

# Quality Requirements for Plate-and-frame Heat Exchangers (API)

## Revision history

| VERSION | DATE          | PURPOSE       |
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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).

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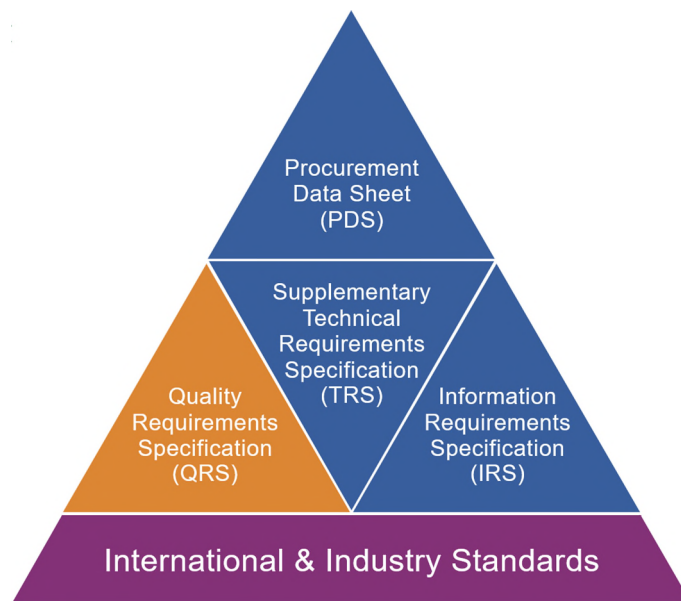
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## Introduction

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 plate-and-frame heat exchangers in accordance with IOGP S-749 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-749), the procurement data sheet (IOGP S-749D) and the information requirements specification (IOGP S-749L) 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 plate-and-frame heat exchangers to IOGP S-749 including:

- a) vendor 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-749 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*

IOGP S-749, *Supplementary Specification to API Standard 667 for Plate-and-frame Heat Exchangers*

ISO 9001, *Quality management systems — Requirements*

ISO 10005, *Quality management — Guidelines for quality plans*

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-749 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 vendor 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 vendor'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             |
| NDE | nondestructive examination                         |
| 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 vendor 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**

Where material certification and traceability requirements are not specified in the parent standard or supplementary specification, material certification and traceability shall be maintained in accordance with 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 |
| <b>1</b> | <b>Operational planning and control activities</b>   |     |   |   |   |
| 1.1      | Quality planning<br>(IOGP S-749, 6.2.4)  | H   | H | R | - |
| 1.2      | Attend pre-inspection/pre-production meeting<br>(IOGP S-749, 4.1, 4.10, 4.11.1)  | H   | W | W | - |
| <b>2</b> | <b>Design and development activities</b>   |     |   |   |   |
| 2.1      | Attend final design review meeting   | H   | - | - | - |
| <b>3</b> | <b>Control of external supply</b>  |     |   |   |   |
| 3.1      | Quality management of external supply scope, risk assessment and controls (e.g. gaskets, frame)  | H   | R | R | - |
| <b>4</b> | <b>Production and service provision</b>  |     |   |   |   |
| 4.1      | Starting materials verification  |     |   |   |   |
| 4.1.1    | Inspection and identification of materials and consumables including gaskets (i.e. certification, including heat treatment certification, chemical and mechanical properties, testing and conformity)<br>(IOGP S-749, 7.8.4, 8.1.1, 8.1.2, 8.2, 10.1.12, 10.1.6) | H   | W | S | - |
| 4.2      | Component manufacture  |     |   |   |   |
| 4.2.1    | Cutting, forming/pressing, machining and markings applied to materials (e.g. plates and nozzles)<br>(IOGP S-749, 7.6.1)  | S   | - | - | - |
| 4.2.2    | Laser welding as per 9.1.2, as applicable for semi-welded plate heat exchangers<br>(IOGP S-749, 9.1.1, 9.1.2)  | H   | W | R | - |
| 4.2.3    | Weld edge preparation, fit-up, tack welding, welding and assembly of fabricated components<br>(IOGP S-749, 9.1.1)  | W   | S | - | - |
| 4.2.4    | Repair of defects in welds, if applicable<br>(IOGP S-749, 10.1.20, 10.1.21)  | H   | W | W | - |
| 4.2.5    | Heat treatment including preparation of equipment, attachment of thermocouples and review of charts<br>(IOGP S-749, 10.1.4, 10.1.10, 10.3.6)   | W   | S | S | - |
| 4.2.6    | Flatness check of gasket seating surfaces of cover flanges and nozzle flanges after completion of welding and heat treatment, including heat transfer plate gasket seating surface, if applicable<br>(IOGP S-749, 7.7.3, 9.2.1)                                  | S   | S | S | - |
| 4.3      | Inspection and test activities as per IOGP S-749   |     |   |   |   |
| 4.3.1    | Inspection and NDE of completed pressure welds, cladding and welds that are not pressure welds but that are welded to the pressure envelope such as attachment welds, external and internal<br>(IOGP S-749, 7.7.7, 7.7.6, 7.7.19, 9.1.6, 10.1, 10.3.3)           | H   | W | R | R |
| 4.3.2    | Inspection and NDE of structural welds<br>(IOGP S-749, 4.2, 10.1.16, 10.1.17, 10.1.18, 10.3.1, 10.3.3)   | W   | W | R | - |

|   | PURCHASER ASSESSMENT ACTIVITIES <i>(continued)</i>  | CAS |   |   |   |
|---|---|-----|---|---|---|
|   |   | A   | B | C | D |
| 4.3.3   | Inspection and NDE of other components (e.g. heat transfer plates)<br>(IOGP S-749, 10.1.1, 10.1.3, 10.1.12, 10.1.15)  | H   | W | R | - |
| 4.3.4   | Production weld hardness testing<br>(IOGP S-749, 4.8, 9.1.1, 10.1.10)   | W   | S | S | - |
| 4.3.5   | Chemical composition check of weld overlay<br>(IOGP S-749, 7.5.4, 10.1.11)  | W   | R | R | R |
| 4.3.6   | Visual and dimensional inspection, including fabrication tolerances before assembly<br>(IOGP S-749, 9.2.1, 9.2.2, 9.2.3)  | H   | W | S | - |
| 4.3.7   | Painting and coating inspection<br>(IOGP S-749, 10.2.9, 9.4.1, 9.4.2)   | W   | W | S | - |
| 4.4   | Assembly  |     |   |   |   |
| 4.4.1   | Final assembly inspection, including gasket installation, bolt tensioning and dimensional verification<br>(IOGP S-749, 7.1.3, 7.6.1, 7.6.2, 7.6.3, 7.6.4, 7.6.5, 7.6.6, 7.6.7, 7.7.13, 7.8, 8.1.3, 9.1.3, 9.2, 9.3, 10.3.4) | H   | W | W | S |
| 4.5   | Final tests, including FAT  |     |   |   |   |
| 4.5.1   | Leak test of assembly (e.g. helium leak test) if applicable<br>(IOGP S-749, 10.1.1, 10.1.3)   | H   | W | W | - |
| 4.5.2   | Hydrostatic or pneumatic testing<br>(IOGP S-749, 10.2, 10.3.2, 11.8)  | H   | W | W | S |
| <b>5</b>  | <b>Release of product or service</b>  |     |   |   |   |
| 5.1   | Verification of conformance to the purchase order including as applicable   |     |   |   |   |
| 5.1.1   | Packaging and preservation<br>(IOGP S-749, 10.2.8, 10.3.6, 11)  | W   | W | R | - |
| 5.1.2   | Final inspection including nameplate and stamping, if applicable<br>(IOGP S-749, 4.1, 7.6.1, 7.7.13, 10.3.2, 10.3.3, 10.3.5, 11.13.2, 11.13.3)  | W   | W | S | - |
| 5.1.3   | Release of equipment<br>(IOGP S-749, 6.3.1)   | H   | H | H | H |
| <b>Key</b><br>H: Hold point<br>W: Witness point<br>R: Review<br>S: Surveillance |   |     |   |   |   |

## Annex B (normative) Certification and traceability requirements

| Item   |   | Certificate type | Traceability level | Additional requirements |
|--|---|------------------|--------------------|-------------------------|
| Plate-and-frame heat exchanger components  | Pressure-retaining parts (e.g. cover plates, connections/nozzles, flanges, heat transfer plates, tie bolts, tie nuts) | 3.1              | Level II           |                         |
|  | Gaskets/seals (i.e. non-metallic components)  | 2.2              | Level II           |                         |
|  | Structural components (e.g. support columns, carrying bar, guide bar)   | 2.2              | Level II           |                         |
|  | External welded attachments   | 3.1              | Level II           |                         |
|  | Welding consumables (e.g. electrodes, rods, wire)   | 3.1              | Level II           |                         |
|  | Welding consumable (i.e. flux)  | 2.2              | Level II           |                         |
| <p><b>NOTE 1 Certificates</b><br/>                     Inspection certificates shall be provided in accordance with ISO 10474 or EN 10204.</p> <p><b>NOTE 2 Traceability</b><br/>                     A. Level I — Full traceability — Material is uniquely identified and its history tracked from manufacture through stockists (where applicable) to the vendor 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).<br/>                     B. Level II — Type traceability — The vendor maintains a system to identify material throughout manufacture, with traceability to a material certificate.<br/>                     C. Level III — Compliance traceability — The vendor maintains a system of traceability that enables a declaration of compliance to be issued by the vendor.</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](http://www.iogp.org)

