

SECTION 11311

OIL/WATER SEPARATOR
3/00

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE

API Publication 421 Design and Operation of Oil-Water Separators

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1997) Standard Specification for Carbon Structural Steel

ASTM E 165 (1995) Standard Test Method for Liquid Penetration Examination

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1996) Structural Welding Code - Steel

FEDERAL SPECIFICATIONS (FS)

FS SS-S-210 (Rev. A Reinst) Sealing Compound, Preformed Plastic for Expansion Joints and Pipe Joints

STEEL STRUCTURES PAINTING COUNCIL

SSPC SP 10 (1994) Near-White Blast Cleaning

1.2 SYSTEM DESCRIPTION

The Contractor shall furnish and install an above grade prefabricated oil/water separator with an integral oil storage reservoir. The separator shall comply with the requirements of this specification and shall be approved by the Contracting Officer's representative. The separator shall be comprised of a tank with an inlet compartment, oil separation compartment with parallel plates, an integral oil storage compartment or area, and an outlet compartment. The tankage shall be rectangular in shape and shall be installed completely above grade. Cylindrical separators with manway access shall not be acceptable. The physical size and capacity of the separator required by these specifications may not match the manufacturer's stated nominal capacity. Oil/water/sediment separator design shall be in accordance with design principles commonly accepted for sedimentation or clarification chambers at wastewater treatment plants and API Publication 421.

1.2.1 Applications

The separator shall remove free oil (60 microns) (.06 mm) and larger and suspended solids from oil-in-water mixtures originating from aircraft rinsing operations. The influent oil-in-water mixture will be pumped to the unit. The oil-water separator shall be sized or selected to treat the influent wastewater to meet treatment performance requirements. No separator shall be acceptable that requires the use of oleophilic filters, chemical additives, adsorbent additives, or any other motorized or chemical mechanical aid.

1.2.2 Influent Characteristics

Provide oil-water separator designed as specified above for a maximum nominal flow of 120 gallons per minute (gpm) 7.6 liters per second (lps). Design flows shall not assume the provision of any flow restriction device; flow restriction devices are specifically prohibited from separator design. Design minimum operating temperatures of the influent oil-in-water mixture will be 45 degrees F 7 degrees C. and ambient air temperatures will range from 30 to 95 degrees F -1 to 35 degrees C. during operation. The design specific gravity of the heaviest oil at operating oil-water temperatures will be 0.93 and the total grease and oil concentration ranges from 0 to 2000 milligrams per liter (mg/L). The design oil globule diameter shall be 60 microns or smaller. The specific gravity of the water at design operating temperature will be 0.9998. The average specific gravity of the suspended solids is 2.5. The influent is further characterized as follows:

Oil-in-Water Mixture	Minimum		Maximum
Total suspended solids	50	to	500 mg/L
pH	6.5	to	8.0

Detergents shall not be used.

1.2.3 Performance Requirements

The grease and oil concentration in the effluent from the oil-water separator shall not exceed the following limitations:

Contaminants	Maximum
Total grease and oil, 30-day average	15 mg/L
Total grease and oil, daily maximum	30 mg/L

In addition, there shall be no ongoing or frequently recurring visible sheen in the effluent.

1.2.4 Maintenance and Operational Requirements

The oil/water separator shall be designed and installed in a manner which allows visual inspection of all internal components from outside the tank. The separator shall be accessible to the "owner" or "operator" for visual and physical inspections without requirement for mechanical or other physical devices to gain access, i.e., covers or grates shall be removable in whole or in segments which do not exceed 75 pounds in weight. All components shall be readily removable for inspection, repair and

maintenance without requirement for reinforcing the tank or container which constitutes the oil/water separator. The unit shall be designed such that it is structurally sound without liquid in the separator. Components such as parallel plate packs or configurations, and other components for which routine servicing is likely to be required shall be removable by hoisting from the separator in units or "packs" which are amenable to cleaning. The separator shall be designed such that standard components are available and can be installed without modification to the separator. This includes parallel plate packs, oil removal system components, weirs, and all other components which can reasonably be assumed to fail over the operational life of the separator.

1.2.5 Product Recovery

Design shall be such that product recovery can be conveniently accomplished from grade level without service personnel entering the separator. The Contractor shall provide an estimate as to man hours and equipment required for product recovery. Provisions for dewatering of the separator will allow dewatering from grade level by either gravity flow or pumping with owner supplied equipment. Dewatering provisions will assume at least weekly access, and the manufacturer/supplier will provide an estimate as to the man hours and equipment required for the dewatering operation.

Oil and other liquid products which separate from water and accumulate at the operating surface of the separator shall be recovered from the surface by methods which have proven successful for applications like those described herein. Static or stationary oil overflow systems will not be acceptable if variations in wastewater flow are anticipated to cause variations in operating level within the separator. This category of oil removal systems includes those which are of the standpipe, weir styles, and others which are set at a fixed level and incapable of continuous variation when the separator is in operation.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Data; GA.

a. Separator;

An analysis which supports the separator design to meet the specified performance shall be submitted. The analysis shall indicate the minimum detention time at the design flow, the calculated overflow rate, the required square feet of projected plate area (square meters) to achieve the specified performance under laminar flow condition. Calculations shall take into account the rate of flow, influent concentrations, oil globule characteristics, fluid temperature, fluid specific gravities, and pH.

b. Accessory equipment;

Data which consists of calculations, and equipment descriptions for the oil-water separator system.

SD-04 Drawings

Drawings; GA.

a. Separator;

Submit shop drawings for separator and accessory equipment including principal dimensions, location of fittings, weirs, baffles, foundations, oil storage, and oil removal equipment or methods.

Drawings for separator and accessory equipment shall demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, including principal dimensions, location of fittings, and unit foundation.

SD-06 Instructions

Instructions; GA.

a. Separator System;

Proposed instructions describing the installation and operation of the system. Methods of product recovery and estimates as to man hours and equipment required for product recovery will be included.

SD-09 Reports

Reports; GA.

a. Shop hydrostatic test;

b. Field Inspection

c. Field hydrostatic test

d. Pre operational test

e. In-service test

Test reports in booklet form showing the results of factory tests performed and tests performed to adjust each component following the installation of the system and the field tests performed to prove compliance with the specified performance criteria.

SD-13 Certificates

Certificates; FIO.

a. Separator Corrosion Protection;

Submit written verification on the fabricator's letterhead that surface preparation and coating application were performed in accordance with the manufacturer's printed recommendations for the coating system.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manuals; FIO.

a. Separator system;

b. Accessory equipment;

Six copies of operating and maintenance instructions shall be prepared by the manufacturer. These instructions shall outline the step-by-step procedures required for system startup, operation and shutdown, routine maintenance, possible breakdowns and repairs, and troubleshooting. These instructions shall include the manufacturer's name model number, service manual parts list, and brief description of the equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the facility, name of the Contractor, and contract number. The Contractor shall provide an estimate of the man hours and equipment required for routine maintenance and product recovery which is specific to the application anticipated. Appropriate cleaning methods for plates shall be described in detail.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, such as subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. If special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.

1.4.2 Handling

Handle separator in such a manner as to ensure delivery to final location in sound, undamaged condition. Take special care not to damage interior and exterior surfaces of separator or any of the critical components of the system which affect separator performance. Make satisfactory repairs to damaged materials at no cost to Government. Carry and do not drag materials.

PART 2 PRODUCTS

2.1 STEEL SEPARATOR

Use 3/16-inch 4.7625 mm minimum thick carbon steel conforming to ASTM A 36. More material having equivalent structural properties and corrosion resistance for tank, hoppers, stationary and adjustable weirs, nozzles, flow distributor and energy dissipator device, seals, and tank cover(s). Weld in accordance with AWS D1.1 to provide watertight tank that will not warp or deform under load. Use welders qualified in accordance with AWS Standard Qualification Procedure. Grind welds smooth and remove weld spatter. Fabricate free of kinks and sharp bends in a manner not to reduce the strength of steel to a value less than that intended by the design. Size and shape of bends shall be uniform. Bolts, stiffeners, washers, nuts, screws, pins, and fittings as required shall be 304 stainless steel. Clean and finish carbon steel surfaces as described in paragraph entitled "Separator Corrosion Protection".

2.1.1 Separator Corrosion Protection

The protection shall consist of a Protective Coating, U.L.-Listed Dielectric Bushings and Cathodic Protection. External tank surfaces and appurtenances shall be resistant to corrosion from the in situ soil, backfill material, groundwater, and surface runoff. Parallel plate material and orientation shall enhance oil coalescence and solids removal, and be corrosion and chemically resistant to the oil-in-water mixture and atmosphere as specified in paragraph entitled, "SYSTEM DESCRIPTION".

a. Protective Coating. After shop conducted hydrostatic tests have been successfully completed, provide a manufacturer's standard coating system to the interior and exterior surfaces of the separator. Prior to shop painting, abrasive blast clean the surfaces in accordance with SSPC SP 10 to a surface profile of 1 to 2 1/2 mils(0.025 to .065 mm). Total dry film thickness of coating system shall not be less than 9 mils(0.23 mm). Repair and replace areas of the coating system which are found to be damaged or defective upon delivery of equipment to the site or found to be defective due to work of the applicator.

b. Cathodic Protection. Provide cathodic protection with test stations as specified in Section 16640, "CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)".

2.2 SEPARATORS OTHER THAN STEEL

Separators constructed of reinforced fiberglass may be provided in lieu of carbon steel. Provide fiberglass tanks with lifting straps. Glass fiber reinforced plastic weirs may be accepted as a suitable weir and baffle material provided that necessary requirements for anchorage of these items include provisions for contraction and expansion. Surfaces shall be seamless, chemically resistant to oil-in-water mixture, and resistant to ultraviolet deterioration. Preserve wood components prior to applying resin laminates to prevent deterioration.

2.2.1 Protective Coating for Other than Steel Separator

After shop conducted hydrostatic tests and have been successfully completed, provide a coating system which will protect the separator from the oil-in-water mixture, in situ soil, and ground water.

2.3 TANK

Parts subject to wear or requiring adjustment, inspection, cleaning or repairs shall be accessible and capable of convenient removal when required.

Provide tank to withstand hydraulic and soil loadings under static and dynamic conditions while empty and during operating conditions. Submit calculations certified by a structural engineer that below grade separator tanks are designed to withstand the burial depth indicated on the drawings or encountered in the field and are provided with holddown pad and other accessories necessary to withstand static and dynamic hydraulic and soil loadings while empty and during operating conditions. Provide adequate support for additional loadings from tank appurtenances including weirs, hoppers, internal supports, parallel plate oil coalescers, equipment transportation, and rapid lowering and braking of load during handling operations. Bolt the tank and accessories to weld-fabricated, structural steel skid base, or mount on manufacturer's standard base. Submit for approval, separator shop drawings which indicate the components of the separator including anchorage details.

2.3.1 Lifting Mechanism

Fit tank with lifting lugs, straps, or supports for handling and installation. Each lifting mechanism shall carry the total dry weight of the tank and attendant appurtenances. Prominently display lifting instructions on a plate located on the outside of the tank.

2.3.2 Connections

As a minimum, fit tank with the connections specified. Other connections are allowable, depending on the equipment supplied and as is standard with the manufacturer.

Connection	Inside Diameter (in.) (mm)	No. Required
Influent	6 (150)	1
Effluent	6 (150)	1
Vent	2 (50)	1

2.4 WEIRS

Attach stationary weirs and adjustable weir supports to tank side walls to provide a watertight seal between adjoining compartments and trough to prevent hydraulic short-circuiting. Use carbon steel for weir plates and baffles. Provide sharp crested weirs of size and section specified by manufacturer. Provide slotted holes in weir plates and baffles or supports to permit horizontal and vertical adjustment of weir or baffle. Use non deteriorating sealant or gaskets for mounting weir plates. Fill voids between tank wall and weir plate with sealant to make watertight.

2.5 TANK DRAINAGE

Provide low points for dewatering tank.

2.6 IDENTIFICATION PLATES

Provide identification and instruction plates necessary data stamped on the plate. Securely affix plates, in prominent location, to tank with nonferrous screws or bolts of not less than 1/8-inch (3 mm) in diameter.

2.7 INSTRUCTION PLATES

Instruction plates shall describe special or required procedures to operate and service equipment, and shall include warnings of hazardous procedures and notice of safety and health requirements. Plates shall be durable and legible throughout equipment life and shall be mounted near tank.

2.8 WARNING STAGE

On entrances to the tank place a permanent sign which states the following: "DO NOT ENTER TANK OR PERFORM HOT WORK ON OR IN TANK UNTIL THE ATMOSPHERE HAS BEEN TESTED AND CERTIFIED GAS FREE AND SAFE".

2.9 INLET COMPARTMENT

Provide inlet compartment of sufficient volume to effectively reduce influent settleable solids and dissipate energy. Provide an inlet

compartment with a minimum below water volume of 15 cubic feet (0.4 cubic meters). Provide nonclogging flow distributor and energy dissipator device. Locate adjustable, primary surface oil overflow weir and sample ports as recommended by the manufacturer. The inlet compartment shall be easily accessible with removable panels to allow maintenance personnel visual inspection of the inlet compartment without entering the separator.

2.10 OIL SEPARATION COMPARTMENT

2.10.1 General

The maximum surface loading rate for the oil separation compartment shall be 1200 gallons per day per square foot (48,890 liters per square meter per day). The separator will also provide a minimum detention time within the oil separation compartment of 15 minutes at design flow. Detention time will be recomputed by calculating the volume of the separation zone within the separator and dividing this volume by the design flow rate.

2.11 PARALLEL PLATES

Equip oil coalescing compartment with easily removable and reinstallable, parallel plates, arranged to optimize separation of free oil from liquid carrier. When plate design permits cleaning in place, provide sufficient access to permit complete cleaning of the plates and removal of the sludge. Provide parallel plates at an angle from 40 to 60 degrees with respect to longitudinal axis of the plate corrugations and space not less than 3/4-inch and not more than 1-1/2-inch (19 mm and not more than 38 mm) apart for removal of free oil and settleable solids. Configuration used shall not promote solids buildup on plates which would increase velocities to point of discharging an effluent of unacceptable quality. The design shall maintain laminar flow at maximum design flow rate throughout plate packs including entrance and exit so as to prevent re-entrainment of oil with water. Flow through plate packs shall be in a downflow mode parallel to plate corrugations or cross-flow perpendicular to plate corrugations, so that the oil collects and coalesces at high point of corrugations and rises to top of pack without clogging from oil or settleable solids. The coalescing device shall be easily removed and reinstalled from ground level, and appropriate cleaning methods will be described in detail in the Operation and Maintenance Manual. The surface area of the plates shall be calculated using the vertical projection of the plates onto a horizontal surface. The effective surface area shall be calculated by reducing the projected area by a factor of 25%. Utilization of the surface area of filtration devices or systems shall not be allowed in computing available surface area for oil/water separators. The minimum effective projected surface area shall be 1790 square feet (166.3 square meters).

2.12 SUPPORTS

Brace and support individual plates or plate packs to withstand loads associated with transportation and operation of units, including in-place cleaning. Equip each plate pack with lifting lugs or other attachments for handling and installation. Each lug shall carry total weight of plate pack.

2.13 BAFFLES

Provide oil retention baffle, and stationary underflow baffle. Position underflow baffle to prevent resuspension of solids that have accumulated in secondary solids hopper.

2.14 OIL STORAGE

Provide oil storage as an integral part of proposed oil-water separator system. The system may provide a separate, but integral compartment for the storage of oil or storage may be provided on top of the oil separation compartment. As a minimum, the separator oil storage compartment shall have a capacity of not less than 10 percent of the total tank volume.

2.15 OUTLET COMPARTMENT

The outlet compartment shall have a minimum volume of 15 cubic feet (0.4 cubic meters). The outlet compartment shall have an adjustable overflow effluent weir and an effluent connection.

2.16 ACCESSORIES AND ACCESSORY EQUIPMENT

Provide bolts, stiffeners, washers, nuts, screws, pins, gaskets, and fittings as required for adjustable weirs, tank covers and parallel plate packs.

2.17 ACCESS COVERS

The separator tank shall be provided with easily removable access panels adequate to allow maintenance personnel accomplish visual inspection, oil and sludge removal, and removal of the plate packs without entering the separator.

PART 3 EXECUTION

3.1 SHOP HYDROSTATIC TEST

Prior to applying coatings, perform hydrostatic test at atmospheric pressure by filling tank with water in the shop for a minimum of 4 hours. Testing shall be conducted after all seams have been cleaned and all welds have been inspected in accordance with ASTM E 165. Acceptance criteria, for the hydrostatic test, is no leakage after 4 hours using a thorough visual inspection for the leaks.

3.2 FIELD INSPECTION

Inspect each component of separator for compliance with requirements specified in PART 2 PRODUCTS. Redesign or modification of equipment to comply with specified requirements, or necessary redesign or modification following failure to meet specified requirements, shall receive particular attention for adequacy and suitability. This element of inspection shall encompass visual examinations and dimensional measurements. Noncompliance with specified requirements, or presence of one or more defects preventing or lessening maximum efficiency of separator operation, shall constitute cause for rejection.

3.3 INSTALLATION

Lift tank as required and place onto level foundation using lifting mechanism provided. Level tank and bolt to supports to prevent hydrostatic uplift and ensure unit stability. Use a lifting bar through lugs to insert plate packs into tank and place on supports. Caulk around packs and pack supports with sealing compound conforming to FS SS-S-210 to prevent hydraulic short-circuiting. Avoid abrupt contact between the packs and the

tank walls and pack supports to avoid damage. Separator system installation shall be conducted in accordance with manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

3.4.1 Field Hydrostatic Test

After separator has been leveled and secured to foundation and parallel plate packs are in place, level effluent overflow weir at elevation specified by manufacturer and hydrostatically test unit at atmospheric or operational pressure (for no leakage) for an additional 8 hours by filling with water. Perform the hydrostatic test prior to backfilling below ground or partially below ground installations.

3.4.2 Pre Operational Test

The manufacturer's service representative shall inspect, operate, and test unit before in-service testing by the Contractor.

Tests shall include but not be limited to the following:

- a. Soundness (without cracked or otherwise damaged parts).
- b. Completeness in all details, as specified.
- c. Correctness of setting, alignment, and relative arrangement of each component.
- d. Verification of proper operation for all system components.

Pre operational Inspection and Test Report:

Submit manufacturer's service representative's pre operational test report. Document inspections, operations, adjustments, and tests performed and indicate whether they were acceptable or not. For unacceptable items, describe corrective action taken or recommended. Include detailed descriptions of points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. Include the manufacturer's certificate that equipment conforms to specified requirements and is ready for permanent operation and that nothing in installation will render manufacturer's warranty null and void.

-- End of Section --