



Exploration & Production

GENERAL SPECIFICATION

ROTATING MACHINERY

GS MEC 281

**Lubrication, Shaft Sealing, and Control Oil Systems
for Special-Purpose Applications
According to API Standard 614**

02	10/04	Rewriting
01	08/03	Change of Group name and logo
00	02/01	First issue
Rev.	Date	Notes



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1. Scope

The purpose of this specification is to clarify the requirements of [API 614](#) standard fourth edition, April 1999.

This document modifies or complements some requirements of [API 614](#) standard, when deemed necessary considering COMPANY experience.

The paragraph numbering is identified in the same way as in [API 614](#) except for additional requirements, which may be presented with new paragraph numbers. The summary sheet at front indicates where to find the information for each paragraph of [API 614](#) shown with a bullet.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
API Standard 614	Lubrication, shaft-sealing, and control-oil systems and auxiliaries for petroleum, chemical and gas industry services

Professional Documents

Reference	Title
	Refer to document called by API 614

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	



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General Specification

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Rev: 02

Total General Specifications

Reference	Title
Not applicable	

3. Comments to API 614

Chapter 1 - General Requirements

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1. Scope	

1.3 Oil systems shall be supplied in accordance with [API Standard 614](#). **VENDOR** shall clearly indicate and submit in his proposal any deviation to this standard and this document.

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2 Referenced publications	
2.1 The PURCHASER and the VENDOR will mutually agree and indicate on the data sheets which set of national or international standards listed in Appendix A shall apply to the scope of supply. Note: The listing presented in Appendix A does not imply each corresponding standard is equivalent to the USA standard. It is the responsibility of the PURCHASER and the VENDOR to verify that the specified standard meets or exceeds the requirements of the standard listed under USA.	Apart from projects based on American codes and standards, ISO standards shall apply wherever possible to the documents specified in this section, unless their requirements are not equivalent. The VENDOR shall submit the list of documents to the COMPANY for approval prior to the order.
4 General	
4.1 Alternative designs	
The PURCHASER will specify whether systems supplied to this standard shall have metric dimensions and comply with applicable ISO standards or have U.S. Customary dimensions and comply with applicable U.S. standards. Appendix A provided in this chapter is a reference list of U.S., ISO, and International Standards to be used to specify the applicable standards.	The SI system of units (ISO 1000) shall be used in all technical documents, drawings, design notes, etc., prior to or following the order, except with regard to the names of NPT taper screw threads.
4.2 Conflicting requirements In case of conflict between this standard and the inquiry or order, the information included in the order shall govern.	In case of conflict between the requirements of API 614, this specification and the other applicable documents specified, the following precedence shall govern: - Local regulations - The job specification and associated

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	data sheets • This general specification • API 614. In the event of discrepancies relative to other documents, only the COMPANY shall be empowered to decide when advised by the VENDOR.
4.3 System selection	
• 4.3.1 Chapters 2, 3 and 4 appendices provide schematics and diagrams of typical complete lubrication, oil-type shaft-sealing, dry gas face-type shaft-sealing, and control-oil systems. These schematics and diagrams illustrate the general philosophy and requirements of this standard and are included to assist the PURCHASER in the selection of an appropriate system. The PURCHASER and the VENDOR shall agree on a mutually acceptable system prior to releasing the order.	VENDOR's proposal shall clearly include details of the proposed oil systems schematics and diagrams.
• 4.3.2 The PURCHASER will define the scope of supply, quality level or the brand of components, system type, general arrangement (including plan and elevation views of the console orientation), space available for the console, service (special purpose, or general purpose), and other requirements. Appendix C may be used to define scope of supply responsibility.	Oil systems come under the responsibility of the rotating equipment MANUFACTURER or the VENDOR who has the full responsibility of the shaft line.
5. Piping	
5.1 General	
5.1.2 Auxiliary systems are defined as piping systems that are in the following services: a. Group I (see Table 1A) 1. Sealing fluid 2. Gland and flushing fluid 3. Recirculation fluid 4. Balance gas	This paragraph is applicable but 316L stainless steel shall be considered as a minimum.

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5. Buffer gas 6. Fuel gas or oil 7. Drains and vents 8. Starting gas 9. Separation gas b. Group II (see Table 1B) 1. Sealing steam 2. Steam injection 3. Water injection 4. Starting air 5. Instrument and control air 6. Drains and vents c. Group III (see Table 1C) 1. Cooling water 2. Liquid wash 3. Drains and vents d. Group IV (see Table 1D) 1. Lubricating oil 2. Control oil 3. Seal oil (see 5.4 for seal oil contaminated with process fluid) 4. Drains and vents Auxiliary systems shall comply with the requirements of Tables 1 and 2, except as modified in referencing standards, including references to Tables 1 and 2 in Chapters 2, 3 and 4 of this standard.	
● 5.1.4 The VENDOR shall furnish all piping systems, including mounted appurtenances, located within the confines of the main unit's base area, any oil console base area, or any auxiliary base area. The piping shall terminate with flanged connections at the edge of the base. When soleplates are specified for the equipment train, the extent of the piping system at the equipment train will be defined by the PURCHASER. The PURCHASER will furnish only interconnecting piping between	Piping shall terminate with flanges connections.

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equipment groupings and off-base facilities.	
• 5.1.15 Special requirements for piping, flanges, gaskets and O-rings, valves, and other appurtenances in special and/or hazardous service will be specified by the PURCHASER.	According to VENDOR specifications.
• 5.1.22 When specified, test valves shall be supplied adjacent to all of the instruments. Test valves shall terminate with a plugged ½-inch NPT connection. When specified, test valves in oil lines shall be vented back to the reservoir. Test valves may be combined with instrument valves supplied according to 5.1.20.	According to VENDOR specifications.
• 5.1.25 When specified, each utility such as air and inert gas supply, cooling water supply and return lines, and others as specified shall be manifolded to a common connection.	Each utility shall be connected to a common manifold connection.
5.4 Process piping	
• 5.4.1 The extent of and requirements for process piping to be supplied by the VENDOR will be specified.	VENDOR shall provide all required process piping for dry gas seals system.
• 5.4.3 When specified, the VENDOR shall review all piping, appurtenances (pulsation suppression devices, intercoolers, aftercoolers, separators, knockout drums, air intake filters, expansion joints), and vessels immediately upstream and downstream of the equipment and supports. The PURCHASER and the VENDOR shall mutually agree on the scope of this review.	Not applicable
5.5 Intercoolers and aftercoolers	
• 5.5.1 When specified, the VENDOR shall furnish an intercooler between each compression stage. Intercoolers shall be air cooled or water cooled as specified.	Not applicable
• 5.5.2 The PURCHASER will specify whether aftercoolers shall be furnished by the VENDOR.	Not applicable

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• 5.5.9 Intercoolers shall be either machine mounted or separately mounted, as specified.	Not applicable
• 5.5.12 When specified, the VENDOR shall furnish the fabricated piping between the compressor stages (or the nozzles of centrifugal compressor bodies) and the intercoolers and aftercoolers. Interstage piping shall conform to ASME B31.3.	Not applicable
6. Instrumentation, Control and Electrical Systems	
6.2 Instrument Installation	
• 6.2.1 Instruments for the console, gas seal module, and equipment may be local or gauge-board mounted as specified. • 6.2.2 When specified, a panel shall be provided and shall include all panel-mounted instruments for the driven equipment and driver. Such panels shall be designed and fabricated in accordance with the PURCHASER's description. The PURCHASER will specify whether the panel is to be freestanding, located on the base of the unit, or in another location. The instruments on the panel shall be clearly visible to the operator from the driver control point. A lamp test push button shall be provided. The instruments to be mounted on the panel shall be specified on the data sheets. • 6.2.3 Panel instruments will be specified by the PURCHASER (See Appendix D for an equipment instrumentation list).	Instruments gauge board and panels will be as per VENDOR's standard but material shall be 316L stainless steel as a minimum.
• 6.2.4.2 All wiring shall be installed in metal conduit, cable trays, or enclosures as specified.	All wiring will be installed in cable trays. Request for derogation will be presented by VENDOR before order if necessary.
• 6.2.5 Instrument connections shall terminate at locations specified. In accordance with 6.1.6, shut-off valves shall be provided within gauge boards.	Isolating valves for each instrument will be provided within the gauge board and instrument electrical connections shall terminate in junction boxes.

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6.3 Alarms and Shutdowns	
• 6.3.2 Switches, transmitters, control devices, and annunciator display units shall be furnished and mounted by the VENDOR as specified.	Transmitters 4 to 20 mA will be used instead of switches.
• 6.3.6 When specified, the VENDOR shall provide an annunciator.	Alarms and shutdowns will be connected to the main unit PLC.
6.4 Instrumentation	
• 6.4.5.1 Pressure indicators shall be located per the data sheets.	This paragraph is applicable.
• 6.4.5.2.1 When specified, liquid-filled gauges shall be furnished in locations subject to vibration.	This paragraph is applicable.
• 6.4.5.3 The VENDOR shall supply all pressure indicators and transmitters as defined by the PURCHASER on the data sheets. Transmitters which provide alarm/trip signals shall be purchased with the minimum response time setpoint available.	This paragraph is applicable.
• 6.4.6.4 When specified, restrictive flow indicators shall be installed in the pressurized inlet line to each continuously lubricated coupling.	This paragraph is applicable.
• 6.4.7.3 When continuously energized solenoids are specified for trip circuits, the VENDOR shall provide the PURCHASER with the coil rating and estimated service life of each solenoid coil based on continuously energized operation. Dual-coil solenoids may be specified for any trip function. Each coil shall be capable of keeping the solenoid in its energized condition. Separate relays shall energize each coil.	The VENDOR shall provide the PURCHASER with all technical information concerning the type of solenoid valves to be used.
• 6.4.8.3 When specified, thermal relief valves shall be provided for components that may be blocked in by isolation valves.	This paragraph is applicable.

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6.5 Electrical Systems	
• 6.5.1 The characteristics of electrical power supplies for motors, heaters, and instrumentation will be specified.	This paragraph is applicable.
• 6.5.4.2 When specified, measurement and remote-control panel wiring may be solid conductors.	Wiring will be according to COMPANY specifications.
• 6.5.7 Electrical materials including insulation, shall be corrosion resistant and nonhygroscopic insofar as is possible. When specified for tropical location, materials shall be given the treatments specified in 6.5.7.1 and 6.5.7.2. • 6.5.9 Control, instrumentation, and power wiring (including temperature element leads) within the limits of the baseplate shall be installed in rigid metallic conduits, cable trays, or enclosures as specified, properly bracketed to minimize vibration and isolated or shielded to prevent interference between voltage levels.	Electrical, control, instruments materials and installation shall be provided according to COMPANY specifications. Request for derogation will be presented by the VENDOR if necessary.
• 6.5.12 The PURCHASER may provide a starting switch for the standby pump motor. This switch should contain manual-on and automatic-start positions only, with a separate manual reset button. The manual reset button allows the standby pump to be manually shutdown while the switch is in the automatic-start position only if the primary pump is providing sufficient pressure (that is, if the pressure-rising limit relay of the low-pressure switch (PSL) (see Figures 2A-2, 2A-3) has been satisfied). A separate electrical disconnect switch with a lockable off position should be provided, but this switch should be provided at a remote location and should be used only for pump maintenance or during the time the equipment is shutdown.	This paragraph is applicable and within VENDOR scope of supply.
7. Inspection, Testing and Preparation for shipment	
• 7.1.1 The PURCHASER will specify the extent of participation in the inspection and	Inspection and testing will be carried out according to COMPANY Project QA/QC plan.

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testing and the amount of advance notification required.	Advance notification will be according to COMPANY Project contract requirements.
7.1.4.2 Witnessed means that a hold shall be applied to the production schedule and that the inspection or test shall be carried out with the PURCHASER or his representative in attendance. For mechanical running or operational tests, this requires written notification of a successful preliminary test.	When the main equipment full load and/or string test is specified, the complete lube oil system shall be mandatory used. • The COMPANY reserves the right to request installation of screen meshes at selected locations upstream and/or downstream filters before the beginning of full load/string test to check cleanliness of the whole system. • In case filters differential alarm set point is activated and/or unacceptable screen mesh cleanliness, the full load/string test shall be postponed until the cleanliness of all lube oil system components have been satisfactorily demonstrated by the VENDOR and accepted by the COMPANY. • When lube oil components cleanliness is satisfactorily achieved, the final full load and/or string test shall be carried out.
7.2 Inspection	
• 7.2.1.3 In addition to the requirements of the governing piping, pressure vessel, and welding code or standard, the PURCHASER may specify the following: a. Parts that shall be subjected to surface and subsurface examination. b. The type of examination required, such as magnetic particle, liquid penetrant, radiographic, and ultrasonic examination. • 7.2.2.1 When radiographic, ultrasonic, magnetic particle, or liquid penetrant inspection of welds or materials is required or specified, the criteria in 7.2.2.2 through 7.2.2.5 shall apply unless other criteria are specified by the PURCHASER. Cast iron may be inspected in accordance with 7.2.2.4 and 7.2.2.5. Welds, cast steel, and wrought material may be inspected in accordance with 7.2.2.2 through 7.2.2.5.	COMPANY Project QA/QC plan shall apply.

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7.2.3.1 During assembly of the system and before testing, each component (including cast-in passages of these components) and all piping and appurtenances shall be cleaned by appropriate methods to remove foreign materials, corrosion products, and mill scale. Note: Purchased components shall be pre-cleaned.	VENDOR shall specify the piping cleanliness level required with the corresponding standard. The oil piping shall be designed and routed in such way that all piping can be dismantled or broken on site, to be cleaned separately or by group of assembled sections. The cleaning method shall be passivation followed by neutralization, drying and preservation, handled by specialized qualified Sub-vendor. For on site final flushing, all bearings inlet and outlet piping sections shall be provided with Te, engineered prefabricated and removable bypasses, with spades located at inlet and outlet of bearing housing, supplied as special tools to minimize piping disassembly. VENDOR shall provide the dedicated study and detailed drawings covering the piping design, the cleaning and the final flushing procedures to be approved by COMPANY.
• 7.2.3.2 When specified, the PURCHASER may inspect for cleanliness the equipment and all piping and appurtenances furnished by or through the VENDOR before heads are welded to vessels, openings in vessels or exchangers are closed, or piping is finally assembled.	Lube oil components cleanliness is a “holding” point. Inspection will be carried out according to COMPANY project QA/QC plan. Advance notification will be according to COMPANY Project contract requirements.
• 7.2.3.3 When specified, the hardness of parts, welds, and heat-affected zones shall be verified as being within the allowable values by testing of the parts, welds, or heat affected zones. The method, extent, documentation, and witnessing of the testing shall be mutually agreed on by the PURCHASER and the VENDOR.	To be mutually agreed between COMPANY and VENDOR.
8. VENDOR's Data	
8.2 Proposals	
• 8.2.3.1 When specified, procurement of components shall not proceed without the PURCHASER's review and acceptance of the selected components. When specified, manufacture of the console shall not proceed	Unless otherwise specified, the MANUFACTURER can proceed without PURCHASER's formal approval but the PURCHASER will have the right to request modification if the maintenance of any



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without the PURCHASER's review of the layout of components and piping.	component is not easily accessible after construction.
8.3 Contract Data	
• 8.3.3.1 When specified, the VENDOR shall submit certified copies of the test data to the PURCHASER prior to shipment.	This paragraph is applicable.



Appendix E Filter rating and cleanliness standard

E.2.6.5 With the exception of Propane and natural gas compressors, the seals gas filter shall be a combined duplex filter/coalescer type.

Chapter 2 - Special purpose oil systems

API	GS
1.1 General	
• 1.1.5 The PURCHASER will specify the equipment's normal operating point on the data sheets.	Refer to the equipment data sheet.
• 1.1.6 Control of the sound pressure level (SPL) of all equipment furnished shall be a joint effort of the purchaser and the VENDOR. The equipment furnished by the VENDOR shall conform to the maximum allowable SPL specified by the PURCHASER.	Oil systems shall be considered as part of the main rotating equipment supply and, as such shall comply with the contractual specified noise requirements of the package.
• 1.1.7 The PURCHASER will specify whether the seal-oil and lube-oil systems are to be separate or combined. If separate systems are specified, the means of preventing interchange of oil between the two systems shall be described in the VENDOR's proposal.	Unless otherwise specified, seal-oil and lube-oil systems shall be separate.
• 1.1.8 Where oil is supplied from a common system to two or more machines (such as a compressor, a gear, and a motor), the oil's characteristics will be specified by the PURCHASER on the basis of mutual agreement with all VENDORS supplying equipment served by the common oil system. Note: The usual lubricant employed in a common oil system is a hydrocarbon oil that corresponds to ISO Grade 32, as specified in ISO 3448.	Whenever possible, TOTAL brand lubricating oils shall be used. VENDOR shall clearly indicate in the proposal the type of lubrication oil to be used.
• 1.1.9 The system shall be designed to supply oil to all equipment specified.	VENDOR assuming full responsibility of the complete shaft line shall check the oil characteristics for the common oil system.
• 1.1.11 The seal-oil system shall be designed to serve the full range of equipment operating conditions specified. These conditions may include but are not limited to the following: a. Settling-out pressures b. Process relief valve settings c. Shop test and field run-ins	This paragraph is applicable.

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d. Start-up conditions.	
• 1.1.13 The PURCHASER will specify whether the installation is indoors (heated or unheated) or outdoors (with or without a roof) as well as the weather and environmental conditions in which the equipment must operate (including maximum and minimum temperatures and unusual humidity, dust, or corrosion conditions).	VENDOR shall supply equipment according to Project contractual environmental data.
• 1.1.15 If applicable, the PURCHASER will specify minimum requirements for clearance around and access to components (especially clearance around and access to coolers, filters and hand valves).	Special care shall be paid to location of all components to ensure safe accessibility and adequate maintainability.
• 1.1.16 Motors, electrical components, and electrical installations shall be suitable for the area classification (class group, and division or zone) specified by the PURCHASER; and shall meet the requirements of NFPA 70, Articles 500, 501, 502 and 504, or equivalent standards per Appendix A of Chapter 1; as well as local codes specified and furnished by the PURCHASER.	Electrical components shall be selected according to Project contractual specifications.
• 1.1.19 The PURCHASER will specify when and where double block and bleed valves are required for isolating a component and how they are to be arranged (see Figure 2A-22f).	Figure 2A-22f is fully applicable but the COMPANY will have the right to request double block and bleed modifications at any time to comply with the Project safety requirements.
• 1.1.20 Coolers, filters, overhead oil tanks, drain traps, accumulators, and other pressure vessels within the scope of Section VIII of the ASME Code shall conform to the code or equivalent code per Appendix A of Chapter 1 and, if specified by the PURCHASER, shall be code-stamped (see 1.9 for overhead tank requirements).	ASME code Section 8 is fully applicable unless otherwise specified.
1.1.21 The console shall perform on the test stand and on its permanent foundation within the specified acceptance criteria. After installation, the performance of the console shall be the joint responsibility of the PURCHASER and the VENDOR.	The performance of the console remains the sole responsibility of the VENDOR, even after installation.

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• 1.1.22 The VENDOR shall advise the PURCHASER of, and both parties shall mutually agree on, any special provisions that are necessary to ensure that an adequate supply of lube or seal oil or both is maintained in the event of complete failure of the lube-oil or seal-oil supply system. These provisions may include emergency pumps, accumulators, rundown tanks, and special arrangements for equipment safety and protection when the equipment decelerates. Provisions shall be adequate for coast-down 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 on the system and its components.	
• 1.1.25 In addition to the requirements of 1.1.24, the PURCHASER may specify that 100-percent radiography, magnetic particle inspection, or liquid-penetrant inspection of welds is required.	No other requirements are specified, VENDOR Standard shall apply.
1.2 Baseplates	
• 1.2.1 The system shall be designed as a console, a single or multiple package, or another arrangement as specified by the PURCHASER. Each package shall have a structural steel baseplate with all system components and related valves and manifolds mounted on the baseplate. The major components (pumps, filters, coolers and reservoir) shall be mounted directly on structural steel.	Unless otherwise specified, this paragraph is applicable with no other arrangement than those described.
1.2.5 Unless otherwise specified, all baseplates shall be provided with at least one opening or hole in each bulkhead section through which grout can be poured and vented. Each opening shall have a clear area of no less than 125 cm ² (20 in. ²) and no dimension less than 100 mm (4 in.), and each shall permit filling and venting of the entire cavity with grout under the baseplate without creating air pockets. Each hole that the grout is to be poured in shall be accessible: no	This paragraph is applicable for baseplates to be filled in with grout.

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component or piping shall be disturbed, and no tripping hazards in walk and work areas shall be created. Each hole shall also be provided with steel curbing 13 mm (1/2 in.) high to prevent accumulated oil or water from entering the grout. Vent holes at least 13 mm (1/2 in.) in diameter shall be provided for each bulkhead compartment.	
1.2.6 When specified, the baseplate shall be suitable for column mounting (that is, of sufficient rigidity to be supported at specified points) without continuous grouting under structural members. The baseplate design shall be mutually agreed on by the PURCHASER and the VENDOR.	This paragraph is applicable but the baseplate design remains under the VENDOR responsibility.
1.2.7 When epoxy grout is specified, the VENDOR shall precoat all the grouting surfaces of the mounting plates with a catalyzed epoxy primer applied to degreased white metal. The epoxy primer shall be compatible with epoxy grout. The VENDOR shall submit to the PURCHASER instructions for field preparation of the epoxy primer.	This paragraph is applicable when epoxy grout is used.
1.3 Oil reservoirs	
1.3.2.1.1 Unless otherwise approved, pumps, coolers, or filters shall not be mounted on top of the reservoir. Note: This may be a user consideration for offshore or other installations where available space is limited.	Equipment may be mounted on top of the reservoir.
1.3.4 Manways and Drains	
To ensure complete drainage, the bottom of each reservoir shall slope continuously, at least 1:50 (1/4 in./ft), to a low point. A flanged drain connection (with a valve and a blind flange) at least 50 mm (2 in.) in size shall be provided. Manway openings shall be provided which will permit unobstructed entry for inspection and cleaning of all interior compartments. If entry is required for cleaning and unless otherwise specified, manways shall be located on top of the reservoir and each manway shall be at least 60 cm x 60 cm or 45 cm in diameter (24 in. x 24 in. or 18 in.	The drain tube shall be routed to the limit of the skid. The flange shall be located outside the skid edge.

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in diameter). Internal manways are not acceptable.	

1.3.5 Features and Appendages

In addition, the oil reservoir shall be fitted with:

- A local temperature gauge
- A vent with oil mist eliminator.

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• 1.3.5.1.8 If the train is driven by a gas or steam turbine and the oil reservoir contains the seal oil, a separate connection shall be provided on the reservoir for the compressor seal oil return line. Note: This line will prevent pressurization of the steam turbine lube oil drain header if the compressor seals fail.	This paragraph is applicable.
• 1.3.5.2 On reservoirs containing seal oil, a specially sized vent is required to handle the total flow of gas coming from the failed seal(s) through the oil drain lines. The VENDOR shall provide the PURCHASER with the vent size and the sizing criteria. Note: Vents routed to flare systems or vapor recovery systems shall be provided with an overpressure protection device. The sizing of this device shall be jointly developed by the PURCHASER and the VENDOR.	This paragraph is applicable. The requirement for an overpressure protection of the vent shall be the sole responsibility of the VENDOR .
• 1.3.8 Provision for insulation When specified by the PURCHASER, reservoirs shall be fitted with insulation clips. The PURCHASER will furnish and install the insulation.	When insulation is required, it shall be purchased and installed by the VENDOR at factory before shipment.
• 1.3.12.1 When specified, an accessible ladder with extended handrails.	When applicable, the VENDOR will supply ladder with extended handrails.
• 1.3.12.2 When specified, handrails around the perimeter of the reservoir top.	When applicable, the VENDOR will supply handrails.
• 1.3.12.3 When specified, nonskid surfaces decking (checker or diamond plate or hot-dipped galvanized steel grating).	This paragraph is applicable.

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1.3.13 Materials Unless otherwise specified, reservoirs and all appendages welded to reservoirs shall be fabricated from Series 300 stainless steel in accordance with ASTM A 240. Pipe connections shall be as specified in 2.1. Note: Carbon steel appendages such as ladders and handrails may be bolted to clips welded to the reservoir.	Reservoirs and all appendages to reservoirs shall be fabricated from 316L as a minimum.
1.4 Pumps and drivers	
1.4.1 The oil system shall include a main oil pump and a standby oil pump. The main and standby pumps shall be identical and suitable for continuous operation. The PURCHASER will specify whether horizontal centrifugal or rotary pumps shall be used. Except as modified in this standard, pumps shall conform to API Std 610 or 676, respectively.	This paragraph is applicable.
1.4.3 When specified, an emergency oil pump shall be furnished to allow safe shutdown without damage to the equipment in the event that both the main and standby pumps fail. The PURCHASER will define the requirements for safe shutdown.	This paragraph is applicable but safe shutdown of equipment remains the sole responsibility of VENDOR.
1.4.4 Unless otherwise specified, oil pumps not submerged inside the reservoir shall be equipped with mechanical seals that have carbon rings with mating tungsten or silicon carbide rings; Viton gaskets and O-rings; and end plates with throttle bushings as outlined in API Std 610 .	VENDOR standard shall be clearly indicated in his proposal.
1.4.5 The PURCHASER will specify if the main oil pump will be turbine or motor driven. Note: It is recommended that the PURCHASER supply electric feeds from independent sources when two motor driven pumps are used. Note: Standby pumps are always motor-driven because of relatively long start-up times for turbine-driven pumps.	Unless otherwise specified, the main oil pump shall be shaft or electrically driven.
1.4.12.3 PURCHASER will specify the minimum inlet steam temperature and pressure and the highest exhaust pressure under which the turbine is expected to	Whenever applicable, refer to Project specifications.

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operate.	
• 1.4.19.1 When specified, a basket-type strainer shall be provided.	This paragraph is applicable.
• 1.4.25.5 When specified, the VENDOR, by bolting and unbolting piping, shall demonstrate that the pump on its baseplate is in compliance with 1.4.24.4.	This paragraph is applicable.
1.5 Coolers	
1.5.1 Twin coolers shall be provided and shall be piped in a parallel arrangement using a continuous-flow transfer valve (see 1.7).	Except for water cooled exchangers, one single air cooler is acceptable provided 2 x 100% fans are supplied (see 1.5.3.6.1).
• 1.5.1.2 When specified, a plate frame or fin fan cooler shall be supplied. The VENDOR shall include in the proposal complete details of any proposed air-cooled or plate frame cooler (see 1.5.3.5).	Unless otherwise specified, this paragraph is applicable.
• 1.5.1.3 When specified, the VENDOR shall supply connections for installation of the PURCHASER's fin fan oil cooler(s) off the oil console (see 1.5.3.6).	This paragraph is applicable.
• 1.5.1.5 The PURCHASER may specify the equalization/fill valve be locked or car sealed in the open position with the equalization/fill line orifice sized by the VENDOR for thermal expansion.	This paragraph is applicable.
1.5.3.1 Each oil cooler shall maintain the lube-oil supply temperature at or below 50°C (120°F).	This paragraph is applicable including at maximum specified ambient temperature.
1.5.3.2 Each cooler shall be sized to accommodate the total cooling load.	Each cooler shall be sized to accommodate 120% of the total cooling load. In case of air coolers, fans and motors shall be sized accordingly. A cooling air system must comply with API 661 Standard. Each cooler shall be sized for 120% of thermal load at maximum ambient temperature. If air coolers are used, two fans must be provided and the cooler must be able of thermal load with one fan electrical motor shutdown.

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	All fans, shafts, coupling and other moving parts of mechanical equipment shall be supplied with non sparking protective guards. All lubrication fittings shall be extended to points outside of guards easily accessible allowing servicing during operation without removing guards. Each fan shall be provided with a vibration shutdown switch of manual reset type, interfaced with unit control panel.
• 1.5.6.2 When specified, the temperature control valve shall be an internal thermostat operated three-port valve.	This paragraph is applicable.
• 1.5.7.1 When specified by the PURCHASER, shell-and-tube or plate frame coolers shall be suitable for use of a 150°C (300°F) heating medium, such as steam or a mixture of steam and water.	Unless otherwise specified, coolers shall not use heating medium such as steam or a mixture of steam and water.
• 1.5.8.1 When specified, duplex cooler oil drains shall be manifolded together with duplex filter clean side oil drains.	Cooler oil drains shall be manifolded with filter clean side oil only when easily practical.
• 1.5.8.2 When specified, vents on the oil side shall be piped back to the reservoir through flow indicators.	This paragraph is applicable.
• 1.5.8.3 When specified, the coolers shall be fabricated with flanged vent and drain nozzles. Screwed and seal-welded, or socket-welded pipe and flange additions to coolers after cooler certification is not acceptable.	This paragraph is applicable.
1.6 Filters	
• 1.6.1.8 The PURCHASER may specify the equalization/fill valve be locked or car sealed in the open position with the equalization/fill line orifice thermal sized by the VENDOR.	This paragraph is applicable.
• 1.6.1.9 When specified, duplex oil filter clean side oil drains shall be manifolded together with duplex cooler drains.	See 1.5.8.1
• 1.6.1.10 When specified, the filter vents shall be piped back to the oil reservoir through	This paragraph is applicable.

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flow indicators.	
• 1.6.4.2 When specified, filter element media shall be non-hydrosopic. If water contamination in the oil reaches 5% for extended time periods (up to 3 months), clean filter cartridges shall not have more than two times the clean filter pressure drop at rated oil viscosity, flow, and temperature.	This paragraph is applicable.
• 1.6.4.3 When a specific filter element or cartridge is required, the PURCHASER will completely specify the make, model number, and type of construction.	This paragraph is not applicable unless other specified.
1.7 Transfer valves	
• 1.7.1.1 The PURCHASER may specify when the flow will be switched between coolers and filters via a single transfer valve serving coolers and filters (see Figure 2A-18).	Unless otherwise specified, this paragraph is not applicable.
• 1.7.5 Spectacle blinds shall be provided if specified or if required to assure tight shutoff.	Tight shut-off valves for the maintenance of filters and coolers shall be provided.
1.8 Accumulators	
• 1.8.4 A manual precharge valve or a constant-pressure regulating system shall be furnished as specified by the PURCHASER (see Figures 2A-16).	Unless otherwise specified VENDOR standard shall apply.
• 1.8.8 When specified by the PURCHASER, the accumulator shall be equipped to maintain the contained oil at the required system oil temperature. The PURCHASER shall provide the details of the required temperature control system.	Unless otherwise specified, VENDOR standard shall apply.
1.9 Overhead tanks	
• 1.9.1.2 Each overhead seal-oil tank (see Figure 2-2) shall be sized so that the oil capacity above the low-level alarm setting is equal to a 2-minute flow at normal seal-oil rates, and each tank shall have the capacity for a 10-minute flow from low-level alarm to low-low-level shutdown, plus sufficient time	As from the low level trip, the capacity shall be such that oil is supplied to the compressor at normal flow rates over the full depressurising time of the compression unit.

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(as specified by the PURCHASER but not less than 3 minutes at normal flow rates after shutdown) for coast-down, block-in, and depressurization of the equipment. Larger tanks may be required for special operating conditions, such as rapid depressurization of high-pressure equipment. The vapor column above the high-level alarm setting shall be no less than 1 minute of normal flow. Note: The PURCHASER and the MANUFACTURER together must determine the required capacity after trip based on the compressor block-in and blowdown and the seal-oil flow rate at various conditions.	
• 1.9.1.4.5 When specified by the PURCHASER, e.g., for dirty, sludge building gas service, the reducing spacer shall project into the bottom nozzle, and a valved blow-down connection shall be provided (see Figure 2-3). The nozzle shall be at least 200 mm (8 in.) long.	This paragraph is applicable.
1.9.1.5 When specified, the reference gas shall be isolated from the seal oil by a bladder of material suitable for the service (see Figure 2A-14).	This paragraph is not applicable.
• 1.9.2.1 When specified, a separately mounted emergency lube-oil rundown tank (either atmospheric or pressurized) shall provide oil for the coast-down period specified by the PURCHASER, but this coast-down period shall not be less than 3 minutes of normal lube-oil flow (see Figures 2A-13a and 2A-13b). Unless otherwise specified, the tank shall be made of Series 300 stainless steel. Note: Coast-down time to be provided by the PURCHASER.	If a separately mounted emergency lube oil rundown tank is required, its capacity shall be such that oil is supplied to the bearings over the full rundown time till standstill.
1.10 Seal-oil Drain traps	
• 1.10.3 When specified, seal-trap vents shall be equipped with mist eliminators (with appropriate connections) to agglomerate the residual oil before the vent gas is recycled to the compressor suction or vented to other disposal outlets. Mist eliminators shall be self-draining or be provided with separate,	It is the VENDOR responsibility to provide a design which prevent oil carry-over.

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automatic drain traps.	
• 1.10.4 The seal gas vent piping arrangement shall be jointly developed by the PURCHASER and the VENDOR. Note: The arrangement of seal-gas vent piping is important to the proper function of the compressor shaft seals.	The vent piping arrangement shall be either designed by the VENDOR or approved by the VENDOR if designed by the COMPANY.
• 1.10.5 As specified by the PURCHASER, the drain line for each trap shall be piped separately to the sewer, degassing drain, or reservoir. Note: Separate piping of the drain lines allows the leakage from each seal to be monitored.	This paragraph is applicable.
1.11 Degassing drum	
Refer to 1.11.2 for definition.	
• 1.11.1 When specified by the PURCHASER, seal-oil degassing facilities shall be provided. Unless otherwise specified, the tank and internals shall be made of Series 300 stainless steel.	This paragraph is applicable but material shall be 316L as a minimum.
• 1.11.3 When specified by the PURCHASER, an electric immersion heater, steam heater, or some other method 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, its heat flow (power) density shall not exceed 2 W/cm^2 (15 W/in.^2). Electric heater elements shall be sheathed in austenitic stainless steel; copper or copper-bearing materials shall not contact the oil. The VENDOR shall provide temperature element and controls for the heater as mutually agreed to with the PURCHASER. Note: Electric immersion heaters should be interlocked by the PURCHASER to be de-energized when the oil level drops below the heater.	Unless otherwise specified, an electric immersion heater shall be provided to assist in degassing the oil. Heater shall be removable type without degassing drum draining. The degassing drum will be provided with a set of additional flanges located at the bottom for nitrogen bubbling/purging device.
1.11.5 The drum shall have a 4-hour minimum retention time, based on the guaranteed total inner-seal oil leakage rate or a minimum liquid volumetric capacity of 60 l (15 gal) per	In addition, the capacity of the degassing drum will allow the seal oil to recover 100% of its flash point original value at the end of the

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compressor body. Note: The drum shall be sized to handle the contaminated oil flow coming out of the seal-trap. The VENDOR shall provide sizing criteria.	predicted retention time.
1.11.6 When specified by the PURCHASER, the degassing drum shall be designed and constructed for pressurized service in accordance with the appropriate recognized pressure vessel codes. The degassing drum shall permit discharge of the gas to the compressor suction or to a disposal outlet.	This paragraph is applicable.
2. Piping	

Oil piping, instruments piping, process piping will be fabricated according to Project specifications requirements.

3. Instrumentation, Control and Electrical Systems

- 3.1.3 Arrangement 1

Not applicable.

- 3.1.4 Arrangement 2

Not applicable.

- 3.1.5 Arrangement 3

This paragraph is applicable.

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3.1.5.4 The shutdown and alarm function outputs from the three multipoint instruments shall be connected through "two out of three" voting logic. The arrangement shall allow operation of any one alarm or shutdown function that will initiate an alarm; operation of two shutdown functions monitoring the same parameter that will initiate a separate alarm and shall cause the served equipment to shutdown.	The first sentence of this paragraph is not applicable (no voting logic).
3.2 Instrumentation	

Instrumentation, Control Systems will be designed and fabricated according to Project specifications requirements.

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3.2.1.1 Straight thermometer	
Dial-type temperature indicators shall be heavy-duty and corrosion-resistant. They should be at least 125 mm (5 in.) in diameter and bimetallic-type or fluid-filled. Black printing on a white background is standard for gauges. Temperature indicators shall be located per the data sheets.	
3.2.7.2 When continuously energized solenoids are specified for trip circuits, the VENDOR shall provide the PURCHASER with the coil rating and estimated service life of each solenoid coil based on continuous energized operation. Dual coil solenoids may be specified for any trip function. Each coil shall be capable of keeping the solenoid in its energized condition. Separate relays shall energize each coil.	This paragraph is applicable.
3.2.8.3 When specified, thermal relief valves shall be provided for components that may be blocked in by isolation valves.	This paragraph is applicable.

4. Inspection, testing and preparation for shipment

4.1 General

Inspection, testing, and preparation for shipment shall be in accordance with Section 7, Chapter 1, unless otherwise specified in this section.

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4.1.1 When specified, the PURCHASER's or the VENDOR's representative will indicate compliance in accordance with the inspector's checklist (Appendix C) by initialing, dating, and submitting the completed checklist to the PURCHASER prior to shipment.	This paragraph is applicable.

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4.3 Testing	
● 4.3.1.2 The PURCHASER will specify whether the purchased oil system shall be used during the shop testing of the equipment. ● 4.3.1.3 Complete-unit tests or other tests of the oil system and the equipment it serves shall be performed in place of or in addition to separate tests of the oil system as specified by the PURCHASER. Details of these tests shall be developed jointly by the PURCHASER and the VENDOR.	The entire purchased oil system shall be used in case of string test and/or full load test of the main equipment. In all other cases, this shall be mutually agreed between COMPANY and MANUFACTURER.
● 4.3.3.9 When specified, the VENDOR, by unbolting and rebolting pump inlet and discharge piping, shall demonstrate that the pump on its baseplate is in compliance with 1.4.24.4.	This paragraph is applicable.

Chapter 3 - General purpose oil systems

API	GS
1.2 General	
• 1.2.5 The PURCHASER will specify the equipment's normal operating point on the data sheets. • 1.2.6 Control of the sound pressure level (SPL) of all equipment furnished shall be a joint effort by the PURCHASER and the VENDOR. The equipment furnished by the VENDOR shall conform to the maximum allowable SPL specified by the PURCHASER.	See comments Chapter 2 Paragraphs 1.15 / 1.16.
• 1.2.7 Where oil is supplied from a common system to two or more machines (such as a compressor, a gear, and a motor), the oil's characteristics will be specified on the data sheets on the basis of mutual agreement with all VENDORS supplying equipment served by the common oil system. Note: The usual lubricant employed in a common oil system is a hydrocarbon oil that corresponds to ISO Grade 32, as specified in ISO 3448.	See comments Chapter 2 paragraph 1.18.
• 1.2.8 The system shall be designed to supply oil to all equipment specified by the PURCHASER.	See comments Chapter 2 paragraph 1.19.
• 1.2.10 The PURCHASER will specify whether the installation is indoors (heated or unheated) or outdoors (with or without a roof) as well as the weather and environmental conditions in which the equipment must operate (including maximum and minimum temperatures and unusual humidity, dust, or corrosion conditions).	See comments Chapter 2 paragraph 1.1.13.
• 1.2.11 When specified, the arrangement of the equipment, including piping and auxiliaries, shall be developed jointly by the PURCHASER and the VENDOR. The arrangement shall provide adequate clearance areas and safe access for operation and maintenance. Note: For some pre-engineered general purpose oil systems, PURCHASER input may be impractical.	See comments Chapter 2 paragraph 1.1.15.

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• 1.2.12 If applicable, the PURCHASER will specify minimum requirements for clearance around and access to components (especially clearance around and access to coolers, filters, and hand valves).	
• 1.2.13 Motors, electrical components, and electrical installations shall be suitable for the area classification (class, group and division or zone) specified on the data sheets and shall meet the requirements of NFPA 70, Articles 500, 501, 502 and 504 or equivalent standards per Appendix A, Chapter 1, as well as local codes specified and furnished by the PURCHASER (see 6.5.1, Chapter 1).	See comments Chapter 2 paragraph 1.1.16.
• 1.2.14 When specified, pumps, filters, strainers, coolers, traps, valves, and all other components that retain oil under pressure and are external to the reservoir shall be made of steel.	Identical to Chapter 2 paragraph 1.1.17 and applicable.
• 1.2.16 When specified, valved vents, drains and piping shall be furnished to permit draining, cleaning, and refilling of idle components while the equipment is in operation.	Identical to Chapter 2 paragraph 1.1.18 and applicable.
• 1.2.17 Coolers, filters, overhead rundown tanks, and other pressure vessels within the scope of Section VIII of the ASME Code shall conform to the code or equivalent code per Appendix A, Chapter 1, and, if specified, shall be code-stamped (see 1.9 for lube oil rundown tank requirements).	Identical to Chapter 2 paragraph 1.1.20. See comments Chapter 2 paragraph 1.1.20.
1.3 Baseplates	
• 1.3.5 When specified, console shall be suitable for grouting. • 1.3.6 When specified, the baseplate shall be suitable for column mounting (that is, of sufficient rigidity to be supported at specified points) without continuous grouting under structural members. The baseplate design shall be mutually agreed on by the PURCHASER and the VENDOR.	See comments Chapter 2 paragraph 1.2.6 / 1.2.7.

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• 1.3.7 When specified, all welding other than that covered by Section VIII, Division 1, of the ASME Code and ASME B31.3, such as welding on baseplates, nonpressure ducting, lagging, and control panels, shall be performed in accordance with AWS D1.1 or equivalent code per Appendix A, Chapter 1.	This paragraph is applicable unless otherwise specified.
1.4 Oil Reservoirs	
• 1.4.4.3 When specified, to ensure complete drainage, the bottom of each reservoir shall be sloped to a low-point drain. • 1.4.4.4 When specified, a flanged drain connection (with a valve and a blind flange) at least 50 mm (2 in.) in size shall be provided.	This paragraph is applicable. See Chapter 2 paragraph 1.3.4.
• 1.4.5.1.4 When specified, an oil level glass arranged to cover the span from at least 25 mm (1 in.) above the rundown level to 50 mm (2 in.) below the pump suction-loss level. The oil level glass shall be located as far away as possible from the oil return lines and be visible from the perimeter of the unit. The maximum and minimum operating levels, rundown level, and suction-loss level shall be indicated on the glass. If more than one level glass is provided, they shall be offset. The top glass shall be of the weld pad type.	See Chapter 2 paragraph 1.3.5.1.3. This paragraph is applicable.

- **1.4.5.4.6** See Chapter 2 paragraph 1.3.5.1.4. This paragraph is applicable.

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• 1.4.6.1.11 When specified, a low-level alarm which actuates at the minimum operating level shall be provided.	See Chapter 2 paragraph 1.3.6.1.11. This paragraph is applicable.
• 1.4.7.1 PURCHASER shall specify if an electric heater shall be furnished.	See Chapter 2 paragraph 1.3.7.1. This paragraph is applicable.
• 1.4.7.1.2 When specified, electric heaters shall have a maximum watt density of 2.32 W/cm² (15 W/in.²).	See Chapter 2 paragraph 1.3.7.2.2. This paragraph is applicable.
• 1.4.8 Provision for Insulation	

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When specified by the PURCHASER, reservoirs shall be fitted with insulation clips. The PURCHASER will furnish and install the insulation.	See comments Chapter 2 paragraph 1.3.8
1.4.9 Plugged connections When specified, each reservoir shall be provided with one threaded and plugged connection at least 25 mm (1 in.) in size above the run-down oil level. This connection may be used for such services as purge gas, make up oil supply, and oil conditioner return.	See Chapter 2 paragraph 1.39. This paragraph is applicable.
1.5 Pumps and drivers	
1.5.1 As a minimum, the oil system shall include an oil pump suitable for continuous operation. An ASME B73.1 horizontal centrifugal or vertical centrifugal (submerged or ASME B73.2 inline), rotary positive displacement, or API pump shall be used.	See comments Chapter 2 paragraph 1.4.1.
1.5.4 When specified, a turbine-driven pump shall be supplied as the main oil pump.	See comments Chapter 2 paragraph 1.4.5.
1.5.4.1 When specified, and when a shaft-driven pump is supplied, an electric-driven stand-by pump shall be provided for start-up and main pump failure backup.	This paragraph is applicable.
1.5.14 When specified, for the protection of externally-mounted centrifugal pumps during flushing and for the initial operation of new oil systems, a removable strainer that is made from ASTM Series 300 stainless steel and has an open flow area equal to 150 percent of the cross-sectional area of the suction pipe shall be installed in the suction piping of each pump between the pump suction flange and the block valve. The temporary strainer shall be identified by a protruding tab and shall have a mesh size adequate to stop all objects that would be injurious to the pump. The piping arrangement shall permit the removal of the strainer without disturbing the alignment of the pump. Note: Strainer can be cone, basket, or Y-type.	This paragraph is applicable.

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● 1.5.19.1 When specified, mounting pads shall be provided for each pump and its driver. Pads shall be larger than the feet of the mounted equipment to allow for leveling of the console or package baseplate without removal of the equipment. The pads shall be fully machined flat and parallel. Corresponding surfaces shall be in the same plane within 150 $\mu\text{m/m}$ (0.002 in./ft) of distance between the pads.	This paragraph is applicable.
1.6 Coolers	
● 1.6.1.2 When specified, a plate frame or fin fan cooler shall be supplied. The VENDOR shall include in the proposal complete details of any proposed air-cooled or plate frame cooler. ● 1.6.1.3 When specified, the VENDOR shall supply connections for installation of the PURCHASER's fin fan oil cooler(s) off the oil console.	See comments Chapter 2 paragraph 1.5.1.2 / 1.5.1.3.
● 1.6.1.7 When specified, for duplex cooler arrangements, the VENDOR shall provide thermal overpressure protection of the oil side of the coolers by providing separate thermal relief valves (see 1.6.1.6).	VENDOR will provide thermal relief valve when required.
● 1.6.2 When specified, a cooling water system or systems shall be designed for the following conditions: a. Velocity over heat exchange surfaces: 1.5 to 2.5 m/s (5 to 8 ft/s). b. Maximum allowable working pressure: ≥ 6.9 barg (≥ 100 psig) c. Test pressure: $\geq 1.5 \times \text{MAWP}$, 10.4 barg ($\geq 150$ psig). d. Maximum pressure drop: 1 bar (15 psi) e. Maximum inlet temperature: 30°C (90°F) f. Maximum outlet temperature: 50°C (120°F) g. Maximum temperature rise: 20 K (30°F) h. Minimum temperature rise: 10 K (20°F)	Identical to Chapter 2 paragraph 1.5.2. This paragraph is applicable.

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i. Fouling factor on water side: $0.35 \text{ m}^2\text{K/kW}$ ($0.002 \text{ hr-ft}^2\text{-}^\circ\text{F/Btu}$). Provision shall be made for complete venting and draining of the system or systems. Note: The VENDOR shall notify the PURCHASER if the criteria for minimum temperature rise and velocity over heat exchange surfaces result in a conflict. The criterion for velocity over heat exchange surfaces is intended to minimize water-side fouling; the criterion for minimum temperature rise is intended to minimize the use of cooling water. The PURCHASER will approve the final selection.	
• 1.6.3.4.1 When specified, a removable-bundle design is required for shell-and-tube coolers with more than 0.5 m^2 (5 ft^2).	This paragraph is applicable.
• 1.6.3.4.6 When specified, the oil-side operating pressure shall be higher than the water-side operating pressure. Note: If selected for general-purpose oil system, this requirement may mandate the oil-pump discharge pressure be well above the lubricated equipment required oil pressure.	Identical to Chapter 2 paragraph 1.5.3.4.6. This paragraph is applicable.
• 1.6.3.5 When specified, and in addition to the requirements of 1.6.3.1 through 1.6.3.3, multiplate type coolers shall have plates of austenitic stainless steel, or as specified by the PURCHASER. • 1.6.3.6 When specified, and in addition to the requirements of 1.6.3.1 through 1.6.3.3, fin fan type coolers shall comply with 1.6.3.6.1 through 1.6.3.6.2.	Each paragraph is applicable.
• 1.6.4 When specified, cooler shells, channels, and covers shall be made of steel.	This paragraph is applicable.
• 1.6.5 When specified, an oil by-pass line around the cooler with a temperature control valve shall be included to regulate the oil supply temperature. This includes oil systems where the PURCHASER supplies the cooler. In no case, however, shall oil by-pass the filter. The control valve shall comply with 1.6.5.1 through 1.6.5.4. Note: When fouling or freezing of the water side of a cooler is a factor, and oil temperature is regulated by adjusting water flow through the cooler, it is possible for	This paragraph is applicable.

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the cooler water side to silt up or freeze and break at low water flow rates.	
• 1.6.5.1 When specified, the oil by-pass valve shall be a thermostatically operated three-port valve.	See comments Chapter 2 paragraph 1.5.6.2.
• 1.6.5.2 When specified, the temperature control valve shall be provided with a manual override that permits operation independent of temperature conditions.	Identical to Chapter 2 paragraph 1.5.6.3. This paragraph is applicable.
• 1.6.5.4 When specified, the temperature control valve body shall be stainless steel.	Unless otherwise specified, this paragraph is applicable.
• 1.6.6.1 When specified by the PURCHASER, shell and tube or plate frame coolers shall be suitable for use of a 150°C (300°F) heating medium, such as steam or a mixture of steam and water.	Identical to Chapter 2 paragraph 1.5.7.1. See comments Chapter 2 paragraph 1.5.7.1.
• 1.6.7 When specified, both the water side and the oil side of the cooler shall be provided with NPS plugged or flanged and blinded drains and vents.	This paragraph is applicable.
1.7 Filters	
• 1.7.2 When specified, replaceable filter shall provide a minimum particle removal efficiency (PRE) for 10 micron particles of 90 percent ($\beta_{10} \geq 10$) and a minimum PRE of 99.5 percent for 15 micron particles ($\beta_{15} \geq 200$), both per ISO 4572 when tested to a minimum terminal differential pressure of 3.5 bar (50 psid). Filter installation shall comply with 1.7.3.1 through 1.7.3.7. Note: See Appendix E of Chapter 1, for additional information concerning filter ratings.	Identical to Chapter 2 paragraph 1.6.1. This paragraph is applicable.
• 1.7.3 When specified, duplex filters shall be provided.	Duplex filters shall be provided.
• 1.7.3.8 For duplex filter arrangements (see 1.7.3), the PURCHASER may specify thermal overpressure protection of the off-line filter.	Identical to Chapter 2 paragraph 1.6.1.8. This paragraph is applicable.
• 1.7.6.2 When specified, filter element media shall be non-hygroscopic. If water	Identical to Chapter 2 paragraph 1.6.4.2. This

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contamination in the oil reaches 5% for extended time periods (up to 3 months), clean filter cartridges shall not have more than two times the clean filter pressure drop at rated oil viscosity, flow, and temperature.	paragraph is applicable.
1.7.6.3 When a specific filter element or cartridge is required, the PURCHASER will completely specify the make, model number, and type of construction.	Unless otherwise specified, VENDOR standard shall apply.
1.8 Transfer Valves	
1.8.1.1 The PURCHASER may specify individual transfer valves independently serving each cooler and filter set (see Figure 2A-17).	Identical to Chapter 2 paragraph 1.7.1. This paragraph is applicable.
1.8.5 Spectacle blinds shall be provided if specified or if required to assure tight shut-off. Note: Transfer valves are not intended to be used as tight shut-off devices for the maintenance of filters and coolers (see 4.3.3.5.7).	Identical to Chapter 2 paragraph 1.7.5. See comments Chapter 2 paragraph 1.7.5.
1.9 Lube-oil Rundown Tanks	
1.9.1 When specified, a separately mounted emergency lube-oil rundown tank (either atmospheric or pressurized) shall provide oil for the coast-down period specified by the PURCHASER, but this coast-down period shall not be less than 3 minutes of normal lube-oil flow (see Figures 2A-13a and 2A-13b). Unless otherwise specified, the tank shall be made of Series 300 stainless steel. Note: Coast-down time is to be provided by the PURCHASER. (This is normally furnished by the SUPPLIER of the equipment served by the oil system, i.e., the rotating equipment SUPPLIER).	A lube oil rundown tank will be provided if no emergency back up is supplied by the VENDOR .
2. Piping	
2.1.2.2 When specified. Radiographic requirements associated with pipe fabrication shall be per ASME B31.3 or the equivalent code per Appendix A, Chapter 1.	Unless otherwise specified, Project specifications requirements are applicable.

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3. Instrumentation and Electrical Systems	
• 3.1.1 As a minimum, the VENDOR shall furnish and mount the alarm and shutdown contacts specified. The alarm setting shall precede the shutdown setting. Recommended alarms and shutdowns are shown in Table 1, Chapter 2.	Instrumentation and electrical systems will be designed and fabricated according to Project specifications requirements.
4. Inspection, Testing, and Preparation for Shipment	
• 4.1.1 When specified, the PURCHASER's or the VENDOR's representative shall indicate compliance in accordance with the inspector's checklist (Appendix C) by initialing, dating, and submitting the completed checklist to the PURCHASER prior to shipment.	Identical to Chapter 2 paragraph 4.1.1. This paragraph is applicable.
4.3 Testing	
• 4.3.1.2 The PURCHASER will specify whether the purchased oil system shall be used during the shop testing of the equipment. • 4.3.1.3 Complete-unit tests or other tests of the oil system and the equipment it serves shall be performed in place of or in addition to separate tests of the oil system as specified by the PURCHASER. Details of these tests shall be developed jointly by the PURCHASER and the VENDOR. • 4.3.1.4 When specified, the VENDOR, by bolting and unbolting piping, shall demonstrate that the pump on its baseplate is in compliance with 1.5.18.2.	Identical to Chapter 2 paragraphs 4.3.1.2, 4.3.1.3 and 4.3.3.9. See Chapter 2 paragraphs 4.3.1.2/4.3.1.3/4.3.3.9 comments.
5. VENDOR's Data	
• 5.1.1 When specified, a coordination meeting shall be held, within 4 to 6 weeks after the purchase commitment. Unless otherwise specified, the VENDOR will prepare and distribute an agenda prior to this meeting, which, as a minimum, shall include review of the following items: a. The purchase order, scope of supply, unit	Identical to Chapter 2 paragraph 5.1.1. This paragraph is applicable.



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responsibility and SUBVENDOR items. b. The data sheets. c. Applicable specifications and previously agreed-on exceptions. d. Schedules for transmittal of data, production, and testing. e. The quality assurance program and procedures. f. Inspection, expediting, and testing. g. Schematics and bills of material. h. The physical orientation of the components, piping, in the auxiliary systems. i. Other technical items.	

Chapter 4 - Self acting gas seal support system

API	GS
1.3 System Selection	
1.3.1 Appendix A provides schematics of typical system components and diagrams of typical, complete dry gas seal support systems and modules. These schematics and diagrams illustrate the general philosophy and requirements of this standard and are included to assist the PURCHASER in the selection of an appropriate system. The PURCHASER and the VENDOR shall mutually agree on an acceptable system.	Two systems are acceptable: - Tandem dry gas seals with intermediate labyrinth (Fig. 4A2) with associated COMPANY schematic. See revised Appendix A. - Tandem dry gas seals without intermediate labyrinth (Fig. 4A3) with associated COMPANY schematic. See revised Appendix A. Unless otherwise specified, Figure 4A2 shall apply. Compressor MANUFACTURER will be fully responsible for the selection of the dry gas seals as per COMPANY VENDOR list and all associated components for logic, control and detection of malfunctions. Unless otherwise specified, heat tracing and insulation shall be provided from compressor casing tie-in point up to dry gas seals housing.
2. Basic Design	
2.1.2 The PURCHASER will specify the VENDOR responsible for each portion of the design, scope of supply, installation, and performance of the dry gas seal system. If the PURCHASER is not the end user, then the end user will approve the VENDORS specified (see Appendix B).	Refer to 1.3.1.
2.1.3 The PURCHASER will specify the equipment's normal operating point.	Compressors operating points are specified on COMPANY project data sheet.
2.1.5 The dry gas seal module shall be designed to serve the full range of equipment operating conditions specified. These conditions may include but are not limited to the following: - Settling-out pressures - Process relief valve settings - Shop test and field run-ins	VENDOR shall provide the seals gas phase envelope curve.

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d. Start-up conditions e. Gas composition. Note: To eliminate the possibility of liquid entering the self-acting seal, all gas streams into the seal should be provided at a temperature 20 degrees above their dew point. On most systems, the discharge temperature of the compressor gas stream will provide this dew point margin.	
• 2.1.6 The PURCHASER will specify the maximum sealing pressure.	Maximum sealing pressure will be confirmed to compressor MANUFACTURER when process studies are completed.
• 2.1.8 The PURCHASER will specify when and where double block and bleed valves are required for isolating a component and how they are to be arranged (see Figure 2A-22F).	The VENDOR shall be fully responsible to deliver equipment safe for operation and maintenance.
• 2.1.9 Filters, drain traps, and other pressure vessels within the scope of Section VIII of the ASME Code shall comply with the code. The PURCHASER will specify if Section VIII vessels shall be code-stamped. Note: Most vessels for gas seal module will be smaller than the size required for code stamp.	Unless otherwise specified, this paragraph is applicable.
• 2.1.11 The VENDOR shall advise the PURCHASER of, and both parties shall mutually agree on, any special provisions that are necessary to ensure that an adequate supply of seal gas and seal buffer gas or seal separation gas is maintained in the event of complete failure of the seal gas supply system. These provisions may include back-up gas bottles and special arrangements for start-up. Provisions shall be adequate for block in vent or purge situations as applicable. The PURCHASER will specify the required block-in time. The PURCHASER and the VENDOR shall mutually agree on the system and its components. Note: The seal and support system may need to be purged at start-up.	VENDOR shall provide a drain with float trap or sight glass with manual drain valve between secondary and tertiary seals for oil leaks detection. In case of gas turbine driven compressors, VENDOR shall insure that the DC lube oil pump shall not supply the compressor bearings.
2.4 Transfer Valves	
• 2.4.3 When specified, provide a strainer with 100-mesh screen when zero leakage	Transfer valves will be tight shutoff type. In all cases, VENDOR shall provide a strainer to be

API	GS
(bubble tight) transfer valves are supplied. Note: This will prevent particulate damage to the valve seat and help to maintain performance.	integrated in valve body.
3 Instrumentation, Control, and Electrical Systems	

• 3.2.2 & 3.2.3 Arrangement 1 and Arrangement 2

This paragraph is not applicable.

In all cases including pressurization, start-up, acceleration, normal operation, extended pressurized shutdown, depressurized shutdown, the seal gas shall filtered and heated considering:

- The phase envelope curve plus a specified margin of 20°C.
- Prevention of hydrate formation.

The resulting seal gas supply design shall be fully detailed in the VENDOR offer and shall conform to the attached schematic as a minimum.

Nitrogen shall be filtered and pressure controlled as necessary to meet the dry gas seal VENDOR requirements.

Unless otherwise specified, gas leaks from primary seals shall be piped to the plant pressurized flare system.

Leakages from secondary seals shall be routed to the atmosphere. Each compressor casing shall have its dedicated vent pipe terminated with a flame arrestor to be provided by VENDOR.

• 3.2.4 Arrangement 3

This paragraph is applicable

Refer to COMPANY schematics in appendix

Primary/secondary seal: malfunction detection will be implemented through compressor UCP with alarm and shutdown conditions. When nitrogen buffer is provided between primary and secondary seals, the compressor pressurisation will not be possible if nitrogen pressure is in alarm and shutdown conditions.

Tertiary seal : Buffer fluid pressure set point will prevent the compressor lube oil system to be started if the preset value is not correct. Alarm and shutdown conditions will be connected to compressor UCP.

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3.2.4.3 The shutdown and alarm function outputs from the three multipoint instruments shall be connected through “two out of three” voting logic and shall allow the operation of any one alarm or shutdown function to initiate an alarm. Operation of two shutdown functions monitoring the same parameter will	The first sentence of this paragraph is not applicable (no voting logic).

API	GS
initiate a separate alarm and shall cause the served equipment to shutdown.	
3.3.1.4 When specified, seal gas flow measurement shall be by an electronic device such as a linear mass flow meter, venturi, or turbine type. The PURCHASER will specify whether the readout device is to be supplied by module MANUFACTURER or by the PURCHASER.	Flow measurement device will be supply by the VENDOR
4. Inspection, Testing, and Preparation for Shipment	
• 4.1.1 When specified, the PURCHASER's or the VENDOR's representative or both shall indicate compliance in accordance with the inspector's checklist (Appendix C) by initialing, dating, and submitting the completed checklist to the PURCHASER prior to shipment.	This paragraph is applicable.
• 4.3.1.2 When specified, the self-acting gas seal module shall be used during the main equipment's mechanical run test. • 4.3.3.4 When specified, a functional test proposed by the VENDOR and agreed to by the PURCHASER of the self-acting seal gas module shall be performed at the VENDOR's shop.	This paragraph is applicable.