International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-612Q

May 2022
Version 2.0

REDLINE
Version 2.0 to Version 1.0

Quality Requirements for Packaged, Integrally Geared Centrifugal Air Compressors (API)

Redline Version

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

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

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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).

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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.

Redline version

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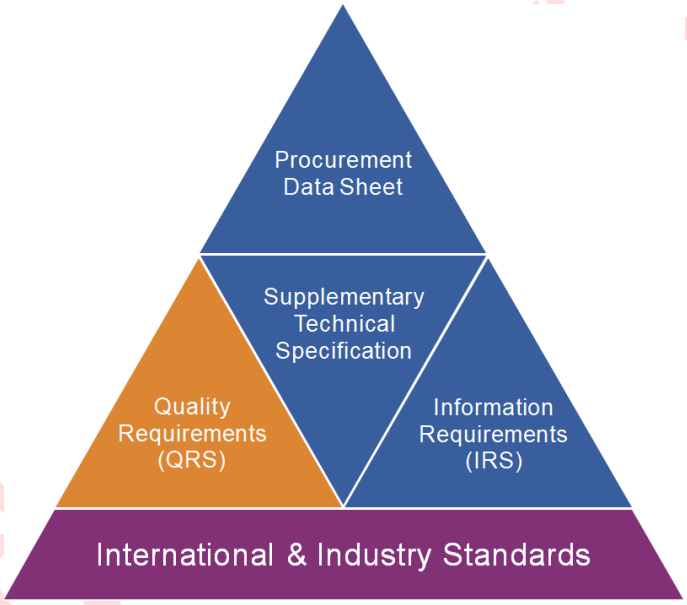
Introduction

The purpose of this quality requirements specification (QRS) is to ~~define~~specify quality management requirements and the proposed extent of purchaser intervention activities for the ~~supply~~procurement of packaged, integrally geared centrifugal air compressors in accordance with IOGP S-612 ~~Supplementary Specification to API Standard 672 Packaged, Integrally Geared Centrifugal Air Compressors~~ for application in the petroleum and natural gas industries.

~~The QRS includes a~~ Purchaser intervention activities are identified through the selection of one of four conformity assessment system (CAS) ~~which specifies standardized user interventions against quality management activities at four different~~ levels~~.~~ based on a risk and criticality assessment. The applicable CAS level is specified by the purchaser in the ~~equipment datasheet~~procurement data sheet or purchase order.

This QRS shall be used in conjunction with the ~~supplementary requirements~~ specification (IOGP S-612), the procurement data sheet (IOGP S-612D) and the information requirements specification (IOGP S-612L) ~~and the equipment data sheets (IOGP S-612D)~~ which together comprise the full set of specification documents. The introduction section in the ~~supplementary requirements~~ specification provides further information on the purpose of each of these documents and the order of precedence for their use.



JIP33 Specification for Procurement Documents
Quality Requirements Specification

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1 Scope

To specify quality management requirements for the supply of packaged, integrally geared centrifugal air compressors to IOGP S-612 ~~Supplementary Specification to API Standard 672 packaged, integrally geared centrifugal air compressors including:~~including:

a) ~~vendor~~supplier quality management system requirements;

b) purchaser conformity assessment (surveillance and inspection) activities;

c) traceability requirements~~;~~.

~~d) evidence of conformity;~~

~~e) factory acceptance.~~

2 Normative references

For the purpose of this document, the documents referenced in IOGP S-612 and those listed below, 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.

API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

~~API Std 672 4th Edition Packaged, Integrally Geared Centrifugal Air Compressors~~

IOGP S-612, *Supplementary Specification to API Standard 672 Packaged, Integrally Geared Centrifugal Air Compressors*

ISO 9001, *Quality management systems — Requirements*

ISO 29001, *Petroleum, petrochemical and natural gas industries — Sector-specific quality management systems — Requirements for product and service supply organizations*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IOGP S-612 and ISO 9000~~:2015~~ (normative to ISO 9001~~:2015)~~), and the following shall apply. ~~To align with the definitions used in API Std 672 the term "purchaser" is used in place of "customer" and the term "vendor" in place of "supplier".~~

3.1 ~~C~~
conformity assessment
~~D~~demonstration that specified requirements ~~relating to a product, process, system, person or body~~ are fulfilled~~.~~

~~NOTE~~Note 1 to entry: Conformity assessment (or assessment) includes but is not limited to review, inspection, verification and validation activities.

~~NOTE~~Note 2 to entry: Assessment activities may be undertaken at a ~~vendor or~~ supplier/sub-~~vendor's~~supplier's premises, virtually by video link, desktop sharing, etc. or by review of information ~~formally submitted for acceptance or for information.~~.

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3.2 C
conformity assessment system
(CAS)
Systems providingsystem that provides different levels of assessment of the vendor's control activities by the purchaser (second party) or independent body (third party) based on evaluation of the vendor's capability to conforminterventions to the product or service specificationassess and obligatory verify supplier conformance to specified requirements. The applicable

Note 1 to entry: CAS level is specified by the purchaser in the data sheet.

NOTE CAS A reflectsapplies to the highest risk and associated extent of verification. CAS D is the lowest.

3.3 Conformity
hold point
H
<conformity assessment witness> point (W)

Inspection or test wherein the purchaser is notifiedchain of activities beyond which an activity shall not proceed without the timingapproval of the inspection or test and a hold is placed on the inspection and test until the purchaser or purchaser'spurchaser or purchaser's representative is in attendance (API Std 672, 3.36).

3.4 Conformity
witness point
W
<conformity assessment observed (O)> point in the chain of activities that the supplier shall notify the purchaser or purchaser's representative before proceeding

Inspection or test where the purchaser is notified of the timing of the inspection or test and it is performed as scheduled regardless of whether the purchaser or purchaser's representative is present (API Std 672, 3.18).

Note 1 to entry: The operation or process may proceed without witness if the purchaser does not attend after the agreed notice period.

3.5
Conformity assessment – surveillance
(S)
Observation<conformity assessment> observation, monitoring or review by the purchaser or purchaser's representative of an activity, operation, process, product or associated information.

3.6
Conformity assessment – review
(R)
Review of the vendor's documentation by the purchaser or purchaser's representative to determine <conformity assessment> review of the supplier's information to verify conformance to requirements.

NOTE Information review requirements are managed on a surveillance basis, and as such do not impose schedule constraints, unless specified as hold points in Annex A, or as conditions specified in the associated IRS

4 Symbols and abbreviations

For purposes of this document, the following abbreviation applies:symbols and abbreviations apply.

CAS C conformity assessment system

IRS I information requirements specification

QMS quality management system

QRS Q quality requirements specification (this document)

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5 Quality requirements

5.1 Quality management system

The ~~vendor~~supplier shall ~~demonstrate~~operate and maintain a quality management system (QMS) that ~~the quality management arrangements established for the supply of products or services conform to~~ conforms with ISO 9001~~:2015~~, ISO 29001, API Specification Q1 or an equivalent quality management system standard ~~agreed with the~~ .

5.2 Conformity assessment system (CAS)

5.2.1

The conformity assessment system (CAS) provides different levels of assessment of the supplier control activities. The CAS level is defined by the purchaser, using a risk-based approach, and included in the purchase order/contract. The defined CAS level may be adjusted by the purchaser during manufacture based on supplier performance and re-assessment of risk.

~~5.2 Conformance assessment~~

NOTE For industrial proven solutions, CAS level D is specified unless risk assessment indicates that a more stringent CAS level is required.

5.2.2

Quality plans and inspection and test plans ~~developed as outputs to operational planning and control for the products or services shall define the specific controls to be implemented by the vendor and when applicable, sub-vendors, to ensure conformance with the specified requirements.~~

~~Controls will address both internally and externally sourced processes, products and services~~

~~Quality plans or inspection and test plans~~ shall include provision~~s~~ for purchaser's intervention activities based on the ~~purchaser~~ CAS~~; see Annex A, as specified~~ level selected in the procurement data sheet or purchase order. See Annex A.

~~Vendor~~5.2.3

Supplier performance in meeting the requirements ~~will~~may be routinely assessed during execution of the scope and where appropriate, corrective action requested and conformity assessment activities increased or decreased consistent with criticality and risk.

~~NOTE 1 For industrial well proven solutions CAS level D is specified unless risk assessment indicates that a more stringent CAS level is required.~~

~~NOTE 2 Irrespective of the CAS level defined by the purchaser, either, by reference to standard and specification requirements or in the scope, the vendor remains responsible for operational planning and control and demonstration of the conformity of products and services with the requirements (ISO 9001, 8.1 and 8.2).~~

6 Certification and ~~T~~traceability

Material certification and traceability shall be ~~provided~~maintained in accordance with Annex B.

~~7 Control of nonconforming products and services~~

~~Nonconformance with specified requirements identified by or to the manufacturer prior to or during the delivery of the products and services shall be corrected such that the specified requirements are satisfied or the user's~~

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~~acceptance of the nonconformance agreed in accordance with purchase order conditions. See ISO 9001, 8.2.3, 8.2.4, 8.5.6 and 8.7.~~

~~8~~ 7 Evidence ~~(~~ — conformance records~~)~~

~~Plans, procedures, methods~~Documents and ~~resultant records~~information shall be provided for in accordance with the associated IRS.

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Annex A
(normative)
Purchaser conformity assessment requirements

This annex defines four conformity assessment systems (CAS) or levels of purchaser assessment.

~~The vendor shall provide for the specified CAS when developing quality plans and inspection and test plans in accordance with section 5.~~

	PURCHASER ASSESSMENT ACTIVITIES	CAS			
		A	B	C	D
1	**Planning and ~~Control Activities~~ control activities**				
1.1	Quality ~~plan (ISO 9001, 8.1 and ISO 10005)~~planning	~~W~~H	R	-	-
1.2	Inspection and test ~~plan (ISO 9001~~planning of complete scope (IOGP S-612, 8.1~~ and ISO 10005)~~, 8.2, 8.3)	~~W~~H	R	R	R
1.3	~~Kick-off, pre~~Pre-production and pre-inspection meeting (IOGP S-612, 8.3)	~~W~~H	~~R~~W	W	W
2	**Design and ~~Development Activities~~development activities**				
2.1	~~Review of vendor package design~~Design review meeting (IOGP S-612, 6.1, 9.1.1)	~~W~~H	~~R~~W	~~R~~-	-
3	**Control of external supply**				
~~2.2~~3.1	~~Weld procedure specification and procedure qualification records (ASME BPVC IX-2017 or ANSI/ASME B31.3 or AWS D1.1) as per requirements of API Std 672, 6.10.4 and API Std 614 Part 1, 4.6~~Lube oil system, intercoolers, after cooler and control panel risk assessment, monitoring and inspection (IOGP S-612, 7.6.6, 7.6.9)	~~W~~H	~~R~~W	R	-
~~2.3~~	~~Non-destructive examination procedures (ASME BPVC V-2017 Non-destructive Examination, ASTM E94 , ASTM E709, API RP578) for compressor components, as per requirements of API Std 614 Part 1, 7.2.2~~	~~W~~	~~R~~	~~R~~	
~~2.~~**4**	~~Repair procedures for welds and castings (API Std 672, 6.10.4)~~**Materials and component manufacturing**	~~W~~	~~R~~	~~R~~	
~~2.5~~4.1	~~Test procedures; (API Std 672, 8.3.2, 8.3.3 & 8.3.4; S-612, 8.3.2, 8.3.3, 8.3.4 and IEC 60034-1)~~Verification of material traceability (see Annex B) (IOGP S-612, 6.10.1.9, 6.10.4, 6.3.3, 7.6.6, 7.6.9, 7.7.3, 7.7.4, 8.2.2.1, Table 2)	~~R~~W	~~R~~S	~~R~~S	~~R~~-
~~**3**~~	~~**Control of External Supply**~~				
~~3.1~~	~~External supply scope, risk assessment and controls (ISO 9001, 8.4)~~	~~W~~	~~R~~	~~R~~	
~~**4**~~	~~**Materials and Component Manufacturing**~~				
4.~~1~~2	~~Review material certification see Annex B~~Verification of certification for electrical and control equipment (CE, UL, hazardous area, type tests) (IOGP S-612, 6.1.8.1)	~~W~~S	~~R~~S	~~R~~S	~~R~~
4.~~2~~3	~~Testing of low voltage~~Routine test for main drive electric motors ~~(IEC 60034-~~ (IOGP S-612, 7.1~~, 19.1)~~.2)	~~R~~W	R	R	-

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4.~~3~~4	~~Testing of medium voltage~~Performance tests for main drive electric motors (IOGP S-612, 7.1.2~~.3)~~)	~~O~~H	~~O~~H	~~R~~W	R
4.~~4~~5	Hydrostatic test of compressor casing ~~(API Std. 672, 8.3.2 and~~ (IOGP S~~-~~-612, 8.3.2)	~~O~~W	R	R	~~R~~-
4.~~5~~6	Impeller ~~over speed~~overspeed test ~~(API Std 672~~ (IOGP S-612, 8.3.3~~.1)~~, 6.5.2.3, 8.2.2.3)	~~O~~W	R	R	-
4.~~6~~7	Non-destructive examination of impeller ~~post~~after the over speed test ~~(API Std 672, 8.3.3.2 and~~ IOGP S-612, 6.10.2.1, 8.2.2, 8.3.3~~.2)~~)	~~O~~W	R	R	-
4.~~7~~8	Rotor balancing and vibration ~~(API Std 672, 6.7.4 and~~ (IOGP S-612, 6.~~7.4)~~12, 6.5.1.2.3, 6.7.4, Annex C, Annex F)	~~O~~W	R	-	-

~~4.8~~	~~Compressor thermodynamic performance test (ASME PTC-10 or ISO 5389 and API Std 672, 8.3.4.1)~~	~~O~~	~~R~~	~~R~~	
4.9	~~Hydrotest~~Hydrostatic test of ~~pressure casing and~~ fabricated pressure equipment ~~(API Std 672, 8.3.2.1~~ and piping (IOGP S-612, 7.6.9, 8.3.2~~.1)~~)	~~O~~W	R	R	~~R~~-
4.10	Lube oil system flushing ~~(API Std 614 Part 1, D3~~ (IOGP S-612, 8.3~~ and API Std 614 Part~~ .4, 8.2.3~~, 7.3.3.8)~~.1)	~~O~~W	R	R	-
4.11	~~Review component certification for electrical and control equipment (CE, UL, Hazardous area, type tests)~~Hardness check of gears in accordance with AGMA 6011 (IOGP S-612, 6.5.3.3)	~~O~~H	~~R~~W	R	R
4.12	Compressor coupling balancing (IOGP S-612, 7.2.1.3)	W	R	-	-
5	**Fabrication**				
5.1	Baseplate manufacture dimensional verification ~~per drawings (API Std 672, 8~~ (IOGP S-612, 7.3~~.5)~~)	~~O~~W	S	-	-
5~~.~~.2	~~Fabricate~~Fabrication of piping and ~~assemble~~assembly of components ~~(API Std 614 Part~~ (IOGP S-612, 7.5.1~~, Section 5)~~.2, 6.2.6, 6.3, 7.4.4.9.1, 7.5.1)	S	S	S	-
5.3	Repair of major welds and castings (IOGP S-612, 6.10.2, 6.10.3, 7.6.9, 8.2.2.1)	H	W	R	R
5.4	NDE of the lifting arrangements (IOGP S-612, 7.3.4.3)	W	W	R	-
5.5	Proof load test of the lifting arrangements (IOGP S-612, 7.3.4, 7.3.5)	H	W	R	R
6	**Package ~~Inspection, Testing~~inspection, testing and ~~Verification Activities~~ verification activities**				
6.1	Pinion shaft electrical and mechanical runout (IOGP S-612, 8.3.4.8.4)	W	R	R	-
6.~~1~~2	Mechanical completion, assembly and material documentation ~~(API Std 672, 8.2.2 and~~ (IOGP S-612, 7.6.6, 8.2.2.3, 6.1.7.1, 6.10.3, 6.11.2, 6.11.4, 7.1.1.6, 7.2.1, 7.2.2, 7.4.1.6, 7.4.6, 7.5.1.11, 8.2.2~~)~~, 8.2.3, 8.3.4, Table 2)	~~W~~H	~~R~~W	~~R~~S	R
6.~~2~~3	~~Hydro and pneumatically test assembly (API Std 614 Part 1, 7.3.2)~~Leak testing of assemblies (IOGP S-612, 6.2.6, 8.3.4.8.1)	~~S~~W	~~R~~W	~~R~~S	R
6.4	Final joint testing including verification of flanged connections (IOGP S-612, 8.3.4.8.1)	W	W	S	R
6.~~3~~5	Functional and logic check of control panel and external control interfaces ~~(API Std 672~~ (IOGP S-612, 7.4.6, 8.3.4.~~5.5)~~3, 8.3.4.4)	~~W~~H	~~O~~W	R	-

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6.~~4~~6	Combined mechanical and performance test with job motor, including noise test for package ~~(API Std 672, 8.3.4 and~~ IOGP S-612, 8.3.4.1, 6.1.3, 6.1.9, 6.6.1, 6.8, 7.5.5.1, 8.3)	~~W~~H	~~W~~H	~~O~~W	~~O~~W
6.7	Check paint system is in accordance with specification for equipment and enclosures (IOGP S-612, 6.10.6.1, 6.10.6.2, 6.10.6.5, 6.9.4, 8.2.1.2, 8.4.2)	H	W	S	S
6.8	Weighing of packaged equipment skid (IOGP S-612, 9.2)	W	W	R	R
7	**Release of ~~P~~product or ~~S~~service**				
7.1	Final inspection, visual and dimensional inspection completeness against ~~PO~~ purchase order and approved drawings and ITP, weight and certificate of conformity~~. (API Std 672~~ (IOGP S-612, 6.1.7.4.1, 8.3.5)	~~W~~H	~~O~~W	S	S
7.2	Preparation for shipment, preservation and storage, and inspection release~~. (API Std 672~~ (IOGP S-612, 8.4)	~~W~~H	~~O~~W	~~R~~W	R

~~7.3~~	~~Final documentation review; as per IOGP S-612L~~	~~W~~	~~R~~	~~R~~	~~R~~

~~W is witness~~

Key

H: Hold point~~, O is observed~~

W: Witness point~~,~~

R: Review

S ~~is surveillance and R is review.~~

~~Note: Definitions for these terms are provided in Clause 3.~~: Surveillance

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~~Material~~Annex B
(normative)
Certification traceability and ~~certification~~ requirements

Item		Certificate ~~T~~type	~~Material~~ Traceability level	Additional ~~R~~requirements
Air compressor package	Core compressor components~~,~~: casing, impellers, pinions, bull gear, rotor shaft	3.1	Level II	
	Pressure vessels and heat exchangers	3.1	Level II	
	Piping and valves	3.1	Level II	
	Remaining materials, per the ITP	2.2	Level III	

~~Explanatory notes:~~

~~**Material Inspection**~~ NOTE 1 Certificates
Inspection certificates shall be provided in accordance with ISO 10474 or EN 10204.

~~A. "~~NOTE 2~~.2" Test Report -~~ Traceability
A ~~document in which the vendor declares that the products supplied are in compliance with the requirements of the PO, and in which test results are supplied based on non-specific inspection and testing.~~

~~A. "3.1" Inspection Certificate - A document with test results based on specific inspection and testing, issued by the vendor and validated by the vendor's authorised inspection representative independent of the manufacturing department.~~

~~B. "3.2" Inspection Certificate - A document prepared by both the vendor's authorised inspection representative, independent of the manufacturing department, and either the purchaser nominated representative or the inspector designated by the regulations in which they declare that the products supplied are in compliance with the requirements of the order and for which test results are supplied.~~

~~C. Additionally, purchaser has specified that all material product testing associated with "3.2" Inspection Certificates be performed in the presence of either a purchaser nominated representative or the inspector designated by the regulations, and the resultant test report stamped as "Witnessed". Failure to adhere to this requirement may lead to rejection of all material(s) being qualified for production.~~

~~D. ~~. Level I ~~—~~ Full ~~T~~traceability ~~—~~ Material is uniquely identified and its history tracked from manufacture through stockists (where applicable) to ~~vendor~~the supplier and to actual position on the equipment with specific location defined on a material placement record~~.~~ (~~T~~the traceability to a specific location only applies to skids / packaged equipment, not to bulks~~)~~
).
B. Level II ~~-~~ — Type ~~Traceability - vendor~~traceability — The supplier maintains a system to identify material throughout manufacture, with traceability to a material certificate.
C. Level III ~~-~~ — Compliance ~~Traceability - vendor~~traceability — The supplier maintains a system of traceability that enables a ~~D~~declaration of ~~C~~compliance to be issued by the supplier.

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