet below.

N. Provide stainless steel duct collars at all hoods. (Ducts from collars and all fans are under Division 15 - vendor of fume hoods to include in his price the cost of any necessary modifications to ductwork shown on drawings.)

O. Provide interior light, light switch, red pilot light to indicate when fan is operating, receptacles as specified in a later article. Install all electrical items according to National Electrical Code.

P. For each pilot light, provide a two color engraved plastic laminate plate to identify the fan number and fan operating speeds. Plates to read "Fan No. XX" (with appropriate number) and "Hi" and "Lo". Characters approximately ¼" high. (Fan operation switched from central control panel.)

Q. Locate cupsinks and holes for faucets so all faucets drip into the cup sink and so the tip of the faucet is 6" to 8" above the sink.

2.17 ISOTOPE HOODS

A. All surfaces exposed in the interior of the hood, and foils at perimeter opening, except glass retaining strips, shall be 16 gauge Type 316 stainless steel with No. 4 satin finish except the work top shall be minimum 14 gauge.

B. The 16 gauge stainless steel baffle shall be held in place with stainless steel screws, and shall be removable to allow cleaning and decontamination of the area behind the baffle. Provide stainless steel adjustment strips, adjustable by means of plastic knobs, at the top and bottom of the baffle.

C. The work surface shall be made in the form of a watertight pan, ½" deep, to contain spillage, with a 6" wide safety ledge across the front edge. It shall be reinforced with a 10 gauge steel channel at the front, and structural reinforcements at the center and rear to support a uniform maximum loading of 200 pounds per square foot.

D. The entire stainless steel hood interior shall be reinforced with angles and plug hats to provide a completely rigid assembly, and shall be welded together to form a self-supporting hood assembly to which the exterior cold-rolled steel parts can be mounted. A stainless steel duct collar shall be provided in the top of the hood plenum chamber in back of the top sloping baffle. Vendor of fume hoods to include in his price the cost of any necessary modifications to ductwork shown on drawings. Construction shall be seamless, except around removable baffle. Omit removable plumbing access panels. Access shall be from exterior and shall be gained by removing hood fascia panels or end panels. The inside end and back panels shall be made in a one-piece wrap-around, welded to the work surface, forming smooth ½" radius corners. All interior corners shall be ½" radius, except top liner, which shall be spot welded to the wrap-around.

E. Weld vent pipes from base cabinet below to the stainless steel deck.

F. All stainless steel work shall conform to the requirements specified in Article 2.16, above, including welding and finishing of welds.

G. Form around cup sink so cup sink is ¼" above deck, but ¼" below front edge of deck. Faucet must drain into cup sink.

H. Other details of construction shall be as specified in Article 2.18 above.

2.18 FUME HOOD PERFORMANCE

A. Hoods shall contain and remove fumes generated within the hoods. Hoods shall be designed to provide a face velocity of 100 cubic feet per minute across the full open face of the hood, except 150 cubic feet per minute at isotope hoods. Hood design shall be such that it will exhaust light or heavy gases efficiently, when the hood is used for ordinary laboratory work in a room free from cross drafts, and without high thermal loads or other special conditions. The air velocity shall be uniform, to a tolerance of ± 10 FPM, over the face of the hood when measured at the top, bottoms, center and sides of the hood face. No reverse currents of air shall occur along the sides, top, bottom or front of the hood.

B. When the sash is down, the air bypass shall control the maximum velocity of air being drawn through the hood so that it does not exceed 4¼ times the face velocity with the sash in the open position.

2.19 REMOVABLE GRILLE AT FUME HOOD HEADS

A. Aluminum: Extruded shapes, bars of 6063 alloy, tempered to strength required. Structural shapes 6061-T6 or 6062-T6. Provide square root shapes. Exposed aluminum, provide fine satin finish, uniform for all members, equal to hand rub with fine steel wool. Mill finish aluminum may be used for all concealed work. Provide stainless steel fasteners, finish to match aluminum.

B. Metal Backup: ASTM A36-70.

C. Vinyl Stripping: Rodofoam semi-rigid, vinyl, 4.0 pounds per cubic foot density, gray color, thickness and size indicated on drawings.

D. Fabricate and erect removable grille; plumb, true, square and level in a substantial manner as per shop drawings; units assembled in single units readily removable.

2.20 HOLES AND CUTOUTS

A. Cut holes, cutouts and other openings in casework, fume hoods, countertops, working surfaces, curbs, backsplashes and other items of metal laboratory casework as necessary to receive sinks, plumbing serivce fixtures, piping, ductwork, electrical fixtures and devices, conduit and wiring and other equipment, fixtures or fittings to be built into or mounted on or adjacent to the metal laboratory casework.

B. Holes, cutouts and openings shall be factory cut where possible. Where size and location of holes and cutouts cannot be determined in advance or depend on future field conditions, hole and cutouts may be made in the field. Field cut holes and cutouts shall be accurately located and neatly made, and surrounding surfaces shall not be damaged.

2.21 ELECTRICAL FIXTURES

A. Electrical fixtures (for fume hoods and other locations noted to be supplied under the casework subcontract) shall be as follows:

1. Switch: 20 amp, single pole, 277 volt, A.C.; Hubbell #1221 or approved equal.

2. Receptacle: 20 amp, 2P-3W grounded type, 125 volt, duplex, Hubbell #5362, or approved equal.

3. Pilot: Red neon, 125 volt, single gang, Hubbell #1375 or approved equal.

4. Plates: Sierra type 302 satin stainless steel.

5. Light Fixtures: Fluorescent rapid start or trigger start, HPF, 120 volt.

6. Lamps: Fluorescent, white (F40W typical). Lamps shall be provided and installed for all fixtures.

7. Combination Receptacle: 20A, 2P-3W, grounded type, 125/250 volt, duplex, Hubbell #5492, or approved equal.

B. The above items shall be pre-wired to a single junction box located behind the fume hood superstructure. The junction box shall be accessible. Provide a ground wire in all flexible conduit.

C. Consult Architect for any items not specified.

2.22 WALL SHELVES AND REAGENT SHELVES

A. Casework fabricator shall provide all shelving and reagent shelving complete, including wood framing or blocking. Detail and fabricate to meet the details shown on drawings, reinforced as necessary and with adequate supports to adequately support the loads.

B. Epoxy resin shall be as specified in Article 2.14 and stainless steel as specified in Article 2.1, Paragraph B. Fabrication shall be in accordance with the requirements of other similar work and materials of this Section.

C. Other wall mounted shelves shall be not less than 3/4" thick, constructed as specified herein for top materials as indicated.

PART 3: EXECUTION

3.1 INSTALLATION

A. Metal laboratory casework and accessories shall be installed under the technical supervision of the manufacturer. The manufacturer shall have a technically qualified superintendent on the site at all times during the installation of the metal laboratory casework. Casework shall be installed by skilled mechanics experienced in this type of work.

B. Coordinate installation with the Mechanical Contractor, Electrical Contractor and other contractors and subcontractors so that piping and wiring may be completed and sinks, service fixtures and equipment can be set in place and connected in the proper sequence.

C. Erect casework plumb, true, square and level in a substantial manner strictly according to approved shop drawings and manufacturer's instructions. Fasten adjacent units together, and securely anchor casework to floors and walls as required. Install all doors, drawers, shelves and other accessories.

D. Install scribe strips and filler panels accurately scribed to abutting construction.

E. Where tops, reagent shelves, sink units, backsplashes, curbs or box curbs abut the wall, seal the casework item to the wall. Apply a bead of approved chemical resistant sealant (adhesive may be noted on the drawing) to seal the voids or cracks. Where exposed, finish smooth at the top. At stainless steel work, a vinyl sealing strip, which clips to the metal, may be used.

F. Level tops, and anchor in place. Cement field joints. After cement is cured, finish joints to form watertight, flush joints without offsets in adjoining surfaces.

G. Install hardware and adjust for proper operation. Tag keys and turn over to Owner as directed.

H. Touch up scratches and other damage to casework finish.

I. Clean casework and leave ready for use. Refer to Section 01700.

3.2 FUME HOOD PERFORMANCE TESTS

A. The metal laboratory casework contractor shall test the first fume hood installed on each floor and one additional fume hood per floor as selected by the Architect and submit a written report of each test to the Architect before final acceptance. Tests shall be conducted in cooperation with the Mechanical Contractor.

B. Hoods shall be tested in an area where there is at least 5 feet of clear space in front and on each side for observation of the airflow pattern entering the hood. This area shall be without cross-drafts or other air currents exceeding 10 FPM that would affect the hood performance in the area in front and around the hood. Exhaust air volume shall be variable to show hood operation at different face velocities within the Specification range.

C. Fume hood face velocities shall be verified as follows: With exhaust blower on, the quantity of air being exhausted shall be determined by measuring the velocity of the air entering the hood face, and multiplying this velocity by the square feet of hood opening. The air velocity shall be determined by averaging at least 6 velocity readings taken at the hood face. Readings shall be taken in the center of a grid made up of 3 sections across the top half of the hood face, and 3 sections across the bottom half of the hood face. Readings shall not vary more than +10 FPM from the average face velocity. When the desired face velocity has been established, the following tests shall be made:

1. Make a complete traverse of the hood face with a cottom swab dipped in titanium tetrachloride to demonstrate that a positive flow or air is maintained into the hood over the entire hood face. No reverse air flows or dead air spaces shall be permitted.

2. Paint a strip of titanium tetrachloride along each end and across the working surface of the hood, in a line parallel with the hood face and 6" back into the hood to demonstrate that no backflows of air exist at these points. The flow of smoke shall be directly to the rear of the hood, without swirling turbulence or reverse flows.

3. A smoke bomb (one-half minute size), shall be discharged within the hood area to show the exhaust capability of the hood and its design efficiency. No reverse air flows will be permitted. Place lighted bomb in the hood area and move it to various places, checking end panels and working surface to verify that no reverse air flows exist at any point. Lower the sash to closed position to verify that a sufficient air volume is flowing through the hood working area to carry away fumes from a massive fume source. Immediately after the smoke bomb stops discharging smoke, the hood area should be purged of smoke.

4. Place a pan of dry ice in hot water in the hood and observe flow of the heavy, white vapors generated. The flow of fumes shall be carried away to the back of the hood. No reverse flows of fumes along the work surface toward the front of the hood shall occur.

D. Repeat tests 1, 2, 3 and 4 for every face velocity setting selected to be tested in the 70-100 FPM range.

E. The fume hood automatic air bypass shall maintain a relatively constant flow of air into the hood at all sash positions. When the sash is down, the air bypass shall control the maximum air velocity being drawn through the hood so that it does not exceed 4¼ times the face velocity when the sash is full open.

F. Check sash operation by raising and lowering sash. Sash shall glide smoothly and freely and hold at any height without creeping, assuring proper counterbalance. No metal-to-metal contact will be allowed.

PART 4: SCHEDULE

4.1 COMPONENT INFORMATION SCHEDULE

A. Refer to the Casework Code on drawing A26. The following schedule supplements the code and drawings by providing a description of the Casework Code.

B. "Component Height and Style" letter designation, first part of the Casework Code is as follows:

Component Hgt. and Style	Description
LB	Indicates low base cabinet component (2'-4-3/4" high unless noted otherwise and 1'-10" deep unless noted otherwise).
LP	Indicated low knee space component (2'-4-3/4" high unless noted otherwise).
HB	Indicates high base cabinet component (2'-11-3/4" high unless noted otherwise and 1'-10" deep unless noted otherwise).
HP	Indicates high knee space component (2'-11-3/4" high unless noted otherwise).
WS	Indicates wall storage cabinet component (2'-6" high unless noted otherwise and 1'-1" deep unless noted otherwise).
FH	Indicates fume hood with volatile storage cabinet below.
TS	Indicates full height (7'-0") closed storage cabinet.
PB	Indicates epoxy resin pegboard.
AS	Indicates plastic laminate adjustable shelving.

C. "Component Width" is the number designation, width in inches, which is the second part of the Casework Code, shown on the drawings, and always follows the first part letter designations shown above.

D.

Component Ht. and Style	Component Type	Description
LB	A	Sink base cabinet component with hinged doors and fixed panel in top ¼.
	A1	Single door hinged left.
	A2	Single door hinged right.
	A3	Double doors.
	B	Base cabinet component w/hinged doors full height and 2 adjustable shelves.
	B1	Single door hinged left.
	B2	Single door hinged right.
	B3	Double doors.
	C	Base cabinet component, drawers in top ¼, hinged door in bottom 3/4 and 1 adjustable shelf.
	C1	1 Drawer, single door, hinged left.
	C2	1 Drawer, single door, hinged right.
	C3	2 Drawers, double doors.
	C4	1 Drawer, double doors.

LB continued	D	Base cabinet component with drawer combinations as indicated below.
	D1	4 equal drawers.
	D2	3 equal drawers
	D3	2 side by side top 1/3. 2 side by side middle 1/3 1 drawer bottom 1/3
	D4	5 equal drawers
	F	Base cabinet component w/no drawers or doors.
	F1	Fixed panel.
	G	File drawer base cabinet component
	G1	File drawer in bottom portion of cabinet with 1 drawer above file drawer.
LP	A	Knee space base component.
	A1	Knee space with no apron with back panel.
	A2	Knee space with 2" apron with back panel.
	A3	Knee space with two drawers w/back panel.
	A4	Knee space with drawer with back panel.
	A5	Knee space with 4" apron with back panel.
	A6	Knee space without apron or back panel.
	A7	Knee space with 2" apron without back panel.
HB	A	Sink base cabinet component with hinged doors and fixed panel in top ¼.
	A1	Single door, hinged left.
	A2	Single door, hinged right.
	A3	Double doors.
	A4	Double doors with intermediate post.
	B	Base cabinet component with hinged doors full height of cabinet and two adjustable shelves.
	B1	Single door, hinged left.
	B2	Single door, hinged right.
	B3	Double doors.
	B4	Double doors with intermediate posts.
	C	Base cabinet component with drawers in top ¼, hinged doors in bottom 3/4, one adjustable shelf
	C1	1 drawer, single door, hinged left.
	C2	1 drawer, single door, hinged right.
	C3	2 drawers, double doors
	C4	1 drawer, double doors
	D	Base cabinet component with drawer combinations, as indicated below:
	D1	4 equal drawers
	D2	4 unequal drawers
	D3	5 unequal drawers
	D4	6 equal drawers
	D5	2 side-by-side drawers in top ¼ and 3 equal drawers in bottom 3/4

HB continued

	E	Base cabinet component with full height bin compartment.
	E1	Single panel, bottom hinged
	F	Asbestos lined volatile storage base cabinet component with hinged doors and adjustable, removeable expanded metal shelf.
	F1	Double doors with flame storage painting
	F2	Doors without flam. storage painting designation (acid storage).
	G	Base cabinet component with file drawer.
	G1	File drawer below with 2 equal drawers above file drawer.
	H	Base cabinet component (1-6" deep) with two drawers in top 1/3, hinged door in bottom 2/3, one adjustable shelf.
	H1	2 Drawers, single door, hinged left.
	J	Base cabinet component with no drawers or doors.
	J1	Fixed panel.
HP	A	Knee Space
	A1	Knww space w/o apron with back panel.
	A2	Knee space with 4½" apron with back panel.
	A3	Knee space with 4½" drawer with back panel.
	A4	Knee space with 2 side-by-side drawers, 4½" high with back panel.
	A5	Knee space without apron or back panel.
	A6	Knee space w/two 4½" drawers w/o back panels.
WS	A	Framless sliding glass door wall cabinet component with 2 adjustable shelves, locked where indicated on drawings (lock within bottom edge)
	A1	2'-6" high x 1'-1" deep.
	A2	2'-6" high x 1'-4" deep.
	B	Solid sliding door wall cabinet component w/2 adjustable shelves.
	B1	2'-6" high x 1'-1" deep.
	B2	2'-6" high x 1'-4" deep.
	C	Solid hinged door wall cabinet component w/2 adjustable shelves.
	C1	2'-6" high by 1'-1" deep single door hinged left
	C2	2'-6" high by 1'-1" deep single door hinged rt.
	C3	2'-6" high by 1'-1" deep double door
	C4	2'-6" high by 1'-4" deep single door hinged lt.
	C5	2'-6" high x 1'-4" deep single door hinged rt.
	C6	2'-6" high x 1'-4" deep double doors
	D	Open shelf wall cabinet w/ajjustable shelves.
	D1	2'-6" high x 1'-1" deep w/2 adjustable shelves

WS continued	E	Wall cabinet component with hinged glass doors with frames and with 2 adjustable shelves or as described below.
	E1	2'-6" high x 1'-1" deep single door hinged left.
	E2	2'-6" high x 1'-1" deep single door hinged right.
	E3	2'-6" high x 1'-1" deep double doors.
	E4	2'-6" high x 1'-4" deep single door hinged left.
	E5	2'-6" high x 1'-4" deep single door hinged right.
	E6	2'-6" high x 1'-4" deep double doors.
	H	Wall cabinet component narcotics locker
	H2	Solid door hinged right with one adjustable shelf and interior solid door (double locked).
	H3	Furnish interior portion of narcotics cabinet.
TS	A	Closed storage component 7'-0" high with solid hinged doors and 5 adustable shelves.
	A1	1'-1" deep.
	A2	1'-4" deep.
	A3	1'-10" deep.
	B	Closed storage component 7'-0" high with glass hinged doors with frames and with 5 adjustable shelves.
	B1	1'-1" deep.
	B2	1'-4" deep.
	B3	1'-10" deep.
	C	Closed storage component, wardrobe, 7'-0" high.
	C1	1'-10" deep w/1 fixed shelf, hanging rod, hinge left.
	D	Closed storage component 7'-0" high with sliding glass doors and 5 adjustable shelves.
	D1	1'-1" deep
	D2	1'-4" deep
	D3	1'-10" deep
FH		Fume hood mounted on high base cabinet components.
	FH36C	3'-0" wide chemical fume hood with removable grille above.
	FH48C	4'-0" wide, chemical fume hood with removable grille above
	FH60C	5'-0" wide, chemical fume hood with removable grille above
	FH72C	6'-0" wide, chemical fume hood with removable grille above
	FH36R	3'-0" wide, radioisotope fume hood with removable grille above.
	FH48R	4'-0" wide, radioisotope fume hood with removabove grille above.
	FH60R	5'-0" wide, radioisotope hood with removable grille above.

PB	A	Removable pegs mounted onto epoxy resin board.
	A1	13" high board, 3 rows of pegs.
	A2	17" high board, 4 rows of pegs.
	A3	24" high board, 6 rows of pegs.
AS	A	Plastic laminate adjustable shelves on heavy duty hardware.
	A1	2'-6" high (3 shelves) mounted 4'-6" high.
	A2	7'-0" high (6 shelves) mounted 6" from floor.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes the refinishing of existing metal casework as indicated on the drawings and specified herein.

C. Related work specified elsewhere:

1. Metal Laboratory Casework: Section 11611.
2. Reconditioning Stone Countertops: Section 11614.
3. Painting: Section 09900.

1.2 SUBMITTAL

A. It is intended that refinished casework match new casework in color. Special colors may be required. Refer to Section 11611.

B. Submit manufacturer's data for each system to be used.

1.3 JOB CONDITIONS

A. Conform to the environmental condition requirements of Section 09900.

PART 2: PRODUCTS

2.1 SPECIFIED SYSTEM

A. The specified system is the refinishing system of Electro-Painters, Inc., 1821 University Avenue, Saint Paul, MN., an attraction-coating process utilizing an electrostatic gun and thermosetting plastic paints, specifically designed for "in-place" refinishing of furniture. Equivalent processes by other applicators will be considered on a prior approval basis. Refer to Article 1.1 herein.

PART 3: EXECUTION

3.1 PREPARATION OF SURFACES

A. Refer to Section 09900. Prepare surfaces to be refinished in conformance with that section and in accordance with the instructions and recommendations of the manufacturer of the refinishing materials and equipment. A smooth, blemish-free surface is intended.

B. Properly mask adjacent surfaces so as to avoid damage by overspray.

3.2 APPLICATION

A. Apply materials in strict accordance with manufacturer's instructions.

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes reconditioning existing stone laboratory countertops where indicated on the drawings. It is intended to provide a smooth "like new" working surface.

C. Related work specified elsewhere:

1. Metal Laboratory Casework: Section 11611.
2. Refinishing Existing Metal Casework: Section 11613.

1.2 SUBMITTALS

A. Submit for approval, complete description of systems proposed to be used.

B. Submit manufacturer's data on all compounds, resins, solvents and other materials to be used.

PART 2: PRODUCTS

Not applicable.

PART 3: EXECUTION

3.1 PREPARATION OF SURFACES

A. Thoroughly sand, grind and steelwool existing surfaces to provide a smooth, unblemished surface. Remove stains whereever possible.

B. Fill cracks and pockmarks with a mixture of stonedust and epoxy resin to generally match the existing impregnated stone. Sand or grind to flush surface.

3.2 APPLYTING TOP SEAL

A. After preparation and filling is completed, apply a laboratory top seal similar to Hamilton's Imperial Top Seal (as accepted by University) and allow to dry a minimum of 4 hours. Then apply second coat and polish.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract and Division 1, General Requirements, apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010, Summary of Work and Special Requirements, for requirements of pre-bid and post-bid evaluation of proposed substitute products, methods, and other conditions.

B. Work under this section includes furnishing and installing insulated door as shown on drawings.

C. Related work specified elsewhere:

1. Demolition: Section 01910.
2. Masonry: Sections 0410, 0420.
3. Lathing, Plastering and Drywall: Section 09100.

1.2 GENERAL INFORMATION

A. Coordination: Coordinate work directly with appropriate contractors and subcontractors as necessary to insure proper fitting of units into areas as shown on drawings.

B. Verify existing building openings to assure delivery of component parts to construction area.

C. Supply General Contractor with dimension drawing for required sleeves and cores.

D. Field Dimensions: Field measure building features as required to insure proper fitting of work.

1.3 PRODUCT HANDLING

A. Package, handle, deliver and store at job site in a manner that will avoid damage to components supplied and to building itself.

1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings and supporting catalog data in accordance with Section 01300. Show all features of assembly, construction, dimensions, mechanical and electrical connections and all other pertinent data.

PART 2: PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the product of Bally Case and Cooler, Inc. Equivalent products of other reputable manufacturers will be considered on a prior approval basis. Refer to Article 1.1 herein.

2.2 PANEL CONSTRUCTION

A. Panels shall consist of interior and exterior metal pans precisely formed with metal dies and checked with gauges for uniformity.

B. Panels shall be made without internal wood or metal structural members, with 100% of each panel, exclusive of metal skins, being urethane insulation.

2.3 FINISH

A. The metal finish shall be stainless steel, type 302, #3 finish, 20 gauge.

2.4 INSULATION

A. Insulation shall be 4" thick rigid urethane foam (poured-in-place, not frothed). It shall conform to ASTM Fire Hazard Materials Tests #E-84-61 and E-162-67 and have a low flame spread rating of 25 or less with a certifying Underwriters' Laboratories label on every panel. The expanding agent shall be only Freon 11 with an inherent pressure of 28 psi when foam is heated to 150°F. (65.6°C.). The thermal conductivity factor ("K") shall not exceed 0.118 BTU per hour (Square Foot) (degree Fahrenheit per inch). Overall coefficient of heat transfer ("U" Factor) shall not exceed .029. The insulation must remain stable at an operating temperature range of minus 90°F. (-67.7°C.) to plus 250°F. (121.1°C.).

2.5 HINGED ENTRANCE DOOR PANELS

A. The door shall be an infitting flush-mounted type.

B. A thermoplastic gasket with a magnetic core shall be mounted on the top edge and along both sides of the door. The bottom edge of the door shall contain an adjustable rubber wiper gasket. The magnetic force of the gasket shall keep the door in a closed position and the gasket shall form a positive tight seal. Gaskets shall be resistant to oil, fats, water, and sunlight and shall be replaceable.

C. Construction of the door panel shall include a heavy, "U" channel type, reinforced steel frame around the entire perimeter of the door opening to prevent racking and twisting.

D. Anti-sweat heater wires shall be concealed behind the metal edge of the door jambs on all four sides. An additional heater shall be concealed beneath the exterior edges of teh door around the entire perimeter. They shall provide sufficient heat to prevent condensation and frost formation.

E. Each door panel shall be provided with an incandescent vapor-proof lamp on the interior. An operating toggle switch and pilot light shall be mounted on the exterior. An inlet box shall be provided for 115 volt, 60 cycle, 1 phase, A.C. service.

F. A 2" diameter flush-face dial-type thermometer shall be mounted on the door panel. It shall provide temperature readings in a range from minus 60°F. (-51.1°C.) to plus 80°F. (26.7°C.).

2.6 HARDWARE FOR HINGED ENTRANCE DOOR

A. Latch and Strike Assembly: The latch and strike assembly shall be made of die-cast zinc or forged brass with chromium finish. The latch shall be made to accommodate a padlock but shall include an inside safety release mechanism to prevent anyone from being locked inside.

B. Hinges: The hinges shall be made of cast aluminum and shall match the latch in general finish and design. Blades shall be noless than 9" and hinges shall be up-lift type with nylon cam on ½" D. stainless steel pin.

PART 3: EXECUTION

3.1 INSTALLATION

A. All components, doors, mechanical and electrical, shall be installed in strict accordance with manufacturer's printed recommendations and instructions and approved fabrication and erection drawings.

- - -

BIDDING REQUIREMENTS, CONTRACT FORMS
CONDITIONS, SPECIFICATIONS AND RELATED DOCUMENTS FOR

JACKSON OWRE MILLARD LYON COMPLEX REMODELING
CONTRACT B (JOML-B)
MINNEAPOLIS CAMPUS
UNIVERSITY OF MINNESOTA
COMMISSION NUMBER 280.02
PROJECT NUMBER MINN. BHRD-HP-5C-070

Donald P. Brown — University of Minnesota
Acting Vice President for Finance and Development

Clinton N. Hewitt
Assistant Vice President for Physical Planning — University of Minnesota

THE ARCHITECTS COLLABORATIVE, INC. — Cambridge, Massachusetts

HEALTH SCIENCES ARCHITECTS & ENGINEERS, INC.
University Park Plaza - Suite 704
2829 University Avenue South East — Minneapolis, Minnesota 55414
(612) 378-3833

The Cerny Associates, Inc. — Minneapolis, Minnesota
Hammel Green and Abrahamson, Inc. — Saint Paul, Minnesota
Setter, Leach and Lindstrom, Inc. — Minneapolis, Minnesota

I hereby certify that these plans, specifications or reports were prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Harry R. Wilcox

Date: May 2, 1977 — Reg. No. 9603

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this Division. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. These conditions supplement provisions of General Conditions and Division 1.

1.2 SHOP DRAWINGS AND EQUIPMENT BROCHURES

A. Refer to and comply with Section 01300.

1.3 DRAWINGS

A. In general, the drawings of the mechanical systems and equipment are to scale. However, to determine exact locations of walls and partitions, the Contractor should consult the architectural and/or structural drawings. Drawings shall not take precedence over field measurements.

B. Plans of piping and ductwork although shown on scale drawings are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail or exact arrangement of construction. If it is found, before installation of any or all construction phases, that a more convenient, suitable or workable arrangement of any or all phases of the project would result by varying or altering the arrangement indicated on the drawings, the Architect/Engineer may require the Contractor to change the location or arrangement of his work without additional cost to the Owner, in accordance with directions from the Architect/Engineer.

C. Where discrepancies are discovered after certain portions or phases of any contract have been installed, the Architect/Engineer reserves the right to require the Contractor to make minor changes in pipe, duct, fixture, or equipment locations or arrangements to avoid conflicts with other work at no additional cost to the Owner.

D. Because the drawings are to a relatively small scale to show as large a portion as is practical, the fact that only certain features of the system are indicated does not mean that other similar or different features or details will not be required. Contractor shall furnish all incidental labor, material or equipment for the systems in their control so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the specifications.

E. In general, pipe lines requiring drainage shall be laid out at the site first, then large pipe mains, then space for air ducts, then electrical conduit. The Mechanical Contractor shall provide extra stub risers, drip-trap-and-rise

installations, and drip and trap assemblies at low points in steam systems as may be required; air vents, rises and drops in forced hot water mains as may be required; and extra lengths and fittings in all phases as may be required to install all systems in the space available and as necessary to avoid interferences.

1.4 CONNECTIONS AND LAYOUT

A. It shall be the responsibility of this Contractor to make connections at terminal points of contract. The piping, ducting and equipment, etc., may be shown with excess clearances for clarity. However, the Contractor shall group pipe and arrange all ducts and equipment to present a neat and workmanlike appearance and to avoid blocking of passageways.

B. All lines shall be constructed from the utility mains, shown on the drawings or designated by the utility company, and connecting to utility service lines on the site, in the building or other structures. Connections shall include furnishing and installing the piping, fittings, valves, etc.

C. Contractor shall arrange for and pay for all costs involved in extending, rerouting and connecting the utilities whether or not part of the work must necessarily be performed by the various utility company crews. Any charges for connections to mains, valving, extending to curb property line or building, furnishing meters or equipment, etc., shall be paid for as part of the work of this division. Regardless of whether the Owner may have to sign with the utility company for any or all of these services, the Contractor shall apply for and include in his bid all fees, city inspection charges, permit charges, (except permits paid by University - see Section 01010) work charges, etc., and shall be ready to deposit with the utility company said fees when required at time of Owner's signing for same.

1.5 SERVICE INTERRUPTION

A. This Contractor shall schedule his work in such a manner that he does not interrupt any services to any University of Minnesota buildings unless authorized by the University. Refer to and comply with requirements of General Conditions, and Division 1.

B. Any service interruptions to a building, or portion of a building shall be cleared and scheduled with the University prior to the interruption.

1.6 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Refer to and comply with Section 01700 requirements. The Contractor shall prepare a portfolio, as soon as possible after equipment has been ordered, of all mechanical equipment furnished by him on the project. This portfolio shall include manufacturer's shop drawings, parts' lists and operating and maintenance instruction of such equipment. Information shall be submitted in triplicate, neatly folded to approximately 8-1/2" x 11" size and bound in indexed loose-leaf binders of adequate size to contain the material. Each binder shall be properly identified. Upon completion of these portfolios, the Contractor shall turn over to the Architect/Engineer, prior to the Owner taking over the building, for approval and delivery to the Owner.

B. Instructions shall contain the following information and services:

1. Manufacturer's recommended cleaning and maintenance procedures.

2. List of materials recommended for maintenance.

3. Complete operating instructions.

4. Name and address of authorized service organizations and parts depot.

5. Where indicated in the specifications, the Contractor shall provide the services of a factory trained representative to instruct the Owner's authorized personnel in the operation, control and maintenance of equipment.

6. Refer to Sections of specifications for additional information to be furnished by the Contractor.

7. The Mechanical Contractor shall instruct the Owner's representative in the use of all equipment and systems, as specified in Section 01700, including the proper procedure for draining and filling chilled water coils.

1.7 OTHER WORK

A. Other work will be performed by separate trades. This Contractor shall give careful consideration to work of all of the general, electrical, elevator and other trades, and all subsidiary trades, and shall organize his work so that it will not interfere with the work of other trades. He must consult all the specifications for correlating information and all drawings for details, dimensions, foundations, pits, etc.

B. Particular care should be taken in the co-ordination of mechanical work in the Basement areas of Unit B/C where piping, ductwork and electrical conduit are installed above suspended plaster ceilings. Careful co-ordination should also occur where ductwork and piping occur above and below a suspended plaster "heat shield" (located over the chiller pit area.)

C. All scaffolding required for mechanical work shall be provided by this contractor, except as otherwise specified in Section 01010 and 01500.

1.8 CLEANING

A. Refer to and comply with requirements of General Conditions, Section 01010 and 01070. The Contractor and Subcontractors for the various phases of the work of this Division shall promptly clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished under any or all contracts in a clean first-class condition.

B. Air surfaces of all new coils, convectors, fan housings, fan wheels, fan motors, air unit plenums and all new air filters shall be wiped or vacuumed clean or washed, if required, leaving the installation in a first-class condition.

C. All new plumbing fixtures shall be thoroughly cleaned of all plaster, stickers, rust stains, and other foreign matter or discoloration, leaving

every part in an acceptable condition and ready for use. The surface of all New floor drains, clean-outs and other equipment shall be cleaned and each item shall be left in a first-class condition. Thoroughly clean all items of equipment furnished such as traps, strainers, pumps, motors, compressors, condensers, etc., leaving each item in a clean first-class condition.

1.9 PAINTING AND STENCILING

A. Painting of final field coats on materials and equipment furnished under the mechanical portion of the contract will be done under the General Construction Contract as described in Section 09900. This Contractor shall, however, refinish and restore to the original conditions and appearance all mechanical equipment which has sustained damage to the manufacturer's prime and finish coats of enamel or paint. Materials and workmanship shall be equal to the requirements described in Section 09900. All painting or paint finish referred to in Division 15 is to be provided by this contractor. This Contractor shall identify piping and indicate direction of flow, by marking the equipment as frequently as necessary for painting and stenciling by General Contractor.

1.10 DEMOLITION, REMODELING, CUTTING AND PATCHING

A. Refer to and comply with requirements of Section 01910.

B. The relocation of existing equipment and piping systems shall be accomplished in the least possible time. Work shall be scheduled so as to minimize the down time for the respective systems involved, and the schedule approved by the University in advance. This will be required for existing services being revamped and/or relocated and all interconnecting portions of these systems shall be installed as complete as practicable prior to actual shut-down for final connections.

C. As applicable, work shall be coordinated with the other contractors, other trades and with the University. In areas where work involved may interfere with existing building operations or require temporary or permanent cessation or relocation of building functions, the University must be consulted so that work schedules can be set up acceptable to all concerned.

D. This Contractor shall furnish and install all materials and equipment to complete remodeled areas of the existing buildings as shown on the plans specified herein, or required to complete the work indicated under this Contract, including all minor items necessary for complete and operating installation. This Contractor shall offset existing piping and ductwork as indicated on the drawings or as required to accomplish the remodeling indicated.

Refer to the architectural drawings for remodeling required.

E. The Mechanical Contractor shall be responsible for all necessary cutting and patching of existing walls, floors, ceilings, etc. required in connection with the new mechanical installation and where necessary because of removal or change of existing work. Refer to the Architectural drawings for area where the General Contractor will provide the cutting, patching and painting.

F. This Contractor shall remove existing mechanical equipment required to accomplish the work as indicated on the drawings. Where required, existing piping, ductwork and other mechanical work and systems shall be relocated or rerouted to accomplish and complete the work.

G. Cutting required for piping shall be core drilled and shall be done by the Mechanical Contractor to the entire satisfaction of the University and Architect/Engineer. Cutting shall be kept to a minimum which will allow the proper placement of the materials.

H. All unsalvagable materials shall be removed in a manner that will avoid damage to materials or equipment to remain and shall be completely removed and legally disposed away from the site.

I. Salvagable materials designated for re-use or relocation shall be carefully removed and shall be protected from damage until they are incorporated into the new work.

J. Salvagable mechanical equipment not specifically stated or specified to be reused should be reviewed with the University's representative as to disposition. If the University desires to retain, the equipment should be carefully removed, protected from damage and turned over to the University at a location outside the building. If the University does not desire the equipment, it should be completely removed and legally disposed away from the site. Equipment shall include but not be limited to air handling units, ductwork, diffusers, control instruments, tubing, piping, valves, plumbing fixtures, trim, drains and cleanouts.

K. See Sections 01010 and 01500 for special requirements such as the use of construction tools, barricades, and protection of the existing building.

L. Refer to Sections 09110, 04200, 09100 and 09900 for execution and requirements for patching and painting and comply with applicable provisions as to materials and workmanship.

1.11 EXCAVATING

A. This Contractor shall do all trenching, excavating and backfilling required for his work. Any street, sidewalks, curb or paved area repairs necessary because of this work shall be his responsibility. Refer to General Conditions, Section 02200 and Section 02400 for requirements of trenching, excavating, backfill and compaction; comply with applicable provisions.

1.12 GOVERNING CODES

A. The mechanical installation shall conform to the current provisions of all local and State codes pertaining to plumbing, heating, ventilation and refrigeration work including, but not necessarily limited to the following:

1. Minnesota Building Code
2. Minnesota State Plumbing Code
3. American Water Works Association
4. National Electric Code
5. Minnesota State Board of Health
6. Minnesota Safety Code and Regulations

7. Sheet metal and Air Conditioning Contractors National Association

8. Local applicable ordinances

1.13 STANDARDS

A. All materials supplied under the mechanical contract requirements shall conform to the latest editions of the following standards:

1. All applicable standards as published by the American Society of Testing Materials.

2. All applicable standards as published by the National Fire Protection Association.

3. American Standards Association

4. American Society of Mechanical Engineers

5. American Society of Heating, Refrigeration and Air Conditioning Engineers.

6. Air Moving and Conditioning Association

1.14 TESTS

A. All work shall be inspected, tested and approved as required by the State of Minnesota and local regulations. Tests shall be made in presence of proper inspectors and Architect/Engineer or their duly authorized representatives. All tests shall be made by the Contractor at his own expense, unless specifically noted otherwise and he shall furnish three (3) test certificates each to the University and Architect/Engineer.

B. All work shall prove absolutely tight under required tests. All types of piping systems, except final tests of completed systems shall be made before pipe is covered or connected to fixtures and equipment. Tests required shall not be less than specified in the following paragraphs.

C. All gauges, tools, pumps, gas, air or other equipment required for testing and initial adjusting of piping systems shall be purchased and provided by this contractor.

D. Piping Tests

1. Sweat copper joints. Provisions shall be made for removal of one (1) percent of the sweat joints in copper piping for inspection and testing. Additional joints may be required to be removed if failure occurs in original one (1) percent tested.

2. Silver Brazed Copper Joints. Mechanics doing silver brazing are required to pass a certifying test. Test shall simulate job conditions using fittings of size and type specified.

a. Test sample shall be two (2) nipples (12" long) and one (1) coupling of the largest size to be used at the job (2" minimum size). Execute one (1) sample in horizontal position, 6'-0" above floor, and one (1) sample in vertical position 5'-0" above floor with upward flow of brazing.

b. Test samples shall be sent to an independent testing laboratory by the contractor, and contractor shall pay all costs of test.

3. Welding

a. All welding shall be done by certified welders and licensed fitters who are thoroughly trained in electric arc and/or gas welding and experienced in the welding positions and materials required. Certification shall be for type of work being performed by welder and shall be accomplished in accordance with ASME "Qualification Standard for Welding Procedures, Welders and Welding Operations." No welds shall be made by any welder until copies of his certification have been submitted to Engineer/Architect.

b. Test Coupons shall be taken as follows, unless otherwise directed by the University as work progresses:

1) Less than 25 welds - 2 coupons

2) Over 25 welds - one coupon, and one coupon per each 50 welds

c. Location of test coupon to be selected by University.

d. In lieu of test coupons as above specified, or in the event of evidence of coupons failing to pass; then X-ray may be used to evaluate the welding.

e. All welds shall be stronger than the parent metal. A minimum of two passes shall be used on all arc welded joints.

f. The University will pay for all laboratory tests of the coupons, except tests taken as a result of failures which shall be paid for by the Contractor.

E. Systems Tests

1. All new soil, waste, storm water and vent conductors, etc., shall be tested with air of 5 psi pressure and shall remain constant for 15 minutes without the addition of air.

2. All new cold, hot and recirculating hot water piping shall be tested and proven watertight under a hydrostatic pressure of 125 psi pressure or 1-1/2 times the working pressure, whichever is greater, for a period of two (2) hours prior to application of pipe insulation and final connection to fixtures.

3. All new gas piping shall be tested with air at 50 psi pressure for a period of two hours. Soap test all joints.

4. All new compressed air piping shall be tested with a 150 psi without drop other than that due to temperature differential over a 24-hour period. Testing medium shall be water pumped compressed air or nitrogen only.

5. All new vacuum piping systems shall be tested at 25 inches of vacuum for a period of one hour with all outlets closed and pump not working. The drop in vacuum shall not exceed 1/4" of mercury during the test.

6. Oxygen Piping System

a. After installation of the piping, but before installation of the outlets, the system shall be blown clear of free moisture and foreign matter by means of water pumped (oil free) dry nitrogen or air.

b. After installation of the station outlet valves, each section of the piping system shall be subjected to a test pressure of 1-1/2 times maximum working pressure, but in no case less than 150 psi, by means of water pumped (oil free) nitrogen or air. This test pressure shall be maintained until each joint has been examined for leakage by means of soapy water. All leaks shall be repaired and the section retested.

c. A 24-hours standing pressure test with water pumped (oil free) nitrogen or air at 1-1/2 times maximum working pressure, but in no case less than 150 psi, shall be made to check the completeness of previous joint tests. Only normal pressure changes due to temperature changes will be permitted.

7. The new Standpipe Piping System shall be tested hydrostatically at 250 psi water pressure for a period of two (2) hours.

8. All new deionized water piping shall be hydrostatically tested at 75 psi pressure for a period of two (2) hours. The deionized water distribution borosilicate glass system shall be guaranteed in writing to continuously deliver deionized water of the following quality:

a. Less than 10,000 ohm centimeters specific resistance change from the storage tank to the most remote user station.

b. Less than 100 total bacteria per millimeter increase from the storage tank to the most remote user station.

c. The deionized water at the user stations shall have:

1) Less than 4 parts per billion copper.
2) Less than 10 parts per billion total heavy metal
3) Less than 20 parts per billion sodium
4) Less than 5 parts per billion boron

d. In addition to the above guarantee, the manufacturer shall submit recommended procedures for obtaining and maintaining the water quality specified.

e. After the piping systems have been completed and pressure tested, the new deionized water system shall be flushed and cleaned to obtain the above quality standards.

9. All new steam and return piping shall be subjected to an air test of not less than 75 psi pressure or 1-1/2 times the working pressure whichever is greater. The pressure shall be maintained for a period of two (2) hours with no drop in pressure. Soap test all joints.

10. All new Hotwater Reheat and Radiation Piping; same as Steam Piping System as specified in 9.

11. All heat recovery supply and return piping; same as steam piping system specified in 9.

12. Chilled Water System shall be subjected to an air test of not less than 150 psi pressure. The pressure shall be maintained for a period of two (2) hours with no drop in air pressure. Soap test all joints.

13. Pump Motors. All motors and/or equipment under the mechanical contract shall be tested under load conditions with the RPM and amperage readings taken and listed on the required certificate.

a. All pumps in addition shall have flow and head listed.

14. Heating, Ventilating, and Air Conditioning

a. All ventilating and air conditioning systems shall be balanced by an independent test and balance agency retained by the University of Minnesota. The agency will be a fully certified member of the Associated Air Balance Council.

b. The Mechanical Contractor shall have ventilating and air conditioning systems installed, cleaned and operating in all areas delivering air through inaccessible ceiling areas so as to remove construction dirt and dust from duct prior to installation of ceilings.

c. All equipment shall be freshly oiled, filters charged with clean media, and installation completely finished prior to acceptance.

15. Hydronic Systems and Chilled Water Systems.

a. All hydronic systems and chilled water systems will be balanced by an independent test and balance agency retained by the University of Minnesota.

16. Fire Safety Precautions

a. See Article 1.33 Section 01010

17. Sterilization of Domestic Water Pipes

a. Upon completion of cold, hot water, and circulating hot water piping systems, this Contractor shall sterilize these systems with chlorine before they are placed in operation. Amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million. Following a contact period of not less than 6 hours, the heavily chlorinated water shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million. All valves in water lines being sterilized shall be opened and closed several times during the 6 hour period.

b. All sterilization work shall be performed in a manner and with methods such as to meet approval of inspector's Office of State Board of Health. Water shall be sampled and tested by the Division of Environmental Health, University Health Service before being placed in service.

c. Special care shall be taken in sterilizing, cleaning and flushing piping to eyewashes and emergency showers.

18. Cleaning and Flushing of Piping Systems. The Contractor in the presence of the University shall thoroughly flush the new chilled water system, hydronic heating systems, Glycol-heat recovery systems, using Wyandott Chemical Corporation's "Conquer" liquid cleaner. The cleaning and flushing procedure shall be in accordance with the following:

a. After the piping systems have been completed and pressure tested, set all hand valves and control valves in an open poisiton.

b. Fill the systems with clean water and start the system pumps.

c. Using the chemical feeders on the chilled water system and the hydronic systems, add one (1) liquid ounce of "Conquer" liquid cleaner per gallon of water in the systems. The liquid cleaner may be added in the same proportion in the Glycol Systems at the point of Glycol fill, then flushed as described below prior to the introduction of the Glycol/Water mixture.

d. After the cleaner has been added to the systems, continue to run the pumps for a period of 4 hours. During this period, the pump strainers shall be inspected and cleaned as required to prevent damage to the pumps, but in no case shall inspection and cleaning be done at greater than one hour intervals.

e. At the end of the 4 hour run, drain all systems completely, then flush with clean water for a 2 hour period discharging dirty water to sewer.

f. Drain systems, remove, clean, and replace all strainer screens and fill systems with clean water.

1.15 IDENTIFICATION

A. All mechanical equipment furnished under these specifications shall be identified with black-white-black laminated 1/8" plastic plates. Plates attached with self-tapping screws. Verify typical locations with Architect prior to installation. Submit samples of one and two line plates for approval prior to ordering.

1.16 RESTORATION OF CONSTRUCTION DISTURBED FOR UTILITIES

A. Refer to General Conditions and Section 01010.

1.17 FUTURE ADDITIONS

A. Pipes and ductwork shall be valved and capped for future completion of spaces as shown on the plans.

1.18 CONNECTIONS TO EXISTING BUILDINGS

A. Connections to the existing building systems shall be made as shown on the plans. Any existing equipment and/or systems affected by these connections shall be replaced into proper operation.

1.19 ENTRY OF LARGE EQUIPMENT

A. If any equipment cannot be brought through regular entrances, Contractor shall so notify the University and Contractor for General Construction, and arrange with him to leave suitable openings for accommodation of such large equipment. All such arrangements shall be subject to approval of Architect/Engineer. Without such arrangements, equipment shall be delivered in sections small enough to permit use of regular entrances. This latter practice is not preferred.

1.20 TEST AND BALANCE SERVICE

A. Under a separate contract, the University will retain a qualified independent firm to provide the services of testing and balancing the air, hydronic, chilled water systems of this Project. The consultant will be responsible to the University and the Architect. It is intended the services will be provided by a firm specializing in testing and balancing air and hydronic systems in building construction and be certified by the Associated Air Balance Council (AABC).

B. It is intended the separate contract will include all services of testing and balancing in accordance with the published standards of the AABC National Standards for Field Measurement and Instrumentation, Total System Balance. The service will include the Pre-construction Plan Check and Continuous Inspection Plan of the AABC. The consultant shall also act as an inspection agency during construction and shall report to the University any discrepancies or items not installed in accordance with the Contract Documents pertaining to the systems he will be testing and balancing.

C. The consultant will provide the testing and balancing service for air and piped systems, such as:

1. Complete ventilating, air conditioning and exhaust systems, including fume hood tests, balancing the air flow to and from all openings, adjusting dampers, fan speeds and other adjustments required to meet the required adjustments to inlet vane dampers; and such other adjustments necessary to provide fully balanced systems performing as intended by the Contract Documents.

2. Piped/pumped systems of all hydronic, chilled water, recirculating domestic water, heat recovery and other systems, balancing the flow to/from each device and making such tests and adjustments necessary to meet the required volume and performance intended by the Contract Documents.

D. Where applicable, the consultant shall test and balance systems in operation at both the normal and emergency mode conditions.

E. The Mechanical Contractor (and his subcontractors and suppliers) shall co-ordinate his Work and cooperate with the test and balance consultant throughout construction as necessary for the consultant to satisfactorily and efficiently perform his services. The Mechanical Contractor shall:

1. Provide the consultant with a schedule of the Work, updating the schedule as the Work progresses and giving the consultant timely notices to allow examinations and permit test and balance services to be accomplished at appropriate times.

2. Advise the consultant of changes, modifications and rearrangements made during the construction progress.

3. Provide a copy of pertinent shop drawings, pertinent equipment brochures, fan curves, coil data, grille register and diffuser submittals, pump submittals, pump curves, control diagrams, other similar data, and any other necessary information required to perform the balancing and adjusting of the HVAC and piped/pumped systems. All such data shall be the final copies accepted by the University and Architect/Engineer.

4. Leave all air and piping balancing devices in the wide open position, and instruct all workmen and subcontractors of this requirement, and free all operating arms and adjustments so they can be easily operated.

5. Allow access to all areas of the Work as necessary to accomplish the test and balance services.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. This section specifies the basic materials and workmanship for the various mechanical trades. Its provisions apply to all work of the Mechanical Contractor.

PART 2: INSTALLATION

2.1 GENERAL

A. All pipes shall be of required size, round and straight and shall be cut, reamed, threaded, beveled for welding and/or otherwise prepared for joining with proper tools. All piping shall be properly enclosed, supported, guided, anchored, sway braced, connected, tested, cleaned and flushed out, properly insulated and protected where required, and run in a neat and orderly manner to the satisfaction of the Architect/Engineer. Lines required to be enclosed in ceilings, chaseways or similar spaces shall be installed to permit such enclosure as intended. This Contractor must lay out his work, properly locate the apparatus and add necessary pipe, sleeve, etc., and take his own measurements at building.

B. All pipes shall be run with proper grade to provide for easy draining and in group runs where applicable. Pipe sizes shown on the drawings are nominal pipe sizes and not outside diameters. Pipes shall be run substantially as indicated on the drawings; however, Architect/Engineer reserve the right to require this contractor to make minor changes in pipe locations where conflicts occur with other trades. Such changes shall be made without extra cost to the Owner.

C. All piping shall be installed with ample provisions for expansion and contraction to prevent damage to same or to building structure. Such provisions shall be made by means of piping offsets, changes in directions, expansion loops and/or suitable expansion joints. Suitable anchors and guides shall be provided to permit proper deflection and compression of offsets, loops and expansion joints. Expansion joints shall not be used in lieu of offsets, changes in direction or loops, except where specified and/or indicated on the drawings or where otherwise obviously necessary.

D. All heating and cooling piping systems shall conform with all applicable requirements of the Code for Pressure Piping, ASA B31.1 and with all applicable state and local codes, except where type and quality of materials, weights, thicknesses, design, pressures or fabrication techniques are called for in these specifications which exceed or upgrade such code requirements, these specifications shall govern.

E. Bolt and gasket sets for all steam piping, except condensate piping, shall be flanged bolts ASTM A193, grade B7 alloy steel with semi-finished hex nut A-194. Gasket shall be flexitallic type C-G, or equal. For condensate piping the bolt material shall be cold rolled steel flanged bolt with hex head and heavy semi-finished hex nut. Gasket shall be 1/16 Cranite ring gasket, or equal.

2.2 PLUMBING PIPING SYSTEM

A. The continuous waste and vent piping method shall be followed for entire plumbing system. Provide domestic hot, circulating hot and cold water, deionized water, compressed air, natural gas, and vacuum lines to all outlets, junction boxes, and fixtures as shown on drawings or specified herein.

B. All water piping shall be pitched to drain points, and up from hot water tanks, supply mains or risers 1/8" per 10 feet wherever possible. Provide a 3/4" hose bibb drain at end of each main and base of each riser and elsewhere as indicated on drawings.

C. All waste and vent piping shall be properly pitched 1/4" to the foot where possible and 1/8" minimum unless indicated otherwise so that all waste piping will drain back to main stacks and vent pipe will drain back to fixture unless loop venting indicates other pitch. Piping shall be properly supported so that it will not sag and form pockets. Joints between cast iron pipe and fittings shall be caulked with pitched oakum, thoroughly forced into joints with caulking tools. The joints shall then be filled with molten lead solidly caulked even with the hub top. Joints for acid resistant waste and vent shall be glass bead with stainless steel or glass reinforced nylon compression type assemblies with teflon liner. Where acid resistant piping connects to cast iron piping, the connecting fitting and the common line shall continue as acid resisting material. Preformed molded rubber rings may be used where specified under Section 15110.

D. Glass pipe shall be installed in accordance with manufacturer's recommendation. Vertical runs of 3", 4" and 6" pipe shall be supported by a ring clamp under the coupling at each floor. 1-1/2" and 2" vertical runs supported every other floor. Horizontal runs supported every 8 to 10 feet.

E. All gas piping shall be installed with plugged drip pockets at low points. Pipe shall be extended to all gas equipment, including safety valves where required or noted to be installed.

F. Consult manufacturer's data and details of rooms containing plumbing fixtures on architectural drawings before roughing-in piping. Plug or cap piping immediately after installation. Waste stuffed in open ends of piping shall be removed before installation of next length of pipe. Minimum size of all water piping shall be 3/4" except for short stubs immediately at fixtures.

G. All groups of fixtures shall have main valves including drain cocks with valves spotted in accessible, but concealed locations. Sectionalizing valves shall be provided where shown to isolate each laboratory bench from the mains.

H. All compressed air piping shall be installed with drip pockets at low points of piping for elimination of moisture. Piping shall be connected near top of receiver with union and valve. Connections at equipment shall consist of a valve and union.

I. All vacuum piping shall be run with as few offsets as possible. Special care shall be given to reaming ends of pipe for this system to eliminate all rough edges.

J. The deionized water borosilicate glass system, as proposed, shall be a completely pressure beaded system, and shall not exceed the pressure ratings of the material installed. It shall be installed to accommodate internal and external stresses normal to a system so installed. All pipe supports, hangers, etc., shall be installed per manufacturer's recommendations.

2.3 HEATING PIPING SYSTEM

A. All steam and condensate piping shall be installed for gravity flow of condensate to traps and/or condensate receivers. Steam and return piping shall pitch at least 1/4" in 10 feet. Provide drip legs and trap assemblies at all rise locations where shown and/or as may be otherwise required. Steam lines shall be pitched for condensate flow in same direction as steam flow except where otherwise specifically shown on the drawings. Runouts to equipment utilizing steam and return shall pitch 1/4" to 1 foot.

B. All hot water heating piping shall be installed with a minimum pitch of 1/8" per 10 feet to free itself of water when drained and/or air when operating. If rises and drops are required in horizontal pipe runs, install a 3/4" IPS by 6" high capped pipe air chamber for hydronic main supply and return risers. See Article 2.5 of Section 15130. Through a reducer, connect a 1/8" copper tube and run the stubs to discharge over a janitor's slop receptor or an equipment room floor drain. On the end of the copper tube near the drain, install a key-operated manual air vent. Provide a gate valve and union on inlet to air vent. On the high side of all hot water finned tube radiation, furnish and install an air vent. See Article 2.5 of Section 15130. Furnish and install a bypass between pump suction and pump discharge with gate valve, strainer and balancing cock on all convertor installations. Bypass line shall be one half the size of the suction piping. Furnish and install on each reheat coil shut-off valves, unions, control valve and flow indicator and a full supply pipe size air chamber at least 4" long with reducer on top to a Taco, Dole, or standard type key-operated air vent valve. Provide copper tubing on air chamber outlets and run tubing to accessible location before installing air vent when necessary for access and when directed by Architect/Engineer.

C. Under no circumstances shall any pipe connections in the field be made by punching a hole in a pipe and inserting or saddling a branch take-off. Reduction in line size for all piping shall be with eccentric fittings, buttweld, or screwed according to size and application. Flanged connections required to match field equipment may be made using slip-on flanges.

D. Trap assemblies for all but steam and drip points and preheat coils shall consist of dirt pocket, strainer, union, trap and gate valve.

E. Trap assemblies for steam main drip points shall consist of gate valve, union, strainer, trap, union, and gate valve.

F. Trap assemblies for preheat coils shall consist of dirt pocket, union, gate valve, trap, union and gate valve. See detail on the drawings.

G. All drip piping shall be welded except for connections to screwed strainers and traps.

H. Glycol-heat recovery system piping shall be pitched similar to hot water heating systems.

2.4 AIR CONDITIONING AND COOLING WATER SYSTEMS

A. All chilled water piping, shall be installed with a minimum pitch of 1/8" per 10 lineal feet to free itself of water and air when drained and of air when operating.

2.5 CONNECTIONS TO MISCELLANEOUS EQUIPMENT

A. Due to the fact that the manufacture of the equipment purchased may vary slightly from that specified and therefore requires some rearranging of equipment different from that indicated on the drawings, the Contractor shall make connections to such re-arranged equipment without additional cost to the Owner. That is for an initial installation arrangement other than that indicated on the drawings.

B. This Contractor shall make all water, waste, vacuum, air, deionized water vent, gas, steam, condensate return, hot water heating and ductwork connections to all equipment that is installed for this project whether or not such equipment is furnished by this Contractor, other contractors, or by the Owner. This includes furnishing and installing piping, shut-off valves, unions, fittings, ductwork, air control devices and insulation.

C. The unpacking, assembling and setting of equipment furnished under other than mechanical sections of these specifications, will be performed by other than this Contractor. This list includes, but is not necessarily limited to the following which are listed in the General and Electrical sections of the specifications and/or Architectural and Electrical drawings:

1. Laboratory Equipment other than what is specified in Section 15310.

2. Environmental Rooms.

3. Sterilizers.

4. Glass and Cage Washers.

5. Louvers.

6. Fin tube radiation covers.

7. Film Developing Equipment.

8. Owner furnished equipment. Section 01010 (1.12).

9. Generally, connection types and sizes are described in the above lists and/or shown on the drawings.

D. The Mechanical Contractor shall coordinate work between the various trades to insure proper installation and operation of all systems. The

following list is presented to assist the Mechanical Contractor with coordination and shall not be considered as inclusive for all coordination required.

1. Preheat, Reheat and Cooling coil connections.

2. Diffusers, Registers, Grilles and Diffusers.

3. Fin tube radiation.

4. Items listed in paragraph (C).

2.7 CONCRETE FOUNDATIONS AND SUPPORTS

A. Foundations, anchors, concrete cover, sleeves, grouts, shims, etc., required for properly placing mechanical equipment furnished under this contract will be provided by the General Contractor, unless specifically stated otherwise. Housekeeping pads, four (4) inches thick, of 3000 pound, 28 day strength concrete, will be furnished for all mechanical equipment located on floor slabs. See Architectural and Structural drawings for concrete work furnished by the General Contractor.

B. All floor openings at equipment rooms above grade will have 4" concrete curbs around them by the General Contractor.

2.8 ELECTRIC MOTORS AND WIRING

A. Motors:

1. Furnish electric motors as required for each motor driven unit. All motors must conform in every respect to the standard specifications of NEMA and bear nameplate of manufacturer, with current operating characteristics noted thereon.

a. Horsepower ratings: All electric motors shall be sized to meet the horsepower requirements of the driven unit at design characteristics including all V-belt and/or drive and coupling losses which are incurred without loading the motor beyond its nameplate horsepower rating. Where V-belt drives are employed the motor horsepower nameplate ratings shall not be less than 107% of the driven unit brake horsepower requirements.

2. All motors shall be provided with ball or roller bearings complete with grease cups. Motors shall be quiet when operating under full load conditions.

3. Unless otherwise specified, motors shall be of the induction type and shall be of speeds, sizes and for electric current characteristics as given in this specification. Motors shall be mounted on sliding cast iron bases as required. Motors shall be General Electric, Century, Allis-Chalmers, Westinghouse, Wagner or approved equal.

4. Motors of 1/3 HP and smaller shall be wound to operate on 120 volts, single phase, 60 cycles, A.C. and motors 1/2 HP and larger shall be wound to operate on 208 volts, 3 phase, 60 cycles, A.C. except where otherwise indicated.

B. Wiring

1. All control wiring will be provided by the Electrical Contractor unless otherwise noted in these specifications.

a. All wire shall be soft annealed copper wire type THW.

2. This Contractor's electrical work shall comply with the requirements of the National Electrical Code. Where this specification or the plans indicate requirements in excess of those of NEC, the compliance with NEC will not relieve the Contractor from furnishing and installing work as shown or specified.

3. All switching, protective devices and control for equipment furnished under these specifications shall be identified with black-white-black laminated 1/8" plastic plates. Plates attached with self-tapping screws.

4. Refer to Motor Schedule on Sheet #E-24 for reference to mechanical work.

2.9 EARTHWORK

A. The General Contractor will furnish all equipment, materials, skills and services required for excavation, backfill and compaction required to perform the work under this contract. Contractor shall refer to Section 0220, Earthwork for general information.

B. All trench work shall be dug, ripped, blasted or jack-hammered to the alignment and depth shown and in segments of minimum length to minimize the time of open trench. Trenches in soil shall be adequately braced and sheeted so as to provide safe and efficient working conditions. All trenches shall be kept free of water at all times. The trench width may vary with regard to required depth and the nature of the undersoil conditions. The finish trench shall be sufficient dimensions to allow the pipe to be laid and joined in the manner intended.

C. All pipes in soil shall be laid on a 6" gravel cushion foundation placed upon sound soil cut true and even so that the pipe will have a bearing for its full length. Gravel cushion to be in accordance with the 1972 Minnesota Standard Specifications for Highway Construction, Section 2502.2, Subdrainage Backfill. Pipe to be located in rock or soils with rock, shall be laid on a 12" minimum thickness sand foundation with at least 12" of sand at sides. At any area where soil stability is unsuitable or questionable, the Contractor shall further excavate until stable soil is reached. Contractor shall then backfill with compacted granular material until proper elevation is reached.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes performing all labor and furnishing all piping materials, fittings, joining methods, protection and pressure for piping used on this project to connect all fixtures and equipment, pipe and fittings of material and type for various services as list below:

C. Related work specified elsewhere:

1. Basic Materials and Methods: Section 15100.

PART 2: PRODUCTS

2.1 PLUMBING PIPE AND MATERIALS

A. At all fixture connections where nipples are necessary between copper tubing and fixtures, such nipples shall be standard weight full iron pipe size brass pipe nipples with suitable brass or copper adapters. Steel or iron nipples will not be permitted at any location in copper lines where connections are made to brass fixture valves or trim.

1. Water Piping

a. Underground Piping: These lines shall be Government Type "K" sinous copper tubing with cast bronze or wrought copper fittings, 15% silver brazing alloy (Handry Harmon, Sil-Fos) or equal in joining pipe with silver solder. See Section 15200 for underground water service.

b. Above-ground Piping: All water lines shall be Type "L" hard drawn ASTM B88-58, with soldered joints and fittings. For 2" and larger size pipe on cold, 140 degree F. hot and 140 degree recirculating hot water all soldered joints shall be made using silver solder with sil-fos, Eutectic 1800, or approved equal. For 1-1/2" and smaller size pipe on all cold, 140 degree F. hot and 140 degree F. recirculating hot water, all soldered joints shall be made using 95/5 solder with No. 50 non-corrosive flux.

2. Sanitary Sewage Piping and Storm Water Piping

a. Underground - beneath building floors and outside of building. These lines shall be service weight cast iron pipe with hub and spigot joints and fittings. Joints for sanitary piping shall be made using preformed

rubber rings which shall be caulked even and solid with tools until full to bead line. For underground storm only, fittings to be C.I. hub and spigot coated with preformed molded rubber ring. Sealing rings shall conform to ASTM 564-65 requirements.

3. Waste Piping

a. Pipe - service weight cast iron (above grade in building). Piping under 2" shall be Schedule 40, galvanized steel with screwed joints.

b. Fittings - same material as pipe.

c. Joints caulked. Hubless C.I. pipe is approved.

4. Vent Piping

a. Pipe - Schedule 40 galvanized steel with exception that urinal vents shall be cast iron.

b. Fittings - cast iron

c. Joints - screwed, caulked.

5. Rainwater Drainage

a. Pipe - Schedule 40 galvanized steel. Service weight C.I. with preformed rubber rings for joints is approved.

b. Fittings - black cast iron drainage.

c. Couplings normally furnished with lengths of pipe shall not be used in the installation of threaded piping. Extra heavy steel, malleable or drainage couplings shall be used.

d. Victaulic fittings and companion flanges may be used in lieu of screwed fittings as specified above for fittings.

6. Acid-Resistant Piping

a. Pipe - These lines shall be "Kimax" or "Pyrex" regular schedule glass pipe or Duriron with Mechanical Joint above grade and "Duriron" or Pyrex with Bury-Pac below grade.

b. Fittings - Hub and spigot below grade. Bead to bead or bead to plain end with compression type coupling made of stainless steel or glass reinforced nylon and teflon liner above grade. Slip joints not permitted after fixture trap.

c. All new waste and vent piping above grade for the project shall be acid resistant with the exception of waste and vents for toilet rooms, drinking fountains, sterilizer waste drains, bottle filling stations, showers, janitor receptors, sink-Dwyer unit, surgical scrub stations, emergency eyewash drain piping and penthouse floor drains. Where horizontal acid waste

piping connects to galvanized or cast iron piping, an acid wye shall be used and the common line shall continue as acid piping.

d. At the Contractor's option, polyethylene or polypropylene are considered acceptable substitutes for glass for horizontal branch lines to sinks, lab benches, etc., not exceeding 60 feet in length, subject to the following conditions:

1. All material furnished shall be self-extinguishing (fire retardant).

2. The contractor and manufacturer shall assume joint responsibility for the proper installation of the material culminating in the issuance to the University by the manufacturer of the following warranty and extended guarantee:

a) Manufacturer shall furnish a written one-year warranty guaranteeing all pipe, fittings, and accessories to be free of defects in material and workmanship.

b) Manufacturer shall provide an extended guarantee of at least 20 years after installation on all pipe, fittings and accessories of their manufacture against failure due to any of the following:

Joint leakage
Chemical corrosion
Environmental stress cracking
Expansion or contraction under system design conditions at the time of original installation.

Under this guarantee, the manufacturer shall supply replacement parts at no charge to the University. In addition, the manufacturer will pay all reasonable direct out-of-pocket labor charges incurred in replacing such defective pipe or fittings in an amount not to exceed $100.00 for each defective length of pipe or individual fittings.

3. The manufacturer shall be responsible for advising the University prior to material acceptance of original installation design conditions that cannot be covered by the extended guarantee.

7. Deionized Water

a. Pipe - Kimax or Corning, small bore low expansion borosilicate glass pipe, equal to Corning's 7740 beaded pressure pipe with minimum nominal pipe size of 1".

b. Fittings - Same requirements as pipe.

c. Joints - Bead end with compression type joint with teflon liner.

8. Air and Vacuum Piping

a. Pipe - Government Type "L" hard copper tubing.

b. Fittings - wrought copper solder type.

c. Joints - 95-5 solder.

9. Oxygen

a. The installation of all oxygen piping system shall be in accordance with all prevailing codes and the latest Standards for "Non-Flammable Medical Gas System" as adopted by the National Board of Fire Underwriters, Pamphlet No. 56F.

b. Pipe - Type "K" hard drawn copper.

c. Fittings - wrought copper.

d. Joints - Silver brazed.

10. Natural Gas

a. Pipe - Schedule 40 black steel pipe. Outside underground pipe shall be coated with two coats of No. 50B bitumastic.

b. Fittings - Extra heavy black malleable iron fittings.

c. Joints - Screwed. Welded when concealed.

11. Exposed Water and Waste Piping to Institutional Equipment

a. Pipe - Red brass pipe standard weight screwed full iron pipe size chromium plated.

b. Fittings - Screwed standard weight brass fittings chromium plated.

12. Silencer Vent from Vacuum Pump

a. Pipe - Schedule 40 galvanized steel

b. Fittings - Same as pipe.

c. Joints - screwed.

13. Condensate Drain Lines

a. Pipe - Schedule 40 galvanized steel

b. Fittings - Same as pipe

c. Joints - Screwed.

2.2 HEATING PIPE AND MATERIALS

A. The Contractor shall furnish and install all pipe indicated on drawings and other small pipes not indicated but necessary for proper operation.

1. Steam Pipe, All Pressures

a. Welding flanges for medium and high pressure steam shall be welding neck flanges Tubeturn Part 31, 300# class and Tubeturn #30, 150# class for low pressure steam and hot water.

b. Pipe 2" and larger shall be standard #A53 seamless black steel pipe. Pipe 1-1/2" and smaller shall be A-53 electric resistance weld.

c. Fittings - up to 2" use socket weld fittings and couplings. Over 2" use butt weld fittings with back-up rings. See 15100, 2.3D for shop fabricated piping.

d. Joints: welded.

3. Condensate Returns

a. Pipe - Schedule 80 #A53 seamless black steel pipe on 2" and larger. Pipe 1-1/2" and smaller shall be A-53 electric butt weld.

b. Fittings - same as for steam pipe except extra heavy weight.

c. Joints - welded.

4. Relief Vents From PRV

a. Same as for steam pipe.

5. Hot Water Heating

a. Pipe - Schedule 40 A-53 seamless black steel pipe on 2" and larger. Pipe 1-1/2" and less shall be A-53 butt weld.

b. Fittings - up to 2" - "XH" cast iron screwed. 2-1/2" and larger same as for steam piping.

c. Joints - welded or screwed.

7. Exposed Steam and Condensate Return to Institutional Equipment - All Pressures

a. Pipe - Red brass pipe standard weight screwed, full iron pipe size, chromium plated.

b. Fittings - Red brass pipe standard weight 125# steam, banded, screwed iron pipe size, chromium plated.

c. Joints - Screwed.

B. All pipes 2" in diameter and less shall have screwed joints, unless otherwise specified.

C. No weldolets shall be used on pipe 2" in diameter or smaller. On pipe 2-1/2" in diameter or larger, where pipe reduction is two sizes or more, weldolets or sockolets may be used where applicable, subject to field inspection before connecting to branch line take-offs.

D. Eccentric and concentric reducers shall be steel butt weld fittings.

E. All welding fittings shall be of the long radius pattern wherever possible.

2.3 COOLING PIPE AND MATERIALS

1. Chilled Water Pipe

   a. Pipe - Schedule 40 A-53 seamless black steel pipe for sizes 2" to 10". Pipe 1-1/2" and less shall be A-53 butt welded.
      - Schedule 30 seamless A-53 black steel pipe for sizes 12" through 16".
      - Schedule 20 seamless A-53 black steel pipe for sizes 18" through 24".

   b. Fittings - Up to 2" - 125# cast iron screwed.
      - 2-1/2" and larger use butt weld with back-up rings.
      - Victaulic couplings and companion flanges may be used for fittings and joints. Style 77 Grade H triple seal gasket-plated nuts and bolts.

   c. Joints - Welded or screwed.

A. All pipes 2" in diameter and less shall have screwed joints. All pipes larger than 2-1/2" in diameter shall have electric arc welded joints.

B. No weldolets shall be used on pipe 2" in diameter or smaller. On pipe 2-1/2" in diameter or larger, where pipe reduction is two sizes or more, weldolets or sockolets may be used where applicable, subject to field inspection before connecting to branch line take-offs.

C. Eccentric and concentric reducers shall be steel butt weld fittings.

D. All welding fittings shall be of the long radius pattern wherever possible.

2.4 GLYCOL - HEAT RECOVERY SYSTEMS

A. Pipe - Schedule 40 seamless black steel pipe on 2" and larger. Pipe 1-1/2" and less shall be A-53 butt welded.

B. Fittings - Up to 2" - XH cast iron screwed. 2-1/2" and larger same as for steam piping. Screwed ends shall be tightly drawn and teflon taped.

C. Joints - Welded or screwed. With screwed joints tightly drawn and teflon taped.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing and installing all valves where shown on the drawings and where necessary for proper control of equipment.

C. Related work specified elsewhere:

1. Basic Materials and Methods: Section 15100.

2. Piping Specialties: Section 15130.

3. Mechanical Support Devices: Section 15140.

PART 2: PRODUCTS AND INSTALLATION

2.1 GENERAL

A. All valves shall have name or trademark stamped or cast into body. All valves shall be designed for a minimum of 150 pounds working pressure unless otherwise noted, but figure numbers may indicate greater pressures.

B. Valves of Powell, Stockman, Walworth, Lunkenheimer, Crane, Sarco, Mueller, Ohio, Hoke, Jenkins, Nibco-Scott, Hammond, Rockwell Nordstrom, RP&C, or Hancock manufacture will be accepted.

C. Of the manufacturers listed, the Contractor is requested to standardize on one make as much as practical but not to the extent of sacrificing quality listed.

D. Provide positive dead-end shut-off valves at all pieces of equipment. Valves shall be individually supported so that equipment can be removed and piping system can remain unstressed and in operation.

2.2 VALVE SCHEDULE

A. Domestic Water Valves

1. Valves 2" size and smaller shall be screwed brass body, 150# WSP, rising stem, solid wedge disc gate valve, Crane #431 UB, or Ohio 7150.

2. 2-1/2" and larger shall be flanged, cast iron body, bronze trim bronze stem, 125# WSP rising stem outside screw and yoke, solid wedge disc gate valve, Powell #1793, Jenkins 651A.

3. Valves 2" and 2-1/2" size on copper water piping may be Walworth #11WS.

4. Install a Sarco Company #1BW or Fairbanks #4502 combination balancing valve and shutoff valve on all hot water circulating lines. Valves shall be all brass construction for 200 psi working pressure with screwed connections.

B. Compressed Air and Vacuum Valves

1. Valves on air and vacuum piping shall be Stockham B22 or Ohio 520 for 150# WSP with air disc.

C. Gas Valves

1. Valves on gas piping 2" and smaller shall be Walworth #559, brass square head gas cock for individual equipment shut-off.

2. Valves on gas piping for shut-off valves at mains and branches shall be Nordstrom No. 143, lubricated plug valve.

3. Valves on gas piping for emergency shut-off in each room shall be NCG Series 480090 ball valve, steel body, screwed. Worcester, Consolidated Brass, Lance and Hills-McCama are approved equal. Valves shall be mounted in recessed cabinet with latch and hinged glass door. Cabinet by this contractor. Minimum cabinet dimensions are 8" x 8" x 3-5/8".

D. Oxygen Valves

1. Valves on oxygen main piping shall be National Cylinder Gas 2500 Series valves. Valves shall be brass, diaphragm type globe valves of leak proof construction.

E. Deionized Water

1. Valves on distilled water lines shall be Chemflow Model 2420 or approved equal with beaded pressure ends.

F. High Pressure Steam (above 15 psig), High Pressure Condensate Return

1. Gate valves 2" and smaller shall have weld ends, unless specified screwed. Hancock #950, 600# WSP, forged steel body, rising stem, OS&Y renewable stainless steel seat rings, solid wedge.

2. Gate valves 2-1/2" and larger shall be Powell #3003, Crane #33-1/2 XUF, 300# WSP cast steel body, weld ends. All gate valves at PRV stations shall have built-up by-pass with valve.

3. Globe valves 2" and under shall have weld ends, unless specified screwed. Hancock #5530, 600# forged steel body, rising stem, OS&Y, renewable stainless steel seat and disc.

4. Globe valves 2-1/2" and over shall have weld ends, unless specified screwed. Powell #3031S-WE, 300# WSP forged steel body.

5. Check valves shall be Crane #36, Powell #560, Jenkins #762A, 200# WSP screwed brass body with regrinding seat and replaceable disc.

G. Low Pressure Steam (Up to 15 psig), Low Pressure Condensate Return

1. Gate valves 2-1/2" and over on supplies to convertors and heating coils. Jenkins 651, Powell Figure No. 1793 flanged ends cast iron 125# WSP body renewable seat and solid wedge.

2. Gate valves 2-1/2" and over for other services than 1. above shall be flanged or weld ends, as specified for application, steel 150# WSP body, rising stem, OS&Y renewable stainless steel seat rings and solid wedge, Powell Figure No. 1503 or Jenkins 1009-CM or 2009-CM or approved equal.

3. Globe valves 2-1/2" and over shall be flanged or weld ends as specified for application, steel 150# WSP body, rising stem, OS&Y renewable stainless steel disc and seat, Powell Figure No. 1531, or approved equal.

4. Gate valves 2" and under shall be screwed ends, bronze 150# WSP body, rising stem, solid wedge, Lunkenheimer Figure No. 2151, Crane 431 UB, Powell No. 514S, or approved equal.

5. Globe valves 2" and under shall be screwed ends, bronze 150# WSP body, renewable composition disc, Powell Figure No. 150, Crane No. 7, or approved equal.

6. Check valves same as F-5 above.

H. Hot Water Heating and Chilled Water, Cooling Systems

1. Gate valves 2-1/2" and over shall have flanged ends, cast iron 125# WSP body, rising stem, OS&Y renewable seat and solid wedge, Powell Figure No. 1793, Jenkins No. 651-A, or approved equal.

2. Gate valves 2" and under shall have screwed ends, bronze 150# WSP body, rising stem, solid wedge, Crane No. 431 UB, Stockham No. B120.

3. Shutoff valves for reheat coils, shall be Crane No. 14-1/2P Globe, 300# WOG brass valve with plug type disc, renewable seat. Minimum size 1/2". Balancing valves for reheat coil shall be combination balancing and shut-off Illinois 4000 or equal up to 1-1/4" Illinois 5000 DR

4. Check valves 2" and under shall be screwed ends, bronze 125#, WSP body, JenkinsNo. 92, or approvied equal. Centerline and Metraflex.

5. Check valves 2" and over shall have flanged ends, cast iron 125# WSP body, Crane #373.

6. Check valves on chilled water and hot water heating pumps shall have flanged ends, semi-steel with bronze trim 125# body center guided silent check valve, renewable seats and discs, Williams-Hager Type 636, or approved equal.

7. Balancing cocks 2" and smaller shall be Crane #250, 125# W.P. Nordstrom #173, Rockford #350, 175# W.P. on all radiation. Dezurik balancing cocks are equal and approved.

8. Balancing cocks 2-1/2" to 4" shall be lubricated plug type, shall be Walworth No. 1796, 1797F 175# WOG. Dezurik balancing cocks are equal and approved.

9. Balancing cocks over 4" size shall be lubricated plug type Walworth No. 1718F. 200# WOG.

10. Where shown on the drawings and other areas at the Contractor's option chilled water valves only maybbe butterfly type with seat material appropriate for temperatures and pressure encountered. Valve shall have lug type body with threaded holes so that valve shall remain bolted to one pipe flange while other flange is removed. Shafts and disc shall be of stainless steel and ductile iron respectively bubble tight shut-off, and latch lock handle, or side winder gear operators on valves 6" and larger. Valves shall meet ASTM Specification 48. Valves shall be as manufactured by Pratt. Dezuric butterfly valves are approved as equal.

11. Hot water systems drain valves (riser and low points of mains). All 3/4" size shall be Rockford No. 350, or approved equal, 125#, bronze stem cock with hose end adapter.

12. Cooling coil relief valve shall be Crane 2606, or approved equal 1/2" size set at 125 psi.

13. Cooling coil air vent valves shall be Crane No. 734, or approved equal, brass try cock, 250#, 1/2" size.

K. Glycol-Heat Recovery

1. Gate, Globe, Balancing Valve and check valves 2" and smaller, same as for hot water heating with screwed ends. Joints shall be tightly drawn and teflon taped.

2. Gate, Globe, Balancing valve and check valves 2-1/2" and over, same as hot water heating, and shall have flanged ends.

2.3 VALVE TAGS

A. All valves not in sight of fixtures or equipment isolated by that valve shall be provided with an approved aluminum, brass or plastic tag. Tags shall be 1/16" thick minimum for metal and 1/8" for plastic and 1.5" diameter (or 1" x 1.5" rect.). Plastic tags shall be P.V.C. or nylon material. Fastening hole drilled 1/4" dia. by 3/8" from edge. Tags shall be stamped for metal and engraved or raised for plastic and numerals filled with contrasting color. Numerals shall be 3/8" high. Fasten to hand wheel with "S" hook. The valve list shall contain the following information:

1. Valve numbers in sequence.

2. Service (with pressure and/or temperature). Identified in accordance with Section 09900.

3. Floor where located.

4. Room number.

5. Nearest column grid intersection.

6. Distance and direction from Item 5.

7. Description and room location of equipment isolated by subject valve. (Abbreviated description of equipment served)

The Health Sciences Physical Plant Maintenance and Operations Group will furnish the Contractor with blank forms to be used as a guide for the above requirements.

B. The gate valves on the emergency showers shall be wired open and tagged "DO NOT CLOSE".

2.4 CHAIN WHEELS

A. All valves having hand wheels located 7'-6" or higher above the equipment room floors shall have Lunkenheimer Fig. 1940, or equal and approved, adjustable sprocket rims with chain guide and rust-proof chain.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes all piping system specialties required to place the mechanical systems in complete working order.

C. Related work specified elsewhere:

1. Basic Materials and Methods: Section 15100

PART 2: PRODUCTS AND INSTALLATION

2.1 UNIONS AND FLANGES

A. Unions or flanged connections shall be used in piping adjacent to all equipment, valves, etc., as applicable for removal of equipment or to facilitate repairs.

B. On hydronic water piping 2" and smaller furnish and install malleable iron unions, 250# WSP with bronze to iron ground joint.

C. Unions for copper water piping shall be Streamline, or approved equal, ground joint type.

D. Furnish and install Petro #1150, 3000# WOG steel to steel, forged steel unions in the following piping systems.

1. Low pressure steam supply and return piping through 2" pipe size.

2. Medium pressure steam supply and return through 2" pipe size.

3. High pressure steam supply and return piping through 2" pipe size.

4. Gas piping, through 3" pipe size.

E. Low pressure (15# and under) steam supply and all hydronic water piping 2-1/2" and over use 150# forged steel gasket type welding neck flanges, Tubeturn Series 15.

F. High and Medium pressure (15# and over) steam supply piping 2-1/2" and over use 300# welding neck flanges, Tubeturn Series 30.

G. On all drip and condensate return lines use 300# welding neck flanges bored for extra heavy pipe.

2.2 DIELECTRIC UNIONS AND FITTINGS

A. All copper water piping, copper drainage piping, compressed air piping and vacuum piping shall have insulated type unions wherever it contacts iron or steel. This includes copper piping connections to iron or steel valves, tanks, water heaters and piping. These connections to and including 1-1/2" size shall be Universal Insulating union, Series 2000, Styles 3 and 4.

B. The above piping connections 2" size and over shall be "Insulket" insulated flange joint as manufactured by Service Engineers, Inc. Gasket shall be sandwich type consisting of a 1/16" layer of Grade XX Industrial formica bonded between two 1/32" layers of non-graphitized asbestos gasket material. Provide one phenolic sleeve and two phenolic washers and two steel washers for each bolt. Washer shall be provided on each flange. Flange on copper side shall be brass or bronze.

2.3 STRAINERS

A. All strainers shall be Y type with brass screens, except stainless steel screens shall be used on high pressure steam (over 15 psig). All strainers shall be complete with blow down gate valve nipple and pipe cap on blow off. Strainer manufactured by Sarco, Mueller, McLean, and Metraflex are approved.

B. All strainers on high pressure steam lines (over 15 psig) shall be 250 pound construction.

C. Strainers shall be installed where shown on drawings and ahead of all traps. When trap used has integral strainer a separate strainer need not be installed. Where strainers are installed in steam lines to coils, convertors, etc., strainer before coil or convertor trap may be omitted. Strainers shall be full line size.

D. All drip piping shall be welded except for connections to screwed strainers and traps.

E. On sizes through 3" where used ahead of traps, or steam regulating valves, the screens shall be 20 mesh; from 4" through 8" they shall be 3/64" perforated and over 8", 1/16" perforated. On water service the screens on strainers through 3" shall be 20 mesh, over 3" shall be 1/8" perforated.

2.4 STEAM TRAPS

A. At the outlet of all pre-heat and reheat steam coils, hot water generators, convertors and at the end of steam main drip points, furnish and install Armstrong bucket traps.

B. Series #800, high pressure traps shall be used on high pressure steam drip points and high pressure returns.

C. Series #880 inverted bucket traps with thermic vent shall be used on all low pressure steam lines, at drip lines, unit heaters, reheat coils and low points in steam lines.

D. All bucket traps shall be furnished with integral strainers on smaller sizes where capacity permits. Brass strainers on low pressure traps and stainless steel strainers on high pressure traps.

E. Series 215 and 216 inverted bucket traps shall be used for high capacity flows.

F. Permissible condensate flow in pounds per hour (low pressure to 15 psig, 1 psig differential):

Series No.	Pounds per hour
880	300
881	550
882	1100
883	2100
814	3200
215	5400
216	9500

G. At drip points of medium and high pressure steam lines (25 to 150 psig), traps shall be sized on a differential of not more than 20% of the inlet pressure.

H. A safety factor of 2 shall be used in determining the size of traps for all drip lines, hot water generators, sterilizers, and convertors and a safety factor of 3 shall be used in determining the size of traps for preheat coils.

I. All finned tube radiation traps shall be thermostatic, syphon multiple bellows type with replaceable stainless steel seats and discs and shall close on traps failure. Inlet of trap shall be a minimum of one inch below discharge of finned tube.

2.5 AIR VENTS

A. Provide and install Bell and Gossett No. 17 Sr. automatic air valve, or approved equal on return side of all hot water reheat coils. This air vent shall be designed to provide manual adjustment in three positions as follows: Automatic Venting Position, Manual Venting Position, or Complete Positive Shut-off. Air vents shall be 1/8 N.P.T.

B. Provide and install Sarco 13W or approved equal automatic air vent at top of all hydronic supply and return risers. Air vents shall be installed in accessible locations with a 3/8" discharge pipe run to nearest F.D. or janitor sink. Provide a gate valve and union on inlet to air vent.

2.6 EXPANSION JOINTS, GUIDES, LOOPS AND ANCHORS

A. Provide and install expansion compensators, expansion joints, guides and anchors as required, shown or specified to handle all thermal expansion and contraction in piping systems.

B. Wherever practical, properly installed expansion loops shall be used to compensate for thermal expansion in piping systems. The loops shall be made of dimensions shown, fabricated with long radius elbows and piping of maximum lengths that space permits where dimensions are not given. Loops shall be installed with "cold spring" so that loop in operation will have approximately equal contraction and expansion from fabricated position. Provide guides for loops. Provide lead sheet wrap where copper pipe would otherwise come in contact with steel guide.

Wherever loops cannot be employed, the following expansion joints shall be used:

1. High Pressure Steam Lines

a. All expansion joints on high pressure lines (125# or above) shall be Yarway Gunpakt, or approved equal, 300# W.S.P. steel body, lubricated slip joint, internally-externally guided with weld ends.

2. Low Pressure and Medium Pressure Steam and Condensate Lines and Hot Water Heating Lines

a. All expansion joints on low pressure and medium pressure steam and return lines and hot water heating lines shall be Yarway Gunpakt, or approved equal, 150# W.S.P. steel body, lubricated slip joint type, internally-externally guided with weld ends.

3. Hot Water Plumbing Lines

a. Expansion compensators 3" and smaller shall be two-ply bronze, externally pressurized with internal guides and internal positive anti-torque devices. Units shall accomodate 1-3/4" pipeline expansion and 1/4" pipe contraction under a working pressure of 150 psi and 250 degrees F. temperature. Unit shall have properly located positioning clips to insure installation at correct end-to-end dimensions for full rated traverse. Units larger shall have sweat ends. Compensators shall be rated for a minimum of 12,000 cycle life as manufactured by Flexonics, Model HB, Zallea, Robert Shaw Fulton or Tube Turns.

b. Expansion joints larger than 3" shall be single or double, self-equalizing stainless steel with flanged ends. Units shall be complete with built-in internal sleeve, and be able to accommodate the expansion noted on drawings under a working pressure of 150 psi and 250 degrees F. temperature. Expansion joints shall be as manufactured by Flexonics, Zallea or Adsco. Provide dielectric fittings between dissimilar metals.

C. Anchors and Guides

1. Anchors and guides shall be provided as necessary as detailed on the drawings. Pipe guides are required on each side of an expansion joint in quantity required by manufacturer. This contractor shall submit detailed drawings showing stops and guides for all expansion joints and loops. Guides for copper piping shall have lead sleeve for electrolytic isolation.

2.7 THERMOMETERS

A. Furnish and install Weiss Vari-angle thermometers or equal and approved with 8" stem. Thermometers shall be V-shape design, die cast aluminum, finished in baked epoxy enamel. Heavy glass protected front shall be firmly secured against rattles by spring action.

Adjustable joint shall completely enclose capillary to prevent tampering and foreign matter from entering instrument.

Locking device shall be made of machined brass and finished in natural color and designed to produce positive lock by simply turning in direction of "lock" position.

Mercury filled-magnifying lens "Red Reading" tube shall be Precision made to guarantee accuracy within 1% of scale range with Silicone shock mounting for lasting durability.

Scale shall be satin faced non-reflective aluminum with bold jet black markings permanently etched and locked in place and adjustable through device at top of scale.

Tapered bulb chambers for stem shall be made of steel, precision ground and uniformly copper-plated. The tapered chamber shall form a metal to metal contact with matching taper in separable sockets assuring maximum speed of response to temperature changes. Trerice, Weksler & March are approved.

B. Thermometers shall be installed in the following locations as well as those shown on drawings and where recommended by the manufacturer.

Equipment	Location	Scale
Reheat system Convertors	Inlet and outlet	30° to 240° F.
Condensate pumps	Inlet	30° to 300° F.
Cooling Coils	Return and supply line	20° to 120° F.
Heat recovery coils	Return and supply line	20° to 120° F.
Chilled Water Booster Pumps	Pump outlet	20° to 100° F.

2.8 PRESSURE GAUGES

A. Furnish and install pressure gauges on high pressure steam, low pressure steam and water lines where scheduled and indicated on the drawings. The pressure range of the gauge shall be 1-1/2 times the highest operating pressure.

B. Gauge types shall be as follows of Ashcroft Mfg. Marsh Trerice & Weksler are approved.

1. High pressure steam --- Ashcroft #1010 with 6" dial, pigtail and Ashcroft #7000 Series shut-off valve.

2. Low pressure steam --- Ashcroft #1010 with 6" dial, gauge cock and Ashcroft #1092 gauge cock.

3. Waterlines --- Ashcroft #1010 with 6" dial, gauge cock and Ashcroft #1106B pulsation damperners.

C. Pressure gauges shall be installed in the following locations as well as those shown on drawings and where recommended by the manufacturer.

Equipment	Location
Reheat System Pumps	Inlet and outlet
Chilled Water Pumps	Inlet and outlet
Cooling Coils	One gauge for each coil. Provide piping from gauge to inlet and outlet of each coil with cocks on each line.
Pressure Reducing Station	High and low side of each
Domestic Cold Water Main	On building side of meter

2.9 FLOOR, WALL AND CEILING PLATES

A. Where uncovered, exposed pipes pass through wall or floors, they shall be fitted with wall or floor plates. Plates shall be at least 1/32" thick, and shall be equipped with set screws for locking around pipe. Plates shall be finished cast brass chromium plated. Plates shall be set tight against wall or floor.

2.10 PIPE SLEEVES

A. Provide sleeves for all pipes that pass through walls, slabs or partitions. Sleeves shall be set and maintained in place by this contractor during the progress of the work. All sleeves shall be cut from new material, cut square and reamed.

B. All pipe sleeves through walls, slabs or partitions shall be 1/2" greater in inside diameter than the external diameter of pipe passing through sleeve except for insulated piping where sleeve shall be large enough to allow for insulation on the piping.

C. All sleeves through partition walls shall be Schedule 40 steel pipe extending full thickness of partition and shall be flush with the finished surface.

D. Sleeves through floor slabs for concealed piping shall be constructed of Schedule 40 steel pipe and shall extend 1/2" unless detailed otherwise above finished floor in classrooms, offices, corridors, etc. See Detail 2/M-88.

E. Sleeves through roof slabs shall be constructed of 22 gauge galvanized iron.

F. Pack space between pipe and all sleeves with oakum, leaving 1" depth for plastic caulking. Caulking shall be Presstite, Dura-gum or approved equal.

2.11 WATER HAMMER ARRESTORS

A. Furnish and install water hammer arrestors, of the size called for, and location as noted, on the plan or on water riser diagrams. Provide arrestors at main ends, flush valve groups, glassware washers, sterilizers, ice machines, etc.

B. Sizes and locations of water hammer arrestors are in accordance with data set forth by the Plumbing and Drainage Institute, Standard PDL-WH-201, for average plumbing systems.

C. Symbol designations shown on the drawings are for sizes established by PDI corresponding to units of various manufacturers that have been accepted by a certification testing program.

D. Arrestors as manufactured by Josam, Wade, Zurn, Blake, Jay R. Smith and Precision Plumbing Products, are accepted.

2.12 VACUUM BREAKERS

A. Vacuum breakers shall be installed on all supplies to flush valves, hose sprays, lab water outlets, janitor sinks, urinals and water closet flush

valve, equipment connections, and at each point where code requires on the potable water system. Vacuum breaker shall be Chicago or Watts.

The reheat systems fill shall be through a Watts #9D vacuum breaker.

2.13 HOSE BIBBS

A. Furnish and install hose bibbs as shown and located on the plans. Interior hose bibbs shall have 3/4" hose thread outlets with integral vacuum breaker. Similar hydrants as manufactured by Wade, Blake, Jay R Smith and Zurn will be accepted as equal.

1. Hose Bibbs - Chicago No. 998 rough chromium plated with vacuum breaker 293.4 handle. Support hose bibb with pipe clamp.

2.14 FLOW MEASURING DEVICES

A. Provide and install flow measuring venturies at each cooling coil and as shown on the drawings as manufactured by Rinco Engineering & Gerrish Company. Robertson Venturis are equal and approved. This shall be a coordinated system, including individual Venturi Flow Stations. Each venturi station shall be complete with quick disconnect valves and a safety shut-off valve, metal identification tag on chain, giving pipe size, venturi series, station identification and meter reading at specified flow rate. Venturi stations shall be one piece brass screwed 3/4" through 2". Sized 2-1/2" and over shall be manufactured from steel with beveled ends for welding. Venturi size and series shall be selected so that design flow rates as shown on the drawings shall be between 10 and 40 inches of water pressure differential with permanent pressure loss of not more than 25% of indicated flow rate differential pressure.

B. Provide and install on each reheat coil, one KG flow indicator. Unit shall be 3/4" NPT pipe size furnished with two automatic quick disconnects, brass bar stock each stamped for unit location, GPM and pressure drop. The disconnects shall be adaptable to KG flow meter for determining pressure drop.

C. Provide and install in each tower equipment room condensate return meters, Cadillac Meter, or equal and approved. Meters shall be installed ahead of condensate return pumps as detailed on the drawings. Units shall be of sizes as indicated on the drawings.

D. Provide and install in each tower equipment room a chilled water flow meter with all necessary equipment. Meter orifice shall be installed in discharge pipes of chilled water pumps #P-3 and P-4. Meters shall be Bailey Meter Co. specification No. M-22-1. Provide orifice and flanges, meter valves, reserviors, settling chambers nipples and reloader with 24 hour chart, surface mounted type. Equipment shall be installed by this Contractor with necessary 1/2" O.D. copper tubing, unions, valves, connectors, all as per manufacturers recommendations. Start up service shall be provided by equipment manufacturer. Equipment provided shall include a mounted transmitter suitable for interface with the existing Honeywell Delta 2000 system in "Unit A".

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing and installing of hangers and supports as required to install all lines under contract.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.

2. Pipe and Pipe Fittings: Section 15110.

3. Valves: Section 15120.

4. Piping Specialties: Section 15130

5. Mechanical Systems Insulation: Section 15160.

D. Hangers shall be of proper strength and placed on correct centers to support the lines with no sagging. (See Schedule below). Any additional steel members required to run the pipes or where indicated on drawings shall be furnished and installed by this Contractor.

E. Groups of three of four lines may be supported on trapeze type hangers in a neat evenly spaced manner. Where any piping, over groups of three, are run along walls or tunnels, they shall be racked vertically on side wall to allow maximum clearance space.

F. Pipe hangers and supports may be secured to steel trusses or beams by welding or using toggle expansion bolts, impact type fasteners or through bolts, as conditions require. Grinnell Fig. 66 welded beam attachment shall be used for large diameter pipes.

G. Where hanger attachments are welded to beams or trusses the attachment shall be fireproofed equal to supporting members.

H. Provide and install protective rubber or armaflex type bumper on all hangers that could be dangerous to maintenance personnel.

PART 2: PRODUCTS AND INSTALLATION

2.1 PIPE HANGERS AND SUPPORTS

A. All individual pipes 3" and smaller shall be supported with Grinnell ring type No. 107-R, or approved equal; larger pipe shall be supported with Grinnell

Company #260 or approved equal. Clevis hangers as required of sizes to span the insulated pipe. Elcen, Carpenter and Patterson or Fee and Mason of identical type are approved equal. Hangers that support copper pipe shall be copper-plated.

B. Unistrut, Powerstrut or Grinnell vertical and horizontal structural supports shall be used with sufficient anchorage to side walls using inserts and anchor bolts. Any inserts or cinch anchors for pipe hangers shall be furnished and set in place by this Contractor unless otherwise noted. All piping except steam supply piping shall be supported as specified in A. above. All steam supply piping 3" and larger shall have insulation shields and shall be supported on Grinnell Company #175 or #171 pipe rolls. Floor supported pipe shall be supported on Grinnell Company Fig. #276, or equal. Where clearance conditions dictate that a Fig. #260 clevis hanger cannot be used, this Contractor shall use the Fig. #171 or 175 pipe rolls.

C. Trapeze hangers shall be Unistrut channels at top and wall 8'-0" o.c. Pipe straps shall be Unistrut P2558. Provide provisions for building in pitch as required. Support members in trapeze hangers shall not be a torch cut. On trapeze hangers provide full circle shield and Uclamp pipes to trapeze.

D. Hangers for insulated piping shall be large enough to encompass insulation and metal shield for same. Provide at hanger points hydrous-calcium silicate insulation in sections 2" longer than hanger shield. Insulation shall have same finish as adjacent covering.

E. Shields shall be provided for all insulated piping at hangers or trapeze bars. Shields for 6" and smaller shall be constructed of 16 gauge galvanized iron. Shields shall be 6" longer than pipe diameter; however, the shielding shall be a minimum of 6" long and a maximum of 18" long. Shields shall completely encompass the covering where pipes are U-clamped to trapeze hangers. Other shields shall cover only bottom half of pipe covering. Shields for 8" to 14" pipe shall be 24 gauge and 24" long. Shields for 16" and larger pipe shall be 12 gauge and 24" long.

F. Vertical pipes shall be supported at each floor by riser clamps.

G. Piping subjected to thermal expansion may be guided at each floor in lieu of riser clamps. An anchor and base support will then be required.

H. Whenever copper piping comes directly in contact with steel support system, and copper plated hangers are not available for use, it shall be this Contractor's responsibility to wrap the pipe with two layers of Minnesota Mining and Manufacturing Company's #33 Electrolytic Tape. The length of tape shall be such to provide 2" overlap on each side of support.

I. Contractor shall consult and cooperate with all other contractors in arrangements of and routing of all supported lines so as to provide maximum clearances, minimum interference and a neat, first-class appearance and accessibility.

J. The following schedule shall be used in establishing distances between supports for steel pipe. When different sizes of pipes are supported on a

common hanger, smallest size line shall govern unless an intermediate support is used.

Pipe or Tube Size	Hanger Spacing	Minimum Rod Diameter
1/2" tube only	5'	1/4"
1/2" - 1"	7'	3/8"
1-1/4" - 1-1/2"	9'	3/8"
2"	10'	1/2"
2-1/2"	11'	1/2"
3"	12'	1/2"
4"	14'	5/8"
5"	16'	5/8"
6"	17'	3/4"
8"	19'	7/8"
10"	22'	7/8"
12"	23'	7/8"
14"	25'	1"
16"	27'	1"
18"	28'	1-1/8"

K. The following schedule shall be used in establishing distances between supports for copper pipe. The smallest pipe hung shall determine the distance between hangers where pipes are supported on trapeze hangers.

Pipe or Tube Size	Hanger Spacing	Minimum Rod Diameter
1/2"	6'	3/8"
3/4"	6'	3/8"
1"	8'	3/8"
1-1/4"	8'	3/8"
1-1/2"	9'	3/8"
2"	9'	3/8"
2-1/2"	10'	1/2"
3"	10'	1/2"
3-1/2"	10'	1/2"
4"	10'	1/2"

L. Pipe hangers and spacing for sewer and waste lines shall be as listed above except that horizontal runs of cast iron and acid resistant piping shall be supported at least once for each pipe section. If glass is used for acid waste piping the pipe hanger spacing shall be in accordance with the pipe manufacturer's recommendations.

M. Horizontal piping behind laboratory casework shall be supported individually every 6'-0' on Unistrut 13/16" channels with Unistrut standard pipe strap. One hole clamp for piping under 1" o.d. may be used. Provide necessary fittings, braces, pipe clamps, bolts, nuts, etc. for hanging pipes from channels.

2.2 PIPE SUPPORT BEHIND CASEWORK

A. The casework will be furnished with adjustable framing channels behind the casework for racking the service piping. This Contractor shall provide

all other necessary channels, framing, fittings, braces, pipe clamps, bolts and nuts, etc., as required to install mechanical work that is to be installed on the frame such as cup sinks, drainage piping, vent piping, air, gas, vacuum and water piping and outlets.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing and installing all vibration eliminators required to prevent excessive vibration transfer to occupied areas.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.

2. Pipe and Pipe Fittings: Section 15110.

3. Mechanical Supporting Devices: Section 15140.

4. Mechanical Systems Insulation: Section 15160.

5. Hot Water Heating System: Section 15650.

6. Ventilation and Air Conditioning: Section 15800.

7. Chilled Water System: Section 15900.

D. Mechanical equipment which shall have vibration isolation are pumps, motors, fans, ceiling hung unit heaters and all moving or rotating units.

E. Provide substantial bases under all units, fans and motors elevated above floor as noted on drawings. Units suspended from overhead construction shall be spring isolated from the structural frame work.

F. Isolator types shall be Mason Industries, Consolidated Kinetics Corporation, Kor Fund Industries, Amber Booth, Vibration Mounting & Controls, Vibragenics, and Vibration Eliminator Company.

PART 2: PRODUCTS AND INSTALLATION

2.1 PIPING

A. All piping on the inlet and discharge connections to all rotating machinery, such as pumps, compressors, etc., shall be vibration isolated from its supports over its entire length.

B. Piping runs within each mechanical equipment room or 30 feet from any connected machinery whichever is greater, shall be supported by resilient hangers providing a minimum static deflection of 1/4 inch. Metallic surfaces of resilient hangers shall be separated by a neoprene rubber element. For

non-liquid filled pipes the resilient hangers shall be Mason Industries type HD, or equal. For liquid filled pipe the resilient hangers shall have spring diameter and hanger box lower hole large enough to permit the hanger rod to swing through a 30° arc before contacting the hanger box and short circuiting the spring. Hangers shall be decompressed to the rated deflection so as to keep the piping at a fixed elevation. The hangers shall be designed with a release mechanism to free the spring after installation is complete and the hanger is to be subjected to its full load. Deflection shall be indicated by means of a scale. Resistent hangers shall be Mason Industries type PC30N, or approved equal.

C. Piping runs more than 30 feet from connected machinery and not within a mechanical equipment room shall be supported by non-metallic elements providing a minimum of 1/4 inch separation between the pipe and both the building and any metallic support such as a hanger, clip or strap. Suitable materials include neoprene, glass fiber or felt, but shall in all cases be appropriate for the particular temperatures encountered. Metallic hangers, externally surrounding pipe that is insulated is sufficient for this separation. Hangers shall be Mason type HD or equal.

2.2 DUCTWORK

A. All supply, return and exhaust ductwork within mechanical equipment rooms or within 30 feet of a connected fan or housing whichever is greater, shall be resiliently supported by non-metallic element as providing static deflection of between 1/8 and 1/4 inch. Hangers shall be Mason Industries type WHD or equal.

2.3 EQUIPMENT ISOLATOR ASSEMBLIES

A. General: As noted on the drawings in the equipment schedules and in these specifications all mechanical equipment shall be mounted on vibration isolators to prevent excessive transmissions of vibration structure borne noise into the building structure. These specifications, and the equipment schedules on the drawings will indicate by alphabetical letters the type of vibration isolator assembly along with the minimum static deflection, in inches, of the isolators to be used. The static deflection referred to is that of the isolators under the combined load of the supported equipment plus any integral subbase or inertia block. Vibration isolators shall be selected in accordance with the weight distribution of the equipment so as to produce reasonably uniform deflection. Mounting systems exposed to high temperature, oil, rust, or other adverse environments shall be suitably resistant to deterioration in such environments. Isolator types described below are Mason Industries.

B. Description of Equipment Isolator Assemblies.

1. Type A Isolator Mounting

a. Double deflection neoprene mountings shall have a minimum static deflection of 0.35. All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided for those areas where bolting is required. Mountings shall be ND.

2. Type B Isolator Mounting

a. Spring isolators shall be free-standing and laterally stable without any housing and complete with 1/4" neoprene acoustical friction pads between the base plate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflections, compressed spring height and solid spring height. Mountings shall be SLF.

3. Type D Isolator Mounting

a. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30° arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

4. Type G Isolator Mounting

a. Vibration isolator manufacturer shall furnish integral structural steel bases. Bases shall be rectangular in shape for all equipment. All perimeter members shall be beams with a minimum depth equal to 1/10th of the longest dimension of the base. Beam depth need not exceed 14" provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of one inch. Bases shall be type WF.

5. Type H Isolator Mounting

a. Vibration isolator manufacturer shall provide steel members welded to height saving brackets to cradle machines having legs or bases that do not require a complete supplementary base. Members shall be sufficiently rigid to prevent strains in the equipment. Inverted saddles shall be type ICS.

6. Type J Isolator Mounting.

a. Vibration isolator manufacturer shall furnish rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of half-inch bars or angles welded in place on 6" centers running both ways in a layer 1-1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with drilled steel members with sleeves welded below the holes to recieve equipment anchor bolts where the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base. Bases shall be type K.

C. Structural Ties and Rigid Connections

1. All vibration isolated equipment shall be free of any structural tie or rigid connection that can short-circuit or block the vibration isolators. All building trash shall be removed from under the base of any isolated equipment. Connecting piping, ductwork and electrical conduit shall not restrict movement of the equipment on its vibration isolators. The preferred methods is to use a flexible connection of sufficient length and with a loop if necessary.

2.4 FLEXIBLE PIPE CONNECTORS

A. For all water and glycol/water connections to rotating equipment, such as pumps, compressors, etc., furnish and install Flexonics Model 301, Flexweld, Universal, Metraflex or approved equal, braided corrugated bronze metal hose for size up to 2 inches. For pipe sizes 2-1/2 inch to 4 inches use Flexonics Model 391, Flexweld, or approved equal. Hose construction shall be for 200 degrees F. water and 200 psi working pressure.

C. At the suction and discharge of each reheat, hot water and Glycol heating pump, furnish and install Flexijoint Model DIBA-4, Garlok, Resistoflex, Dore or approved equal, teflon connectors. Connectors shall have 125 psi flanges and rated for minimum of 250 psi burst pressure at 220 degrees F.

D. At the suction and discharge of each primary and secondary chilled water pump, furnish and install Flexijoint Model DIBA-3, Garlok, Dore' or Resistoflex approved equal, teflon connectors. Connectors shall have 150 psi flanges, and rated for minimum of 300 psi burst pressure at 110 degrees F.

E. At discharge of vacuum pumps furnish and install flexible pipe connections as specified in Paragraph A above. stzes up to 4".

F. All piping with flexible connectors shall be independently supported so that there is no weight on the connection.

G. At the steam coil piping connection between coil and first valve in the condensate return, furnish and install a flexible pipe connector as shown in drawing details. Flexonics Model 301 or approved equal, braided corrugated stainless steel metal hose with single braid covering for size up to 2 inches. For pipe sizes 2-1/2 inch to 4 inches, use Flexonics Model #401 or approved equal. Hose construction shall be for 250 degrees F. water and 200 psi working pressure. Size of flexible connector shall be same size as steam coil outlet tapping.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the thermal insulation of all hot and cold piping, ductwork, vessels, equipment and other components of the mechanical systems.

C. Related work specified elsewhere:

1. Basic Materials and Methods: Section 15100.

2. Painting: Section 09900.

1.2 DEFINITIONS

A. Concealed insulated surfaces shall mean piping, ductwork and equipment located above suspended ceilings, and in chases.

B. Exposed insulated surfaces shall mean piping, ductwork and equipment located in shafts, mechanical rooms, tunnels and rooms without suspended ceilings, etc.

C. Mechanical equipment rooms shall be considered as un-airconditioned space for figuring the insulation of return air ductwork.

PART 2: PRODUCTS AND INSTALLATION

2.1 APPLICATION

A. Insulation shall be applied to clean, dry surfaces with pipe surfaces at room temperature. Insulation shall be butted firmly together. Longitudinal and end joints shall be sealed with compatible jackets, facings and adhesives.

B. Insulation shall be continuous through sleeves and wall and ceiling openings.

C. Metal shields will be provided at insulated piping hangers, as specified in Section 15140.

2.2 INSULATION MATERIALS

A. Insulation materials shall be furnished by Johns-Manville, Owens-Corning Fiberglas, Baldwin-Ehert-Hill, Certainteed Saint Gobain, Gustin Bacon, or approved equal.

B. Adhesives, mastics and coatings shall be furnished by Benjamin Foster (B.F.) Insul-Coustic (I.D.), Chicago Mastic (CMC) or approved equal.

C. All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and UL 723. Flame spread rating shall not exceed 25 and smoke developed rating shall not exceed 150 or in the case of flexible insulation as specified herein (Armstrong Armaflex) flame spread rating shall not exceed 25 and smoke developed rating shall not exceed 225. Accessories such as adhesives, mastics, cements, tapes, glass fabric and asbestos cloth for fittings shall have the same component ratings.

D. Calcium silicate rigid inserts shall be installed at all outside hangers. Inserts between the pipe and pipe hangers shall consist of rigid pipe insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall not be less than the following lengths:

1/2" to 2-1/2" pipe size	12" long
3" to 6" pipe size	15" long
8" to 10" pipe size	18" long
12" and over pipe size	24" long

2.3 JACKETS AND FACINGS

A. Where a jacket is specified the insulation jacket for fiberglass insulation shall be an all service jacket. Jackets and end laps shall be sealed with insul-Coustic 215 adhesive or Chicago Mastic 17-465 adhesive applied to two surfaces or with self-sealing type lap system.

B. Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal.

2.4 COLD PIPING

A. All domestic cold water piping, horizontal waste pipes under electric water coolers, horizontal waste pipe in equipment room ceilings receiving condensate from cooling coils shall all be insulated.

B. The insulation shall be a sectional type fiberglass pipe insulation 1" thick, 3 lbs per cubic foot density suitable for temperatures -60°F to +450°F. having a vapor barrier jacket cemented on. Piping in equipment rooms shall also have a 6 oz canvas jacket cemented on. Fittings, valve bodies and flanges for cold piping for sizes 3" and smaller shall be insulated with JM-301 or equivalent cement equal to thickness of adjacent pipe insulation. Over 3" fittings shall be insulated with mitered segments of pipe insulation secured with 16 gauge copper wire. A finish coat of 301 cement shall be applied over segments. Apply Unifit or Zeston cover with CMC adhesive 17-465 on the throat and secure it to adjacent pipe covering. Further secure with two wraps of 1-1/2" wide Unifit tape. Stapling of vapor barrier jacket will not be allowed.

C. Chilled water piping shall be insulated as above except piping over 8" and larger shall be covered with 1-1/2" thickness insulation. Large strainer shall have flanges only left uninsulated for easy removal.

2.5 HOT PIPING

A. All steam piping, condensate return piping, hot water heating piping, reheat coil piping, domestic hot and recirculating hot water piping, heat recovery system piping and relief valve vent piping shall all be insulated.

B. The insulation shall be a sectional type fiberglass pipe insulation of 3 lb per cubic foot density suitable for temperatures of -60°F to +450°F. and having an all service jacket cemented on. Piping in equipment rooms shall have an additional cover, a 6 oz canvas jacket cemented on. Fittings, valve bodies and flanges on piping 3" and smaller shall be insulated with JM-301 or equivalent cement equal to thickness of adjacent pipe insulation. Over 3", fittings shall be insulated with mitered segments of pipe insulation secured with #16 gauge copper wire. A finish coat of #301 cement shall be applied over segments. Apply Unifit or Zeston cover with CMC adhesive 17-465 on the throat and secure it to adjacent pipe covering. Further secure with two wraps of 1-1/2" wide Unifit tape.

C. Insulation shall be of the following thickness:

1. Hot Water

   a. Temperature of 100° to 149°F
      3" and smaller - 1" thick
      3-1/2" and larger - 1-1/2" thick

   b. Temperature of 150°F to 212°F (includes condensate returns)
      3" and smaller - 1-1/2" thick
      3-1/2" through 6" - 2" thick
      8" and larger - 2-1/2" thick

2. Steam

   a. Zero to 50 psig
      2" and smaller - 2" thick
      2-1/2" through 4" - 2-1/2" thick
      5" through 6" - 3" thick
      8" and larger - 3-1/2" thick

   b. Over 50 psig
      2" and smaller - 2-1/2" thick
      2-1/2" through 4" - 3-1/2" thick
      5" through 6" - 4" thick
      8" and larger - 4-1/2" thick

2.6 COLD EQUIPMENT

A. Chilled water pumps shall be insulated with 2" Foamglas encased in sheet metal. The pump casings shall be completely enclosed with insulation, except bearings and packings which shall be left uncovered. The enclosure shall be made in two pieces split halfway up so that the top half is easily removable for pump inspection. The enclosure shall be made as tight as possible using rubber gaskets and felt to seal cracks and other areas around openings. The insulated sheet metal enclosure shall be firmly attached to the pump base.

2.7 HOT VESSELS AND EQUIPMENT

A. Domestic hot water heaters, hot water reheat converter, flash tanks, condensate receivers and air separators shall be insulated. The insulation shall be rigid block hydrous calcium silicate insulation having a minimum density of 11 pounds per cubic foot.

B. Insulation shall have an average thermal conductivity not to exceed .37 BTU per inch per square foot per degree F. per hour at a mean temperature of 300°F. It shall be suitable for use with temperatures to 600°F and shall be 2" thick. Insulation shall be placed with joints staggered and all edges brought into firm contact and shall be cut or scored where necessary to fit the shape and contour of the vessel. Insulation shall be secured in place with 1/2" wide x .015 galvanized annealed wire on not over 12" centers. All joints shall be filled with particular manufacturer's recommended insulation cement well trowelled into the openings. The entire installation shall be covered with a layer of expanded metal lath weighing 2-1/2 pounds per square yard, laced together at all edges with 16 gauge galvanized soft annealed wire. Insulation shall be finished with a 1/2" coat of finishing cement to which Portland cement, to a maximum of 25% dry weight, may be added for a harder finish. A 20 x 20 glass mesh shall be applied over the cement embedded in one coat of B.F. 30-36 and brush coat applied over fabric.

2.8 DUCTWORK INSULATION

A. All supply and return ductwork shall be insulated internally with 1" thick, 1-1/2 lb density fiberglass duct liner having a black fire resistant skin surface rated for velocities up to 4000 fpm. Insulation shall meet NFPA Pamphlets 90A and 90B fire-resistant requirements and shall conform to U.L. Publication #181.

B. The insulation shall be applied in fabricated pieces sized to the interior duct surfaces with the black coated surface exposed to the air stream. It shall be firmly held in place with a fire resistant adhesive such as Benjamin Foster 85-10 or 85-20, or approved equal covering a minimum of 100% of the duct surface. In addition, insulation on the top and sides of horizontal ducts and all sides of vertical ducts shall be further secured with Omark, Duradyne KSM capacitor discharge studs and caps, or approved equal, on 15" centers. Discharge stud and cap shall be an integral unit so that the stud does not penetrate the cap. Exposed longitudinal edges of insulation shall be coated with a heavy layer of Benjamin Foster's 60-30 fire resistive mastic, or approved equal, prior to installation in the duct system. Transverse edges shall be covered with a "U" shaped sheet metal protector secured to the duct.

1. Duct sizes listed on the drawings are internal sizes. Where insulation is applied to the inside of the ducts, the metal size of the duct shall be increased in amount to result in internal dimensions equal to that shown on the drawings.

C. All exhaust ductwork in the mechanical equipment rooms shall be insulated internally as specified above. Insulation for a portion of exhaust ducts connecting to louvers shall be external insulation as specified in Article 2.10. Fume hood duct insulation is also specified in Article 2.10.

2.9 OUTDOOR AIR DUCTS AND UNUSED LOUVERS

A. All ducts and internal ouver covers shall be fabricated of double walled galvanized sheet metal with 2" thick, 6 lb density fiberglass insulation between. Outer cover shall be #18 gauge with #22 gauge galvanized sheet metal on the inside. All outside seams shall be soldered water tight.

2.10 EXHAUST AIR DUCTS

A. Apply insulation to all exhaust air ducts from exhuast louver of roof outlet back through the duct system to the exhaust damper and 3 feet beyond the damper or 5' back from roof outlet for all fume hood exhaust ducts.

B. The ducts shall be insulated with 2" thick 3 lb. density fiber glass board with all purpose vapor barrier jacket, foil scrim kraft jacket, Johns-Manville 814 Spin Glass FSK or approved equal. Insulation shall have a conductivity of 0.23 BTU/in per square foot per °F per hour at a mean temperature of 75°F.

C. Insulation shall be applied with edges tightly butted and impaled over welded pins and secured with clips. Pins shall be spaced to hold insulation securely in place but not over 18" centers. Joints shall be sealed with FSK tape.

D. Roll type aluminum cover bead shall be applied at all corners. JM Duramesh 20 x 20 glass fabric shall be applied as finish over FSK embedding the fabric in a coat of Benjamin Foster 30-36 Sealfas. A finish brush coat of adhesive shall be applied over fabric.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing equipment, materials and performing all labor necessary to revise location of existing water main and building service.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100
2. Pipe and Pipe Fittings: Section 15110
3. Valves: Section 15120
4. Piping Specialties: Section 15130
5. Mechanical Supporting Devices: Section 15140
6. Mechanical Systems Insulation: Section 15160

PART 2: PRODUCTS AND INSTALLATION

2.1 WATER SERVICE

A. The 8" cast iron water main and 4" cast iron service to building on the west side of Jackson-Owre shall be relocated as indicated on plans to clear new extension of the electrical transformer vault underground. Provide new manhole at new 4" valved connection to 8" main. All piping shall be extra heavy cast iron pipe with 250 lb. mechanical joints and lead tipped gaskets. Provide clamps on all cast iron bend fittings and concrete anchors on main bends.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing all equipment, materials and performing all labor necessary to connect the soil and waste piping systems and other related systems.

C. Related work specified elsewhere:

1. Basic methods and materials: Section 15100.

2. Pipe and pipe fittings: Section 15110.

PART 2: PRODUCTS AND INSTALLATION

2.1 GENERAL

A. All floor drains provided under this contract shall be of Josam Manufacturing Company, Jay R. Smith, Blake, Wade Manufacturing Company, Zurn Industries or approved equal, of type and size specified or indicated on the drawings. Except where otherwise specified or indicated, strainers for 2" floor drains shall be at least 5" in diameter, for 3" drains shall be at least 7" in diameter and for 4" drains strainers shall be at least 9" in diameter. Drains shall have nickel bronze strainers unless otherwise specified. Floor drains in floors resting on earth shall have spigot or hub outlet for caulked joint. The following numbers are taken from the Josam catalog.

B. Floor drains shall have threaded, spigot or hub outlet as required for proper connection to piping and shall be provided with a trap having a cleanout. When indicated on the drawings, floor drain or trap shall be provided with an auxiliary opening on inlet side of trap for indirect waste connection. There shall be no threaded auxiliary inlets in the ground. Drains installed in connection with waterproofing membrane, copper or lead flashing shall be provided with drainage flange, weepholes and flashing clamp.

C. The Contractor shall provide 16 oz. copper flashing or 8# lead flashing to extend 12" from clamping ring on all floor drains other than floor drains in slab on earth.

2.2 FLOOR DRAINS IN FLOORS ON GRADE

A. Mechanical Equipment Rooms: Josam No. 850-ZZV cast iron body floor drain, integral spigot outlet, cleanout flush with floor and backwater valve, and polished brass strainer.

B. Toilet Rooms and Showers and Miscellaneous Drains: Josam No. 200-ZZ-V, cast iron body floor drain, integral spigot outlet, Nikaloy strainer with backwater valve.

C. Where funnels are called for on the drawings, provide a Josam No. 510-Q-11 8" grate assembly. (Series 7020 floor drain grate modified to accept a type 5404 drain body.)

D. Acid Resisting: Duriron 7801-B or 9058-B with separate Palmer type backwater valve calked into Duriron tee. Provide a Durcomet 100 funnel and strainer plate when funnel is noted on plan.

2.3 FLOOR DRAINS IN FLOORS ABOVE GRADE

A. Mechanical Equipment Rooms: Josam No. 300-37A cast iron floor drain with I.P.S. outlet, 1910 deep seal P-traps with cleanout. Use shallow trap where necessary. Polished brass strainer. When funnels are called for on drawings provide a series #510-Q-11, 8" Dia. grate. Field welded funnels on grates will be unacceptable.

B. Toilet Rooms and Showers Miscellaneous Drains: Josam No. 300-36AK cast floor drain with I.P.S. outlet, 1910 deep seal P-trap with cleanout and Nikaloy strainer. Use shallow trap where necessary, provided flashing clamp areas where membrane occurs.

C. Flush Rim Floor Drain (F.R.F.D.): Josam No. 49850 cast iron drain with porcelain enamel inside. Double drainage flange and weepholes, clamping device, 3/4" I.P.S. flushing connections; flushing rim top with hinge grate. Trap to be Duriron P-trap, acid-proof. Provide solid hinged Nikaloy cover with integral strainer for all animal rooms.

D. Fume Hood Exhaust Duct Drips: Josam V-232-FC cast iron drip drain with open top and anti-splash dome strainer. Provide clamping flange and clamping device.

E. Acid Resisting: Duriron 5501-CF with Duriron P-trap. Where funnel is called for on the drawings, provide a Durcomet 100 funnel and strainer plate.

2.4 CLEANOUTS

A. Cleanouts, placed in accessible locations, shall be provided in all drainage lines where indicated on the drawings and where necessary to permit rodding out of the entire drainage system. Cleanouts shall be provided at the base of each new soil or waste stack and at the base of each new downspout riser.

B. Cleanout plugs and tees for bell and spigot piping shall have a cast iron body and a Minneapolis pattern cast brass plug. On threaded piping, cleanouts shall consist of a Minneapolis pattern cast brass plug screwed into a suitable fitting. Cleanouts on piping installed in inaccessible furred spaces above inaccessable ceiling or below floors on grade shall be provided with extensions to bring cover flush with finished wall or floor.

C. Cleanouts on acid-proof piping shall be of acid-proof material. See list below for type of frame and cover to be provided in the wall or floor.

D. All cleanouts shall be Zurn Manufacturing Company of the following figure numbers. Products as manufactured by Josam, Jay R. Smith, Blake or Wade are acceptable.

1. Finished Floors of Asphalt, Vinyl, Rubber or Other Composition: ZN-1325-5, bronze plug cleanout with nickel bronze round frame and round recessed cover.

2. Finished Floors of Terrazzo or Cement: ZN-1325 bronze plug cleanout with ZN-1385-2 nickel bronze round frame and round cover.

3. Finished Floors with Ceramic or Quarry Tile Finishes: ZN-1325-1 bronze plug cleanout with nickel bronze square frame and round cover.

4. Unfinished Floors and Traffic Areas: ZN-1326-10 bronze plug cleanout with cast iron frame, heavy duty grate and anchorage lugs.

5. Walls: Wall cleanout plugs in finished walls shall be Fig. ZN-1329-20 and square access covers shall be Fig. No. ZN-1375-1. Wall cleanouts in unfinished walls shall be Fig. ZN-1370 cleanout plug and housing with secured round access cover.

6. Ceilings: Cleanouts shall be provided with full size cleanout pipe with a brass coupling and a Fig. No. ZN-1329-20 polished nickel, bronze plug.

7. Carpeted Rooms: Z-1323 bronze brass countersunk plug, round brass scoriated cover flush with concrete floor. Carpeting shall be continuous over cleanout and shall be marked by a single chrome-plated round head screw protruding through the carpet and screwed through the center of the brass cover.

All exposed cleanout covers shall be chromium plated in walls and shall be nickel bronze in floors.

2.5 INDIRECT WASTE CONNECTION

A. Funnel drain connections receiving the discharge from indirect wastes shall be connected to the inlet side of trap on floor drain or to a separate trap. Indirect wastes shall be provided with a fixed air gap arrangement in connection to trap or shall be provided with a funnel drain connection.

2.6 ROOF JACKETS

A. Vent stacks from sewer, soil, waste and drain lines shall be extended at least 12" above roof, and shall be encased in frostproof jackets, Moore, Sure Seal or equal, each having an air space of at least 1" between the outside surface of pipe and inside surface of frost jacket. The top of the frost jacket shall be designed as to permit the insertion therein of a testing plug of such form that it can be readily seen until removed, and said plug shall be removed at once after a final inspection has been made and approved by Engineer. Vent pipe shall be cast iron where same passes through roof slab.

B. Roof jackets shall be constructed of 16 oz. copper for all pipes sizes 6" and smaller, and 20 oz. copper for all pipes larger than 6".

B. Roof jackets shall be constructed of 16 oz. copper for all pipes sizes 6" and smaller, and 20 oz. copper for all pipes larger than 6".

C. Acid-proof, frost-proof, type roof jackets shall be constructed of 6 pound sheet lead.

2.7 MANHOLES

A. Furnish and install such units where shown and as detailed on drawings as part of the sanitary sewer and water service systems.

B. The manholes shall be of Cretex Companies, Inc., or equal, manufactured of prefabricated reinforced poured concrete ring type and of 4'-0" diameter. The top sections where shown shall be of concentric or eccentric reducer, 48" diameter to 27" diameter.

C. The existing manhole rings and covers shall be reused as indicated on the detail plans. Frames to be fastened by bolts and grouting. All manholes shall have aluminum or C.I. steps.

2.9 SUMP PUMPS

A. Mechanical Equipment Rooms

1. Furnish and install where shown and detailed on the drawings complete duplex sump pumps each to be an Enpo-Cornell Model 150-M-BR-476, 1/2 HP, 208 volt, 60/3 phase, all bronze casting. Each unit shall pump 30 gpm against 23 feet of head. Pumps shall be installed in existing 36" round by 30" deep sump basin. Provide new bolt down cover for basin having manhole, vent connection, discharge pipe connection, and electrical cable connection.

2. Provide float switches in basin and electric cable from switches and pumps to a wall mounted control panel. Panel shall contain low level switch, high level switch, high water alarm, electric alternator and magnetic starters with thermal overload. The Electrical Contractor will provide power wiring to the control panel. All other wiring required shall be provided by the Mechanical Contractor. Controls shall allow both pumps to operate in event of high capacity return.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing of all equipment, materials and performing all labor necessary to connect the plumbing fixtures, trim and other related systems.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.
2. Pipe and Pipe Fittings: Section 15110.
3. Valves: Section 15120.
4. Piping Specialties: Section 15130.
5. Mechanical Supporting Devices: Section 15140.
6. Mechanical Systems Insulation: Section 15160.

PART 2: PRODUCTS AND INSTALLATION

2.1 GENERAL

A. Furnish and install fixtures and trim of first grade quality and finish, free from flaws and scratches. All fixtures shall have ground backs groups of fixtures shall be matched. Fixtures and trim are to be furnished as listed and shown under catalog numbers, unless otherwise noted and described.

B. The following fixtures are taken mainly from the American-Standard, Elkay, Duriron Company, Inc., catalogs and are used to designate type of fixtures desired. Fixtures of similar type and grade may be used in place of those specified, all subject to Engineer's approval. Crane, Kohler, Haws, Watrous, Just, Carlton, Halsey-Taylor and Speakman are approved.

C. All faucets, loose key stops, and flexible tube risers listed shall be Chicago Faucet Company.

D. Flush valves shall be Sloan, Delaney or Watrous.

E. Toilet seats shall be be Church, Beneke, Olsonite, or Sperzel.

F. Trim of similar type and grade may be used in place of those specified, all subject to Engineer's approval.

2.2 FINISH OF TRIMMINGS

A. All exposed flush, waste and supply pipes at the fixtures shall be chromium plated brass pipe, iron pipe size. The faucets, stops, valves, pop-up wastes, traps, flush valves, etc., shall be heavy cast brass, chromium plated. All chromium plate shall be applied over a nickel plated base.

2.3 FIXTURE SUPPORTS

A. Fixtures hung from partitions adjacent to pipe spaces shall be supported with carriers.

B. Fixtures hung from partitions, finished one side only, are to be supported as the type of fixture may demand, either with bolts extending directly from the fixture or from bolts extending from the fixture hanger, entirely through the partition. Bolts shall be welded to a steel plate, set plumb, on the opposite side of the partition and securely anchored. End of bolts or rods shall have C.P. cap nuts.

C. Fixtures hung from partitions finished both sides, the fixture shall be hung in a like manner mentioned above, except that anchor plates shall be placed within the partition and securely anchored. End of bolts or rods shall have C.P. cap nuts.

D.. Anchor bolts for supporting plumbing fixtures shall be the sole responsibility of the Mechanical Contractor. He shall furnish the bolts and/or anchorage and shall be solely responsible for the correct location of the bolts. All anchors are to be placed as the walls are being laid up to avoid drilling.

E. All anchor holes in the fixtures are to be utilized.

F. Carriers listed are as manufactured by Josam. Units as manufactured by Zurn or Wade will be acceptable.

2.4 CLEANING

A. After fixtures and trim are installed, place suitable guards on fixtures and trim to prevent use and protect from paint and plaster during construction. Prior to final inspection, clean off all labels and remove any construction dirt, rust, paint and plaster.

2.5 FIXTURE MOUNTING HEIGHTS

A. Fixture mounting heights shall be as shown on the architectural drawings.

B. Note special rough-in heights for handicapped.

2.6 PLUMBING FIXTURE SCHEDULE

A. The fixtures listed herein refer to fixture numbers noted on the drawings.

Item F-1 Water Closet

Bowl:	American-Standard 2502.011	Siphon jet action; elongated bowl, wall hung, 1-1/2" top spud, vitreous china.
Valve:	Sloan 115-F-Y1-YV	Chrome plated, with vacuum breaker, inlet opposite handle 38" above floor, 1" screwdriver angle stop, wall flange, 1-1/2" spud nut and flange.
Seat:	Church 5320.403	Black solid plastic, open front, with self-sustaining hinge for elongated bowl.
Support:	Josam 10000 Series/ Unitron Fittings	Carrier shall be furnished with block base or short foot supports to support fixture free and independent of finished wall. Carrier shall also be furnished with integral stack fitting with vent connections as required and carrier lugs with china caps. Mounting height floor to rim shall be 15".

Item F-1A Water CLoset - Handicapped

Same as F-1 water closet except mounting height floor to rim shall be 18".

Item F-2 Urinal

Urinal:	American-Standard 6530.18	Vitreous china blowout urinal with extended shields, integral flush spreader and trap, 1-1/4" top spud, 2" back outlet threaded connection, and supporting bolts.
Valve:	Sloan 180-F-Q-YV	Chrome plated with vacuum breaker, 1" screwdriver stop, flush connection and coupling for 1-1/4" top spud, wall and spud flanges.
Support:	Josam 17810	Urinal carrier with hanger plate, fixture bolts, bearing plate, steel pipe uprights, block bases and chrome plated trim. Mounting height floor to rim shall be 24".

Item F-2A Urinal-Handicapped

Same as F-2 urinal except mounting height floor to rim shall be 19".

Item F-3 Lavatory

Lavatory:	American-Standard 0361.055	20 x 18 vitreous china, anti-splashback, front overflow, soap depression, faucet holes 4" centers. Holes thru backsplash for thru going bolts.
Support:		Cast iron wall hanger and lag screws through anchor holes for block walls. Hanger for stud wall shall be full back plate between studs fastened and lavatory attached with through going bolts.

Trim:	Chicago 1802	Quaturn Centerset fitting with No. 1000 handles, 3-3/4" spout, No. E12 softflo and coupling nuts; polished chromium plated.
Waste:	American-Standard 2412.013	Lavatory drain, 4" tailpiece, 1-1/2" diameter and integral perforated grid.
Trap:	American-Standard 4403.010	Adjustable "P" cast brass trap with tubing drain to wall, 1-1/2" inlet, 1-1/2" outlet, ground swivel joints, cleanout plug, slip inlet with brass coupling nut, escutcheon and chrome finish.
Supplies:	Chicago #1006	1/2" chrome plated angle stops with 1/2" I.P.S. femal inlet chrome plated deep escutcheons, with 1/2" chrome plated flexible risers.

Item F-3A Lavatory - Handicapped

Lavatory:	American-Standard 0361.055	Same as F-3.
Support:		Same as F-3.
Trim:	Chicago Faucet HC 785-E3	Combination lavatory fitting with No. GN1A rigid Gooseneck spout, with No. E-3 softflo aerator and No. 317 wrist blade handles chrome plated.
Supplies:	Chicago #1006	Same as F-3.
Waste:	American-Standard 2412.013	Same as F-3
Trap:	American-Standard 4403.010	Same as F-3.

Item F-4 Electric Water Cooler - (Wall Hung)

Electric Water Cooler:	Halsey Taylor WC7A	Unit shall deliver 7 G.P.H. of 50° water at 90° ambient and 80° inlet water; all stainless top and cabinet; two stream mound building projector; right and left hand operation; separate valve and diaphragm automatic stream regulator shall be mounted within cabinet. Compressor shall be hermetically sealed with start capacitor; system controlled by primary and secondary protection thermostats.
Supply:		3/8" I.P.S. connection with 3/8" I.P.S. flexible tube riser with loose key stop.
Waste:		Removable grid strainer plate; 1-1/4" O.D. slip connection with 1-1/4" tailpiece.
Trap:	American-Standard 4418.018	Adjustable "P" cast brass trap with swivel Ell, 1-1/4" inlet and outlet; ground swivel joint; cleanout; chrome finish. All drain piping to be concealed.

Item F-5 Janitor Receptor

Receptor:		Concrete receptor to be furnished by General Contractor. Floor drain shall be furnished by Mechanical Contractor as specified in Section 15260 for on-grade or above grade installations.
Trim:	Chicago 897	Quaturn combination sink fitting with vacuum breaker, 3/4" hose thread on spout, No. 369 handles with adjustable wall brace, pail hook and No. 4 1/2" flanged female adjustable arms with integral stops. Polished chromium plated. Center line of faucet to be mounted 48" above floor.

Item-F-6 Sink

Sink:	Elkay LR1720	17" x 20" single compartment, 18 gauge, type 302, self-rim stainless steel sink; 4 faucet holes. Undercoating.
Trim:	Chicago Faucet 1102	Classic top mount deck sink fitting with No. L8-8" swing spout; NO. E3 softflow; No. 1000 handles; self-closing thumb control spray with 4 feet of hose. Inlet shanks on 8" centers.
Supplies:	Chicago Faucet 442-LK	1/2" I.P. female inlet and outlet angle stops with lock shield cap and No. 293-6 loose key handle. Polished chromium plated.
Waste:	Elkay LK-35	Standard duo strainer; fits 3-1/2" opening; 4-1/2" top diameter; stainless conical basket with neoprene Stopper; C.P. brass; 1-1/2" O.D. tailpiece.
Trap:	American-Standard 4403.010	Adjustable "P" cast brass trap with tubing drain to wall; 1-1/2" inlet and outlet; ground swivel joint; cleanout plug; slip inlet; escutcheon; chrome finish.

Item F-7 Emergency Shower and Eyewash

Emergency Shower

Trim:	Haws 8162H&V	Wall mounted lifesaver emergency shower complete with 10" diameter deluge shower head with 1" inlet and 1" I.P.S. stay-open rachet ball valve with chain pull ring, wall flange and inter-connecting fittings. Use H model for 8'-0" ceilings. Use V model for 9'-0" ceilings.

Eye/Face Wash

Trim:	Haws 7760-BT	Wall mounted aerated eye/face wash complete with mounting brackets; stay-open ball valve activated by push handle; stainless steel bowl; strainer and 1-1/2" O.D. tailpiece.

Supply:	Chicago Faucet 442-LK	1/2" I.P. female inlet and outlet angle stop with lock shield cap and No. 293-6 loose key handle. Polished chromium plated.
Trap:	American-Standard 4403.044	Adjustable "P" cast brass trap with tubing drain to wall; 1-1/2" inlet and outlet; ground swivel joint; cleanout plug; slip inlet; escutcheon; chrome finish.

Item F-8 Clinical Service Sink

Clinic Service Sink:	American-Standard 9512.013	20" x 24" clinic service sink wall hung, blow-out flushing action, flushing rim, vitreous china, 1-1/2" brass top spud, 4" back outlet, stainless steel bolt cover plates.
Flush Valve:	Sloan Royal 117HO(1")	Quiet exposed service sink flush valve with 1" offset, chrome plated, metal oscillating non-hold open handle; 1" I.P.S. screw driver bak-chek angle stop with protective cap; adjustable tail-piece, vacuum breaker flush connection and spud coupling for 1-1/2" top spud; wall and spud flanges. Centerline of valve 38" above floor.
Trim:	Chicago Faucet Co. No. 184	Quaturn double service sink fitting with No. 319 6" wrist blade handles. No. "R" integral stop arms; No. EX2 2" extension pieces stationary mixing spout with plain outlet, pail hooks and wall brace below spout attaching to flush pipe strap for 1-1/2" O.D. flush pipe.
Support:	Josam 17735	Carrier shall be floor anchored with support plates, adjustable coupling, mounting studs, pipe uprights and chrome plated trim.
Rim Guards:	American-Standard 7832.017	Stainless steel spring type rim guards for front and sides.

Item F-9 Surgical Scrub Station

Scrub Station:	Amsco Model CE-11 or Market Forge SS10-2	Two position, one-piece heavy stainless steel construction, complete with removable perspec divider panel, showerheads, solenoid water control valves, water hammer arrestor; soap reservoir and soap dispenser; low voltage touch-on, touch-off water control switches; touch-on 5 second automatic off surgical control switches; non-scald thermostatic water control valve.
Supplies:	Chicago 45LK	1/2" chrome plated straight stops on 1/2" hot and cold water supply piping.
Trap:		2 - 2" cast brass "P" traps with cleanouts, chrome finish.
Support:		Integral support brackets.

Item F-10 Omitted

Item F-11 Lavatory

Lavatory:	American-Standard 5300.124	16" x 14" vitreous china, anti-splashback, front overflow, soap depression, faucet holes 6" on center. Holes thru backsplash for thru going bolts.
Support:		Same as F-3.
Trim:	Chicago Faucet 104-317	Combination backset lavatory fitting with E12 softflow and #317 4" wrist handles.
Supplies:		Same as F-3.
Waste:	American-Standard 2412.013	Same as F-3.
Trap:	American-Standard 4403.010	Same as F-3.

Item F-12 Clinical Service Sink

Clinical Service Sink:	American-Standard 9512.013	Same as F-8
Flush Valve:	Sloan Royal 312YB	Quiet concealed service sink flush valve for right side mounting, exposed foot pedal operator, 1" IPS screwdriver bak-check angle stop, vacuum breaker with 1-1/4" elbow connection from wall to 1-1/2" exposed spud connection with spud coupling, wall spud flanges.
Support:	Josam 17735	Same as F-8
Rim Guards:	American-Standard 7832.017	Same as F-8

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing, installation and connection of all laboratory fixtures and trim as located on the drawings and scheduled herein including all piping, sleeves, valves, stops, sinks, and sink and laboratory fixtures and trim furnished under other sections or furnished by the Owner.

C. Related work specified elsewhere:

1. Laboratory Casework: Section 11610 and 11620.

2. Basic Materials and Methods: Section 15100.

3. Mechanical Systems Insulation: Section 15160.

4. Plumbing Fixtures and Trim: Section 15300.

D. Connected but not furnished or installed under this section:

1. All fixtures identified herein with "LX" and "LXFH" numbers. The trim, traps, supplies, rough-in and final connections to the fixtures, however, shall be provided and installed by Mechanical Contractor as scheduled herein.

2. All fixtures furnished by the Owner as identified on the drawings.

PART 2: PRODUCTS

2.1 LABORATORY FIXTURES

A. The fixtures schedules refer to fixture numbers noted on the drawings.

B. All sink supplies shall be supplied with loose key stops. Where deck type trim is specified, supplies shall be Chicago #1006. On back mounted trim, supplies shall be Chicago #45LK or 442LK.

C. This Contractor will furnish and install composition sinks and seal sinks to underside of table top with an acid-proof, waterproof compound, Johns-Manville Company "Volseal", or approved equal. All supports for sinks in metal cabinets will be furnished by the General Contractor. This Contractor shall provide the General Contractor with dimensional data for support of sinks in metal cabinets. Hole through top for sink and faucets will be provided by the General Contractor.

D. Exposed water piping at fixtures shall be iron pipe size, chromium plated brass pipe.

E. Sinks, composition material shall be Durcon 2A as manufactured by Duriron Company, Inc., Kemresin by Kewaunee Manufacturing Company, or approved equal. Durcon numbers are scheduled.

F. Where stainless steel sinks are specified they shall be Type 316, 18 gauge stainless, have underside sound deadened, and shall be self rim type.

G. Stainless steel sinks shall be furnished with holes to receive trim as indicated on plans.

2.2 SCHEDULE OF LABORATORY FIXTURES

Item L-1

Sink-SS
Elkay #MLR1517 15" x 17-1/2" x 7-1/2" single bowl with #LK-337 strainer and 1-1/2" tailpiece, Kimax #6700 1-1/2" glass swivel "P" trap.

Item L-2

Sink-SS
Elkay #MLR2222 22" x 22" x 7-1/2" single bowl with #LK-337 strainer and 1-1/2" tailpiece, Kimax #6700 1-1/2" glass swivel "P" trap.

Item L-2.1

Sink SS
Same as "L-2" except 10" deep bowl.

Item L-3

Sink-SS
Elkay #MDLR2522 25" x 22" x 10" single bowl with #LK-337 strainer and 1-1/2" tailpiece, Kimax #6700 1-1/2" glass swivel "P" trap.

Item L-4

Sink-SS
Elkay #MLR3122 31" x 22" x 7-1/2" single bowl with #LK-337 strainer and 1-1/2" tailpiece, Kimax #6700 1-1/2" glass swivel "P" trap.

Item L-5

Sink-SS
Elkay #MDLR3322 33" x 22" x 10" double bowl with 2 #LK-337 strainers and 1-1/2" tailpieces, Kimax #6700 1-1/2" glass swivel "P" trap, #6512P long 90 and #6521 sanitary "T" for continuous waste of glass pipe.

Item L-6

Sink-SS
Elkay #MDLR4322 43" x 22" x 10" double bowl with 2 #LK-337 strainers and 1-1/2" tailpieces, Kimax #6700 1-1/2" glass swivel "P" trap, #6512P long 90 and #6521 sanitary "T" for continuous waste of glass pipe.

Item L-7

Sink-SS
Elkay #MDLR4822 48" x 22" x 10" double bowl with 2 #LK-337 strainers and 1-1/2" tailpieces, Kimax #6700 1-1/2" glass swivel "P" trap. #6512P long 90 and #6521 sanitary "T" for continuous waste of glass pipe.

Item L-8

Sink-Epoxy
Durcon #15 16" x 12" x 8" single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-9

Sink-Epoxy
Durcon #25 18" x 15" x 8" single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-10

Sink-Epoxy
Durcon #35 21" x 18" x 10" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-11

Sink-Epoxy
Durcon #50 24" x 16" x 8" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-12

Sink-Epoxy
Durcon #55 25" x 15" x 10" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-13

Sink-Epoxy
Durcon #59 28" x 15" x 12" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-14

Sink-Epoxy
Durcon #60 28" x 20" x 8-3/4" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-15

Sink-Epoxy
Durcon #67 36" x 20" x 16" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-16

Sink-Epoxy
Durcon #CS-4 3" x 6" oval cup sink, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap. Sink shall be mounted in cabinet top.

Item L-17

Sink-Epoxy
Same as "L-16" above except sink to be bracketed off wall with S.S. straps bolted to wall and sink.

Item L-18

Sink-Epoxy
Durcon #CS-12 3" x 9" oval cup sink, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap. Sink shall be mounted in cabinet top.

Item L-19

Sink-Epoxy
Same as "L-18" above except sink to be bracketed off wall with S.S. straps bolted to wall and sink.

Item L-20

Sink-Epoxy

Durcon #DB6 36" x 15" x 8" deep single bowl in a 59-25/32" x 23-27/32" drainboard unit with no back-splash; #SO-3 1-1/2" tailpiece, Kimax #6728 tail-piece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-21

Sink-Epoxy

Durcon #DB8 24" x 15" x 8" deep single bowl in a 34-3/4" x 23-3/4" drainboard unit with no back-splash; #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-22

Sink-Epoxy

Durcon #DB9 18" x 15" x 8" deep single bowl in a 34-27/32" x 23-7/8" drainboard unit with no backsplash, #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-23

Sink-Epoxy

Durcon #76 42" x 20" x 12" deep single bowl with #SO-3 1-1/2" tailpiece, Kimax #6728 tailpiece assembly and #6700 1-1/2" glass swivel "P" trap.

Item L-24

Auxiliary Trim

Provide Durcon beehive overflows for epoxy sinks of sizes as follows:

BH-4	4" high	12 units
BH-6	6" high	12 units

Overflows shall be given to Owner's representative for distribution to proper rooms.

- - -

2.3 LABORATORY FIXTURES FURNISHED BY OTHERS

A. The following equipment will be furnished and set in place by others. The Mechanical Contractor shall rough-in, furnish and install chrome plated trim indicated, and make final connections to equipment as follows. Refer to Section 11610 for manufacturer details.

Item L-183 and 189 Centrifuge

Provide shut-off valve at wall on cold water supply with adapter and copper tubing to unit. Provide 1-1/2" glass "P" trap with 12" standpipe at wall and glass drain from unit.

Item L-211 Lab Glass Dryer

Provide 1-1/2" glass "P" trap and glass drain pipe from unit.

Item L-326 and 328 Lab Glass Washer

Provide shut-off valves at wall on hot water, distilled water and air supplies with adapters and copper tubing to unit (glass pipes for distilled water). Provide 1-1/2" glass "P" trap and glass drain pipe from unit.

Item L-327 Lab Glass Washer

Same as L-326 above except omitting air supplies and adding a cold water supply connection.

Item L-338 Lab Glass Washer

Same as L-326 above except omitting air and hot water supplies and adding a cold water supply connection.

Item L-329 Lab Glass Washer

Same as L-326 above except omitting air supplies.

Item L-389 Spectrophotometer

Provide shut-off valve at wall on cold water supply with adapter and copper tubing to unit. Provide 1-1/2" glass "P" trap with 12" standpipe at wall and glass drain from unit.

Item L-464 Mass Spectrometer

Provide shut-off valves at wall on hot water, cold water and air supplies. Provide Powers Reg. Co. #440-131-1575 thermostate water mixing valve with vacuum breaker, on-off valve, thermometer all for exposed location. Provide connection from mixing valve to unit. Provide 1-1/2" glass "P" trap with 12" standpipe at wall and copper drain from unit.

Item L-468 Spectrophotometer

Same as #L-389.

Item S-834 and 835 Distillation Still

Provide shut-off valves at wall on cold water and distilled water supplies with adapter and copper tubing to unit for cold water and glass piping for distilled water. Provide copper tubing drain in wall into tailpiece fitting of nearest sink.

Item S-855 Deionizer

Provide shut-off valve at wall on distilled water supply and pipe to unit.

Item P-121 Embalming Water Control System

Provide shut-off valves inside cabinet on hot and cold water supplies and connect to unit. Provide 2" chrome plated "P" trap at unit with galvanized pipe to drain.

Item P-665 Glasswashing Sink

Provide shut-off valves at wall under sink for hot water, cold water and deionized water. Provide back mounted mixing faucet with aerator (B2), back mounted deionized water faucet (K), back mounted pre-rinse unit (N), LK-337 strainers with 1-1/2" tailpieces and Kimax #6700 1-1/2" glass swivel "P" trap.

Item P-690 Scrub Sink

Room J-88.1 Provide shut-off valves at wall under sink for hot and cold water. Provide 2 back mounted mixing faucets with aerators and wrist action handles (D3) and a back mounted eye wash unit (P).

Room 0-19.3 thru 19.7 - Provide shut-off valves at wall under sink for hot and cold water. Provide back mounted mixing faucet with aerator, wrist action handles and tall gooseneck spout (D4).

For all sinks provide LK-337 strainers with 1-1/2" tailpieces and Kimax #6700 1-1/2" glass swivel "P" traps.

Item R-462, 463 and 465 Ice Flakes

Provide shut-off valve at wall on cold water supply with adapter and copper tubing to unit. Provide 1-1/2" glass "P" trap with 12" standpipe at wall and copper pipe drain from unit.

Item R-629 Refrigerator

Provide shut-off valve at wall on cold water supply with adapter and copper tubing to unit. Provide copper drain to nearest floor drain.

Item R918 and 919 Controlled Environment Room

Same as R-629 above.

Item R-920 Cold Rooms

Provide shut-off valves in suspended ceiling for cold water hot water, air, gas and vacuum piping for future connections to equipment in room. Provide 4" supply air duct and 4" exhaust air duct capped in suspended ceiling for future connection to room equipment.

Item M-811 Clothes Dryer

Provide 4" exhaust duct to outside with a dryer vent housing in outside wall.

Item M-855 Kitchen Unit

Provide shut-off vales at wall on hot and cold water supplies with copper tubing to unit. Provide 1-1/2" glass "P" trap and glass pipe from unit to wall.

Item M-885 Clothes Washer

Provide 3/4" hose bibbs at wall on hot and cold water supplies with rubber hoses to washer. Provide 2" chrome plated "P" trap with 2'-0" long standpipe at wall and galvanized pipe to drain.

2.4 LABORATORY FUME HOODS FURNISHED BY OTHERS

A. The following fume hoods will be furnished set in place by Others. The Mechanical Contractor shall rough in, furnish and install trim as indicated and make final connections to hoods. All fittings exposed within the hoods shall be coated with aluminum bronze epoxy finish. All handles shall be indexed for service connected.

Item LXFH-1 Chemical Hood (3ft.)

Refer to Section 11611 for manufacturers details.
Fittings and Controls: Item L-16 Cup Sink; #LC962-Vo-GA remote control valve and #LC986-E7 with flange outlet for gas, air and vacuum services; #LC962-VOA remote cold water control valve; #LC988-GN2B-E7 side outlet turret with gooseneck spout and nozzle; 7" round duct for 520 cfm exhaust.

Item LXFH-2 Chemical Hood (4ft.)

Same as LXFH-1 except 9" round duct for 760 cfm exhaust.

Item LXFH-3 Chemical Hood (5ft.)

Same as LXFH-1 except 10" round duct for 930 cfm exhaust.

Item LXFH-4 Chemical Hood (6ft.)

Same as LXFH-1 except 12" round duct for 1250 cfm exhaust.

Item LXFH-5 Isotope Hood (3ft.)

Refer to Section 11611 for manufacturers details.
Stainless steel cup sink with tailpiece in counter by hood manufacturer
Fittings and Controls: Kimax #6700 1-1/2" glass swivel "P" trap; #LC962-VO-GA remote control valve and #LC986-E7 wall flange outlet for gas, air and vacuum services; #LC962-VOA remote cold water control valve; #LC988-GN2B-E7 side outlet turret with gooseneck spout and nozzle; 7" round duct and filter in housing for 520 cfm exhaust.

Item LXFH-6 Isotope Hood (4ft.)

Same as LXFH-5 except 9" round duct and filter in housing for 760 cfm exhaust.

Item LXFH-7 Isotope Hood (5ft.)

Same as LXFH-5 except 10" round duct and filter in housing for 930 cfm exhaust.

Item LXFH-8 Laminar Flow Biological Safety Hood (4 ft.)

Refer to Section 11611 for manufacturers details. Provide #LC962-VO-GA remote control valve and #LC986-E7 wall flange outlet for gas, air and vacuum services for hood only in Room 0-442. All hoods to exhaust 200 cfm through an 8" round duct.

Item LXFH-9 Laminar Flow Hood (4,5 and 6 ft)

Refer to Section 11611 for manufacturers details. Provide #LC962-VO-GA remote valve and #LC986-E7 wall flange for gas and vacuum services for hood as follows: Room 0-448 (G & V), 0-452 (G & V), J-496.4(G). Air through hood is 100% recirculated back to room.

Item LXFH-10 Laminar Flow Biological Safety Hood (4 ft.)

Refer to Section 11611 for manufacturer details. Provide #LC962-VO-GA remote control valve and #LC986-E7 wall flange outlet for gas, air and vacuum services for hood. Air through hood is 100% recirculated back to room.

Item Existing Hoods

The Casework Contractor will relocate some existing hoods into remodeled areas as noted on the drawings. The Mechanical Contractor shall rough in and make final connections to hoods as required reusing existing trim unless otherwise noted.

2.5 LABORATORY TRIM

A. Index Buttons: All brass furnished shall be identified with a color coded plastic index button on the fixture handle as herein scheduled and noted under the particular fixture number that call for cross arm or wheel handles.

Service	Lettering and Color	Button Color
Cold water	CW-White	Green
Hot water	HW-White	Red
Gas	GAS-White	Blue
Air	AIR-White	Orange
Vacuum	VAC-White	Yellow
Distilled water	DW-Black	White
Steam	STEAM-White	Black
Oxygen	OXY-Black	Orange
Nitrogen	N-Black	Gray

B. Faucet trim shall be specialized laboratory design with three arm or four arm handles and plastic index buttons indicating the type of service. Furnish deck type, wall type goosenecks where scheduled. All working parts that move in water including seat, lower stem, washer retained and nut shall be of monel metal to insure maximum resistance to corrosion and abrasion. Entire working unit shall be removable and interchangeable with any other faucet on laboratory equipment and shall be held in place by a cap nut, housing, conical packing and brass packing washer. Removable unit shall be readily convertible to self-closing type without disturbing permanent installation of the fixtures. All faucets shall be slow compression type and close with pressure. All faucets shall have female outlets so designed to take a standard 3/8" filter pump and/or an anti-splash spout and without the use of intermediate fittings. All sink faucets shall be furnished with Chicago Faucet, or equal, No. 441LK stops. All sink faucets shall be polished chrome plated unless otherwise specified.

C. Distilled water faucets shall be Chicago Faucet with heavy silver plating on inside and a Butler silver plating on outside, cross index handles, self-closing units.

D. All outlets, cocks and inlet shanks shall be furnished and installed with rough-in and final connections, as a portion of the mechanical contract, unless otherwise noted.

E. This Contractor shall check countertop material for installation of lab outlets as they vary from lab to lab.

F. Laboratory trim located on laboratory casework shall be as scheduled. For locations see drawings. Numbers listed are Chicago Faucet, or approved equal. Refer to Alternate # for use of Water Saver Faucet equipment.

2.6 LABORATORY TRIM SCHEDULE

A. The addition of a number 2 after the letter designating the type of faucet indicates the ommission of the #E7 serrated nozzle and the addition of an #E3 softflow aerator. Refer to drawings for locations.

Item A Faucet

#LC932-VB-E7 back mounted single faucet with a swing spout, vacuum breaker and #E7 serated nozzle.

Item B Faucet

#LC940-VB-E7 back mounted combination mixing faucet with swing spout, vacuum breaker and #E7 serated nozzle.

Item C Faucet

#LC934 back mounted single faucet with rigid gooseneck spout, vacuum breaker and #E7 serated nozzle.

Item D Faucet

#LC943 back mounted combination mixing faucet with rigid gooseneck spout, vacuum breaker and #E7 serated nozzle.

Item D3 Faucet

Same as "D" except with aerator and 4" wrist blade handle.

Item D4 Faucet

Same as "D3" except with 13" high rigid gooseneck spout.

Item E Faucet

#LC926-VB-E7 deck mounted single faucet with a swing spout, vacuum breaker and #E7 serated nozzle.

Item F Faucet

#LC931-VB-E7 deck mounted combination mixing faucet with swing spout, vacuum breaker and #E7 serated nozzle.

Item G Faucet

#LC928 deck mounted single faucet with a rigid gooseneck spout, vacuum breaker and #E7 serated nozzle. Total height of unit shall be 1'-0".

Item H Faucet

#LC930 deck mounted combination mixing faucet with a rigid gooseneck spout, vacuum breaker and #E7 serated nozzle. Total height of unit shall be 1'-0".

Item H3 Faucet

Same as "H" except gooseneck spout is for a total height of 1'-4-1/4".

Item J Faucet

#1200 modified concealed mounting combination mixing faucet with a #GN2B-E4 rigid gooseneck spout and rose spray and 4" wrist blade handles.

Item J3 Faucet

Same as "J" plus a self-closing thumb control spray with 4 feet of hose.

Item K Faucet

#LC970 back mounted single faucet with a rigid spout and #E7 serated nozzle. All internally silver plated for deionized water systems.

Item L Faucet

#LC969 deck mounted single faucet with a rigid spout and #E7 serated nozzle. All internally silver plated for deionized water system. Total height of unit shall be 1'-0".

Item M Faucet/Tempering Valve

#LC926-VB-E7 modified deck mounted single faucet with a rigid spout, vacuum breaker and E7 serated nozzle A chrome "T" shall be inserted between faucet discharge and vacuum breaker. Insert in "T" a dial thermometer, Powers #894-3709. In sink cabinet under sink mount a thermostatic mixing valve Powers #440-1500. Valve shall have thermostatic mixer, integral stops, strainers and check valves.

Item N Pre-Rinse Unit

#510 back mounted combination mixing faucet with check valves on supplies, 24" riser pipe, 36" flexible S.S. hose, self-closing valve on spray head.

Item P Wash Unit

Haws #7626 back mounted aerated eye/face wash unit complete with stay-open ball valve activated by push handle, chrome pipe extension, anti-turn mounting lugs and wall plate.

Item Auxiliary Trim

Provide 30 Chicago Faucet Co. #E-17 Welch aspirator for installation on the aforementioned faucets. Asperators shall be given to Owner's representative for distribution to proper rooms.

2.7 LABORATORY OUTLET SCHEDULE

A. The following items are designated on the drawings for all the outlets for vacuum, gas and compressed air.

Item G, A,V

#LC980-907 deck mounted turret with a ground key cock for gas, air and vacuum.

Item G1, A1, V1

#LC980-907 turret mounted on pipe under re-agent shelf with a ground key cock for gas, air and vacuum.

Item G2, A2, V2

#LC986-907 back mounted flange with a ground key cock for gas, air and vacuum.

Item G3, A3, V2

#LC981-907 duplex turret mounted on pipe under re-agent shelf with duplex ground key cocks for gas, air and vacuum.

Item G4, A4, V4

#LC981-907 deck mounted duplex turret with duplex ground key cocks for gas, air and vacuum.

Item G5, A5, V5

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing of all equipment and material, and performing all labor necessary to provide natural gas at all outlets shown.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.

2. Pipe and Pipefitting: Section 15110.

3. Valves: Section 15120.

4. Piping Specialties: Section 15130.

5. Mechanical Suppporting Devices: Section 15140.

6. Gas Outlets: Section 15310.

PART 2: PRODUCTS AND INSTALLATION

2.1 GAS SERVICE REQUIREMENT

A. This Contractor shall connect to existing gas risers and mains as indicated on drawings extending gas piping to laboratory outlets as required. The existing gas service into Jackson-Owre shall be revised as indicated for enlarged electrical transformer vault.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing of all equipment and material, and performing all labor necessary to provide compressed air at outlets shown.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100

2. Pipe and Pipe Fittings: Section 15110

3. Valves: Section 15120

4. Piping Specialties: Section 15130

5. Mechanical Supporting Devices: Section 15140

6. Laboratory Fixtures and Trim Section 15310

PART 2: PRODUCTS AND INSTALLATION

2.1 COMPRESSED AIR REQUIREMENTS

A. This Contractor shall connect to existing compressed air risers and mains as indicated on drawings extending air piping to laboratory outlets as required. At the base of new compressed air risers, furnish and install Armstrong 1" No. 71 snap action ball float traps. Provide drip leg and gate valve in front of trap with drain valve on discharge side.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing of all equipment and material, and performing all labor necessary to provide vacuum at all outlets shown.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100

2. Pipe and Pipe Fittings: Section 15110

3. Valves: Section 15120

4. Piping Specialties: Section 15130

5. Mechanical Supporting Devices: Section 15140

6. Laboratory Fixtures and Trim: Section 15310

2.1 MATERIALS

A. Laboratory Vacuum Pump

1. Furnish and install one (1) new single vacuum pump, Size OV-5A as manufactured by the Nash Engineering Company. The Unit shall be capable of passing fluids directly through the pump to waste and shall include the following:

2. One (1) Model AHC-50 single stage, positive displacement, non-pulsating, liquid seal, rotary vacuum pump. The pump shall have enclosed rotors with conical porting that facilitates adjustment of internal clearances.

3. The pump shall have a capacity of 40 cfm at 25" Hg. The new pump shall be driven by a close coupled 3 hp, 1750 rpm, ODP motor powered by 208 volts, 3 phase, 60 cycles. Pump shall be mounted on common steel base. Pump shall be connected to existing control tank as indicated in piping details on drawing. Verify existing conditions for interconnections of pumps.

4. The pump manufacturer shall conduct operating tests to verify that actual performance is within five percent of nominal setting. Certified test data for the vacuum pump shall be made available to the Owner at no charge.

5. For pump, provide and install a discharge separator-silencer, seal water line strainer, 120 volt solenoid valve, anti-siphon fitting and vacuum switch.

6. New electrical controls shall provide alternating control for the new and the existing vacuum pumps. Included in the control equipment shall be two (2) vacuum switches; high and low set, shall through suitable relays, sequence vacuum pump operation: Upon closure of low set switch, vacuum pump #1 will start. Continued rise in pressure in system will close high set pressure switch and start vacuum pump #2. Provide a manual transfer switch to alternate the lead vacuum pump.

7. Provide all controls, magnetic starter with protection on each leg, relays and terminal strip mounted in a NEMA 1A enclosure for the new pump. Control voltage shall be 120 volt, 60 cycle. Provide all interwiring required.

8. The Electrical Contractor will provide the disconnects at the motor control center and power wiring to the panel location.

9. Sieman Hinsch equipment is approved as equal.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing and install all equipment, materials and performing all labor necessary for an oxygen piping system.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.
2. Pipe and Pipe Fittings: Section 15110.
3. Valves: Section 15120.
4. Mechanical Supporting Devices: Section 15140.
5. Laboratory Fixtures and Trim: Section 15310.

D. Furnished by Owner:

1. Oxygen Tanks with regulators and valves.

2.1 OXYGEN REQUIREMENTS

A. This Contractor shall connect to the Owner's oxygen tank equipment as indicated on drawings and extend oxygen piping to laboratory outlets as required.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing of all equipment, material and performing all labor necessary for the deionized water system.

C. Related work specified elsewhere.

1. Basic Methods and Materials: Section 15100.
2. Pipe and Pipe Fittings: Section 15110.
3. Valves: Section 15120.
4. Mechanical Supporting Devices: Section 15140.
5. Laboratory Fixtures and Trim: Section 15310.

PART 2: PRODUCTS AND INSTALLATION

2.1 DEIONIZED WATER SYSTEM

A. This Contractor shall connect to existing deionized water risers and mains as indicated on drawings extending piping to laboratory faucets as required.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes installation of a complete wet standpipe system with fire department hose valves, hose cabinet connections and connections to existing water service and fire department siamese all as indicated on the drawings and as specified below.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100

2. Piping Specialties: Section 15130

3. Mechanical Supporting Devices: Section 15140

2.1 PIPE AND PIPE FITTINGS

A. This Contractor shall make a 4" connection to existing 4" fire water service in the basement of Lyon Lab and extend 4" loop into crawl space and sub-basement connecting to all new 4" standpipes in stair towers.

B. Standpipe Piping

1. Pipe - Seamless standard weight steel pipe.

2. Fittings - 250 psi welded fittings.

3. Joints - Welded or approved grooved pipe method suitable for pressures as noted above.

2.2 VALVES

A. Fire department valves in stair towers shall be Allenco Fig. 170 U, Elkart Fig. U-25, or equal, angle valve with cap and chain. Valve shall be UL approved 300#, cast brass with satin trim and red enamel hand wheel. Outlet threads to Minneapolis Fire Department specifications. Valves shall be mounted in cabinets as detailed on the drawings. Cabinets shall be Elkart series 1600, Allenco Fig. 280 AL, or equal, modified recessed cabinet 11" deep with flush trim and double strength glass, hinged door panel, steel prime coated.

B. All shut off valves shall be UL labelled OS and Y or Butterfly 300# MWP. Where valves are called out on Drawings to be supervised they shall be provided

with tamper switches. These will be wired by the Electrical Contractor into fire alarm system. Provide cabinets for riser valves as detailed on drawings.

C. Check valves shall be UL approved 300# MWP with soft seat. Fire department check valve shall be equipped with 1/2" ball check. Ball drips shall be piped to floor drain.

2.3 FIRE HOSE CABINETS

A. Hose cabinets will be furnished and installed in walls by the General Contractor. This Contractor shall provide a 1-1/2" pipe from 4" standpipe to each cabinet and connect to the 1-1/2" hose valve furnished with the cabinet.

2.4 ALARM

A. A flow switch shall be installed at the existing meter and detector check at location indicated on plans. The Electrical Contractor will wire the flow switch into fire alarm system.

2.5 INSTALLATION

A. The sprinkler work shall conform to NFPA standards, the City of Minneapolis, and the insurance company having jurisdiction: All work required for respective systems shall be performed by workmen skilled in this trade. All work shall be neat and piped in a workmanlike manner. Piping shall be run in strata provided with no interference with other trades.

B. All required permits for system related work shall be obtained and paid for by this contractor.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing all equipment, materials and performing all labor necessary to connect the steam heating systems and other related systems.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.
2. Pipe and Pipe Fittings: Section 15110.
3. Valves: Section 15120.
4. Piping Specialties: Section 15130.
5. Mechanical Supporting Devices: Section 15140.
6. Vibration Isolation: Section 15150.
7. Mechanical Systems Insulation: Section 15160.

D. Furnished but not installed under this section:

1. Steam coils.

E. Installed but not furnished under this section.

1. Pneumatic control valves on steam coils and room radiation.

PART 2: PRODUCTS AND INSTALLATION

2.1 HUMIDIFIERS

A. Furnish and install humidifiers in built-up air handling units and the packaged air handing unit where shown on the drawings. Humidifiers shall be of a type which discharge clean, dry steam without drip or objectionable noise. Humidifier design shall utilize a steam jacketed valve and separating chambers, an asbestos muffler and an insulated stainless steel steam jacketed distribution manifold for this purpose. Each humidifier shall be furnished with a normally closed, full modulating direct acting pneumatic valve, a .045" perforated strainer, an inverted bucket type steam trap, and stainless steel discharge manifolds suitably sized to traverse plenum and equipped with internal stainless steel silencing screen. Each humidifier shall be accurately sized according

to pounds of steam required per hour and 12 psi inlet steam pressure. Humidifiers shall be Armstrong Series 30 or approved equal.

B. On all multiple manifold installations in built-up air handling unit housings, the humidifier supplier shall furnish a normally open temperature switch which shall be installed as shown on the drawings and will be wired under temperature control.

C. See drawings for humidifier schedule.

2.2 PREHEAT COILS

A. Preheat coils for built-up air handling units shall be Wing Model VIFB. Capacities shall be based on 4 psi coil inlet pressure. Maximum face velocity shall be 800 F.P.M. and number of rows shall be as scheduled on the drawings.

1. Each heating coil shall consist of built-in series of vertical finned heating elements and by-passes with interlocked dampers controlled by pneumatic damper motor and air stream thermostat. Dampers shall be constructed and arranged so as to completely enclose and isolate the heating coil passes when no temperature rise is required.

2. Finned heating elements shall be fabricated of 5/8" O.D. seamless copper tubes with rectangular aluminum fins. Each tube shall be individually secured to steam and return headers by a brazed joint. Finned elements shall be factory tested at 200 psig steam and 1,000 pounds hydrostatic pressure.

3. The coil shall be prepitched and casings shall be constructed of 14 gauge galvanized and painted with rust inhibitive paint. Dampers shall be constructed of 16 gauge cold rolled steel with baked enamel finish. The volume of air passing through the coil shall not vary more than ± 5%, regardless of the position of the internal dampers.

4. See drawings for schedule.

2.3 PRESSURE REDUCING VALVE AND TRIP VALVES

A. Furnish and install pressure reducing valves)RV) and trip valves of the size and capacities shown in the schedule on the drawings. Pressure reducing stations shall be comprised of two approximately 60% capacity valve trains in parallel. Each valve train shall have two PRV's and a trip valve in series. The first PRV in each train (H.P. valve) shall reduce steam pressure from approximately 125 to 60 psig. The second PRV (L.P. valve) shall reduce steam pressure from approximately 60 to 15 psig.

The L.P. PRV shall be equpped with a pressure pilot. The H.P. PRV shall be equipped with a pressure pilot and a safety pilot. The trip valve shall be equipped with a trip pilot. Control lines and pilot valves shall be arranged to provide the following safety controls. The P.P. valve shall be capable of reducing from 125 to 15 psig through override by the safety pilot in the event that the L.P. valve fails. The L.P. valve shall be capable of reducing from 125 to 15 psig in the event that the H.P. valve fails. The trip valve shall be capable of stopping all steam flow in the event that both PRV's fail. Control lines shall be connected where shown on the drawings.

B. Pressure reducing valves shall be of the single seated dead-end service type, pilot operated reducing valves. Valves shall be Spence ED pilot type valves with stainless steel seats and discs. Valves shall be 300 pound cast steel construction.

C. Trip valves shall be of the single dead-end service type, pilot operated. Valves shall be Spence ED of 300 pound cast steel construction.

D. Noise suppressors shall be Spence multihole plates located as shown on the drawings. Noise level measure 10 feet from the reducing station shall not exceed 80 decibels. Suppressors shall be of 150 pound construction.

E. See section 01100, substitution Alternate No. for Alternate manufacturers.

2.4 CABINET UNIT HEATER

A. Types and capacities as shown on the drawings. Capacities based on 2 psig steam and 60°F entering air. Nesbitt or equal Modine, McQuay, Airtherm, Dunham Bush, or Trane.

B. Heating elements of copper tube expanded into aluminum fins, with tubes bonded to headers, supported in the cabinets with brackets arranged to allow free movement and adjustable for pitch. Elements tested at not less than 150 psig.

C. Fans driven from a three-speed motor 120/60/1 electric characteristics.

D. Cabinets No. 16 gauge steel, prime coat finish over rust preventive. Access cover to disconnect switch with tamper-proof operator.

E. Recessed units shall have full lap frames. Units shall be inverted air flow with front inlet and outlet grilles.

F. Fan speed and air capacities shall not exceed the values listed on the drawings and all units shall have a Class II or less AMCA sound measurement classification.

G. Motors shall be 120-60-1 with thermal overload. Units shall be complete with line voltage thermostats. The Electrical Contractor will wire the motor switch and thermostat.

2.5 UNIT HEATERS

A. Furnish and install Trane, McQuay, Carrier, Modine or Herman Nelson unit heaters. Units shall be propeller type; either horizontal or vertical projection as shown on the drawings. Heater capacity shall be as noted on the drawings when using two (2) psig steam and 60 degrees F. entering air. Unit heaters shall have throw and radius of diffusion sufficient to cover the areas served.

B. Motors shall be 120-60-1 with thermal overload. Units shall be complete with line voltage thermostats. The Electrical Contractor will wire the motor switch and thermostat.

2.6 HEATING COILS

A. Heating coils shall be Trane type N or NS, McQuay type 8J or 8SOR, or Westinghouse type HM, shall be installed in the built-up air handling units as shown, and shall be of the steam distributing type with fins securely bonded to the tubes.

1. Fin thickness shall be .012 inch. Coils shall be pitched within the casings and tested tight with a hydrostatic pressure of 150 psig.

2. Coils shall be with fin spacing as required based on four (4) psig steam entering coil.

3. See drawings for schedule.

2.7 FLASH TANKS

A. Furnish and install flash tanks where shown on the drawings and in accordance with the details shown. Tanks shall be of size indicated on the drawings with tappings for inlet, outlet, vent and drain connections. Tanks shall be constructed of standard steel pipe Schedule 40 with flanged or welded ends.

B. Tanks shall be supported by angle iron brackets on the wall, from the ceiling or by a floor stand. Tanks shall be all welded construction, rust proofed and finish painted outside.

2.8 CONDENSATE PUMPS AND RECEIVERS

A. Furnish duplex pump and receivers as manufactured by Hoffman, or equal and approved. Pumps shall be vertical submerged centrifugal type mounted outside the receiver with bronze impeller and liners and with stainless steel shaft. Other approved manufacturers are Weil and Domestic.

B. Motors shall be 1750 RPM, all-angle dripproof construction, mounted above the highwater level. Motors shall be non-overloading at any working pressure below design pressure.

C. The receiver shall be cast iron provided with vent, overflow drain connections in all cases.

D. Pump discharge shall be provided with a pressure gauge, non-slam check valve and gate valve. Provide vent piping to ceiling and back down to floor drain.

E. Provide float switches in receiver and electric cable from switches and pumps to a wall mounted control panel. Panel shall contain low level switch, high level switch, high water alarm, electric alternator and magnetic starters with thermal overload. The Electrical Contractor will provide power wiring to the control panel. All other wiring required shall be provided by the Mechanical Contractor. Controls shall allow both pumps to operate in event of high capacity return.

F. Refer to Schedule on the drawing.

2.9 FINNED TUBE RADIATION

A. Furnish and install where shown on the drawings, Sterling, Standard, Dunham Bush, Webster, Nesbitt or Vulcan finned tube radiation. All radiation shall be IBR rated and approved. Element length indicated on the drawings are minimum finned element lengths.

B. The heating elements shall be constructed of steel tubes and steel fins with fins of 20 gauge thickness securely bonded to pipe. All elements shall be installed on slide cradle hangers to eliminate all expansion noise. Wall hangers shall be of 12 gauge steel with side plates of 14 gauge steel. Hangers shall be bonderized and prime-coated. This Contractor shall furnish and install hangers for all finned tube radiation whether he provides enclosure or not.

C. The various heating elements and sloping top covers are indicated on the plans including capacity required.

1. Selection of finned tube radiation is based on 2 psi steam entering with 65°F entering air and gravity air circulation.

D. The heating units in stair towers shall be 2 high fin with flat top and 2 side cover for free standing installation. Provide pipe stand under unit bolted to floor.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing all equipment, materials and performing all labor necessary to connect the hot water heating systems and other related systems.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.

2. Pipe and Pipe Fittings: Section 15110.

3. Valves: Section 15120.

4. Piping Specialties: Section 15130.

5. Mechanical Supporting Devices: Section 15140.

6. Vibration Isolation: Section 15150.

7. Mechanical Systems Insulation: Section 15160.

D. Installed but not furnished under this section.

1. Pneumatic control valves on room radiation and reheat coils.

PART 2: PRODUCTS AND INSTALLATION

2.1 CONVERTORS

A. Furnish and install steam in the shell and water in the tube instantaneous heater having cast iron heads, 3/4" O.D. copper tube, steel tube sheets and steel tube supports. Unit shall be Bell & Gossett Type SU, Patterson-Kelly, Bernstrom and Dunham Bush Type DS, or Taco Type S.

B. Convertors shall be constructed in accordance with ASME code for unfired pressure vessels for a working pressure of at least 125 psig. Water velocity shall not exceed 5 feet per second and the heating surface shall be based on a scale factor of 0.001. Capacity of units shall be as scheduled herein for heaters with 2 psig steam.

C. This Contractor shall furnish and install saddles and remaining framework as shown on the drawings for mounting convertors.

D. See drawings for Convertor Schedule.

2.2 BOOSTER PUMPS

A. Furnish and install base mounted forced hot water circulating pumps having a leakproof mechanical seal, John Crane specifically for water service from 40"F to 210°F. Pumps shall be Allis-Chalmers, Chicago Pump Company, Peerless, Armstrong, Aurora, Ingersoll-Rand, Bell & Gossett, Taco, Dunham Bush and Thrush.

B. Base mounted motor and pumps shall be complete with steel base plate. Certified pump curves shall be furnished with shop drawings. Special emphasis is placed on flat head characteristics of pump operation. Pump impeller diameter shall not be less than 90% of the maximum diameter to promote quiet operation. All pumps shall operate at 1750 RPM.

C. Pumps shall have grease lubricated ball bearings. Piping to pumps shall be properly installed and aligned to prevent any distortion of the pump casing under all operating conditions. Pump characteristics shall be as scheduled on the drawings.

2.3 FINNED TUBE RADIATION

A. Furnish and install where shown on the drawings, Sterling, Standard, Dunham Bush, Webster,Nesbitt or Vulcan finned tube radiation. All radiation shall be IBR rated and approved. Element length indicated on the drawings are minimum finned element lengths.

B. The heating elements shall be constructed of steel tubes and steel fins with fins of 20 gauge thickness securely bonded to pipe. All elements shall be installed on slide cradle hangers to eliminate all expansion noise. Wall hangers shall be of 12 gauge steel with side plates of 14 gauge steel. Hangers shall be bonderized and prime-coated. This Contractor shall furnish and install hangers for all finned tube radiation whether he provides enclosure or not.

C. The various heating elements and sloping top covers are indicated on the plans.

1. Selection of finned tube radiation is based on 195°F water entering and 165°F water leaving with 65°F entering air and gravity air circulation.

2.4 CONVECTORS

A. Furnish and install where shown on the drawings Sterling, Airtherm, Trane hot water heating convectors. Front panels shall be constructed from 16 gauge sheet steel, bonderized and prime-coated, secured by key operated locks. Cabinets shall be semi-recessed type, with wall guard and access doors.

B. Heating coils shall be copper tube with aluminum fins encased in a steel frame. Air vent assembly consisting of a manual air vent, copper tubing reducing coupling to connect with a copper air chamber. See piping detail on drawings.

C. All units shall be selected on 195 degrees F. water entering and 165 degrees F. water leaving with 65 degrees F. entering air.

2.5 HYDRONIC SYSTEMS ACCESSORIES (Radiation, Reheat, and Heat Recovery Systems)

A. Expansion Tanks

1. Closed expansion tanks shall be constructed according to ASME codes and bear label of the same. Construction shall be black steel. Tanks as manufactured by Bell & Gossett and Bremen.

2. All tanks shall be complete with gauge glass with guards and cocks, overflow, drain valve, air charging valve, fill, system connection and opening for float.

3. Furnish and install McDonnell Miller Series 69 float switch set at one quarter level to indicate a remote low level light. Wiring by Mechanical Contractor with 120-60-1 characteristics. Low level alarm lights shall be brought to a central location in Basement Mechanical Room where directed by Architect/Engineer.

4. See drawings schedule for sizes of tanks.

B. Air Separator

1. Furnish and install as shown on the drawings Bell & Gossett Rolairtrol, Thrush, Armstrong or Taco air eliminator complete with strainer. Install unit for easy access for strainer clearing and provide blow down valve piped to floor drain. Unit sizes shall be as scheduled on the drawings.

C. Provide and install ASME pressure relief valves for radiation, reheat and heat recovery systems. Pipe relief valve discharge to nearest floor drain.

2.6 HEAT RECOVERY SYSTEMS

A. This contractor shall furnish and install a 50% ethylene glycol mixture heat recovery systems for air handling units in the towers. The systems shall be complete with air to water coils, piping, controls, valves, insulation, pumps, air separator, tanks, and fill, etc., complete as detailed on the drawings. System fill of 50% glycol mixture shall be by this Contractor

1. Coils shall be the same as specified in Section 15900 for cooling coils, except provided continuous aluminum fins in lieu of copper. See schedule on drawings for size.

2. Pumps: Pumps shall be close-coupled, vertical split-case centrifugal pump, having a leak proof mechanical seal with cast iron casing, bronze impellor stainless steel shaft and heavy duty motor.

a. Pumps shall be base mounted as shown on plans, complete with certified pump curves furnished with shop drawings. Special emphasis is placed on flat head characteristics of pump operation. Pump impeller diameter shall not be less than 90 percent of the maximum diameter to promote quiet operation.

b. Pump characteristics shall be as scheduled on the drawings.

c. Pumps shall be Bell and Gossett, Taco, Thrush, Ingersoll Rand, Aurora, Chicago and Allis-Chalmers.

3. Expansion tank and accessories shall be the same as specified in Article 2.5 above and sized on the drawings.

4. Thermometers and pressure gauges shall be the same as specified in Section 15130 and located as shown on the drawings.

2.7 HYDRONIC SYSTEMS CHEMICAL FEEDER

A. Feeding Equipment: Furnish and install as shown on the drawing. Continuous by-pass feeders of 2-1/2 gallon capacity for the reheat piping system. The feeder shall be supplied with fill and drain valves, filling funnel, gauge glass fittings and gauge glass, gauge glass float, flow regulator valve, flow indicator, and miscellaneous fittings for connection of fill and drain accessories. Design operating pressure shall be 125 psig maximum.

B. Equipment specified is based on Western Company and Mogul Chemical Company water treatment data. Similar equipment as manufactured by Mitco, Walco, Norman and Dearborn Company are approved equal. All equipment provided shall be a single water treatment company for individual responsibility on service and equipment. Provide one year supply of chemicals for the above systems. All chemical furnished shall meet the Minnesota Pollution Control Agency Standards. Furnish test equipment for determination of PH, treatment residual and bleed-off control.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing all equipment, materials and performing all labor necessary to connect the ventilation and air conditioning systems.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100

2. Mechanical Supporting Devices: Section 15140.

3. Vibration Isolation: Section 15150.

4. Mechanical Systems Insulation: Section 15160.

D. Installed but not furnished under this section.

1. Steam Coils.

2. Cooling Coils

PART 2: PRODUCTS AND INSTALLATION

2.1 SHEET METAL WORK

A. All ducts shall be constructed from zinc-coated iron or steel sheets unless listed otherwise, and they shall conform accurately to the dimensions indicated on the drawings. All ducts shall be installed in accordance with the recommendations of the latest edition of the ASHRAE Handbook (1975 Equipment Volume) Chapter on Air Duct Design. Gauges of metal and reinforcing shall be in accordance with the tables as follows:

Table #4 Low Pressure Ducts - Return and exhaust ducts
Table #5 Low Pressure Ducts - Round exhaust ducts
TAble #7 Medium Pressure Ducts - Supply ducts, Fume Hood ducts

B. All joints on supply air duct work application, according to manufacturer's recommended procedure. Relief and exhaust air ducts at the point of entering or leaving the building, ductwork containing duct humidifiers, and any point where moisture can collect, shall be soldered absolutely water tight.

C. Flat areas of duct over 18" in either dimension shall be cross broken. Cross breaking is not required if the ducts are insulated.

D. All ductwork shall be run substantially as shown on the drawings. However, where conflicts occur with other trades, the Architect/Engineer reserves the right to require the contractor to make minor changes in duct locations. Whenever possible, ducts shall be run close to beams or floor slabs above, and where two or more ducts cross each other they must be arranged in such a manner as to get the greatest possible clearances underneath. This Contractor shall avoid running ductwork in the plumbing or electrical strata. This Contractor shall not cover service panels or electrical outlets.

E. Where internal thermal insulation is specified for ducts, they shall be constructed so the sizes shown on the drawings are the dimensions inside the insulation. A reduction in duct area because of the installation of sound insulation will not be permitted.

F. All horizontal ductwork shall be securely anchored to the building construction in a manner to be free from vibration and swaying under all conditions of operation. Hangers for ducts smaller than 30" x 15" shall be supported with trapeze hangers, consisting of galvanized steel straps metal screwed to the duct in accordance with the following schedule.

STRAP SIZE	DUCT SIZE	HANGER SPACING
18 ga. x 1" W	Up to 17" x 11"	8'-0" o.c.
18 ga. x 1" W	18" x 12" to 30" x 15"	6'-0" o.c.

Ductwork larger than 30" x 15" shall be supported with trapeze hangers consisting of rods and angles. Rivets or bolts shall be used for attaching hangers to ductwork.

G. All vertical duct risers that pass through floors shall have supporting angles that shall be securely fastened to ducts with rivets (no screws) attached to the ducts with the angles supported on adjoining floor or beam construction in an approved manner. Angles shall be galvanized and shall be placed on at least two sides of the duct.

ANGLE SIZE	DUCT SIZE
1-1/2" x 1-1/2" x 1/8"	36" x 18"
2" x 2" x 1/8"	48" x 24"
2" x 2" x 3/16"	Larger than 48" x 24"

H. The minimum duct size shall be 6" x 6". Curved elbows shall have a centerline radius equal to 1-1/2 times the width of the duct. Where space conditions prevent the curved elbows specified above and/or where square turns are indicated on the drawings, the contractor shall use multi-type turning vanes, such as "Ducturns" or he may construct the vanes to conform with the following requirements. Changes in size throughout shall be of perfect rectangular cross section. Vanes shall be well-braced and rough or raw edges shall be avoided to prevent objectionable noise, they shall be double thickness type and shall be the same gauge as the duct in which they are installed. Vanes shall be pre-assembled on runners before being installed in the elbow. Vanes shall conform to the following table:

DUCT WIDTH INCHES	VANE SPACING INCHES	INSIDE BLADE RADIUS INCHES	OUTSIDE BLADE RADIUS INCHES	RUNNER WIDTH INCHES
Up to 25"	1-1/2 centers	2	1	5
Above 25"	3-1/4 centers	4-1/2	2-1/4	9

I. All branch take-offs, from the main shall be of the "divertor" type.

J. All weather louvers in outside walls will be furnished and installed under the general construction work section of these specifications. This contractor shall make watertight connections to louver frames for all weather louvers. At fresh air intakes provide soldered drain pans with threaded drain connections to collect any waste water entering through louvers or accumulating from melting snow. Extend pan drains to floor drains. Contractor shall blank-off all unused weather louvers areas with sheet metal and insulate blanked-off section as per Section 15160.

J. Acoustical Vanes: Where indicated on the drawings, furnish and install acoustical type turning vanes. These shall be Sono-Turn, as manufactured by Sound Control products, or Acoustiturn as manufactured by Air Filter Corporation. Acoustical type turning vanes shall be commercially manufactured with published sound attenuating data available. Field or shop fabricated items are not acceptable.

K. Backdraft dampers shall be constructed of rolled aluminum leaves, 26 gauge, attached to steel rods supported in a steel frame. Dampers shall be provided with position indicators. Each leaf of the shutter shall be edged with a neoprene strip tightly folded into the metal to prevent "rattling". All leaves shall be linked together to operate as a unit.

L. Provide protective rubber or armaflex type bumpers on all hangers and corners of ducts that could be dangerous to maintenance personnel.

2.2 VOLUME, AIR FLOW DEVICES AND BALANCING DAMPERS

A. This Contractor shall furnish and install the required air devices necessary to produce the specified air volumes without excess air resistance or noise.

Butterfly dampers shall be installed at all branch take-offs or in trunk ducts at branch take-off locations, except for any flat or square take-offs for supply air branches which shall have volume extractors with operators accessible from outside the ductwork. Dampers shall be reinforced to prevent vibration, and shall be equipped with approved damper rods, quadrants and locking devices. Quadrants shall be marked to indicate damper position. Where ducts are insulated, quadrants shall be set to finish flush with insulation. Up to and including 3 square feet duct area, use one butterfly damper, from 3 square feet duct area up to and including 6 square feet duct area use two butterfly dampers each with locking quadrant. Over 6 square feet duct area use opposed blade dampers with standard channel welded frame and oilite brass bearings. Maximum blade width shall be 6". Splitter dampers shall be used only for special conditions and where specifically shown on drawings. No dampers shall be installed in fume hood exhaust ductwork.

B. Each canopy hood shall have an opposed blade balancing damper installed in the exhaust ductwork.

2.3 SHEET METAL DUCTWORK FOR FUME HOODS

A. All ductwork used for fume hood exhaust shall be factory made, similar to Semco Inc. spiral ducts having circumferential slip joints for straight lengths and fittings. Joints shall be cemented together with an epoxy cement and joint covered with a "Hardkast" epoxy patch suitable for 400°F. inside temperature. All ducts shall be fabricated of type 316 stainless steel.

B. All ducts shall be round or oval with 5 piece curved or sweep elbows. Square elbows will not be allowed. Dampers, turning vanes, deflector, etc. and other similar duct inserts will not be allowed as ducts must be open from hood to roof discharge.

C. All ducts shall be supported at each floor penetration and hung from ceiling construction as detailed on plans.

D. Make bolted flange connections to fume hood exhaust fan and to roof discharge as detailed on plans.

2.4 ACCESS DOORS, PANELS AND CLEANOUTS

A. Where reheat coils, motorized dampers, smoke dampers, fire dampers, control equipment, etc., are installed in ducts, provide access panels made air tight with gasketed edges. Access panels shall be as detailed on the drawings. Provide access doors between obstructions at each change of direction and/or not more than 20'-0" o.c. on horizontal ducts and at the bottom of each duct riser. Access doors shall be sized in accordance with equipment maintenance and duct cleaning requirements of the system. Additional access panels beyond those on the drawings shall be installed to fulfill this spacing requirement. Use Ventlok sponge rubber gasketing material. The panels shall be double wall construction with 1" of rigid insulation fill and shall be attached to the duct with cam latches. Omit access panel insulation and double wall construction if ducts are not specified to be insulated. For other than reheat coils the access panels shall be of adequate size to permit maintenance of the equipment. For reheat coils the access panels shall be installed on the side of the duct so that the coil and valves can be serviced through one ceiling access panel. The duct panel shall be at the air inlet side for coil cleaning and shall be sized as follows:

Reheat Coil Depth	Access Panel Size
6" to 15"	10" W. x (coil depth -2") D.
15" to 21"	12" W. x (coil depth -2") D.
21" and above	18" W. x (coil depth -2") D.

Normally coil access panels shall be installed on the sides of ducts. However, where pipes, conduit, etc., interfere with easy access, panels may be installed on the bottom of the duct. The Contractor shall secure the Architect's permission before using bottom mounted panels.

B. See paragraph 2.11 C. for access panels at fire and motorized smoke dampers.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Install flexible connections at connections between all fan suction and discharge openings, ventilating machines and sheet metal ducts or housings,

these connections shall be made of fire resistant, waterproof duct fabric, closely woven glass fabric, double-coated with neoprene material, 30 oz. weight, similar to "Ventglass", as manufactured by Ventfabrics.

B. This contractor shall use 1" x 1" x 1/2" angles to clamp the duct fabric to the rectangular ductwork, fan suction and discharge openings and ventilating machines, using 5/16" stove bolts or rivets on approximately 6" centers. Use #14 gauge, 1" wide bands to bolt fabric to round openings. Joints shall not be located at corners of ducts and must be lapped joints and completely airtight. All connections shall be a minimum of .6" wide and shall be made with slack in the fabric.

2.6 SOUND ATTENUATING FAN ENCLOSURES

A. This Contractor shall construct acoustical enclosures for all the new supply air units except Unit S-120. Enclosures shall be assembled from factory made panels, floor channels, corner brackets, insulated access doors, etc. all as manufactured by Semco Inc, or equal and approved. Equipment manufactured by Koppers Co., Industrial Acoustics Co., United Sheet Metal will be approved as equal. All enclosures shall have the unsupported side and top of 4" thick acoustical panels with 2" thick acoustical panels installed against existing concrete block walls.

B. Panels shall be 2" and 4" nominal thickness, fabricated with 22 gauge galvanized steel or aluminum perforated sheets on the interior and 18 gauge galvanized steel or aluminum sheets on the exterior. Edges of panels shall be sealed with channel frames or extrusions for structural stability. Sound retarding and absorbing fill shall be incombustible, inert, mildew resistant and vermin proof. Panels shall have a minimum "U" factor of .16 BTU per hour per square foot per degree F.

C. Plenum design shall have combustion requirements that do not exceed the following:

1. Flame Spread - not over 25
2. Smoke Developed - not over 50

D. Openings for fan discharge duct shall be cut and framed by this Contractor. Panel connections and erection shall be in accordance with the manufacturer's recommendations. Entire enclosure shall be capable of withstanding a negative internal pressure of 6 inches. W.C. Panels shall set on a 6" high x 8" wide concrete curb provided by the General Contractor. This Contractor shall provide necessary angle irons or channels at wall juncture to provide air tight and structural strength at that connection.

E. Panels and doors shall have the following minimum transmission loss characteristics.

Frequency (CPS)	125	250	500	1000	2000	4000
Attenuation (DB)	27	34	30	51	61	66

Acoustical and absorption coefficients shall be compatible with the above sound transmission class.

2.7 NOISE ATTENUATORS

A. This Contractor shall furnish and install sound attenuators of types as scheduled on the drawings. Units shall be as manufactured by Koppers Company Inc. or Industrial Acoustics or approved equal. The attenuators shall be constructed of 22 gauge galvanized steel sheets with an acoustical filler of 435# fiberglass. Units shall be Industrial Acoustics low static pressure resistance type "L" and be 5 feet long minimum except as noted otherwise.

B. Attenuators shall have the following minimum transmission loss characteristics.

Frequency (CPS)	106	212	425	850	1700	3400	6000
Attenuation(DB)	8	13	19	29	37	29	21

2.8 FLEXIBLE DUCT

A. Flexible insulated ducts shall be a factory assembled unit, with spin-on fitting with integral volume damper with locking quadrant device for connection to the branch duct and a downstream coupler specifically designed to lock in to the coupler collar furnished on the air diffusers or registers. This collar must be verified with units furnished with the ceiling system.

B. The duct shall consist of a galvanized or vinyl coated spring steel wire helix or resilient steel band and woven fiberglas mesh liner, 1" insulation and a factory sealed vapor barrier. The product shall bear UL Class I air duct label as tested under UL 181 and required by NFPA 90A.

1. Flame Spread - not over 25
2. Smoke Developed - not over 50

C. Flexible duct assembly shall have a thermal conductivity "K" factor of 0.25 at 75 degrees F. mean. Assemblies shall be constructed for conveying air at 250 degrees F. at a maximum velocity of 2400 F.P.M. and 1-1/2 inches of maximum internal positive static pressure and 1/2" maximum negative pressure.

D. Assemblies shall consist of insulated duct lengths of 5'-0", with no splices in a run of duct with 45 degrees total bends the maximum that are allowed in the 5'-0" run. The assembly shall have a minimum straight run acoustical attenuation of the following:

Frequency (CPS)	125	250	500	1000	2000	4000
Attenuation (DB)	15	18	17	18	14	9

E. Flexible insulated ducts assembly shall be Owens-Corning Fiberglass, XLC, Glass Flex Type OC-41, wiremold 49-K Thermaflex Type M-KA, H. K. Porter Co., or Genflex.

2.9 EQUIPMENT

A. Vaneaxial Fans: Fans shall be units as manufactured by Joy Mfg. or Western Eng. & Mfg. Fans shall be AMCA rated and certified with airfoil designed blades having variable pitch controllers all suitable for Class II operation. All units shall use standard type motor. Units manufactured by Joy Mfg. shall

have belt drives with motor mount external to fan. Units manufactured by Western Eng. & Mfg. can be either direct or belt drive. All fans shall be provided with extended oilers and discharge vane sections. Refer to Schedule on drawings for size, capacity, etc of units required.

1. Casing shall be formed for perfect cylindrical configuration and finished with an epoxy paint. Impellers shall be factory spin-tested for 150% of maximum rating, balanced by electronic means for no vibration.

2. Pitch of all blades shall be simultaneously changed by a pneumatic operator for positive positioning. Variable pitch mechanism shall be enclosed within the fan hub with a single lever arm being the only control element located in the airstream.

3. Fans shall be provided with inlet bells and discharge cones. Fan casing shall be provided with a rolled angle iron shroud for anchoring to base frame support. Provide vibration eliminator in base as indicated on plans.

4. AMCA certified test curves shall be provided on all fans showing initial operating conditions as well as ultimate future requirements. Test data shall show CFM, static pressure, RPM and BHP at both operating conditions.

B. Centrifugal Fans: Fans shall be manufactured by Trane, Peerless, Barry or approved equal. These fans shall be AMCA rated and certified, non-power overloading, airfoil blade, backward curved fans in Class II Construction, for all supply fans. Fans shall have 1-1/4" tapping in bottom of scroll, with plug for drainage. Fans shall be arrangement 3 and fans under 36" shall be convertible. Refer to Schedule on drawings for size and capacity of units required.

1. Each fan shall be equipped with two or more heavy duty grease lubricated anti-friction bearings. Class II fans shall have precision built spherical roller bearings.

2. All fan wheels, shafts and the interior and exterior of fan housing shall be factory cleaned of rust, mill scale, etc. degreased then given a primer coat of red lead or zinc chromate, and then sprayed with two (2) coats of chlorinated rubber base paint to prevent corrosion.

3. Adjustable inlet vanes shall be provided on all fans. Inlet vanes shall have positive control linkage and be individually supported at both ends by a precision bronze bearing. Vanes on double inlet fans shall be interconnected to operate in unison. The control arm shall be suitable for automatic operation.

4. AMCA certified test curves shall be provided on all centrifugal fans which will be required to operate at an initial condition different from its ultimate future requirement. Test shall be run at initial and final CFM and static pressure conditions.

5. Centrifugal fans shall be substituted for vaneaxial fans in Supply Air Units #S-100, 101, 102, 104, 106 and 107 under Alternate # C.

C. Propeller Fans: Propeller fans shall be Trane, Champion, Greenheck, Acme, Chicago Blower, American Standard, Barry, York, Carrier or Peerless, and shall

be direct or belt-driven as noted. Units shall be complete with mounting panel, three (3) or more blade propellors, steel hub, blade guard, terminal box, ball bearing motor and belt guard. Fans shall be rated and certified per AMCA standards. This Contractor shall furnish all sheet metal, blank-off panels, supports, etc., necessary for satisfactory installations and operation of these fans.

D. Fume Hood Exhaust Fans: Fume hood exhaust fans shall be industrial type units Buffalo type AW, Barry Series 600AH, Peerless Series A, or Sturtevant Series 400A, having a backwardly inclined high efficiency air handling wheel. Fan housings shall be cast iron or steel plate construction with frictionless self-aligning, resilient mounted, pillow type bearings. No oilite type bearings are to be used. All hood exhaust fans shall be arrangement 9 and shall have 1-1/4" tapping in bottom of scroll, with plug for drainage. The entire interior of the exhaust fans, including fan wheels and shafts, shall be coated with six (6) coats of baked phenalic (approximately 5 mils thick), Plasite, Heresite, or approved equal.

1. All fans shall be equipped with a bolted on scroll access panel, rolled to fit the scroll curvature and made of metal same gauge as the scroll. Panels shall be fitted with asbestos gaskets and made airtight.

E. Utility Blower Fan Sets: Utility sets as scheduled shall be Trane, Champion, Chicago Blower, American Standard, Barry, York, Carrier or Peerless. Units shall be standard built together, motor and fan mounted on a common base with hood. Fan wheels, in general, shall be backward curved, certified non overloading, except where noted. Provide scroll drain tapping with plug. Fans shall be equipped with frictionless self-aligning, resilient mounted, pillow type bearings. No oilete type bearings shall be used. Fans shall be rated and certified per AMCA. Provide inlet vane controls on units indicated.

F. Inline Exhaust Air Fans: These fans shall be Cook, Aerovent, Penn, or approved equal, centri-vane inline centrifugal fan. Motor shall be out of the air stream. Fan units shall be belt drive or direct drive as scheduled on the drawings with direct drive units having external disconnect. Fan housing, fan wheel and supports shall be aluminum. Isolation mounts shall be extruded rubber. Provide inlet vane controls on units indicated.

1. All fans shall be equipped with a bolted on scroll access panel, rolled to fit the scroll curvature and made of metal same gauge as the scroll. Panels shall be fitted with asbestos gaskets and made airtight.

G. Belt Guards: All fans shall be furnished with variable speed drives and installed with guards to enclose all belts, drive shafts and rotating equipment. These guards are to be constructed of 20 gauge galvanized steel with 16 gauge 3/4" diamond mesh screen or expanded metal. The mesh screen or expanded metal shall be spot or stitch welded to the frame. The guard shall be supported on brackets from the floor or fan base. Openings shall be provided in guards to permit tachometer readings for both motor and driven unit. Guards shall comply with the requirements of the Minnesota Industrial Commission and be designed for easy removal for belt replacement.

H. Packaged Air Handling Units: This Contractor shall furnish and install all package air handling units. These units shall be draw-through type and contain components as scheduled herein. Units shall be Trane, Carrier, York, McQuay, Dunham Bush, Westinghouse or approved equal, low pressure type or medium pressure type when inndicated.

1. The casing shall be of sectional construction, enclosing fans, bearings, heating and cooling coils and drain pan. See Section 15830 for filter requirements. Units shall be constructed of heavy gauge furniture steel, suitably reinforced. Exterior shall be smooth construction with removable side panels for access and inspection. Access doors shall be airtight, yet easily removable. Casings shall be designed so coils can be removed. Casings and all accessories shall be given a protective enamel paint finish. Unit shall be medium pressure type.

2. Fans shall be double width, double inlet, multi-blade centrifugal type and shall be statically and dynamically balanced at the factory. Fans shall be installed on proper sized one-piece hollow or solid shafts. Bearings shall be self-aligning resilient mounted, pillow block type bearings externally mounted. No oilite type bearings are acceptable. Fans shall have "AMCA" seal. Motor shall be mounted on slide rail base with V-belts, belt guard, and adjustable sheave. Motors shall have a service factor of 1.4. Motors shall be outside of unit casing.

a. Packaged air handling units having internal bearings are satisfactory providing:

(1) Two fan units shall have three (3) bearings and split shaft similar to a double inlet fan with a shaft extension and adequate access panels to service bearings and replace shaft if necessary.

(2) One fan unit shall have similar service and replacement capability.

3. Casing unit panels and coil panels shall be insulated internally with 1" blanket fiber glass type insulation, with neoprene coating on air side to eliminate wear. Drain pans shall be complete with seamless 1/2" cellular foam-in place insulation.

4. Heating coils shall be same as specified in Section 15600. Heating coils for these units shall be steam distributing type coil, with 1" copper condensing tubes and continuous aluminum fins. See the Drawing Schedule for those units with one or two heating coils.

5. Cooling coils shall be similar to those specified in Section 15900.

I. Belt Drives: All fans shall be equipped with V-belt drives, adjustable motor sheaves and belts. See fan schedule for units requiring 2 sets of drives, sheaves and belts. Drives shall be as manufactured by Allis-Chalmers Company, Browning Manufacturing Company, and Gates Rubber Company. All pulleys shall be carefully and accurately balanced for static and dynamic accuracy. The number of belts and grooves for each unit shall be based on a 150% overload rating. The overloading rating shall be applied to motor nameplate horsepowers for each fan, not brake horsepower. Pitch diameter of pulleys are not given, but driven speed must be maintained as closely as possible where regular stock size pulleys are used with 1750 RPM motors. Variable speed sheaves shall be selected so the pitch diameter at design conditions is midway between the minimum and maximum for the particular sheave. All drives shall be supplied with at least the minimum number of belts as outlined below.

0 - 1-1/2 HP -- 1 belt
2 - 7-1/2 HP -- 2 belts

All drives above 7-1/2 HP shall be supplied with number of belts as recommended by the drive manufacturer. The belts shall be furnished in matched and sealed sets.

2.10 REGISTERS, GRILLES, DIFFUSERS AND CONTROL DEVICES

A. This Contractor shall furnish and install all registers, grilles, diffusers and such air distribution accessories indicated, on the drawings, that are necessary to effect uniform distribution of air. All registers, grilles and diffusers furnished by the Mechanical Contractor shall have prime and finish coat as selected by the Architect. Draw all air outlet and return devices tight to ceilings and/or walls to eliminate dirt streaking using extra screws if necessary to secure a tight fit. This contractor shall refer to architectural drawings for type of ceilings and be responsible for proper type of frame for type of ceiling or wall. Registers, grilles,diffusers and control devices by Waterloo-Anemostat, Carnes & Krueger, Titus and Tuttle & Bailey are approved as equal to Titus equipment specified.

B. Linear supply diffusers, shall be Titus Model #TBDI-57,58 and 59 one and two slot insulated T-bar diffuser of size - capacity indicated in schedule on drawings. Units shall be furnished with a center T-bar, air pattern controllers; exposed surfaces finished in an off-white baked enamel.

C. Supply air registers shall be Titus #272-FS5 aluminum construction with vertical face bars on 3/4" centers, horizontal rear bars and removable key operated opposed blade dampers with 1-1/4" margin. All bars shall be adjustable. Registers in walls shall be set in #115 surface mounted frame.

D. Return and exhaust air registers shall be Titus #3-FL5 aluminum construction with horizontal face bars on 3/4" centers and removable key operated opposed blade dampers with 1-1/4" margin. Registers in walls shall be set in #115 surface mounted frame.

E. Return and relief air grille shall be Titus #3-FL aluminum construction with horizontal face bars on 3/4" centers and 1-1/4" margin. Grilles in walls shall be set in #115 surface mounted frame.

F. Round diffusers shall be Titus #TMA aluminum construction with adjustable air pattern by screwing center cone. All diffusers shall be provided with equalizing grid and opposed blade volume damper in neck of diffuser and duct.

G. Ceiling supply air panels shall be Titus #TLFH all aluminum construction complete with air valves, distribution face plate to fitinto a plaster ceiling. Exposed portions shall have a white baked enamel finish.

2.11 DUCT SLEEVES

A. Furnish and install sleeves at all locations where ducts pass through walls, floors, or partitions not fire rated. Sleeves shall be fabricated of 16 gauge galvanized iron with angle iron stiffeners as required to prevent bending.

B. Sleeves shall be 1/2" larger in dimension than the duct passing through and shall be 1/4" larger than through-going insulated duct.

C. Sleeves passing through finished walls, ceilings and partitions shall be set flush with finished surface. Sleeves through floors in exposed and concealed areas shall be extended 1/4" above the finished floors.

D. Seal the space between the duct and sleeve with plastic caulking such as Presstite or Duragum. Sleeves shall be set and maintained in place by this Contractor during the progress of the work.

E. Where ducts pass through fire partitions the ducts and sleeves shall be constructed per Paragraph 2.11.

2.12 AUTOMATIC FIRE DAMPERS

A. Furnish and install fire dampers in all ducts where shown on the drawings, where required by the City of Minneapolis, where required by NFPA Pamphlet 90-A and Minnesota Building Code and as indicated below:

1. Where horizontal duct pierces fire partition.

2. At the junction of each branch duct with main vertical duct at utility core wall.

3. At each point where a vertical duct pierces a floor.

B. All fire dampers shall bear UL label and shall be constructed and installed in accordance with NFPA Pamphlet 90-A and as detailed on the drawings. Steel sleeves as shown shall be attached to walls and floors and to the fire damper.

C. All dampers shall have approved damper position indicators so that damper position can be determined without removing the access panel. Access panels with glass insert will be acceptable in lieu of damper position indicator. Glass used shall have essentially the same fire rating as a metal panel. Where possible fire damper access panels shall be installed on the sides of ducts, although best access to fusible links shall govern. Minimum access panel size shall be 14" x 14" clear access. Where one dimension of duct allows less than 14" the other dimension shall be increased to 18" minimum.

D. Fire doors shall meet all description as listed above, but shall be rated 3 hours.

E. Fire dampers and fire doors shall be Air Balance, Advanced Air, Ruskin and Air Stream, United Sheet Metal Co., Tuttle & BAiley or approved equal.

2.13 HOODS

A. Fume hoods will be furnished and installed by the Equipment Supplier. The Mechanical Contractor shall make duct connections to each hood as indicated on the drawings.

B. Canopy hoods will be built and installed by this Mechanical Contractor. He will also connect the discharge ducts to each hood as indicated on the drawings.

2.14 ACCESS DOORS, PANELS AND CLEANOUTS

A. Where fire dampers, control equipment, etc., are installed in ducts, provide access panels made air tight with gasketed edges. Provide access doors between obstructions at each change of direction and/or not more than 20'-0" o.c. on

horizontal ducts and at the bottom of each duct riser. Access doors shall be sized in accordance with equipment maintenance and duct cleaning requirements of the system. Additional access panels beyond those on the drawings shall be installed to fulfill this spacing requirement. Use Venlok sponge rubber gasketing material. The panels shall be double wall construction with 1" of rigid insulation fill and shall be attached to the duct with cam latches. Omit access panel insulation and double wall construction if ducts are not specified to be insulated. The access panels shall be of adequate size to permit maintenance of the equipment.

B. See paragraph 2.12 for access panels at fire dampers.

2.15 AIR TERMINAL UNITS

A. Terminal units shall be of sizes indicated on the drawings and of capacities indicated in schedule on the drawings. Units shall be designed for medium pressure operation (1" to 5" SP), shall be pressure independent and shall reset air volume mechanically within ± 5% of required air flow regardless of changes in system air pressure. Units shall be as manufactured by Titus, Tempmaster, Barber Colman and Metco Corporation.

B. Terminal units shall be of three different types as follows:

1. Units #1 through 9 shall be similar to Titus LS-VA having a variable volume damper positioned by a pneumatic motor.

2. Units #1C through 9C shall be similar to Titus LSR having two stage boxes with capabilities to change air volume from 100% to 50% when repositioned by a pneumatic damper. Units shall also be furnished internally with a 1 row hot water reheat coil.

3. Units #10 through #16 shall be similar to Titus HICP having a pneumatic damper controlling the quantity of supply air entering the box and a pneumatic damper controlling the quantity of induced return air entering the box. Units shall be capable of varying quantity of supply air from 100% to 50%, adding 0 to 50% return air while holding box discharge air quantity at 100% rated capacity.

C. Terminal units shall have heavy gauge galvanized steel casings lined with 1" thick 1-1/2 lb density fiberglass duct insulations. Unit radiated sound without allowance for ceiling absorption shall not exceed NC-25 at .75 inches w.g. inlet static pressure. Manufacturer shall submit both Sound Power Level data regarding 10-12 watts in Center Frequency Preferred Octabe Bands and Noise Criteria ratings for both discharge and radiated sound.

D. Pneumatic motors for each unit will be sent to the unit manufacture to install motors at the factory for proper operation of dampers. A P.E. switch or room stat by Temperature Control Contractor will position the pneumatic damper motors to control temperature of space.

2.16 HEAT RECOVERY COIL

A. Furnish and install an air to air heat pipe heat exchanged #TRU-125-20.3-60-5-14 as manufactured by Q-Dot Corp., or equal and approved. Coil shall have no moving parts, of continuous plate type design, have a center vertical partition to prevent crossflow of air and be capable of operating between -30°F to +120°F. Unit shall be capable of heating 2,550 cfm of fresh air from -20" to -31"F with 2550 cfm of exhaust entering at 70°F. Air pressure drop shall not exceed 1.35". Coil shall be 60" x 18" having 8.5 sq. ft. of face area in an air velocity of 600 fpm through each side.

B. Unit shall be furnished with tilt control package to prevent frost occuring on exhaust coil and also to regulate quantity of heat recovered. Provide necessary motor, relays, switches, etc. Wiring of unit controls shall be provided by this Contractor.

C. Unit shall be installed in Room #0-19.1 on the fresh air intake duct of Sup Unit #S-120 and the discharge duct of Exhuast Unit GE-120. Provide necessary framing to support unit from ceiling construction, flexible duct connection to coil to allow coil to tilt and tight duct connections to prevent crossover air flow or contamination.

2.17 EXISTING UNITS

A. This Contractor shall replace the existing 1/2 HP single speed motor on the supply unit in basement ceiling of Millard corridor room #B-16.1 with a new two speed, 1750 and 825 RPM, separate windings, 3/4 HP motor wired 208/3/60. Reuse existing sheaves but provide new V-belt. The Electrical Contractor will provide a two speed switch and will wire the switch and motor. Verify voltage of existing motor.

B. This Contractor shall replace the existing 1/3 HP single speed motor on the general exhaust unit #E-33 in Millard Penthouse Room #510 with a new two speed, 1750 and 825 RPM, separate windings, constant torque 1/2 HP motor wired 208/3/60. Reuse existing sheaves but provide new V-belt. The Electrical Contractor will provide a two speed switch and will wire the switch and motor. Verify voltage of existing motor.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing all equipment, materials and performing all labor necessary for air filtration systems and related systems.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.

2. Ventilation and Air Conditioning: Section 15800.

PART 2: PRODUCTS AND INSTALLATION

2.1 AIR FILTERS AND AIR HANDLING UNITS

A. Air filters shall be as manufactured by the American Air Filter Company, Inc., Cambridge Filter Corporation, Farr, Mine Safety Appliance, or Continental Air Filter Company. All units shall be similar to physical dimensions to permit satisfactory installation and servicing in the space allocated on the plans. The Electrical Contractor will provide a separate electrical circuit terminating in a junction box near each air supply unit. All wiring from the junction box, including the necessary fused disconnect switches and other materials and labor necessary to complete the power wiring and control circuits for the filter asembly shall be furnished and installed by the Mechanical Contractor. On roll type filters, an auxiliary switch shall be provided by the Mechanical Contractor to permit manual operation of the filter drive motor when the unit supply fan is not operating. For sizes see drawing schedule.

B. Roll Type Prefilters. These shall be American Air Filter Company's Roll-O-Matic, Type H, Model G horizontal and Type V Model J, Verticals, Cambridge Filter Corporation Type Var or Har, Farr, Mine Safety Appliance, Continental Conomac Type VA or Type ELA, automatic renewable media type air filter, complete with casing, top and bottom media covers, 1/6 HP motor and external drive mechanism, timer, screens, rolls of glass fiber filter material, control box, media feed switch, incline draft gauge, relay and media runout switch and light. The control shall be automatic pressure drop type which senses filter pressure drop and advances the media one complete new section by automatically controlling the drive motor through the timer. The glass fiber blankets shall be sprayed with a fine Underwriter's approved non-inflammable Visco Filter media shall perform satisfactorily down to -20°F. Pressure drop across the clean filter assembly shall not exceed 0.17" W.G. The air filter guage shall be Dwyer Model No. 250-AF. This Contractor shall provide

filter media for use in each unit during the temporary heating season. This Contractor shall also provide one new roll of filter media for each unit at time of air balance and an extra packaged supply of filtering media equal to one complete refilling shall be given to the Owner. The media shall be 2" thick and have an efficiency of 85% by the NBS dust spot method.

C. Electrostatic Type After-Filter. These shall be AAF Model D, Rollotron, Cambridge or approved equal, consisting of an electrostatic section of the entering side and an automatic disposable media type on the air leaving side. The filters shall be sized for the air volumes indicated for the specific units with an efficency of not less than 90% as measured by the NBS Dust Spot Test Method using atmospheric air. The collector elements in the agglomerating section shall be of all aluminum construction. Ionizing voltage shall be 12,000 volts and plate voltage shall be 5,800 volts. The storage section shall be heavy gauge zinc coated steel with a 2" thick glass fiber blanket pre-coated with a fine non-inflammable, Underwriter's approved adhesive. The average operating resistance shall be 0.35" of water gauge. The fiberglass media shall be fed across the air stream automatically from a compressed clean roll at a pre-determined rate by an adjustable electric timing device. Used media and accumulated dirt shall be compressed and wound into an enclosed compact roll for easy disposal. The unit shall be furnished complete with:

1. External and internal agglomerator housing, agglomerating cells and storage units for assembly of the filter bank and miscellaneous assembly hardware.

2. Power pack for end mounting.

3. Two unit access door switches, manual reset type.

4. Two unit access door switch warning lights.

5. Two combined switch and signal lights for inside unit housing.

6. Two enameled warning signs for unit access doors.

7. Spare ionizing wires.

8. High voltage cable from power pack to agglomerator.

9. One roll of media for each filter section.

10. Media runout control

11. Control panel, including automatic cascade timer control, warning signal light and a manual switch.

12. Trash screen. (Air distribution baffle screen).

13. 1/6 HP motor and external drive assembly with removable cover.

14. Provide and install at each electrostatic filter bank in each supply fan unit a Dwyer 250AF or equal and approved air filter draft gauge inclined tube type with a range of 0.10 - 1.0 inches of water, furnished complete with static pressure tips, tubing, mounting assembly, extra bottle of red gauge oil, oil dropper and instructions. Accessories shall be mounted in a suitable metal case with hinged door and cam lock and shall be secured to housing adjacent to draft gauge.

15. An extra packaged supply of filtering media equal to one complete refilling shall be given to the Owner by this Contractor when the building is occupied by the Owner.

D. Start-up condition (Electrostatic Filter). In some cases the built-up supply air systems will be set up to operate with less than 50% of their final design air quantity. It shall be this Contractors responsibility to blank off on two sides with sheet metal a certain percentage of the collector cells. (See drawings schedule) to maintain a proper minimum air velocity across the electrostatic filter. If filter manufacturer recommends removal of the blanked off collector cells, these shall be turned over to the Owner for future use.

2.2 EXHAUST HOOD FILTER FOR RADIOACTIVE HOODS

A. Furnish and install high efficiency filter and housing as detailed on Drawing M-16 for the radioactive exhaust hoods. See Drawing Schedule Sheet M-29 fume hood schedule for absolute filter requirements.

1. Filters shall be AAF Astrocel, or Cambridge Absolute on Flanders Series 800, or Farr, rated 99.97% efficient on standard DOP test eith 0.3 micron particle. Filter shall have glass asbestos media mounted in a stainless steel frame. Filters shall be fire retardant up to 250°F. and shall be capable of withstanding 100% RH. Provide a 2" throw-away type fiberglass filter to act as prefilter.

2. Absolute filters shall be 11-1/2" deep and prefilters shall be 2" deep. See Drawing Schedules for filter overall dimensions required.

3. Air filter gauge across filters shall be Dwyer 209-AF, or equal with a range of 0.20" - 3.0" water.

4. Before installation the absolute filters shall be tested and approved by the University of Minnesota Department of Environmental Health.

2.3 THROW-AWAY FILTERS

A. Throw-away filters shall be equal to AAF-Amer-Glas replaceable 2" thick filters. Contractor shall install new filter media before building is turned over to University. An additional set of filter media shall be given to the Owner at this time also.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the furnishing all equipment, materials and performing all labor necessary for the chilled water systems and other related systems.

C. Related work specified elsewhere:

1. Basic Methods and Materials: Section 15100.

2. Pipe and Pipe Fittings: Section 15110.

3. Valves. Section 15120.

4. Piping Specialties: Section 15130.

5. Mechanical Supporting Devices: Section 15140.

6. Vibration Isolation: Section 15150.

7. Mechanical Systems Insulation: Section 15160.

8. Hot Water Heating System: Section 15650.

9. Ventilation and Air Conditioning: Section 15800.

D. Furnished but not installed under this section:

1. Cooling coils.

E. Installed but not furnished under this section:

1. Pneumatic control valves on chilled water piping to coils.

PART 2: PRODUCTS AND INSTALLATION

2.1 CHILLED WATER PUMPS #P-1 THROUGH P-4

A. Pumps shall be horizontally split casing type with suction and discharge in the lower half to permit inspection access to rotating parts without disconnecting the suction or discharge piping, coupling or motor.

B. Pumps shall have non-overloading characteristics and shall be furnished at the midpoint of the pump curve. Pumps shall have a flat curve characteristic

and be capable of operating with a 10% variation on either side of the point of selection to allow for drift in the system curve. Provide ARI certified pump curves for all pumps.

C. Chilled water pumps shall operate on a system basis as shown on the drawings. Chilled water pumps shall be equipped with stainless steel shaft sleeves and precision John Crane mechanical seals on both sides of the impeller. Pump casings shall be 250 psi thickness. Renewable bronze casing wearing rings shall be provided.

D. If special tools are required for replacement of the wear rings a set of tools shall be included for each size and style pump furnished on the project. The shaft sleeves and impeller shall be keyed to the shaft by means of a common key. To preclude any leakage along the shaft beneath the shaft sleeve, compression "O" rings shall be furnished between each sleeve and shaft.

E. Each pump shall be mounted on a heavy cast iron sub-base having a drip lip and tap for drain piping. Pipe drains to nearest floor drain. A flexible coupling shall connect the pump with the electric motor. Shaft coupling shall be protected by a metal guard. The pumps shall have the capacity as shown on the drawing schedule.

F. Pumps and motors shall be checked for alignment prior to initial start-up. The alignment shall be accomplished prior to grouting with the coupling checked with a dial indicator. Each base mounted pump shall be furnished with plugged tappings on the suction and discharge of the pump housing for pressure gauge connections and an air vent petcock on top of pump casing.

G. All chilled water pump motors shall be NEMA Class B, T frame, 1750 RPM, standard induction squirrel cage type motors suitable for a variable frequency type speed controller. Controllers will be furnished and wired by the Electrical Contractor. Pumps shall be standard units as manufactured by Peerless Pumps, Allis-Chalmers, Aurora, Ingersoll-Rand, Fairbanks Morse, or equal and approved. Motors shall be furnished with Therma-Sentry or equal electronic motor protection.

2.2 EXPANSION TANK AND CHILLED WATER SYSTEM ACCESSORIES

A. Refer to Section 15650.

2.3 CHILLED WATER COILS

A. All coil capacities and selection data shall be certified in accordance with ARI Standard 410-64, and each coil shall bear the ARI certification label. Coil shop drawings shall include complete computer selection performance data.

B. The primary surface shall be 5/8" O.D. seamless copper tubes with continuous copper fins extending from tube to tube. The fins shall be mechanically bonded to the tubes to provide a permanent bond. The casing shall be zinc grip galvanized steel, 16 gauge formed end supports and top and bottom channels. The channels shall have 3/8" holes 3" on centers for fastening to coil supports. See detail on drawings for coil installation and support. All coils shall be supplied for same end connections. Holes shall be drilled in bottom of coil casing for condensate drainage, casing shall then be painted with two coats of Heresite.

C. Tubes shall be without turbulators. Coils shall be drainable, double row water coils, in which each row starts and terminates in a common header with "U" bends joined with silver brazing. Serpentining shall be required to result in specified capacities with maximum pressure drop of 20 feet. All coils shall be suitable for 150 psig working pressure and piped to counterflow of water and air. All coils shall be 6 row with 8-10 fins per inch to give capacity indicated.

D. Coils shall be of sizes and capacities as scheduled on drawings. Inlet water temperature to coils shall be 43°F with 12°F rise.

2.4 CHILLED WATER PUMPS #P-5 - P-6

A. Furnish and install circulating pumps having a leakproof mechanical seal, John Crane specifically for water service from 40°F to 150°F. Pumps shall be Allis-Chalmers, Chicago Pump Company, Peerless, Armstrong, Aurora, Ingersoll-Rand, Bell & Gossett, Taco, Dunham Bush and Thrush.

B. Pumps shall be flexible coupled (Falk or Lovejoy), single suction, centrifugal pump with cast iron casing, bronze impeller and stainless steel shaft. Provide coupling guard. All pumps shall operate at 1750 RPM.

C. Base-mounted motor and pumps shall be complete with steel base plate. Certified pump curves shall be furnished with shop drawings. Special emphasis is placed on flat head characteristics of pump operation. Pump impeller diameter shall not be less than 90% of the maximum diameter to promote quiet operation.

D. Pumps shall have grease lubricated ball bearsing. Piping to pumps shall be properly installed and aligned to prevent any distortion of the pump casing under all operating conditions. Pump characteristics shall be as scheduled on the drawings.

E. Each pump shall be furnished with an extra mechanical seal.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 15010 General Provisions - Mechanical apply to all work of this section. Refer to Article 20 of the Information for Bidders and Article 1.23 of the General Conditions for requirements on pre-bid and post-bid evaluation of proposed substitute products, materials, etc.

B. Work under this section includes furnishing all equipment, materials and performing all labor required to complete the automatic temperature control systems.

C. Related work specified elsewhere:

1. Basic methods and materials: Section 15100

2. Pipe and pipe fittings: Section 15110

D. Furnished but not installed under this section:

1. Modulating dampers.

2. Regulating valves.

PART 2: PRODUCTS AND INSTALLATION

2.1 AUTOMATIC CONTROL SYSTEMS

A. The Automatic Control System shall consist of Honeywell, Johnson Service or Powers Regulator temperature and humidity control equipment. The systems shall be the pneumatic control type, except that electronic equipment components shall be used where specified. The systems shall be installed under the full-time supervision of an authorized installation engineer.

2.2 AIR COMPRESSOR AND DRYER

A. This Contractor shall furnish and install 2 new tank mounted air compressors, one in each new equipment tower. Each compressor shall have a minimum capacity of 8.6 cfm at 80 psig when driven at 400 RPM by a 2 HP motor wired 208/3/60. Motor shall be controlled by a pressure switch. The Electrical Contractor will provide a magnetic starter and power wiing from starter to motor. All other wiring required shall be provided by this Contractor. each unit shall be provided with the following:

1. Low resistance intake air filter (Purolator or equal).

2. High pressure tank relief valve.

3. Vibration isolation shall be Type "B-J" for .75" static deflection.

4. Belt Guards, totally enclosed.

5. 60 gallon high pressure storage tank with drain test cock and automatic moisture removal trap.

6. Pressure switch.

7. Pressure reducing valves.

8. Gauges.

9. Check valves.

B. Refrigeration air dryers shall be installed in the air discharge line from each compressor, but ahead of the receiver. The dryers shall include a hermetically sealed non-cycling refrigeration unit, a pre-cooler heat exchanger, a hot gas bypass valve to permit load variations from 5-100% capacity without on-off compressor operation or freeze-ups and air blockage, and a moisture separator. The moisture separator shall be of the coalescing filter type capable of removing 98% of all particles of water and dirt to .04 microns from the effluent air. Dryer shall be provided with a 3 valve manifold plus automatic moisture removal trap piped to floor drain.

1. Dryer instrumentation and equipment shall include panel-mounted refrigerant suction compound pressure-temperature gauges, outlet pressure gauge, Aquadex moisture indicator, safety pressure switch, power-on light and automatic trap.

2. Alarms and indicators shall be furnished to indiate high pressure drop across separator and low freon charge.

3. Dryer Operating Conditions:

a.	Outlet dew point at line pressure with 100°F inlet air	+35°F.
b.	Inlet pressure	100 psig
c.	Inlet air temperature	100°F
d.	Electrical characteristics	460/3/60
e.	Electrical class	NEMA 1

4. Dryers shall be Pall Trinity or approved equal. Hankinson and Ingersoll-Rand with identical characteristics are acceptable.

C. A central station SUB-MICRON air filter shall be provided. This filter shall be rated for 97% efficiency at rated air flow. Pressure reducing stations shall be provided to reduce high pressure air to that pressure reducing stations.

D. Complete air piping shall be provided for the penumatic control system, adhering to the highest standard of quality and workmanship and subject at all times to approval of the architect and engineer.

2.3 TEMPERATURE CONTROL PIPING

A. Piping

1. Pipe - Type "L" hard drawn copper or virgin polyethylene. Polyethylene tubing shall meet the stress and crack test performed per ASTM D 1693, and shall be classified as flame retardant and must be rated as self-extinguishing capable of passing ASTM-635 flammability tests.

2. Fittings - extruded of wrought copper or sharp barb type that does not require spring clips.

3. Joints - soldered, except compression fittings shall be used at instruments or compatible with polyethylene fittings as specified above.

B. All lines in the equipment rooms and in other unfinished spaces shall be run exposed in a neat and orderly manner with pipe runs grouped as much as possible. All tubing and conduit which must run exposed shall follow vertical and horizontal contours to the satisfaction of the Architect/Engineer and be rigidly secured to the building construction at 4'-0" o.c. Tubing shall not be allowed to be fastened to ductwork or electric conduit. All lines in finished spaces shall be run concealed with the majority of each piping installed above the suspended ceilings and in furred walls.

C. Suitable drip legs and drain valves shall be installed at all low points in the piping system to eliminate accumulated condensate.

D. Air piping or controllers shall not be installed in outdoor air intakes where freezing conditions may occur.

E. All tubing or piping, except local individual room control, shall be number coded or color coded for future identification and servicing of the control system.

F. All non-metallic polyethylene tubing run in mechanical equipment rooms, utility areas, or finished spaces where other tubing is exposed shall be run within adequately supported rigid metallic raceway, EMT pipe or duct. Terminal single lines shall be hard drawn copper except if the run is less than 12", in which case flexible polyethylene tubing enclosed with flexible spring may be used.

G. Non-metallic polyethylene tubing used for thermostat fittings shall be 5/32" diameter clearly marked "branch" and "main". These two lines shall be wrapped with a polyethylene cover. A complete line of fittings shall be available for "dry wall" construction, plaster, brick, precast or tile walls. Where tubing exits the wall into the suspended ceiling area, the tubing shall be run into conduit, or protected with "spring" covering to the valve. Tubing run in flexible spring covering shall not exceed 12". Suitable plastic grommets shall be used where polyethylene tubing enters or leaves the conduit or junction boxes for the final connections.

H. Non-metallic polyethylene tubing installed in concealed locations such as suspended ceilings and pipe chases shall be run parallel to the lines of the building, be adequately supported, and protected as in subparagraph 6 above.

I. Non-metallic polyethylene tubing installed within walls and not adjacent to other services shall be installed in a neat and workmanship manner, adequately supported and run parallel to the building lines.

J. Polyethylene tubing in 4, 7 or 12 1/4" black tubes individually numbered shall be wrapped with a Mylar tape all enclosed in a .062 jacket of polyvinyl. Bundled tubing of this type may be used for switching lines and shall be self-supporting tied firmly to the structural members. Refer to paragraph 6 for support of tubing.

K. Tubing installed inside or behind control panels shall be neatly tied and supported.

L. Provide valved connection to storage tank and 1/2" copper tubing in crawl space between the two new compressors and to the NE corner for the future tower. Line shall serve as standby air between air compressor tanks. Line to NE shall serve all new rooms in that area until compressor is installed in NE Tower.

M. System testing.

1. The entire pneumatic piping system shall be tested by placing it under 30 psi pressure for 24 hours with a drop not exceeding 1 psi during that time.

2. All temperature control systems shall be checked out under operating conditions with the actual operations verified and temperature readings taken around each control point to provide the correct control function or operation. All damper function shall be similarly verified. These facts shall also be included with the required certificates.

3. Temperature control air piping buried in slabs shall have a continuous air test on the piping while slabs are being poured.

2.4 ELECTRICAL WORK

A. All wiring of PE and EP switches and electric control devices shall be by this contractor, except as otherwise noted.

2.5 CONTROL INSTRUMENTS AND EQUIPMENT

A. In general, the control instruments and equipment furnished for this installation shall be the best product of its type produced by the manufacturer. The following specifications are intended to set a minimum standard for the particular device described.

B. Dampers: Frames shall be constructed of two hot dipped sheets welded together to form a corrugated blade. Frames shall be hot dipped galvanized steel. Blade width shall be a maximum of 6". All blades shall have replaceable rubber seals along the blade edge. Frames shall have metal stops with rubber seals to seat against ends of each blade. Dmapers shall have nylon bearings and oil impregnated shafts. All linkages shall have oil impregnated bearings and shall be enclosed in the dampers frame. No linkage shall be allowed in the air stream. Modulating dampers shall be opposed blade; two-position dampers shall be parallel blade.

C. Pneumatic Space Thermostats: They shall be of the proportional-positioning type with adjustable throttling range, non-bleed, key operated type, internal stops and be capable of operating on a change in temperature of plus or minus 1°F at the thermostat location. Furnish four dozen keys with the installation. Thermostat finish shall be as selected by architect. Stat located on outside wall shall be insulated to prevent cold wall influence.

D. Pneumatic Insertion Sensors: Sensors shall be proportioning in action, of corrosion resistance construction, with appropriate range sending range. Fahrenheit on a calibrated gauge located as indicated on plan. Sensors shall be factory calibrated with all adjustments at the centrally located controller. Provide a red reading, angle duct, industrial type thermometer beside each insertion sensor.

E. Pneumatic Actuators: All shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or two-position action as specified. When so specified in the sequence of operation or where more than two actuators are to be operated in sequence to each other, provide position feedback positive positioners with adjustable startpoint and operating range. Construction shall be piston-type operator, rolling neoprene diaphragm and aluminum body. Operators of plastic type construction are not acceptable.

F. Pneumatic Sensor Controllers: These shall be force-balance, non-bleed pneumatic amplifiers designed for corrosion resistance to high humidity and with integral gauge ports. Controllers shall be field adjustable to either direct or reverse action and for width of proportional band.

1. Authority of compensating sensors shall also be adjustable at the controller.

2. Controllers shall have capability of remote control point adjustment from a proportional manual switch located as directed.

G. Pneumatic Space Humidistats: Shall be similar in design to the space thermostats. Units shall be actuated by a human-hair bi-wood element, with modulating key set and adjustable throttling range of 20 to 80 percent.

H. Electronic Pneumatic Relays: Electronic - pneumatic relays shall be completely transistorized and contained in unitized completely enclosed cabinets. Cabinet shall contain terminal strip and all pneumatic and electronic adjustments. Electronic signals from controllers shall be converted to modulating pneumatic signal to operations.

I. Relays and Switches: Relays of the positive and gradual-acting type and switches shall be furnished and installed as required for the successful operation of the system. All switches shall include suitable indicating plates. Positive positioning devices shall be utilized on all operators where sequencing is specified.

J. Control Valves:

1. Valves for reheat hot water service shall be gradual-acting types. Valves shall be suitable for use with 210°F hot water and shall be leakproof under a

static head of 100 psi. Valves shall have renewable composition discs and parabolic throttling guides. Valves shall have a shut off rating of not less than 50 psi. Valves shall be Honeywell VP 514C, Johnson V-3752, V-5250, or equal. Valves shall have a maximum pressure drop of 5 feet.

2. Valves for steam service, unless otherwise specified on coils, converters, heaters, etc., shall be of the single seated, dead end service type, except those specified double seated. All valves shall have linear characterized throttling plugs. Valves for sequence control shall have positive positioning devices. All other valves shall be standard motor equipped. See schedule of drawings for valve capacity for each air handling unit. Valves shall have a maximum pressure drop of 3 psig.

3. Two way control valves for chilled water service shall be Honeywell VP 514B and VP514E, Johnson V-5460, or equal normally closed. Valves shall be suitable for use with 35 degree F. to 200 degree F. water. Where this valve does not meet flow requirements Honeywell series 9101, or equal, shall be used. See schedule on drawings for valve capacity of each air handling unit. Valves shall have a maximum pressure drop of 5 feet.

4. Three way control valves for chilled water shall be Honeywell VP 516 Johnson V-4322 mixing valve, or approved equal. Where this valve does not meet flow requirements, Honeywell series 1600, Johnson V-5840, or equal, shall be used.

K. Unit Control Panels:

1. Furnish and install unit control panels for all air supply units, converter assemblies, hot water heater units, heat recovery systems, etc. Panels shall be constructed of steel or plastic laminate and all piping, wiring, supplementary relays and switches shall be concealed behind the cover or in the back panel. All controllers, unless otherwise noted, thermometers, RH indicators, main air gauges and branch air gauges shall be mounted on the face of the unit panel.

L. Thermometers:

1. Furnish and install Honeywell #W655, or equal, round dial remote bulb thermometer. Thermometer shall have suitable operating ranges and shall be installed so as to be conveniently read in the following locations on the supply air units.

(a) Outside air intake of Units.

(b) Mixed air stream on units.

(c) After heat recovery coil of units.

(d) Supply air discharge of units.

2.6 GAUGES

A. There shall be a minimum of one gauge on all branch lines from all controls. There shall also be sufficient gauges on main lines to indicate pressure in

location of groups of controls. There will not have to be a gauge on main line to thermostats in finished rooms, but there shall be a gauge installed in the branch line to the hot water reheat coil valves in the suspended ceiling spaces and in the branch lines to the room unit valves. The gauges shall be a standard product of the control manufacturer for measuring air line pressure.

2.7 OPERATING INSTRUCTIONS

A. Upon completion of the work, the manufacturer shall have a qualified representative fully acquainted with the installation to instruct the Owner's Operator in the fundamentals and operation of the system. This instruction period shall not be less than ten (10) full working days. The manufacturer shall also, upon completion and acceptance of the work, provide the Owner with three (3) typewritten and/or printed sets of operating and maintenance instructions including sheets describing fundamentals of each system in the installation. One (1) similar set shall be provided for the Architect-Engineer, all sets being neatly clipped in heavy manila folders.

B. The manufacturer shall also mount one (1) set of charts consisting of complete control diagrams, wiring diagrams, etc., adjacent to the equipment in a conspicious location. Charts shall be mounted in a glass enclosed case, or laminated plastic.

C. When the system is completely installed and proven to be in operating condition by the control manufacturer and ready for acceptance, the manufacturer shall furnish to the Owner twelve (12) extra packaged gauges of the same type supplied on the instruments in the equipment rooms. Also he shall supply the Owner with twelve (12) complete sets of instrument adjusting keys and any special wrenches, screw-drivers, or tools necessary for normal service of the same.

2.8 SEQUENCES OF CONTROL

A. Supply Air Unit #S-100:

1. Unit motor will be controlled by a H.O.A. switch mounted in the motor control center near the supply unit. Exhaust fans #RE-100 and GE-100 will be interlocked electrically with this supply unit.

2. When fan motor is energized, the fresh air dampers shall fully open. A static pressure controller with its sensing bulb in the discharge duct shall maintain proper duct pressure by modulating the inlet vanes on the supply air blower intake.

3. A heat-cool switch located in the supply unit control panel shall control the cycles of operation as follows:

a. Heat Cycle: The chilled water coil valves shall be positively closed. The normally open preheat coil steam valves and the coil face and bypass dampers shall be placed under the control of an averaging type sensor/controller with the sensor located in the preheat coil discharge. The sensor/controller shall modulate the coil steam valves and the face and bypass dampers to maintain 45°F. discharge temperatures. When outdoor temperature is below 35°F. the steam valves shall remain fully open. Two steam valves sized 1/3 and 2/3 capacity shall be provided for the preheat coils.

A sensor/controller with the sensor located in the supply fan discharge duct shall modulate the normally open coil steam valve on the reheat coil to maintain discharge air temperature of 57°F.

A humidistat located in the suction duct of Exhaust Unit GE #100 shall modulate the normally closed humidifier steam valve to maintain desired relative humidity. A high limit stat located in the humidifiers discharge air shall prevent relative humidity from exceeding 90%. Valve shall close on fan shutdown.

A low limit stat with its sensor in the discharge duct shall stop the blower motor at all temperatures below 45°F.

b. Cool Cycle: The preheat coil steam valves shall be positively closed, the face and bypass dampers fully open to the bypass position, the reheat coil steam valve and the humidifier steam valve shall all be positively closed.

A sensor/controller with the sensor located in the supply fan discharge duct shall modulate the normally closed chilled water coil valve to maintain discharge air temperature of 57"F. Selected room thermostats shall be capable of resetting discharge temperature.

B. Supply Air Units #S-101, S-102, S-104, S-106 and S-107

1. Control of these units shall be similar to Unit S-100, with humidifier sensor in its respective general exhaust unit duct. Exhaust fans will also be interlocked electrically as previously indicated.

C. Supply Air Unit #S-119 (Jackson Penthouse)

1. This existing unit will be furnished with a Heat-Cool selector switch, heat cycle and means to shut-off heat cycle when switch is turned to cool cycle. Sequence will be similar to Supply Unit #S-120.

2. Under this Contract cooling controls shall be added as follows: The booster pump #P-6 shall be started by a P-E switch and shall run continuously on the cooling cycle. A sensor/controller with the sensor located in the supply fan discharge duct shall modulate a three way valve in the coil water supply piping to maintain a discharge temperature of 57°F. Selected room thermostats shall be capable of resetting the discharge air temperature.

D. Supply Air Unit #S-120

1. Unit motor will be controlled by a H.O.A. switch mounted on the wall near the unit. Exhaust Fan #GE-120 will be interlocked electrically with this supply unit.

2. When supply unit motor is energized the fresh air damper shall fully open.

3. A heat-cool switch located in the supply unit control panel shall control the cycles of operation as follows:

a. Heat Cycle: The chilled water coil 3 way valve shall be open to full coil recirculation with booster pump P-5 stopped. The normally open

preheat coil steam valve and the coil face and bypass dampers shall be placed under the control of an averaging type sensor/ controller with the sensor located in the preheat coil discharge. The sensor/ controller shall modulate the coil steam valve and the face and bypass dampers to maintain 45°F. discharge temperatures. When outdoor temperature is below 35°F. the steam valve shall remain fully open. One steam valve shall be provided for the preheat coils.

A sensor/controller with the sensor located in the supply fan discharge duct shall modulate the normally open coil steam valve on the reheat coil to maintain discharge air temperature of 57°F.

A humidistat located in the suction duct of Exhaust Unit GE #120 shall modulate the normally closed humidifier steam valve to maintain desired relative humidity. A high limit stat located in the humidifiers discharge air shall prevent relative humidity from exceeding 90%. Valve shall close on fan shutdown.

A low limit stat with its sensor in the discharge duct shall stop the blower motor at all temperatures below 45°F.

b. Cool Cycle: The preheat coil steam valve shall be positively closed, the face and bypass dampers fully open to the bypass position, the reheat coil steam valve and the humidifier steam valve shall all be positively closed.

The booster pump #P-5 shall be started by a PE switch and shall run continuously on the cooling cycle. A sensor/controller with the sensor located in the supply fan discharge duct shall modulate a three way valve in the water water supply piping to maintain a discharge air temperature of 57°F. Selected room thermostats shall be capable of resetting discharge temperature.

D. Exhaust Unit #RE-100

1. Unit motor will be electrically interlocked with Supply Unit #S-100.

2. When fan motor is energized the static pressure controller on Supply Unit #S-100 shall also maintain proper return duct pressure by modulating the inlet vanes on this return fan intake.

3. Motorized dampers on discharge duct connected to outside exhaust louver and to return connection on Supply Unit #S-100 shall be controlled as follows:

a. When the outside air temperature is below 60°F the return damper is fully open and the exhaust damper is closed.

b. When the outside air temperature is between 61°F and 80°F the return damper is closed and the exhaust damper is fully open.

c. When the outside air temperature is above 80°F the return damper is fully open and the exhaust damper is closed.

d. When the fan motor is stopped the return damper shall remain open and the exhaust damper shall be fully closed.

E. Exhaust Unit #RE-101, RE-102, RE-104, RE-106 and RE-107

1. Control of these units shall be similar to Unit #RE-100 with return duct connections and static pressure damper control to its respective supply unit.

F. Exhaust Unit #GE-100

1. Unit motor will be electrically interlocked with Supply Unit #S-100.

2. When fan motor is energized, the static pressure controller on Supply Unit #S-100 shall also maintain proper exhaust duct pressure by modulating the inlet vanes on this general exhaust fan intake.

3. When this unit is energized the exhaust air damper shall fully open and shall close when fan is stopped.

G. Exhaust Units #GE-101, GE-102, GE-104, GE-106, GE-107

1. Control of these units shall be similar to Unit #GE-100 with static pressure damper control from its respective supply unit.

H. Exhaust Unit #GE-119 (Jackson)

1. Unit motor will be electrically interlocked with existing Supply Unit #S-119 (variable air volume).

2. Control of this unit shall be similar to Unit #GE-100 with static pressure damper control from Supply Unit #S-119.

I. Exhaust Unit #GE-120 (Animal Quarters)

1. Unit motor will be electrically interlocked with Supply Unit #S-120.

2. When unit is energized the exhaust air damper shall fully open and shall close when fan is stopped.

J. Exhaust Unit #GE-121 (Operating Room)

1. Unit will be started and stopped by a push button.

2. When unit is energized the exhaust air damper shial fully open and shall close when fan is stopped.

K. Exhaust Unit #GE-122 (Welding Hood)

1. Control shall be similar to Unit #GE-121.

L. Exhaust Unit #GE-123 (J-O VAult)

1. Provide a two stage 120 volt cooling thermostat to start and stop unit.

M. Exhaust Unit #GE-124 (Millard Vault)

1. Provide a two stage 120 volt cooling thermostat to start and stop unit.

N. Exhaust Units #GE-125 and 126 (S.E. Tower)

1. Provide a pneumatic cooling stat, motorized intake damper and P.E. switch. When space is too hot, stat shall open intake damper and start exhaust fan.

O. Exhaust Units #GE-127 and 128 (S.W. Tower)

1. Provide a pneumatic cooling stat, motorized intake damper and P.E. switch. When space is too hot, stat shall open intake damper and start exhaust fan.

P. Exhaust Unit #TE-100 (Owre Toilets)

1. Control shall be similar to Unit #GE-121.

Q. Exhaust Unit #TE-101 (Millard Toilets)

1. Control shall be similar to Unit #GE-121.

R. Fume Hood Exhaust Units #FE-100 thru #FE-140 and Indicated Existing Units

1. Unit motors will run continuously on either high or low speed. Refer to Paragraph S below for control cycle.

2. Furnish and install pressure differential switches in all new and indicated existing fume hood exhaust systems. Units shall operate properly with the varying pressure differentials expected. Switch shall actuate an indicator lite mounted on the hood. Switch shall be installed within one foot of hood connection. Wiring of switch will be provided by the Electrical Contractor.

S. Room Controls

1. Rooms with only radiation: A pneumatic room stat shall position normally open pneumatic steam or hot water radiator valves to hold room at stat setting.

2. Rooms with radiation and variable air terminal box: Same as #1 plus room stat shall also position pneumatic damper motor on air terminal box to hold room at stat setting. The radiastion valve shall be sequenced to modulate open on a temperature fall after the box discharge air is at its maximum temperature.

3. Rooms with radiation and induction air terminal box: Same as #2.

4. Rooms with radiation and two position air terminal box with reheat coil: Same as #1 plus room stat shall also position a normally closed hot water reheat coil valve to hold room at stat setting. The radiation valve shall be sequenced to modulate open on a temperature fall after the box discharge air is at its maximum temperature.

The air terminal boxes will be furnished with two discharge air quantity capabilities. When the exhaust hood fan in that respective room is on high

speed, the box will discharge 100% capability. When the exhaust fan is switched to low speed and EP switch shall position a pneumatic damper on the terminal box to reduce the air discharge capacity to 50%. The pneumatic damper motor shall be sent to the box manufacturer for factory mounting and adjustment. The EP switch will be wired by the Electrical Contractor.

5. Rooms without radiation but with any of the air boxes mentioned above: Same sequence as specified but without radiation valve control.

T. Cabinet Unit Heaters

1. A pneumatic room thermostat shall position a normally closed steam valve on the heater coil to hold room at stat setting. An aquastat on the return pipe of the heater coil shall start and stop heater fan. Wiring of aquastat will be provided by the Electrical Contractor.

U. Reheat Coil Water Convertor

1. Pump motor will be started and stopped by a push button.

2. An outside air sensor located to be shielded from the sun and other sources of radiation shall reset a submaster discharge water controller, with its sensor in the convertor discharge water, which in turn controlls a normally open steam valve. The water temperature shall vary from 180°F to 110°F as outside air temperature varies 50°F to 95°F. Steam Valve shall be closed when pump is inoperative.

3. A differential pressure controller shall modulate a normally closed pneumatic valve at the pump discharge to control water flow in the piping system. Pressure drop through valve shall not exceed 5 feet.

V. Chilled Water Pump Controls - Pumps #L Through #4

1. An industrial pneumatic differential pressure transmitter shall sense pressure difference in supply and return chilled water lines at top points indicated on plans. The transmitter shall transfer the signal to a pressure current converter which will interface directly to the SCR variable speed pump controller. The pump controller will be provided by the Electrical Contractor.

W. Chilled Water Pump Controls - Pumps #5 and 6

1. Pump motors will be started and stopped by a P.E. switch and shall run continuous during the cooling season. Refer to Article C and D above.

X. Heat Recovery Pumps - #9 and 10

1. Pump motors will be started and stopped by a push button.

Y. Smoke and Fire Detection

1. All smoke and heat detection devices that affect the air handling systems controls will be furnished and installed by the Electrical Contractor. The Electrical Contractor will provide all wiring from detection devices to the air handling unit control panels. This Contractor shall connect to the

wiring circuit with an EP switch with unit control panel and provide the following control sequence on the air handling units.

a. On signal from smoke and fire detection the affected area supply, return and exhaust fans shall shut down and all smoke dampers shall close. Smoke dampers shall be pneumatic motorized dampers at locations indicated on the drawings.

2.9 CENTRAL DATA CENTER

A. The control systems as described in these specifications shall be fully compatible for integration into the central data center. All controls shall be chosen so that they will not have to be changed when the connection is accomplished.

B. Provisions shall be made in the form of resistance or thermocouple, capped tees and shut-off vales, etc. to provide the following indication as scheduled.

C. Insertion wells shall be Honeywell 14500430 for future insertion of sensors compatible with Honeywell Delta 2000 system.

D. Schedule of Remote Inputs

Definitions	Symbol
a. Start-Stop Control	SS
b. Programmed Start Stop of Day Night Control	P/SS
c. Temperature indication	T/C
d. Pressure indication	PI
e. Run Indication	RI
f. Flow Alarm (liquid or air)	FA
g. Filter Alarm	FLT
h. High Alarm	HI
i. Low Alarm	OW
j. Control Point Adjustment (Reset)	CPA
k. Relative Humidity Indication	RH
l. Other Alarms, as stated	X
m. Liquid Level	LL
n. Programmed Day-Night Control	P/DN

E. All Supply Air Units

All Supply Air Units	Indication	Alarm	Control
Supply Fan	RI	FA	P/SS
Freeze Alarm		X	
Filter Alarms (2 thus)		FLT	
Discharge Air	T/C	Hi/Lo	CPA
Air Leaving Preheat Coil	T/C		
Outside Air	T/C		
Air Leaving Heat Recovery Coil	T/C		
Relative Humidity	RH		CPA

F. Reheat Coil Convertors

Reheat Coil Convertors	Indication	Alarm	Control
Supply water	T/C		CPA
Circulating Pumps		FA	
Expansion Tank		LL	

G. Miscellaneous

Fume Hood Fans	RI	FA	
General Exhaust Fans	RI	FA	
Return-Exhaust Fans	RI	FA	
Toilet Exhaust Fans	RI	FA	
Sump Pumps-SW Tower		LL	
Chilled Water Pumps	RI	FA	

- - -

BIDDING REQUIREMENTS, CONTRACT FORMS
CONDITIONS, SPECIFICATIONS AND RELATED DOCUMENTS FOR

JACKSON OWRE MILLARD LYON COMPLEX REMODELING
CONTRACT B (JOML-B)
MINNEAPOLIS CAMPUS
UNIVERSITY OF MINNESOTA
COMMISSION NUMBER 280.02
PROJECT NUMBER MINN. BHRD-HP-5C-070

Donald P. Brown — University of Minnesota
Acting Vice President for Finance and Development

Clinton N. Hewitt — University of Minnesota
Assistant Vice President for Physical Planning

THE ARCHITECTS COLLABORATIVE, INC. — Cambridge, Massachusetts

HEALTH SCIENCES ARCHITECTS & ENGINEERS, INC.
University Park Plaza - Suite 704
2829 University Avenue South East — Minneapolis, Minnesota 55414
(612) 378-3833

The Cerny Associates, Inc. — Minneapolis, Minnesota
Hammel Green and Abrahamson, Inc. — Saint Paul, Minnesota
Setter, Leach and Lindstrom, Inc. — Minneapolis, Minnesota

I hereby certify that these plans, specifications or reports were prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Date: May 2, 1977 — Reg. No. 9112

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this Division. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Provisions of this section apply to all work of the Electrical Contractor.

1.2 CODES AND STANDARDS

A. The entire installation shall meet all requirements of the 1975 National Electrical Code (NFPA 70) and all State and local regulations as they may apply. Standards of the following associations or organizations shall be followed and applied where applicable as minimum requirements.

(UL)	Underwriters Laboratories
(IEEE)	Institute of Electrical and Electronic Engineers
(NEMA)	National Electrical Manufacturers Association
(NFPA)	National Fire Protection Association
(NBFU)	National Board of Fire Underwriters
(EEI)	Edison Electric Institute
(IPCEA)	Insulated Power Cable Engineers Association
(ASTM)	American Society for Testing and Materials
(OSHA)	Occupational Safety and Health Act of 1970
	National Electric Safety Code (Handbook H30) of the National Bureau of Standards.

B. The rules and regulations of the University of Minnesota Physical Planning and Development Department shall be checked and complied with where applicable.

1.3 PERMITS, LICENSES AND INSPECTION

A. All Electrical Work or Wiring accomplished on University of Minnesota property shall be inspected by a University Electrical Inspector. The Electrical Contractor shall file a University of Minnesota Request for Electrical Inspection. The request forms are available from the Engineering & Construction Division of the Physical Planning Department and will normally be given to the Electrical Contractor at a pre-construction meeting.

B. No project consisting of electrical work or wiring shall be installed until a request is on file with the Engineering & Construction Division, Electrical Inspection Office. The Electrical Contractor shall retain a copy of the request, which has been signed by the University Electrical Inspector.

C. Requests for electrical inspection will give the phone number to call for all inspections required by the Office of Electrical Inspection. A request for final inspection shall be made within 48 hours of project completion.

D. A permit number for the project will be assigned to the Request for Inspection by the University. A permit application will be made and fee paid to the University Building Official by the appropriate departments and will not be the Contractor's responsibility.

1.4 GUARANTEES AND TESTS

A. All wiring shall be tested for opens, shorts and grounds with megger equipment prior to acceptance. Contractor shall be responsible for proper installation of all items in this Contract and shall remedy, free of charge, any defects in materials and workmanship and repair all damage resulting therefrom in accordance with provisions of the General Conditions. The Electrical Contractor shall be required to test and supervise the initial operation of all equipment and special systems. He shall demonstrate the equipment and systems and instruct the operator(s) selected by the University in such operation and maintenance as required to acquaint him thoroughly with the best practice.

B. Specific equipment warranties different than one year shall take precedence. Specific tests beside those mentioned above shall be performed as required in other sections of these specifications.

C. Incandescent lamps are excluded from the provisions of guarantees, but they shall not be installed until final completion of the project to replace the temporary incandescent lamps used for construction lighting.

1.5 DIMENSIONS AND CORRELATION

A. For the purpose of clearness and legibility the drawings are essentially diagrammatic and are intended to indicate size, capacity and location but not exact details or arrangements of construction. Architectural, mechanical and structural drawings shall be examined for rough in dimensions and installation requirements so that all details of the project are understood and work procedures known before bid and installation. Exact locations and details shall be obtained from dimensioned drawings but shall not take precedence over field dimensions.

B. Miscellaneous equipment (pull boxes, junction boxes, fittings and expansion joints) necessary to complete the work satisfactorily shall be furnished and installed even though not specifically shown on plans.

C. This Contractor shall cooperate with other contractors for proper anchorage, placement and accomplishing of all work. In general, plumbing and ventilating lines are laid out first. Interference between the work of the various contractors shall be resolved before installation. In the event of conflict of space requirements or location with other trades, he shall refer the matter to the University for decision.

1.6 CUTTING, PATCHING AND DEMOLITION

A. This Contractor shall be responsible for all necessary cutting and patching required in connection with his work and where necessary because of removal or change of existing work. Cutting of structural members and finished surfaces shall not be allowed without permission from the Architect or Structural

Engineer. These cutting and patching requirements will be modified only if general construction specifications and drawings specifically and clearly state that certain or all portions of same required for each of the various trades is to be performed by the General Contractor. Refer to Section 01910.

B. This Contractor shall remove existing electrical conduits, wires, fixtures, boxes and wiring devices from the existing construction to accomplish the work as shown on the plans. Electrical equipment not shown to be reused shall remain the property of the University and shall be salvaged or removed from the site as specified in Article 1.7 of this Section of the specification. Abandoned conduit in ceilings, walls and floor slab shall be cut off below new finish line to allow new finish surface to be applied. Contractor shall verify that circuits or wiring removed do not interrupt service of any kind beyond the remodeled area. If necessary, Contractor shall re-route conduit and wire to maintain services to areas beyond the remodeled spaces. Where conduits to be abandoned cannot be removed from walls or from panel boards the conduit shall be plugged and effectively removed from the conduit systems. The Contractor shall reuse existing conduit and outlets where practical.

C. The Electrical Contractor shall repaint all areas where he has performed cutting and patching at rooms, spaces or locations that are not repainted under the General Contract. Generally these will be locations where no demolition, cutting and patching is performed by the General Contractor.

D. Contractor shall carefully review the Contract Documents for all other contractors with respect to coordination of the demolition, removal and remodeling work. Cutting and patching to expose and remodel existing mechanical or electrical systems shall not be construed as the work of another contract unless specifically called for on another contractor's documents.

E. Refer to General construction specificatins for execution and requirements for patching and painting and comply with applicable provisions as to materials and workmanship.

1.7 SALVAGEABLE MATERIAL AND EQUIPMENT

A. All existing electrical materials and equipment are to be removed by this Contractor and shall remain the property of the University unless indicated otherwise by the University.

B. Removed materials and equipment that the University no longer wishes to retain shall become the property of the Contractor, and he shall dispose of it off the University of Minnesota's property at no additional cost to the University.

C. Any removed materials and equipment to be delivered to the University shall be delivered to the following address:

University of Minnesota
Como Yard
3009 Como Avenue Southeast
Minneapolis, Minnesota 55414

1. All materials and equipment delivered or returned to Como Storage Yard shall be in the same condition it was prior to being removed from project sites or Como Storage Yard.

2. Delivery shall be made to the Como Yard during regular working hours or as the University may direct. The Como Yard has personnel and equipment to handle the material delivered to the Yard.

D. All removed materials and equipment shall be tagged with the following information.

1. General description.

2. Location removed from.

3. Date removed.

4. Contractor's name.

E. When removing existing equipment and material, the Contractor shall take particular care to prevent damage to or loss of equipment and material which are to remain.

1.8 EXCAVATING

A. Contractor shall do all trenching, excavating and backfilling required for his work. Any street, sidewalks, curb or paved area repairs necessary because of Electrical Contractor's work shall be his responsibility. Refer to General Conditions, Section 02200 and Section 02400 for requirements of trenching, excavating, backfill and compaction; comply with applicable provisions.

1.9 CLEANING

A. The Contractor shall periodically remove waste and rubbish and maintain order. Premises shall be left clean and free of debris and unused construction materials before acceptance. Refer to Sections 01010 and 01700 and comply with applicable provisions.

B. All electrical materials, equipment and apparatus including light fixtures and lamps shall be thoroughly cleaned, to be free of dust, dirt, rust and foreign materials before acceptance.

1.10 PAINTING AND LABELING

A. All equipment furnished under this Contract shall be factory finished and painted or galvanized. Any marred finishes on this equipment shall be painted to match as a responsibility of this Contractor.

B. Provide typewritten card index with plastic cover describing circuits in each panelboard.

C. For transformer and primary switchroom doors provide permanent standard porcelainized, 9" x 12" "DANGER HIGH VOLTAGE" signs.

D. Provide engraved 1/8" black-white-black laminated bakelite or plastic labels securely fastened with screws or escutcheon pins to identify electrical equipment as follows:

1. Panelboard name, and voltage fastened on inside of hinged door.

2. Distribution switchboard name on the front and individual distribution switches or breakers. Blank plates shall be provided for "spare" switches.

3. All main power and special system junction boxes. Locate these on the inside of flush boxes and in finished areas and outside of the box where they are surface mounted or in equipment spaces.

4. All motor control stations, combination starters in motor control centers, starters and disconnects, except when these items are adjacent to each other, only one label is necessary.

5. Plastic imprinted adhesive labels (Dymo Tape) will not be acceptable except for Item (3).

E. Provide engraved identification for switch and wiring device plates (Section 16310) and flush mounted motor controls where shown on plans. All engraving shall be sized as large as possible and shall be paint filled, black is standard; use red for emergency. For motor controls engrave on 3/8" black-white-black plastic laminate.

F. Exposed conduit with primary cables shall be painted orange continuously and stenciled every ten feet with 1" high black letters, "13,800 VOLTS".

G. Refer to other sections of these specifications for labeling, graphic diagrams and high voltage signs that must be provided with individual equipment.

1.11 QUALITY AND WORKMANSHIP

A. All materials shall be new, free from defects and shall be listed by, or bear the Underwriter's label where subject to such approval. Materials shall be of the same manufacture or brand for each type of material unless designated otherwise.

B. All materials and finishes shall be adequately protected during construction, from moisture, temperature extremes and physical abuse. All materials shall be assembled in a workmanlike manner in accordance with current recommended standard practice. Certain work such as painting, patching, core drilling and welding shall be done at the Electrical Contractor's direction, responsibility and expense but accomplished by workmen skilled in the particular trades.

1.12 SHOP DRAWINGS

A. Refer to Section 01300.

1.13 LIST OF MATERIALS, LIST OF SUBCONTRACTORS AND OTHER SUBMITTALS

A. Refer to Section 01300

1.14 SAMPLES

A. Refer to Section 01300.

B. All requests for substitutions prior to bidding (see Article 12 of the Instructions to Bidders).

1.15 OPERATION AND MAINTENANCE INSTRUCTIONS AND AS-BUILT DRAWINGS

A. Refer to Section 01700.

1.16 TEMPORARY ELECTRIC SERVICE AND LIGHTING

A. This Contractor shall install temporary secondary electric services and lighting for the remodeling of the JOML complex as outlined in Temporary Facilities, Section 01500 and herein.

B. Temporary non-building (construction) service shall be provided. The Electrical Contractor shall arrange for the electric service with the University of Minnesota Electrical Construction Superintendent. The electrical energy costs will be paid by the University directly to the power company. The Electrical Contractor shall furnish all materials and labor for the temporary service.

C. Safety Lighting

1. The Contractor shall provide safety lighting at temporary walkways or security fences.

D. Temporary Lighting and Receptacle Services: Provide from existing panel board risers in remodeling areas temporary electrical centers as described below.

1. Temporary service center shall be nominal 60 ampere, 120/208 volt, 3 phase, 4 wire. Provide a 60 ampere, 3 phase circuit breaker in existing panelboard. Provide 1-1/4"-4#6 THW to the temporary service center located central to the construction. Provide a 12 circuit load center panel, 8-20 amp. 1 pole breakers. From load center panelboard install a receptacle panel consisting of 6-20 ampere, 120 volt, 3 wire grounding type duplex receptacles. Each receptacle shall be served by a separate circuit. Provide GFI breakers or receptacles as required by code.

2. Temporary service center shall be provided in quantities of no less than 15 distributed through the remodeled areas.

3. From the temporary service locations each individual contractor shall provide his own portable cords and outlets for hand tools.

4. Existing light fixtures and receptacles may be used for illumination and power during construction where demolition is not extensive or removal of the fixtures and receptacles is not required. Where demolition is extensive and temporary lighting is required the Electrical Contractor shall provide (a service center and) a sufficient (minimum 800) number of rubber covered lamp sockets uniformly spaced so that in general 200 watt lamps (maximum) will provide satisfactory lighting on temporary cable connected to the temporary service and located for all trades. Lighting shall be adequate to provide suitable working conditions for high quality workmanship, as approved by the University, and safe lighting conditions. All trades will provide their own portable cords and outlets in the building for portable tools. All light bulbs will be furnished by General Contractor, but shall be installed, removed and reinstalled as burn out occur by the Electrical Contractor.

5. The entire installation of construction light and power shall meet code requirements and shall be safe, substantially supported and adequately connected.

6. Temporary electric energy costs will be paid by the University. Electric service and energy costs for heavy electrical loads such as large welders shall be provided by each Contractor and shall not be taken from this service. The energy demand shall not exceed the service and any damage resulting from misuse, overloading or faulty equipment shall be paid for by the responsible persons.

7. After the electrical installations are complete, prior to occupancy and when approved by the University, all temporary electrical services, wire, conduits, devices and equipment shall be removed by the Electrical Contractor.

8. Temporary lighting and panelboards have been installed in the south west and south east mechanical towers under an early Contract and will remain for use by this Electrical Contractor. This temporary service shall be maintained by the Electrical Contractor until removal is scheduled or the system is to become part of the building electrical system as shown on the drawings. Any portions of the system to be removed will be removed by the Electrical Contractor.

9. The Electrical Contractor shall submit a plan view and a one line diagram type sketch (3 copies) of the proposed temporary service connections to the University of Minnesota Electrical Construction Superintendent for approval at least one week in advance of the desired start of the installation of the same. The sketch shall show and describe all cables, raceways, switches, and overcurrent protection (fuses) and any additional information as may be required by the University.

10. After approval by the University Electrical Construction Superintendent, the Contractor may then proceed with installation of the temporary service.

11. Before energizing the temporary service connected to the University of Minnesota electrical system, the Contractor shall submit to the University Electrical Construction Superintendent (3 copies) of "REQUEST FOR TEMPORARY CONSTRUCTION ELECTRIC SERVICE CONNECTION TO UNIVERSITY OF MINNESOTA ELECTRICAL SYSTEM" form with Part A completed. Copies of this form are available from the University Electrical Construction Superintendent.

12. The Electrical Contractor shall meet University requirements for switching and overcurrent protection of the temporary electric service served from the University's distribution system.

E. Temporary primary service Jackson Owre transformer vault.

1. Transformer vault construction and major switchboard remodeling or replacement shall be coordinated and sequenced to keep the number and length of outages to a minimum. Except for minor switching outages the number of primary outages will be limited to three with a maximum length of outage not to exceed two days.

2. To accomplish the vault and switchboard work with a minimum outage requirement a suggested sequence of work is outlined below.

a. Install barriers at transformers and switchboards and perform all vault and switch board room expansions.

b. Install partial new switchboard and north service bus duct previous to removal of the existing switch board and prepare all secondary services to make crossover connections.

c. In the transformer vault install the transformer at the north end of the vault. Install the new primary feeder from the primary switching vault with the conduit only stubbed into the vault. Install ample wire to temporarily connect to the new transformer.

d. During a scheduled outage connect in the new primary feeder in the primary switching vault and make secondary crossover connections at the switchboard. Energize the switchboard through the tie switch.

e. Remove the existing transformers, service bus duct, secondary switchboard and complete the remaining vault work. Prepare the remainder of the secondary switchboard for connection to the installed portion.

f. Install the second transformer service bus duct and primary switches. With the existing primary service disconnect locked open connect primary switch and second transformer.

g. Schedule an outage to transfer the load to the second transformer and connect the remainder of the secondary switchboard.

h. With the new primary feeder discconect switch locked out disconnect the temporary connectior to the north transformer and complete the primary installation.

i. Schedule a switching outage to open the tie switch and energize the remaining part of the switchboard from the second transformer for normal operations.

F. Temporary Primary Service Millard Transformer vault.

1. Transformer vault construction and major switchboard remodeling or replacement shall be coordinated and sequenced to keep the number and length of outages to a minimum. Except for minor switching outages the Number of outages will be limited to two with a maximum length of outage not to exceed 2 days.

2. To accomplish the vault and switchboard work with a minimum outage requirement a suggested sequence of work is outlined below.

a. Under scheduled outage temporarily connect switchboards #1 and 2 to Millard transformer via tunnel, temporary services will match existing services in capacity.

b. Remove the existing secondary services from the Millard transformer to the pullbox in Millard mechanical room.

c. Install barriers, shoring and partitions, expand the vault, and extend the primary switchgear pad.

d. Complete the service to switchboard No. 1 with exception of the connection at the Millard transformer.

e. Under a scheduled outage transfer the secondary temporary service to the Lyons lab transformer.

f. With cam # 11 switch and tie switch locked out install the new primary switchgear and make necessary modifications to the existing switchgear. Complete the secondary connections and make the necessary primary modifications to the Millard transformer.

g. Under another scheduled outage remove temporary wiring and make final connections at switchboard No. 1. Energize the new primary switchgear.

h. Continue the installation of the remaining work.

Special Outage Requirements

1. All Primary temporary materials and Millard switchboard #1 Secondary temporary materials shall be new. The University shall maintain the right to retain these temporary materials.

2. Any temporary services to and from transformer vaults shall not jeopardize the security of the vault. It shall be the contractors responsibility to provide any barriers, keying, or partitions to maintain such security.

3. In the Millard Lyons transformer vault where existing transformers are used for temporary secondary service it shall be the contractors responsibility to provide any additional cooling such as fan or air conditioning and any load monitoring to protect the transformer from overload beyond its rating.

H. Service Energization and Outage Procedures

1. Upon being installed, all service disconnecting means and primary (above 600 volts) switches shall be left open and tagged with University hold cards in the name of a person to be designated by the Owner. In no case shall these cards be removed without that person's approval.

2. The Contractor shall submit all requests for energizations and outages to the Owner in writing on a University of Minnesota "Request for Electric Energization and/or Outage" form (4 copies).

3. Energization and/or outage requests shall be submitted in writing to the Electrical Construction Superintendent for approval at the earliest possible date, and in no case less than two weeks (14 calendar days) before the desired execution date.

a. Energizations and outages will be scheduled at the convenience of the Owner.

b. In the case of an emergency, the Owner reserves the right to cancel or change the scheduling up to 24 hours before the previously approved starting

time. There shall be no additional cost to the Owner for energizations and/or outages rescheduled at the Owner's request where at least 24 hours notice has been given by the Owner to the Contractor.

c. During the energization and/or outage the Contractor shall follow the switching procedures prepared by the University.

4. Before submitting any energization and/or outage requests, the Contractor shall verify with the University Electrical Construction Superintendent that the following requirements have been met.

a. All equipment and material shall be on the job site. All request related installations that can be worked on without an energization and/or outage shall be complete, tested, available for inspection, and ready for service.

b. All shop drawings, test reports, installation data, and operational data shall have been submitted and approved.

c. The Contractor shall have submitted the required energizing and outage bar graph schedule.

5. The first energized operation of each primary switch installed under the contract shall be by the Contractor. All subsequent operations of these switches shall be by the Owner.

6. At the time of energizing each primary feeder and/or equipment, the Contractor shall be prepared to handle any situation that may arise from a cable or equipment failure or other faults on the system. If a failure or a fault, it is the Contractor's responsibility to check out and place the system in proper operation with the required personnel and equipment, as soon as possible.

Primary 13.8 KV feeders shall be connected in such a way that there is parallelability across the 13.8KV tie switches and between all incoming 13.8KV feeders. That is, all building feeders and transformers shall be transferable between 13.8KV incoming feeders without having to be shut off.

7. All work performed under outages shall be done on overtime basis.

8. All primary and secondary temporary connections will be performed by the Electrical Contractor. All temporary power supplied from emergency generators during outage will be supplied by the University.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements of pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the basic construction materials for erection and installation of the building electrical systems.

PART 2: PRODUCTS AND INSTALLATIONS

2.1 RACEWAYS AND FITTINGS

A. All electrical conduit shall be galvanized, rigid, steel conduit where required for mechanical protection. Heavy wall, galvanized steel or intermediate steel conduit shall be used in all runs in poured concrete. EMT 1-1/4" or smaller may be used in furred ceilings, interior partitions, walls or where exposed and not subject to mechanical injury. No conduit smaller than 3/4" shall be used except on specific instruction from the Engineer or where noted on the plans. EMT shall not be used in poured concrete construction.

B. Flexible conduit, Greenfield, shall be used for motor connections and between recessed fixtures, and their junction boxes. Provide jacketed type Sealtite conduit for connections to exterior or wet location equipment. For motors conduit shall not exceed 18" in length and equipment in grounding conductor shall be provided within the raceway run with the circuit conductors. Greenfield may be used inside of counters and cabinets when approved by the Engineer.

C. Conduit for underground secondary circuits shall be rigid galvanized conduit with 20 MIL bonderized PVC cover, Robroy Industries, Plasti-Bond or equal.

D. P.V.C. conduit shall be used where specified for special installations only, conduit shall be Carlon Type 40 or equal approved for indoor application.

E. All steel conduit and all locknuts, fittings, couplings, nipples and connectors shall be protected from corrosion by hot dip galvanizing or cadmium coating both inside and out, except electrical metallic tubing shall have only enamel or epoxy coating on the interior. All rigid conduit shall have standard pipe threads.

F. In shafts, vertical runs of conduit up to 2" in diameter may be supported at every floor but support intervals shall not exceed 14', 2-1/2" and larger conduit may be supported at every second floor but support intervals shall not exceed 28'. For cable support in all conduit runs in vertical shafts, provide internal cable supports every 20 feet. Cable supports shall be segmented canvas bakelite type, non-ventilated, for either 600 volt or 15 KV insulated cables. Supports shall be O.Z. type DR or approved equal.

G. All conduits crossing building expansion joints shall be provided with O.Z. grounding type expansion fittings, Type EX or AX.

H. Conduits shall be dried, cleaned and de-burred before wire is pulled. Standard locknuts and fittings shall be used with rigid conduits, O.Z. Type A or B insulated steel bushings shall be used on all 1-1/4" or larger conduits. Terminations at cabinets and junction boxes shall be with double locknuts and phenolic bushings (1" and larger).

I. All exposed conduit shall be run parallel to wall and floors and shall be supported in a substantial manner with pipe straps expansion bolts, screws, lag screws, clamps, mineralac clamps or Kindorff or Unistrut trapeze hangers.

Conduit Sizes	Maximum Spacing of Supports
3/4" and under	7 feet
1" and over	10 feet

J. Condulets shall not be used for 1-1/2" or larger conduits. EMT conduit fittings shall be raintight gland compression type or equivalent approved by the Engineer. Indenter, set screw or slip-on types are not acceptable. Couplings and connectors shall be malleable iron or steel.

K. Where rigid steel conduit emerges from a floor slab, other than a permanent wall, a coupling fitting shall be set flush with finished floor, so that a pipe plug can be inserted for future connections or if the line is abandoned. Where conduit penetrates an existing floor slab the conduit shall be grouted in with a fire resistant grout equaling the fire barrier requirement.

L. All outdoor conduit shall be graded a minimum of 6 inches per 100 feet with no traps. Pitch to drain into manholes, pull boxes or suitably located drain tees. Where cold slabs occur or in cold rooms, conduit shall not be trapped. Where conduits penetrate roofed areas, provide pitch pockets per Section 07510.

M. In areas indicated on the plans, install all wiring and conduit work to meet all requirements for a hazardous location as defined in National Electrical Code, Article 500, for flammable gases, under Class 1, Division 1 or Division 2 as indicated. Provide seal off fittings wherever conduits enter or leave the space and within 18" on either side of all wiring devices.

N. All conduit where possible shall be concealed in the ceiling, floor or wall construction unless indicated as exposed on the plans. In corridors all conduit on the existing ceiling may be exposed above the future dropped ceiling line. All conduit in walls shall be concealed. All transitions from recessed to surface shall be done with the use of LB's or junction boxes. All surface conduit on the existing ceilings shall be kept tight against the structure. Conduits shall cross beams with the use of condulet fitting.

O. Conduit shall be Youngstown, Republic or equal.

2.2 WIREWAYS

A. Gutters and wireways shall be constructed of galvanized sheet steel conforming to Code requirements. Covers shall be screw cover type and all elbows and fittings shall be made without sharp edges or projections.

B. Gutters and wireways shall be of sufficient cross section to contain conductors, including all splices.

C. Provide permanent welded ground lug in all gutters or wireways. Cover screw connections or sheet metal screws will not be acceptable.

D. Wireways shall be Square D or equal.

2.3 OUTLET, JUNCTION AND PULL BOXES

A. All outlet boxes shall be galvanized. Standard 4" octagonal boxes shall be used for ceiling outlets except as otherwsie specified or required. Ceiling outlet boxes shall be equipped with 3/8" fixture studs where required. Outlet boxes in furred construction shall be supported by bar hangers or lightweight channel iron; exposed ceiling outlet boxes shall be secured by wood screws, machine screws, toggle bolts or lead anchors as applicable. All boxes shall be supported independently of support from connecting conduit.

B. Standard 4" square boxes with proper plaster rings shall be used for device outlets in plastered walls. Gang boxes with plaster rings shall be used where more than two devices occur at one location unless specifically called out otherwise on the plans.

C. Use properly sized tile boxes and covers for device outlets in glazed tile, brick and unfinished concrete block walls. These boxes shall be ganged where two or more devices occur at one location, unless specifcally called out otherwise on the plans.

D. Standard 4-11/16" square boxes shall be used for ceiling and other outlets as required for additional wire space.

E. Square boxes with industrial covers shall be used for exposed wall outlets.

F. Provide Appleton, Killark, or Crouse Hinds FS and FD condulets for outdoor outlets and ceiling outlets wherever required for vaportight fixtures and wet locations. Provide explosion-proof cast boxes for Class I Division I and Division 2 areas.

G. Covers shall be provided for all outlet boxes, as required, and shall be of a design to fit the particular box and location, and shall be readily adjustable for alignment with the walls and finishes. Where these covers are to receive a finish coat of paint, Electrical Contractor shall furnish same with one coat of primer. In finished spaces, covers shall be similar to those specified under finishing plates, Section 16310.

H. Light fixtures without integral J-boxes suitable for wiring temperature rating shall have J-boxes installed in an accessible location close to fixture.

I. All pull boxes are not shown on the plans but they shall be provided as required for ease of wire pulling and in long runs (90 feet or more), or when more than four quarter bends shall occur in any conduit run. All pull boxes shall be sized to conform to requirements of the National Electrical Code. Pull boxes shall be recessed in all finished portions of building.

J. All junction and pull boxes shall be accessible and permanently labeled to identify the system and wiring within. Refer to Section 16010.

K. Outlet boxes shall be Appleton, Steel City, Raco, or equal.

2.4 WIRE AND CABLE

A. All wire and cable furnished and installed under this contract shall be new and of the best quality. Wire and cable shall be of size, type and number shown on plans. All conductors shall be of soft annealed copper of not less than 98% conductivity and in all other respects to the requirements of the ASTM specifications, latest edition. Unless otherwise noted, insulation shall be rated at 600 volts.

B. Conductors No. 4 through 750 MCM the Contractor may substitute aluminum conductors for copper provided the following requirements are met.

1. The aluminum conductors electrical characteristics are equal to or greater than the specified copper conductors.

2. The circuit length is less than 200 ft.

3. The Contractor resizes conduit, pullboxes, wireways, panel and switchboard gutter spaces, switch enclosures, and all connector lugs.

4. Compression type fittings specifically designed for aluminum such as Burndy Hyplug.

5. Submit voltage drop figures for each circuit to the University previous to any installations.

C. All branch circuit wiring shall be color coded according to Article 210-5 of the National Electrical Code and as follows:

1. 120/208 volt: A - black; B - red; C - blue; Neutral - white; Ground - green; travelers - yellow;

2. All feeders if not color coded shall be permanently marked with paint or tape at their terminations for identification.

D. All feeder wire #6 or larger shall be type THW and branch circuit wire #8 and smaller shall be type XHHW or THWN-THHN, unless indicated otherwise, of sizes shown on plans. All wire larger than Number 6 shall be stranded. Unless indicated otherwise, no wire smaller than Number 12 shall be used for branch circuits. Number 14 may be used for relay and motor control.

E. All wire pulled through the wiring channels of continuously mounted fluorescent fixtures shall be type RHH and THWN. Wire connected to recessed type and vaportight fixtures shall be type AF. All underground wires exterior to the building shall be in conduit and shall be type THW or THWN. Branch wire in high ambient areas shall be type THHN.

F. Interior helical spring twist type connectors shall be used on number 8 and smaller wire sizes. These shall be Ideal 70 or 450 Series, Scotchlocks or approved equal.

G. Number 6 and larger wires shall terminate in solderless lugs. All terminations taps and splices shall be compression type Burndy, Hydent or approved equal.

H. No splices shall be made in any conductor except when absolutely necessary and then in approved junction or pull boxes. Secondary service wires and feeders shall be of one continuous run without splices.

I. To relieve strain on the insulation and the conductors when pulling wire, a wire pulling lubricant shall be used, powdered soapstone or approved equal except for isolated power systems shown on the plans and specified under Section 16600 where no lubricant shall be used.

J. Portable cords for receptacles, equipment and ceiling attachments shall be Type SJO. All cords shall have a grounding conductor and cords shall be properly installed with cord grip devices at each end. Conductor size shall be #14 stranded minimum.

K. Refer to Section 16500, 16600 and 16900 for wiring and conductor requirements for specific systems. Refer to Section 16200 for 15KV cables.

L. Wire and cable shall be General Cable, General Electric, Rome, Hatfield, Anaconda or equal.

2.5 SURFACE RACEWAYS

A. In laboratories, and where shown on plans, provide surface metal raceways complete with wiring and receptacles as indicated. Surface raceways shall be Wiremold, or approved equal with special colors to be selected by Architect to coordinate with casework.

B. Provide all hardware elbows, fittings, boxes (if required) and back entry devices as necessary. Standard 10' bases, 5' covers and 5' dividers shall be used. Contractor shall cut raceways as required to fit the spaces allocated and for assembly in continuous odd length rows. Surface raceways shall be back fed from flush in wall horizontal electrical boxes.

C. All surface raceways shall be provided with a green color insulated copper ground conductor. This conductor shall be connected to the supply panelboard ground bus and to each ground screw on each receptacle.

D. Surface raceways shall be provided where shown on the plans as follows:

1. In laboratories and as noted provide Wiremold #G-3000. Install receptacles and stainless steel plates where shown and of type indicated as listed in Section 16310.

2.6 CABLE TRAYS

A. Provide a complete cable tray system including all necessary hardware, horizontal bend fittings, vertical inside and outside bend fittings, tees, crosses, offsets, splice plates, blind end plates, hanger rods and clamps and support hanger brackets as required, and as shown on plans. Vertical and horizontal offsets shall be provided as necessary to coordinate with the Mechanical and Structural Installation.

B. System shall be Chalfant Series 6S, trough type, galvanized 16 gauge steel, in standard 10' lengths. Openings shall be 3-3/16" oval with 1-3/4" rungs between. Trays shall be 9", 12", or 18" wide as indicated on plans.

C. Provide two support rods every 8' or wall bracket support where applicable. At feed points provide #6SCB425 conduit to tray adapter fitting. For vertical runs provide nylon cord lacing every 3' for substantial bracing. Cable tray systems of Binkley, Huskey/Burndy, P&W and Cope shall also be approved.

D. For primary and secondary cable support in primary switchgear rooms and vaults provide similar system, except aluminum ladder type, as sized by drawings. Ladder shall be Husky Burndy to match and extend existing system. All rungs shall be 12" apart and welded. All splices shall be bolted.

E. Electrical Contractor shall provide and install an approved fire barrier where cables penetrate a fire rated partition at stairwells and mechanical towers. Barrier shall be MultiCable Transit Assembly by Nelson Electric or rigid steel conduit.

F. Manufacturer of cable tray shall provide shop drawings complete with plan layout indicating all sizes and components of the system.

G. Where primary and secondary cable is installed in cable tray the cable shall be secured to the tray with nylon tie wrap every 2'.

2.7 FLOOR BOXES & OUTLETS

A. Provide floor boxes or through floor outlet fittings where shown on the plans completely wired and equipped with receptacle or wiring device. Boxes and fittings shall be installed so that the tops are perfectly flush with the finished floor. All exposed parts shall have satin aluminum finish. Verify floor finish before ordering boxes. Provide carpet flanges where necessary.

B. Floor pedestal outlets for telephone and power shall be through-floor outlet fittings (after set type) Hubbell FA 1500 Series box assembly. Assemblies shall be suitable for a floor type and thickness. Provide a surface floor fitting for each outlet completely wired with pedestals and receptacles as specified below:

1. Office Areas: Pedestals shall be standard type: Hubbell SC-3090-telephone; Hubbell SC-3091-single duplex receptacle; Hubbell SC-3092-double duplex receptacle. Provide 20 amperes duplex receptacles as specified under Section 16310. Finish shall be satin chrome with stainless steel plates.

C. Pedestals on casework shall be mounted on conduit stubs from standard Junction Boxes or condulets from below the counter.

1. Laboratory Areas: Pedestals on casework for power shall be heavy duty type Hamilton #36L115 or 36L117 with receptacles as indicated on the plans and specified in Section 16310. Finish shall be satin aluminum with stainless steel plate as required.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provision - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the basic installations, assemblies, methods of fabrication and supporting devices for the electrical system.

PART 2: PRODUCTS AND INSTALLATIONS

2.1 GROUNDING CONTINUITY

A. All conduit systems, equipment housings, material housings, junction boxes, cabinets, motors, ducts, wireways, light fixtures, portable equipment and all other conductive surfaces shall be solidly grounded in accordance with the National Electrical Code to form a continuous, permanent and effective grounding system.

B. Grounding continuity shall be established by using standard couplings, connectors, fittings and green jacketed copper conductor in conduit with circuit conductors for motors and equipment connections.

C. Refer to Section 16220 for a complete description of the service grounding system.

D. Certain areas on the 2nd floor are classified as surgical areas and will require an equal potential grounding system as specified in Section 16600.

2.2 CASEWORK ELECTRICAL UTILITIES

A. The Electrical Contractor shall furnish and install all receptacles, boxes, plates, pedestals and all conduit and wiring required and shown on the plans for all casework electrical requirements. The Casework Contractor will provide all cutouts for the electrical outlet boxes required for the various electrical devices.

B. Electrical Contractor shall coordinate and provide all data to the Casework Contractor for the correct placement of all required outlets. Both the casework schedule, equipment details and the electrical plans shall be studied and referred to before proceeding with the installation. It shall be the Contractor's responsibility to provide a satisfactory and coordinated installation.

C. Fume hoods will be package units and will come complete with their components installed and partially prewired. The Electrical Contractor shall provide all power circuits to these units and make all connections. In addition, provide conduit, wire and connections at each hood for the pilot lights and the pressure switch in the duct above the hood. Pilot light and pressure switch will be furnished and installed by the Casework and Electrical Contractors, respectively. Pressure switch is furnished by mechanical.

2.3 MILLWORK ELECTRIC UTILITIES

A. The Electrical Contractor shall furnish and install all receptacles, boxes, plates, pedestals and all conduit and wiring required and shown on the plans for all millwork electrical requirements. The General Contractor will provide all cutouts for the electrical outlet boxes required for the various electrical devices.

B. Electrical Contractor shall coordinate and provide all data to the General Contractor for the correct placement of all required outlets. The millwork details and the electrical plans shall be reviewed before proceeding with the installation to assure a correct and coordinated installation.

2.4 EQUIPMENT CONNECTIONS

A. Completely wired outlets and disconnects shall be installed as required for equipment furnished by others. Verify connection requirements for all equipment, installed or furnished by others, before installation.

B. In general, the service to equipment is laid out for anticipated electrical requirements as listed on Architectural Equipment Schedule. Actual equipment furnished may differ and shall be checked from the shop drawings to assure proper power supply. Report any differences to the University for procedure or adjustment. Equipment will be furnished by General, Mechanical or Electrical (Group I) and the University (Group II).

C. Package environmental rooms will be provided and installed by the University (Group II). The electrical contractor shall provide the 120/208 volt, 3 phase, 4 wire feeder and disconnect sized as shown on the plans. Final location of the disconnect shall be coordinated with the University's equipment. Electrical Contractor shall cooperate fully with the University in the placement and installation of this feeder and disconnect. The University will extend wiring from this disconnect and make all final connections to the equipment and room.

2.5 INSTALLATION IN STEEL STUD PARTITION WALLS

A. As shown on architectural plans some interior walls are steel stud, drywall type. These walls fit to horizontal members at the ceiling and floor consisting of 18 gauge sheet steel or 1/8" aluminum channels.

B. All low voltage wiring, except telephone cable and all 120 volt and higher circuits shall be installed in conduit. All steel stud openings to permit horizontal conduit runs shall be cut by this Contractor if not furnished as standard by the stud subcontractor.

C. All openings in these walls for all electrical devices will be provided by the wall subcontractor as directed by the Electrical Contractor. Provide box cover rings or other mounting devices where required.

D. All openings in the horizontal wall support members for conduit shall be provided by the Electrical Contractor. These openings shall be neatly drilled to the approximate size of the service entering.

E. The Electrical Contractor at his option may wire duplex receptacles shown in partitions by providing a junction box above the ceiling and dropping a single conduit run to each receptacle in lieu of running continuous conduit from receptacle to receptacle.

2.6 VIBRATION CONTROL

A. Tran formers shall be installed in a special manner to minimize transfer of vibration to adjacent structure or equipment.

1. Floor mounted oil immersed transformers and their associated substation components shall be placed on top of pads.

a. Pads shall be vibration isolation type of compressed glass fiber jacketed in neoprene or of multiple layers of ribbed-neoprene or waffle pattern neoprene of sufficient height and of proper stiffness to support the load without exceeding 1/4" static deflection.

b. The floor shall be grouted or shimmed to assure a level base for alignment. The pads shall be loaded in accordance with the loading rates recommended by the manufacturer.

2.7 FASTENERS AND SUPPORTS

A. All fastening and supports shall be of an approved type. The use of wire, nails, etc., for fastening exposed conduits is prohibited. Threaded inserts, expansion or toggle bolts shall be used for fastening to masonry walls.

B. Where possible conduits shall be grouped together and rigid racks of angle iron or structural channels shall be provided. Individual conduits shall be clipped to the ceiling or wall with malleable iron pipe straps wherever possible. Where individual conduits must be hung from the ceiling approved conduit supports and rod hangers must be used.

C. Provide rigid rods or bars for the support of lighting outlet boxes and grid boxes. No perforated metal straps may be used.

D. Provide supporting frame racks of angle iron, flat bar, and channel structural members wherever required for the support of wiring troughs, safety switches, motor starters and controls, and associated equipment. Supporting frame racks shall be rigidly bolted or welded together and adequately braced to provide a substantial structure. The welds and edges of all brackets shall be filed or ground smooth for painting. Racks, supports and frames shall be Kindorff, Steel City, Unistrut or approved equal.

E. Supporting frame racks shall be mounted on permanent walls wherever practicable. Where free standing supporting frame racks are required they shall be located in an area as approved by the Engineer in order to avoid interference with the normal operation and maintenance of building equipment. Supporting frame racks shall be of ample size to provide for a workmanlike arrangement of all equipment mounted thereon. All wood panels shall be 3/4" minimum thickness plywood; all panels shall be provided with two coats of fire-retardant enamel on both sides and edges. Plywood shall be Building Grade with Pine or Fir finish on both sides. Plywood inside of cabinets or panels may be 1/2" thick minimum.

2.8 INSTALLATION IN CABLE TRAYS

A. Low voltage cables including telephone, television, computer, intercom, etc., above ceilings may be installed without conduit in corridor only and shall be

neatly secured and laid into cable trays in an organized manner. Refer to Section 16100, Article 2.6 Low Voltage cable in walls or above room ceiling shall be in conduit.

B. Inside of cable trays provide nylon ties every 10 feet to bundle small wires. Leave space always on the same side where feasible for telephone cables and space for future cables of other systems.

C. When approaching cable trays from walls, conduits shall be run at right angles (not random), shall be neatly installed using conduit brackets.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes providing complete electric service systems including service, service entrance equipment, transformers, feeders, grounding, fusing and all connections and terminations as shown on drawings and specified. The service shall be 13.8KV, 3 phase, 4 wire grounded 60HZ and shall be connected to the University of Minnesota electrical distribution system at points indicated on the drawings.

C. Provide from the existing primary switching vault at Jackson Owre new fusing and primary feeder to the Jackson Owre transformer vault. Provide in the Jackson Owre vault primary switches, transformer and feeders.

D. In the Millard transformer vault modify the existing primary switchgear and feeders. Provide new primary switches, fuses, transformer and feeders.

1.2 PRIMARY AND SECONDARY VOLTAGE INTERRUPTIONS

A. Electric service interruptions involving University property or required by the contractor to perform his work shall be arranged for and approved by the University before interruption.

B. Requests for primary outages and energizations shall be submitted in writing to the University's Electrical Construction Superintendent for approval at the earliest possible date, and in no case later than two weeks prior to the outage and/or energization. Proposed outage information shall be submitted on a University of Minnesota "Request for Electric Outage" form (3 copies) available from the University's Electrical Construction Superintendent.

1. The Contractor shall verify with the University's Electrical Superintendent that all equipment and installation involved is completed, tested, and ready for service and that all related shop drawings and operational data have been submitted before submitting the outage and/or energization requests.

2. The Contractor shall have all material for each high voltage 15KV termination and shop drawing thereof (1 copy) prepared and available for inspection by the Electrical Superintendent of Construction on the job site at least 72 hours before terminating is scheduled to begin.

C. Scheduled outages will be scheduled at the convenience of the Owner. The Owner reserves the right to cancel or change the scheduling of any such outage up to 24 hours before its previously approved starting time. There shall be no additional cost to the Owner for scheduled outages, or for outages re-scheduled at the Owner's request where at least 24 hours notice has been given by the Owner to the Contractor.

D. The Contractor shall minimize all outages on the Owner's electrical system and shall employ sufficient workmen so that work will be carried on concurrently at more than one location, when necessary to accomplish this. A minimum of twelve (12) weeks before the first outage desired by the Contractor or upon request by the Owner, the Contractor shall submit a reproducible schedule (bar graph form) of his proposed sequence of all the primary electric feeder and substation outages and energizations; and temporary vault use involved in the project. This schedule shall show construction time in calendar days required for and between the various outages and energizations and shall include any weekend work. The schedule shall list the work to be completed during and between each outage. After the schedule has been reviewed by the Owner, the Contractor shall submit it to the Engineer (1 copy) and Owner (5 copies) with the dates he proposes to commence and complete the various schedule entries. As work progresses, the Contractor shall revise, update and resubmit the schedule as the Owner shall request.

E. At the time of energizing each 13,800 volt feeder, the Contractor shall be prepared to handle any situation that may arise from a cable or equipment failure or other faults on the system. If a failure or a fault, it is the Contractor's responsibility to check out and place the system in proper operation with the required personnel and equipment, as soon as possible.

F. Primary 13.8 KV electric feeders shall be made available for terminating during prime time hours. All work done on an overtime basis under this Contract shall be done with no additional expense to the University.

1.3 PRIMARY SYSTEM ENERGIZATION

A. Upon being installed all primary switches shall be locked open and tagged with hold cards in the name of a person to be designated by the University. Hold cards are available from the University's Electrical Construction Superintendent. In no case shall these cards be removed without that persons approval.

B. This Contractor shall submit to the University for approval the section to be energized along with the date and time this is to take place. This request shall be in writing and the Contractor shall receive written approval before proceeding to energize that section of the system. The first energized operation of each 13.8 KV switch installed under the contract shall be by the Contractor. All subsequent operations of these switches shall be by the University, except where specifically stated in writing beforehand between the University and the Contractor.

C. Refer to Section 16010 for further energization requirements.

PART II: PRODUCTS AND INSTALLATION

2.1 PHASE IDENTIFICATION

A. Phase Marking signs (A, B, C) shall be attached to the equipment which consists of laminated signs of 1/8" stock plastic with white lettering on black background, the letters shall be 1/2" tall. Inscription shall be symmetrical on the sign. These signs shall be attached to surface with self-tapping screws or an expoxy glue.

B. Phases shall not be marked in pull boxes or cable trays.

C. Phases shall be established and marked in an approved or specified manner at all transformer, switchgear, switch connections and terminations A, - B, - C, left - to - right, front - to - rear or top - to - bottom, when facing the front of the equipment.

2.2 PRIMARY CABLE AND SPLICING INSTALLATION

A. Primary service cables shall be 3 - 1/C, #2, 15KV, shielded ethylene propylene rubber, 7 strand, compact round, copper cables for use on grounded neutral system for each feeder. Provide with each set of feeder cables a #2AWG, THW, 600 volt neutral conductor. The primary cable and installation shall meet all current IPCEA standards. Cable shall be Okonite "Okoguard", Collyer EPR or approved equal. All cable shall have continuous surface printed identification showing manufacturer's name, insulation type, size and voltage rating. All cable shall be new and shall be delivered to the job site in coils or on reels; each coil and/or reel shall have a label for proper identification with manufacturer's name, trade name of wire, size and UL labels.

B. Cables for the new primary feeder from the Jackson Owre primary switching vault to the Jackson Owre transformer vault shall be installed in 4" rigid steel conduit. All other primary cable will be installed in cable tray as discribed in Paragraph 2.3-D.

C. Care shall be exercised while installing all cables so as not to injure the cable. The cable shall be handled in accordance with the cable manufacturer's recommendations and at no time shall be bent in a radius smaller than ten (10) times the overall cable diameter. Pulling lubricant shall be as approved by the cable manufacturer. All conduits shall be clean and free of all foreign objects before pulling in cables. The contractor shall have the cable manufacturer make the following record copy submittals to the University by at least one week before starting cable installation:

1. A data sheet or report (3 copies) stating the maximum A.C. and/or D.C. voltage that can be applied to the 15 kv cables during the Contractor's field installation acceptance and subsequent proof high voltage A.C. and/or D.C. tests.

2. Certified factory cable test reports (3 copies) for each cable production run showing that the cable equals or exceeds the requirements of the governing standard.

D. Cables in cable tray and locations not protected with conduit shall be arc proofed. The arc-proofing shall consist of bundling the conductors of each circuit, including the ground conductor, with "SCOTCH" brand electrical tape #27, applying a wrap of "IRVINGTON" brand arc-proofing tape #7700 after the cable has been installed. The tape shall be wound spirally with half-lap joints over the grouped cables. Finally, random wrap "SCOTCH" brand electrical tape #27 over the arc-proofing tape to prevent unraveling. Feeder identification shall be located over the fireproofing.

G. Each phase conductor shall be given a continuity and a direct-current high potential test after installation and after terminations have been made, but before connections have been made to busses or apparatus. The phase conductor shall be tested to 80% of manufacturer's test voltage. The voltage shall be

raised in 4000 volt increments with a 60 second charge time at each increment to reach 80% of cable manufacturer's test voltage or 32,000 volts whichever is less. The last increment of voltage shall be applied to the cable for 15 minutes. Leakage current will be read after each step. Discharge time to 20 KV shall be recorded on each phase and voltage shall be recorded after 1 minute of discharge. Three copies of the test report shall be furnished to the Engineer within 24 hours after completion of the tests.

2.3 PRIMARY SERVICE ENTRANCE EQUIPMENT

A. GENERAL

1. Provide and install dead front type, free standing, metal enclosed, fused and unfused, 15 KV load interrupter type switchgear of the number and type shown on the drawings and specified herein. The required number of free standing sections shall be bolted together to form one rigid unit with each section of the unit containing switch and protective devices of the arrangement, number, ratings, and type shown on the drawings and specified. Provide modifications to existing switchgear as shown on the drawings with equipment as specified herein.

B. Jackson Owre Primary Switch

1. Enclosure.

a. Construction shall be of the compact frame type using die-formed, welded and bolted members. The sides, top and rear shall be bolted on. All enclosing covers shall be fabricated from not less than 11 gauge steel. Ventilation openings shall be provided for each section. All back panels shall be removable.

b. All cubicle assemblies shall be sized to fit into the spaces provided as measured to scale from the drawings and shall be the responsbility of this Contractor. Maximum height of any cubicle shall not exceed 96" (not including top pot heads). Switchgear shall be finished with one coat of metal primer followed by a finish coat of ASA #61 light gray baked enamel or equivalent.

c. Each switch cubicle shall have a single, full length, flanged front door over switch. The flanged door shall close over a projecting door frame. The door shall be equipped with a rotary latch type handle and securing bolts. Provision shall be made for operating the switch mechanism by a non-removable handle without opening the full length door. When the switch is open, the switch operating handle shall be in a fully down position against the front of the enclosure. A rectangular, high impact type glass observation window shall be provided in the door over the switch so sized and located that the open and closed positions of the switch shall be readily discernible. Operating handles shall have provisions for multiple padlocking in both on and off positions. Complete unit shall comply with the latest applicable standards of ANSI, IEEE and NEMA.

2. Inner Construction and Electrical Design.

a. The two switchgear sections shall be group mounted and each section shall be completely isolated by a metal barrier of at least #12 gauge steel.

b. Each section shall be completely front accessible and externally operable.

c. Each section shall be designed, braced, and contain sufficient volume and venting top, bottom and front, to prevent distortion of the cubicle under normal operating conditions as well as under interruption of rated short circuit currents.

d. Each switch section shall be designed with bussing and lugs necessary to receive conduit and wire entery with stress cone connection from the incoming feeder and pot heads to receive cable in cable tray on the outgoing feeder.

e. Main buses shall be rated 600 ampere at 13.8 KV, 95 KV BIL and a maximum design voltage of 15.5 KV uninsulated tin or silver plated aluminum insulators for voltage class and BIL specified. All contact surfaces of the switchgear phase and ground bus shall be silver plated or equivalent. The primary switchgear shall be connected so that phasing is A-B-C, reading left to right facing the operational side of the equipment.

f. A 600 ampere ground bus shall be furnished firmly secured to each vertical section and shall extend the entire length of the switchgear. Lugs shall be provided for copper ground cable.

g. The integrated primary switchgear lineup and its component parts shall be designed and constructed to withstand and protect against the stresses associated with a fault condition of not less than 250 MVA, 3 phase, symmetrical at a nominal system voltage of 13.8KV. Also the integrated assembly and its component parts shall be designed and constructed for operation at or above the following ratings:

VOLTAGE

Nominal	13.8KV
Maximum Design	14.5KV
Basic Impulse Level	95 KV

CONTINUOUS LOAD CURRENT

Bus (Phase and ground)	600 amp

AIR LOAD INTERRUPTER SWITCH

Continuous Load Current	600 amp
Load Current Interrupting	600 amp
Momentary (10 cycle, Rms., Asym.)	20,000 amp
Fault Closing (Rms., Asym.)	20,000 amp

h. Switchgear shall be States Electric, Shallbetter, Kearney.

3. Interlocks

a. Doors to individual switches shall be Kirk key interlocked with switches to prevent opening of doors under load. Provide a key for each lock that is installed.

4. Switches

a. All switches shall be three gang non fused, load interrupting type as shown on plans with front drive handles. They shall be quick make, quick break type with direct acting spring charged mechanism for both close and open operation.

b. Switches shall be rated for 600 amperes, continuous and load interrupting, 13.8 KV nominal, 15.5 KV maximum and 95 BIL. Switches shall be rated for 250 MVA, 3 phase symmetrical and 20,000 asymmetrical amperes, momentary, and fault closing.

c. All switches shall have an operations counter visible from front of cubicle without opening of doors. Operations counter shall be set at zero before switch is turned over to the University. There shall be visible air clearance between live parts when switch is in the open position.

d. Switches shall be Kearney ISO Quensur.

C. Existing Primary Switchgear Modification and New Switchgear Addition Millard Transformer Vault.

1. As indicated on the drawings the Millard, Lyons primary switchgear is to be modified and extended to serve an additional trnsformer in the Millard transformer valut. Provide all labor, materials equipment as detailed specified and required to accomplish the work and match the existing equipment. The Contractor shall field verify exact details of all switchgear busing and equipment before beginning the work. It is the contractors responsibility to coordinate all work and schedule required outages and energizations with the University as specified in Articles 1.2 and 1.3 of this section. The existing switchgear is Continental Electric using Kearney iso-quensur switches.

2. The work shall include but not be limited to the following items.

a. Relocation of an existing fuse section.

b. Installation of a new bus transition section.

c. Addition of a new primary switch between existing switchgear and the relocated fuse sections. The new switch will connect to the existing fuse holder terminals of the relocated section and through those fuses serve an existing transformer.

d. Extension of the main busing through the new switch and the relocated fuse section to an additional new primary switch.

e. Installation of a new primary switch section and fuse section to the end of the existing relocated fuse section.

f. Extend ground buss through new sections.

3. Enclosure

a. New switchgear enclosures shall be manufactured to match existing enclosures in height and depth.

b. All cubicle assemblies shall be sized to fit into the spaces provided as measured to scale from the drawings and shall be the responsibility of this Contractor. Switchgear shall be finished with one coat of metal primer followed by a finish coat to match exisint of baked enamel or equivalent.

c. Each switch cubicle shall have a single, full length, flanged front door over switch of fuse assembly. The flanged door shall close over a projecting door frame. The door shall be equipped with a rotary latch type handle and securing bolts. Provision shall be made for operating the switch mechanism by a non-removable handle without opening the full length door. When the switch is open, the switch operating handle shall be in a fully down position against the front of the enclosure. Two rectangular, high impact type glass observation windows shall be provided in the door over the switch so sized and locatedthat the open and closed positions of the switch shall be readily discernible. Operating handles shall have provisions for multiple padlocking in both on and off positions. Complete unit shall comply with the latest applicable standards of ANSI, IEEE and NEMA.

4. Inner Construction and Electrical Design

a. All switchgear assemblies including those between existing sections of switchgear shall be group mounted with at least 12 gauge steel full length barriers between adjacent sections. The assembly shall be so designed that additional switch sections can be added on the new end.

b. Each section shall be designed, braced, and contain sufficient volume and venting top, bottom, front, and rear, to prevent distortion of the cubicle under normal operating conditons as well as under interruption of rated short circuit currents.

c. Main buses shall be rated 600 ampere at 13.8 KV, 95 KV BIL and a maximum design voltage of 15.5 KV uninsulated copper supported on NEMA rated porcelain insulators for voltage class and BIL specified. All contact surfaces of the switchgear phase and ground bus shall be silver plated or equivalent. The primary switchgear shall be connected so that phasing is A-B-C, reading left to right facing the operational side of the equipment.

d. A 600 ampere ground bus shall be furnished firmly secured to each vertical section and shall extend the entire length of the switchgear. The ground bus shall be bolted to the existing ground bus.

e. The new primary switchgear addition and its component parts shall be designed and constructed to withstand and protect against the stresses associated with a fault condition of not less than 250 MVA, 3 phase, symmetrical at a nominal system voltage of 13.8KV. Also the new switchgear sections and their component parts shall be designed and constructed for operation at or above the following ratings:

<u>VOLTAGE</u>

Nominal	13.8KV
Maximum Design	15.5KV
Basic Impulse Level	95 KV

CONTINUOUS LOAD CURRENT

Bus (Phase and ground)	600 amp

AIR LOAD INTERRUPTER SWITCH

Continuous Load Current	600 amp
Load Current Interrupting	600 amp
Momentary (10 cycle, Rms., Asym.)	20,000 amp
Fault Closing (Rms., Asym.)	20,000 amp

FUSE

Interrupting (60 cycle, Rms., Asym.)	20,000 amp

f. Each cubicle shall have provisions for extending main and ground buses in each direction to adjoining cubicle and for future additions of cubicles.

g. All switchgear shall be States Electric Manufacturing or Shallbetter Industries Inc.

5. Interlocks

a. Doors to individual switches shall be Kirk key interlocked with switches to prevent opening of doors under load. Provide a key for each lock that is installed.

6. Switches

a. All switches shall be three gang, fused, load interuupting type as shown on plans with front drive handles. They shall be quick make, quick break type with direct acting spring charged mechnism for both close and open operation. The fusing shall be in an adjacent section from the switch complete with busing between switch and fuse.

b. Switches shall be rated for 600 amperes, continuous and load interrupting, 13.8 KV nominal, 15.5 KV maximum and 95 BIL. Switches shall be rated for 250 MVA, 3 phase symmetrical and 20,000 asymmetrical amperes, momentary, and fault closing.

c. All switches shall have an operations counter visible from front of cubicle without opening of doors. Operations counter shall be set at zero before switch is turned over to the University. Visible air clearance between live parts when switch is open shall be at least 6".

d. Switches shall be Kearney iso quensur.

D. Fuses

1. In fusible units, fault current protection shall be provided by the fuse rating and type as shown on the drawings. 15 KV fuse assemblies shall

have individual insulating and isolating barriers between each cubicle outside 15 KV fuse assembly and side of the cubicle. Fuses shall allow easy removal or installation from the front. Fuses will operate during the first half cycle on maximum fault conditions with no expulsion of gases or foreign matter from the tube.

2. Fuses shall be sized as shown on the drawings. Fuses shall be S & C or approved equal, disconnecting 45° muffler type holder with SM-5 (slow speed) fuses.

E. Terminations

1. Pot head terminations shall be G & W or approved as equal, 1/C, 15 KV flange mounted capnut type with stuffing box cable entrance. Clamp type terminations shall be used on the capnuts. Each cable shall be stress cone terminated within the pot head with G & W 15 KV GN-UN stress cone kit or approved equal. Pot heads shall be filled with a hard resin-base, oil insoluable compound as recommended by the pot head manufacturer. Pot heads shall be used for termination of the feeder cables leaving the switchgear and entering the cable tray.

2. Stress cone terminations shall be provided for all terminal connections of 15 KV cable where feeders enter the switchgear through conduit entry or where cables connect to transformer lungs. Stress cones shall be built-up type, with all tapes shields, solder, flux, cement, insulating paint, tinned braid and side formed solder lugs for the particular size cable shown on the plans. On transformer bushings the tape shall extend to the first raised portion of the bushing. Stress cones shall be G & W as approved equal. All shield braid conductors shall be properly extended and grounded as required in other sections of these specifications.

3. Provide sealing bushings, conduit flanges or potheads at each opening where a cable or conduit enters or leaves a switchgear bay.

F. Labeling, Tests and Shop Drawings

1. All doors giving access to high voltage components or buses shall be provided with a "Danger-High Voltage" sign, porcelainized and not less than 9" x 12" in size, installed by the switchgear manufacturer. Provide and install a laminated plastic nameplate with 1-1/2" high white on black lettering provided to identify each bay. These nameplates shall be entitled with the specific building feeder shown on plans. Contractor shall verify with the University the exact inscriptions to be used.

2. A laminated plastic nameplate with 1/2" high white on black lettering shall be mounted on each transformer. Thecontractor shall contact the Owner for the inscription(s) to be used.

3. It shall be required that the integrated switchgear assembly and shop drawings be provided with an externally mounted nameplate indicating the manufacturer's drawing number and the following ratings: voltage (KV nominal, KV maximum design and BIL), short circuit interrupting (MVA), momentary (amperes), and fault closing (amperes). In addition, each bay shall bear a nameplate indicating continuous and interrupting ratings of the load interrupter in amperes.

4. The primary switchgear manufacturer shall submit (4 copies) the maximum allowable values for high voltage D-C field tests, contact resistance across the load interrupter switch, and contact resistance across the switch assembly. Submit two (2) copies to University with the switchgear shop drawings and the other two (2) copies in the "Maintenance and Operating Instructions" manual.

5. Shop drawings shall include detailed switchgear front, top, and end views; switchgear dimensions, an isometric or equivalent single line bussing diagram; sizes, material, platings and ratings of phase and ground busses; nameplate entries and schedules; component material lists; key interlocking diagram; fuse and fuse holder manufacturer, (type, and sizes); installation and mounting details and requirements; notes listing features and accessories as will be furnished to meet specification requirements; termination spaces, pullboxes and hardware; and all other important equipment information.

2.4 TRANSFORMERS

A. Each transformer shall be oil type liquid immersed, Class OA transformer designed for indoor use and shall have the following ratings;

1. 95KV BIL

2. 65°c temperature rise.

3. 60 cycle

4. 13,800 volt, 3 phase delta connected primary winding

5. 120/208 volt 3 phase grounded wye secondary winding. No T-T connections will be accepted.

6. Maximum 63db sound rating.

7. 5.75% impedance.

8. 2 - 2-1/2% taps above and 2 - 2-1/2% taps below rated high voltage.

B. Transformers shall be manufactured in accordance with all applicable ANSI and NEMA Standards, and come complete with the following accessories:

1. Liquid drain plug.

2. Liquid-level marking.

3. Filling plug in cover.

4. Provisions for rolling.

5. Tank grounding provisions.

6. Internally grounded neutral.

7. Relief device with diaphragm for venting the tank in event of internal fault of explosive violence.

8. Lifting lugs.

9. Handhole in cover (sealed with re-usable oil resistant gaskets).

10. Magnetic liquid-level gauge.

11. Dial-type thermometer.

12. Externally mounted diagrammatic nameplate (located below low voltage bushings).

13. Pressure-vacuum gauge.

14. Tank base shall be undercoated with asphaltum compound for rust protection (or equivalent).

15. Complete set of replacement gaskets for handhold cover.

16. Tap changer, externally operated.

17. Mounting plates and provisions for fan cooling.

C. The basic construction of the transformer shall include top mounted primary bushings ready for connection of primary cables with stress cone connections. The basic construction shall also include side mounted low voltage bushings sized for the number of secondary lug connections.

D. The transformer manufacturer should be required to supply the following characteristics with his shop drawings:

1. Efficiency at full load, 3/4 load, 1/2 load and 1/4 load.

2. No load loss.

3. Impedance.

4. Exciting current.

5. Per cent regulation at 80 percent P.F. and 85°C.

6. Per cent regulation at 100% P.F. and 85°C.

7. Full load losses at 85°C.

8. Dimensions

9. Weight

10. Gallons of liquid.

11. Voltage rating.

12. Basic impulse level of primary and secondary windings.

13. Nameplate location, layout and entries including normal impedance.

14. Tap arrangement and percentage of nominal voltages at different tap settings.

E. Transformer shall be General Electric, Westinghouse or Niagara.

F. Transformer Secondary Connections.

1. The secondary cable neutral connections to the transformer shall be color coded white or neutral gray.

2. Cable connections between the Busduct and the transformer shall be made using Burndy Hydent compression type connectors or approved equal. Adapter bus shall be used on the transformer if necessary to allow the use of Burndy compression type connectors.

3. No protective covering shall be used over the transformer secondary terminals.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Certain electrical loads determined to be critical and necessary to the operation of the building are connected to separately derived power systems on a standby basis. These loads include stair lighting, egress lighting, and exit lighting.

C. All wiring for emergency systems shall be installed in separate conduit systems and fed from emergency panelboards and power sources. The systems shall operate from the basic building power system under "normal" conditions and shall operate from battery inverter during "emergency". Transfer from one system to the other shall be automatic.

PART 2. PRODUCTS AND INSTALLATION

2.1 BATTERY INVERTER POWER SYSTEM

A. Battery inverter power unit shall be a self-contained power pack capable of supplying rated load emergency power at 120/240 volts 60 cycle A.C. for a period of 90 minutes.

B. The inverter shall be a Solid state SCR inverter with built-in fault protection. The inverter shall be capable of delivering a sine wave output 120/240 volt, 1 phase 60 cycles with a voltage regulation of 2% and frequency regulation of 1% from 0 to full load and .8 to unity power factors. The emergency battery section shall be Nickel Cadmium batteries to supply the load as indicated below. Automatic transfer shall occur in 50 mille seconds. Inverter shall have accessories as follows:

1. Automatic shutoff when voltage reaches 87% on battery power.
2. Test switch
3. DC Ammeter and volt meter
4. Battery charger and pilot light.
5. AC ammeter and volt meter
6. Inverter power on light
7. 5 second delay to retransfer.

C. Operation: With normal power applied, the voltage to the power pack shall feed both the output load and the battery charger. Upon loss of normal power, the inverter shall automatically disengage itself from all input lines and switch to the inverter. Upon return of normal power after the specified delay the load will be transferred to normal power.

D. Enclosure: The inverters shall be enclosed in a 12 gauge steel cabinet finished in a baked on enamel with a removable hinged and key latched front cover. Inverters above 1.5KVA shall be free standing cabinets no more than two sized 29" wide 23" deep 43" high. Inverters 15KVA and below shall be a single wall cabinet 36" wide 10-1/2" deep by 48" high.

E. Inverters shall be sized as follows:

Inverter #1	1.5 KVA
Inverter #2	5.5 KVA
Inverter #3	5 KVA

F. Inverters shall be Standby systems or approved equal.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instruction to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. A complete grounding service system shall be provided as described herein and as shown on the plans. Service grounds are required for each transformer and each main service switchboard. All grounding shall conform to the requirements of Article 250 of the NEC.

PART 2. PRODUCTS AND INSTALLATION

2.1 GROUND BUS

A. A 1/4" x 2" bare copper bar stock ground bus shall be attached to the walls of each transformer vault as an extension of the existing ground bus with copper fittings and brass screws or bolts. Solderless connectors shall be used for the grounding system.

B. The uninsulated 1/4" x 2" copper ground bus in each transformer vault shall be bonded to transformer and primary switch housings and shall be suitably interconnected to provide a continuous bus. Ground bus mounting supports shall be provided to match existing.

2.2 MAIN SECONDARY SERVICE GROUNDING

A. Provide a system grounding bus the entire length of the secondary main switchboard for connection of the grounding electrode conductor, equipment grounding conducturs, and main bonding jumper. Equipment grounding bus in switchboards is sized in Section 16300.

B. Provide a grounding electrode conductor as shown on the plans from the switchboard equipment grounding conductor to common grounding bus in the transformer vault. Also provide a grounding conductor from this common grounding bus to the building water service. Condutors are sized on the plans. All ground conductors shall be cadweld connected to the common grounding bus.

2.3 TESTS

A. Ground resistance tests shall be made with a null voltage tester and three copies of the test report shall be forwarded to the Engineer for approval.

B. Ground resistance shall not exceed 25 ohms.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes all secondary electrical distribution equipment and accessories herein specified and shown on plans to provide a complete connected and fully operating system.

C. All equipment and wiring shall be designed and connected for operating on the 120/208 volt, 3 phase, 4 wire wye connected, grounded neutral secondary system.

PART 2: PRODUCTS AND INSTALLATION

2.1 BUS DUCT

A. Provide bus ducts as sized and as shown on plans. Low voltage busway systems shall consist of totally enclosed lengths and fittings as necessary, using 10' standard lengths wherever possible. All busway shall be listed by Underwriters Laboratories and so labeled. Maximum voltage drop shall be 2.5 volts per 100 feet for the system on a rated load basis.

B. Main electric service busduct shall be feeder type 3 phase, 4 wire full neutral with a 50% internal ground. Bus shall be complete with elbows, hangers through wall flanges, switchboard connections and cable tap boxes as required.

C. Mechanical tower busduct risers shall be plugin type 3 phase, 3 wire plus a 50% internal ground. The busduct shall have polarized plugin openings a maximum of 24" on center. Plugin busduct shall come complete with outlets, taps, elbows, hangers, fittings, cable tap boxes, and spring loaded floor supports as required. Plug outlets shall be of the dead front type with positive catch arranged so that in opening or closing the cover, the installer will not touch live parts. Outlets shall be arranged so plugs can be inserted or removed only when plug is in off position.

D. Busduct serving MDC-SET shall be feeder type 3 phase, 4 wire with a 50% neutral and a 50% internal ground.

E. All busway shall be of the totally enclosed compact design type consisting of formed sheet steel housing with external mounting flanges. Bus bars shall be tin or silver plated aluminum for the full length.

F. All busway shall be low impedance rated 600 volt suitable for use on a 120/208 volt system. Feeder buss shall withstand 200,000 amps symetrical short circuit fault current and plugin busduct shall withstand 100,000 amps.

G. . Joints shall be of high compression bolt type which clamps all bus bars at one time.

H. All cable connections to the bus duct shall be with Burndy "Hydent" compression type connections, or approved equal.

I. Bus duct shall be suppolted at every 5' interval with 1/4" threaded rod hangers in horizontal runs and at each floor with floor flange bolted supports in vertical runs. Provide a fire barrier where bus duct penetrates floor slabs and fire rated walls.

J. Bus duct shall be finished in medium gray enamel over a rust inhibitor and hardware shall be cadmium or zinc plated.

K. Busduct shall be Westinghouse, General Electric, Square D, or ITE.

2.2 BUSWAY PLUGS

A. All plugs shall consist of sheet steel housings finished to match bus duct. Provide necessary clamps for quick attachment of the plug to the busway. Provide solderless mechanical terminals for all wire connections and include ground terminal. All current carrying parts shall be silver plated.

B. Plug bases shall have stab shields and positive pressure reinforced stabs and shall be suitable for either copper or aluminum bus bar type busway. Provide padlocking type cover catches and means for padlocking in off position.

C. Plugs shall be 240 volt, 3 pole interrupter switch type, quick-make, quick-break, interlocked cover type with releasable interlock. Switch unit shall be capable of interrupting 12 times its continuous current rating. Fuse clips shall be positive pressure type with rejection-type clips for current limiting fuses. Switch shall have horsepower ratings for standard or time delay fusing in accordance with NEMA Standards. Switch shall be cord or rod operable from the floor.

D. Plugs shall be of the same manufacture as the bus duct and shall be sized as shown on the plans and required by Code.

2.3 PANELBOARDS

A. Panelboards shall be the dead front type with mains arranged as shown on the panelboard schedule for 120/208 volt, 3 phase, 4 wire, wye connection. Enclosures shall be code guage steel complete with door-in-door type trim. The inner door shall be the locking type and the outer door shall be secured by trim type screws on the side opposite the hinge. Trim shall be held in place by cadplated pan head bolts. Circuits shall be listed on clear plastic covered, typewritten card indexes attached to the inner side of the inner doors. Each protective device shall be designated by a number at the device. Final room numbers as provided by the Owner shall be used for all circuit indexes.

B. Panel bus bars shall be solid copper and shall be aligned and rigidly supported on back pan by insulators connected to a removable mounting panel. All lugs shall be copper-bronze for bolted lug connection. Each panelboard shall contain individual insulated neutral bus of same ampacity as the main bus.

Where scheduled panelboards shall contain a separate ground bus which shall consist of a minimum of 16 (30 circuit panelboards) and 24 (42 circuit panelboards) 16 solderless connector lugs for #14 thru #4 conductors and a single

lug for up to #1/0. All circuit breakers shall be attached to bus by means of machine screw connections, and shall be removable from the front without de-energizing the panel. Rough-in boxes shall have a minimum width of 20 inches and minimum depth of 4-1/2 inches. Full length vertical buses and cross breaker connection including all hardware shall be provided and installed in all future circuit breaker spares and spaces. All panelboards shall be keyed with identical Corbin Lock #157-67, using WEM-1 key.

C. Each panelboard shall be identified with a black-white-black laminated plastic plate attached to the inner trim. Letters and numbers shall be cut through the black and into the white of the plate. Inscription shall be symmetrical about the centerline of the plates, and plates shall be attached with self-tapping screws. Identification shall correspond to designations used in the specifications and on the plans.

D. The panelboards shall be dead front type with front removable bolt-in circuit breakers with thermal magnetic trips of sizes shown on schedule on plans. Contractor shall provide a suitable circuit breaker sized for the load for each branch circuit shown on the plans if inadvertently not identified or noted in the panelboard schedule. Panelboards shall be designed for 120/208 volt, 3 phase, 4 wire, wye connected, solid neutral.

E. Circuits shall be connected as shown on the plans for a balanced three phase load. Circuit breaker number for all 3 pole and 2 pole breakers shall have numbers sequenced as follows: 3 pole breaker shall be labeled 1, 2, 3,. Typewritten index shall have corresponding numbers in sequence to allow index labeling of a 3 pole circuit without spaces between these numbers.

F. All circuit protective devices shall be molded case circuit breakers with thermal magnetic trips for 120/208 volt 277/480 volt as indicated. All two and three pole circuit breakers shall have common trips.

1. Circuit breakers shall conform to the following minimum characteristics based upon General Electric nomenclature:

a. Branch Circuit Panelboards, 120/208 volt.

Amps.	Volts	Frame	Sym. I.C. - RMS - 240V
15-100	240	THQB	10,000

G. New panelboards in existing enclosures shall conform to specifications applying to new panels. New trims shall be constructed of the door in door construction to adapt the existing enclosure to the new panel. New dead fronts shall be constructed adapting the new panel to the trim. All new trims shall be bolted to the enclosure with panhead cad plated bolts.

H. New circuit breakers installed in existing panels shall be of the same manufacture of the existing panel and shall be compatable with existing circuit breakers and spaces. The new circuit breakers shall have interrupting capacity equal to or greater than the existing circuit breakers.

I. Fusible switch panel boards located in the mechanical towers shall be 240 volt, 3 phase, 3 wire with a ground bus. Panel size shall be capable of housing the branch switches listed in the panel board schedule and shall have a current rating no less than listed in the schedule.

J. All panelboard rough in boxes shall be constructed of code gauge galvanized steel. All trim shall be code gauge steel chemically cleaned and treated to provide a bond between paint and metal surfaces. The panel trim shall be finished in ASA-61 light gray.

K. Panelboards shall be Square D, Westinghouse, General Electric, I.T.E., or approved equal. Manufacturer's shop drawings shall include busing details, mounting methods and lug arrangements.

2.4 FUSES

A. Provide and install secondary fuses in all fusible switches, motor control centers, switchboards sized as shown on the plans. Provide spare fuses as specified in other sections for the specific equipment. High voltage fuses are specified in Section 16200.

B. Fuses shall be 250 volt class as required for the particular equipment. Fuses shall be Bussmann or approved equal. All current limiting fuses shall be Class R rejection type.

1. Fuses in the main switch board disconnect switches shall be of the silver sand current limiting type, Buss Hi-Cap, type KRP-C, except as otherwise indicated or shown on the plans.

2. Fuses protecting feeders to 120/208 volt panelboards shall be dual element silver sand type, Buss Fusetron FRN (250V), below 150 amperes and Buss Low Peak LPN (250V) from 150 amperes and above.

3. Fuses protecting feeders to power panels, motor control centers and bus duct risers shall be of the current limiting, dual-element type, Buss Low-Peak Fuses LPN (250V) 600 amperes and below and Buss Hi-Cap KRP-C above 600 amperes.

4. All motors, whether served from individual disconnects or from a motor control center, shall be protected by Buss Dual Element Fusetron Fuses - FRN (250V) to 150 amperes and Buss Low Peak LPN (250V) from 150 amperes and above based on nameplate amperes and service factor.

5. All requests for substitutions shall be submitted in advance of bid to the engineer in writing and shall include a coordination table showing that the substitution will provide a coordinated system of overcurrent protection and that the short circuit current let-thru shall not exceed the interrupting capability of the equipment or devices being protected.

6. Contractor shall furnish to the University one set of three of each size and type of all fuses installed in the switchboards for each transformer vault. For each main disconnect furnish 3 spare fuses. Furnish one set of three each, of each size and type of fuses used in each motor control center and each power panel. The Contractor shall indicate by letter to the University with copy to Engineer the list and location of all spare fuses.

2.5 SAFETY SWITCHES

A. Provide safety switches where required and as shown, sized according to the load served or the feeder or branch wire capacity, for motors and equipment. Switches shall be fused or unfused as indicated and as required.

B. Safety switches shall be heavy duty type, 250 volt, 2 pole or 3 pole as required. Switches shall be visible blade type with quick-make, quick-break operating mechanism, full cover control circuit disconnect and means for padlocking.

C. Safety switches shall be NEMA I or NEMA 3R raintight for wet or outdoor locations.

D. Safety switches shall be Westinghouse, General Electric, Allen Bradley, Square D or I.T.E.

2.6 SECONDARY SWITCHBOARDS

A. Jackson Owre secondary switchboard shall be a front accessible board designed for 120/208 volt, 3 phase, 4 wire with current ratings and devices as indicated on the drawings. The switchboard shall be a special construction no greater in depth than 30" and a total length of the combined sections no greater than indicated on the drawings. The switchboard shall be manufactured by States Electric Mfg. or Shallbetter Industries Inc.

B. Millard main secondary switchboard shall be a rear accessible switchboard designed for 120/208 volts, 3 phase, 4 wire, with current ratings and devices as indicated on the drawings. The board may be the depth necessary to accommodate the devices specified. The switchboard shall be manufactured by States Electric Mfg, Shallbetter Industries Inc., Westinghouse, General Electric, ITE or Square D.

C. Main distribution center switchboards shall be front accessible switchboards designed for 120/208 volts with current ratings devices and main lugs as indicated on the drawings. The board shall be no greater in depth than 20". Main distribution switchboards shall be manufactured by States Electric Mfg., Shallbetter, Westinghouse, General Electric, ITE or Square D.

D. All switchboards shall have the following characteristics.

1. All branch protective devices shall be group-mounted with necessary bus connection straps. Where space for a future device is called for, all necessary buses except device connecting straps shall be furnished. Full length vertical buses shall be provided in every section. All future bus extensions shall be drilled.

2. Switchboards shall be completely self-supporting structures of the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw-on code gauge steel plates with ventilation louvers on rear and side. Switchboards shall include all protective devices and equipment as listed on drawings.

3. Bus terminals shall be tin or silver plated aluminum sized on the basis of not more than 800 ampere per square inch current density. The bus bars shall be mounted on supports of high impact non-tracking insulating material and shall be braced to withstand mechanical forces exerted during short circuit conditions of 50,000 amps RMS symetrical based on NEMA Standards. A-B-C type bus arrangement left to right top-to-bottom and front-to-rear shall be used throughout to assure convenient and safe testing and maintenance.

4. Sections shall be designed for 120/208 volts, 3 phase, 60Hz with full capacity neutral unless otherwise indicated on the plans. Main bus ratings shall be as shown on the plans. Provide 50% ground bus in all switchboards.

5. All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film. The switchboard exterior shall be finished in ASA-#61 light gray. All hardware used on conductors shall have a high tensile strength and have a suitable protective finish.

6. Switchboards shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position.

E. All main and distribution section individual switching devices shall be fusible, 3 pole, quick make, quick break, 250 volt hinged door type sized as shown on plans.

1. Switches shall bolt directly to the buses and shall be front accessible, heavy duty type.

2. Switches shall be individually enclosed in a steel compartment so that no live parts are accessible to the operator whether the door is open or closed.

3. Switches shall have solderless lug connectors with line shields. Contacts shall be silver alloy with spring reinforced fuse clips. Provide Class R fuse rejection clips for all current limiting fuses.

4. The door shall be interlocked with the switch mechanism so that with the switch energized the door cannot be opened and vice versa. Door latch shall be equipped with means for double padlocking.

5. Switches shall be rated for a maximum short circuit current of 50,000 amps without fusing.

6. All switches shall be equipped with fuses as specified in Section 16300.

7. Shop drawings shall be furnished providing the following information: complete rating, short-circuit withstandability of bus and of lowest rated device, overall outline dimensions including space available for conduits, circuit schedule showing circuit number, device description, device frame ampere rating, trip or fuse clip ampere rating, feeder cicuit indentifcation, conductor ratings and one-line diagram with each circuit device numbered.

F. Metering:

1. Kilo watt hour voltage and current metering shall be lprovided for each main switch in each distribution section as indicated on the plans.

a. Current transformers shall be provided for three phases of each switch, rated 600 volts and current ratio of 5 to the closest rating of the main buss. Current transformers shall be window type, General Electric Type JAH-0 or Westinghouse equivalent.

b. Kilo watt hour meters shall be drawout type. Meter shall be for use on a 120/208 volt, three phase 60 hz system with grounded neutral circuit. Dial-type maximum demand register resetting type with 15 minute block interval

type shall be provided. Multiplier ratios shall be shown on front of each watt hour meter. Meter shall be General Electric Type DSM-65 or Westinghouse equivalent.

c. For each set of current transformers provide rotary 4 position selector switch (one for the Ammeter and one for the Volt Meter with pistol grip rated 20 amperes and located in metering panel. Positions are phase A, phase B, phase C andoff. Selector switch shall be Westinghouse Type W-2, or General Electric equivalent.

d. For each of the ammeter selectro switches above and mounted in the metering panel provide switchboard mounting shunt type ammeter, rated 0 to C.T. ampere rating. Meter shall be General Electric, Westinghouse, or approved equal.

e. For each of the volt meter selector switches provide a switch board mounted, 150 volt - volt meter. Volt meter connectors shall be fused. Volt meters shall be General Electric, Westinghouse or approved equal.

f. Provide permanent marking and identification for each rotary selector to identify the particular switchboard and phase being monitored.

2. Kilowatt-hour meter information shall be submitted in writing to the Electric Construction Superintendent for approval at the earliest possible date, and no case later than two weeks prior to energizing. This information shall be submitted on and as required on a University of Minnesot "Electric Wall-hour Meter Installation or Removal" form (3 copies) available from Electrical Construction Superintendent.

2.7 CIRCUIT BREAKERS

A. Provide circuit breakers where shown on the plans, sized according to the load served or the feeder or branch wire capacity for motors and equipment. Circuit breakers shall be surface or flush mounted in NEMA I enclosures as indicated.

B. Circuit breakers shall be molded case with thermal magnetic trips for 120/208 volt as indicated or required.

C. Circuit breakers shall conform to the following minimum characteristics based upon General Electric nomenclature unless otherwise noted:

a) 120/208 volt application:

Amps.	Volts	Frame	Sym. I.C. - RMS - 240V
15-100	240	THQB	10,000
125-225	600	TFJ/TFK	25,000

D. Circuit breakers shall be General Electric, Square D, Westinghouse, I.T.E., or approved equal.

2.8 DISTRIBUTION SWITCH UNIT BC SUBSTATION #4C

A. Distribution switch to be installed in existing substation #4C distribution section shall be bolted pressure, load break, switch with shunt trip for single phase and ground fault protection.

1. Switches shall be 3 pole, 480 volt with ampere rating as shown on plans.

2. Provide manual switch operator that does not rotate when switch operates magnetically. Fuse cover door shall be mechanically interlocked to prevent opening when switch is on "ON" position.

3. Switch shall have silver tungsten arc tips, insulating arc chutes, ebony asbestos base and non-ferrous and non-magnetic bolting mechanism.

4. Electric operator shall be stored energy shunt trip type.

5. The switch shall be equipped with current limiting, high interrupting capacity Class L Bussmann KRFC fuse.

6. Switches shall bolt directly to the switchboard buses and shall be front accessible.

7. Switches shall have solderless lug connectors with line shields. Contacts shall be silver alloy with spring reinforced fuse clips. Provide Class R fuse rejection clips for current limiting fuses.

8. The door shall be interlocked with the switch mechanism so that with the switch energized the door cannot be opened and vice versa.

9. Switches shall be rated for a maximum short circuit rating of 200,000 amperes with current limiting fuses and 100,000 amperes rms symmetrical with current limiting time delay fuse.

10. Switch shall be Pringle to match the existing installation.

B. Provide and install all accessory equipment to make a complete installation.

1. Provide and install General Electric JAH-0 2000:5 current transformers 1/phase.

2. Ammeter switch General Electric #16SB1CA19

3. Ammeter General Electric #50-171141LS-VE1LMH with 0 to 2000 amp scale.

4. Test jack General Electric #12XLA12AL.

5. Any cabinet panels or hardware to make a complete installation.

6. Ground fault detector and current transformer. General Electric to match existing.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes the wiring devices, relays, and miscellaneous electrical equipment permanently installed to operate and control with 120/208 volt electrical system loads.

PART 2: PRODUCTS AND INSTALLATION

2.1 WIRING DEVICES AND PLATES

A. Provide wiring devices as shown on the plans and identified by the appropriate symbols. Hubbell numbers are used to identify the particular type of devices required except where otherwise noted. Pass & Seymour, Leviton, Sierra, General Electric or approved equal switches and receptacles shall be provided. All switches and receptacles shall be U.L. listed and meet NEMA WD-1-1971 performance tests for specification grade devices.

B. All receptacles shall be grounding type. Connect green covered ground conductor to ground terminal at each receptacle.

C. Switch, receptacle and all other plates (including telephone, television, clock, etc., and for all empty outlet boxes) shall be satin stainless steel, Sierra 302 or approved equal with Type 302, stainless steel screws. In dark rooms plates shall be Sierra #400 flat black. Weatherproof plates for outdoor and wet locations shall be duplex Sierra #WPD-8.

D. All receptacle bodies and switch toggles shall be brown.

E. All receptacle plates other than the standard duplex 125 volt 20 ampere type shall be engraved with black filled letters indicating volts, amperes, and phase; for example, "208V-20A-1PH".

F. All receptacle and switch plates for the emergency electrical system shall be engraved "EMERGENCY" with red filled letters.

G. Receptacles:

Poles/ Wires	Volts	Amps	Configuration	Cat. No.	Use	Remarks
2P-3W	250	20A	6-20R	5461	Equipment	Single
2P-3W	125	20A	5-20R	5362	General & Surface Raceway	Duplex-

Poles/ Wires	Volts	Amps	NEMA Configuration	Hubbell Cat. No.	Use	Remarks
2P-3W	125	20A	L5-20R	9308	Equipment	Single Twist Lock
2P-3W	125	30A	5-30R	9308	Equipment	Single
2P-3W	250	30A	6-30R	9330	Equipment	Single
3P-4W	125/250	20A	14-20R	8410	Equipment	Single
3P-4W	250-3PH	20A	15-20R	8420	Equipment	Single
3P-4W	125/250	30A	14-30R	9430	Equipment	Single
3P-4W	250-3PH	60A	15-60R	8460	Welder & Equipment	Single
3P-4W	125/250	30A	L14-30R	3430	Equipment	Single Twist
4P-5W	120/208	30A	L21-30R	45105	Equipment	Single
4P-4W	120/208	60A	18-60R L6-20R 14-50R L-2120	7301	Equipment	Single

H. Special Receptacles:

1. Ground fault interrupter (GFI) receptacles shall be 15 ampere duplex, 120 volt, Pass & Seymour #1591 or 1591-F feed through receptacle as required. Install receptacle complete with Sierra #WP-8 stainless steel plates with weatherproof covers where indicated. Plates shall match specified device plates for general use.

2. Ceiling mounted receptacles in dark rooms, etc., shall be 2P-3W, 120 volt, 15 ampere, Appleton #11450G with outlet box hanger eyelets for light fixture support.

3. Refer to Section 16600 Article 2.2 Isolated Power Systems for 120 volt hospital grounding receptacles. All receptacles in operatories or surgery rooms shall be of this type.

I. Ceiling Service Reel Receptacles:

1. Ceiling service reel receptacles indicated on the equipment schedule and plans as M471 shall be provided by the electrical contractor. Contractor shall provide all necessary mounting hardware, bracket etc to the building structure for a secure installation. Units shall be as follows:

a. M471 - Recessed, 2 reel service, with 2-120 volt, 1 phase NEMA L5-20R connector bodywith seal cover and 20'-3#16 cable per reel. Unit shall be Chemetron Medical Products #669202-64.

b. M471A - Same as M471 except single reel service. Chemetron #669201-64.

c. M471B - Same as M471 except with 1 - 120 volt, 1 phase NEMA L5-20R connector body with seal cover and 1 - 208 volt, 1 phase NEMA LG-20R connector body with seal cover. Chemetron #669202-120/208-64.

d. M471C - Same as M471 except four reel service with explosion proof connector body. Chemetron #669204-64.

J. Switches:

Poles	Amps.	Volts.	Cat. No.	Remarks
Single 20	20 amp.	120 - A.C.	1221	Toggle - Quiet
Double	20 amp.	120 - A.C.	1222	Toggle - Quiet
Three Way	20 amp.	120 - A.C.	1223	Toggle - Quiet
Four Way	20 amp.	120 - A.C.	1224	Toggle - Quiet
SPDT	20 amp.	120 - A.C.	1557	Momentary Contact
Single	20 amp.	120 - A.C.	1750/1781	Weatherproof
SPDT	20 amp.	120 - A.C.	1385	Maintained Contact
Single	20 amp.	120 - A.C.		Toggle - Quiet Grounding Type

K. Pilot Lights:

1. Pilot lights for single pole switches shall be lighted switch handle type, 125 volt, 20 ampere with red light Sierra #5027R.

2. Pilot lights for 3 way switches shall be combination toggle switch with lamp holder and red jewel. Lampholder shall be extra long life Sierra #2156 (120 volt) and jewel shall be rectangular acrylic red plastic Sierra #406R.

3. Individual remote or signal pilots shall be Sierra #2156 (120 volt) extra long life lampholder and lamp with round red acrylic plastic jewel Sierra #405R.

2.2 TIME SWITCHES

A. For animal lighting and other loads as shown provide automatic Time Switch with 24 hour dial powered by a self-starting synchronous motor.

B. Time Switch contacts sahll be capable of switching 40 amperes per pole continuously at 120 volt and shall be DPST as required. Provide clock motor voltage ratings as required.

C. Enclosure shall be NEMA flush type. Enclosure shall be finished in baked gray epoxy enamel, with combination 1/2", 3/4" knockouts on bottom, both sides, top and back. Provide with lock and key.

D. Time Switches shall be Tork Model 277-1962-FLI or Paragon or approved equal.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes furnishing and installation of all fixtures complete with lamps and ballasts where required as shown on the plans and on the fixture schedule. Capital letters adjacent to outlets indicate the fixture type and small letters indicate the manner of switching. Where continuous row fixtures are specified it shall be understood that the capital letter next to the outlet identifies all fixtures in the row and all rows are made up of either four or eight foot long fixtures in combination to complete the row. Catalog numbers listed below are for basic four foot long fixtures. Contractor shall be responsible for exact quantities of fixtures required in any row. The channels may be eight feet long, but all plastics, hinged doors and louver sections shall not exceed four feet long. Unless otherwise noted a suitable and typical fixture shall be furnished and installed at each fixture outlet (or as otherwise indicated on the drawings) though inadvertently not identified on the plans or not listed on the fixture schedule.

PART 2: PRODUCTS AND INSTALLATION

2.1 INSTALLATION

A. Fixtures shall be hung from the suspended ceiling grid, tees, etc., except industrial and strip fluorescent fixtures shall be mounted from structure. Provide all clips, sheet metal screws, anchors, etc. for a secure installation.

B. Electrical Contractor shall coordinate the fixture installation for all ceiling types and shall check ceiling finishes, clearances, structure suspension system etc., before placing fixture orders to insure correct application. Refer to architectural reflected ceiling plans and details for details of ceiling systems and exact locations of fixtures.

1. Coordinate the installation, placement and cutting of suspended ceiling components with the ceiling system manufacturer and/or installer.

2. Provide plaster frames for recessed fixtures where applicable.

3. Provide all additional structural members where required for fixture support when not furnished with the ceiling system or by the ceiling installer.

4. Surface mounted fluorescent fixtures shall be mounted from Steel City #6029 or edgewise 1-1/2" Lather's channels provided by the Electrical Contractor.

Provide 3/16" studs and locknuts for every four feet and at the ends of all fixture rows. Channels shall rest on the ceiling support system and shall be securely fastened into place.

C. All fixtures shall be hung straight and true and as design of fixture and accepted practice dictate. All fixtures shall be cleaned immediately before the final inspection. All fixtures shall be newly lamped and in perfect operating condition at the completion of the job. All necessary devices and auxiliary fittings required for a complete and workmanlike installation shall be furnished and installed by this Contractor.

2.2 LAMPS

A. All incandescent lamps shall be inside frosted, rated at 125 volts unless otherwise noted in the fixture listing. Lamps shall be standard 1000 hour life type except R and PAR Type 2000 hours.

B. Mercury vapor lamps shall be deluxe white or beauty lite inside frosted rated for 24,000 hours life except 100 watt lamps shall be 16,000 hours rated.

C. Tungsten halogen lamps shall be rated for 2000 hours and 120 volts.

D. Rapid start fluorescent lamps shall be T-12 white, 3200 (min.) initial lumens and 20,000 hours lamp life.

E. Lamps shall be Sylvania, Westinghouse, General Electric or approved equal.

2.3 BALLASTS

A. Fluorescent ballasts shall be for 120 volts premium high power factor and CBM-ETL approved. Provide multiple lamp ballasts wherever possible. Ballasts shall have internal thermal automatic resetting protection and inert solid fill and capacitor protection to meet Class "P" U.L. rating. Sound ratings shall be "A" for rapid start. Fluorescent ballasts shall be "Premium" Jefferson, General Electric, Westinghouse or Universal equivalent to Advance Mark II Kool Koil.

B. Mercury vapor ballasts shall be 120 volt constant wattage high power factor type Jefferson, Sola, General Electric or approved equal. Mercury vapor ballasts and light fixtures for interior use shall be designed suitable for application with room ambient noise level of 30NC without additive noise contribution to exceed the noise curve criteria. Fixture manufacturer shall be responsible for the proper ballast application and mounting to insure acceptable operation for the application defined.

C. The fluorescent ballast manufacturer shall provide a two-year guarantee against defects in workmanship or material which includes an in-warranty service program providing for the payment of authorized labor charges incurred in the replacement of defective in-warranty ballasts.

2.4 LIGHT FIXTURES

A. All fixtures shall be U.L. approved and manufactured, installed and wired in accordance with the latest rulings of the National Board of Fire Underwriters and national, state and local codes and ordinances.

B. Incandescent fixtures shall be wired with asbestos-covered, heat resistant wire as required. Fluorescent fixtures shall be internally wired and with not less than No. 16 stranded wire with thermoplastic, asbestos or silicone insulation as listed in Table 402-3 of the National Electrical Code.

C. All fluorescent fixtures shall be designed, tested and guaranteed by the manufacturer for ballast coil temperature not to exceed the U. L. limit of 105°C and ballast case temperature not to exceed 90°C for the particular application.

D. The major suspended ceiling is an inverted T lay-in system. All light fixture details and mounting methods shall be designed to accommodate the ceiling system.

2.5 FIXTURE SCHEDULE

Type	Description	Lamp
A	A 2' x 4' recessed 4 lamp fluorescent fixture for installation in an inverted T lay-in ceiling with a regressed aluminum framed lens. Chassis, wiring channel and end plate shall be constructed of not less than 20 gauge steel chemically treated then finished in high temperature baked white enamel with reflectivity of 85%. Fixture shall be wired for 2 lamp switching. The fixture shall be air handling type with both return and heat extract capabilities and shall be capable of at least 230 CFM of air flow with a negative static pressure of .05 inches of water. Adjustable vanes shall be provided in both return and extract channels. Lens shall be 100% virgin acrylic pattern K-19. Air handling slots will be painted white Columbia #2446G-84-244.	f-F40
A-1	Same as Type 'A' except 3 lamp. Columbia #2446G-84 243.	3-F40
A-2	Same as Type 'A' except 2 lamp. Columbia #2446 G-84-242.	2-F40
A-3	Same as Type 'A' except the fixture shall be a flange type for plaster ceiling. Columbia #2446F-84-244.	4-F40
A-4	Same as Type 'A-3' except 2 lamp. Columbia #2446F-84-243.	2-F40
A-5	Same as Type 'A-3 except 2 lamp. Columbia #2446F-84-242.	2-F40
A-6	2' x 4' - 2 lamp lay-in fluorescent fixture relocated from the same area.	2-F40
A-7	2' x 4' - 3 lamp lay-in fluorescent fixture relocated from the same area.	3-F40

Type	Description	Lamp
A-8	Same as Type 'A' except 2 lamp surface, Columbia #6115-52-242	2-F40
A-9	Same as Type 'A-3' but 1' x 4' - 2 lamp for plaster ceiling. Columbia #2446-P-84-142	2-F40
A-10	Same as Type 'A9' but non-air handling, Columbia #2146-P-84-142	2-F40
A-11	Same as Type 'A8' but for accoustical tile ceiling. Columbia #2446-G-84-142	2-F40
B	A 2' x 2' recessed fluorescent fixture with specular anodized aluminum parabolic baffled doors for installation in a linear aluminum strip ceiling. See detail 1/a39. The fixture shall be air handling heat extract with black air handling reveal. The fixture shall be for Type 'F' ceiling without plaster flange. Adjustable wing supports shall be furnished to support the fixture from the ceiling structural members. Structural members by others. Columbia #4553F-43-222U. Fixture shall be oriented so lamps are perpendicular to corridor.	2-FB40
B-1	Same as Type 'B' except with plaster trim. Columbia #4553F-43-222U.	2-FB40
C	Recessed square incandescent downlight with milligroove baffle and a parabolic specular alzak reflector. Fixture shall have a special large square trim and be complete with special mounting brackets to mount to steel stud supports furnished by others. See detail 4/a39. Kurt Versen #H7840.	1-150W
C-1	Same as Type 'C' but standard trim and mounting brackets for acoustical ceiling, Kurt Verson #7840	1-150W
D	Under cabinet mounted 24" fluorescent fixture with acrylic plastic diffuser. 20 gauge steel finished in white enamel. Alkco 320H.	1-F20W
E	A ceiling mounted exit light with a single metal stencil face, over all matte white finish with 6" red letters with downlight. The fixture shall come with special canopy and stem to extend to bus above ceiling. See Architectural Detail 10/a38 and 12/a38. Devine #GC50-SW-F6-120V.	2-F6T5
E-1	Same as 'E' except double face. Devine #GC55-SW-F6-120V.	2-F6T5
E-2	Same as 'E' with Arrow Left. Devine #GL50L-SW-F6-120V	2-F6T5
E-3	Same as 'E' with Arrow Right. Devine #GL50R-SW-F6-120V	2-F6T5
E-4	Same as 'E' with Double Arrow. Devine #GC50D-SW-F6-120V	2-F6T5

Type	Description	Lamp
E-5	Same as 'E' with Arrow Left/Arrow Right. Devine #GC55LR-SW-F6-120V.	2-F6T5
E-6	Same as 'E-1' with Double Arrows. Devine #GC55D-SW-F6-120V.	2-F6T5
E-7	Same as Type 'E' except wall mounted. Devine #GS50-SW-F6-120V.	2-F6T5
E-8	Same as 'E-7' with Arrow Left. Devine #GS50L-SW-F6-120V	2-F6T5
E-9	Same as 'E-7' with Double Arrow. Devine #GS50D-SW-F6-120V.	2-F6T5
E-10	Same as 'E-7' with Double Arrow. Devine #GS50D-SW-F6-120V	2-F6T5
E-11	Same as 'E-5 but end mounted. Devine #GE55LR-SW-FG-120V	2-F6T5
E-12	Same as Type 'E-5' with standard canopy for installation on existing ceilings. Devine #GL55LR-SW-F6-120V.	2-F6T5
E-13	A wall mounted single face warning sign with a plexiglas face panel and red letters on white background. Wording shall read "Dark Room in Use". Lettering shall be 2-1/2" minimum, Devine #G560.	2-F6T5
E-14	Same as type 'E' with standard canopy to be installed in existing ceilings. Devine #GL50SW-F6-120V.	2-F6T5
E-15	Same as type 'E-6' with a standard canopy for installation on an existing ceiling. Devine #GL55D-SW-F6-120V.	2-F6T5
E-16	Same as 'E-4' with canopy.	
E-17	Same as 'E-7' with Arrow Right.	
F	A wall mounted 36" fluorescent fixture with acrylic plastic diffuser. 20 gauge steel finished in white enamel. Alkco 3235.	2-F30W
G	A 6" x 4' recessed 2 lamp fluorescent fixture with deep regressed translucent acrylic lens and extruded aluminum frame and trim with baked white enamel finish. Fixture shall be suitable for mounting in plaster ceiling. Lens shall be KSH-19A. Fixture shall be Columbia #SL12-240-G or approved equal.	2-F40W
G-1	Same as 'G' except one lamp. Columbia #SL6-140-G or approved equal.	1-F40W
H	Keyless porcelain socket. Pass and Seymour #44.	1-100/A-19
I	Not used	

J	Wall mounted 4" x 4' one-lamp fluorescent fixture with white acrylic wrap around finish. Fixture channel shall be 20 gauge steel finished in white enamel. Morris Kurtzen Inc. #A-40.	1-F40
K	A wall mount fluorescent fixture with wrap around white translucent plastic acrylic diffuser. Peerless #GP-1753-240RS or approved equal.	2-F40W
K-1	Same as 'K' only one lamp. Peerless #GP-1753-140RS	1-F40W
L	Existing pendant mounted 4-lamp fluorescent fixture relocated from Room 298.	4-F40
M	Existing pendant mounted 2-lamp fluorescent fixture relocated from Room 210F, or 210G. Pendant lengths to match existing fixtures in the new location.	2-F40
N	Existing pendant mounted 2-lamp fluorescent fixture relocated from Room 219, 221A, or 318. Pendant lengths shall match existing stems in the new location.	2-F40
O	Not Used	
P P	Ceiling mounted operating Room light. See specifications, Section 16400 2.6B	
Q	Not Used	
R	Wall mounted operating room light. See Specification 16400, 2.6C	
S	Ceiling mounted RLM Dome fixture with white porcelain enamel finish inside and out. Fixture shall be 1/2" conduit mounted to match existing conduit lengths. Miller #AE-3041.	1-150/A23
T	Not Used	
U	Wall mounted cast socket with vaportight glass globe. Miller #AC-1012.	1-150/A23
U1	Same as 'U'.	1-100/A21
V	Existing surface mounted 2-lamp fluorescent fixture relocated from Room 301.	2-F40
W	A pendant mounted 1' x 4' industrial fluorescent fixture with baked enamel finish, no uplight and turret type sockets. Provide chain suspension as required to suspend fixture below ducts or at height indicated on plans. Miller ID-2100-04, Sylvania #QY10-2404NA or approved equal.	2-F40

2.6 EXAM AND SURGICAL LIGHTS

A. Equipment Item M-483 - Examination Light

1. Equipment Item M-489 shall be wall bracket examination light.

2. Examination light shall be model JF-2/30 LID, by Luxo.

3. Fixture must comply with applicable requirements of NFPA's National Electrical Code and must be listed by Underwriter's Laboratories, Inc.

4. The exam light shall be constructed of extruded aluminum and heavy gauge steel finished with an oyster white baked on enamel. The fixture shall come complete with end brackets for arm exam lights and an unswitched convenience outlet. The fixture shall have one uplight and one down light. Maximum leakage current shall be 2 5 micro amps.

B. Equipment Item M-492 - Minor Operating Light

1. Equipment Item M-492 shall be a minor operating light fixture for ceiling track mounting with single lighthead/crossarm arrangement.

2. Minor operating room lights shall be Amsco Model AS-01-22 with a 22" diameter reflector and lighthead suspended from a 54" surface track. Lights to be ceiling mounted. Fixture shall be 120 volt, 60 Hz, single phase. Furnish and install lamps for fixture. Bolts and suspension support is by the General Contractor. Leakage to ground current shall not exceed 25 micro amps.

3. Fixture must comply with applicable requirements of NFPA's National Electric Code and Flammable Anesthetics Code and must be listed by Underwriter's Laboratories, Inc.

C. Equipment Item M-498 - Surgical Light, Wall Mounted

1. Equipment Item M-498 shall be a wall mounted light for minor surgical and examining work, with single 12" diameter lighthead.

2. Surgical light shall be AMSCO (Burton) #220, or approved equal.

3. Lighthead is suspended from a spring counter-balanced offset arm and yoke assembly which are attached to an extension arm which is mounted from the wall bracket assembly. The extension arm is rotatable through 180° around the wall bracket.

4. Lighthead has a 12" diameter Alzak reflector with step down design to provide Universal focus within a range of 20" to 42" from the lamphead. Unit shall include a cylindrical filter surrounding the lamp which color corrects light from the lamp and filters out heat. Fixture shall be 120 volt, 60 Hz, single phase. Provide and install 150 watt P25/8 spotlight lamp. Leakage to ground current shall not exceed 25 micro amps.

2.7 INDIVIDUAL WALL MOUNTED INCANDESCENT DIMMERS

A. Incandescent wall dimmers shall be sized and installed as shown on the

plans. Each wall dimmer shall be complete with:

1. On-off switch
2. Integral heat sink.
3. Solid state SCR circuitry
4. RFI filter
5. Rotary control
6. Square law operation.

B. Wall dimmer shall be manufactured by Lutnar Centurian, Hunt or approved equal.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Work under this section includes completely installed, connected, operating and tested systems as herein specified and as shown on the plans and riser diagram details. Equipment shall consist of factory assembled components with warranties and guarantees as herein specified.

PART 2: PRODUCTS AND INSTALLATION

2.1 PUBLIC TELEPHONE CONDUIT SYSTEM

A. The Electrical Contractor shall install conduit and outlet boxes for those telephone outlets indicated on the plans. A conduit outlet installation shall consist of a double gang box with a single gang device ring plate as specified in Section 16310, conduit from the outlet box to the corridor cable tray and all necessary brackets and supports. Provide a heavy gauge stranded nylon pull cord in all empty conduits.

B. All telephone conduit shall be 3/4 inch, unless otherwise shown. Pull-boxes are not shown on the plans, but shall be provided, as required for ease of wire and cable pulling; and in conduit runs that would otherwise be more than 90 feet in length; and in runs that would otherwise contain more than two 90-degree bends. Double offsets will not be allowed in any telephone conduit run. Radius of all conduit bends shall conform to the following schedule.

Size of Conduit in Inches	Inside Diameter of Conduit in Inches	Minimum Radius of Bends in Inches
3/4	0.82	8.2
1	1.05	10.5
1-1/4	1.38	13.8
1-1/2	1.61	16.1
2	2.07	20.7
2-1/2	2.47	24.7
3	3.07	30.7
3-1/2	3.55	35.5
4	4.07	40.7

C. All pullboxes in telephone conduit runs shall be sized according to schedule shown in Details 1/E32 and 2/E32. Pullboxes shall be recessed in all finished portions of the buidling.

D. Telephone Closets shall be furnished by the General Contractor unless otherwise indicated consisting of 3/4" thick painted plywood inside

of the wall cavity with a steel frame and door. See Detail 16/A49 for construction of cabinet. The Electrical Contractor shall provide a 9" cable tray "T" stubbed into the telephone cabinet as indicated on the plans.

E. All telephone equipment, services and cables will be installed by Northwestern Bell Telephone Company. This contractor shall cooperate as necessary to aid in location, provide prints and/or identify conduit and cable tray locations.

F. In telephone cabinets, provide conduit floor sleeves as indicated on the plans for vertical distribution of telephone and communications cables. Floor sleeves to be as sized on the drawings and to extend a maximum of 2-inches above and below the floor slab. All conduit sleeves shall be grouted in place with 2 hour rated concrete grout. University Telephone Services shall designate which sleeves are to be in use at occupancy. Sleeves not in use at occupancy shall be sealed with an approved 2-Hour-Rated, non-hardening duct seal compound and shall be capped. Sleeves that will be in use at occupancy will be sealed by the Telephone Company after their cable is installed. Electrical contractor shall provide a sufficient amount of the approved duct seal material for this purpose to the Telephone Company.

G. In Mechanical towers reserved and shown for telephone terminal boards, the General Contractor shall provide and install plywood back boards. Plywood pieces shall be sized as shown on plans.

H. A 20 ampere, 120 volt dedicated circuit terminated in a double duplex outlet shall be provided on each telephone terminal board located in cabinets or mechanical tower. Conduit serving outlet box must approach from top so that terminal board is clear below.

2.2 CLOCKS

A. Provide a clock outlet at locations indicated on the plans. All clocks shall operate from 120 volt A.C. with the power source connected to the building wiring system as shown.

B. Clock Outlets shall be a clock hanger outlet Sierra #2123 with NEMA #5-15R receptacle and stainless steel plate.

C. Elapse time clocks and control designated as Equipment M#321 on the plans shall be as follows:

1. ELAPSED TIMER/CLOCK

a. Sorgel ECT 200-2 digital, dual face elapsed time indicator and clock for flush mounting in wall. Trim will be primed to be painted out with wall. The light display shall be neon gas with one inch characters which are plainly visible at 30 feet away. The 60 minute elapsed timer shall incorporate circuitry allowing a count to be held and then resumed when actuated from the control panel. The solid state design allows the elapsed timer to instantly reset. The timer/clock shall have an extra set of contacts, that when closed will actuate the timer. This circuitry allows interfacing with either the Code 4 Alarm or monitor output.

b. The clock shall be capable of either displaying 12 hour or 24 hour time. In the 12 hour mode, the lighted display shall either indicate AM or PM time. Three intregal buttons shall set the hour, minute, and second display. Clock shall be set to indicate 24 hour time.

c. The elapsed time/clock shall have front accessable fuses and be mounted in a durable, phenolic case.

2. ELAPSED TIMER/CLOCK CONTROL

a. Shall be a Sorgel ECT 120-12A control panel for use with the ECT 120-2. The control panel shall consist of red lighted "count/reset" and "hold" button mounted on a stainless steel faceplate. A pre-installed wiring harness shall connect the control panel to the elapsed timer/clock.

2.3 COMMUNICATIONS CONDUIT SYSTEMS

A. General

1. Furnish and install empty conduit and boxes as shown on plans and specified hereinafter for television, and sound systems. Wiring and equipment will be provided and installed by the University.

2. All conduit shall be 3/4" or larger where indicated. All boxes shall be double gang or larger where indicated. All conduit stubs shall have bushed ends.

3. All outlet boxes shall be provided with plates or covers unless otherwise noted. Plates for standard size wiring boxes shall be blank stainless steel to match device plates specified in Section 16310. Provide engraving where indicated for device plates. Plates for larger boxes shall be flat 14 gauge galvanized steel. These plates shall be provided with properly applied zinc chromate flat prime coat. Final paint coats will be by the General Contractor.

4. Electrical Contractor shall coordinate and verify specified device plate engraving with the University. Plates shall be punched by the Electrical Contractor to receive the University's wiring device. Verify with the University wiring device opening required before plate is punched.

5. Sound system back boxes shall be recessed suitable for 8" speaker. Soundelier T198-8.

2.4 FIRE ALARM AND SMOKE DETECTION SYSTEM

A. Scope

1. Provide and install a complete, electrically supervised, low voltage, 4-wire Class A, closed circuit, zoned non-coded, fire alarm system as described herein and as shown on the plans. All components of the entire system shall be listed, labeled, or approved for its application as fire alarm equipment for NFPA 72A by Underwriters' Laboratories, Inc.

2. The fire alarm system specified under this section shall be totally solid-state using computer oriented digital technology. The system must be

a standard with the manufacturer to insure on-going parts availability and trained technical support. The initial installation must include all push-buttons, indicators, switches, pilot indicators, and digital displays, phone line interface equipment and software, to make it a completely operable system. The system must be designed in a modular fashion to insure future expansion capability whether it be additional data gathering panels or annunciator capability.

3. The system is designed on a building quadrant basis, each quadrant shall be fully operational as a local alarm system utilizing only equipment located within the quadrant as herein specified.

4. Alarm initiating devices, alarm signalling devices, magnetic door holders and any other remote fire alarm devices located on a floor will be electrically routed to the designated remote data gathering panel location.

5. Data gathering panels shall be located as shown on the drawings. Alternate locations will not be considered.

6. A fire alarm control unit will be provided for each quadrant where shown on drawings.

7. A fire alarm annunciator will be located at the Fireman's entrance to J.O.M.L.

8. The central processing unit is existing and is located in Room 75 3rd floor unit BC. All data gathering panel signal connections will be made to this processor.

9. A fire alarm printer located in Room B19 of Lyon's Laboratory will be included.

10. All programming and interface equipment necessary to cause the fire alarm system to function as a complete system and as described under operation shall be included in this contract.

11. The fire alarm system shall be designed to operate on standby backup battery power. All portions of the system, alarm printer, annunciator modules and all data gathering panels shall be designed to operate for a minimum of 24 hours on battery power. Upon failure of normal 120 v ac commerical power, the system shall automatically and instantly revert to battery power. The fact that the system is operating on backup power shall be recorded on the alarm printer.

12. With restoration of commercial power the system shall automatically switch from battery power to 120v ac. The system shall be supplied with an automatic battery charging capability. This battery recharging capability shall be designed to fully charge the standby batteries in a maximum of 30 hours. Restoration of commercial power shall be recorded on the printer.

B. <u>Code Requirements</u>

1. It is the intent of this specification to describe a local fire alarm signaling system in full compliance with NFPA Pamphlet 72A for local protection signaling systems.

2. Sections of this specification will describe in detail certain operating functions of the system, however, omission of specific descriptions of portions of Pamphlet 72A shall not be construed as relieving the sub-contractors under this section for work form complying with all of the requirements of Pamphlet 72A, as well as any local conditions which may be imposed upon such systems by local authority. All fire and sprinkler supervisory transmitting devices, control units, annunciator; printer and data gathering panels utilized to perform the following specific requirements shall have UL listing for the type of service performed.

C. Operation

1. Each quadrant of the building shall operate as an independent local fire alarm system and the activiation of any manual station, heat detector, water flow switch or a smoke detector at a smoke door shall cause the following:

a. Sound all alarm horns located within that quadrant at 120 beats per second.

b. All smoke door holders shall be released.

c. The Annunciator located at the Fireman's Entrance sounds a local audible alarm and by means of an individual LED indicates the alarm zone. The audible alarm may be acknowledged and silenced at the Annunciator, but the LED remains lighted.

d. The printer shall provide local audible alarm and red printout of fire alarm zone by floor, device, and quadrant with year, month, day and time of alarm occurrence. The audible alarm may be silenced by operation of silence switch at printer.

e. Any subsequent alarms will be annunciated at the Annunciator as described above and recorded at the printer on a change of state basis.

2. When the Fire Alarm Control Unit for the alarm quadrant has been reset to Normal the following will occur:

a. The local audible alarm at the Annunciator will sound. Operation of acknowledge switch at Annunciator will silence local alarm and extinguish the alarm LED.

b. The printer will record "Return to Normal" condition with Time of Day.

3. Proof of Central Processor Operation. The Existing Central processor incorporates circuitry which continuously monitors the scanning and data processing cycles. On central processor failure, an audible/visual signal shall operate if scanning fails or if incoming data is not processed. A means for testing the central processor failure circuitry shall be provided to prove operation.

4. Event commands. The System shall have capability of providing an automatic output (contact closure) as the result of an alarm input. This

capability shall automatically trip auxiliary protective signaling devices, release all door holders in all quadrants, trip remote station protective signaling devices, and provide remote pilot light annunciation.

5. The Systems shall be capable of printing - The time of day and day of the year shall be printed each hour. Any printer activity shall include the time of day.

6. Alarm display and Annunciation. All Protection System alarm signals shall provide audible signal, nixie tube or dot matrix display of the alarm point and type of alarm, as well as a printed record for alarm acknowledge and return to normal changes of state.

7. Fault Detection and Isolation. A fault detector shall be provided to automatically condition the circuit when a fault occurs so that the data transmission continues on an uninterrupted basis. Both audible and visual annunciation of a fault condition shall be provided. A printed record shall be provided to show the remote signal encoding devices affected by the fault.

8. Standby Power. Power for the system furnished under this contract shall be supplied from two sources: a primary (main) power supply; and secondary (standby) supply. The primary and secondary power sources shall supply all data gathering panels. To provide this reliable source of standby power for the system, an uninterruptible power supply consisting of batteries and battery charger shall be used.

9. Start-Up Operation. The fire alarm system shall be fully operational as soon as 1 zone is electrically connected and the existing central processor unit is operational. Fire alarm zones shall be added one zone at a time during construction. The system shall remain fully operational with no down time for programming or reprogramming. Operation during this construction phase includes sounding of fire alarm signalling devices, annunciation of specific zone at J.O.M.L. entrance, and fully operational printer in Room B19 of Lyons Laboratory.

10. All data transmitted between the Central Processor, Annunciator, data gathering panels and printer shall be transmitted in digital form. Individual data bits are to be grouped into word format and transmitted as coded messages. A double transmission, echo transmission, or multiparity bit technique must be used to insure message integrity. Transmission system failure must be annunciated immediately as a "no response" with printout of time and address of the data group failing to respond. The printer will provide an hourly log of all remote groups not responding.

11. The data transmission system must be compatible with and capable of operating over standard voice grade leased telephone lines. The system shall be capable of operating half duplex over a type 3002 data transmission pair. The system shall be designed so that additional leased line interfaces can be added to the system at any time in the future.

D. Equipment

1. Fire Alarm Annunciator (annunciator) shall be Honeywell W1103 or approved equal annunciator modules provided at the Fireman's Entrance to

J.O.M.L. The annunciator shall provide 160 zones of fire alarm annunciation and shall be expandable to 200 zones.

a. The annunciator shall provide two light emitting diode (LED) annunciators and an alarm/trouble acknowledge switch for each fire alarm zone.

LED No. 1 indicates a fire alarm condition in that specific zone.

LED No. 2 indicates a trouble condition in that specific zone.

b. A tone will occur at the annunciator on occurrence of any alarm or trouble condition and LED No. 1 or LED No. 2 will flash indicating alarm or trouble. Acknowledging the alarm or trouble condition at the annunciator will silence the tone and cause the proper LED to remain "steady on" indicating the existence of the alarm or trouble condition.

c. The annunciator shall include the ringback feature on rest of fire alarm panel or correction of trouble condition.

d. At the annunciator provide two notebooks containing mylar graphic identification on a per floor basis of all zones reporting at the annunciator. The graphic identification shall consist of floor plans with all necessary rooms, stairs or equipment to identify the zone. The zone shall be labeled as it reads on the annunciator and printer with any explanation or translation to clearly describe the zone. An attachment shall be provided and the notebook shall be firmly attached to the building structure.

2. Fire Alarm Printer shall be Honeywell W1002A or approved equal printer module located in Room B19 Lyons Laboratory. The printer shall be U.L. listed.

a. The printer shall provide red printout on fire alarm or trouble and black print on acknowledge or restoration of alarm or trouble. A description of the point type shall be provided with each print out. An audible alarm shall sound on occurrence of alarm or trouble.

b. The printer shall provide a "no response" printout when any point fails to respond and an hourly status summary of points in the system that are not responding.

c. Year, month, day and time printout shall be provided with each alarm.

d. A scan indicator LED shall indicate that printer is in communcation with the Central Processor Unit.

e. Printer operating controls shall include five pushbuttons identified as:

All Points Log
Status Log
Alarm Log
Reset
Silence

3. Central Processing Unit is an existing Honeywell Delta 1000 located in Room 75 on the third floor of Unit BC.

a. The CPU shall have the capability of automatically initiating commands upon an alarm occurrence. Any input point may be assigned as an event initiator.

b. A change of status at the alarm initiator shall cause a pre-defined series of commands, called an event program, to occur.

c. Present use of the alarm initiator capability shall be to cause all alarm signalling devices in all quadrants to sound and all door holders in all quadrants to release when an alarm occurs in one quadrant. It shall be possible to select which type alarm initiating devices shall cause all signalling devices in other quadrants to sound.

d. All programming circuits, or hardware including interface equipment, necessary to cause the existng central processor to function as described in Section 16500 2.4 shall be included in this contract.

4. Data Gathering Panels shall be Honeywell W1020 Series or approved equal located as shown on the plans.

a. All data gathering panels shall be of solid state plug-in circuit board construction and shall be supplied factory pre-wired.

b. All data gathering panels shall be provided with the capability to monitor digital inputs for four-wire supervised detection loops. End of line resistors will be located in the panel.

c. All data gathering panels shall be able to receive an alarm from any zone even if there is a trouble condition on that zone.

d. All data gathering panels shall include an alternate signalling circuit to provide for alarm transmission to the quadrants control unit and to the municipal fire department. This alarm circuit shall be fully supervised to provide a signal output for all fire alarm conditions of the primary digital transmission alarm circuit. Discrete visual identification shall be made for fire and trouble conditions. The primary and alternate signalling circuits shall remain independent so that any failure on one will not render the other system inoperative. The alarm signal transmitted to the municipal fire department shall be transmitted by both the digital transmission system and the alternate circuit.

5. The Fire Alarm Control Units (control unit) shall be Honeywell W939B or approved equal located in each quadrant in quantities shown on the plans. The control unit provides 24v dc power to ionization smoke detectors, magnetic door holders and fire alarm signalling devices.

a. Two supervised signaling circuits shall be provided. The wiring of the initiating device circuit and both signaling circuits shall be supervised for open and ground faults.

b. The control unit shall operate from 120v, 60Hz or from a standby 24v battery. A maintenance-free, sealed battery and automatic charger shall

be provided. The battery shall be sized to provide twenty-four hour standby operation. The battery charger shall be temperature compensated for maximum battery life, protected against a shorted output, and shall charge the battery to 70% of its capacity within 12 hours and to 100% of its capacity within 30 hours of a discharge.

c. The control unit shall include visual indication of power on, trouble, alarm, test switch, reset switch, silence switch, disconnect switch for municipal connection and door release relay. Trouble contacts shall be SPDT and alarm contacts shall be DPDT.

d. The control unit shall be surface mounted.

6. Manual Stations shall be Honeywell 46A or approved equal semi-flush, breakglass type. Stations shall be red with raised white lettering. A spare glass rod shall be provided with each station. Semi-flush stations shall mount to standard electrical boxes.

7. Thermal Detectors shall be Honeywell T4057 or approved equal 190°F fixed temperature or combination 135°F fixed temperature and rate of rise type as indicated on the drawings.

8. Duct Mounted Ionization Type Smoke Detectors shall be provided in supply fan discharge and return fan inlet as shown on the plans and in transfer ducts before fire/smoke dampers.

a. An alarm condition at any duct smoke detector will shut down the specific supply-return fan combination and close motorized fire/smoke dampers.

b. On supply-return unit manual elapsed time (0 - 15 minutes) timer located adjacent to the controllers fan control shall allow override of the supply/ return fan detectors to purge smoke from units. When the selected time lapses detectors shall be capable of shutting down supply/ return fan combination.

c. Duct mounted detectors shall be of the dual chamber ionization type. They shall be designed for use in air streams with an appropriate enclosure, and sampling tubes to assure cross-sectional sampling of the air stream within the duct. The duct detectors shall be completely self-contained, including power supply, isolated alarm and trouble contact outputs, power, and alarm indicating lamps, key-operated reset switch, and test connection for portable test equipment. The detectors shall be as manufactured by Pyrotronics, Inc., Honeywell Inc. or approved equal.

d. The detectors shall have been tested for performance and stability in accordance with Underwriters' Laboratories Standard 167.

e. Duct mounted detectors shall be of the type that portable test equipment designed for the purpose can be used to perform complete electrical measurements of the circuit voltage, sensitivity, etc., with the detectors installed in the system at the location of each detector.

f. The detectors shall operate from 120v ac.

g. Alarm and trouble signals will be provided for each combination of a supply and return fan or each fire/smoke damper.

9. Fire Alarm Horns shall be Honeywell SC806 series or approved equal. Units shall be red, flush mounted in finished areas and surface mounted in unfinished areas and shall operate on 24v dc. Weatherproof housings shall be provided for all exterior horns. Horn deflectors shall be provided for horns above corridor ceiling.

10. Smoke Detectors and Door Holders at Smoke Doors shall be integral with the door operator and will be furnished by the General Contractor. All necessary conduit wire and junction boxes for connection of the detector door holders will be provided by the Electrical Contractor. Detectors and holders shall be for operation on24v dc supplied by quadrant control units. Detector and door holder shall be wired separately for master door release by the fire alarm system.

11. Wiring

a. All fire alarm wiring shall be in conduit and shall be #14 and #18 made up of twisted pairs of 600 volt THHN 90°C or TFN 90°C insulation wire in quantities listed below.

1. Data gathering panel trunk lines 13#14 and 6#18

2. Horn circuits 4#14

3. Area smoke detectors 4#18

4. Manual Stations 4#18

5. Area heat detection4 #18

6. Duct smoke deltection 4 #18

7. Door holder smoke detector 4#14, 4#18, 2#14 are power to the smoke detector, 2#14 are power to the door holder, 4#18 are signal.

8. All power wiring from power supplies data gathering panels, duct smoke detectors or printer to power panels or motor controls shall be #12, 600 volt THHN 90°C general building wiring.

b. All signal wiring shall be Honeywell preassembled cable, Beldon or approved equal.

E. Supplier Requirements

1. The entire fire alarm system shall be supplied by one supplier who shall show satisfactory evidence that he has been providing said systems for at least five years; maintains a fully-equipped service organization and is prepared to offer post-warranty service.

2. Shop Drawings. Prior to delivering any equipment the FAS supplier shall submit to the Architect/Engineer for approval, the required number of copies of Shop Drawings as stipulated in Section 01300. Submittals shall include connection diagrams, specification date sheets, schedules showing location and function of each device, a complete system riser diagram and schematic block diagram showing all types of devices, operating parts, showing all functions and control. Submittals indicating typical one line risers and typical specification sheets only will not be acceptable.

3. Testing, adjusting and calibration of the various system components shall be the responsibility of the Fire alarm system supplier. A final test for owner acceptance shall be performed by the System supplier in conjunction with a representative of the University.

4. Training. The fire alarm system supplier shall provide complete detailed written operating instructions and manuals as required in Section 01300 and instruct a selected University representative a minimum of 4 hours in the operation of the system.

5. Service. The System supplier must employ factory trained service organization. The organization shall have had five years previous experience in servicing multiplexing type alarm signaling equipment.

6. Guarantee. The entire installation shall carry a one (1) year guarantee after acceptance of the system by the Owner. The equipment supplier shall guarantee all devices against defects in material or workmanship.

- - -

PART 1: GENERAL

1.1 SCOPE

A. Conditions of Contract, Division 1 General Requirements and Section 16010 General Provisions - Electrical apply to all work of this section. Refer to Article 12 of the Instructions to Bidders, Article 7 of the General Conditions and Section 01010 - Summary of Work and Special Requirements for requirements on pre-bid and post-bid evaluation of proposed substitute products, methods and other conditions.

B. Contractor shall provide all equipment, materials and wiring necessary for complete installations of the systems herein specified and as shown on the plans, and in the motor schedules.

PART 2: PRODUCTS AND INSTALLATION

2.1 MOTOR WIRING

A. The Contractor shall provide and install all disconnect switches, motor starters, push buttons or special starting controls unless indicated by others on the motor schedule. He shall provide and install all conduit boxes, fittings and wiring for all motors and controls (except as noted below) as shown on the plans or as required. He shall oil all motors if required before starting and verify the mechanical or equipment supplier to see that any motor he connects is running in the proper direction. Check all overloads and fuses under operating conditions to assure that they are sized for proper motor protection without nuisance tripping and replace those found inadequate or improper. All overloads shall be sized for maximum rating allowed by Code. Overloads are not required on single phase motors equipped with internal thermal protectors. The motor schedule on the plans is included for the Contractor's convenience' any motor inadvertently omitted from this list but shown on the plans shall be connected.

B. In general, equipment and control wiring shall be provided as follows.

1. All PE and EP switches, control solenoids, relays, motorized dampers, for air handling units and low voltage transformers for air handling equipment will be wired by Temperature Control Contractor. Electrical interlocking for air conditioning equipment shall be done by the Mechanical Contractor including conduit and wiring. Where manual-off-automatic switches are specified make connections so pneumatic switches are in the automatic circuit only.

2. All other wiring, unless otherwise indicated, shall be provided by the Electrical Contractor. Provide wiring and connections for pressure switches, float switches, etc., as noted in the Motor schedule and required, unless otherwise indicated.

3. Electrical Contractor shall provide all power interlock wiring of controllers for Mechanical and Equipment Contractors as scheduled or required unless otherwise indicated Where safety interlock wiring is required the interlock shall be included in the manual ckt. as well as automatic.

4. Electrical Contractor shall provide line voltage wiring and fractional horsepower starter for cabinet horizontal unit heaters. Electrical Contractor shall connect PE switches or aquastats provided by others.

C. The Mechanical and Equipment Contractors will furnish schematic wiring diagrams to the Electrical Contractor for all of their equipment that must be wired by the Electrical Contractor. Where manual-off-automatic switches are specified make connections so pneumatic switch or controlling device is in the automatic circuit only.

D. Electrical Contractor shall furnish and install fused disconnect switch sized and fused if necessary, where required by Code for each motor.

E. All fractional HP manual starters, push buttons, controllers, disconnects, and selector switches shall be labeled by Electrical Contractor with "Equipment" as shown on motor schedule with an engraved black bakelite plate fastened with Minnesota Mining permanent adhesive. Where no push button is required, furnish and install same type on label on disconnect switch or starter. All flush switches which are in public access areas (not closets or equipment rooms), shall have labels engraved directly onto the plate. Wherever the controller and disconnect are together, only one label is required.

F. Provide fuses for all disconnect switches and combination as specified in Section 16300. Provide electrical interlock disconnect devices for all switches with interlock circuits.

2.2 MOTOR CONTROLS

A. Provide magnetic starters with three overload elements, push button or selector switch and reset button as required on housing, or remote push botton or selector switch and pilot light if shown for all motor controllers shown on plans and designated in the motor schedule.

1. Coil voltages shall be 120 volts as required.

2. Starters for outdoor and wet locations shall be NEMA 3, raintight.

3. Provide auxiliary contacts for each starter as indicated in the motor schedule in addition to the holding contact where required. In cases where more than 4 contacts are required, provide separate multi-pole relay in the starter or adjacent to it in a separate NEMA 1 box.

B. Two speed motor starter shall be 2 winding starters made up of 2 - 3 pole starters with 6 overloads and necessary control wiring to operate with the controls shown on the motor schedule. Each two speed starter shall include an automatic sequence decelerating relay which will interpace a time delay between high speed and low speed whether in the remote mode of operation or local mode of operation.

C. Provide where shown on plans fractional HP manual starting switch units complete with overload elements, neon type pilot light and number of poles as required. Equip these starters with Satin Stainless Steel plates in finished areas to match wiring device plates specified under "Wiring Devices" with engraved designations.

D. Provide all miscellaneous relays required for interlocking single phase motors and for control of such equipment as filter drive motors and electronic precipitator power. Relays shall be one, two or three pole as required rated 10 amp (15 amp for precipitators), 60 hz and in NEMA 1 enclosures.

E. All relays and pilot or control transformers shall be separately fuse protected on both incoming and load side.

F. All motor controls shall be Square D, General Electric, Westinghouse, Allen Bradley, or approved equal. Controls shall be of the same manufacturer.

2.3 MOTOR CONTROL CENTERS

A. Motor control centers in the JOML complex shall be designed for 208 volt, 3 phase, 3 wire combination motor starters detailed and scheduled on the plans. The control centers shall be totally enclosed, dead front, free standing, 90" high constructed of code gauge steel with structures bolted together to form one assembly. Units shall be finished with baked gray enamel. Buses may be copper or tin plated aluminum.

1. The combination fused switch and magnetic starter units shall be hinged door type.

2. The fused switches shall be quick-make, quick-break, handle operated. Switches for all starters with interlock control circuits shall be provided with integral electrical disconnect.

3. Magnetic starters shall be across-the-line, full voltage type with controls as indicated on the schedule.

4. Horizontal and vertical bus shall be of copper or aluminum construction with horizontal bus rating as shown on plans braced to withstand 40,000 amps fault current. In no cases shall vertical bus be rated less than 50% of horizontal bus.

5. All motor control centers shall be furnished with 50% ground bus.

6. Motor control centers shall be front mounted only, NEMA Class I, Type B.

7. Provide fuses for each starter switch as specified in Section 16300. Provide 3 spare fuses for each size of motor nameplate rating in each motor control center.

8. Each combination starter unit shall be stab connected to the buses, except bolt-in above 400 amp. All combination starters shall have numbered unit pre-wired terminal boards. Provide same type disconnect switch only where indicated.

9. Each section shall have unobstructed horizontal wireways at top and bottom which shall match with adjacent units to provide continuous horizontal wireway. Each section shall include vertical wireway. Horizontal and vertical wireways shall be isolated from busses.

10. Unused spaces shall be covered by blank plates, and all other spaces shall be fully equipped for future use.

B. Motor control center in the existing B-C complex shall be designed for 480 volt, 3 phase, 3 wire construction. All other motor control center characteristics shall be as described in 2.3.A. Bus shall extend and be tapped for future extension.

C. Individual combination starters shall be equipped with reset buttons, selector switch or push buttons and pilots as indicated on the drawings.

1. Each starter shall have three overload protectors. These shall be individually supplied for the exact motor that each is intended to protect as verified by the nameplate at the job which may not necessarily agree with the size indicated in the motor schedule. Size all overloads for the largest maximum size permitted by the NEC.

2. Starters shall have at least two auxiliary contacts plus a holding coil contact. Provide extra contacts where indicated; where more than 4 contacts are required, provide a separate multi-pole relay in the starter or in an adjacent unit.

3. Starters for cooling tower fans shall be 2 speed, variable torque, single winding type.

D. Provide permanent labels on the front of each combination starter or disconnect to identify the equipment controlled. Label shall be engraved black-white-black bakelite fastened with permanent bonding adhesive.

E. All motor control centers shall be structured with buses supported to withstand 40,000 amperes RMS symmetrical for short circuit conditions.

2.4 VARIABLE FREQUENCY MOTOR DRIVERS

A. Furnish and install variable speed adjustable frequency invertertype motor drivers to be applied to constant pressure variable flow chilled water pumps as described below. The variable motor drive package shall contain all major assemblies for automatic and manual operation and system motor overload, single phase protectors, and power factor correction.

B. Equipment

1. Furnish sizes and quantities as indicated below, Emerson Electric Company, Industrial Controls Division, AS4000 Series Accuspede motor drives.

2. The adjustable speed motor drive center shall be NEMA Class I, type B, wiring in a NEMA I all steel welded enclosure. The center shall be fully enclosed, top entry, top existing free standing vertical structure with front accessibility to allow wall or back to back mounting. The center shall come complete with all necessary copper bussing, incoming circuit breaker or disconnect to provide a short circuit withstandability of 40,000 Amps. The enclosure shall come with a copper ground bus extending the full length of the equipment.

3. The adjustable speed motor drive shall be an automatic/manual adjustable frequency inverter type converting the incoming power to load determined adjusted frequency and voltage, maintaining the volts/HZ constant to within $\pm$ 2% throughout the entire motor speed range.

4. The inverter shall be voltage source design with a phase control adjustable voltage D.C. power supply and a bridge type inverter section. The inverter output shall be six step and shall employ complimentary communication.

5. The inverter shall have the capability of running the specified motor or any other standard NEMA B design motor or combination of NEMA B motors in simplex, duplex or triplex operation as described below for specific applications.

6. The inverter shall be designed to operate in an ambient temperature range of 10°C to 40° with a speed regulation of 1%.

7. The inverter shall include a tapered torque limit control for motor protection. If the motor goes into torque limiting control for more than 60 seconds, contact shall close and activate an alarm bell and a set of relay operated contacts shall be furnished for remote alarming in addition to local alarm.

8. Inverter accessories:

a) Instantaneous over current trip.

b) Phase loss protection

c) Phase reversal protection

d) Over voltage protection

e) Under voltage protection

f) Input circuit breaker

g) Output starter with 3 overloads.

h) Redundant self contained cooling fans.

i) Over temperature protection

j) Hard wired logic modules with screw terminals.

k) Removable power semiconductor modules

l) 30 to 1 speed range 3 - 60 HZ.

m) Adjustable torque limit to 150%

n) Adjustable volts per HZ

o) Adjustable upper and lower speed limit

p) Separate adjustable accel and decel rates.

q) Process signal follower

r) manual/automatic control

s) 150% overload rating, one minute

t) Divided AC control compartment.

u) 120 volt max control wiring.

v) Signal input section capable of receiving a 4 to 20 mile amp signal from a Honeywell model 411 deferential pressure transmitter.

w) HOA control for each motor.

C. Application

1. All chilled water pump motors will be standard NEMA B t frame integral Hp induction motors as listed below and will be furnished by the Mechanical Contractor.

Motor No.	HP	FLA	LRA	VOLTS	PHASE	RPM	NOTES
83	50	143A	725	208	3P	1750	Simplex
89	25	75A	365	208	3P	1750	Simplex
95	60	74A	398	480	3P	1750	
96	60	74A	398	480	3P	1750	Triplex Mot 105 is future
105	100	94A	664	480	3P	1750	

2. Simplex variable speed drivers shall be furnished and installed for each of motors 83 and 89. Simplex drive shall be complete with a control section, inverter section and power factor correction section.

3. A triplex variable speed drive unit shall be furnished and installed with one inverter for operation of motors 95, 96 and 105. Motor 105 shall be provided in the future however. The variable speed drive shall be designed with full capabilities of operating the three motors. All controls, circuit breakers, starters and bus capacities shall be furnished and sized for the three motors. The drive unit shall be designed so that it is fully functional with motors 95 and 96 only without major rewiring. The drive shall consist of a control section, inverter section, motor control section, and power factor correction section. The power factor correction section shall contain capacitors as indicated on the motor schedule with space for an additional 30 KVAR withthe addition of motor 105. The drive unit from indication from the pressure transmitter shall modulate a motor speed until full speed is reached apply the motor to the 60 cycle buss of the motor control section and repeat the modulation in a sequential manner the remaining motors until demand is satisfied. Reduction of capacity will be in reverse order.

D. Test Requirements

1. The capability of the inverter to perform per specification shall be documented by a factory test and witnessed by an authorized agent as assigned by the engineer. All modules, voltage levels, and signals shall be tested and recorded priorto the systems test. Each VFD shall be system

tested at 100%, 80% and 50% of maximum, and fully loaded to the load requirement for each speed. The VFD shall be overloaded to demonstrate the proper functioning of the IOT circuit. Test at maximum design and minimum operating speed. While performing tests, critical data shall be tabulated and recorded for; voltage, full load current and all SCR hold-off time. Compare recorded data to VFD design parameter to ensure proper transient capacity. The 4-20 ma input signal shall be simulated to confirm the VFD's ability to track properly. A written report of such tests will be submitted to the Owner.

2. Prior to initial start-up and at the time of start-up factory trained personnel will provide complete on-site operating instruction. The University of Minnesota will provide ample time so that arrangements suitable to the supplier can be made, but shall in no case be later than 10 working days from initial start-up notice.

2.5 POWER FACTOR CORRECTION

A. Provide and install power factor correction capacitors for certain new 3 phase motors as indicated and sized on the motor schedule. Capacitors shall be integrally fused, indoor or outdoor, dustproof or weatherproof with factory attached brackets for wall, floor or shelf mounting as required for the application.

B. Capacitors shall be connected at the motor terminals and switched with the motor starter unless otherwise indicated on the plans. Provide all necessary mounting hardware, brackets, channels, etc. for a secure installation.

C. Capacitors shall be, non-PCB, mounted in oil tight enclosed complete with fuse and blown fuse indication. Calmount "E" Myron Zacker Inc. or equivalent Sprague, Westinghouse or General Electric.

D. Capacitors applied to existing motors shall be sized and installed as indicated on the plans.

E. Capacitors applied to existing motor control centers shall be sized as shown on the plans and shall be installed with mounting frame to firmly secure the capacitors to the top of the MCC.

- - -