International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-612

May 2022
Version 2.0

REDLINE
Version 2.0 to Version 1.0

Supplementary Specification to API Standard 672 Packaged, Integrally Geared Centrifugal Air Compressors

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
2.0	May 2022	Second Edition
1.0	November 2018	First Edition

Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

Disclaimer

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Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

This second edition cancels and replaces the first edition published in December 2018.

Due to technical writing requirements leading to extensive changes, this second edition should be treated as a new document.

ABOUT THE REDLINE VERSION

This Redline version aims at comparing Version 2.0 to Version 1.0 but may not capture all changes.

The Redline version is not a specification document. It is a mark-up copy provided for information only. The user must refer to the official published version.

Table of Contents

List of Tables

Introduction

The purpose of this specification is to define a minimum common set of ~~supplementary~~ requirements for the procurement of packaged, integrally geared centrifugal air compressors in accordance with API ~~s~~Standard 672, ~~4~~5th Edition ~~2004~~, August 2019, Packaged, Integrally Geared Centrifugal Air Compressors for Petroleum, Chemical, and Gas Industry Services for application in the petroleum and natural gas industries.

~~This JIP33 standardized procurement~~This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Supplementary Technical Specification

~~It~~This specification is ~~required~~ to ~~use all of these documents~~be applied in conjunction with ~~each other when applying this specification,~~the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows~~:~~.

IOGP S-612: Supplementary ~~s~~Specification to API Standard 672 ~~for~~ Packaged, Integrally Geared Centrifugal Air Compressors

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to API Standard 672, following the API Standard 672 clause structure ~~of the parent standard, to assist in cross-referencing the requirements. Where clauses~~. Clauses from ~~the parent standard (~~API Standard 672 ~~) are~~ not ~~covered in this specification, there are no supplementary requirements or modifications to the respective clause. The terminology used within~~amended by this specification ~~follows that of~~ apply as written to the ~~parent standard and otherwise is in accordance with ISO/IEC Directives, Part 2~~extent applicable to the scope of supply.

Modifications to ~~the parent standard~~ API Standard 672 defined in this specification are identified as *Add* (add to clause or add new clause), *Replace* (part of or entire clause) or *Delete*.

IOGP S-612D: Procurement Data ~~s~~Sheet~~s~~ for Packaged, Integrally Geared Centrifugal Air Compressors (API)

~~This document provides project~~The procurement data sheet defines application specific requirements ~~where the supplementary~~, attributes and options specified by the purchaser for the supply of equipment

to the technical specification ~~and its parent standard require the purchaser to define an application specific requirement. It~~ . The procurement data sheet may also ~~includes~~ include fields for supplier provided information ~~required by the purchaser for~~ attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents ~~are~~may also ~~listed~~be incorporated or referenced in the procurement data sheet~~s,~~ to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-612L: Information ~~r~~Requirements for Packaged, Integrally Geared Centrifugal Air Compressors (API)

~~This document~~The IRS defines the information requirements, including contents, format, timing and purpose~~, for information~~ to be provided by the ~~vendor~~supplier. It may also ~~defines the~~define specific conditions which ~~must be met for conditional~~invoke information requirements ~~to become mandatory. The information requirements listed in the IRS have references to the source of the requirement.~~ .

IOGP S-612Q: Quality ~~r~~Requirements for Packaged, Integrally Geared Centrifugal Air Compressors (API)

~~This document includes a~~The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) ~~which specifies standardized user interventions against quality management activities at four different~~ levels~~.~~ on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the data ~~sheets~~sheet or in the purchase order.

~~The~~The terminology used within this specification and the supporting procurement data sheet, IRS and QRS follows that of API Standard 672 and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

The procurement data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The supplementary specification and QRS are fixed documents.

~~Unless defined otherwise in the purchase order, the~~The order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser defined requirements (procurement data sheet~~s~~, IRS, QRS);

d) this specification;

e) ~~the parent standard~~API Standard 672.

1 Scope

1.1

Add to section

This specification covers ~~constant speed electric motor driven~~ integrally geared centrifugal air compressor~~,~~ driven by a constant speed electric induction motor with a shaft power range of up to ~~1500~~1,500 kW ~~,~~for plant and instrument air application.

~~Note:~~ NOTE This specification ~~may~~can also be applied ~~for a~~to steam turbine driven air compressor packages. However, the requirements for the steam turbine driver are not covered within this specification.

~~Note: The compressor is assumed to be spared.~~

1.2

Add to section

This specification ~~is applicable for~~ applies to spared basic duty packages~~,~~.

2 Normative References

The following publications are referred to in this document, the procurement data sheet (IOGP S-612D) or the IRS (IOGP S-612L) in such a way that some or all of their content constitutes requirements of this specification.

Delete from section

API Standard 614, *Petroleum, Petrochemical and Natural Gas Industries—Lubrication, Shaft-sealing and Oil-control Systems and Auxiliaries*

Add to section

ANSI/API Standard 614:2008, Petroleum, Petrochemical and Natural Gas Industries—Lubrication, Shaft-sealing and Oil-control Systems and Auxiliaries

API Recommended Practice 687:2001, Rotor Repair

ASME B1.20.1, Pipe Threads, General Purpose, Inch

ASME BTH-1, Design Of Below-The-Hook Lifting Devices

ASTM A350/A350M, Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components

BS 4235-1, Specification for metric keys and keyways - Part 1: Parallel and taper keys

IEC 60034-1, Rotating Electrical Machines – Part 1: Rating and Performance

IEC 61043, Electroacoustic – Instruments for the measurement of sound Intensity – Measurements with pairs of pressure sensing microphone

IOGP S-715, Supplementary Specification to NORSOK M-501 Coating and Painting for Offshore, Marine, Coastal and Subsea Environments

ISO 281, Rolling bearings — Dynamic load ratings and rating life

ISO 4406, Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles

ISO 2151, Acoustics — Noise test code for compressors and vacuum pumps — Engineering method (Grade 2)

ISO 9614-2, Acoustics — Determination of sound power levels of noise sources using ~~the proven vendor's standard design.~~sound intensity — Part 2: Measurement by scanning

ISO 12944-2, Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments

ISO 12944-5, Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems

ISO 12944-6, Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 6: Laboratory performance test methods

ISO 12944-9, Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 9: Protective paint systems and laboratory performance test methods for offshore and related structures

ISO 14691, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications

ISO 19901-5:2021, Petroleum and natural gas industries — Specific requirements for offshore structures — Part 5: Weight control during engineering and construction

ISO 20816 (all parts), Mechanical vibration — Measurement and evaluation of machine vibration

ISO 21457, Petroleum, petrochemical and natural gas industries — Materials selection and corrosion control for oil and gas production systems

ISO 21940-11, Mechanical vibration — Rotor balancing — Part 11: Procedures and tolerances for rotors with rigid behaviour

ISO 21940-32, Mechanical vibration — Rotor balancing — Part 32: Shaft and fitment key convention

SAE AS4059, Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

Add new term

3.1.59
undesirable speed
Critical speed up to three times the operating speed of each shaft.

Add new term

3.1.60
carbon steel
Alloy of carbon and iron containing up to 2 % mass fraction carbon and up to 1.65 % mass fraction manganese and residual quantities of other elements, except those intentionally added in specific quantities for deoxidation (usually silicon and/or aluminium).

Add new term

3.1.61
low alloy steel
Steel containing a total alloying element content of less than 5 % mass fraction, or steels with less than 10.5 % mass fraction chromium but more than that specified for carbon steel.

3.2 Acronym and Abbreviations

Add to section

MT magnetic particle testing

PT penetrant testing

PTFE polytetrafluoroethylene

6 Basic Design

6.1 General

~~*Add to section*~~

6.1.3 Sound Pressure Level

6.1.3.1

Delete first sentence

Add new section

6.1.3.4 The ~~A-weighted~~ sound pressure level~~, for the compressor unit at rated duty under free field operating conditions,~~ shall be ~~limited within the noise limit specified in the data sheet.~~

~~Sound pressure level measurement shall be taken~~ measured at 1.0 m (3.3 ft) from the skid boundary~~ and at 1.0 m (3.3 ft) from the discharge blow-off silencer outlet~~.

~~**6.1.4 Packaged Equipment**~~

~~*Replace section with*~~

~~The scope of the compressor package shall include, as a minimum, the following:~~

~~a. Integrally geared centrifugal air compressor~~

~~b. Compressor gear box breather and screen~~

~~c. Main drive coupling and coupling guard~~

~~d. Main driver~~

~~e. Inlet air filter and silencer with weather hood and support leg~~

~~f. Variable inlet guide vane~~

~~g. Discharge blow-off valve and silencer~~

h. Inlet and discharge expansion joint

i. Blow-off line expansion joint for off-skid blow-off valve and silencer

j. Intercoolers and aftercooler

k. Moisture separator and automatic drainer, or drain traps

l. Lube oil system (common) for compressor, gear and driver with lube oil reservoir including demister, lube oil filter, lube oil pump (main and auxiliary including coupling and driver for auxiliary lube oil pump), lube oil heater complete with piping, valves and instrumentation

m. On-skid interconnecting piping, fitting and valves including control valves and pressure relief valves, as applicable

n. Control, monitoring and protection instruments with on-skid instruments, control panel, control, signal and power cables, and junction box

o. Noise attenuation device such as acoustic insulation and noise enclosure to meet required noise limit

p. Skid baseplate with lifting lugs

q. Local emergency stop push button.

For off-shore installation, the compressor package shall be a complete unit installed on a single skid.

6.1.5 Environmental Conditions

Add to section

The compressor package shall be suitable for outdoor installation with ambient conditions as specified in the data sheet.

Any additional requirements for weather protection, such as enclosure, winterization, topicalization based on any special site, or environmental conditions shall be specified in the data sheet.

6.1.6 Cooling Water Systems

Add to section

For alternative cooling medium, the fouling factor specified in the data sheet, shall be used.

The cooling water maximum inlet temperature specified in the data sheet, based on project environmental maximum ambient conditions shall be used.

6.1.7 Package Arrangement

Add new section

6.1.7.4

The package shall conform to skid envelope dimension limits, as specified in the data sheet.

Add new section

6.1.7**3.5**

~~If specified by the purchaser, the intake opening~~ Sound pressure level measurements shall be ~~located opposite to the prevailing wind direction.~~

~~The vendor shall propose the location and orientation of the air intake. The purchaser shall verify the proposed location and orientation with respect to exhaust gas emissions~~taken at 1.0 m (3.3 ft) from ~~nearby equipment~~the discharge blow-off silencer outlet.

6.1.8 Motors and Electrical Components

~~**Replace first**~~

6.1.8.4

Delete second sentence ~~with~~

~~Motors, electrical components, and electrical installations shall be suitable for the area classification (class, group, and division or zone) specified by the purchaser and shall meet the requirements of the applicable sections of IEC 60079 or NFPA 70, Articles 500, 501, 502, and 504, as well as local codes.~~

~~*Add new section*~~

~~6.1.8.1~~

~~Unless otherwise specified in the data sheet, motors and other electrical components shall be rated for safe area application.~~

~~*Add new section*~~

~~6.1.8.2~~

~~Unless otherwise specified in the data sheet, the compressor skid shall be non-Ex zone certified.~~

6.1.9 Performance Criteria

Add ~~to~~new section

~~Compressor thermodynamic and mechanical performance, as specified in the data sheet, shall be validated by the vendor during the performance and mechanical run tests. The thermodynamic performance test may be performed on one machine of multiple order of identical machines.~~

6.1.9.4 The turndown capacity of the compressor shall be greater than or equal to 15 % of the rated capacity.

6.1.10 Purchaser Connections

~~*Replace*~~*In first sentence, replace "DN 12 (NPS ½)" with*

~~All openings or nozzles~~DN 20 (NPS ¾)

Add to section

Nozzles for purchaser ~~connection~~ connections DN 50 (NPS 2) or larger shall be ~~DN 20 (NPS ¾) or larger~~ flanged in accordance with ~~ISO 6708~~ASME B16.5.

Add to section

Nozzles for purchaser's connections smaller than DN 50 (NPS 2) shall be threaded in accordance with ASME B1.20.1 or flanged in accordance with ASME B16.5.

6.2 Pressure Casings

Add new section

6.2.5 Jackscrews, guide rods and cylindrical casing-alignment dowels shall be in accordance with 6.12.1.

Add new section

6.~~1.10.1~~

~~Nozzles for purchaser connections larger than DN 50 (NPS 2).~~**6** Jackscrews shall be ~~flanged per ASME B16.5.~~ in accordance with 6.12.1.3.

Add new section

6.~~1.10.~~**2**

~~Nozzles for purchaser connections smaller than DN 50 (NPS 2) may.~~**7** Guide rods shall be ~~threaded per ASME B1.20.~~in accordance with 6.12.1.1 ~~or flanged~~.

Add new section

~~6.1.10.3~~

~~Proprietary connection types shall not be used for purchaser connections unless specifically approved by the purchaser.~~

~~6.1.12 Compressor Performance~~

~~6.1.12.1~~

~~*Add to section*~~

~~The turn down capacity shall be at least 15 % less than the rated capacity.~~

~~6.1.13 Mounting Surfaces~~

~~*Replace first sentence with*~~

~~Mounting surfaces shall meet the following criteria:~~

~~*Add to section*~~

~~When shims are used under the driver mounting pad, they shall be full-face stainless steel shims.~~

~~6.2 Pressure Casings~~

~~6.2.2~~

~~*Add to section*~~

~~The maximum discharge pressure shall not be less than the discharge pressure based on maximum rotational speed.~~

~~*Add new section*~~

~~6.2.4~~

~~Jackscrews, guide rods, cylindrical casing-alignment dowels or other necessary devices shall be provided to allow disassembly and reassembly.~~

~~*Add new section*~~

~~6.2.4.1~~

~~When jackscrews are used as a means of parting contacting faces, one of the faces shall be relieved (counter bored or recessed) to prevent a leaking joint or improper fit caused by marring of the face.~~

~~*Add new section*~~

~~6.2.4.2~~

~~Guide rods shall be of sufficient length to prevent damage to the internals or casing studs by the casing during disassembly and reassembly.~~

~~*Add new section*~~

~~6.2.5~~

.8 Lifting lugs ~~or eyebolts shall be provided for lifting the top half of the gear casing.~~shall be in accordance with 6.12.1.2.

6.3 Casing Connections

Add new section

6.3.~~10~~**11**~~-~~

~~The package shall be provided with means of draining of~~ Each compressor ~~casing~~section shall have a drain.

6.5 Rotating Elements

6.5.1 Shafts

6.5.1.2

6.5.1.2.3

Replace list item a) with

a) for radial sensing areas 6 µm (0.25 mil) peak to peak;

6.5.1.4

Replace section with

Fillet radii of shaft keyways shall be in accordance with ASME B17.1 or BS 4235-1.

Add new section

6.5.1.5 ~~For shafts with keyways, ISO 21940-32 shall be followed for shaft~~ Shaft and fitment key conventions shall be in accordance with ISO 21940-32.

6.5.2 Impellers

~~6.5.2.2~~

Add ~~to~~new section

6.5.2.3 The ~~Impeller~~ impeller construction and attachment method shall ~~ensure positive retention of~~retain the impeller-to-shaft connection with ~~necessary~~a locking arrangement ~~to prevent impeller loosening in service, especially during start-up, over speed, reverse rotation and surge events.~~

~~6.6 Seals and Sealing System~~

~~6.6.3~~

~~*Add to section*~~

~~If specified in the data sheet, a buffered-seal design shall be provided for compressors~~.

6.7 Dynamics

~~6.7.1 Critical Speeds~~

~~6.7.1.4~~

~~*Replace section with*~~

~~For the purposes of this standard, critical speeds and other resonant conditions of concern are those with an amplification factor (AF) equal to or greater than 2.5.~~

6.7.2 Lateral Analysis

~~*Replace*~~*Delete second sentence ~~with~~*

~~A report is not required, unless specified in the data sheet. The vendor shall specify lateral critical speed values in the data sheet.~~

~~**6.7.3 Torsional Analysis**~~

~~6.7.3.1~~

~~*Replace second sentence with*~~

~~A report is not required, unless specified in the data sheet. The vendor shall specify torsional natural frequencies in the data sheet, based on the drive train supplied.~~

~~**6.7.4 Vibration and Balancing**~~

~~*Add new section*~~

~~6.7.4.4~~

~~Rotor assembly shall be dynamically balanced to balance grade G1 as per ISO 21940-11.~~

~~*Add new section*~~

~~6.7.4.5~~

~~The total combined electrical and mechanical runout shall not exceed 6.35 µm (0.25 mils).~~

6.8 Bearings and Bearing Housings

6.8.1 Bearings ~~- -~~ General

6.8.1.1

Replace section (including note) with

~~If approved by the purchaser, anti-friction bearings may be used only for low-speed bull gear shaft rotors. Rolling element bearings shall not be used on pinion shaft rotors.~~

Pinion shaft rotors shall have hydrodynamic radial bearings and thrust bearings or hydrodynamic radial bearings and thrust collar.

Add new section

6.8.1.~~3~~4

Basic L10 rating life ~~(L10~~ rolling element bearing ~~life) for anti-friction bearing, as~~ defined ~~in~~by ISO 281 ~~,~~ shall be ~~50000~~50,000 hours or more.

6.9 Lubrication

6.9.2

Replace "API 614" with

ANSI/API Standard 614:2008

Add new section ~~heading~~

6.9.~~5~~7 Lube Oil Cooler

~~Add new section~~

6.9.~~5~~7.1

~~When an air~~ Air-cooled lube oil coolers design ~~is specified for~~ shall be a single-bay with 2 x 100 % fans.

6.9.7.2 Air-cooled lube oil cooler~~, oil shall be cooled in a single bay two fan air-cooled unit. The tube bundle design shall be per TEMA Class C as a minimum, with~~ header box design ~~to~~shall be ~~of the~~ removable cover plate~~, removable bonnet~~ or plug type construction.

Add new section

~~**6.9.5.2**~~

~~The heat exchanger materials shall comply with Table 4.~~

~~Add new section heading~~

6.9.~~6~~8 Lube Oil Filter

6.9.8.1 ~~Dual filters~~Each lube oil filter shall be ~~provided, each~~ sized for at least 100 % of the flow ~~as a minimum.~~
.

~~Add new section~~

~~**6.9.6.1**~~

~~The filters shall be designed for on-line change-over and on-line replacement of the off-line unit.~~

~~Add new section~~

6.9.8.2 ~~The~~ Lube oil filters shall be equipped with a differential pressure local indicating transmitter.

~~**6.9.7**~~

~~Lubrication system design shall guarantee priming of the main oil pump prior to compressor start-up.~~

~~Add new subheading~~

Add new section

6.9.8 Lube Oil Reservoir

~~Add new section~~

6.9.~~8~~9.1~~Lube~~ The lube oil reservoir capacity ~~shall be based on minimum 3 minutes~~ retention time~~. Retention time less than 3 minutes~~ shall be ~~subject~~greater or equal to ~~the purchaser's approval~~three minutes.

Add new section

6.9.89.2 A The lube oil reservoir shall have a temperature-controlled electric immersion heater shall be provided. .

Add new section

6.9.10 Gearbox

The compressor gear box shall have a breather and a screen.

6.10 Materials

6.10.3 Castings

6.10.3.3

Delete 'if specified'

Add new section heading

6.10.65 Material Selection

Add new section

6.10.65.1 Material selection requirements shall be in accordance with this specification and the mechanical data sheet for air compressor package.

Add new section

6.10.6.2

Material selection philosophy shall be in accordance with the recommendations and guidelines of ISO 21457, unless explicitly specified in Table 42.

6.10.5.2 Intercooler and aftercooler exchangers shall use fresh water or a glycol-water mixture.

Add new section

6.10.6.3

Material selection for components and accessories shall be based on following minimum requirements specified in Table 4. Alternative materials per the vendor's standard, if equivalent or superior than specified may be considered, subject to the purchaser's approval.

Add new section

6.10.6.4 Coating

Material of construction for core compressor and gear components shall follow the vendor's standard approved by the purchaser.

Add new section

6.10.6.5

Depending on service conditions, if specified in the data sheet, volutes shall be internally coated with a corrosion or erosion resistant coating.

6.10.6.1 Non-marine coating systems shall be selected in accordance with ISO 12944-5.

6.10.6.2 Offshore and marine coastal coating systems shall be in accordance with ISO 12944-9 or IOGP S-715.

6.10.6.3 Stainless steel equipment items and piping shall be coated when operating at a temperature greater than 60 °C (140 °F) in a marine atmosphere.

6.10.6.4 Insulated stainless steel equipment and piping shall be coated.

6.10.6.5 Coating under insulation shall be in accordance with IOGP S-715.

6.10.6.6 Onshore and non-marine coating systems shall be qualified to ISO 12944-6.

Add new Table 2

Table 4 – 2—Material sSelection

Item	Material of construction (base case) *(Note 1)* Construction (Base Case) [a]	Material of construction (harsh environment) *(Note 1)* Construction (Harsh Environment) [b]
Diffuser	Manufacturer's standard	Stainless steel
Inlet Air Filter/Silencerair filter/silencer	Carbon steel (hot dip galvanized)	316 stainless steel
Intercooler/Aftercooler (Water Cooled) *(Note 2)*		
Shell	Carbon steel or cast iron (coated) *(Note 3)*	Carbon steel or cast iron (coated) *(Note 3)* or 316 stainless steel
Tube	316 stainless steel or 90/10 Cu-Ni or admiralty brass	316 stainless steel or 90/10 Cu-Ni or admiralty brass
Tube sheet / Bbaffle	Compatible with the tube material	Compatible with the tube material
Intercooler/Aftercooler/Lube Oil Cooler (Air Cooled) *(Note 2)*		
Tube	Carbon steel with aluminium fins	316 stainless steel
Tube sheet / Header Box/ Tube Supportheader box / tube support	Carbon steel (coated)	316 stainless steel
Lube Oil System Components		
Lube Oil Cooler		
Shell	Carbon steel	316 stainless steel
Tube	90/10 Cu-Ni or admiralty brass	90/10 Cu-Ni or admiralty brass
Tube sheet	Brass	Brass
Lube Oil Reservoiroil reservoir	Carbon steel (coated)	316 stainless steel
Lube Oil Pipingoil piping	Carbon steel	316 stainless steel

Lube ~~Oil Piping~~ oil piping (downstream of lube oil filter)	Stainless steel	316 stainless steel
Lube ~~Oil Filter~~oil filter	Carbon steel (coated)	316 stainless steel
Piping, Tubing and Miscellaneous Items		
Air / ~~Cooling Water Piping~~cooling water piping	Carbon steel (coated) ~~*(Note 3)*~~	
Tubing and fittings	316 stainless steel	316 stainless steel
Blow-off ~~S~~silencer housing	Carbon steel (hot dip galvanized)	316 stainless steel
Blow-off ~~S~~silencer internals	316 stainless steel	316 stainless steel
Base ~~F~~frames	Carbon steel (coated or hot dip galvanized) ~~*(Note 3)*~~	Carbon steel (coated or hot dip galvanized) ~~*(Note 3)*~~
Instrument ~~H~~housing	Stainless steel or aluminium	316 stainless steel or aluminium
Junction ~~B~~box	Carbon steel (hot dip galvanized) or 304 stainless steel or aluminium	316 stainless steel or aluminium
Noise ~~E~~enclosure	Carbon steel (coated)	Carbon steel (coated)
Local ~~Control Cabinet~~control cabinet	Carbon steel (coated)	Carbon steel (coated)

~~Note 2 Cooling water is assumed to be fresh water or glycol-water mixture.~~

~~Note 3 Refer to 6.10.7~~

[a] Base case ~~requirements apply~~ applies to atmospheric corrosion category C1 to C3 (low to medium corrosivity~~).~~) defined by ISO 12944-2.

[b] Harsh environments appl~~y~~ies to corrosion category C4 to CX (high to extreme corrosivity) ~~as per~~defined by ISO 12944-2 ~~definition~~.

~~*Add new section heading*~~

~~**6.10.7 Coating**~~

~~*Add new section*~~

~~**6.10.7.1**~~

~~Surface preparation, coating and coating activities shall, as a minimum, conform to the requirements of ISO 12944 (all parts) or alternative equivalent standard approved by the purchaser.~~

~~*Add new section*~~

~~**6.10.7.2**~~

~~For offshore applications, the requirements of ISO 12944-9 shall be applicable.~~

~~*Add new section*~~

~~**6.10.7.3**~~

~~Cast iron, carbon steel and low alloy steel external surfaces shall be coated.~~

Add new section

6.10.7.4

Bearings, seals, flange mating faces, instrument dials, instrument cases, cable trays and cables, shafts, polished or machined surfaces, control valve stems, nameplates and item tags shall not be coated. These items shall be protected from blasting and coating being applied to adjacent equipment.

Add new section

6.10.7.5

Stainless steel equipment items and piping shall be coated when:

a. operating at a temperature exceeding 60 °C (140 °F) in an offshore environment

b. insulated.

Add new section heading

6.10.7.6 Coating Procedure Specification

Add new section

6.10.7.6.1

If specified in the data sheet, surface preparation and coating shall be in accordance with a qualified coating procedure specification, conforming to ISO 12944-8 or alternative equivalent standard, and following the recommendations of the coating manufacturer.

Add new section

6.10.7.6.2

The coating procedure specification proposed by the vendor shall describe complete coating related works to be performed, including surface preparation, coating application, qualification and inspection.

7 Accessories

7.1 Drivers

7.1.1 General

7.1.1.5

Replace section with

The driver nameplate rating, exclusive of the service factor, shall be at least 110 % of the maximum power required for all of the specified operating conditions.

Delete "If specified,"

7.1.2 Electric Motors

7.1.2.1

~~Replace~~ Delete section *~~with~~7.1.2.1*

~~**7.1.2.1**~~

Add new section

~~**7.1.2.1.1**~~

~~Motors shall conform to either IEC 60034, NEMA MG-1 or IEEE 841, unless otherwise specified in the motor data sheet.~~

~~*Add new section*~~

~~**7.1.2.1.2**~~

~~Enclosure for main driver motors shall be totally enclosed fan cooled (TEFC), totally enclosed air to air cooled (TEAAC) or totally enclosed water to air cooled (TEWAC).~~

~~*Add new section*~~

~~7.1.2.1.~~ 7.1.2.3 Electric Motor Construction Features

7.1.2.3.1 For general outdoor environments, motors shall have~~, as~~ a minimum~~, weather~~ ingress protection class of IP55.

7.1.2.3.2 For environments with areas exposed to powerful water jets and deluge or offshore open deck, ~~IP56 weather~~motors shall have a minimum ingress protection class ~~shall be used, as a minimum~~of IP56.

~~*Add new section*~~

~~**7.1.2.1.4**~~

7.1.2.3.3 ~~Motor~~ Motors shall be supplied with a minimum of Class F insulation.

~~*Add new section*~~

~~**7.1.2.1.5**~~

~~Motor shall be suitable for direct on line starting, unless otherwise specified in the data sheet.~~

~~*Add new section*~~

~~**7.1.2.1.6**~~

7.1.2. 3.4 ~~Main~~The main driver motor shall be ~~provided~~supplied with stator winding anti-condensation type space heater.

7.1.2.3.5 The stator winding space heater shall ~~remain~~be energized when the main drive motor is not running.

~~*Add new section*~~

~~7.1.2.1.~~**7.1.2.3.6** Motors with sleeve bearings shall be equipped with one x and one y radial proximity probes per bearing.

~~*Add new section*~~

~~**7.1.2.1.8**~~

7.1.2.3.7 Lube oil for motors equipped with sleeve bearings shall be fed through the common pressurized lube oil system ~~as~~ used by the compressor and gearing.

~~*Add new section*~~

~~**7.1.2.1.9**~~

7.1.2. 3.8 ~~Motor~~ Motors equipped with sleeve bearings shall have one dual element bearing metal resistance temperature detector per bearing.

~~*Add new section*~~

~~**7.1.2.1.10**~~

7.1.2.3.9 Medium voltage motors shall have a minimum of two embedded 3-wire P~~T~~t100 resistance temperature detectors for windings per each phase of stator windings.

~~**7.1.2.1.11**~~

~~For a vendor supplied local control panel, bearing and winding resistance temperature detectors shall be connected to a local controller.~~

~~*Add new section heading*~~

Add new section

~~**7.1.2.3**~~**7.1.2.4 Electric Motor Testing**

~~*Add new section*~~

7.1.2.~~3~~4.1

~~Routine tests are not required for~~ When low-voltage motors ~~which are already~~less than 600 V have been type tested ~~to an approved standard, such as~~in accordance with IEC 60034~~-1:2017, 9.1~~-1, routine tests may be omitted.

~~*Add new section*~~

7.1.2.~~3~~4.2

~~For medium~~ Medium voltage motors~~, the following minimum testing~~ shall be ~~performed by the motor manufacturer:~~

~~a. No load test (measurement of~~ no-load ~~characteristics, losses and determination of locked-rotor current)~~ tested.

~~b. Measurement of~~ **7.1.2.4.3** The stator-winding resistance of medium voltage motors shall be tested.

7.1.2.4.4 ~~c. Insulation~~ The insulation resistance ~~test~~ of ~~stator winding~~ medium voltage motors shall be tested.

7.1.2.4.5~~d. Determination of~~ The efficiency of medium voltage motors shall be determined for 50 %, 75 % and 100 % of rated load.

~~e. Vibration measurement at bearing housings~~

7.1.2.4.6~~f. Phase sequence~~ The vibration of medium voltage motors shall be measured and assessed against the agreed criteria in ISO 20816.

7.1.2.4.7 The phase sequencing, direction of rotation~~,~~ and terminal marking of medium voltage motors shall be performed.

~~g. Noise test~~

7.2 Couplings and Guards

7.2.1 Couplings

7.2.1.~~1~~2

~~*Replace second sentence with*~~

~~The flexible elements shall be corrosion-resistant alloy. Coated flexible elements shall not be used.~~

~~*Add to section*~~

~~*Unless otherwise specified* *in* *the data sheet, coupling and guard design and manufacture*~~

In list section d), replace "125 mm (5 in.)" with

200 mm (8 in.)

Add new list section g)

g) Coupling shall conform to ISO 14691.

7.2.1.~~2~~3

~~*Add to section*~~

~~Main drive coupling spacer shall be 200 mm (8 in.) length minimum.~~

~~**7.2.1.7**~~

Replace section with

~~The coupling-to-shaft juncture shall be designed to transmit power at least equal to the power rating of the coupling including any service factor and any transient operating conditions.~~

~~*Add new section*~~

~~**7.2.1.8**~~

The coupling assembly shall be dynamically balanced to Grade 2.5 ~~as per~~ in accordance with ISO 21940-11.

7.2.2 Coupling Guards

7.2.2.2

In second sentence, replace "comply with specified standards such as ANSI B11.19, ISO 14120 or other applicable nationally recognized standards." with

be in accordance with ANSI B11.19 or ISO 14120.

7.3 Baseplate/Support Structure

7.3.2

Add ~~new~~to section

~~**7.3.2.1**~~

Baseplate welding shall be continuous.

~~All welding shall be continuous.~~

~~*Add new section*~~

~~**7.3.2.3**~~

~~Design code for baseplate lifting lugs shall be specified in the data sheet.~~

~~*Add new section*~~

~~**7.3.2.4**~~

~~For off-shoreoffshore installation of skid, additional certifications for lifting lugs and lifting beams shall be specified by the purchaser.~~

~~**7.3.4**~~

~~*Add to section after first sentence*~~

~~Baseplate structural members provided for supporting~~, the compressor~~, gear and driver shall be in full contact with the foundation or grout to ensure direct transmission of dynamic forces to the foundation or support beneath the baseplate.~~

~~**7.3.10**~~

~~*Replace first sentence with*~~

~~The driver mounting plates shall be furnished with axial and lateral jackscrews the same size as or larger than the vertical jackscrews package shall be a complete unit installed on a skid for a single lift.~~

7.3.11

In first sentence, delete "If the supported driver weighs more than 225 kg (500 lb),"

7.3.13

Add to section

Baseplates shall be provided with a drain connection of DN 50 (NPS 2~~).~~) minimum.

Add new section

7.3.14

For offshore installation, the compressor package shall be a complete unit installed on a skid for a single lift.

.4 Controls and Instrumentation

7.4.1 General

7.4.1.~~2~~1

Replace "API 614" with

ANSI/API Standard 614:2008

~~*Replace section with*~~

~~Unless otherwise specified, controls and instrumentation shall be designed for outdoor installation and meet the requirements of IP65 or NEMA 4X.~~

~~Instrumentation and control systems shall be designed for continuous operation at the specified ambient temperature without any degradation of the measurement and control accuracy specified by the manufacturer.~~

~~**7.4.1.4**~~

~~*Replace first sentence with*~~

~~The microprocessor shall be capable of communication with the purchaser's distributed control system (DCS).~~

~~*Add new section*~~

~~ANSI/API Standard 614:2008~~

7.4.1.5

Add to section

Interface between the local control panel and the purchaser's safety instrument system shall be through hard-wired signal interface.

~~The local control panel shall have a communication interface with the purchaser's control system, as specified in the data sheet, via a high integrity ethernet communication link for remote operation and control, data monitoring and retrieval.~~

~~*Add new section*~~

~~**7.4.1.4.2**~~

~~Any interface between the vendor's local control panel and the purchaser's safety instrument system shall be through hard-wired signal interface.~~

~~*Add new section*~~

~~**7.4.1.7**~~

~~The vendor supplied local control panel shall have provision for:~~

~~a. Remote start and stop of compressor~~

~~b. Remote and local read-out of vibration data.~~

7.4.2 Control Systems

~~**7.4.2.1**~~

~~*Replace section with*~~

~~Unless otherwise specified in the data sheet, capacity modulation with variable inlet guide vane shall be provided.~~

~~*Add new section*~~

7.4.2.3

Add to section

When surge control ~~and detection~~ is based on monitoring motor current ~~as the primary monitoring signal~~, an additional ~~secondary~~ monitoring signal based on ~~process conditions (~~discharge pressure or flow~~)~~ shall be provided~~, if specified by the purchaser in the data sheet~~.

Add new section

7.4.2.7

Field analogue instruments, transmitters and control valves shall be provided with the specified communication protocol.

~~If specified by the purchaser, complete control system or parts thereof (anti-surge controller, performance controller, vibration monitoring) may be integrated into the purchaser's control system. For such cases, the vendor shall provide suitable termination in junction boxes or skid edge remote input and output cabinet for interface to the purchaser's cable.~~

~~*Add new section*~~

~~**7.4.2.7.1**~~

~~All field analogue instruments such as transmitters and control valves shall be provided with a suitable communication protocol, as defined in the data sheet, to facilitate effective communication, remote monitoring and diagnostics from the purchaser's control system.~~

Add new section

~~7.4.2.7.2~~

~~The vendor shall provide control narrative and control algorithm which will be required by the purchaser to develop control logic and system control documentation for implementation in the purchaser's control system.~~

~~The control narrative and control algorithm shall include:~~

~~a. List of network interface~~

~~b. Cause and effect~~

~~c. Logic drawing~~

~~d. Hardwired signal list.~~

Add new section

7.4.2.8

When air compressors are operating in parallel, the controller for parallel operation shall be capable of load-sharing.

~~*Add new section heading*~~

~~**7.4.2.9 Parallel Operation**~~

~~*Add new section*~~

~~**7.4.2.9.1**~~

~~For systems comprising of more than one compressor unit, a load-sharing controller for parallel operation of the units shall be provided and integrated into the compressor control panel.~~

~~*Add new section*~~

~~**7.4.2.9.2**~~

~~Automatic start of standby compressor in case failure of duty compressor shall be provided and integrated into the compressor control panel.~~

7.4.3 Instrument and Control Panels

7.4.3.1

~~*Replace first sentence with*~~

~~When provision of a local control system is included in the vendor's scope, a panel from which startup and shutdown can be accomplished shall be provided and shall include the following:~~

~~*Add to list*~~

~~r. Ammeter for the electric motor.~~

Replace list item j) with

j) local and provision for remote read-out of vibration and position data;

7.4.4 Instrumentation

7.4.4.1

Replace "API 614" with

ANSI/API Standard 614:2008

7.4.4.3 ~~Thermocouples and Resistance Temperature Detectors~~Thermowells

~~*Add to section*~~

~~If specified in the data sheet, bearing metal temperature sensors shall be provided for hydrodynamic bearings.~~

7.4.4.~~5~~3.2

Replace "DN 19" with

DN 20

7.4.4.6 Vibration and Position Detectors

7.4.4.~~5.1~~6.2

Replace ~~item a.~~second sentence with

~~a. Radial vibration probes as per 7.4.4.5.2.1;~~

Accelerometers shall be flush mounted, installed and calibrated in accordance with ANSI/API Standard 670.

Add new section ~~heading~~

~~**7.4.4.5.2 Radial vibration monitoring**~~

~~*Replace section with*~~

7.4.4.~~5.2.1~~

~~One *x* and one *y* radially oriented non-contacting shaft vibration probe shall be provided for each pinion shaft bearing next to an impeller stage.~~

~~**7.4.4.5.2.2**~~

6.3 Angular orientation of probe mounting holes shall be the same for both ends of each pinion.

Add new section ~~heading~~

7.4.4.~~5.3 Axial position monitoring~~

~~*Add new section*~~

~~**7.4.4.5.3.1**~~

6.4 ~~Axial~~Thrust bearings shall have axial position monitoring with two proximity probes ~~shall be provided for thrust bearings.~~ .

Add new section

7.4.4.6.5~~.3.2~~

Proximity probes shall be installed to sense the shaft itself or an integral axial surface of the shaft, within an axial distance of 300 mm (12 in.) from the thrust bearing.

~~For compressors with pinion shafts using only thrust collars, axial displacement probes on pinion shaft are not required.~~

~~*Add new section*~~

~~**7.4.4.5.3.3**~~

Add new section ~~heading~~

~~**7.4.4.5.4 Accelerometers**~~

7.4.4.6.6 Vibration and axial position transducers shall be in conformance with ANSI/API Standard 670.

Add new section

7.4.4. 7~~5.4.1~~

~~Gear casing~~ Hydrodynamic bearings shall have ~~a machined surface for mounting high frequency accelerometer in accordance with API Std 670.~~ dual element bearing metal temperature sensors.

Add new section

~~**7.4.4.5.4.2**~~

~~If specified in the data sheet, a high frequency accelerometer shall be supplied, installed and calibrated in accordance with API Std 670 on the machined surface of the gear casing.~~

~~*Add new section heading*~~

~~**7.4.4.5.5 Vibration monitoring system**~~

~~*Add new section*~~

~~**7.4.4.5.5.1**~~

~~For a vendor supplied local control panel, all vibration and position detectors shall be monitored by the compressor local control panel.~~

~~*Add new section*~~

~~**7.4.4.5.5.2**~~

~~The vendor shall state the target material for the probes.~~

~~*Add new section*~~

~~**7.4.4.5.5.3**~~

~~Vibration monitoring system shall be calibrated as per API Std 670.~~

Replace section heading with

7.4.4.8 Pressure Limiting Valve and Pressure Relief Valves

Add new section

7.4.4.78.1

Relief Pressure-relief valves shall not discharge to a location within normal operation or maintenance access areas that can impact personnel. .

Add new section

7.4.4.78.2

If radial Radial pressure-relief valves are used, they shall have a guard installed to prevent discharge impacting personnelguards.

Add new section

7.4.4.78.3

Calculations shall be provided for all Pressure-relief valve sizes andsize, settings, including and accumulation, to verify that all possible modes of equipment for each compressor failure have been taken into accountmode shall be calculated.

Add new section

7.4.4.9 Gauges

All pressure transmitters on the skid shall be provided with single block and bleed manifolds.

Add new section

7.4.4.10

7.4.4.9.1 Local gauges shall be liquid filled.

7.4.4.9.2 Level gauge gauges shall span shall encompass maximum and minimum operational level including high and low trip set points. as a minimum.

Add new section

7.4.4.119.3

The scale on level glass or magnetic level gauges shall indicate the percentage or units of length consistent with system of units used in the data sheet.

Add new section

7.4.4.10 Discharge blow-off valves shall have stainless steel internals with soft PTFE seat.

Add new section

7.4.4.11 Pressure transmitters shall be provided with block and bleed manifolds.

Add new section

7.4.4.12 Control valves except blow-off valves shall be mounted ~~with sufficient clearance around~~ to permit servicing and disassembly without removing the valve body from the line.

Add new section

7.4.4.13 Mechanical switches shall not be ~~approved by the purchaser~~provided.

Add new section

7.4.4.14

~~Instrument tubing~~ Compression tube fittings shall be flareless, double-ferrule type.

Add new section

7.4.4.15

Compression fittings shall be ~~of the double-ferrule type.~~

~~*Add new section*~~

~~**7.4.4.15**~~

~~Tubing fittings and fitting components shall be~~ from a single manufacturer ~~and not interchanged with fittings from other manufacturers~~.

~~*Add new section*~~

~~**7.4.4.16**~~

~~Discharge blow-off valves shall have stainless steel internals with soft polytetrafluoroethylene (PTFE) seat.~~

7.4.5 Alarms and Shutdowns

7.4.5.1 General

~~*Add to Table 3*~~

7.4.5.1.2

Delete first sentence

Replace second sentence with

Alarms and shutdowns shall be in accordance with Table 1.

Table ~~3 –~~1—Equipment Monitoring

Delete "Recommended" from third column header

Add rows "Compressor axial position", "Motor radial vibration", "Motor bearing temperature" and "Motor winding temperature"

Add footnote g

Condition	Alarm	Shutdown
Compressor ~~Axial Position~~ axial position (high / high-high)	X	X
~~High~~ Motor ~~R~~radial vibration [g] (high / high-high)	X	X
~~High~~ Motor ~~Bearing temperature~~[f] bearing temperature [g] (high / high-high)	X	X
~~High~~ Motor ~~W~~winding temperature (high/ high-high)	X	X
~~Seal air pressure[g] (low)~~	~~X~~	
[g] Applies when the motor is equipped with sleeve bearing.		

~~*Add to Notes*~~

~~[f] When motor equipped with sleeve bearing~~

~~[g] If applicable~~

7.4.5.3 Alarm and Shutdown Devices

7.4.5.3.~~4~~1

~~*Replace with*~~

~~If specified, shutdown system shall be provided with switches or another suitable means to permit testing without shutting down the unit.~~

Delete second sentence

Add new section

7.4.5.3.4 The compressor main drive electric motor shall have a local emergency stop push button.

7.4.6 Electrical Systems

7.4.6.1

Replace "API 614" with

ANSI/API Standard 614:2008

Add new section

~~**7.4.6.7 Purchaser's Interface**~~

7.4.6.8 ~~The vendor shall provide cable~~ Cable trays, conduits~~,~~ and transit frames ~~etc.~~ for routing the purchaser~~'~~'s electrical power and control cables to the respective consumer on the skid~~.~~ shall be provided.

~~*For an enclosed skid,*~~ *Add new section*

7.4.6.9 Voltages less than 1 kV shall have a single-point electrical interface ~~shall be provided. For medium voltage~~ .

Add new section

7.4.6.10 Main driver motors greater than 1 kV shall have a separate electrical interface ~~shall be provided for the main driver motor~~.

Add new section

7.4.6.11 Signal and power cable separation shall conform to API Standard 670, Table 3.

Add new section

7.4.6.12 Instrument intrinsically safe cable and non-intrinsically safe cable shall be separated by separate trays or a metal plate.

7.5 Piping

7.5.1 General

7.5.1.~~2~~1

~~*Replace first sentence with*~~

~~A manifolded cooling water piping system shall terminate with flanged single supply and single return connections at the edge of the package.~~

Replace "API 614" with

ANSI/API Standard 614:2008

7.5.1.2

Delete "If specified,"

7.5.1.3

Replace ~~section~~"API 614" with

ANSI/API Standard 614:2008

Add new section

7.5.1.8 Seal welding of galvanized pipe ~~in cooling water service~~ shall not be used.

Add new section

7.5.1.9

~~All utility lines such as instrument air, cooling water supply~~ Utility piping and ~~cooling water return~~tubing shall be provided with a single-point tie-in connection with an isolation valve located at skid edge.

Add new section

7.5.1.10 Drain lines shall be terminated to the edge of the baseplate with an isolation valve at the purchaser~~"~~s tie-in point.

Add new section

7.5.1.11

~~All ASTM A105/A105M~~ When the minimum design temperature is less than -9.4 °C (15 °F), carbon steel flanges shall be ~~limited to design minimum temperatures of -9.4 °C (15 °F) and warmer. For colder climates,~~ ASTM A350/A350M Grade LF2 Class 1 ~~material shall be used.~~ .

Add new section

7.5.1.12

~~All slip~~ Slip-on flanges shall be double welded.

Add new section

7.5.1.~~12~~13

The installation of permanent in-line strainers shall permit dismantling of strainer elements without removing strainer body or housing.

Add new section

7.5.1.~~13~~14

~~If expansion~~ Expansion joints ~~are~~ used in compressed air service ~~, they~~ shall be metallic bellows type ~~joints~~.

Add new section

7.5.1.~~14~~15

Compressor discharge check valves shall be ~~of~~ piston type or dual ~~plate (dual~~ disk~~)~~ design ~~and of full~~in 316L stainless steel construction.

Add new section

7.5.1.~~15~~16

Ball valves constructed so that the ball is held in place with a threaded portion of the valve body shall not be used, unless the valve halves are positively secured together ~~(such as sealwelding)~~by seal welding by the valve manufacturer.

Add new section

~~**7.5.1.16**~~

7.5.1.17 Seal welded ball valves shall be hydrotested after welding.

Add new section

7.5.1.18 Quarter turn block valves ~~used for critical~~ in isolation ~~such as isolation valves upstream and downstream of the control valve and isolation valves for safety transmitter, shall include~~ services shall have a locking mechanism capable of accepting a ~~pad lock or~~ car seal ~~for the purpose of locking or car-sealing the valve in its intended position~~ or pad lock.

Add new section

7.5.1.~~17~~19

Valve stems and valve shafts shall be designed for stem retention.

~~Valve stems and shafts for all valves (including check valves with external shafts) shall be blow-out proof if:~~

~~a. The stem or shaft becomes separated from the closure device~~

~~b. The stem nut becomes detached from the yoke~~

~~c. The packing gland is removed.~~

~~Valve stems shall be designed such that the~~

Add new section

7.5.1.20 The weakest link ~~is~~ of the valve stem design shall be outside of the pressure boundary.

Add new section

~~**7.5.1.18**~~

7.5.1.21 The anti -blow-out stem retention configuration shall be located internally to the valve.

Add new section

7.5.1.22 Ball and butterfly valves shall have an anti-static device.

Add new section

7.5.1.~~19~~23

~~All~~ When the service is air or water, carbon steel ~~air and water~~ piping shall have ~~1.5 mm (1/16 in.)~~ a corrosion allowance ~~as a minimum.~~ of 1.5 mm (1/16 in.) or greater.

7.5.2 Oil Piping

7.5.2.1

In first sentence, replace "API 614" with

ANSI/API Standard 614:2008

Add new section

7.5.2.4 Tubing may be used ~~on~~ for sizes DN 15 (NPS ~~1/2~~ ½) and smaller. ~~Tube~~

Add new section

7.5.2.5 Compression tube fittings shall be ~~of~~flareless, double-ferrule type.

~~*Add new section heading*~~

~~**7.5.4 Pipe Support**~~

~~*Add new section*~~

~~**7.5.4.1**~~

~~The vendor shall provide the purchaser with the allowable load and movement at the tie-in point.~~

~~*Add new section*~~

~~**7.5.4.2**~~

7.5.3 Instrument Piping

In first sentence, replace "API 614" with

ANSI/API Standard 614:2008

Add new section

7.5.5 Pipe support

7.5.5.1 Piping shall ~~be designed to~~ withstand reaction forces from pressure-relief and blow-off valves.

~~*Add new section*~~

7.5.~~4.3~~5.2

~~Bracings shall be provided for vent, drain and small~~Small-bore connections DN 50 (NPS 2) and smaller shall have bracing.

Replace section ~~heading~~7.6 title with

7.6 Intercoolers, Aftercoolers, and Other Pressure Equipment

7.6.~~2~~1

~~*Add new section*~~

Replace "API 614" with

ANSI/API Standard 614:2008

7.6.2 ~~.1~~

Add to section

The drain valve shall be fitted at the lowest point of the cooler inclusive of the moisture separator.

~~**Add new**~~

7.6.3

Replace section (including note) with

~~**7.6.2.2**~~

Electronically operated automatic drain traps with bypass shall be provided.

~~*Add new section*~~

~~**7.6.2.3**~~

~~Solenoids for the~~ When drain traps~~, if used,~~ use a solenoid, the solenoid shall be H-rated, with ~~full~~ stainless steel body and soft seal ~~(PTFE, etc.).~~.

7.6.6~~**.3**~~

Add to section

Air-cooled cooler materials shall be in accordance with Table 2.

~~Alternative configuration, based on the vendor's standard proven design may be used, if approved by the purchaser.~~

~~Approval shall be subject to the vendor submitting a satisfactory proposal on heat exchanger maintenance and cleaning of shell and tube side for fouling.~~

~~Water on the shell side of a sea-water cooled heat exchanger is not acceptable.~~

~~**7.6.5**~~

~~*Replace second sentence with*~~

~~U-bend shall not be used unless approved by the purchaser.~~

~~*Replace Note 1 with*~~

~~Note 1: Refer to 6.10.6.3 and Table 4 for material selection of the intercooler and aftercooler components.~~

~~**7.6.6**~~

~~*Add to section*~~

~~Refer to 6.10.6.3 and Table 4 for material selection of the air~~

Add new section

7.6.~~7~~9

Non-integral aftercooler, oil cooler and ~~any other~~ fabricated pressure equipment ~~part of the package~~ shall be designed and constructed ~~to~~in accordance with the specified pressure design code ~~specified in the data sheet.~~
.

Add new section

7.6.~~8~~10

~~Integrated~~ The integrated intercooler and aftercooler part of the compressor casing or extended pressure casing shall be ~~as per the vendor's~~vendor's standard design and construction.

~~**Add new section 7.6.9**~~

~~*If specified in the data sheet, vessels shall be ASME code stamped or be compliant with the essential safety requirements of the Pressure Equipment Directive (PED) 2014/68/EU.*~~

Replace section 7.7 title with

7.7 Inlet Air Filter~~/~~ and Silencer

~~*Add to section*~~

~~Refer to 6.10.6.3 and Table 4 for material selection of the inlet~~

Add new section

7.7.3 Inlet air filter and silencer~~.~~ materials shall be in accordance with Table 2.

Add new section

7.7.4 The piping between the inlet air filter or silencer and the compressor~~'s~~ air inlet flange~~,~~ shall be 316 stainless steel or carbon steel with non-metallic lining or insert.

Replace section 7.9 title with

7.9 Special Tools and Spare Parts

Add new section

7.~~7.1~~9.3

~~If specified in the data sheet, a self-cleaning pulse-jet type inlet filtration system~~ Spare parts shall be ~~provided~~the same as were supplied for the original component.

8 Inspection, Testing, and Preparation for Shipment

~~**8.2 Inspection**~~

8.1 General

~~*Add to item c.*~~

~~Final assembly maintenance and running clearances for bearings and seals shall be submitted with as-built data.~~

8.1.1

Replace "API 614" with

ANSI/API Standard 614:2008

8.2.2 Material Inspection

~~*Add to section*~~

~~Material certificates shall be provided in accordance with Annex B of S-612Q.~~

8.2.2.1

Replace "API 614" with

ANSI/API Standard 614:2008

8.2.2.3

In second sentence, replace "API 614" with

ANSI/API Standard 614:2008

8.3 Testing

~~**8.3.2 Hydrostatic Tests**~~

~~**8.3.2.1**~~

~~*Add after first sentence*~~

~~Minimum hydrotest pressure shall not be less than 150 kPa (20 psi).~~

~~*Add new section*~~

~~**8.3.2.5**~~

~~The minimum hold time of hydrotest pressure shall be 30 minutes.~~

8.3.3 Impeller Overspeed Test

8.3.3.~~2~~1

~~Replace first~~Add to second sentence before "Impeller"

Whole

8.3.3.3

Replace section with

~~After~~On completion of the overspeed test, each impeller shall be examined by magnetic particle or liquid penetrant methods.

Add ~~to~~new section

8.3.3.4

~~Linear indications on~~ Acceptance criteria for MT and PT inspection of the impeller shall ~~not~~ be ~~acceptable~~in accordance with API Recommended Practice 687:2001, Table 1.8-1, Severity level A.

8.3.4 Combined Mechanical and Performance Tests

8.3.4.1

Add to first sentence before "performance"

thermodynamic

Add to section

The thermodynamic performance test shall be performed on at least one machine of multiple order of identical machines.

8.3.4.2

Replace "Aerodynamic" with

Thermodynamic

8.3.4.8.2

In second sentence, replace "API 614" with

ANSI/API Standard 614:2008

Add new section ~~heading~~

8.3.4.~~8~~11 Lube Oil Flushing and Cleanliness Test

~~Add new section~~

8.3.4.~~8~~11.1

~~Lube~~ The lube oil flushing and cleanliness test shall be carried out using a 100 mesh stainless steel screen.

Add new section

8.3.4.811.2 The lube oil flushing and cleanliness test shall be performed at least 1one hour prior to the combined performance and mechanical run test, in accordance with the cleanliness standard as per ISO 4406-3 Grade 17/14 or SAE AS 4059 Class 8.

8.3.4.11.3 The flushing test fluid shall have a contamination level of ISO 4406 Grade 17/14/12 or SAE AS4059 Class 8.

Add new section heading

8.3.4.912 Noise Test

Add new section

8.3.4.912.1 Noise tests shall be conducted as perin accordance with ISO 2151-2 using .

8.3.4.12.2 For multiple identical compressor packages, noise testing shall be carried out on at least one compressor package.

8.3.4.12.3 The sound intensity scanning method as pershall be in accordance with ISO 9614-2 and using a.

8.3.4.12.4 The sound intensity system meeting the requirements of shall be in accordance with IEC 61043 Class 1.

Add new section

8.3.4.9.2

For multiple, identical compressor packages, it may be sufficient to carry out noise testing on only one compressor package.

Add new section

8.3.4.9.3

For vendor's standard equipment, data from previous tests on identical equipment may be accepted, if agreed by the purchaser.

Add new section

8.3.4.9.4

Any safety margin required to cover for measurement uncertainty between the measured sound power level and guaranteed sound power level shall be specified by the purchaser.

8.4 Preparation for Shipment

All exposed machined and un-coated surface shall be protected with vapour-proof corrosion inhibitor to protect against onset of corrosion.

Add new section

8.4.814

All visibleVisible display units and control panel front face shall be adequately protected against damagevisible scratches during transportation and handling.

~~*Add new section*~~

~~**8.4.10**~~

~~The vendor shall provide completed preservation checklists and preservation report detailing all preservation activities performed.~~

Add new section

8.4.11.15

Provision for turning on the anti-condensation heater for motors while they are idle shall be ~~clearly~~ stated in the preservation procedure.

Add new section

8.4.~~12~~16

Open ~~pipes, flexible hoses, open tubes, etc.~~piping connections shall be blanked~~-off and capped~~ with material of compatible metallurgy.~~ Valves that are~~

Add new section

8.4.17 The outboard connection of valves open to the atmosphere ~~in the final installed position shall have their outboard connection either~~ shall be plugged or blinded.

~~*Add new section heading*~~

~~8.6 Control Panel Test~~

~~*Add new section*~~

~~**8.6.1**~~

~~The compressor control panel shall be functionally tested to verify correct functioning of control logic, alarms, shutdown functions and trip set points.~~

~~*Add new section*~~

~~**8.6.2**~~

~~The anti-surge controller shall be tested to verify the surge anticipation and surge detection algorithm. The anti-surge controller test procedure shall be developed and mutually agreed between the purchaser and the vendor.~~

~~*Add new section*~~

~~8.6.3~~

~~Control panel hard-wire verification testing and wiring continuity check on the skid shall be performed by the vendor and documented in the test report.~~

9 Vendor Data

Add new section

9.2 Weight and Centre of Gravity Data~~Proposals~~

~~9.2.3 Technical~~

~~*Add to list*~~

~~s. A list of priced capital spares.~~

~~9.3 Contract Data~~

~~9.3.4 Parts Lists and Recommended Spares~~

The weight data of equipment for installation offshore shall be provided in accordance with ISO 19901-5:2021, Section 8.

The vendor shall submit separate lists for following three categories of spares:

a. Capital spares

b. Commissioning spares

c. Operation and maintenance spares.

9.3.4.2

Replace first sentence with

The vendor shall provide recommended stocking quantities of commission spares and operation and maintenance spares.

Add new section

9.3.4.3

The list of capital spares shall include the following items, as a minimum:

a. Set of high speed (pinion shaft) rotors

b. Set of impellers for individual stages

c. Set of diffusers

d. Set of radial bearing for all high speed pinions

e. Set of thrust bearing for all high speed pinions

f. Set of shaft seals

g. Set of lube oil pumps (main and auxiliary)

h. Sore compressor service kit.

Add new section

9.3.4.4

Maintainable items such as instruments, shaft seals, gearbox seal, solenoids, control valve, actuated valve, pressure relief valve, air Inlet filter, lube oil filter, heater and lube oil pump motor shall be included as a minimum in the list of operation and maintenance spares.

Add new section

9.3.4.5

Spare parts shall comply with all requirements applicable as for the original component.

Annex B
(normative)
Referenced Documents

Delete from list

API Std 541	Form-Wound Squirrel Cage Induction Motors – 250 Horsepower and Larger
API Std 546	Brushless Synchronous Machine – 500 kVA and Larger, Second Edition
API Std 617	Axial and Centrifugal Compressors and Expander-Compressors for[12] ISO 10418, *Petroleum*, Chemical and Gas Industry
ASME B16.1125	Cast Iron Pipe Flanges and Flanged Fittings Classes 25 and 250
ASTM A515/A515M	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
IEC 79	

Add to list

ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASTM A105/A105M	Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A350/A350M	Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components
IEC 1043	Electroacoustic - Instruments for the Measurement of Sound Intensity - Measurements with Pairs of Pressure sensing Microphones
IEC 60034	Rotating Electrical Machines
IEC 60079	Explosive atmospheres
ISO 281	Rolling Element Bearing – Dynamic Load Ratings and Rating Life
ISO 2151 2	Acoustics – Noise test code for compressors and vacuum pumps Engineering method (Grade 2)
ISO 4406-3	Hydraulic fluid power – Fluids – method for coding the level of contamination by solid particles
ISO 9614-2	Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning
ISO 12944	Paints and varnishes – Corrosion protection of steel structures by protective paint *and natural gas industries — Offshore production installations — Process safety systems*
[13] ISO 14691	13880, *Petroleum and natural gas industries*: Flexible couplings for mechanical power transmission - General purpose applications — *Content and drafting of a technical specification*
ISO 21457	Petroleum, Petrochemical and natural gas industries- Material selection and corrosion control for oil and gas production systems
ISO 21940-11	Mechanical vibration — Rotor balancing — Part 11: Procedures and tolerances for rotors with rigid behaviour
ISO 21940-32	Mechanical vibration — Rotor balancing — Part 32: Shaft and fitment key convention
NEMA MG-1	Motors and Generators
NFPA 70	National Electrical Code
SAE AS 4059E	Aerospace Fluid Power - Contamination Classification for Hydraulic Fluids

Bibliography

Add to section

[12] ISO 10418, *Petroleum and natural gas industries — Offshore production installations — Process safety systems*

[13] ISO 13880, *Petroleum and natural gas industries — Content and drafting of a technical specification*

[14] ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

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