MATERIAL AND EQUIPMENT STANDARD

FOR

LIGHT DUTY CENTRIFUGAL PUMPS

ORIGINAL EDIRTION

Mar. 1996

This standard specification is reviewed and updated by the relevant technical committee on Oct. 1999(1) and Nov. 2011(2). The approved modifications are included in the present issue of IPS.

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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 are based on internationally acceptable standards and include 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 document.

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 the amendments and supplements to ASME Standard B 73.1M-2001 Edition, "Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process".

For ease of reference, the clauses and paragraph numbering of ASME Standard B 73.1M have been used throughout this Standard.

Clauses and paragraphs in ASME Standard not mentioned, are remained unchanged.

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

Sub. : The ASME Standard clause or paragraph is deleted and substituted by a new clause or Paragraph.

Add. : A new clause or paragraph with a new number is added.

Mod.: Part of the ASME Standard, clause or paragraph is modified, and/or a new statement or comment is added to that clause.

Del.: The ASME Standard clause is deleted without any replacement.

1. SCOPE

This Standard covers the minimum requirements for horizontal end suction centrifugal pump chemical process for use in refinery services, gas, chemical and petrochemical plants and where applicable in explorations, productions and new ventures.

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

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Oct. 1999. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 125 on Oct. 1999. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on Nov. 2011. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No 316 on Nov. 2011. These modifications are included in the present issue of IPS.

1.1 Conflicting Requirements

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

- **First Priority :** Purchase order and variations thereto.
- **Second Priority :** Data sheets and drawings.
- **Third Priority :** This Standard Specification.

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

2. ALTERNATIVE DESIGN

No deviations or exceptions from this Standard shall be permitted without the written prior approval of the purchaser.

Intended deviations shall be separately listed by the vendor and supported by reasons thereof for purchaser consideration. **(Mod.)**

2.1 Units

This Standard is based on International System of Units (SI), as per IPS-E-GN-100 except where otherwise specified. **(Add.)**

3. NOMENCLATURE AND DEFINITIONS

3.2 Diameter Nominal, written as DN 15, 25, etc., has been used for pipe sizes in accordance with ISO 6708 and Appendix A of this Standard. **(Add.)**

3.3 Pressure Nominal, written as PN 20, 50, etc., has been used for flange ratings in accordance with ANSI-ASME, B 16.5, ISO 7268 and Appendix B of this Standard. **(Add.)**

4. DESIGN AND CONSTRUCTION FEATURES

4.3 Casing

4.3.2 Boss connections if required shall be DN 15 (½ inch) minimum. **(Mod.)**

4.3.3 For temperatures higher than 177°C the casing shall be center-line mounted. **(Mod.)**

4.3.5.1 Jacket connections shall be DN 15 (½ inch) minimum. **(Mod.)**

4.3.7 The stress used in design of pressure casing for any given material shall not exceed the values given for that material in Section VIII, Division 1 of the ASME Code at the maximum specified operating temperature. For cast materials, the factor specified in the code shall be applied. Pressure casing shall comply with the applicable rules of Section VIII, Division 1 of the ASME Code. Manufacturers' data report forms and stamping, as specified in the code, are not required. **(Add.)**

4.3.8 The pressure casing shall be designed for the maximum discharge pressure plus tolerance for head and speed increases at the pumping temperature. **(Add.)**

4.4 Impeller

4.4.1 Close type impellers are preferred. **(Mod.)**

4.4.4 Impellers shall be keyed to the shaft. **(Mod.)**

4.5 Shaft

4.5.1 Shaft sleeves shall extend beyond seal end plate for pumps, employing throttle bushing. **(Mod.)**

4.6 Shaft sealing

4.6.1 Mechanical seals shall be furnished, unless otherwise specified. **(Mod.)**

4.6.7 Mechanical seals shall be of the single balanced type unless otherwise specified by purchaser of recommend by vendor. **(Add.)**

4.7 Bearing

4.7.6 Drain size shall be DN 15 (½") minimum. **(Mod.)**

4.8 Material of Construction

The use of chaplets in pressure casting shall be held to minimum, cleaned , corrosion – free (plating is permitted), of a composition compatible with the casting and not to be used in impeller castings. Chaplets and other defects (in casing other than cast iron) shall be repaired by weld metal compatible with the casing composition . Repair procedure including weld maps shall be submitted for purchasers' approval. Weld repairs shall be inspected according to same quality standard used to inspect the casting or other defects, shall be replaced by weld metal equivalent to the casing composition. Casings shall be heat treated following any major repair. A major repair is to be taken

as either a removal of more than 50% of the wall thickness, or a length of more than 150 mm in one or more directions, or a total surface area of all repairs exceeding 20% of the total casting surface area. **(Add.)**

4.12 Miscellaneous Design Features

4.12.1 An auxiliary device to control spray form stuffing box/seal chamber leakage shall be provided. Local regulations may require additional guards. Dry flexible disc couplings shall be supplied unless otherwise approved by purchaser. Felxible elements of couplings shall be of corrosion resistant materials. **(Mod.)**

4.12.8 Flanged suction and discharge nozzles shall be integral with the casing. **(Add.)**

4.12.9 All required vents shall be valved. **(Add.)**

4.13 General Design Features **(Add.)**

4.13.1a) The head curve for the pump shall be continuously rising from the specified capacity point to the shut off point.

b) The pump head at shut-off shall be at least 110%, but not exceed 120%, of the head at the specified capacity point

c) Pumps for parallel operation shall have equal head rise to shut-off.

d) Pump suction specific speed shall not exceed 216 in SI Unit System and 13000 in customary units. **(Add.)**

4.13.2 Unless otherwise specified the pumps and auxiliaries shall be suitable for outdoor installation, in the climatic zone specified. **(Add.)**

5. GENERAL INFORMATION

5.1 Application

5.1.3 Sound

Pumps shall be designed & manufactured to minimize the generation of noise and shall not exceed the noise limits given in the following table, at 1m from the equipment surface.

Sound Pressure Limit in dB re 20 MPa	
Pump	87 dB
Pump + Driver	90 dB

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

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

Where excessive noise from equipment can not be eliminated by low noise design, corrective measures preferably should take the form of acoustic insulation for pipes, gearbox, etc. where noise hoods are proposed, prior approval of the Purchaser shall be obtained regarding construction, materials and safety requirements.

Noise control measures shall cause neither hindrance to operations nor any obstruction to routine maintenance activities. Requirements of IPS-G-SF-900 shall be followed. **(Sub.)**

5.2 Tests

5.2.1 Hydrostatic

Change 10 minutes minimum to 30 minutes minimum. **(Mod.)**

5.2.2 Performance

Performance tests for all pumps are required and shall be performed. **(Mod.)**

5.3 Nameplates

The text on nameplates shall be in English language and the data in SI unit. The information on nameplate shall include item number, year of manufacture, and the name of manufacturer. **(Mod.)**

5.4 Drivers(Add.)

5.4.1 The type of driver will be specified by the purchaser. The driver shall be sized to meet the maximum specified operating conditions, including bearing, mechanical seal, and coupling losses, as applicable, and shall be in accordance with the applicable specification, as stated in the inquiry and order. The driver shall be suitable for satisfactory operation under the utility and site conditions specified by the purchaser. **(Add.)**

5.4.2 Motor drives shall comply with IPS-M-EL-131, IPS-M-EL-132 and turbine driver with IPS-M-PM-240**.** **(Add.)**

5.4.3 The starting conditions for the driven equipment will be specified by the purchaser, and the starting method shall be mutually agreed upon by the purchaser and the vendor. The driver's starting-torque capabilities shall exceed the speed-torque requirements of the driven equipment.

(Add.)

6. REFERENCES

6.1 Other Publication

The latest edition of the following Standards to the extent specified herein shall be part of this Standard:

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

"Boiler and Pressure Vessel Code: Section VIII"

"Rules for Construction of Pressure Vessels"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

E 44	"Guide for Radiographic Testing"
E 125	"Reference Photographs for Magnetic Particle Indications on Ferrous Casting"

E 142 "Method for Controlling Quality of Radiographic Testing"

E 709 "Practice for Magnetic Particle Examination"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-M-EL-131 "Material and Equipment Standard for Low Voltage Induction Motors"

IPS-M-EL-132 "Material and Equipment Standard for Medium and High Voltage Induction Motors"

IPS-M-PM-240 "Material and Equipment Standard for General Purpose Steam Turbines"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

6708 "Pipe Components-Definition of Nominal Size"

7268 "Pipe Components-Definition of Normal Pressure" **(Mod.)**

8. INSPECTION **(Add.)**

8.1 General

8.1.1 After advance notification of the Vendor by the purchaser, the purchaser's representative shall have entry to all vendor and subvendor plants where manufacturing, testing, or inspection of the equipment is in progress. **(Add.)**

8.1.2 The Vendor shall provide sufficient advance notice to the purchaser before conducting any inspection or test that the purchaser has specified to be witnessed or observed. **(Add.)**

8.1.3 The purchaser will specify the extent of his participation in the inspection and testing. **(Add.)**

8.1.4 When shop inspection has been specified by the purchaser, the purchaser and the vendor shall coordinate manufacturing hold points and inspectors' visits. **(Add.)**

8.1.5 The Purchaser's representative shall have the right to reject any parts of the equipment which do not comply with the purchase order. **(Add.)**

8.1.6 The Vendor shall keep the following data available for at least 5 years for examination by the purchaser or his representative upon request:

a) Necessary certification of materials, such as mill test reports.

b) Purchase specifications for all items on bills of materials.

c) Test data to verify that the requirements of the specification have been met.

d) Results of documented tests and inspections.

e) Final-assembly maintenance and running clearances.

f) If specified, details of all repairs and records of all heat treatment performed as part of repair procedure. **(Add.)**

8.1.7 Pressure-containing parts shall not be painted until the specified inspection of the parts is completed. **(Add.)**

8.2 Material Inspection **(Add.)**

When radiographic, ultrasonic, magnetic particle, or liquid penetrant inspection of welds or materials is required or specified, the criteria in 7.2.l through 7.2.4 shall apply unless otherwise are specified by the purchaser. Cast iron may be inspected in accordance with 7.2.3 and 7.2.4 welds, cast steel,

may be inspected in accordance with 7.2.l through 7.2.4.

8.2.1 Radiography

Radiography shall be in accordance with ASTM E 94 and ASTM E 142. The acceptance standard used for welded fabrication shall be Section VIII Division 1, UW-52, of the ASME Code. The acceptance standard used for castings shall be Section VIII, Division 1, Appendix 7 of the ASME Code. **(Add.)**

8.2.2 Ultrasonic inspection

Ultrasonic inspection shall be in accordance with Section V, Article 5 of the ASME Code.

The acceptance standard used for welded fabrications shall be Section VIII, Division 1, Appendix 12 of the ASME Code. The acceptance standard used for castings shall be Section VIII, Division 1, Appendix 7 of the ASME Code. **(Add.)**

8.2.3 Magnetic particle inspection

Both wet and dry methods of magnetic particle inspection shall be in accordance with ASTM E 709.

The acceptance standard used for welded fabrications shall be section VIII, Division 1, Appendix 6 of the ASME Code. The acceptability of defects in castings shall be based on a comparison with the photographs in ASTM E 125. For each type of defect, the degree of severity shall not exceed the limits of Table 1. **(Add.)**

TABLE 1 - MAXIMUM SEVERITY OF DEFECTS IN CASTINGS

TYPE	DEFECT	MAXIMUM SEVERITY LEVEL
I	LINEAR DISCONTINUITIES	1
II	SHRINKAGE	2
III	INCLUSIONS	2
IV	CHILLS AND CHAPLETS	1
V	POROSITY	1
VI	WELDS	1

8.2.4 Liquid penetrant inspection

Liquid penetrant inspection shall be in accordance with Section V, Article 6 of the ASME Code.

The acceptance standard used for welded fabrications shall be Section VIII, Division 1, Appendix 8 of the ASME Code. The acceptance standard used for castings shall be Section VIII, Division 1, Appendix 7 of the ASME Code. **(Add.)**

9. PREPARATION FOR SHIPMENT **(Add.)**

9.1 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.)**

9.3 The equipment shall be prepared for shipment after all testing and inspection have been completed and the equipment has been approved by the purchaser. The preparation shall include that specified in 8.3.1 through 8.3.8. **(Add.)**

9.3.1 Packing used in tests shall be removed from the stuffing boxes. **(Add.)**

9.3.2 Exterior surfaces, except for machined surfaces, shall be given at least one coat of the manufacturer's standard paint. Stainless steel parts need not be painted. **(Add.)**

9.3.3 Exterior machined surfaces shall be coated with a suitable rust preventive. **(Add.)**

9.3.4 Internal areas of cast iron and carbon steel bearing housings and oil systems' components shall be coated with a suitable oil-soluble rust preventive. **(Add.)**

9.3.5 Flanged openings shall be provided with metal closures at least 5 millimeters thick, with rubber gaskets and at least four full-diameter bolts. For studded openings, all nuts needed for the intended service shall be used to secure closures. **(Add.)**

9.3.6 Threaded openings shall be provided with steel caps or round-head steel plugs in accordance with ANSI B 16.11. The caps or plugs shall be of material equal to or better than that of the pressure casing. In no case shall nonmetallic (such as plastic) caps or plugs be used. **(Add.)**

9.3.7 The equipment shall be identified with item and serial numbers. Material packed separately shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number of the equipment for which it is intended. No material shall be shipped separately. **(Add.)**

9.3.8 Exposed shaft couplings shall be wrapped with waterproof, moldable waxed cloth or vapor-phase-inhibitor paper. The seams shall be sealed with oilproof adhesive tape. **(Add.)**

9.4 Bearing assemblies shall be fully protected from the entry of moisture and dirt. If vapor-phase-inhibitor crystals in bags are installed in large cavities to absorb moisture, the bags must be attached in an accessible area for ease of removal. Where applicable, bags shall be installed in wire cages attached to flanged covers, and bag locations shall be indicated by corrosion-resistant tags attached with stainless steel wire. **(Add.)**

9.5 One copy of the manufacturer's standard installation instructions shall be packed and shipped with the equipment. **(Add.)**

10. GUARANTEE AND WARRANTY (Add.)

10.1 Mechanical

Unless exception is record by the Vendor in his proposal, it shall be understood that the Vendor agrees Unless to the following guarantees and warranties:
a) the following 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 alteration, repairs and replacements free of charge, with no field labor charges, on the purchaser' s job site. **(Add.)**

10.2 Performance

The pump shall be guaranteed for satisfactory performance at all operating conditions specified on the data sheet. Performance tolerance should be:

Rated differential head	**-2 to +5 (Percent)**
Rated power	**-0 to +4 (Percent)**

(Add.)

APPENDICES

APPENDIX A

PIPE COMPONENTS NOMINAL SIZE (Add.)

The purpose of this Appendix is to establish an equivalent identity for the piping components nominal sizes in Imperial System and SI Unit System.

TABLE A1

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.

APPENDIX B

PIPE FLANGES PRESSURE TEMPERATURE RATING

The purpose of this Appendix is to establish an equivalent identity for the pipe flange nominal pressure temperature ratings in Imperial System and SI Unit System.

TABLE B1

PN [1]	ANSI RATING CLASS
20	150
50	300
68	400
100	600
250	1500
420	2500

[1] Pressure Nominal, bar.