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USACE / NAVFAC / AFCEC / NASA **UFGS-46 24 16 (February 2011)**

Preparing Activity: USACE **Superseding**
UFGS-44 42 26 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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02/11

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SECTION 46 24 16

COMMINUTORS

02/11

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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).

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PART 1 GENERAL

1.1 REFERENCES

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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 2016) Standard Specification for Gray Iron Castings
ASTM A153/A153M	(2016a) 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	(2017) Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

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

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 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 STANDARD PRODUCTS

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. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.2 NAMEPLATES

Major equipment items shall have 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, manufacturer's name or trademark may be cast integrally with comminutor, stamped, or otherwise permanently marked.

2.3 PROTECTION FROM MOVING PARTS

Moving parts of the equipment, such as drive chains and sprockets, shall be fully enclosed in removable guards. Equipment above the level of the sewage-carrying channel shall be fully enclosed in a cast-iron or 1.720 mm (14 gauge) 14 gauge sheet steel or wrought-iron housing. Housing shall be provided with a sufficient number of doors or removable panels to insure ready access to any part of equipment for repairing, replacing, or cleaning. Joints between the housing and the concrete foundation shall be made leakproof.

2.4 MATERIALS

Provide materials that conform to the following:

2.4.1 Cast Iron

ASTM A48/A48M Class 30, minimum.

2.4.2 Bearings

ABMA 9 and ABMA 11.

2.4.3 Aluminum Alloy

ASTM B108/B108M.

2.4.4 Miscellaneous Metal

Bolts, nuts, anchors, washers, and other types of supports necessary for the installation of equipment shall be of steel or wrought iron, galvanized according to the requirements of ASTM A153/A153M. Anchor bolts and nuts for the comminutor, motor, or power unit shall be Type 316 stainless steel, ASTM F593.

2.5 ELECTRIC MOTOR AND CONTROLLER

Electric motor shall conform to NEMA MG 1. Motor controller shall conform to NEMA ICS 2.

2.6 COMMINUTOR

The comminutor shall be of the [rotating] [or] [oscillating] type for use in a sewage treatment plant. It shall consist of an electric motor-driven mechanical shredder or cutter with [gear motor] [hydraulic drive] capable of continuous and automatic operation and shall reduce sewage solids to particle sizes between 6.4 and 9.5 mm 1/4 and 3/8 inch. The cutting and screening mechanism shall 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 will properly function as a unit.

2.6.1 Rotating Drum Type

The rotating drum type comminutor shall 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 shall pass through a stationary comb section cutting against it as the cutters rotate. The unit shall have a smooth, continuously available torque, 360-degree rotation with equal performance in either direction of rotation. Casing shall be 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. The casing shall have the manufacturer's recommended concave semi-circular screen of stainless steel attached to it.

2.6.2 Rotating Disc or Conical Type

The rotating disc or conical type comminutor shall include a stationary grid frame cutter-comb support with cutter-combs, rotating cutter plate/screen with adjustable teeth, and a drive assembly. The cutter plates shall be 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. The frame, grid, and discs shall be of close-grained cast iron or aluminum alloy. The conical screen shall be constructed of the manufacturer's recommended stainless steel.

2.6.3 Oscillating Type

The oscillating type comminutor shall include a stationary semi-circular screen, a stationary cutter bar mounted on a support casing, an

oscillating cutter bar, and a drive assembly. Cutter bars shall be adjustable and readily removable for inspection, sharpening, or replacement. The oscillation shall be actuated by mechanical conversion of the driver rotation. Casing shall be 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. The casing shall have the manufacturer's recommended semi-circular screen of stainless steel attached to it.

2.7 MOTOR CONTROLLER

The control panel shall be mounted where indicated. The motor controller shall be rated as indicated and conform to NEMA ICS 2. The control system shall include 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]. The reversing controller shall sense jams and reverse motor rotation as often as necessary, and will continue to operate providing partial sweeps on the comminutor arm, with no danger of motor damage. An audible and visual alarm system shall be provided to signal both field operator and area office in case of malfunction.

2.8 DESIGN

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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.

****

Comminutor shall be 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. Head loss at maximum flow shall not exceed [_____] mm inches of water. Comminutor shall be designed for [free] [controlled] discharge. [Downstream submergence shall be [_____] mm inches at maximum flow for controlled discharge units.] Comminutor shall be capable of operating satisfactorily at zero flow.

2.9 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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Electric motor shall be constant speed, [totally enclosed] [totally enclosed fan cooled] [explosion-proof], capable of operating in air, partially or completely submerged. Motors shall be 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 shall be capable of withstanding any loadings produced by the thrust, out-of-balance, and vibrating forces resulting from operating conditions. Gears shall be wrought or alloy steel except that worm gears shall be bronze. Flame hardened gears will not be acceptable. Housing shall be close-grained cast iron, fabricated steel, or aluminum alloy.

2.10 GEAR MOTOR MOUNTING

The comminutor gear motor shall be mounted [close-coupled with the comminutor] [on [an open] [a gas tight] stand with universal shaft to the comminutor. Universal shaft shall be enclosed in protective piping to elevation indicated. Protective piping shall be provided with a tapped and plugged hole for drainage] [on an extension pipe at the elevation indicated with universal shafting to the comminutor. Extension pipe shall be equipped with handholds to allow inspection and repair of shafting].

2.11 HYDRAULIC DRIVE

Hydraulic actuator shall be mounted on the unit and connected to the shaft. The pressurized hydraulic fluid shall be by a power unit that includes an oil reservoir, motor-driven positive displacement pump, and all necessary control valves. The pump motor shall be constant speed [totally enclosed] [totally enclosed fan cooled] [explosion-proof], vertical type suitable for outdoor service and conform to NEMA MG 1. Motor shall be protected against overload, low voltage, and unbalanced voltage. Rubber-covered abrasion-resistant pressure hose with suitable connectors shall be provided for connecting the power unit to the hydraulic actuator.

2.12 CUTTING ELEMENTS

Secured elements, combs, teeth, and bars shall be corrosion- and wear-resistant chrome-tungsten type alloy or equal possessing Brinell Hardness of 450 or better. Elements shall be readjustable to compensate for wear, and removable for sharpening or replacement.

2.13 BEARINGS

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

2.14 LUBRICATION

All moving parts of the comminutor shall be lubricated and protected from flooding according to the manufacturer's recommendations. Bearings shall be either oil or grease lubricated. Gear reduction unit shall be oil lubricated. Oil lubricated bearings and reduction units shall have sight glass or other positive means of determining oil level. Grease-lubrication pressure-line fittings and oil fill and drain lines shall be easily accessible when comminutor is in place.

2.15 ANCHORAGE

2.15.1 Installation Within a Channel

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

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

2.15.2 Installation Within a Pipeline

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

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Comminutor shall have standard flanged or bell and spigot connections for installation in pipeline.

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.

3.3 ELECTRICAL WORK

Provide electrical equipment and wiring in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical characteristics shall be 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.

3.4 PAINTING

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 shall be as specified in Section 09 90 00 PAINTING, GENERAL.

3.5 SPECIAL TOOLS

Special tools shall be furnished for the proper operation and maintenance of equipment, and shall be installed 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.

3.6 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.

3.7 FIELD TESTS

After installation of comminutor is complete, conduct operational tests required to demonstrate that the comminutor will operate 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. Each test report shall indicate the final position of controls.

3.7.1 Scheduling

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

3.7.2 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. The test period shall include 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. Installed controls shall be test operated to assure that operational requirements of paragraph MOTOR CONTROLLER are satisfied. Two complete cycles shall be made to verify that the system continues to function satisfactorily under all requirements.

3.8 TRAINING

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

****

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

3.9 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. The instructions shall list possible breakdown, methods of repair, and a troubleshooting guide. The instructions shall include piping layout, equipment layout, and simplified wiring and control diagrams of the system as installed.for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Identify the manuals by title, equipment and manufacturer. Manuals shall be submitted and approved prior to the field training course.

-- End of Section --