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USACE / NAVFAC / AFCEC / NASA **UFGS-22 13 36 (February 2009)**

Preparing Activity: USACE **Superseding**
UFGS-22 13 36 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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02/09

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SECTION 22 13 36

PNEUMATIC SEWAGE EJECTORS
02/09

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

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

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

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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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 Reference Identifier (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 SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.39	(2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C115/A21.15	(2020) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

COMPRESSED AIR AND GAS INSTITUTE (CAGI)

CAGI B19.1	(2010) Safety Standard for Compressor Systems

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

MSS SP-58	(2018) Pipe Hangers and Supports -

	Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA MG 1	(2018) Motors and Generators

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

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

1.2 SUMMARY

****

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.

****

Provide sewage ejectors of the duplex pneumatic type 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.

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other

submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Installation

SD-03 Product Data

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

SD-10 Operation and Maintenance Data

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

1.4 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 EXTRA MATERIALS

Submit spare parts data for each different item of material and equipment specified and include a complete list of parts and supplies, with current unit prices and source of supply. Provide one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and tat 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. Submit data consisting of manufacturer's descriptive and technical literature, catalog cuts, performance charts and curves, and installation instructions

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 Protection from Moving Parts

Fully enclose or guard belts, pulleys, chains, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto.

2.2 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the following requirements:

2.2.1 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.

2.2.2 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.

2.2.3 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.

2.2.4 Motor Controls

Motor controls shall conform to NEMA ICS 2.

2.2.5 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.

2.2.6 Steel Pipe

Steel pipe shall conform to ASTM A53/A53M, standard weight, zinc coated.

2.2.7 Cast Iron Pipe Fittings

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

2.2.8 Malleable Iron Fittings

Malleable iron fittings shall conform to ASME B16.3.

2.2.9 Malleable Iron Unions

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

2.2.10 Pipe Hangers and Supports

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

2.2.11 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 A153/A153M.

2.3 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 B1.20.2MASME 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.

2.4 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 m^3/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 CAGI B19.1. Air compressor unit shall be a factory packaged assembly. Each duplex compressor system shall be provided with [automatic alternation system] [manual alternation system].

2.5 AIR RESERVOIR

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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.

2.6 ELECTRIC MOTOR

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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.

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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.

2.7 CONTROLS

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

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Provide an automatic-control system 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 signaling 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.

2.8 ELECTRICAL WORK

Provide electric motor driven equipment specified complete with motor, motor starter, wiring, and controls 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.

2.9 FACTORY PAINTING

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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.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 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.

3.2.1 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.

3.2.2 Steel Pipe Joints

Install steel pipe 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.

3.2.3 Pipe Hangers and Supports

Use pipe hangers and supports 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.

3.3 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. Remove and replace, at no additional cost

to the Government, any valve that does not seat tightly or does not operate satisfactorily.

3.3.1 Gate Valves

Open gate valves 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.

3.3.2 Check Valves

Provide check valves with freely operating, positively seating flaps, and easily removable covers.

3.4 EQUIPMENT INSTALLATION

Submit drawings containing 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. Unless otherwise indicated, install all equipment in accordance with manufacturer's recommendations. Installation of the air [compressor] [compressor and air reservoir] shall conform to CAGI B19.1.

3.5 FIELD PAINTING

Field painting, required for ferrous surfaces not furnished at the factory, is specified in Section 09 90 00 PAINTS AND COATINGS.

3.6 CONCRETE FOUNDATIONS

Provide concrete for foundation as specified in Section 03 30 00 CAST-IN-PLACE 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 30 00 CAST-IN-PLACE CONCRETE. Foundation bolts, as required, shall be provided for positioning during the placement of the concrete.

3.7 TESTS

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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.

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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 perform such other tests as will ensure that the ejectors have been installed in accordance with the specifications.

3.8 MANUFACTURER'S FIELD SERVICES

Provide services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment in accordance with the approved Operation and Maintenance Manuals. Submit [6] [_____] copies of operation and [6] [_____] copies of maintenance manuals as 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.

-- End of Section --