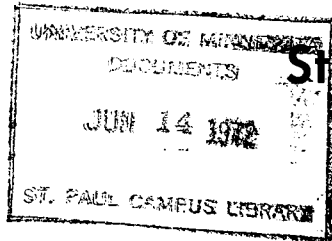


FOOD SCIENCE AND INDUSTRIES NO. 12

V. S. PACKARD, JR.



Stainless Steel Corrosion

STAINLESS STEEL... CARE AND USE

The cost of stainless steel equipment is high. Whether you buy bulk tanks, processing equipment, or home cooking ware, your investment is worth protecting. A strong corrosion-control program adds life to equipment, and should be considered a must.

"STAINLESS" STEEL... MISNAMED?

Although stainless steel is highly resistant to conditions which readily corrode other metals or alloys, it is not completely stainproof. Even within the group of alloys termed "stainless," corrosion resistance varies greatly. Practical usage factors frequently determine the kind of metal required, occasionally at the expense of stainless qualities.

KINDS OF STAINLESS STEEL¹

1. Martensitic: chromium steels which can be hardened by heat.

Characteristics--great load and shock strength, low corrosion resistance.

Some uses--knives, blades, mill parts, nuts, bolts.

Typical member--Type 410.

2. Ferritic: chromium steels having larger amounts of chromium than the martensitic; not appreciably hardened by heat.

Some uses--trim, moulding, counters, exteriors.

Typical member--Type 430.

3. Austenitic: chromium-nickel alloys; not hardenable by heat.

Characteristics--high degree of corrosion resistance.

Some uses--suitable for product contact, such as milk processing and handling equipment.

Typical member--300 series stainless steels.

4. Precipitation-hardenable stainless steels: of the different alloys in this group, the chromium-nickel-copper type probably has widest application in food processing; hardenable by heat.

Characteristics--the copper is not extractable by food products or sanitizers (unlike "white metals"), and would not be a potential cause of oxidized flavor; it has good corrosion resistance and great strength, and is not subject to preferential corrosion in contact with 300 series, 18-8 type steels.

Some uses--shafts, pistons, bearings, bolts, and nuts.

Typical member--17-4-PH (Armco Steel Corporation designation).

The stainless steels probably most frequently used in the dairy industry are 300 series 18-8 types. The "300" is a type designation indicating certain characteristics; 18 refers to percent chromium, and 8 to percent nickel.

Surface finishes as classified arbitrarily by the steel industry are: No. 1, No. 2D, No. 2B, No. 3, No. 4, No. 6, No. 7, No. 8. The first three are unpolished, the others polished. Each category, though, includes a wide range of finishes. Characteristics of each finish include smoothness, sheen, color, and light reflectivity. To rate a given number, steels must be manufactured by certain procedures.

CORROSION OF STAINLESS STEELS

To be assured that stainless steel equipment you buy is of the quality and type desired, always

¹ All information under this heading was obtained from the article by H. L. Mitten, Jr., Journal of Milk and Food Technology, 25(3): 91. 1962

refer to 3-A standards as established by the International Association of Milk and Food Sanitarians, the U. S. Public Health Service, and the Dairy Industry Committee.

Even the most corrosion-resistant stainless steels must be handled properly to insure long life. Factors influencing corrosion are:

1. Improper Use of Cleaners and Sanitizers:

Chemical agents that clean and sanitize dairy equipment vary in corrosiveness. Use them all strictly according to label instructions, with special attention to: (a) quantity, (b) temperature of solution, and (c) duration of exposure to equipment.

Some formulations of chlorine are among the most corrosive sanitizers in common use. Iodine compounds of similar formulation are also highly corrosive. Because these agents' corrosiveness increases with acidity, rinse all equipment before using an acid cleaner. After acid treatment, neutralize with an alkaline solution, followed by a hot water rinse. It is essential to prevent combined acid-sanitizer action on stainless steel.

On clean equipment, minimum amounts of sanitizer will effectively kill remaining bacteria. Dirty equipment having only a very thin layer of milkstone or water hardness deposit cannot be sanitized adequately, even with excessive quantities of sanitizer.

Ordinary deposits on milk handling equipment frequently consist of chemical agents called "chlorides." They are highly corrosive. Deposition of these compounds can be prevented or greatly retarded by use of suitable cleaners properly applied.

Hard water is the source of several chemicals that cause corrosion. It may also destroy detergent

action. Cleaners can be formulated to cope with water hardness to some extent. Shop around for the right cleaner for your water supply; or install a softening device, if necessary. Keep equipment dry to slow corrosive action.

2. Action of Unlike Metals:

Corrosive conditions may be established when two different metals are in contact.

Do not use "white" metals with stainless steel or magnetic "400" series stainless steels with nonmagnetic "300" series. Construct CIP (clean in place) lines from stainless steels of similar series.

Never use tops of bulk tanks or vats for tool storage. Prevent weld spatter from falling on stainless steel.

Again, this kind of corrosive action is accelerated by wet surfaces.

3. Harsh Abrasives:

When stainless steel is scratched, the protective influence of its natural (oxide) film is lost. When this occurs, stainless steel is unique in reacting like two dissimilar metals, as noted above. Pitting corrosion results.

Never use steel wool or metallic sponges to scrub stainless steel. Fiber brushes and sponges are adequate to remove dirt when equipment has been kept reasonably clean.

4. Stray Electric Currents:

Stray electric currents from improper or frayed wiring cause pitting corrosion. Good grounding is essential.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. Luther J. Pickrel, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55101.

2M--12/65