Engineering Standard

SAES-G-115 30 September, 2003
Lubrication, Shaft Sealing
and Control Oil Systems

Saudi Aramco DeskTop Standards

Table of Contents

1 Scope

This Standard defines the minimum mandatory requirements governing the design and installation of lubrication, shaft sealing and control oil systems for special purpose applications. This standard is not applicable to combustion gas turbine lubrication systems. This standard may not be attached to or made a part of purchase orders.

2 Conflicts and Deviations

2.1 Any conflicts between this Standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs) or industry standards, codes and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department, Saudi Aramco, Dhahran.

2.2 Direct all requests to deviate from this Standard in writing to the Company or Buyer Representative, who shall follow internal company procedure SAEP-302 and forward such requests to the Manager, Consulting Services Department, Saudi Aramco, Dhahran.

3 References

The selection of material and equipment and the design, construction, maintenance and repair of equipment and facilities covered by this Standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

SAEP-302	*Instruction for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Standard*

Saudi Aramco Engineering Standards

SAES-A-112	*Meteorological and Seismic Design Data*
SAES-G-116	*Field Cleaning and Flushing of Lube/Seal Oil Systems*

Saudi Aramco Materials System Specifications

01-SAMSS-017	*Auxiliary Piping for Mechanical Equipment*
17-SAMSS-515	*Auxiliary Electrical Systems for Skid-Mounted Equipment*

32-SAMSS-013	*Lubrication, Shaft Sealing and Control Oil Systems for Special Purpose Applications*
34-SAMSS-831	*Instrumentation for Packaged Units*

Saudi Aramco Forms and Data Sheets

SA-8004-ENG & SA-8004-M-ENG	*Lubrication, Shaft Sealing and Control Oil Systems Data Sheet*

Saudi Aramco Standard Drawing

AA-036281	*Arrangement 3 (CW) Mechanical Seals, Centrifugal Pumps Plan 54*

3.2 Industry Codes and Standards

American Petroleum Institute

API STD 614	*Lubrication, Shaft Sealing and Control Oil Systems for Special Purpose Applications*

4 Design

4.1 General

4.1.1 Lubrication, shaft sealing and control oil systems for special purpose applications shall be in accordance with 32-SAMSS-013.

4.1.2 The system layout shall be such that all system components including locally mounted indicators, switches, controllers, transmitters etc., are easily accessible for maintenance purposes. Indicators throughout the system shall be easily legible from the sides of the console.

4.1.3 Piping shall be in accordance with 01-SAMSS-017. Piping layout shall be designed to ensure maximum accessibility to all system components. Flanged connections shall be provided to facilitate assembly/removal of piping without the necessity to remove other system components.

4.2 System Schematics

4.2.1 Barrier fluid systems for pressurized dual mechanical seals of centrifugal pumps shall be in accordance with Standard Drawing AA-036281.

4.2.2 Wherever possible, system components shall be in accordance with options set forth in API STD 614, chapter 2, Appendix A.

4.3 Baseplates

4.3.1 Compressor oil systems may be installed on the main equipment baseplate.

4.3.2 Barrier fluid systems in accordance with Standard Drawing AA-036281 shall be mounted on a console together with the lube oil system if applicable. For offshore and restricted space applications, the systems may be mounted on the main equipment baseplate if so specified.

4.3.3 Oil systems for centrifugal pump trains shall normally be installed on a separate console. For offshore or other restricted space applications systems may be mounted integrally with the main baseplate.

4.4 Reservoirs

Optional requirements for reservoir per API STD 614, Figure 2A-21, for the various oil systems shall be in accordance with Table 1.

Table 1 – Selection Table for Reservoir Design Options

Type of Oil System	Lube Oil	Lube/Seal Oil	Seal Oil	Barrier Fluid
Option				
2A-21 a	Yes	Yes	Yes	No
2A-21 b	(2)	Yes	Yes	(2)
2A-21 c	Yes	Yes	Yes	(1)
2A-21 d	(2)	Yes	Yes	(2)
2A-21 e	No	No	No	No

NOTES:

(1) If required by mechanical seal manufacturer.

(2) Only if purifier is available at site.

If the reservoir is provided with a vapor extraction system, the air inlet and exhaust shall be positioned at corners of the reservoir, diagonally to each other. Gases shall be vented to a safe area.

4.5 Pumps and Drivers

4.5.1 The use of an emergency lube oil pump or a rundown tank shall be considered for each individual application.

4.5.2 For all applications, lube and seal oil pumps shall always be driven by their own drivers. Main shaft driven pumps are not permitted.

4.5.3 Main and stand by pumps shall be instrumented to allow each to operate as main or standby units. Switch-over circuitry shall include automatic switching from standby to operating unit.

4.5.4 Reservoir top-mounted submerged pumps shall have a block and check valve in the pump discharge line. In addition, free standing pumps shall have a block valve in the suction line.

4.5.5 The use of a booster pump for a combined compressor lube and seal oil system shall be considered for each individual application. The application of a booster pump is influenced by the required seal oil pressure level.

4.6 Coolers

4.6.1 An economic evaluation shall be made to select either a shell-and-tube type, a plate type or an air cooled air heat exchanger.

4.6.2 Exchangers utilizing seawater as the cooling fluid shall be subject to a design inlet cooling water temperature of 35°C for summer conditions and 10°C for winter conditions. The maximum permissible cooling water outlet temperature shall be 50°C.

4.6.3 Where raw well water is used as the cooling fluid, the design cooling water inlet temperature shall be established from actual reservoir water data.

4.6.4 All coolers shall be provided with a bypass with temperature control valve except for small coolers where the Vendor is allowed to supply his standard cooler design. Temperature control shall be such that upon valve failure, the oil shall be routed through the cooler.

4.6.5 A high/low temperature transmitter or switch, option 2A-17b of API STD 614, will be required for compressor lube and seal oil systems. For lube oil and barrier fluid systems for centrifugal pumps, the transmitters or switches shall be installed as indicated on Standard Drawing AA-036281.

4.6.6 For water-cooled heat exchangers, the oil pressure shall be higher than the cooling water pressure.

4.6.7 For air-cooled heat exchangers, the design shall be based on minimum site temperatures as specified in SAES-A-112.

4.7 Filters

A differential pressure transmitter with local indicator is required unless a differential pressure indicator is shown on the relevant Standard Drawing.

4.8 Accumulators

4.8.1 Bladder type accumulators for control oil systems and barrier fluid systems shall be in accordance with Figure 2A-15 of API STD 614. The design shall include provisions for complete venting.

4.8.2 The bladder material shall not deteriorate by contact with the lube and/or seal oil or the pressurizing gas. The capacity and number of accumulators shall be determined by the system Vendor.

4.8.3 Charge gas connection block valves shall be of the tight shutoff design.

4.9 Overhead Tanks

4.9.1 For sour gas applications {50 ppm H_2S or more} with liquid film seals, the use of an overhead tank system similar to Figure 2A-14 of API STD 614 is required.

The bladder type transfer barrier vessel is more reliable if kept to a smaller size and will require multiple vessels to supply to rundown requirement of the system as specified in paragraph 1.9.1.2 of 32-SAMSS-013, chapter 2. A single overhead tank can be common to the barrier vessels.

For sweet gas applications, the barrier vessels are not required and the reference gas can be in direct contact with the seal oil in an overhead tank.

For non liquid film seal applications, a rundown tank may be required to provide adequate pressure and lubrication to the seal faces during rundown or loss of seal oil pressure.

4.9.2 The overhead tank high level shall normally be annunciated according to API STD 614 Figure 2A-14, option 2A-14c.

4.9.3 The action of the level control valve per API STD 614 Figure 2A-14, option 2A-14d, shall normally open upon failure.

4.9.4 For compressors, an emergency lube oil pump or a rundown tank in accordance with API STD 614 Figure 2A-13A is required.

For other applications, the requirement for a lube oil rundown tank in accordance with API STD 614 Figure 2A-13A shall be determined on

an individual basis. Parameters influencing the necessity for a lube oil rundown tank are:

a) Post shutdown lubrication requirements
b) Availability of DC power
c) Vendor's recommendations

4.10 Seal Oil Drain Traps

4.10.1 Normally, for compressors in a closed loop, the drain trap vents shall be returned to the compressor suction piping. For compressors in sweet gas service, the vents may be returned to the compressor suction or the flare header. In sour gas service, the vents shall be piped to the flare header and the oil shall be piped to a reclamation system or to the low pressure hydrocarbon sewer.

4.10.2 Demisters in accordance with API STD 614 option 2A-12d will always be required in closed loop compressor installations.

4.10.3 The installed elevation of the drain traps shall ensure proper draining when operating at the lowest compressor suction pressure.

4.11 Degassing Drums

4.11.1 A degassing drum will be required when contaminated seal oil contains dissolved process gas which can readily separate at atmospheric pressure, such as hydrogen or light (sweet) hydrocarbon gasses.

4.11.2 Degassing drums shall be equipped with a vapor extracting system disposing gasses to a safe area.

4.12 Controls and Instrumentation

4.12.1 Normally, a gauge board will be required to include panel mounted indicators and switches. A control station which could include hand switches, push buttons and annunciation lights may be included on the same panel board provided that their enclosures meet the area classification requirements and the installation is in accordance with the requirements of 34-SAMSS-831 and 17-SAMSS-515.

4.12.2 If the layout and system complexity allows locally mounted indicators, switches and transmitters may also be locally mounted or may be included on a switch rack. The latter is preferred, in view of ease of installing field wiring.

4.12.3 Motor control centers will normally be located in the plant's switchgear room and consequently are not part of the oil system Vendor's scope of supply. Local circumstances may dictate alternate scope of supply requirements which should be evaluated on an individual basis.

4.12.4 When the oil system is an integral part of the main baseplate, switch racks, gauge boards and panels shall also be mounted on the main baseplate. When the oil system is mounted on a separate console, switch racks, gauge board and panels shall be mounted on the edge of the console.

4.12.5 Switch rack, gauge board and panel layouts, together with mounting locations are subject to review and approval by the Coordinator, Electrical Systems Division, Consulting Services Department.

5 Installation

5.1 All piping connections for the lube and seal oil system shall terminate in a flanged connection at the edge of the baseplate.

5.2 All instrumentation and controls requiring an electrical supply shall be wired to terminal boxes. The terminal boxes may be included on the gauge board or may be mounted on the edge of the console to facilitate ease of installing field wiring. Separate terminal boxes are required for AC and DC signals per 34-SAMSS-831. Electrical installations shall be in accordance with 17-SAMSS-515.

5.3 Water cooled heat exchangers may be mounted within the confines of the system console. Air-cooled heat exchangers shall be free-standing.

5.4 For systems which include accumulators, the availability of a suitable charge gas at site shall be verified. Unless the system Vendor recommends otherwise, nitrogen shall be used for charging accumulators.

5.5 Unless plant layout prohibits, oil or barrier fluid systems shall be installed parallel to the longitudinal side of the main equipment baseplate. It shall be ascertained that the system location shall not obstruct accessibility to the main equipment for maintenance or operation purposes.

5.6 Reservoir installation elevation shall ensure proper drainage of the oil return piping.

5.7 For a large or complex system, a scale model of the system may be desired, with particular attention being paid to operability and maintainability, to ensure satisfactory unit layout. The need for a scale model shall be considered for each

individual application. 3-D CAD drawings are an acceptable and often preferred alternative to scale models.

5.8 The system shall be flushed on site in accordance with SAES-G-116.

6 Testing and Inspection

6.1 Single lift package systems shall be completely piped, wired and tested under controlled conditions at the point of manufacture.

6.2 Hydrostatic tests are always required for each individual unit.

6.3 System functional tests shall always be performed. These tests shall include verification of all temperatures, pressures, flows and levels. Tests shall be witnessed.

6.4 A cleanliness test shall always be performed. This test shall be witnessed.

Revision Summary

30 September, 2003	Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with minor changes.