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Rotary Type Positive Displacement Compressors - Part 1: Process Compressors (ISO 10440-1)

Group Instruction for Supply

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the second issue of Engineering Technical Practice (ETP) GIS 34-106. This Group Instruction for Supply (GIS) is based on ISO 10440-1:2007 Petroleum, petrochemical and natural gas industries - Rotary-type positive-displacement compressors - Part 1: Process compressors.

This ISO standard was developed in parallel with API Std 619, fourth edition, with the intent that it will be identical to the API Std 619, fifth edition.

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REVISION FOR REVIEW



Introduction

- a. Requirements for rotary type positive displacement compressors for process duty are based on ISO 10440-1:2007 Petroleum, petrochemical and natural gas industries - Rotary-type positive-displacement compressors - Part 1: Process compressors.
- b. Requirements of this GIS are modifications to ISO 10440-1.
- c. Modifications to ISO 10440-1 are identified as Add, Modify to Read, or Delete.
- d. Paragraph numbers in this specification correspond to ISO 10440-1.
- e. Paragraphs of ISO 10440-1 that are not revised remain applicable.



1 Scope

Add

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

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

Add

1.1 Alternative designs

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

Any alternative design needs to meet the requirements of the application in terms of HSSE, thermodynamic performance, mechanical reliability, maintainability, etc. Therefore the alternative design should be reviewed and approved by the appropriate project technical authority.

1.2 Conflicting requirements

In case of conflicts, order of precedence shall be:

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

2 Normative references

Add

The following referenced documents may, to the extent specified in subsequent clauses and normative annexes, be required for full compliance with this GP:

- For dated references, only the edition cited applies.
- For undated references, the latest edition (including any amendments) applies.

BP

GIS 06-601	Painting of Metal Surfaces.
GIS 12-201	Low Voltage Induction Motors (IEC).
GIS 12-202	Low Voltage Induction Motors (IEEE 841).
GIS 12-203	High Voltage Induction Motors (IEC).
GIS 12-204	Medium Voltage Induction Motors (API 541).



GIS 12-205	Synchronous Motors (IEC).
GIS 12-206	Synchronous Motors (API 546).
GIS 15-011	Noise Control.
GIS 18-014	Heat Exchanger Tube End Fixing.
GIS 26-101	Shell and Tube Heat Exchangers (ISO 16812 or API 660).
GIS 26-103	Air Cooled Heat Exchangers (ISO 13706 or API 661).
GIS 34-301	General Purpose Steam Turbines (API 611).
GIS 34-302	Special Purpose Steam Turbines (ISO 10437 or API 612).
GIS 34-303	Gas Turbines (API 616).
GIS 34-501	Special Purpose Gear Units (API 613).
GIS 34-502	General Purpose Gear Units (API 677).
GIS 34-503	Special Purpose Couplings (API 671).
GIS 34-701	Special Purpose Oil Systems (ISO 10438).
GIS 34-705	Machinery Protection Systems (API 670).
GIS 42-101	Fabrication, Assembly, Erection, and Inspection of Carbon, Carbon Manganese, and Low Alloy Steel Pipework (ASME B31.3).
GIS 42-102	Fabrication, Assembly, Erection, and Inspection of Austenitic and Duplex Stainless Steel, Cupro-Nickel, Nickel Base Alloy, Titanium and Zirconium Pipework (ASME B31.3).
GIS 46-010	New Pressure Vessels.
GP 12-45	Electrical for Packaged Equipment.
GP 30-70	Control and Instrumentation in Vendor Packaged Equipment.
GP 32-10	Quality Management for Manufacturing - Overall Strategy.
GP 32-11	Quality Management for Manufacturing - Implementation of QA/QC Requirements into the PSCM Process.
GP 32-12	Quality Management for Manufacturing - Rotating Equipment.
GP 42-10	Piping Systems (ASME B31.3).

British Standards Institute (BS)

BS EN 953	Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards.
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International Organization for Standardization (ISO)

ISO 10440-2	Petroleum and natural gas industries - Rotary-type positive-displacement compressors - Part 2: Packaged air compressors (oil-free).
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4 General

4.1 Pressure design code

Modify First Sentence to Read

Pressure design code shall be subject to agreement with BP.

The pressure design code to be used depends on national regulations, type of vessel, materials and fabrication method, etc.

The pressure design code specified by the vendor needs to be reviewed and agreed by appropriate project technical authority to ensure it meets the requirements of the application and any local regulations.



Requirements for and guidance on pressure design codes can be found in GP 46-01.

5 Basic design

5.1.19 Add

- a. Sound power levels shall comply with GIS 15-011.

This specifies a limit of 80 dBA.

- 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.

5.1.20 Add

- a. 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.
- b. 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.
- c. Area classification within an enclosure shall be subject to agreement between BP and Vendor.

The area within an enclosure would normally need to have a separate area classification from the surrounding area. For example, if an area classification would otherwise be Zone 2 (Division 2), equipment within an enclosure would normally need to be suitable for a Zone 1 (Division 1) area. This needs to be agreed between the appropriate BP project technical authority and the vendor and depends on the enclosure design and ventilation rates, the potential for hydrocarbon leaks within the enclosure, and the need for equipment within the enclosure to remain operational.

Requirements for and guidance on area classification can be found in GP 44-65.

5.2 Pressure casing

5.2.17 Add

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

5.3 Casing connections

5.3.2 Modify Last Sentence to Read

Flanged connections may be integral with the casing or, for casings of weldable material, may be formed by a butt welded pipe nipple or transition piece and shall terminate with a welding neck flange.

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.



5.3.3 Add

Welded connections shall be attached prior to casing heat treatment.

5.3.4 Add

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

5.3.8 Modify to Read

Pipe nipple shall have a welding neck flange.

5.4 **External forces and moments****5.4.1** Add

Actual forces and moments acting on each nozzle shall be calculated, presented in tabular form, and shall be less than the allowable limits set by Vendor. The party responsible for calculating the actual forces and moments shall be subject to agreement between Vendor and BP.

This is a critical interface between the compressor Vendor, who supplies the nozzles and the engineering contractor, who typically designs and installs the pipework. The calculation of actual forces and moments requires data from both the Vendor and engineering contractor and BP needs to agree with the Vendor whether calculations are to be performed by compressor vendor, the engineering contractor or a third party based on complexity of the piping and ability to perform the calculations.

5.5 **Rotating elements****5.5.1** **Rotors****5.5.1.3** Delete from First Sentence

“If specified or”

5.5.1.5 Modify to Read

Shaft ends shall comply with GIS 34-503.

5.6 **Shaft seals****5.6.1** **General****5.6.1.3** Add

Shaft seals and ancillary systems shall be suitable for operation at pressures up to maximum allowable working pressure.

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 need to be suitable.*
- *Machine is on standby but pressurised from an external source, and seals and ancillary systems need to be suitable.*

Add**5.6.1.10** **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 extreme pressure (EP)

