



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

MATERIAL STANDARD
FOR
CENTRIFUGAL PUMPS FOR GENERAL SERVICES
NPCS-MS-RE-02
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GENERAL

- 1 This standard covers the minimum requirements for Centrifugal Pumps for General Services. This standard is not applicable for pumps in hydrocarbon and high duty services.
- 2 This standard is supplemented by the specification sheets on which the operating conditions and minimum special requirements are listed in detail. In case of conflicts between documents listed below, the ones appearing earlier in the list shall take precedence over those appearing later:
 - a) Purchase Order.
 - B) Data sheets.
 - C) The **requirements** of the requisitions.
 - D) This standard.
 - E) Other standards and specifications referred to in the above documents.
 - F) Vendor **drawings**.
- 3 Compliance by the vendor with the provisions of this standard does not relieve him of the responsibility of furnishing unit of proper design, mechanically suited to meet mechanical and performance guarantees **at the specified operating conditions**. Any deviation **from** this standard shall have written approval of purchaser. Exceptions other than those included in the above mentioned document shall not be considered.
- 1.4 Vendor shall only supply equipment of proven design and construction, of which satisfactory operation over at least a three year period can be proven in similar service and operating conditions.
- 1.5 All documentation shall be **issued**, using **SI metric system of measurement**, except for:
 - Pipe and flange sizes in inches.
 - Flange ratings in lbs.
 - Viscosity in cp.
 - Pressures in kg/cm².

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The English language shall be used for all correspondence, documents, catalogues, drawings and nameplates.

2 STANDARDS AND CODES

2.1 Centrifugal Pumps for General Services shall be designed, manufactured, assembled, inspected and tested in accordance with the editions that are in effect at the time of the purchase order of the following documents.

- API 610 Centrifugal Pumps in General Refinery.
- SHI Standard of the Hydraulic Institute, latest Edition, Centrifugal Pumps Section.
- ASME American Society of Mechanical Engineers, Boiler and Pressure Vessel Code: Section VIII, Unfired Pressure Vessel, Division 1 and 2, Section IX Welding Qualifications.
- ASTM American Society for Testing Materials.
- AFBMA The Anti-Friction Bearing Manufacturer's Association Standards.
- ANSI American National Standard Specifications.
 - B 1.1 "Screw Threads"
 - B 2.1 "Pipe Threads"
 - B 4.1 "Class FN-1, Cylindrical Fits"
 - B 16.1 "Cast Iron Pipe Flanges and Flanged Fittings, Class 125"
 - B 16.5 "Steel Pipe and Flanged Fittings"

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3 DESIGN

3.1 DESIGN CRITERIA

- 3.1.1 The variation of the performance curve (differential head/capacity) shall be such that the head increases gradually as the flow capacity decreases. With the delivery side closed, the value of the differential head shall lie between 110% and 120% of the head required for the design delivery flow. In some cases, these values shall vary, and shall be duly indicated in the data sheet. Any values lying outside these limits shall require the approval of purchaser during the tendering stage and shall be explicitly indicated in the data sheet.
- 3.1.2 When two or more pumps are intended to operate in parallel, the pertinent performance curves shall equally rise to shutoff.
- 3.1.3 Vendor shall indicate in the pump data sheet, the maximum and minimum delivery flows of which it is capable without endangering its normal mechanical and hydraulic performance.
- 3.1.4 The impeller diameter of pumps with constant-speed drivers shall be such that at least a 5% increase in head at the rated capacity can be obtained by installing a larger diameter impeller of the same pattern.
- 3.1.5 The best efficiency point for the furnished impeller shall be between the rated point and the normal point. However, in no case the rated point should be beyond 115% of the best efficiency point of the-rated impeller. More over the minimum continuous stable flow less than 20% of the best efficiency point, shall not be considered.
- 3.1.6 The correction factors given in the latest edition of the " Standards of the Hydraulic Institute " shall be used for sizing pumps handling liquids more viscous than water.
- 3.1.7 All equipment covered by this standard shall be designed for operation outdoor totally unprotected from the weather.



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- 3.1.8 The equipment shall conform to the project noise specification. The maximum permissible sound level shall not exceed 85 dBA measured at 1 m from pump and driver surface for the recommended range of operation.
- 3.1.9 Vendor shall supply a complete set of all special tools that are required. For the maintenance and installation of the pumps sets, the tools are to be supplied in a tool box.
- 3.1.10 Vendor shall submit recommendations for erection, initial operation and two years normal operation. Vendor shall indicate where each recommendation is additional to the spare parts already included in the requisition.
- 3.1.11 The equipment of instrument shall conform to the project instrument specification.
- 3.2 MECHANICAL DESIGN
- 3.2.1 General
- 3.2.1.1 Bracket (foot mounted) units and/or close-coupled (motor-pump) units with the impeller mounted on an extension of the motor shaft are only acceptable when specified on the individual pump specification sheet.
- 3.2.1.2 Pumps shall be provided with suitable means to facilitate disassembly of gasketed joints, such as eye bolts, lugs, jack screws, etc., and with all special hand tools necessary to dismantle and assemble the unit. Cradles, bolt tensioners, etc., required for maintenance in the field, shall be described with separate prices for consideration with proposal.
- 3.2.2 Suction and Discharge Flanges
- 3.2.2.1 In the event of differing standardization (DIN, UNI, etc.) , or non standard diameters agreed with Purchaser , vendor shall supply the counterflange with its ends duly machined according to the instructions of purchaser.



3.2.2.2 Unless otherwise specified in the purchase order, the suction and discharge flanges shall have the same rated testing pressure. This shall be determined on the basis of the maximum temperature and pressure that may be expected during operation and shall never be less than the value indicated under Point 5.2.1.

3.2.3 Thickness of Casing

3.2.3.1 The thickness of casing shall be calculated on the basis of the hydrostatic test pressure of the pump. This thickness shall then be oversized by an additional 3 mm, unless a greater value indicated as corrosion allowance. At no point, shall the thickness of the casing be less than the value **calculated** by the ASME Code.

3.2.4 Miscellaneous Connections

3.2.4.1 All pumps shall be provided with a vent connection, unless the pump is made self-venting by the arrangement of nozzles.

3.2.4.2 All horizontal pumps shall be provide with a drain connection.

3.2.4.3 The back of all flanges shall be either full-faced or spot-faced.

3.2.4.4 Flange bolt holes shall straddle the horizontal and vertical centerlines.

3.2.4.5 All vent, lantern ring, case drain, or seal **recirculation** connection on pumps shall be 1/2" IPS minimum. The respective plugs shall be solid and, in the case of pumps handling acid, corrosive or abrasive products or products containing suspended solids, shall fit flush with the inside wall of the casing.

3.2.5 Impellers

3.2.5.1 Pinning of the impeller is not acceptable. All impellers shall be keyed to their shafts except that "Taperlock" construction is acceptable in vertical pumps up to 93°C pumping temperature.

3.2.5.2 Pumps with wearing rings installed on the casing and the impeller are preferred.

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3.2.5.3 In any case, as a minimum requirement, the casing shall be fitted with a wearing ring and the thickness of the impeller in the "ring" area shall be such to permit subsequent modification or, possibly, the incorporation of a ring, if considered necessary, for pump maintenance purposes.

3.2.5.4 The hardness differential between contacting surfaces formed by materials with a tendency to cause seizure in the casing and impeller wearing rings, shall be greater than 50 Brinell.

3.2.5.5 The replaceable wearing rings shall be secured in place by means of screw pins. The use of spotwelds is not acceptable.

3.2.5.6 For cast Iron, Bronze, hardened 11-13 percent Chromium, and materials of similar low galling tendencies, the minimum clearance given in table below shall be used. For diameters greater than 5.999" (152.37 mm), the minimum diametral clearance shall be 0.017" (0.43 mm) plus 0.001" (0.025 mm) for each additional inch (25 mm) of diameter or fraction thereof. For materials with greater galling tendencies and/or for operating temperatures above 260°C, 0.005" (0.127 mm) shall be added to these diametral clearances.

Minimum running clearances

<u>Diameter of Rotating Member at Clearance</u> (mm)	<u>Minimum Diametral Clearance (mm)</u>
<50	0.254
50.000 - 63.4.74	0.279
63.500 - 76.174	0.304
76.200 - 88.874	0.355
88.900 - 101.574	0.405
101.600 - 114.274	0.406
114.300 - 126.974	0.406
127.000 - 152.374	0.431

3.2.5.7 Interstage bushings on multistage pumps may have clearances to the manufacturer's standard, provided the clearances are stated in the proposal and are approved by purchaser.

3.2.5.8 For vertical pumps, the running clearances specified in 3.2.5.6 shall not apply to the clearances of steady bearings or interstage bushing if materials of low galling tendencies used. The clearances used shall be stated in the proposal and approved by purchaser.