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API Standard 614
September 1973

LUBRICATION, SHAFT-SEALING, AND CONTROL OIL SYSTEMS FOR SPECIAL-PURPOSE APPLICATIONS

FOREWORD

This standard is based upon the accumulated knowledge and experience of manufacturers and users of lubrication, shaft-sealing, and control oil systems. The objective of this publication is to provide a purchase specification to facilitate the manufacture and procurement of such systems for special-purpose applications in petroleum refinery service.

This standard requires the purchaser to specify certain details and features. Although it is recognized that the purchaser may desire to modify, delete, or amplify sections of this standard, it is strongly recommended that all modifications, deletions, and amplifications be made by supplementing this standard, rather than by rewriting or by incorporating sections thereof into another complete standard.

Suggested revisions are invited and should be submitted to the director of the Division of Refining, American Petroleum Institute, 1801 K Street, N.W., Washington, D.C. 20006.

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LUBRICATION, SHAFT-SEALING, AND CONTROL OIL SYSTEMS FOR SPECIAL-PURPOSE APPLICATIONS

SECTION 1—GENERAL

1.1 Scope

1.1.1 This standard is intended to cover the minimum requirements for lubrication systems, oil-type shaft-sealing systems, and control oil systems for special-purpose applications. Such systems may serve compressors, gears, pumps, and drivers. Internal combustion engines are not covered by this standard.

1.1.2 This standard, when specified, shall take precedence over any section of other API standards covering the same subject.

1.2 Alternative Designs

The vendor may offer alternative designs (see 7.2 for proposal requirements).

1.3 Conflicting Requirements

In case of conflict between this standard and the inquiry or order, the inquiry or order shall govern.

1.4 System Selection

Appendix A provides schematics of typical system components and typical complete lubrication systems, shaft-sealing systems, and control oil systems. The schematics are included to assist the purchaser in the selection of an appropriate system. The purchaser and the vendor shall agree upon a mutually acceptable system prior to the release of the order. The purchaser's data sheets shall define the scope of supply, the quality or brand of equipment, the system type, the general arrangements, and other requirements.

1.5 Referenced Publications

The latest editions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this standard:

*ANSI**

B1.1: Unified Screw Threads
B2.1: Pipe Threads (Except Dryseal)
B16.5: Steel Pipe Flanges and Flanged Fittings
B31.3: Petroleum Refinery Piping

API

Std. 610: Centrifugal Pumps for General Refinery Services
Std. 611: General-Purpose Steam Turbines for Refinery Services
Std. 615: Sound Control of Mechanical Equipment for Refinery Services
RP 550: Manual of Installation of Refinery Instruments and Control Systems: Part I—Process Instrumentation and Control

ASME†

Boiler and Pressure Vessel Code:
Section VIII, Divisions 1 and 2
Section IX, Welding Qualifications

ASTM‡

A 106: Specification for Seamless Carbon Steel Pipe for High-Temperature Service
A 192: Specification for Seamless Carbon Steel Boiler Tubes for High-Pressure Service
A 194: Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
A 269: Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A 312: Specification for Seamless and Welded Austenitic Stainless Steel Pipe

* American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

† American Society of Mechanical Engineers, 345 East 47th Street, New York, N.Y. 10017.

‡ American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

*ISA**

S5.1: Instrumentation Symbols and Identification

NEMA†

MG-1: Motors and Generators

NFPA‡

Bulletin No. 70: National Electrical Code, Articles 500 and 501

TEMA§

Standards, codes, and specifications

1.6 Definitions of Terms

1.6.1 Certain terms used throughout this standard are defined as follows:

Block-in time refers to the period required (after the driver is tripped) to isolate (valve-in) and depressure a compressor or another item of equipment from its system.

Booster pump refers to an oil pump that takes suction from the discharge of another pump to provide oil at a pressure higher than usual.

Coastdown time refers to the period required (after the driver is tripped) for the equipment to come to rest.

Component refers to such machinery and hardware items as pumps, coolers, and filters that are a part of the oil system.

Console refers to a total oil supply system whose components and controls are packaged as a single unit on a single continuous base. This arrangement requires only external connections by the purchaser. Instrument panels, if any, may be separate from the console when specified by the purchaser.

Continuous-flow transfer valve refers to a device that can simultaneously divert both inlet and outlet flows from one component to its twin without altering the continuity of full flow through the mechanism. This valve provides tight shutoff of the idle component to permit its maintenance.

Control oil refers to the oil the main equipment requires to operate such components as relays, servos, and power pistons.

Cool-off time refers to the period required (after the driver is tripped) to maintain oil circulation through the equipment to prevent damage from heat effects.

Emergency pump refers to a separate oil pump having adequate pressure and capacity to enable safe shutdown of main equipment when the main and the standby pumps are inoperable.

Equipment refers to main machinery served by the oil systems.

Main pump refers to the oil pump usually operated.

Multiple-package arrangement refers to a total oil supply system whose components are separated into individually packaged units. Each package is on a single base and is complete in all respects, including controls. This arrangement requires only the purchaser's interconnection between packages and external connections.

Normally open and normally closed, usually referred to as "on-the-shelf" positions, designate the positions of automatically controlled electric switches, valves, and the like, when in a deenergized condition. It is emphasized that during normal operation of the equipment the positions of such devices are not necessarily normally open nor normally closed.

Shaft-driven describes a particular oil pump whose mechanical drive is furnished by the shaft of one of the items of equipment.

Special-purpose application refers to a system designed and constructed to provide at least three years of uninterrupted supply and control of oil to the specified equipment. Such design and construction presupposes and allows for the capabilities of transfer between and shutdown of main and spare components of the set for maintenance.

Standby pump refers to the oil pump that maintains the equipment's normal operation when the main pump does not meet system requirements.

1.6.2 Terms relating to oil reservoir capacities and configurations are defined in 2.2.5 (see also Fig. 1).

* Instrument Society of America, 400 Stanwix Street, Pittsburgh, Pa. 15222.

† National Electrical Manufacturers Association, 155 East 44th Street, New York, N.Y. 10017.

‡ National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110.

§ Tubular Exchanger Manufacturers Association, Inc., 331 Madison Avenue, New York, N.Y. 10017.

SECTION 2—BASIC DESIGN

2.1 General

2.1.1 The system shall be designed to continuously meet all the operating conditions of the equipment served and shall be suitable for a minimum of three years of continuous operation.

•2.1.2 When designated on the data sheets provided in Appendix B, the vendor shall furnish oil—for the conditions required—to specified equipment that is supplied by others. The system shall be designed to comply with this requirement.

2.1.3 All equipment shall use a single lubricant, preferably a hydrocarbon oil, having approximate viscosities of 150 Saybolt Universal seconds (SUS) at 100 F and 43 SUS at 210 F.

•2.1.4 The system shall be suitable for unsheltered outdoor operation and shall be winterized for the particular plant atmosphere (including temperature) specified by the purchaser.

•2.1.5 The system shall be designed in console or in another arrangement specified by the purchaser. Each unit shall have a suitable structural- or flat-steel baseplate with unit components and related valves, manifolds, and the like mounted in accordance with 2.11.1. All bases with pumps, coolers, or filters shall be of the drip-rim type with a 1-inch minimum drain connection.

Grout and vent holes shall be provided in the base to enable solid grouting of each complete assembly. These holes shall be accessible for pouring without disturbing any components or piping and shall be provided with ½-inch-high steel curbing to prevent accumulated oil or water from entering the grout.

2.1.6 Exposed pump, filter, strainer, cooler, gage, switch, trap, and valve parts, as well as all other exposed component parts retaining oil under pressure, shall be made of steel. The components shall be piped, valved, and installed with clearances adequate to permit maintenance and replacement during operation.

Valved vent, drain, and bypass piping shall be furnished to permit draining, cleaning, and refilling of idle components while the equipment is in operation.

•2.1.7 The purchaser shall specify when and where double blocks and bleeds are required for component isolation.

•2.1.8 Coolers, filters, overhead oil tanks, drainers, accumulators, and other pressure vessels within the scope of Section VIII of the ASME Code or any specified state or local code shall conform to the applicable code and, if specified by the purchaser, shall be code stamped.

•2.1.9 Control of the sound level of the system shall be the joint effort of the purchaser and the vendor. The purchaser shall specify on the data sheets the special requirements necessary or API Standard 615, or both.

•2.1.10 The vendor shall advise the purchaser of any special provisions necessary to ensure the supply of lube or seal oil, or both, in the event of complete failure of the lube or seal oil supply system, as well as after equipment trip. These provisions may include emergency pumps, accumulators, rundown tanks, and special arrangements to facilitate deceleration. Provisions shall be adequate for coastdown time, cool-off time, and block-in time, as applicable; the purchaser shall specify the required block-in time. The purchaser and the vendor shall mutually agree upon the system and its components.

•2.1.11 All electrical components and installations shall conform to the requirements of NFPA Bulletin No. 70 and specified local codes. The purchaser shall indicate on the data sheets the hazard class or the type electrical equipment required.

2.1.12 All construction and repair weldings shall be performed by welders qualified in accordance with Section IX of the ASME Code. All welding procedures shall conform to Section VIII of the ASME Code.

2.2 Oil Reservoirs

2.2.1 Reservoirs shall be separate from the equipment baseplate unless otherwise approved by the purchaser. Reservoirs having top-mounted components

NOTE: A bullet (•) in the margin indicates that a decision by the purchaser is required. Decisions should be indicated on the data sheets (see Appendix B) when provisions are made therein; otherwise, they should be stated in the inquiry or in the order.

shall be rigid enough to prevent sagging and vibration. Components attached to tops of reservoirs shall be mounted on pads to ensure that no holes extend into reservoirs.

2.2.2 Reservoirs shall be sealed to prevent entrances of dirt and water. Top-surface openings shall be raised at least one inch and then gasketed. Reservoir tops and components mounted thereon shall be designed to avoid pockets that can collect water and debris.

2.2.3 To ensure complete drainage, the bottom of each reservoir shall slope to a low-point drain connection. Manway openings shall be provided to permit inspection and cleaning of all interior compartments. Pump-suction connections shall be located near the high end of the reservoir bottom. All oil return lines shall enter the reservoir above the maximum operating level away from the pump suction to avoid disturbance at the pump suction. Each relief-valve return shall be piped separately back to the reservoir. Except as specified in 2.2.9, reservoir pipe connections shall be flanged.

2.2.4 A fill opening equipped with a strainer shall be provided. A dipstick oil-level indicator shall be furnished and shall be graduated in gallons and marked with levels in acocrdance with 2.2.5. A breather-filter cap and a two-inch minimum blind-flanged vent connection shall also be furnished.

A reflex-type, welding-pad oil-level gage shall be supplied and shall be positioned to span the area from at least one inch above the maximum operating level to a point between one and two inches below the minimum operating level.

2.2.5 RESERVOIR CAPACITIES AND CONFIGURATIONS (See Fig. 1)

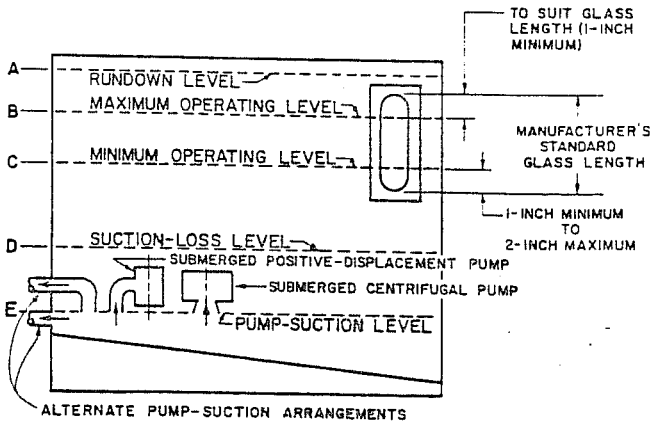
a. Definitions

Maximum operating level refers to the highest level that oil should be allowed to reach during normal operation of the unit.

Minimum operating level refers to the lowest level that oil should be allowed to reach during normal operation of the unit.

Normal flow refers to the total amount of oil that bearings, seals, couplings, steady-state controls, and so forth require. Normal flow does not include oil bypassed directly to the reservoir.

Rundown level refers to the highest level that oil in the reservoir may reach during system idleness.



Charge capacity is the total volume below level A.
Low-level alarm is set at level C.
Normal operating range is any level between levels B and C.
Retention capacity is the total volume below level C.
Rundown capacity is the volume between levels A and B.
Suction-loss level, level D, is above level E as required by pump-suction vortex and net pump-suction head requirements.
Working capacity is the volume between levels C and D.

NOTE: The dipstick level indicator is graduated in gallons from levels A to E and is marked with levels A through E.

FIG. 1—Reservoir Levels and Capacities and Oil-Level Glass Details.

Suction-loss level refers to the level at which the pumps begin to lose prime.

Working capacity refers to the volume between the minimum operating level and the suction-loss level.

b. Criteria for Reservoir Sizing

1. The working capacity shall be sufficient for at least 5 minutes of normal flow.

2. The retention time shall be 8 minutes, based upon normal flow and total volume below the minimum operating level.

3. The rundown capacity shall include the oil contained in all components, bearing and seal housings, control elements, and vendor-furnished piping that drain back to the reservoir; the rundown capacity shall also include a 10 percent minimum allowance for the purchaser's interconnecting piping.

NOTE: Rundown may cause some backup in the drain lines entering the reservoir.

4. Based upon the stated manufacturer's expected oil-usage rate, the capacity between the minimum and the maximum operating levels in an oil system that discharges seal oil from the unit shall be sufficient for a minimum of three days of operation with no oil being added to the reservoir.

5. The free surface of oil in the reservoir shall be a minimum of 0.25 square foot per gallon per minute of normal flow.

•**2.2.6** When specified, either a removable steam-heating element external to the reservoir or a thermostatically controlled electric immersion heater shall be provided for heating the charge capacity of oil prior to startup in cold weather. The heating device shall have sufficient capacity to heat within 12 hours the oil in the reservoir from the specified minimum site-ambient temperature to the equipment manufacturer's minimum required temperature. If an electric immersion heater is used, its watt density shall not exceed 15 watts per square inch.

•**2.2.7** When specified, reservoirs shall be fitted with clips for heat insulation. The purchaser shall furnish and install the insulation.

•**2.2.8** When there is a possibility of the reservoir being overpressured due to the leaking of compressor shaft seals, the reservoir shall be provided with a special vent sized to handle the total flow of gas from the seals to the reservoir via the oil drain lines. This vent shall be provided with an overpressure-protective device when specified.

2.2.9 Each reservoir compartment shall be provided with two ¾-inch minimum size plugged connections above the rundown oil level. These connections may be used for such services as purge gas, makeup, oil supply, and clarifier return. One connection shall be strategically located to ensure an effective sweep of purge gas toward the vents.

2.2.10 Joints, pads, connections, and the like shall be both internally and externally welded to eliminate cavities, potential sources of corrosion and contamination. Reservoir wall-to-top junctions may be welded from the outside if a full-penetration weld is utilized. Internal joints shall be smoothed as necessary to eliminate pockets and to provide an unbroken finish for any interior protection.

•**2.2.11** A clearly accessible ladder with extended handrails shall be provided when specified or when components or valves are to be mounted on a reservoir top at least 3 feet above grade.

•**2.2.12** No interior coating or paint shall be applied unless the purchaser approves in advance the materials and the method of application.

•**2.2.13** When specified, a grounding clip or pad shall be welded to the reservoir prior to final cleaning of the reservoir interior. The purchaser shall furnish details of the clip or pad.

2.3 Pumps and Drivers

•**2.3.1** The oil system shall include a main oil pump and a standby oil pump. If specified, an emergency oil pump shall be furnished as a protective service to allow safe shutdown.

•**2.3.2** The purchaser shall specify the pumps to be either vertical or horizontal. Nonlubricated-type couplings shall be used for vertical pumps submerged in reservoirs.

Spacer-type couplings made of forged steel shall be used for horizontal pumps. The purchaser shall specify either gear-type or flexible-disk-type couplings; flexible-disk elements shall be made of stainless steel. Rigid and removable coupling guards shall be provided to enclose exposed couplings on horizontally mounted pumps. The guards shall conform to specified state and local regulations.

2.3.3 Oil pumps external to the reservoir shall be equipped with mechanical seals having tungsten carbide and carbon mating faces as outlined in API Standard 610.

•**2.3.4** Pumps may be of either centrifugal or positive-displacement construction as specified by the purchaser. Centrifugal pumps shall conform to API Standard 610 and shall have a head curve continuously rising toward shutoff suitable for parallel operation. The sections of API Standard 610 covering bearings shall apply to all types of pumps.

•**2.3.5** Each pump shall have its own driver. Unless otherwise specified, the main oil pump shall be driven by a steam turbine and the standby oil pump shall be driven by an electric motor if the system employs these two types of drivers. Shaft-driven pumps or air- or gas-driven pumps may be provided only if approved by the purchaser. Motors shall comply with NEMA MG-1.

2.3.6 Steam turbines shall conform to API Standard 611. If the standby pump is turbine driven, the overspeed trip (if used) shall be set at least 25 percent above the normal operating speed.

2.3.7 The minimum requirements for the sizing of drivers shall be according to API Standard 610. Drivers shall have sufficient power to operate under all expected operating conditions. Drivers for positive-displacement pumps shall be capable of operating at the pump relief-valve setting (including accumulation) with oil viscosity corresponding to a temperature of

50 F. Drivers for centrifugal pumps shall be capable of operating while the pumped oil is at 50 F at system pressure.

The purchaser shall approve air or gas flow, pressure, and conditions to ensure operation of air or gas motors used as drivers.

2.3.8 The pump capacities for lube and control oil systems shall be based upon the particular system's maximum usage (including transients) plus a minimum of 15 percent. The pump capacity for a seal oil system shall be based upon the system's maximum usage plus either 10 gallons per minute or 20 percent, whichever is greater. Maximum system usage shall include the equipment vendor's allowance for normal wear.

2.3.9 Check valves shall be provided on each pump discharge to prevent reverse flow through the idle pump. Positive-displacement pumps shall be furnished with separate external relief valves. The relief valves shall meet ASME and specified local code requirements and shall be suitable for proper relief and reseating without subsequent leakage.

2.3.10 The oil system shall be provided with suitable pressure-regulating devices sized to prevent undue pressure rises that may occur when both main and standby oil pumps are in operation. The devices shall operate smoothly with no hunting, chattering, or transients occuring that can cause equipment shutdown. The pressure-regulating devices shall be arranged to avoid any excessive temperature buildup resulting from oil recirculation.

NOTE: The sizes of bypass valves shall allow for ranging from maximum usage of one pump to minimum usage of two pumps.

2.3.11 All pumps shall be installed with flooded suction. Suction piping shall be arranged to avoid pockets in which air can accumulate or become trapped. Designs for suction piping, for suction block valves, for pump casings, and for all other components (particularly those for a booster pump arrangement) shall consider the possibility of overpressure caused by a leaking discharge check valve. Relief valves shall be provided where necessary.

•**2.3.12** If specified, a temporary cone- or basket-type strainer with an open flow area equal to 150 percent of the cross-sectional area of the suction pipe shall be installed in the suction piping between the suction flange and the pump block valve to protect pumps during flushing and initial operation of new oil systems. The temporary strainer shall be identified by a protruding tab and shall have a mesh size adequate to stop all objects too large to pass through the pump. The piping arrangement shall permit the removal of the strainer without disturbing pump alignment.

A compound-type pressure gage shall be installed between the temporary strainer and the pump suction to detect excessive fouling of the strainer.

2.3.13 The standby oil pump shall be furnished with an automatic startup control to maintain safe system operation in the event the main pump does not meet system requirements. The startup control shall be actuated by devices that sense such malfunctions as low pressure, low differential pressure, and low oil level. If the standby oil pump is turbine driven, the automatic startup control shall actuate a quick-opening steam valve. The control system shall have a manual reset.

A restriction orifice, a test bleeder valve piped to the return oil line or to the reservoir, and a pressure gage shall be provided in the pressure-sensing device connection to permit checking the operation of the standby oil pump controls while the main pump is in operation.

•**2.3.14** For each system requiring booster pumps, an adequate supply of low-pressure oil shall be provided to prevent limitation of the high-pressure booster pumps even when both boosters are running. When specified, the vendor shall provide an auxiliary suction to the booster pumps or a low-suction pressure switch to alarm or to trip the booster pumps.

2.4 Coolers

2.4.1 Twin coolers shall be provided and shall be piped in a parallel arrangement utilizing a continuous-flow transfer valve. Each cooler shall be sized to accommodate the total cooling load. Water shall be on the tube side. The oil-side operating pressure shall be higher than the waterside operating pressure.

2.4.2 Shell-and-tube-type coolers shall be used and shall be constructed in accordance with TEMA Class C. Each cooler shall have a removable bundle and a removable channel cover. Tubes shall not be smaller than ⅝-inch outside diameter (OD); the minimum tube wall shall be 18 Birmingham wire gage. U-bend tubes shall not be permitted.

•**2.4.3** Unless otherwise specified, materials for the coolers shall be steel for the shells, the channels, and the covers; naval brass for the tube sheets; and inhibited admiralty for the tubes.

•**2.4.4** Tube-side water velocities at rated conditions shall be between 5 and 8 feet per second. The waterside fouling factor shall be 0.002 and the maximum waterside differential pressure shall be 10 pounds per square inch (psi).

NOTE: When fouling of the cooler's waterside is a factor, the purchaser may specify a bypass be used on the oil side of the cooler to achieve adequate temperature control; in no case, however, shall oil bypass the filter. When specified, the vendor shall furnish the oil-cooler piping and a constant-temperature control valve.

•**2.4.5** The minimum design pressure for coolers shall not be less than the maximum operating pressure of the system, nor less than the relief-valve setting for positive-displacement pumps, nor less than the maximum discharge pressure (at trip speed for turbine drives) for centrifugal oil pumps. The waterside design pressure shall be suitable for the specified cooling-water pressure, but shall not be less than 75 pounds per square inch gage (psig). When specified, coolers shall be suitable for 300 F steam heating.

2.4.6 Coolers preferably shall be arranged for self-venting.

2.5 Filters

2.5.1 Full-flow twin oil filters shall be furnished downstream of the coolers and shall be piped in a parallel arrangement utilizing a continuous-flow transfer valve (may be the same valve used for the coolers). Filters shall have cover lifters for covers weighing over 35 pounds. Filter elements shall be easily replaced with filter cases in place.

2.5.2 Control oil shall be filtered; if it is filtered separately from the main oil stream, twin filters having replaceable elements shall be provided and shall be piped in a parallel arrangement utilizing a continuous-flow transfer valve.

2.5.3 Filtration shall be 10-microns* nominal. Oil supply to piston pumps shall be filtered to 5-microns nominal.

2.5.4 For hydrocarbon and synthetic oils, the pressure drop for clean filters shall not exceed 5 psi at 100 F operating temperature at normal flow. Cartridges shall have a minimum collapsing differential pressure of 50 psi. Bypass relief valves are prohibited.

2.5.5 The minimum design pressure for filters shall not be less than the maximum operating pressure of the system, nor less than the relief-valve setting for positive-displacement pumps, nor less than the maximum discharge pressure (at trip speed for turbine drives) for centrifugal oil pumps.

2.5.6 A valved differential-pressure indicating switch shall be provided to measure filter differential pressure and shall be equipped with single-pole, double-throw contacts for alarm.

NOTE: The differential indicator shall span the filter-cooler set when a single continuous-flow transfer valve is used.

2.5.7 Systems with booster pumps shall be provided with twin 10-micron nominal rated filters piped in a parallel arrangement utilizing a continuous-flow transfer valve. These filters shall be located downstream of the booster pumps to protect the oil seals against damage from products of pump deterioration.

•**2.5.8** When specified, a 2-micron nominal secondary filter with a bypass valve, for which piping is arranged to prevent deposit of foreign matter in the bypass, shall be furnished for continuously lubricated flexible couplings. As specified by the purchaser, either a pressure gage shall be provided between the filter and the coupling or a differential pressure alarm shall be provided across the filter.

2.6 Accumulators

2.6.1 The system shall include an accumulator if one is required to maintain sufficient oil pressure when servo-control transients would be excessive or while the standby pump accelerates from an idle condition to speed.

•**2.6.2** Accumulators shall be commercially available bladder-type or fabricated vessels. A manual precharge valve or a constant-pressure regulating valve shall be furnished as specified.

a. The fabricated-vessel accumulator, if used, shall be equipped with an armored reflex-type glass gage positioned to show the oil level when the vessel is precharged at the controlled normal operating pressure.

* Micron particle size implies the shape of a spherical bead; thus, a 10-micron particle is a sphere having a diameter of 10 microns. Within the element's recommended maximum pressure drop, 10-microns nominal implies that the efficiency of the filter on 10-micron or larger particles would be no less than 90 percent for the life of the element.

Absolute micron particle ratings are larger. A micron-absolute filter rating implies zero particles passing at micron rating or larger; for example, a filter rating may rate 10-microns nominal and 15-microns absolute.

b. A pressure gage for checking precharge pressure in the accumulator shall be provided.

c. The physical location and the piping arrangement of the accumulator shall prevent the existence of pockets in which foreign materials or air could accumulate.

2.6.3 Accumulator designs shall not allow gas precharge to be delivered with the oil to the equipment nor to impair the flow of oil.

2.6.4 Accumulators shall be isolated from the oil-pump start controls to eliminate any delay in the starting signal.

2.7 Overhead Tanks

•**2.7.1** Separately mounted or machine-mounted overhead tanks shall be provided when required by the designs of the seals and the seal-oil control system or when specified by the purchaser as an emergency oil-rundown tank.

Seal-oil overhead tanks, illustrated in Fig. 2, shall be sized for the oil capacity above the low-level alarm setting to be equal to a 2-minute flow at normal seal oil rates and shall include capacity for a 10-minute flow from low-level alarm to trip plus sufficient time—no less than two minutes after trip—for coastdown and block-in. Vapor volume above the high-level alarm setting shall be no less than 1-minute normal oil flow.

2.7.2 Overhead tanks shall be provided with at least one 6-inch nozzle for access and inspection. A bottom outlet nozzle, if used, shall extend 1 inch inside the vessel in order to retain foreign matter. A minimum ¾-inch drain and blowdown connection shall be furnished.

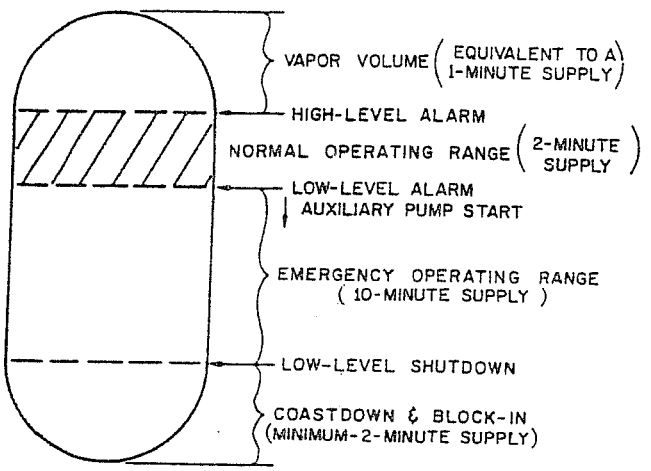


FIG. 2—Seal-Oil Overhead Tank.

2.7.3 The low-oil-level trip switch shall be a separate float- or displacer-operated switch.

•**2.7.4** When specified by the purchaser, the reference gas shall be isolated from the oil by a bladder of material suitable for the service.

2.8 Purifiers

•**2.8.1** When specified, a slipstream-type purifier (clarifier- or centrifuge-type cleanup system) selected principally for the removal of water and oxidation products shall be provided. The purifier shall be a complete package mounted either integrally or separately as specified.

2.8.2 Purifier capacity shall be at least 1 percent of the rate of normal flow through the reservoir. Feed to the purifier shall be from the drain end of the reservoir. Purifier operation shall be independent of the operation of the oil system. A protective device shall be included to prevent loss of oil via the cleanup system.

2.9 Seal Oil Drain Traps

2.9.1 One drain trap per seal shall be provided and a crossover line and valve shall be included where seals operate at the same pressure.

a. Drain traps may be manual for nontoxic gas services having seal pressures under 150 psig and maximum seal leakages of 10 gallons per day per seal (seals in a deteriorated condition).

b. Automatic traps are required for all other conditions up to 800 psig and may be mechanical float-type traps if of a single-lever design. At higher pressures, a snap-acting level controller and a separate control valve shall be used.

2.9.2 Traps shall be furnished with reflex-type glass gages. The inlet piping shall enter the seal traps above the oil level.

•**2.9.3** When specified, seal-trap vents shall be equipped with mist eliminators to agglomerate most of the residual oil before vent gas is recycled to the compressor suction or vented to other disposal outlets.

•**2.9.4** The drain line for each trap shall be piped separately to the sewer, to the degasser, or to the reservoir as specified by the purchaser.

NOTE: Separate piping of the drain lines allows monitoring individual leakage from each seal.

2.10 Degassing Drum

•**2.10.1** Degassing facilities shall be provided if specified.

2.10.2 A gas-tight baffle and a liquid seal shall divide the degassing drum into two sections in order to confine the disengaged gas to one side of the drum. The gas side of the drum shall be vented and shall be provided with connections for an inert-gas purge. The purchaser shall pipe the gas vent to a safe location. Fig. 3 illustrates a typical arrangement.

•**2.10.3** As specified by the purchaser, electricity, steam, or another means of heating shall be provided to assist in degassing the oil. If a steam heater is used, it shall be external to the drum and shall be removable. If an electric immersion heater is used, it shall have a watt density not exceeding 15 watts per square inch.

2.10.4 The drum proportions and the holdup time shall allow for the maximum flow possible from all traps to assure maximum release of engaged gas.

•**2.10.5** When there is a possibility of the seal system overpressuring the drum, the drum shall be provided with a special vent sized to handle the total flow of gas from the seals to the drum via the oil drain lines. This vent shall be provided with an overpressure-protective device when specified.

2.11 Piping

2.11.1 The vendor shall furnish all piping with its mounted appurtenances within the confines of the main base area, the console base area, and any auxiliary base area. The vendor-furnished piping shall terminate with flanged connections at the edge of the respective base. All welding shall be performed by welders qualified in accordance with Section IX of the ASME Code.

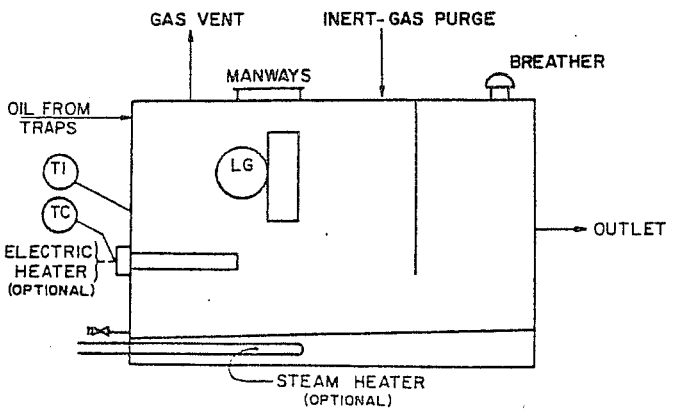


FIG. 3—Typical Degassing Drum Arrangement.

The purchaser shall furnish only the interconnecting piping between each package and between the packages (or console) and the equipment. Special consideration should be given to the selection of the interconnecting piping in order that the proper alloy is maintained throughout the system.

2.11.2 Piping shall be designed in accordance with ANSI B31.3.

2.11.3 Piping shall be arranged to provide the flexibility and the accessibility necessary for proper operation, maintenance, and cleaning. Piping shall be securely fastened to minimize vibration and to prevent breakage during shipment and operation.

2.11.4 Bolting shall conform to the following specifications:

1. Threading for pressure bolting shall conform to ANSI B1.1.
2. The quality of bolting for pressure joints and piping shall be based upon the actual bolting temperature defined by ANSI B31.3.
3. Nuts shall conform to ASTM A 194, Heavy Grade 2 or 2H.

2.11.5 All such system components as pipe fittings, flanges, valves, control-valve bodies or heads, relief valves, and balance cylinders that contain flammable or toxic gas or oil shall be made of steel and shall be a minimum of ¾-inch nominal pipe size (NPS). Piping of ½-inch NPS or tubing of ½-inch OD (0.065-inch minimum wall) will be permitted between instruments and the valves adjacent to the instruments.

2.11.6 Valves shall have bolted bonnets and glands and shall be suitable for repacking under pressure. If approved by the purchaser, block valves for primary service pressure ratings above 900 pounds may be of either a welded-bonnet or an integral-bonnet construction with bolted glands.

Instrument valves for oil and gas serving such protected areas as panels and gage boards may be ½-inch American Standard Taper Pipe Thread instrument-type valves (1) if a block valve is provided upstream of the instrument valve in the sensing line and (2) if the instrument valve is protected against accidental disassembly.

2.11.7 Control-valve heads actuated by oil shall be vented to the reservoir.

2.11.8 Nominal pipe sizes of 1¼ inches, 2½ inches, 3½ inches, 5 inches, 7 inches, and 9 inches shall not be used.

2.11.9 Piping shall be seamless carbon steel manufactured in accordance with ASTM A 106 or ASTM A 192. Schedule 80 shall be used as a minimum for sizes 1½ inches and smaller; Schedule 40 shall be used as a minimum for sizes 2 inches and larger.

All supply piping downstream of the filter shall be seamless stainless steel in accordance with ASTM A 312. Schedule 40 shall be used as a minimum for sizes 1½ inches and smaller; Schedule 10 shall be used as a minimum for sizes 2 inches and larger. Where space does not permit the use of pipe, ¾-inch and 1-inch ASTM A 269 seamless stainless steel tubing with steel fittings and minimum wall thicknesses of 0.095 inch and 0.109 inch, respectively, shall be furnished. The make and the model of the fittings shall be subject to the approval of the purchaser.

2.11.10 Piping fabrications preferably shall be accomplished by bending and welding. Welded fittings shall be butt welded or socket welded except as noted below. Flanges shall be in accordance with ANSI B16.5. Use of backup rings is prohibited. Threaded valve connections shall be held to a minimum and shall be seal welded (except to instruments) for flammable or toxic gas or oil services. Pipe bushings shall not be used. Pipe threads shall be tapered in accordance with ANSI B2.1. Pressure piping downstream of oil filters shall be free of internal obstructions that could accumulate dirt; socket-welded fittings are therefore not acceptable in this portion of oil piping.

2.11.11 All oil drains shall be sized to operate no more than half full and shall be arranged to ensure good drainage despite possible foaming. Horizontal runs shall slope continuously downward toward the reservoir; the angle of each slope shall be a minimum of ½ inch per foot. The various elevation differences necessary to comply with these requirements shall be considered when arranging the equipment, the components, and the reservoir.

2.11.12 Threaded steel joints that are to be welded shall be fitted dry, without the use of thread lubricants or compounds. The seal weld shall cover all exposed threads and shall consist of at least two passes, the throat of the finished weld being a maximum of ⅜-inch thick.

•**2.11.13** Instrument and control air tubing downstream of filter regulators shall be made of either stainless steel or copper as specified.

2.11.14 Unless otherwise specified, all valves shall have steel bodies and stainless steel internals and trims. Continuous-flow transfer valves shall also have stainless steel plugs.

SECTION 3—CONTROLS AND INSTRUMENTATION

3.1 General

3.1.1 The oil system shall be suitable for orderly startup, stable operation, warning of abnormal conditions, and shutdown of main equipment in the event of impending damage.

3.1.2 All control valves, relief valves, solenoid-, bellows-, and diaphragm-operated valves, and all other valves handling flammable or toxic fluids shall have steel bodies with stainless steel internals and trims. Control heads for flammable fluids shall be made of steel.

3.1.3 All solenoids shall have continuous-duty ratings.

3.1.4 Controls and control panels shall be completely piped, requiring only the purchaser's external piping connections.

3.1.5 Controls and control panels shall be completely wired. When more than one wiring point is required for controls or instrumentation, wiring to all items shall be provided from a terminal box. All wiring shall be installed in protective metal conduits or enclosures.

3.1.6 All controls and instruments shall be located and arranged for ease of visibility by the operators as well as for accessibility for tests, adjustments, and maintenance.

3.1.7 Valved bleeders are required between instruments and their valves for services over 200 psig.

3.1.8 When failure or malfunction of a reducing valve may cause overpressure and resultant hazard or damage to downstream equipment or components, a relief valve discharging to the reservoir shall be furnished (see Fig. A-24 for typical arrangement).

3.1.9 The suggested or recommended practices set forth in API RP 550, Part I, shall be followed as

guidelines for the installations of flow, level, temperature, and pressure instruments; automatic controllers; control valves and positioners; alarms and protective devices; and instrument piping and wiring.

3.2 Panels

•**3.2.1** At least one instrument panel for the oil sytsem shall be provided by the vendor when specified. The vendor shall furnish and mount on or in the panels the instruments specified on the data sheets. Spaces or cutouts, or both, shall be supplied as specified for the purchaser's instruments. The configuration of the panels shall be as specified.

•**3.2.2** The types of instruments and the locations of the panels shall be specified by the purchaser.

•**3.2.3** After all the equipment locations have been fixed, the pressure instruments shall be piped to the terminal locations specified by the purchaser. A shutoff valve within each panel shall be provided for all lines except those for shutdown-sensing devices.

3.3 Alarms and Shutdowns

3.3.1 The vendor shall furnish as a minimum the following alarm and shutdown contacts (or bearing metal-temperature detectors). The alarm setting shall precede the shutdown setting.

	Alarm	Shutdown
Low lube-oil pressure for each level	X	X
Low level in reservoir for each item	X	. . .
Low seal-oil level or low seal-oil differential pressure for each item	X	X
High overhead-tank level for each item	X	. . .
High thrust-bearing oil or metal temperature for each item (purchaser shall specify the arrangement required)	X	. . .
Standby pump running for each item (not required if the purchaser's alarms are from the motor starter)	X	. . .
High oil-filter differential pressure for each item	X	. . .

3.3.2 A separate housing shall be furnished for each pressure- or temperature-sensing switch. "Single-pole, double-throw" switches shall be used.

3.3.3 "Open" (deenergize) to alarm and "close" (energize) to trip electric switches shall be furnished.

•**3.3.4** The vendor shall furnish a "first-out" type of annunciator when an annunciator system is specified.

3.3.5 All instruments and controls other than shutdown-sensing devices shall be installed with sufficient valving to permit removing instruments and controls while the system is in operation.

3.3.6 Piping to a pressure switch for alarms shall include an orifice, a T-connection, a pressure gage, and a bleeder valve to test the alarm. The arrangement of the shutdown-sensing device shall permit its being checked during operation where a redundant system (such as a "two-out-of-three" system) is employed. Alarm- and shutdown-switch settings shall not be adjustable from outside the housing. Pressure elements shall be made of 18 chromium-8 nickel (18 Cr-8 Ni) stainless steel.

3.4 Thermometers

Either 6-inch minimum size industrial thermometers or 5-inch minimum size dial bimetallic or mercury-filled thermometers shall be mounted in the oil piping of the cooler inlets and outlets and in the oil piping at the outlet of each radial and thrust bearing. Individual 18 Cr-8 Ni stainless steel wells shall be furnished in pressurized or flooded locations.

3.5 Pressure Gages

3.5.1 Pressure gages shall be furnished at the discharge of each oil pump, at each bearing and seal inlet oil header, and at the control inlet oil header.

3.5.2 Each pressure gage shall have a 4½-inch minimum size dial, a ½-inch NPS male connection, and an 18 Cr-8 Ni stainless steel bourdon tube and movement. Each gage shall be suitably valved to permit its removal while the system is in operation.

3.6 Flow Indicators

3.6.1 Flow indicators shall be furnished in the atmospheric oil-drain return line from each bearing, gear, and seal and in either the pressured inlet piping or the outlet piping of each continuously lubricated coupling.

3.6.2 Steel nonrestrictive flow indicators shall be used for atmospheric drain lines. Steel restrictive flow indicators shall be used for pressured lines.

3.6.3 Each flow indicator shall be of the "bull's-eye" type and shall be installed with its bull's-eye glass preferably in a vertical plane to facilitate viewing the flow of oil through the particular line.

SECTION 4—INSPECTION AND TESTS

4.1 Inspection

4.1.1 The inspector representing the purchaser shall have entry to the plants, including the subvendor plants, where work on or testing of components or subassemblies is being performed. It shall be the responsibility of the vendor to notify the subvendors of the purchaser's inspection requirements.

•**4.1.2** It is intended that the purchaser's inspection work be facilitated by assigning to the vendor the responsibility of furnishing the inspector or his representatives with all requested material certifications, mill test reports, purchase specifications or bills of materials, hydrostatic and running test data, and the like necesary to verify the vendor's compliance with the requirements of the specifications.

4.1.3 At least five days prior to scheduled shop tests, the vendor shall inform the purchaser of the planned test dates.

4.1.4 At least five days prior to the required system inspection, the vendor shall inform the purchaser of the planned inspection date.

4.1.5 During assembly of the system and prior to testing, each component and all piping shall be cleaned by pickling, or by another appropriate method, to remove foreign materials, corrosion products, and mill scale.

•**4.1.6** The purchaser shall specify whether the purchased oil system shall be used during the shop testing of the main equipment.

4.1.7 Acceptance of shop tests shall not constitute a waiver of requirements to meet the field performance under specified operating conditions, nor does inspection in any way relieve the vendor of his responsibilities.

4.2 Hydrostatic Tests

4.2.1 Each cooler, filter, accumulator, and other pressure vessel shall be hydrostatically tested at 1½ times its design pressure. Tests shall be in accordance with code requirements where applicable.

4.2.2 Each component, subassembly, and assembled oil system shall be hydrostatically tested at 1½ times its design pressure.

4.2.3 Cooling-water jackets and other components of the system handling cooling water shall be hydrostatically tested at 1½ times the design pressure of the cooling-water system; in no case, however, shall this hydrostatic test pressure be less than 115 psig.

4.2.4 Tests shall be maintained for durations of at least 30 minutes to permit complete examination of parts under pressure.

4.3 Operational Tests

4.3.1 The completed oil system shall be shop run to test operation, sound level, and cleanliness. The running tests shall be conducted under normal system operating conditions for at least 4 hours.

4.3.2 The low-oil-pressure alarm, the standby-pump start, and the shutdown switches purchased for the project shall be used for the operational tests.

4.3.3 The operational tests shall be conducted using an oil with the same viscosity and characteristics recommended for actual field operations.

Oil temperatures (except as noted in 4.3.6) and oil pressures during the operational tests shall simulate field conditions.

4.3.4 If steam is not available for the operational tests, turbine drivers shall be tested with compressed gas.

4.3.5 The operational testing of the oil system shall be conducted in the following sequence:

1. The oil system shall be thoroughly checked for leaks and all leaks shall be corrected before testing is resumed.
2. The relieving pressures shall be determined in order to establish the subsequent proper operation of each relief valve.
3. A filter–cooler changeover shall be accomplished without the system's delivery pressure dropping to the automatic-start setting of the standby pump.
4. The control valve shall be demonstrated to have suitable capacity, response, and stability by starting, running, and stopping a second pump (main or standby) without the relief valves lifting and without the delivery pressure dropping below 75 percent of the differential pressure between the normal operating and shutdown pressures.

5. The oil-pressure control valve shall be determined capable of controlling the oil pressure by successfully operating only the main pump or the standby pump at minimum oil requirements. Minimum oil requirements shall be the sum of the normal bearing- and seal-oil requirements plus the steady-state control-oil requirements.

4.3.6 Conformity to the following criteria for system cleanliness shall be demonstrated:

•1. After 1 hour of oil circulation at design flow rate at a temperature of 160 F (or lower, as component design dictates), screens placed at all discharge terminations from the console or the packages and at other strategic points mutually agreed upon by the purchaser and the vendor shall be within the particle count limits listed in Table 1.

Screen mesh shall be No. 100 plain weave, 0.005-inch diameter stainless steel wire with a 0.0059- by 0.0059-inch opening. Particles shall not exceed 0.010 inch (greatest dimension) and shall display random distribution on the screen. Piping, coolers, and valves shall be hammered frequently during the test.

TABLE 1—Maximum Number of Particles

Nominal Pipe Size (Inches)	Schedule 40 or Less	Schedule 80	Schedule 160	Extra Strong
1 or less	6	3	4	. . .
1-1½	13	11	9	6
2	21	18	14	11
3	46	41	34	26
4	80	72	58	49
6	180	163	132	117

2. Visual inspection at approximately two to six points selected by the inspector shall be made to verify system cleanliness. The system shall be considered clean when such foreign matter as scale, rust, metal shavings, and sand are not visible to the naked eye and grittiness is not detectible to the touch.

4.3.7 If dismantling of the oil system is required to improve operation, the initial running test shall not be acceptable and final tests shall be run after corrections are made. In any event, the demonstration of cleanliness shall be conducted only after the final assembly.

SECTION 5—SHIPPING PREPARATIONS AND PROCEDURES

5.1 Coatings

5.1.1 After all tests are completed and after inspection is made, all exposed machined surfaces shall be thoroughly coated with a suitable rust preventive that is compatible with the normal charge oil or that can be completely removed by flushing with the normal charge oil.

5.1.2 Each exterior part of the unit, except machined surfaces, shall receive a shop coat of paint.

5.1.3 The surfaces of reservoirs, tanks, accumulators, coolers, filters, piping, and all other parts that will be in contact with system oils shall be cleaned and shall be coated with a suitable rust preventive. Turbine drivers shall be dried thoroughly.

5.2 Packing

5.2.1 Each flanged opening shall be provided with a solid full-face gasketed metal cover, ¼-inch minimum thickness, retained by four bolts. All unpiped threaded openings shall be fitted with solid-steel, round-shank plugs or caps.

•**5.2.2** Lube and seal oil systems shall be packed securely for specified domestic or foreign shipment. Lifting points or lugs shall be clearly marked. The system and all parts shipped separately shall be properly tagged and identified with an item number and all special markings as specified in the order. Items enclosed in protective coatings shall be identified outside the covering.

5.2.3 The base and all components and piping of any console or package shall be shipped as a single assembly. To minimize entrance of contaminants, no components shall be disassembled for shipment.

5.3 Tags

5.3.1 Each filter shall be shipped with clean elements installed and with a securely affixed all-weather tag outside stating "SHIPPED WITH CLEAN ELEMENTS INSTALLED."

5.3.2 All components (individual pieces, as well as packaged sets) shipped with mounted preassembled piping, tubing, or wiring shall comply with Occupational Safety and Health Administration (OSHA)

requirements and shall carry outside securely affixed large, red, all-weather tags stating in bold letters: "THIS SYSTEM HAS BEEN PREASSEMBLED AND TESTED FOR OPERABILITY AND SAFETY, AND COMPLIES WITH ALL REQUIREMENTS OF OSHA, AND SHALL NOT BE DISTURBED BY UNAUTHORIZED PERSONNEL."

5.4 Storage

Each system prepared for shipment shall be suitable for outdoor storage at the job site for a period of at least three months. If storage for more than three months is contemplated, the purchaser shall consult the vendor regarding proper protection.

SECTION 6—REQUIRED DRAWINGS AND DATA

6.1 Drawings

•**6.1.1** The purchaser shall state in the inquiry and in the order the number of copies of drawings required and the time period within which the drawings must be submitted. If the time requirement specified in the inquiry cannot be met, the vendor shall propose for the purchaser's approval a schedule for the submission of the drawings and the data.

6.1.2 The vendor shall submit to the purchaser preliminary drawings for review regarding their compliance with the specifications. Review of the vendor's drawings shall be made promptly after receipt by the purchaser. Such review shall not constitute permission to deviate from any requirements of the order unless specifically agreed upon in writing.

The vendor shall then furnish in the quantity specified certified final copies of outline and foundation drawings of the console and each package and of the piping layout and the panel outline; fabrication drawings of the reservoir, the degassing drums, and the pressure vessels; system schematics and bills of materials; and outline and foundation drawings of individual components.

6.1.3 The vendor shall furnish one reproducible copy or the requested number of prints of drawings of the oil system. The following items of information shall be included on the outline drawings and on other drawings and data as applicable:

1. Purchaser's name, job number, and order number.

2. Purchaser's equipment item number.

3. Net and operating weights of each console or package and the net weight of the heaviest component that must be handled for maintenance purposes.

4. All principal dimensions, including those required for the purchaser's foundation and piping designs. Dimensions shall include all vertical and horizontal clearances necessary for maintenance purposes.

5. Direction of rotation of all oil pumps.

6. Complete utility requirements (electrical loads, water, steam, air and gas) and complete data on driver ratings and net driver loadings.

7. Sizes, types, locations, and identifications of vent, drain, oil, water, conduit, instrument, and control connections and of all other major and minor external connections (including those to be plugged). Maximum allowable forces and moments from the purchaser's piping shall be stated.

8. Bills of materials for auxiliary piping, fittings, and all other equipment furnished by the vendor.

9. Make, size, and type of couplings supplied by the vendor. The details of any required coupling housing attachment shall be illustrated.

10. List of reference drawings.

11. Special winterization features, if any.

6.1.4 If inclusion of items 7 through 11 of 6.1.3 will delay the submission of drawings beyond the date specified in the order, a preliminary set of drawings (complete with all other information and including sizes, types, and locations of major connections) shall be sent to the purchaser by that date.

The final completed drawings shall be sent to the purchaser as soon as possible after that date.

6.1.5 The vendor shall furnish schematic drawings of the lubrication, the shaft-sealing, and the control oil systems supplied. These drawings or their associated bills of materials shall include and identify each component by its make, type, size, capacity, pressure rating, and material and shall state the control and protective settings and other data as applicable.

6.1.6 Cross-sectional or assembly-type drawings showing parts and design features shall be provided for all components furnished.

6.2 Data Required

6.2.1 No later than 45 days before the scheduled shipping date, the vendor shall furnish the required number of copies of installation, operation, and maintenance manuals for the oil system and for all auxiliaries and instruments furnished by the vendor. If the purchase order covers more than one oil system, the manual must be clearly indexed to distinguish between the systems and to identify for service all component parts. For each system, the manual shall include instructions covering installation, final tests and checks, startup, shutdown, operating limits, operating procedures, maintenance procedures, and clearances; the manual shall also include complete sets of drawings and parts lists.

A parts list for each vendor-supplied component shall be furnished and shall include the pattern, stock, or production-drawings numbers and the materials of construction to identify completely each part in order that the purchaser may determine the interchangeability of parts with other equipment furnished by the same original manufacturer. Standard purchased items shall be identified by the original manufacturer's numbers.

6.2.2 The vendor shall furnish completed "as built" system data sheets.

6.2.3 The vendor shall submit a supplementary proposal for spare parts not included in his original quotation. This supplementary proposal shall be forwarded to the purchaser promptly after the receipt of approved drawings and in time to permit ordering and delivering parts prior to field startup. Price lists for these spare parts shall not be included in the instruction manual.

•6.2.4 If specified, the purchaser shall furnish after completion of inspection and tests certified copies of his test logs, including all operational data, performance responses, and sound levels for each system.

SECTION 7—PROPOSALS

7.1 Drawings and Data

7.1.1 The vendor shall submit with the proposal API data sheets completed to the furthest extent practicable.

7.1.2 The proposal shall include preliminary outline drawings, arrangement drawings, and schematic diagrams.

7.1.3 All utility requirements shall be stated and shall include such items as steam, water, electricity, and air or gas consumptions, plus driver ratings and net loads. The data may be placed on the data sheets; however, any approximated data shall be clearly defined as such.

7.1.4 Net and gross operating weights shall be stated.

7.1.5 The reservoir charge capacity shall be stated.

•7.1.6 When requested by the purchaser, the vendor shall submit with the proposal a list of recommended spare parts, their prices, and their delivery.

7.2 Compliance with Specifications

The proposal must include either a specific statement that the system and all components are in strict accordance with the purchaser's specifications or a list specifying and explaining any and all deviations therefrom. Deviations may include alternative designs or systems equivalent to and guaranteed for the specified duties.

7.3 Delivery Date

The delivery date shall be specified in the vendor's proposal as a fixed number of weeks after the receipt of the order.

7.4 Warranty and Guarantee

Unless specific exception is recorded by the vendor in his proposal, it shall be understood that he guarantees and agrees to the following:

• a. The oil system shall be guaranteed for satisfactory performance at rated capacity and under other operating conditions specified on the data sheets.

b. All components and component parts shall be warranted by the vendor against fault in design, defective or improper materials, poor workmanship, and failure from normal usage for one year after being placed in the specified service, but not exceeding 18 months after the date of shipment. If any defects or malfunctions occur during the warranty period, the vendor shall make all necessary or desirable alterations, repairs, and replacements free of charge, f.o.b. factory. Field labor charges, if any, shall be negotiated between the purchaser and the vendor.

APPENDIX A

TYPICAL SCHEMATICS OF SYSTEM COMPONENTS AND COMPLETE SYSTEMS

General Notes

1. The schematics presented herein illustrate the general philosophy and requirements of this standard and typify commonly used systems. The systems illustrated may be modified as necessary and as mutually agreed upon by the purchaser and the vendor to provide a system or systems adequate for a particular application.

•2. Instrument piping and valving details are not shown on most of the schematics. However, these details are illustrated in Fig. A-1 and shall apply unless otherwise specified.

•3. When specified or when necessary for the conditions and functions involved, equivalent transmitters (pilot operators) with suitable separate control valves shall be substituted for the direct-acting control valves shown on the schematics. The transmitter-controller schemes illustrated show pneumatic transmission; actual transmission shall be pneumatic, hydraulic, or electric as specified by the purchaser.

4. External control connections are shown on the control valves to illustrate more clearly the intended function of the system. Where applicable and when permitted by the purchaser, these control valves may be of the self-contained type without external connections.

5. Relief valves are illustrated as angle-type valves, the most common pattern. A straight-through pattern may be used if it is adequate for the required service conditions.

6. A typical arrangement for a relief valve to protect a low-pressure system (see Par. 3.1.8) is illustrated in Fig. A-24.

•7. Relief valves for the sole purpose of thermal expansion protection of blocked-in equipment (e.g., coolers or filters) are not shown but shall be supplied when specified. The purchaser should mark "THERM" outside the relief valve symbol on the schematic when the relief valve is for thermal expansion protection only.

8. The accumulators for most of the systems illustrated are shown downstream of the filters, but it is recommended that they be upstream of the filters whenever the system and the application permit.

9. The purchaser's connections shown are based on a console arrangement. When a multiple-package arrangement is used, the purchaser must make additional connections among the separate groups.

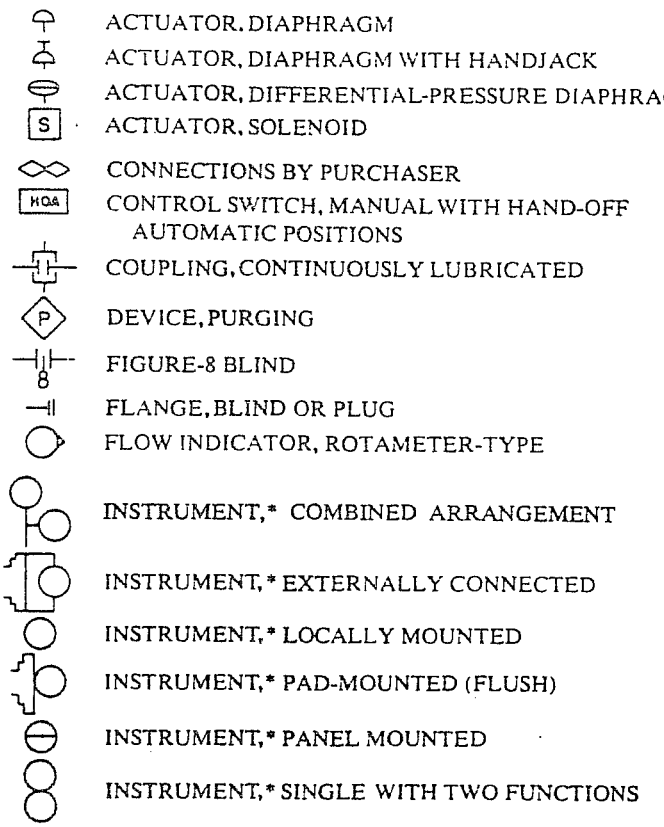
Legend for Schematics

The following legend is provided to facilitate interpretation and understanding of the schematics presented herein. Some of the abbreviations and symbols listed are from ISA S5.1.

ABBREVIATIONS

AS	AIR SUPPLY
ES	ELECTRIC SUPPLY
FG	FLOW GLASS
FO	FLOW RESTRICTION ORIFICE
H-P	HIGH PRESSURE
LC	LEVEL CONTROLLER
LG	LEVEL GLASS
LI	LEVEL INDICATOR
LIC	LEVEL-INDICATING CONTROLLER
L-P	LOW PRESSURE
LSH	HIGH-LEVEL SWITCH
LSHH	VERY HIGH-LEVEL SWITCH
LSL	LOW-LEVEL SWITCH
LSLL	VERY LOW-LEVEL SWITCH
LT	LEVEL TRANSMITTER
LV	LOOP-ACTUATED LEVEL-CONTROL VALVE
LY	RELAY IN LEVEL-CONTROL LOOP
PCV	DIRECT-ACTING PRESSURE CONTROL VALVE
PDCV	DIRECT-ACTING DIFFERENTIAL-PRESSURE CONTROL VALVE
PDI	PRESSURE DIFFERENTIAL INDICATOR
PDSH	HIGH-DIFFERENTIAL-PRESSURE SWITCH
PDSL	LOW-DIFFERENTIAL-PRESSURE SWITCH
PDSLL	VERY LOW-DIFFERENTIAL-PRESSURE SWITCH
PI	PRESSURE INDICATOR
PSH	HIGH-PRESSURE SWITCH
PSL	LOW-PRESSURE SWITCH
PSV	PRESSURE RELIEF VALVE
PV	LOOP-ACTUATED PRESSURE-CONTROL VALVE
PY	RELAY IN PRESSURE-CONTROL LOOP
SS	STEAM SUPPLY
TC	TEMPERATURE CONTROLLER
TCV	DIRECT-ACTING TEMPERATURE-CONTROL VALVE
TI	TEMPERATURE INDICATOR
TIT	TEMPERATURE INDICATING TRANSMITTER
TSH	HIGH-TEMPERATURE SWITCH
TSL	LOW-TEMPERATURE SWITCH
TW	THERMOWELL

SYMBOLS



ACTUATOR, DIAPHRAGM
ACTUATOR, DIAPHRAGM WITH HANDJACK
ACTUATOR, DIFFERENTIAL-PRESSURE DIAPHRAGM
ACTUATOR, SOLENOID
CONNECTIONS BY PURCHASER
CONTROL SWITCH, MANUAL WITH HAND-OFF AUTOMATIC POSITIONS
COUPLING, CONTINUOUSLY LUBRICATED
DEVICE, PURGING
FIGURE-8 BLIND
FLANGE, BLIND OR PLUG
FLOW INDICATOR, ROTAMETER-TYPE
INSTRUMENT,* COMBINED ARRANGEMENT
INSTRUMENT,* EXTERNALLY CONNECTED
INSTRUMENT,* LOCALLY MOUNTED
INSTRUMENT,* PAD-MOUNTED (FLUSH)
INSTRUMENT,* PANEL MOUNTED
INSTRUMENT,* SINGLE WITH TWO FUNCTIONS
LINE, ELECTRICAL
LINE, HYDRAULIC
LINE, PNEUMATIC
LINE STRAINER
MANUAL RESET FEATURE
ORIFICE, FLOW RESTRICTION
PIPING, OIL AND GAS
REDUCER OR SWAGE NIPPLE
TRAP
TUBING, CAPILLARY (FILLED SYSTEM)
VALVE, 2-PORT
VALVE, 3-PORT MANUAL
VALVE, 3-PORT FOR ACTUATOR
VALVE, 6-PORT CONTINUOUS FLOW TRANSFER MANUALLY OPERATED
VALVE, CHECK
VALVE, GATE OR TWO-WAY VALVE ACTUATOR OPERATED
VALVE, GLOBE
VALVE, NEEDLE
VALVE, RELIEF

FC PORTS FAILING CLOSED
FI PORT FAILURES INDETERMINATE
FL PORTS FAILING LOCKED IN POSITION
FO PORTS FAILING OPEN

*Letters within baloon indicate the function of the instrument.

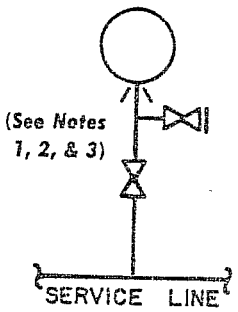
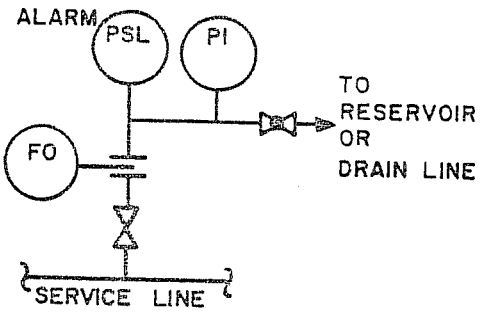
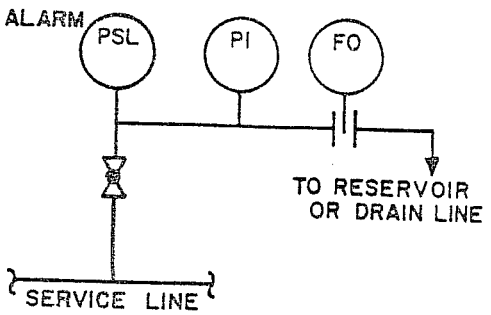


FIG. A-1.1—Pressure Gages, Switches, Transmitters.

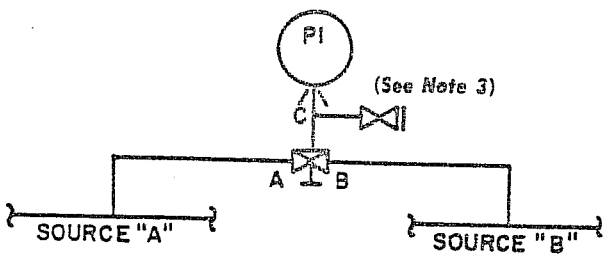


TYPICAL DESIGN



ALTERNATIVE DESIGN (See Note 4)

FIG. A-1.2—Combined Instrument System for Low-Pressure Alarm and Pump-Start Switches.



VALVE PORTING

POSITION	CONNECTED	CLOSED
1	A,C	B
2	NONE	A,B,C
3	B,C	A

Connection from "A" to "B" ports to be impossible.

FIG. A-1.3—Single Pressure Gage for Differential-Pressure Use.

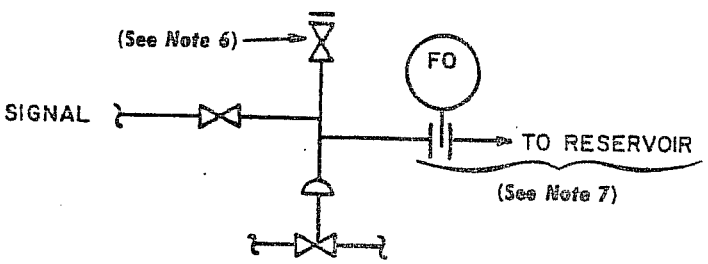


FIG. A-1.4—Diaphragm Actuator. (See Note 5)

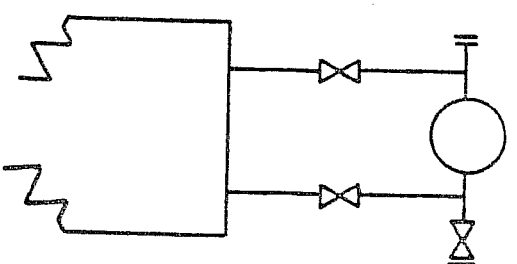


FIG. A-1.5—Externally Connected Level Instruments.

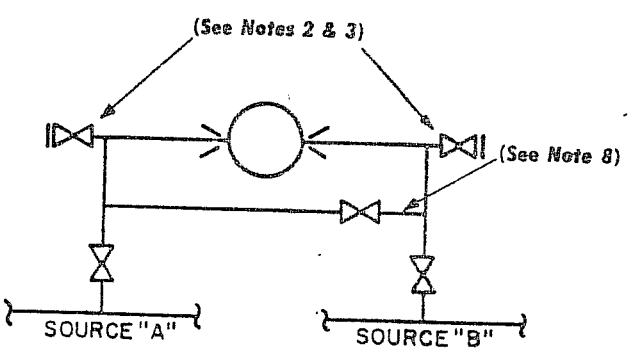
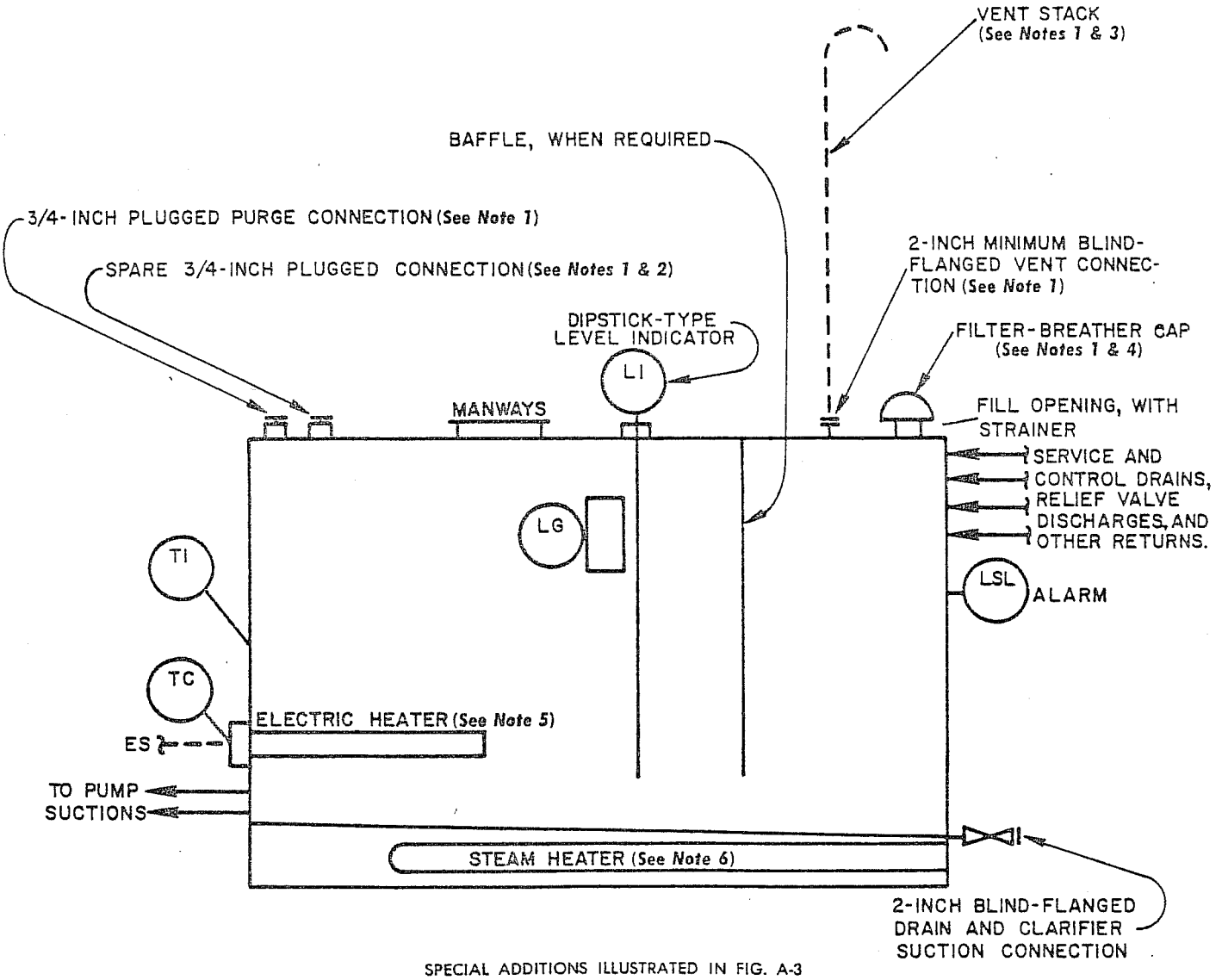


FIG. A-1.6—Differential Diaphragm Actuators, Indicators, Switches, Transmitters.

Notes:

1. **OPTION A-1a:** If approved by the purchaser, a combination "block and bleed gage valve" may be substituted for individual block and vent-bleed valves except as specified in Note 2.
2. **OPTION A-1b:** Unless otherwise specified by the purchaser, block and vent-bleed bleed valves shall be omitted for all instruments in trip service.
3. For services of 200 psig and lower, bleed valves may be omitted except for Fig. A-1.2 or when Note 2 applies.
4. **OPTION A-1c:** For cold climates.
5. Not required for air signals unless other devices are receiving the same signal.
6. Omit for Fig. A-1.2.
7. For oil service.
8. Valved bypass required if full pressure of "A" or "B" will damage the differential device in any way (including changing instrument calibration).

FIG. A-1—Instrument Piping Details.

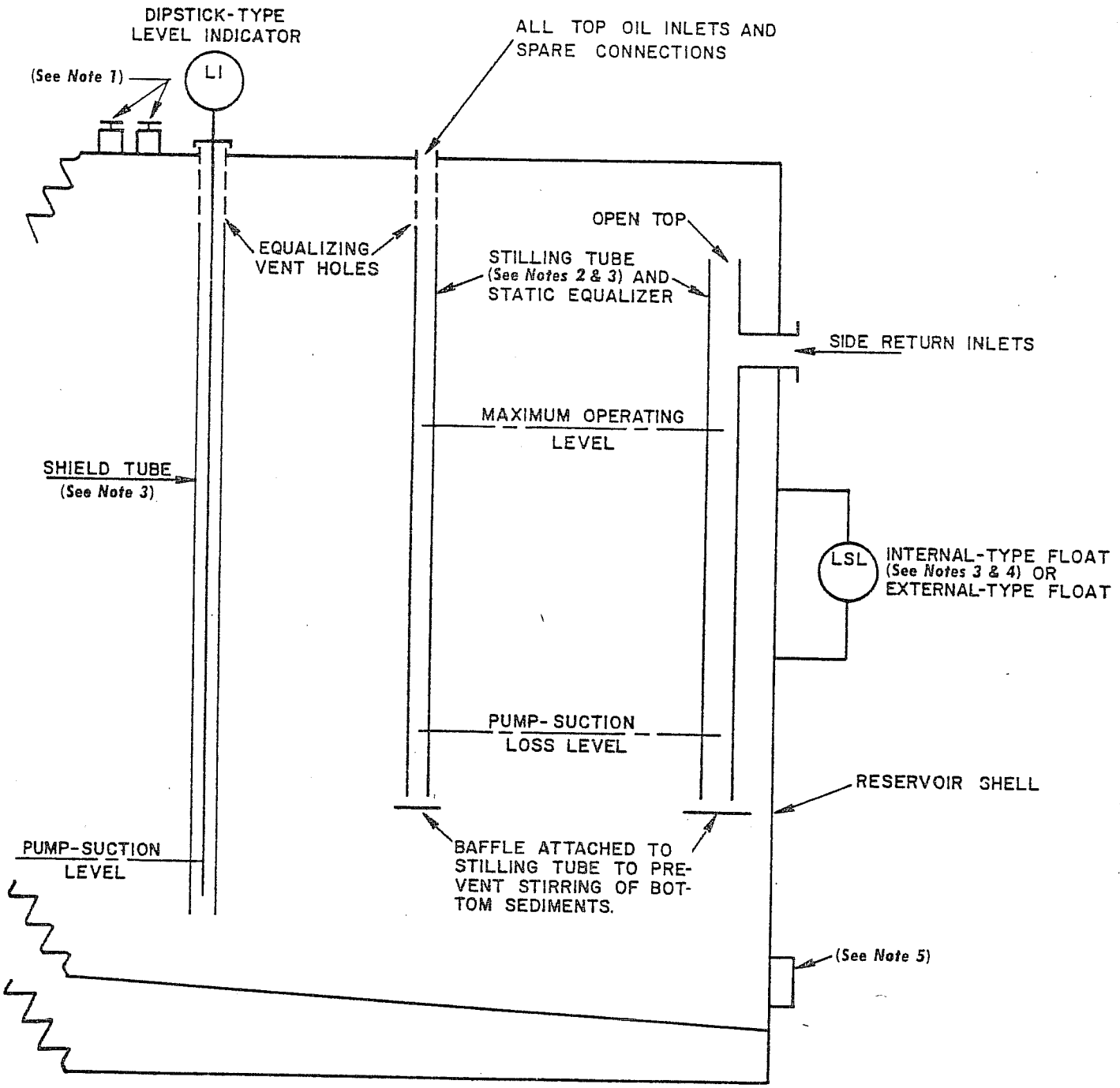


SPECIAL ADDITIONS ILLUSTRATED IN FIG. A-3

Notes:

1. Required in each compartment when a gas-tight baffle is used.
2. OPTION A-2a: The purchaser may specify a particular clarifier return in addition to the spare top connection.
3. To be furnished by the purchaser if required.
4. OPTION A-2b: An optional tight cap shall be substituted when specified by the purchaser.
5. OPTION A-2c: The purchaser may specify an electric heater.
6. OPTION A-2d: The purchaser may specify a steam heater.

FIG. A-2—Oil Reservoir (Standard Arrangement).

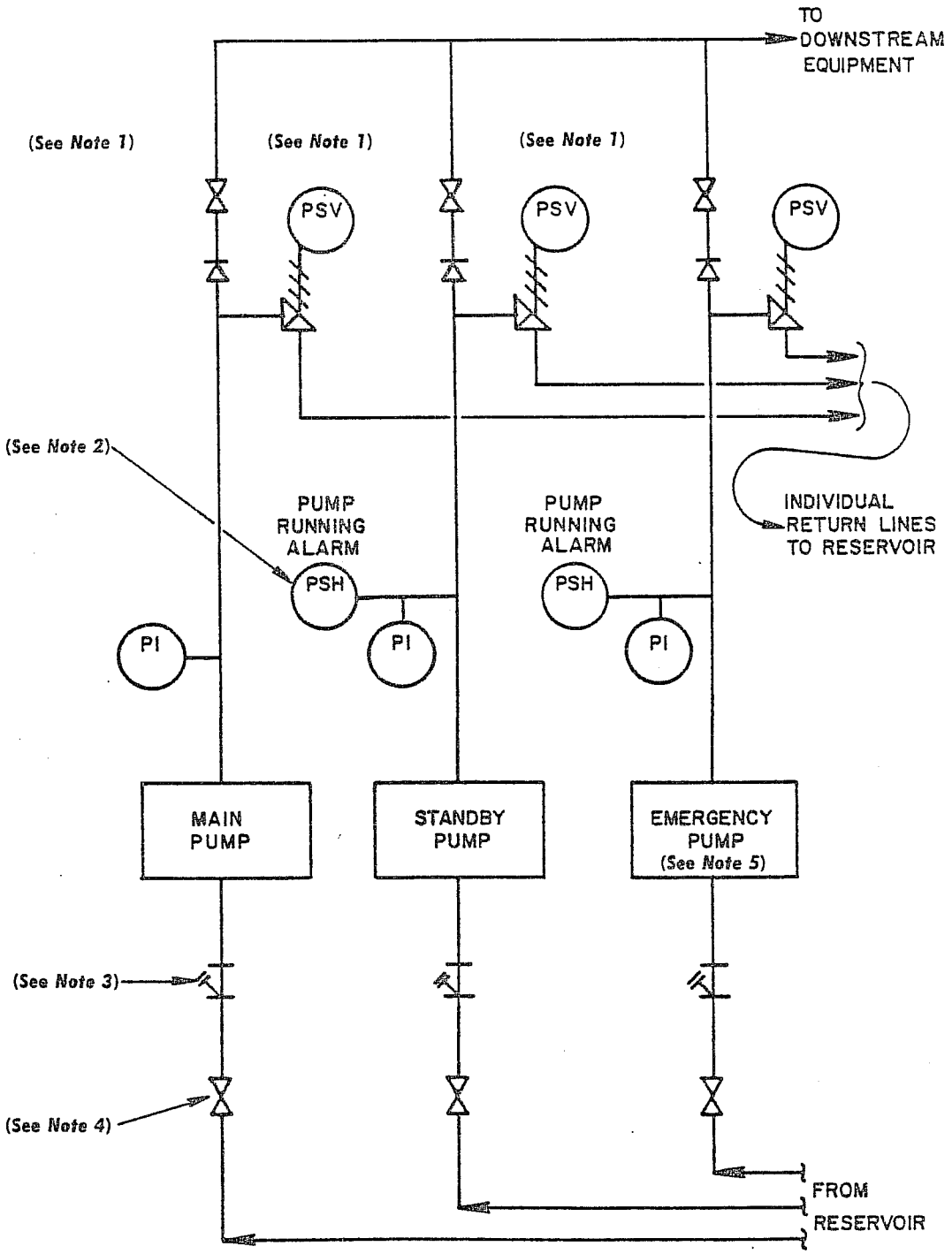


SPECIAL ADDITIONS TO FIG. A-2

Notes:

1. Neither the purge connection nor the vent connection shall have a shield or a tube.
2. A stilling tube arranged to prevent splashing and to provide free release of foam and gas is required for every return inlet and spare connection.
3. To prevent corrosion, all shields and stilling tubes shall be made of stainless steel.
4. The internal-type float shall be protected by a static-conducting shield.
5. OPTION A-3a: Two tapped grounding pads (one positioned diagonally to the other).

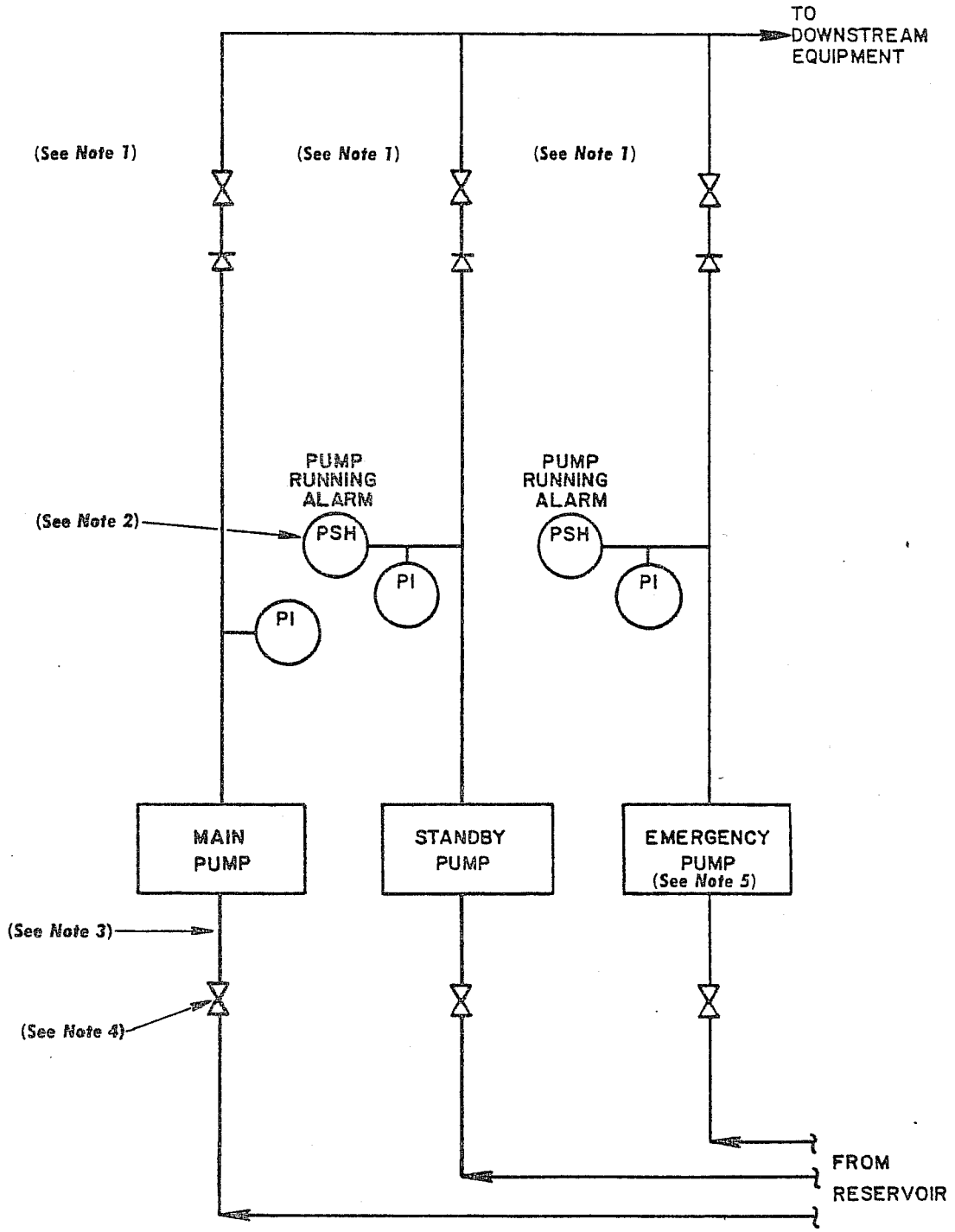
FIG. A-3—Oil Reservoir (Additions for Neutralizing Static Electricity).



Notes:

1. Provide valved vents at all high points.
2. OPTION A-4a: Omit alarm switches (1) if the running signal is taken from the motor starter or (2) if the alarm switch is on the turbine driver (See Fig. A-7, Note 3).
3. Instead of a line strainer, a basket-type screen is required on the suction of pumps submerged in the reservoir.
4. Omit the suction valves if pumps are located within the reservoir.
5. OPTION A-4b: The purchaser may specify an emergency pump.

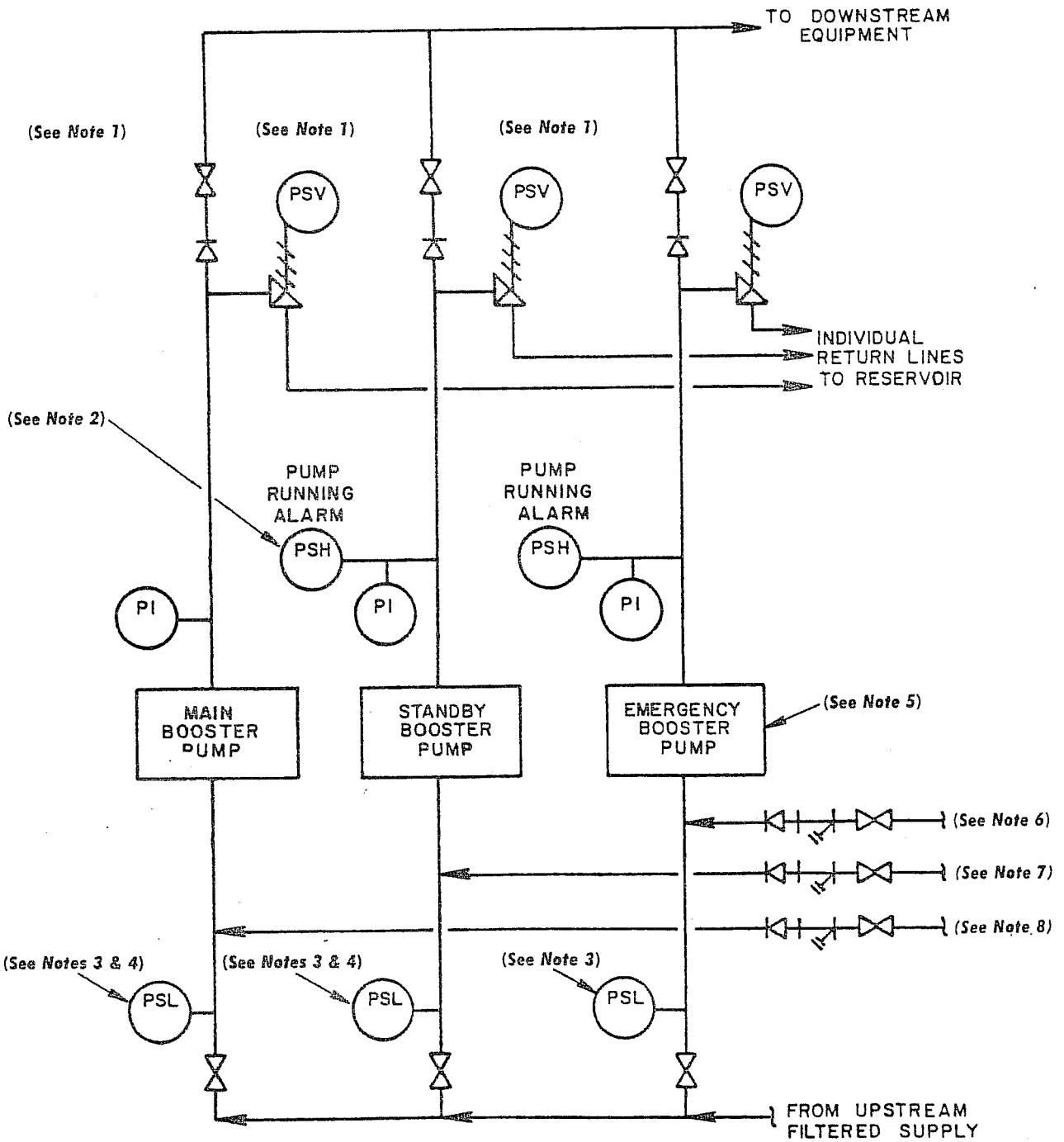
FIG. A-4—Primary Pump Arrangements (Positive-Displacement Pumps).



Notes:

1. Provide valved vents at all high points.
2. OPTION A-5a: Omit alarm switches (1) if the running signal is taken from the motor starter or (2) if the alarm switch is on the turbine driver (See Fig. A-7, Note 3).
3. OPTION A-5b: Temporary pump-suction strainers (See Par. 2.3.12).
4. If pumps are located within the reservoir, omit the suction valves and provide permanent basket-type strainers on the pump suctions.
5. OPTION A-5c: The purchaser may specify an emergency pump.

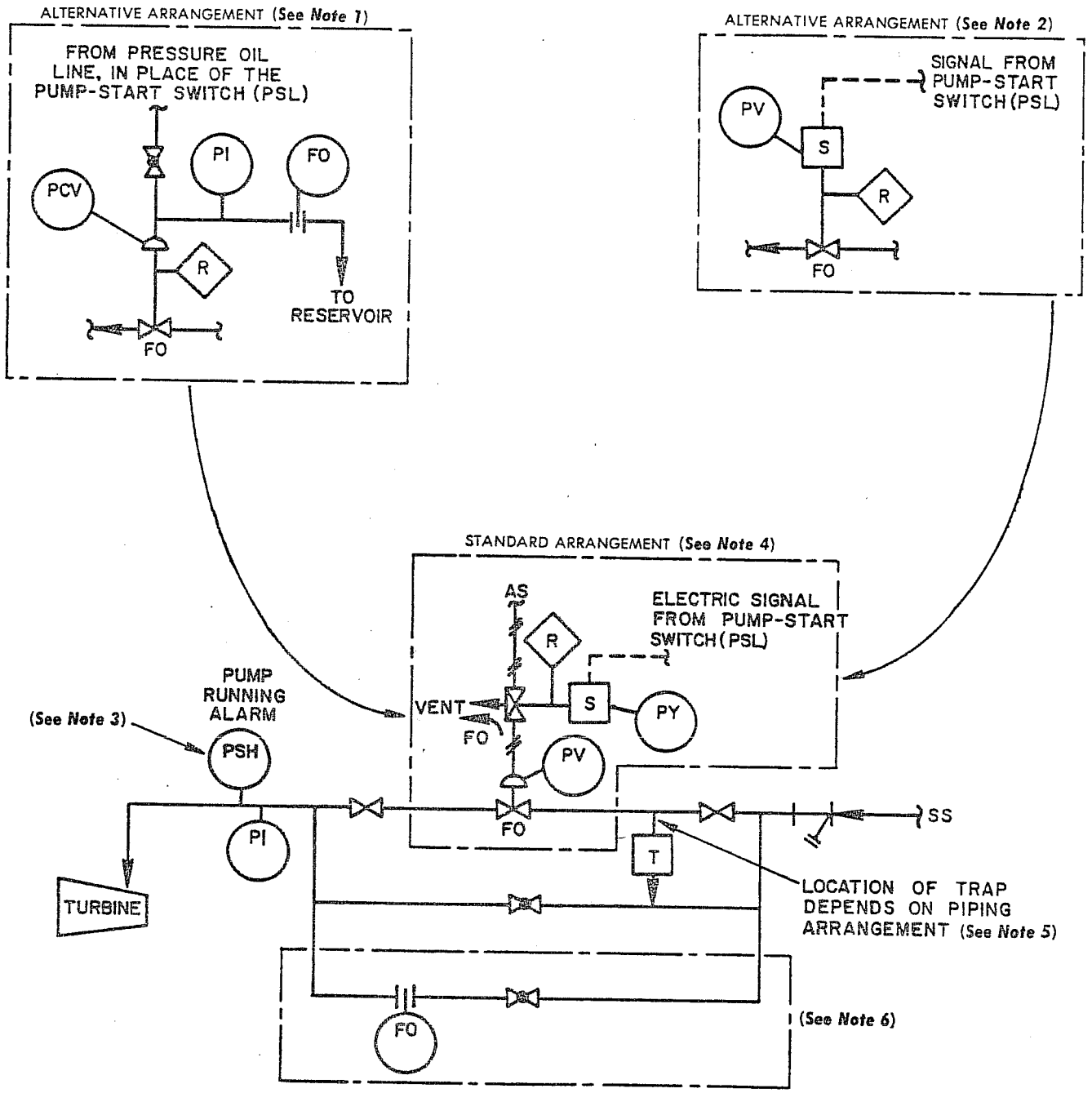
FIG. A-5—Primary Pump Arrangements (Centrifugal Pumps).



Notes:

1. Provide valved vents at all high points.
2. OPTION A-6a: Omit alarm switches (1) if the running signal is taken from the motor starter or (2) if the alarm switch is on the turbine driver (See Fig. A-7, Note 3).
3. OPTION A-6b: The purchaser may specify an alarm for the pump.
4. OPTION A-6c: The purchaser may specify a trip switch for the pump. CAUTION: TRIP SWITCHES ARE NOT RECOMMENDED IF AUXILIARY PUMP SUCTIONS ARE USED.
5. OPTION A-6d: The purchaser may specify an emergency booster pump.
6. OPTION A-6e: The purchaser may specify an auxiliary emergency pump suction from the reservoir.
7. OPTION A-6f: The purchaser may specify an auxiliary emergency pump suction from the reservoir.
8. OPTION A-6g: The purchaser may specify an auxiliary emergency pump suction from the reservoir.

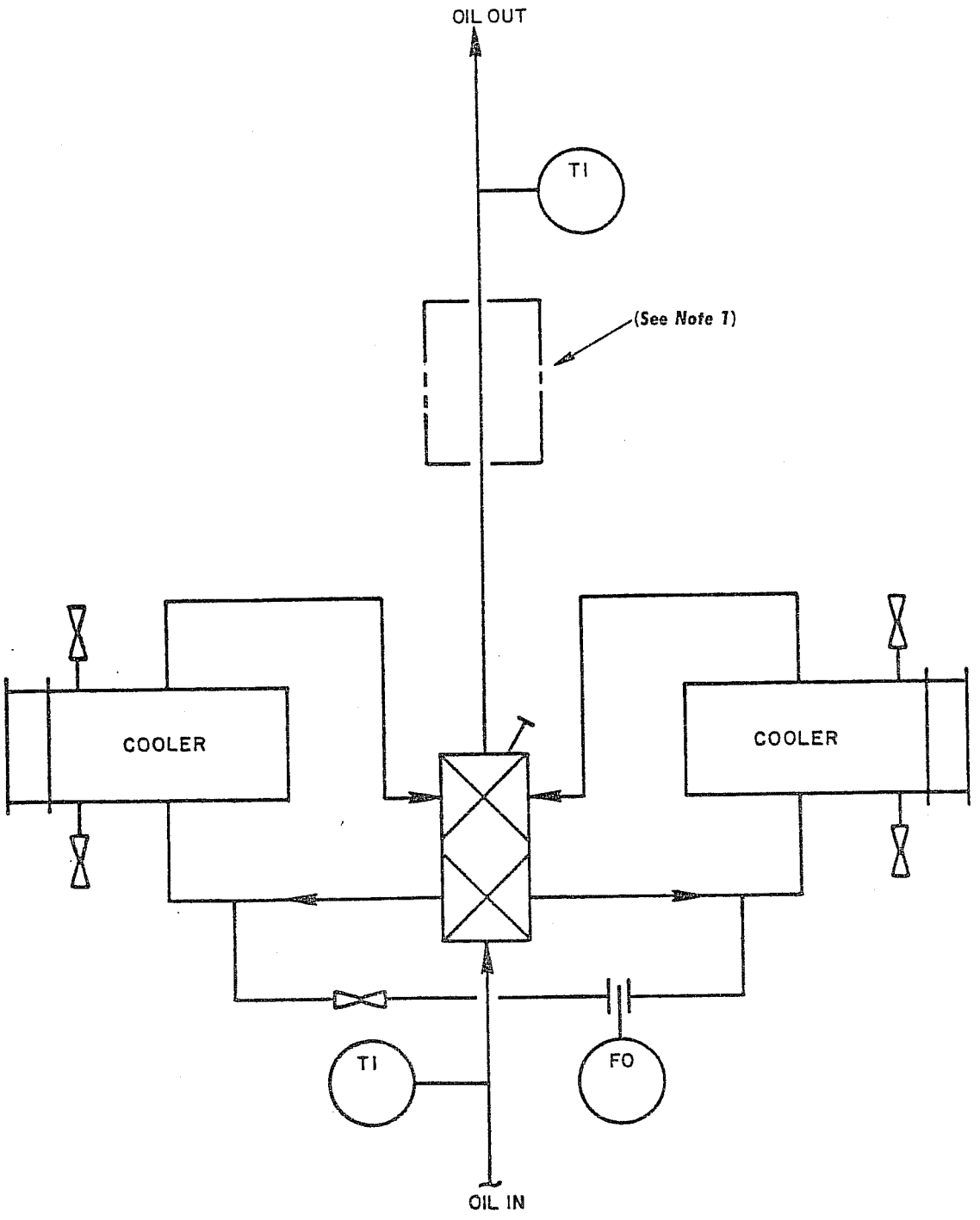
FIG. A-6—Booster Pump Arrangements (Positive-Displacement Pumps).



Notes:

1. OPTION A-7a: Direct hydraulic control for automatic start system.
2. OPTION A-7b: Direct-acting solenoid valve when size is available for automatic start system.
3. OPTION A-7c: Alarm switch on turbine driver. Fig. A-4, A-5, and A-6 illustrate alternate locations for the alarm switch.
4. Electric air control for automatic start system.
5. Depending upon the configurations of the piping and the turbine, additional traps or drains may be required.
6. OPTION A-7d: Warmup or idling bypass.

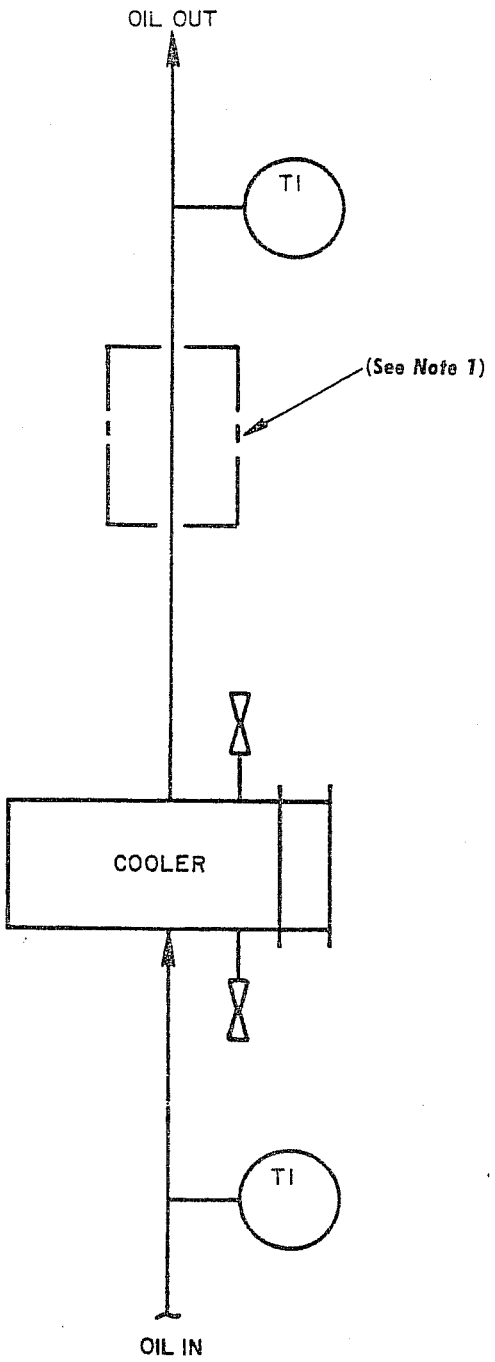
FIG. A-7—Automatic Start Systems for Turbine Drives.



Notes:

1. OPTION A-8a: Bypass oil line and constant-temperature control valve (See Fig. A-12).

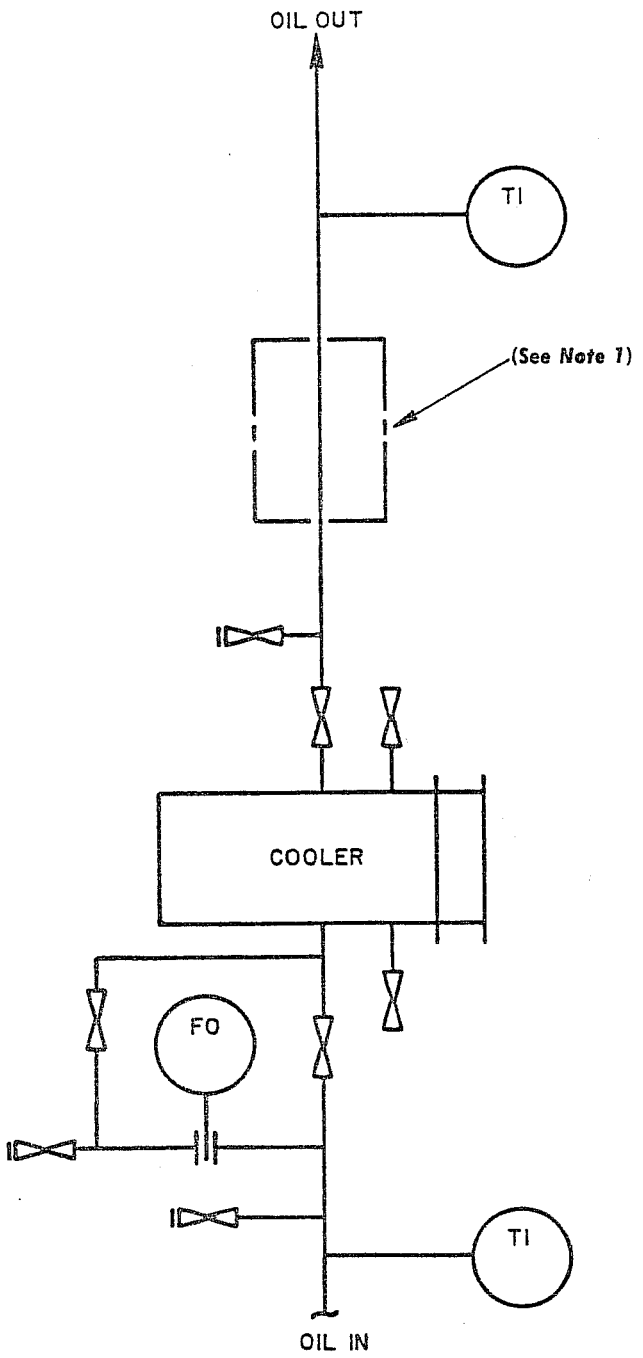
FIG. A-8—Twin Oil Coolers with a Continuous-Flow Transfer Valve.



Notes:

1. OPTION A-9a: Bypass oil line and constant-temperature control valve (See Fig. A-12).

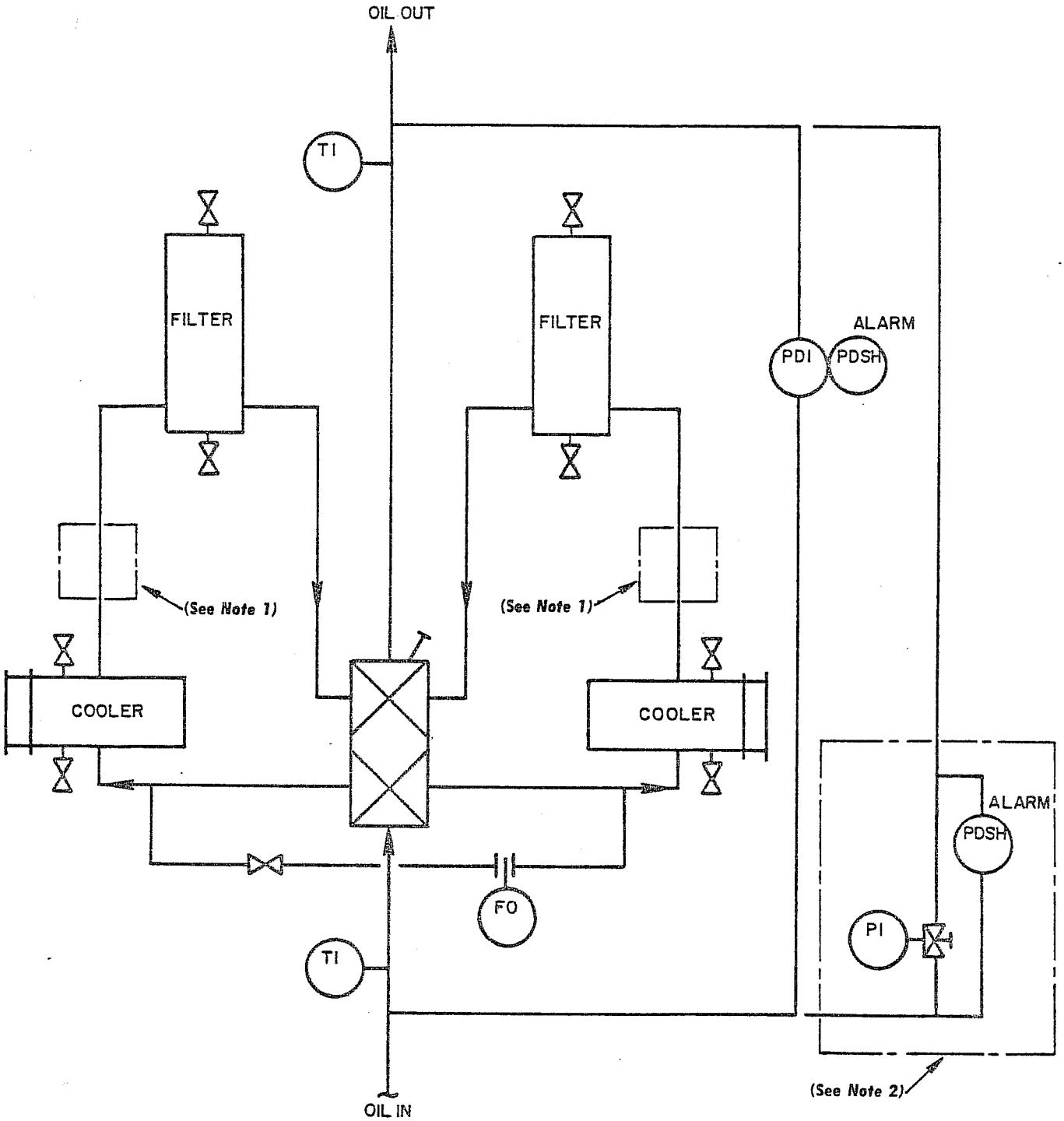
FIG. A-9—Single Oil Cooler.



Notes:

1. OPTION A-10a: Bypass oil line and constant-temperature control valve (See Fig. A-12).

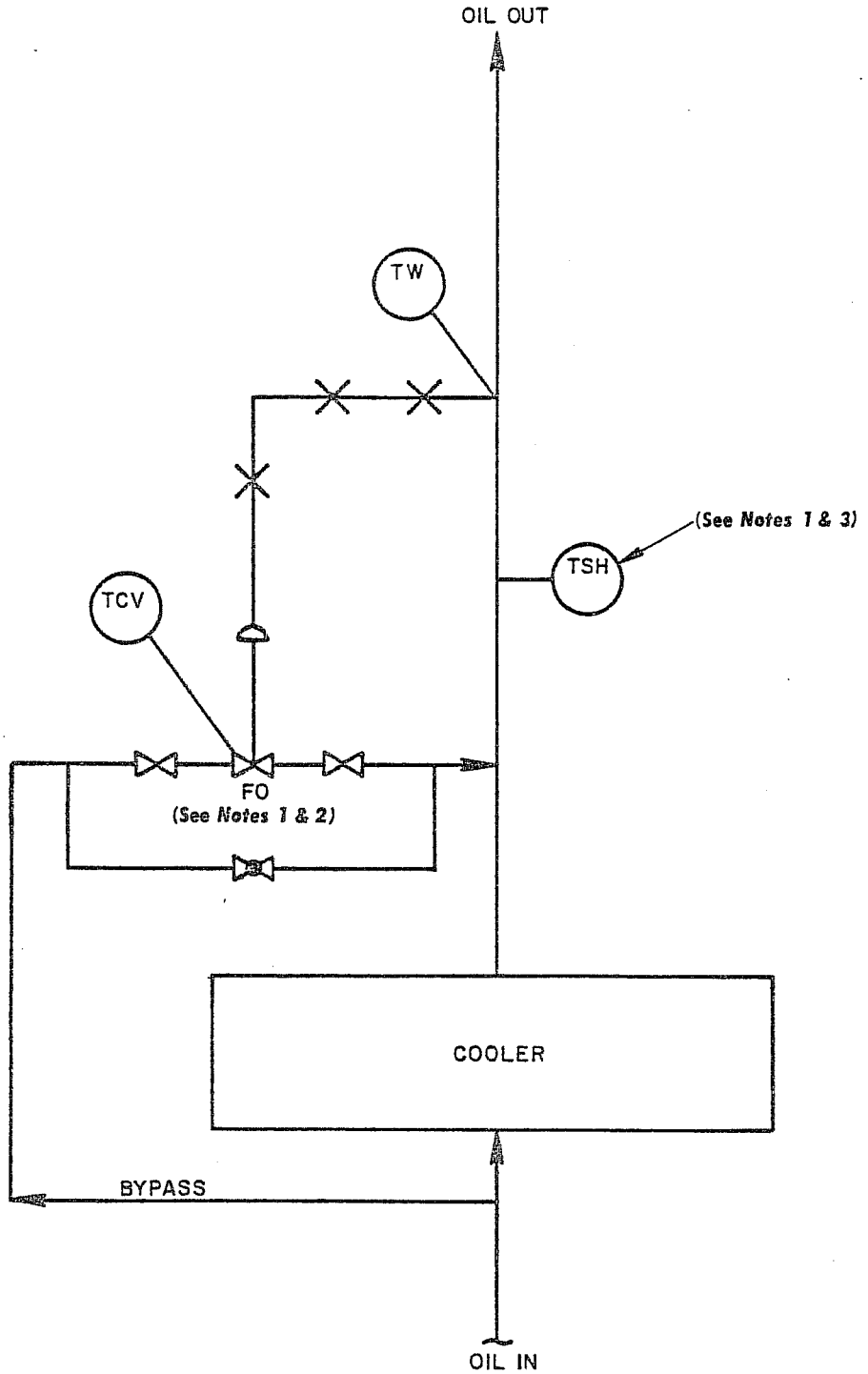
FIG. A-10—Single Oil Cooler Having Provisions for Connecting a Temporary Cooler.



Notes:

1. OPTION A-11a: The purchaser may specify a bypass oil line and a constant-temperature control valve for both coolers (See Fig. A-12).
2. OPTION A-11b: Alternate type and arrangement of differential pressure instruments.

FIG. A-11—Twin Oil Coolers and Twin Oil Filters Having the Same Continuous-Flow Transfer Valve.

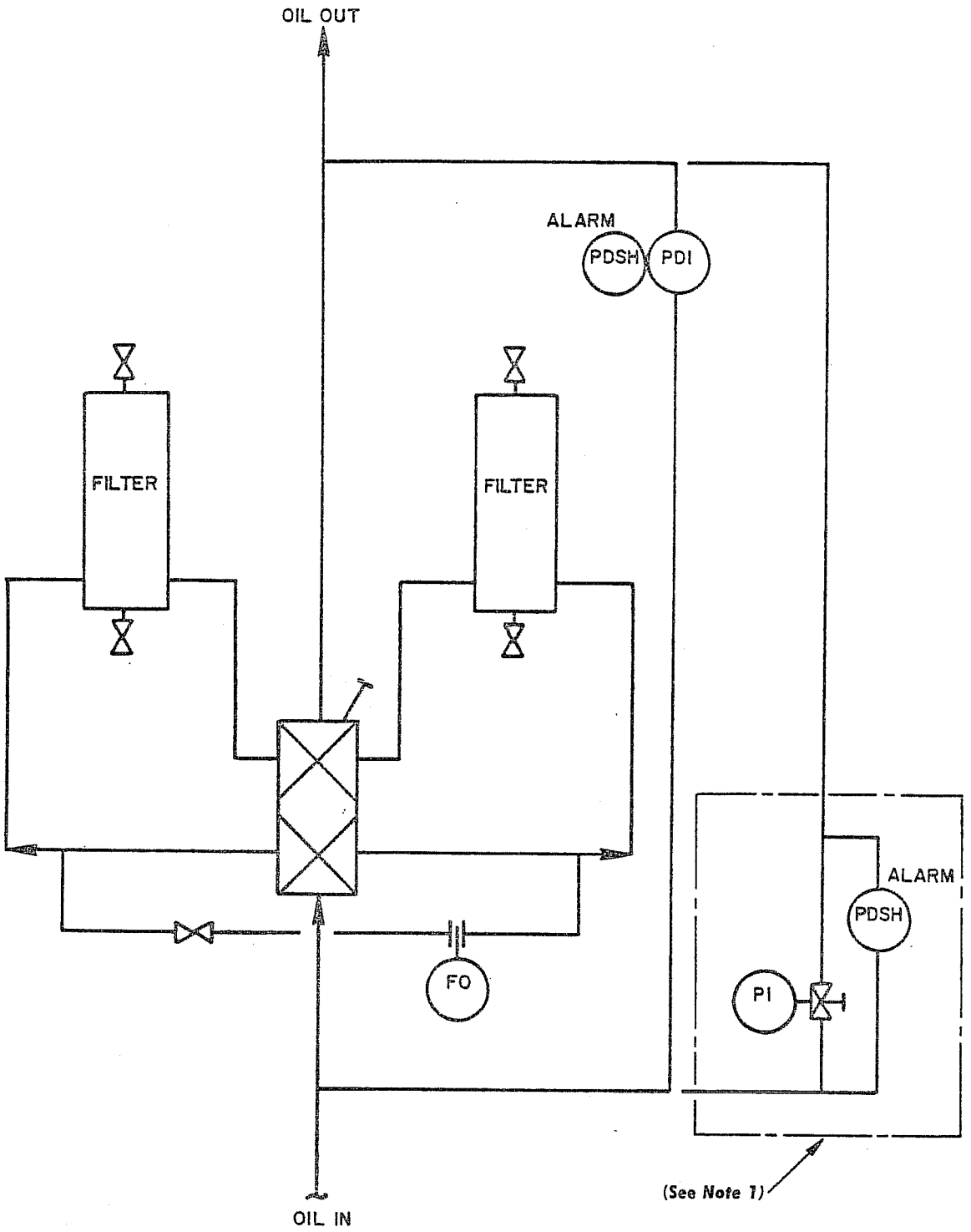


This arrangement is valid only when the oil-cooler bypass and oil-temperature control valve is used for automatic temperature control and maintenance of high water velocity (See Par. 2.4.4).

Notes:

1. **OPTION A-12a:** If the FO feature of the TCV is not acceptable, the purchaser may specify an FC valve using a pneumatic TIT to control the bypass valve and a TSL be substituted for alarming.
2. **OPTION A-12b:** If the FO feature of the TCV is not acceptable, the purchaser may specify an FL valve using a pneumatic TIT to control the bypass valve equipped with a pneumatic lockup valve.
3. **OPTION A-12c:** If oil temperature is critical and if the FO feature of the TCV is not acceptable, it is recommended that the purchaser specify both a TSH alarm and a TSL alarm.

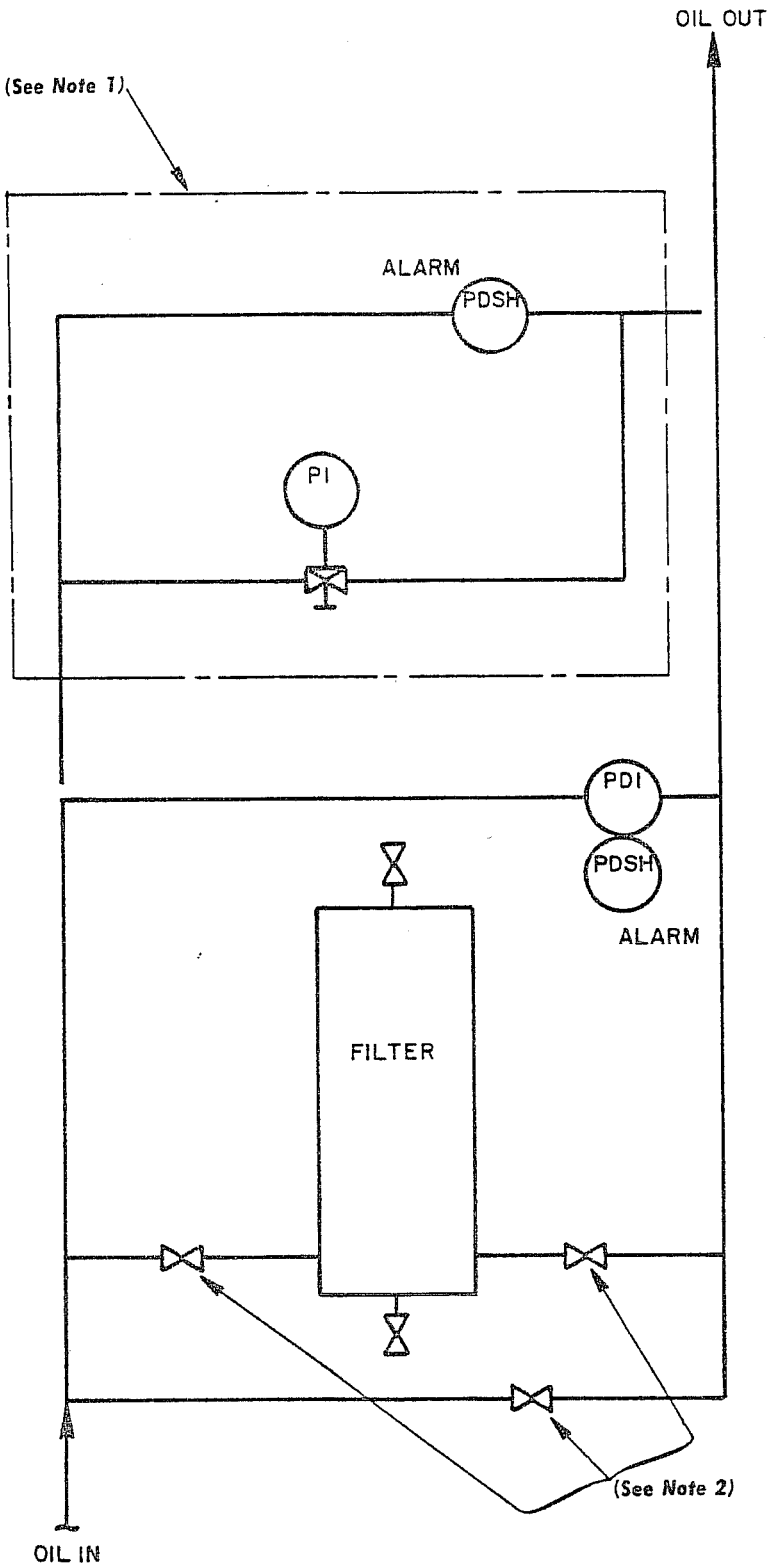
FIG. A-12—Oil-Cooler Bypass and Oil-Temperature Control Valve.



Notes:

1. OPTION A-13a: Alternate type and arrangement of differential pressure instruments.

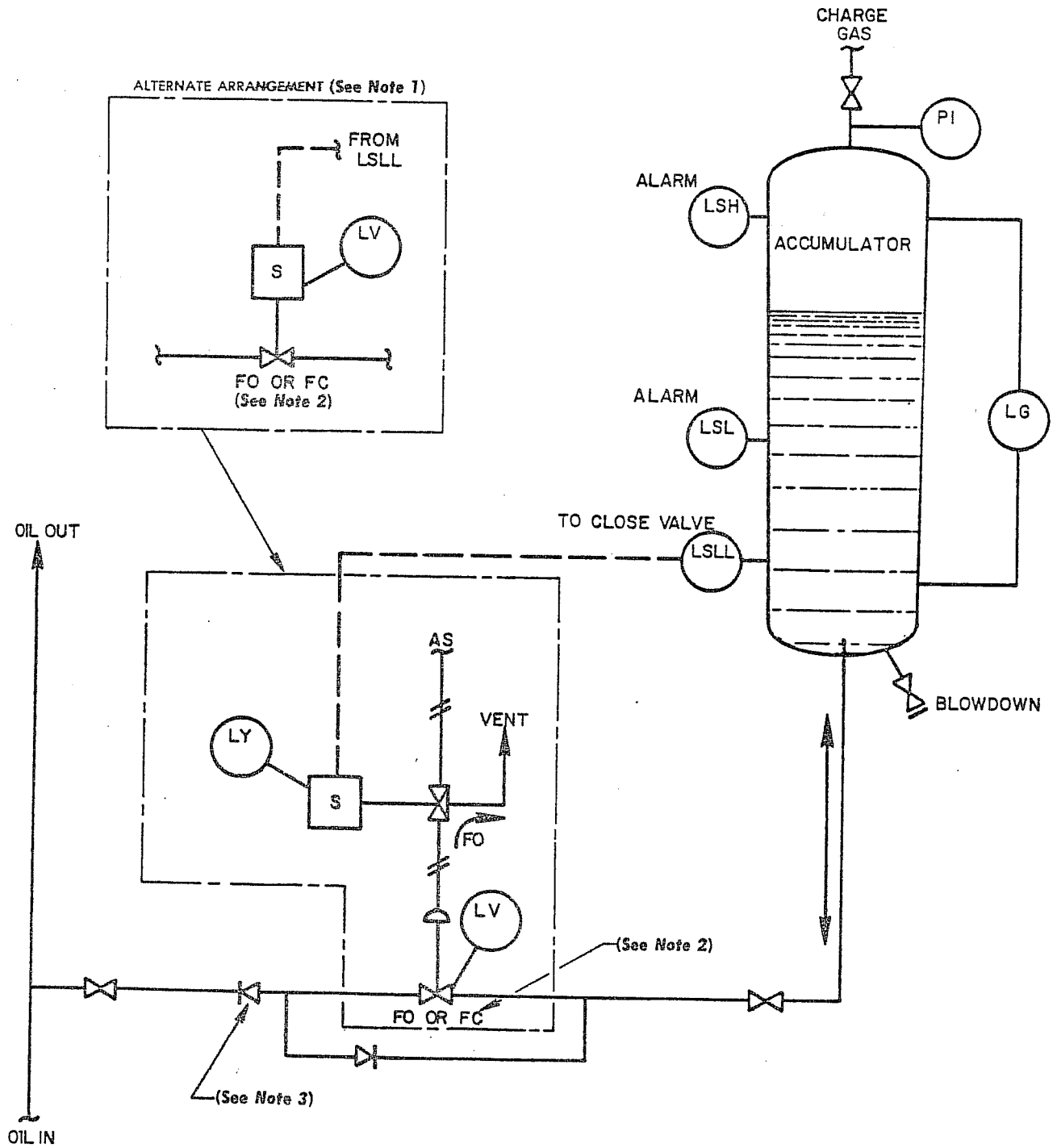
FIG. A-13—Twin Oil Filters Having a Continuous-Flow Transfer Valve.



Notes:

1. **OPTION A-14a:** Alternate differential instrumentation.
2. **OPTION A-14b:** The purchaser may specify a continuous-flow transfer valve to replace these valves.

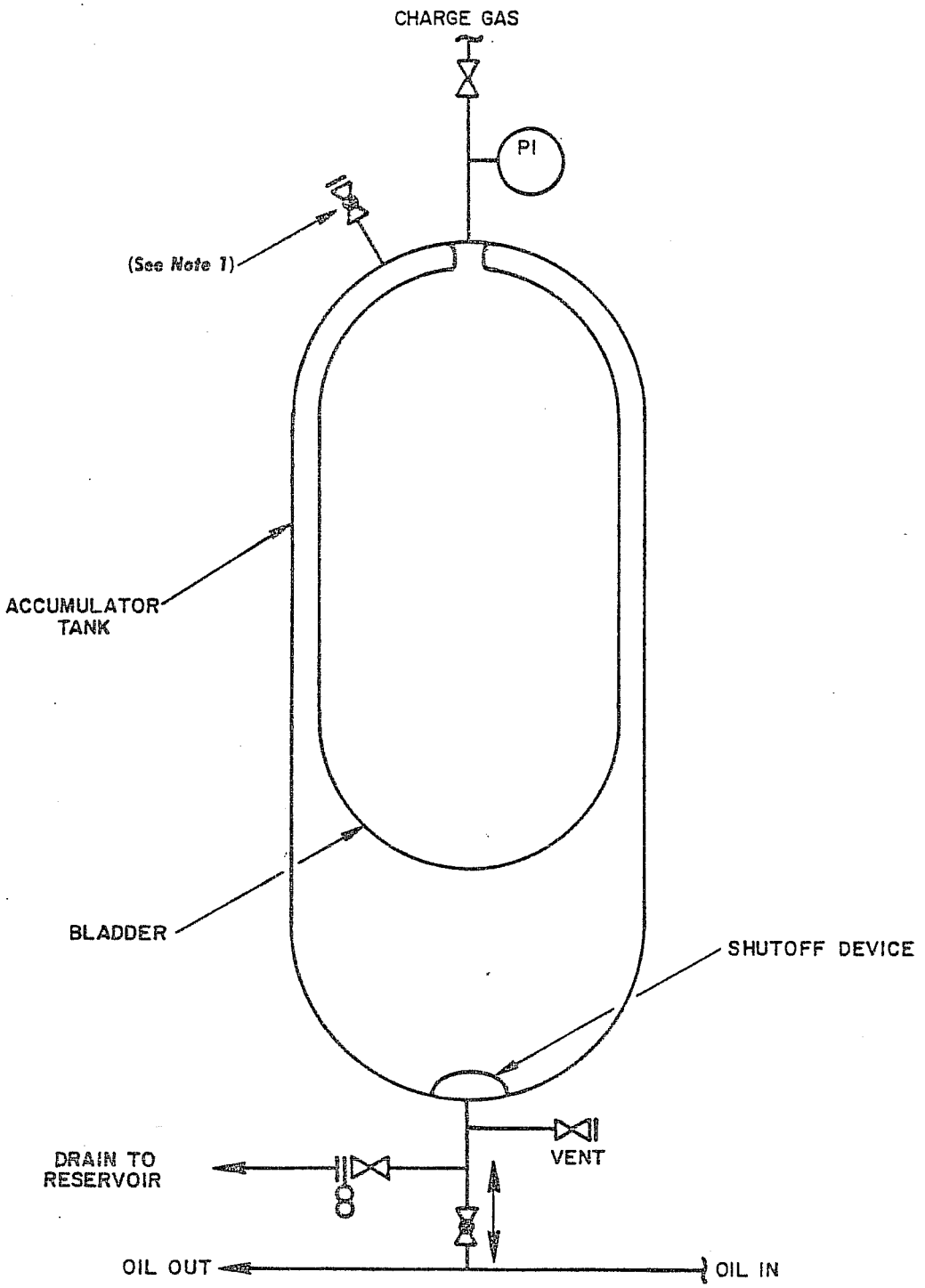
FIG. A-14—Single Oil Filter for Either the Main Oil Stream or the Coupling Oil.



Notes:

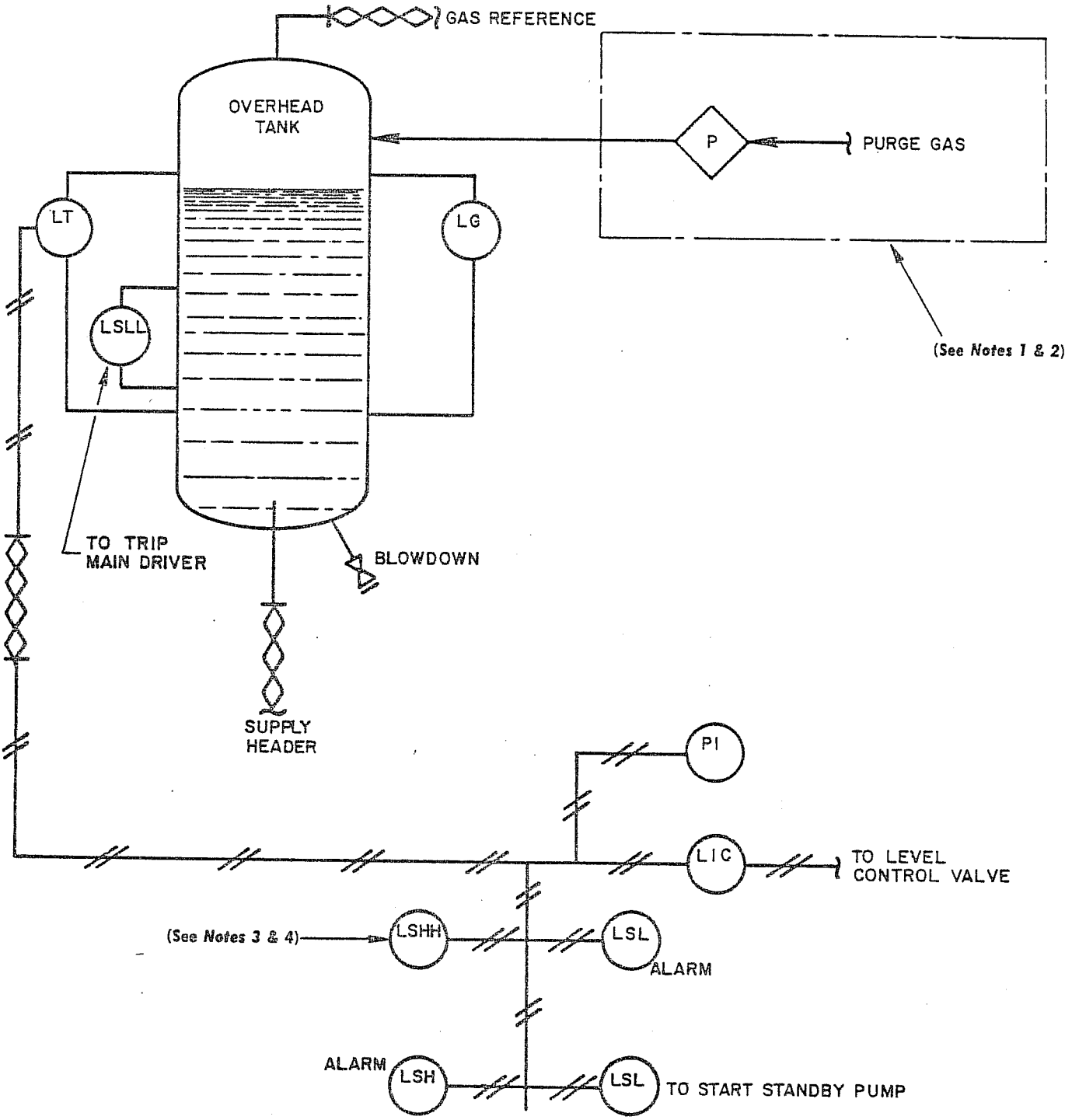
1. OPTION A-15a: Direct-Acting solenoid valve when size is available.
2. The purchaser must specify the desired failure action for the LV.
3. Seat or disk drilled to reduce recharging rate after upsets.

FIG. A-15—Accumulator (Direct-Contact Type).



Notes:
1. OPTION A-16a: The purchaser may specify a valved vent.

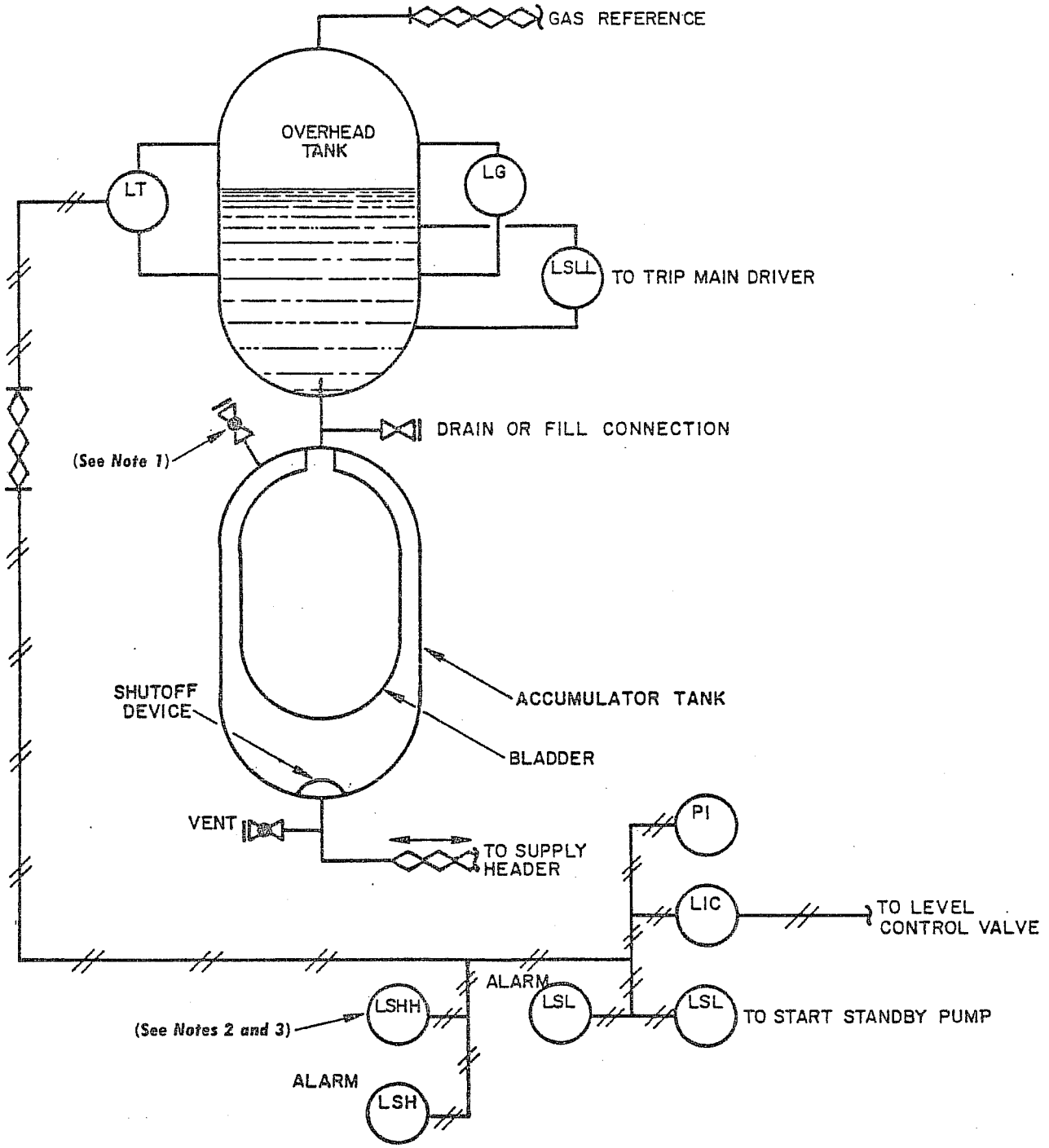
FIG. A-16—Accumulator (Bladder Type).



Notes:

1. OPTION A-17a: The purchaser may specify a connection for the use of purge gas.
2. OPTION A-17b: The purchaser shall specify the flow control when it is to be supplied by the vendor.
3. OPTION A-17c: If pump is for seal oil only, the purchaser may specify a switch to stop the pump.
4. OPTION A-17d: The purchaser may specify an alarm switch if pumps are lube and seal combined.

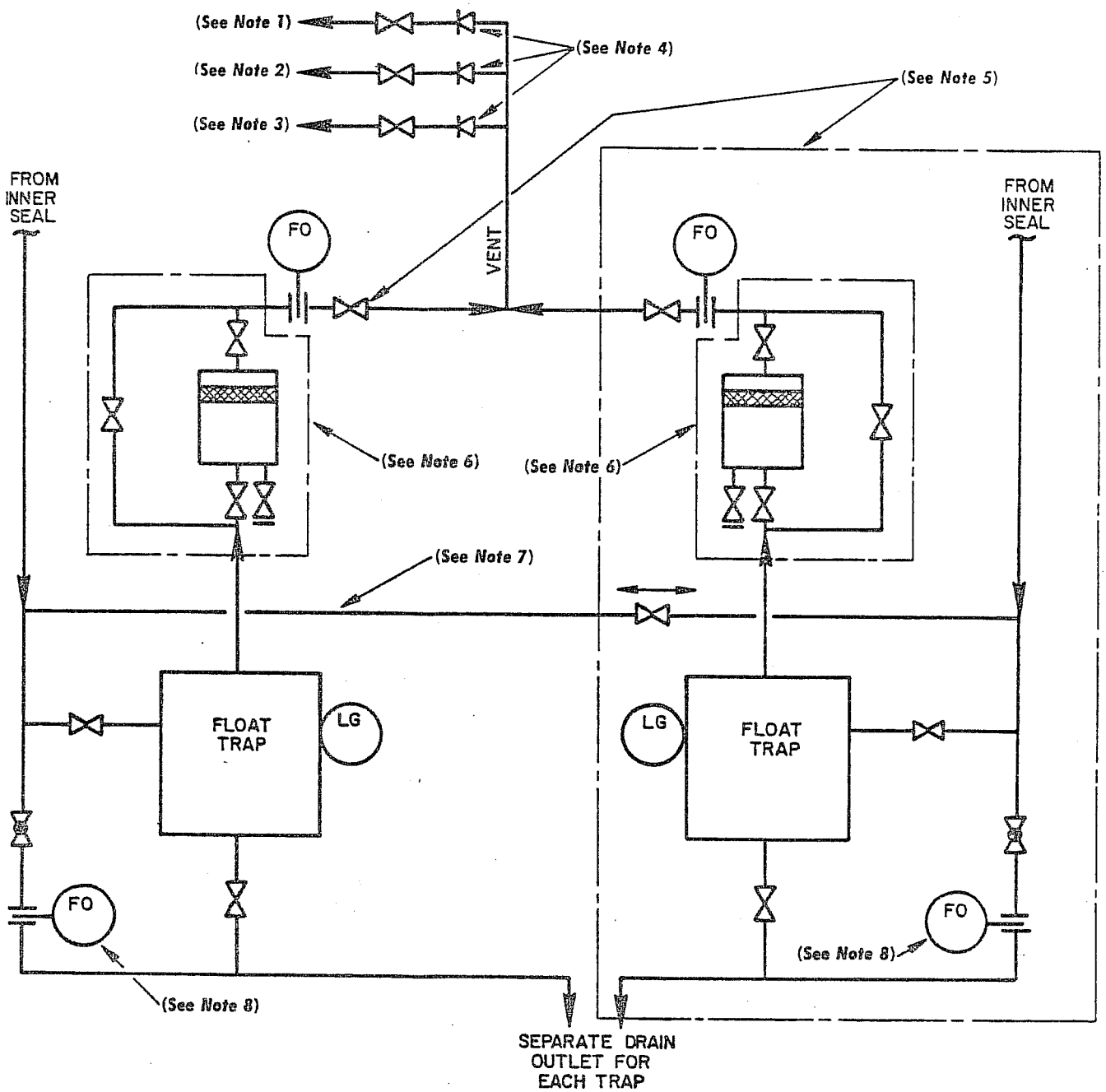
FIG. A-17—Overhead Tank (Direct-Contact Type) with Instrumentation.



Notes:

1. OPTION A-18a: The purchaser may specify a valved vent.
2. OPTION A-18b: If pump is for seal oil only, the purchaser may specify a switch to stop the pump.
3. OPTION A-18c: The purchaser may specify an alarm switch if pumps are lube and seal combined.

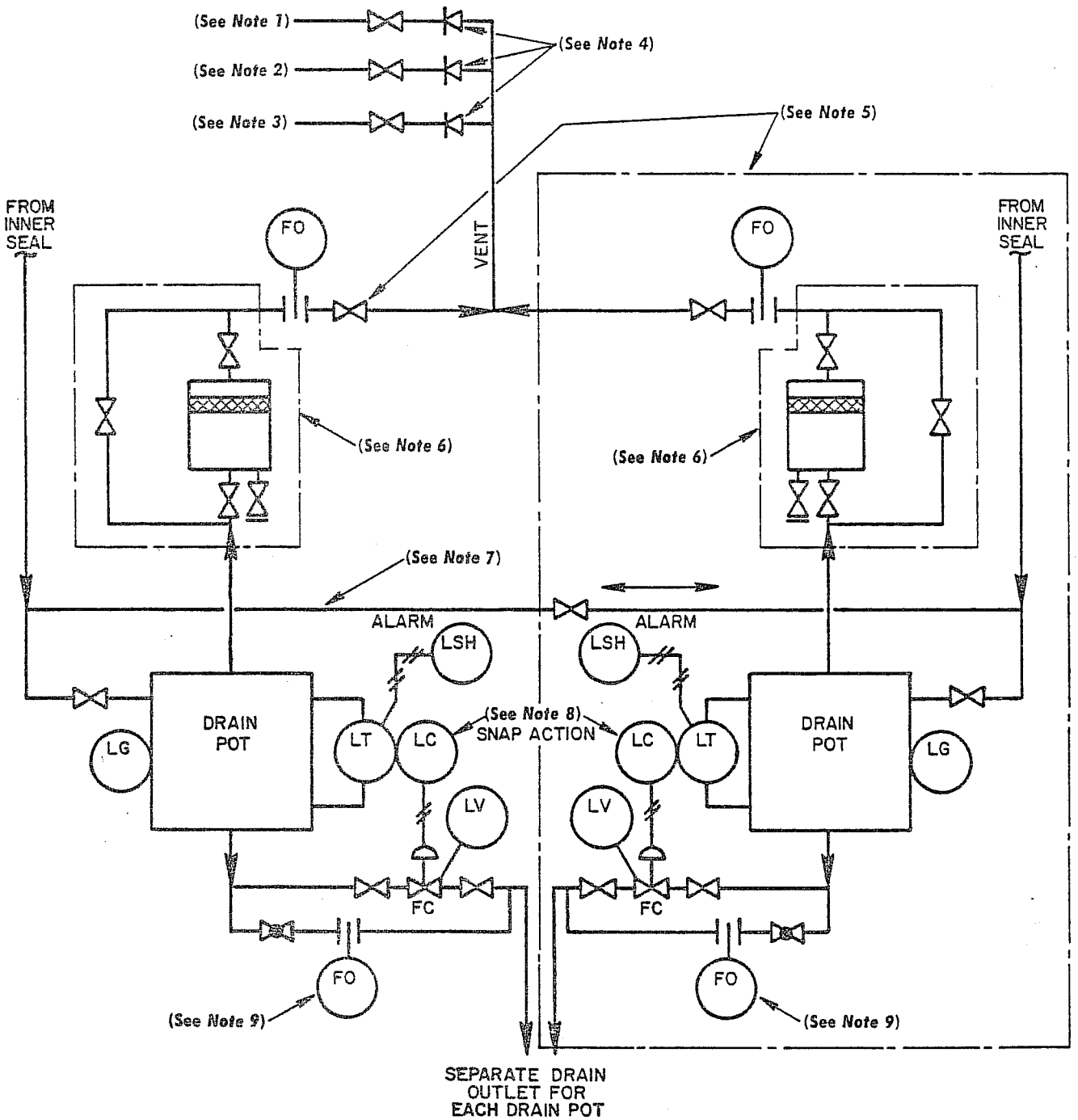
FIG. A-18—Overhead Tank with Instrumentation and a Bladder-Type Accumulator.



Notes:

1. OPTION A-19a: The purchaser may specify a vent to the flare.
2. OPTION A-19b: The purchaser may specify a vent to the gas system.
3. OPTION A-19c: The purchaser may specify a vent to the suction of a lower-stage compressor.
4. OPTION A-19d: The purchaser may specify check valves.
5. This equipment shall be omitted for a compressor with only a single seal.
6. OPTION A-19e: The purchaser may specify mist eliminators.
7. Omit if the seals are not at the same pressure.
8. OPTION A-19f: The purchaser may specify omission of the FO's for low-pressure service.

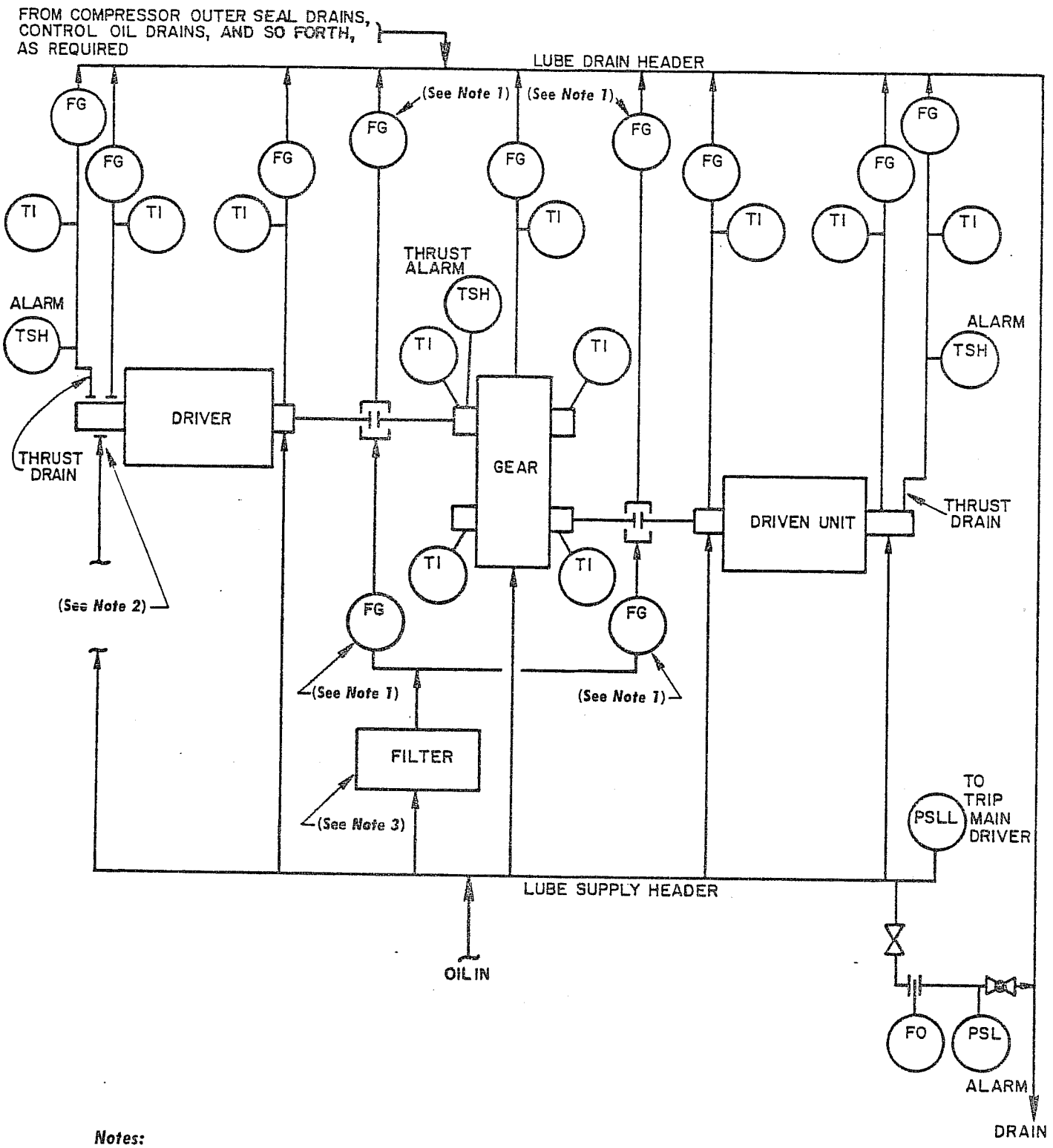
FIG. A-19—Float-Controlled Inner Seal Drainers.



Notes:

1. OPTION A-20a: The purchaser may specify a vent to the flare.
2. OPTION A-20b: The purchaser may specify a vent to the gas system.
3. OPTION A-20c: The purchaser may specify a vent to the suction of a lower-stage compressor.
4. OPTION A-20d: The purchaser may specify check valves.
5. This equipment shall be omitted for a compressor with only a single seal.
6. OPTION A-20e: The purchaser may specify mist eliminators.
7. Omit if the seals are not at the same pressure.
8. OPTION A-20f: The purchaser may specify omission of snap-action level controllers for pressures of 800 psig or lower.
9. OPTION A-20g: The purchaser may specify omission of the FO's for low-pressure service.

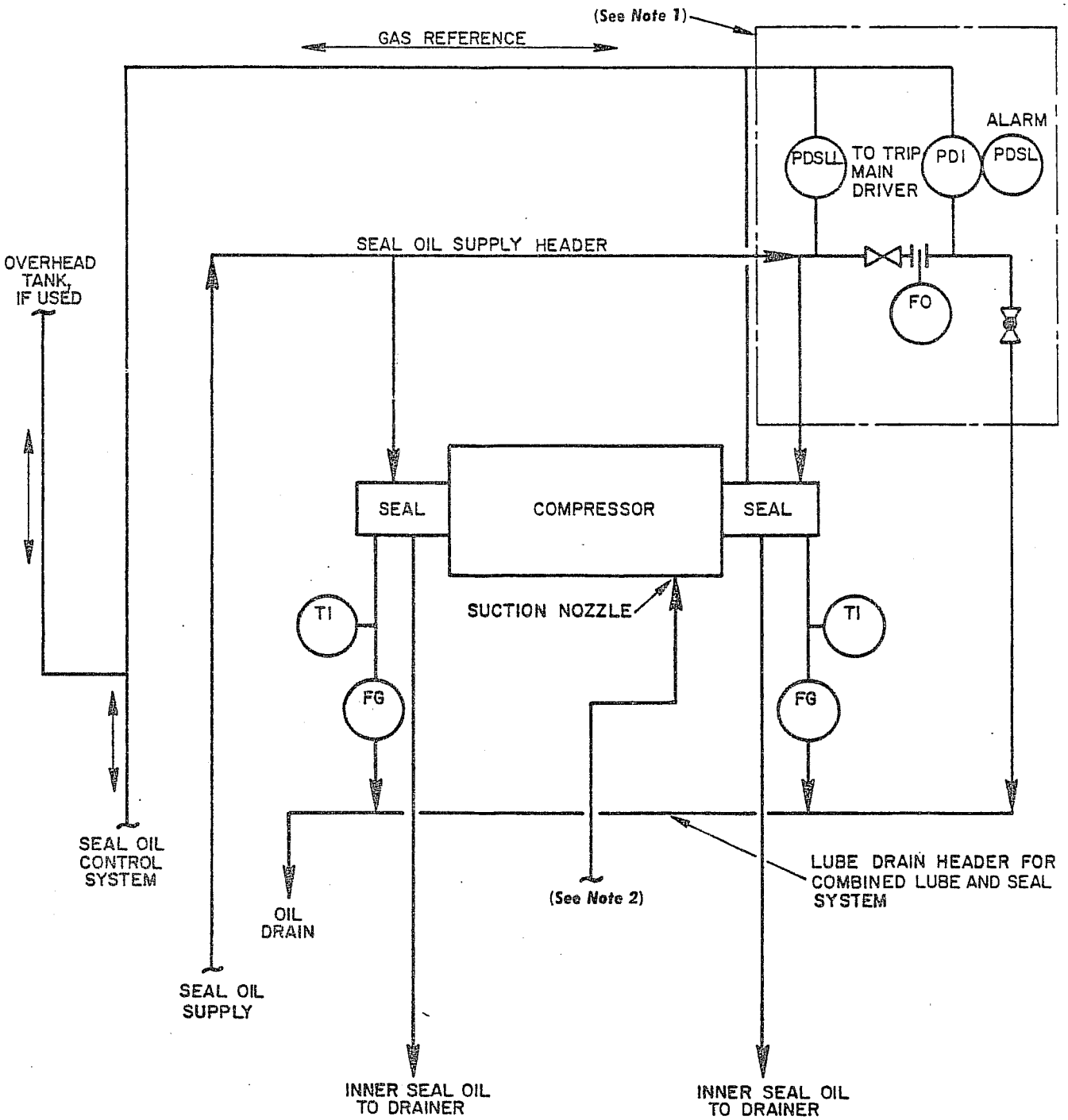
FIG. A-20—Transmitter-Controlled Inner Seal Drainers.



Notes:

1. FG's for couplings are required in the drain lines (preferable location) or in the supply lines—not in both. The location of the FG's should be selected for the most accurate indication to suit the vendor's equipment system.
2. Insulate all connections if insulation is required by the motor design.
3. OPTION A-21a: Single oil filter for coupling oil (See Fig. A-14).

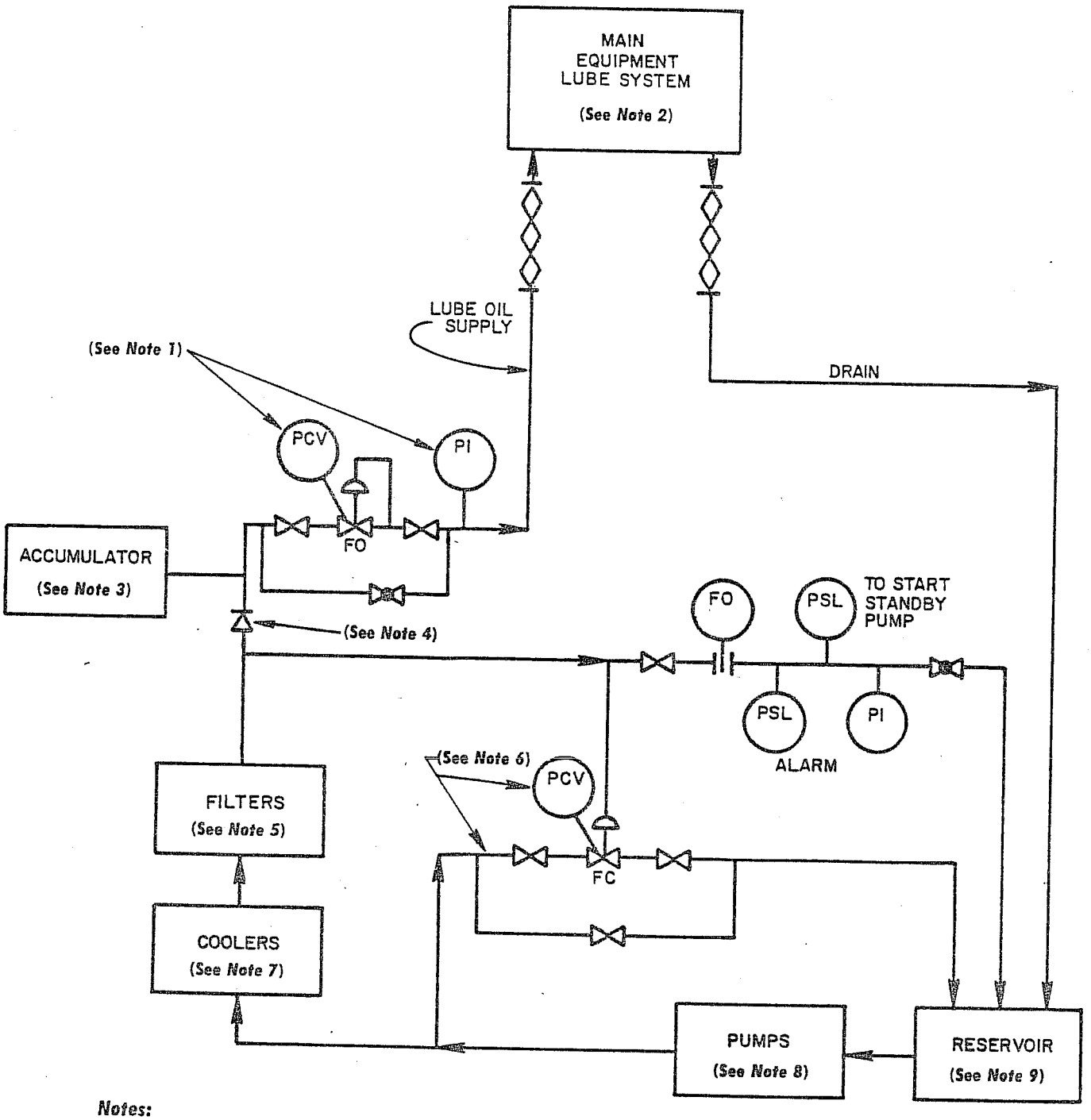
FIG. A-21—Lubrication System at Main Equipment Only.



Notes:

1. Omit if furnished separately on overhead tank system.
2. OPTION A-22a: Vent from inner seal oil drainers on higher stage (See Fig. A-19, OPTION A-19c or Fig. A-20, OPTION A-20c).

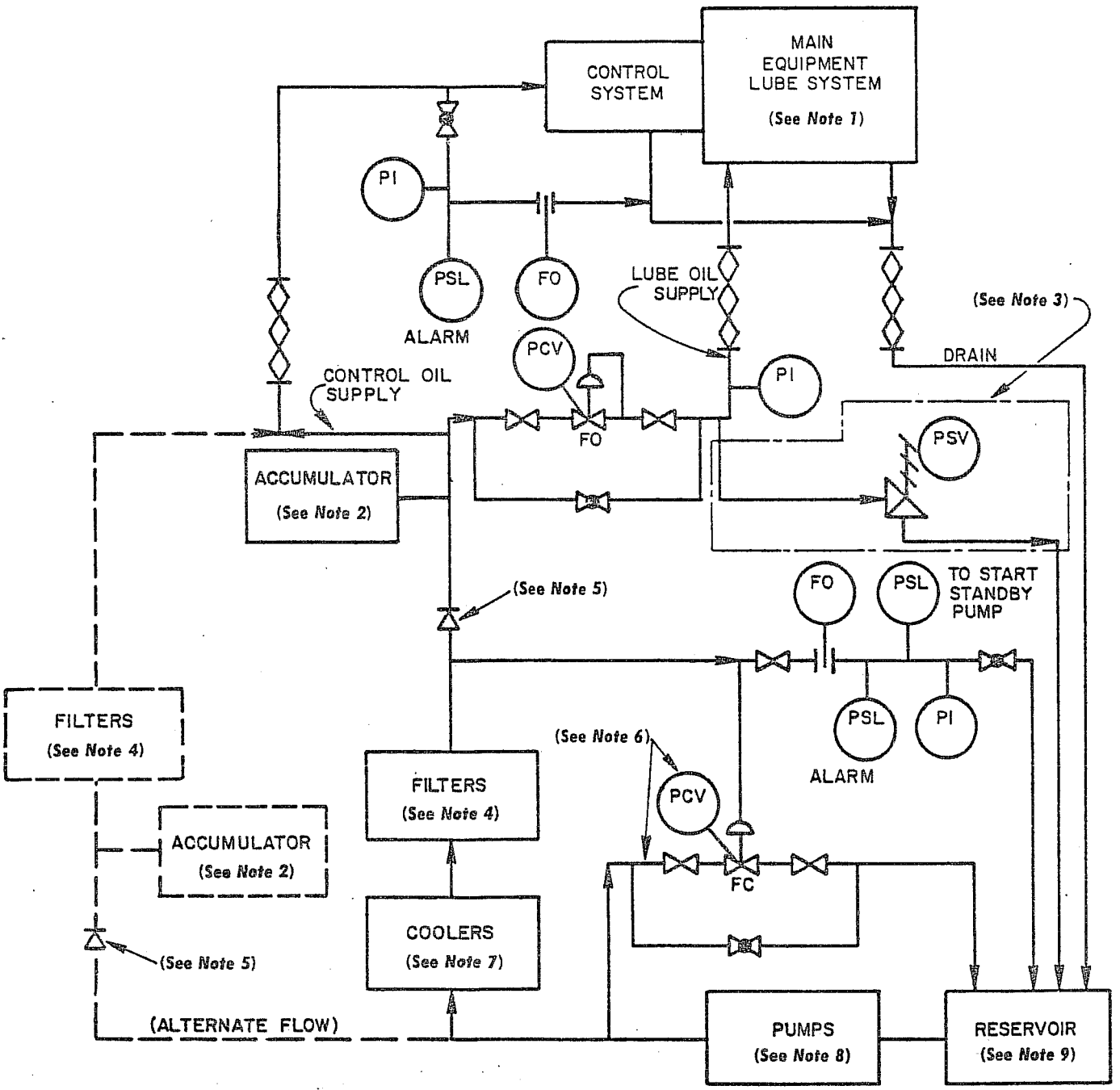
FIG. A-22—Seal Oil System at Compressor Only.



Notes:

1. Omit PCV and PI when the pressure of the lube oil supply is higher than the pressure of the cooling water.
2. Lubrication system at main equipment only (See Fig. A-21).
3. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
4. Omit check valve if accumulator is not used.
5. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
6. Omit the bypass PCV circuit if centrifugal pumps are used.
7. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
8. Primary pumps (See Fig. A-4 and A-5).
9. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-23—Lube Oil System Only.

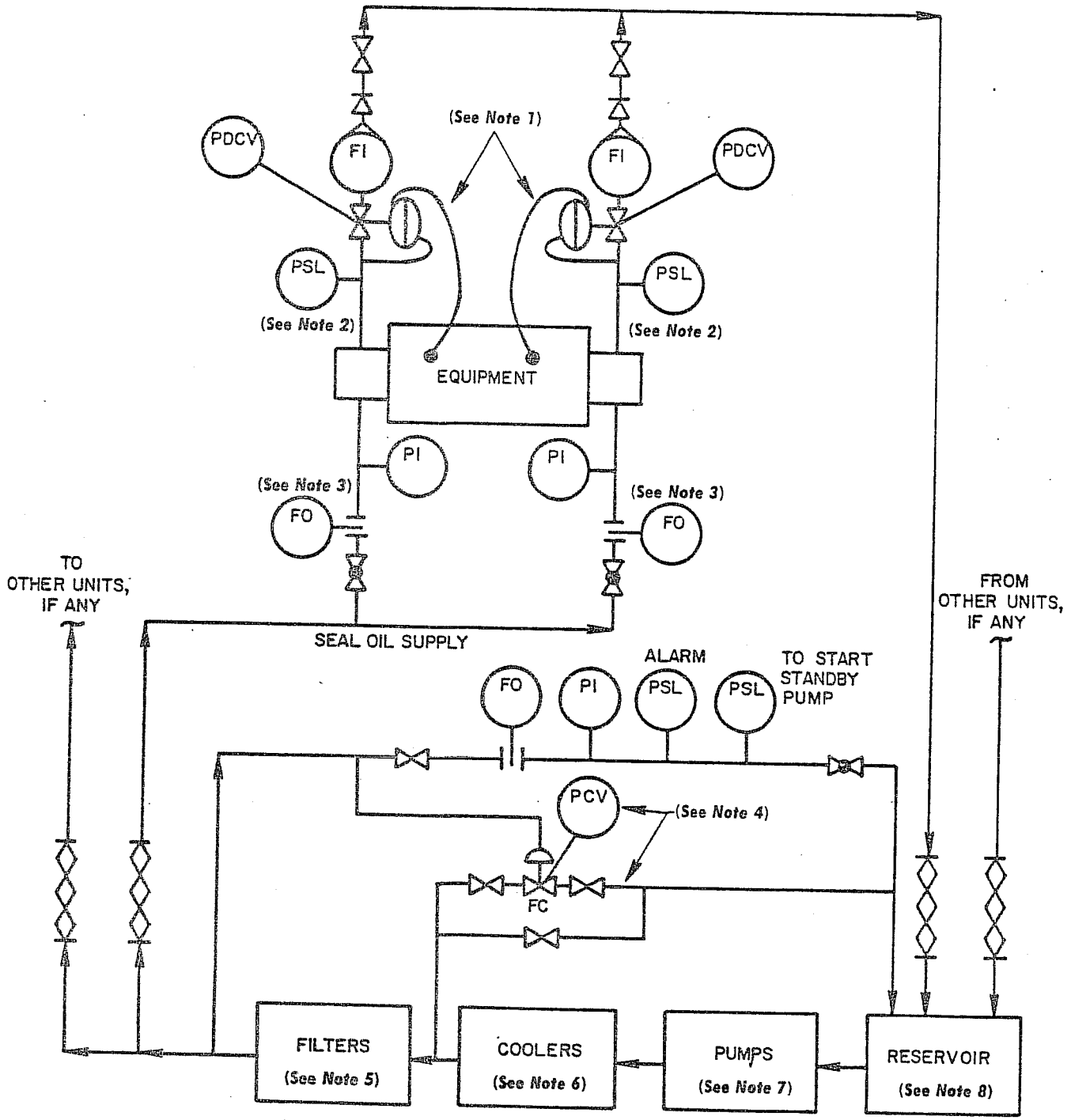


This arrangement is valid only when the pressure of the control oil supply is higher than the pressures of the lube oil supply and the cooling water.

Notes:

1. Lubrication system at main equipment only (See Fig. A-21).
2. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
3. Typical arrangement for any system where a control valve failure can jeopardize or damage a low-pressure system.
4. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
5. Omit check valve if accumulator is not used.
6. Omit the bypass PCV circuit if centrifugal pumps are used.
7. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
8. Primary pumps (See Fig. A-4 and A-5).
9. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-24—Lube Oil and Control Oil Systems.

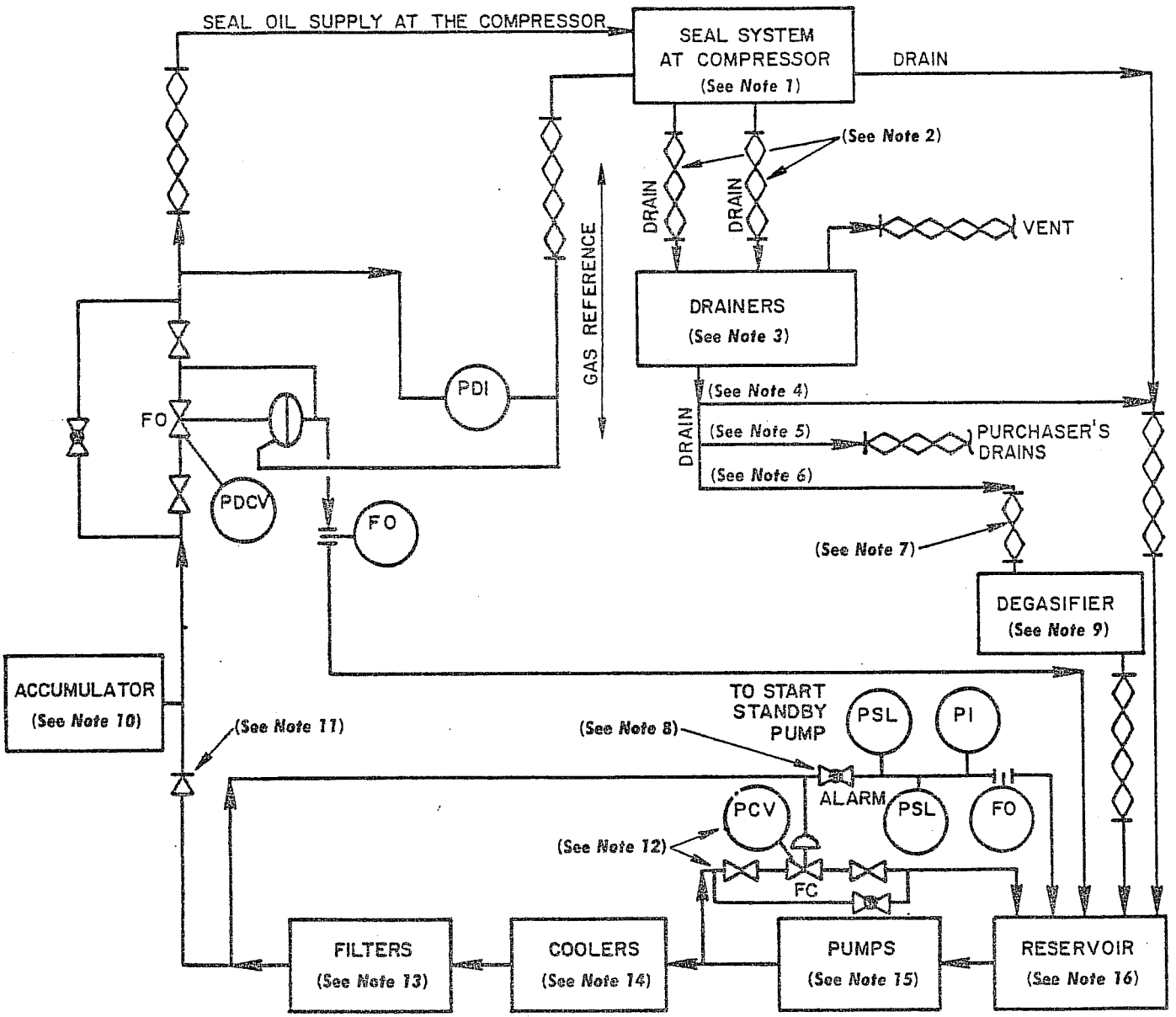


This arrangement is valid only when the pressure of the seal oil supply is higher than the pressure of the cooling water.

Notes:

1. Each direct-acting differential-pressure control valve must be referenced to sense the pressure acting at the corresponding mechanical inner seal.
2. OPTION A-25a: Switch to alarm or trip, or both.
3. OPTION A-25b: Flow restriction orifice.
4. Omit the bypass PCV circuit if centrifugal pumps are used.
5. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
6. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
7. Primary pumps (See Fig. A-4 and A-5).
8. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-25—Seal Oil Circulation System for Double Mechanical Seals.

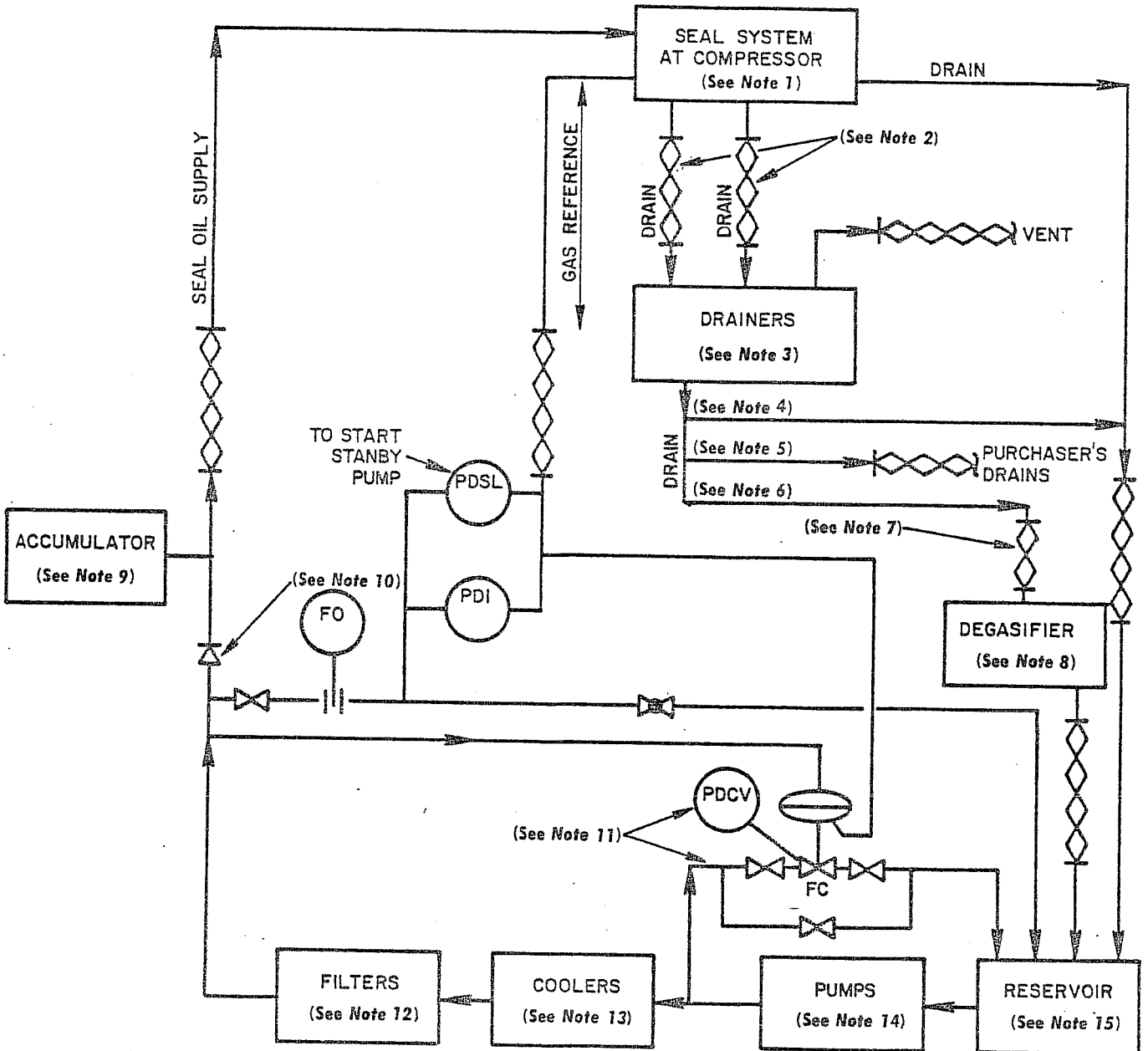


This arrangement is valid only when the pressure of the seal oil supply at the compressor is lower than the pressure of the cooling water. If the pressure of the cooling water is lower, refer to Fig. A-27.

Notes:

1. Seal oil system at compressor only (See Fig. A-22).
2. Connections by vendor when drainers are mounted on compressor baseplate.
3. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
4. OPTION A-26a: Drain to reservoir.
5. OPTION A-26b: Drain to purchaser's drains.
6. OPTION A-26c: Drain to degassing drum.
7. Connections by vendor if degasifier is mounted on compressor baseplate.
8. Nonstandard venting and control arrangement shown only to illustrate the alternative design for a combined instrument system for low-pressure alarm and pump-start switches (See Fig. A-1.2).
9. OPTION A-26d: Degassing drum (See Fig. 3).
10. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
11. Omit check valve if accumulator is not used.
12. Omit the bypass PCV circuit if centrifugal pumps are used.
13. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
14. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
15. Primary pumps (See Fig. A-4 and A-5).
16. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-26—Low-Pressure Seal Oil System Only for Contact Seals (No Overhead Tank).

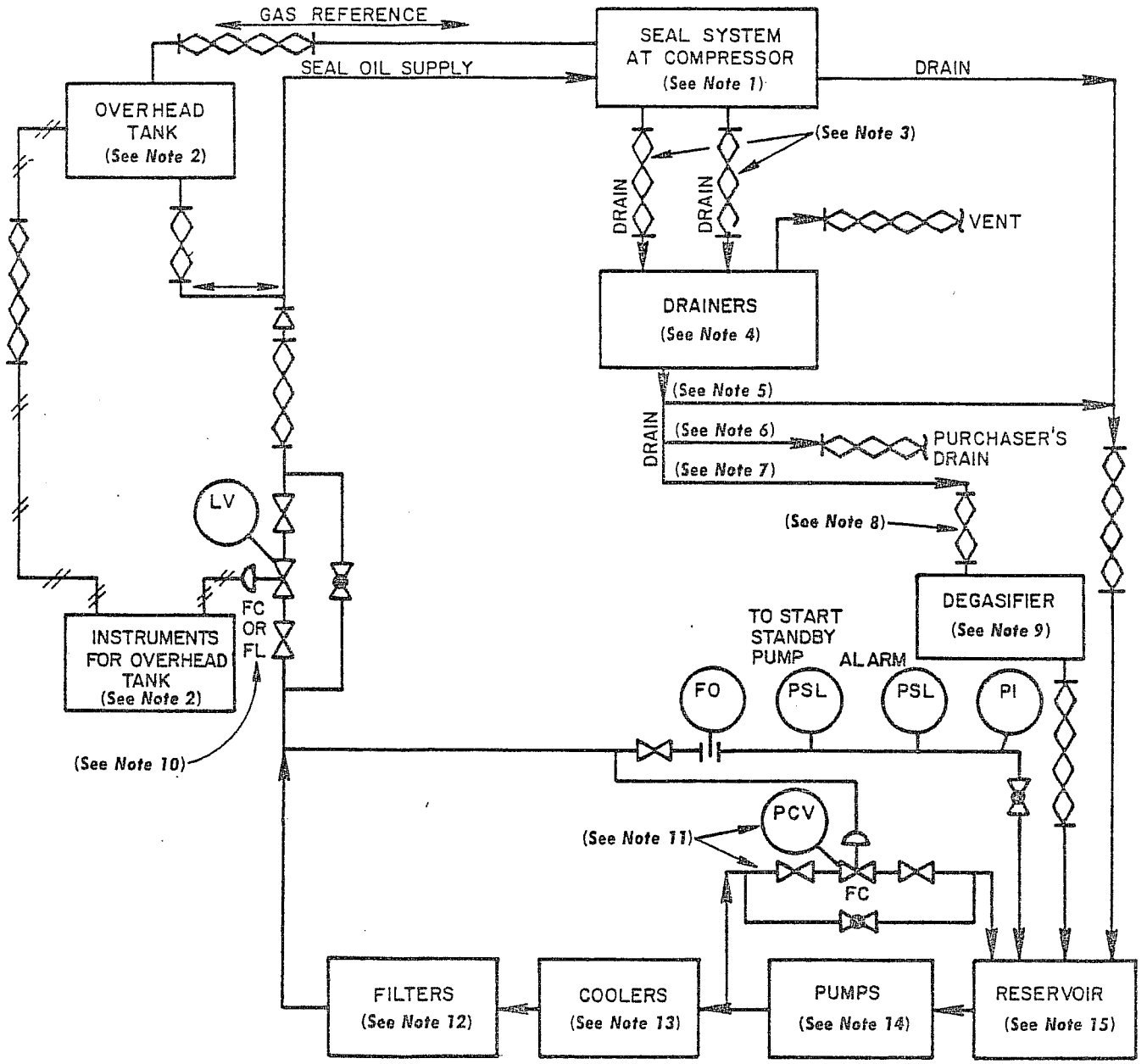


This arrangement is valid only when the pressure of the seal oil supply is higher than the pressure of the cooling water. If the pressure of the cooling water is higher, refer to Fig. A-26.

Notes:

1. Seal oil system at compressor only (See Fig. A-22).
2. Connections by vendor when drainers are mounted on compressor baseplate.
3. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
4. OPTION A-27a: Drain to reservoir.
5. OPTION A-27b: Drain to purchaser's drains.
6. OPTION A-27c: Drain to degassing drum.
7. Connections by vendor if degasifier is mounted on compressor baseplate.
8. OPTION A-27d: Degassing drum (See Fig. 3).
9. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
10. Omit check valve if accumulator is not used.
11. Omit the bypass PCV circuit if centrifugal pumps are used.
12. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
13. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
14. Primary pumps (See Fig. A-4 and A-5).
15. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-27—High-Pressure Seal Oil System for Contact Seals (No Overhead Tank).

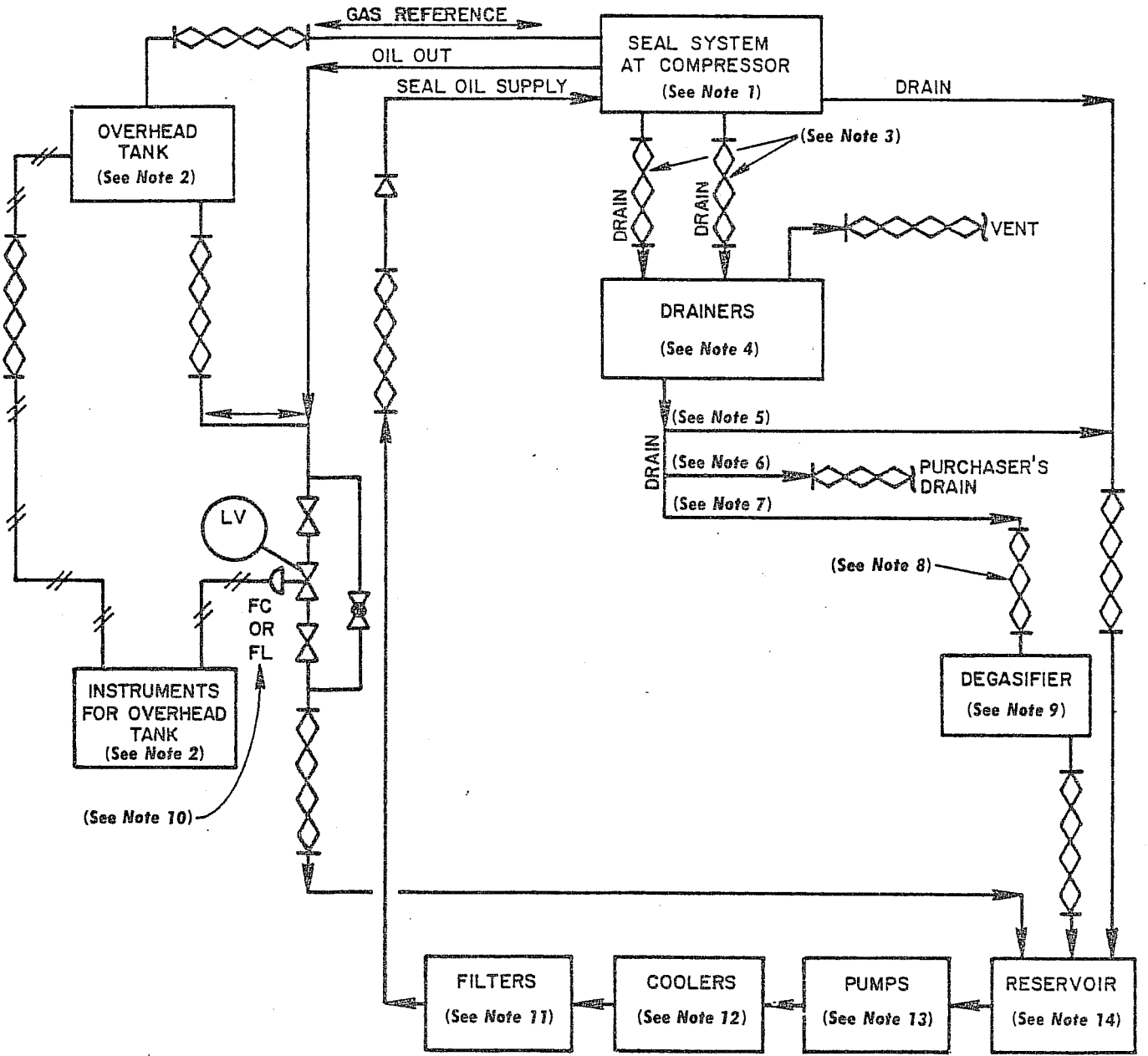


This arrangement is valid only when the pressure of the seal oil supply is higher than the pressure of the cooling water.

Notes:

1. Seal oil system at compressor only (See Fig. A-22).
2. Overhead tank with instrumentation (See Fig. A-17 or A-18).
3. Connections by vendor when drainers are mounted on compressor baseplate.
4. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
5. OPTION A-28a: Drain to reservoir.
6. OPTION A-28b: Drain to purchaser's drains.
7. OPTION A-28c: Drain to degassing drum.
8. Connections by vendor if degasifier is mounted on compressor baseplate.
9. OPTION A-28d: Degassing drum (See Fig. 3).
10. OPTION A-28e: The purchaser must specify the desired failure action for the LV.
11. Omit the bypass PCV circuit if centrifugal pumps are used.
12. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
13. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
14. Primary pumps (See Fig. A-4 and A-5).
15. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-28—Seal Oil System Only for Film-Type Seals (Overhead Tank Upstream of Seals).

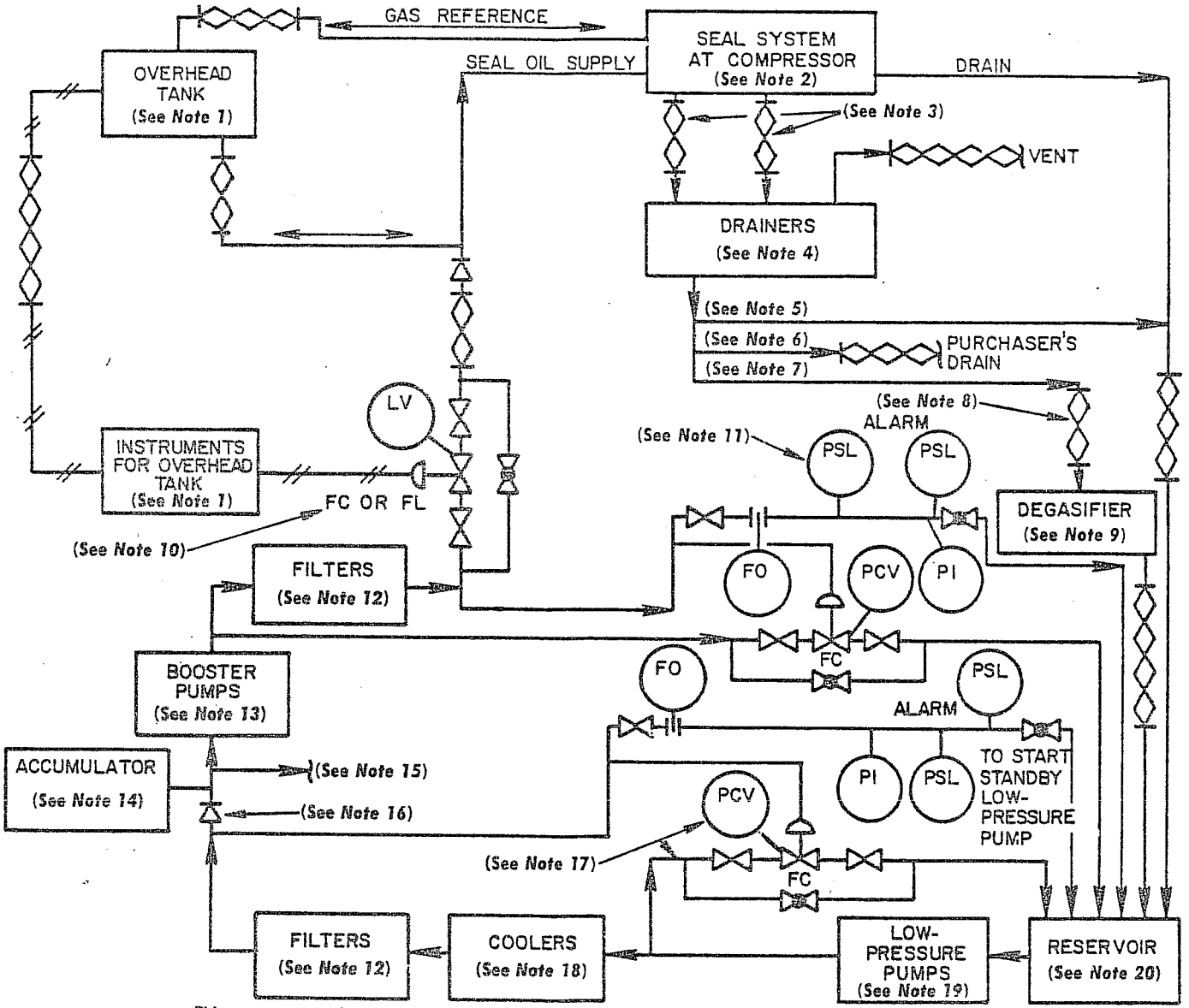


This arrangement is valid only when the pressure of the seal oil supply is higher than the pressure of the cooling water.

Notes:

1. Seal oil system at compressor only (See Fig. A-22).
2. Overhead tank with instrumentation (See Fig. A-17 or A-18).
3. Connections by vendor when drainers are mounted on compressor baseplate.
4. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
5. **OPTION A-29a:** Drain to reservoir.
6. **OPTION A-29b:** Drain to purchaser's drains.
7. **OPTION A-29c:** Drain to degassing drum.
8. Connections by vendor if degasifier is mounted on compressor baseplate.
9. **OPTION A-29d:** Degassing drum (See Fig. 3).
10. **OPTION A-29e:** The purchaser must specify the desired failure action for the LV.
11. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
12. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
13. Primary pumps (See Fig. A-4 and A-5).
14. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-29—Seal Oil System Only for Film-Type Seals (Overhead Tank Downstream of Seals).

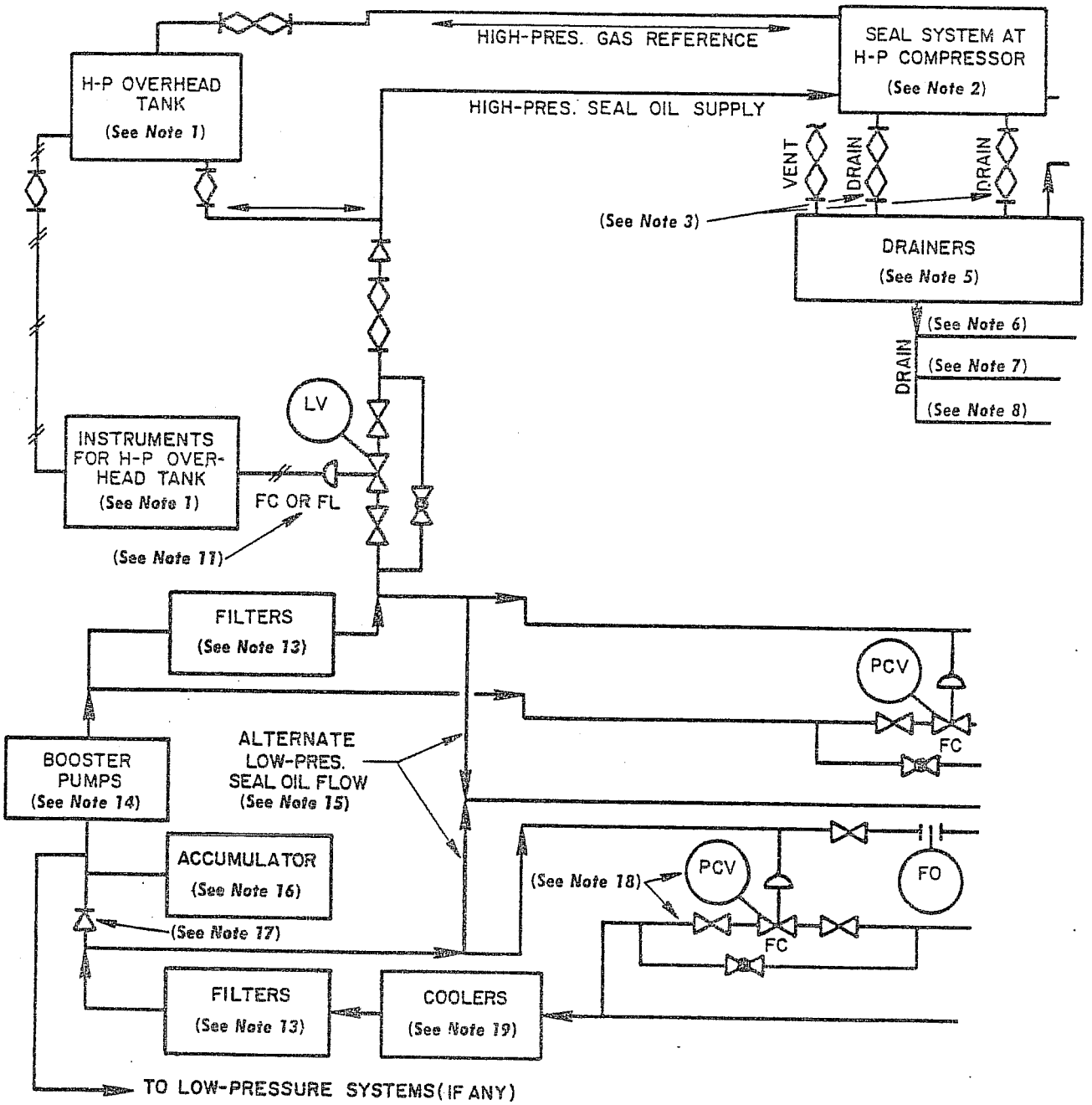


This arrangement is valid only when the oil pressure in the coolers is higher than the water pressure.

Notes:

1. Overhead tank with instrumentation (See Fig. A-17 or A-18).
2. Seal oil system at compressor only (See Fig. A-22).
3. Connections by vendor when drainers are mounted on compressor baseplate.
4. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
5. **OPTION A-30a:** Drain to reservoir.
6. **OPTION A-30b:** Drain to purchaser's drains.
7. **OPTION A-30c:** Drain to degassing drum.
8. Connections by vendor if degasifier is mounted on compressor baseplate.
9. **OPTION A-30d:** Degassing drum (See Fig. 3).
10. **OPTION A-30e:** The purchaser must specify the desired failure action for the LV.
11. **OPTION A-30f:** Switch to start standby booster pump.
12. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
13. Booster pumps (See Fig. A-6).
14. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
15. To lube oil system, control oil system, or other low-pressure systems.
16. Omit check valve if accumulator is not used.
17. Omit the bypass PCV circuit if centrifugal pumps are used.
18. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
19. Primary pumps (See Fig. A-4 and A-5).
20. Oil reservoir (See Fig. A-2 and A-3).

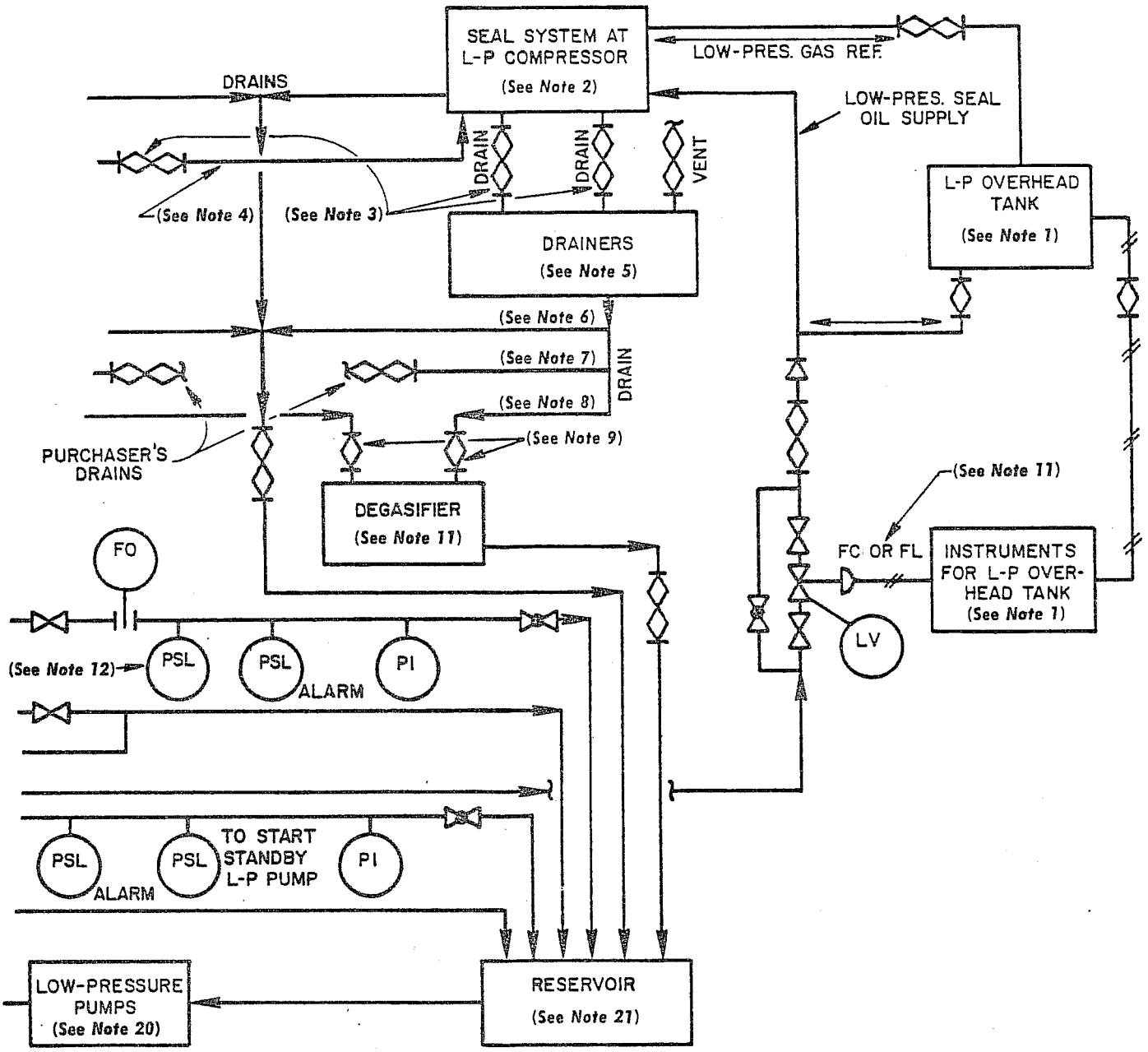
FIG. A-30—Seal Oil System Only with Booster Pumps and Overhead Tank.



Notes:

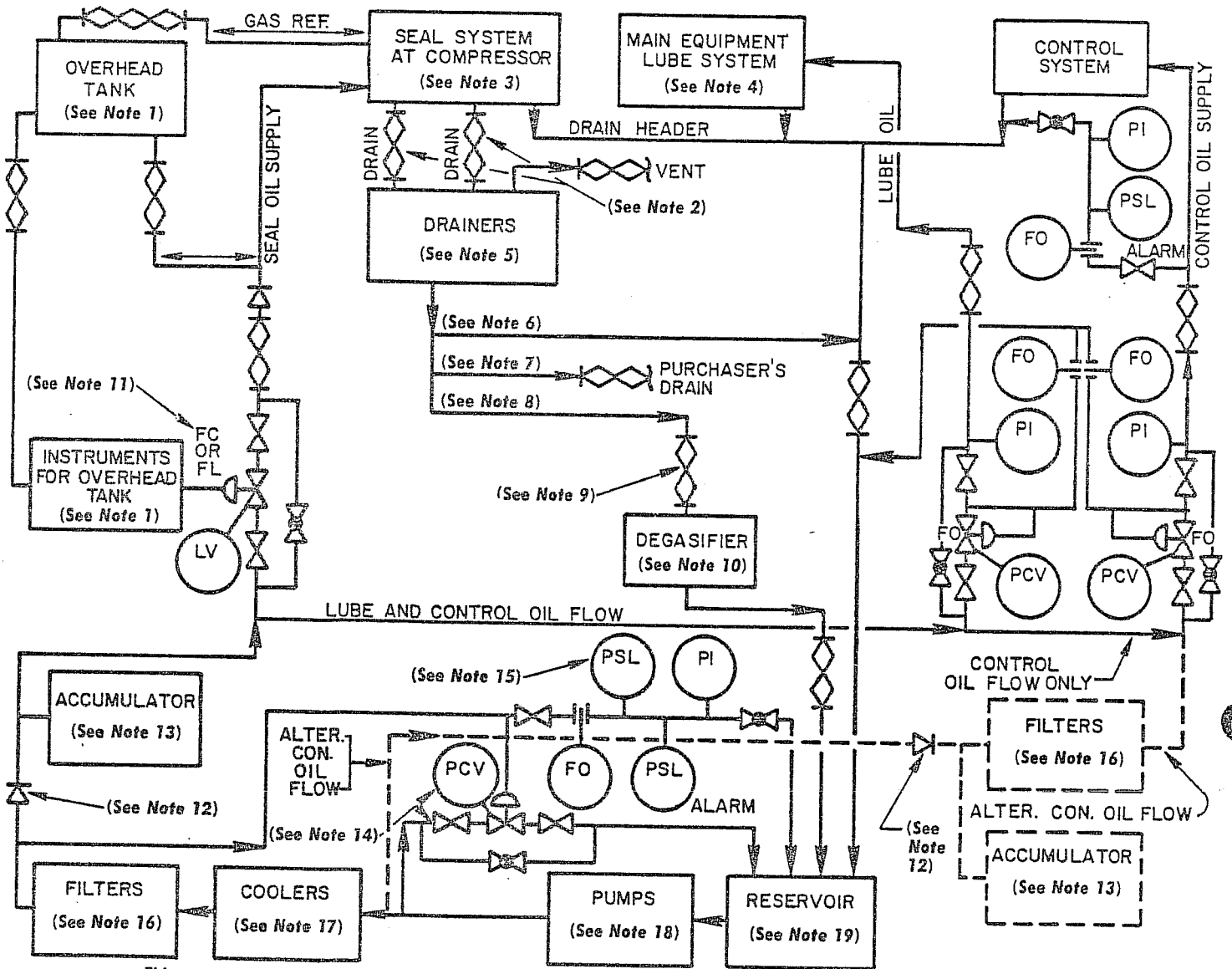
1. Overhead tank with instrumentation (See Fig. A-17 or A-18).
2. Seal oil system at compressor only (See Fig. A-22).
3. Connections by vendor when drainers are mounted on compressor baseplate.
4. OPTION A-31a: Vent to suction (See Fig. A-19, A-20, and A-22).
5. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
6. OPTION A-31b: Drain to reservoir.
7. OPTION A-31c: Drain to purchaser's drains.
8. OPTION A-31d: Drain to degassing drum.
9. Connections by vendor if degassifier is mounted on compressor baseplate.
10. OPTION A-31e: The purchaser must specify the desired failure action for the LV.

FIG. A-31—Seal Oil System Only for Tandem Compressors



11. **OPTION A-31f:** Degassing drum (See Fig. 3).
12. **OPTION A-31g:** Switch to start standby booster pump.
13. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
14. Booster pumps (See Fig. A-6).
15. The source for the low-pressure seal oil depends upon the required pressure.
16. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
17. Omit check valve if accumulator is not used.
18. Omit the bypass PCV circuit if centrifugal pumps are used.
19. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
20. Primary pumps (See Fig. A-4 and A-5).
21. Oil reservoir (See Fig. A-2 and A-3).

Having Booster Pumps and Overhead Tanks.

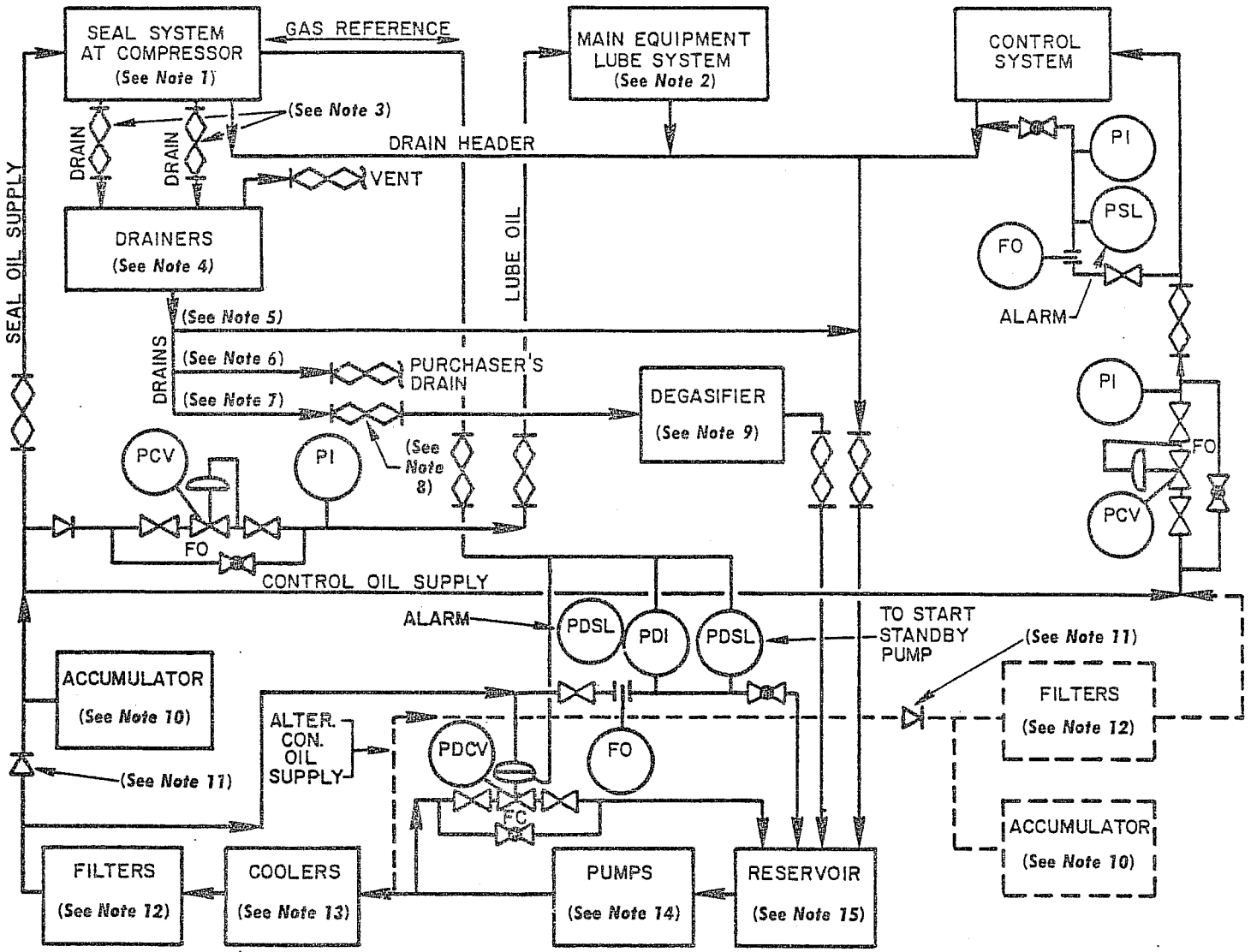


This arrangement is valid only when the pressure of the seal oil supply is higher than the pressure of the control oil supply.

Notes:

1. Overhead tank with instrumentation (See Fig. A-17 or A-18).
2. Connections by vendor when drainers are mounted on compressor baseplate.
3. Seal oil system at compressor only (See Fig. A-22).
4. Lubrication system at main equipment only (See Fig. A-21).
5. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
6. OPTION A-32a: Drain to reservoir.
7. OPTION A-32b: Drain to purchaser's drains.
8. OPTION A-32c: Drain to degassing drum.
9. Connections by vendor if degasifier is mounted on compressor baseplate.
10. OPTION A-32d: Degassing drum (See Fig. 3).
11. OPTION A-32e: The purchaser must specify the desired failure action for the LV.
12. Omit check valve if accumulator is not used.
13. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
14. Omit the bypass PCV circuit if centrifugal pumps are used.
15. OPTION A-32f: Switch to start standby pump.
16. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
17. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
18. Primary pumps (See Fig. A-4 and A-5).
19. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-32—Combined Seal, Lube, and Control Oil Systems (Including Overhead Tank).



This arrangement is valid only when the minimum seal oil pressure is higher than the control oil pressure.

Notes:

1. Seal oil system at compressor only (See Fig. A-22).
2. Lubrication system at main equipment only (See Fig. A-21).
3. Connections by vendor when drainers are mounted on compressor baseplate.
4. Float-controlled inner seal drainers (See Fig. A-19) or transmitter-controlled inner seal drainers (See Fig. A-20).
5. OPTION A-33a: Drain to reservoir.
6. OPTION A-33b: Drain to purchaser's drains.
7. OPTION A-33c: Drain to degassing drum.
8. Connections by vendor if degasifier is mounted on compressor baseplate.
9. OPTION A-33d: Degassing drum (See Fig. 3).
10. Direct-contact-type accumulator (See Fig. A-15) or bladder-type accumulator (See Fig. A-16) when required.
11. Omit check valve if accumulator is not used.
12. Single oil filter (See Fig. A-14) or twin oil filters (See Fig. A-13).
13. Single oil cooler (See Fig. A-9, A-10, A-12) or twin oil coolers (See Fig. A-8, A-11, A-12).
14. Primary pumps (See Fig. A-4 and A-5).
15. Oil reservoir (See Fig. A-2 and A-3).

FIG. A-33—Combined Seal, Lube, and Control Oil Systems for Contact Seals (No Overhead Tank).

APPENDIX B

TYPICAL DATA SHEETS OF OIL SYSTEM MANUFACTURERS

General Notes

1. The following data sheets* were designed under the assumption that the oil systems will be included in the scope of supply by the vendor of the main equipment the oil systems will serve. To eliminate duplication, these data sheets rely on the main equipment data sheets for site information and utility conditions. If an oil system is procured independently, the purchaser must supplement these data sheets with sufficient site and utility information to enable the oil system vendor to select and rate all components of the system.

2. These data sheets do not include detailed requirements of pumps and drivers. The purchaser should cover these items by including additional data sheets (API or other) or by utilizing the blank lines provided for use where minimal information only is adequate for the purchaser's needs. For coolers, the purchaser may use the data sheet provided or he may attach and use a standard heat exchanger data form.

3. To reduce the vendor's task and to expedite completion of the bid, the purchaser should indicate when he does not require all the vendor's information for which provision is made on the data sheets.

4. Panel-mounted items (see Page 56) specified by the purchaser will replace the locally mounted items shown on the oil system diagrams. In the event both locally mounted and panel-mounted instruments are required, the purchaser must so indicate on the data sheets.

*The data sheets presented in Appendix B were submitted to API as typical of those used by oil system manufacturers and are not in strict accordance with the specifications of this standard. API assumes no responsibility in connection with their use. They are reproduced herein as a convenience to the reader.

OIL SYSTEM DATA SHEET

JOB NO. _____ ITEM NO. _____
PAGE ___ OF ___
REQUISITION NO. _____
PURCHASE ORDER NO. _____
INQUIRY NO. _____
BY _____ DATE _____ REV. NO. ___

APPLICABLE TO: ○ PROPOSAL ◉ PURCHASE ○ AS-BUILT

FOR _____
SITE _____
OIL SYSTEM (S) FOR _____
SUPPLIER _____ MANUFACTURER _____

NOTES: 1. THE PARTY TO COMPLETE THE INFORMATION IS INDICATED AS FOLLOWS:
○ PURCHASER ☐ VENDOR ▽ EITHER, BUT BY VENDOR IF NOT BY PURCHASER.
2. A DOT • INDICATES THE STANDARD SPECIFIES A REQUIREMENT, VALUE OR CRITERION.
3. DESIGNATIONS IN ( ) ARE APPLICABLE PORTIONS OF THE STANDARD. NUMBERS WITHOUT A PREFIX ARE PARAGRAPH NUMBERS, THOSE PREFIXED "T" ARE TEXT FIGURE NUMBERS, THOSE PREFIXED "A" ARE APPENDIX "A" FIGURE NUMBERS.

APPLICABLE DOCUMENTS:

- ○ DOCUMENTS LISTED ON PAGE NO. _____
- ○ LUBE AND SEAL OIL SYSTEMS _____
- ◉ CENTRIFUGAL PUMPS _____
- ◉ GENERAL-PURPOSE TURBINES _____
- ○ INDUCTION MOTORS _____
- ○ _____ _____
- ○ _____ _____
- ○ SOUND LEVELS (2.1.9) _____
- ○ OTHER CODES (2.1.8) _____
- ○

INSTALLATION DATA:

- GENERAL SITE DATA ○ PAGE NO. ____
- UTILITIES DATA ○ PAGE NO. ____
- LOCATION: MAIN EQUIPMENT ○ PAGE NO. ____
- OIL SUPPLY SYSTEM ○ GRADE ○ _____
- INNER SEAL DRAINERS ○ _____
- DEGASSING DRUM ○ _____
- OIL SYSTEM PANEL ○ _____
- ○ WINTERIZE ○ TROPICALIZE ○ _____

OVERALL SYSTEM SCHEMATICS: (1.4, AND APPENDIX "A")

	FIG.NO.	OPTION NOS.	COMMENTS
○ SEPARATE LUBE OIL SYSTEM (A23, A24)			
○ SEPARATE SEAL OIL SYSTEM (A25-A31)			
○ COMBINED LUBE & SEAL SYSTEM (A32, A33)			
○ LUBE OIL AT MAIN EQUIPMENT (A21)			
○ SEAL OIL AT MAIN EQUIPMENT (A22)			

▽ RELIEF VALVES TO PROTECT LOW PRESSURE SYSTEMS (3.1.8, A24a): ▽ NO ▽ YES, FOR _____

EQUIPMENT OIL REQ'D.:

		NORMAL GPM	NORMAL PSIG	AFTER TRIP GPM	AFTER TRIP PSIG
☐ LUBE OIL:	DRIVEN EQUIP.				
☐	PRIME MOVER				
☐	GEARS				
☐	COUPLINGS				
☐	_____				
☐	TOTAL				
☐ CONTROL OIL:	NORMAL				
☐	TRANSIENT				
☐	_____				
☐ SEAL OIL:	AT _____				
☐	AT _____				
☐	AT _____				
☐	AT _____				
☐	AT _____				
☐	TOTAL				

▽ OIL TYPE & VISCOSITY: _____

BASIC SYSTEM DETAILS:

- ○ COMPRESSOR BLOCK-IN TIME (1.6.1) ____ MINUTES
- ☐ EQUIPMENT COAST-DOWN TIME (1.6.1) ____ MINUTES
- ☐ EQUIPMENT COOL-OFF TIME (1.6.1): DRIVER ____ MINUTES
- ☐ _____ OTHER ____ MINUTES
- ☐ MINIMUM START-UP OIL REQUIREMENT (2.2.6): ____ SSU

SUPPLY ARRGT. (2.1.5):	LUBE OIL	SEAL OIL	COMBINED
○ SEPARATE CONSOLE	○	○	○
○ MULTI-PACKAGE:	○	○	○
○ PACKAGE NO.1			
○ PACKAGE NO.2			
○ PACKAGE NO.3			
○			

BASES (2.1.6):	CONSOLE	PKG. #1	PKG. #2	PKG. #3
○ FABR. STEEL	○	○	○	○
○ FLAT STEEL	○	○	○	○
○ NON-SKID DECK	○	○	○	○
○				

JOB NO. _____ ITEM NO. _____
PAGE NO. ___ OF ___

OIL SYSTEM DATA SHEET

REQUISITION NO. _____
BY DATE REV. NO.

RESERVOIR: (2.2)

	○ SEPARATE LUBE	○ LUBE/SEAL COMB.	○ SEPARATE SEAL
○ SERVICE APPLICATION			
○ PURCHASER'S ITEM NO.			
○ FIGURE NOS. (T1, A2, A3)			
○ INCLUDING OPTION NOS.			
○ OTHER REQUIREMENTS			
_____			
○ MATERIAL			
▽ INTERIOR COATING			
□ NORMAL FLOW (2.2.5), GPM			
◘ FREE SURFACE (2.2.5), SQ.FT./GPM			
▽ WORKING CAPACITY, MINUTES (2.2.5) & GAL.			
▽ RETENTION CAPACITY, MINUTES (2.2.5) & GAL.			
◘ RUNDOWN CAPACITY (2.2.5), GAL.			
◘ NORMAL OPERATING RANGE (2.2.5) GAL.			
□ CHARGE CAPACITY (2.2.5, T1), GAL.			
○ INSULATION SUPPORTS (2.2.7)	○	○	○
▽ SEPARATING BAFFLE (A2)	▽	▽	▽
▽ LADDER WITH HANDRAILS (2.2.11)	▽	▽	▽
◉ FLANGED VENT (2.2.4),			
▽ OVERSIZE FLANGED VENT (2.2.8),			
○ PRESS. RELIEF DEVICE (2.2.8), TYPE & MAT'L.			
○ _____			
○ GROUNDING PAD OR CLIP (2.2.13, A3a)	○	○	○

○ TOP MOUNTED COMPONENTS: PERMITTED _____

□ ACTUAL _____

APPROX. DIMENSIONS (TANK ONLY): L x W x H _____ _____ _____

PUMPS AND DRIVERS: (2.3)

	○ LUBE	○ LUBE & SEAL	○ SEPARATE SEAL OIL		○ BOOSTER SEAL OIL	
○ SERVICE APPLICATION						
○ FLOW SCHEMATIC (A4–A6)						
○ INCLUDING OPTION NOS.						
▽ EMERGENCY PUMP SYSTEM						
▽ EMERGENCY PUMP DUTY						
_____						
PUMP SERVICE	MAIN/STDBY.	EMERGENCY	MAIN/STDBY.	EMERGENCY	MAIN/STDBY.	EMERGENCY
○ PUMP ITEM NO.						
○ PUMP TYPE						
○ PUMP DATA PAGE NO.						
○ TEMPORARY STRAINER (2.3.12)	○	○	○	○	○	○
○ DRIVER ITEM NO.						
◉ TURBINE DRIVER FOR						
○ TURBINE DATA PAGE NO.						
◉ ELECT. MOTOR DRIVER FOR						
○ ELECT. MOTOR DATA PAGE NO.						
○ OTHER DRIVER: _____ FOR						
○ OTHER DRIVER DATA PAGE NO.						
○ TURB. AUTO-START REQUIRED	○	○	○	○	○	○
○ AUTO-START BY VENDOR (A7)	○	○	○	○	○	○
○ BOOSTER SUCTION PROTECTION (2.3.14)						

JOB NO. _____ ITEM NO. _____

PAGE NO. ___ OF ___

OIL SYSTEM DATA SHEET

REQUISITION NO. _____

BY _____ DATE _____ REV.NO. _____

COOLERS: (2.4)

SERVICE APPLICATION	○ LUBE OIL	○ LUBE & SEAL	○ SEPARATE SEAL OIL
○ PURCHASER'S ITEM NUMBERS			
◉ TWIN UNITS (2.4.1, A8, A11)			
○ SINGLE UNIT (A9, A10)			
○ INCLUDING OPTION NUMBERS			
◉ BYPASS TEMP. CONTROL (2.4.4, A12)			
○ INCLUDING FIG. A-12 OPTION NOS.			
○ WATER SIDE FOR STEAM HEATING (2.4.5)			
○ FULL DETAILS ON PAGE NO. ###			
▽ WATER SIDE CORROSION ALLOWANCE			
▽ MANUFACTURER			
▽ MODEL			
◉ TEMA CLASS			
▽ FOULING FACTOR: WATER / OIL SIDE			
□ DUTY: BTU/HOUR			
▽ TUBE: L. x O.D. x BWG			
◉▽ DESIGN / TEST PSIG, SHELL SIDE			
◉▽ DESIGN / TEST PSIG, TUBE SIDE			
○ CODE: CONSTRUCTION / STAMP	○ / ○	○ / ○	○ / ○
◉▽ TUBE WATER VELOCITY: FT./SEC.			
◉▽ MATERIAL: SHELL			
◉▽ CHANNELS & COVERS			
◉▽ TUBE SHEETS			
◉▽ TUBES			

DO NOT COMPLETE THE DETAILS BELOW THE "PAGE NO." LINE WHEN A SEPARATE DATA PAGE IS USED.

FILTERS: (2.5)

▽ SERVICE APPLICATION	○ LUBE, ○ SEAL ▽ & CONTROL OIL	▽ SEPARATE CONTROL OIL	○ SEPARATE SEAL OIL	○ BOOSTER PUMP DISCHARGE OIL	○ SEPARATE COUPLING OIL
○ PURCHASER'S ITEM NOS.					
○ TWIN (2.5.1, 2.5.5, A11, A13)					
○ SINGLE (2.5.7, A14)					
○ INCLUDING OPTION NOS.					
○ MICRONS (NOMINAL)					
▽ MANUFACTURER					
▽ MODEL					
▽ DESIGN / TEST, PSIG					
○ CODE: CONST. / STAMP	○ / ○	○ / ○	○ / ○	○ / ○	○ / ○
□ ΔPSI: CLEAN / FAIL					
▽ MATERIAL: CASE & TOP					
▽ CARTRIDGES					

○ FURNISH SETS OF EXTRA CARTRIDGES: ○ PER SERVICE. ○ PER FILTER. (EXTRA OVER OTHER ORDERED SPARES).

CONTINUOUS FLOW TRANSFER VALVES: (2.4.1, 2.5.1, 2.11.14)

▽ SERVICE APPLICATION	○ LUBE, SEAL ▽ & CONTROL OIL	▽ SEPARATE CONTROL OIL	○ SEPARATE SEAL OIL	○ BOOSTER PUMP DISCHARGE OIL	○ COUPLING OIL (OPT. A-14b)
▽ MANUFACTURER					
▽ MODEL					
▽ WITH LIFTING JACK	▽	▽	▽	▽	▽
□ RATING: PSIG					
◉▽ MATERIALS: BODY					
◉▽ PLUG OR BALL					
◉▽ TRIM					

OIL SYSTEM DATA SHEET

JOB NO. _____ ITEM NO. _____
PAGE NO. ___ OF ___
REQUISITION NO. _____
BY DATE REV. NO.

ACCUMULATORS: (2.6)

SERVICE APPLICATION	LUBE OIL	CONTROL OIL	SEAL OIL	SEAL OIL BOOSTER
○ PURCHASER'S ITEM NO.				
▽ REQUIRED: YES OR NO & QUANTITY				
▽ SERVICE COMBINED WITH				
○ DIRECT CONTACT TYPE (A15)				
○ BLADDER TYPE (A16)				
○ INCLUDING OPTION NOS.				
○ VALVE FAILURE ACTION FOR FIG.A-15				
☐ RUNDOWN (2.1.10,2.6.1,T2), MINUTES				
_____				
○ _____				
▽ MANUFACTURER				
▽ MODEL				
☐ NOMINAL / USABLE CAPACITY, GALS.				
▽ MATERIAL: SHELL				
▽ BLADDER				
▽ DESIGN / TEST, PSIG				
○ CODE: CONSTRUCTION / STAMP	○ / ○	○ / ○	○ / ○	○ / ○
○ INCLUDE: CHARGE PRESSURE GAGE	○	○	○	○
○ MANUAL CHARGE VALVE	○	○	○	○
○ GAS SUPPLY REGULATOR	○	○	○	○

OVERHEAD TANKS: (2.7,T2)

SERVICE APPLICATION	RUNDOWN LUBE	LOW PRESS.SEAL	MED.PRESS.SEAL	HIGH PRESS. SEAL
▽ REQUIRED: YES OR NO				
▽ SERVICE COMBINED WITH				
○ DIRECT CONTACT TANK (A17)				
○ TANK PLUS BLADDER TYPE (A18)				
○ INCLUDING OPTION NOS.				
◉ RUNDOWN (2.1.10,2.7.1,T2), MINUTES				
○ PURGE GAS (A17c): TYPE OF GAS				
☐ SCFM REQUIRED				
○ INCL. CONTROL				
_____				
OVERHEAD TANK (A17,A18): ITEM NO.				
○ CORROSION ALLOWANCE				
▽ MATERIAL				
▽ TOTAL CAPACITY, GALS.				
▽ DESIGN / TEST, PSIG				
○ CODE: CONSTRUCTION / STAMP	○ / ○	○ / ○	○ / ○	○ / ○
_____				
ACCUMULATOR UNIT (A18): ITEM NO.				
○ CORROSION ALLOWANCE				
▽ MANUFACTURER & QUANTITY				
▽ MODEL				
▽ MATERIAL: SHELL				
▽ BLADDER				
☐ NOMINAL / USABLE CAPACITY, GALS.				
▽ DESIGN / TEST, PSIG				
○ CODE: CONSTRUCTION / STAMP	○ / ○	○ / ○	○ / ○	○ / ○
_____				

JOB NO. _____ ITEM NO. _____

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OIL SYSTEM DATA SHEET

REQUISITION NO. _____

BY DATE REV. NO.

DRAINERS FOR INNER SEAL OIL: (2.9)

SERVICE APPLICATION	LOW PRESSURE SEAL OIL	MED. PRESSURE SEAL OIL	HIGH PRESSURE SEAL OIL
○ PURCHASER'S ITEM NO.			
○ FLOAT CONTROLLED (A19)			
○ TRANSMITTER CONTROLLED (A20)			
○ POTS ONLY, FOR MANUAL DRAIN	○	○	○
○ WITH: VALVING	○	○	○
○ FLUSH LEVEL GLASS	○	○	○
○ HIGH LEVEL SWITCH	○	○	○
○ INCLUDING OPTION NOS.			
▽ RETENTION: HOURS / GALS.			
FLOAT TRAP:			
▽ MANUFACTURER / MODEL			
▽ PRESSURE RATING			
▽ MATERIALS: BODY			
▽ FLOAT / TRIM			
DRAIN POT:			
○ CORROSION ALLOWANCE			
▽ MATERIAL			
▽ DESIGN / TEST, PSIG			
○ CODE: CONSTR. / STAMP	○ / ○	○ / ○	○ / ○
MIST ELIMINATOR:			
○ CORROSION ALLOWANCE			
▽ MAT'L: SHELL			
▽ DEMISTING MESH			
▽ DESIGN / TEST, PSIG			
○ CODE: CONSTR. / STAMP	○ / ○	○ / ○	○ / ○

DEGASSING DRUM: (2.10,T3)

○ PURCHASER'S ITEM NO.	
○ SERVICE USED IN	
○ TO FIG.3 OR OTHER	
○ INCLUDING OPTION	
○ THERMOSTAT CONTROL	
□ OPERATING TEMP., °F	
□ GPM: NORMAL / MAX.	
□ NORMAL HOLDUP, MINUTES	
□ NORM. / MAX. CAPACITY, GALS.	
○ PURGE GAS: TYPE	
□ SCFM REQUIRED	
○ FLOW CONTROL	
○ CORROSION ALLOWANCE	
▽ MATERIAL	
▽ INTERIOR COATING	
▽ OVERSIZED VENT (2.10.5)	
○ VENT RELIEF DEVICE (2.10.5)	

JOB NO. _____ ITEM NO. _____

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OIL SYSTEM DATA SHEET

REQUISITION NO. _____

BY DATE REV.NO.

INSTRUMENTS AND CONTROLS: (3.1 & 3.3-3.6)

◉ SWITCH ACTIONS: CONTACTS TO ○OPEN ○CLOSE TO ALARM

◉ CONTACTS TO ○OPEN ○CLOSE TO TRIP

○ CONTACTS TO ○OPEN ○CLOSE TO START STANDBY PUMP

○ CONTACTS TO ○OPEN ○CLOSE TO START EMERGENCY PUMP

○ CALIBRATIONS: ○STANDARD ENGLISH (U.S.A.) SYSTEMS ○ _____

○ AIR SIGNALS: ○3 TO 15 PSIG ○ _____

○ ○ _____

○ CONNECTIONS: ◉TERMINALS AT EDGE (3.1.5) OF ○BASE ○PANEL

○ ○BY PURCHASER DIRECT TO INSTRUMENTS

_____

○ SUBSTITUTE PNEUMATIC-OPERATED (FOR DIRECT-ACTING) CONTROL VALVES: ○ALL VALVES ○ _____

○ POSITIONERS REQUIRED ON PNEUMATIC-OPERATED VALVES: ○ALL ○ _____

○ VALVE FAILURE POSITION: ○FAIL OPEN FOR _____

○ ○FAIL CLOSED FOR _____

○ ○FAIL LOCKED FOR _____

_____

○ INCLUDE THERMAL RELIEF VALVES ON: _____

○ ADDITIONAL OIL SYSTEM INSTRUMENTS (NOT INCLUDED IN FIGURES AND OPTIONS): _____

_____

○ ALL ITEMS LOCALLY MOUNTED, EXCEPT: ○SEE PAGE ___ FOR PANEL-MOUNTED ITEMS. ○ _____

_____

○ MANUFACTURERS AND MODELS: ○VENDOR'S STANDARD ○PER PAGE ___ DETAILS ○ _____

_____

_____

PANELS: (3.2)

○ PANEL NUMBER OR IDENTIFICATION			
○ SERVICE			
○ SUPPLIED BY			
○ LOCATION			
○ TYPE: FREE STANDING	○	○	○
○ MOUNTED ON			
○ OPEN OR FULLY ENCLOSED			
○ WEATHER-TIGHT	○	○	○
○ PURGED OR PRESSURIZED			
○ PURGE OR PRESSURE GAS			
○ REAR ACCESS DOORS	○	○	○
○ _____			
○ SUN AND WEATHER ROOF EXTENSION	○	○	○
○ LIGHTING: PANEL FRONT / REAR			
○ INTERIOR HEATER (AND CONTROL)			
○ LIMITS: MAX. HEIGHT ABOVE FLOOR			
○ LOWEST ITEM ABOVE FLOOR			
○ SPARE TERMINALS REQUIRED			
○ MINIMUM WIRE SIZE			
▽ MATERIALS: FRONT PANEL			
▽ OTHER PANELS & DOORS			
▽ CHASSIS			

_____

○ PANEL-MOUNTED ITEMS: SEE PAGE

_____

_____

_____

_____

_____

JOB NO. _____ ITEM NO. _____

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OIL SYSTEM DATA SHEET

REQUISITION NO. _____

BY _____ DATE _____ REV.NO. _____

PANEL-MOUNTED ITEM DETAILS:

USE THE FOLLOWING CODE LETTERS TO SHOW DETAILS: (REFER TO ITEM NO.4 ON FIRST PAGE OF API-614 APPENDIX "B")

F - FLUSH MOUNT ON FRONT
H - PURCHASER REMOTE MOUNT (IN CONTROL HOUSE) VENDOR'S NEMA-1 ENCLOSED ITEM
S - SURFACE MOUNT ON FRONT
P - PURCHASER SUPPLY AND MOUNT
C - CUT-OUT FOR PURCHASER'S ITEM
R - REAR-OF-PANEL MOUNT
V - VENDOR SUPPLY AND MOUNT
M - MOUNT BY VENDOR OF PURCHASER'S ITEM

- ○ PANEL IDENTIFICATION

PRESSURE INDICATORS:

- ○ LUBE PUMP DISCHARGES
- ○ SEAL PUMP DISCHARGES
- ○ EMERGENCY PUMP DISCH.
- ○ LUBE OIL HEADERS
- ○ CONTROL OIL AT USERS
- ○ COUPLING OIL
- ○ COMPRESSOR SEAL GAS
- ○ PURGE GAS SUPPLY
- ○ ACCUMULATOR GAS
- ○ STEAM TO PUMP TURBINE
- ○ MAIN TURBINE INLET
- ○ MAIN TURB. FIRST STAGE
- ○ MAIN TURB. EXTRACTION
- ○ MAIN TURBINE EXHAUST
- ○ COMPRESSOR SUCTION
- ○ COMPRESSOR DISCHARGE
- ○ EACH COMPRESSOR SECTION
- ○ BALANCE CHAMBER

DIFFERENTIAL PRESSURE INDICATORS:

- ○ LUBE OIL FILTERS
- ○ SEAL OIL FILTERS
- ○ BOOSTER OIL FILTERS
- ○ CONTROL OIL FILTERS
- ○ COUPLING OIL FILTERS
- ○ COMPRESSOR SEALS
- ○ SEAL GAS
- ○ OIL PURIFIER
- ○ COMPRESSOR AIR FILTER

PURGE GAS FLOW INDICATORS:

- ○ RESERVOIRS
- ○ DEGASSING DRUM
- ○ OVERHEAD TANKS

MISCELLANEOUS:

- ○ EQUIPMENT TACHOMETER
- ○ EQUIPMENT SPEED CONTROL
- ○ EQUIPMENT AMMETER
- ○ COMPR. INLET CONTROLLER
- ○ ANNUNCIATOR SYSTEM

- ○ PANEL IDENTIFICATION

OVERHEAD SEAL TANKS A18,A19):

- ○ LEVEL INDICATORS
- ○ LEVEL SWITCHES
- ○ SIGNAL AIR PRESSURE

LEVELS:

- ○ RESERVOIR INDICATOR
- ○ RESERVOIR SWITCH
- ○ RUNDOWN TANK INDICATOR
- ○ RUNDOWN TANK SWITCH
- ○ ACCUMULATOR INDICATOR
- ○ ACCUMULATOR SWITCH
- ○ SEAL DRAINER INDICATOR
- ○ SEAL DRAINER SWITCH
- ○ DEGASSER INDICATOR

TEMPERATURE:

- ○ RESERVOIR
- ○ COOLED OIL INDICATOR
- ○ COOLED OIL SWITCH
- ○ EQUIPMENT BEARINGS
- ○ EQUIPMENT THRUST INDIC.
- ○ EQUIPMENT THRUST SWITCH
- ○ OIL FROM SEAL INDICATOR
- ○ MAIN TURBINE INLET
- ○ COMPRESSOR INLETS
- ○ COMPRESS. OUTLETS INDIC.
- ○ COMPRESS. OUTLETS SWITCH

PUSHBUTTON STATIONS:

- ○ MAIN EQUIPMENT START
- ○ MAIN EQUIPMENT STOP
- ○ COMPRESSOR BLOCK-IN
- ○ COMPRESSOR UNBLOCK

MONITORS:

- ○ VIBRATION
- ○ AXIAL POSITION

JOB NO. _____ ITEM NO. _____

PAGE NO. ___ OF ___

OIL SYSTEM DATA SHEET

REQUISITION NO. _____

BY _____ DATE _____ REV.NO. _____

MAKES AND MODELS - INSTRUMENTS AND CONTROLS:

USE THE FOLLOWING CODE LETTERS TO INDICATE INTENT:

N - NO SUBSTITUTION
X - PREFERRED, BUT VENDOR MAY PROPOSE A SIMILAR ITEM FOR PURCHASER'S CONSIDERATION.
E - ELECTIVE (OPTIONAL) BY VENDOR, SUBJECT TO PURCHASER'S APPROVAL.

	MANUFACTURER	MODEL / SIZE
AIR-OPERATED ITEMS:		
GAGE (INDICATOR), LOCAL		
GAGE, PANEL-MOUNTED		
SWITCH, LOCAL		
SWITCH, PANEL-MOUNTED		
OIL VALVE, LOW PRESSURE		
OIL VALVE, HIGH PRESSURE		
TURBINE AUTO-START STEAM		
TRANSMITTERS (AIR):		
PRESSURE, LOW		
PRESSURE, HIGH		
DIFFERENTIAL PRESSURE		
TEMPERATURE		
LEVEL, RESERVOIR		
LEVEL, LOW-PRESSURE		
LEVEL, HIGH PRESSURE		
PRESSURE GAGES (DIRECT READING):		
PRESSURE, LOW		
PRESSURE, HIGH		
DIFFER'L., LOW PRESS.		
DIFFER'L., HIGH PRESS.		
TEMPERATURE GAGES (DIRECT READING):		
RESERVOIR		
PRESSURE SUPPLY SYSTEM		
EQUIPMENT RADIAL BRGS.		
EQUIPMENT THRUST BRGS.		
SWITCHES (DIRECT ACTING):		
PRESSURE, LOW		
PRESSURE, HIGH		
DIFF. PR., LOW PRESSURE		
DIFF. PR., HIGH PRESSURE		
LEVEL, RESERVOIR		
LEVEL, LOW PRESSURE		
LEVEL, HIGH PRESSURE		
TEMPERATURE		
FLOW GLASSES:		
NON-RESTRICTIVE		
RESTRICTIVE		

	MANUFACTURER	MODEL / SIZE
CONTROL VALVES (DIRECT ACTING):		
PRESSURE, LOW		
PRESSURE, HIGH		
DIFF.PR., LOW PRESSURE		
DIFF.PR., HIGH PRESSURE		
SPECIAL VALVES:		
TEMP., FILLED SYSTEM		
TURBINE START, HYDRAULIC		
SOLENOID VALVES:		
AIR 3-WAY		
AIR 3-WAY, MANUAL RESET		
TURB. STEAM, WITH RESET		
RELIEF VALVES:		
OIL, LOW PRESSURE		
OIL, HIGH PRESSURE		
STEAM, TURBINE EXHAUST		
THERMAL, OIL		
THERMAL, WATER		
LEVEL GLASSES:		
PAD TYPE, LOW PRESSURE		
PAD TYPE, HIGH PRESSURE		
COLUMN TYPE, LOW PRESS.		
COLUMN TYPE, HIGH PRESS.		
THERMOWELLS:		
THREADED (BORED)		
FLANGED (BORED)		
RESERVOIR HEATER:		
ELECTRIC ELEMENT		
THERMOSTAT		
ANNUNCIATORS AND ALARMS:		
PURGE FLOW CONTROL: SEE PAGE NO (S). _____		

JOB NO. _____ ITEM NO. _____

PAGE NO. ____ OF ____

OIL SYSTEM DATA SHEET

REQUISITION NO. _____

BY _____ DATE _____ REV. NO. _____

PIPING AND TUBING: (2.11)

○ DOUBLE BLOCKS & BLEED (2.1.7) FOR: _____

STEEL FITTINGS FOR TUBING (2.11.9):

○ MFR. _____ MODEL _____

INSTR./CONTR. AIR AFTER AIR FILTS. (2.11.13):

○ ○ S.S. ○ COPPER

○ HEAT TRACING REQUIRED:

○ FURNISHED BY PURCHASER

○ VENDOR DRAWINGS SPECIFY REQUIREMENTS

○ _____

PAINTING: (5.1)

○ COMPONENT SUPPLIER'S STANDARD

○ UNIFIED, SYSTEM SUPPLIER'S STANDARD

○ SPECIAL: _____

MISCELLANEOUS:

◉ SPARE PARTS QUOTATION WITH PROPOSAL (7.1.6)

◉ SPARE PARTS QUOTATION AFTER CONTRACT (6.2.3)

◉ ABOVE BASED ON NORMAL SUPPLY FOR ____ MONTHS

OIL PURIFIER: (2.8)

○ PURCHASER'S ITEM NO. _____

○ SERVICE USED IN _____

○ TYPE _____

○ PORTABLE, OR MOUNTED ON _____

▽ RATED GPM _____

▽ MANUFACTURER _____

▽ MODEL _____

□ DRIVER: FOR _____

▽ HP & ENCLOSURE _____

○ V./PH./HZ. _____

SHOP INSPECTION: (4.1)

○ REQUIRED FOR SYSTEM ASSEMBLIES

○ REQUIRED FOR COMPONENTS

○ MATERIAL CERTIFICATIONS TO BE FURNISHED

○ AS SPECIFIED BY PURCHASING DOCUMENTS

○ AS SPECIFIED BY _____

○ SUPPLY CERTIFIED COPIES OF ALL TEST LOGS AND DATA (6.2.4)

SHOP TESTS OF SYSTEMS: (4.1 - 4.3)

	REQUIRED	WITNESSED
◉ CLEANLINESS	○	○
◉ FOUR-HOUR RUN	○	○
◉ CHECK CONTROLS	○	○
◉ CHANGEOVERS	○	○
◉ ONE- AND TWO-PUMP OPERATION	○	○
○ SOUND LEVELS	○	○
○ USE FOR DRIVER EQUIPMENT TESTS	○	○
○ USE FOR DRIVEN EQUIPMENT TESTS	○	○
◉ HYDROSTATIC	○	○
○ _____		

◉ SUPPLY CERTIFIED COPIES OF ALL TEST LOGS AND DATA (6.2.4)

PREPARATION FOR SHIPMENT: (5.1-5.4)

GENERAL:

◉ INSTALL NEW FILTER ELEMENTS AND TAG (5.3.1)

○ INCLUDE EXTRA FILTER ELEMENT SETS PER PAGE ____

○ BOX ABOVE EXTRA SETS WITH THE ○ SYSTEM ○ OTHER SPARES

◉ "OSHA" WARNING TAG ON EACH ASSEMBLY (5.3.2)

○ _____

	VENDOR'S STANDARD	PURCHASER'S STANDARD
SYSTEM & COMPONENTS:		
○ DOMESTIC	○	○
○ EXPORT	○	○
○ EXTENDED STORAGE	____ MONTHS	____ MONTHS
SPARE PARTS:		
○ DOMESTIC	○	○
○ EXPORT	○	○
○ EXTENDED STORAGE	____ MONTHS	____ MONTHS