ISLAMIC REPUBLIC OF IRAN
MINISTRY OF PETROLEUM

IPS-M-PM-200(1)

IRANIAN PETROLEUM STANDARD

IPS

MATERIAL AND EQUIPMENT STANDARD

FOR

RECIPROCATING COMPRESSORS FOR PROCESS SERVICES

FIRST EDITION

DECEMBER 2003

DEPUTY MINISTER
FOR
ENGINEERING & TECHNOLOGY
RESEARCH AND STANDARDS

FOREWORD

This Standard is intended to be used within and for Iranian Ministry of Petroleum (N.I.O.C, N.I.G.C, N.P.C., N.I.O.R.D.C. and other affiliate organizations and companies) and has been prepared on the basis of the recognized standards, scientific publications, technical documents, accumulated knowledge and experiences in petroleum industries at national and international levels.

Iranian Petroleum Standards are prepared by Iranian Petroleum Standards Organization reviewed and amended by the relevant technical standard committees to incorporate acceptable comments made by oil, gas and petrochemical experts.

Standards are finally approved by the "Standards High Council" of Iranian Ministry of Petroleum.

Iranian Petroleum Standards (IPS) are subject to amendment withdrawal, if required, thus the latest edition of IPS shall be applicable.

Any comment or recommendation submitted to the "Iranian Petroleum Standards Organization" will be evaluated in the relevant technical committee and will be considered in the next revision, upon approval.

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 etc.

"PURCHASER" : Means the "Company " Where this standard is 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.

"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.

"SHOULD" : Is used where a provision is advisory only.

"SHALL" : Is used where a provision is mandatory.

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MATERIAL AND EQUIPMENT STANDARD

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RECIPROCATING COMPRESSORS FOR PROCESS SERVICES

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0. INTRODUCTION

This Standard gives technical specifications and general requirements for the purchase of "Reciprocating Compressors for Process Services" for use in oil, Gas and Petrochemical Industries and is based on API Standard 618, Fourth Edition, June 1995, and shall be apply in conjunction with that document.

Note: This is a revised version of the standard specification for reciprocating compressors for process services, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Guidance for Use of this Standard

The amendments/supplement to API Standard 618, Fourth Edition June 1995, given in this Standard are directly related to the equivalent sections or clauses in API Standard 618. For clarity, the section and paragraph numbering of API Standard 618 has been used as for as possible. Where clauses in API are referenced within this Standard, it shall mean those clauses are amended by this Standard. Clauses in API that are not amended by this Standard shall remain valid as written.

The following annotations, as specified hereunder, have been used at the bottom right hand side of each clause or paragraph to indicate the type of change made to the equivalent clause or paragraph of API.

Sub. (Substitution)	:	The clause in API shall be deleted and replaced by the new clause in this Standard.
Del. (Deletion)	:	The clause in API shall be deleted without any replacement.
Add. (Addition)	:	The new clause with the new number shall be added to the relevant section of API.
Mod. (Modification)	:	Part of the clause or paragraph in API shall be modified and/or the new description and/or statement shall be added to that clause or paragraph as given in this Standard.

SECTION 1

GENERAL

1.1 Scope

This Specification, contains the minimum requirements for reciprocating compressors and their drivers for use in refinery services, chemical plants, gas plants, petrochemical plants and where applicable in exploration, production and new ventures.

Compliance with the provision of this Standard does not relieve the Vendor of the responsibility of furnishing compressors of proper design, mechanically suited to meet operating guarantee at the specified service condition. Unless specific exception accompanied by a description of the proposed substitute is recorded under the heading "Exception" in manufacturer's proposal, it shall be mutually understood that the proposal, is based on equipment, which complies strictly with the requirements of this Standard. **(Mod.)**

1.2 Alternative Design

SI Unit System, dimension and rating in accordance with IPS-E-GN-100 shall be used, Unless otherwise specified. **(Mod.)**

1.3 Conflicting Requirements

In case of conflict between documents relating to the inquiry or purchase order the following priority of documents, whichever more stringent realized by the company shall apply:

- First priority: purchase order (including attachments) and variations thereon.

- Second priority: data-requisition sheets and drawings.

- Third priority: this specification.

All conflicting requirements shall be referred to the purchaser in writing. The purchaser will issue conforming documentation if needed for clarification.

Mandatory requirements can not be superseded by any of the foregoing. **(Sub.)**

1.5 Referenced Publications

Throughout 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.

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-M-PM-115 "Centrifugal Pumps for General Services"

IPS-M-PM-140 "Positive Displacement Pumps-Rotary"

IPS-M-PM-240 "General Purpose Steam Turbines"

IPS-M-PM-250 "Special Purpose Steam Turbines"

IPS-M-PM-260 "Industrial Combustion Gas Turbine for Process Services"

IPS-M-PM-290 "Internal Combustion Diesel Engines"

IPS-M-PM-300 "Special Purpose Gear Units for Process Services"

IPS-M-PM-310 "Special Purpose Couplings"

IPS-M-PM-320 "Lubrication, Shaft Sealing, and Control Oil System for Special Purpose Applications"

IPS-G-ME-220 "Shell and Tube Heat Exchangers"

IPS-G-ME-245 "Air Cooled Heat Exchangers"

IPS-M-EL-132 "Induction Motors"

IPS-E-GN-100 "Units"

IPS-E-EL-110 "Electrical Area Classification and Extent"

IPS-G-SF-900 "Noise and Vibration Control"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

A285 "Pressure Vessel Plates, Carbon Steel Low and Intermediate-Tensile Strength"

B 111 "Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock"

E 165 "Liquid Penetrant Inspection" **(Mod.)**

SECTION 2

BASIC DESIGN

2.1 General

2.1.2 Compressors shall be designed to minimize the generation of noise conforming to the requirements of IPS-G-SF-900.Unless otherwise specified the following limits shall be met at any measuring location, 1 m from the equipment surface:

Sound Pressure Limit in dB re 20 mPa	
Compressor	87 dB
Compressor + Driver	90 dB

If the equipment produces impulsive noise, the above limits shall be taken 5dB lower, thus 82dB for compressor and 85dB for the compressor + 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 may take the form of acoustic insulation for pipes, gearboxes, etc. Where acoustic insulation and/or noise hoods are proposed, prior approval of the purchaser shall be obtained regarding construction, materials and safety requirements.

Noise control measures shall cause no hindrance to operations nor any obstruction to routine maintenance activities. **(Sub.)**

2.1.7 All electrical components and installations shall meet the requirements of IPS-E-EL-110.

(Mod.)

2.1.12 The capacity at the normal operating point certified by the manufacturer is to have no negative tolerance. The compressor vendor shall submit the design tolerance between the compressor's rated capacity and the required capacity. This tolerance should not be more than 3%. **(Sub.)**

2.1.14 Unless otherwise specified, all equipment shall be designed for outdoor installation.. **(Mod.)**

2.1.20 Compressor and drive train shall also be capable to operate continuously in any condition of loading or unloading that can be achieved with the capacity control system provided when operating at rated suction conditions . **(Add.)**

2.2 Allowable Speed

Unless otherwise specified, compressor speeds and corresponding average piston speeds for lubricated cylinder, shall be limited to the following maximum:

INSTALLED POWER	MAXIMUM COMPRESS. SPEED	MAXIMUM AVERAGE PISTON SPEED
25 kW and below	500 rpm	6 m/s
25-150 kW	400 rpm	5 m/s
150 kW and above	375 rpm	4 m/s

For special high pressure services these maximum speeds could be considerably lower, based on the manufacturer's experience.

The average piston speed in compressors handling saturated hydrocarbon gases and in non-lubricated compressor cylinders shall not exceed 3.5 m/s. **(Mod.)**

2.3 Allowable Discharge Temperature

2.3.2 The high discharge temperature trip signal, which will shut down the unit, shall be set at 20°C above the maximum operating discharge temperature. Each cylinder shall have its own dedicated temperature measuring point for this purpose, which shall be located as close as possible to the cylinder discharge valve. **(Mod.)**

2.4 Rod and Gas Loadings

2.4.5 The compressor shall be capable handling momentary excursions of operation up to 15 percent above the maximum allowable continuous combined rod-load and maximum allowable continuous gas load ratings. **(Mod.)**

2.4.6 Predicted combined rod loading for specified normal and worst case condition (i.e., at relief valve set pressure of part load) shall be submitted at the time of proposal. **(Add.)**

2.6 Compressor Cylinders

2.6.1 General

2.6.1.2 Unless otherwise specified in data sheet, horizontal cylinders shall be provided, which shall have top suction and bottom discharge. **(Sub.)**

2.6.1.5 Stud holes shall be counter bored (chamfered). **(Mod.)**

2.6.2 Cylinder appurtenances

2.6.2.3 Liners shall extend the full length of the cylinder, and shall be pinned or doweled from outside to prevent possible rotation. **(Mod.)**

2.6.2.11.4 Also adequate clearance shall be provided to permit the use of torque wrenches, including multipliers for torque values over 300 Nm. **(Mod.)**

2.6.3 Cylinder cooling

2.6.3.5.4 Pumps in the cooling system shall be centrifugal type pumps and shall be of the Horizontal close coupled type, unless other types are specified in the data sheet. Pumps shall comply with IPS-M-PM-115, "Centrifugal Pumps for General Services". Pumps shall have nodular cast iron or steel casings. The type of drivers shall be as indicated in the data sheet. Each pump shall have a suction strainer, which shall be provided with a 40 mesh SWG 32 stainless steel screen.

(Add.)

2.7 Valves and Unloaders

2.7.3 The design of valves shall aim for maximum valve life. If valves are required to operate by different gas compositions, the manufacturer shall clearly state in his proposal which of the gas compositions the valve design has been optimized and which restrictions are to be applied during operation on other gases. **(Mod.)**

2.7.4 The proposed type and material of gaskets shall be subject to the purchaser's approval.**(Mod.)**

2.7.5 All valves located at the bottom side of a cylinder shall be provided with an arrangement to retain the complete valve assembly, including cage, in position while the cover plate is removed or installed. **(Mod.)**

2.7.11 Replace sentence of the “When specified”, by the “unless otherwise specified” .

2.8 Pistons, Piston Rods, and Piston Rings

2.8.1 Hydraulic tightening methods are strongly preferred for all piston rod nuts. Piston with diameters larger than 500 mm, may only be furnished with the explicit approval of the purchaser. **(Mod.)**

2.8.6 Tail rods, if used, shall have forged steel enclosures which will contain the rod in the event of rod failure. **(Mod.)**

2.9 Crankshafts, Connecting Rods, Bearing and Crossheads

2.9.9 Vendor shall provide a crank case purge connection for injection of a dry, inert gas by the purchaser. This connection shall be in an accessible location at the maximum practical distance away from the crankcase breather. **(Add.)**

2.10 Distance Pieces

2.10.4 Solid metal distance piece covers shall be provided. **(Mod.)**

2.10.5 Each distance piece compartment shall be provided with a valve (plugged, bottom drain connection) and a top vent connection for hooking-up to purchaser's vent system. Packing vent piping inside of distance piece shall be capable to withstand for the maximum allowable working pressure of cylinder. **(Mod.)**

2.11 Packing Case and Pressure Packing

2.11.2 Cap bolts are not allowed. **(Mod.)**

2.11.3 Connections on packing case shall be minimum DN20 (3/4"). **(Mod.)**

2.11.4.2 Cooling passages and their respective sealing between the cups shall be designed such that any entrainment of process gas into the coolant system is positively prevented. **(Mod.)**

2.11.8 For services containing H2S, the API arrangement is mandatory. **(Mod.)**

2.12 Compressor Frame Lubrication

2.12.3 Twin full-flow filter shall be furnished. **(Mod.)**

2.12.3.2 The pump shall be rotary internal screw type and shall be driven by an electric motor. The electric motor driver shall be suitable for the area classification specified and shall comply with IPS-M-EL-132. **(Mod.)**

2.12.4 Coolers shall be furnished with removable bundles and the minimum tube wall thickness shall be 1.65 mm (16 BWG).The Vendor shall design the lubrication oil system such that the oil pressure at cooler outlet be at least 100 kPa (1 bar) higher than the maximum water pressure stated in the data sheet in order to prevent oil contamination in case of cooler failure. **(Mod.)**

2.12.6 Dual filters shall be supplied complete with a separate or integral continuous-flow transfer valve. **(Mod.)**

2.12.7 Delete "when specified" from this clause and replace it by "If the specified minimum ambient temperature is less than the minimum lube oil temperature required by the manufacturer for starting,". **(Mod.)**

2.12.9 When an auxiliary pump is furnished or when coolers or filters are too large to be located within the confines of the compressor base, the pump, coolers, filters, interconnecting piping, and instruments shall be mounted together on a skid. **(Add.)**

2.12.10 Required quantity and specification for the cylinder and/or frame lubricating oil shall be specified in the proposal. **(Add.)**

2.13 Cylinder and Packing Lubrication

2.13.1.1 Unless otherwise specified single-plunger, per-point lubrication shall be furnished. **(Mod.)**

2.13.1.7 Each compressor cylinder shall have a minimum of two lubricating points **(Mod.)**

2.13.2.4 Lubricator reservoirs shall be equipped with a low level alarm. Piston rod packing of cylinders with a rated discharge pressure of 10000 kPa g (100 bar g) or more shall have a minimum of two lubricating points unless otherwise specified.

Piston Rod packing of cylinders with a rated discharge pressure above 25000 kPa g (250 bar g) shall have a minimum of three lubricating points unless otherwise specified. Lubricating points shall be made on the upper side of the piston rod. **(Mod.)**

2.14 Materials

2.14.1 General

2.14.1.2 When vendor's quoted material specification is DIN, JIS, or other Foreign Standard, the proposal shall indicate the nearest above named American Specification equivalent along with exact and specific deviation, (chemical properties, physical properties, testing, etc.) for purchaser's evaluation of equivalence for service intended. **(Mod.)**

2.14.1.11 The anti-seize compound shall be suitable for the operating temperature. **(Mod.)**

2.14.2 Pressure containing parts

2.14.2.1 Gray cast iron shall not be used for compressor cylinders, above 7000 kPa g cylinder relief valve pressure. Nodular cast iron (also known as ductile iron) shall not be used. **(Mod.)**

2.15 Nameplates and Rotation Arrows

2.15.3 Unless otherwise specified the text on the nameplates shall be in English language **(Mod.)**

SECTION 3

ACCESSORIES

3.1 Drivers

3.1.1 General

3.1.1.1 The full flow relief condition at the discharge and normal conditions at the suction shall be taken into account when sizing the driver. If a diesel engine is specified as the main driver, it shall be per IPS-M-PM-290. **(Mod.)**

3.1.1.3 Any limitation on starting or special provision to be furnished by the purchaser shall be stated in the Vendor's Proposal. **(Mod.)**

3.1.1.6 V-belt drives are not permitted. **(Mod.)**

3.1.1.7 The Vendor shall make provisions for jacking in two horizontal directions (axial and transverse) for foot mounted drivers and gearboxes mounted on vendor furnished base plates. **(Add.)**

3.1.2 Motor drivers

3.1.2.5 Electric motors for main drives as well as auxiliary drives shall be as specified in data sheet and shall also comply with IPS-M-EL-132. **(Sub.)**

3.1.2.12 Anti-friction bearings are not acceptable. **(Mod.)**

3.1.3 Turbine drivers

3.1.3.1 Steam turbine drivers shall conform to API Std. 611, as supplemented by IPS-M-PM-240 or to API Std. 612, as supplemented by IPS-M-PM-250 and related data sheet whichever is applicable.

Gas turbine drivers shall comply with API Std. 616. as supplemented by IPS-M-PM-260 and related data sheet. **(Mod.)**

3.1.3.2 When specified, a separate lube oil system in accordance with API Std. 614 as supplemented by IPS-M-PM-320 shall be furnished for a turbine drive train. **(Sub.)**

3.2 Couplings and Guards

3.2.1 Couplings

3.2.1.2 Couplings and coupling mountings shall comply with API Std. 671 as amended/supplemented by IPS-M-PM-310. **(Mod.)**

3.2.1.3 Use of quill shaft shall be highlighted in the Vendor's Proposal. **(Mod.)**

3.4 Belt Drives

Delete this section. **(Del.)**

3.5 Mounting plates

3.5.1.2.11 Delete "when specified" from this Clause. **(Mod.)**

3.5.1.2.12 Unless otherwise specified anchor bolts will be furnished by the Vendor in this Case.

The design and method of installation in the foundation will be subject to the vendor's review and approval. **(Sub.)**

3.6 Controls and Instrumentation

3.6.1 General

3.6.1.1 The control and instrumentation shall be adequate for controlling the compressor safely and efficiently at the operating conditions specified in data sheet. **(Mod.)**

3.6.1.9 Each piston rod of a horizontal compressor shall be provided with a non-contacting probe for rod run-out measurement.

The probe shall be located in the out-board distance piece on the packing case flange and shall be wired to an outside junction box, where the proximator is located. The junction box shall provide plug type connections for portable read-out equipment. **(Add.)**

3.6.2 Control system

3.6.2.2 Vendor shall select controls to avoid any loaded or unloaded condition which could damage the compressor. Vendor shall state in the proposal the extent of unloading required for start-up (if not specified by the purchaser). **(Mod.)**

3.6.2.5 If clearance pockets are recommended by the Vendor, they shall be preferably of the 2-position type (open and closed) and shall be pneumatically actuated. **(Mod.)**

3.6.3 Instrument and control panels

3.6.3.3 Wiring termination for different voltages if any shall be housed in separate enclosures. **(Mod.)**

3.6.4 Instrumentation

3.6.4.5 Relief valves

3.6.4.5.1 Delete "when specified" from first sentence. Brass or Cast iron safety/relief valves and fittings are not allowed. All safety relief valves shall have flanged inlet and outlet connections.**(Mod.)**

3.6.5 Alarms and shutdowns

3.6.5.1 Direct switches in alarm and shutdowns are not allowed. A combinations of signal transmitter with switch and/or trip amplifier shall always be used. **(Mod.)**

3.6.5.4 All instruments and controls including alarm and shutdown sensing devices, shall be installed with sufficient valve for isolation to permit testing and removal while the system is in operation. **(Mod.)**

3.6.5.9 Alarm and shutdown devices shall be energized at normal operating conditions of the system and be installed such that device failure, power supply failure, wire breakage etc. will cause alarm and/or shutdown. **(Sub.)**

3.6.5.11 Minimum instrumentation shall include the following switches:

a) Excessive vibration alarm, High frame vibration.

b) Excessive engine jacket water temperature (each cylinder) pre-alarm and shutdown with alarm.

c) Low oil level or drive failure on forced feed lubrication alarm. **(Add.)**

3.7 Piping and Appurtenances

3.7.1.5 Vendor shall clearly identify, on schematic drawing, all piping requiring insulation or heat tracing. **(Mod.)**

3.7.1.6 All purge and vent connections shall be piped up to a single purge and vent connection. **(Mod.)**

3.7.1.7 Delete "when specified" from the first sentence. **(Mod.)**

3.7.1.11 Using threaded connections are allowed only on instruments, when approved by the purchaser, **(Mod.)**

3.7.1.12.9 Delete this Clause. **(Del.)**

3.7.1.13 The application of hydraulic fastening tools, or similar, shall be possible for:

a) Class 1500 flanges of DN 150 and larger.

b) Class 2500 flanges of DN 100 and larger. **(Mod.)**

3.7.2 Frame lubricating oil piping requirements

3.7.2.5 All lubricating oil lines shall be made of AISI 316L stainless steel and shall have flanged connections. **(Mod.)**

3.8 Inter-Coolers and After-Coolers

3.8.3 Unless otherwise specified, water-cooled shell-and-tube intercoolers and after coolers shall be designed and constructed in accordance with TEMA R, as amended / supplemented by IPS-G-ME-220, Finned tubes and U tubes are not acceptable. **(Sub.)**

3.8.7 When air coolers are specified, they shall conform to IPS-G-ME-245. **(Sub.)**

3.9 Pulsation and Vibration Control Requirements

3.9.1 General

a) The manufacturer shall provide pulsation suppression devices at the suction and discharge side of each cylinder. Cylinders operating in parallel may be connected to a common suction and a common discharge pulsation suppression device.

b) Volume bottles (defined as vessels without any internals, with a diameter of at least twice the line connection diameter, and having an internal volume of at least 12 times the piston displacement per revolution of all connected cylinders) shall be used as pulsation suppression devices.

The use of inter coolers and/or after coolers as pulsation suppression devices are not permitted.

c) Vendor shall supply a moisture separator for each interstage, either separate from or integral with the suction pulsation damper. All separators shall be designed, constructed and inspected in accordance with ASME Code, Sect. VIII, Div. 1, (latest revision) and be

code stamped. Each separator operating below 6800 kPa g (68 bar g) shall have one hour minimum liquid holding capacity and be equipped with an automatic drain trap with inlet and outlet block valves, check valve, bypass with globe valve, and an equalizing line with block valve. Each separator operating above 6800 kPa g (68 bar g) shall have four hours minimum liquid holding capacity and shall have two manual globe type drain valves in series. Liquid volumes shall be based on the condensation that occurs when using minimum cooling water temperatures as during winter months. Each separator shall be equipped with a level gage and high level pre-alarm switch. All piping between the separators and drain traps shall be supplied by the Vendor and shall be (type 304 stainless steel). **(Mod.)**

3.9.2 Design approaches

3.9.2.6 If the result of an acoustical and/or the results of a mechanical response analysis are such, that modifications to the piping and/or pulsation suppression devices are necessary, the following descending order of priority shall be used by the manufacturer in making proposals for modifications:

1) Increase of volume bottle and/or pipe volume.

2) The application of orifices. The restriction orifice plates shall be tagged as instrument flow orifice plates.

3) The application of other types of pulsation suppression devices.

Each modification is subject to the purchasers approval. **(Mod.)**

3.9.2.8 Replace "should normally be specified" in the first sentence by "shall be performed". **(Mod.)**

3.9.3 Pulsation suppression devices

3.9.3.4 All butt welds for pulsation suppression devices shall be 100 percent radiographed. **(Sub.)**

3.9.3.21 Volume bottles shall be designed and constructed for full vacuum service. Minimum design pressure for suction volume bottles shall be two third (2/3) of the rating of the discharge bottle or as specified by the purchaser on the data sheets. **(Add.)**

3.9.4 Supports for pulsation suppression devices

3.9.4.1 Delete "If specified" from this clause. **(Mod.)**

SECTION 4

INSPECTION, TESTING, AND PREPARATION FOR SHIPMENT

4.1 General

4.1.8 All certificates shall contain the following information as a minimum:

- Name of purchaser.
- Purchase order number and date.
- Manufacturer's order number.
- Identification number of certificate and its date of issue.
- Material specification(s).
- Dimensions in SI Units, unless otherwise specified or approved.
- Material charge number, or batch number.
- Mechanical properties recorded from test results.
- Chemical composition recorded from results of chemical analysis.
- NDT methods and results, when and where applicable.
- Heat treatment procedures, furnace charge number and heat treatment records, where applicable.
- Any supplementary or additional information as may be required. **(Add.)**

4.1.9 If specified on data sheet, third party witnessed material test certificates, are required for pressure-containing parts in hydrocarbon services and for crank shafts, connecting rods, crossheads, piston rods, cylinder liners, and main bolts and nuts. **(Add.)**

4.2 Inspection

4.2.1.3(b) Magnetic particle inspection shall be carried out on all surfaces after final machining. Dye penetrant inspection shall be used only when magnetic particle inspection is not feasible. **(Mod.)**

4.2.2.1 Full non-destructive inspection shall be carried out on all critical areas of cylinder castings, such as abrupt changes in section, weld ends, at the junction of risers, gates or feeders to the castings and areas of high stress. Prior to inspection, the purchaser and manufacturer shall agree the critical areas and the type of non-destructive testing which shall be applied. Radiographic inspection shall be applied, whenever possible. **(Mod.)**

4.2.3.2 The oil system shall be circulated in the manufacturer shop. The oil system shall meet the test screen cleanliness requirements specified in API - 614 as amended and supplemented by IPS-M-PM-320. **(Sub.)**

4.3 Testing

4.3.2 Hydrostatic and Gas Leakage Tests

4.3.2.2 All cast pressure containing parts for toxic or flammable services greater than 12 molecular weight shall have a gas pressure test as described above. Nitrogen may be used for services greater than 12 molecular weight. **(Mod.)**

4.3.3 Mechanical Running Test

4.3.3.2 Delete "when specified" from this Clause and replace “Unless otherwise specified”. **(Mod.)**

4.3.3.5 Auxiliary equipment not integral with compressor such as auxiliary oil pumps, oil coolers, filters, etc. shall be subjected to a functional test and cleanliness verification as a subassembly in the vendor's shop if not used during a compressor running test. **(Sub.)**

4.3.3.6 The compressor shall be dismantled for inspection which shall be carried out as follows:

- Internal surface of cylinder liners to be checked for roundness, required surface finish and material imperfections.

- Piston rings and rider rings to be checked for gap clearance, groove clearance and bearing surface

- Piston rod to be checked on packing area surface and run out which shall be in accordance with the limits of (2.6.2.1).

- All valve assemblies to be checked for correct lifting height of valve plates and leakage (leakage test of valves to be done either with air or with low viscosity solvent, water is not allowed).

- Main bearings, crank bearings and cross head to be checked for correct bonding of Babbitt material to the base metal and for correct bearing surface.

- Crankshaft journal, crank pin and cross head pin to be checked for the bearing contact area.

- Crankcase to be internally inspected to check:

- Locking device of all bearing bolt nuts.

- Correct fitting of lubricating oil piping to main bearing.

- Correct securing of lubricating oil piping in the crankcase.

4.3.4 Other tests

4.3.4.2 Replace "when specified" by "unless otherwise specified". **(Mod.)**

4.3.4.4 Packaged unit test

When specified, such components as gears, the driver, the control panel, and all auxiliaries that make up the complete compressor unit shall be tested together with the compressor during the mechanical running test. This will include, but not necessarily be limited to, coolers, vessels, piping, all instrumentation and all electrical equipment in the scope of supply of the Vendor. Compressor control system and all associated instrumentation shall be demonstrated to be fully and correctly operational. Details of the extent and the procedure of the test shall be included in the proposal. The final version of the test procedure shall be subjected to purchaser's approval. **(Add.)**

4.4 Preparation for Shipment

4.4.1 Preparation for shipment shall be in accordance with the requirements of the inquiry and/or the purchase order(s) and the supplements appertaining thereto. The preparation shall make the equipment suitable for 12 months of outdoor storage from the time of shipment. **(Mod.)**

4.4.3.11 All materials shall be shipped together and separate shipment is not acceptable. **(Mod.)**

SECTION 5

VENDOR'S DATA

5.2 Proposals

5.2.3 Technical data

t. The Vendor's Proposal shall also contain an installation list containing the following:

1) Compressor manufactured at the proposed point of manufacture having comparable speed, power, rating, cylinder size, and discharge pressure of a gas of comparable analysis and characteristics.

2) Date of installation and beginning of continuous process service. **(Sub.)**

5.3 Contract Data

5.3.1.1 The purchaser will state in the inquiry and in the order the number of prints and/or reproducible required and the times within which they are to be submitted by the vendor (6 numbers shall be furnished unless otherwise noted). **(Mod.)**

5.3.2.1 The purchaser's order number and the purchaser's equipment item number shall be provided on every drawing. **(Mod.)**

5.3.3 Performance data

5.3.3.1 Delete "when specified". **(Mod.)**

5.3.3.2 In any case the Vendor is responsible for satisfactory load reversal for all specified operating conditions. **(Mod.)**

SECTION 6

GUARANTEE AND WARRANTY

6.1 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:

During a period of 12 months after the date of commissioning, the Vendor shall, with all possible speed and without cost to the purchaser, replace or repair the goods or any part thereof found to be defective due to faulty material, workmanship or to any act or omission of the Vendor. In particular the Vendor shall reimburse any transportation and other charges incurred by the purchaser in effecting such replacement or repair at the point of use. **(Add.)**

6.2 Performance

The compressor shall be guaranteed for satisfactory performance at all operating conditions specified on the data sheet. Performance tolerance should be as detailed in Par. 2.1.1.2. **(Add.)**

APPENDICES

APPENDIX D

REPAIRS TO GRAY AND NODULAR IRON CASTINGS

D.1 Scope

Add to this clause:

Any repair and/or repair method is subject to the explicit approval of the purchaser. **(Mod.)**

APPENDIX G

FIGURES AND SCHEMATICS

Add to note 6 of Figure G.4:

The packing flare connection line between connection G and the liquid collection pot in "type B" and "type C" arrangements shall be provided with a pressure and temperature indicator, which shall be located as close as practical to the distance piece connections G. **(Mod.)**

APPENDIX H

MATERIAL SPECIFICATION FOR MAJOR COMPONENT PARTS

Delete from table H-1 the following:

- cylinders	gray iron		
- compressor cylinder head	gray iron		
- valve seats and guards	cast iron		
- packing	cases	cast iron	**(Mod.)**

Note to Users

The IPS Standards 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 publications are based on internationally acceptable standards and include selections from the options 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 or diversity of conditions of each project or work.

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 users of IPS publications are therefore requested to send their views and comments, including any addendum prepared for particular cases to the Ministry of Petroleum, Standards and Research Organization. These comments and recommendations will be reviewed by the relevant technical committee and will be incorporated in the formal revision of the relevant IPS. The IPS publications are reviewed and revised approximately every five years.

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