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USACE / NAVFAC / AFCEC / NASA **UFGS-46 20 20 (February 2011)**

Preparing Activity: USACE **Superseding**
UFGS-22 13 23 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SEWAGE BAR SCREEN AND MECHANICAL SHREDDER

02/11

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SECTION 46 20 20

SEWAGE BAR SCREEN AND MECHANICAL SHREDDER
02/11

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NOTE: This guide specification covers the requirements for sewage bar screen and mechanical shredder 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

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NOTE: Refer to UFC 3-240-02 for design requirements. This guide specification is written for one bar screen and mechanical shredder.

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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 A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 3	(2005; R 2010) Medium-Voltage Controllers Rated 2001 to 7200 V AC
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NEMA MG 1 (2018) Motors and Generators

NATIONAL FLUID POWER ASSOCIATION (NFLPA)

NFLPA T2.13.1 (2007; 5th Ed) Recommended Practice – Hydraulic Fluid Power – Use Of Fire Resistant Fluids In Industrial Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1677 (2016) Tests and Procedures for Carbon Steel and High Strength Low Alloy Steel Tubing

UNDERWRITERS LABORATORIES (UL)

UL 98 (2016) UL Standard for Safety Enclosed and Dead-Front Switches

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

Materials And Equipment; G[, [_____]]

SD-03 Product Data

Spare Parts

Framed Instructions

SD-06 Test Reports

Tests

SD-10 Operation and Maintenance Data

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

1.3 DELIVERY, STORAGE, AND HANDLING

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

1.4 EXTRA MATERIALS

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. Furnish special tools for the proper operation and maintenance of equipment, installed in a wall-mounted hardwood or metal container.

Submit spare parts data for each different item of material and equipment specified, after approval of the detail 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, and a list of the parts recommended by the manufacturer to be replaced after [1][and][3] year(s) of service.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

a. Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products, that conform to the respective publications and other requirements specified and 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.

b. Each major item of equipment shall have manufacturer's name, address, and catalog or model number on a plate securely attached to item. In

lieu of nameplate on the shredder and bar screen, manufacturer's name or trademark may be cast integrally with shredder, stamped, or otherwise permanently marked.

c. Fully enclose moving parts of the equipment, such as drive chains and sprockets, in removable guards. Equipment above the level of the sewage-carrying channel shall be fully enclosed in a cast iron or 1.897 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 ensure ready access to any part of equipment for repairs, replacements, or cleaning. Joint between the housing and the concrete foundation shall be made leakproof.

d. Submit detail drawings consisting of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Detail drawings shall also contain 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.

2.1.1 Bearings

ABMA 9 and ABMA 11.

2.1.2 Iron, Steel, and Miscellaneous Metal

2.1.2.1 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.

2.1.2.2 Malleable Iron

ASTM A47/A47M, grade No. 32510, minimum.

2.1.2.3 Structural Steel

ASTM A36/A36M.

2.1.3 Motors, Electric

NEMA 250, NEMA ICS 1, NEMA ICS 3, NEMA ICS 4, NEMA ICS 6 and NEMA MG 1.

2.1.4 Motor Controls

NEMA ICS 2.

2.1.5 Switches, Enclosed

UL 98.

2.2 ELECTRICAL WORK

Provide electrical equipment and wiring 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.

2.2.1 Electric Motors

Provide equipment complete with motors of the [open] [totally enclosed] ball-bearing squirrel-cage induction type, with a maximum speed not to exceed 1800 rpm. Motors shall be of sufficient capacity to drive equipment at the specified capacity without exceeding rating shown on nameplate attached to the motor.

2.2.2 Motor Controls

Motor controls shall be provided to control the motor in the manner indicated or specified. Motor controls shall be coordinated with the associated motor and shall have properly sized thermal-overload protective elements. Except where otherwise indicated, starters shall be provided in [general-purpose] [weatherproof] enclosures. Where manual control is specified, starter shall be provided with a start-stop pushbutton in the cover. Where automatic control is specified, starter shall be provided with a hand-off-automatic selector switch in the cover. Each starter shall bear an appropriate nameplate or stencil identifying equipment controlled.

2.3 HYDRAULIC WORK

Hydraulic equipment and application shall be in accordance with Section 41 24 26 HYDRAULIC FLUID POWER SYSTEMS. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring or hydraulic connections required for controls and devices but not shown on electrical or hydraulic plans, shall be provided under this section of the specification.

2.3.1 Fluid Motors

Equipment shall be provided complete with fluid motors of the [vane] [piston] type. Motors shall be of sufficient capacity to drive equipment at the specified rating without exceeding rating shown on the nameplate attached to the motor.

2.3.2 Hydraulic Controls

Provide controls in the manner indicated or specified, coordinated with the associated equipment, and having properly sized overload protective elements.

2.3.3 Fluid Power Valves

SAE J1677.

2.3.4 Fluid Tubing

SAE J1677.

2.3.5 Hydraulic Fluid

NFLPA T2.13.1.

2.4 MECHANICALLY-CLEANED BAR SCREEN

Bar screen shall consist of a stationary bar screen, a screen rake, a rake mechanism operated by [an electric] [a hydraulic] drive unit, and a dead plate and rake-cleaning device, where required. Equipment shall be installed so as not to obstruct the flow of sewage to bar screen. Unless otherwise specified, metal that is submerged in the sewage-carrying channel or that comes in contact with sewage shall be of wrought iron, steel, cast iron, or other equally corrosion-resistant metal.

2.4.1 Bar Screen

Each bar screen shall be suitable for installation in a rectangular channel [_____] m [_____]-feet [_____]-inches wide by [_____] m [_____]-feet [_____]-inches deep, and shall be designed for handling sewage flows as follows:

a. Minimum, [_____] cubic meters/day MGD.

b. Average, [_____] cubic meters/day MGD.

c. Maximum, [_____] cubic meters/day MGD.

2.4.2 Screen Rake

Rake shall be designed to rake up screenings collected on the bar screen and in the openings between bars, and to convey screenings to a [drain platform] [collection trough] [grinder]. Rake shall be of cast iron, steel, or other suitable material not less than [_____] mm inch thick. Rake teeth shall be spaced so as to pass between bars of the screen. Rake teeth plate shall be easily removable and replaceable.

2.4.2.1 Rake Mechanism

Mechanism shall be revolving-frame, automatic-hoist, endless-chain type, or screw-drive type and shall include parts and accessories necessary for a complete operating unit. Parts of the mechanism shall be amply proportioned for stresses that may occur during fabrication, erection, and operation. Individual parts that are alike in each unit shall be interchangeable. Shearing pins or an overload-release mechanism shall be provided for overload protection. Rake speed shall not exceed [_____] m/second feet per minute. Rake mechanism shall be provided with a complete and adequate system of lubrication to moving parts subject to wear. Bearings shall be grease- or oil-lubricated except submerged bearings which shall be of alloy-bearing metal designed to operate without any lubrication and to prevent accumulation of deposits.

2.4.2.2 Revolving-Frame-Type

Revolving-frame-type rake mechanism shall consist of two pairs of structural-steel-angle rake arms mounted on a horizontal shaft. Screen rakes shall be attached to steel crossbars mounted on the outer end of each pair of rake arms. Entire rake mechanism shall revolve about the horizontal shaft.

2.4.2.3 Automatic-Hoist-Type

Automatic-hoist-type rake mechanism shall consist of a reciprocating rake mounted on a horizontal shaft or frame and guided by steel channels or

angles at each end of the frame. Rake and frame shall be pulled up the slope of the guide rails by two or more cables operating over motor-propelled grooved drums. After screenings are discharged, rake frame shall be automatically tilted and lowered to the bottom of screen.

2.4.2.4 Endless-Chain-Type

Endless-chain-type rake mechanism shall consist of a drive chain, drive sprockets, and sprocket wheels mounted on a drive shaft, and an idler shaft where required, operating two endless chains with rakes securely attached.

a. Drive chain connecting motor sprocket with the drive shaft and the endless chain shall be of malleable iron with heat-treated-steel pins or rivets. A chain tightener or takeup bracket shall be provided for drive chain. Chains shall be of suitable size and design to withstand strains imposed.

b. Sprockets for the drive and endless chains shall be of semi-steel or cast iron with chilled teeth and rims. Rims and teeth of the sprockets shall be accurately ground to fit chains. Sprockets shall be of size recommended by the equipment manufacturer. Shafting shall be of cold-rolled steel, straight and true, and of ample diameter to transmit the power required without undue deflection. Keyways where required shall be accurately cut. Malleable iron or bronze safety collars shall be provided where required to keep shafting and sprockets in alignment.

2.4.2.5 Screw-Drive Type

Screw-drive type rake mechanism shall consist of a reversing threaded screw-drive and bearing nut attached to rake. Rake shall have reciprocating action.

2.4.2.6 Rake Mechanism Control Equipment

Starting of motor shall be actuated by means of [automatic time switch for intermittent operation, adjustable to give 3 to 60 minutes between cycles] [float switch for automatic operation at predetermined levels] [float switch for automatic operation at predetermined rise in head of sewage on the upstream side of the screen bar]. [Floats shall be constructed of corrosion-resistant metal.]

a. Endless-Chain-Type-Rake Mechanism: A motor-reversing switch shall be provided so that direction of travel of the rake mechanism can be reversed in the event of jamming. The motor-reversing switch shall be a double-throw externally operable switch enclosed in a [raintight] [watertight] enclosure. The switch shall be marked: "Forward," "Off," "Reverse."

b. Automatic Hoist-Type Rake Mechanism: Starters for this type of rake mechanism shall be of the reversing type. Control devices shall be so arranged that on completion of upward travel of the rake mechanism, motor will be stopped and then reversed, and rake will travel to the lower position, at which point motor will again stop and be automatically adjusted for the next automatic operation.

c. Revolving Frame-Type Rake Mechanism: An emergency stop push-button and a rake limit switch, to always stop the rake out of water after

discharge of screenings, shall be provided in a weatherproof enclosure.

d. Bearing Type Rake Mechanism: Travel of the rake in a downward or upward direction shall be controlled by proximity switches. Frequency of raking shall be adjustable. Rake delay shall be on the [top] [bottom]. Rake drive shall be [hydraulic] [electric]. Overload protection shall be provided for down and up stroke. Drive shall have a control panel (minimum NEMA ICS 2) mounted.

e. Rake Wiper: Where required to remove screenings from rake, a rake wiping or scraping device shall be provided at the discharge point of rake. Device shall consist of either a plate attached to swinging hinged arms or a continuous hinged plate actuated by motion of the rake. Wiper shall be so designed that after cleaning of the rake is completed, wiper will fall into the proper place ready for the next scraping operation. Fall of wiper shall be controlled either mechanically or hydraulically to absorb any shock.

f. Dead Plate or Apron: A wrought iron or steel dead plate shall be provided where required to prevent any deposited screenings from falling into the downstream side of rake. Dead plate shall be not less than 2.657 mm (12 gauge) 12 gauge metal if required by the design and type of rake mechanism installed, and shall be rigidly braced if required.

2.5 MECHANICAL SHREDDER, CUTTER, OR GRINDER

2.5.1 Operation Requirements

Shredder, cutter, or grinder unit shall be suitable to receive screenings from screening unit specified and to discharge resulting pulp into the sewage flow. Machine shall be operated by an electric drive unit and shall be designed to cut sewage solids, including sticks, rags, and stringy material without clogging, jamming, or stalling moving parts. Grinder and drive unit shall be direct connected by a flexible or friction-type coupling and integrally mounted on a structural steel or cast iron base. Grinder shall be provided with a water-flushing system where required to flush ground solids through the machine. Machine shall have a capacity of grinding [_____] kg pounds of sewage screening per hour.

2.5.2 Control Equipment

Control shall be so arranged that shredder motor will automatically start when the rake-mechanism motor starts. A relay shall be provided to allow the shredder to continue to run for a predetermined time after rake mechanism has stopped, and to automatically stop the shredder motor.

2.5.3 Cutter Mechanism

Cutter shall consist of cutting blades or impellers mounted on a revolving shaft or drum in contact with a stationary cutter screen or blade. Cutting devices shall be of tool steel or other material equally suitable for cutting tools, and shall be accurately cut and ground to size to provide sharp cutting edges having extreme resistance to wear.

2.5.4 Bearings

Bearings shall be of the self-aligning ball or roller type. Bearings and bearing supports shall be designed to safely carry and withstand the

stresses imposed by the disintegrating action of the grinder.

2.5.5 Stuffing Boxes

Wherever the drum shaft passes through the machine housing, provide stuffing boxes of proper depth and construction.

2.5.6 Lubrication

Bearings and moving parts, subject to wear, shall be provided with adequate devices for grease or oil lubrication.

2.6 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.

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

3.3 CONCRETE FOUNDATIONS

Use concrete for foundations as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Concrete foundations shall be integral with, and of same strength as the building floor, unless otherwise specified. Concrete used in foundations that are entirely separated from the surrounding floor shall be 17 MPa 2500 psi. When new foundations are constructed on existing concrete, new concrete shall be bonded to old as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Furnish foundation bolts, as required, for proper positioning during placement of concrete.

3.4 FIELD PAINTING

Field painting is specified in Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD QUALITY CONTROL

3.5.1 Tests

After installation of the sewage bar screen and mechanical shredder is complete, conduct operational tests required to demonstrate that the sewage bar screen and mechanical shredder will operate in accordance with the requirements of this section of the specifications. Each test report shall indicate the final position of controls.

3.5.2 Manufacturer's Field Services

Obtain the services of the 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.

3.6 CLOSEOUT ACTIVITIES

3.6.1 Framed Instructions

Provide framed instructions, including wiring and control diagrams, showing the complete layout of the entire system, posted where directed. The framed instructions shall be posted before acceptance testing of the systems. 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. Submit proposed diagrams, instructions, and other sheets, prior to posting.

3.6.2 Operating and Maintenance Instructions

Submit operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Submit maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions shall include simplified diagrams for the system as installed.

3.6.3 Training

Provide a field training course for designated operating and maintenance 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. Field training shall cover all of the items contained in the Operating and Maintenance Instructions.

-- End of Section --