

Supplementary Specification to API Standard 610 Centrifugal Pumps

NOTE This version (S-615J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-615.

Revision history

VERSION	DATE	PURPOSE
1.1	January 2022	Issued for Public Review
1.0	January 2019	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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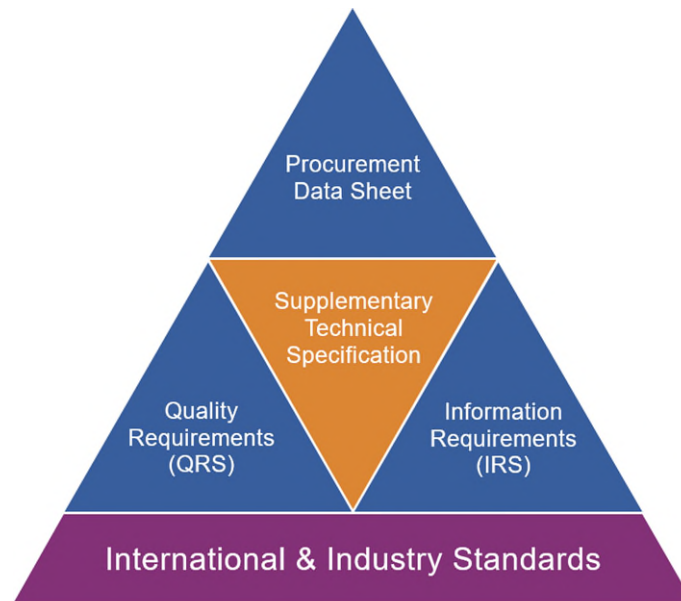
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Introduction

The purpose of this specification is to define a minimum common set of requirements for procurement of centrifugal pumps in accordance with API Standard 610, 12th Edition, January 2021, Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries, for application in the petroleum and natural gas industries.

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

This specification is to be applied in conjunction with the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows.

S-615: Supplementary Specification to API Standard 610 Centrifugal Pumps

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to API Std 610, following the API clause structure. Clauses from API Standard 610 not amended by this specification apply as written to the extent applicable to the scope of supply.

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

S-615D: Procurement Data sheets for Centrifugal Pumps

The procurement data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The procurement data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the procurement data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

S-615L: Information Requirements for Centrifugal Pumps

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

S-615Q: Quality Requirements for Centrifugal Pumps

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) 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 sheet or in the purchase order.

The terminology used within this specification and the supporting procurement data sheet, IRS and QRS follows that of API 610 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.

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 sheets, IRS, QRS);
- d) this specification;
- e) API Standard 610.

1 Scope

Add after second paragraph

This specification does not apply to all pumps and services within the scope of API Standard 610.

Justification

This requirement clarifies what pumps are included in the scope of the S-615 specification.

Add to section

This specification does not apply to all pumps and services within the scope of API Standard 610. The scope excludes the following:

- a) types:
 - OH4, BB4 and BB5 pumps;
 - single volute overhung pumps requiring a driver rated in excess of 150 HP (112 kW);
 - overhung pumps with two or more stages;
 - double suction overhung pumps.
- b) services:
 - pumps in cryogenic services (less than -148 °F (-100 °C));
 - pumps in multi-phase service.
- c) auxiliaries:
 - pumps with drivers (less than 1340 HP (1000kW));
 - pumps with API Standard 614 force feed lubrication systems.

Justification

Provides details of the pumps that are included in the scope of IOGP S-615 specification.

3 Terms and Definitions

3.1.23 maximum discharge pressure

Replace definition with

Maximum suction pressure plus the maximum differential pressure that the pump is capable of developing at shut-off when operating with the maximum specified relative density (specific gravity) with:

- the maximum impeller diameter at the rated speed for constant speed applications;
- the rated impeller diameter at the trip speed for variable speed applications.

3.1.24 **maximum dynamic sealing pressure**

Replace last sentence of NOTE with

See API Standard 682.

3.1.25 **maximum operating temperature**

Replace last sentence of NOTE with

See API Standard 682.

3.1.46 **pressure casing**

Replace definition with

Composite of all stationary pressure-containing parts of the pump, including all nozzles, seal glands, seal chambers and all auxiliary process fluid containing piping permanently attached to the pump casing but excluding the stationary and rotating members of mechanical seals

Add new term

3.1.69 **unless otherwise specified**

indicate that the default requirement is applied unless the owner's engineer (end-user or company's appointed engineer) specifies otherwise.

NOTE If the purchaser is not the owner's engineer, the purchaser needs the approval from the owner's engineer to specify different requirements.

Add new term

3.1.70 **major weld repair**

Weld repair where castings have leaked on hydrostatic test, or the depth of the cavity after preparation for repair exceeds 20 % of the actual wall thickness, or 25 mm (1 in.), whichever is smaller, or where the extent of the cavity exceeds 65 cm² (10 in.²). NOTE Repairs that do not comply with these criteria are minor repairs.

6 Basic Design

6.1 General

6.1.1 Equipment reliability

Add to section

For field proven equipment, the vendor shall provide experience of 24000 operating hours with the same equipment in at least three comparable installations with satisfactory performance.

Justification

The requirement provides a definition for field proven equipment, 24 000 operating hours is approximately 3 years which is typical in the oil and gas industry, 3 installations is also typical within the oil and gas industry.

Add to section

The vendor's proposal shall only include equipment of proven reliability with equivalent design features to the units proposed and operating in comparable service conditions.

Justification

The requirement ensures all equipment that is offered as part of the proposal shall be of equivalent design to ensure it meets project requirements and for ease of comparison.

6.1.1.2

Delete "If specified,"

Justification

The documentation shall be provided so that the purchaser can have confidence in the equipment ability to operate successfully in the intended service

6.1.5**6.1.5.1****Add to section**

The proposed rated impeller diameter for pumps with constant speed drivers shall be not be less than 80 % of the maximum casing impeller diameter.

Justification

The requirement ensures that the pump has a flexible operating envelope. 80% is a typical industry standard.

Add to section

For pumps with variable speed drives, the impeller diameter giving the maximum efficiency shall be selected.

Justification

This ensures the maximum possible pump efficiency.

Add to section

When the selected impeller is of maximum size for the casing, then the driver and pump shall be capable of the speed increase necessary to give a 5 % increase in head as specified in 6.1.4.

Justification

This requirement ensures that for a variable speed pump subclause 6.1.5 of API standard can still be met.

Add to section

When the selected impeller is of maximum size for the casing, the driver and pump selected shall have design margin to absorb head shortfall during testing.

Justification

This ensures that the -3 % head tolerance allowed by table 16 for performance testing can be accounted for in the design.

6.1.11Replace second sentence with

With the exception of OH6 type pumps, suction-specific speed values shall not exceed 11000 gpm, rpm, ft (213 m³/s, rpm, m).

Justification

Suction specific speed is an index related to the onset flow of suction recirculation. The limit that has been agreed by the workgroup is a generally accepted limit for centrifugal pumps.

Add to section

Pumps provided with suction inducers shall not be used unless approved by the purchaser.

Justification

The purchaser would like to know when a suction inducer is proposed to be used.

Add to section

When an inducer is provided, the suction-specific speed shall be stated for the impeller only.

Justification

This is to ensure that the impeller meets the suction specific speed criteria.

6.1.14Replace section with

Orifice plates shall not be used.

Justification

Using an orifice plate can alter the pump curve, their use should be managed and approved by the deviation process to seek purchaser permission.

6.1.15Delete "If specified,"**Justification**

This is to improve pump control and reliability

Add to section

The head rise from rated point to shutoff shall be at least 10 %.

Justification

This is to improve pump control and reliability

Add to section

A pump suction side restriction ring shall not be used.

Justification

At higher pump flowrates a suction side restriction can cause significant head loss and higher NPSHR.

6.1.31Add to section

Non-rotating maintenance parts weighing more than 55 lbs (25 kg) shall have a tapped hole to fit a removable lifting eye.

Justification

This requirement defines the weight as agreed by the workgroup where additional lifting equipment is required in order to protect operations and maintenance personnel

6.1.36 Warm Up and Cool DownAdd to section

For floating applications, the vendor shall state the maximum inclination and time period of oscillation for pump operation.

Justification

For floating applications, the maximum inclination and time period of oscillation for pump operation are critical for safe operation of the pump.

6.1.37 Bolting and Threads**6.1.37.1**Replace first sentence with

The details of threading shall conform to ASME B1.1, ASME B1.13M, ISO 261 or another international standard.

Justification

Amendment allows other internationally standardized bolting threading to be used. The requirement also allows vendors from countries such as Japan or Germany to provide bolting that conforms to the equivalent international standard.

Add new section**6.1.42 Insulation and Heat Tracing****6.1.42.1**

Personnel protection hot insulation shall be applied to all parts that are exposed to contact with persons during control and routine maintenance operations for surface temperatures above 140 °F (60 °C).

Justification

This is a safety requirement for the protection of personnel, 140 °F (60 °C) is agreed as the temperature and taken from the OSHA requirements.

6.1.42.2

When insulation is applied to the pump, the vendor shall provide stand-offs and clearance from the insulated surface throughout for pipe flanges, valves and instrument equipment for the facilitation of maintenance.

Justification

This is to allow for the fitment of the insulation and access for maintenance.

6.1.42.3

When required due to environmental or process conditions and when the pump is on standby, heat tracing and insulation shall be applied to pump and auxiliary components to maintain all the equipment in its normal operating state.

Justification

This requirement ensures that pumps that are on standby duties are kept warm and can be started quickly when required.

6.3 Pressure Casings**6.3.1**Replace first sentence with

The maximum discharge pressure shall be the maximum suction pressure plus the maximum differential pressure that the pump is capable of developing at shut-off when operating with the maximum specified relative density (specific gravity) with the maximum impeller diameter at the rated speed for constant speed applications or the rated impeller diameter at the trip speed for variable speed applications.

Justification

Maximum discharge pressure definition is to allow a possible future impeller upgrade to maximum diameter or operation at overspeed for VSD units, the maximum discharge pressure should be based on worst case conditions (shut in head at maximum impeller diameter and shut head at maximum impeller diameter and maximum speed for variable speed applications).

Delete second sentence**Justification**

New requirement replaces this clause.

6.3.2

Delete "If specified," from first paragraph

Justification

The pump casing is required to be rated for the maximum conditions possible

Add NOTE 2

NOTE 2 The vendor is limited to the maximum impeller diameter provided in the data sheet to the casing pressure rating.

Justification

The intention of the note is to understand the maximum impeller diameter that can be installed in the selected pump casing that will not exceed the casing rating maximum pressure.

6.3.8

Replace first sentence with

All pressure casing parts as defined in 3.1.46 shall have the same MAWP.

Justification

This requirement provides the pump with design robustness, and process safety and clarity. This requirement is also important for pumps that are to be operated in parallel.

Delete second sentence

Justification

Requirement in this sentence are deleted because sentence 1 of 6.3.8 is replaced with a alternative requirement.

Delete third sentence

Justification

Requirement in this sentence are deleted because sentence 1 of 6.3.8 is replaced with a alternative requirement.

6.3.9

Replace first sentence

All pressure casing casings parts as defined in 3.1.46 shall have the same MAWP.

Justification

This requirement ensures that the pump design is robust with high process safety.

Delete second sentence

Justification

The requirements for the MAWP of pressure casings are address by the amended first sentence of this API requirement.

6.3.14

Add to section

Centreline or near centreline supported pumps operating above 500 °F (260 °C) shall have a casing guide or key slot along the centreline and at each support pedestal.

Justification

Allows thermal expansion of the pump in the axial direction without detriment to coupling alignment. 260°C and 500 °F is agreed by the workgroup and vendors to be a suitable temperature limit for use of the casing key guide.

Add to section

For pumps with four centreline or near centreline mounting feet, the key guides shall be on the non-drive end pedestals guiding thermal expansion away from the coupling end of the pump.

Justification

Allows thermal expansion of the pump in the axial direction without detriment to coupling alignment.

6.4 Nozzles and Pressure Casing Connections

6.4.1 Casing Opening Sizes

6.4.1.2

Add to section

Drain connections of pumps handling fluids with a viscosity greater than or equal to 400 cP shall not be less than DN25 (NPS 1).

Justification

Larger connection for viscous service drains added to enable pump to be drained more easily.

Add to section

Drain connections of pumps handling fluids with a higher than ambient pour point temperature shall not be less than DN25 (NPS 1).

Justification

Larger connection for viscous service drains added to enable pump to be drained more easily.

Add to section

Drain connections of pumps pumping slurries shall not be less than DN25 (NPS 1).

Justification

Larger connection for slurry service drains added to enable pump to be drained more easily.

Add to section

Drain connections of pumps shall be installed so that the pump is free draining.

Justification

Free draining connections ensure that pumps are completely drained.

6.4.2 Suction and Discharge Nozzles**6.4.2.1****Replace second sentence with**

Pumps shall have suction and discharge flanges of equal rating.

Justification

It is not good practice to have the pressure and temperature spec break as part of the pump. If the suction and discharge flanges are rated differently it is almost impossible to properly hydrotest the pump. Similarly, when in operation if the pump is accidentally pressurized to full discharge pressure [as can easily happen when there is a standby and running pump] the pump suction flange and casing section can be over pressured.

6.4.3 Auxiliary Connections**6.4.3.1****Add to section**

Full penetration butt welds shall be used when the pump nozzles are Class 900 or above.

Justification

Full penetration welded connections for above class 900 are considered to be more reliable than other welding such as socket welding.

Add to section

Full penetration butt welds shall be used when the minimum pumping temperature is 32 °F (0 °C) or below.

Justification

Full penetration welded connections for pumping temperatures below 32 °F (0 °C) are considered to be more reliable than other welding such as socket welding.

Add to section

Full penetration butt welds shall be used when the pump service is for extremely hazardous.

Justification

Full penetration welded connections for extremely hazardous services are considered to be more reliable than other welding such as socket welding.

Add to section

Full penetration butt welds shall be used when NACE MR0175 or NACE MR0103 is applicable.

Justification

Full penetration welded connections for NACE services are considered to be more reliable than other welding such as socket welding.

6.4.3.5Replace seventh sentence with

Plastic plugs, including temporary plugs used for shipping, shall not be permitted.

Justification

This is an improvement of the API requirement to ensure that plastic plugs are also not provided for shipping the equipment.

6.4.3.10Replace first sentence with

Piping less than NPS 2 (DN50) shall be gusseted in two orthogonal planes to increase the rigidity of the piped connection, in accordance with the following stipulations, except connections for seal flush piping and gauges.

Justification

The vibration of small-bore fittings is well known and can lead to cracks in welds with eventual leaks.

6.6 Rotors**6.6.3**Replace third sentence with

Collets shall not be used in vertical pumps.

Justification

Collets are a device to lock the pump impeller onto the shaft. The collet can come loose if the pump spins backwards or subject to adverse thrust.

Add new section**6.6.14**

Impellers with four vanes shall not be provided in double volute pumps.

Justification

Impellers with four vanes create vibration resonance with the cutwater

Add new section

6.6.15 Repairs

6.6.15.1

Repairs to machining errors shall be approved by the purchaser prior to commencement.

Justification

Operating companies would like to know if a repair has been made, as it could introduce an area of weakness

6.6.15.2

Metal plating shall not be used for shaft or impeller repairs.

Justification

Metal plating is not considered acceptable for shaft or impeller repairs.

6.6.15.3

Weld repair of shaft shall not be permitted.

Justification

Repairs of shafts are not acceptable as it is considered that the shaft would not be robust.

6.7 Wear Rings and Running Clearances

6.7.3

Replace first sentence with

Renewable wear rings shall be held in place by a press fit with a least three equally spaced axial screws or by tack welding in at least three equally spaced places.

Justification

Renewable wear rings should be securely held using screws or tack welding, locking pins (now excluded from the requirement) are not permitted.

6.7.5

Add to section

The quoted pump performance and curve shall be based on the clearances used by the vendor after making allowances for added clearance based on temperature, viscosity and galling tendencies.

Justification

Suppliers typically provide proposals based on standard clearances. For pumps with added clearances, supplier to confirm the basis of pump performance.

Add new section**6.7.6**

Run-out of casing wear rings and casing-to-cover area shall not exceed 0.002 in. (50 µm) TIR.

Justification

This is to ensure good alignment and fit between parts

6.8 Mechanical Shaft Seals**6.8.2**Replace section with

The seal cartridge shall be removable without disturbing the driver, except for vertical pumps types OH5 and OH6.

Justification

The additional requirement regarding OH5 and OH6 pumps is added because for this kind of pump design it is not possible to maintain the seals without disturbing the driver.

6.8.11Replace first sentence with

When deemed to be required by the vendor, jackets shall be provided on seal chambers for heating.

Justification

This is to ensure that the vendor understands that it is their responsibility to identify when the seal chamber jackets are required.

6.9 Dynamics**6.9.2 Torsional analysis****6.9.2.1**In first sentence of NOTE, replace “three general types” with

four general types

Justification

Additional analysis note d is added as this sentence needs to be updated to reflect four items.

Add to list item c) of NOTE

Transient conditions used for torsional analysis include short circuit between two phases, start-up and, if specified, re-acceleration.

Justification

The requirement clarifies what conditions should be considered as transient for the torsional analysis

Add new list item d) to NOTE

- d) stress analysis performed for the transient conditions to verify that shaft-end, coupling and drive-component ratings are not exceeded.

Justification

The requirement is agreed to be added for operating companies who have lower VSD motor rating threshold.

6.12 Materials

6.12.1 General

6.12.1.8

Replace first sentence with

The vendor shall supply ISO 10474 / EN 10204 type 3.1 material inspection certificates for process pressure containing components, parts welded directly to pressure containing components, pressure retaining components, impellers, shafts and lifting points.

Justification

This requirements clarifies the type of material certificate that is required for certain pump components.

Replace second sentence with

Material certificates for components exposed to sour service shall confirm compliance with NACE/ISO MR0175/ISO 15156 (all parts) or NACE/ISO MR0103/ISO 17945 in accordance with the data sheet.

Justification

This requirements clarifies the details that are required to be included on the material certificates for material items in sour service.

6.12.2 Castings

6.12.2.3

Add to section

Major weld repairs shall be documented with repair procedures, weld maps and weld repair reports.

Justification

Purchaser requires evidence that major weld repairs have been undertaken to the correct standard

Add to section

Castings shall be heat-treated after major weld repairs according to the applicable material standard.

Justification

Repaired material shall be heat treated for strength and integrity.

Add to section

Heat treatment shall be performed after minor weld repairs when specified in the applicable material standard.

Justification

Want to avoid the use of heat treatment to only where specified in a material standard or where agreed.

6.12.2.5Replace section with

Casting repairs made in the vendor's shop shall be carried out in accordance with a weld repair procedure compliant with the component material specification.

Justification

The workgroup decided to remove the "If specified", a detailed weld repair procedure will ensure that any repairs to high quality.

Add to section

For major repairs as defined in 3.1.70, the vendor shall prepare for submittal to the purchaser for approval, documentation including weld repair maps showing the location and dimensions of weld repair cavities, qualification records, drawings, photographs, heat treatment detail, non-destructive examination requirements and other specified documents.

Justification

Major weld repairs are required to be defined so the vendor understands when they should be providing the required information for any particular repairs.

6.13 Nameplates and Rotation Arrows**6.13.2**Add new list item m)

m) year of manufacture,

Justification

It is agreed by workgroup that year of manufacture should be included on the nameplate.

Add new list item n)

n) shaft lift (for vertical pumps).

Justification

It is agreed by workgroup that shaft lift should be included on the nameplate.

7 Accessories

7.1 Drivers

7.1.3

Replace section with

For drive-train components that have a mass greater than 220 lb (100 kg), the equipment feet shall have vertical jackscrews.

Justification

It is agreed by the work group that components over 100kg should have jackscrews in order to facilitate alignment

Add to section

When jackscrews are not fitted, a clearance of at least 2 in. (50 mm) shall be provided by the vendor under the driver for the use of a hydraulic jack.

Justification

This is to aid the movement of heavy components on the pump skid

7.1.5

Replace second sentence with

An overload of 10 % above the motor rated power at the pump rated duty point shall be applied during the test period when required for pump maximum power and motors with VSD drives.

Justification

This is requirement ensures that alternative conditions such as a higher percentage than API requires, the pump maximum power, or motors with VSD drives can be tested.

Add to section

During shop testing, when the contract motor is used, the motor rating shall not be exceeded without purchaser's approval.

Justification

It is the purchaser's responsibility to decide what risk to the motor there could be if operated above rated power during testing.

7.1.7

Replace section with

For offshore applications when the power generation is in island mode during pump start-up, the motor driver starting torque capability at 80 % motor voltage shall exceed the speed-torque requirements of the driven equipment by at least 10 % of the required torque along all points on the driven equipment speed-torque curve.

Justification

It was decided by the workgroup that additional requirements are needed to what is stated in the API for pump and motor testing. This is particularly applicable for offshore applications when the power generation is in island mode.

7.1.8

Add to section

For vertical pumps, the vendor shall shop mount, align and match mark the motor.

Justification

Matchmarking enables the the motor to be re-mounted in correct position when it is removed.

7.2 Couplings

7.2.2

Add to list item g)

Couplings shall be balanced to ISO 21940-11, grade G6.3 or a more stringent balance grade.

Justification

Balance has been decided by the workgroup as the minimum acceptable level required for balancing

7.3 Guards

7.3.2

7.3.2.1

Delete "If specified,"

Justification

If specified is removed as it allows acceptable coupling guard non-sparking material requirements to be incorporated in the data sheet.

7.4 Baseplates

7.4.8

Replace sentence with

Prior to mounting the equipment, the vendor shall perform an internal verification to ensure that the baseplate meets the flatness requirements while supported at the foundation bolt holes only.

Justification

The purchasers needs to be confident that the baseplates will be delivered to site with required flatness, this requirement only requires the check to be done by the vendor.

7.4.14

Replace sixth sentence with

Every bulkhead section of the baseplates shall have in the corner a vent hole at highpoint corners at least 0.5 in. (13 mm) in diameter.

Justification

Workgroup experience is that vent holes at corners provide better locations for venting when filling with grout.

Add new section

7.4.25

7.4.25.1

The baseplate shall have two grounding lugs located at diagonally opposite corners.

Justification

Grounding lugs are required for equipment and personnel safety

7.4.25.2

The baseplate grounding lugs shall have ½ in. (13 mm) brass studs, nuts and washers.

Justification

Grounding lugs are required for equipment and personnel safety

7.5 Instrumentation

7.5.2 Auxiliary Process Liquid Piping

7.5.2.2

Replace first sentence with

For equipment with hydrodynamic bearings (sleeve radial bearing and anti-friction thrust bearing), provision shall be made for mounting two radial-vibration probes in each bearing housing.

Justification

This allows the fitting of probes to monitor radial vibration and axial position.

Add after first sentence

Probes shall be located so that any spill is avoided during probe change out.

Justification

This avoids potential oil spillage during probe installation and change-out.

7.6 Piping and Appurtenances

7.6.1 General

7.6.1.6

Delete "If specified,"

Justification

A single inlet and outlet connection reduces hook-up costs during installation

Add new section

7.6.1.9

Tubing shall not be used for process wetted systems, with the exception of secondary seal plans.

Justification

Piping for process wetted systems provides better integrity than tubing

Add new section

7.6.1.10

Brackets and supports welded on the mechanical equipment or on the baseplate shall have full length welds.

Justification

Stitch welding is considered to be less reliable than full length welds

7.6.2 Auxiliary Process Liquid Piping

7.6.2.4

Add to section

The orifice plate shall be removable and flat.

Justification

This requirement reduces time and cost of maintenance.

Add to section

Restriction orifices shall have the size and orifice tag number stamped on the upstream side of the orifice tab.

Justification

This allows easy identification of orifice plates reducing the risk that the wrong orifice plate is installed, and allows this ease of checking that the orifice is installed in the correct direction.

7.6.2.6

Replace first sentence with

Threaded vent and drain connections shall not be permitted.

Justification

Flanged connections are considered more reliable than threaded connections

7.6.2.8

Replace second sentence with

Unions shall not be used.

Justification

Socket welded unions are not as reliable as flanged connections

8 Inspection, Testing and Preparation for Shipment**8.1 General****8.1.5**

Replace section with

Prior to release for shipment, the purchaser's and vendor's representative's shall mutually agree compliance in accordance with an inspector's checklist (e.g. that provided in Annex E) by initialling and dating the completed checklist.

Justification

The inspectors checklist shall be mutually agreed in order to improve the quality of the equipment delivered

8.2 Inspection**8.2.2 Pressure Casing and Process Piping Materials Inspection****8.2.2.6**

Table 14—Pressure Casing and Process Piping Material Inspection Requirements

Add rows “Fabricated casing welds” and “Casing attachment welds”

Type of Component	Requirements by Inspection Class ^{a, g}		
	I	II	III
Fabricated casing welds	VI	VI, plus MT or PT	VI, plus MT or RT (100 %)
Casing attachment welds	VI	VI, plus MT or PT	VI, plus MT or PT

8.2.2.7

Replace first sentence with

When sour service is specified, the hardness of parts, welds and heat-affected zones shall be verified as being within allowable values by testing.

Justification

This requirement removes this if specified statement in the API 610 specification. The workgroup has decided that hardness testing shall be undertaken if sour service is specified on the datasheet.

8.2.2.8

Delete "If specified," from first sentence

Justification

This requirement removes this if specified statement in the API 610 specification. The workgroup has decided that PMI shall be undertaken for pressure boundary parts.

8.3 Testing

8.3.1 General

Replace first sentence with

The vendor shall submit to the purchaser the detailed procedures for all running tests and all specified optional tests.

Justification

This mandates the optional requirement to provide testing procedures for review.

8.3.2 Hydrostatic Test

8.3.2.2

Add to section

The test shall be conducted after completion of case machining, except when the requirements of 8.3.2 apply.

Justification

This ensures that all machining is complete before testing and reduces the risk of installation of leaking equipment.

8.3.2.10

Replace second paragraph with

Areas that require machining after hydrostatic testing shall be identified on the hydrotest report that is submitted to the purchaser prior to the start of post-hydrostatic test machining.

Justification

The hydrotest report shall be reviewed and accepted by the purchaser prior to hydrostatic test post machining.

8.3.2.12

Replace first sentence with

All pump pressure-containing parts shall be tested to the same pressure.

Justification

This requirement is to ensure robustness of pump design.

Add new section

8.3.2.17

Any repairs required after the hydrostatic test shall be subjected to the purchaser's approval.

Justification

The workgroup have agreed that the purchaser should be able to approve pumps repairs so that the manufactured pump is robust

8.3.3 Performance Test**8.3.3.1**

Add to section

The spare rotor purchased with the main equipment shall undergo the same performance test and mechanical running tests as the main equipment.

Justification

The spare rotor shall be performance tested to ensure correct function during operation.

Add to section

The vendor shall provide the spares required for testing of the spare rotor (e.g. gaskets, O-rings).

Justification

To ensure that the cost of spares are included.

8.3.3.2**8.3.3.2.2**

Add to section

Containment seal and quench drains shall be open or unplugged during the performance test.

Justification

This is to ensure that the mechanical seal operating correctly.

Add new section**8.3.3.2.8**

Pumps specified for oil mist lubrication shall have running tests performed whilst using the vendor's oil mist supply system.

Justification

The requirement adds clarity for testing of pumps with oil mist lubrication.

8.3.3.3**8.3.3.3.1**

Delete "If approved by the purchaser,"

Justification

This requirement mandates that substitute seals may be used for the performance testing, this protects the contract seals.

Add to section

The vendor shall use either the job or the shop buffer/barrier system during bare-shaft pump performance test.

Justification

This reduces the complexity and cost of the performance test

8.3.3.3.2**Replace section with**

When leakage during test is over the limit specified in the test procedure, the assembled pump and seal shall be re-tested to demonstrate satisfactory seal performance.

Justification

This amends existing API requirement so that as all mechanical seals are required to leak a small amount of fluid to function correctly.

8.3.3.4**8.3.3.4.3****Add to section**

For pumps operating in the parallel, the performance test shall confirm that each pump has the same shut off head within a tolerance of $\pm 3\%$.

Justification

This test proves that the pumps have been manufactured similarly enough that they can be controlled in parallel

Add to section

For pumps operating in parallel, the head values of the pumps shall be equal ($\pm 1.5\%$) at all points on the curve from 80 % to 110 % of BEP.

Justification

This test proves that the pumps have been manufactured similarly enough that they can be controlled in parallel

8.3.3.4.6

Delete "If specified,"

Justification

This is a decision bullet, the workgroup agreed that curves and test data shall be submitted prior to shipment so that any problems can be rectified at the manufacturers works.

8.3.3.6

Replace first sentence with

Bearing temperatures, i.e. bearing metal, or bearing housing, and bearing oil temperatures, i.e. oil sump, shall be measured and recorded throughout the test.

Justification

Bearing oil temperatures shall be recorded and reviewed to ensure that they are not excessively high.

Replace second sentence with

Where supplied, the contract temperature detectors shall be used during the test.

Justification

This is to ensure that the temperature detectors are functioning correctly.

Delete third sentence

Justification

This sentence is deleted because the requirement is generally captured in sentence 1

8.3.3.7

Add to section

When specified, for vertical submerged pumps, the performance test shall be conducted with the pumps operated at minimum submergence.

Justification

The original requirement did not cover testing for vertical pumps, this is also an "if specified statement similar to 8.3.3.7 of API 610 12th edition.

8.3.3.8

8.3.3.8.1

Add to section

When the impeller(s) are required to be modified after the performance test to achieve the hydraulic performance by under filing, over filing, V-cutting or any similar technique, a drawing detailing the modification shall be submitted for purchaser's approval.

Justification

If under filing, over filing, or V-cutting is used to for modification full documentation is required to be submitted firstly in order to approve that kind of modification and secondly so that if the impeller has to be re-ordered in future it is possible to manufacture that exact same impeller to give the same performance.

Add to section

When the impeller is to be modified, the vendor shall submit full proposals for retesting the pump.

Justification

Any modified impeller should be retested to ensure that it meets the design criteria.

8.3.3.8.2

Add to section

If a retest is performed, the rotor shall be rebalanced prior to retest in accordance with 9.2.4.2.

Justification

Rebalancing ensures the rotor stable operation when in service.

8.3.4.2 Mechanical Run Test

8.3.4.2.1

Delete "If specified."

Justification

This mandates the requirement for bearing oil stabilization testing. This test ensures that the bearing oil system is functioning correctly.

Add after first sentence

Pumps shall be run on the test stand at the rated flow and the pressure, power, speed, filtered and unfiltered vibration, lube oil parameters (flow, temperature, and pressure) and bearing temperature measured and recorded at intervals of 15 minutes for at least 1 hour.

Justification

The requirement provides confidence that the pumps has been mechanically tested to meet operational requirements

Add to section

Mechanical run test parameters shall also conform to the requirements specified in 8.3.3.6.

Justification

This is to ensure the pump is fully tested during the mechanical run test.

8.3.4.3 NPSH required test**8.3.4.3.1****Replace section with**

If specified, the pump shall be given an NPSH required test or submergence test (vertical submerged type pumps) in accordance with HI 14.6 or ISO 9906 except with the additional requirements of this standard.

Justification

This amendment to the requirement adds the submergence test for vertical pumps.

8.4 Preparation for Shipment**8.4.3****8.4.3.1****Replace first sentence with**

Axial movement of rotors with no thrust bearings shall be blocked.

Justification

This is to protect the rotor whilst in transit.

Add to section

Axial and radial movement of rotors with hydrodynamic bearings shall be blocked.

Justification

This is to protect the rotor whilst in transit.

8.4.3.7**Add to section**

Threaded openings that are normally plugged during service shall be fitted with full rating plugs in accordance with ASME B16.11.

Justification

Stainless steel plugs are required to maintain integrity of sealing during delivery and storage on site before commissioning. ASME B16.11 contains dimensional and technical requirements for the correct supply of plugs.

9 Specific Pump Types

9.2 Between-bearings Pumps (Types BB1, BB2, BB3 and BB5)

9.2.5 Bearings and Bearing Housings

Add new section

9.2.5.5

On multi-stage pumps, bearing housings shall be doweled after verification of stuffing box runout.

Justification

Dowelling the pump bearing housing will help to maintain its correct position.

9.2.7 Testing

9.2.7.4

Delete "If specified,"

Justification

Baring inspection shall ensure correct functioning and that there are no wear areas

9.3 Vertically Suspended Pumps (Types VS1 Through VS7)

9.3.3 Rotors

9.3.3.2

Add to section

The shaft of vertical pumps shall not be less than 1 in. (25 mm) in diameter.

Justification

Minimum diameter ensures shaft stability during operation.

9.3.6 Bushings and Bearings

9.3.6.1

Add to section

Vertical pump bushings shall not shrink or swell when the pump is operated with no lubrication during start up (dry column) or during periods of standby.

Justification

For correct operation of the pump bushings shall maintain their size during the specified conditions.

9.3.8 Accessories**9.3.8.3 Mounting Plates****9.3.8.3.1**Add to section

The mounting plate shall be continuously welded to the outer casing on both sides.

Justification

This is to ensure integrity of connection between pump casing and mounting flange.

Add to section

The mounting plate shall be machined on its bottom surface to align with the sole plate.

Justification

This is to ensure that the pump will be correctly aligned when it is installed.

Add to section

Shims shall not be used between the bottom of the mounting plate and the top of the sole plate.

Justification

Shims could lead to misalignment.

9.3.8.3.2Delete "If specified,"**Justification**

Separate sole plate facilitates easier installation of the pump.

Add after first sentence

The bottom of the sole plate shall be blasted and prepared for epoxy grout.

Justification

The sole plate is prepared in case of onshore installation.

Add to section

The sole plate shall have four levelling screws located adjacent to each holding down bolt hole.

Justification

Levelling screws facilitate correct pump alignment.

9.3.9 Testing

9.3.9.1

Replace second sentence with

When a reduced length test is agreed upon, the length of the pump shall include at least two lineshaft bearings.

Justification

This is to provide the required stability to the shaft during operation.

9.3.13 Double-casing Diffuser (VS6) and Volute (VS7) Pumps

9.3.13.2

Replace section with

Complete outer-case venting shall be ensured by means of a DN25 (NPS 1) minimum flanged high-point vent connection.

Justification

The 1 inch connection ensures that venting will occur quickly prior to starting for VS6 and VS7 vertical pumps.

9.3.13.3

Replace section with

Complete venting of the inner assembly within the seal chamber or associated auxiliary process piping shall be ensured by means of a DN15 (NPS ½) minimum flanged high-point vent connection.

Justification

The 1/2 inch connection ensures that venting will occur quickly prior to starting for VS6 and VS7 vertical pumps.

9.3.13.4

Replace section with

The suction can shall have an internal drain piped to the surface and terminating with a DN 25 (NPS 1) minimum flanged connection.

Justification

A large drain is required to allow draining and to dispose of sluggish materials that can accumulate at the bottom of the pump.

Add to section

The internal drain pipe shall have means for removal from the underside of the discharge head.

Justification

Removal of the drain pipe facilitates easier pump maintenance.

Add new section

9.3.13.7

Bowls shall be flanged and shall have metal-to-metal rabbeted fits.

Justification

This may not be industry standard requirement. This is to ensure that all OEM's provide flanged bowls with metal-to-metal rabbeted fits.

10 Vendor's Data

10.1

Replace first sentence with

The contents of IOGP S-615L and Annex L shall be used to define requirements for proposals, contract documentation and vendor data content.

Justification

API VDDR requirements are replaced with the IOGP IRS.

10.2

Delete "If specified,"

Justification

Annex L is an informative Annex and used to be section 10 in the 11th edition of API 610. This mandates that vendor data is required to be provided with the purchase of a pump package.

Annex L (informative) Contract Documents and Engineering Design Data

L.2 Proposals

L.2.2 Drawings

L.2.2.1

Replace "vendor drawing and data requirements (VDDR)" with

IRS (IOGP S-615L)

Justification

API VDDR requirements are replaced with the IOGP IRS.

L.2.3 Technical Data for Proposal

L.2.3.2

Add new list item r)

r) test procedure for vertical pumps that cannot be tested completely assembled.

Justification

Purchaser would like to understand at the bid stage how large vertical pumps will be tested.

L.3.1 General

L.3.1.1

Replace "agreed VDDR form (see Figure L.1 for example form)" with

IRS (IOGP S-615L)

Justification

API VDDR requirements are replaced with the IOGP IRS.

L.3.1.3

Replace "VDDR form" with

IRS (IOGP S-615L)

Justification

API VDDR requirements are replaced with the IOGP IRS.

L.3.2 Drawings and Technical Data

Replace "agreed VDDR form" with

IRS (IOGP S-615L)

Justification

API VDDR requirements are replaced with the IOGP IRS.

L.3.4 Parts Lists and Recommended Spares

Add new section

L.3.4.7

For antifriction bearings, the spare parts list shall include full bearing designation number with appropriate suffixes that clearly indicate the bearing type, size, cage type, and selected internal clearance or pre-load.

Justification

This defines the data to be provide spare parts of antifriction bearings. Note that this information is not currently requested in Annex L.

L.3.5 Installation, Operation, Maintenance and Technical Data Manuals

L.3.5.1 General

L.3.5.1.2

In first sentence, replace "VDDR" with

IRS (IOGP S-615L)

Justification

API VDDR requirements are replaced with the IOGP IRS.

In second sentence, replace "VDDR" with

the IRS (IOGP S-615L)

Justification

API VDDR requirements are replaced with the IOGP IRS.

Figure L.1—Example Distribution Record

Delete Figure L.1

Justification

API VDDR requirements are replaced with the IOGP IRS.

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