MATERIAL AND EQUIPMENT STANDARAD

FOR

CENTRIFUGAL PUMPS

FOR

GENERAL SERVICES

FIRST EDITION

MAY 2006

This standard specification is reviewed and updated by the relevant technical committee on May 2013. The approved modifications are included in the present issue of IPS.

FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS is based on internationally acceptable standards and includes selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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GENERAL DEFINITIONS:

Throughout this Standard the following definitions shall apply.

COMPANY:

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER:

Means the “Company” where this standard is a part of direct purchaser order by the “Company”, and the “Contractor” where this Standard is a part of contract documents.

VENDOR AND SUPPLIER:

Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:

Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR:

Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR:

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:

Is used where a provision is mandatory.

SHOULD:

Is used where a provision is advisory only.

WILL:

Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor.

MAY:

Is used where a provision is completely discretionary.

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0. INTRODUCTION

This Standard specification gives amendment and supplement to ISO Standard 5199 (2002), "Technical Specification for Centrifugal Pumps Class II ", for use in oil, gas and petrochemical industries.

It shall be used in conjunction with data/requisition sheets for Present Standard's Subject.

Guidance for Use of this Standard

For ease of reference, the clause or section numbering of ISO Standard 5199 (2002) has been used throughout this Standard. Clause in ISO Standard 5199 (2002) not mentioned, remain unaltered. For the purpose of this Standard, the following definitions shall hold:

Sub. (Substitution): The ISO Std. Clause is deleted and replaced by a new clause.

Del. (Deletion) : The ISO Std. Clause is deleted without any replacement.

Add. (Addition) : A new clause with a new number is added.

Mod. (Modification): Part of the ISO Std. Clause is modified, and/or a new description and/or condition is added to that clause.

1. SCOPE

1.1 This Standard specifies the minimum requirements for centrifugal pumps of single-stage, multistage, horizontal or vertical construction for use in water and general services, with any driver and installation to use in oil, gas and petrochemical industry in Iran.

This Standard is not applicable for Pumps in hydrocarbon and heavy duty services, which are covered in IPS-G-PM-105 **(Sub.)**

1.3 Compliance by the pump manufacturer with the provisions of this Standard does not relieve him of the responsibility of furnishing pumps and accessories of proper design, mechanically suited to meet operating guarantees at the specified service conditions.

No deviations or exceptions 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 purchasers consideration. **(Mod.)**

1.4 Selected equipment shall be in all respect, well within the range of the manufacturer proven experience, and shall not involve the use or application of any prototype design or components.

Vendors offering shall be a unit of duplicate size and design which has a successful record of proven service at operating condition similar to those specified. An installation list shall be submitted upon request. In the event no similar unit is available, the vendor may offer an alternative with a detailed explanation of where the offering differs from his field proven equipment. **(Add.)**

1.5 The International System of Units (SI) in accordance with IPS-E-GN-100 shall be applied, unless otherwise specified. **(Add.)**

Note 1:

This is a revised version of this standard, which is issued as revision (1)-2006. Revision (0)-1993 of the said standard specification is withdrawn.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on Aug. 2013. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No. 384 on Aug. 2013. These modifications are included in the present issue of IPS.

2. NORMATIVE REFERENCES

Throughout of this standard, the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date, shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies. **(Mod)**

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

B16.1	"Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800"
B16.5	"Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys"
B16.11	"Forged Steel Fittings, Socket-Welding and Threaded"
B16.42	"Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300"

BSI (BRITISH STANDARDS INSTITUTION)

BS EN 10204 type 2.2

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-GN-100	"Engineering Standard for Units"
IPS-G-SF-900	"General Standard for Noise Control and Vibration"
IPS-M-EL-131	“Material and Equipment Standard for Low voltage induction motor”
IPS-M-EL-132	"Material and Equipment Standard for Medium and high voltage induction motor"
IPS-G-PM-105	"General Standard for Centrifugal Pumps for petroleum, Petrochemical and Natural Gas Industries"

3. TERMS AND DEFINITIONS

3.26 Specific Speed

The effect of suction lift on a centrifugal pump is related to its head, capacity and speed which shall be intended to furnish a unit that matches the requirements at the highest possible efficiency and prevention of any cavitations specially when intending for pump probable future growth. **(Add.)**

3.27 Suction Specific Speed

An index of pump suction operating characteristics determined at the best efficiency point with the maximum diameter impeller. **(Add.)**

4. DESIGN

4.1 General

Vertical pumps shall be limited to services where NPSH or head capacity limitations make a horizontal pump impractical.

Bracket / Foot mounted units are acceptable unless specified by purchaser.

Pumps that have a suction specific speed greater than 13000 (Metric) are not acceptable and will not be considered.

Closed couple pumps shall be radial split casing and be limited to rated capacities/total head less than 100 cubic meter per hour/ 100 meter of water respectively.

In order to maximize the interchangeability, pump dimensions should preferably conform to ISO 2858 Std. Similarly the mechanical seals shall be of the universal type interchangeable where possible between ASME and ISO Std. **(Mod.)**

4.1.1 Conflicting Requirements

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

First priority : Purchase order and variations thereto.

Second priority : Data sheets and drawings.

Third priority : This Specification.

All conflicting requirements shall be referred to the purchaser in writing. The purchaser will issue confirmation document if needed for clarification. **(Sub.)**

4.1.2 Pump H-Q curve, characteristic curve

If specified, the rated flow shall be with in the region of 70-110% of Best Efficiency Point of the furnished impeller. The rated impeller diameter shall not be greater than 97% of the maximum impeller diameter **(Mod.)**

4.2 Prime Movers

Where applicable, all induction motors supplied by pump manufacturer shall be in strict accordance with requirements of IPS-M-EL-132.

Where applicable, reciprocating internal combustion engines shall be in accordance with IPS-M-PM-290. **(Mod.)**

4.5 Branches (Nozzles) and Miscellaneous Connections

4.5.2 Inlet and Outlet Branches

One and two stage pumps shall have suction and discharge flanges of equal rating. Pumps shall be furnished with flanged suction and discharge nozzles integral with the casing. Flanges shall conform to ASME standard (B16.1, B16.5, B16.42 where applicable)

When the manufacturer/supplier standard is not in accordance with ASME, companion flanges compatible with the piping class shall be supplied. **(Mod.)**

4.8 Impellers

4.8.2 Securing of impellers

Pinning of the impeller is not acceptable. All impellers shall be keyed to their shafts. Impellers for multistage pumps shall be individually secured against axial movement in either direction along the shaft. **(Mod.)**

4.9 Wear Rings or Equivalent Components

Unless otherwise specified, renewable wear rings shall be furnished on both the casing and impeller. **(Mod.)**

4.11 Shaft and Shaft Sleeves

4.11.7 Securing and sealing of shaft sleeve

Unless otherwise specified, replaceable shaft sleeves to protect the shaft where it passes through the stuffing boxes or mechanical seal are required on all pumps. Shaft sleeves shall extend beyond the outer face of the gland (seal plate). **(Mod.)**

4.11.10 Reverse Rotation

Vertical pump that could be damaged by reverse rotation shall be provided with non-reverse ratchet. **(Add.)**

4.12 Bearings

4.12.5 Bearing housing design

Bearing housing shall be arranged so that the bearing can be replaced without disturbing pump driver or mounting. Bearing housing for horizontal pumps shall be equipped with replaceable oil seals on shaft passages to effectively retain the oil inside the housing and prevent entry of foreign material into the housing. Bearing housing on vertical pumps shall have equally adequate protection.

If forced lubrication system and or grease is not used, bearing and bearing housing shall be arranged for flingers or oil rings lubrication.

Bearing oil temperature shall not exceed 82°C based on specified operating conditions and specified ambient temperature. For temperatures above 82°C cooling system shall be provided.

Cooling coil shall be 316 stainless steel as minimum. Piping connections shall be outside the bearing housing. **(Mod.)**

4.13 Shaft Sealing

4.13.1 General

The pump manufacturer shall guarantee the seals provided.

All mechanical seals shall be of the single, inside hydraulically balanced design, unless otherwise specified on the individual pump data sheet. **(Mod.)**

4.13.3 Mechanical seals

14.13.3.1 All mechanical seals shall be according to API 682. **(Mod.)**

4.16 Baseplate

4.16.1 General

Baseplate shall be provided with lifting lugs for at least a four points lift of the baseplate complete with all equipment mounted without permanently distorting or damaging the baseplate.

Two earthing lugs are required at diagonally opposite corners on the baseplate. **(Mod.)**

4.16.5 Assembly of pump and driver on baseplate

4.16.5.3 Alignment positioning screws shall be provided for each pump set component that weighs more than 50kg to facilitate transverse horizontal adjustments. Baseplate vertical leveling screws shall be provided for pump sets weighting more than 75kg. **(Add.)**

5. MATERIALS

5.2 Material Composition and Quality

Material of construction shall be identified and tested in accordance with internationally recognized standard such as ASTM, AISI, DIN, BS, etc.

Unless otherwise specified, supplier shall provide, traceability of materials used for pressure parts, wear rings, shaft sleeves, impeller and shaft. All materials shall be provided with inspection/test certification in accordance with BS EN 10204 .The minimum level of inspection document shall be BS EN 10204 type 2.2. **(Mod.)**

5.3 Repairs

After weld repair all castings shall be post weld heat treated as required by casting specification. All weld repairs shall be visually examined and or undergo magnetic particle inspection or Dye penetration examination. **(Mod.)**

6. SHOP INSPECTION AND TESTS

6.3 Tests

6.3.3 Hydrostatic test

6.3.3.1 Test pressure is maintained for at least 30 min. The chloride content of test water shall be less than 50 P.P.M. for Austenitic S.Steel materials. **(Mod.)**

6.3.4 Performance test

6.3.4.3 NPSHR test shall be performed at each test point expect shut-off unless otherwise specified by purchaser. **(Add.)**

6.3.4.5 If a noise test is required, the test of airborne noise emitted by the pump shall be carried out in accordance with IPS-G-SF-900. **(Sub.)**

6.3.4.6 Whenever possible pumps and prime mover shall be subjected to combined test run. **(Add.)**

6.3.4.7 Certified test curves are required, curves shall be drawn from the test data obtained for the purchased pump and shall include head, efficiency, NPSH and brake horse power recalculated to the proper specific gravity plotted against capacity. **(Add.)**

6.3.4.8 Job mechanical seals or packing shall be used during the running and performance tests but shall not be used for the hydrostatic test. If the pump is driven by the driver of the manufacturer test bench, the results shall be corrected to expected speed of the job driver in site load condition.**(Add.)**

6.3.4.9 If it is necessary to dismantle a pump for some other corrections such as improvement of power, NPSH, or mechanical operation, the initial test will not be acceptable, and the final performance test shall be run after correction is made, unless otherwise specified. **(Add.)**

6.3.4.10 Manufacture shall provide a test report including comparison to contract tolerances and conclusion i.e. acceptable / compliant. **(Add.)**

6.3.4.11 Vendor shall demonstrate that the pump can operate at the quoted minimum continues flow without giving rise to vibration of unacceptable values. **(Add.)**

7. PREPARATION FOR DISPATCH

7.1 Shaft Seals

Mechanical seal shall be installed unless otherwise agreed. For packed pumps, prior to shipment, the soft packing used during running tests shall be removed, in this case a warning label shall be securely attached to the pump. **(Sub.)**

7.2 Preservation for Transport and Storage

Bearings, bearing housings, and oil systems including reservoirs, coolers, filters and piping shall be thoroughly cleaned. Mechanical seal assemblies shall be fully protected from rusting and entry of moisture and dirt. **(Mod.)**

7.4 Openings

All flanged openings shall be protected with metal cover-plates to prevent damage during shipment. Closures shall be a minimum of 5 mm thick and shall be installed with a full size gasket using a minimum of four (4) full diameter bolts.

Threaded openings shall be provided with steel caps or round head steel plugs in accordance with ASME B16.11.

The caps or plugs shall be of material equal to or better than of the pressure casing. Non-metallic caps are not allowed. **(Mod.)**

7.5 Piping and Auxiliaries

All instruments and valves including auxiliary systems must be securely mounted and/or supported to eliminate damage during shipment, storage, operation and maintenance.

Connections furnished on the purchased pump shall be impression stamped to agree with Manufacturer's connection table listed on the general arrangement drawing. Tagging in lieu of stamping is only acceptable where the connections because of size or geometry can not be impression stamped.

Pump with seals installed, driver, baseplate and all furnished auxiliaries (except spacers and coupling bolts) shall be shipped fully assembled. Coupling spacers and bolts shall be separately boxed and securely attached to the baseplate. **(Sub.)**

7.6 Identification

Each item shall be identified with its item number. Tags shall be corrosion resistant metal and impression stamped, "Item No...." tags shall be attached to each component with wire. This tag is in addition to the equipment nameplate.

Miscellaneous parts shall be tagged or marked with the tag item number for which they are intended. All such parts shall be suitably boxed, firmly attached to the main item and shipped with the unit. **(Sub.)**

8. VENDOR'S DATA

8.1 Proposals

Vendor's proposal shall include the information specified in items a through n.

a) An individual delivery schedule for each equipment item number.

b) The duration of time required for certification of all information, drawings, etc.

c) Preliminary outline dimension drawing, (double case vertical pumps must show the length of the outer case).

d) Typical cross sectional drawing.

e) Centrifugal pump performance curves which include differential head, efficiency, water NPSHR, and brake mechanical power (hp) all expressed as functions of capacity.

These curves shall be extended to at least 125 percent of capacity at peak efficiency.

The head capacity curve for maximum diameter impeller(s) shall be shown. The minimum continuous stable/thermal flow shall also specified.

Where fluids more viscous than water are specified, the viscous curve must be drawn along with the water curve.

Viscosity corrections shall be made in accordance with the correction factors given in the latest edition of the "Standards of the Hydraulic Institute".

Manufacturer's published performance test curves are acceptable except when viscosity correction factors are used. When applicable, manufacturer shall state viscosity correction factors used to determine corrected head capacity and efficiency.

The eye areas of the first stage impeller identification number shall also be noted on the curve.

f) Details of proposed pressure lubrication systems including lube oil schematic when required.

g) Completed purchaser's data sheets.

h) Preliminary outline dimensional drawings of electric motors.

i) Preliminary outline dimensional drawings of steam turbines.

j) Preliminary outline dimensional drawings of reciprocating combustion engines.

k) Preliminary outline drawing of speed changers with completed purchaser's data sheets.

l) Two years & start up priced list of recommended spares.

m) Special hand tools necessary as per clause 4.17 of this Standard shall be described with separate prices for consideration.

n) The delivery data specifying fixed number of calendar days from the receipt of the written order. **(Add.)**

8.2 Drawings

8.2.1 Approval of drawings shall not relieve Manufacturer of any responsibility in meeting the requirements of specifications nor shall such approval be considered as permitting deviations from specifications or purchaser order requirements, unless specifically agreed to in writing. **(Add.)**

8.2.2 All drawings and data submitted must be identified with the purchaser's order number and equipment tag number. **(Add.)**

8.2.3 Prior to final drawing submittal, the manufacturer shall add to his drawings, notes and data requested by the purchaser. This is required since these drawings are used by the purchaser in the field for erection and installation. Also, these drawings are incorporated into the purchaser's bound documents for the ultimate users record.

8.2.4 Outline drawings per following clauses 8.2.4.1 to 8.2.4.6 shall be furnished. **(Add.)**

8.2.4.1 Certified correct dimensional drawings of completely, assembled units, which shall show:

a) Identification data for pump, coupling and driver.

b) Direction of Rotation.

c) Weight.

d) Adequate dimensional data to permit the design of foundation, piping and wiring connection.

e) Location of motor junction box(es).

f) Piping connection identified, with the size, rating, and facing indicated.

g) Clearance required for disassembly and maintenance. **(Add.)**

8.2.4.2 Auxiliary connections listed on the composite outline drawing identified as follows:

a) Not furnished this order.

b) Not drilled this order.

c) Plugged requires field piping by purchaser.

d) Plugged, not required this order.

e) Piped by manufacturer.

f) Including the seal flush, lubricating oil control and electrical systems. **(Add.)**

8.2.4.3 The composite outline drawing shall also reference any supplementary drawings required to complete the pump auxiliary piping, seal flushing and cooling water piping, identified by the applicable designation of piping arrangement for seals, as per Annex F. **(Add.)**

8.2.4.4 A cross sectional drawing (without dimensions) which identifies parts and a listing of the parts which agree with the equipment furnished shall be supplied. **(Add.)**

8.2.4.5 A general arrangement and layout of auxiliary piping and system show its approximate location and routing relating to the major components, type, size, capacity and pressure rating shall be furnished, a bill of material must be shown on the drawing. **(Add.)**

8.3 Curves

8.3.1 The certified test curve shall be drawn from actual test data obtained for the purchased pump and shall include head, brake horse power (recalculated to proper specific gravity and viscosity), and efficiency plotted against capacity. **(Add.)**

8.3.2 The water NPSH curve shall be included, drawn from actual test data if a NPSH test was specified; otherwise a representative curve may be substituted and labelled "Typical" or "Catalogue Curve". **(Add.)**

8.3.3 The curve shall include the maximum and minimum diameters of the impeller supplied, eye area of the first stage impeller, identification number of the impeller, and pump serial number. Viscosity correction, if applicable; shall be indicated **(Add.)**

8.3.4 The vendor shall provide full information to enable completion of the data sheets, first for "as purchase" and then for "as built". This should be done by the vendor correcting and filling out the data sheets and shipping copies to the purchaser. **(Add.)**

8.4 Data

8.4.1 Vendor shall provide lubrication schedule including all equipment furnished by the manufacturer and show:

a) Recommended lubricant for use during break-in and normal operation, to meet purchaser requirements.

b) Method of application of the lubricant.

c) Quantity of initial fill.

d) Quantity of lubricant shipped with initial order.

e) Recommended break in period of initial application.

f) Recommended time between change of lubrication.

g) Refill quantities and quality if different from initial change.

h) Technical specification of each lubricant to be used including ISO viscosity grade number, etc.

i) Expected annual consumption.

j) Any special lubrication precautions, or detailed lubrication considerations to be observed on the equipment. **(Add.)**

8.4.2 The part list shall include all equipment furnished by the manufacturer and sub-supplier and shall show pattern, stock or production drawing numbers, materials of construction and quantities of items required per pump. **(Add.)**

The list shall completely identify each part so that parts interchange-ability with other equipment furnished by the same manufacturer may be determined. Standard purchased items shall be identified by the original manufacturer's numbers. **(Add.)**

8.4.3 Recommended spare parts list shall be submitted including price and delivery in addition to the standard data required on the complete parts list. It shall be noted that this list will generally be required promptly and in time to permit ordering and delivery of spare parts prior to field start up).

9. GUARANTEE AND WARRANTY

9.1 Mechanical

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor agrees to the following guarantees and warranties:

a) All equipment and component parts shall be warranted by the vendor against defected materials, design and workmanship for 1 years after start-up or 18 months after shipment, whichever is longer.

b) If any mal-performance or defects occur during the guarantee and warranty period, the vendor shall make all necessary alterations, repairs and replacements free of charge, with no field labor charges, on the purchaser's job site. **(Add.)**

9.2 Performance

The pump shall be guaranteed for satisfactory performance at all operating conditions specified on the data sheet. **(Add.)**