

MATERIAL AND EQUIPMENT STANDARD

FOR

POSITIVE DISPLACEMENT PUMPS - ROTARY

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0. INTRODUCTION

This specification gives the amendment and supplement to corresponding API standard: 676, First edition, september 1980, reaffirmed December 1987; "Positive Displacement Pumps-Rotary".

It shall be used in conjunction with data sheets for Rotary pumps.

For ease of reference, the clause or section numbering of API Std 676 has been used throughout this specification.

Clauses in API Std. 676 not mentioned remain unaltered.

For the purpose of this specification, the following definitions shall hold:

- Sub. (Substitution)** : The API Std. clause is deleted and replaced by a new clause.
- Del. (Deletion)** : The API Std. clause is deleted without any replacement.
- Add. (Addition)** : A new clause with a new number is added.
- Mod. (Modification)** : Part of the API Std. clause is modified, and/or a new description and/or condition is added to that clause.

1. GENERAL

1.1 Scope

This Standard Specification contains the minimum technical requirements for rotary positive displacement pumps for use in refinery services chemical plants, petrochemical plants, and where applicable in exploration, production and new ventures. Selected equipments shall be in all respect within the range of the manufacturer’s proven experience and not involve the use or application of any prototype design or component.

Compliance with the provisions of this specification does not relieve the pump manufacturers of the responsibility of furnishing pump and accessories of proper design mechanically suited to meet operating guarantees at the specified service conditions.

No deviation or exception from this Standard shall be permitted without written approval of the Company. Intended deviations shall be separately listed by the Vendor and supported by reasons thereof for Purchaser’s consideration. (Sub.)

1.2 Alternative Designs

International System of Units (SI) in accordance with IPS-E-GN-100 shall be used, unless otherwise specified. (Mod.)

1.3 Conflicting Requirements

In the case of conflict between documents relating to the inquiry or order, the following priority of document shall apply:

- First priority : Purchase order and variations thereto
- Second priority : Data sheets and drawings
- Third priority : This specification (Sub.)

1.5 Referenced Publications

1.5.1 The latest editions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this standard: (Add)

IPS (IRANIAN PETROLEUM STANDARDS)

M-PM-240	"General Purpose Steam Turbine"
M-PM-250	"Special Purpose Steam Turbine"
M-EL-132	"Induction Motors"
M-PM-300	"Special Purpose Gear Units"
M-PM-320	"Lubrication, Shaft Sealing and Control Oil Systems for Systems for Special Purpose Application"
E-SF-900	"Noise and Vibration Control"
E-EL-110	"Electrical Area Classification and Extent"
E-GN-100	"Units"

SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)

AISI (AMERICAN IRON AND STEEL INSTITUTE)

HYDRAULIC INSTITUTE STANDARDS

(Mod.)

1.5.3 Deleted (Del.)

2. BASIC DESIGN

2.1 General

2.1.2 Pumps shall be designed to minimize the generation of noise and shall not exceed the noise limits given in the supplementary clauses bellow.

All definitions, notations, measuring equipment, measuring procedures, test reporting, calculation methods and calculation procedures shall be in accordance with IPS-E-SF-900. (Sub.)

2.1.2.1 Unless otherwise specified, the following limits shall be met at any measuring location not less than 1m from the equipment surface:

SOUND PRESSURE LIMIT IN dB	
Pump	87
Pump + driver	90

If the equipment produces impulsive and/or narrow band noise, the above limits shall be taken 5 dB lower, thus 82 dB for pump and 85 dB for pump + driver.

The above requirements apply in absence of reverberation and background noise from other sources, and for all operating conditions between minimum flow and rated flow. (Add.)

2.1.7 All equipment covered by this specification shall be designed for operation outdoors, unless otherwise specified on the individual pump data sheet. (Mod.)

2.2 Ratings and Speeds

2.2.2 Add "and Maximum Temperature" after rated capacity. (Mod.)

2.2.3 pump speed shall not exceed 1500 rpm. Pump which do not require timing gears, may operate at higher speeds subject to purchaser's authorization. (Mod.)

2.3 Pressure Casings

2.3.10 Areas of the pump which are normally subjected to suction pressure shall be designed to withstand the maximum discharge pressure. (Add.)

2.3.11 Casing shall be provided with 3 mm minimum corrosion allowance. (Add.)

2.4 Casing Connections

2.4.1 Suction and discharge connections DN 40 and larger shall be furnished with flanged suction and discharge nozzles integral with the casing, and orientations shall be indicated on the proposal.

Flanged suction connections shall be suitable for the maximum discharge pressure and pumping temperature.

2.4.4.3 Flanges that are thicker or have a larger diameter than required by ANSI may be furnished, but they shall be faced and drilled as specified in ANSI Standard. (Sub.)

2.4.4.4 Deleted (Del.)

2.4.6 Connections for drains, vents, seal cages, jackets and lubrication shall be DN 15 minimum. (Add.)

2.5 Rotating Element

2.5.1 All major rotating elements, and also assembled rotors shall be statically and dynamically balanced. (Mod.)

2.5.4 Dynamic shaft deflection under the maximum conditions of load shall not exceed 0.05 mm at the face of the stuffing box. (Add.)

2.6 Mechanical Seals and Conventional Packing

2.6.3.1 The pump vendor shall be responsible to obtain a full guarantee from the seal manufacturer for seals provided. Unless otherwise specified, mechanical seals shall be of the single, inside, hydraulically balanced design when the sealing pressure exceeds 450 kPa (4.5 bar. a). (Mod.)

2.6.3.3 When seal gland plates are used, they shall be of the same material as the pump case except for carbon steel and cast iron casings which shall be 18 Cr 8 Ni. Gland plates retaining mechanical seals shall have at least four bolts. (Mod.)

2.6.4 Stuffing boxes for conventional packing

2.6.4.6 Stuffing boxes shall preferably be integral with the pump casing. (Add.)

2.6.4.7 Packed stuffing boxes shall be flushed at the throat bushing if the liquid contains abrasive particles such as catalysts or coke in concentration of 11.98 Kg/m³ or more, or fails to provide the required lubrication for the packing. (Add.)

2.7 Bearings

2.7.5 Bearing housings preferably shall be arranged so that the bearings can be replaced without disturbing the pump drive or the pump mounting. In general internally lubricated type bearings are acceptable when the fluid pumped has no damaging effect on the bearings. (Add.)

2.8 Lubrication

2.8.2 In the case of a unit having oil lubricated bearings in separate housings, constant-level oilers shall be furnished. The oilers' volume shall be 120 cm³. (Mod.)

2.8.3 When pressure lubrication is required or specified for externally lubricated bearings, the pump vendor shall provide a self-contained lubrication system complete with oil pump reservoir, piping, filters, necessary controls and instrumentation, and water cooled or air cooled oil cooler as specified by the purchaser. (Add.)

2.9 Material

2.9.1.5 Steel casings are required for pumps located within process unit areas, handling a stream containing any flammable liquids or toxic materials. (Add.)

2.10 Nameplates and rotation arrows

2.10.1 The following Information shall also be indicated on nameplate:

- a) Equipment item number;
- b) Design pressure and temperature;
- c) RPM;
- d) Size and type of pump;
- e) Maximum allowable working pressure;
- f) Differential head;
- g) Total weight;
- h) Hydrostatic test pressure.

The serial number shall also be cast in or stamped on the pump casing. (Mod.)

3. ACCESSORIES

3.1 Drivers

3.1.5 All induction motors supplied by the pump vendor shall be in accordance with IPS Std. M-EL-132. (Mod.)

3.1.6 All steam turbines supplied by the pump vendor shall be in accordance with IPS Std's. M-PM-240 or M-PM-250. (Mod.)

3.1.7 Belt or chain drives are not acceptable. (Sub.)

3.2 Couplings and Guards

3.2.1 The coupling shall be capable of transmitting the total torque through the whole range of the pump performance curve as well as accommodating both angular and lateral misalignments.

The spacer piece shall be positively restrained from flying out in the event of failure of the flexible element. (Mod.)

3.2.3 Removable metallic guards shall be supplied by the vendor. Guards shall be non-spark type and sufficiently heavy and rigid in design to avoid contact with coupling or shaft as a result of bodily contact. (Mod.)

3.2.4 The couplings shall be dynamically balanced when the coupling size-speed relationship is such that balancing is recommended by the coupling manufacturer. (Add.)

3.3 Baseplates

3.3.1 The minimum size of base plate drain shall be 1". (Mod.)

3.3.4 For units having a gross weight of 50 Kg or more, the baseplate shall be provided with lifting lugs for a four-point lift. (Mod.)

3.3.6 Anchor bolts shall be furnished by the vendor, unless otherwise specified in data/requisition sheet. (Sub.)

3.3.7 Bases shall have a grout hole not less than 100 millimeters in diameter where practical and located so the base can be grouted in place without removal of pump, driver, or any auxiliaries. The grout hole shall be arranged so that the pumped fluid will not accumulate over the open grout. Adequate vent holes shall be provided to insure a complete distribution or grout. (Mod.)

3.3.9 Base plates shall be provided with two welded on earthing studs positioned diagonally at opposite end complete with two nuts and two washers per earthing. (Mod.)

3.4 Relief Valves

3.4.1 Delete purchaser from this clause and substitute vendor. (Mod.)

3.5 Auxiliary Piping

3.5.1 Stainless steel tubing and piping shall be cleaned with a suitable solvent. Cleaning shall be performed at vendor's shop.

3.5.4 Copper tubing and brass fittings are not acceptable. (Mod.)

3.5.7 Piping threads shall be taper pipe threads conforming with ANSI standards. Tapped openings for pipe threads shall conform with the ANSI for steel pipe flanges and flanged fittings. (Add.)

4. INSPECTION AND TESTS

4.2 Inspection

4.2.3 Shop inspection shall be carried out as follows prior to tests and performance testing.

For all pumps, shop inspection shall include a dimensional check against approved outline drawings combined with a visual check for good workmanship. Other types of inspection may be specified in purchase order or data sheet. (Add.)

4.3 Tests

4.3.1 General

4.3.1.2 The vendor shall notify the purchaser or his authorized representative not less than 15 days prior to the date the equipment will be ready for test. (Sub.)

4.3.2 Hydrostatic test

4.3.2.1 The minimum test pressure for casing shall be 780 kPa. g. [7.8 bar (g)].

The water used for the test shall contain a suitable wetting agent. The liquids with chloride content are not permitted for hydrostatic test of austenitic stainless steel materials. After completion of shop tests, pumps are to be thoroughly cleaned. (Mod.)

4.3.2.2 Pressure casing shall be hydraulically tested for at least four hours. (Mod.)

4.3.4 Optional test

4.3.4.2 If the NPSH required by the pump differs from the specified available NPSH by 0.3m or less, an NPSH suppression test is required. (Mod.)

4.3.4.4 Certified performance data and curves shall be supplied. (Mod.)

4.4 Preparation for Shipment

4.4.2.2 Unless otherwise specified the rust preventive applied to unpainted exterior machined surfaces shall be of a type:

- a) To provide protection during outdoor storage for a period of twelve months exposed to a normal industrial environment. and;
- b) To be removable with mineral spirits or any standard solvent. (Mod.)

4.4.3 Each pump shall be identified as required by the purchase order. No material shall be shipped separately. Miscellaneous parts shall be properly tagged by securely affixed metal tags and marked with the item number for which they are intended. All such parts shall be suitably boxed, firmly attached to the baseplate and shipped with the unit. (Sub.)

5. GUARANTEE AND WARRANTY

5.2 Performance

5.2.1 The complete pumping assembly shall be guaranteed for pressure, capacity and power consumption at specified design and operating condition, and satisfactory application in all respects to the operating conditions specified on the individual pump specification sheet. Permissible variations from the specified performance is as follows:

Capacity	Guarantee Point
	Minus Zero, plus 3% at the pump
	rated discharge pressure.
Brake Kilowatt	plus 4%
(Sub.)	

6. VENDOR'S DATA

6.2 Contract Data

6.2.2 Data

6.2.2.2 Illustrated spare parts list shall be furnished. Vendor's offer shall include recommended spare parts for two years of continuous operation with price list. (Mod.)

APPENDICES**APPENDIX A
ROTARY PUMP DATA SHEET**

Rotary Pump Data Sheet with SI Units shall be applied, unless otherwise specified.

**APPENDIX D
PIPE COMPONENTS NOMINAL SIZE**

The purpose of this Appendix is to present the equivalent identities for the piping component nominal size in imperial and SI Systems.

TABLE D-1

NOMINAL SIZE		NOMINAL SIZE		NOMINAL SIZE		NOMINAL SIZE	
DN ⁽¹⁾	NPS ⁽²⁾	DN	NPS	DN	NPS	DN	NPS
15	½	100	4	500	20	1000	40
20	¾	125	5	600	24	1050	42
25	1	150	6	650	26	1100	44
32	1¼	200	8	700	28	1150	46
40	1½	250	10	750	30	1200	48
50	2	300	12	800	32	1300	52
65	2½	350	14	850	34	1400	56
80	3	400	16	900	36	1500	60
90	3½	450	18	950	38	1800	72

(1) Diameter nominal, mm.

(2) Nominal pipe size, Inch.

(Add.)

**APPENDIX E
PIPE FLANGE PRESSURE TEMPERATURE RATING**

The purpose of this Appendix is to present the equivalent identities for the pipe flange nominal pressure temperature ratings in imperial and SI Systems.

TABLE E -1

PN RATING - BAR ⁽¹⁾	ANSI RATING - lb
20	150
50	300
65	400
100	600
150	900
250	1500
420	2500

(1) The indicated PN ratings are introduced by ISO Standard No. 7268.

(Add.)