

REDLINE

Version 2.0 to Version 1.0

# Quality Requirements for High-voltage Three-phase Cage Induction Motors (IEC)

Redline Version

## Revision history

VERSION	DATE	PURPOSE
2.0	November 2024	Second Edition
1.0	January 2021	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).

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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 January 2021. 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 (from Clause 1 onwards) 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.**

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## Introduction

The purpose of this quality requirements specification (QRS) is to specify quality management requirements and the proposed extent of purchaser intervention activities for the procurement of high-voltage three-phase cage induction motors in accordance with IOGP S-704 for application in the petroleum and natural gas industries.

Purchaser intervention activities are identified through the selection of one of four conformity assessment system (CAS) levels based on a risk and criticality assessment. The applicable CAS level is specified by the purchaser in the procurement data sheet (PDS) or purchase order.

The IOGP S-704 specification documents follow a common structure (as shown below) comprising a specification, also known as a technical requirements specification (TRS), a PDS, an information requirements specification (IRS) and this QRS. These four specification documents, together with the purchase order, define the overall technical specification for procurement.



### JIP33 Specification for Procurement Documents Quality Requirements Specification (QRS)

This QRS is to be applied in conjunction with the specification, the PDS and the IRS, referred to in this document as IOGP S-704, IOGP S-704D and IOGP S-704L respectively. Further information on the purpose of these documents and the order of precedence for their use is provided in the introduction of the specification.

## 1 Scope

~~To specify~~ This QRS specifies quality management requirements for the supply of high-voltage three-phase cage induction motors to IOGP S-704 ~~Supplementary Specification to IEC 60034-1 High Voltage Three-phase Cage Induction Motors~~ including:

- a) ~~manufacturer~~ supplier quality management system (QMS) requirements;
- b) purchaser conformity assessment (surveillance and inspection) activities;
- c) traceability requirements;
- d) ~~evidence of conformance~~;
- e) ~~factory acceptance~~.

## 2 Normative references

For the purpose of this document, the documents referenced in IOGP S-704 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*

EN 10204, Metallic products - Types of inspection documents

IOGP S-704, *Supplementary Specification to IEC 60034-1 for High-voltage Three-phase Cage Induction Motors*

ISO 9000:2015, Quality management systems — Fundamentals and vocabulary

ISO 9001:2015, *Quality management systems — Requirements*

ISO 10474, Steel and steel products — Inspection documents

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

## 3 Terms, definitions and abbreviated terms

### 3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IOGP S-704 and ISO 9000:2015 (normative to ISO 9001:2015) and the following shall apply.

#### 3.1.1

##### **conformity assessment**

demonstration that specified requirements ~~relating to a product, process, system, person or body~~ are fulfilled.

Note 1 to entry: "Conformity assessment ~~(or~~ " is also referred to as "assessment) ~~."~~

Note 2 to entry: Conformity assessment includes ~~but is not limited to~~ review, inspection, verification and validation activities.

Note ~~2–3 to entry: Conformity~~ assessment activities may be undertaken at ~~a manufacturer/supplier/sub-supplier's supplier~~ premises, virtually by video link, desktop sharing, etc. or by review of information ~~formally submitted for acceptance or for information.~~

### 3.1.2 conformity assessment system CAS

system ~~providing that provides~~ different levels of ~~assessment of the manufacturer's control activities by the purchaser (second party) or independent body (third party) based on evaluation of the manufacturer's capability to conform to the product or service specification~~ interventions to assess and obligatory verify supplier conformance to specified requirements.

Note 1 to entry: CAS level A ~~reflects~~ applies to the highest risk and associated extent of verification. CAS level D is the lowest.

### 3.1.3 hold point H

<conformity assessment> point in the chain of activities beyond which an activity shall not proceed without the approval of the purchaser or purchaser's representative.

### 3.1.4 witness point W

<conformity assessment> point in the chain of activities ~~that at which~~ the manufacturer/supplier shall notify the purchaser or purchaser's representative before proceeding.

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

### 3.1.5 surveillance S

<conformity assessment> observation, monitoring or review, by the purchaser or purchaser's representative, of an activity, operation, process, product or associated information.

### 3.1.6 review R

<conformity assessment> review of the ~~manufacturer's supplier's records, procedures and supporting information to verify~~ and/or validate 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.~~

## 4.3.2 Symbols and abbreviations Abbreviated terms

~~For purposes of this document, the following symbols and abbreviations apply.~~

CAS            conformity assessment system

FAT            factory acceptance test

IRS            information requirements specification

ITP            inspection and test plan

PDS            procurement data sheet

QMS quality management system

QRS quality requirements specification ~~(this document)~~

TRS technical requirements specification

## **54 Quality requirements**

### **54.1 Quality management system (QMS)**

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

### **54.2 ~~Conformance assessment~~ Conformity assessment system (CAS)**

#### ~~5.2.1~~

~~Quality plans and inspection and test plans developed as outputs to operational planning and control shall define the specific controls to be implemented by the manufacturer to ensure conformance with the specified requirements.~~

#### ~~5.2.2~~

~~Controls shall address both internally and externally sourced processes products and services.~~

#### ~~5.2.3~~

~~Quality plans and inspection and test plans shall include provision for the purchaser as specified in the data sheet. See Annex A.~~

#### **54.2.41**

~~Manufacturer performance in meeting the requirements will 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.~~

The CAS provides different levels of assessment of 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 the supplier's performance and re-assessment of risk.

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

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

#### **64.2.2**

Quality plans and inspection and test plans shall include provision for purchaser intervention activities based on the CAS level selected in the PDS or purchase order. See Table A.1.



### 4.2.3

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

### 4.2.4

If any subcontracted or scope of supply occurs outside of the primary supplier location, it shall include interventions within the primary inspection and test plan (ITP) or secondary ITP. It is discouraged to use "hold" (H) within Table A.1, section 3 and recommended to use "surveillance" (S).

## **5 Certification and traceability**

The manufacturer shall maintain traceability of sub-assembly components to the original component manufacturer tag / serial number and where applicable, associated certification. ~~See ISO 9001, 8.5.2.~~

## ~~7—Control of nonconforming products services~~

~~Nonconformance with specified requirements identified by or to the manufacturer. Machine certification and traceability shall be corrected such that the specified requirements are satisfied or the purchaser's acceptance of the nonconformance agreed maintained for the components/items listed in accordance with purchase order conditions. See ISO 9001, 8.2.3, 8.2.4, 8.5.6 and 8.7 Table B.1.~~

## **8 Evidence (— conformance records)**

~~Plans, procedures, methods and resultant records~~ Documents and information shall be provided for in accordance with ~~the associated IRS~~ IOGP S-704L.

## Annex A (normative) Purchaser conformity assessment requirements

This annex Table A.1 defines four conformity assessment systems (CAS) levels or levels of purchaser assessment.

**Table A.1 — Purchaser conformity assessment requirements**

Purchaser assessment activities		CAS			
		A	B	C	D
<b>1</b>	<b>Operational planning and control activities</b>				
1.1	Quality planning (ISO 9001, 8.1 and ISO 10005)	H	W	<u>RS</u>	<u>R-</u>
1.2	Inspection and testing planning (ISO 9001, 8.1 and ISO 10005)	H	W	<u>RW</u>	R
1.3	Attend pre-inspection/pre-production readiness (kick-off) meeting for planning of design, review, production and inspection and testing activities	H	<u>WH</u>	<u>SH</u>	<u>S-</u>
<b>2</b>	<b>Design and development activities</b>				
2.1	Ex-certificate (IOGP S-704, 15.1.2) Attend design review meeting for finalizing design and release for production	<u>RH</u>	<u>RH</u>	<u>RH</u>	<u>R-</u>
<b>3</b>	<b>Externally provided products and services (outsourced)</b>				
2.23.1	Design calculation Verify external supply scope from sub-suppliers for bought out items List includes sub-suppliers of materials/components such as fixing hardware, bearing assembly, terminal/bushings, heat exchanger (type as applicable), purge unit (for hazardous area installations), control system/panels including wiring and components (IOGP S-704, 8.6, 11.4.2.3.4, 11.4.3.3.3, 11.4.3.3.5, 11.4.4.2, 9.12.1.4) 11.4.6, 11.4.15.4, Table 26)	H	<u>-W</u>	<u>-S</u>	-
2.3	Welding inspection	<u>W</u>	-	-	-
2.4	Welding procedure qualification	<u>W</u>	-	-	-
2.5	Non-destructive testing process and personnel qualification	<u>W</u>	-	-	-
<b>3</b>	<b>Control of external supply</b>				
3.1	External supply scope, risk assessment and controls (ISO 9001, 8.4)	H	W	R	S
3.2	Nominated sub-suppliers and services review	W	R	S	S
<b>4</b>	<b>Production and service provision</b>				
4.1	Sub-assembly				
4.1.1	Rotor lamination assembly	W	S	S	-
4.1.21	Brazing of short-circuit rings Stator winding inspection prior to impregnation (IOGP S-704, 11.3.3.4) 4.1, 11.4.4.5, 11.4.4.10)	<u>WH</u>	<u>SW</u>	S	-

4.1.3	Stator lamination assembly	W	S	S	-
4.1.4 <del>2</del>	Production of winding coils Rotor balancing quality grade check (IOGP S-704, 11.3.3.4.5.2, 11.3.34.5.3, 11.3.34.5.4, 11.4.5.5, 11.4.5.6, 11.3.34.5.7, 11.3.3.8)	W <del>H</del>	S <del>W</del>	S <del>W</del>	- <del>S</del>
4.1.5	End winding connections and bracing (IOGP S-704, 11.3.3.4)	W	S	S	-
4.1.6	Winding impregnation (IOGP S-704, 11.3.3.1)	W	S	S	-
4.1.7	Enclosure welding (IOGP S-704, 9.1.2.12, Table 16C)	W	S	S	-
4.1.8	Surface preparation (IOGP S-704, 9.1.2.12, Table 16C)	W	S	S	-
4.2	Inspection and testing				
4.2.1	Testing inspection and test activities as per IOGP S-704 (IOGP S-704, 9.1.1.1, 9.1.1.2, 9.1.2.10, 9.1.2.11, 9.4.1, Table 16A, Table 16B)	H	H	W	R
4.2.2 <del>1</del>	Special testing identified in IOGP S-704D and as per IOGP S-704 (IOGP S-704, 9.1.1.2, 9.1.2.12, Table 16C) In-process testing of motor and associated systems complying to specification, standards, etc. including those in accordance with IOGP S-704, Table 16, section "Special tests", test No.9 "Dielectric dissipation test (tan δ) on stator windings", test No.10 "Partial discharge test on complete stator", test No. 11 "Sealed winding conformance test", test No. 14 "Stator core test" and test No.15 "Surge comparison test of complete stator assembly" (IOGP S-704, 11.4.12.3, Table 16)	H	H <del>W</del>	W	R <del>-</del>
4.2.3 <del>2</del>	Non-destructive testing of welded enclosure Final tests, including factory acceptance test (FAT)	H	W	S	S
4.2.4 <del>2.1</del>	Positive material identification Routine test of all components where a material has been specified motor and associated systems in accordance with IOGP S-704, Table 16, section "Routine tests" (IOGP S-704, 8.6.2.3.2, 9.1, 9.2, 10.4.13, 10.4.2, 10.4.6, 11.1, 11.3.21.1, 11.3.2.3, 11.3.2.6, 11.5, 11.3.2.8, 11.4.3.4.1, 11.3.65.1, 11.4.2, 11.4.3.8.4.5, 11.5.1.2, 11.4.3.2, 11.4.3.3, 11.4.4, 11.4.5.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.12, 11.4.13, 11.4.15, Table 16, Table 2f)	H	R <del>W</del>	- <del>S</del>	- <del>S</del>
4.2.2.2	Special test of motor in accordance with IOGP S-704, Table 16, section "Routine tests", test No. 13 "Measurement of electrical and mechanical run out (measured at slow roll speed - 200 rpm to 300 rpm)" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.3	Performance tests				
4.2.2.3.1	Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 1 "No-load characteristic (saturation curve) at rated frequency" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.3.2	Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 2 "Locked rotor current test" (IOGP S-704, Table 16)	H	W	W	S

4.2.2.3.3	Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 3 "Locked rotor torque test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.3.4	Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 4 "Temperature rise test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.3.5	<del>Retor balancing</del> ( <del>IOGP S-704, 11.3.4.2, 11.3.4.3, 11.3.4.4</del> ) Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 5 "Sleeve bearing inspection" (IOGP S-704, Table 16)	H	<del>W</del>	<del>W</del>	<del>S</del>
4.2.2.3.6	<del>Winding diagnostic testing prior to impregnation</del> ( <del>IOGP S-704, 11.3.3.1</del> ) Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 6 "Determination of efficiency, power factor and slip at 100 %, 75 % and 50 % load" for single-speed motor" (IOGP S-704, Table 16)	H	W	<del>W</del>	<del>S</del>
4.2.2.3.7	Performance test of motor in accordance with IOGP S-704, Table 16, section "Performance tests", test No. 6A "Determination of efficiency, power factor and slip at 100 %, 75 % and 50 % load" for converter duty motor" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4	Special tests				
4.2.2.4.1	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 1 "Rated rotor temperature vibration test (heat run test)" (IOGP S-704, Table 16)	H	H	H	H
4.2.2.4.2	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 2 "Overspeed test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.3	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 4 "Measurements of shaft voltage at no-load" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.4	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 5 "Bearing temperature rise at no-load" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.5	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 6 "Noise level at no load" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.6	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 7 "Measurement of moment of inertia" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.7	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 8 "Measurement of torque and current as function of speed during starting" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.8	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 9 "Dielectric dissipation test (tan δ) on stator windings" (IOGP S-704, Table 16)	H	W	W	S

4.2.2.4.9	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 10 "Partial discharge test on complete stator" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.10	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 11 "Sealed winding conformance test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.11	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 12 "Unbalanced response test" (IOGP S-704, Table 16)	H	H	H	H
4.2.2.4.12	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 13 "Bearing housing natural frequency test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.13	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 14 "Stator core test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.14	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 15 "Surge comparison test of complete stator assembly" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.15	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 16 "Sample coil test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.16	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 17 "Heat exchanger performance verification test" (IOGP S-704, Table 16)	H	W	W	S
4.2.2.4.17	Special test of motor in accordance with IOGP S-704, Table 16, section "Special tests", test No. 18 "Hydrostatic pressure test of heat exchanger tubing devices" (IOGP S-704, Table 16)	H	W	W	S
4.2.7.5	<b>Final dimensional inspection</b>	H	W	W	S
5.1	<del>Release of product or service</del> <b>Conformance to purchase order</b>				
5.1.1	<del>Handling</del> <b>Verify handling, packaging, preservation and packaging storage of motors before release</b> (IOGP S-704, 6.6.6.1, 1.4.7.5)	W	W	WS	R
5.1.2	<del>Final physical inspection including information and</del> <b>Release equipment release for shipment</b>	H	H	WH	SH
<p><b>Key</b></p> <p>- <del>is</del> No intervention performed</p> <p>H <del>is</del> Hold point</p> <p>W <del>is</del> Witness point</p> <p>R <del>is</del> Review</p> <p>S <del>is</del> surveillance and R <del>is</del> review; <del>is</del> Surveillance</p> <p>NOTE Definitions for these terms are provided in Clause 3</p>					

## Annex B (normative) Certification and traceability requirements

Table B.1 provides the certification and traceability requirements for the equipment and component parts.

Table B.1 — Certification and traceability requirements

<u>Item</u>		<u>Certificate type</u> <sup>a</sup>	<u>Traceability level</u> <sup>b</sup>	<u>Additional requirements</u>												
<u>Equipment item 1</u>	<u>Heat exchanger assembly</u>	<u>2.1</u>	<u>Level III</u>													
<u>Equipment item 2</u>	<u>Bearing assembly</u>	<u>2.1</u>	<u>Level III</u>													
<p><sup>a</sup> <u>Inspection certificates shall be provided in accordance with ISO 10474 or EN 10204.</u></p> <p><sup>b</sup> <u>Traceability levels are defined in the following table.</u></p> <table border="1"> <thead> <tr> <th><u>Level</u></th> <th><u>Traceability</u></th> <th><u>Definition</u></th> </tr> </thead> <tbody> <tr> <td><u>Level I</u></td> <td><u>Full traceability</u></td> <td><u>Material is uniquely identified and its history tracked from manufacture through stockists (where applicable) to the supplier and to the actual position on the equipment with the specific location defined on a material placement record (the traceability to a specific location only applies to skids / packaged equipment, not to bulks).</u></td> </tr> <tr> <td><u>Level II</u></td> <td><u>Type traceability</u></td> <td><u>The supplier maintains a system to identify material throughout manufacture, with traceability to a material certificate.</u></td> </tr> <tr> <td><u>Level III</u></td> <td><u>Compliance traceability</u></td> <td><u>The supplier maintains a system of traceability that enables a declaration of compliance to be issued by the supplier.</u></td> </tr> </tbody> </table>					<u>Level</u>	<u>Traceability</u>	<u>Definition</u>	<u>Level I</u>	<u>Full traceability</u>	<u>Material is uniquely identified and its history tracked from manufacture through stockists (where applicable) to the supplier and to the actual position on the equipment with the specific location defined on a material placement record (the traceability to a specific location only applies to skids / packaged equipment, not to bulks).</u>	<u>Level II</u>	<u>Type traceability</u>	<u>The supplier maintains a system to identify material throughout manufacture, with traceability to a material certificate.</u>	<u>Level III</u>	<u>Compliance traceability</u>	<u>The supplier maintains a system of traceability that enables a declaration of compliance to be issued by the supplier.</u>
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