

SECTION 23 05 15

COMMON PIPING FOR HVAC
02/14

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE STANDARDS ASSOCIATION (JSA)

JIS A 0203	(2014) Concrete Terminology
JIS A 1108	(2018) Method of Test for Compressive Strength of Concrete
JIS A 1110	(2006) Methods of Test for Density and Water Absorption of Coarse Aggregates
JIS A 5758	(2022) Sealants for Sealing and Glazing in Buildings
JIS A 9504	(2021) Man Made Mineral Fibre Thermal Insulation Materials
JIS B 0209-1	(2001) ISO General Purpose Metric Screw Threads-Tolerances-Part 1 : Principles and Basic Data
JIS B 1112	(2019) Cross-Recessed Head Wood Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 1220	(2015) Set of Anchor Bolt for Structures
JIS B 2011	(2013) Bronze, Gate, Globe, Angle, and Check Valves (Amendment 2)
JIS B 2031	(2015) Gray Cast Iron Valves (Amendment 1)
JIS B 2032	(2013) Wafer Type Rubber-Seated Butterfly Valves
JIS B 2061	(2017) Faucets, Ball Taps and Flush Valves
JIS B 2220	(2012) Steel Pipe Flanges
JIS B 2239	(2013) Cast Iron Pipe Flanges
JIS B 2240	(2006) Copper Alloy Pipe Flanges
JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings

JIS B 2311	(2015) Steel Butt-Welding Pipe Fittings for Ordinary Use
JIS B 2312	(2015) Steel Butt-Welding Pipe Fittings
JIS B 7410	(1997) Liquid-In-Glass Thermometers for Testing of Petroleum Product
JIS B 7505-1	(2017) Aneroid Pressure Gauges-Part 1: Bourdon Tube Pressure Gauges
JIS B 8267	(2015) Construction of Pressure Vessel
JIS B 8285	(2010) Welding Procedure Qualification Test for Pressure Vessels
JIS C 3605	(2022) 600 V Polyethylene Insulated Cables, Type CV
JIS F 0602	(1995) Shipbuilding-Non-Asbestos Gaskets to Cargo Piping System-Application Standard
JIS G 3138	(2021) Rolled Steel Bars for Building Structure
JIS G 3201	(2008) Carbon Steel Forgings for General Use (Amendment 1)
JIS G 3202	(2008) Carbon Steel Forgings for Pressure Vessels (Amendment 1)
JIS G 3454	(2019) Carbon Steel Pipes for Pressure Service (Amendment 1)
JIS G 3455	(2016) Carbon Steel Pipes for High Pressure Service
JIS G 3456	(2019) Carbon Steel Pipes for High Temperature Service
JIS G 3459	(2017) Stainless Steel Pipes (Amendment 1)
JIS G 4051	(2018) Carbon Steels for Machine Structural Use (Amendment 1)
JIS G 4053	(2018) Low-Alloyed Steels for Machine Structural Use (Amendment 1)
JIS G 4107	(2015) Alloy Steel Bolting Materials for High Temperature Service (Amendment 1)
JIS G 4303	(2012) Stainless Steel Bars
JIS G 4305	(2015) Cold-Rolled Stainless Steel Plate, Sheet and Strip (Amendment 1)
JIS G 5151	(1991) Steel Castings for High Temperature and High Pressure Service

JIS G 5501	(2020) Grey Iron Castings
JIS H 3100	(2018) Copper and Copper Alloy Sheets, Plates and Strips
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 3401	(2001) Pipe Fittings of Copper and Copper Alloys
JIS K 7311	(1995) Testing Methods for Thermoplastic Polyurethane Elastomers
JIS HB 40-1	(2019) Ferrous Materials & Metallurgy I
JIS HB 40-2	(2019) Ferrous Materials & Metallurgy II

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 834-1	(1999) Fire-Resistance Tests-Elements of Building Construction-Part 1: General Requirements
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MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM (MLIT)

MLIT-M	(2019) Public Building Construction Standard Specification
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1.2 GENERAL REQUIREMENTS

- [Section 23 30 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section]
- [Section 40 17 30.00 40 WELDING GENERAL PIPING applies to work specified in this section.
-] Submit Material, Equipment, and Fixture Lists for pipes, valves and specialties including manufacturer's style or catalog numbers, specification and drawing reference numbers, and warranty information.

Submit Record Drawings for pipes, valves and accessories providing current factual information including deviations and amendments to the drawings, and concealed and visible changes in the work.

Submit Coordination Drawings for pipes, valves and specialties showing coordination of work between different trades and with the structural and architectural elements of work. Detail all drawings sufficiently to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Indicate on drawings where conflicts or clearance problems exist between various trades.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion

in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists[G]

SD-02 Shop Drawings

Record Drawings[; G[, [____]]]

Coordination Drawings[G]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[]

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Provide standard products in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use includes applications of equipment and materials under similar circumstances and of similar size. Ensure the product has been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record are acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

Ensure the equipment items are supported by service organizations located in Japan. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. Select service organizations that are reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 Manufacturer's Nameplate

Provide a nameplate on each item of equipment bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been

substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions are considered mandatory, the word "should" is interpreted as "shall." Reference to the "code official" is interpreted to mean the "Contracting Officer." For Navy owned property, interpret references to the "owner" to mean the "Contracting Officer." For leased facilities, references to the "owner" is interpreted to mean the "lessor." References to the "permit holder" are interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, are applied as appropriate by the Contracting Officer and as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Provide instructors thoroughly familiar with all parts of the installation and trained in operating theory as well as practical operation and maintenance work.

Give instruction during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished is as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.7 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation,

maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 ELECTRICAL HEAT TRACING

Provide heat trace systems for pipes, valves, and fittings. System include all necessary components, including heaters and controls to prevent freezing.

Provide self-regulating heaters consisting of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature along its length. Ensure heater is able to be crossed over itself without overheating. Obtain approval before used directly on plastic pipe. Cover heater with a radiation cross-linked modified polyolefin dielectric jacket in accordance with JIS C 3605.

Provide heater with self-regulating factor of at least [90] percent, in order to provide energy conservation and to prevent overheating.

Operate heater on line voltages of [120] [208] volts without the use of transformers.

Size Heater according to the following table:

Pipe Size (DN)

(Millimeter Diameter)	Minus 23 degrees C	Minus 29 degrees C
80 or less	16 watts per meter (wpm)	16 watts per meter (wpm)
100	16 wpm	26 wpm
150	26 wpm	26 wpm
200	2 strips/16 wpm	2 strips/26 wpm
300 to 356	2 strips/26 wpm	2 strips/26 wpm

Control systems by an ambient sensing thermostat set at 4 degrees C either directly or through an appropriate contactor.

2.2 PIPE AND FITTINGS

Submit equipment and performance data for pipe and fittings consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis. Submit design analysis and calculations consisting of surface resistance, rates of flow, head losses, inlet and outlet design, required radius of bend, and pressure calculations. Also include in data pipe size, shape, and dimensions, as well as temperature ratings, vibration and thrust limitations minimum burst pressures, shut-off and non-shock pressures and weld characteristics.

2.2.1 Type BCS, Black Carbon Steel

Ensure pipe DN6 through DN300 is Schedule 40 black carbon steel, conforming to JIS G 3454.

Ensure pipe DN6 through DN250 is Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to JIS G 3454.

Ensure pipe DN300 through DN610 is 9.52 millimeter wall seamless black carbon steel, conforming to JIS G 3454.

Ensure fittings DN50 and under are 1034 kilopascal working steam pressure (wsp) banded black malleable iron screwed, conforming to JIS G 3454 and JIS B 2301.

Ensure unions DN50 and under are 1724 kilopascal female, screwed, black malleable iron with brass-to-iron seat, and ground joint, conforming to JIS B 2301.

Ensure fittings DN65 and over are Steel butt weld, conforming to JIS B 2312 to match pipe wall thickness.

Ensure flanges DN65 and over are 1034 kilopascal forged-steel conforming to JIS B 2220, welding neck to match pipe wall thickness.

2.2.2 Type BCS-125, 862 kilopascal Service

Ensure pipe DN6 through DN40 is Schedule 40 steam, Schedule 80 condensate, furnace butt weld, black carbon steel, conforming to JIS G 3456.

Ensure pipe DN50 through DN250 is Schedule 40 steam, Schedule 80 condensate, seamless or electric-resistance welded black carbon steel, conforming to [Grade B (electric-resistance welded)] or [Type S (seamless)] and JIS G 3456.

Ensure pipe DN300 through DN610 is 9.52 millimeter wall, [seamless] or [electric-resistance] welded black carbon steel, conforming to JIS G 3454.

Ensure fittings DN50 and under are 862 kilopascal wsp, cast iron, screwed end, conforming to JIS G 5501 and JIS G 3454 and JIS B 2301.

Ensure fittings DN50 and under are 1034 kilopascal wsp banded black malleable iron screwed, conforming to JIS G 3455 and JIS B 2301.

Ensure fittings DN25 through DN50 are 14 or 21 megapascal water, oil, or gas (wog) to match pipe wall, forged carbon steel socket weld, conforming to JIS G 3455 and JIS B 2301.

Ensure fittings DN50 and under are 862 kilopascal wsp, cast iron, screwed end, conforming to JIS G 3454 and JIS B 2301.

Ensure fittings DN65 and over are wall thickness to match pipe, long radius butt weld, black carbon steel, conforming to JIS G 4051 and JIS B 2311.

Ensure couplings DN50 and under are commercial standard weight for Schedule 40 pipe and commercial extra heavy weight for Schedule 80 pipe, black carbon steel where threaded, and 14 or 21 megapascal wog forged carbon steel, conforming to JIS G 3455 and JIS B 2301, where welded.

Ensure flanges DN65 and over are 1035 kilopascal, forged carbon-steel welding neck, with raised face or flat face and concentric serrated finish, conforming to JIS G 3455 and JIS B 2301.

Conform grooved pipe couplings and fittings in accordance with paragraph GROOVED PIPE COUPLINGS AND FITTINGS.

2.2.3 Type CPR, Copper

2.2.3.1 Type CPR-A, Copper Above Ground

Ensure tubing DN50 and under is seamless copper tubing, conforming to JIS H 3300, Type L (hard-drawn for all horizontal and all exposed vertical lines, annealed for concealed vertical lines).

Ensure fittings DN50 and under are 1034 kilopascal wsp wrought-copper solder joint fittings conforming to JIS H 3401.

Ensure unions DN50 and under are 1034 kilopascal wsp wrought-copper solder joint, conforming to JIS H 3401.

2.3 PIPING SPECIALTIES

Submit equipment and performance data for piping specialties consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis. Submit design analysis and calculations consisting of surface resistance, rates of flow, head losses, inlet and outlet design, required radius of bend, and pressure calculations. Also include in data pipe size, shape, and dimensions, as well as temperature ratings, vibration and thrust limitations minimum burst pressures, shut-off and non-shock pressures and weld characteristics.

2.3.1 Air Separator

Air separated from converter discharge water is ejected by a reduced-velocity device vented to the compression tank.

Provide a commercially constructed separator, designed and certified to separate not less than 80 percent of entrained air on the first passage of water and not less than 80 percent of residual on each successive pass. Provide shop drawings detailing all piping connections proposed for this work.

Ensure the air separator is carbon steel, designed, fabricated, tested, and stamped in conformance with JIS B 8267 for service pressures not less than 862 kilopascal.

2.3.2 Air Vents

Provide manual air vents using 10 millimeter globe valves.

Provide automatic air vents on pumps, mains, and where indicated using ball-float construction. Ensure the vent inlet is not less than DN20 and the outlet not less than 8 millimeter. Orifice size is 3 millimeter. Provide corrosion-resistant steel trim conforming to [JIS G 4303] JIS G 4305. Fit vent with try-cock. Ensure vent discharges air at any pressure up to 1034 kilopascal . Ensure outlet is copper tube routed.

2.3.3 Dielectric Connections

Electrically insulate dissimilar pipe metals from each other by couplings, unions, or flanges commercially manufactured for that purpose and rated for the service pressure and temperature.

2.3.4 Expansion Vibration Isolation Joints

Construct single or multiple arch-flanged expansion vibration isolation joints of steel-ring reinforced chloroprene-impregnated cloth materials. Design joint to absorb the movement of the pipe sections in which installed with no detrimental effect on the pipe or connected equipment. Back flanges with ferrous-metal backing rings. Provide control rod assemblies to restrict joint movement. Coat all nonmetallic exterior surfaces of the joint with chlorosulphinated polyethylene. Provide grommets in limit bolt hole to absorb noise transmitted through the bolts.

Ensure joints are suitable for continuous-duty working temperature of at least 121 degrees C.

Fill arches with soft chloroprene.

Ensure joint, single-arch, movement limitations and size-related, pressure characteristics conform to MLIT-M.

2.3.5 Flexible Pipe

Construct flexible pipe vibration and pipe-noise eliminators of wire-reinforced, rubber-impregnated cloth and cord materials and be flanged. Back the flanges with ferrous-metal backing rings. Ensure service pressure-rating is a minimum 1.5 times actual service, with surge pressure at 82 degrees C.

Construct flexible pipe vibration and pipe noise eliminators of wire-reinforced chloroprene-impregnated cloth and cord materials. Ensure the pipe is flanged. Provide all flanges backed with ferrous-metal backing rings. Coat nonmetallic exterior surfaces of the flexible pipe with an acid- and oxidation-resistant chlorosulphinated polyethylene. Rate the flexible pipe for continuous duty at 896 kilopascal and 121 degrees C.

Ensure unit pipe lengths, face-to-face, are not less than the following:

<u>INSIDE DIAMETER (DN)</u>	<u>UNIT PIPE LENGTH</u>
To 65, inclusive	305 millimeter
80 to 100, inclusive	450 millimeter
125 to 300, inclusive	600 millimeter
To 80, inclusive	450 millimeter
110 to 250, inclusive	600 millimeter
300 and larger	914 millimeter

2.3.6 Flexible Metallic Pipe

Ensure flexible pipe is the bellows-type with wire braid cover and designed, constructed, and rated in accordance with the applicable requirements of MLIT-M.

Minimum working pressure rating is [345] [690] kilopascal at 149 degrees C.

Ensure minimum burst pressure is four times working pressure at 149 degrees C. Bellows material is JIS G 3459 corrosion-resistant steel. Ensure braid is JIS G 4053 corrosion-resistant steel wire.

Ensure welded end connections are Schedule 80 carbon steel pipe, conforming to JIS G 3456.

Provide threaded end connections; hex-collared Schedule 40, JIS G 3459 corrosion-resistant steel, conforming to JIS G 3459.

Ensure flanged end connection rating and materials conform to specifications for system primary-pressure rating.

2.3.7 Flexible Metal Steam Hose

Provide a bellows type hose with wire braid cover and designed, constructed, and rated in accordance with the applicable requirements of MLIT-M.

Ensure the working steam pressure rating is 862 kilopascal at 260 degrees C

Ensure minimum burst pressure is nine times working steam pressure at 149 degrees C.

Ensure bellows material is JIS G 3459 corrosion-resistant steel. Braid is JIS G 4053 corrosion-resistant steel wire.

Provide welded end connections; Schedule 80 carbon steel pressure tube, conforming to JIS G 3456.

Provide threaded end connections; hex-collared Schedule 40, JIS G 3459 corrosion-resistant steel, conforming to JIS G 3459.

Ensure flanged end connection rating and materials conform to specifications for system primary-pressure rating.

2.3.8 Metallic Expansion Joints

Provide metallic-bellows expansion joints conforming to MLIT-M.

2.3.9 Hose Faucets

Construct hose faucets with 15 millimeter male inlet threads, hexagon shoulder, and 20 millimeter hose connection, conforming to MLIT-M. Ensure hose-coupling screw threads conform to JIS B 0209-1.

Provide vandal proof, atmospheric-type vacuum breaker on the discharge of all potable water lines.

2.3.10 Pressure Gages

Ensure pressure gages conform to JIS B 7505-1 and to requirements specified herein. Pressure-gage size is 90 millimeter nominal diameter. Ensure case is corrosion-resistant steel, conforming to any of JIS G 4053 series of JIS G 3138. Equip gages with adjustable red marking pointer and damper-screw adjustment in inlet connection. Align service-pressure reading at midpoint of gage range.

Fit steam gages with black steel syphons and steam service pressure-rated gage cocks or valves.

2.3.11 Sight-Flow Indicators

Construct sight-flow indicators for pressure service on 80 millimeter and smaller of bronze with specially treated single- or double-glass sight windows and have a bronze, nylon, or tetrafluoroethylene rotating flow indicator mounted on SUS 304, or SUS 316 corrosion-resistant steel shaft. Body may have screwed or flanged end. Provide pressure- and temperature-rated assembly for the applied service. Flapper flow-type indicators are not acceptable.

2.3.12 Sleeve Couplings

Sleeve couplings for plain-end pipe consist of one steel middle ring, two steel followers, two chloroprene or Buna-N elastomer gaskets, and the necessary steel bolts and nuts.

2.3.13 Thermometers

Ensure thermometers conform to JIS B 7410, except for being filled with a red organic liquid. Provide an industrial pattern armored glass thermometer, (well-threaded and seal-welded). Ensure thermometers installed 1800 millimeter or higher above the floor have an adjustable angle body. Ensure scale is not less than 180 millimeter long and the case face is manufactured from manufacturer's standard polished aluminum JIS G 4053 series polished corrosion-resistant steel. Provide thermometers with nonferrous separable wells. Provide lagging extension to accommodate insulation thickness.

2.3.14 Pump Suction Strainers

Provide a cast iron strainer body, rated for not less than 172 kilopascal at 38 degrees C, with flanges conforming to JIS B 2239. Strainer construction is such that there is a machined surface joint between body and basket that is normal to the centerline of the basket.

Ensure minimum ratio of open area of each basket to pipe area is 3 to 1. Provide a basket with JIS G 4053 series corrosion-resistant steel wire mesh with perforated backing.

Ensure mesh is capable of retaining all particles larger than 1,000 micrometer, with a pressure drop across the strainer body of not more than 5 kilopascal when the basket is two-thirds dirty at maximum system flow rate. Provide reducing fittings from strainer-flange size to pipe size.

Provide a [differential-pressure gage] fitted with a two-way brass cock across the strainer.

Provide manual air vent cocks in cap of each strainer.

2.3.15 Line Strainers, Water Service

Install Y-type strainers with removable basket. Ensure strainers in sizes DN50 and smaller have screwed ends; in sizes DN65 and larger, strainers have flanged ends. Ensure body working-pressure rating exceeds maximum service pressure of installed system by at least 50 percent. Ensure body has cast-in arrows to indicate direction of flow. Ensure all strainer bodies fitted with screwed screen retainers have straight threads and gasketed with nonferrous metal. For strainer bodies DN65 and larger, fitted with bolted-on screen retainers, provide offset blowdown holes. Fit all strainers larger than DN65 with manufacturer's standard ball-type blowdown valve. Ensure body material is [cast bronze conforming to MLIT-M] [cast iron conforming to Class 30]. Where system material is nonferrous, use nonferrous metal for the metal strainer body material.

Ensure minimum free-hole area of strainer element is equal to not less than 3.4 times the internal area of connecting piping. Strainer screens perforation size is not to exceed 1.14 millimeter. Ensure strainer screens have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material is [SUS 304, or SUS 316 corrosion-resistant steel] [Monel metal].

2.3.16 Line Strainers, Steam Service

Install Type Y strainers with removable strainer element.

Use flanged body end connections for all valves larger than DN50, unless butt weld ends are specified. Use [screwed] [socket] weld for sizes DN50 and under to suit specified piping system end connection and maintenance requirements [or be welded].

For strainers located in tunnels, trenches, manholes, and valve pits, use welded end connections.

Body working steam pressure rating is the same as the primary valve rating for system in which strainer is installed, except where welded end materials requirements result in higher pressure ratings. Ensure body has integral cast or forged arrows to indicate direction of flow. Provide strainer bodies with blowdown valves that have discharge end plugged with a solid metal plug. Make closure assembly with tetrafluoroethylene tape. Ensure bodies fitted with bolted-on screen retainers have offset blowdown holes.

Body materials are [cast steel conforming to JIS G 5151, Grade WCB] [forged carbon steel conforming to JIS G 3202 or JIS G 3201] [manufacturer's standard metallurgical equivalents for service pressures of 1035 kilopascal wsp and greater, and for lower pressure ratings where welding is required] [cast iron conforming to JIS B 2031, Class B, for service pressures 862 kilopascal wsp and less].

Ensure minimum free-hole area of strainer element is equal to not less than 3.4 times the internal area of connecting piping. Strainer screens perforation size is not to exceed 0.51 millimeter or equivalent wire mesh. Strainer screens have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material is SUS 304, or SUS 316 corrosion-resistant steel and fitted with backup screens where necessary to prevent collapse.

2.4 VALVES

Submit equipment and performance data for valves consisting of corrosion resistance and life expectancy. Submit design analysis and calculations consisting of rates of flow, head losses, inlet and outlet design, and pressure calculations. Also include in data, pipe dimensions, as well as temperature ratings, vibration and thrust limitations, minimum burst pressures, shut-off and non-shock pressures and weld characteristics.

2.4.1 Ball and Butterfly Valves

Ensure ball valves conform to JIS B 2061. For valve bodies in sizes DN50 and smaller, use screwed-end connection-type constructed of copper alloy. For valve bodies in sizes DN50 DN65 and larger, use flanged-end connection type, constructed of material. Balls and stems of valves DN50 and smaller are manufacturer's standard with hard chrome plating finish. Balls and stems of valves DN65 and larger are manufacturer's standard corrosion-resistant steel alloy with hard chrome plating. Balls of valves DN150 and larger may be Brinell hard chrome plating. Ensure valves are suitable for flow from either direction and seal equally tight in either direction. Valves with ball seals held in place by spring washers are not acceptable. Ensure all valves have adjustable packing glands. Seats and seals are fabricated from tetrafluoroethylene.

Ensure butterfly valves conform to JIS B 2032 and are the wafer type for mounting between specified flanges. Ensure valves are rated for 1034 kilopascal shutoff and nonshock working pressure. Select bodies of cast ferrous metal conforming to JIS B 2239 for body wall thickness. Seats and seals are fabricated from resilient elastomer designed for field removal and replacement.

2.4.2 Drain, Vent, and Gage Cocks

Provide [T-head] [lever handle] drain, vent, and gage cocks, ground key type, with washer and screw, constructed of polished JIS B 2240 and rated 862 kilopascal wsp. Ensure end connections are rated for specified service pressure.

Ensure pump vent cocks, and where spray control is required, constructed of manufacturer's standard polished brass. Ensure cocks are 15 millimeter male, end threaded, and rated at not less than 862 kilopascal at 107 degrees C.

2.4.3 Gate Valves (GAV)

Ensure gate valves DN50 and smaller conform to JIS B 2011. For valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated use union-ring bonnet, screwed-end type. Make packing of non-asbestos type materials. Use rising stem type valves.

Ensure gate valves DN65 and larger, are Type I, (solid wedge disc, tapered seats, steam rated); Class 125 (862 kilopascal steam-working pressure at 178 degrees C saturation); and 1379 kilopascal, wog (nonshock), conforming to JIS B 2031 and to requirements specified herein. Select flanged valves, with bronze trim and outside screw and yoke (OS&Y) construction. Make packing of non-asbestos type materials.

2.4.4 Globe and Angle Valves (GLV-ANV)

Ensure globe and angle valves DN50 and smaller, are 862 kilopascal conforming to JIS B 2011 and to requirements specified herein. For valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated, use union-ring bonnet, screwed-end type. Ensure disc is free to swivel on the stem in all valve sizes. Composition seating-surface disc construction may be substituted for all metal-disc construction. Make packing of non-asbestos type materials. Ensure disk and packing are suitable for pipe service installed.

Ensure globe and angle valves, DN65 and larger, are cast iron with bronze trim. Ensure valve bodies are cast iron conforming to JIS B 2011. Select flanged valves in conformance with JIS B 2239. Valve construction is outside screw and yoke (OS&Y) type. Make packing of non-asbestos type materials.

2.4.5 Standard Check Valves (SCV)

Ensure standard check valves in sizes DN50 and smaller are 862 kilopascal swing check valves except as otherwise specified. Provide lift checks where indicated. Ensure swing-check pins are nonferrous and suitably hard for the service. Select composition type discs. Ensure the swing-check angle of closure is manufacturer's standard unless a specific angle is needed.

Use cast iron, bronze trim, swing type check valves in sizes DN65 and larger. Ensure valve bodies are cast iron, conforming to JIS B 2031 and valve ends are flanged in conformance with JIS B 2239. Swing-check pin is approved equal corrosion-resistant steel. Angle of closure is manufacturer's standard unless a specific angle is needed. Ensure valves have bolted and gasketed covers.

2.4.6 Nonslam Check Valves (NSV)

Provide check valves at pump discharges in sizes DN50 and larger with nonslam or silent-check operation conforming to JIS B 2031. Select a valve disc or plate that closes before line flow can reverse to eliminate slam and water-hammer due to check-valve closure. Ensure valve is Class 125 rated for 1379 kilopascal maximum, nonshock pressure at 66 degrees C in sizes to DN300. Use valves that are [wafer type to fit between flanges conforming to JIS B 2239]. Valve body may be cast iron, or equivalent strength ductile iron. Select disks using manufacturer's standard bronze, aluminum bronze, or corrosion-resistant steel. Ensure pins, springs, and miscellaneous trim are manufacturer's standard corrosion-resistant steel.

2.5 MISCELLANEOUS MATERIALS

Submit equipment and performance data for miscellaneous materials consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

2.5.1 Bituminous Coating

Ensure the bituminous coating is a solvent cutback, heavy-bodied material to produce not less than a 0.30 millimeter dry-film thickness in one coat, and is recommended by the manufacturer to be compatible with factory-applied coating and rubber joints.

For previously coal-tar coated and uncoated ferrous surfaces underground, use bituminous coating solvent cutback coal-tar type.

2.5.2 Bolting

Ensure flange and general purpose bolting is hex-head and conforms to JIS G 4107, above (bolts, for flanged joints in piping systems where one or both flanges are cast iron). Heavy hex-nuts conform to JIS B 1181. Square-head bolts and nuts are not acceptable. Ensure threads are coarse-thread series.

2.5.3 Elastomer Caulk

Use two-component polysulfide- or polyurethane-base elastomer caulking material, conforming to JIS K 7311.

2.5.4 Escutcheons

Manufacture escutcheons from nonferrous metals and chrome-plated except when JIS G 4053 series corrosion-resistant steel is provided. Ensure metals and finish conforms to Japanese standard.

Use one-piece escutcheons where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. Ensure all escutcheons have provisions consisting of internal spring-tension devices or setscrews for maintaining a fixed position against a surface.

2.5.5 Flashing

Ensure sheetlead conforms to Japanese standard

Ensure sheet copper conforms to JIS H 3100 and be not less than 4.88 kilogram per square meter weight.

2.5.6 Flange Gaskets

Provide compressed non-asbestos sheets, conforming to JIS F 0602, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated to 399 degrees C.

2.5.7 Grout

Provide shrink-resistant grout as a premixed and packaged metallic-aggregate, mortar-grouting compound conforming to JIS A 0203.

Ensure shrink-resistant grout is a combination of pre-measured and packaged epoxy polyamide or amine resins and selected aggregate mortar grouting compound conforming to the following requirements:

Tensile strength		13.100 Megapascal, minimum
Compressive strength	96.527 Megapascal, minimum JIS A 1108	
Shrinkage, linear		0.003 mm per millimeter, maximum
Water absorption	0.1 percent, maximum JIS A 1110	
Bond strength to		6.895 Megapascal, minimum steel in shear minimum

2.5.8 Pipe Thread Compounds

Use polytetrafluoroethylene tape not less than 0.05 to 0.08 millimeter thick in potable and process water and in chemical systems for pipe sizes to and including DN25. Use polytetrafluoroethylene dispersions and other suitable compounds for all other applications upon approval by the Contracting Officer; however, do not use lead-containing compounds in potable water systems.

2.6 SUPPORTING ELEMENTS

Submit equipment and performance data for the supporting elements consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

Provide all necessary piping systems and equipment supporting elements, including but not limited to: building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. Ensure supporting elements are suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being supported.

Ensure supporting elements conform to requirements of MLIT-M, except as noted.

Ensure attachments welded to pipe are made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.

Ensure supporting elements exposed to weather are hot-dip galvanized or stainless steel. Select materials of such a nature that their apparent and latent-strength characteristics are not reduced due to galvanizing process. Electroplate supporting elements in contact with copper tubing with copper.

Ensure masonry anchor group-, type-, and style-combination designations are in accordance with JIS A 5758 and JIS B 1112. Provide support elements, except for supplementary steel, that are cataloged, load rated, commercially manufactured products.

2.6.1 Building Structure Attachments

2.6.1.1 Anchor Devices, Concrete and Masonry

Ensure anchor devices conform to JIS A 5758 and JIS B 1220.

For cast-in, floor mounted, equipment anchor devices, provide adjustable positions.

2.6.1.2 Beam Clamps

Ensure beam clamps are center-loading conforming to MLIT-M.

When it is not possible to use center-loading beam clamps,

eccentric-loading beam clamps, conforming to MLIT-M may be used for piping sizes DN50 and less and for piping sizes DN50 through DN250 provided two counterbalancing clamps are used per point of pipe support. Where more than one rod is used per point of pipe support, determine rod diameter in accordance with referenced standards.

2.6.1.3 C-Clamps

Do not use C-clamps.

2.6.1.4 Inserts, Concrete

Use concrete conforming to MLIT-M inserts. When applied to piping in sizes DN50 and larger and where otherwise required by imposed loads, insert and wire a 305 millimeter length of 13 millimeter reinforcing rod through wing slots. Submit proprietary-type continuous inserts for approval.

2.6.2 Horizontal Pipe Attachments

2.6.2.1 Single Pipes

Support piping in sizes to and including DN50 by conforming to MLIT-M solid malleable iron pipe rings, except that, use split-band-type rings in sizes up to DN25.

Support piping in sizes through DN200 inclusive by conforming to MLIT-M.

Use MLIT-M assemblies on vapor-sealed insulated piping and have an inside diameter larger than pipe being supported to provide adequate clearance during pipe movement.

Where thermal movement of a point in a piping system DN100 and larger would cause a hanger rod to deflect more than 4 degrees from the vertical or where a horizontal point movement exceeds 13 millimeter, use conforming to MLIT-M.

Support piping in sizes larger than DN200 with conforming to MLIT-M.

Use conforming to MLIT-M shields on all insulated piping. Ensure area of the supporting surface is such that compression deformation of insulated surfaces does not occur. Roll away longitudinal and transverse shield edges from the insulation.

Provide insulated piping without vapor barrier on roll supports with conforming to MLIT-M saddles.

Provide spring supports as indicated.

2.6.2.2 Parallel Pipes

Use trapeze hangers fabricated from structural steel shapes, with U-bolts, in congested areas and where multiple pipe runs occur. Ensure structural steel shapes [conform to supplementary steel requirements] [be of commercially available, proprietary design, rolled steel].

2.6.3 Vertical Pipe Attachments

Ensure vertical pipe attachments are conforming to MLIT-M.

Include complete fabrication and attachment details of any spring supports in shop drawings.

2.6.4 Hanger Rods and Fixtures

Use only circular cross section rod hangers to connect building structure attachments to pipe support devices. Use pipe, straps, or bars of equivalent strength for hangers only where approved by the Contracting Officer.

Provide turnbuckles, swing eyes, and clevises as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.

2.6.5 Supplementary Steel

Where it is necessary to frame structural members between existing members or where structural members are used in lieu of commercially rated supports, design and fabricate such supplementary steel in accordance with MLIT-M.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Submit certificates for pipes, valves and specialties showing conformance with test requirements as contained in the reference standards contained in this section. Provide certificates verifying Surface Resistance, Shear and Tensile Strengths, Temperature Ratings, Bending Tests, Flattening Tests and Transverse Guided Weld Bend Tests.

Fabricate and install piping systems in accordance with JIS HB 40-1 and JIS HB 40-2.

Ensure connections between steel piping and copper piping are electrically isolated from each other with [dielectric couplings (or unions)] [flanged with gaskets] rated for the service.

Make final connections to equipment with [unions] [flanges] provided every 30480 millimeter of straight run. Provide unions in the line downstream of screwed- and welded-end valves.

Ream all pipe ends before joint connections are made.

Make screwed joints with specified joint compound with not more than three threads showing after joint is made up.

Apply joint compounds to the male thread only and exercise care to prevent compound from reaching the unthreaded interior of the pipe.

Provide screwed unions, welded unions, or bolted flanges wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.

Securely support piping systems with due allowance for thrust forces, thermal expansion and contraction. Do not subject the system to mechanical, chemical, vibrational or other damage as specified in MLIT-M.

Ensure field welded joints conform to the requirements of the JIS HB 40-1

and JIS HB 40-2 and JIS B 8285.

[Accomplish preheat and postheat treatment of welds in accordance with JIS B 8285.

] [Take all necessary precautions during installation of flexible pipe and hose including flushing and purging with water, steam, and compressed air to preclude bellows failure due to pipe line debris lodged in bellows. Ensure installation conforms to manufacturer's instructions.

] 3.2 VALVES

Provide valves in piping mains and all branches and at equipment where indicated and as specified.

Provide valves to permit isolation of branch piping and each equipment item from the balance of the system.

Provide riser and downcomer drains above piping shutoff valves in piping DN65 and larger. Tap and fit shutoff valve body with a DN15 plugged globe valve.

Provide valves unavoidably located in furred or other normally inaccessible places with access panels adequately sized for the location and located so that concealed items may be serviced, maintained, or replaced.

3.3 SUPPORTING ELEMENTS INSTALLATION

Provide supporting elements in accordance with the referenced codes and standards.

Support piping from building structure. Do not support piping from roof deck or from other pipe.

Run piping parallel with the lines of the building. Space and install piping and components so that a threaded pipe fitting may be removed between adjacent pipes and so that there is no less than DN15 of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Arrange hangars on different adjacent service lines running parallel with each other in line with each other and parallel to the lines of the building.

Install piping support elements at intervals specified hereinafter, at locations not more than 900 millimeter from the ends of each runout, and not over 300 millimeter from each change in direction of piping.

Base load rating for all pipe-hanger supports on insulated weight of lines filled with water and forces imposed. Deflection per span is not exceed slope gradient of pipe. Ensure supports are in accordance with the following minimum rod size and maximum allowable hanger spacing for specified pipe. For concentrated loads such as valves, reduce the allowable span proportionately:

<u>PIPE SIZE (DN)</u> <u>MILLIMETER</u>	<u>ROD SIZE</u> <u>MILLIMETER</u>	<u>STEEL PIPE</u> <u>MILLIMETER</u>	<u>COPPER PIPE</u> <u>MILLIMETER</u>
25 and smaller	10	2500	1850

<u>PIPE SIZE (DN)</u> <u>MILLIMETER</u>	<u>ROD SIZE</u> <u>MILLIMETER</u>	<u>STEEL PIPE</u> <u>MILLIMETER</u>	<u>COPPER PIPE</u> <u>MILLIMETER</u>
32 to 40	10	3050	2500
50	10	3050	3050
65 to 90	13	3700	3700
100 to 125	16	5000	4300
150	20	5000	5000
200 to 300	22	6100	6100
356 to 457	25	6100	6100
508 and over	32	6100	6100

Provide vibration isolation supports where needed. Refer to Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT where A/C equipment and piping is installed.

Support vertical risers independently of connected horizontal piping, whenever practicable, with fixed or spring supports at the base and at intervals to accommodate system range of thermal conditions. Ensure risers have guides for lateral stability. For risers subject to expansion, provide only one rigid support at a point approximately one-third down from the top. Place clamps under fittings unless otherwise specified. Support carbon-steel pipe at each floor and at not more than 4572 millimeter intervals for pipe DN50 and smaller and at not more than 6096 millimeter intervals for pipe DN65 and larger.

3.4 PENETRATIONS

Provide effective sound stopping and adequate operating clearance to prevent structure contact where piping penetrates walls, floors, or ceilings into occupied spaces adjacent to equipment rooms; where similar penetrations occur between occupied spaces; and where penetrations occur from pipe chases into occupied spaces. Occupied spaces include space above ceilings where no special acoustic treatment of ceiling is provided. Finish penetrations to be compatible with surface being penetrated.

- [Accomplish sound stopping and vapor-barrier sealing of pipe shafts and large floor and wall openings by packing to high density with properly supported fibrous-glass insulation or, where ambient or surface temperatures do not exceed 49 degrees C, by foaming-in-place with self-extinguishing, 0.9 kilogram density polyurethane foam to a depth not less than 152 millimeter. Finish foam with a rasp. Ensure vapor barrier is not less than 3 millimeter thick vinyl coating applied to visible and accessible surfaces. Where high temperatures and fire stopping are a consideration, use only mineral wool with openings covered by 1.6 millimeter sheet metal.

]3.5 SLEEVES

Provide sleeves where piping passes through roofs, masonry, concrete walls and floors.

Continuously [weld] [brazed] sleeves passing through steel decks to the deck.

Ensure sleeves that extend through floors, roofs, load bearing walls, and fire barriers are continuous and fabricated from Schedule 40 steel pipe, with welded anchor lugs. Form all other sleeves by molded linear polyethylene liners or similar materials that are removable. Ensure diameter of sleeves is large enough to accommodate pipe, insulation, and jacketing without touching the sleeve and provides a minimum 10 millimeter clearance. Install a sleeve size to accommodate mechanical and thermal motion of pipe precluding transmission of vibration to walls and the generation of noise.

Pack the space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration solid with a mineral fiber conforming to JIS A 9504. Provide this packing wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, fill the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration with an elastomer caulk to a depth of 13 millimeter. Ensure all caulked surfaces are oil- and grease-free.

Ensure through-penetration fire stop materials and methods are in accordance with ISO 834-1.

Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

Ensure sleeve height above roof surface is a minimum of 305 and a maximum of 457 millimeter.

3.6 ESCUTCHEONS

Provide escutcheons at all penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, provide escutcheons on both sides of the partition. Where suspended ceilings are installed, provide plates at the underside only of such ceilings. For insulated pipes, select plates large enough to fit around the insulation. Use chrome-plated escutcheons in all occupied spaces and of size sufficient to effectively conceal openings in building construction. Firmly attach escutcheons with setscrews.

3.7 FLASHINGS

[Provide flashings at penetrations of building boundaries by mechanical systems and related work.

]3.8 UNDERGROUND PIPING INSTALLATION

Prior to being lowered into a trench, clean all piping, visually inspected for apparent defects, and tapped with a hammer to audibly detect hidden defects.

Further inspect suspect cast-ferrous piping by painting with kerosene on external surfaces to reveal cracks.

Distinctly mark defective materials found using a road-traffic quality yellow paint; promptly remove defective material from the site.

After conduit has been inspected, and not less than 48 hours prior to being lowered into a trench, coat all external surfaces of cast ferrous conduit with a compatible bituminous coating for protection against brackish ground water. Apply a single coat, in accordance with the manufacturer's instructions, to result in a dry-film thickness of not less than 0.30 millimeter.

Ensure excavations are dry and clear of extraneous materials when pipe is being laid.

Use wheel cutters for cutting of piping or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting is not permitted.

Begin laying of pipe at the low point of a system. When in final acceptance position, ensure it is true to the grades and alignment indicated, with unbroken continuity of invert. Blocking and wedging is not permitted.

[Point bell or grooved ends of piping upstream.]

Make changes in direction with long sweep fittings.

Provide necessary socket clamping, piers, bases, anchors, and thrust blocking. Protect rods, clamps, and bolting with a coating of bitumen.

Support underground piping below supported or suspended slabs from the slab with a minimum of two supports per length of pipe. Protect supports with a coating of bitumen.

On excavations that occur near and below building footings, provide backfilling material consisting of 13800 kilopascal cured compressive-strength concrete poured or pressure-grouted up to the level of the footing.

Properly support vertical downspouts; soil, waste, and vent stacks; water risers; and similar work on approved piers at the base and provided with approved structural supports attached to building construction.

[Provide cleanout, flushing, and observation risers.]

3.9 HEAT TRACE CABLE INSTALLATION

Field apply heater tape and cut to fit as necessary, linearly along the length of pipe after piping has been pressure tested and approved by the Contracting Officer. Secure the heater to piping with [cable ties] [fiberglass tape]. Label thermal insulation on the outside, "Electrical Heat Trace."

Install power connection, end seals, splice kits and tee kit components provide a complete workable system. Terminate connection to the thermostat and ends of the heat tape in a junction box. Ensure cable and conduit connections are raintight.

3.10 DISINFECTION

[Disinfect water piping, including all valves, fittings, and other devices, with a solution of chlorine and water. Ensure the solution contains not less than 50 parts per million (ppm) of available chlorine. Hold solution for a period of not less than 8 hours, after which the solution contains not less than 10 ppm of available chlorine or redisinfect the piping. After successful sterilization, thoroughly flush the piping before placing into service. Flushing is complete when the flush water contains less than 0.5 ppm of available chlorine. Water for disinfected will be furnished by the Government. Approve disposal of contaminated flush water in accordance with written instructions received from the Environmental authority having jurisdiction through the Contracting Officer and all local, State and Federal Regulations.]

[Flush piping with potable water until visible grease, dirt and other contaminants are removed (visual inspection).]

3.11 OPERATION AND MAINTENANCE

Provide Operation and Maintenance Manuals consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures and safety precautions. Submit test data that is clear and readily legible.

3.12 PAINTING OF NEW EQUIPMENT

Factory or shop apply new equipment painting, as specified herein, and provided under each individual section.

3.12.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied withstands 125 hours in a salt-spray fog test, except that equipment located outdoors withstand 500 hours in a salt-spray fog test. Conduct salt-spray fog test is in accordance with Japanese Industry Standards, and for that test the acceptance criteria is as follows: immediately after completion of the test, the inspected paint shows no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shows no signs of rust creepage beyond 3 mm on either side of the scratch mark.

Ensure the film thickness of the factory painting system applied on the equipment is not less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C, design the factory painting system for the temperature service.

3.12.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal, surfaces subject to temperatures in excess of 50 degrees C.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Selected color of finish

coat is aluminum or light gray.

- a. Temperatures Less Than 50 Degrees C: Immediately after cleaning, the metal surfaces subject to temperatures less than 50 degrees C receives one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm, one coat of primer applied to a minimum dry film thickness of 0.0255 mm; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm per coat.
- b. Temperatures Between 50 and 205 Degrees C: Metal surfaces subject to temperatures between 50 and 205 degrees C Receives two coats of 205 degrees C heat-resisting enamel applied to a total minimum thickness of 0.05 mm .
- c. Temperatures Greater Than 205 Degrees C: Metal surfaces subject to temperatures greater than 205 degrees C receives two coats of 315 degrees C heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm.

-- End of Section --