
USACE / NAVFAC / AFCEA / NASA UFGS-22 13 36 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-11313 (March 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2007

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SECTION 22 13 36

PNEUMATIC SEWAGE EJECTORS 04/06

NOTE: This guide specification covers the requirements for pneumatic sewage ejectors.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the

Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C115/A21.15 (2005) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C203 (2002) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.1 (2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B16.3 (1998; R 2006) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.39 (1998; R 2006) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B19.3 (1991; Addenda A 1994; Addenda B 1995) Safety Standard for Compressors for Process Industries

ASME BPVC SEC VIII D1 (2007) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M (2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 53/A 53M (2006a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58 (2002) Standard for Pipe Hangers and

Supports - Materials, Design and
Manufacture

MSS SP-69 (2003; R 2004) Standard for Pipe Hangers
and Supports - Selection and Application

MSS SP-70 (2006) Standard for Cast Iron Gate Valves,
Flanged and Threaded Ends

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check
Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2003) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA ICS 2 (2000; Errata 2002; R 2005; Errata 2006)
Standard for Industrial Control and
Systems: Controllers, Contractors, and
Overload Relays Rated Not More than 2000
Volts AC or 750 Volts DC: Part 8 -
Disconnect Devices for Use in Industrial
Control Equipment

NEMA MG 1 (2006; Errata 2007) Standard for Motors
and Generators

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 11.01 (1982; E 2004) Black (or Dark Red) Coal
Tar Epoxy-Polyamide Painting System

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions
in Section 01 33 00 SUBMITTAL PROCEDURES and edit
the following list to reflect only the submittals
required for the project. Submittals should be kept
to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the
submittal requires Government approval. Some
submittals are already marked with a "G". Only
delete an existing "G" if the submittal item is not
complex and can be reviewed through the Contractor's
Quality Control system. Only add a "G" if the
submittal is sufficiently important or complex in
context of the project.

For submittals requiring Government approval on Army
projects, a code of up to three characters within
the submittal tags may be used following the "G"
designation to indicate the approving authority.
Codes for Army projects using the Resident
Management System (RMS) are: "AE" for
Architect-Engineer; "DO" for District Office
(Engineering Division or other organization in the

District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Installation

Drawings shall contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Materials and Equipment
Sewage Receiver
Air Compressor
Air Reservoir
Electric Motor
Controls

Data shall consist of manufacturer's descriptive and technical literature, catalog cuts, performance charts and curves, and installation instructions.

Spare Parts

Spare Parts data, as specified.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G][; G, [_____]]

[Six] [_____] copies of operation and [six] [_____] copies of maintenance manuals are required for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder shall be furnished upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system start-up, operation, and shut-down. Operating manuals shall include the manufacturer's name, model number, parts list, and a brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance

procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SPARE PARTS

The Contractor shall submit spare parts data for each different item of material and equipment specified and shall include a complete list of parts and supplies, with current unit prices and source of supply.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

2.1.4 Protection from Moving Parts

Belts, pulleys, chains, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or guarded.

2.2 GENERAL PERFORMANCE

NOTE: Select maximum sphere size required for
project. Normal facilities allow entrance of solids
up to 65 mm (2-1/2 inches). Larger solids may be

required to be handled depending on type of solids in entering sewage.

Consider requiring small capacity ejectors for office buildings and small residential group applications be provided as completely factory assembled, preconnected and coordinated components, packaged units for ease in installation.

The sewage ejectors shall be of the duplex pneumatic type and shall be complete with [receivers,] [receivers and compressors,] electric motors, control equipment, piping, and all necessary accessories. Capacities of all equipment and materials shall be not less than those specified or indicated. Ejector shall be able to pass through maximum sphere size of [65] [75] [100] [] mm [2-1/2] [3] [4] [] inch diameter.

2.3 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the following requirements:

2.3.1 Check Valves

Check valves shall conform to MSS SP-80, Type 3 or 4, Class 125, except that valves on the discharge side of the receivers shall be provided with replaceable valve seats.

2.3.2 Cast Iron Gate Valves

NOTE: Consider ball valves for small capacity, 1.25 - 2.5 liters per second (20-40 gpm), ejectors. For 80 to 100 mm (3-4 inch) valves, manufacturers claim noiseless operation with virtually no wear on moving parts.

Cast iron gate valves shall conform to MSS SP-70, Type I, II, or III, Class 125, threaded or flanged ends.

2.3.3 Bronze Gate Valves

NOTE: Consider ball valves for small capacity, 1.25 - 2.5 liters per second (20-40 gpm), ejectors. For 80 to 100 mm (3-4 inch) valves, manufacturers claim noiseless operation with virtually no wear on moving parts.

Bronze gate valves shall conform to MSS SP-80, Type 1, Class 125.

2.3.4 Motor Controls

Motor controls shall conform to NEMA ICS 2.

2.3.5 Cast Iron Pipe

Cast iron pipe shall conform to AWWA C115/A21.15, Class 150, as applicable

to pipe barrel only; ASME B16.1, Class 125, for pipe flange.

2.3.6 Steel Pipe

Steel pipe shall conform to ASTM A 53/A 53M, standard weight, zinc coated.

2.3.7 Cast Iron Pipe Fittings

Cast iron pipe fittings shall conform to ASME B16.1.

2.3.8 Malleable Iron Fittings

Malleable iron fittings shall conform to ASME B16.3.

2.3.9 Malleable Iron Unions

Malleable iron unions shall conform to ASME B16.39, Type B.

2.3.10 Pipe Hangers and Supports

Pipe hangers and supports shall conform to MSS SP-58 and MSS SP-69, Type [_____] hanger, Type [_____] supports.

2.3.11 Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, washers, and all other types of support necessary for the installation of the equipment shall be furnished and shall be of steel galvanized according to ASTM A 153/A 153M.

2.4 SEWAGE RECEIVER

Sewage receiver shall be of cast iron or welded steel construction conforming to ASME BPVC SEC VIII D1. Sewage inflow and outflow pipe connections shall be flanged; air-supply and vent-piping connections shall be screwed. Pipe threads shall conform to ASME B1.20.1, and pipe flanges shall conform to ASME B16.1. The receiver shall be designed for a working pressure of [_____] kPa psi and tested at a pressure 50 percent greater than the working pressure. Receiver shall be provided with suitable support and a manhole or handhole conveniently located. Steel receiver shall be coated [inside] [inside and outside] with coal tar primer and enamel conforming to the requirements of AWWA C203 in all respects of material and application, or shall be coated with a coal-tar epoxy paint system conforming to the requirements of SSPC PS 11.01. The interior walls of the receiver and inflow and outflow openings, approaches and fittings shall be free from any obstructions that might interfere with the free passage of raw unscreened sewage. Ejector unit shall have sufficient capacity for the discharge of sanitary sewage under the conditions of rate of flow, static head, and friction loss. As used herein, rate of flow is the continuous rate of flow into the ejector station; static head is the difference between the invert elevations of the inlet sewer to the ejector station and the force main at the point of final discharge; and friction loss is computed on the basis of the indicated continuous rate of flow.

2.5 AIR COMPRESSOR

NOTE: If compressed air is to be supplied from a central plant, this paragraph will be deleted. If a central air supply is used, a pressure-reducing

valve may be required and will be specified.
Indicate m³/s (cfm) and kPa (psi) requirements for compressors on the drawings. Include an air reservoir to the air compressor in this paragraph if needed.

Air shall be supplied to the sewage receivers by air compressors of capacities indicated to supply air to operate the ejectors. Each compressor shall be equipped with suction silencer, complete automatic lubrication system, an air filter, and means for cooling. The compressors shall be designed for operation without water seal or any water connection.

The air compressor shall conform to ASME B19.3. Air compressor unit shall be a factory packaged assembly. Each duplex compressor system shall be provided with [automatic alternation system] [manual alternation system].

2.6 AIR RESERVOIR

NOTE: A manhole will be specified for tanks larger than 1000 mm (36 inches) in diameter. An inspection opening will be specified for tanks 1000 mm (36 inches) in diameter or smaller.

If the equipment furnished requires a compressed-air reservoir for proper operation, the tank shall be constructed in conformance with ASME BPVC SEC VIII D1, with flanged or screwed inlet and outlet connections as required. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating compliance shall be provided. The storage tank shall be designed for a working pressure of [_____] kPa psi and tested at a pressure 50 percent greater than the working pressure. The tank shall be fitted with a pressure gauge, [manhole,] [inspection openings,] blowoff cock, and a safety valve set at [_____] kPa psi. The connection to the compressor shall be provided with a check valve and a shutoff valve.

2.7 ELECTRIC MOTOR

NOTE: If more than one type motor is required, each type will be specified. Motors installed above grade in normal-atmosphere frames will have open type frames. Motors installed in pits below grades will have dripproof frames.

Each electric motor shall conform to NEMA MG 1 and shall be suitable for operation of [_____] -volt [_____] -Hz [_____] -phase alternating current. Motor frames shall be of the [open] [dripproof] [totally enclosed] [explosion proof] type. Temperature rise shall be based on minus 40 degrees C minus 40 degrees F ambient temperature.

2.8 CONTROLS

NOTE: NEMA 3R and NEMA 4 Types are exterior panel types.

An automatic-control system shall be provided for each ejector. The controls shall consist of suitable devices for regulating the cycle of each sewage receiver and each compressor. Valves and accessories as required to control the flow of air to the sewage receiver, to exhaust the residual air, and to vent the receiver to the outside shall be provided. Pressure switches to control the operation of each compressor shall be provided on the air reservoir. Automatic controls shall be enclosed in a NEMA 250, [Type 12] [Type 3R] [Type 4] panel and shall be completely wired and tested with internal connections being made on terminal blocks. Sensor, motor control, and motor shall be factory preconnected. Local or remote alarm signalling shall be provided as required. An air operated automatic valve shall be provided between air compressor and ejector to control admission and relief of air to and from ejector, and to prevent waste materials or gases from entering compressor. The ejection cycle shall be controlled by a fully transistorized solid-state electronic liquid level control device, which shall activate the compressor motor. The liquid level control device shall sense liquid level by use of a stainless steel probe mounted in the receiver. The ejection cycle shall be adjustable from [_____] to [_____] seconds by an integral adjustable timer. Controls shall include manual-off-automatic three-way switch.

2.9 ELECTRICAL WORK

Electric motor driven equipment specified shall be provided complete with motor, motor starter, and controls. Electrical equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical characteristics shall be as indicated. Motor starters shall be provided complete with properly sized thermal overload protection and other appurtenances necessary for the motor control specified. Starters shall be furnished in [general purpose] [watertight] [explosion-proof, Class I, Division 1] enclosures. Motors shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating on the motor. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices but not shown shall be provided.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

The sewage influent and effluent lines shall be flanged cast iron. The air piping shall be steel with malleable iron unions and fittings.

3.1.1 Cast Iron Pipe Joints

Flanges of the pipe shall be wiped clean, and the sections shall be pushed together evenly after a cloth-reinforced rubber gasket, as furnished by the manufacturer, has been placed between the flanges. Bolts and nuts shall be loosely assembled by hand and then tightened evenly with a wrench of the type and length recommended by the manufacturer. Opposite nuts shall be turned alternately to avoid damage from excessive tightening.

3.1.2 Steel Pipe Joints

Steel pipe shall be installed with sufficient unions to facilitate maintenance and removal of pipe and fittings. After cutting and before threading, pipe shall be reamed. Threads shall be full cut, and no more than three threads on the pipe shall remain exposed after assembly. Joints

shall be made tight with a stiff mixture of graphite and oil, or an inert filler and oil, or an approved thread lubricant, applied with a brush to the male threads only. Caulking of threaded joints will not be permitted.

3.1.3 Pipe Hangers and Supports

Pipe hangers and supports shall be used on all pipe runs longer than 3 m 10 feet. The pipe hangers and supports shall be spaced at not more than 3 m 10 feet. Horizontal pipe shall be supported near fittings at each change in direction of piping and not more than 1.5 m 5 feet apart at valves. Vertical piping shall be supported at base, at intervals not more than 4.5 m 15 feet and at terminations.

3.2 VALVE INSTALLATION

Valves installed in the steel pipeline shall be bronze with screwed ends, and valves installed in the cast-iron pipeline shall have bronze-mounted iron bodies with flanged ends. Each valve shall have the year of manufacture cast in the body. The Contractor shall remove and replace, at no additional cost to the Government, any valve that does not seat tightly or does not operate satisfactorily.

3.2.1 Gate Valves

Gate valves shall be opened by turning counterclockwise. The operating nut shall have an arrow cast in the metal, indicating the direction of opening. Before the valve is installed, the stuffing boxes shall be tightened and the valve operated to see that all parts are in working condition.

3.2.2 Check Valves

Check valves shall be provided with freely operating, positively seating flaps, and easily removable covers.

3.3 EQUIPMENT INSTALLATION

Unless otherwise indicated, all equipment shall be installed in accordance with manufacturer's recommendations. Installation of the air [compressor] [compressor and air reservoir] shall conform to ASME B19.3.

3.4 PAINTING

NOTE: Corrosion coating for items exposed to direct
sunlight should be high-build epoxy in lieu of coal
tar epoxy.

The equipment shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Field painting required for ferrous surfaces not furnished at the factory is specified in Section 09 90 00 PAINTS AND COATINGS.

3.5 CONCRETE FOUNDATIONS

Concrete for foundation shall be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete foundations shall be integral with and of the same class as the building floor unless otherwise indicated. Class B concrete shall be used in foundations that are entirely

separated from the surrounding floor. When new foundations are constructed on existing concrete, the new concrete shall be bonded to the old as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE. Foundation bolts, as required, shall be provided for positioning during the placement of the concrete.

3.6 TESTS

NOTE: Consider accepting a Certificate of
Compliance for capacity of ejectors of small size
capacity where requiring shop tests or installed
tests for capacity would add disproportionately to
the cost.

The Contractor shall either furnish the manufacturer's report of ejector capacity determined by shop tests or make such tests as may be necessary to determine the capacity, and shall make such other tests as will ensure that the ejectors have been installed in accordance with the specifications.

3.7 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment in accordance with the approved [Operation and Maintenance Manuals](#).

-- End of Section --