Preparing Activity: USACE Superseding
UFGS-46 24 16 (February 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 46 24 16

COMMINUTORS
05/21

NOTE: This guide specification covers the requirements for comminutor for use in sewage treatment plants normally handling domestic sewage.

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).

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.

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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 BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(2015) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings

ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM F593	(2022) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA MG 1	(2021) Motors and Generators

1.2 SUBMITTALS

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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.

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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

Comminutor; G[, [_____]]

SD-03 Product Data

Spare Parts

Submit after approval of the drawings and not later than [_____] months prior to the date of beneficial occupancy.

Materials and Equipment

Framed Instructions

SD-06 Test Reports

Field Tests

Booklet form.

SD-10 Operation and Maintenance Data

Operating Instructions; G[, [_____]]

[Six] [_____] copies each of the operation and maintenance manuals.

1.3 QUALITY CONTROL

1.3.1 Manufacturer's Services

Obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified to supervise the installing, adjusting, and testing of the equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect from weather, humidity and temperature variations, dirt and dust, or other contaminants all equipment delivered and placed in storage.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide materials and equipment conforming to the respective publications and other requirements specified and which are the standard products of a manufacturer regularly engaged in the manufacture of the products. Provide items of equipment that essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening. Ensure equipment is supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.1 Nameplates

Provide nameplates for major equipment items to include manufacturer's name, address, type or style, catalog number and model or serial number on a plate securely attached to item of equipment. In lieu of nameplate on the comminutor, integrally casting the manufacturer's name or trademark with comminutor, stamping, or otherwise permanently marking is acceptable.

2.1.2 Protection From Moving Parts

Fully enclose moving parts of the equipment, such as drive chains and sprockets, in removable guards. Fully enclose all equipment above the level of the sewage-carrying channel in a cast-iron or 1.720 mm (14 gauge) 14 gauge sheet steel or wrought-iron housing. Provide housing with a sufficient number of doors or removable panels to insure ready access to any part of equipment for repairing, replacing, or cleaning. Ensure all joints between the housing and the concrete foundation are made leakproof.

2.1.3 Design

****

NOTE: Refer to UFC 3-240-02 for design requirements. The following information should be shown on the project drawings covered by the specification as appropriate:

a. Size and type of channel pipe or joint in which comminutor is to be mounted. Specify whether comminutor access openings are located within pits or manholes.

b. Minimum, average, and maximum sewage flows. The maximum rating of a comminutor should be made with the combs fully submerged.

c. Normal and maximum liquid levels, including flooding level for submersible drive.

d. Allowable head loss at maximum flow. Head loss should not be set too low for it could exclude rotating type comminutors.

e. Whether comminutor has free discharge or controlled discharge.

f. Whether location requires explosion-proof equipment.

g. Electrical power characteristics.

h. Type of drive mounting and elevations pertinent thereto.

i. Channel design, size and type, should be conducted in manner that optimizes channel width and allows for maximum competition among comminutor suppliers. If the channel width is designed too narrow it could exclude rotating type comminutors.

j. Each comminutor device should have a by-pass for maintenance and repair purposes.

****

Provide a comminutor capable of passing a minimum flow of [_____] cubic meters/second million gallons per day (mgd), an average flow of [_____] cubic meters/second mgd, and a maximum flow of [_____] cubic meters/second mgd. Ensure the head loss at maximum flow does not exceed [____] mm inches of water. Design comminutor for [free] [controlled] discharge. [Design so the downstream submergence is [_____] mm inches at maximum flow for controlled discharge units.] Ensure comminutor is capable of operating satisfactorily at zero flow.

2.2 COMPONENTS

2.2.1 Electric Motor and Controller

Provide electric motors that conform to NEMA MG 1. Provide motor controller that conforms to NEMA ICS 2.

2.2.2 Comminutor

Provide a comminutor of the [rotating] [or] [oscillating] type for use in a sewage treatment plant. Comminutor consists of an electric motor-driven mechanical shredder or cutter with [gear motor] [hydraulic drive] capable of continuous and automatic operation and must reduce sewage solids to particle sizes between 6.4 and 9.5 mm 1/4 and 3/8 inch. The cutting and screening mechanism are required cut or shred all sewage solids including sticks, rags, and stringy material, without removing them from the sewage flow, without clogging the screen, and without binding, jamming, or stalling the moving parts.

Submit drawings indicating clearances required for maintenance and operation, containing complete wiring and schematic diagrams, equipment

layout and anchorage, and any other details required to demonstrate that the system has been coordinated and properly function as a unit.

2.2.2.1 Rotating Drum Type

Rotating drum type comminutors are required to include a slotted drum that functions as a screen and support for the rotating cutters, a casing supporting the stationary cutters, and a drive assembly. Evenly spaced cutting teeth pass through a stationary comb section cutting against it as the cutters rotate. Ensure the unit has a smooth, continuously available torque, 360-degree rotation with equal performance in either direction of rotation. Provide casing made of close-grain cast iron or aluminum alloy of adequate strength and rigidity to withstand all loads imposed on it from the operation of the comminutor and drive assembly. Provide casing with manufacturer's recommended concave semi-circular screen of stainless steel attached to it.

2.2.2.2 Rotating Disc or Conical Type

Rotating disc or conical type comminutors include a stationary grid frame cutter-comb support with cutter-combs, rotating cutter plate/screen with adjustable teeth, and a drive assembly. Cutter plates are fixed and keyed to the center drive shaft permitting only one cutter tooth and a cutter comb to be engaged at one time for load power saving. Provide frame, grid, and discs made of close-grained cast iron or aluminum alloy. Construct the conical screen of the manufacturer's recommended stainless steel.

2.2.2.3 Oscillating Type

Oscillating type comminutors include a stationary semi-circular screen, a stationary cutter bar mounted on a support casing, an oscillating cutter bar, and a drive assembly. Ensure cutter bars are adjustable and readily removable for inspection, sharpening, or replacement. Actuate oscillation by mechanical conversion of the driver rotation. Provide a casing made of close-grain cast iron or aluminum alloy of adequate strength and rigidity to withstand all loads imposed on it from the operation of the comminutor and drive assembly. Construct the casing of the manufacturer's recommended semi-circular screen of stainless steel attached to it.

2.2.3 Motor Controller

Mount the control panel where indicated. Ensure the motor controller is rated as indicated and conform to NEMA ICS 2. Ensure the control system includes an automatic motor starter reset for power failure protection [and an automatic drive motor reversal with time delay for jamming protection in the event of hard particle entrapment in the comminutor cutters]. Design the reversing controller to sense jams and reverse motor rotation as often as necessary, while continuing to operate providing partial sweeps on the comminutor arm, with no danger of motor damage. Provide an audible and visual alarm system to signal both field operator and area office in case of malfunction.

2.2.4 Gear Motor

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NOTE: Totally enclosed motors should be used except in locations where explosive-proof equipment is required.

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Provide an electric motor of constant speed, [totally enclosed] [totally enclosed fan cooled] [explosion-proof], capable of operating in air, partially or completely submerged. Ensure motors are UL listed for Class I, Div I, Group D service, horizontal or vertical type, suitable for outdoor use and conforming to NEMA MG 1. The unit is required to be capable of withstanding any loadings produced by the thrust, out-of-balance, and vibrating forces resulting from operating conditions. Supply gears made of be wrought or alloy steel except that worm gears be bronze. Flame hardened gears are not acceptable. Construct housing of close-grained cast iron, fabricated steel, or aluminum alloy.

2.2.5 Gear Motor Mounting

Mount the comminutor gear motor [close-coupled with the comminutor] [on [an open] [a gas tight] stand with universal shaft to the comminutor. Enclose universal shaft in protective piping to elevation indicated. Provide protective piping with a tapped and plugged hole for drainage] [on an extension pipe at the elevation indicated with universal shafting to the comminutor. Equip extension pipe with handholds to allow inspection and repair of shafting].

2.2.6 Hydraulic Drive

Mount hydraulic actuator on the unit and connected to the shaft. Supply pressurized hydraulic fluid using a power unit that includes an oil reservoir, motor-driven positive displacement pump, and all necessary control valves. Ensure the pump motor is constant speed [totally enclosed] [totally enclosed fan cooled] [explosion-proof], vertical type suitable for outdoor service and conform to NEMA MG 1. Protect motor against overload, low voltage, and unbalanced voltage. Provide rubber-covered abrasion-resistant pressure hose with suitable connectors for connecting the power unit to the hydraulic actuator.

2.2.7 Cutting Elements

Fabricate all secured elements, combs, teeth, and bars of a corrosion- and wear-resistant chrome-tungsten type alloy or equal possessing Brinell Hardness of 450 or better. Ensure all elements are readjustable to compensate for wear, and removable for sharpening or replacement.

2.2.8 Bearings

Provide bearings of the antifriction type having a rating-life expectancy (L-10) of 100,000 hours when equipment is operating continuously. [Provide intermediate guide bearings, where required for extended shafting, for adequate support and alignment made of the ball bearing type enclosed in a self-aligning pillow block housing.]

2.2.9 Lubrication

Lubricate and protect all moving parts of the comminutor from flooding according to the manufacturer's recommendations. Ensure bearings are either oil or grease lubricated. Ensure gear reduction unit is oil lubricated. Provide oil lubricated bearings and reduction units with a sight glass or other positive means of determining oil level. Ensure grease-lubrication pressure-line fittings and oil fill and drain lines are easily accessible when comminutor is in place.

2.3 MATERIALS

Provide materials that conform to the following:

2.3.1 Cast Iron

ASTM A48/A48M Class 30, minimum.

2.3.2 Bearings

ABMA 9 and ABMA 11.

2.3.3 Aluminum Alloy

ASTM B108/B108M.

2.3.4 Miscellaneous Metal

Provide bolts, nuts, anchors, washers, and other types of supports necessary for the installation of equipment made of steel or wrought iron, galvanized according to the requirements of ASTM A153/A153M. Ensure all anchor bolts and nuts for the comminutor, motor, or power unit are Type 316 stainless steel, ASTM F593.

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 INSTALLATION

Install materials and equipment as shown and in accordance with the approved written recommendations of the equipment manufacturer.

3.2.1 Installation within a Channel

****

NOTE: Delete this paragraph when comminutor is to be installed in a pipeline.

****

Ensure the comminutor, motor, power unit, guide bearings, and all equipment requiring attachment to structural supporting members are furnished complete with bolts, nuts, anchors, washers, sole plates, or any other type of supports necessary for the installation of the equipment.

3.2.2 Installation within a Pipeline

****

NOTE: Delete this paragraph when comminutor is to be installed in a channel.

****

Provide comminutor with standard flanged or bell and spigot connections for installation in pipeline.

3.2.3 Electrical Work

Provide electrical equipment and wiring in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide electrical characteristics as indicated. Provide 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 on electrical plans.

3.2.4 Painting

Thoroughly clean, prime, and give two finish coats of paint to all equipment at the factory in accordance with the recommendations of the manufacturer. Ensure all field painting complies with Section 09 90 00 PAINTING, GENERAL.

3.2.5 Special Tools

Furnish special tools for the proper operation and maintenance of equipment. Install in a wall-mounted hardwood or metal container. Furnish a complete set of manufacturer's recommended spare parts including cutting teeth and combs or other cutting elements, fasteners, screens, seals or bearings, etc. Include a complete list of parts and supplies with current unit prices and source of supply in the spare parts data submission.

3.2.6 Framed Instructions

Post, where directed, framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system. Prepare condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. Submit proposed diagrams, instructions, and other sheets, prior to posting. Post the framed instructions before acceptance testing of the systems.

3.3 FIELD TESTS

After installation of comminutor is complete, conduct operational tests required to demonstrate that the comminutor operates in accordance with the specified requirements. Submit test reports showing all field tests performed on the installed system to adjust each component and all field tests performed to prove compliance with the specified performance criteria. Ensure each test report indicates the final position of controls.

3.3.1 Scheduling

Provide the Contracting Officer [14] [_____] calendar days notice of the dates and times scheduled for the tests.

3.3.2 Tests

Test the comminutor mechanism in the operation mode to demonstrate correct alignment, smooth operation, proper adjustment, freedom from vibration, and freedom from noise and overheating of moving machinery. Ensure the test period includes one hour of operation in each specified range and not

less than one cycle of automatic stop, reversal, and restart. Measure head losses at the specified flow ranges during the tests to assure that the requirements are met. Test operate installed controls to assure that operational requirements of paragraph MOTOR CONTROLLER are satisfied. Make two complete cycles to verify that the system continues to function satisfactorily under all requirements.

3.4 CLOSEOUT ACTIVITIES

3.4.1 Training

****

NOTE: Consult equipment manufacturers for recommended time required to train personnel for the proper operation of the unit and insert number of hours.

****

Provide a field training course for operating and supervising staff members. Provide training for a total period of [_____] hours of normal working time and must start after the system is functionally complete but prior to final acceptance tests. Ensure the field instructions cover all of the items contained in the operating and maintenance instructions.

3.4.2 Operating Instructions

Provide manual of operation explaining in detail step-by-step procedures required for system startup, operation, and shutdown. Include parts list, and a brief description of all equipment and operating features in the instructions.

Provide maintenance manuals explaining in detail routine maintenance procedure including inspection, adjustments, lubrication, and cleaning. List possible breakdown, methods of repair, and a troubleshooting guide in the instructions. Include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed in the instructions for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Identify the manuals by title, equipment and manufacturer. Submit and obtain approval of all manuals prior to the field training course.

-- End of Section --