
USACE / NAVFAC / AFCEA / NASA UFGS-44 46 20 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-13234 (September 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 19 March 2007

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SECTION 44 46 20

FLOATING COVER FOR SLUDGE-DIGESTION TANKS 04/06

NOTE: This guide specification covers the requirements for floating cover for sludge-digestion tank.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

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).

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2005 e13) Steel Construction Manual

AISC 360 (2005) Specification for Structural Steel Buildings

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP (2005) Fundamentals Handbook, I-P Edition

ASHRAE FUN SI (2005) Fundamentals Handbook, SI Edition

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA P5 (2005) Standard for Waterborne Preservatives

ASME INTERNATIONAL (ASME)

ASME B31.1 (2004; Addenda 2005) Power Piping

ASME BPVC SEC IX (2004; 2005 Addenda; 2006 Addenda) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASTM INTERNATIONAL (ASTM)

ASTM A 167 (1999; R 2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 36/A 36M (2005) Carbon Structural Steel

ASTM B 209 (2006) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 209M (2006) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B 370 (2003) Copper Sheet and Strip for Building Construction

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

Field Erection

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.

SD-03 Product Data

Floating Cover

A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

Spare Parts

Spare parts data for each different item of material and equipment specified.

Framed Instructions

A copy of the instructions proposed to be framed and posted.

SD-06 Test Reports

Testing Coating Testing

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-10 Operation and Maintenance Data

Operating and Maintenance Manuals[; G][; G, [____]]

[Six] [____] copies of operation and [six] [____] copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and 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. Manuals shall be approved prior to the field training course.

1.3 QUALIFICATIONS

Procedures and welders shall be qualified in accordance with the code under which the welding is specified to be accomplished.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.5 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.

1.6 SPARE PARTS

The Contractor shall submit spare parts data for each item of equipment and material specified, after approval of the related submittals 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.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall 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.

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 Special Tools

One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

2.2 GENERAL DESIGN REQUIREMENTS

NOTE: Include only non-gasholding covers or only
gasholding covers, not both.

Floating cover shall conform to the general design requirements specified and as shown.

2.2.1 Non-Gasholding Floating Cover

NOTE: A ceiling plate serves two functions: first,
it submerges floating scum; second, it protects the
structural truss assembly from corrosive digester
contents and gas. However, the ceiling plate may be
deleted if its worth does not exceed the cost.
Covers with attic space designs will be seal welded
to prevent entrance of digester gas into attic space.

The floating cover shall be a rigid steel structure designed to float on the liquid contents of the digestion tank as indicated. The cover shall consist of [structural steel radial truss sections] [arched radial beams] with cover plates welded to [trusses] [beams] and to each other to form a gas-tight support system for roof, sidewalls, [ceiling] and appurtenances required for a complete installation. [The ceiling shall be of welded steel plate and shall float on the liquid surface, keeping floatable scum submerged and in contact with actively digesting sludge. The plate shall slope radially upward from a vertical rim plate at the tank wall to a circular gas dome at the center of the tank.] The installed weight of the digester cover and appurtenances, including any necessary concrete ballast, shall be sufficient to provide a static gas pressure of at least [_____] Pa inches water column. Additional supports shall be provided as required to maintain the stability of the cover when it is subjected to uneven live loads.

2.2.2 Gasholding Floating Cover

NOTE: All volume under gasholder cover (ceiling) and in upper 300 mm (12 in.) of sidesheet cylinder may not be considered as usable gas storage because gas in this portion of holder cannot be withdrawn without a sudden loss of gas pressure.

Coordinate with paragraph Non-Gasholding Floating Cover.

The gasholding floating cover shall be a rigid steel structure designed to float on a gas layer above the liquid contents of the digestion tank as indicated. The cover shall consist of [structural steel radial truss sections] [arched radial beams] with cover plates welded to [trusses] [beams] and to each other to form a gas-tight support system for roof, sidewalls, [ceiling] and appurtenances required for a complete installation. [The ceiling shall be of welded steel plate and shall float on a gas layer above the liquid contents of the digester. The ceiling shall provide scum submergence when the gas pressure is reduced and the cover is allowed to settle on the digester contents. The plate shall slope radially upward from the vertical sidewall to a circular gas dome at the center of the tank.] An extended rim skirt shall extend below the digester liquid level to contain the produced gas. The gasholder shall have an effective gas storage capacity of [_____] cubic meters feet at an operating pressure of [_____] Pa inches water column. The cover shall be capable of vertical liquid surface travel of [_____] mm feet with minimum to maximum gas storage available over this range of travel. Volume under gasholder cover [ceiling] and in upper [_____] [300] mm [12] inch of sidesheet cylinder shall not be considered as usable gas storage.

2.2.3 Coordination

The floating cover and the digester gas, heating, and mixing system shall be coordinated to ensure proper operation and interface between the two items.

2.3 STRUCTURAL DESIGN REQUIREMENTS

NOTE: Live, snow, and vacuum loads depend upon geographical area of installation. Dead and roof loads vary depending on type of roof construction and equipment to be installed on the cover. Various manufacturers must be consulted to determine loads to be specified.

Coordinate with paragraph Non-Gasholding Floating Cover.

The floating cover shall be self-supporting when resting in an empty tank and shall be designed to withstand a live, snow, and vacuum load of [_____] kPa psf and a dead load and roof load of [_____] kPa psf. Design and construction shall be in accordance with the applicable sections of AISC 325 and AISC 360. [Ceiling plates shall not be considered as a structural member in calculations.]

2.4 FRAME ASSEMBLY

The frame assembly shall be of minimum 6.4 mm 1/4 inch thick ASTM A 36/A 36M structural steel radial truss sections.

2.5 ROOF DECK, WOOD

NOTE: Select the type of roof system required by the design.

The roof deck shall consist of not less than 50.8 x 101.6 mm 2 x 4 inch wood rafters and not less than [50.9] [_____] mm [2] [_____] inch thick tongue and groove sheathing. Lumber shall be any species and grade of sufficient quality to support the roof loads and shall be free from large cracks, knotholes, and loose material. All lumber shall be pressure treated in accordance with AWPA P5. Rafters shall be bolted to the top chord of each truss and installed in the intermediate spaces as required to provide a maximum span of 610 mm 24 inches between rafters. Sheathing shall be nailed to the rafters.

2.6 ROOF DECK, CAST-IN-PLACE CONCRETE

NOTE: Select the type of roof system required by the design.

Corrugated steel sheets shall be installed directly on the steel framework. Concrete deck shall be cellular, perlite, or vermiculite in accordance with Section 03 51 00 ROOF DECKING, CAST-IN-PLACE LOW DENSITY CONCRETE.

2.7 ROOF DECK, PRECAST CONCRETE

NOTE: Select the type of roof system required by the design.

A precast concrete deck shall be installed in compliance with Section

03 41 36.00 10 PRECAST ROOF DECKING.

2.8 ROOF DECK, STEEL

NOTE: Select the type of roof system required by
the design.

The roof deck shall be of 6.4 mm 1/4 inch minimum thickness ASTM A 36/A 36M steel plate and shall be designed, installed, and welded in compliance with the applicable sections of AISC 325 and AISC 360. The roof shall be made up of fabricated assemblies which shall be piecemarked for erection. Prefabricated insulated metal panels may be provided in lieu of the roof deck, roofing, and insulation if they comply with all of the design requirements specified herein.

2.9 ROOF INSULATION

NOTE: The coefficient of heat transmission through the roof in W per square meter, per degree K (Btuh, per square foot, per degree F) temperature difference will be inserted. Uninsulated covers generally are the standard practice. The boiler size generally is increased to compensate for heat losses in the roof. Before insulation is specified, an economic analysis of the cost of roof insulation versus the cost of increased boiler size will be made. In this analysis, the cost of fuel for the boiler may be minor where excess sludge gas is wasted. Insulation of covers varies with design of covers. For truss supported roof with ceiling covers, lightweight concrete or urethane may be added to ceiling plate. For designs without ceilings, urethane may be added to exterior of roof to provide insulation.

Insulation shall be of sufficient thickness to provide a coefficient of heat transmission (U-value) through the complete roof construction, air-to-air, not exceeding [_____] watt per square meter/degree K Btu per hour, per square foot/degree F temperature difference when calculated in accordance with ASHRAE FUN SIASHRAE FUN IP. Material and installation shall be in accordance with Section 07 22 00 ROOF AND DECK INSULATION.

2.10 ROOFING

NOTE: Roofing and flashing are not required on steel plate roof decks and paragraphs ROOFING and FLASHING should be deleted if only steel plate decks are specified.

Roofing shall be in accordance with Section 07 51 13 ASPHALT BUILT-UP ROOFING.

2.11 FLASHING

Flashing shall be light cold-rolled temper 340 g 12 ounce copper conforming to ASTM B 370, type 301, 302, 304, or 316 stainless steel conforming to ASTM A 167, or alloy 3003, 3004, alclad 3003, and alclad 3004 aluminum conforming to ASTM B 209M ASTM B 209. Flashing shall be installed around the periphery of the cover and shall extend approximately 150 mm 6 inches below the top of the deck. The flashing shall be formed to act as a gravel stop. Flashing shall be installed around the center dome, manholes, and other openings as required to ensure a watertight structure.

2.12 RIM SKIRT FOR GASHOLDING COVERS

NOTE: Delete this paragraph if non-gasholding covers are specified.

An extended rim skirt shall be provided around the periphery of the cover and extend below the liquid level to contain the gas. If necessary for proper operation of the pressure relief valve, a precast or cast-in-place concrete ballast ring shall be provided. Precast concrete ballast rings shall be attached to the bottom of the rim skirt by steel straps welded to the rim skirt. Cast-in-place concrete ballast ring shall be cast integrally with the rim skirt with reinforcing bars welded to the rim skirt for support.

2.13 WALL GUIDES AND ROLLERS

NOTE: Delete inapplicable types of guides.
Vertical guides should be used on all covers except gasholder covers over 9 m (30 feet) in diameter. Spiral guides are recommended for gasholders over 9 m (30 foot) diameter to protect against tipping. Teflon slide plates have replaced rollers on spiral guide type system on some digester cover systems. The floating cover in the low or nonoperational position will rest on tank supports or corbels. The number and size of corbels cast into the tank wall should take into account dead and live loading of floating cover. Some tank designs may utilize top cover supports instead of corbels. On truss supported covers, one corbel per truss is usually supplied around the inside wall of the digester.

[Vertically guided covers shall be equipped with [_____] peripheral guide rollers located on the cover and vertical wall guides located on the inside face of the digester tank wall. The rollers shall prevent tipping of the cover when subjected to unbalanced loads. The vertical guides shall prevent rotation of the cover during its vertical travel.] [Spirally guided covers shall be provided with spiral guides mounted in the rim skirt and arranged to engage rollers set in the wall of the tank. The spiral guides shall assure that the gasholder remains level under all operating conditions, preventing the gasholder from tilting or binding under any operating conditions.]

2.14 APPURTENANCES

Appurtenances provided shall include the following:

2.14.1 Gas Dome

A gas dome shall be provided to prevent light materials from the sludge from carrying over into the gas piping.

2.14.2 Gas Pipe Housing

A gas pipe housing shall be provided when required to allow vertical travel of the cover without conflict with interior gas piping. A gas mixing compressor and housing shall be added as required.

2.14.3 Drain Sumps and Access Wells

**NOTE: Delete this paragraph if ceiling plates are
not specified. If steel roof is specified, provide
only two drain sumps.**

[A drain sump shall be provided at every other truss] [Two drain sumps shall be provided, on opposite sides of the cover,] for collection of water that collects in the floating cover. An access well with an aluminum ventilating cover shall be provided for each drain sump.

2.14.4 Manhole

**NOTE: Delete this paragraph if ceiling plates are
not specified.**

A manhole with cover shall be provided to allow access to the digestion tank. The manhole shall be gas tight.

2.14.5 Entrance Hatch

**NOTE: Include "cover attic space" for covers with
ceiling plates. Include "digester" for covers
without ceiling plates.**

An entrance hatch shall be provided to permit access to the [cover attic space] [digester].

2.14.6 Sampling Well

A sampling well with quick-opening gas tight cover shall be provided. The well shall extend below the liquid level to allow sampling of the digester contents without releasing the gas from the tank.

2.14.7 Pressure-Vacuum Relief Unit

A combination pressure-vacuum relief unit with a flame arrester designed to protect against excessive pressure and vacuum and to prevent accidental

ignition of gas within the digester from external sources shall be provided. Valve materials shall be impervious to the attack of digester gas, and interior parts shall be readily accessible for inspection and maintenance.

2.15 FABRICATION

The floating cover shall be shop fabricated in subassemblies as large as practicable for shipping. The gas dome shall be completely shop fabricated with top and bottom rings, truss chord connection plates, and top plate in place. The gas pipe housing, sampling wells, manhole, and entrance hatch shall be completely shop assembled and match-marked for proper installation.

PART 3 EXECUTION

3.1 FIELD ERECTION

Assembly and installation shall be in accordance with manufacturer's written instructions.

3.2 PAINTING

Paint preparation and application shall be in accordance with manufacturer's instructions and following:

3.2.1 Preparation and Application

All metal surfaces, except aluminum, bronze, brass, and stainless steel, and equipment normally factory finished shall be painted. Surface preparation and painting shall be performed in the field. Ferrous metal surfaces shall be prepared in accordance with **SSPC SP 10** and painted with coal tar bitumastic for surfaces exposed to digester sludge and high build polyamide or amine epoxy system for exterior surfaces.

3.2.2 Coating Testing

Coatings shall be examined for flaws and tested for thickness and holidays. Thickness of coatings shall be measured by a commercial film thickness gauge. Coatings shall be tested for pinholes, holidays, and other defects with an electric detector equipped with an audible signal that operates when a flaw defect is detected. The detector shall be a 90-volt wet sponge type pinhole detector.

3.2.3 Coating Repair

If welding is required after application of the coating or if the coating is damaged in any way, repair shall consist of preparing the affected area in compliance with **SSPC SP 10** and reapplying the coating to that area. If holidays are detected or film thickness is insufficient, the surface shall be prepared and additional coats applied in the affected area in compliance with manufacturer's instructions.

3.3 TESTING

**NOTE: Delete the bracketed part of this paragraph
if ceiling plates are not specified.**

After erection and installation of the cover, the tank shall be filled with water and the cover floated on the water, trapping air beneath the cover. Water shall be furnished by the [Government] [Contractor]. Welded seams shall be checked for leaks by application of a soapsuds solution. Leaks shall be repaired by rewelding and the cover shall be retested until no leaks are discovered. [The trapped air shall be released and the cover shall be floated on the water, testing all seams for watertightness. Leaks shall be repaired by rewelding and the cover shall be retested until the ceiling is watertight.] Volume of [water] [air] shall be added such that cover travels the full range of design in order to test vertical and/or spiral roller and guide systems.

3.4 WELDING

NOTE: If the need exists for more stringent pipe
welding requirements, delete the sentences in the
first set of brackets.

[Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX Boiler and Pressure Vessel Code. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05 05 23.00 14 WELDING, STRUCTURAL.] [Welding and nondestructive testing procedures for piping shall be as specified in Section 43 02 00 WELDING PRESSURE PIPING.]

3.5 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.6 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. The instructions shall show wiring and control diagrams and complete layout of the entire system. The instructions shall also include, in typed form, 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. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.7 FIELD TRAINING

A field training course shall be provided 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 manuals](#).

-- End of Section --