
USACE / NAVFAC / AFCEA / NASA UFGS-44 42 26 (April 2006)

Preparing Activity: USACE

Replacing without change
UFGS-11331 (July 2003)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRD dated 1 April 2006

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04/06

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SECTION 44 42 26

COMMINUTOR
04/06

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

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).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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 BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11 (1990; R 1999) Load Ratings and Fatigue
Life for Roller Bearings

ABMA 9 (1990; R 2000) Load Ratings and Fatigue
Life for Ball Bearings

ASTM INTERNATIONAL (ASTM)

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

ASTM A 48/A 48M (2003) Gray Iron Castings

ASTM B 108 (2003a) Aluminum-Alloy Permanent Mold
Castings

ASTM F 593 (2002e2) Stainless Steel Bolts, Hex Cap
Screws, and Studs

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1996; R 2004) 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 (2003; R 2004) Motors and Generators

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

Comminutor[; G][; G, [_____]]

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.

SD-03 Product Data

Spare Parts

Spare parts data for each different item of materials and equipment specified, after approval of the drawings and not later than [_____] months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies with current unit prices and source of supply.

Materials and Equipment

A complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions.

Framed Instructions

Proposed diagrams, instructions, and other sheets, prior to posting.

SD-06 Test Reports

Field Tests

Test reports in booklet form 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.

SD-10 Operation and Maintenance Data

Operating Instructions[; G][; G, [_____]]

[Six] [_____] copies of operation explaining in detail step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include parts list, and a brief description of all equipment and operating features.

[six] [_____] copies of 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. The manuals shall be identified by title, equipment and manufacturer. Manuals shall be submitted and approved prior to the field training course.

1.3 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.

1.4 MANUFACTURER'S SERVICES

The Contractor shall obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installing, adjusting, and testing of the equipment.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall conform to the respective publications and other requirements specified and shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall 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

Materials shall conform to the following:

2.4.1 Cast Iron

ASTM A 48/A 48M Class 30, minimum.

2.4.2 Bearings

ABMA 9 and ABMA 11.

2.4.3 Aluminum Alloy

ASTM B 108.

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 A 153/A 153M. Anchor bolts and nuts for the comminutor, motor, or power unit shall be Type 316 stainless steel, ASTM F 593.

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.

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

NOTE: Refer to TM 5-814-3 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

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

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

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

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

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

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

PART 3 EXECUTION

3.1 INSTALLATION

All materials and equipment shall be installed as shown and in accordance with the approved written recommendations of the equipment manufacturer.

3.2 ELECTRICAL WORK

Electrical equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Electrical characteristics shall be as indicated. 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, shall be provided under this section of the specification.

3.3 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.

3.4 TRAINING

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.

3.5 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. The Contractor shall 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.

3.6 FIELD TESTS

After installation of comminutor is complete, the Contractor shall conduct operational tests required to demonstrate that the comminutor will operate in accordance with the requirements of this section of the specifications.

3.6.1 Scheduling

The Contractor shall give the Contracting Officer [14] [_____] calendar days notice of the dates and times scheduled for the tests.

3.6.2 Tests

The Contractor shall 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. Head losses at the specified flow ranges will be measured 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.

3.7 FRAMED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system shall be posted where directed. 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 shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

-- End of Section --