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USACE / NAVFAC / AFCEC / NASA | **UFGS-46 43 21 (February 2011)**
Change 2 - 02/13
Preparing Activity: NAVFAC | **Replacing without change**
UFGS-44 42 23 (November 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2014
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SECTION 46 43 21

CIRCULAR CLARIFIER EQUIPMENT

02/11

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USACE / NAVFAC / AFCEC / NASA | UFGS-46 43 21 (February 2011)
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SECTION 46 43 21

CIRCULAR CLARIFIER EQUIPMENT
02/11

****
NOTE: This guide specification covers the requirements for circular clarifier for use in sewage treatment plants.

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 items(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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****
NOTE: This guide specification is for treatment of domestic sewage only. Special consideration must be given to sewage containing industrial wastes.
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NOTE: The following information shall be shown on the project drawings or provided by the project designer:

1. Type of clarifier: primary or secondary

2. Dimensions of clarifier tank

3. Whether clarifier is of center feed/peripheral overflow type or peripheral feed/center overflow type

4. Whether influent enters through side of tank or through center column when clarifier is center feed/peripheral overflow type

5. Whether rapid sludge removal system is to be used and the number and size of the sludge uptake pipes

6. Size of influent well when clarifier is center feed/peripheral overflow type

7. Size and section of effluent trough when clarifier is peripheral feed/center overflow type

8. Size and section of weirs and baffles; and anchorage details

9. Electrical characteristics for motor

10. Sizes of piping, points of connection to plant piping, and types of joints for wall castings and sleeves

This guide specification may be used to prepare specifications for either primary or secondary clarifiers; where both are used on a project, a separate section should be prepared for each type.

****

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NOTE: Reliability and Maintainability (RAM) Data: A survey by the Naval Facilities Engineering Service Center (NFESC) collected RAM data on 278 collectors at 134 plants nationwide. The report of survey contains general statistical data rating manufacturers' equipment in terms of the average time of operation between breakdowns. Information included in the report may be obtained by calling Dr. D. B. Chan, DSN 551-4191, or commercial (805) 982-4191; or by writing to: Commanding Officer, Naval Facilities Engineering Service Center, Code 411, 560 Center Drive, Port Hueneme, CA 93043-4328.

****

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.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(1990; R 2008) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 2015/915-1	(2002A) Accuracy Classification System - Tangential Measurement Tolerance Tables for Cylindrical Gears
AGMA 908	(1989B; R 1999) Information Sheet: Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth
AGMA ISO 10064-6	(2010A) Code of Inspection Practice - Part 6: Bevel Gear Measurement Methods
AGMA ISO 17485	(2008A; Supplement 2008) Bevel Gears - ISO System of Accuracy (Including Supplement - Tolerance Tables 2008)
ANSI/AGMA 2011	(1998A; R 2004) Cylindrical Wormgearing Tolerance and Inspection Methods
ANSI/AGMA 6001	(2008E) Design and Selection of Components for Enclosed Gear Drives
ANSI/AGMA 6013	(2006A; R 2011) Standard for Industrial Enclosed Gear Drives
ANSI/AGMA 6034	(1992B; R 2005) Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors
ANSI/AGMA 6113	(2006A; R 2011) Standard for Industrial

	Enclosed Gear Drives (Metric Edition)
ANSI/AGMA 9000	(2011D) Flexible Couplings - Potential Unbalance Classification
ANSI/AGMA 9002	(2004B; R 2011) Bores and Keyways for Flexible Couplings (Inch Series)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2010) Specification for Structural Steel Buildings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2008; Errata 2010) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASME INTERNATIONAL (ASME)

ASME B17.1	(1967; R 2013) Keys and Keyseats
ASME B17.2	(1967; R 2013) Woodruff Keys and Keyseats
ASME B18.21.1	(2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.21.2M	(1999; R 2005) Lock Washers (Metric Series)
ASME B18.22M	(1981; R 2010) Metric Plain Washers
ASME B29.100	(2011) Precision Power Transmission, Dbl-P-Power Transmission, Dbl-P-conveyor Roller Chains, Attachments and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A325	(2010; E 2013) Standard Specification for Structural Bolts, Steel, Heat Treated,

	120/105 ksi Minimum Tensile Strength
ASTM A325M	(2013) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A36/A36M	(2012) Standard Specification for Carbon Structural Steel
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B221	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D256	(2010) Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D3034	(2008) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics

ASTM E84	(2013a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F593	(2013) Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	(2009; E 2011) Standard Specification for Stainless Steel Nuts

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2000; R 2008; E 2010) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA MG 1	(2011; Errata 2012) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2014; AMD 1 2013; Errata 2013; AMD 2 2013) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D) Paint, Epoxy-Polyamide, General Specification for

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL METARIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.3 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.

The Guide Specification technical editors have designated 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 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.][for 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

Circular clarifier system

SD-03 Product Data

Clarifier mechanism

Grout Materials

Electrical control system

SD-08 Manufacturer's Instructions

Circular clarifier

SD-10 Operation and Maintenance Data

Circular clarifier, Data Package 3[; G][; G, [_____]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Posted operating instructions for motor and gear motor

1.4 DELIVERY, STORAGE, AND HANDLING

Equipment and parts shall be packaged for shipment to prevent breakage and damage to components. Deliver materials to the site, inspect for damage, unload and store with a minimum of handling. Store materials off the ground and under a weathertight covering.

1.5 MANUFACTURER'S REPRESENTATIVE

Furnish the service of the clarifier equipment manufacturer's representative or technician, experienced in installation and operation of the type of systems being provided, to supervise the erection, start-up, acceptance tests, and final inspection.

1.6 POSTED OPERATING INSTRUCTIONS

Provide, in accordance with Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS.

1.7 QUALITY ASSURANCE

1.7.1 Drawing Requirements

Show the complete assembly of the circular clarifier system with all components, mechanisms, and parts; each with an assigned number corresponding to the equipment manufacturer's parts list. Show details for each component of the clarifier mechanism including installation of piping, anchorage, wiring, and tank floor surfacing.

PART 2 PRODUCTS

2.1 CIRCULAR CLARIFIER, GENERAL

****
NOTE: The concrete section of the project specification should provide for the clarifier tank to be constructed in accordance with Section 03 30 00.00 10, CAST-IN-PLACE CONCRETE, Section 03 30 00 CAST-IN-PLACE CONCRETE. Concrete should be 25 MPa 3500 psi minimum 28-day compressive strength with 50 mm 2 inch maximum aggregate size and 22.70 liters 6 gallon per bag maximum water-cement ratio. Walls should have smooth form finish. Floor should have base slab poured to a minimum of 50 mm 2 inches below indicated finish elevation; and then be given a screed finish followed by raking to roughen the surface.
****

****
NOTE: When center feed/peripheral overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), center column used as influent pipe, influent well, and (peripheral) weirs and scum baffles.
****

****
NOTE: When peripheral feed/center overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), influent skirt, and effluent trough and weir assembly.

****

Clarifier equipment shall include clarifier mechanism [with effluent trough and weir assembly], [weirs and baffles,] [influent skirt,] and piping. Structural steel shall conform to ASTM A36/A36M. Completely or intermittently submerged steel members shall have a minimum thickness of 6 mm 1/4 inch. Cast iron shall conform toASTM A48/A48M, Class 30 minimum.

2.2 CLARIFIER MECHANISM

****
NOTE: Delete requirements for and references to rapid sludge removal system when this system is not included in the project.
****

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

****
NOTE: When center feed/peripheral overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), center column used as influent pipe, influent well, and (peripheral) weirs and scum baffles.
****

****
NOTE: When peripheral feed/center overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), influent skirt, and effluent trough and weir assembly.
****

****
NOTE: Use first bracketed wording in the second sentence when rapid sludge removal system is not included in the project; use second bracketed wording in this sentence when rapid sludge removal system is included.
****

****
NOTE: Other items associated with the circular clarifier, but not covered in this section, include (when used) valves, sluice gates, and perimeter handrail. These items should be covered in the

appropriate sections of the project specification.
****

Shall include sludge collector assembly [with rapid sludge removal system]; drive assembly; [supporting bridge or] center column and access bridge; operating platform and access walkway thereto; influent [well] [skirt and effluent trough and weir assembly]; scum removal assembly; overload protection and alarm; and electrical control equipment. The drive shall rotate the sludge collector assembly, which shall be designed to [move settled sludge to a centrally located sludge hopper] [concentrate settled sludge ahead of pipes for rapid sludge removal system]. Mechanism shall be so designed that there will be no chains, sprockets, bearings (except sleeve bearings when used), or operating mechanism below the liquid surface or in contact with the liquid. The mechanism shall be assembled in the shop to ensure proper fitting of parts, match-marked for erection, and disassembled for shipment.

2.2.1 Design

****
NOTE: Insert torque value(s) as follows: bridge-supported mechanisms for tanks of 6-8.5 m 20-28 feet diameter, use 2,710 joules 2,000 foot-pounds; bridge-supported mechanisms for tanks of 9-12 mm 30-40 feet diameter, use 5,420 joules 4,000 foot-pounds; bridge-supported mechanisms (peripheral feed/center overflow type only) for tanks of 13-18 m 42-60 feet diameter, use 8,130 joules 6,000 foot-pounds; center-column-supported mechanisms for tanks less than 16.8 mm 55 feet diameter, use 27,100 joules 20,000 foot-pounds; center-column-supported mechanisms for tanks 16.8 to 23 m 55 to 75 feet diameter, use 40,650 joules 30,000 foot-pounds.

This guide specification is written for one clarifier. If the project includes more than one circular clarifier, all necessary pluralizations should be made or use made of the word "each."
****

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

****
NOTE: Use peripheral speed of 0.04 to 0.06 meter per second 8 to 12 fpm for primary clarifier, 0.035 to 0.05 meter per second 7 to 10 fpm for secondary clarifier.
****

****

NOTE: Use recommended values from UFC 3-301-01, Structural Engineering, for wind load and ice load.
****

Clarifier mechanism shall be designed to have a minimum continuous output torque rating of [_____] joules foot-pounds [for center-column-supported units and [_____] joules foot-pounds for bridge-supported units] with the scraper arms rotating at a constant speed which will produce a peripheral speed of [_____] meter per second fpm. Clarifier mechanism and its component parts shall be designed, with a safety factor of 2.5, to withstand all structural and mechanical stresses brought about by the following loadings: continuous output rated torque load; dead load; wind load of [_____]; ice load of [_____] (except on scum skimmer); and a live load of 2.5 kPa 50 psf on the access bridge [or on access section of supporting bridge]. Under maximum load, deflection of access bridge shall not exceed 1/240 of span [; deflection of supporting bridge shall not exceed 1/360 span]. Clarifier mechanism shall be designed for continuous 24-hour service under design load without excessive wear, damage, or failure. Stresses developed under aforementioned operating conditions and loads shall not exceed stresses allowed under AISC 360.

2.2.2 Sludge Collector Assembly

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

****
NOTE: Delete requirements for and references to rapid sludge removal system when this system is not included in the project.
****

Shall include scraper arms, scraper blades, [and] center drive cage/drum [or center shaft] [, and rapid sludge removal system].

2.2.2.1 Scraper Arms

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

****
NOTE: Use first bracketed wording in the second sentence when rapid sludge removal system is not

included in the project; use second bracketed wording in this sentence when rapid sludge removal system is included.

****

****

NOTE: Fiberglass reinforced plastic grating squeegees, weirs and baffles are available but require special consideration for anchorage and expansion. Fiberglass reinforced plastic may be allowed as an optional material provided that the necessary requirements for anchorage of these items, including provision for expansion and contraction, are incorporated in the project specification or shown on the project drawings.

****

Shall be fabricated of structural steel, using welded truss construction of triangular or box section [; or shall be structural steel shapes or closed end pile supported either by steel guy-rods or steel tie-rods or both]. Steel scraper blades, with attached squeegees, shall be welded or bolted to underside of scraper arms and shall be designed to [move settled sludge to a centrally located sludge hopper] [concentrate settled sludge ahead of pipes for rapid sludge removal system]. Scraper arms shall be connected to [center shaft or] center drive cage/drum by bolted or welded connections. Scraper blades shall be steel plate having a minimum thickness of 6 mm 1/4 inch. Squeegees shall be of bronze [, fiberglass reinforced plastic,] or stainless steel having a minimum thickness of 3 mm 1/8 inch [for metal, 6 mm 1/4 inch for fiberglass reinforced plastic], and shall be connected to scraper blades with bronze or stainless steel bolts and nuts with provision for vertical adjustment of not less than 50 mm 2 inches.

2.2.2.2 Center Drive Cage/Drum

Shall be fabricated of structural steel, using box truss or cylindrical drum construction. Center drive cage/drum shall be connected to drive assembly with machine screws or by a bolted connection.

2.2.2.3 Center Shaft

****

NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/ center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.

****

Shall be a solid steel shaft or steel pipe conforming to ASTM A53/A53M, Schedule 40. Steel pipe shall have solid shaft stub ends or machined flange at top and steel cap at bottom.

2.2.2.4 Rapid Sludge Removal System

****

NOTE: Delete requirements for and references to

rapid sludge removal system when this system is not included in the project.

****

Rapid sludge removal system shall include [_____] mm inch diameter sludge uptake pipes of PVC 1120 or PVC 1220 conforming to ASTM D1784, ASTM D3034, SDR 35 or ASTM D2241, SDR-26, attached to the scraper arms and arranged so that the flow from each can be observed, adjusted, and sampled in the sludge well. Lower end of the uptake pipes shall be attached to scraper arms with steel clamps or O-ring fittings. Uptake pipe system shall include all necessary intermediate clamps and supports and shall terminate in a suitable fitting or flexible coupling in sludge well. Discharge end of each uptake pipe shall be provided with an adjustable slip tube or orifice control gate to permit flow adjustment. Sludge well shall be of structural steel plate having a minimum thickness of 6 mm 1/4 inch and shall include a stationary and rotating section separated by a chloroprene seal.

2.2.3 Drive Assembly

****

NOTE: Delete reference to chain drives when clarifier tank is more than 12 m 40 feet in diameter. Check with manufacturer.

****

Shall include motor, speed reduction and turntable gearing, turntable bearing assembly, drive assembly bearings, and belt drives [or chain drives, or both]. Design of drive assembly shall be such as to permit sustained operation at the continuous output torque rating without excessive wear and to develop twice the continuous output torque rating without damage to or failure of drive assembly components.

2.2.3.1 Motor

****

NOTE: Use first bracketed wording when considered necessary to specify minimum wattage horsepower; otherwise, use second bracketed wording (adequate motor).

****

****

NOTE: Delete reference to chain drives when clarifier tank is more than 12 m 40 feet in diameter. Check with manufacturer.

****

Motor shall be constant speed, totally-enclosed, fan-cooled, horizontal vertical type, suitable for outdoor service, and conforming to NEMA MG 1. Motor wattage horsepower shall be [_____] [watts minimum] [HP minimum] [adequate to drive the sludge collector assembly continuously at the maximum load encountered under any operating condition without overloading or exceeding the nameplate rating of the motor.] Motor shall be suitable for operation on [_____] volt, [_____] phase, [_____] hertz service. Motor shall be protected against overload, low voltage, and unbalanced voltage. Motor shall provide the starting torque needed to move sludge collector assembly from a dead stop in a dewatered clarifier tank as well as torque needed to move it from a dead stop under the maximum loading specified in paragraph entitled "Design," without overloading. Motor shall be

close-coupled to or on input shaft of primary speed reducer; or shall drive speed reducer by a belt [or chain drive]. Flexible coupling for connecting shafts of close-coupled motor and speed reducer shall conform to the applicable requirements of ANSI/AGMA 9002, and ANSI/AGMA 9000. Motor position shall be adjustable to increase or decrease belt [or chain] tension.

2.2.3.2 Speed Reduction and Turntable Gearing

****
NOTE: Delete references relating to pinion-and-spur-gear reduction unit and intermediate speed reducer when clarifier tank is less than 11 m 35 feet in diameter.
****

****
NOTE: Delete reference to worm-gear reduction unit when clarifier tank is more than 11 m 35 feet in diameter.
****

Speed reduction and turntable gearing for primary [and intermediate] speed reducer[s] shall be worm or helical or a combination thereof. Gearing for turntable shall be [a worm gear reduction unit] [or] [a pinion-and-spur-gear reduction unit]. Speed reduction and turntable gearing shall be designed with a AGMA service factor as recommended in the applicable AGMA Standards ANSI/AGMA 6113 ANSI/AGMA 6013, ANSI/AGMA 6034 or when drive is operating at full load motor wattage horsepower, 24 hours a day continuous running. Gearing shall be designed to withstand any loadings produced by thrust, out-of-balance, and vibration resulting from operating conditions and shall operate from zero rpm to a speed consistent with the maximum peripheral speed specified in paragraph entitled "Design." All component parts of the speed reduction and turntable gearing shall be designed to permit sustained operation at the continuous output torque rating for the life expectancy specified without excessive wear and to develop twice the continuous output torque without damage to or failure of any component part. Gears shall conform to applicable requirements of the following AGMA Standards (AGMA 908, AGMA ISO 10064-6, AGMA ISO 17485, ANSI/AGMA 2011, ANSI/AGMA 6034, AGMA 2015/915-1). Gears for primary [and intermediate] reducer[s] shall be not less than AGMA Quality 10, AGMA 2015/915-1, AGMA ISO 10064-6, AGMA ISO 17485, ANSI/AGMA 2011, or ANSI/AGMA 6113 ANSI/AGMA 6013. Gears for turntable shall be not less than AGMA Quality 6, AGMA ISO 10064-6, AGMA ISO 17485, ANSI/AGMA 2011. Gears shall be certified as meeting the specified quality. Worm gears shall be of cast bronze or shall have bronze rim with inner portion of cast steel or nodular cast iron. Worms shall be of hardened ground alloy steel or high-test heat-treated nodular cast iron. Helical gears shall be of cast or forged alloy steel; helical angle shall not exceed 0.31 rad 18 degrees. Spur gear shall be internal or external; shall be of cast iron, nodular cast iron, heat treated cast alloy steel, or heat-treated forged steel; and shall have an endurance and strength rating of 1,000,000 cycles. Spur gear teeth shall be hardened by the through-hardening, contour-induction-hardening, nitriding, or carburizing processes; flame-hardened gears will not be acceptable. Shafts, bolting, and keys for gears shall conform to ANSI/AGMA 6001; shafts shall be of structural steel. An oil or grease lubrication system shall be provided for speed reduction gearing. Bath lubrication using oil seals for containment or lubrication systems which rely upon an oil circulating pump shall include

means to stop drive motor in event of insufficient lubrication. Pressure indicating devices influenced by oil sludge or changes in oil viscosity will not be acceptable. Speed reduction and turntable gearing shall be fully enclosed in cast iron or fabricated steel housings provided with dust and oil seals. [Mating surfaces of turntable and intermediate gear reducer housing shall be machined in such manner and to such tolerances that accurate alignment of the pinion will be assured.]

2.2.3.3 Gearmotor

Gearmotor, where practicable, may be used in lieu of separate motor and primary speed reducer. Motor component of gearmotor shall be as specified in paragraph entitled "Motor." Speed reducing component of gearmotor shall conform to the applicable requirements specified in paragraph entitled "Speed Reduction and Turntable Gearing," and in ANSI/AGMA 6113 ANSI/AGMA 6013 and ANSI/AGMA 6034.

2.2.3.4 Turntable Bearing Assembly

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

Turntable bearing assembly shall include the turntable bearings upon which the turntable and attached sludge collector assembly are supported; the turntable; and the drive assembly/turntable support base. Assembly shall be designed for all radial and axial loads imposed by drive assembly and sludge collector assembly. Arrangement of component parts shall permit replacement of balls or rollers, or the bearing raceways, or complete bearing unit. Bearing raceway material shall have adequate strength to withstand all radial and axial loads and shall have a Rockwell "C" hardness of not less than 58. Turntable bearing assembly [for a center-column-supported clarifier mechanism] shall also be designed to support, where applicable, drive assembly, turntable, spur gear, and one end of access bridge. [A bridge-supported clarifier mechanism may incorporate a submerged split-case, water-lubricated bottom guide bearing or an intermediate steady bearing where manufacturer's design requires use of such bearing in addition to turntable bearings.] A design incorporating a bottom support bearing will not be acceptable. Bearing shall run in an oil bath or be grease-lubricated. Turntable and drive assembly/turntable base shall be of cast iron, nodular cast iron, or steel; if of steel, these parts shall have sufficient thickness to provide the rigidity necessary to maintain alignment of sludge collector assembly. Turntable shall be cast integrally with spur gear or be fastened to the spur gear with machine screws or bolts.

2.2.3.5 Drive Assembly Bearings

Drive assembly bearings shall be ball or roller bearings having a minimum rated life expectancy (L10) as specified in this paragraph when clarifier mechanism is operating continuously at torque rating specified in paragraph entitled "Design." Load rating and fatigue life shall be based on ABMA 9

and ABMA 11, as applicable. Bearings shall be either oil lubricated or grease lubricated.

Worm and primary helical gearbox bearings	L10 100,000 hours
Gearmotor, direct drive	L10 100,000 hours

****
NOTE: Delete references relating to pinion-and-spur-gear reduction unit and intermediate speed reducer when clarifier tank is less than 11 m 35 feet in diameter.
****

[Spur and intermediate helical gearbox bearings	L10 17,000 hours]
Gearmotor, indirect drive	L10 17,000 hours

2.2.3.6 Chain Drives and Belt Drives

****
NOTE: Delete reference to chain drives when clarifier tank is more than 12 m 40 feet in diameter. Check with manufacturer.
****

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

Belt drives [and chain drives] incorporated in drive assembly shall include V-belt-and-pulley [and chain-and-sprocket] arrangements, except that belt drives shall not be used directly on the [center shaft or on the] center drive cage/drum. Belt drives [and chain drives] shall be designed with a minimum safety factor of 4 as applied to ultimate breaking or transmission strength of the belt [or chain] with respect to loads transmitted at twice the continuous output torque rating of the clarifier mechanism. Belts shall be rayon corded with heat- and -oil-resistant rubber covering. [Chain shall be roller type conforming to ASME B29.100 and shall have steel links. Sprockets shall conform to ASME B29.100 and shall be of heat-treated ground alloy steel or of high-test cast iron conforming to ASTM A48/A48M, Class 40 minimum, cast in a chill mold; teeth bearing surfaces shall have a Brinell hardness of not less than 360 and a minimum hardened zone depth of 5 mm 3/16 inch. Sprockets shall be stress relieved before machining. Sprocket teeth shall be accurately ground to fit the chain.] Pulleys [, sprockets,] and other motive power transmitting connections shall be key mounted. Drive pulley [or drive sprocket] on output shaft of primary speed reducer shall be connected to shaft by a shear-pin hub arrangement designed to protect motor against overload [; sprocket shall have a bronze bushing with grease lubrication]. Design of shear-pin hub arrangement shall be such that it will not bind or freeze into position, preventing it from performing its intended function. Machinery guards shall be fabricated of steel and weatherproof.

2.2.4 [Scum Removal Assembly

****
NOTE: Select the applicable paragraphs(s) from the following:
****

****
NOTE: When center feed/peripheral overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), center column used as influent pipe, influent well, and (peripheral) weirs and scum baffles.
****

****
NOTE: In cold climates where ice build-up is a problem, require heated scum trough and hinged or pivoting skimming blades in lieu of fixed blades.
****

Shall include skimmer assembly and [heated] scum trough. Skimmer assembly shall continuously move surface scum to tank periphery and automatically flush the scum into scum trough. Assembly shall discharge scum with a minimum discharge of water.

2.2.4.1 Skimmer Assembly

****
NOTE: In cold climates where ice build-up is a problem, require heated scum trough and hinged or pivoting skimming blades in lieu of fixed blades.
****

****
NOTE: Delete references to and requirements for aluminum wherever a corrosion problem with aluminum may be anticipated.
****

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

Skimmer assembly shall include a [fixed] [hinged or pivoting] skimming blade, a hinged or pivoting plow blade with wiper blades, and support legs. Skimming blade shall be of structural steel and shall extend from influent well to scum trough. Plow blade shall be structural steel [or aluminum], shall be the width of the scum trough, and shall have grease- and oil-resistant chloroprene wiper blades securely clamped in position with a

bronze [or aluminum] backing plate. The plow blade and its hinged or pivoted connections shall be designed so as to assure proper alignment and continuous contact between wiper blades, scum trough approach ramp, and scum baffle. Plow blade shall have provision for field adjustment in the vertical plane. Suitable means shall be provided to carry plow blade smoothly over the scum trough. Corrosion-resistant materials shall be used for moving parts within the skimming assembly in such manner as to ensure that corrosion will not freeze joints, springs, and other moving or adjustable parts into position. Blades shall be adequately supported from one scraper arm [or by center shaft and a grooved roller on the scum baffle]; bracing shall be provided where necessary to maintain rigidity of assembly. Support legs shall be of structural steel.

2.2.4.2 Scum Trough

Scum trough shall be welded structural steel, minimum thickness 6 mm 1/4 inch; shall have a flanged connection for the scum discharge pipe; and shall be supported from the tank wall. The inclined approach ramp leading to discharge section of scum trough shall be shaped to contain the scum as it is moved up the incline to the trough by the plow blade.

****
NOTE: When peripheral feed/center overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), influent skirt, and effluent trough and weir assembly.
****

****
NOTE: In cold climates where ice build-up is a problem, require heated scum trough and hinged or pivoting skimming blades in lieu of fixed blades.
****

a. Scum Removal Assembly: Shall include scum skimmer and [heated] scum trough. Scum skimmer shall continuously move surface scum around influent raceway to scum trough.

b. Scum Skimmer: Scum skimmer shall include skimming blade and support leg[s] and shall be mounted on the one scraper arm. Skimming blade and support leg[s] shall be of structural steel. The skimming blade shall extend from clarifier tank wall to influent skirt. Scum skimmer shall be hinged and counter weighted to provide for passing under scum trough, piping, and other obstructions within clarifier tank. The skimming blade shall have provision for field adjustment in the vertical plane.

c. Scum Trough: Scum trough shall be of the adjustable dipping weir type and shall include collector pipe and operator. Scum trough shall be provided in peripheral raceway where indicated.

(1) Collector pipe shall be steel pipe conforming to ASTM A53/A53M Schedule 20 minimum. Pipe shall have a 1.05 rad 60 degree wide slot cut symmetrically about the vertical axis, with the horizontal edges of the slot parallel to the longitudinal axis of the pipe. At maximum intervals of 750 mm 30 inches, a 50 mm 2 inch wide band of full circumference shall be left for stiffness. The

pipe shall be plugged on inboard end and open on effluent end. End supports shall include a rolled steel collar welded to an adjustable steel end plate. A grease and oil-resistant, watertight seal shall be provided, so constructed that it will allow smooth motion of the rotating pipe; seal shall be readily renewable without removing pipe. End supports shall be secured to concrete tanks walls by stainless steel anchor bolts of 16 mm 5/8 inch minimum diameter.

(2) Operator: A manual operating lever shall be mounted on the collector pipe. Lever shall be steel pipe having a minimum diameter of 31 mm 1 1/4 inches and shall be secured to collector pipe with a chain or bolted connection. Lever shall extend at least 0.91 m 3 feet above the top of the tank wall and shall permit rotation of collector pipe at least 0.52 rad 30 degrees each side of the vertical axis.

]2.2.5 Center Column

****
NOTE: When center feed/peripheral overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), center column used as influent pipe, influent well, and (peripheral) weirs and scum baffles.
****

Shall be of structural steel, shall be cylindrical in shape, and shall support entire clarifier mechanism, including inboard end of access bridge. [Center column shall also serve as influent pipe and shall have large openings at its upper end to direct influent flow into influent well at a low velocity.] Top of center column shall be machined to provide an accurate fit with the drive assembly. Center column shall be attached to drive assembly with bolts or machine screws. Bottom of center column shall have a bolting flange with minimum of four equally spaced holes for anchorage to the concrete tank. The equipment manufacturer shall supply a template to accurately locate anchor bolts for center column.

2.2.6 Access Bridge, Walkway, and Operating Platform

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

****
NOTE: Delete "raised pattern floor plate" or "grating." Grating is recommended when snow or ice build-up is anticipated; otherwise, use floor plate.
****

****
NOTE: Fiberglass reinforced plastic grating squeegees, weirs and baffles are available but require special consideration for anchorage and expansion. Fiberglass reinforced plastic may be allowed as an optional material provided that the necessary requirements for anchorage of these items, including provision for expansion and contraction, are incorporated in the project specification or shown on the project drawings.
****

Access bridge shall be of structural steel and shall extend from tank sidewall to the center and beyond sufficient to support walkway and operating platform. [Where bridge supported unit is used, the supporting bridge shall be used as the access bridge.] Walkway and operating platform shall be skidproof galvanized steel [raised-pattern floor plate] [grating] [or fiberglass reinforced plastic]. Walkway and operating platform shall have a double railing not less than one m 3 feet 6 inches in height on both sides of walkway and around outside of operating platform; railing shall be of galvanized structural steel section or of standard 38 mm 1 1/2 inch galvanized pipe conforming to ASTM A53/A53M. Walkway shall be not less than 750 mm 30 inches wide. [Raised-pattern floor plate] [Grating] shall be of a design and material thickness necessary to keep deflection to less than 6 mm 1/4 inch with a uniform load of 5 kPa 100 pounds per square foot.

2.2.7 Supporting Bridge

****
NOTE: When center feed/peripheral overflow type clarifier is larger than 11 m 35 feet in diameter or peripheral feed/center overflow type clarifier is larger than 18 m 60 feet in diameter, delete requirements for and references to bridge-supported clarifier mechanisms and those components peculiar thereto, including support bridge, center shaft, and scraper arms of structural shapes.
****

Shall include two structural steel beams and braces of sufficient depth and thickness to support entire clarifier mechanism within the specified maximum allowable deflection.

2.2.8 Influent Well

****
NOTE: When center feed/peripheral overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), center column used as influent pipe, influent well, and (peripheral) weirs and scum baffles.
****

The center influent well shall be structural steel, 6 mm 1/4 inchminimum thickness, reinforced and stiffened with structural sections. The well shall project below and 100 mm 4 inches above the water level and shall be designed to radially diffuse and dampen the influent liquid without

inhibiting the clarifier process. A slot with a baffle shall be provided at water level to permit escape of floating material. Where required by manufacturer's design, a standard bolted flange shall be provided for connection of the influent pipe.

2.2.9 Influent Skirt

****
NOTE: When peripheral feed/center overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), influent skirt, and effluent trough and weir assembly.
****

****
NOTE: Delete references to and requirements for aluminum wherever a corrosion problem with aluminum may be anticipated.
****

The tangential inlet shall be curved sheet steel shaped to direct influent liquid through the influent raceway. Influent skirt shall be steel sheet [or aluminum sheet, minimum thickness] 1.8 mm 14 gage, with bars or structural shapes at top and bottom for rigidity. [Aluminum shall conform ASTM B209M ASTM B209 or ASTM B221M ASTM B221, Alloy 6061, Temper T6.] Sheets shall be prepunched and structural shapes shall be predrilled for ease of field installation. Influent skirt shall be located where indicated and shall be supported by adjustable galvanized hanger rods, hung from structural tees or shapes welded to anchor plates bolted to tank wall. Supporting assembly shall be capable of a minimum horizontal and vertical adjustment of one inch for final location and leveling of influent skirt. [Dielectric insulators shall be provided where aluminum and ferrous metals are in contact.]

2.2.10 Effluent Trough and Weir Assembly

****
NOTE: When peripheral feed/center overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), influent skirt, and effluent trough and weir assembly.
****

****
NOTE: Use square effluent trough when clarifier tank diameter is larger than 8.5 m 28 feet; for smaller tanks, use circular effluent trough. However, a weir length longer than usual in a smaller tank may require a square trough (Insert a minimum weir length equal to clarifier tank circumference unless it is determined that a longer weir length is required.).
****

****

NOTE: Delete fourth sentence when circular effluent trough is specified (Use square effluent trough when clarifier tank diameter is larger than 8.5 m 28 feet; for smaller tanks, use circular effluent trough. However, a weir length longer than usual in a smaller tank may require a square trough (Insert a minimum weir length equal to clarifier tank circumference unless it is determined that a longer weir length is required.)).

NOTE: Insert a minimum weir length equal to clarifier tank circumference unless it is determined that a longer weir length is required.

NOTE: Fiberglass reinforced plastic grating squeegees, weirs and baffles are available but require special consideration for anchorage and expansion. Fiberglass reinforced plastic may be allowed as an optional material provided that the necessary requirements for anchorage of these items, including provision for expansion and contraction, are incorporated in the project specification or shown on the project drawings.

Assembly shall include effluent trough, effluent weirs, and supporting members. Effluent trough shall be [square] [or] [circular] and of sufficient size for length of weir specified in this paragraph. Effluent trough sections shall be of welded structural steel construction. [Trough sections shall not end at corners; all corner joints shall be welded.] Joints between sections shall have bolted connections with suitable rubber gaskets. Weir plates shall be attached to each side of the effluent trough; not less than [_____] mm feet of weir length shall be provided. Weir plates shall be structural steel [or fiberglass reinforced plastic]. Weir plates shall be V-notched and of size and section as indicated. Weir plates shall be bolted to effluent trough and shall have slotted or oversize holes and plate washers to permit horizontal and vertical adjustment of weir. Weirs shall have overlapping splice plates to ensure proper alignment. Effluent trough and weir shall be supported from bridge structure; outrigger beams shall be provided where necessary. Supporting members shall be of sufficient cross section to prevent vertical movement due to the flotation forces developed with trough empty and liquid level in tank at base of V-notch weir. Supporting assembly shall be capable of a minimum vertical adjustment of 75 mm 3 inches to permit leveling of trough.

2.2.11 Electrical Control System

Shall include enclosure; main and branch circuit breakers; starter, contactors, and reset buttons; pushbuttons; and all necessary wiring. Electrical control system shall be in accordance with NEMA ICS 1 and NEMA ICS 2. Design, fabrication, and installation of electrical components shall be in accordance with requirements of NFPA 70. Electrical controls shall be mounted in outdoor weatherproof enclosure, NEMA 3R. Electrical control system components shall be completely wired and mounted in the enclosure at the manufacturer's plant and tested prior to shipment from the

factory. The electric service available is [_____] volts, [_____] phase, [_____] Hertz, [_____] wire. Pushbuttons and reset switches shall be installed on the outside of the door, properly identified with laminated phenolic name plates. Components on outside of enclosure and on internal panels shall be identified by engraved laminated phenolic legend plates. Connecting electrical wiring and related equipment are specified in Division entitled "Electrical."

2.2.11.1 Control System Enclosure

Electrical control system enclosure shall be outdoor unit with support legs and shall be constructed of sheet steel. Screened ventilating openings shall be installed in the enclosure. Enclosure shall have rubber-gasketed door provided with continuous piano hinge and cylinder locking type door latch. A copy of the external wiring connections and a circuit breaker index print shall be secured to the inside of door. Control panel shall be mounted on legs formed from steel angles welded to the bottom of the enclosure. The legs shall have bottom plates drilled with holes for securing the panel to access bridge at or near the drive assembly.

2.2.11.2 Circuit Breakers

Circuit breakers shall be thermal magnetic type. Main circuit breaker shall have a maximum capacity of 150 percent of the electrical load. The main circuit breakers shall be an external handle mechanism, with positive locking device, mounted outside the enclosure to permit operation of breaker from outside the enclosure. Branch circuit breakers shall be E-frame bolt-on type mounted on interior bus bar. Branch circuit breakers shall be provided for each drive motor, control circuit, [trough heating device,] and receptacle. Panel shall include spaces for two additional circuit breakers.

2.2.11.3 Motor Starter [, Contactors,] and Pushbutton Station

A pushbutton actuated magnetic motor starter with overload and undervoltage protection shall be provided for the motor. Starter shall have thermal overload protection in each phrase and short circuit protection. Overload protective devices shall give adequate protection to motor windings, shall be of thermal inverse-time-limit type, and shall include manual-reset type pushbutton. Pushbutton station shall be 2-button Start-Stop. [Provide contactors for trough heating devices.]

2.2.11.4 Overload Protection and Alarm Device

Clarifier mechanism shall have an overload protection and alarm device designed to indicate load on the mechanism at all times, to surround an alarm in case of impending excessive load, and to stop the mechanism when such load is reached. Device shall be of the torque-actuated or indicating-ammeter type, mounted except for alarm, in enclosure. Overload alarm shall include an industrial-type horn or 150 mm 6 inch bell, relay, reset button, test circuit, and an independent On-Off switch. Horn or bell shall be constructed of noncorrodible material and shall be suitable for remote mounting. [Provide auxiliary contacts in alarm circuit for transmission of signal to existing alarm system.]

2.2.11.5 Wiring

Control circuits shall be wired with 1.8 mm No. 14 gage stranded, 1 mm 2/64 inch insulation machine-tool wire with ring tongue compression type lugs

and number tags on both ends of wires. Circuit breakers and power circuits shall be wired with necessary gauge wire, minimum size 2.5 mm No. 12 gage with wire lugs and number tags. Wires shall be secured with either plastic ties or wiring duct, or both. Wires going to components mounted on the enclosure door shall be secured in a cable-like bundle and strapped to the door and the enclosure with sufficient slack to allow easy operation of the door. Circuits requiring field connection shall be terminated on panel terminals.

2.2.12 Lubrication Fittings

Bearings and other moving parts subject to wear shall be provided with adequate means for lubrication. Lubrication shall be by grease or oil, as suitable. Greased bearings shall be provided with fittings suitable for grease gun service. Where grease fittings would not be easily accessible, grease tubing shall be extended to a convenient location. Grease fittings shall be of a type that prevents overlubrication and build-up of pressure injurious to the bearings. Each oil reservoir shall be liberal in size and provided with an opening for filling, an overflow opening at the proper location to prevent overfilling, an oil-level sight glass, and a drain at the lowest point.

2.2.13 Key Mounted Connections

Where connections between shafts and sprockets, gears, pulleys, and other component parts are specified to be key mounted, keys and keyways shall conform to ASME B17.1 or ASME B17.2.

2.2.14 Weir Plates and Scum Baffles

****
NOTE: When center feed/peripheral overflow type clarifier is not specified for the project, delete references to this type and the requirements for those components peculiar thereto, including scum removal assembly (for this type), center column used as influent pipe, influent well, and (peripheral) weirs and scum baffles.
****

****
NOTE: Delete references to and requirements for aluminum wherever a corrosion problem with aluminum may be anticipated.
****

****
NOTE: Fiberglass reinforced plastic grating squeegees, weirs and baffles are available but require special consideration for anchorage and expansion. Fiberglass reinforced plastic may be allowed as an optional material provided that the necessary requirements for anchorage of these items, including provision for expansion and contraction, are incorporated in the project specification or shown on the project drawings.
****

Shall be steel [or aluminum conforming to ASTM B209M ASTM B209 or ASTM B221M

ASTM B221, Alloy 6061, Temper T6] [or fiberglass reinforced plastic]. Weirs shall be V-notched and of size and section as indicated. Scum baffles shall be of size and section as indicated. Weir plates and baffles or their supports shall have slotted or oversize holes and plate washers as indicated to permit horizontal and vertical adjustment of the weir and baffle. Weirs and baffles shall have overlapping splice plates as indicated to ensure proper alignment. [Splice plates, washers, and baffle supports used with fiberglass reinforced plastic shall be fiberglass reinforced plastic.] There shall be no projection of bolts, nuts, or splice plates on inboard side of the scum baffle. Sealant for mounting weir plates shall be a two-component polysulfide-rubber-base sealant.

2.3 CLARIFIER PIPING

****
NOTE: Delete piping applications not covered in this section. In general, piping external to the clarifier tank which is part of the sewage plant interconnecting piping system should be covered in a separate piping section in the project specification.
****

INFLUENT[,] [SLUDGE REMOVAL,] [SCUM REMOVAL,] [EFFLUENT,] [AND] [TANK DRAIN] PIPING:

2.3.1 Pipe and Fittings

****
NOTE: Delete piping applications not covered in this section. In general, piping external to the clarifier tank which is part of the sewage plant interconnecting piping system should be covered in a separate piping section in the project specification.
****

****
NOTE: Delete bracketed items if not included in project.
****

Pipe and fittings [, except as otherwise specified [in this section] [in Section 22 00 00 PLUMBING, GENERAL PURPOSE,]] shall be ductile iron, of sizes as indicated. Pipe within clarifier tank [and above ground] shall be flanged pipe conforming to AWWA C115/A21.15. Flanges shall be plain-faced without projection. Bolts, nuts, and gaskets for flanged joints shall be as set forth in Appendix to AWWA C115/A21.15. [Buried pipe shall conform to AWWA C151/A21.51, using push-on or mechanical joints conforming to AWWA C111/A21.11.] Fittings shall conform to AWWA C110/A21.10. Pipe and fittings shall be cement-mortar lined, double thickness, as specified in AWWA C104/A21.4 with tolerance of plus 3 mm 1/8 inch permitted. Connecting pipe and fittings [valves] [and] [sluice gates] are specified in Division entitled "Mechanical."

2.3.2 Sleeves and Wall Castings

Shall conform to AWWA C110/A21.10, with sizes and joints as indicated.

2.4 ANCHOR AND CONNECTING BOLTS, NUTS, AND WASHERS

Iron and steel shall be attached with zinc-coated steel, stainless steel bolts. Aluminum [fiberglass reinforced plastic] shall be attached with stainless steel machine bolts. Steel bolts shall conform to ASTM A325M ASTM A325, Type 3, maximum hardness of Rockwell "C" 32. Nuts shall conform to ASTM A563M ASTM A563, Grade as specified for the bolt material used. Zinc coating shall be in accordance with ASTM A153/A153M. Stainless steel bolts and nuts shall conform to ASTM F593 and ASTM F594, respectively. Stainless steel shall be AISI Type 302. Circular washers shall conform to ASME B18.22M ASME B18.21.1, lock washers to ASME B18.21.1 ASME B18.21.2M. Bolt sizes and locations shall be as shown on the approved shop drawings for the equipment [, except as otherwise indicated]. Steel anchor bolts for center column shall be 16 mm 5/8 inch diameter minimum with 64 mm 2 1/2 inchprojection, 225 mm 9 inch embedment, and 75 mm 3 inch hook on embedded end. Templates shall be furnished for accurate positioning of anchor bolts.

2.5 [FIBERGLASS REINFORCED PLASTIC

****

NOTE: Fiberglass reinforced plastic grating squeegees, weirs and baffles are available but require special consideration for anchorage and expansion. Fiberglass reinforced plastic may be allowed as an optional material provided that the necessary requirements for anchorage of these items, including provision for expansion and contraction, are incorporated in the project specification or shown on the project drawings.

****

Isophthalic polyester resins reinforced with a minimum of 30 percent (by weight) glass fibers, with edges sealed and thermally cured in molds, free of voids and porosity. Grating bearing and cross bars shall be molded at the same time or pultruded and bonded into one-piece construction. Grating shall be square or rectangular mesh capable of supporting 5 kPa 100 pounds per square foot on a 1200 mm 48 inch span with a maximum deflection of 7.5 mm 0.303 inch. Sheet goods shall be two stage compression molded laminates with 6 mm 1/4 inch minimum thickness; 70 MPa 10,000 pounds per square inch minimum tensile strength when tested in accordance with ASTM D638 ASTM D638; and 16 to 19 joules per 25 mm 12 to 14 foot pounds per inch of notch (Izod) impact resistance when tested in accordance with ASTM D256. Fiberglass reinforced plastic shall have a flame spread rating of 25 or less and fuel contributed rating of zero when tested in accordance with ASTM E84, and rated as self-extinguishing when tested in accordance with ASTM D635. Color blue-green.

]2.6 GROUT MATERIALS

Cement, fine aggregate, and water shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.7 SPARE PARTS

Spare parts shall be identical and interchangeable with original parts and shall be furnished in clearly marked containers. Spare parts shall be the standard ones recommended by the manufacturer in his operation, maintenance, or instruction manual, furnished in the number recommended.

2.8 TOOLS

Special tools necessary for the proper maintenance and operation of the equipment shall be furnished together with a properly identified hardwood or metal box for their storage.

2.9 MATERIALS PROTECTION

****
NOTE: The field painting section of the project specification should provide for repair of damaged coat after erection.
****

Sandblast exposed surfaces of ferrous metals, including those to be submerged, in accordance with SSPC SP 10/NACE No. 2; and apply a four-coat system conforming to MIL-DTL-24441. Apply the system in the following order: one coat of Formula 150, one coat of Formula 151, one coat of Formula 156, and one coat of Formula 152. Final total dry film thickness shall be not less than 0.25 mm 10 mils. Maximum time between coats shall be 72 hours. The following items shall be finished in accordance with the manufacturer's standard practice suitable for end use environment: Motors, gearmotors, speed reducers, chains, sprockets, shafts, exposed drive train elements, and pushbutton stations. Aluminum shall have an AA-MM10-C22-A41 finish, as defined in AA DAF45. [Treat machined or cut edges of fiberglass reinforced plastic with resin sealer as recommended by the fiberglass reinforced plastic product manufacturer.]

PART 3 EXECUTION

3.1 GENERAL

****
NOTE: Delete bracketed portions when services of an engineer representative of the clarifier equipment manufacturer are not desired. It is generally recommended that these services be furnished for navy projects.
****

Install clarifier equipment in accordance with the recommendations of the manufacturer of the clarifier mechanism, as approved. Take special care to correctly align equipment components. [After final positioning of center column, provide full bearing under base plate using non-shrink grout.] For equipment utilizing V-belt drives, adjust sheave alignment and belt tension in accordance with equipment manufacturer's recommendations. [The Contractor shall procure the services of an engineer representative of the manufacturer of the clarifier mechanism to inspect the equipment after erection, for final inspection, startup, and acceptance tests. The representative shall also be available at the clarifier site for a period of not less than one day to instruct operating personnel during initial operation period.]

3.2 SURFACING OF CLARIFIER TANK FLOOR

****
NOTE: Delete bracketed portions when services of an engineer representative of the clarifier equipment manufacturer are not desired. It is generally

recommended that these services be furnished for navy projects.

****

Following installation of the clarifier mechanism, bring clarifier tank floor to finish grade by means of cement-mortar grout surfacing swept into place by use of the sludge collector arms, as herein specified. Do not begin surfacing operation until after [the installed equipment has been inspected by the engineer representative of the manufacturer and] scraper arms and scraper blades have been adjusted to give correct clearance above final floor elevation. Perform surfacing operation in accordance with the approved recommendations of the manufacturer of the clarifier equipment, except as otherwise specified. If grout proportions for the surfacing are not given in the manufacturer's recommendations, use a cement-mortar grout composed of one part cement and three parts fine aggregate with sufficient water as needed for conditions of placement and with one teaspoon of powdered aluminum added per bag of cement. Immediately before the surfacing operation is begun, clean the floor of all dirt, soil, and other substances which would prevent the proper bonding of the surfacing to the concrete subfloor. Bring the grout surfacing to finish grade, as near as possible, by hand. If the manufacturer's recommended procedure calls for use of straightedges attached to scraper arms, fasten a 50 by 150 mm 2 by 6 inches metal clad wooden straightedge to each scraper arm approximately 6 mm 1/4 inch below the scraper blade to form a suitable screed; rotate scraper arms manually to complete the surfacing operation; use of drive unit to move the arms will not be permitted. Prevent grout from entering sludge cone; immediately remove any grout which falls in the sludge cone or on clarifier tank walls. Immediately after surfacing operation is complete, clean clarifier tank floor and circular clarifier equipment of deposits of excess grout. Remove screeds and install squeegees.

3.3 PIPING

****

NOTE: Delete piping applications not covered in this section. In general, piping external to the clarifier tank which is part of the sewage plant interconnecting piping system should be covered in a separate piping section in the project specification.

****

Make flanged joints up tight, taking care to avoid undue strain on flanges. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Install flanged pipe so that adjoining flange faces are not out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. Replace by one of proper dimension any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein. Provide hangers and supports where necessary to support piping. [For buried piping, use push-on joints or mechanical joints, and make in accordance with AWWA C600; for mechanical joints, also follow recommendations of Appendix A to AWWA C111/A21.11. Replace by one of proper dimensions any pipe or fitting that does not allow sufficient space for proper installation of jointing materials.]

3.4 WEIRS

Mount weir plates against a double bead of the sealant previously specified

for this purpose. Use sufficient thickness of sealant to fill all voids between concrete tank and weir plates.

3.5 REPAIR PAINTING

Inspect painted surfaces for holidays, scratches, chipping, and other damage. Refinish imperfections by cleaning burrs and rough surfaces and sanding to a smooth finish, prime and repaint.

3.6 FIELD TESTS AND INSPECTIONS

3.6.1 General

The Contractor shall perform all field tests and provide all labor, equipment, and incidentals required for tests. The Contracting Officer will witness field tests and conduct all field inspections. The Contractor shall give the Contracting Officer ample notice of dates and times scheduled for tests.

3.6.2 Tests

Test circular clarifier mechanism as in operation to demonstrate correct alignment, smooth operation, proper adjustment of flow distribution, freedom from vibration, and freedom from noise and overheating of moving machinery. Include in test at least two full cycles of successful operational sequences to demonstrate that the system continues to function satisfactorily after meeting all operational requirements.

-- End of Section --