
**Petroleum, petrochemical and natural
gas industries — Axial and centrifugal
compressors and expander-
compressors —**

**Part 3:
Integrally geared centrifugal
compressors**

*Industries du pétrole, de la pétrochimie et du gaz naturel —
Compresseurs axiaux et centrifuges et compresseurs-détenteurs —
Partie 3: Compresseurs centrifuges et axiaux à multiplicateur intégré*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 1, *Process compressors*.

This first edition, together with ISO 10439-1, ISO 10439-2, and ISO 10439-4, replaces ISO 10439:2002.

ISO 10439 consists of the following parts, under the general title *Petroleum, petrochemical and natural gas industries — Axial and centrifugal compressors and expander-compressors*:

- *Part 1: General requirements*
- *Part 2: Non-integrally geared centrifugal and axial compressors*
- *Part 3: Integrally geared centrifugal compressors*
- *Part 4: Expander-compressors*

Introduction

This International Standard is based on the 7th edition of the American Petroleum Institute standard API 617.

Users of this International Standard should be aware that further or differing requirements might be needed for individual applications. This International Standard is not intended to inhibit a supplier from offering or the purchaser from accepting alternative equipment or engineering solutions for the individual application. This can be particularly appropriate where there is innovative or developing technology. Where an alternative is offered, the supplier should identify any variations from this International Standard and provide details.

A asterisk (*) at the beginning of the paragraph of a clause or subclause indicates that either a decision is required or further information is to be provided by the purchaser. This information should be indicated on data sheets or stated in the enquiry or purchase order (see examples in [Annex A](#), ISO 10439-2:2015, Annex A, and ISO 10439-4:2015, Annex A).

This International Standard includes the following annexes:

- [Annex A](#): Datasheets
- [Annex B](#): Vendor (Supplier) data and drawing requirements (VDDR)
- [Annex C](#): Nomenclature
- [Annex D](#): Typical materials for integrally geared compressors
- [Annex E](#): Inspector's checklist
- [Annex F](#): External forces and moments
- [Annex G](#): Rating formulae for integral gearing

[Annex A](#) and [Annex G](#) form a normative part of this part of ISO 10439. [Annexes B](#) to [F](#) are for information only.

In this International Standard, where practical, US customary units are included in parentheses for information.

Petroleum, petrochemical and natural gas industries — Axial and centrifugal compressors and expander- compressors —

Part 3: Integrally geared centrifugal compressors

1 Scope

This part of ISO 10439 specifies minimum requirements and gives recommendations for axial compressors, single-shaft and integrally geared process centrifugal compressors, and expander-compressors for special purpose applications that handle gas or process air in the petroleum, petrochemical, and natural gas industries. This part of ISO 10439 specifies integrally geared centrifugal compressors in conjunction with ISO 10439-1.

NOTE 1 See API 672 for packaged plant instrument air compressors.

NOTE 2 Expander stages are sometimes provided on these machines.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5389, *Turbocompressors — Performance test code*

ISO 8068, *Lubricants, industrial oils and related products (class L) — Family T (Turbines) — Specification for lubricating oils for turbines*

ISO 10439-1, *Petroleum, petrochemical and natural gas industries — Axial and centrifugal compressors and expander-compressors — Part 1: General requirements*

API 670, *Machinery protection systems*

AGMA 2015-1-A01, *Accuracy classification system — Tangential measurements for cylindrical gears*

AGMA 2101-D04, *Fundamental rating factors and calculation methods for involute spur and helical gear teeth*

ASME PTC 10-1997, *Performance test code on compressors and exhausters*

3 Terms, abbreviated terms, and definitions

For the purposes of this document, the terms, abbreviated terms, and definitions given in ISO 10439-1 apply.

NOTE A cross-section showing nomenclature of an integrally geared centrifugal compressor is included in [Annex C](#).

4 General

4.1 Dimensions and units

The dimensional and unit requirements shall be in accordance with ISO 10439-1.

4.2 Statutory requirements

The statutory requirements shall be in accordance with ISO 10439-1.

4.3 Unit responsibility

The unit responsibilities shall be in accordance with ISO 10439-1.

4.4 Basic design

4.4.1 Performance

4.4.1.1 The sectional head-capacity characteristic curve of each compressor section shall rise continuously from the rated point to predicted surge. The compressor, without the use of a bypass, shall be suitable for continuous operation at any capacity at least 10 % greater than the predicted surge capacity shown in the proposal.

4.4.1.2 Unless otherwise specified, the design lubricant shall be hydrocarbon oil of viscosity Grade 32 with an FZG load stage of 5, in accordance with ISO 8068. Viscosity Grade 46 with an FZG load stage of 5 can be used as a design lubricant, with the purchaser's approval. Oils with extreme pressure (EP) additives shall not be used.

NOTE Typical oil used in refineries and chemical plants has an FZG of 5 or higher. Requiring a higher FZG by design can require the need for special oil for this equipment.

4.5 Materials

Materials shall be in accordance with ISO 10439-1:2015, 4.5.

NOTE Refer to [Annex D](#) for typical materials.

4.6 Casings

Casings shall be in accordance with ISO 10439-1:2015, 4.6 and [4.6.1](#) to [4.6.6](#).

4.6.1 Pressure-containing casings

4.6.1.1 * The maximum allowable working pressure of each pressure casing shall be at least equal to the specified relief valve set pressure for that casing. The purchaser will specify the relief valve set pressure(s) for final discharge pressure and intermediate casing pressures, if applicable.

NOTE If only one relief valve pressure is specified, its set pressure does not usually apply to the intermediate pressure.

4.6.1.1.1 When a relief valve set pressure is not specified, each pressure casing shall be rated for at least 125 % of the maximum specified discharge pressure (gauge) of that pressure casing as determined by the supplier. System protection shall be furnished by the purchaser.

4.6.1.2 Socket-head or spanner-type bolting shall not be used externally unless specifically approved by the purchaser. For limited space locations, integrally flanged fasteners might be required.

4.6.2 Casing repair

Casings repairs shall be in accordance with ISO 10439-1:2015, 4.6.2.

4.6.3 Material inspection of pressure-containing parts

Casing material inspection of pressure-containing parts shall be in accordance with ISO 10439-1:2015, 4.6.3.

4.6.4 Pressure casing connections

Pressure casing connections shall be in accordance with ISO 10439-1:2015, 4.6.4 and [4.6.4.1](#) and [4.6.4.2](#).

4.6.4.1 Main process connections

Main process connections shall be in accordance with ISO 10439-1:2015, 4.6.4.2.

4.6.4.2 Auxiliary connections

4.6.4.2.1 If flanged or machined and studded openings are impractical, threaded connections can be used where they do not come in contact with flammable or toxic gas, with the purchaser's approval as follows:

- a) on non-weldable materials, such as cast iron;
- b) where essential for maintenance (disassembly and assembly).

These threaded openings shall be as specified in ISO 10439-1:2015, 4.6.4.3.8.

4.6.4.2.2 Auxiliary connections shall be at least DN 20 (NPS 3/4-in). See [4.11.1.7](#) to [4.11.1.8](#) and [Table 1](#) for auxiliary gearbox connections.

NOTE See ISO 10439-1:2015, 4.6.4.1.3 for allowable connection sizes.

4.6.4.2.3 Threaded connections for pipe sizes DN 20 (NPS 3/4-in) to DN 40 (NPS 1-1/2-in) size are permissible with the approval of the purchaser.

NOTE See ISO 10439-1:2015, 4.6.4.1.3 for allowable connection sizes.

4.6.5 Casing support structure

The mounting of the pressure casing (volute) to the gearbox shall be in accordance with ISO 10439-1:2015, 4.4.1.7. Bolting used to mount pressure casings shall be in accordance with ISO 10439-1:2015, 4.6.1.7.

4.6.6 External forces and moments

4.6.6.1 The supplier shall furnish the allowable forces and moments for each main process nozzle which has a customer connection in tabular form with the proposal. If nozzle loadings are not furnished, they shall be no less than NEMA SM23.

NOTE 1 Forces and moments allowed on integrally geared compressors are generally less than those allowed in ISO 10439-2 compressors (see [Annex F](#)).

NOTE 2 Piping system design needs to be rigorous in order to avoid piping expansion joints.

4.6.6.2 Pressure casing and supports shall be designed to have sufficient strength and rigidity to avoid adversely affecting impeller running clearances, gear contact pattern, seals, bearings, and coupling alignment.

4.6.7 Variable inlet and/or diffuser guide vanes

4.6.7.1 * Adjustable guide vanes shall be provided when specified or required by the supplier to meet specified operating conditions.

4.6.7.2 When provided, adjustable inlet guide vanes and operating mechanisms shall be suitable for all specified operating conditions, as well as start-up, shutdown, trip-out, settling-out, and momentary surge.

4.6.7.2.1 Guide vanes shall be mounted in replaceable bushings. Vanes can be positioned in the housing by replaceable permanently sealed rolling element bearings, if approved by the purchaser.

4.6.7.2.2 When adjustable guide vanes are used for toxic, flammable, or explosive process gas, then the linkage passing through the casing or enclosure shall be sealed to prevent leakage.

4.6.7.2.3 The inlet guide vanes shall be located sufficiently close to the eye of the impeller to be effective.

4.6.7.2.4 The vane foils shall have an aerodynamically smooth surface, especially where the shank enters the gas stream through the housing. A cantilevered design in lieu of a centre-supported vane design is preferred.

4.6.7.2.5 The vanes shall be designed such that the vanes will tend to open on loss of the control signal.

4.6.7.2.6 A vane control system consisting of a valve positioner with direct driven local position indicator shall be provided that will be visible during operation of the machine.

4.6.7.2.7 * Additional components to the vane control system in [4.6.7.2.6](#) shall be as specified.

4.6.7.3 * If specified, the actuation shaft seal shall be buffered using a barrier gas.

4.7 Rotating elements

4.7.1 Each impeller and shaft shall be clearly marked with a unique identification number. This number shall be on an accessible area that is not prone to maintenance damage.

4.7.2 Unless other shaft protection is approved by the purchaser, renewable components shall be furnished at close clearance points. Sleeves, spacers, or bushings shall be made of materials that are corrosion-resistant in the specified service (see ISO 10439-1:2015, 4.5.1.6 for limitations).

4.7.2.1 Shaft sleeves shall be provided under shaft end seals. Sleeves shall be treated to resist wear and sealed to prevent gas leakage between the shaft and sleeve.

4.7.3 Thrust loads from impellers and gears shall be absorbed by individual thrust bearings on pinions or transmitted to the bull gear thrust bearing by means of thrust rider rings fixed to the pinions and bull gear. All specified operating conditions and start-up conditions shall be evaluated for residual thrust loads.

NOTE Balance pistons are normally not used. Thrust balancing can be achieved by helix thrust force direction of the gearing and offsetting impeller aerodynamic thrust forces.

4.7.4 Impeller requirements shall be in accordance with ISO 10439-1:2015, 4.7.10.

4.8 Dynamics

Dynamics requirements shall be in accordance with ISO 10439-1.

4.8.1 For equipment covered in this part of ISO 14039, a lateral analysis shall be carried out for each shaft. For the bull gear, this shall consist only of an undamped critical speed map.

4.9 Bearings and bearing housings

Bearings and bearing housings shall be in accordance with [4.9.1](#) to [4.9.4](#) and ISO 10439-1:2015, 4.9.

4.9.1 General

4.9.1.1 Unless otherwise specified, radial and thrust bearings shall be of the hydrodynamic fluid film type.

4.9.1.2 Unless otherwise specified, thrust bearings and radial bearings shall be fitted with bearing-metal temperature sensors installed in accordance with API 670.

4.9.1.2.1 As design criteria, bearing metal temperatures shall not exceed 100 °C (212 °F) at specified operating conditions with a maximum oil inlet temperature of 50 °C (120 °F).

4.9.1.2.2 In the event the design criteria in [4.9.1.2.1](#) cannot be met, the purchaser and the supplier shall agree on acceptable bearing metal temperatures.

4.9.2 Hydrodynamic radial bearings

4.9.2.1 Sleeve or pad radial bearings shall be used and shall be split for ease of assembly. The use of non-split designs requires the purchaser's approval. The bearings shall be precision bored with steel, copper, cupro-nickel, or bronze-backed babbitted liners, pads, or shells. The bearings shall be equipped with anti-rotation pins and shall be positively secured in the axial direction.

4.9.2.2 * If specified, tilting pad bearing pads shall be copper-alloy backed.

4.9.2.3 * Unless otherwise specified, the liners, pads, or shells shall be in axially split housings. The bearing design shall not require removal of the coupling hub to permit replacement of the bearing liners, pads, or shells unless approved by the purchaser.

4.9.3 Hydrodynamic thrust bearings

4.9.3.1 Thrust bearings can be fixed-geometry (e.g. tapered-land) or tilting-pad type, steel-backed and babbitted, arranged for continuous pressurized lubrication to each side.

NOTE See [4.7.3](#) for thrust rider rings.

4.9.3.2 If specified, bearings shall be tilting pad on one or both sides.

4.9.3.3 Hydrodynamic thrust bearings shall be selected at no more than 50% of the bearing manufacturer's ultimate load rating. In sizing thrust bearings, consider the following for each specified application:

- a) the shaft speed;
- b) the temperature of the bearing babbitt;
- c) the deflection of the bearing pad;
- d) the minimum oil film thickness;
- e) the feed rate, viscosity, and supply conditions of the oil over the specified allowable oil supply condition range;

- f) the design configuration of the bearing;
- g) the babbitt or other bearing surface material alloy and pad material;
- h) the turbulence of the oil film;
- i) load changes due to process changes over the specified operating range.

NOTE See ISO 10439-1:2015, 3.1.60 for a definition of ultimate load rating for hydrodynamic thrust bearings.

4.9.3.4 Thrust bearings shall be sized for continuous operation under the most adverse specified operating conditions. Calculations of the thrust forces shall include, but shall not be limited to, the following factors:

- a) seal maximum design internal clearances and twice the maximum design internal clearances;
- b) pressurized rotor diameter step changes;
- c) stage maximum differential pressures;
- d) specified extreme variations in inlet, interstage, and discharge pressures;
- e) the maximum thrust force that can be transmitted to the compressor thrust bearing by other equipment in the train (i.e. couplings, gears, or a motor without a thrust bearing);
- f) the maximum thrust force from the sleeve bearing type drive if the motor or generator is directly connected.

4.9.4 Bearing housings

4.9.4.1 The term bearing housing refers to all bearing enclosures including the gearbox.

4.9.4.2 Bearing housings for pressure-lubricated hydrodynamic bearings shall be arranged to minimize foaming. The drain system shall be adequate to maintain the oil and foam level below shaft seals.

4.9.4.3 Oil reservoirs and housings that enclose moving lubricated parts (such as bearings and shaft seals), highly polished parts, instruments, and control elements shall be designed to minimize contamination by moisture, dust, and other foreign matter during periods of operation and idleness.

4.9.4.4 Provision shall be made in the bearing housings for the probes specified in [5.5.7.1](#).

4.10 Shaft end seals

4.10.1 Process seals and seal systems shall be in accordance with ISO 10439-1:2015, 4.10.

NOTE 1 Typical cross sections of various seal systems are given in ISO 10439-1:2015, Annex B.

NOTE 2 Equipment covered in this part can be available with any of the shaft end seal types covered in ISO 10439-1 or additional hybrid types are available.

4.10.2 * The purchaser shall specify the type of shaft end seal(s) to be provided and all operating conditions including start-up, shutdown, and settling-out conditions.

4.11 Integral gearing

4.11.1 The supplier shall dowel or key the gearbox to the mounting plate to maintain alignment.

NOTE Integrally geared compressors are fixed to the mounting plate and are not to be moved for alignment (to avoid distortion of the gearbox).

4.11.1.1 To the maximum extent practical, gearboxes shall be designed with internal oil passages to minimize external piping. External piping connections shall conform to the requirements of ISO 10439-1:2015, 4.6.4.3.

4.11.1.2 The design of internal piping and tubing shall achieve proper support and protection to prevent damage from vibration or from shipment, operation, and maintenance. Cantilevered piping in excess of 10 pipe diameters shall include reinforcing gussets in two planes at all pipe-to-flange connections.

4.11.1.3 The gearbox shall be designed to permit rapid drainage of lube oil and to minimize oil foaming (which could lead to excessive heating of the oil). For gears with pitch line velocities of more than 125 m/s (25 000 ft/min), consideration should be given to design features such as windage baffles, false bottoms, adequate sump depth, and an additional full-size drain connection.

4.11.1.4 A removable and gasketed inspection cover or covers shall be provided in the gearbox to permit direct visual inspection of the full-face width of the pinion(s) and gear. The inspection opening or openings shall be at least one-half the width of the gear face.

4.11.1.5 Permanent coatings or paint shall not be applied to the interior of the casing, unless the purchaser approves in advance the material and method of application.

4.11.1.6 A single lube-oil supply connection is preferred.

4.11.1.7 A single lube-oil drain connection from the gear casing is preferred. The minimum drainpipe size shall be sized to be no more than half full and shall be based on the total inlet flow to the gear casing, as shown in [Table 1](#).

Table 1 — Drain pipe sizes

Inlet flow rate		Minimum drain size ^a	
Litres per minute	US Gallons per minute	Millimetres	Inch
74	19	50	2
176	46	75	3
370	97	100	4
1 146	302	150	6
^a Nominal pipe size.			

4.11.1.8 Gearboxes shall be provided with a plugged or flanged-and-blinded purge gas connection.

4.11.2 Gearbox split lines shall use a metal-to-metal joint. Adequate sealing shall be provided with a suitable joint compound or groove-type seals. Gaskets (including string type) shall not be used on the gearbox split lines.

4.11.3 Gear rating

4.11.3.1 When a gearbox has a gear mesh with a ratio of 7:1 or greater, all of the gearing in that gearbox shall be rated in accordance with [Annex G](#). All other gear sets shall be rated per API 613.

4.11.3.2 The rated power of the gearing shall not be less than the driver nameplate rating multiplied by the driver service factor. When there are multiple pinions, the power rating of the gear sets shall not be less than the following:

- a) 110 % of the maximum power transmitted by the gear set.
- b) The maximum power of the driver (including service factor) prorated between all the gear sets, based on normal power demands. If the maximum transmitted torque occurs at a continuous operating speed other than the maximum continuous speed, this torque and its corresponding speed shall be the basis for sizing the gear set.

4.11.3.3 The power rating based upon both pitting resistance and bending strength shall be calculated for each member of each gear set in the unit. The pinion and bull gear teeth can have different ratings due to differences in material properties, geometry factors, and number of cycles under load. The lowest of the four ratings (pinion bending, pinion pitting, bull gear bending, bull gear pitting) shall be used as the gear rating (see [Annex G](#)). Wherever possible, gear sets shall be designed such that failure will occur due to pitting rather than bending (i.e. wear out before breaking).

NOTE Higher gear ratios require a large number of teeth; therefore, it might not be possible to provide tooth design (which will fail in pitting rather than bending) without compromising other aspects of the gear design (i.e. higher pitchline velocities).

4.11.3.4 Gearing shall be designed and manufactured to meet the requirements of AGMA 2015-1-A01, accuracy Grade 4.

NOTE For equivalent loading conditions, gearing produced to higher quality levels will always result in longer service life and reduced bearing loads.

4.11.3.5 The manufacturer shall provide documentation showing that the required quality levels in [4.11.3.4](#) have been met.

4.11.3.6 The pinion face width to working pitch diameter ratio (L/d ratio) shall be limited based on pinion tooth hardness, as follows:

4.11.3.6.1 For pinion hardness equal to or less than 38 Rc (BHN 354), L/d shall be limited to 2,0 maximum.

4.11.3.6.2 For pinion hardness equal to or greater than 58 Rc (BHN 615), L/d shall be limited to 1,6 maximum.

4.11.3.6.3 For pinion hardness between 38 and 58 Rc (BHN 354 and BHN 615), L/d shall be limited to $L/d = 2,76 - 0,02 \times H$ (see [Figure 1](#)), where H is the hardness in Rockwell C.

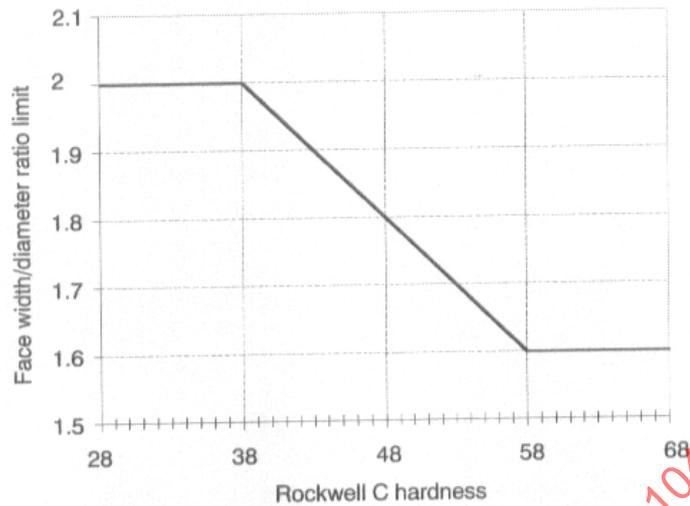


Figure 1 — Face width limit

4.11.3.7 The material used for gearing shall meet the specifications for AGMA 2101 Grade 2 material, as a minimum. If a superior grade of material is used, credit for the better material shall not be taken in the gear rating.

4.11.3.8 The tooth portion of pinions shall be integral with their shafts.

4.11.3.9 The bull gear can be integral with or separate from its shaft. Separate shafts shall be assembled into the bull gear with an interference fit suitable for all torque requirements including pulsations.

4.11.3.10 Shafts shall be made of one-piece, heat-treated steel that is suitably machined. Shafts that have a finished diameter larger than 200 mm (8 in) shall be forged steel. Shafts that have a finished diameter of 200 mm (8 in) or less shall be forged steel or hot rolled barstock, providing such barstock meets all quality and heat treatment criteria established for shaft forgings.

4.11.3.11 Gearboxes shall not require a break-in period.

4.11.3.12 The gearing shall be designed to withstand all internal and external loads inherent to geared, rotating machinery systems to the limit of the installed driver.

4.11.3.13 The unplated tooth surface on loaded faces of completed gears shall have a finish, as measured along the pitch line, of $0,8 \mu\text{m}$ ($32 \mu\text{in}$) Ra or better.

4.11.3.14 Hunting tooth combinations are preferred. To achieve this, it can be necessary for the manufacturer to adjust the exact gear ratio. If such adjustment is impractical, the purchaser and the supplier shall negotiate a solution. At least one mesh shall be hunting tooth.

NOTE A hunting tooth combination is preferred because the intent is for every tooth on a pinion to mesh with as many teeth as possible on the mating gear before the same teeth mesh again or repeat. However, with multiple pinion units, a hunting tooth combination is not as critical because the gear wheel meshes with multiple pinions and is, therefore, not as susceptible to the problems of non-hunting tooth designs.

4.11.3.15 Each gear and each pinion shall be supported between two bearings. Overhung designs are not permitted.

4.12 Nameplates and rotation arrows

4.12.1 Nameplates and rotation arrows shall be in accordance with [4.12.2](#) and [4.12.3](#) and ISO 10439-1:2015, 4.12.

4.12.2 The following data shall be clearly stamped or engraved on the nameplate(s):

- a) supplier's name;
- b) serial number;
- c) size, type, and model;
- d) rated capacity;
- e) rated power;
- f) gear ratio;
- g) rated input speed or speed range for variable speed driver;
- h) purchaser item number;
- i) maximum allowable working pressure of each pressure-containing casing;
- j) maximum and minimum allowable working temperature of each pressure-containing casing;
- k) hydrostatic test pressure for each pressure-containing casing;
- l) maximum sealing pressure of each pressure-containing casing.

NOTE Normally, multiple nameplates are provided.

4.12.3 Rotation arrows shall be cast-in or attached for the bull gear rotation at a readily visible location.

NOTE See ISO 10439-1:2015, 4.12.

5 Accessories

Accessories shall be in accordance with ISO 10439-1:2015, Clause 5.

5.1 Drivers

Drivers shall be in accordance with ISO 10439-1:2015, 5.1.

5.2 Couplings and guards

Couplings and guards shall be in accordance with ISO 10439-1:2015, 5.2.

5.3 Lubrication and sealing systems

Lubrication and sealing systems shall be in accordance with ISO 10439-1:2015, 5.3.

5.4 Mounting plates

Mounting plates shall be in accordance with ISO 10439-1:2015, 5.4.

5.4.1 * If specified or approved by the purchaser, the oil reservoir shall be integral with the baseplate.

5.4.2 * If specified, the baseplate shall have a series of machined mounting pads suitable for mating to field-installed soleplates to facilitate installation.

NOTE See API RP 686 2nd edition, [Annex C, Figure C.1](#).

5.4.3 * If specified, when machined mounting pads as indicated in [5.4.2](#) have been specified, the supplier shall also supply the soleplates needed for field installation.

5.5 Controls and instrumentation

5.5.1 Controls and instrumentation shall be in accordance with ISO 10439-1:2015, 5.5.

5.5.2 Control systems

5.5.2.1 * For a constant-speed centrifugal compressor, the control signal shall actuate either a purchaser-furnished control valve in the compressor inlet piping or the adjustable inlet guide vanes or variable diffuser vanes furnished by the supplier as an integral part of the compressor, as specified.

5.5.2.2 If adjustable inlet guide vanes or variable diffuser vanes are specified, the supplier shall also furnish a guide-vane positioner compatible with the type of control signal specified by the purchaser.

5.5.2.3 * If specified, the guide vane positioner shall include a local manual override. A direct-driven vane position indicator that will be visible during operation of the machine shall be provided.

5.5.3 Instrument and control panels, when supplied, shall be in accordance with ISO 10439-1:2015, 5.5.3.

5.5.4 Instrumentation, when supplied, shall be in accordance with ISO 10439-1:2015, 5.5.4.

5.5.5 Alarms and shutdowns, when supplied, shall be in accordance with ISO 10439-1:2015, 5.5.5.

5.5.6 Electrical systems, when supplied, shall be in accordance with ISO 10439-1:2015, 5.5.6.

5.5.7 Vibration, position, and bearing temperature.

5.5.7.1 Unless otherwise specified, the following transducers shall be provided: two radial-vibration probes adjacent to each radial bearing, two axial-position probes for each shaft equipped with a thrust bearing, and a one-event-per-revolution probe for each shaft.

5.5.7.2 Vibration and axial position transducers shall be supplied, installed, and calibrated in accordance with API 670.

5.5.7.3 * If specified, radial shaft vibration and axial position monitors shall be supplied and calibrated in accordance with API 670.

5.5.7.4 Two bearing temperature sensors shall be supplied, installed, and calibrated for each radial and thrust bearing in accordance with API 670.

NOTE The second sensor can be used as a spare.

5.5.7.5 * The purchaser shall specify the type of temperature sensors required per API 670.

5.5.7.6 * If specified, a bearing temperature monitor shall be supplied and calibrated in accordance with API 670.

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5.5.7.7 * If specified, an accelerometer shall be supplied, installed at the shaft on the gearbox, and calibrated in accordance with API 670.

NOTE Commercially available accelerometers that have hazardous area certifications have difficulty reaching high gear mesh frequencies.

5.5.7.8 * If specified, an accelerometer monitor shall be supplied, installed, and calibrated in accordance with API 670.

5.6 Piping and appurtenances

5.6.1 General

Piping and appurtenances furnished shall be in accordance with [5.6.1.1](#) to [5.6.2.3](#) and ISO 10439-1:2015, 5.6.

5.6.1.1 When a baseplate has been specified, the supplier shall furnish all piping systems, including mounted appurtenances, located within its confines. The piping shall terminate with flanged connections at the edge of the baseplate. The purchaser will furnish only interconnecting piping between equipment groupings and off base facilities.

NOTE The oil reservoir and oil system can be combined in the baseplate (see [5.4.1](#)).

5.6.1.2 * If specified, a liquid injection manifold shall be supplied. It shall include a throttle valve, an armoured flow meter, a check valve, a pressure indicator, and a block valve for each injection point.

5.6.2 Process piping and accessories

5.6.2.1 Unless otherwise specified, process piping, if furnished, shall be in accordance with ISO 10438-1, ISO 10438-2, and ISO 10438-4.

NOTE API 614 5th edition is identical to ISO 10438 (all parts):2007.

5.6.2.2 * If specified, the purchaser shall furnish piping specifications for supplier furnished process piping.

5.6.2.3 * If specified, the supplier shall provide process gas heat exchangers in accordance with purchaser-provided specifications.

NOTE 1 Refer to ISO 10438-1 for process heat exchanger requirements.

NOTE 2 API 614 5th edition is identical to ISO 10438 (all parts):2007.

5.7 Special tools

Special tools shall be in accordance with ISO 10439-1:2015, 5.7.

6 Inspection, testing, and preparation for shipment

6.1 General

General requirements for inspection, testing, and preparation for shipment shall be in accordance with ISO 10439-1:2015, 6.1. Also refer to [Annex E](#) for inspector's checklist.

6.2 Inspection

Requirements for inspection shall be in accordance with [6.2.1.1](#) to [6.2.1.2](#) and ISO 10439-1:2015, 6.2.

6.2.1 Gear contact checks

6.2.1.1 Each set of installed gears shall be checked for contact in the job gearbox at the supplier's shop.

6.2.1.2 A thin coating of colour transfer material (such as Prussian blue) shall be applied at three locations, 120 degrees apart, to four or more teeth of the dry degreased gear. (Layout dye shall not be used for the assembly contact check.) With the gear held firmly, the coated teeth shall be rotated through the mesh with a moderate drag torque applied in a direction that will cause the teeth to contact on the normally loaded faces. The colour transfer shall show evidence of contact distributed across each helix, as prescribed by the supplier. Prior to the contact tests, the supplier shall make available to the purchaser a contact drawing or supplier engineering specification that defines the acceptable contact. The results of the contact check shall be preserved by lifting the contrasting colours from a tooth by applying and peeling off a strip of clear adhesive tape and then applying the tape to a notated sheet of white paper. The drawing or specification and the results of the contact checks shall be preserved for at least 20 years and shall be available to the purchaser on request.

NOTE Unmodified leads generally show about 80 % contact across the tooth length.

6.3 Testing

In addition to the requirements of ISO 10439-1:2015, 6.3, the compressor shall be tested in accordance with [6.3.1](#) and [6.3.2](#). Other tests that can be specified are described in [6.3.3](#).

6.3.1 Mechanical running test

6.3.1.1 The requirements of [6.3.1.1.1](#) to [6.3.1.1.5](#) shall be met before the mechanical running test is performed.

6.3.1.1.1 The contract shaft seals and bearings shall be used in the machine for the mechanical running test.

6.3.1.1.2 Compressors covered in this part generally do not use oil-injected seals or seal-oil systems. When these are specified, testing shall be as agreed between user and supplier.

NOTE For guidance, see ISO 10439-1:2015, 6.3.2.

6.3.1.1.3 Oil viscosity, pressures, temperatures, and filtration shall be within the range of operating values recommended in the supplier's operating instructions for the specific unit being tested. Overall oil flow rates for each oil supply line shall be measured.

6.3.1.1.4 Following the mechanical running test, the requirements of ISO 10439-1:2015, 6.3.5.10 shall be met, as well as the requirements of [6.3.1.4.1](#) and [6.3.1.4.2](#).

NOTE API 614 5th edition is identical to ISO 10438 (all parts):2007.

6.3.1.1.5 Facilities shall be installed to prevent the entrance of oil into the compressor during the mechanical running test. These facilities shall be in operation throughout the test.

6.3.1.2 The mechanical running test of the equipment shall be conducted as specified in [6.3.1.2.1](#) to [6.3.1.2.4](#).

NOTE Testing with the contract coupling(s) is preferred.

6.3.1.2.1 The equipment shall be accelerated to the maximum continuous speed and run until bearings, lube-oil temperatures, and shaft vibrations have stabilized.

NOTE Operating equipment at or near-critical speeds is normally avoided.

6.3.1.2.2 For variable speed machines, the speed shall be increased to trip speed and the equipment shall be run for a minimum of 15 min.

6.3.1.2.3 The speed shall be reduced to the maximum continuous speed, and the equipment shall be run for 4 h continuous operation.

6.3.1.2.4 The following seal flow data shall be taken during the mechanical running test to ensure that the seals are installed and operating properly:

- a) for single dry gas seals, flow in the vent line from each seal shall be measured;
- b) for tandem dry gas seals, flow in the primary and secondary vent line from each seal shall be measured;
- c) for double dry gas seals, the total seal gas flow to each seal shall be measured.

NOTE 1 Seal performance at contract conditions is normally determined in separate tests by the seal manufacturer (see ISO 10439-1:2015, 4.10 for the requirements).

NOTE 2 Flow in the vents of single or tandem seals can include buffer or separation gas in addition to process gas leakage through the seal.

6.3.1.3 During the mechanical running test, the requirements of [6.3.1.3.1](#) to [6.3.1.3.7](#) shall be met.

6.3.1.3.1 During the mechanical running test, the mechanical operation of all equipment being tested and the operation of the test instrumentation shall be satisfactory. The equipment measured unfiltered vibration shall not exceed the limits of ISO 10439-1:2015, 4.8.8.8 and shall be recorded at the operating speed. Any other test acceptance criteria shall be agreed and stated in the test agenda.

6.3.1.3.2 Casing vibration shall not exceed an overall level of 4 Gs peak at gear mesh frequency.

6.3.1.3.3 While the equipment is operating at maximum continuous speed or other speeds, vibration data shall be acquired to determine amplitudes at frequencies other than synchronous. This data shall cover a frequency range from 0,25 times to 8 times the maximum continuous speed. If the amplitude of any discrete, nonsynchronous vibration exceeds 20 % of the allowable vibration as defined in ISO 10439-1:2015, 4.8.8.8, the purchaser and the supplier shall agree on the requirements for any additional testing and on the equipment acceptability.

6.3.1.3.4 The mechanical running test shall verify that lateral critical speeds below running speed conform to the requirements of ISO 10439-1:2015, 4.8.2.

6.3.1.3.5 * If specified, shop verification of the unbalanced response analysis shall be performed in accordance with ISO 10439-1:2015, 4.8.3.

6.3.1.3.6 * If specified, all real-time vibration data as agreed by the purchaser and the supplier shall be recorded and a copy provided to the purchaser.

6.3.1.3.7 * If specified, the user can bring in vibration equipment to record baseline readings.

6.3.1.4 Following the mechanical running test, the requirements of ISO 10439-1:2015, 6.3.7.2 shall be met, as well as the requirements of [6.3.1.4.1](#) and [6.3.1.4.2](#).

6.3.1.4.1 The tooth mesh shall be inspected for proper contact and for surface damage resulting from the test.

6.3.1.4.2 Spare rotor sets ordered to permit concurrent manufacture shall also be given a mechanical running test in accordance with the requirements of this standard. Complete spare set shall be run as a unit.

6.3.2 Assembled compressor gas leakage test

6.3.2.1 After the mechanical running test is completed, each completely assembled compressor casing intended for toxic, hazardous, or flammable service shall be tested as required in [6.3.2.2](#) and/or, if specified, [6.3.2.3](#).

NOTE These tests are intended to verify the integrity of the casing joint. Some shaft seal designs are not gas tight. Therefore, leakage from these seals during this test is acceptable.

6.3.2.2 The assembled compressor (including end seals) shall be pressurized, with an inert gas, to the maximum sealing pressure or the maximum seal design pressure, as agreed by the purchaser and the supplier; held at no less than this pressure for a minimum of 30 min and subjected to a soap-bubble test, or alternate method, to check for gas leaks. The test shall be considered satisfactory when no casing or casing joint leaks are observed. If design mole weight is less than 12, the test gas shall be helium.

NOTE The test gas mole weight will approximate or be less than the contract gas mole weight.

6.3.2.3 * If specified, the assembled compressor (with or without end seals installed) shall be pressurized with an inert gas to the maximum specified discharge pressure, held at this pressure for a minimum of 30 min, and subjected to a soap-bubble test, or alternate method, to check for gas leaks. The test shall be considered satisfactory when no casing or casing joint leaks are observed.

NOTE The requirements of [6.3.2.2](#) and [6.3.2.3](#) can necessitate two separate tests.

6.3.3 * Optional tests

The purchaser should specify whether any of the following shop tests shall be performed. The purchaser and the supplier shall agree upon test details prior to the test.

6.3.3.1 Performance test

6.3.3.1.1 The compressor shall be performance tested in accordance with ASME PTC 10-1997 or ISO 5389, as specified. A minimum of five points, including surge and overload, shall be taken at normal speed and vane setting. For variable speed or variable vane machines, additional points can be specified.

NOTE Refer to the applicable test code for general instructions. ASME PTC 10-1997 does not apply to some low-pressure ratio compressors. Refer to PTC 10-1997, 1.2.2 for the selection of the appropriate test code to be used.

6.3.3.1.2 For variable speed or variable vane machines, head and capacity shall have zero negative tolerance at the normal operating point (or other point as specified), and the power at this point shall not exceed 104 % of the supplier-predicted shaft power value. This tolerance shall be inclusive of all test tolerances. Surge shall comply with provisions of [4.4.1.1](#).

NOTE Both of the performance test codes referred to have provision for calculating inaccuracy based on instrumentation and procedures. These test inaccuracies are already included in the above tolerance and, therefore, are not to be further added.

6.3.3.1.3 For constant-speed compressors, the capacity shall be as specified in [6.3.3.1.2](#). The head shall be within the range of 100 % to 105 % of the normal head. The horsepower, based on measured head at normal capacity, shall not exceed 107 % of the value at the specified normal operating point. If the power required at this point exceeds 107 %, excess head can be removed by trimming impellers at the purchaser's option.

6.3.3.1.4 The performance test shall be conducted using only one contract rotor set, unless additional performance testing is specified.

6.3.3.1.5 Compressors with intermediate specified process pressures shall have individual sectional head (pressure) tolerances as agreed.

6.3.3.2 Complete unit test

Such components as compressors, gears, drivers, and auxiliaries that make up a complete unit shall be tested together during the mechanical running test. A separate auxiliary test can be performed with the purchaser's approval. The complete unit test can be performed in place of or in addition to separate tests of individual components specified by the purchaser. If specified, torsional vibration measurements shall be made to verify the supplier's analysis.

6.4 Preparation for shipment

6.4.1 Preparation for shipment shall be in accordance with [6.4.1.1](#) and ISO 10439-1:2015, 6.4.

6.4.1.1 * If specified, the fit-up and assembly of machine-mounted piping, intercoolers, etc. shall be completed in the supplier's shop prior to shipment.

7 Supplier's data

Supplier's data shall be in accordance with ISO 10439-1:2015, Clause 7.

7.1 General

7.1.1 The information to be furnished by the supplier is specified in [Annex B](#) and ISO 10439-1:2015, Clause 7. The supplier shall complete and forward the VDDR form in [Annex B](#) to the address or addresses noted on the inquiry or order. This form shall detail the schedule for transmission of drawings, curves, and data as agreed to at the time of the order, as well as the number and type of copies required by the purchaser.

7.1.2 On the data sheets and in drawings and tables, the shaft rotational direction shall be designated by the abbreviations CW or CCW (see [4.12.3](#)).

7.1.3 Suppliers shall provide bearing temperature alarm and shutdown limits.

7.2 Proposals

Proposals shall be in accordance with ISO 10439-1:2015, 7.2.

7.3 Contract data

Contract data shall be in accordance with ISO 10439-1:2015, 7.3.

Annex A
(normative)

Datasheets

The datasheets are also available in electronic format via <http://standards.iso.org/iso/>.

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	REVISION	0	1	2	3	4
	DATE					
	BY					
INTEGRALLY GEARED COMPRESSOR DATA SHEET (API 617-8TH Chapter 3) SI UNITS (bar)						
	REV/APPR					
	JOB NO.	ITEM NO.				
	PAGE 1 OF 2	REQ'N NO.				

1	APPLICABLE TO:	<input type="radio"/> PROPOSAL	<input type="radio"/> PURCHASE	<input type="radio"/> AS BUILT		
2	FOR	UNIT				
3	SITE	SERIAL NO.				
4	SERVICE	NO. REQUIRED				
5	MANUFACTURER	DRIVER TYPE (†3.1†)				
6	MODEL	DRIVER ITEM NO.				
7	APPLICABLE STANDARD:	<input type="radio"/> US	<input type="radio"/> ISO			
8	NOTE: INFORMATION TO BE COMPLETED BY:	<input type="radio"/> PURCHASER	<input type="checkbox"/> MANUFACTURER	<input type="checkbox"/> PURCHASER OR MANUFACTURER		
9	OPERATING CONDITIONS					
10	(ALL DATA ON PER UNIT BASIS)		NORMAL	OTHER CONDITIONS (1-2.1.1.1)		
11			(†2.1.1.2)	RATED	B	C
12			(NOTE †)			
13	<input type="radio"/> GAS HANDLED (ALSO SEE PAGE ____)					
14	<input type="checkbox"/> GAS PROPERTIES (†2.1.1.4)					
15	<input type="checkbox"/> N(m³/h) (10 ³ barA & 0C DRY)					
16	<input type="radio"/> WEIGHT FLOW (lb/min) <input type="radio"/> WET <input type="radio"/> DRY					
17	INLET CONDITIONS					
18	<input type="radio"/> PRESSURE (barA)					
19	<input type="radio"/> TEMPERATURE (C)					
20	<input type="radio"/> RELATIVE HUMIDITY %					
21	<input type="radio"/> MOLECULAR WEIGHT					
22	<input type="checkbox"/> Cp/Cv (K ₁) OR (K _{AVG})					
23	<input type="checkbox"/> COMPRESSIBILITY (Z ₁) OR (Z _{AVG})					
24	<input type="checkbox"/> INLET VOLUME (m³/h) <input type="radio"/> WET <input type="radio"/> DRY					
25	DISCHARGE CONDITIONS					
26	<input type="radio"/> PRESSURE (barA)					
27	<input type="checkbox"/> TEMPERATURE (C) (ESTIMATED)					
28	<input type="checkbox"/> Cp/Cv (K ₂) OR (K _{AVG})					
29	<input type="checkbox"/> COMPRESSIBILITY (Z ₂) OR (Z _{AVG})					
30	<input type="checkbox"/> GHP REQUIRED (kW)					
31	<input type="checkbox"/> TRAIN (B kW) REQUIRED					
32	<input type="checkbox"/> (B kW) REQUIRED AT DRIVER INCL. EXT. LOSSES (GEAR, ETC)					
33	<input type="checkbox"/> SPEED of driver (rpm)					
34	<input type="checkbox"/> TURNDOWN (%)					
35	<input type="checkbox"/> POLYTROPIC HEAD (N-m/kg)					
36	<input type="checkbox"/> POLYTROPIC EFFICIENCY (%)					
37	<input type="radio"/> CERTIFIED POINT					
38	<input type="checkbox"/> PERFORMANCE CURVE NUMBER					
39	PROCESS CONTROL (1-3.4.2.†)					
40	<input type="radio"/> METHOD	<input type="radio"/> SUCTION THROTTLING	<input type="radio"/> VARIABLE INLET	<input type="radio"/> SPEED VARIATION	<input type="radio"/> DISCHARGE	<input type="radio"/> VARIABLE DIFFUSER
41		FROM ____ (barA)	GUIDE VANES	FROM ____ %	BLOWOFF OR	GUIDE VANES
42		TO ____ (barA)	(3-2.4)	TO ____ %	RECIRCULATION	(3-2.4)
43	SIGNAL	<input type="radio"/> SOURCE (†3.4.2.†)				
44		TYPE <input type="radio"/> ELECTRONIC <input type="radio"/> PNEUMATIC <input type="radio"/> OTHER				
45		RANGE ____ MA ____ (barG)				
46	REMARKS: Note 1: IF GAS ANALYSIS IS GIVEN, MANUFACTURER SHALL SUPPLY GAS PROPERTIES, OTHERWISE DATA SHALL BE SUPPLIED BY USER					
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						

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		REVISION	0	1	2	3	4
		DATE					
INTEGRALLY GEARED COMPRESSOR DATA SHEET (API 617-8TH Chapter 3) SI UNITS (bar)		JOB NO.	ITEM NO.				
		PAGE	3	OF	12	REQ'N NO.	
CONSTRUCTION FEATURES (1 COLUMN PER STAGE, USE ADDITIONAL SHEETS IF NEEDED)							
1							
2	Rotor	Rotor 1					
3	Stage	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
4	<input type="checkbox"/> CASING:						
5	MODEL						
6	CASING SPLIT						
7	MATERIAL						
8	THICKNESS (mm)						
9	CORROSION ALLOWANCE (mm)						
10	MAX. ALLOWABLE PRESS (barG)						
11	TEST PRESS (barG)						
12	MAX. ALLOWABLE TEMP. (C)						
13	MAX. OPERATING TEMP (C)						
14	MIN. OPERATING TEMPERATURE (C)						
15	MAX CASING CAPACITY (m ³ /h)						
16	<input type="checkbox"/> INLET CONNECTIONS (1-2.3.2.2.1, 1-2.3.2.2.7)						
17	TYPE						
18	ORIENTATION						
19	FLANGED OR STUDDED?						
20	MATING FLG & GASKET BY VENDOR?						
21	GAS VELOCITY (m/s)						
22	<input type="checkbox"/> DISCHARGE CONNECTIONS (1-2.3.2.2.1, 1-2.3.2.2.7)						
23	TYPE						
24	ORIENTATION						
25	FLANGED OR STUDDED?						
26	MATING FLG & GASKET BY VENDOR?						
27	GAS VELOCITY (m/s)						
28	<input type="radio"/> INTERMEDIATE MAIN PROCESS CONNECTIONS (2-2.4.5)						
29	DISCH. PRESSURE (barG)						
30	INLET PRESSURE (barG)						
31	<input type="checkbox"/> ADJUSTABLE INLET GUIDE VANES						
32	MATERIAL						
33	NO. INLET GUIDE VANES						
34	<input type="checkbox"/> IMPELLER:						
35	DIAMETER						
36	Number of VANES						
37	TYPE (OPEN, ENCLOSED, ETC.)						
38	TYPE FABRICATION						
39	MATERIAL						
40	MIN. YIELD STRENGTH (MPa)						
41	HARDNESS: (Rc) (BRINNEL)						
42	SMALLEST TIP INTERNAL WIDTH (mm)						
43	MAX. MACH. NO. @ IMPELLER EYE						
44	MAX. IMPELLER HEAD @ 100% SPEED (m)						
45	MAX. IMPELLER TIP SPEED (m/s)						
46	<input type="checkbox"/> DIFFUSER GUIDE VANES						
47	ADJUSTABLE?						
48	MATERIAL						
49	NO. GUIDE VANES						
50	REMARKS:						
51							
52							
53							
54							
55							
56							

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	REVISION	0	1	2	3	4
	DATE					
INTEGRALLY GEARED COMPRESSOR DATA SHEET (API 617-8TH Chapter 3) SI UNITS (bar)						
JOB NO. _____		ITEM NO. _____				
PAGE 4 OF 12		REQ'N NO. _____				
CONSTRUCTION FEATURES, continued (1 COLUMN PER STAGE, USE ADDITIONAL SHEETS IF NEEDED)						
1	Stage 1 Stage 2 Stage 3 Stage 4 Stage 5 Stage 6					
2	<input type="checkbox"/> SHAFT SLEEVES:					
3	MATERIAL _____					
4	AT SHAFT SEALS? _____					
5	OTHER LOCATIONS? _____					
6	<input type="checkbox"/> SHAFT SEALS: (†2.8.11, †2.8.15)					
7	<input type="radio"/> SEAL TYPE (†2.8.13)					
8	<input type="radio"/> SETTLING OUT PRESSURE (barG)					
9	<input type="radio"/> MINIMUM SEALING PRESSURE (barG)					
10	<input type="radio"/> TYPE BUFFER GAS, PRIMARY					
11	<input type="checkbox"/> PRESSURE (barG) (†2.8.16)					
12	<input type="checkbox"/> FLOWRATE (kg/h) (†2.8.16)					
13	<input type="checkbox"/> FILTRATION (†2.8.16)					
14	<input type="radio"/> TYPE BUFFER GAS, SECONDARY					
15	<input type="checkbox"/> PRESSURE (barG) (†2.8.16)					
16	<input type="checkbox"/> FLOWRATE (kg/h) (†2.8.16)					
17	<input type="checkbox"/> FILTRATION (†2.8.16)					
18	<input type="checkbox"/> FLOWRATE TO PROCESS					
19	<input type="radio"/> BUFFER GAS SYSTEM REQUIRED					
20	<input type="radio"/> MANIFOLD (†3.5.14)					
21	<input type="radio"/> METHOD OF CONTROL (†2.8.15) _____					
22	<input type="radio"/> BUFFER GAS CONTROL SYSTEM SCHEMATIC BY VENDOR					
23	<input type="radio"/> PRESSURIZING GAS FOR SUBATMOSPHERIC SEALS (†2.8.2.4) <input type="radio"/> EDUCTOR <input type="radio"/> INJECTION (†2.8.2.3)					
24	<input type="checkbox"/> SEAL MANUFACTURER _____ <input type="radio"/> SYSTEM RELIEF VALVE SET PT. _____					
25	BEARING TEMPERATURE DETECTORS (2-3.4.7)			VIBRATION DETECTORS: <input type="radio"/> SEE ATTACHED API-670 DATA SHEET		
26	<input type="radio"/> SEE ATTACHED API-670 DATASHEET			<input type="radio"/> TYPE _____ <input type="checkbox"/> MODEL _____		
27	<input type="radio"/> THERMOCOUPLES TYPE _____			<input type="radio"/> MFR _____		
28	<input type="radio"/> RESISTANCE TEMP DETECTORS			<input type="radio"/> NO. AT EA SHAFT BEARING _____ TOTAL NO. _____		
29	<input type="radio"/> RESISTANCE MATERIAL _____ (ohm)			<input type="radio"/> OSCILLATOR-DETECTORS SUPPLIED BY _____		
30	<input type="checkbox"/> ALARM TEMPERATURE (C) _____			<input type="radio"/> MFR _____ <input type="checkbox"/> MODEL _____		
31	<input type="checkbox"/> SHUTDOWN TEMPERATURE (C) _____			<input type="radio"/> MONITOR SUPPLIED BY (2-3.4.7.2) _____		
32	<input type="radio"/> PROVISION FOR LOCAL DISCONNECT (†2.7.4.6)			<input type="radio"/> LOCATION _____ ENCLOSURE _____		
33	<input type="radio"/> LOCATION-JOURNAL BEARING			<input type="radio"/> MFR. _____ <input type="checkbox"/> MODEL _____		
34	NO. EA PAD _____ EVERY OTHER PAD _____ PER BEARING			<input type="checkbox"/> SCALE RANGE _____ ALARM <input type="checkbox"/> SET @ _____ (µm)		
35	OTHER _____			<input type="radio"/> SHUTDOWN: <input type="checkbox"/> SET @ _____ (µm) <input type="radio"/> TIME DELAY _____ (sec)		
36	<input type="radio"/> LOCATION-THRUST BEARING			<input type="radio"/> CASING VIBRATION TRANSDUCERS		
37	NO. EA PAD _____ EVERY OTHER PAD _____ PER BEARING			<input type="radio"/> CASING VIBRATION MONITORS		
38	OTHER _____			AXIAL POSITION DETECTOR:		
39	NO. (INACT) EA PAD _____ EVERY OTHER PAD _____ PER BEARING			<input type="radio"/> SEE ATTACH. API-670 DATA SHEET		
40	OTHER _____			<input type="radio"/> TYPE _____ <input type="checkbox"/> MODEL _____		
41	<input type="radio"/> LOCAL DISCONNECTION (†2.7.4.6)			<input type="radio"/> MFR _____ <input type="radio"/> NO. REQUIRED _____		
42	<input type="radio"/> MONITOR SUPPLIED BY (2-3.4.7.4)			<input type="radio"/> OSCILLATOR-DEMODULATOR SUPPLIED BY _____		
43	<input type="radio"/> LOCATION _____ ENCLOSURE _____			<input type="radio"/> MFR _____ <input type="checkbox"/> MODEL _____		
44	<input type="radio"/> MFR _____ <input type="checkbox"/> MODEL _____			<input type="radio"/> MONITOR SUPPLIED BY _____		
45	<input type="checkbox"/> SCALE RANGE _____ ALARM <input type="checkbox"/> SET @ _____ (C)			<input type="radio"/> LOCATION _____ ENCLOSURE _____		
46	<input type="radio"/> SHUTDOWN: <input type="checkbox"/> SET @ _____ (C) <input type="radio"/> TIME DELAY _____ (sec)			<input type="radio"/> MFR. _____ <input type="checkbox"/> MODEL _____		
47	<input type="checkbox"/> SCALE RANGE _____ ALARM <input type="checkbox"/> SET @ _____ (µm)					
48	<input type="radio"/> SHUTDOWN: <input type="checkbox"/> SET @ _____ (µm) <input type="radio"/> TIME DELAY _____ (sec)					
49	KEY PHASOR REQUIRED					
50	<input type="radio"/> COMPRESSOR <input type="radio"/> GEAR H.S. <input type="radio"/> GEAR L.S.					
51	REMARKS: _____					
52	_____					
53	_____					
54	_____					
55	_____					
56	_____					

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INTEGRALLY GEARED COMPRESSOR DATA SHEET (API 617-8TH Chapter 3) SI UNITS (bar)	JOB NO. _____	ITEM NO. _____				
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CONSTRUCTION FEATURES, ROTORS (1 COLUMN PER ROTOR, USE ADDITIONAL SHEETS IF NEEDED)						
1						
2	<input type="checkbox"/> DRIVER SPEEDS:	PITCH LINE VELOCITY (m/s) _____				
3	MAX. CONT. _____	NORMAL DIAMETRAL PITCH _____				
4	TRIP SPEED _____	HELIX ANGLE _____ PRESSURE ANGLE _____				
5						
6	<input type="checkbox"/> ROTOR NUMBER	BULL GEAR	ROTOR 1	ROTOR 2	ROTOR 3	ROTOR 4
7	SPEED (rpm)					
8	SERVICE POWER (kW)					
9	SERVICE FACTOR					
10	NUMBER OF TEETH					
11	FACE WIDTH (mm)					
12	AGMA GEOMETRY FACTOR "J"					
13	AGMA GEOMETRY FACTOR "I"					
14	MINIMUM HARDNESS (Rc)					
15	ROTOR WEIGHT (INC WHEELS) (kg)					
16	BACKLASH (mm)					
17	GEARBOX FULL LOAD POWER LOSS _____					
18	<input type="checkbox"/> LATERAL CRITICAL SPEEDS (DAMPED)					
19	FIRST CRITICAL					
20	SECOND CRITICAL					
21	THIRD CRITICAL					
22	FOURTH CRITICAL					
23	<input type="radio"/> LATERAL ANALYSIS ADDITIONAL REQUIREMENTS (12.6.2.14)					
24	<input type="radio"/> TRAIN LATERAL ANALYSIS REQUIRED (12.6.2.6)					
25	<input type="radio"/> TRAIN TORSIONAL ANALYSIS REQUIRED (12.6.7.1)					
26	<input type="checkbox"/> TORSIONAL CRITICAL SPEEDS:					
27	FIRST CRITICAL					
28	SECOND CRITICAL					
29	THIRD CRITICAL					
30	FOURTH CRITICAL					
31	<input type="radio"/> LIST OF TRAIN UNDESIRABLE SPEEDS (12.6.14)					
32	<input type="radio"/> STABILITY ANALYSIS (12.6.5)					
33	<input type="checkbox"/> VIBRATION:					
34	ALLOWABLE TEST LEVEL (PK-PK)					
35	<input type="checkbox"/> BALANCE PISTON:					
36	MATERIAL					
37	FIXATION METHOD					
38	NORMAL CLEARANCE (mm)					
39	AREA (mm ²)					
40	FLOW, NORMAL CLEARANCE (kg/h)					
41	FLOW, 2x NORMAL CLEAR (kg/h)					
42	<input type="radio"/> PRESS. CONN. BAL LINE (2-2.5.4.3)					
43	REMARKS:					
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						

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CONSTRUCTION FEATURES, ROTOR BEARINGS (1 COLUMN PER ROTOR, USE ADDITIONAL SHEETS IF NEEDED)							
1	RADIAL BEARINGS, DRIVE END	BULL GEAR	ROTOR 1	ROTOR 2	ROTOR 3	ROTOR 4	
2	<input type="checkbox"/> TYPE						
3	<input type="checkbox"/> MANUFACTURER						
4	<input type="checkbox"/> LENGTH (mm)						
5	<input type="checkbox"/> SHAFT DIAMETER (mm)						
6	<input type="checkbox"/> UNIT LOAD (ACT/ALLOW)						
7	<input type="checkbox"/> BASE MATERIAL						
8	<input type="checkbox"/> BABBIT THICKNESS (mm)						
9	<input type="checkbox"/> NUMBER OF PADS						
10	<input type="checkbox"/> LOAD: BETWEEN/ON PAD						
11	<input type="checkbox"/> PIVOT: CENTER/OFFSET, %						
12	<input type="checkbox"/> RADIAL BEARING SPAN						
13							
14	RADIAL BRG, OPPOSITE DRIVE END						
15	<input type="checkbox"/> TYPE						
16	<input type="checkbox"/> MANUFACTURER						
17	<input type="checkbox"/> LENGTH (mm)						
18	<input type="checkbox"/> SHAFT DIAMETER (mm)						
19	<input type="checkbox"/> UNIT LOAD (ACT/ALLOW)						
20	<input type="checkbox"/> BASE MATERIAL						
21	<input type="checkbox"/> BABBIT THICKNESS (mm)						
22	<input type="checkbox"/> NUMBER OF PADS						
23	<input type="checkbox"/> LOAD: BETWEEN/ON PAD						
24	<input type="checkbox"/> PIVOT: CENTER/OFFSET, %						
25	THRUST BEARINGS, ACTIVE						
26	<input type="checkbox"/> TYPE						
27	<input type="checkbox"/> MANUFACTURER						
28	<input type="checkbox"/> UNIT LOADING (max) (MPa)						
29	<input type="checkbox"/> UNIT LOAD (ULT.) (MPa)						
30	<input type="checkbox"/> AREA (mm ²)						
31	<input type="checkbox"/> NUMBER OF PADS						
32	<input type="checkbox"/> PIVOT: CENTER / OFFSET, %						
33	<input type="checkbox"/> PAD BASE MATERIAL						
34	<input type="checkbox"/> COPPER BACKED?						
35	<input type="checkbox"/> COLLAR MATERIAL						
36	<input type="checkbox"/> INTEGRAL OR REPLACEABLE COLLAR?						
37	<input type="checkbox"/> SIZING CRITERIA						
38	<input type="checkbox"/> FLOODED OR DIRECTED LUBRICATION?						
39	THRUST BEARINGS, INACTIVE						
40	<input type="checkbox"/> TYPE						
41	<input type="checkbox"/> MANUFACTURER						
42	<input type="checkbox"/> UNIT LOADING (max) (MPa)						
43	<input type="checkbox"/> UNIT LOAD (ULT.) (MPa)						
44	<input type="checkbox"/> AREA (mm ²)						
45	<input type="checkbox"/> NUMBER OF PADS						
46	<input type="checkbox"/> PIVOT: CENTER / OFFSET, %						
47	<input type="checkbox"/> PAD BASE MATERIAL						
48	<input type="checkbox"/> COPPER BACKED? (2-2.7.3.7)						
49	<input type="checkbox"/> COLLAR MATERIAL						
50	<input type="checkbox"/> INTEGRAL OR REPLACEABLE COLLAR?						
51	<input type="checkbox"/> SIZING CRITERIA (2-2.7.3.5)						
52	<input type="checkbox"/> FLOODED OR DIRECTED LUBRICATION?						
53	REMARKS: _____						
54	_____						
55	_____						
56	_____						

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1	<input type="checkbox"/> OTHER CONNECTIONS					
2	SERVICE:	NO. SIZE TYPE				
3	<input type="checkbox"/> LUBE-OIL INLET	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				<input type="checkbox"/> PRESSURE <input type="checkbox"/> TEMPERATURE <input type="checkbox"/> SOLVENT INJECTION <input type="checkbox"/> PURGE FOR: <input type="checkbox"/> BRG. HOUSING <input type="checkbox"/> BTWN BRG & SEAL <input type="checkbox"/> BTWN SEAL & GAS
4	<input type="checkbox"/> LUBE OIL OUTLET	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
5	<input type="checkbox"/> SEAL-OIL INLET	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
6	<input type="checkbox"/> SEAL-OIL OUTLET	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
7	<input type="checkbox"/> SEAL GAS INLET	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
8	<input type="checkbox"/> SEAL GAS OUTLET	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
9	<input type="checkbox"/> CASING DRAINS	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
10	<input type="checkbox"/> STAGE DRAINS	<table border="1" style="width: 100%;"><tr><td> </td><td> </td><td> </td></tr></table>				
11	<input type="radio"/> INDIVIDUAL STAGE DRAINS REQUIRED (†3.2.17)					
12	<input type="radio"/> VALVED & BLINDED					
13	<input type="radio"/> VALVED & BLINDED & MANIFOLD					
14	LUBRICATION AND SEALING SYSTEMS (†2.10) (†3.5.1.2)					
15	<input type="radio"/> SEE ATTACHED API614 DATASHEET					
16	<input type="radio"/> SEPARATE <input type="radio"/> COMBINED					
17	<input type="radio"/> INTEGRAL OIL RESERVOIR (†3.3.2.1)					
18	<input type="radio"/> OIL TYPE (2-2.10.2)					
19	ACCESSORIES					
20	COUPLING AND GUARDS (3.2)					
21	NOTE: SEE ROTATING ELEMENTS - SHAFT ENDS					
22	<input type="radio"/> SEE ATTACHED API-671 DATA SHEET <input type="radio"/> KEYLESS HYDRAULIC <input type="radio"/> KEYED <input type="radio"/> FLANGED <input type="radio"/> OTHER _____					
23	COUPLING FURNISHED BY _____	MOUNTED BY _____				
24	MANUFACTURER _____	TYPE _____	MODEL _____			
25	COUPLING GUARD FURNISHED BY: _____					
26	TYPE: <input type="radio"/> FULLY ENCLOSED <input type="radio"/> SEMI-OPEN <input type="radio"/> OTHER _____					
27	COUPLING DETAILS					
28	<input type="checkbox"/> MAX O.D. _____ (mm)	<input type="radio"/> PLUG AND RING GAUGES (†3.2.5) <input type="radio"/> LAPPING TOOL				
29	<input type="checkbox"/> HUB WEIGHT _____ (kg)	LUBRICATION REQUIREMENTS:				
30	<input type="checkbox"/> SPACER LENGTH _____ (mm)	<input type="radio"/> NON-LUBE <input type="radio"/> CONT. OIL LUBE <input type="radio"/> OTHER _____				
31	<input type="checkbox"/> SPACER WEIGHT _____ (kg)	<input type="checkbox"/> QUANTITY PER HUB _____ (L/min)				
32	MOUNTING PLATES (†3.3)					
33	<input type="radio"/> BASEPLATES FURNISHED BY (†3.3.2.1) _____					
34	<input type="radio"/> COMPRESSOR ONLY <input type="radio"/> DRIVER <input type="radio"/> GEAR					
35	<input type="radio"/> OTHER _____					
36	<input type="radio"/> NONSKID DECKING (†3.3.2.4) <input type="radio"/> SLOPED DECK (†3.3.2.4.1)					
37	<input type="checkbox"/> LEVELING PADS OR TARGETS (†3.3.2.6)					
38	<input type="checkbox"/> COLUMN MOUNTING (†3.3.2.5)					
39	<input type="radio"/> SUB-SOLE PLATES REQUIRED (†3.3.2.10)					
40	<input type="checkbox"/> STAINLESS STEEL SHIM THICKNESS _____ (mm)					
41	<input type="radio"/> MACHINED MOUNTING PADS REQUIRED (†3.3.2.9)					
42	ANTI-SURGE SYSTEM (†3.3.2.2) FURNISHED BY <input type="radio"/> PURCHASER <input type="checkbox"/> SUPPLIER					
43	<input type="checkbox"/> ANTI-SURGE VALVE <input type="radio"/> SIZING ONLY					
44	PRESSURE UPSTREAM: _____ (barG) DOWNSTREAM Δ P _____ (barG)					
45	<input type="checkbox"/> Δ P VALVE _____ STROKE TIME OPEN - CLOSE _____ (sec)					
46						
47	<input type="checkbox"/> RECIRCULATION VALVE <input type="radio"/> SIZING ONLY					
48	<input type="checkbox"/> BLOWOFF VALVE <input type="radio"/> SIZING ONLY					
49	<input type="checkbox"/> CONTROL SYSTEM					
50	<input type="checkbox"/> PIPING					
51	<input type="checkbox"/> FLOWELEMENT					
52	<input type="checkbox"/> _____	<input type="checkbox"/> _____	REMARKS: _____ _____ _____ _____ _____ _____			
53	<input type="checkbox"/> _____	<input type="checkbox"/> _____				
54	<input type="checkbox"/> _____	<input type="checkbox"/> _____				
55	<input type="checkbox"/> _____	<input type="checkbox"/> _____				
56	<input type="checkbox"/> _____	<input type="checkbox"/> _____				
57	<input type="checkbox"/> _____	<input type="checkbox"/> _____				
58	<input type="checkbox"/> _____	<input type="checkbox"/> _____				

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UTILITIES								
1	UTILITY CONDITIONS:			MANUALS				
2	<input type="radio"/> STEAM :			<input type="radio"/> DRAFT MANUAL FOR REVIEW (15.3.5.12)				
3	DRIVERS			<input type="radio"/> TECHNICAL DATA MANUAL (15.3.5)				
4	INLET MIN	_____ (barG)	_____ (C)	MISCELLANEOUS:				
5	NORM	_____ (barG)	_____ (C)					
6	MAX	_____ (barG)	_____ (C)					
7	EXHAUST. MIN	_____ (barG)	_____ (C)					
8	NORM	_____ (barG)	_____ (C)					
9	MAX	_____ (barG)	_____ (C)	<input type="checkbox"/> RECOMMENDED STRAIGHT RUN OF PIPE DIAMETERS				
10	ELECTRICITY:			<input type="checkbox"/> BEFORE SUCTION				
11		DRIVERS	CONTROL	SHUTDOWN	<input type="radio"/> COMPRESSOR TO BE SUITABLE FOR FIELD RUN-IN ON AIR (12.116)			
12	VOLTAGE	_____	_____	_____	<input type="radio"/> PROVISION FOR LIQUID INJECTION (12.110)			
13	HERTZ	_____	_____	_____	<input type="radio"/> INJECTION MANIFOLD (2-3.5.12)			
14	PHASE	_____	_____	_____	<input type="radio"/> VENDOR'S REVIEW & COMMENTS ON PURCHASER'S			
15	<input type="radio"/> REDUCED VOLTAGE START (1-3.16)			<input type="radio"/> CONTROL SYSTEMS (1-3.4.1)				
16	NUMBER OF STARTS (12.6.6.4)			<input type="radio"/> SHOP FITUP OF VENDOR PROCESS PIPING (1-4.4.3.11)				
17	<input type="radio"/> INSTRUMENT AIR:			<input type="radio"/> WELDING HARDNESS TESTING (14.2.15)				
18	MAX PRESS	_____ (psig)	MIN PRESS _____ (barG)	<input type="radio"/> DESIGN AUDIT (15.14)				
19	<input type="checkbox"/> ROTATION, VIEWED OPP. DRIVE END			<input type="radio"/> BALANCE PISTON ΔP (15.3.3.15)				
				<input type="radio"/> PROVIDE TAIL END SCHEDULES (15.3.3.2)				
				<input type="radio"/> BOROSCOPIC INSPECTION PORTS (2-2.3.2.4)				
20	SHOP INSPECTION AND TESTS: (1-4.1.4)			VENDOR'S REPRESENTATIVE SHALL (1-2.1.13)				
21	<input type="radio"/> (SEE INSPECTOR'S CHECKLIST)			REQ'D	WIT/OB V	<input type="radio"/> OBSERVE FLANGE PARTING		
22	HYDROSTATIC (14.3.2)			●		<input type="radio"/> CHECK ALIGNMENT AT TEMPERATURE		
23	IMPELLER OVERSPEED (14.3.3)			●		<input type="radio"/> BE PRESENT AT INITIAL ALIGNMENT		
24	MECHANICAL RUN (14.3.6)			●		<input type="checkbox"/> WEIGHTS: (kg)		
25	<input type="radio"/> CONTRACT COUPLING	<input type="radio"/> IDLING ADAPTOR(S)				COMPR.	GEAR	
26	<input type="radio"/> CONTRACT PROBES	<input type="radio"/> SHOP PROBES				DRIVER	BASE	
27	<input type="radio"/> PURCHASER VIB. EQUIPMENT (2-4.3.11.0)					ROTORS:	COMPR.	
28	VARY LUBE & SEAL OIL PRESSURES			○		DRIVER	GEAR	
29	AND TEMPERATURES (14.3.6.15)			○		COMPRESSOR UPPER CASE		
30	POLAR FORM VIB DATA (14.3.6.12)			○		MAX. FOR MAINTENANCE (IDENTIFY)		
31	TAPE RECORD VIB DATA (14.3.6.13)			○		TOTAL SHIPPING WEIGHT		
32	SHAFT END SEAL INSP (14.3.6.2.2)			○		<input type="checkbox"/> SPACE REQUIREMENTS: (mm)		
33	GAS LEAK TEST AT DISCH PRESS (2-4.3.2.3)			○		COMPLETE UNIT:	L _____ W _____ H _____	
34	<input type="radio"/> POST TEST INTERNAL INSP (14.3.8.5)			○		SPECIAL TOOL PACKAGING		
35	<input type="radio"/> BEFORE GAS LEAKAGE TEST			○		<input type="radio"/> METAL STORAGE CONTAINER		
36	<input type="radio"/> AFTER GAS LEAKAGE TEST			○		<input type="radio"/> OTHER: _____		
37	PERFORMANCE TEST (GAS) (AIR) (2-4.3.3.1.1)			○		PAINTING:		
38	COMPLETE UNIT TEST (2-4.3.3.2)			○		<input type="radio"/> MANUFACTURER'S STD.		
39	TANDEM TEST (2-4.3.3.3)			○		<input type="radio"/> OTHER _____		
40	GEAR TEST (2-4.3.3.4)			○		NAME PLATE (2-2.11.2) <input type="radio"/> US CUSTOMARY <input type="radio"/> METRIC		
41	HELIUM LEAK TEST (14.3.8.2)			○		SHIPMENT: (4.4)		
42	SOUND LEVEL TEST (14.3.8.3)			○		<input type="radio"/> DOMESTIC <input type="radio"/> EXPORT <input type="radio"/> EXPORT BOXING REQ'D.		
43	AUX. EQUIPMENT TEST (14.3.8.4)			○		<input type="radio"/> OUTDOOR STORAGE MORE THAN 6 MONTHS (14.4.1) _____ MO		
44	FULL LOAD / SPEED / PRESS TEST (14.3.8.6)			○		SPARE ROTOR ASSEMBLY PACKAGE (14.4.3.1)		
45	HYDRAULIC COUPLING INSP (14.3.8.7)			○		<input type="radio"/> HORIZONTAL STORAGE <input type="radio"/> VERTICAL STORAGE		
46	SPARE PARTS TEST (14.3.8.8)			○		<input type="radio"/> METAL STORAGE CONTAINER		
47	INSPECTOR'S CHECKLIST COMPLIANCE (14.16)			○		<input type="radio"/> N2 PURGE <input type="radio"/> OTHER: _____		
48	GAS SEAL TEST VENDOR SHOP (14.3.5)			○				
49	MATERIALS INSPECTION REQUIREMENTS (1-4.2.1.3)							
50	<input type="radio"/> RADIOGRAPHY REQUIRED FOR	_____				<input type="radio"/> LOW TEMPERATURE (12.2.15.2) _____		
51	<input type="radio"/> ULTRASONIC REQUIRED FOR	_____				MIN. DESIGN METAL TEMPERATURE _____ (C)		
52	<input type="radio"/> MAGNETIC PARTICLE REQUIRED FOR	_____				AT CONCURRENT PRESSURE _____ (barG)		
53	<input type="radio"/> LIQUID PENETRANT REQUIRED FOR	_____				<input type="radio"/> OTHER TRAIN COMPONENTS (12.2.15.2)		
54						<input type="radio"/> Q.C. OF INACCESSIBLE WELDS (12.3.11.2)		
55	REMARKS: _____							
56	_____							

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1 INTER COOLER(S) - BETWEEN 1st and 2nd STAGE							
2 SERVICE OF UNIT:		TYPE:			ITEM NO.		
3 SIZE:		<input type="checkbox"/> HORIZ <input type="checkbox"/> VERT			CONNECTED IN <input type="checkbox"/> PARALLEL <input type="checkbox"/> SERIES		
4 SURF/UNIT: (GROSS/EFF)		(m ²) SHELLS/UNIT:			SURF/SHELL: (GROSS/EFF)		
5 PERFORMANCE OF ONE UNIT							
		SHELL SIDE			TUBE SIDE		
8 <input type="radio"/> FLUID NAME							
9 <input type="checkbox"/> FLUID QUANTITY, TOTAL (kg/h)							
10 VAPOR--IN/OUT							
11 LIQUID--IN/OUT							
12 <input type="checkbox"/> TEMPERATURE--IN/OUT (C)							
13 <input type="checkbox"/> SPECIFIC GRAVITY							
14 <input type="checkbox"/> VISCOSITY, LIQUID (mPa-s)							
15 <input type="checkbox"/> SPECIFIC HEAT, (kJ/kg C)							
16 <input type="checkbox"/> THERMAL CONDUCTIVITY, (kJ/m h C)							
17 <input type="checkbox"/> LATENT HEAT, (kJ/kg C)							
18 <input type="checkbox"/> INLET PRESSURE, (barG)							
19 <input checked="" type="checkbox"/> VELOCITY, (m/s)							
20 <input checked="" type="checkbox"/> PRESSURE DROP--ALLOW/CALC, (bar)							
21 <input checked="" type="checkbox"/> FOULING RESISTANCE--MINIMUM (hr m ² C/kJ)							
22 <input type="checkbox"/> HEAT EXCHANGED (kJ/hr)		MTD CORRECTED			(C)		
23 <input type="checkbox"/> TRANSFER RATE, (kJ/hr m ² C)		SERVICE			CLEAN		
24 <input type="checkbox"/> CONSTRUCTION OF ONE SHELL					SKETCH: BUNDLE NOZZLE ORIENTATIONS		
25 DESIGN/TEST PRESSURE, (barG)		SHELL SIDE			TUBE SIDE		
26 DESIGN TEMPERATURE, (C)							
27 NO. PASSES PER SHELL							
28 CORROSION ALLOWANCE, (mm)							
30 NOZZLES:		INLET					
31 SIZE & RATING		OUTLET					
		VENT-DRAIN					
33 TUBE NO.		O.D. (mm THK (MIN) (AVG))			LENGTH (m) PITCH (mm) <input type="checkbox"/> 30 <input type="checkbox"/> 60 <input type="checkbox"/> 90 <input type="checkbox"/> 45		
34 TUBE TYPE		MATERIAL					
35 SHELL MATL		I.D. (mm)			O.D. (mm) SHELL COVER MATL (INTEG)(REMOV)		
36 CHANNEL OR BONNET MATL		CHANNEL COVER MATL					
37 TUBESHEET--STATIONARY MATL		TUBESHEET--FLOATING MATL					
38 FLOATING HEAD COVER MATL		IMPINGEMENT PROTECTION					
39 BAFFLES--CROSS MATL		TYPE			%CUT (DIA) (AREA) SPACING: C/C INLET (mm)		
40 BAFFLES--LONG MATL		SEAL TYPE					
41 SUPPORTS--TUBE		U-BEND			TYPE		
42 BYPASS SEAL ARRANGEMENT		TUBE--TUBESHEET JOINT					
43 GASKETS--SHELL SIDE		-- TUBE SIDE					
44 --FLOATING HEAD							
45 ASME SECTION VIII CODE REQUIREMENTS:		<input type="checkbox"/> DESIGN & TEST <input type="checkbox"/> STAMP <input type="checkbox"/> NOT APPLICABLE			<input checked="" type="radio"/> TEMA CLASS		
46 WEIGHT/SHELL (kg)		FILLED WITH WATER (kg)			BUNDLE (kg)		
47 REMARKS							
48							
49							
50							
51							
52							
53							
54							
55							
56							

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1	INTER COOLER(S) - BETWEEN 2nd and 3rd STAGE						
2	SERVICE OF UNIT: _____				ITEM NO _____		
3	SIZE: _____	TYPE: _____	<input type="checkbox"/> HORIZ	<input type="checkbox"/> VERT	CONNECTED IN <input type="checkbox"/> PARALLEL <input type="checkbox"/> SERIES		
4	SURF/UNIT: (GROSS/EFF) _____ (m ²)		SHELLS/UNIT: _____		SURF/SHELL: (GROSS/EFF) _____		
5	PERFORMANCE OF ONE UNIT						
6				SHELL SIDE		TUBE SIDE	
7							
8	<input type="radio"/> FLUID NAME						
9	<input type="checkbox"/> FLUID QUANTITY, TOTAL (kg/h)						
10	VAPOR--IN/OUT						
11	LIQUID--IN/OUT						
12	<input type="checkbox"/> TEMPERATURE--IN/OUT (C)						
13	<input type="checkbox"/> SPECIFIC GRAVITY						
14	<input type="checkbox"/> VISCOSITY, LIQUID (mPa-s)						
15	<input type="checkbox"/> SPECIFIC HEAT, (kJ/kg C)						
16	<input type="checkbox"/> THERMAL CONDUCTIVITY, (kJ/m h C)						
17	<input type="checkbox"/> LATENT HEAT, (kJ/kg C)						
18	<input type="checkbox"/> INLET PRESSURE, (barG)						
19	<input checked="" type="radio"/> VELOCITY, (m/s)						
20	<input checked="" type="radio"/> PRESSURE DROP--ALLOW/CALC, (bar)						
21	<input checked="" type="radio"/> FOULING RESISTANCE--MINIMUM (hr m ² C/kJ)						
22	<input type="checkbox"/> HEAT EXCHANGED _____ (kJ/hr)			MTD CORRECTED _____ (C)			
23	<input type="checkbox"/> TRANSFER RATE, (kJ/hr m ² C)			SERVICE _____ CLEAN _____			
24	<input type="checkbox"/> CONSTRUCTION OF ONE SHELL					SKETCH: BUNDLE NOZZLE ORIENTATIONS	
25				SHELL SIDE		TUBE SIDE	
26	DESIGN/TEST PRESSURE, (barG)						
27	DESIGN TEMPERATURE, (C)						
28	NO. PASSES PER SHELL						
29	CORROSION ALLOWANCE, (mm)						
30	NOZZLES: _____ INLET						
31	SIZE & _____ OUTLET						
32	RATING _____ VENT-DRAIN						
33	TUBE NO. _____	O.D. _____ (mm THK (MIN) (AVG) _____)	(mm LENGTH _____ (m) PITCH _____ (mm)				
34	TUBE TYPE _____			MATERIAL _____			
35	SHELL MATL _____ ID. _____ (mm) O.D. _____ (mm)			SHELL COVER MATL _____ (INTEG)(REMOV)			
36	CHANNEL OR BONNET MATL _____			CHANNEL COVER MATL _____			
37	TUBESHEET--STATIONARY MATL _____			TUBESHEET--FLOATING MATL _____			
38	FLOATING HEAD COVER MATL _____			IMPINGEMENT PROTECTION _____			
39	BAFFLES--CROSS MATL _____			TYPE _____	% CUT (DIA) (AREA) _____	SPACING: C/C _____	INLET _____ (mm)
40	BAFFLES--LONG MATL _____			SEAL TYPE _____			
41	SUPPORTS--TUBE _____			U-BEND _____	TYPE _____		
42	BYPASS SEAL ARRANGEMENT _____			TUBE--TUBESHEET JOINT _____			
43	GASKETS--SHELL SIDE _____			-- TUBE SIDE _____			
44	FLOATING HEAD _____						
45	ASME SECTION VIII CODE REQUIREMENTS: <input type="checkbox"/> DESIGN & TEST <input type="checkbox"/> STAMP <input type="checkbox"/> NOT APPLICABLE <input checked="" type="radio"/> TEMA CLASS _____						
46	WEIGHT/SHELL _____ (kg)			FILLED WITH WATER _____ (kg)		BUNDLE _____ (kg)	
47	REMARKS: _____						
48	_____						
49	_____						
50	_____						
51	_____						
52	_____						
53	_____						
54	_____						
55	_____						
56	_____						

		REVISION	0	1	2	3	4		
		DATE							
INTEGRALLY GEARED COMPRESSOR DATA SHEET (API 617-8TH Chapter 3) SI UNITS (bar)		JOB NO.	ITEM NO.						
		PAGE	11	OF	12	REQ'N NO.			
1 INTER COOLER(S) - BETWEEN 3rd and 4th STAGE									
2	SERVICE OF UNIT:				ITEM NO.				
3	SIZE:	TYPE:	<input type="checkbox"/> HORIZ	<input type="checkbox"/> VERT	CONNECTED IN	<input type="checkbox"/> PARALLEL	<input type="checkbox"/> SERIES		
4	SURF/UNIT: (GROSS/EFF) _____ (m ²)		SHELLS/UNIT: _____		SURF/SHELL: (GROSS/EFF) _____				
5 PERFORMANCE OF ONE UNIT									
6			SHELL SIDE		TUBE SIDE				
7									
8	<input type="radio"/> FLUID NAME								
9	<input type="checkbox"/> FLUID QUANTITY, TOTAL (kg/h)								
10	VAPOR--IN/OUT								
11	LIQUID--IN/OUT								
12	<input type="checkbox"/> TEMPERATURE--IN/OUT (C)								
13	<input type="checkbox"/> SPECIFIC GRAVITY								
14	<input type="checkbox"/> VISCOSITY, LIQUID (mPa-s)								
15	<input type="checkbox"/> SPECIFIC HEAT, (kJ/kg C)								
16	<input type="checkbox"/> THERMAL CONDUCTIVITY, (kJ/m h C)								
17	<input type="checkbox"/> LATENT HEAT, (kJ/kg C)								
18	<input type="checkbox"/> INLET PRESSURE, (barG)								
19	<input checked="" type="checkbox"/> VELOCITY, (m/s)								
20	<input checked="" type="checkbox"/> PRESSURE DROP--ALLOW/CALC, (bar)								
21	<input checked="" type="checkbox"/> FOULING RESISTANCE--MINIMUM (hr m ² C/kJ)								
22	<input type="checkbox"/> HEAT EXCHANGED _____ (kJ/hr)		MTD CORRECTED _____ (C)						
23	<input type="checkbox"/> TRANSFER RATE, (kJ/hr m ² C)		SERVICE _____		CLEAN _____				
24	<input type="checkbox"/> CONSTRUCTION OF ONE SHELL					SKETCH: BUNDLE NOZZLE ORIENTATIONS			
25			SHELL SIDE		TUBE SIDE				
26	DESIGN/TEST PRESSURE, (barG)								
27	DESIGN TEMPERATURE, (C)								
28	NO. PASSES PER SHELL								
29	CORROSION ALLOWANCE, (mm)								
30	NOZZLES:		INLET						
31	SIZE &		OUTLET						
32	RATING		VENT-DRAIN						
33	TUBE NO.	O.D. (mm)	THK (MIN) (AVG) (mm)	LENGTH (m)	PITCH (mm)	<input type="checkbox"/> 30	<input type="checkbox"/> 60	<input type="checkbox"/> 90	<input type="checkbox"/> 45
34	TUBE TYPE		MATERIAL						
35	SHELL MATL	I.D. (mm)	O.D. (mm)	SHELL COVER MATL _____ (INTEG)(REMOV)					
36	CHANNEL OR BONNET MATL		CHANNEL COVER MATL _____						
37	TUBESHEET--STATIONARY MATL		TUBESHEET--FLOATING MATL _____						
38	FLOATING HEAD COVER MATL		IMPINGEMENT PROTECTION _____						
39	BAFFLES--CROSS MATL	TYPE		% CUT (DIA) (AREA)	SPACING: C/C	INLET (mm)			
40	BAFFLES--LONG MATL		SEAL TYPE _____						
41	SUPPORTS--TUBE	U-BEND		TYPE _____					
42	BYPASS SEAL ARRANGEMENT		TUBE--TUBESHEET JOINT _____						
43	GASKETS--SHELL SIDE		-- TUBE SIDE _____						
44	--FLOATING HEAD								
45	ASME SECTION VIII CODE REQUIREMENTS:		<input type="checkbox"/> DESIGN & TEST	<input type="checkbox"/> STAMP	<input type="checkbox"/> NOT APPLICABLE	<input type="radio"/> TEMA CLASS _____			
46	WEIGHT/SHELL (kg)	FILLED WITH WATER _____ (kg)		BUNDLE _____ (kg)					
47	REMARKS								
48									
49									
50									
51									
52									
53									
54									
55									
56									

INTEGRALLY GEARED COMPRESSOR DATA SHEET (API 617-8TH Chapter 3) SI UNITS (bar)		REVISION	0	1	2	3	4
		DATE					
		JOB NO.	ITEM NO.				
		PAGE	12	OF	12	REQ'N NO.	

1 INTER COOLER(S) - BETWEEN 4th and 5th STAGE	
2 SERVICE OF UNIT:	ITEM NO. _____
3 SIZE: _____ TYPE: _____ <input type="checkbox"/> HORIZ <input type="checkbox"/> VERT	CONNECTED IN <input type="checkbox"/> PARALLEL <input type="checkbox"/> SERIES
4 SURF/UNIT: (GROSS/EFF) _____ (m ²)	SHELLS/UNIT: _____ SURF/SHELL: (GROSS/EFF) _____
5 PERFORMANCE OF ONE UNIT	
6	
7	SHELL SIDE TUBE SIDE
8 <input type="radio"/> FLUID NAME	
9 <input type="checkbox"/> FLUID QUANTITY, TOTAL (kg/h)	
10 VAPOR--IN/OUT	
11 LIQUID--IN/OUT	
12 <input type="checkbox"/> TEMPERATURE--IN/OUT (C)	
13 <input type="checkbox"/> SPECIFIC GRAVITY	
14 <input type="checkbox"/> VISCOSITY, LIQUID (mPa-s)	
15 <input type="checkbox"/> SPECIFIC HEAT, (kJ/kg C)	
16 <input type="checkbox"/> THERMAL CONDUCTIVITY, (kJ/m h C)	
17 <input type="checkbox"/> LATENT HEAT, (kJ/kg C)	
18 <input type="checkbox"/> INLET PRESSURE, (barG)	
19 <input checked="" type="radio"/> VELOCITY, (m/s)	
20 <input checked="" type="radio"/> PRESSURE DROP--ALLOW/CALC, (bar)	
21 <input checked="" type="radio"/> FOULING RESISTANCE--MINIMUM (hr m ² C/kJ)	
22 <input type="checkbox"/> HEAT EXCHANGED (kJ/hr) MTD CORRECTED _____ (C)	
23 <input type="checkbox"/> TRANSFER RATE, (kJ/hr m ² C) SERVICE _____ CLEAN _____	
24 <input type="checkbox"/> CONSTRUCTION OF ONE SHELL	
25	SHELL SIDE TUBE SIDE
26 DESIGN/TEST PRESSURE, (barG)	
27 DESIGN TEMPERATURE, (C)	
28 NO. PASSES PER SHELL	
29 CORROSION ALLOWANCE, (mm)	
30 NOZZLES: _____ INLET	
31 SIZE & _____ OUTLET	
32 RATING _____ VENT-DRAIN	
SKETCH: BUNDLE NOZZLE ORIENTATIONS	
33 TUBE NO. _____ O.D. _____ (mm) THK (MIN) (AVG) _____ (mm) LENGTH _____ (m) PITCH _____ (mm) <input type="checkbox"/> 30 <input type="checkbox"/> 60 <input type="checkbox"/> 90 <input type="checkbox"/> 45	
34 TUBE TYPE _____ MATERIAL _____	
35 SHELL MATL _____ ID. _____ (mm) O.D. _____ (mm) SHELL COVER MATL _____ (INTEG)(REMOVE)	
36 CHANNEL OR BONNET MATL _____ CHANNEL COVER MATL _____	
37 TUBESHEET--STATIONARY MATL _____ TUBESHEET--FLOATING MATL _____	
38 FLOATING HEAD COVER MATL _____ IMPINGEMENT PROTECTION _____	
39 BAFFLES--CROSS MATL _____ TYPE _____ % CUT (DIA) (AREA) _____ SPACING: C/C _____ INLET _____ (mm)	
40 BAFFLES--LONG MATL _____ SEAL TYPE _____	
41 SUPPORTS--TUBE _____ U-BEND _____ TYPE _____	
42 BYPASS SEAL ARRANGEMENT _____ TUBE--TUBESHEET JOINT _____	
43 GASKETS--SHELL SIDE _____ -- TUBE SIDE _____	
44 _____ FLOATING HEAD _____	
45 ASME SECTION VIII CODE REQUIREMENTS: <input type="checkbox"/> DESIGN & TEST <input type="checkbox"/> STAMP <input type="checkbox"/> NOT APPLICABLE <input checked="" type="radio"/> TEMA CLASS _____	
46 WEIGHT/SHELL _____ (kg) FILLED WITH WATER _____ (kg) BUNDLE _____ (kg)	
47 REMARKS: _____	
48 _____	
49 _____	
50 _____	
51 _____	
52 _____	
53 _____	
54 _____	
55 _____	
56 _____	

Annex B (informative)

Vendor (Supplier) data and drawing requirements (VDDR)

B.1 VDDR for integrally geared compressors

The vendor (supplier) data and drawing requirements (VDDR) for integrally geared compressors are also available in electronic format via <http://standards.iso.org/iso/>. The text for details of the description is given in [B.2](#).

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/	/	/	/	20. Allowable external forces and moments for each nozzle in tabular form (with proposal)					
/	/	/	/	21. Gear quality documentations					
/	/	/	/	22. Gear tooth contact check results					
/	/	/	/	23. Certificates for gear materials					
/	/	/	/	24. Predicted noise sound level (proposal)					
/	/	/	/	25. Metallurgy of major components (in proposal)					
/	/	/	/	26. Lateral analysis report					
/	/	/	/	27. Torsional analysis report					
/	/	/	/	28. Vibration analysis report					
/	/	/	/	29. Performance curves for each compressor section (proposal/as-built)					
/	/	/	/	30. Impeller overspeed test report					
/	/	/	/	31. Mechanical running test report					
/	/	/	/	32. Coupling selection and rating					
/	/	/	/	33. List of recommended spare parts					
/	/	/	/	34. List of special tools					
/	/	/	/	35. Preparation for storage at job site before installation					
/	/	/	/	36. Weather protection and winterization required at job site					
/	/	/	/	37. Tabulation of all utilities					
/	/	/	/	38. List of similar machines					
/	/	/	/	39. Operating restrictions to protect equipment during start-up operation and shutdown					
/	/	/	/	40. List of components requiring purchaser's approval					
/	/	/	/	41. Summary of materials and hardness of materials exposed to H2S					
/	/	/	/	42. Seal leakage rates					
/	/	/	/	43. Interstage cooler system data					
/	/	/	/	44. Drawings, details and description of instrumentation and controls					
/	/	/	/	45. Minimum length of straight pipe required at machine inlet or side inlets					
/	/	/	/	46. Maximum and minimum allowable seal pressure for each compressor					
/	/	/	/	47. Statement of manufacturer's testing capabilities					
/	/	/	/	48. Performance test data and curves					
/	/	/	/	49. Back-to-back impeller machine supplier to provide thrust-bearing loads versus differential pressure curve					
/	/	/	/	50. Production delivery schedule					
/	/	/	/	51. Testing procedures					
/	/	/	/	52. Progress reports					

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/	/	/	53. Installation manual				
/	/	/	54. Operating and maintenance manual				
/	/	/	55. Technical data manual				

a Proposal drawings and data do not have to be certified. Typical data shall be clearly identified as such.
b Purchase may indicate in the column the desired time frame for submission of data.
c Bidder shall complete these two columns to reflect the actual distribution schedule and include this form with the proposal.

NOTES:

1. Where necessary to meet the scheduled shipping date, the supplier shall proceed with manufacture upon receipt of the order and without awaiting the purchaser's approval of drawings.
2. The supplier shall send all drawings and data to the following:

3. All drawings and data shall show project, purchase order, and item numbers as well as plant location and unit. One set of the drawings and instructions necessary for field installation, in addition to the copies specified above, shall be forwarded with shipment.
4. See the descriptions of required items that follow.
5. All of the information indicated on the distribution schedule shall be received before final payment is made.
6. If typical drawings, schematics, bills of material are used for proposals, they shall be marked-up to show the expected weight and dimensions to reflect the actual equipment and scope proposed.

Nomenclature:

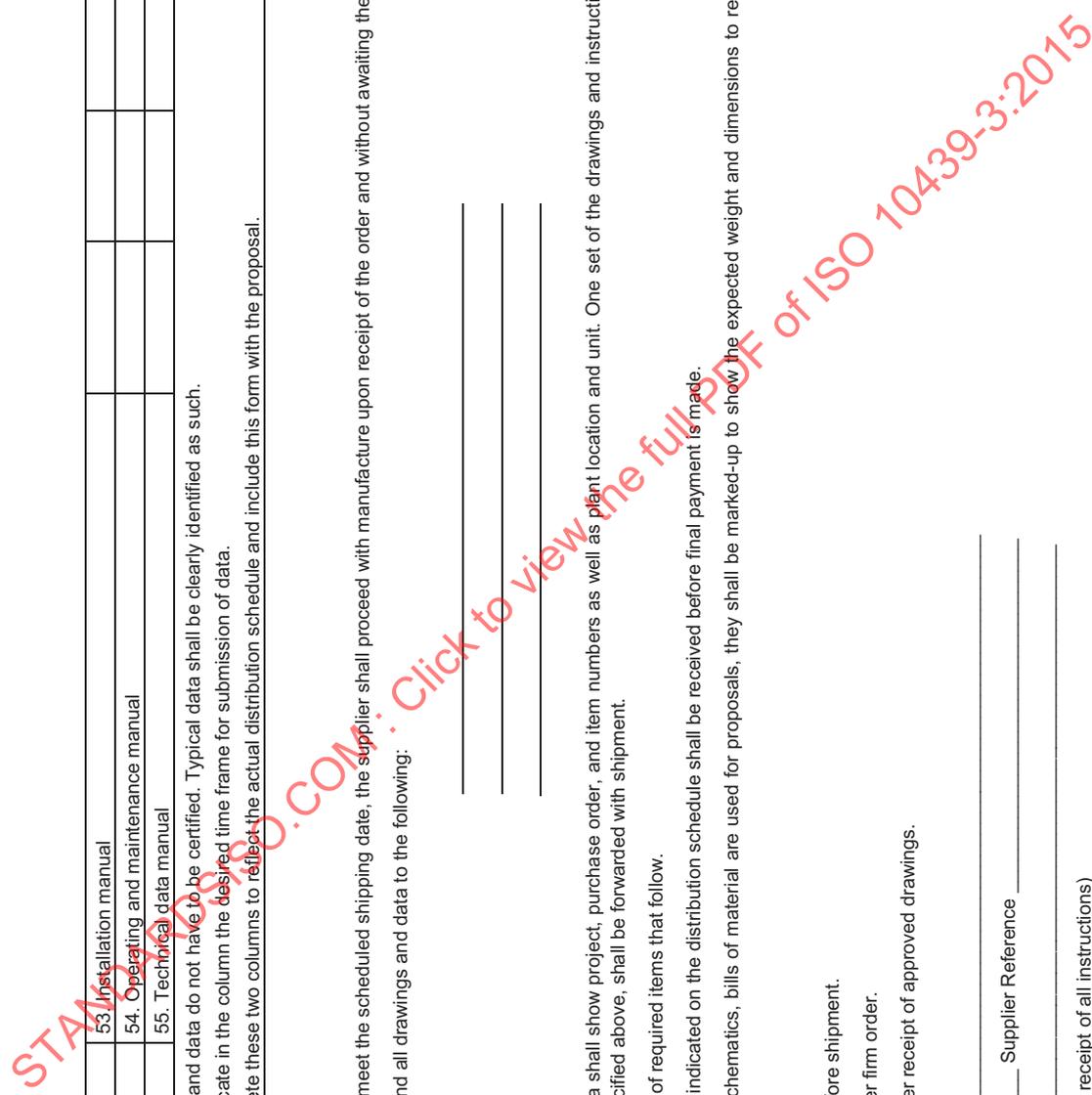
- S — number of weeks before shipment.
- F — number of weeks after firm order.
- D — number of weeks after receipt of approved drawings.

Supplier _____

Date _____ Supplier Reference _____

Signature _____

(Signature acknowledges receipt of all instructions)



Supplier _____
Date _____ Supplier Reference _____
Signature _____
(Signature acknowledges receipt of all instructions)

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B.2 Descriptions

- 1) Certified dimensional outline drawing and list of connections, including the following:
 - i) the size, rating, and location of all customer connections;
 - ii) approximate overall and handling weights;
 - iii) overall dimensions and maintenance and dismantling clearances;
 - iv) shaft centering height
 - v) dimensions of base plate (if furnished) for train- or skid-mounted package, complete with diameters, number, and locations of bolt holes and thicknesses of sections through which the bolts shall pass;
 - vi) grounding details;
 - vii) forces and moments allowed for suction and discharge nozzles;
 - viii) centre of gravity and lifting points;
 - ix) shaft-end separation and alignment data;
 - x) direction of rotation;
 - xi) winterization, tropicalization, and/or noise attenuation details, when required;
 - xii) sketches to show lifting of assembled machine and major components and auxiliaries.
- 2) Cross-sectional drawings and part numbers of major equipment.
- 3) Rotor assembly drawings and part numbers.
- 4) Thrust-bearing assembly drawings and part numbers.
- 5) Journal-bearing assembly drawings and bill of materials.
- 6) Coupling assembly drawing and bill of materials.
- 7) Lube-oil schematic and bill of material including the following:
 - i) oil flows, temperatures, and pressure at each point;
 - ii) control alarm shutdown settings for pressure and temperature;
 - iii) total heat loads;
 - iv) utility requirements including electrical, water, air, and steam;
 - v) pipe, valve, and orifice sizes;
 - vi) instrumentation, safety devices, control schemes, and wiring diagrams.
- 8) Lube-oil arrangement drawing and list of connections.
- 9) Lube-oil component drawings and data, including the following:
 - i) pumps and drivers;
 - ii) coolers, filter, and reservoir;
 - iii) instrumentation.
- 10) Seal system schematic and bill of material, including the following:
 - i) flows oil or gas, temperatures, and pressures at each point;

- ii) control, alarm, and shutdown settings for pressure and temperatures;
 - iii) total heat load for coolers, if required;
 - iv) utility requirements including electrical, water, air, and steam;
 - v) pipe, valve, and orifice sizes;
 - vi) instrumentation, safety devices, control schemes, and wiring diagrams;
 - vii) filtration requirements;
 - viii) height of overhead tank above centreline of machine.
- 11) Seal system arrangement drawing and list of connections.
- 12) Seal system components drawing and data, including the following:
- i) pumps and drivers;
 - ii) coolers, filter, and reservoirs;
 - iii) instrumentation.
- 13) Seal assembly drawing and part numbers.
- 14) Electrical and instrumentation arrangement drawing and list of connections:
- i) vibration warning and shutdown limits;
 - ii) bearing temperature warning and shutdown limits;
 - iii) lube-oil temperature warning and shutdown limits;
 - iv) lube-oil pressure warning and shutdown limits;
 - v) lube-oil level warning and shutdown limits;
 - vi) machine discharge pressure and temperature warning and shutdown limits;
 - vii) seal, pressure, temperature, flow warning, and shutdown limits.
- 15) Electrical and instrumentation arrangement drawing and list of connections.
- 16) Buffer gas system schematic and bill of material.
- 17) Buffer gas system arrangement drawing and list of connections.
- 18) Buffer gas system component drawings and data, including the following:
- i) control devices;
 - ii) pressure and filtration requirements.
- 19) Data sheets provided with proposal as-built.
- 20) Supplier shall furnish the allowable forces and moments for each nozzle in tabular form with the proposal.
- 21) The supplier shall provide documentation showing the gear has met the quality levels of AGMA 2015-1-A01, Grade 4.
- 22) The supplier shall make available to the purchaser the results of the gear tooth contact check for each gear set installed in the job gear box.

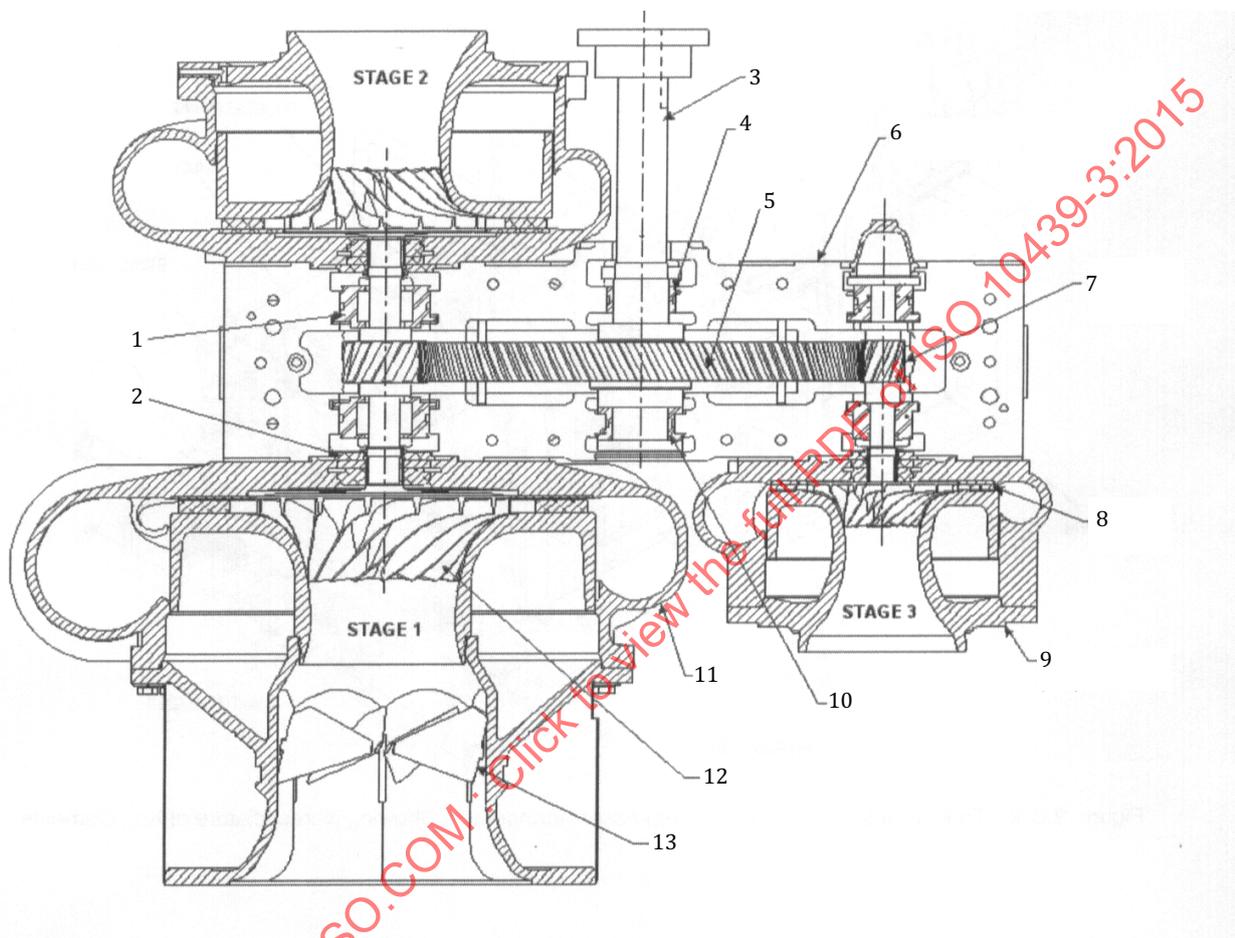
- 23) Certificates for gearing materials:
- i) mill test reports for all gear element components;
 - ii) UT of all gear element components after rough machining;
 - iii) record of all heat treatment and resulting hardness versus case depth of all welds on rotating elements;
 - iv) MP of gear and pinion teeth;
 - v) results of quality control checks;
 - vi) gear tooth surface finish;
 - vii) plating of teeth;
 - viii) tooth profile, helix deviation pitch error, and cumulative pitch error;
 - ix) contact checks in job casing;
 - x) records of all radiographs and UT;
 - xi) hardness versus case depth.
- 24) Predicted noise level, sound pressure, and sound power level.
- 25) Metallurgy of major components identified with ASTM, AISI, ASME, or SAE numbers stated in proposal.
- 26) Lateral analysis report when specified shall also include a stability analysis.
- 27) Torsional analysis report.
- 28) Vibration analysis conducted on machines that require disassembly after balancing to allow machine assembly. The supplier shall also provide historic unbalance data for the machine size and type.
- 29) Performance data and curves, sufficient performance data to enable the purchaser to properly design a control system and surge prevention.
- 30) Dimensions taken from each impeller before and after overspeed testing shall be submitted for review.
- 31) Mechanical running test report to include the following:
- i) unfiltered vibration;
 - ii) plots showing synchronous vibration and phase angle, filtered and unfiltered;
 - iii) when specified, data shall be furnished in polar form;
 - iv) when specified, tape recordings shall be made of all real-time vibration data;
 - v) electrical and mechanical runout at each probe;
 - vi) immediately upon completion of each witnessed mechanical or performance test, copies of the log and data recorded during the test shall be given to the witnesses.
- 32) Coupling selection and rating.
- 33) List of spare parts recommended for start-up and normal maintenance purposes.
- 34) List of the special tools furnished for maintenance.
- 35) The supplier shall provide the purchaser with instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the job site and before start-up.

- 36) A description of any special weather protection required for start-up, operation, and period of idleness under the site conditions specified on the data sheets.
- 37) A complete list of utility requirements: quantity, filtration, and supply pressure of the following:
- i) steam;
 - ii) water;
 - iii) electricity;
 - iv) air;
 - v) gas;
 - vi) lube oil and seal oil (quantity and supply pressure);
 - vii) heat loads;
 - viii) power ratings and operating power requirements for auxiliary drivers.
- 38) A list of machines similar to the proposed machines that have been installed and operating under conditions analogous to those specified in the inquiry.
- 39) Any start-up, shutdown, or operating restrictions required to protect the integrity of the equipment, including any unacceptable speeds due to natural frequencies.
- 40) A list of any components that can be construed as being of alternative design, requiring purchaser's acceptance.
- 41) A summary of the materials of construction for the compressor, including hardness for materials exposed to H₂S.
- 42) The maximum seal gas rates (injection or eduction) and rated or expected inner seal-oil leakage rates, if applicable. When self-acting dry gas seals are supplied, expected seal gas consumption, minimum seal gas supply flow, and primary vent flow should be given at maximum sealing pressure and at conditions over the operating envelope of the machine.
- 43) When interstage coolers are furnished, the supplier shall provide the following:
- i) drawing showing cooling system details;
 - ii) data for purchaser's heat and material balances;
 - iii) details of provisions for separating and withdrawing condensate;
 - iv) supplier's recommendations regarding provision for support and piping expansion.
- 44) Drawings, details, and descriptions of the operations of instrumentation and controls, as well as the makes, materials, and type of auxiliary equipment. The supplier shall also include a complete description of the alarm and shutdown facilities to be provided.
- 45) The minimum length of straight pipe required for proper flow characteristics at the inlet and at any side inlet connection.
- 46) Maximum and minimum allowable seal pressure for each compressor.
- 47) A statement of the manufacturer's capability regarding testing (including performance testing) of the compressor and any other specified items on the train. Details of each optional test specified shall be included.

- 48) Performance curves shall be submitted for each section (between purchasers process nozzles) of each casing, as well as an overall curve for the train. All curves submitted prior to complete performance testing shall be marked “predicted”.
- i) Any set of curves resulting from a test shall be marked “tested”;
 - ii) If a performance test is specified, the supplier shall provide test data and curves when the test has been completed; the surge points shall be shown on the performance curves.
- 49) For compressors that have a back-to-back impeller arrangement, the supplier shall furnish a curve showing the expected loading on the active or inactive side of the thrust bearing versus any combination of differential pressures across the low pressure and high pressure sections of the casing.
- 50) The supplier shall provide production and delivery schedules.
- 51) The supplier shall submit detailed procedures, including acceptance criteria for the mechanical running test and all optional tests, at least 6 weeks before the first running test.
- 52) The supplier shall submit progress reports.
- 53) All information required for the proper installation of the equipment shall be compiled in a manual that shall be issued no later than the time of final certified drawings.
- 54) A manual containing all required operating and maintenance instructions shall be supplied not later than 2 weeks after all specified tests shall have been successfully completed.
- 55) The supplier shall provide a “technical data manual within 30 days of completion” of shop testing including the following:
- i) necessary certification of materials;
 - ii) purchase specification for all items on the bill of materials;
 - iii) test data to verify requirements of specifications have been met;
 - iv) heat treat records;
 - v) results of quality test and inspections;
 - vi) mechanical running test data log;
 - vii) final assembly maintenance and running clearances;
 - viii) the supplier is also required to keep this data available for examination by the purchaser upon request, for at least 5 years.

Annex C (informative)

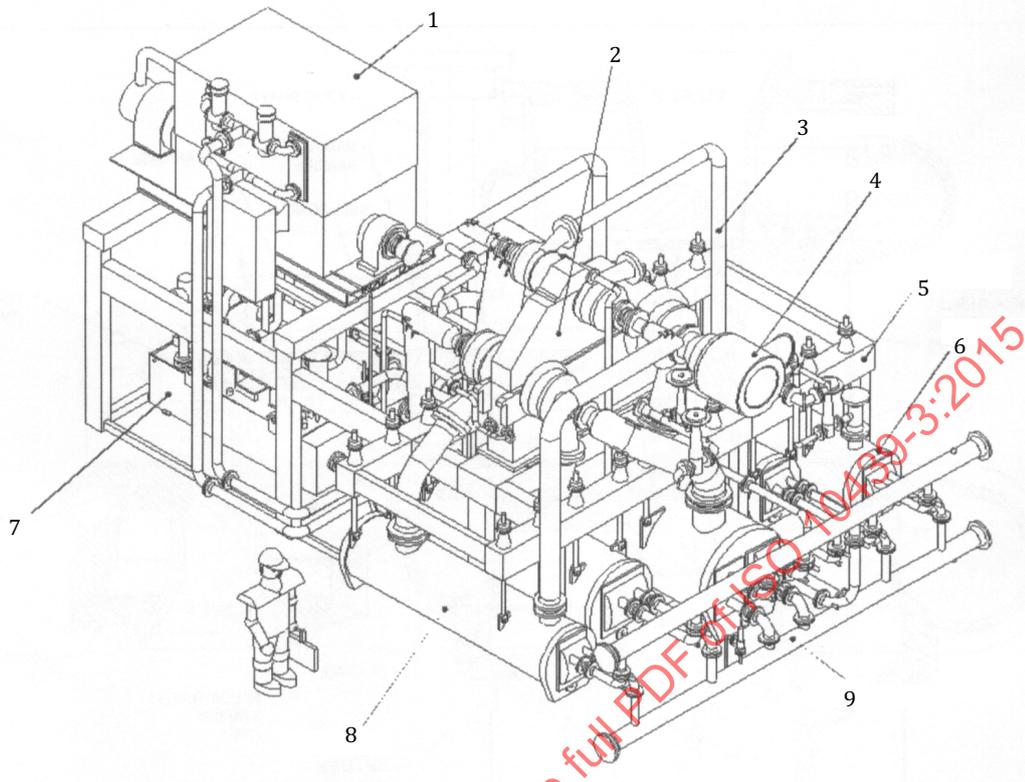
Nomenclature



Key

- | | | | |
|---|------------------------------|----|------------------------------|
| 1 | radial/thrust bearing (typ.) | 8 | diffuser (typ.) |
| 2 | seal (typ.) | 9 | suction cover (typ.) |
| 3 | input shaft | 10 | radial thrust bearing (typ.) |
| 4 | radial bearing | 11 | pressure casing (typ.) |
| 5 | bull gear | 12 | impeller (typ.) |
| 6 | gear case | 13 | inlet guide vane |
| 7 | pinion (typ.) | | |

Figure C.1 — Cross-sectional view 3-stage, 2-pinion compressor



Key

- | | |
|------------------|----------------|
| 1 driver | 6 aftercooler |
| 2 compressor | 7 oil system |
| 3 process piping | 8 intercooler |
| 4 inlet | 9 water header |
| 5 steel frame | |

Figure C.2 — Typical integrally geared compressor package

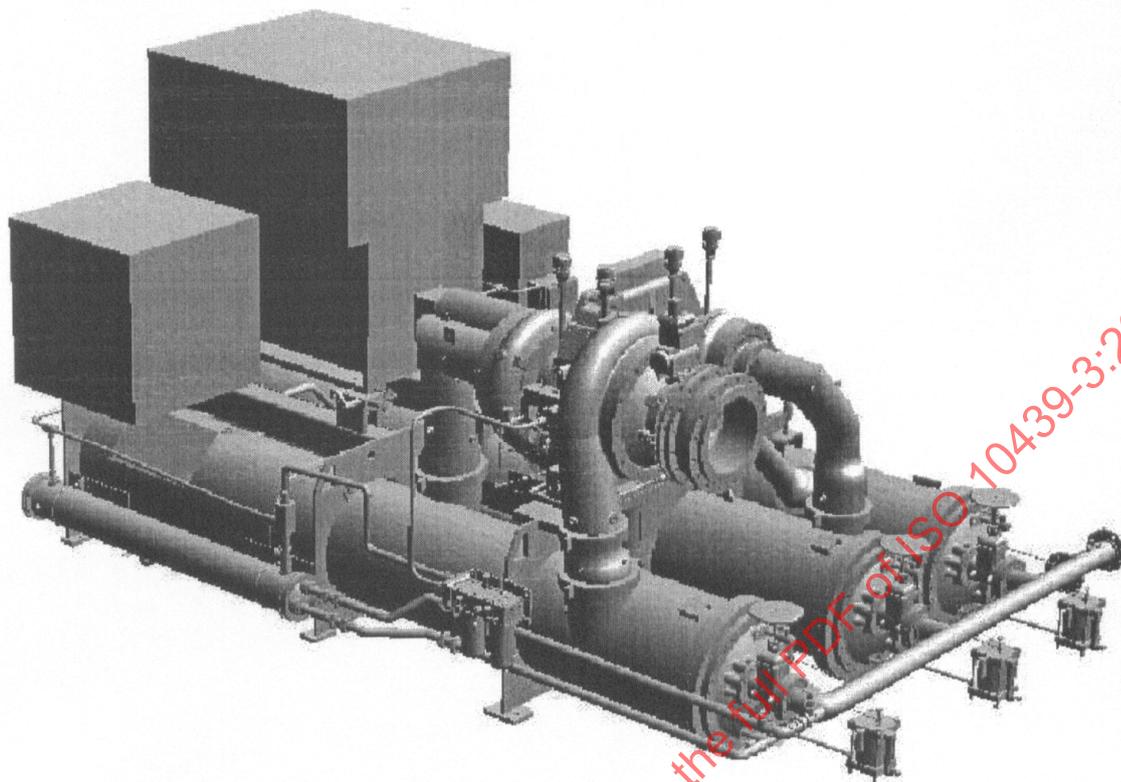


Figure C.3 — Typical integrally geared compressor arrangement

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Annex D (informative)

Typical materials for integrally geared compressors

The materials listed in this annex are considered equivalent as far as suitability for service. This does not imply that they are exactly equivalent. There can be significant differences in testing and other material requirements. The list of typical materials is also available in electronic format via <http://standards.iso.org/iso/>.

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Table D.1

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS									
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material			Form	Temperature Limits	
				EN 1561 EN-GJL-250	EN 1561 EN-GJL-300	EN-JS1059		Minimum temperature °C (°F)	Maximum temperature °C (°F)
Casing, Inlet Casing, Discharge Casing	Cast iron	ASTM A 278, Class 30	JIS G5501 FC200	EN 1561 EN-GJL-250	EN-JL1040	Cast	-45 (-50)	230 (450)	
		ASTM A 278, Class 40	JIS G5501 FC300	EN 1561 EN-GJL-300	EN-JL1050	Cast	-28 (-20)	260 (500)	
	Austenitic cast iron	ASTM A 436, Type 2	JIS G5510 FCA-NiCr202			Cast	-45 (-50)	260 (500)	
		ASTM A 571, Type D-2M Class 1 and 2	JIS G5510 FCDA-Ni22			Cast	-195 (-320)	260 (500)	
	Ductile iron	ASTM A 395	JIS G5502	EN 1563 EN-GJS-400-18U-RT	EN-JS1059	Cast	-28 (-20)	260 (500)	
	Cast steel	ASTM A 216, Grade WCB ^b	JIS G5102 SCW450	EN 10213 GP240GH ISO 4991-G240 similar reference DIN 1681 GS-38	1.0619 1.0420	Cast	-28 (-20)	400 (750)	
		ASTM A 352, Grade LCB	JIS G5152 SCPL1	GC24E	1.1156	Cast	-45 (-50)	345 (650)	
		ASTM A 352, Grade LC2	JIS G5152 SCPL21	EN 10213 G9Ni10	1.5636	Cast	-75 (-100)	345 (650)	
		ASTM A 352, Grade LC3	JIS G5152 SCPL31	EN 10213 G9Ni14	1.5638	Cast	-100 (-150)	345 (650)	
		ASTM A 352, Grade LC4	similar reference JIS G5152 SCPL31	EN 10213 G9Ni14	1.5638	Cast	-115 (-175)	345 (650)	
		ASTM A 352, Grade LC9	JIS G 5101 SC450 JIS G 5101 SC480			Cast	-195 (-320)	205 (400)	
		ASTM A 352, Grade LCC	similar reference JIS G5152 SCPL1	EN 10213 G17Mn5 EN 10213 G20Mn5 similar reference SEW 685 G26CrMo4	1.1131 1.6220 1.7221	Cast	-45 (-50)	345 (650)	

NOTE 1 The materials shown in this table are those commonly used by compressor manufacturers, but the list is not all inclusive. Other suitable materials can exist and can be used as indicated by specific design considerations.

NOTE 2 Descriptions of AISI Types (cross-referenced to UNS) can be found in SAE HS1086. Descriptions of UNS Types can also be found in ASTM DS 561.

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Temperature Limits	
						Minimum temperature °C (°F)	Maximum temperature °C (°F)
		ASTM A 217	JIS G5151	EN 10213	Cast	-28 (-20)	345 (650)
	Cast stainless steel	ASTM A 743/744 or A 351, Grade CF3, CF3M	CF3: JIS G5121 SCS19A CF3M: JIS G5121 SCS16A CF8, JIS G5121 SCS13A CF8M: JIS G5121 SCS14A	1.4309 1.4409 1.4308 1.6902 1.4408	Cast	-195 (-320)	345 (650)
		ASTM A 743/744 or A 351CF8 or CF8M		CF8: EN 10213 GX5CrNi19-10 or SEW 685 GX6CrNi18-10 CF8M: EN 10213 GX5CrNiMo19-11-2	Cast	-195 (-320)	345 (650)
		ASTM A 351, Grade CF3MA or CF8MA	JIS G5121 SCS19A	CF3MA: EN 10213 GX2CrNiMo19-11-2 CF8MA: EN 10213 GX5CrNiMo19-11-2	Cast	-195 (-320)	345 (650)
		ASTM A 487 Grade CA6NM Class A and B	JIS G 5121 SCS6	EN 10213 GX4CrNi13-4	Cast	-45 (-50)	345 (650)
		ASTM A 757 Grade E3N	JIS G 5152 SCPL1	EN 10213 GX3CrNi13-4	Cast	-75 (-100)	345 (650)
		ASTM A 757 Grade D1Q1	JIS G 5152 SCPL11 similar reference	SFW 685 G15CrMo9-10	Cast	-28 (-20)	345 (650)
		ASTM A 747 Grade CB7Cu-1	JIS G5121 SCS 24		Cast		
	Cast aluminium	ASTM A 356 or A 357	JIS G5151	NA	Cast	-195 (-320)	150 (300)
	Cast Hastelloy	ASTM A 494 Grade CW2M	JIS H5701 NMCrC similar reference		Cast		

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							Temperature Limits	
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Minimum temperature °C (°F)	Maximum temperature °C (°F)	
		ASTM A 494, Grade N-7M	JIS H4551 NW0665		Cast			
	Cast titanium	ASTM B 367, Grade C3 or C4	C3: JIS H4600 Class 2 C4: NA	NA	Cast	-45 (-50)	150 (300)	
		ASTM B 367, Grade C5	JIS H4600 Class 3		Cast			
Casing, Inlet Casing, Discharge Casing								
Fabricated	Steel	ASTM A 285, Grade C	JIS G3118 SGV450		Plate	-45 (-50)	345 (650)	
		ASTM A 516, Grade 55, 60, 65, 70	55: JIS G3118 60 SGV410; JIS G3118 65 SGV410; JIS G3118 70 SGV450; JIS G3118 SGV480	55: EN 10028-2 P235GH 60: EN 10028-2 P265GH 65: EN 10028-2 P355GH EN 10025 S355J2+N 70: EN 10028-2 P355GH	Plate	-45 (-50)	345 (650)	
		ASTM A 203, Grade A or B	A: JIS G3127N255 SL2 B: NA	12Ni9	Plate	-60 (-75)	345 (650)	
		ASTM A 203, Grade D or E	D: JIS G3127N255 SL3 E: JIS G3127N275 SL3	EN 10028-4 12Ni14	Plate	-105 (-160)	345 (650)	
		ASTM A 537, Class 1 or 2	1: JIS G3115 2: SPV355; JIS G3115 SPV450	EN 10028-6 P355QH EN 10028-6 P460QH 1.8871	Plate	-60 (-75)	345 (650)	
		ASTM A 353	JIS G3127N520 SL9	EN 10028-3 X8Ni9 1.5662	Plate	-195 (-320)	345 (650)	

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS - TYPICAL MATERIALS FOR MAJOR COMPONENTS							
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Temperature Limits	
						Minimum temperature °C (°F)	Maximum temperature °C (°F)
		ASTM A 553, Type I	JIS G3127N590 SL9	EN 10028-3 X8Ni9	Plate	-195 (-320)	345 (650)
		ASTM A 553, Type II	JIS G3127N590 SL9	EN 10028-3 X8Ni9	Plate	-170 (-275)	345 (650)
		ASTM A 266, Class 1 or 4	JIS G3202 SFVC1	EN 10222-4 P355NH	Forged	-28 (-20)	345 (650)
		ASTM A 336, Class F1	JIS G3202 SFVA F1	EN 10222-2 16Mo3	Forged	-28 (-20)	345 (650)
		ASTM A 414	JIS G3116	EN 10120	Sheet	-28 (-20)	345 (650)
		ASTM A 508, Class 5a [now: Grade 5 Class 2]	JIS G3204 SFVQ3	20NiCrMo14-6	Forged	-28 (-20)	345 (650)
		ASTM A 350, Grade LF2	JIS G3205 SFL2	EN 10222-3 12Ni14	Forged	-45 (-50)	345 (650)
		ASTM A 350, Grade LF3	JIS G3205 SFL3	EN 10222-3 12Ni14	Forged	-100 (-150)	345 (650)
		ASTM A266 CL.1	JIS G3202 SFVC1		Forged	-28 (-20)	345 (650)
		ASTM A662 Grade B	JIS G3205 SFL1	EN 10028-4 P355N EN 10028-4 P355NL2	Plate	-45 (-50)	345 (650)
		ASTM A 765 Grade IV	JIS G3201 SF490A	EN 10222-4 P355QH1	Forged	-30 (-20)	345 (650)
		ASTM A 350 Grade LF6 Class 1	JIS G3201 SF340A	DIN 17103 TStE 355	Forged	-50 (-60)	345 (650)

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Temperature Limits	
						Minimum temperature °C (°F)	Maximum temperature °C (°F)
	Stainless steel	ASTM A 240, Type 304, 304L, 316, 316L	304: JIS G4304 SUS304, JIS G4305 SUS304	304: EN 10028-7 X5CrNi18-10 304L: EN 10028-7 X2CrNi18-9			
		ASTM A 240, Type 321	JIS G4305 SUS304L 316: JIS G4304 SUS316, JIS G4305 SUS316 316L: EN 10028-7 X5CrNiMo17-12-2 321: EN 10028-7 X2CrNiMo17-12-2 or EN 10028-7 X5CrNiMoTi17-12-2 321: EN 10028-7 X5CrNiTi18-10	1.4301 1.4307 1.4401 1.4404 1.4571 1.4541			
		ASTM A 182, Grade F304, F304L, F316	F304: JIS G3214 SUS F304 F304L: JIS G3214 SUS F304L F316: JIS G3214 SUS F316 F321: JIS G3214 SUS F321	F304: EN 10222-5 X5CrNi18-10 F304L: EN 10222-5 X2CrNi18-9 F316: EN 10222-5 X5CrNiMo17-12-2 or EN 10222-5 X5CrNiMoTi17-12-2 F321: EN 10222-5 X5CrNiTi18-10	Forged	-195 (-320)	345 (650)
		ASTM A 182, Grade F321			Forged	-195 (-320)	345 (650)
		ASTM A 182, Grade F 6NM	JIS G3214 SUS F6 NM	EN 10222-5 X3CrNiMo13-4	Forged	-45 (-50)	345 (650)
		AISI Type 304L	JIS G3214 SUS 304L		Plate	-195 (-320)	345 (650)
	Aluminium	ASTM B 209, Alloy 6061 or 7075	6061: JIS H4000 6061 7075: JIS H4000 7075		Plate	-195 (-320)	150 (300)

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							Temperature Limits	
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Minimum temperature °C (°F)	Maximum temperature °C (°F)	
		ASTM B 211, Alloy 6061 or 7075	6061: JIS H4040 6061 7075: JIS H4040 7075		Bar	-195 (-320)	150 (300)	
		ASTM B 247, Alloy 6061 or 7075	6061: JIS H4140 6061 7075: JIS H4140 7050		Forged	-195 (-320)	150 (300)	
		AMS 4108, Alloy 7050	JIS H4140 7050		Forged	-195 (-320)	150 (300)	
Diffuser, shroud, guide vanes								
	Cast iron	ASTM A 48 or A 278, Class 30	JIS G5501 FC250	EN 1561 EN-GJL-250	Cast	-195 (-320)	345 (650)	
	Ductile iron	ASTM A 536	JIS G5502	EN 1563 EN-GJS-400-15U	Cast	-195 (-320)	345 (650)	
	Cast steel	ASTM A 216, Grade WCB	JIS G5102 SCW450	EN 10213 GP240GH ISO 4991-G240 similar reference DIN 1681 GS-38	Cast	-195 (-320)	345 (650)	
		ASTM A 352, Grade LCB	JIS G5152 SCPL1	GC24E	Cast	-45 (-50)	345 (650)	
	Steel	ASTM A 283, A 284, A 285, A 516 or A 543	JIS G3101 SS400	EN 10025 S235JR EN 10025 S355J2+N 1.0577	Plate	-195 (-320)	345 (650)	
		ASTM A 36	JIS G3101 SS400	EN 10025 S235JR 1.0038	Plate	-195 (-320)	345 (650)	

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							Temperature Limits	
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Minimum temperature °C (°F)	Maximum temperature °C (°F)	
	Stainless steel	ASTM A 743/744 or A 351, Grade CA15, or CF8M	JIS G5121 SCS13A, JIS G5121 SCS19A	CF8: EN 10213 GX5CrNi19-10 or SEW 685 CF8M: EN 10213 GX5CrNiMo19-11-2	Cast	-195 (-320)	345 (650)	
		ASTM A 240, Type 410	JIS G4304 SUS410, JIS G4305 SUS410	EN 10088-2 X12Cr13	Plate	-195 (-320)	345 (650)	
		ASTM A 276, Type 410	JIS G4303 SUS410	EN 10088-3 X12Cr13	Bar	-195 (-320)	345 (650)	
		AISI Type 304	JIS G4304 SUS304		Plate	-195 (-320)	345 (650)	
		AISI Type 304L	JIS G3214 SUS304L	similar reference EN 10250 X6Cr-NiTi18-10	Plate	-195 (-320)	345 (650)	
	ASTM A 182, Grade F321, F316Ti		F321: JIS G 3214 SUS E321 F316Ti:	F316 Ti: EN 10250 X6CrNiMoTi17-12-2 F321: EN 10250 X6CrNiTi18-10	Forged	-195 (-320)	345 (650)	
	ASTM A662 Grade B		JIS G3205 SFL1	EN 10028-4 P355N EN 10028-4 P355NL2	Plate	-195 (-320)	345 (650)	
	ASTM A 350 Grade LF6 Class 1		JIS G3201 SF340A	DIN 17103 TStE 355	Forged	-195 (-320)	345 (650)	
	ASTM A 182, Grade F 6NM		JIS G3214 SUS F6 NM	EN 10250 X3CrN-iMo13-4	Forged	-195 (-320)	345 (650)	

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b Normalized or normalized and tempered.

Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							Temperature Limits	
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Minimum temperature °C (°F)	Maximum temperature °C (°F)	
		ASTM A 487 Grade CA6NM Class A and B	JIS G5151 SCPH 32 similar reference	EN 10213 GX4CrNi13-4	Cast	-195 (-320)	345 (650)	
		ASTM A 757 Grade E3N	JIS G5152 1991 SCPL1	EN 10213 GX3CrNi13-4	Cast	-195 (-320)	345 (650)	
	Titanium	ASTM B 367, Grade C5	JIS H4600 Class 3		Cast			
	Aluminium	ASTM B 26, Alloy 355 or C355	JIS H5202 AC4D		Cast	-195 (-320)	345 (650)	
Fixed, Pre-whirl, De-whirl, and Variable Stator Vanes								
	Stainless Steel	ASTM A478 Type 347	JIS G4309 SUS347		Bar	-195 (-320)	345 (650)	
		ASTM A240 Type 304 or 304L	304: JIS G4304 SUS304, JIS G4305 304 SUS304L: JIS G4304 SUS304L, JIS G4305 SUS304L		Plate	-195 (-320)	345 (650)	
		ASTM A276 Type 316/316L	316: JIS G4303 316 SUS316L: JIS G4303 SUS316L		Bar	-195 (-320)	345 (650)	
Shaft								
	Steel	ASTM A 470, Class 1	similar reference JIS G3201 SF540A		Forged	-28 (-20)	345 (650)	

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Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							Temperature Limits	
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Minimum temperature °C (°F)	Maximum temperature °C (°F)	
		ASTM A 470, Class 7	similar reference JIS G3204 SFVQ3(WH) 10325UA-UE)	SEW 555 26NiCr-MoV11-5 SEW 555 26NiCr-MoV14-5	Forged	-115 (-175)	400 (750)	
		AISI Type 4340	JIS G4053 SNCM439	EN 10083-3 30CrNi-mo8	Forged	-115 (-175)	345 (650)	
		AISI Type 4140	JIS G4053 SCM440	EN 10083-3 42CrMo4	Forged	-28 (-20)	400 (750)	
		AISI Types 1040-1050 ^a	JIS G4051 S40C	EN 10083-2 C45E	Bar or Forged	-28 (-20)	345 (650)	
		AISI Types 4140-4150 ^a	JIS G4053 SCM440	EN 10083-3 42CrMo4	Bar or Forged	-28 (-20)	400 (750)	
		AISI Type 2320 ^a	NA		Bar or Forged	-110 (-170)	345 (650)	
		AISI Type 2330	NA		Bar or Forged	-110 (-170)	345 (650)	
		AISI Type 9310	JIS G4053 SNCM 625		Bar or Forged			
		ASTM A 522, Type 1	JIS G3127N520 SL9	EN 10222-3 X8Ni9	Forged	-195 (-320)	345 (650)	
		ASTM 4340-4345	ASTM maybe replaced to AISI. JIS G4053 SNCM439	EN 10083-3 30CrNi-mo8 ISO 4957-55NiCr-MoV7	Forged	-115 (-175)	345 (650)	
	Stainless steel	ASTM A 336, Grade F6	G3214 SUS F410-C	EN 10088-3 X12Cr13	Forged	-60 (-75)	345 (650)	

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Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							Temperature Limits	
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Minimum temperature °C (°F)	Maximum temperature °C (°F)	
		ASTM A 473, Type 410	JIS G3214 SUS F410	EN 10088-3 X12Cr13	Forged	-60 (-75)	345 (650)	
		ASTM A1021, Grade D, Class 2 (422)	NA		Forged	-60 (-75)	345 (650)	
		ASTM A 182, Grade F 6NM	JIS G3214 SUS F6 NM	EN 10250 X3CrNiMo13-4	Forged	-60 (-75)	345 (650)	
	Precipitation hardening stainless steel	ASTM A 705, Types 630 or XM-12	JIS G3214 SUS F630	EN 10250 X5CrNiCuNb16-4	Forged	-75 (-100)	345 (650)	
	Nickel Alloys	ASTM A 564, Type 630 or XM-12	JIS G4303 SUS 630	EN 10250 X5CrNiCuNb16-4	Bar	-270 (-454)	345 (650)	
		AMS 4676	JIS H4553		Bar			
Impellers								
Cast and Forged	Aluminium	ASTM B 26, Alloy C355	JIS H5202 AC4C		Cast	-195 (-320)	150 (300)	
	Precipitation hardening stainless steel	ASTM A 747, Type CB7CU-1 or CB7CU-2	JIS G5121 SCS 24		Cast	-75 (-100)	345 (650)	
	Steel	ASTM A 148	JIS G5111		Cast	-28 (-20)	345 (650)	
		ASTM A 487 Gs 4Q	JIS G5111 SCMnCrM2		Cast	-45 (-50)	345 (650)	
	Stainless steel	ASTM A 743/744 or A 351, Grade CA15	JIS G5121 SCS1		Cast	-45 (-50)	345 (650)	
		or CA6NM			Cast	-45 (-50)	345 (650)	

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Table D.1 (continued)

INTEGRALLY GEARED COMPRESSORS – TYPICAL MATERIALS FOR MAJOR COMPONENTS							
Component	Materials	Material Code	Equivalent JIS Material	Equivalent EN Material	Form	Temperature Limits	
						Minimum temperature °C (°F)	Maximum temperature °C (°F)
		ASTM A 743/744 or A 351, Grade CF-5, CF3M, CF8 or CF8M	CF3: JIS G5121 SCS19A CF3M: JIS G5121 SCS16A CF8: JIS G5121 SCS13A CF8M: JIS G5121 SCS14A		Cast	-195 (-320)	345 (650)
	Aluminium	ASTM A 356 or A 357	JIS G5151		Cast	-195 (-320)	345 (650)
	Titanium	ASTM B 367, Grade C3 or C4	C3: JIS H4600 Class 2 C4: NA		Cast	-195 (-320)	150 (300)
		ASTM B 367, Grade C5	JIS H4600 Class 3		Cast	-45 (-50)	345 (650)
		ASTM B 348, Grade 5	JIS H4650 Class 60		Cast	-195 (-320)	345 (650)
		ASTM B 348, Grade 19	NA		Cast		
		ASTM B 381, Grade F-19	NA		Forged		
	Inconel	ASTM B 637 Alloy N07718	JIS G4902 NCF718		Bar or Forged		
Fabricated (covers, hubs, blades)	Aluminium	ASTM B 209, Alloy 6061 or 7075	6061: JIS H4000 6061 7075: JIS H4000 7075		Plate	-195 (-320)	150 (300)
		ASTM B 211, Alloy 6061 or 7075	6061: JIS H4040 6061 7075: JIS H4040 7075		Bar	-195 (-320)	150 (300)
		ASTM B 221, Alloy 6061 or 7075	6061: JIS H4040 6061 7075: JIS H4040 7075		Extruded	-195 (-320)	150 (300)
		ASTM B 247, Alloy 2618,	2618: JIS H4140 2618 6061: JIS H4140 6061 7075: JIS H4140 7050		Forged	-195 (-320)	150 (300)

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