Date of issue:
March 2025

Affected publication:
IOGP S-728, Supplementary Specification to API Standard 674 Reciprocating Positive Displacement Pumps, First Edition, May 2021

ADDENDUM 1

This addendum (Version 1.01) replaces Edition 1.0 published in May 2021.

List of updates

Section	Update
Section 2	New normative references ANSI/AGMA 9000, IOGP S-700, IOGP S-712, IOGP S-713 and ISO 14691
Section 3	New term 3.45 “bearing system life”
6.5.4	Subclause replaced with two new requirements
Table 7	First, second and third rows amended
6.8.2.4	First sentence amended
6.8.2	New subclauses 6.8.2.5 and 6.8.2.6
6.8.2	New subclause 6.8.2.7, Equation (1) and NOTE
6.11.3.1	Subclause amended
6.11.4.3	New list item c)
7.1.4.2	First sentence amended
7.1.4.2	Second sentence replaced
7.2.1	New subclauses 7.2.1.1 and 7.2.1.2
7.4.2	New subclauses 7.4.2.12 through 7.4.2.15
7.7.1.3	New subclauses 7.7.1.3.1 through 7.7.1.3.3
8.3.8	One new requirement
Annex C	Annex type changed from “informative” to “normative”
Annex C	One new requirement
C.1	New subclauses C.1.9 and C.1.10
C.1	New Table C.1

International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-728
March 2025
Version 1.01
ADDENDUM 1 TO FIRST EDITION (MAY 2021)

Supplementary Specification to API Standard 674 Reciprocating Positive Displacement Pumps

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.01	March 2025	Addendum 1
1.0	May 2021	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).

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).

Table of Contents

Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of reciprocating positive displacement pumps in accordance with API Standard 674 Positive Displacement Pumps—Reciprocating, Third Edition, December 2010, including Errata 2, 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 Reciprocating Positive Displacement Pumps

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 Reciprocating Positive Displacement Pumps

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.

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

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

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.

2 Normative References

Add to clause

AGMA 6013, *Standard for Industrial Enclosed Gear Drives*

ANSI/AGMA 9000, *Flexible Couplings - Potential Unbalance Classification*

HI 6.1-6.5, *American National Standard for Reciprocating Power Pumps for Nomenclature, Definitions, Application, and Operation*

IEC 60079 (all parts), *Explosive atmospheres*

IOGP S-700, *Supplementary Specification to API 671 Special Purpose Couplings*

IOGP S-712, *Supplementary Specification to API 677 General Purpose Gear Units*

IOGP S-713, *Supplementary Specification to ANSI/API Standard 613 Special Purpose Gear Units*

IOGP S-717, *Supplementary Specification to ISO 15664 Noise Emitting Equipment*

ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

ISO 12944 (all parts), *Paints and varnishes — Corrosion protection of steel structures by protective paint systems*

ISO 14691, *Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications*

NACE MR0175/ISO 15156, *Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons*

NACE MR0103/ISO 17945, *Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments*

NFPA 70, *National Electrical Code*

3 Terms and Definitions

Add new term

3.45
bearing system life
The calculated life of the combined system of bearings in the pump.

4 General

4.1 Units of Measurement

Replace subclause with

The technical data and its associated system of units shall be in accordance with IOGP S-728D.

4.2 Subvendor control

Replace "the International Standard" with

this specification

6 Basic Design

6.1 General

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)

6.5 Cylinder Connections

6.5.4

Replace subclause with

Butt welded connections size DN 50 (NPS 2) and smaller shall be reinforced with four-way gusseting in two perpendicular planes.

Butt welded connections size DN 50 (NPS 2) and smaller shall have a first natural frequency greater than 250 Hz.

6.5.5

Add new list item c)

c) if the service is non-hazardous, non-toxic, non-flammable and the corrosion rate is less than 125 µm/yr (5 mil/yr).

6.5.14 Flanges:

6.5.14.1

Replace first sentence with

Flanges shall conform to ISO 7005-1 or B16.42.

6.5.14.2

Delete subclause 6.5.14.2

6.5.14.4

Replace "I6.42" with

ASME B16.42

6.7 Liquid End Features

6.7.1 Liners

6.7.1.1

Delete "Unless otherwise specified," from subclause

6.7.2 Pistons, Plungers, and Piston Rods

6.7.2.4

Add to subclause

Hollow plungers shall have at least 3.2 mm ($^1/_8$ in.) wall thickness.

6.7.4 Gaskets

Replace “To prevent extrusion, and for operating pressures over 2,400 mPa” with

To prevent extrusion for operating pressures over 2,400 kPa

6.8 Power End Running Gear

6.8.2

6.8.2.3

Table 7—Bearing Selection

Delete "and Pump energy density below limits" from first and second rows of column "Condition"

Delete "and Pump energy density above limits" from third row of column "Condition"

6.8.2.4

In first sentence, add after "alternative rolling element arrangements"

and lubrication

Add new subclause

6.8.2.5

The bearing system life shall be equivalent to at least 25,000 h with continuous operation at rated conditions.

Add new subclause

6.8.2.6

The bearing system life shall be equivalent to at least 16,000 h at maximum radial and axial loads at rated speed.

Add new subclause, including Equation (1) and NOTE

6.8.2.7

If specified, the system life shall be calculated as shown in Equation (1).

L10h,system = [(1/L10hA)^3/2 + (1/L10hB)^3/2 + ... + (1/L10hN)^3/2]^-2/3 (1)

where

L10hA is the basic rating life, L10h, in accordance with ISO 281 for bearing A

L10hB is the basic rating life, L10h, in accordance with ISO 281 for bearing B

L10hN is the basic rating life, L10h, in accordance with ISO 281 for bearing N

N is the number of bearings

NOTE When calculated using Equation (1), bearing system L10h life requires the L10hN life of each individual bearing to be significantly higher than system L10h. E.g. for a system with two bearings to meet a bearing system life L10h of 25,000 h, each individual bearing life L10hN will require around 40,000 h.

6.8.3

Delete "or sufficient wall thickness for re-boring" from second sentence

6.8.5

In second sentence, replace "'AGMA 6010"' with

AGMA 6013

In third sentence, replace "AGMA 6010" with

AGMA 6013

6.9 Direct-Acting Pump

Add new subclause

6.9.8

Direct-acting pump drives shall have a minimum DN 15 (NPS ½) drain connection that evacuates the cylinder.

6.11 Materials

6.11.2 General

6.11.2.1

Add to subclause

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

6.11.2.11

In second sentence of first paragraph, replace "MR0 175" with

NACE MR0175/ISO 15156 and/or NACE MR0103/ ISO 17945

In third sentence of first paragraph, replace "NACE Standard MR0 175" with

NACE MR0175/ISO 15156 and/or NACE MR0103/ ISO 17945

In first sentence of subclause a), replace "MR0175" with

NACE MR0175/ISO 15156 and/or NACE MR0103/ ISO 17945

6.11.3 Positive Material Identification (PMI)

6.11.3.1

Replace "6.11.2.15" with

6.11.2.9

6.11.4 Castings

6.11.4.3

Add new list subclause c)

c) Ferrite castings in sour service shall be post-weld heat treated.

6.12 Nameplates and Rotation Arrows

6.12.2

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

6.12.4

Add new list item m)

m) year of manufacture.

7 Accessories

7.1 Drivers

7.1.4 Gear Units

7.1.4.2

Replace first sentence with

Coupled gears shall be single helical or double helical type conforming to AGMA 6013.

Replace second sentence with

If specified, gears shall conform to the following:

a) IOGP S-712 for general-purpose gear units;

b) IOGP S-713 for special-purpose gears units.

7.1.4.3

In last sentence, replace "AGMA 6010" with

AGMA 6013

7.2 Couplings and Guards

7.2.1

Add new subclause

7.2.1.1

Unless otherwise specified, all-metal-flexible element couplings shall meet AGMA 9000 Class 9.

Add new subclause

7.2.1.2

If specified, couplings shall conform to the following:

a) ISO 14691 for general-purpose couplings;

b) IOGP S-700 for special-purpose couplings.

7.2.5

Replace first sentence with

Couplings shall be selected with a service factor based on the peak torque produced by the motor during start-up, during transient load conditions or at 100 % PLV operation.

7.4 Mounting Plates

7.4.2 Baseplate and Skid

Add new subclause

7.4.2.12

The mounting pads of the pumps shall be the reference plane for all other surfaces.

Add new subclause

7.4.2.13

If a separate gear is fitted, the mounting pads of the gear shall be the reference plane.

Add new subclause

7.4.2.14

The shimmed units shall be aligned in the Supplier's workshop and fixed in the permanent position on the baseplate with dowel pins.

Add new subclause

7.4.2.15

The reference plane mounting pads shall be mounted without shims or dowels.

7.5 Controls and Instrumentation

7.5.4 Instrumentation

Add new subclause

7.5.4.5 Instrument Certification

Calibration certificates shall be provided for all instrumentation installed on the equipment.

Add new subclause

7.6 Auxiliary Piping

7.6.4

For services that are hazardous, toxic or flammable, the drain and vent piping connections shall be piped to the skid edge.

Add new subclause

7.6.5

All auxiliary piping connections shall be piped to the skid edge.

7.7 Pulsation and Vibration Control Requirements

7.7.1 General

7.7.1.2

Replace second and third sentence of subclause a) with

Pulsation control devices shall be supplied by the Vendor.

7.7.1.3

Add new subclause

7.7.1.3.1

Acoustic simulation of piping system mechanical analysis shall be performed for the following types of pumps:

a) pumps in hazardous service (e.g., toxic, flashing hydrocarbons);

b) pumps with drive power rating exceeding 75 kW.

Add new subclause

7.7.1.3.2

Acoustic simulation of piping system mechanical analysis shall include the following, within the acoustic boundary agreed by the company:

a) effects of piston and valve motions;

b) clearance volume;

c) pump manifold;

d) pulsation suppression devices;

e) pipe system.

Add new subclause

7.7.1.3.3

Piping system mechanical analysis shall include mechanical natural frequencies and mode shapes.

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-728D and IOGP S-728Q.

8.3 Testing

8.3.1 General

8.3.1.1

Replace subclause with

Equipment shall be tested in accordance with 8.3.2, 8.3.3, 8.3.4 and either 8.3.5 or 8.3.6 as appropriate.

8.3.2 Hydrostatic Testing

8.3.2.2

Replace "SECTION VII" with

SECTION VIII

8.3.4 Mechanical Run Test

8.3.4.7

Delete subclause 8.3.4.7

8.3.8 NPIP/NPSH Test

Add new subclause

The NPIP/NPSH test shall be performed if the NPIPR is within 35 kPa (5 psi) of the NPIPA.

8.4 Preparation for Shipment

8.4.3

8.4.3.1

Add to subclause

Painting shall conform to the requirements of ISO 12944.

Add to subclause

A high durability paint system shall be applied.

In Annex C heading, replace "informative" with "normative"

Annex C
(normative)

Pulsation and Vibration Control Techniques

Add before subclause C.1

The pulsation and vibration control techniques shall be in accordance with Annex C.

C.1 Definition of Design Analysis

Add new subclause

C.1.9 Allowable Pressure Drop

Steady state allowable pressure drop through pulsation suppression devices shall not exceed the following:

a) for the suction system, 2 % of mean absolute line pressure or 15 kPa (2 psi), whichever is greater;

b) for the discharge system, 2 % of mean absolute line pressure.

Add new subclause

C.1.10 Allowable Piping System Acoustic Shaking Force

Acoustic non-resonant shaking forces in the piping span shall not exceed the SFpmax (i.e., the maximum piping non-resonant shaking peak-to-peak force guideline based on support strength N (lbf)) values calculated in accordance with Table C.1.

Add new Table C.1

Table C.1—SFpmax Calculations

Unit System	Ground-supported Piping	Rack-supported Piping
SI	44.5 × DN	3.5 × DN
USC	250 × NPS	20 × NPS

Key

SFpmax	is the maximum piping non-resonant shaking peak-to-peak force guideline based on support strength N (lbf)
DN	is the nominal pipe size in millimeters
NPS	is the nominal pipe size in inches

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