International Association of Oil & Gas Producers

SPECIFICATION

IOGP S-615

January 2023

Version 2.0

REDLINE

Version 2.0 to Version 1.0

Supplementary Specification to API Standard 610 for Centrifugal Pumps

JIP33 JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
2.0	January 2023	Second Edition
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).

Disclaimer

Copyright notice

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 2019.

Due to technical writing requirements leading to extensive changes, this second edition should be treated as a new document.

ABOUT THE REDLINE VERSION

This Redline version aims at comparing Version 2.0 to Version 1.0 but may not capture all changes.

The Redline version is not a specification document. It is a mark-up copy provided for information only. The user must refer to the official published version.

Table of Contents

List of Tables

List of Figures

Introduction

The purpose of this specification is to define a minimum common set of ~~supplementary~~ requirements for procurement of centrifugal pumps in accordance with ~~ANSI/~~API Standard 610, 1~~1~~2th Edition ~~September 2010~~, January 2021, Centrifugal Pumps~~, which is an identical adoption of ISO 13703:2010 with the same title,~~ for Petroleum, Petrochemical, and Natural Gas Industries for application in the petroleum and natural gas industries.

~~This JIP33 standardized procurement~~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

~~It~~This specification is ~~required~~ to ~~use all of these documents~~be applied in conjunction with ~~each other when applying this specification,~~ the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows~~:~~.

IOGP S-615: Supplementary ~~s~~Specification to ~~ANSI/~~API Standard 610 for Centrifugal Pumps

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to ~~ANSI/~~API Standard 610, following the API clause structure ~~of the parent standard, to assist in cross-referencing the requirements. Where clauses~~. Clauses from ~~the parent standard (ANSI/~~API Standard 610~~) are~~ not ~~covered in this specification, there are no supplementary requirements or modifications to the respective clause. The terminology used within~~amended by this specification ~~follows that of~~ apply as written to the ~~parent standard and otherwise is in accordance with ISO/IEC Directives, Part 2~~extent applicable to the scope of supply.

Modifications to ~~the parent standard~~API Standard 610 defined in this specification are identified as Add (add to clause or add new clause), Replace (part of or entire clause) or Delete.

IOGP S-615D: Procurement Data ~~s~~Sheet ~~s~~ for Centrifugal Pumps (API)

~~This document provides project~~The procurement data sheet defines application specific requirements ~~where the supplementary~~, attributes and options specified by the purchaser for the supply of equipment to the technical specification ~~and its parent standard require the purchaser to define an application specific requirement. It~~. The procurement data sheet may also ~~includes~~ include fields for supplier provided information ~~required by the purchaser for~~ attributes subject to purchaser's technical evaluation.

Additional purchaser supplied documents ~~are~~may also ~~listed on~~be incorporated or referenced in the procurement data sheet~~s,~~ to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-615L: Information ~~r~~Requirements for Centrifugal Pumps (API)

~~This document~~The IRS defines the information requirements, including contents, format, timing and purpose~~, for information~~ to be provided by the ~~vendor~~supplier. It may also ~~defines the~~define specific conditions which ~~must be met for conditional~~invoke information requirements ~~to become mandatory. The information requirements listed on the IRS have references to the source of the requirement.~~ .

IOGP S-615Q: Quality ~~r~~Requirements for Centrifugal Pumps (API)

~~This document includes a~~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) ~~which specifies standardized user interventions against quality management activities at four different levels.~~levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser ~~on~~in the data ~~sheets~~sheet or in the purchase order.

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

~~Unless defined otherwise in the purchase order, the~~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 sheet~~s~~, IRS, QRS);

d) this specification;

e) ~~the parent standard~~API Standard 610.

1 Scope

Add ~~after second paragraph~~to section

This specification does not apply to all pumps ~~and,~~ services and auxiliaries within the scope of ~~ANSI/~~API ~~Std~~ 610. The ~~scope excludes the~~ following~~:~~ ones are excluded from this specification.

a) ~~t~~Types:

- OH4, BB4 and BB5 pumps;
- single volute overhung pumps requiring a driver rated in excess of ~~112 kW (~~150 HP (112 kW);
- overhung pumps with two or more stages;
- double suction overhung pumps~~;~~ .

b) ~~s~~Services:

- pumps in cryogenic services ~~[< -~~(less than -148 °F (-100 °C ~~(-148 °F)];~~));
- pumps in multi-phase (liquid, gas, solid) service.

c) ~~a~~Auxiliaries:

- pumps with drivers ~~> 1 000kW (1 340~~ (greater than 1475 HP~~);~~ (1100 kW));
- pumps with ~~ANSI/API Std 614 force feed~~ pressure-lubrication systems~~.~~ (force feed).

2 Normative ~~r~~References

~~*Delete from clause*~~

~~*ISO 1940-1 Mechanical vibration — Balance quality*~~*Add to start of section*

The following publications are referred to in this document, the procurement data sheet (IOGP S-615D) or the IRS (IOGP S-615L) in such a way that some or all of their content constitutes requirements ~~for rotors in a constant (rigid) state~~of this specification.

Add to section

ASME B1.20.1, *Pipe Threads, General Purpose, Inch*

EN 10204, *Metallic products - Types of inspection documents*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads* — *Part 1:* ~~Specification and verification of balance~~*Dimensions,* *tolerances* *and designation*

ISO ~~9906 Rotodynamic pumps — Hydraulic performance acceptance tests~~

~~ISO 21049:2004 Pumps — Shaft sealing systems for centrifugal and rotary pumps~~

~~ANSI/HI 1.6 Centrifugal Tests~~

~~*Add to clause*~~

~~ISO 9906 Rotodynamic pumps — Hydraulic performance acceptance tests - Grades 1, 2 and 3 -~~ 228-1, *Pipe threads where pressure-tight joints are not made on the threads*~~Second Edition~~

ISO 21940-11 Mechanical vibration — Rotor balancing — *Part* 11: Procedures and *1: Dimensions, tolerances* for rotors with rigid behaviour*and designation*

ANSI/API Std 682 Pumps — Shaft sealing systems for centrifugal and rotary pumps

ANSI/HI 14.6 Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

ISO 10474, *Steel and steel products — Inspection documents*

ISO 80079-36, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements*

Delete from section

EN 13463-1, *Non-electrical equipment for use in potentially explosive atmospheres—Part 1: Basic method and requirements*

3 Terms, Definitions, Acronyms, and definitionsAbbreviations

3.1 Terms and Definitions

3.22 maximum discharge pressure

Replace subclause with

maximum discharge pressure is 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;
- the rated impeller diameter at the trip speed for variable speed applications

3.23 maximum dynamic sealing pressure

Replace fifth sentence of note with

See ANSI/API Std 682.

3.24 maximum operating temperature

Replace second sentence of note with

See ANSI/API Std 682.

3.43 pressure casing

Replace subclause 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

3.1.40
observed

Delete term 3.1.40

3.1.46
pressure casing

In definition, replace "connections" with

process-liquid piping permanently attached to the pump casing

Replace NOTE with

NOTE The atmospheric side of the seal gland, the seal quench (piping) plan, auxiliary piping and valves not permanently attached to the pump casing are not part of the pressure casing.

3.1.68
witnessed

Replace definition with

Point, in the chain of activities, at which the supplier notifies the purchaser or purchaser's representative before the operation or process.

NOTE The operation or process may proceed without witness if the purchaser does not attend after the agreed notice period.

Add new term 3.1.69

3.1.69
extremely hazardous service
Service with process fluids that are defined by the applicable national codes and standards or by the purchaser or process licensor as extremely hazardous.

Add new term 3.1.70

3.1.70
major weld repair
Weld repair where castings have leaked on hydrostatic test, the depth of the cavity after preparation for repair exceeds 20 % of the actual wall thickness, or 1 in. (25 mm), whichever is smaller, or where the extent of the cavity exceeds 10 % of the surface area or 10 in.^{2} (65 cm^2), whichever is smaller.

NOTE Repairs that do not comply with these criteria are minor repairs.

Add new term 3.1.71

3.1.71
unless otherwise specified
Statement indicating that the default requirement is applied unless the owner specifies otherwise.

NOTE This is intended to prevent a specification change or deviation without proper consent by the owner when the order is issued by one of their agents (i.e. by a contractor).

~~5 Requirements~~

~~5.1 Units~~

~~*Replace subclause with*~~

~~The units required for all vendor's documentation shall be as per the data sheet units. However, piping dimensions shall be in accordance with ANSI.~~

6 Basic ~~d~~Design

6.1 General

6.1.1 Equipment Reliability

6.1.1.1

Add to ~~subclause~~section

~~Only equipment of proven reliability with equivalent design features to the units proposed and operating in similar service conditions shall be included in the vendor's proposal. Prototypes shall not be proposed. The vendor shall confirm that the quoted equipment (including pump, driver and gear) design is proven and demonstrate experience of 24 000 operating hours with the same equipment in at least three similar installations by providing the related necessary evidence.~~

The vendor's proposal shall provide details of at least two units of the equipment model, offered from the proposed point of manufacture, having comparable power and power per stage, speed, operating and design pressures, operating and design temperatures, pumped fluid, installation location (onshore/offshore) and environment, that have been delivered between 5 and 15 years ago.

6.1.~~4~~1.2

Delete "If specified,"

6.1.5

Add to ~~subclause~~section

~~For fixed speed pumps, the proposed rated impeller diameter for pumps with constant speed drivers shall be not be greater than 95 % or less than 80 % of the maximum impeller diameter that can be installed in the pump casing.~~

For pumps with variable speed drives, the ~~impeller diameter giving the maximum efficiency~~pump, motor and variable speed device shall be selected~~. If this results in the~~ to give the maximum overall unit efficiency.

Add to section

For pumps with variable speed drives, when the selected impeller ~~diameter being the~~is of maximum size for the ~~chosen~~ casing, ~~then~~ the driver and pump shall be capable of ~~the~~a speed increase necessary to give a 5 % increase in head ~~(per subclause 6.1.4 of ANSI/API Std 610) and to correct any head shortfall during testing, including the -3 % tolerance allowed by Table 16 of ANSI/API Std 610~~.

6.1.~~7~~11

Replace second sentence ~~of second paragraph~~ with

~~During operation, the seal chamber pressure shall be at least a gauge pressure of 35 kPa (0,35 bar; 5 psi); see ANSI/API Std 682.~~

~~6.1.9~~

~~Replace subclause with~~

~~The pump suction-specific speed shall be calculated in accordance with Annex A of ANSI/API Std 610.~~ With the exception of OH6 type pumps, suction-specific speed values shall not exceed ~~213 m³/s, rpm, m (11 000 gpm~~12000 usgpm, rpm, ft~~). Suction-specific speed values higher than 213 m³/~~ (232 m³/s, rpm, m ~~(11 000 gpm, rpm, ft) may be accepted if the vendor can demonstrate proven experience of at least 3 years of operation at similar operating conditions such as NPSH margins and percentage of operating point to BEP.~~).

~~Pumps with~~ Add to section

With the exception of OH6 type pumps, suction inducers ~~may~~ shall not be ~~considered if~~used unless approved by ~~purchaser. In which case~~ the ~~vendor shall:~~owner.

~~clearly indicate that the proposed pump includes a suction~~ Add to section

~~–~~ When an inducer~~;~~

~~–~~ ~~state~~ is provided, the suction-specific speed shall be stated for the impeller only~~;~~.

~~–~~ *~~clearly show~~Add to section*

A suction side restriction ring, i.e. bull ring, located near the ~~allowable operating region on~~impeller eye to reduce suction recirculation shall not be used.

6.1.13

In list item c), replace 3 % with

2 %

6.1.14

Add to section

Discharge orifices shall only be used when accepted by the owner.

Add to section

When a pump with a discharge orifice is proposed, the pump predicted performance curve with the orificed pump performance curve overlaid shall be included in the vendor's proposal.

6.1.~~10~~15

~~Add to subclause at end of first paragraph~~

~~The proposal and final test curves for pumps in viscous service shall also include:~~

– the expected performance curves with Delete "If specified viscous product;,"

– the maximum expected absorbed powers based on a cold viscous start up and normal viscous operation.

6.1.11

Replace subclause with

Pumps that have stable head versus flowrate curves (continuous head rise to shutoff) are required for all applications. Add to section

The head rise from rated point to shutoff shall be at least 10 %. If a discharge orifice is required as a means of providing a continuous rise to shutoff, this shall be subject to purchaser's approval. Where offered, the vendor shall furnish full performance curves for the pump with and without the orifice installed.

A% for an individually operated pump suction side restriction ring, commonly known as a "Bull Ring" is not allowedthat is not flow controlled.

6.1.24

Add to subclause

Any non-rotating maintenance part weighing more than 25 kg shall be supplied with an appropriately located tapped hole to fit a removable lifting eye.

6.1.2822

Add to subclause

For floating applications, the vendor shall state the maximum inclination and time period of oscillation at which the pump can operate.

6.1.29 Bolting and threads

6.1.29.1

Replacebefore first sentence with

The details of threading shall conform to ISO 261, ISO 262, ISO 724, ISO 965 (all parts), ANSI/ASME B1.1 or other internationally standardized threading.

Add new subclause

6.1.35

Any requirement for instantaneous start-up shall be specified on the data sheet.

Add new subclause

6.1.36 Warm upPump lubricating oil and cool down

The vendor bearing temperatures shall specify onnot exceed the data sheet details of a separate warm-up (or cool-down) line, if required, to achieve instantaneous start-up of the pump with the pumping temperatures indicated on the data sheet. If an instantaneous start-up is not possible under any circumstances, the vendor shall make provisions to ensure that rapid heat-up does not damage the pump, accessories, or seals. The vendor shall submit the warm-up (or cool-down) procedurelimits specified in 6.10.2.7.

Add to section

Pumps with fan cooling, wet sump lubrication and pumping temperatures over 500 °F (260 °C) shall have provision for one of the following:

a) external oil circulation system;

b) bearing housing cooling coil;

c) bearing housing water jacket.

Add to section

The bearing housing connections for external oil circulation systems, bearing housing cooling coils or bearing housing water jackets shall be plugged unless cooling is required.

Add ~~new subclause heading~~to section

~~**6.1.37 Insulation and heat tracing**~~

~~*Add new subclause*~~

When provision for connecting an external oil circulation system is ~~6.1.37.1~~

~~If~~ specified, ~~personnel protection hot insulation~~the oil return connection shall be ~~applied to all parts that are exposed to contact with persons during control and routine maintenance operations.~~

~~*Add new subclause*~~

~~**6.1.37.2**~~

~~If specified, frost protection or wax formation protection heat tracing and insulation shall be applied to all necessary parts~~aligned with the normal sump oil level to maintain ~~all the equipment in its normal operating state when the pump is on standby.~~

~~*Add new subclause*~~

~~**6.1.37.3**~~

~~Where such insulation is required, insulation shall comply with the requirements specified on the data sheet. The vendor shall provide sufficient stand-offs and clearance from the insulated surface throughout for pipe flanges, valves and all instrument equipment to allow the fitment of the insulation and access for maintenance. Surface coatings under insulation shall comply with the requirements specified on the data sheet.~~

~~*Add new subclause*~~

~~**6.1.38**~~

~~All equipment installed~~proper oil level in ~~a hazardous area shall be certified for use in explosive atmospheres in accordance with applicable regulatory requirements.~~ the sump.

6.3 Pressure casings

6.3.1.31

Replace subclause with

The maximum discharge pressure is defined in 3.22.

NOTE The basis of determining maximum discharge pressure is an application issue.

6.3.5

Replace paragraph after note 2 with

The pump-seal chamber and seal gland shall have a pressure-temperature rating at least equal to the maximum allowable working pressure and temperature of the pump casing to which it is attached, in accordance with subclause 3.1.52 of ANSI/API Std 682:2014.

6.3.6

Replace subclause with

All parts referred to in the definition of pressure casing shall have the same MAWP.

6.3.10

Replace third sentence of note with

ANSI/API Std 682 specifically requires O-ring gaskets on low temperature [< 175 °C (350 °F)] pressure-seal gland plates.

6.3.11

Add to subclause

Centreline or near centreline supported pumps operating above 204 °C (400 °F) shall have a casing guide or key slot along the centreline and at each support pedestal. 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.

6.4 Nozzles and pressure casing connections

6.4.1 Casing opening sizes

6.4.1.2

Add to subclausesection

Drain connections of pumps handling fluids with a viscosity ≥ 400 cP, or products with higher than ambient pour point temperature, or slurries shall be DN25 (NPS 1) minimum and shall be free draining.

~~6.4.2 Suction and discharge nozzles~~

~~6.4.2.1~~

Non-rotating maintainable parts weighing more than 51 lbs (23 kg) shall feature provisions for the attachment of lifting accessories for safe mechanical lifting.

~~*Replace second sentence with*~~

~~All pumps shall have suction and discharge flanges of equal rating.~~

~~6.4.3 Auxiliary connections~~

~~6.4.3.1~~

6.1.36

Add to ~~subclause~~section

For floating applications, the proposed design shall conform to the specified vessel motion design criteria.

Add to section

Unproven design variations necessary to meet the specified vessel motion design criteria shall not be proposed.

6.1.37 Bolting and Threads

6.1.37.1

In first sentence, add after "ISO 261"

or another equivalent international standard

Add new section

6.1.42 Insulation and Heat Tracing

6.1.42.1

When specified, thermal insulation or guarding shall be applied as personnel protection to any part accessible to personnel during operation and maintenance when the non-insulated surface temperature of the part is greater than 140 °F (60 °C) or less than 0 °F (-18 °C).

6.1.42.2

When insulation is applied to the pump, the specified stand-offs and clearances from the insulated surface for pipe flanges, valves and instrument equipment shall be provided throughout.

6.1.42.3

Requirements for heat tracing and/or insulation necessary for the safe and reliable start-up, operation and standby of the pumping unit under the specified process and environmental conditions shall be stated in the vendor's proposal.

Add new section

6.1.43

Pump hydraulic designs utilizing impeller vane machining techniques of underfiling, overfiling, V-cutting or similar shall not be permitted.

Add new section

6.1.44

Pump performance curves and performance data for proposal, acceptance (post order) and as-built (tested) shall be based on running clearances inclusive of applicable additional running clearance allowances for the worst-case temperature, viscosity and material galling tendencies.

6.3 Pressure Casings

6.3.6~~Socket welded connections shall not be used when:~~

~~a) the pump nozzles are Class 900 or above, or;~~

~~b) the minimum pumping temperature is 0 °C (32 °F) or below, or;~~

~~c) the pump is for hazardous service, or;~~

~~d) NACE MR0175 or NACE MR0103 is applicable.~~

~~**6.4.3.10**~~

Add new list item c)

c) for any pump types: 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 with:

1) maximum impeller diameter at the rated speed for constant speed applications;

2) rated impeller diameter at the trip speed for variable speed applications.

Add new list item d)

d) for any pump types: the MAWP as specified by the purchaser.

6.3.8

Replace first sentence with

~~Piping less than DN50 (NPS 2) shall be gusseted~~Pressure casing parts defined in ~~two orthogonal planes to increase~~3.1.46 including suction canister on VS6/VS7 pumps shall have the same MAWP.

Delete second sentence

Delete third sentence

6.3.9

Replace first sentence with

~~rigidity~~HPRT pressure casings parts defined in 3.1.46 shall have the same MAWP.

Delete second sentence

6.3.14

Add to section

Centerline or near-centerline supported pumps operating above 500 °F (260 °C) shall have a guide, key slot or equivalent design feature between the pump and the baseplate at each support pedestal and at the centre of the ~~piped connection, in accordance with~~pressure casing.

Add to section

Centerline or near-centerline supported pumps operating above 500 °F (260 °C) that have four mounting feet shall include the following ~~stipulations.~~:

a) guide, key slot or equivalent design feature between the pump and the baseplate at the non-drive end support pedestals;

b) drive end mounting feet pinned to the support pedestals.

Add to section

Centerline or near-centerline supported pumps operating above 500 °F (260 °C) that have four mounting feet shall have the drive end mounting feet pinned to the support pedestals.

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, products with a higher than ambient pour point temperature or slurries shall be the largest size possible for the proposed pump and at least NPS 1 (DN 25).

6.4.2 Casing Nozzle Connections

6.4.2.1

Delete "One- and two-stage" from second sentence

6.4.3 Auxiliary Connections

6.4.3.1

Add to section

Full penetration butt welds shall be used when any of the following apply.

a) The pump nozzle rating is ASME B16.5, Class 900 and above.

b) The minimum pumping temperature is 32 °F (0 °C) and below.

c) Due to the nature of the pumpage, any of the following apply:

1) pump specified to be in hot service;

2) service classed as any of the following:

i) extremely hazardous;

ii) highly corrosive;

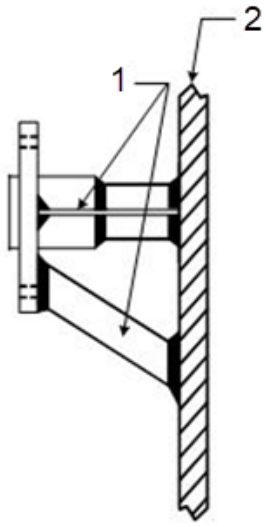
iii) compliant with either NACE MR0175 or NACE MR0103.

6.4.3.10

In first sentence, replace "NPS 1" with

NPS 2 (DN 50)

Replace ~~item c)~~Figure 20 with



~~c)~~

Key

1 Two-plane gusseting (welded to flange)

2 Equipment wall

Figure 20—Typical Gusset Design

In first sentence of list section c), replace "at or near the connection end of the piping" with

on the back of the flange

In second sentence of list section c), replace "pipe" with

back of the flange

Add to list section c)

Gussets shall not ~~be bolted to~~overhang the ~~casing.~~

~~**6.4.3.11**~~

~~*Add to subclause after fifth sentence*~~

~~Plugs that may require subsequent removal or plugs in cast iron casings shall be 316 stainless steel~~flange.

6.6 Rotors

6.6.3

Replace third sentence with

Collets shall not be used in vertical pumps.

Add new ~~subclause~~section

6.6.~~15~~14

~~Impellers with four vanes shall not be provided in double~~6.6.14.1

Double volute pumps~~.~~

~~Add new subclause~~

~~6.6.16~~

~~Repairs to correct machining errors~~ whose impellers have an even number of vanes shall be subject to ~~approval by the purchaser.~~ owner's acceptance.

6.6.14.2

The proposal shall include technical justification illustrating how vane passing pressure pulses and associated vibrations are minimized.

Add new section

6.6.15 Repairs

6.6.15.1

Repairs to machining errors on rotating components shall be subject to owner's acceptance prior to commencement.

6.6.15.2

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

6.6.15.3

Weld repair of shaft shall not be permitted.

6.7 Wear ~~r~~Rings and ~~r~~Running ~~c~~Clearances

6.7.3

In first sentence, replace "locking pins, screws (axial or radial), or by tack welding" with

at least three equally spaced~~6.7.3~~

~~Replace subclause with~~

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

~~6.7.4~~

~~*Replace first sentence with*~~

~~Running clearances shall meet the requirements of 6.7.4 a) to 6.7.4 c). Quoted pump performance and curve shall be based on the clearances used by the vendor after making allowances for any added clearance based on temperature, viscosity and galling tendencies.~~

~~*Add new subclause*~~

~~6.7.5~~

~~Run-out of casing wear rings and casing-to-cover area shall not exceed 50 µm (0,002 in) TIR.~~

Delete second sentence

6.8 Mechanical ~~s~~Shaft ~~s~~Seals

6.8.~~1~~2

~~*Replace subclause with*~~

~~Pumps shall be equipped with mechanical seals and sealing systems in accordance with ANSI/API Std 682. Pump and seal interface dimensions shall be in accordance with Table 7 and Figure 26 of ANSI/API Std 610. The purchaser shall specify the category of seal required. The purchaser should use the datasheets in ANSI/API Std 682 for this purpose.~~

~~The pump vendor shall be responsible for the engineering co-ordination, installation and performance of the mechanical seal and its auxiliary facilities such as circulation, injection, quenching and cooling.~~

~~6.8.2~~

~~*Replace subclause with*~~

~~*The seal cartridge shall be removable without disturbing the driver,* Add to end of sentence~~

except for vertical pumps type~~s~~ OH5 and ~~OH6~~for vertical pumps type OH6 with the motor mounted directly on the pump gearbox.

~~6.8.7~~

~~*Replace second sentence with*~~

NOTE Refer to 9.1.3.2 for vertical pumps.

6.8.11~~Symbols shall be in accordance with those specified in ANSI/API Std 682.~~

~~6.8.11~~

~~*Replace first sentence with*~~

Add after "If specified, "

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

~~6.9 Dynamics~~

~~6.9.2 Torsional analysis~~

~~6.9.2.1~~

~~*Add to end of item c)*~~

~~Transient conditions include short circuit between two phases, start-up and, if specified, re-acceleration. A stress analysis shall be performed for the transient conditions to ensure that shaft end, coupling and drive-component ratings are not exceeded.~~

~~6.9.2.10~~

~~*Replace first sentence with*~~

~~If either a steady-state, damped-response analysis or a transient torsional analysis is performed, the vendor shall furnish a detailed report of the torsional analysis.~~

~~6.9.3 Vibration~~

~~6.9.3.3~~

~~*Replace second sentence with*~~

~~The plotted spectra shall be included with the pump test results.~~

~~6.9.4 Balancing~~

~~6.9.4.1~~

~~*Replace first sentence with*~~

~~Impellers, balancing drums and similar major rotating components shall be dynamically balanced to ISO 21940-11, grade G2.5.~~

~~6.9.4.4~~

~~*Replace first sentence of first paragraph with*~~

~~If specified, impellers, balancing drums and similar major rotating components shall be dynamically balanced to ISO 21940-11, grade G1 (equivalent to 4*WIn* in USC terminology).~~

~~*Replace second sentence of third paragraph with*~~

~~In international standards, unbalance is expressed as a balance quality grade of ISO 21940-11.~~

6.10 Bearings and ~~b~~Bearing ~~h~~Housings

~~**6.10.1 Bearings**~~

~~**6.10.1.1**~~

~~*Replace second paragraph with*~~

~~The bearing type and arrangement shall be selected in accordance with the limitations in Table 10 of ANSI/API Std 610.~~

~~**6.10.1.4**~~

~~*Replace third sentence with*~~

~~Pressed steel cages shall not be used.~~

6.10.2 Bearing ~~h~~Housings

6.10.2.~~4~~7

~~*Replace first sentence with*~~

~~Cooling, including an allowance for fouling, shall be provided to maintain oil and bearing temperatures as follows, based on the operating conditions and the lubrication system design ambient temperature specified on the data sheet:~~

~~*Replace item a) with*~~

~~a) for pressurized systems, unless otherwise specified on the datasheet, oil outlet temperature below 70 °C (160 °F) and bearing metal temperatures (if bearing temperature sensors are supplied) less than 93 °C (200 °F); during shop testing, and under the most adverse specified operating conditions, the bearing-oil temperature rise shall not exceed 28 K (50 °R);~~

~~*Replace item b) with*~~

~~b) for ring-oiled or splash systems, unless otherwise specified on the datasheet, an oil-sump temperature below 82 °C (180 °F); during shop testing, the sump oil temperature rise shall not exceed 40 K (70 °R) above the ambient temperature in the test cell measured at the time of each reading and (if bearing-temperature sensors are supplied) outer ring temperatures shall not exceed 93 °C (200 °F).~~

Add to section

Pump bearing cooling shall not take any credit for the effect of driver cooling air.

~~6.11 Lubrication~~

~~6.11.4~~

~~*Replace subclause with*~~

~~**Grease lubrication shall not be used except for VS4 and VS5 pumps as per subclause 10.2.9.3.12.4 of ANSI/API Std 610. Grease lubrication may be used for OH3 pumps subject to approval by the purchaser.**~~

In NOTE, replace "EN 13463-1" with

ISO 80079-36

6.12 Materials

6.12.1 General

6.12.1.8

Replace first sentence with

ISO 10474/EN 10204 type 3.1 material inspection certificates shall be supplied for the following:

a) process pressure-containing components;

b) parts welded directly to pressure-containing components;

c) process pressure-retaining components (e.g. pressure fasteners);

d) impellers;

e) shafts;

f) all lifting points.

Replace second sentence with

~~O-rings shall be selected and their application limited in accordance with ANSI/API Std 682.~~

~~**6.12ISO 10474/EN 10204 type 3.1.8**~~

~~*Replace subclause with*~~

~~The vendor shall furnish~~ material inspection certificates ~~that include chemical analysis and mechanical properties for the heats from which the material is supplied for the items listed below. Items (excluding lifting points) in sour service shall be supplied with material certificates containing a declaration of conformity~~ to NACE MR0175/ISO 15156 (all parts) or NACE MR0103/ISO 17945 as specified ~~on the data sheet.~~

- ~~all process pressure-containing~~ shall be supplied for components~~, including any material welded directly to them;~~
- ~~all process pressure retaining components;~~
- ~~impellers;~~

~~— shafts;~~

~~— lifting points~~ in wet sour service.

6.12.2 Castings

~~6.12.2.3~~

~~*Add to item a)*~~

~~Weld repairs shall be defined as major when 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 when the extent of the cavity exceeds approximately 65 cm² (10 in²). All other weld repairs shall be considered minor.~~

~~Major weld repairs shall be documented.~~

~~Castings shall be heat-treated after major weld repairs according to the applicable material standard. Heat treatment after minor weld repairs is not required except where specified in the applicable material standard or upon agreement between the vendor and the purchaser.~~

6.12.2.5

Replace ~~subclause~~first sentence with

~~For casting~~Casting repairs made in the vendor's shop ~~, these~~ shall be carried out in accordance with a weld repair procedure compliant with the component ~~ASTM~~ material specification~~. For major repairs as defined in 6.12.2.3, the vendor shall prepare documentation including weld repair maps showing the location and dimensions of weld repair cavities, qualification records, drawings, photographs, heat treatment detail, non-destructive examination~~ or with the requirements ~~and other specified documents shall be submitted for purchaser's approval. The purchaser shall specify if approval is required before proceeding with repair. Repairs made at the foundry level shall be controlled by the casting material~~ of Table 11.

Delete second sentence

Add to section

For major repairs as defined in 3.1.69, repair procedures shall be subject to owner's acceptance prior to any repair commencing.

Add to section

Castings shall be heat-treated following major weld repairs in accordance with the applicable material standard specification ~~("producing specification").~~.

Add new section

6.12.2.7

Repairs to casting machining errors shall be subject to owner's acceptance prior to commencement.

6.12.3 Welding

6.12.3.43

~~Delete from item~~ In first paragraph, replace "d)" with

e)

~~The purchaser shall specify if the following additional examinations shall be performed:~~

~~1) magnetic-particle or liquid-penetrant examination of auxiliary connection welds;~~

~~2) ultrasonic or radiographic examination of any casing welds.~~

Add new list section e)

e) joints, including deck plate to structural members and brackets and supports, shall be continuously seal-welded on both sides or full penetration welded to prevent crevice corrosion.

6.13 Nameplates and ~~r~~Rotation ~~a~~Arrows

~~6.13.1~~

~~Replace subclause with~~

~~A nameplate shall be securely attached at a readily visible location on the equipment (including after any insulation is fitted) and on any other major piece of auxiliary equipment.~~

6.13.2

~~Replace first sentence with~~

~~The nameplate shall be stamped with characters of 5 mm (0,2 in) minimum size, and in the language specified by the purchaser with the following information, in units consistent with the data sheet:~~

Add ~~to~~new list item m)

~~k~~m) year of manufacture~~;~~

~~l) shaft lift (for vertical pumps).~~

~~6.13.3~~

~~Replace subclause with~~

~~In addition to being stamped on the nameplate, the pump serial number shall be plainly and permanently marked on the pump casing main constituents: casing, casing cover, lower and upper half casings, discharge head and suction can~~.

7 Accessories

7.1 Drivers

7.1.3

Delete "Unless otherwise specified,"

Replace ~~subclause with~~

~~*For drive-train components that have a mass "*~~*greater than ~~100~~500 lb (225 kg ~~(220 lb~~), the equipment feet ~~shall be provided with vertical jackscrews. The vendor shall allow a minimum clearance of 50 mm (2 in) under the driver to enable the use of a hydraulic jack when there are no jackscrews fitted.~~" with*

greater than 220 lb (100 kg), the mounting feet

7.1.~~4~~7

Delete "Unless otherwise specified,"

Replace ~~second sentence with~~

~~On pumps where it is only possible to carry out shop testing with the contract motor, the motor rating shall be sufficient to permit shop testing with water. An overload of 10 % above the motor rated power at the pump rated duty point may be allowed during the test period subject to approval of the motor manufacturer.~~

~~7.1.6~~

~~*Replace subclause with*~~

~~*For which ever type of pump starting method is specified (for example against "*~~*a closed discharge valve~~, open system, bypass) the motor driver starting torque capability at 80 % voltage shall exceed the speed torque requirements of the driven equipment by 10 % minimum of the required torque, along all points on the driven equipment speed-torque curve.~~" with*

~~7.1.7~~

~~*Replace subclause with*~~

~~Vertical suspended pumps and vertical in-line pumps shall have motors designed for vertical service. Unless otherwise specified on the data sheet, motors for vertical pumps shall have solid shafts. If the pump thrust bearing is in the motor, the motor shall meet the shaft and base tolerances shown in Figure 36 of ANSI/API Std 610. For all vertical pumps, the vendor shall shop mount, align, and match mark the motor. Specific motor requirements will be incorporated on the motor data sheet.~~

the specified mode of pump start-up

7.1.8

Add to section

For vertical pumps, the motor shall be shop mounted, aligned and match marked.

7.2 Couplings ~~and guards~~

7.2.2

Add new list section h)

h) The minimum coupling service factor shall be 1.5.

7.~~2.~~3 Guards

~~*Replace subclause with*~~

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

7.3.2 ~~.14~~

~~*Replace subclause with*~~

~~Coupling guards shall be constructed of an agreed spark-resistant material (see subclause 6.10.2.6 and note of ANSI/API Std 610).~~

~~7.3 Baseplates~~

~~7.3.5~~

~~Replace~~7.3.2.1

In first sentence ~~of~~, replace "If specified" with

Unless the pump is installed in a nonhazardous location (safe area)

7.3.2.2

Replace "EN 13463-1" with

ISO 80079-36

7.3.3

7.3.3.4

Replace "EN 13463-1" with

ISO 80079-36

7.4 Baseplates

7.4.8

Delete "If specified," from second paragraph ~~with~~

~~This requirement shall be demonstrated in the pump vendor's shop prior to mounting of the equipment and with the baseplate supported at the foundation bolt holes only.~~

7.~~3.6~~4.14

~~*Replace first paragraph third sentence with*~~

~~Shim packs shall not be thicker than 13 mm (0,5 in) nor contain more than 3 shims.~~

~~**7.3.10**~~

Replace sixth sentence with

~~Vent holes at least 13 mm (0,5 in) in diameter shall be provided at each of the corners in each~~Every bulkhead section of the baseplate~~.~~

~~**7.3.13**~~

~~*Replace subclause with*~~

~~For pump baseplates required to be un-grouted, the baseplate and pedestal support assembly shall maintain alignment and the deflection criteria defined in Table 13 of ANSI/API Std 610 when the pump is subjected to the nozzle loads defined in Table 5 of ANSI/API Std 610.~~

~~**7.3.17**~~

~~*Replace first sentence with*~~

~~Transverse and axial alignment positioning jackscrews shall be provided for drive-train components having~~ shall have a ~~mass greater than 100 kg (220 lb) to facilitate transverse horizontal and longitudinal adjustments~~vent hole of at least 0.5 in. (12 mm) diameter located at each corner.

Add new ~~subclause~~section

7.~~3.22~~4.25

~~Two~~7.4.25.1

The baseplate shall have two grounding lugs ~~shall be provided on each baseplate,~~/bosses located at diagonally opposite corners ~~with 13 mm (1/2 in~~.

7.4.25.2

The baseplate grounding lugs/bosses shall be provided with 0.5 in. (12 mm) brass studs, nuts and washers.

7.4.25.3

All baseplate mounted equipment shall be earthed to the baseplate.

7.5 Instrumentation

7.~~3~~5.2 Vibration, ~~p~~Position, and ~~t~~Temperature ~~d~~Detectors

7.~~3~~5.2.2

Replace first sentence with

For equipment with hydrodynamic bearings, i.e. sleeve radial bearing and anti-friction thrust bearing, provision shall be made for mounting two radial-vibration probes in each bearing housing~~, two axial-position~~.

Add to section

Mounting points for vibration probes ~~at the thrust end of each machine. Provision for mounting a one-event-per-revolution probe in each driver shall be made.~~

~~*Add to subclause after first sentence*~~

~~Probes~~ shall be located ~~so~~such that any lube oil spill ~~is avoided~~ during probe installation or change-out is minimized.

~~7.4.2.3~~

~~*Replace first sentence with*~~

~~Hydrodynamic thrust and radial bearings shall be fitted with bearing metal temperature detectors.~~

~~*Add new sub-clause*~~

~~7.4.2.5~~

~~A complete instrument list and individual instrument data sheets shall be submitted to the purchaser for all instruments supplied by the vendor.~~

7.5~~6~~ Piping and ~~a~~Appurtenances

7.5~~6~~.1 General

7.5~~6~~.1.4~~6~~

~~*Replace subclause with*~~

~~Barrier or buffer fluid reservoirs shall be designed for mounting on the pump baseplate or motor support stand (vertical pumps). These reservoirs and the fluid circulation tubing shall be fully installed and supported.~~

~~7.5.1.6~~

~~*Replace subclause with*~~

~~Each piping system shall be manifolded to a single purchaser's inlet or outlet flanged connection to the edge and within the boundary of the baseplate.~~

~~NOTE The datasheet allows selection of this option for vent, cooling and drain connections.~~

~~*Add new subclause*~~

~~7.5.1.9~~

~~Other than for seal plans, tubing shall not be used for any process wetted systems.~~

~~*Add new subclause*~~

~~7.5.1.10~~

~~Brackets and supports welded on the mechanical equipment or on the baseplate shall have full length welds. Stitch welding is unacceptable.~~

~~7.5~~Delete "If specified,"

Delete NOTE

7.6.2 Auxiliary ~~p~~Process ~~l~~Liquid ~~p~~Piping

7.~~5~~6.2.4

Replace second sentence with

~~Add to subclause~~

~~The orifice~~Restriction orifices shall ~~be~~have a ~~removable, flat~~tab extending from the orifice plate ~~mounted between flanges.~~ .

Add after third sentence

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

Add after third sentence

The orifice plate shall be removable and flat.

7.~~5~~6.2.6

Replace first sentence with

~~Replace subclause with~~

~~Except for connections to cast iron, threaded~~Threaded vent and drain connections ~~are~~ to the casing shall not be permitted.

7.~~5~~6.2.8

Replace second sentence with

~~Replace subclause with~~

~~Unions~~Socket-welded unions shall not be used.

~~7.6 Special tools~~

~~Add new subclause~~

~~7.6.3~~

~~Operating procedures for special tools, if any, shall be included in the installation, operating and maintenance manual.~~

8 Inspection, tTesting, and pPreparation for sShipment

8.1 General

8.1.51

8.1.1.2

Delete "or observed" from second sentence of first paragraph

Delete NOTE 2

8.1.5

Replace subclause"If specified," with

Prior to release for shipment, the purchaser's

Replace ", dating and the vendor's representative shall mutually agree compliance in accordancesubmitting the completed checklist to the purchaser before shipment" with

an inspector's checklist such as that provided in ANSI/API Std 610 Annex E by initialling and dating the completed checklist.

8.2 Inspection

8.2.1 General

8.2.1.1

In list item f), replace "(see L.3.1 and L.3.2)" with

(see IOGP S-615L)

8.2.2 Pressure casing materials inspection Casing and Process Piping Materials Inspection

8.2.2.1

Add to sub-clause

The vendor shall submit to the purchaser the detailed pertinent non-destructive examination procedures.

Table 14 – —Pressure Casing and Process Piping Material Inspection Requirements

Add row "Fabricated casing material inspection requirementswelds"

Add rows to Table 14

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

	Requirements by Inspection Class [a, g]

Type of Component	I	II	III
Fabricated casing welds [f]	VI, plus 100 % MT or PT	VI, plus 100 % MT or PT	VI, plus 100 % MT or PT, plus 100 % RT or UT

8.2.2.7

Replace first sentence with

~~When sour service is specified, the hardness~~Hardness testing of parts, welds and heat-affected zones shall be ~~verified as being~~performed to verify that values are within the allowable ~~values~~ limits for sour services or when specified by ~~testing~~the purchaser for other applications.

8.2.2.8

Delete "If specified," from first sentence

8.3 Testing

8.3.1 General

8.3.1.1

Replace first sentence with

The detailed procedures for all specified running and optional tests shall be delivered within the timeframe specified in IOGP S-615L.

Add new section

8.3.1.4

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

Add new section

8.3.1.5

Seal gland drains connected to the containment seal and quench chambers shall not be plugged during running tests.

8.3.2 Hydrostatic Test

8.3.2.1

Add to section

The hydrostatic test shall be conducted after completion of pressure casing welding and machining, except when the requirements of 8.3.2.10 apply.

8.3.2.10

Add to end of second paragraph

with a machining map

8.3.2.11

Delete fourth sentence

8.3.2.12

Replace first sentence with

~~Pressure boundary parts of alloy materials, including overlays shall be subject to positive material identification (PMI) using recognized testing methods, instrumentation and standards.~~

~~8.3 Testing~~

~~8.3.1 General~~

~~**8.3.1.1**~~

~~*Replace first sentence with*~~

~~The vendor shall submit to the purchaser detailed procedures for all running tests and all specified optional tests (subclause 8.3.4 of ANSI/API Std 610).~~

~~**8.3.1.2**~~

~~*Replace first sentence with*~~

~~Performance and NPSH test shall be conducted using the methods and uncertainty requirements of ISO 9906 Grade 1, ANSI/HI 14.6 (for centrifugal pumps) or ANSI/HI 2.6 (for vertical pumps).~~

~~8.3.2 Hydrostatic test~~

~~**8.3.2.1**~~

~~*Add to sub-clause*~~

~~The vendor shall submit to the purchaser the detailed hydrostatic test procedure.~~

~~**8.3.2.2**~~

~~*Add to subclause after first sentence*~~

~~The test shall be conducted after completion of case machining except when subclause 8.3.2.10 of ANSI/API Std 610 applies.~~

~~**8.3.2.9**~~

~~*Replace third sentence with*~~

~~Gland plates and removable seal chambers shall be tested as specified in ANSI/API Std 682.~~

Delete NOTE from subclause

8.3.2.10

Replace second paragraph with

Any areas that are to be machined after hydrostatic testing shall be identified on the hydrotest report that shall be submitted to the purchaser prior to start of post hydrostatic test machining.

8.3.2.12

Replace subclause with

All pumps Pump pressure-containing parts shall be tested to the same pressure. Segmental testing shall not be allowed.

Delete second sentence

Delete third sentence

Delete fourth sentence

Add new subclausesection

8.3.2.17

AnyPressure boundary repairs requiredthat require welding or machining, except when the requirements of 8.3.2.10 apply, after thesuccessful hydrostatic test shall be subject to approval by the purchaser. owner's acceptance.

8.3.3 Performance tTest

8.3.3.3

8.3.3.1

Add to subclausenew NOTE

Spare rotor purchased with the main equipment shall undergo the same performance test and mechanical running tests as the main equipment. The vendor shall provide all necessary spares (gaskets, O-rings, etc.) associated with the test.

8.3.3.2

Replace first sentence with

The following requirements of a) through j) shall be met while the pump is operating on the test stand and before the performance test is performed.

Replace item b) with

b) Substitute sealsNOTE The shop buffer/barrier system may be used during the performance test if needed to prevent damage to the contract seals or if the contract seals are not compatible with the test liquid. See subclause 10.3.6 of ANSI/API Std 682:2014. Shop buffer or barrier liquid systems may be used during bare-shaft pump performance test.

8.3.3.3.2

Replace ~~item c) first paragraph first sentence~~section with

~~Containment seal and quench drains shall be left open or unplugged during the performance test. The seal (or seals) shall not have a~~Seal leakage that exceeds the permitted rate ~~during any phase of the pump performance test that is in excess of that specified in subclause A.1.3 of ANSI/~~specified in API ~~Std~~ 682~~:2014, or as otherwise agreed by the vendor and the purchaser.~~

~~*Replace item c) second paragraph second sentence with*~~

~~Subclause A.1.3 of ANSI/API Std 682:2014, should be reviewed to confirm that a zero-visible-leakage criterion is appropriate for the seals being tested.~~

~~*Delete NOTE from item c)*~~

~~*Replace item d) with*~~

~~d) If leakage during test is over limit specified in the test procedure,~~ 10.3.2.3.1 shall require the assembled pump and seal ~~shall~~to be re-~~tested~~run to ~~demonstrate satisfactory seal performance.~~ prove that the seal leakage is below that specified in API 682, 10.3.2.3.1.

8.3.3.4

8.3.3.4.3

Add to ~~list~~section

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

~~**8.3.3.3**~~

~~*Replace item a) with*~~

~~a) The vendor shall record test data, including head, flowrate, power and vibration at a minimum of six points:~~

~~1) shut off (vibration for information only);~~

~~2) minimum continuous stable flow (beginning of allowable operating region);~~

~~3) midway between minimum continuous flow and rated flow;~~

~~4) within ± 2 % of rated flow;~~

~~5) approximately the best efficiency flow (if rated flow is not within 5 % of best efficiency flowrate);~~

~~6) end of allowable operating region.~~

~~*Add to end of item b)*~~

~~Pumps~~In addition, pumps that ~~are specified to~~ operate in parallel and are not individually flow controlled shall~~:~~

~~1) have~~ comply with the ~~same shut off~~ head ~~(within a~~ tolerance ~~of ± 3 %), which shall be confirmed at the performance test;~~allowed in 6.1.13 c).

2) between 80 % and 110 % of best efficiency point, the tested head of the second pump shall be less than 101,5 % and greater than 98,5 % of the tested head of the first pump at the same flow. This does not allow the second pump to be outside the contractual performance limits.

8.3.3.4.5

In second sentence, replace "(see L.2.4, L.3.2.2, and example in Annex M)" with

(see IOGP S-615L and example in Annex M)

8.3.3.4.6

Delete "If specified,"

Replace item e)"L.3.2.2" with

e) In addition to formal submittal of final data in accordance with 10.3.2.2 of ANSI/API Std 610, curves and test data (corrected for speed, specific gravity, clearances and viscosity) shall be submitted within 24 h after completion of performance testing for the purchaser's review and acceptance prior to shipment.

IOGP S-615L

8.3.3.56

8.3.3.6.2

Replace first sentence with

Replace item b)For ring-oiled or splash systems including systems with

b) If applicable purge-oil mist, the bearing temperatures of the oil sump and bearing oil temperatures housing or bearings fitted with detectors shall be measured and recorded throughout the test. Where supplied

Replace second sentence with

For pure-oil mist systems, the contract resistance temperature of the bearing housing or bearings fitted with detectors shall be used duringmeasured and recorded throughout the test.

Delete third sentence

8.3.3.78.3.3.6

Replace subclause with

If

Add to section

When specified, the performance test shall be conducted with:

a) test stand NPSHA controlled to no more than 110 % of the NPSHA specified on the data sheet;

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

NOTE It is the purpose of this test to evaluate pump performance with the specified NPSHA at pump suction.

~~8.3.3.7~~8.3.3.8

8.3.3.8.1

Add to ~~item a)~~section

~~The~~ The vendor shall notify the owner when any modifications to the impeller~~(s) shall not~~ are made.

Add to section

When the impeller is required to be modified after the performance test to ~~correct~~ achieve the specified hydraulic performance by ~~under filing, over filing, V-cutting or any~~ specific vane machining techniques other ~~such technique, unless approved by the purchaser. If approved, the vendor shall submit a drawing showing the details of the~~than impeller diameter reduction, the proposed modification and a detailed drawing shall be subject to owner's acceptance.

~~*Replace item b) with*~~

~~*b)*~~ *Add to section*

If ~~specified, disassembly of multistage pumps for~~ any ~~head adjustment (including less than 5 % diameter change) after test~~ such specific vane machining techniques are undertaken, the pump shall ~~require the~~ be fully re-tested.

Add to section

When an impeller, inducer or rotor ~~to be~~ is post-test machined, the component or complete rotor shall be rebalanced prior to retest or shipment in accordance with 6.9.3 and 9.2.4.2 as applicable.

8.3.3.8.2

Add to section

If any disassembly or retest is performed, the rotor shall be rebalanced prior to retest in accordance with ~~this specification and shall be cause for retest~~9.2.4.2.

8.3.4 Optional ~~t~~Tests

8.3.4.2 Mechanical ~~run test~~Run Test

8.3.4.2.1

Replace first sentence with

~~*Replace subclause with*~~

~~After oil temperature stabilisation (subclause 6.10.2.4 of ANSI/API Std 610), the~~ The pump shall be run on the test stand for at least 1 hour.

Add to section

During the mechanical run test, the rated flow ~~for 2 hours. Oil temperature stabilisation is achieved when the rise is not greater than 1 °C (2 °F) over a 10 minute period.~~

~~8.3.4.2.2~~

~~*Replace subclause with*~~

~~During the mechanical run test, pump flow rates, pressures~~, pressure, power, speed, ~~filtered and unfiltered~~ vibration, ~~lube oil flow, temperature, and pressure and~~ bearing ~~temperature,~~oil or housing temperatures shall be measured and recorded ~~at intervals of 15 minutes or less during the first hour of testing, and at 30 minute intervals thereafter for the rest of~~continuously throughout the test ~~duration. The parameters measured~~ .

Add to section

During the mechanical run test, the pump shall ~~conform to the requirements specified by the purchaser for the performance test~~operate without visible leaks, other than allowable seal leakage as defined in API 682, 10.3.2.3.1 or as specifically agreed between owner and vendor.

Add to section

During the mechanical run test, the pump shall not display any temperature, vibration or noise non-conformities.

Add to section

If it is necessary to dismantle a pump for any correction such as due to noise, vibration or leakage, the mechanical run test shall be repeated after the correction is made.

8.3.4.3 NPSH ~~r~~Required ~~t~~Test

8.3.4.3.1

~~*Replace subclause with*~~

~~*If specified, NPSH3 or*~~*Add to section*

For vertical submerged pumps, a minimum submergence test ~~(vertical submerged type pumps)~~ shall be ~~determined at each test point identified in 8.3.3.3 a), except shut-off. Refer to the data sheet for the type~~performed instead of ~~NPSH3 test~~an NPSH required ~~and~~test if the minimum submergence test is more restrictive.

Add new NOTE

NOTE A minimum submergence test is more restrictive than an NPSH required test when the required submergence of a pump inlet bell, to avoid the ~~acceptance criteria~~occurrence of free-surface air vortices, is greater than the submergence needed to provide the required NPSH for the pump.

~~8.3.4.3.3~~

~~*Replace seventh sentence with*~~

~~These NPSH3 curves shall be developed and submitted in accordance with hydraulic institute standards ANSI/HI 14.6 or ISO 9906, as specified.~~

8.4 Preparation for ~~s~~Shipment

8.4.~~2~~3

8.4.3.1

Replace first sentence with

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

Add to section

Radial movement of rotors with hydrodynamic radial bearings shall be blocked.

8.4.~~2.4~~

~~*Replace first sentence with*~~

~~Refer to the data sheet for the applicable painting specification. If the vendor's standard is acceptable to purchaser, then exterior surfaces, except for machined surfaces, shall be given at least one coat of the vendor's standard paint. The vendor shall submit to the purchaser the detailed painting procedure.~~

~~8.4.2~~3.7

~~*Add to subclause*~~

~~Threaded openings which are normally plugged during service shall be fitted with stainless~~

*Delete "*steel ~~*plugs*~~ *caps or steel"*

Replace "in accordance with ~~ASME B16.11~~ 6.4.3.7" with

in accordance with 6.4.3.5

Add to section

Temporary plastic plugs shall not be permitted.

9 Specific ~~p~~Pump ~~t~~Types

~~**9.1 Single-stage overhung pumps**~~

~~**9.1.3 Integral gear-driven (type OH6) pumps**~~

~~**9.1.3.7**~~

~~*Replace first sentence with*~~

~~Inducers, impellers and similar major rotating components shall be dynamically balanced to ISO 21940-11, grade G2.5, or to a residual unbalance of 7 g·mm (0,01 oz·in), whichever is greater.~~

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

~~9.2.1 Pressure casings~~

~~9.2.1.2~~

~~*Replace subclause with*~~

~~Pumps for service temperatures below 120 °C (248 °F) may be foot-mounted.~~

~~9.2.4 Dynamics~~

~~9.2.4.2 Rotor balancing~~

~~9.2.4.2.2~~

~~*Replace second paragraph first sentence with*~~

~~Table 19 of ANSI/API Std 610 shows ISO 21940-11, grade G2.5 for all interference fit rotors to speeds of 3 800 r/min.~~

9.2.5 Bearings and ~~b~~Bearing ~~h~~Housings

Add new ~~subclause~~section

9.2.5.5 ~~.5~~

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

~~9.2.6 Lubrication~~

~~9.2.6.4~~

~~*Replace subclause with*~~

~~Pressure-lubrication systems shall be as specified on the data sheet.~~

~~9.2.7 Testing~~

~~9.2.7.5~~

~~*Replace subclause with*~~

~~Hydrodynamic bearings shall be removed, inspected by the purchaser or the purchaser's representative, and reassembled after the performance test is completed.~~

9.3 Vertically ~~s~~Suspended ~~p~~Pumps (~~t~~Types VS1 ~~t~~Through VS7)

~~9.3.3 Rotors~~

~~9.3.3.2~~

~~*Add to subclause*~~

~~The shaft of vertical pumps shall be 25 mm (1 in) in diameter (minimum). Shaft length shall not exceed 6 000 mm (236 in).~~

~~**9.3.5 Dynamics**~~

~~*Replace subclause with*~~

~~The vendor is not required to furnish a dynamic analysis of the pump and its support structure to confirm acceptability of the design.~~

9.3.6 Bushings and ~~b~~Bearings

9.3.6.1

Add to ~~subclause~~section

Bushings shall maintain dimensional stability for the specified product and temperature for operating, transient and standby conditions.

9.3.6.3

Add after "VS4"

and VS5

~~If specified that VS pumps shall operate for short periods with no lubrication (dry column during start up) or shall be subject to periods of standby, the bushings shall not shrink or swell.~~

9.3.8 Accessories

9.3.8.3 Mounting ~~p~~Plates

9.3.8.3.1

Add to ~~subclause after first sentence~~section

~~This~~When separate from the main body flange, the mounting plate shall be continuously welded to the ~~can (~~outer casing~~)~~ on both sides ~~and machined on its bottom surface~~.

Add to ~~align with the sole plate. No shims shall be used~~section

Contact areas between ~~the bottom of the~~ mounting plate and ~~the top~~sole plate(s) shall be flat and perpendicular to the centerline of the shaft.

Add to section

Machining tolerances shall be in accordance with 7.4.8.

9.3.8.3.2

Delete "If specified,"

Add after first sentence

Grout contact surfaces of the sole plate~~.~~

~~9.3.8.3.2~~

~~*Replace subclause with*~~

~~A minimum of four alignment-position screws shall be provided for each drive-train component that has a mass greater than 100 kg (225 lb) to facilitate horizontal adjustment.~~

~~9.3.8.3.3~~

~~*Replace subclause with*~~

~~Pumps~~ shall be ~~provided with a separate sole plate for bolting and grouting to the foundation (see Figure 38 of ANSI/API Std 610). The bottom of the~~ sand-blasted and coated in accordance with the requirements of 7.4.16.

Add to section

The sole plate shall be ~~blasted and prepared for epoxy grout. This plate shall be machined on its top surface for mounting of the discharge head, can or motor support and shall have four levelling screws, one~~provided with a total of four removable jacking screws, each located adjacent to ~~each~~a holding down bolt hole.

9.3.9 Testing

9.3.9.1

~~*Replace subclause with*~~

~~*Pumps shall be tested as complete assemblies unless otherwise agreed by the purchaser and subsequently specified on the data sheet. Any*~~*Add to section*

When a reduced length test is proposed, the length of ~~vertical~~ the pump ~~tested~~ shall include at least two ~~lineshaft bearings. Suction cans, if supplied, are not required for performance testing~~line shaft bearings.

9.3.10 Single-case Diffuser (VS1) and Volute (VS2) Pumps

Add new section

9.3.10.7

Single-case diffuser (VS1) and volute (VS2) pump bowls shall have O-ring seals.

Add new section

9.3.10.8

For single-case diffuser (VS1) and volute (VS2) pumps, multiple bowl stack up tolerances from the rabbeted fits shall be evaluated to ensure that the concentricity of the assembly is maintained during shipping and operation.

9.3.11 Single-casing Axial Flow (VS3) Pumps

Add new section

9.3.11.3

Single-casing axial flow (VS3) pump bowls shall have O-ring seals.

Add new section

9.3.11.4

For single-casing axial flow (VS3) pumps, multiple bowl stack up tolerances from the rabbeted fits shall be evaluated to ensure that the concentricity of the assembly is maintained during shipping and operation.

9.3.13 Double-casing ~~d~~Diffuser (VS6) and ~~v~~Volute (VS7) ~~p~~Pumps

9.3.13.~~3~~2

Replace ~~subclause~~section with

~~Complete outer-case venting shall be ensured by means of a DN25 (NPS 1) minimum~~ A flanged high-point vent connection with a minimum diameter of NPS 1 (DN 25) shall be provided for complete outer case venting.

9.3.13.~~4~~3

Replace ~~subclause~~section with

~~Complete~~A flanged high-point vent connection with a minimum diameter of NPS ½ (DN 15) shall be provided for complete venting of the inner assembly ~~within the~~, seal chamber ~~or~~and associated auxiliary process ~~piping shall be ensured by means of a DN15 (NPS ½) minimum flanged high-point vent connection~~ liquid piping.

9.3.13.~~5~~4

Replace ~~subclause~~section with

The suction ~~can~~cannister shall be supplied with an internal drain ~~piped to the surface and terminating with a DN 25 (NPS 1)~~ with a minimum diameter of NPS 1 (DN 25).

Add to section

The drain pipe shall extend internally down the length of the pump to the bottom of the suction cannister.

Add to section

The drain shall terminate above the top of the mounting plate in a flanged connection.

Add to section

The internal drain pipe shall be ~~a~~affixed to the bowl assembly and column ~~bolting~~.

Add to ~~avoid vibration.~~ section

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

Add new ~~subclause~~section

9.3.13.7

~~Bowls~~Double-casing diffuser (VS6) and volute (VS7) pump bowls shall be flanged ~~and~~ .

Add new section

9.3.13.8

Double-casing diffuser (VS6) and volute (VS7) pump bowls shall have metal-to-metal rabbeted fits.

Add new section

9.3.13.9

Double-casing diffuser (VS6) and volute (VS7) pump bowls shall have O-ring seals.

Add new section

9.3.13.10

For double-casing diffuser (VS6) and volute (VS7) pumps, multiple bowl stack up tolerances from the rabbeted fits shall be evaluated to ensure that the concentricity of the assembly is maintained during shipping and operation.

10 Vendor's ~~d~~Data

10. 1 ~~2 Proposals~~

~~10.2.3 Technical data~~

~~*Replace item l) with*~~

~~l) a list of similar machines installed and operating under similar conditions;~~

~~*Replace item n) with*~~

~~n) calculated specific speed and suction specific speed;~~

~~*Add to list*~~

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

~~10.2.5 Options~~

~~*Replace subclause with*~~

~~The vendor shall furnish an outline of the procedures used for each of the special or optional tests that have been specified by the purchaser or proposed by the vendor.~~

~~10.3 Contract data~~

~~10.3.2 Drawings and technical data~~

~~10.3.2.2~~

~~Certified test curves and data (see example in Annex M) and valid calibration certificates for all test instrumentation shall be submitted after testing in accordance with the IRS and shall include head, power recalculated to the proper specific gravity and efficiency plotted against flowrate.~~

~~**10.3.4 Parts lists and recommended spares**~~

~~*Add new subclause*~~

~~**10.3.4.3**~~

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

~~**10.3.5 Data manuals**~~

~~*Add new sub-clause*~~

~~**10.3.5.4 Manufacturing record book**~~

~~A manual containing all manufacturing records, personnel qualifications, certification and inspection and test reports. As a minimum, the manufacturing record book shall include all as built and verifying documentation detailed in the inspection and test plan.~~

Replace first sentence with

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

Delete second sentence

~~Annex L~~
~~(informative)~~
~~Vendor drawing and data requirements~~

~~L.1 General~~

~~*Replace sub-clause and Figure L.1 with*~~

~~Refer to S-615L for proposal and contract document requirements. The document content requirements are given in S-615L and ANSI/API Std 610 6.9.2.10, 8.3, 10.2, 10.3, L.2, I.1.4 and I.3 as amended by S-615L.~~

Bibliography

Add to Bibliography

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

[109] API Specification Q2, *Specification for Quality Management System Requirements for Service Supply Organizations for the Petroleum and Natural Gas Industries*

[110] ASTM E415, *Standard Test Method for Analysis of Carbon and Low-Alloy Steel by Spark Atomic Emission Spectrometry*

[111] ASTM E1086, *Standard Test Method for Analysis of Austenitic Stainless Steel by Spark Atomic Emission Spectrometry*

[112] IEC 60034-1, *Rotating Electrical Machines – Part 1: Rating and Performance*

[113] IOGP S-703, *Supplementary Specification to IEC 60034-1 Low Voltage Three Phase Cage Induction Motors*

[114] IOGP S-704, *Supplementary Specification to IEC 60034-1 High Voltage Three-phase Cage Induction Motors*

[115] IOGP S-711, *Specification for Diesel Engines*

[116] IOGP S-712, *Supplementary Specification to API Standard 677 General Purpose Gear Units*

[117] IOGP S-715, *Supplementary Specification to NORSOK M-501 Coating and Painting for Offshore, Marine, Coastal and Subsea Environments*

[118] IOGP S-733D, *Procurement Data Sheet for Low Voltage Motors (IEEE Std 841)*

[119] ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country code*

[120] ISO 9001, *Quality management systems — Requirements*

[121] ISO 10005, *Quality management — Guidelines for quality plans*

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