



GS 134-3

**LUBRICATION, SHAFT SEALING, AND
CONTROL OIL SYSTEMS FOR
SPECIAL
PURPOSE APPLICATIONS TO API 614**

October 1994

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SCOPE AND PURPOSE This BP Group Guidance for Specification covers requirements for lubrication systems, oil-type shaft-sealing systems, and control-oil systems for special-purpose applications. These systems may serve equipment such as compressors, gears, pumps and drivers. This Specification does not apply to internal combustion engines. It is for use with data sheets to adapt it for specific applications. It supplements the API standard, defining a number of the optional clauses and substituting, modifying or qualifying certain other clauses in the light of BP experience.											
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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

This Guidance for Specification defines a number of optional API clauses and may substitute, add to or qualify other API clauses using BP's knowledge and experience world-wide.

Application

This Guidance for Specification is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.

It is a transparent supplement to [API 614](#) Third Edition, dated 1992, showing substitutions, qualifications and additions to the API text as necessary. As the titles and numbering of the BP text follow those of API, gaps in the numbering of the BP document may occur. Where clauses are added, the API text numbering has been extended accordingly.

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options. It also gives guidance on the implementation of any 'Specification' or 'Approval' actions; specific actions are indicated by an asterisk (*) preceding a paragraph number.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Specification Ready for Application

A Specification (BP Spec 134-3) is available which may be suitable for enquiry or purchasing without modification. It is derived from this BP Group Guidance for Specification by retaining the technical body unaltered but omitting all commentary, omitting the data page and inserting a modified Foreword.



Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. GENERAL

1.1 Scope

- 1.1.1 This Specification covers BP requirements for lubrication systems, oil-type shaft sealing systems, and control-oil systems for special-purpose applications. These systems may serve equipment such as compressors, gears, pumps and drivers. This Specification does not apply to internal combustion engines.

They shall meet the requirements of [API 614](#), Third Edition, dated 1992 except as amplified and modified herein.

This Specification is for use with an API style data sheet to adapt it for each specific application.

(Substitution)

1.2 Alternative Designs

Requirements alternative to those prescribed will be acceptable provided it can be shown to the satisfaction of the purchasers' professional engineer that the required performance and function is attained.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

(Substitution)

1.3 Conflicting Requirements

In case of conflict between various documents, their order of precedence shall be:-

- (a) Local Authority or Statutory Regulations.
- (b) The Equipment Requisition or Order.
- (c) Data sheets.
- (d) This Specification.
- (e) Referenced industry standards.

(Substitution)

1.4 System Selection

- 1.4.1 System components such as reservoirs, pumps, coolers, filters, accumulators, overhead tanks and drainers, together with complete



systems, shall be in accordance with the relevant Figures of Appendix A of [API 614](#).

(Qualification)

2. BASIC DESIGN

2.1 General

2.1.2 *Oil systems may be integrated into the equipment underbase provided the design is a standard proven arrangement.*

2.1.4 Components handling sour process fluids or oil that has been in direct contact with sour process fluids shall conform to the requirements of BP Group [GS 136-1](#). For the purpose of this Specification, the following shall be used in defining sour service:-

- (a) For equipment which contains gas, or gas plus liquid, Figure 1 shall be used.
- (b) For equipment which contains only liquid, Figure 2 shall be applied, using the pressure and H₂S content of the gas at the point where it was last in equilibrium with the liquid.

(Addition)

Sour gas service often has to be considered in respect of compressor seal-oil systems. The following points are relevant:-

- (a) *Many parts of a typical compressor seal-oil system will contain oil and gas. However, the gas and oil is not considered to be a true multiphase system. For this reason Figure F1 of BP Group [GS 136-1](#) is used for components containing oil and gas.*
- (b) *[NACE Standard MR-01-75](#) is not specific regarding systems containing liquid only. The approach used in 2.1.4.(b) has proved to be acceptable. For seal systems incorporating sour-oil degassers operating at, or below atmospheric pressure, the seal oil supply pipework, reservoir, pumps, coolers, filters and sweet seal-oil drains do not need to be designed to NACE requirements provided that the gas in the degasser contains no more than 10 mol% H₂S.*

2.1.6 Noise levels at or beyond 1 m from the surfaces of the equipment shall not exceed 85 dB(A) unless an alternative limit is specified on the data sheet.

(Substitution)

Noise limits below 85 dB(A) may be required in some countries.



2.1.13 The layout of systems shall be specifically designed for ease of maintenance and operation. The layout shall be such that obstruction-free access is provided to all items which may require maintenance or adjustment during normal operation, e.g. turbine drivers, filters, coolers, controllers, etc. Specifically, there shall be no obstruction in front of the filters, coolers, pumps, control valves, sour oil traps, etc. The access shall be of adequate width to permit simple removal of the relevant items and should not be less than 700 mm .
(Substitution)

2.1.14 Electrical equipment shall be as specified in BP Group [GS 130-2](#) .
(Qualification)

2.1.17 On hydrogen service, toxic service, or Class 900 and higher services, double isolation is required as follows:-

- (a) Double block valves shall be provided for all vents and drains used in normal operation.
- (b) Double block and bleed valves shall be provided for the isolation of equipment normally required to be maintained with the system in operation.

(Substitution)

See Appendix A for definition of Hydrogen Service and Toxic Service.

2.1.20 *For compressors handling flammable or toxic gas with mechanical seals an emergency seal-oil supply is not always needed. The seals are usually designed so that the faces stay closed on loss of seal-oil pressure. Slight leakage across the faces is possible but this is usually acceptable. If even slight leakage is not allowed (e.g. for very toxic gas) it is possible to use an overhead tank arrangement for rundown oil. Some designs need an emergency seal-oil supply to prevent damage to the seals on rundown. This should be checked for each application.*

Assessment of the need for an emergency oil supply must consider the likelihood of total oil-supply failure, and the likely consequences if oil-supply failure does occur. The following points are relevant:-

- (a) *In a typical refinery application, the main oil pumps are usually steam turbine driven, and the auxiliary pumps are usually electric motor driven. The likelihood of total oil-supply failure is low.*
- (b) *In a typical offshore application where both main and stand-by pumps are electric motor driven, the likelihood of total oil-supply failure is greater.*
- (c) *Light rotors with lightly loaded bearings are unlikely to suffer bearing damage in rundown without lube oil. There are many steam turbine driven process compressors in the BP Group of up to say 4 MW without emergency lube-oil systems.*



- (d) *Heavy rotors such as electric motors or large steam turbines and compressors could suffer bearing damage on rundown. Emergency lube-oil systems are usually required.*
- (e) *High-speed/high-power gearboxes could suffer from gear-tooth damage on rundown. Emergency lube-oil systems are often required. It is best to seek the gear vendor's experience.*
- (f) *Large steam turbines and gas turbines could suffer bearing damage due to 'heat-soak'. Emergency lube-oil systems are usually fitted.*
- (g) *If the main oil pump is shaft driven the likelihood of total oil-supply failure is reduced.*
- (h) *If the machine is spared it may be possible to accept an increased risk of damage, provided that the damage is relatively minor (i.e. bearing wipe only).*

Emergency oil-supply systems of the overhead-tank type (either pressurised or non-pressurised) are usually used because of their simplicity and reliability.

If weight and space are a problem, it may be preferable to use a d.c. emergency lube-oil pump rather than an overhead rundown tank.

2.3 Oil Reservoirs

2.3.5 Features and Appendages

- 2.3.5 (c) For reservoirs over 1 m³ capacity, level gauge glasses are to be of fire-resistant glass with means of isolation in the event of gauge glass failure.
(Qualification)

- 2.3.5 (f) Reservoirs containing lube oil only shall be vented to atmosphere. The vent system shall be independent from those for reservoirs containing seal oil, and from those for degassing drums.

Reservoirs containing seal oil shall be vented to atmosphere. The vent system shall be independent from those for reservoirs containing lube oil only, and from those for the gas-side of degassing drums.

On reservoirs containing seal-oil, the vent(s) shall be sized such that overpressure does not occur with maximum gas flow into the reservoir.

Vent sizing criteria shall be stated by the vendor, but as a minimum shall cover:-



- (i) The gas flow through seals with maximum design clearance, with settle-out pressure in the casing.
- (ii) The maximum gas flow from drain traps. See also 2.12.2 of this Specification.

(Substitution)

Reservoirs containing lube oil only should preferably be vented locally, provided that oil mist emission does not occur. Otherwise vents should be routed to a well ventilated location.

Reservoirs containing seal oil should be vented to a well ventilated location, where the estimated maximum release of gas will not present a hazard.

All vent lines should be stainless steel with a separate low-point drain to prevent water vapour which condenses from returning to the reservoir

2.3.6 Capacity and Configurations

2.3.6.2 Criteria for Sizing

2.3.6.2.2 *To minimise size and weight, for offshore installations, lube oil reservoirs with 5 minute retention time may be acceptable if satisfactory operating experience can be demonstrated.*

2.3.6.2.3 Backup in drain lines shall not be permitted when sizing rundown capacity of reservoirs.

(Substitution for note following text of [API 2.3.6.2.3](#))

2.3.7 Heating

2.3.7.1 *Electric heaters are preferred because of their simplicity of operation and control and minimum maintenance requirements.*

The number of heaters and their location require careful consideration to ensure that all the oil is heated to the required temperature. This is particularly important for tanks of small height and several compartments e.g. in skid base-frames.

2.3.7.2 Electric immersion heaters which are mounted horizontally shall be installed in sealed tubes which allow the heaters to be removed during operation.

(Qualification)

2.3.8 *Insulation of reservoirs should be considered only for applications in exposed locations or low ambient temperatures.*



2.3.9 Plugged Connections

Purge connections for inert gas shall be provided on all reservoirs. Seal oil reservoirs (whether common with lube-oil reservoirs or otherwise) in flammable or toxic gas service, shall be fitted with equipment including isolating valve, flow controller and flow indicator, to provide a continuous inert gas purge. Purge flowrate shall be sufficient to prevent air ingress at all times, including oil system startup, i.e. during reservoir level draw-down, and to avoid 'in-breathing' following shutdown when cooling of the reservoir contents is taking place.

Where an inert gas purge is provided, vents from the machine bearings, and/or seal chambers, shall be returned to their respective reservoirs.

(Addition)

All reservoirs containing seal oil or combined lube/seal oil on flammable or toxic gas service should be purged with nitrogen.

Although it is known that mixtures of air and oil mist can be flammable, it is considered that the likelihood of an explosive atmosphere is very low for a reservoir containing lube-oil only. As far as is known within BP there have never been any explosions in lube-oil reservoirs. It is not considered necessary to purge reservoirs containing lube-oil only.

2.3.10 Provision for Oil Conditioner

Valved supply and return connections for oil conditioners shall be provided on all reservoirs.

(Addition)

2.3.13 Materials

Reservoirs and all appendages welded to reservoirs shall be fabricated from type 316 stainless steel in accordance with [ASTM A 240](#).

(Substitution)

Stainless steel is the preferred material for lube-oil reservoirs. However, good service can be obtained from carbon steel provided that the environment and service conditions do not produce a corrosive (e.g. wet or acidic) atmosphere in the vapour space. In general, stainless steel should be used unless there is good evidence to support the use of carbon steel.

2.4 Pumps and Drivers

2.4.1 Where the main machinery is not spared, vertical submerged pumps shall not be used.

(Qualification)



This is a requirement because it is undesirable to remove a vertical submerged pump from a reservoir which is in service.

2.4.2 *See 2.1.20 of this Specification.*

2.4.4 *If the duty is appropriate, centrifugal pumps shall be used.*

Problems have been experienced on high-pressure seal-oil pumps. A check of the vendor's previous experience is necessary for pressures in excess of 150 barg.

2.4.5 When machinery trains have an installed spare, the main oil pump may be shaft driven. For variable speed units where the oil pump operates at variable speed, it shall be sized on the basis of 120% of the normal flow at 100% speed and/or 110% of the normal flow at minimum speed whichever is the greater.

(Qualification)

2.4.6 *It is not usual to provide remote actuation for shutdown of steam-turbine driven oil pumps.*

2.4.14 *The most effective mesh size for temporary strainers for centrifugal pumps has been found to be about 3 mm opening size.*

2.4.15 *The permanent suction strainers for rotary pumps should have a mesh size as specified by the pump manufacturers. (Typically 60 mesh is used.)*

2.4.20.2 Pumps shall be supplied with flexible membrane type spacer couplings. They shall be of a design in which the spacer piece is retained if a flexible element ruptures.

(Qualification)

2.5 Coolers

2.5.1 Single coolers may be supplied for machinery trains that are themselves spared.

(Qualification)

For offshore installations where space and weight are at a premium, single plate type titanium coolers may be considered for machinery trains that are not spared. This type of cooler is very much smaller and lighter than the normal duplex shell and tube type, and is significantly cheaper.

2.5.2 For fresh or recirculated water the velocity in the exchanger tubes shall be 0.9 m/s to 1.5 m/s.

(Substitution for velocity quoted in [API 2.5.2](#))



2.5.5 For seawater cooling the water shall be on the tube side, and all water-side components shall be in seawater corrosion resistant alloy. Organic coatings on carbon steel are not acceptable unless cathodic protection in the form of a sufficient quantity of zinc or aluminium sacrificial anodes can be installed to provide 3 years service before anode replacement is required. Because of the risk of galvanic corrosion, all components shall be fabricated from, or clad with, the same alloy. 90/10 copper-nickel alloy in the solid form is the most appropriate for use as tubes, and in the solid or clad form for tube plates and water-box components. Tube water velocities shall be maintained between 0.9 and 2.4 m/s for this alloy.

(Qualification)

2.5.6 For all systems an oil by-pass line shall be installed around the cooler, together with a three-way thermostatic valve for automatic regulation of the oil supply temperature.

(Addition)

2.5.8 The drain lines shall be piped to a convenient location at the skid edge.

(Addition to [API 2.5.8](#))

2.6 Filters

2.6.1 Vents shall be piped back to the reservoir with a sight glass located immediately downstream of the vent valve. Drains shall be piped to a convenient location at the skid edge.

(Addition)

2.6.4 *Paper-element filters should not be used unless good experience is proven. They are susceptible to clogging if there is water in the oil.*

2.6.9 When oil-lubricated gear couplings are supplied for the main equipment, a nominal 2 micrometre secondary filter with a bypass valve, a differential pressure alarm and a differential pressure gauge shall be provided in the coupling supply line.

(Addition)

2.6.10 A sampling point shall be provided immediately downstream of the filters to allow a representative sample of the circulating oil to be obtained. The sample connection shall be fitted with a restriction orifice and shall terminate in a flanged and blanked valve.

(Addition)



2.7 Transfer Valves

- 2.7.1 Individual transfer valves independently serving each cooler and filter set are required as shown in Figure A-17 of Appendix A to [API 614](#).

(Qualification)

- 2.7.4 Transfer valves shall give reliable isolation of the off-line equipment for maintenance purposes. This shall be achieved without the use of spectacle blinds.

(Substitution)

2.8 Accumulators

- 2.8.1 The commercially available precharged bladder-type accumulator is preferred to the direct contact type.

(Addition)

For pump changeover transients it should be possible to avoid the use of an accumulator, particularly if direct acting control valves are used. However, accumulators have proved necessary in many instances.

For liquid-film seal-oil systems, the accumulator function is usually provided by the seal-oil overhead tank. There should be no need for separate accumulators.

The commercially available precharged bladder-type accumulator is preferred because it is simple to operate and has been found to be reliable in service. Several accumulators in parallel may be needed to provide the necessary quantity of oil. This may become impractical if a large quantity of oil is required.

A constant pressure regulate bladder-type accumulator is capable of supplying larger quantities of oil, but is more complicated.

For systems requiring a large amount of oil, direct contact accumulators are usually necessary.

2.9 Overhead Tanks

- 2.9.1 Seal-Oil Tanks

- 2.9.1.1 *Through-flow overhead tanks are sometimes proposed as they involve relatively simple controls, and they avoid temperature problems. However, oil contamination may occur rapidly, and clean-up may be impracticable. Hence, where the consequences of oil contamination could be serious, e.g. for hydrocarbon, toxic or corrosive gases, they should not be used. A dead-ended system should be used instead. See also 2.9.1.5 of this Specification.*

- 2.9.1.2 The overhead tank capacity from the low-level alarm to the low-level shutdown may be reduced to 3 minutes. However, the capacity for coast-down may need to be greater than 3 minutes.



(Qualification)

API 614 requires 11 minutes capacity from normal operating level to machine trip (shutdown) level. A further capacity is required to cover coast-down, block-in and vent time which may be as much as 10 minutes or longer. This can result in a very large vessel. It is considered that the 11 minutes oil capacity above the trip level is difficult to justify. It is only of value in giving the operators time to restore the oil supply in the hope of avoiding a trip (no similar period is available for lube-oil supply failure). It is considered that 3 minutes oil capacity above the trip level is satisfactory and it keeps the vessel to a reasonable size.

An important consideration in respect of sizing the overhead tank is to define the gas pressure allowed in the casing when all the seal oil has drained from the overhead tank. It is often unrealistic to assume that the casing pressure will have reduced to atmospheric pressure. The venting time required to reach atmospheric pressure is sometimes excessively long; also, the back pressure in the vent system could be significant (e.g. flare line pressure). This subject must be discussed for each job. However, the following points are useful for guidance:-

- (a) For oil-film seals there is a leakage path to atmosphere when the overhead tank is empty. Gas leaks into the seal drains, the seal-oil reservoir, and probably the bearing housings, etc. The seal reservoir vent will be sized to cope with this leakage. However, the gas pressure should be vented to the lowest realistic level to minimise the leakage to atmosphere. On hydrocarbon gas duty, a maximum pressure of about 70 mbar (ga) (1 psig) is often assumed for sizing the overhead tank.*
- (b) For mechanical seals without a gas-pressurised overhead tank, the pressure is less critical because the leakage across the seal faces is very small.*
- (c) On mechanical seals with an overhead tank directly pressurised by process gas, the pressurising line forms a leakage path to atmosphere (bypassing the mechanical seal) when the overhead tank is empty. The gas pressure should be vented to the lowest realistic level (i.e. as for oil-film seals) unless the pressurising line is automatically isolated when the overhead tank is empty.*

2.9.1.4

- (b) The reference-gas system, e.g. compressor connections, piping and overhead tank connections, shall be sized such that even under the most severe pressure transients the overhead tank pressure closely follows the seal chamber pressure without loss of seal-oil differential pressure at the seals.*

(Addition)

Of particular concern is a rapid rise in the sealed pressure when tripping a suction throttled machine. Gas has to be transferred into the overhead tank via the reference gas system at a high flowrate in order to maintain seal-oil differential pressure. Reference gas pipe size and the porting into the seal housing must not impose undue restrictions.



- 2.9.1.4 Level gauge glasses are to be of fire resistant glass with means of isolation in the event of gauge glass failure.
(Qualification)
- 2.9.1.5 *Bladder-type seal-oil overhead tanks are often a maintenance problem. If a large oil capacity is required several bladder tanks are often needed, which adds to the complication. Bladder tanks should be avoided if possible. The following points are relevant:-*
- (a) *Bladders are not normally necessary for hydrocarbon gases. The amount of hydrocarbon gas dissolved in the oil in a direct interface, dead-ended, overhead tank is small and does not cause problems.*
 - (b) *Bladders are not normally necessary for gas containing small amounts of acid gases (e.g. H₂S, CO₂). For example, compressors with direct interface overhead tanks on services with up to 2.5 mol% of H₂S are operating with no evidence of problems.*
 - (c) *Bladders may be necessary if the gas is very corrosive, very toxic, or reactive with the oil.*
- 2.9.1.6 For systems incorporating bladders, the working displacement of the bladder tanks shall be at least equal to the total capacity of the respective overhead tanks.
(Addition)
- 2.9.1.7 In systems incorporating bladders, the low seal-oil/reference-gas differential pressure shutdown shall be actuated by a switch sensing differential pressure directly, and not by a level switch as shown in Figure A-14 of Appendix A to [API 614](#).
(Addition)
- If a bladder-type overhead tank is used ([API 614](#) Appendix A Figure A-14) it is important that the correct quantity of oil is contained in the overhead tank. The bladder must neither become fully collapsed nor fully expanded over the working capacity range of the overhead tank.*
- For example, if the bladder becomes fully expanded before the low-level trip level is reached, the trip will never operate, irrespective of the seal-oil differential pressure. This could happen if the overhead tank was overfilled or if it accumulated some liquid condensate from the reference gas. Hence the requirement for a differential pressure switch.*
- 2.9.1.8 Seal-oil overhead tanks shall be lagged and heat traced if necessary to maintain the oil at the correct temperature and to prevent condensation of the process gas.
(Addition)
- 2.9.1.9 The reference-gas line shall rise continuously from the seals to the overhead tank so that it is self draining (i.e. no liquid traps).



(Addition)

2.9.2 Lube-Oil Tanks

Guidance about when an emergency lube-oil rundown tank is necessary is given in para. 2.1.20 of this Specification.

(Qualification)

2.9.2.4 If an atmospheric tank is used as shown in Figure A-13A of Appendix A to [API 614](#), the vent shall be fitted with a filter against airborne foreign matter, a baffle against water ingress, and shall terminate in a downward-facing opening to prevent the ingress of birds.

(Addition)

2.9.2.5 Lube-oil overhead tanks shall be lagged and heat traced if necessary to ensure that, at any ambient temperature specified on the data sheet, their contents are maintained at a temperature acceptable to the machinery that the system supplies.

(Addition)

The oil in the emergency run-down tank is kept warm by the flow through it. Provided this keeps the oil comfortably above its pour point there should be no need to lag the tank.

2.10 Oil Conditioners

2.10.1 Conditioners shall be provided for all oil systems which service machinery trains that include steam turbines.

(Qualification)

Further examples of where oil conditioners may be required are:

- (i) *Oil system which service pumps where the lube oil can be contaminated from continuous steam quench on the seals.*
- (ii) *Equipment installed in damp or high-humidity environments.*
- (iii) *Equipment installed in dusty or sandy environments.*

The use of one centrifuge to cover two machines is often acceptable. Where there are a large number of machines each by themselves too small to justify an individual centrifuge a portable centrifuge may be justified.

Coalescence or centrifuge-type conditions are not capable of removing dissolved gases.

Vacuum degassing systems can be very effective for removing dissolved gases as well as water and solid contamination. They will be most applicable where contamination by process gas is anticipated. They can be used for combined seal-oil degassing and reservoir-oil clean-up systems.



A problem with degassing systems is that some types can remove the additives in the lube oil (i.e. antioxidants, rust inhibitors, etc.). Care should be taken when selecting the degasser type.

2.11 Seal-Oil Drain Traps

2.11.1 *If the traps are not at the same pressure (e.g. because of the axial balance line pressure drop) the gas flow can reverse on the low-pressure seal causing poor drainage and perhaps oil migration into the compressor. Some manufacturers do not like cross-connections between seal traps for this reason. One way to ensure the seals both operate at the same pressure is to use buffer gas.*

2.11.3 Mist eliminators shall be supplied on seal-trap vents.

(Qualification)

Adequate venting of seal-oil drain traps is important. The gas flow helps the drainage of the contaminated seal oil and prevents migration of seal oil into the compressor. The following points should be considered:-

- (a) *Some oil vapour may pass the mist eliminator. If the oil is damaging to the process (e.g. catalyst poisoning, or refrigerant circuit fouling) the vent gas should not be returned to the compressor.*
- (b) *The vent lines should not include 'liquid traps' in which lube oil could collect and prevent free venting.*
- (c) *If the traps are vented to nominally the same pressure as the sealed pressure, it may be necessary to supply buffer gas to ensure an adequate differential pressure across the trap (i.e. to ensure an adequate gas flow rate through the trap).*

2.11.5 The drain from each seal-oil drain trap shall be provided with separate valved connections to waste and to the degasser, thus permitting choice of route to the plant operator.

(Substitution)

2.12 Degassing Drum

2.12.1 Seal-oil degassing facilities shall be provided if the gas is toxic, flammable, or liable to degrade the oil.

Oil degradation (reduction in viscosity and flash point) is particularly a problem on heavy hydrocarbon gases, particularly at high pressure. The simple heated degasser (as [API 614](#) Figure 4) will normally remove C3 and lighter hydrocarbons. More complicated degassers using a combination of heating, agitation and inert gas sparging will normally remove hydrocarbons down to C4. Hydrocarbons of C5 and heavier will not be removed. If the gas contains significant quantities of C5 hydrocarbons and heavier, it will be necessary to use a vacuum degassing system.

Experience to date suggests the following:-



- (a) *If the content of C5 and heavier is less than 0.1 mol% degassing is relatively easy and simple, degassing drums (perhaps with nitrogen sparging) are adequate.*
- (b) *If the content of C5 and heavier is greater than 0.1 mol% particular care needs to be taken in the specification of the degassing drum. Vacuum degassing may be necessary.*

2.12.2 The gas-side vent shall be completely independent from vents from seal-oil reservoirs and seal housings, and from all lube-system vents. It shall be piped to flare or to a well ventilated location where the estimated maximum release of gas will not present a hazard.

(Addition)

When vented to a flare system, care needs to be taken with respect to the design pressure of the degassing drum to ensure that it is suitable for operation at the maximum backpressure that could pertain in the flare system. See [API 614](#) 2.12.6.

The vent(s) shall be sized such that with maximum gas flow that could occur under any conditions, overpressure of the reservoir will not occur. The sizing criteria shall be stated by the vendor but, as a minimum, shall cover the gas flow through all drain trap outlet valves wide open (or their bypasses if larger) with settle-out pressure in the traps.

(Addition)

2.13 **Piping**

2.13.2 The piping for each utility shall be manifolded to a common connection.

(Qualification)

2.13.7 For auxiliary piping in hydrogen service, connections shall be butt-welded, socket-welded or flanged. Surface finish of flanges shall be between Ra 3.2 and Ra 6.3 micrometres, as defined by [ISO 468](#). Threaded connections shall not be used. Pipe size shall be at least NPS 1 (DN 25).

(Addition)

2.13.10.1 Material for oil and gas piping shall be Type 316 in accordance with [ASTM A 312](#).

(Substitution)

2.13.10.3 Stainless steel flanges, shall be used.

Manufacturers use stainless steel flanges as standard, because corrosion of bore and face of carbon steel flanges usually occurs.

(Qualification)



- 2.13.11.3 Compression couplings may be used only on instrument impulse lines downstream of the first block valve.

(Qualification of API 2.13.15)

3. INSTRUMENTATION, CONTROL AND ELECTRICAL SYSTEMS

3.1 General

- 3.1.2 Detailed requirements for instrumentation and control equipment shall be as specified in BP Group [GS 130-2](#).

(Qualification)

Control valves shall be direct-acting wherever practical.

(Addition)

Direct - acting pressure control valves are preferred because they give better speed of response to meet transient requirements, e.g. pump changeovers. It may not be possible to use a direct - acting control valve for seal-oil spillback duty if the range of operating conditions is very wide. (Refer to [API 614](#) Appendix A para. A.1.3.)

- 3.1.6 *The requirement for control valve isolation and by-pass valves may be relaxed in certain circumstances, e.g. where the machinery is spared, or where a shut-down of short duration may be acceptable to replace/repair the control valve. Reduction in congestion results from omission of these valves plus savings in weight and cost.*

3.2 Instrument Gauge Boards and Panels

- 3.2.1 Instruments shall be mounted on a gauge-board, installed on the console.

(Qualification)

- 3.2.3 When an instrument panel is provided it shall incorporate the more important instruments including indicators for:-

- (a) Lube-oil header pressure: each pressure level.
- (b) Seal-oil/gas differential pressure: each pressure level.
- (c) Control-oil header pressure.

(Substitution)

4. INSPECTION AND TESTING

- 4.2 *Inspection*

- 4.2.1.5 *The following is a list of typical inspection requirements:-*



- (a) *Materials of all critical components.*
- (b) *Fabrication procedures including welding procedures, heat treatment, non-destructive testing, welder qualifications.*
- (c) *Major repairs.*
- (d) *Hydrostatic and gas testing of all pressurised components.*
- (e) *Operational tests.*
- (f) *Sound level tests.*
- (g) *Dimensions of critical assemblies.*
- (h) *Cleanliness.*
- (i) *Painting and corrosion prevention.*
- (j) *Packing.*
- (k) *Purchase specification for major items.*

(Addition)

4.4 Preparation for Shipment

- 4.4.3.4 Any internal carbon steel surfaces that will be in contact with the system oils shall be preserved for storage by wetting with the actual oil to be used in service and inserting vapour phase inhibitors. If preservative oils are used they shall be compatible with the oil used in service.

(Substitution)



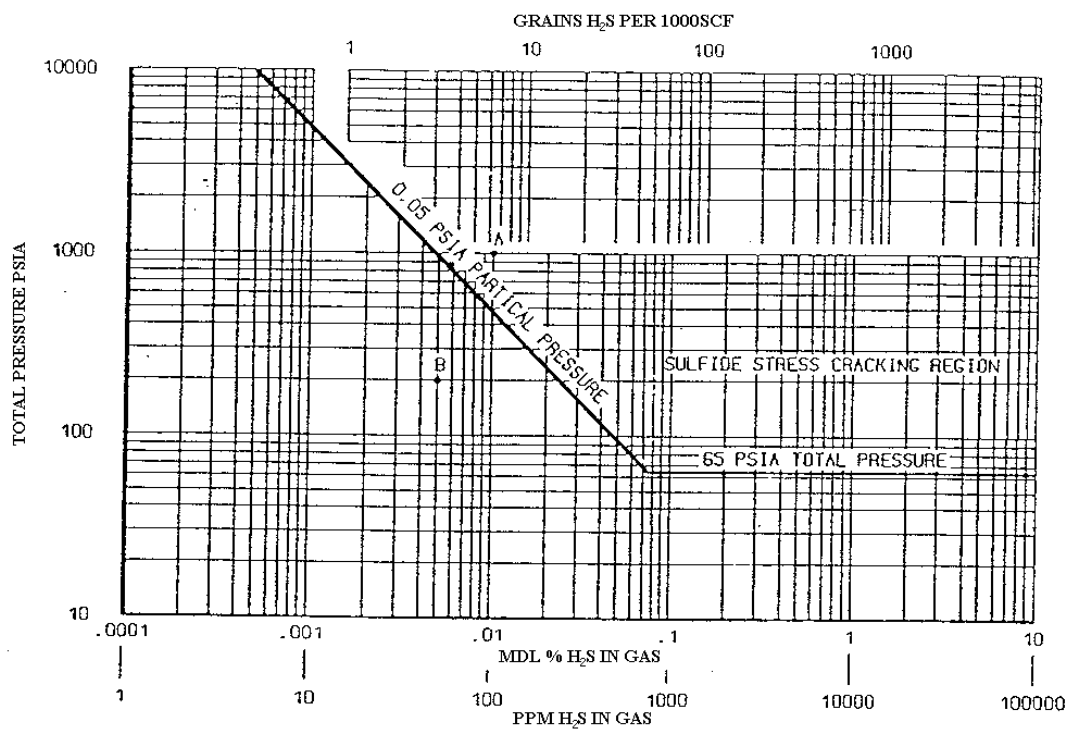


FIGURE 1
SULPHIDE STRESS CRACKING REGION GRAPH: SOUR GAS SYSTEMS
 (see [1.3.1.1 NACE](#) document)

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 National Association of Corrosion Engineers, Houston, Texas)



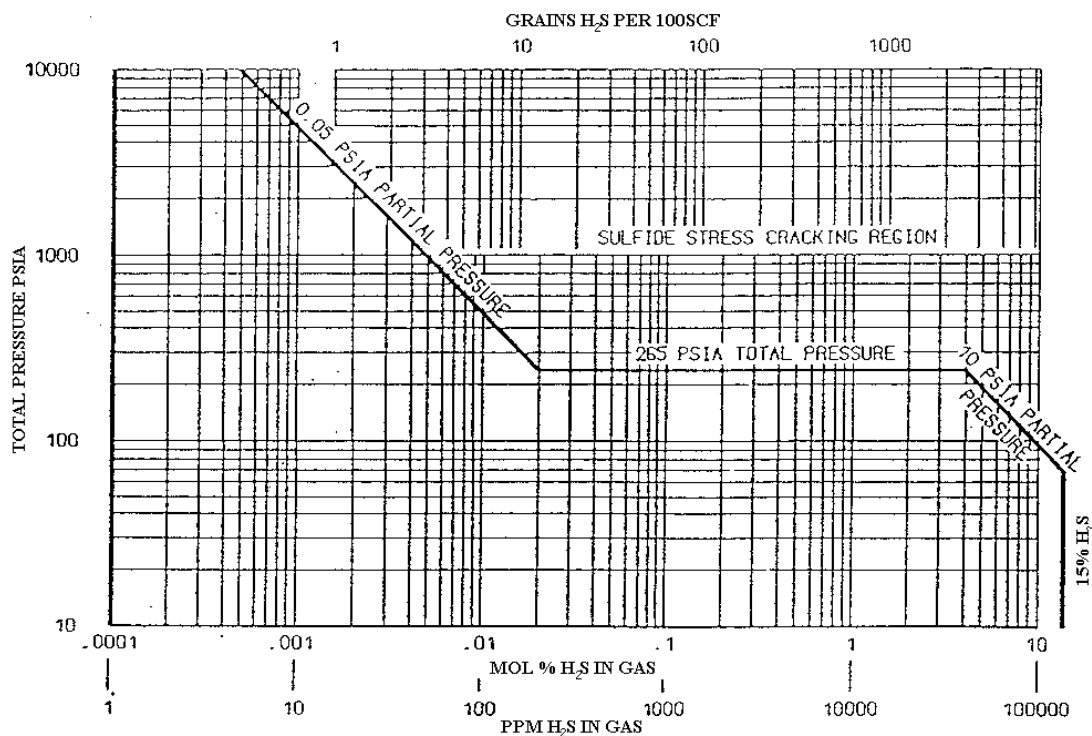


FIGURE 2
SULPHIDE STRESS CRACKING REGION GRAPH:
SOUR MULTIPHASE SYSTEMS

(see [1.3.1.1 NACE document](#)) (The above figure is reproduced by kind permission of the National Association of Corrosion Engineers, Houston, Texas)



DEFINITIONS AND ABBREVIATIONS**Definitions**

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

Hydrogen service: Gaseous mixtures containing hydrogen at a partial pressure of 5 bara or more.

Toxic service: Fluids containing toxic substances which can produce serious irreversible damage, unless prompt restorative measures are taken.

Abbreviations

API	American Petroleum Institute
ASTM	American Society for Testing and Materials
DN	Diameter Nominal
ISO	International Standards Organisation
NACE	National Association of Corrosion Engineers
NPS	Nominal Pipe Size
Ra	Root Average



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

International

[ISO 468](#) Surface Roughness - Parameters, their Values and General Rules for Specifying Requirements

American

[API 614](#) - Third Edition Lubrication, Shaft-Sealing, and Control-Oil Systems for Special-Purpose Applications

[NACE MR-01-75](#) Standard Material Requirements - Sulphide Stress Cracking Resistant Metallic Materials for Oilfield Equipment
(to be replaced by [ISO 10438](#))

BP Group Documents

BP Group [GS 130-2](#) Instrumentation and Electrical Equipment for Rotating Machinery
(replaces BP Std 128)

BP Group [GS 136-1](#) Materials for Sour Service to [NACE Standard MR-01-75](#)
(replaces BP Std 153)

