MATERIAL AND EQUIPMENT STANDARAD

FOR

CENTRIFUGAL PUMPS

FOR

GENERAL SERVICES

FIRST EDITION

MAY 2006

CONTENTS : Page No.

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 specification. Clause in ISO Standard 5199 (2002) not mentioned, remain unaltered. For the purpose of this specification, 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. Pumps used in the chemical process industries (e.g. those conforming to IPS-M-PM-135) are typical of those covered by this Standard.

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

1.2 This Standard includes design features concerned with installation, maintenance, and safety for these pumps including base-plate, couplings and auxiliary piping. **(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. **(Sub.)**

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 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. **(Add.)**

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

Note: This is a revised version of the standard specification for Centrifugal Pumps for General Services, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

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	"Units"
IPS-G-SF-900	"Noise and Vibration Control"
IPS-M-EL-132	"Induction Motors"
IPS-M-PM-105	"Centrifugal Pumps for Process Services"
IPS-M-PM-135	"Light Duty Centrifugal Pumps"

ISO (INTERNATIONAL ORGANIZATION for STANDARDIZATION)

2858	"End-suction centrifugal pumps (rating 16 bars)"

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. The Specific Speed shall be calculated from formula shown on page 12 of the Hydraulic Institute Standards, 14th. Edition. **(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.

If specified, in-line pumps may be proposed for appropriate services. Integrally geared or direct drived pumps can be selected.

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.)**

4.3 Critical Speed, Balance and Vibration

4.3.2 Balance and vibration

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

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

4.7 Branch (nozzle) Flanges

If specified ASME Standard may be used. **(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 Sealing

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). Shaft sleeve material shall at least be of SS316. **(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

4.12.1 General

The radial and thrust bearings shall be preferably of rolling element type. **(Mod.)**

4.12.3 Bearing temperature

Based on specified operating conditions and ambient temperature, the pump manufacturer/supplier shall specify if cooling or heating is necessary to maintain bearing temperatures within the limit given by the bearing manufacturer. **(Sub.)**

4.12.4 Lubrication

Horizontal pump bearings shall be arranged for oil lubrication unless otherwise specified on the individual pump data sheet **(Mod.)**

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 coil or 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 .Unless otherwise specified, mechanical seals shall be employed for pumps operating at more than 5 barg.

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

4.13.3.2 Springs shall be Alloy 20 or 316 S. S. except that metal bellows, where used, shall be of seal manufacturer's recommended material for the service. Metal bellows shall have a corrosion rate less than 0.05 mm per year.

Gland plate gasket shall be of the pressure sealing type (o ring, spiral wound metallic etc.) and capable of withstanding the full temperature of the pumped fluid.

Metal seal ring shall not have sprayed overlay in place of solid face. Seal gland plates shall be of stainless steel material.

Gland plates retaining mechanical seals shall have at least four bolts **(Mod.)**

4.16 Base Plate

4.16.1 General

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

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

4.16.5 Assembly of pump and driver on base plate

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. Base plate 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, 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 150 P.P.M. for Austenitic S.Steel materials. **(Mod.)**

6.3.4 Performance test

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, and brake mechanical power recalculated to the proper specific gravity plotted against capacity. **(Add.)**

6.3.4.8 Mechanical seals or job 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.)**

7. PREPARATION FOR DISPATCH

7.1 Shaft Seals

Mechanical seals are 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.

Two sets of new and unused packing shall be shipped with the pump, properly identified, but not installed. **(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 Securing of Rotating Parts for Transport

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, base-plate 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 base-plate. **(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 m.

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

b) The length 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) 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. **(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 Certified correct dimensional drawings or specified components of the driven train shall be supplied. **(Add.)**

8.2.4.5 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.)**

8.2.4.6 A general arrangement and layout of auxiliary piping to show its approximate location and routing relating to the major components shall be furnished. A material list must be shown on the drawing. **(Add.)**

8.2.5 Schematic drawings of auxiliary system:

a) Shall include and identify all components by make, type, size, capacity, pressure rating, materials and the like, as applicable.

b) Shall show the seal in cross section with parts numbered and identified. Installation and setting dimensions shall be shown. A bill of material must be included on the drawing. Stuffing box shall be fully dimensioned.

c) Shall describe installation, operating and maintenance procedures for all equipment, auxiliaries and instruments furnished by the manufacturer and any sub suppliers. **(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 mechanical power (hp) (recalculated to proper specific gravity), 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 labeled "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.)**

Note: Manufacturer's test data is not required.

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. NIOC, Exxon or Shell oils only to be specified.

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) Note 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).

8.4.4 A certification by the Manufacturer test engineer(s) shall be submitted, that the equipment has been tested and performed satisfactorily. **(Add.)**

9. Guarantees

9.1 Performance

The complete pumping assembly shall be guaranteed for satisfactory mechanical and hydraulic performance at all operating conditions specified on the data sheets, including the range between minimum continuous stable flow and rated flow. **(Add.)**

Permissible variation from the specified performance is as follows:

	Guarantee Point	**Shutoff**
Differential head 170 m	Minus 2%, Plus 5%	Minus 10%, Plus 1%
Differential head over, 170 m	Minus 2%, Plus 3%	Minus 8%, Plus 8%
Efficiency	Minus ½ point of efficiency	
Brake mechanical power(hp)	Plus 4%	
Required NPSH	Plus 0%	

9.2 Mechanical

If any defect or mal-performance occur during the period of 12 months after the equipment start up, the vendor shall make all necessary alterations, repairs, and replacements free of charge, fob factory. Field labour charges, if any, shall be subject to negotiation between vendor and purchaser.

(Add.)