



Document No.	GIS 34-106
Applicability	Group
Date	19 January 2004

Guidance on Industry Standard for API 619 Rotary Type Positive Displacement Compressors

GIS 34-106

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GIS 34-106. This Guidance on Industry Standard (GIS) is based on parts of heritage documents from the merged BP companies as follows:

British Petroleum

GS 134-9 Rotary Type Positive Displacement Compressors to API 619 (to API 619 Second Edition, May 1985. Reaffirmed, May 1991).

Amoco (ACES)

A RE-COMP-619-P Rotating Equipment—Compressors—API 619 Rotary—Procurement Specification.

A RE-COMP-00G Rotating Equipment—Compressors—Guide.

Gulf of Mexico Deepwater (GOMDW)

1400-20-ME-SP-2046 Rotary-Type Positive Displacement Compressor, Addendum to API Standard-619 (to API 619 Third Edition, June 1997).

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Introduction

- a. Guidance for rotary type positive displacement compressors is based on American Petroleum Institute (API) Standard 619, "Rotary Type Positive Displacement Compressors for Petroleum, Chemical, and Gas Industry Services", Third Edition, June 1997.
- b. Guidance statements of this GIS are modifications to API 619.
- c. Modifications to API 619 are identified as Add, Modify to Read, or Delete.
- d. Paragraph numbers in this GIS correspond to API 619.
- e. Paragraphs of API 619 that are not revised remain applicable.

1. Scope

Add

- b. Standard utility air compressors of 400 kW (540 hp) or less with not more than 9 bar (130 psig) discharge pressure shall comply with ISO 10440-2.

Standard utility or instrument air compressors are generally purchased as packaged units.

1.1 Alternative designs

Add

- a. Vendor may supplement quotation with alternate quotation if more efficient or more reliable unit can be offered.
- b. Alternative quotations shall be identified as "Alternate Bid".
- c. Alternate designs shall be acceptable if required performance and function are attained, subject to BP approval.

1.2 Conflicting requirements

Modify to Read

In case of conflicts, order of precedence shall be:

- a. Local codes and standards.
- b. Purchase order/requisition/contract.
- c. Project data sheet/drawings.
- d. This GIS.
- e. Referenced BP documents.
- f. National or International standards



2. References

2.1 Standards

2.1.2 Add

Vendor shall obtain necessary approvals direct from authorities concerned.

4 Basic design

4.1 General

4.1.13 Add

- a. Sound power levels shall comply with **GIS 14-XXX**.
- b. Noise data for proposed equipment shall be submitted on data sheets with proposal.
- c. If Vendor cannot meet limits without addition of noise attenuation features, levels with and without these features shall be stated in proposal. Noise attenuation measures proposed by Vendor shall not conflict with other requirements.
- d. Noise attenuating enclosures shall be accepted only if there is no alternate form of noise control. Design of enclosures shall be such that normal operation and maintenance are not unduly compromised. Instrumentation and controls shall be either mounted externally to enclosure or shall be clearly visible and controllable from outside enclosure.
- e. Enclosures shall be adequately ventilated and cooled. Instrumentation, sensors, and cables installed inside enclosures shall not be subjected to an environment that causes component to be operated outside Vendor specified ambient temperature limits.
- f. The area classification within an enclosure shall be agreed between the purchaser and vendor.

For instance if an area classification would otherwise be Zone 2 (Division 2), equipment within enclosure shall normally need to be suitable for a Zone 1 (Division 1) area.

4.2 Pressure casing

4.2.5 Add

Suitable joint compound shall be recommended by the vendor and shall be subject to BP approval.

4.2.11 Add

- a. Studded connections shall be furnished with studs installed.
- b. Blind stud holes should only be drilled deep enough to allow preferred tap depth of 1-1/2 times major diameter of stud.

4.3 Casing connections

4.3.1 Add

Flanged connections are preferred. Studded connections on casing nozzles hinder installation and maintenance since piping has to be sprung to remove casings or spool pieces. There is also the risk of broken studs being left in casing.

4.3.3 Add

Welded connections shall be attached prior to casing heat treatment.



4.3.4 Add

Casing drains shall have valves and flanges but shall not be manifolded.

4.3.5 Add

Threaded case openings require the approval of BP.

4.3.7 Add

If connections other than ASME are supplied, mating parts shall be supplied by Vendor and details shall be subject to BP approval.

4.5 Rotating elements**4.5.1 Rotors****4.5.1.5 Modify to Read**

Shaft ends shall be tapered in accordance with GIS 34-503.

4.6 Shaft seals**4.6.1 General****4.6.1.1 Add**

Shaft seals and ancillary systems shall be suitable for operation at pressures up to maximum allowable working pressure as defined in Paragraph 4.2.2.

Although it is not intended to run machines up to relief valve pressure continuously, two transient situations may arise:

- *Machine runs up to relief valve pressure, and seals and ancillary systems must be suitable.*
- *Machine is on standby but pressurised from an external source, and seals and ancillary systems must be suitable.*

4.6.1.4 Add

Vendor shall specify if buffer gas injection is required for specified operating conditions. If buffer gas injection is required, system shall include at a minimum:

- a. Duplex Filter.
- b. Automatic differential pressure controller.
- c. Differential pressure indicator.
- d. Low pressure alarm.
- e. Buffer gas pressure gauge.

4.6.4 Mechanical (contact) type**Add****4.6.4.3 Seals for sour gas**

Mechanical seals of compressors handling sour gases shall be suitable for operation with high quality straight mineral oils.

Lubricating oil for turbo machinery normally contains additives to minimise oxidation, foaming, emulsification, and to enhance EP properties. These additives can react with nonhydrocarbon contaminants in seal oil systems resulting in deposits or plating on seals and high seal oil leakage.



In particular, zinc based additives (commonly used to enhance EP Properties) should not be used in sour gas duties containing H₂S.

Similarly, phosphor based additives (also used to improve EP properties) should not be used in applications if temperatures exceed 45°C (113°F). Straight mineral oils that contain no additives have been successfully used but must be restricted to seal systems and risk of oxidation of the oil minimised. N₂ blanketing of seal oil reservoirs with reservoir and seal chamber vents manifolded has proved an effective barrier to oxidation.

If these arrangements cannot be made, antioxidation additive may be necessary. These are stable with temperatures well in excess of those in bearings and seals. However, commercially available straight mineral oils do not include antioxidation additives, and special formulation would be necessary.

4.6.7 Seal buffer gas

Add

- a. Noncontact dry gas tandem design seals shall have buffer gas.
- b. The control method for the buffer gas shall be differential pressure control.

4.7 Dynamics

4.7.2 Torsional analysis

4.7.2.5 Delete "When specified"

4.7.3 Vibration and balance

4.7.3.1 Add

Magnitude of vibration during startup and acceleration to operating speed shall not exceed 150% of limits in Table 1.

4.8 Bearings

4.8.1 General

Add

- d. Radial and thrust bearings shall be capable of withstanding reverse rotation for short periods of time without damage.

Reverse rotation can occur on tripping if stored energy on discharge side of compressor is large compared to kinetic energy of rotor system. Maximum permissible stored energy to avoid reverse rotation will depend on how system blows down on tripping. Limit of twice kinetic energy should minimise risk.

Further risk remains from leakage through nonreturn valves. If feasible these should be backed up by automatic closure of block valves. Compressors should be designed to accept some reverse rotation.

4.8.4 Hydrodynamic thrust bearings

4.8.4.1 Add

Faces of thrust collar, when mounted on the shaft, shall not have more than 8 µm (0.0003 in) total indicated runout.

