Part MM
Metallic Materials

MM-1 PURPOSE AND SCOPE

The purpose of this Part is to identify metallic materials considered acceptable for use in hygienic service. It identifies material specifications, grades and alloys, matching filler metals, fabrication guidelines, and other attributes necessary for this service. It also specifies the data that must be submitted to the MM Subcommittee for any new or unlisted alloy that is proposed for inclusion into Part MM.

MM-2 ALLOY DESIGNATIONS

MM-2.1 General

This Part identifies for use those metallic materials of construction that have demonstrated the ability to meet welding and surface finish criteria as set forth in other parts of this Standard. It is the responsibility of the owner/user to ensure that any metallic materials selected for use from those listed in Tables MM-2.1-1 through MM-2.1-3 are appropriate for its intended application. The guidelines and criteria listed in this Part of the standard indicate a general acceptability for use and do not address the specifics of fabrication or requirements of any given service.

MM-3 USES OF SPECIFICATIONS

MM-3.1 General

The documents listed in MM-4.2, MM-4.3, MM-4.4, MM-4.5, and MM-4.6 may contain references to codes, standards, or specifications not listed in this Part of this Standard. Such unlisted codes, standards, or specifications are to be used only in the context of the listed documents in which they are referenced. Where documents listed in MM-4.2, MM-4.3, MM-4.4, MM-4.5, and MM-4.6 contain design rules that are in conflict with this Standard, the design rules of this Standard shall govern.

MM-3.2 Listed Specifications

Materials purchased to specifications listed in the appropriate sections of MM-4.2, MM-4.3, MM-4.4, MM-4.5, and MM-4.6 may be used for applications governed by this Standard. Fittings must be purchased to the requirements of Part DT. Valves must meet the requirements of SG-3.3.2.3. Materials used in applications governed by this Standard shall conform to a specification listed in the above paragraphs, except as provided in MM-3.3.

MM-3.3 Unlisted Specifications

Alloys in specifications not listed in MM-4.2, MM-4.3, MM-4.4, MM-4.5, and MM-4.6 may be used for applications governed by this Standard provided they conform to a published specification covering composition, physical and mechanical properties, method and process of manufacture, heat treatment and quality control, and otherwise meet the chemical composition requirements of one of the specifications listed in MM-4.2, MM-4.3, MM-4.4, MM-4.5, and MM-4.6. Alloys not listed in Tables MM-2.1-1 through MM-2.1-3 may be used for applications governed by this Standard provided the following requirements are met:

(a) the applicable requirements of MM-8 are met
(b) the specific written permission of the owner/user is obtained

MM-3.4 Unknown Materials

Materials of unknown origin or specification shall not be used in hygienic service.

MM-3.5 Reclaimed Materials

Reclaimed pipe/tube and other piping components may be used, provided they are properly identified as conforming to a published specification listed in MM-4.2, MM-4.3, MM-4.4, MM-4.5, or MM-4.6 or to a published specification not listed in those paragraphs and otherwise meeting the minimum requirements of MM-8. Sufficient cleaning and inspection shall be made to determine minimum wall thickness and freedom from imperfections that would be unacceptable in the intended service.

MM-3.6 Designation of Alloy and Fluid Service

The user is responsible for designating the specific alloy, from MM-2, to be used for each system having a product-contact surface. The user is also responsible for identifying the appropriate fluid service category for piping or tubing, in accordance with the definitions in the current edition of ASME B31.3, Process Piping Code.
platinum, gold, and others, may be used for product contact surfaces in process instrumentation.

**MM-5.2 Filler Metals and Consumable Inserts**

Filler material shall conform to a published specification. Table MM-5.1.2-1 lists the recommended filler metals for welding the listed austenitic, superaustenitic, and duplex stainless steels and nickel alloys.

Table MM-5.1.2-2 lists the recommended materials from which inserts may be made for use in welding the listed superaustenitic and duplex stainless steels.

Filler materials other than those listed in Tables MM-5.1.2-1 and MM-5.1.2-2 may be used with the prior approval of the owner/user provided that:

(a) they produce weld metal having corrosion resistance equal to or greater than that of the base metal

(b) the welding procedure is qualified in accordance with Section IX of the ASME BPVC

Proprietary filler materials may be used with the prior agreement of the owner/user, provided all procedure and performance qualification requirements of Part MJ of this Standard and Section IX of the ASME BPVC are met.

**MM-5.2.1 Austenitic Stainless Steels.** Only the low-carbon grades of stainless steel filler metals may be used to weld these alloys.

**MM-5.2.2 Superaustenitic Stainless Steels.** The superaustenitic stainless steels in Tables MM-2.1-1 and MM-2.1-3 are prone to the precipitation of undesirable secondary intermetallic phases such as sigma and chi. This precipitation typically occurs in the range of 1,000°F (540°C) to 1,900°F (1,040°C). This is a concern during welding and other thermomechanical processes, including solution annealing. It is, therefore, desirable to keep exposure time within this temperature range to a minimum.

Owners/users are cautioned that any service temperature, heat treatment, or welding procedure that exposes this material to these temperatures should be minimized. The material manufacturer should be consulted for specific instructions regarding heat treatment.

**MM-5.2.3 Consumable Inserts for Orbital Welding of Listed Alloys.** Table MM-5.1.2-2 lists the most common alloys from which consumable inserts are machined for use in welding specific superaustenitic and duplex stainless steels. Other nickel–chromium–molybdenum inserts may be used as long as the corrosion resistance of the final weldment meets or exceeds that of the base metal.

**MM-5.2.4 Duplex Stainless Steels.** The corrosion resistance and mechanical properties of duplex stainless steels are based on having roughly equal amounts of ferrite and austenite in the microstructure at room temperature.

The listed duplex stainless steel, UNS S32205, may be prone to the precipitation of undesirable secondary intermetallic phases such as sigma and chi. This precipitation occurs continually in the range of 1,200°F (650°C) to 1,830°F (1,000°C). Owner/users are cautioned that any service temperature, heat treatment, or welding procedure that exposes this material to these temperatures should be minimized. The material manufacturer should be consulted for specific instructions regarding heat treatment.

**MM-5.3 Field Bending of Tubing**

Field bending of tubing is permitted for diameters up to and including 1/2 in. (12.7 mm). Post-bending heat treatment is not required. Bending of tubing of any diameter requires prior written permission from the owner/user. Consult the material manufacturer for recommended minimum bend radii.

**MM-5.4 Heat Treatment**

Heat treatment of process components made from the common austenitic stainless steels in Table MM-2.1-1 is not addressed by this Standard. For other alloys and/or fabrication processes, components may require heat treatment. The material manufacturer should be consulted.

**MM-6 MECHANICAL PROPERTIES**

**MM-6.1 General**

The specific service environment for which the alloys in Tables MM-2.1-1 through MM-2.1-3 may be used is not within the scope of this Standard. The possibility of material deterioration in service should be considered by the owner/user. Carbide phase degradation of corrosion resistance, susceptibility to intergranular corrosion of austenitic materials, or grain boundary attack of nickel-based alloys are among those items requiring attention.

**MM-6.2 Tubing/Piping**

All tube or pipe used for product contact surfaces, cleaning solution contact surfaces, and nonproduct contact surfaces shall meet the mechanical property requirements of the specification to which they are manufactured.

**MM-6.3 Fittings and Welded Components**

Refer to DT-2 for strength requirements for fittings and valves.

MTRs for fittings are not required to list mechanical properties; however, if they do, they must comply with the specifications for the raw materials from which the fittings were fabricated. It should be understood that the mechanical properties for worked products, such as