

SECTION G3000MTG

SITE HEATING, VENTILATING, AND AIR CONDITIONING 07/02

1. G3000M GENERAL

This document provides technical guidance to architects and engineers performing mechanical design services for Naval Facilities Engineering Command, Southwest Division. If you have not done work for the government before, you should read this guide carefully prior to beginning work on Southwest Division projects. Military construction requirements often differ from commercial practice and this guide provides a comprehensive listing of the plumbing requirements for military projects. Direct requests for variances and/or suggestions for improvements to this document to Code 03CN.

1.1 SYSTEM DESCRIPTION

- a. Provide an exterior heat distribution steam and condensate return system or high temperature hot water return supply system. The heat distribution system shall include pre-engineered, factory fabricated and pre-insulated piping system, cathodic protection, valve manholes and other appurtenances, complete and ready for operation. The exterior distribution system shall include all piping and components to a point at least 150mm (6 inches) inside the building and valve manhole walls. The piping system shall not use any part of the building or valve manhole structure as an anchor point.
- b. Provide an exterior buried chilled water or/and heating hot water distribution system. The distribution system shall be pre-engineered factory prefabricated and pre-insulated piping system, valve manholes and other appurtenances complete, and ready for operation. The exterior distribution system includes all piping and components up to the first piping connection above ground or within the each building.
- c. Provide natural gas distribution system including piping, fittings, valves, main gas regulator and meter valves box, and other appurtenances. The exterior distribution system includes all piping and components up to approximately 5 feet from the buildings.
- d. The exterior heat distribution system and equipment provided shall be of current production and shall essentially duplicate systems that have been in satisfactory use for at least 5 years, at three locations. The system must have been operated under pressure, temperature and site characteristics that are equal to or more severe than the operating conditions in this specifications and must distributed the same medium. The system shall be supported by service organization that is, in the opinion of the contracting officer, reasonably convenient to the site. Approval by contracting officer is required for products or services of this system.
- e. Phasing of work and provision of temporary equipment or highline will be required to maintain continuous utility service to existing installations during construction as required in the RFP

1.2 SYSTEM REQUIREMENTS

- a. The steam and high temperature hot water supply system, condensate and high temperature hot water return system shall be as specified in the RFP.
- b. The working pressure and temperature of the chilled water and low temperature heating hot water piping system shall be as specified in the RFP.
- c. The natural gas operating pressure shall be as specified in the RFP.

- d. Design of the exterior heat distribution system shall be for site classification Class A-Severe condition.
- e. The [main steam piping and condensate], [high temperature hot water supply and return] piping shall be in separate conduits. Asbestos cement or plastic conduit is not acceptable.
- f. Cathodic protection shall be provided for system with steel protective casings.
- g. Steam traps are to be sized based on the requirement, not by the pipe size.
- h. Provide a 25 mm (1 inch) bypass (warm-up line) around all steam valves 150 mm (6 inches) and larger. Provide a 20 mm (0.75 inch) sample line and gate valve at each condensate receiver and at each manhole.
- i. Provide thrust blocks, markers, warning and identification tape, and other accessories as required.

1.3 CRITERIA

Site HVAC system design and installation shall comply with the latest edition of the following:

- a. The International Mechanical Code
- b. Applicable ASME code and Standards
- c. Military Handbook MIL-HDBK-1003/8A, "Exterior Distribution of Steam, High Temperature Water, Chilled Water, Natural Gas and Compressed Air."
- d. National Association of Corrosion Engineers (NACE)

Naval Facilities Engineering Command has officially adopted the International Mechanical Code (IPC) as the codes to be used for Naval facilities. These documents are available from International Conference of Building Officials (ICBO). They may be reached via telephone at 800-284-4406. or the Internet homepage at

<http://www.icbo.org>

MIL-HDBKS referenced in this document can be found on NAVFAC's Internet homepage at

http://www.efdlant.navfac.navy.mil/lantops_15/publications.htm

ACOE TI referenced in this document can be found on Army Corps of Engineers Internet homepage at

<http://www.hnd.usace.army.mil/techinfo/ti.htm>

Other applicable guidance and criteria. For further guidance and sources of criteria refer to the latest revision of:

- a. "Guide For Architect-Engineer Firms, Southwest Division, Naval Facilities Engineering Command."
- b. Parametric Cost Estimate (PCE) or EFD 1391 Package

Southwest Division documents and guidance can be found on the SWDIV Internet homepage at

<http://www.efdsww.navfac.navy.mil/CapitalImprovements/BusinessLineServices.htm>

1.4 COMPLIANCE VERIFICATION

Compliance with the requirements for the site HVAC system will be determined by a review of the design and construction submittals and by field inspection. See Document 00911, "Project Kickoff And Design Completion", for submittal requirements. See Section 01330, Submittal Procedures, for Submittal Descriptions (SD-xx) and requirements.

Verification of satisfactory system performance shall be via Performance Verification Testing, as detailed in this section.

1.4 DESIGN SUBMITTALS

Design Analyses, Drawings and Specifications Submittal requirements shall be as described in the RFP for each individual project. See Section 00911 – "Design Requirements".

1.6 CONSTRUCTION SUBMITTALS

Construction Submittal requirements shall be as described in the RFP for each individual project. See Section 01330 – "Submittal Procedures".

1.7 CATHODIC PROTECTION.

- a. Check with the Activity for the type of cathodic protection to be used. Cathodic protection system shall be anode header wire system using No. 6 high molecular weight polyethylene header wire (HMWPE). Anodes shall not be connected directly to the pipe.
- b. Test stations shall be post mounted and placed at the manhole or nearby building. Test stations shall be located at each end of each cathodically protected section.
- c. Do not use dielectric unions. Only flanges are acceptable for dielectric isolation.
- d. System shall be designed by a National Association of Corrosion Engineers (NACE) certified Cathodic Protection Specialist.

1.8 EXTERIOR DISTRIBUTION SYSTEM INSTALLATION, INSPECTION AND TESTING

Materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, testing, and repair of the site steam and condensate, high temperature hot water, chilled water and heating hot water distribution system shall be in accordance with the approved manufacturer procedure. Backfill and overall installation shall meet the requirements of the piping system manufacturer.

Provide factory-trained field technical assistance for material unloading, field joint installation instruction, piping installation and testing if required in the RFP. Manufacturer representative shall inspect the system before backfill and provide written approval and certification of the installation.

G3040 HEATING DISTRIBUTION

Pre-engineered and factory fabricated piping system including all required component such as carrier pipes, and fittings, insulation, protective casing, anchors, guides, pipe supports, expansion loops and bends, and cathodic protection for the system supplied.

G3041 STEAM SUPPLY

CARRIER PIPE

Steam and high temperature hot water supply piping shall be steel, seamless ASTM A 53/ A 53M, Grade B, or ASTM A 106, Grade B or electric-resistance welded, ASTM A 53/A 53M, Grade B.

Provide Weight Class STD (Standard) for welding end connections. Provide Weight Class XS (Extra Strong) for threaded end connections. All underground piping shall be welded. Joint will not be allowed in factory fabricated straight section of the carrier pipe. Factory fabricated piping sections as part of the expansion loop or bend shall all be welded joints 100% radiographically inspected in accordance with ASME B31.1.

CASING

Casing shall be smooth-wall steel, electric resistance spiral welded conforming to ASTM A 134, ASTM A 135, or ASTM A 139 with minimum wall thickness of 0.250 inch (6 mm).

INSULATION

Minimum insulation thickness shall be in accordance with the following tables in which the insulations listed have passed the 96 hour boiling water test:

TABLE -1 MINIMUM PIPE INSULATION THICKNESS (inches)

For Steam (16 to 408 psig) and High Temperature Hot Water Supply and Return (250 to 450 degrees F)

Nominal Pipe Diameter (inches)	INSULATIONS For Drainable/Dryable Systems			INSULATIONS For other Pre-Engineered Systems	
	Paroc	Epitherm Delta	Kaylo-10 Thermo-12 Super Caltemp	Calcium Silicate	WSL Polyurethane
1.0	2.0	2.5	4.0	N/A	N/A
1.5	2.0	2.5	4.0	N/A	N/A
2.0	2.5	3.5	4.5	N/A	N/A
2.5	2.5	3.5	4.5	N/A	N/A
3.0	3.0	4.0	5.0	1.0	1.23
4.0	3.0	4.0	5.0	1.0	1.22
5.0	3.0	4.0	5.0	N/A	N/A
6.0	3.5	4.5	5.5	1.5	1.34
8.0	3.5	4.5	5.5	2.0	1.21
10.0	4.0	5.0	6.0	2.5	1.31
12.0	4.0	5.0	6.0	2.0	1.29
14.0	4.0	5.0	6.0	N/A	N/A
16.0	4.0	5.0	6.0	N/A	N/A
18.0	4.0	5.0	6.0	N/A	N/A

G3042 CONDENSATE RETURN

CARRIER PIPE

Condensate and high temperature hot water return piping shall be steel, ASTM A 53/A 53M Grade B, or ASTM A 106 Grade B, Schedule 80 or electric-resistance welded, ASTM A 53/A 53M, Grade B Schedule 80, Joint will not be allowed in factory fabricated straight section of the carrier pipe. Factory fabricated piping sections as part of the expansion loop or bend shall all be welded joints 100% radiographically inspected in accordance with ASME B31.1.

CASING

Casing shall be smooth-wall steel, electric resistance spiral welded conforming to ASTM A 134, ASTM A 135, or ASTM A 139 with minimum wall thickness of 0.250 inch (6 mm).

INSULATION

Minimum insulation thickness shall be in accordance with the following tables in which the insulations listed have passed the 96 hour boiling water test:

TABLE -2 MINIMUM PIPE INSULATION THICKNESS (inches)
 For Condensate Return and High Temperature Hot Water Return system

Nominal Pipe Diameter (inches)	Paroc	Epitherm	Kaylo-10 Thermo-12 Super Caltemp	Polyurethane
1.0	1.5	2.0	3.0	N/A
1.5	1.5	2.0	3.0	N/A
2.0	1.5	2.0	3.0	0.77
2.5	2.0	2.0	3.0	N/A
3.0	2.0	2.5	3.5	1.05
4.0	2.0	2.5	3.5	1.05
5.0	2.5	2.5	3.5	N/A
6.0	2.5	3.0	4.5	1.32
8.0	2.5	3.0	4.5	N/A
10.0	3.0	4.0	5.0	N/A
12.0	3.0	4.0	5.0	N/A
14.0	3.0	4.0	5.0	N/A
16.0	3.0	4.0	5.0	N/A
18.0	3.0	4.0	5.0	N/A

All piping in the manhole shall be insulated with pre-molded calcium silicate insulation and felt covering and with aluminum or stainless steel jacket.

G3043 HOT WATER SUPPLY SYSTEM (PIPING)

A. HIGH TEMPERATURE HOT WATER

High temperature hot water supply same as D3041. High temperature hot water return same as D3042.

B. HEATING HOT WATER

Same as G3051.

G3044 PUMPING STATIONS

See D3000 for primary hot water pumping station requirements

A. REINFORCED CONCRETE MANHOLES

Manholes shall be 2.44m by 2.44m (8 feet by 8) extending 0.3m (1 foot) above grade. Concrete shall be of 30 MPa (4350 psi) minimum 28-day compressive strength, air-entrained admixture 133 grams per cubic meter (0.008 lbs/cubic feet), with water-reducing admixture 814 grams per cubic meter (0.05 lbs/cubic feet), reinforced with deformed steel bars. Construct manhole base and sides in one monolithic pour. Cast-iron steps with nonslip surfaces and spaced 300 to 400 mm (12 inches to 16) inches apart on centers shall be firmly embedded in concrete walls for access to bottom of manholes. Lids are to be steel or aluminum. Three-fourths are to be solid and one-fourth to be grating. Maximum weight of the lid shall be 18 kg (40 lbs). Sump pit shall be at least 450mm (18 inches) diameter and 300mm (12 inches) deep. Any abandoned manholes resulting from work associated with these sites shall be broken up and filled.

B. MANHOLE SUMP PUMP

Provide an electric motor operated sump pump in each manhole. Pump to be of the vertical self-supported type with the following characteristics.

1. Minimum Requirement Specifications

- a. Size Discharge: 50mm (2 inches) steel piping
- b. Capacity: 1.6 L/s (25 gpm)
- c. Ft. Head: 105 kPa (15 psi)
- d. Size of Motor: 0.373 kw, (0.5 hp) 110 volt single phase, 60 cycle
- e. Operating temperature design must be 121 degrees C (250 degree F) minimum

2. Motor Support

Heavy cast pedestal accurately machined with integral bracket to support discharge pipe. The pedestal houses the upper bearing and is completely machined to receive and accurately align the motor. The motor and pump shafts are connected by a flexible coupling so that the motor may be easily removed without disturbing the pump and piping by merely removing four screws.

3. Motor

Frame 56C, totally enclosed non-ventilated 0.373 KW (1/2 HP), 1750 RPM, single phase, 110 V, 60 cycle. The motor shall have electrostatic epoxy finish, lip seals on output shaft, gasketed conduit box, stainless steel shaft, double sealed bearings, Class F insulation and have a 1.15 service factor, which includes thermal overload protection.

4. Float Control

- a. 2 Pole Float Control
- b. Must be a water tight, two level non-alternating unit
- c. NEMA - 4 water tight
- d. Type AW-1
- e. Form N4
- f. Heavy copper float with brass float rod
- g. Height of pedestal: As required by designer

5. Additional Required Pump Characteristics

- a. Cast iron impeller capable of pumping 20 mm (0.75 inches)diameter solids.
- b. There shall be a thrust ball bearing located at motor support.
- c. There shall be one bronze oil permanently lubricated sleeve type guide bearing located in pump housing, and one bronze intermediate bearing of the same type.

- d. A high temperature mechanical shaft seal is needed in the pump housing to maintain oil lubrication in the shaft column pipe.

6. Power Supply and Alarm Light and Accessories

- a. Flashing red light mounted on pole adjacent to pit.
- b. Duplex weatherproof outlet
- c. Disconnect

G3050 COOLING DISTRIBUTION

Pre-engineered and factory fabricated piping system including all required component such as carrier pipes, and fittings, insulation, protective casing, anchors, guides, pipe supports, expansion loops and bends. Include requirements for a cathodic protection system if required for the location.,

G3051 CHILLED WATER PIPING

Refer to the following web site for information on underground, chilled water distribution:

www.permapipe.com

CARRIER PIPE

Chilled water and heating hot water piping shall be ASTM B 88M/ASTM B88, Type L or M copper tubing. ANSI B16.18 or B16.22 with solder joint fittings.

Or steel, ASTM A 53, Type E (electric resistance welded Grade A or B), ASTM A 53, Type S (seamless, Grade A or B) or ASTM A 106 (seamless Grade A or B). Provide ANSI B16.9 butt welding fittings except joints 50 mm (2 inches) and smaller may be socket- welded. Provide Weight Class STD (Standard) Schedule 40 black steel pipe for welding end connections. Provide Weight Class XS (Extra Strong) Schedule 80 for threaded end connections.

For chilled water piping or applications with temperatures not exceeding 73 degrees F, high-density polyethylene carrier pipe made from a high-density, high molecular weight resin can be used if specified in the RFP. The ASTM cell classification shall be 345434C and the Plastics Pipe Institute shall rate the polyethylene as PE3408. All fittings shall be injection molded and have the same thickness and pressure rating as the piping. Fabricated and/or mitered fittings that are not in accordance with ASTM D-3261 shall not be allowed.

CASING

Factory applied conduit shall be, ASTM D 1784, Class 12454-B compound extruded seamless PVC Plastic Pipe, or ASTM D 2996 filament wound fiberglass RTR plastic pipe, or ASTM D1248, Type 3, Class C high-density polyethylene (HDPE). Gluing, taping or hot air welding of the conduit shall not be allowed. Conduit material, size and thickness shall be as follows:

TABLE -3 MINIMUM CONDUIT SIZE AND THICKNESS (inches)
For Chilled Water and Heating Hot Water Piping

Carrier Pipe (Inches)	Minimum Conduit Size (Inches)	Minimum Conduit Thickness (Inches)
2	4	0.060
3	6	0.060
4	8	0.080
6	10	0.100

8	12	0.120
10	14	0.120

INSULATION

Carrier pipe insulation shall be factory applied polyurethane or polyisocyanate conforming to ASTM C-591 with 32 kg/cubic meter (2 lb/cubic ft) minimum density, 90% minimum closed cell content and maximum initial thermal conductivity of 0.023 W/m-degree K (0.16 BTU-in/hr-square foot-degree F). The insulation shall completely fill the annular space between the service pipe and jacket and shall be bonded to both. Systems using open cell insulation or a non-bonded design shall not be allowed.

Provide each section of carrier pipe including factory applied insulation and conduit with waterproof conduit ends at both ends of each section of carrier pipe. Gluing, taping or hot air welding of the conduits shall not be allowed.

All fittings and components shall be designed and factory fabricated. Field insulation of fittings will not be allowed. The fittings conduits shall be molded and shall be extrusion welded or butt fusion welded joint.

For distribution systems serving multiple buildings, provide isolation valves on supply and return lines at take-offs for service to each building. Valves shall be located in valve boxes.

G3053 PUMPING STATIONS

See SECTION D3000 for chilled water primary pumping requirements.

See G3044 for reinforced concrete manhole and manhole sump pump requirements

G3054 COOLING TOWERS ON SITE

See SECTION D3000 for cooling tower requirements.

G3060 FUEL PIPING

NATURAL GAS DISTRIBUTION SYSTEM ()

Conform to requirements of ASME B31.8, "Gas transmission and Distribution Piping Systems".

MATERIALS AND EQUIPMENT

a. Aboveground: Black steel per ASTM A 53, Schedule 40, threaded ends for sizes 50 mm (2 inches) and smaller; otherwise, plain end beveled for butt welding..

b. Underground: Provide Polyethylene (PE) pipe conforming to ASTM D 2513 Grade PE2406 or PE3408, Standard Dimension Ratio (SDR) shall be based on the working pressure of the system. Pipe and fittings shall have heat fusion joints. Provide detectable aluminum for plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of direct buried piping. Tape shall be detectable by an electronic detection instrument.

c. Steel Pipe Fittings: Provide ANSI/ASME B16.3, black malleable iron threaded fittings or ASME/ANSI B16.9, butt-welding fittings. Flanges and flanged fittings shall be ASME/ANSI B16.5 steel flanges.

d. Polyethylene Fittings: ASTM D 2513 heat fusion fittings.

e. Below Ground Polyethylene Valves: ANSI B16.40. Provide PE valves only for underground PE piping

f. Transition Fittings: Manufacturer's standard fittings. Steel to plastic (PE) with tapping tee or sleeve. Coat or wrap steel pipe with heavy duty plastic coating.

g. Valve Boxes: Street valve box with the word "GAS" cast into the box cover. Heavy duty cast iron cover for roads and traffic areas and standard duty concrete cover for other areas.

f. Gas Main Regulator Station: Include steel or ductile iron body regulator valve, ASME PTC 25.3 relief valve, steel or cast iron with stainless steel basket strainer, regulator bypass piping and plug or ball valves. The regulator station shall be in underground vault or above ground as specified. Provide enclosures or bollards around the aboveground gas main regulator station if specified in the RFP.

g. Buried metallic pipe fittings and accessories shall be shop coated for corrosion protection or cathodically protected. Paint metallic piping and fittings and accessories aboveground and in vaults.

PRESSURE TESTS

Pressure test per NFPA 54 at 1.5 times maximum working pressure, but in no case less than 350 kPa (50 PSI). Repair leaking joints and repeat test until no reduction in pressure occurs

System purging procedure shall conform to NFPA 54 and ASME B31.8. Failure to purge may result in explosion within line when air to gas is at correct mixture.

-- End of Section --