International Association of Oil & Gas Producers

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# Supplementary Specification to API Standard 674 Positive Displacement Pumps - Reciprocating

Public Review Draft

JIP33
JOINT INDUSTRY PROGRAMME

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## Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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# Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2014).

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# Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of positive displacement pumps - reciprocating in accordance with API Standard 674 Positive Displacement Pumps - Reciprocating, Third Edition, December 2010, including Errata to April 2015, Reaffirmed November 2016 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 data sheet, quality requirements specification (QRS) and information requirements specification (IRS) as follows.

**IOGP S-728: Supplementary Specification to API Standard 674 Positive Displacement Pump - Reciprocating**

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to API Standard 674, following the API Standard 674 to the extent applicable to the scope of supply.

Modifications to API Standard 674 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-728D: Data Sheet for Positive Displacement Pump - Reciprocating**

The data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The 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 data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

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**IOGP S-728Q: Quality Requirements for Positive Displacement Pump - Reciprocating**

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.

**IOGP S-728L: Information Requirements for Positive Displacement Pump - Reciprocating**

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.

The terminology used within this specification and the supporting data sheet, QRS and IRS follows that of API Standard 674 and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

The 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 (data sheet, QRS, IRS);

d) this specification;

e) API Standard 674.

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# 1 Scope

*Replace clause with*

This standard covers the minimum requirements for reciprocating positive displacement bareshaft pump and, if applicable, its associated lube oil system (LOS) only for use in the petroleum, petrochemical and gas industry services. Both direct-acting and power-frame types are included. Complete reciprocating positive displacement pump packages, controlled-volume pumps, hydraulically driven pumps and rotary pumps are not included.

# 2 Normative References

*Add to section*

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

HI 6.1-6.5:2015, *Reciprocating Power Pumps for Nomenclature, Definitions, Application, and Operation*

# 3 Terms and Definitions

*Add new term*

**3.21a**
**net positive suction pressure required**
**NPSHR**
Minimum value of NPSH required as determined by the vendor when based on testing with water and including preliminary estimated system acceleration head.

# 4 General

## 4.1 Units of Measurement

*Replace subclause with*

Technical data and associated system of units shall be in accordance with data sheet IOGP S-728D.

## 4.2 Subvendor control

*Add to end of last sentence*

and as modified by this specification.

# 6 Basic Design

## 6.1 General

### 6.1.1

*Add to subclause*

Equipment of proven design shall be proposed.

*Add to subclause*

Equipment of prototype design shall not be proposed.

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**6.1.5**

*Replace first sentence with*

If the equipment sound pressure level exceeds the specified threshold, the requirements of IOGP S-717 shall apply.

**6.1.15**

*In first sentence, replace "(see 8.3.6)" with*

(see 8.3.7)

**6.1.18**

*Replace first sentence with*

Bolting shall conform to 6.1.18 a) through 6.1.8 g).

**6.1.18**

*Add new section*

g) Flange bolt holes shall straddle horizontal and vertical centre lines.

## 6.3 Ratings

**6.3.3**

*Add after first sentence*

In sizing the liquid end of the pump, the volumetric efficiency shall not exceed 90 % for piston type and 95 % for plunger type.

**6.3.4**

*Add new second sentence*

In the determination of the power-pump power requirements, the pump efficiency shall not be greater than 90 % and not more than 87 % for gear driven pumps.

## 6.4 Pressure-Containing and Pressure-Retaining Parts

**6.4.4**

*Add to subclause*

Tapped holes shall be chamfered a minimum of 1.5 mm ($^{1}/_{16}$ in.).

## 6.5 Cylinder Connections

**6.5.5**

*Add new list item c)*

c) on services that are non-hazardous, non-toxic, non-corrosive or non-flammable.

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### 6.5.14 Flanges:

**6.5.14.4**

*Replace "I6.42." with*

ASME B16.42

**6.5.14.6**

*Add to subclause*

Non-standard (oversized) flanges shall be approved by the Purchaser.

## 6.7 Liquid End Features

### 6.7.1 Liners

**6.7.1.1**

*Replace subclause with*

Piston-type liquid end non-replaceable cylinders shall have replaceable liners in accordance with 6.7.1.2 through 6.7.1.6.

### 6.7.2 Pistons, Plungers, and Piston Rods

**6.7.2.1**

*Add to subclause*

The type of coatings shall suit the process application and site environment.

**6.7.2.4**

*Add subclause*

Hollow plungers shall have at least 3.2 mm ($^{1}/_{8}$ in.) wall thickness.

**6.7.2.5**

*Replace "gas end" with*

power end

### 6.7.3 Valve Seats

*Add new section*

d) Maximum velocities through the valves shall be considered in the design with the aim of maximizing component life.

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### 6.7.4 Gaskets

*Replace subclause with*

To prevent extrusion for operating pressures over 2,400 kPA (24 bar) (350 psi) or temperatures over 180 °C (350 °F), the cylinder and valve gaskets shall be of one-piece construction and confined.

## 6.8 Power End Running Gear

### 6.8.2

*Add to subclause*

Anti-friction bearings shall have steel or brass cages. Non-metal cages are not acceptable.

### 6.8.3

*In second sentence, delete ...."or sufficient wall thickness for re-boring"*

### 6.8.11

*Add to subclause*

If specified, a DN 15 (NPS 1/2) purge connection shall be provided separate from the vent connection.

### 6.8.12

*Add to subclause*

The design of the distance piece shall incorporate a DN 15 (NPS $^1/_2$) minimum drain connection to completely evacuate the distance piece.

*Add to subclause*

Multiple drains shall be manifolded and piped to a single termination connection.

## 6.9 Direct-Acting Pump

*Add new subclause*

### 6.9.8

Direct-acting pump drives shall have a minimum DN 15 (NPS $^1/_2$) drain connection that evacuates the cylinder.

## 6.10 Lubrication

### 6.10.2 Lubrication for Liquid End and Power End

#### 6.10.2.1

*Replace subclause with*

The type of lubricator (for example hydraulic, mechanical or lubricating pumps) shall be proposed.

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## 6.11 Materials

### 6.11.2 General

**6.11.2.1**

*Add to subclause*

When cast iron is otherwise acceptable for the service, cast iron shall be nodular cast iron.

**6.11.2.8**

*Add to subclause*

Austenitic stainless steel parts shall be at least grade 316 / 316L material.

**6.11.2.11**

*Replace "MRO 175" with*

MRO 103/175

## 6.12 Nameplates and Rotation Arrows

**6.12.2**

*Delete "if direction of rotation affects performance and/or reliability"*

**6.12.4**

*Add new list item m)*

m) year of manufacture.

*Add new subclause*

**6.12.6**

The nameplate text shall be in the English language with characters a minimum of 5 mm ($^{3}/_{16}$ in.) in height.

*Add new subclause*

**6.12.7**

In addition to appearing on the nameplate, the pump serial number shall be stamped on the pump casing.

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# 7 Accessories

## 7.4 Mounting Plates

### 7.4.2 Baseplate and Skid

#### 7.4.2.5

*Replace first sentence with*

The baseplate or skid shall be provided with certified lifting eyes or lifting lugs for at least a four-point lift.

#### 7.4.2.8

*Replace "nonskid" with*

non-slip

## 7.5 Controls and Instrumentation

### 7.5.5 Alarms and Shutdowns

#### 7.5.5.2

*Replace subclause with*

Alarm and trip switch functions shall be in accordance with Table 9a.

*Add to subclause*

Additional alarms and shutdowns considered essential to safeguard the equipment shall be specified.

*Add to subclause*

Instruments and controls other than shutdown sensing devices shall have valving to permit their replacement while the system is in operation.

*Add to subclause*

If shutoff valves are specified for shutdown sensing devices, a means of locking the valves in the open position shall be provided.

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*Add new table*

**Table 9a—Minimum Alarms and Trip Functions**

| Condition | Annunciated alarm | Annunciated shutdown |
|---|---|---|
| Overspeed | | x |
| Unit shutdown | | x |
| Failure of cylinder lubricator | x | |
| High winding temperature | | x |
| Over current protection | | x |
| Earth fault protection | | x |
| High bearing temperature | | x |
| High rod packing temperature | | x |
| High lube oil filter differential | x | |
| High or low lube oil temperature | x | |
| High or low lube oil reservoir level | x | |
| Low lube oil pressure | | x |
| Low pressure frame lubrication system | | x |
| High casing vibration | | x |

## 7.6 Auxiliary Piping

*Replace second sentence with*

If space does not permit the use of DN 15, 20, 25 (NPS $^{1}/_{2}$, $^{3}/_{4}$ or 1) pipe, seamless tubing shall be used.

*Add to subclause*

Piping connections smaller than DN 15 (NPS $^{1}/_{2}$) shall not be used.

*Add to subclause*

Cooling water connections shall be at least DN 20 (NPS $^{3}/_{4}$).

*Add new subclause*

**7.6.4**

On services that are hazardous, toxic or flammable, the pump packing leakage shall be contained and vented to a low pressure vent flare or safe venting area.

*Add new subclause*

**7.6.5**

Packing venting inside enclosures or buildings shall not be used.

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*Add new subclause*

**7.6.6**

The elevation of the pump centre line shall provide access for piping auxiliary connections.

*Add new subclause*

**7.6.7**

The impact of acceleration head loss on process piping in the vendor's scope shall be determined.

*Add new subclause*

**7.6.8**

The system acceleration head shall be calculated in accordance with Annex E and HI 6.1-6.5.

## 7.7 Pulsation and Vibration Control Requirements

### 7.7.1 General

**7.7.1.2**

*Replace section a) with*

a) Suction (if required) and discharge pulsation control devices such as dampeners, accumulators, hydraulic isolators, inhibitors, suppressors, stabilizers, acoustic filters and selected piping configurations shall be supplied.

*Add new subclause*

**7.7.1.4**

C.1.3 shall be applied for the following critical installations:

a) multiple pumps in parallel;

b) variable speed pumps;

c) pumps with multiple fluid types;

d) high process safety risk, for example flammable fluids at high rates or pressures.

## 7.8 Special Tools

*Add new subclause*

**7.8.3**

Special tools shall be provided with applicable supporting documentation for example testing certificates, calibration certificates, certificates of conformity and Ex certificates.

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*Add new subclause*

**7.8.4**

Lifting equipment shall be certified for use in the country of operation.

*Add new subclause*

**7.8.5**

Pressure gauges shall be in metric or imperial customary units.

**7.8.6**

*Add new subclause*

Dual scale gauges shall not be used.

# 8 Inspection, Testing, and Preparation for Shipment

## 8.1 General

**8.1.1**

*Replace subclause with*

Inspection, testing and certification shall be carried out in accordance with IOGP S-728Q.

**8.1.2**

*Delete "If specified,"*

**8.1.3**

*Add to subclause*

If specified, the Purchaser's appointed representative shall be granted permission to photograph the equipment in the scope of the purchase order during manufacturing, assembly and testing.

**8.1.6**

*In second sentence and NOTE, replace "five working days" with*

ten working day

## 8.3 Testing

### 8.3.1 General

**8.3.1.1**

*Add to subclause*

Equipment used for recording data during testing shall have a valid calibration certificate.

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*Add to subclause*

Measuring equipment for inspection and testing shall have a resolution and accuracy at least five times finer than the tolerance of the parameter being measured.

*Add to subclause*

Calibration standards shall be at least five times as accurate as the equipment being calibrated.

*Add to subclause*

Equipment shall be drained and dried after testing.

### 8.3.2 Hydrostatic Testing

**8.3.2.2**

*Replace "ASME VII" with*

ASME VIII

**8.3.2.5**

*Add to subclause*

New seals, gaskets and o-rings shall be used to rebuild the pump.

### 8.3.4 Mechanical Run Test

**8.3.4.7**

*Delete subclause*

## 8.4 Preparation for Shipment

**8.4.1**

*Add to last sentence of second paragraph after "Purchaser"*

and in accordance with the Vendor's guidelines.

**8.4.3**

**8.4.3.1**

*Add to subclause*

Equipment painting / coating shall be vendor standard.

**8.4.3.7**

*Replace first sentence with*

Lifting points and COG of equipment shall be clearly identified on the appropriate supporting documentation such as general arrangement drawings and lifting and handling procedures.

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*Add new subclause*

**8.4.9**

Regulated substances, such as the following, shall be tagged at openings to indicate nature of contents and precautions for shipping, storage and handling:

a) insulating oils;

b) corrosion inhibitors;

c) anti-freeze solutions;

d) desiccants;

e) chemical substances;

f) hydrocarbon substances.

*Add new subclause*

**8.4.10**

**8.4.10.1**

Regulated substances shall have a material safety data sheet (MSDS).

**8.4.10.2**

If a substance is exempt from requiring a MSDS, a statement to that effect shall be issued to the Purchaser.

**8.4.10.3**

Before shipment, MSDSs shall be forwarded to the receiving facility.

**8.4.10.4**

MSDSs in protective envelopes shall be affixed to the outside of each package.

# 9 Vendor's Data

## 9.1 General

**9.1.1**

*Replace "(See Annex B.)" with*

(See 9.2.2.1.)

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## 9.2 Proposals

### 9.2.2 Drawings

#### 9.2.2.1

*Replace first and second sentences with*

Documentation and data requirements in the proposal shall be as specified in IOGP S-728L.

### 9.2.3 Technical Data

*In list item c), replace "(See Annex B)" with*

(See 9.2.2.1)

*Replace list item f) with*

f) List of spare parts recommended for start-up (commissioning), normal maintenance purposes and two years operation.

## 9.3 Contract Data

### 9.3.1 General

#### 9.3.1.1

*Replace "(See Annex B.)" with*

(See 9.2.2.1.)

#### 9.3.1.4

*In last sentence, replace "Annex B" with*

9.2.2.1

### 9.3.2 Drawings and Technical Data

*At end of subclause, replace "(See Annex B)" with*

(See 9.2.2.1)

### 9.3.3 Progress Reports

*Replace NOTE with*

See 9.2.2.1.

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### 9.3.5 Installation, Operation, Maintenance, and Technical Data Manuals

#### 9.3.5.1 General

*Delete last sentence*

#### 9.3.5.2 Installation Manual

*Replace last sentence with*

See 9.2.2.1.

#### 9.3.5.3 Operating and Maintenance Manual

*Replace last sentence with*

See 9.2.2.1.

#### 9.3.5.4 Technical Data Manual

*Replace last sentence with*

See 9.2.2.1.

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# Annex B
(informative)
# Vendor Drawing and Data Requirements

*Delete annex*

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# Annex D
(informative)
# Reciprocating Positive-Displacement Data Sheets

*Delete annex*

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