

Quality Requirements for High-voltage Synchronous Machines (IEC)

Revision history

VERSION	DATE	PURPOSE
1.0	April 2024	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).

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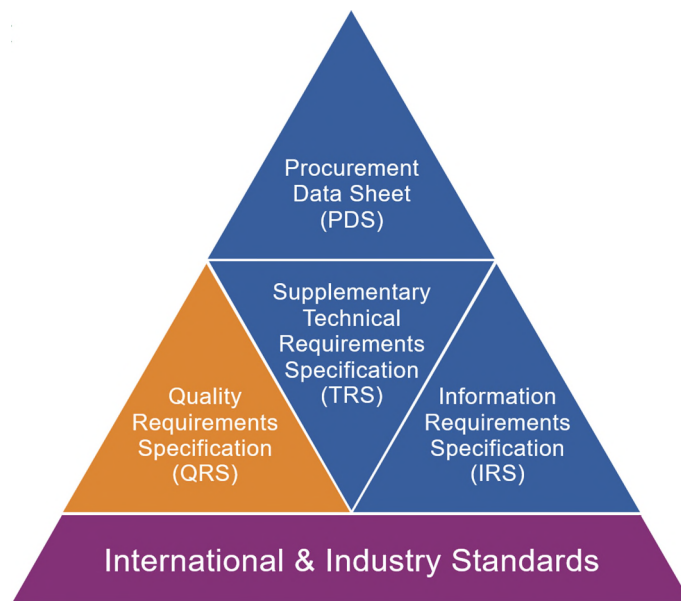
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Introduction

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 synchronous machines in accordance with IOGP S-745 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 or purchase order.

This QRS shall be used in conjunction with the specification (IOGP S-745), the procurement data sheet (IOGP S-745D) and the information requirements specification (IOGP S-745L) which together comprise the full set of specification documents. The introduction section in the 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 (QRS)

1 Scope

To specify quality management requirements for the supply of high-voltage synchronous machines to IOGP S-745 including:

- a) supplier quality management system requirements;
- b) purchaser conformity assessment (surveillance and inspection) activities;
- c) traceability requirements.

2 Normative references

For the purpose of this document, the documents referenced in IOGP S-745 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-745, *Supplementary Specification to IEC 60034-1 for High-voltage Synchronous Machines*

ISO 9001, *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 and definitions

For the purpose of this document, the terms and definitions given in IOGP S-745 and ISO 9000 (normative to ISO 9001), and the following shall apply.

3.1

conformity assessment

demonstration that specified requirements are fulfilled

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

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

3.2

conformity assessment system

CAS

system that provides different levels of purchaser interventions to assess and verify supplier conformance to specified requirements

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

3.3

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

3.4**witness point****W**

<conformity assessment> point in the chain of activities that the 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.

3.5**surveillance****S**

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

3.6**review****R**

<conformity assessment> review of the supplier's information to verify conformance to requirements

4 Symbols and abbreviations

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

CAS	conformity assessment system
FAT	factory acceptance test
IRS	information requirements specification
QMS	quality management system
QRS	quality requirements specification (this document)

5 Quality requirements**5.1 Quality management system**

The supplier shall operate and maintain a quality management system (QMS) that conforms with ISO 9001, ISO 29001, API Specification Q1 or an equivalent quality management system standard.

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.

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 shall include provision for purchaser intervention activities based on the CAS level selected in the procurement data sheet or purchase order. See Annex A.

5.2.3

Supplier performance in meeting the requirements 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.

6 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.

Machine certification and traceability shall be maintained for component/item listed in Annex B.

7 Evidence — conformance records

Documents and information shall be provided for in accordance with the associated IRS.

Annex A (normative)

Purchaser conformity assessment requirements

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

	PURCHASER ASSESSMENT ACTIVITIES	CAS			
		A	B	C	D
1	Operational planning and control activities				
1.1	Quality planning	H	W	S	-
1.2	Inspection and testing planning	H	H	W	R
1.3	Attend pre-inspection/pre-production (kick-off) meeting for planning of design, review, production and inspection and testing activities	H	H	H	-
2	Design and development activities				
2.1	Design review				
2.1.1	Attend design review meeting for finalizing design and release for production	H	H	-	-
3	Control of external supply				
3.1	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-745, 11.4.2.3.4, 11.4.3.3.3, 11.4.3.3.5, 11.4.4.2, 11.4.6.1, 11.4.9.1.1, 11.4.16.4.1, 11.4.18.7, Table 27)	H	H	S	-
4	Production and service provision				
4.1	Sub-assembly				
4.1.1	Stator winding inspection prior to impregnation (IOGP S-745, 11.4.4.1, 11.4.4.3, 11.4.4.4)	H	W	S	S
4.1.2	Rotor balance quality grade check (IOGP S-745, 11.4.5.2, 11.4.5.3, 11.4.5.4, 11.4.5.5, 11.4.5.6, 11.4.5.7)	H	W	W	S
4.2	Inspection and test activities as per IOGP S-745				
4.2.1	In-process testing of synchronous machine and associated systems complying to specification, standards, etc. including those in accordance with IOGP S-745, Table 16, section "Routine tests", test number 2 "Air-gap measurement between stator and rotor of main machine and exciter" and the special tests requested in IOGP S-745D in accordance with IOGP S-745, Table 16, section "Special tests", test number 8 "Dielectric dissipation test (tan δ) on stator windings", test number 9 "Partial discharge test on complete stator", test number 10 "Sealed winding conformance test", test number 13 "Stator core test" and test number 14 "Surge comparison test of complete stator assembly" (IOGP S-745, 11.4.12.3.2, Table 16)	H	W	W	-
4.2.2	Final tests, including factory acceptance test (FAT)				
4.2.2.1	Routine test of synchronous machine and associated systems in accordance with IOGP S-745, Table 16, section "Routine tests" (IOGP S-745, 9.1, 9.2, 10.3, 10.4.2, 10.4.6, 11.1, 11.3.1.1, 11.3.1.5, 11.3.5.1, 11.3.9.2.4, 11.4.2, 11.4.3, 11.4.4.2, 11.4.4.4, 11.4.4.5, 11.4.5.4, 11.4.5.5, 11.4.5.6, 11.4.5.7, 11.4.5.8, 11.4.5.10, 11.4.5.11, 11.4.5.12, 11.4.5.13, 11.4.5.14, 11.4.5.15, 11.4.7.5, 11.4.7.7, 11.4.7.8, 11.4.7.9, 11.4.7.10, 11.4.8, 11.4.9.1, 11.4.9.2.10, 11.4.9.2.3, 11.4.9.2.5, 11.4.9.2.6, 11.4.9.2.7, 11.4.12.1, 11.4.12.2, 11.4.12.3.2, 11.4.12.5.3, 11.4.14.1, 11.4.14.3, 11.4.16.1.2, 11.4.17.3, 11.4.17.4, 11.4.18, Table 16, Table 27)	H	W	W	S

	PURCHASER ASSESSMENT ACTIVITIES (continued)	CAS			
		A	B	C	D
4.2.3	Performance tests				
4.2.3.1	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 1 "No-load characteristic (saturation curve) at rated frequency"	H	W	W	S
4.2.3.2	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 2 "Locked rotor current test"	H	W	W	S
4.2.3.3	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 3 "Locked rotor torque test"	H	W	W	S
4.2.3.4	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 4 "Temperature rise test"	H	W	W	S
4.2.3.5	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 5 "Sleeve bearing inspection"	H	H	H	H
4.2.3.6	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 6 "Determination of efficiency at 100 %, 75 % and 50 % load at rated power factor for single speed motor"	H	W	W	S
4.2.3.7	Performance test of synchronous machine in accordance with IOGP S-745, Table 16, section "Performance tests", test number 6A "Determination of efficiency at 100 %, 75 % and 50 % load at rated power factor for converter duty synchronous motor"	H	W	W	S
4.2.4	Special tests				
4.2.4.1	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 1 "Rated rotor temperature vibration test (heat run test)"	H	H	H	H
4.2.4.2	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 2 "Measurements of shaft voltage at no-load"	H	W	W	S
4.2.4.3	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 3 "Bearing temperature rise at no-load"	H	W	W	S
4.2.4.4	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 4 "Tests for the construction of the no-load V curve"	H	W	W	S
4.2.4.5	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 5 "Noise level at no load"	H	W	W	S
4.2.4.6	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 6 "Measurement of moment of inertia"	H	W	W	S
4.2.4.7	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 7 "Measurement of torque and current as function of speed during starting"	H	W	W	S
4.2.4.8	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 8 "Dielectric dissipation test (tan δ) on stator windings"	H	W	W	S
4.2.4.9	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 9 "Partial discharge test on complete stator"	H	W	W	S
4.2.4.10	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 10 "Sealed winding conformance test"	H	W	W	S
4.2.4.11	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 11 "Unbalanced response test"	H	H	H	H
4.2.4.12	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 12 "Bearing housing natural frequency test"	H	W	W	S
4.2.4.13	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 13 "Stator core test"	H	W	W	S

	PURCHASER ASSESSMENT ACTIVITIES <i>(continued)</i>	CAS			
		A	B	C	D
4.2.4.14	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 14 "Surge comparison test on complete stator assembly"	H	W	W	S
4.2.4.15	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 15 "Sample coil test"	H	W	W	S
4.2.4.16	Special test of synchronous machine in accordance with IOGP S-745, Table 16, section "Special tests", test number 16 "Sudden short-circuit test"	H	W	W	S
4.2.4.17	Special test of synchronous machine and associated systems in accordance with IOGP S-745, Table 16, section "Special tests", test number 17 "Heat exchanger performance verification test"	H	W	W	S
4.2.4.18	Special test of synchronous machine and associated systems in accordance with IOGP S-745, Table 16, section "Special tests", test number 18 "Hydrostatic pressure test of heat exchanger tubing devices"	H	W	W	S
4.2.4.19	Special test of synchronous machine and associated systems in accordance with IOGP S-745, Table 16, section "Special tests", test number 19 "Generator control panel functional test"	H	W	W	S
5	Release of product or service				
5.1	Verification of conformance to the purchase order including as applicable				
5.1.1	Handling, packaging, preservation and storage of synchronous machines before release (IOGP S-745, 6.6, 11.4.7.4)	W	W	S	-
5.1.2	Release of equipment	H	H	H	H
Key H: Hold point W: Witness point R: Review S: Surveillance					

Annex B (normative)

Certification and traceability requirements

Item		Certificate type	Traceability level	Additional requirements
Equipment item 1	Heat exchanger assembly	2.1	Level III	
Equipment item 2	Bearing assembly	2.1	Level III	
Equipment item 3	Exciter assembly	2.1	Level III	
	Automatic voltage regulator	2.1	Level III	
	Permanent magnet generator (for synchronous generator)	2.1	Level III	
<p>NOTE 1 Certificates Inspection certificates shall be provided in accordance with ISO 10474 or EN 10204.</p> <p>NOTE 2 Traceability A. Level I — Full traceability — Material is uniquely identified and its history tracked from manufacture through stockists (where applicable) to the supplier and to actual position on the equipment with specific location defined on a material placement record (the traceability to a specific location only applies to skids / packaged equipment, not to bulks). B. Level II — Type traceability — The supplier maintains a system to identify material throughout manufacture, with traceability to a material certificate. C. Level III — Compliance traceability — The supplier maintains a system of traceability that enables a declaration of compliance to be issued by the supplier.</p>				

Registered Office

City Tower
Level 14
40 Basinghall Street
London EC2V 5DE
United Kingdom
T +44 (0)20 3763 9700
reception@iogp.org

Brussels Office

Avenue de Tervuren 188A
B-1150 Brussels
Belgium
T +32 (0)2 790 7762
reception-europe@iogp.org

Houston Office

15377 Memorial Drive
Suite 250
Houston, TX 77079
USA
T +1 (713) 261 0411
reception-americas@iogp.org

www.iogp.org

