

MATERIAL AND EQUIPMENT STANDARD
FOR
WATER BLASTING EQUIPMENT

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1. SCOPE

1.1 This specification contains the minimum general requirements for high pressure water blasting equipment used to clean effectively the inner and outer walls of fouled pipes, and tubes of, heat exchangers, coolers, condensers, water drain pipes, hydraulic pressure steel pipes, turbine blades, pump impellers and other equipment to be used in refinery services, chemical plants, gas plants, petrochemical plants and new ventures, where applicable.

No derivation from this specification is permitted without explicit approval of the Company.

The intended deviations shall be clearly indicated and separately listed in the Vendor's proposal.

Compliance with the requirements of this Standard does not relieve the Vendor of the responsibility for furnishing a unit of proper design, strength, workmanship and materials to suit the specified operating conditions.

1.2 In case of conflict between this Standard and inquiry or order following priority of documents shall apply:

First priority : Purchase order and variations thereto.

Second priority : Data-requisition sheets.

Third priority : This specification Standard.

2. REFERENCES

Following standards to the extent specified herein form part of this Standard:

API (AMERICAN PETROLEUM INSTITUTE)

API 674 "Positive Displacement Pumps-Reciprocating"

IPS (IRANIAN PETROLEUM STANDARD)

IPS-E-PM-400 "Vendor Data Requirements"

IPS-M-EL-132 "Electric Motors"

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

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIAL)

D 380 "Methods of Testing Rubber Hose"

D 518 "Test Method for Rubber Deterioration-Surface Cracking"

D 622 "Methods of Testing Rubber Hose for Automotive Air and Vacuum Brake System"

D 1149 "Specification for Octylortho-Phthalate Ester Plasticizers"

SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)

J 516 "Hydraulic Hose Fittings"

J 517 "Hydraulic Hose"

100 R₁ "Steel Wire Reinforced, Rubber Covered Hydraulic Hose"

100 R₂ "High Pressure, Steel Wire Reinforced, Rubber Covered Hydraulic Hose"

100 R₃ "Double Fiber Braid (Nonmetallic), Rubber Covered Hydraulic Hose"

100 R₄ "Wire Inserted Hydraulic Suction Hose"

100 R₅ "Single Wire Braid, Textile Covered Hydraulic Hose"

100 R₆ "Single Fiber Braid, (Nonmetallic), Rubber Covered Hydraulic Hose"

100 R₇ "Thermoplastic Hydraulic Hose"

100 R₈ "High Pressure Thermoplastic Hydraulic Hose"

100 R ₉	"High Pressure, 4-Spiral Steel Wire Reinforced, Rubber Covered Hydraulic Hose"
100 R ₁₀	"Heavy Duty, 4-Spiral Steel Wire Reinforced, Rubber Covered Hydraulic Hoses"
100 R ₁₁	"Heavy Duty, 6-Spiral Steel Wire Reinforced, Rubber Covered Hydraulic Hose"
100 R ₁₂	"Heavy Duty, High Impulse, 4-Spiral Wire Reinforced, Rubber Cover Hydraulic Hose"

3. HIGH PRESSURE PUMP

3.1 General

High pressure pump shall be in accordance with API Std. 674 latest edition and shall also meet the requirements of Clauses 3.1.1 through 3.1.13.

3.1.1 Piston pumps shall not be used. Plunger pumps incorporated several cylinders into one pump with a smooth flow shall be used.

3.1.2 Pressure side of the plunger pump shall be protected by means of pressure control and safety devices.

3.1.3 The clutch between the pump and driver must be provided with a removable cover or guard.

3.1.4 The pump shall be equipped with a pressure adjustment device for continuous adjustment of the operating pressure, with a full lift safety valve to keep the pressure from exceeding the max. permissible operating pressure, and with a return line which drains off all excess water.

3.1.5 High pressure pump and driver (electric motor or internal combustion engine) shall be mounted on a common frame equipped with water reservoir, hose reel, and other accessories. Frame may be stationay or mobile upon request.

3.1.6 The connection between the suction line and the pump shall be of a flexible type. The flowrate in the suction line shall be specified.

3.1.7 When a centrifugal pump is additionally installed, the pump capacity shall be 1½ to 2 times as high as the suction volume of the high pressure pump.

A brake tank should be installed on the suction side.

3.1.8 When required pulsation dampeners shall be installed.

3.1.9 Maximum pump operating pressure must not exceed pressure rating for spray guns, hoses, valves or other devices in the high pressure line.

3.1.10 A shut-off device in the high pressure line shall be required.

3.1.11 If a centrifugal pump is being used on the suction side a suction stabilizer shall be provided.

3.1.12 A switch-over filter element with a mesh size of not less than 50 mm shall be included.

The filter area shall be at least three times the size of the suction line diameter.

3.1.13 The suction stabilizer must be installed directly in front of the pump.

3.2 Pump Head

The pump head housing shall be of high quality, durable material.

4. DRIVER

4.1 The type of driver shall be specified by the Purchaser. The driver shall be sized to meet the maximum operating conditions, including external gear and/or coupling losses, and shall be in accordance with applicable specifications as stated in the inquiry and order.

4.2 All electrical motor drives including auxiliary equipment shall comply with Standard IPS-M-EL-132.

4.3 Internal combustion engine shall comply with Standard IPS-M-PM-290.

4.4 The fuel tank of diesel engine shall have capacity of 8 hrs. continuous operation and the fuel level shall read at the device control.

5. COUPLING

5.1 The flexible shaft coupling shall be of steel, and shall connect the shaft of the coupling at the driver (motor and/or engine) with the drive shaft of the pump.

5.2 Coupling shall be covered by a non-sparking guard in such a way that a contact with the parts rotating during operation be excluded.

6. BASE FRAME

Base frame shall be of the drain-rim or drain pan type and shall have a raised lip. Connections for a drain shall be tapped (DN 25 minimum) in the raised lip at the pump end and shall be located for complete drainage. The pan or upper surface of the baseframe shall have adequate slope toward the drain end.

7. HYDRAULIC HOSE

7.1 General

7.1.1 Hoses shall withstand to surge pressure. Surge pressures higher than the maximum operating pressure will shorten hose life and should be taken into account by the hydraulic designer.

7.1.2 The hydraulic designer must consider the system demands on the hose assembly and correlate those demands with the test parameters defined, with particular concern for frequency and amplitude of pressure fluctuations.

7.2 Size Designation

Hose sizes are normally designated by the nominal hose inside diameter.

7.3 Hose Identification

The entire length of hoses shall be legibly marked, parallel to the longitudinal axis, with a stripe or stripes showing type designation and the fractional nominal hose inside diameter size repeated at intervals of not less than 460 mm.

Additionally, a colored yarn shall be incorporated into the wall of the hose identifying the manufacturer. The color shall be as designated by the rubber manufacturer's association.

7.4 Steel Wire Reinforced, Rubber Covered Hydraulic Hose

Steel wire reinforced, rubber covered hydraulic hose shall conform to SAE 100 R₁.

7.5 High Pressure, Steel Wire Reinforced, Rubber Covered Hydraulic Hose

High pressure steel wire reinforced rubber covered hydraulic hose shall conform to SAE 100 R₂.

7.6 Double Fiber Braid (Non-Metallic), Rubber Covered Hydraulic Hose

Double fiber braid rubber covered hydraulic hose shall conform to SAE 100 R₃.

7.7 Wire Inserted Hydraulic Suction Hose

Wire inserted hydraulic suction hose shall conform to SAE 100 R₄.

7.8 Single Wire Braid, Textile Covered Hydraulic Hose

Single wire braid textile covered hydraulic hose shall conform to SAE 100 R₅.

7.9 Single Fiber Braid, (Nonmetallic), Rubber Covered Hydraulic Hose

Single fiber braid, rubber covered hydraulic hose shall conform to SAE 100 R₆.

7.10 Thermoplastic Hydraulic Hose

Thermoplastic hydraulic hose shall conform to SAE 100 R₇.

7.11 High Pressure Thermoplastic Hydraulic Hose

High pressure thermoplastic hydraulic hose shall conform to SAE 100 R₈.

7.12 High Pressure, 4-Spiral Steel Wire Reinforced, Rubber Covered Hydraulic Hose

High pressure, 4-spiral steel wire reinforced, rubber covered hydraulic hose shall conform to SAE 100 R₉.

7.13 Heavy Duty, 4-Spiral Steel Wire Reinforced, Rubber Covered Hydraulic Hose

Heavy duty, 4-spiral steel wire reinforced, rubber covered hydraulic hose shall conform to SAE 100 R₁₀.

7.14 Heavy Duty, 6-Spiral Steel Wire Reinforced, Rubber Covered Hydraulic Hose

Heavy duty, 6-spiral steel wire reinforced, rubber covered hydraulic hose shall conform to SAE 100 R₁₁.

7.15 Heavy Duty, High Impulse, 4-Spiral Wire Reinforced, Rubber Covered Hydraulic Hose

Heavy duty high impulse, 4-spiral wire reinforced rubber covered hydraulic hose shall conform to SAE 100 R₁₂.

7.16 Suction Hose

Hoses used for suction applications must be selected to insure the hose will withstand the negative pressure of the system.

7.17 Measuring Hose Tubes

The nominal length (L) of hose tubes with swivel fittings shall be measured from sealing head to sealing head, hoses equipped with other fittings shall be measured on overall length as shown in the following:

- a) Hose tubes equipped with male fitting on one end and with swivel fitting on the other.

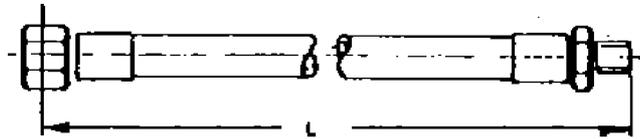


Fig. a

- b) Hose Tubes equipped with 90° swivel fittings on both ends. Elbow angle $\alpha = 180^\circ$, (see Fig. e for configuration only)

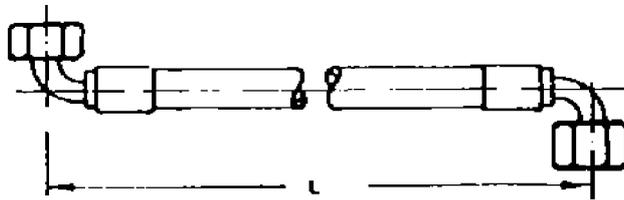


Fig. b

- c) Hose tubes equipped with 0° swivel fittings on both ends.

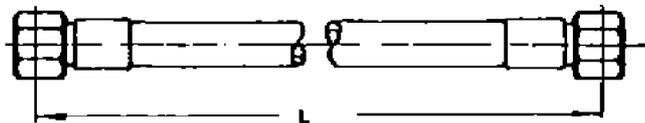


Fig. c

Fig. c

- d) Hose tubes equipped with 45° swivel fittings. Elbow angle $\alpha = 0^\circ$ (see Fig. e for configuration only)

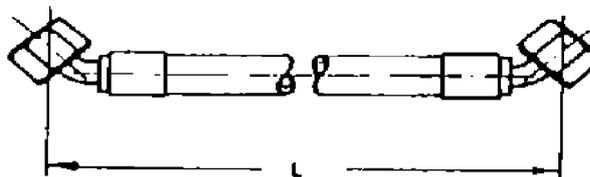


Fig. d

e) Elbow angle:

For hose tubes with two elbows (45° or 90°) as shown in Figs. d and b the elbow angle as illustrated in Fig. e has to be stated.

In case that both elbows are fitted in the same direction, as shown in Fig. d, state 0°. The example in Fig. e shows an elbow angle of 220°.

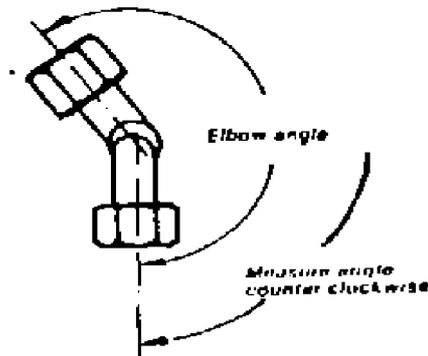


Fig. e

8. SAFETY VALVE

8.1 The maximum operating pressure and the set pressure of the safety valve shall be marked on the outside of the valve.

Full disassembling and readjusting information of the safety valve shall be included in the instruction manual.

8.2 The full-lift safety valves shall be selected in consideration of the respective mode of operation, the medium pumped and the maximum operating temperature, especially according to :

- a) The maximum nominal flow volume;
- b) the minimum permissible excess operating pressure;
- c) the maximum permissible excess operating pressure.

8.3 In order to prevent the escaping medium from causing direct or indirect danger to persons or the surrounding area, relief tube must be connected to the spring housing.

The relief tube attached must be flexible so that the dynamic stress during operation and the reaction forces caused by the blowing-off process will not impair the function and the adjustment.

8.4 The safety valve shall be accessible for the purpose of checking its function and for maintenance, and it shall be protected against any damaging impact from outside.

8.5 The tube must be such as to allow the nominal flow volume to flow off readily.

8.6 Full instruction procedure adjustment of the relief valve shall be submitted by the Vendor.

9. CONTROL

9.1 As a minimum the automatic control units shall monitor the following functions:

- The driving motor or engine;
- the temperature of the pressurized water;
- the oil pressure;
- the water supply pressure.

In the event of any interruption of the normal working conditions, the control unit shall be shut-down the driving indicating at the same time the cause of interruption by means of control lamps.

9.2 If the water supply pressure (feed water line) becomes too low, and/or if the water filter becomes clogged, the drive motor shall be shut-down.

A control lamp shall show the reason.

9.3 Oil pressure shall be controlled in the oil circulation system and shut-down the unit if the required pressure is not reached. At the same time, a control lamp shall be light up, indicating, OIL PRESSURE.

9.4 The water temperature shall be controlled by a reliable means installed at the pump head, monitoring the water temperature. In case of the water temperature in the pump head has reached the maximum permissible valve, the drive shall be shut-down.

A light up control lamp shall indicate "WATER TEMPERATURE".

9.5 The operating pressure shall be controlled by a reliable means, monitoring the discharge pressure.

The driver shall be shut-down if the pressure rises above the preset value by as little as 2%. A control lamp shall indicate the cause of interruption.

"OPERATING PRESSURE EXCEEDED"

9.6 Control of Clutch Drive

Clutch shall be installed between engine and pump, and be fully engaged. A switch contact device shall shut-down the engine in the event of partial engagement of the clutch either by operator negligence, or as a result of vibration.

10. TEST AND PROCEDURES FOR HYDRAULIC HOSE AND HOSE ASSEMBLIES

10.1 General

Unless otherwise agreed upon between the manufacturer and purchaser, tests for evaluating conformance of product with specifications shall be on the basis of qualification tests and inspection tests set forth in this Standard.

Tests may be conducted by the manufacturer, the Purchaser, or both, as decreed by the Purchaser.

10.2 Test Procedures

The test procedures described in the current issue of ASTM D 380, Standard methods of testing rubber hose, shall be followed. However, in cases of conflict between the ASTM specifications and those described in Clause 10.3 below the latter shall take precedence.

10.3 Standard Tests

10.3.1 Dimensional check test

The hose shall conform to all dimensions tabulated in the applicable specification as mentioned in SAE J 517.

Reinforcement diameter and finished outside diameter measurements shall be made by calculation from measurement of the outside circumference. Use of a flexible tape graduated to read the diameter directly shall be acceptable. Inside diameter measurements shall be made by means of suitable expanding ball or telescopic gages.

Concentricity shall be measured both over the reinforcement and the finished outside diameter using either a dial indicator gage or a micrometer. The foot of the measuring instrument contacting the inside of the hose shall be rounded to

conform to the curvature of the hose. The readings shall be taken at 90 deg. intervals around the hose and acceptability based on the total variation between high and low readings.

Inside and outside diameter measurements shall be made at a minimum distance of 25.4 mm and concentricity measurements at a minimum distance of 12.7 mm, back from the ends of the hose.

10.3.2 Proof test

Hose and/or hose assemblies shall be hydrostatically tested to the specified proof pressure as mentioned in SAE J 517 for a period of not less than 30 s nor more than 60 s. There shall be no indication of failure or leakage.

10.3.3 Change in length test

Measurements for the determination of elongation or contraction shall be conducted on a previously untested, unaged hose assembly having at least 300 mm length of free hose between hose couplings. The hose assembly shall be attached to the pressure source and pressurized to the max. specified operating pressure as mentioned in SAE J 517 for a period of 30 s, after which time the pressure shall be released. After allowing the hose to restabilize for a period of 30 s following pressure release, reference marks 250 mm apart shall be accurately placed on the hose outer cover, midway between the hose couplings. The hose shall then be repressurized to the specified pressure for a period of 30 s, after which time, while the hose is pressurized, the distance between the reference marks shall be measured. This length shall be the final length.

The change in length shall be computed using the following formula: EMBED Equation

$$\% \text{ Change} = \frac{(\text{Final length} - \text{Original length}) 100}{\text{Original length}}$$

(- %) Change = contraction.

(+ %) Change = elongation.

Change in length test for one sample shall not exceed those specified in SAE J 517.

10.3.4 Burst test

Hose and/or hose assemblies on which the end fittings have been attached not over 30 days shall be subjected to a hydrostatic pressure increased at a constant rate so as to attain the specified minimum burst pressure as mentioned in SAE J 517 within a period of not less than 15 s nor more than 30 s. There shall be no leakage, hose burst, or indication of failure below the specified minimum burst pressure.

10.3.5 Cold bend test

Hose and/or hose assemblies shall be subjected to -40°C temperature for 24 hrs in a straight position. After this time and while still at the specified temperature, the sample shall be evenly and uniformly bent over a mandrel having a diameter equal to twice the minimum specified bend radius. Bending shall be accomplished within a period of not less than 8 s nor more than 12 s.

Hoses of less than 25.4 mm nominal inside diameter shall be bent 180 deg. over the mandrel and hoses of 25.4 mm nominal inside diameter and larger shall be bent 90 deg. over the mandrel.

After bending, the sample shall be allowed to warm to room temperature, then visually examined for cover cracks and subjected to the proof test. There shall be no cover cracks or leakage. (In lieu of the bending test, hoses of 25.4 mm nominal inside diameter and over may be considered acceptable if samples of tube and cover pass the Low Temperature Test on Tube and Cover of ASTM D 380).

10.3.6 Oil resistance test

After 7 oh immersion in ASTM No. 3 oil at the designated temperature, the volume change of specimens taken from the hose inner tube and cover shall be within the specified limits.

10.3.7 Ozone resistance test

The cover compound shall be tested in accordance with the latest issue of ASTM D 622, procedure 9, and ASTM D 1149. Where space limitations prohibit the use of a hose, specimen cover stock tested in accordance with ASTM D 518, procedure B, may be substituted.

10.3.8 Impulse test

Impulse testing shall be conducted with unaged hose assemblies and, where the individual Standard requires, also with aged assemblies.

The test assemblies shall be impulsed on suitable equipment with the hose bent to the minimum bend radius. Hoses of less than 25.4 mm nominal inside diameter shall be bent either 90 or 180 deg. and hoses of 25.4 mm nominal inside diameter and over shall be bent 90 deg. Individual Standards may designate impulsing in a straight position on specific sizes.

The test assembly free length of hose measured between couplings shall be computed using the following:

$$90 \text{ deg. bend free length} = \frac{\pi (\text{Min. bend radius})}{2} + 2 (\text{hose OD})$$

$$180 \text{ deg. bend free length} = \pi (\text{Min. bend radius}) + 2 (\text{hose OD})$$

$$\text{Straight free length} = 356\text{-}457 \text{ mm.}$$

Where aged samples are required refer to the individual standards. The test fluid shall be circulated through the assemblies at the specified temperature with a tolerance of $\pm 3^{\circ}\text{C}$. The impulse rate shall be 30-75 cpm at the specified pressure. Circulation of the test fluid shall be at a rate which will maintain uniform bore temperature. Cooling or heating of the test chamber shall not be permitted.

The impulse pressure curve must fall entirely within the shaded area of Fig. 10.1 and should conform as closely as possible to the curve as shown. Unless failure occurs first, the impulse test shall continue for the specified number of cycles.

It is recommended the test fluid be changed frequently to prevent breakdown.

10.3.9 Leakage test

Unaged hose assemblies on which the end fittings have been attached not over 30 days shall be subjected to a hydrostatic pressure equal to 70% of the specified minimum burst pressure for a period of 5-5.5 min. and then reduced to zero after which the 70% of minimum burst pressure shall be reapplied for another 5 min. There shall be no leakage or evidence of failure. This test is to be considered a destructive test and sample shall be destroyed.

10.3.10 Visual examination of product

All bulk hose shall be visually inspected to see that the hose identification has been properly applied and all assemblies shall be inspected to see that the correct fittings are properly installed.

10.3.11 Electrical conductivity test (for thermoplastic hose only)

Hose assemblies having a free length of 152 ± 13 mm without fluid and capped to prevent entry of moisture shall be exposed to a minimum of 85% relative humidity at $24 \pm 3^\circ\text{C}$ for a period of 168 hrs. Surface moisture shall be removed prior to testing.

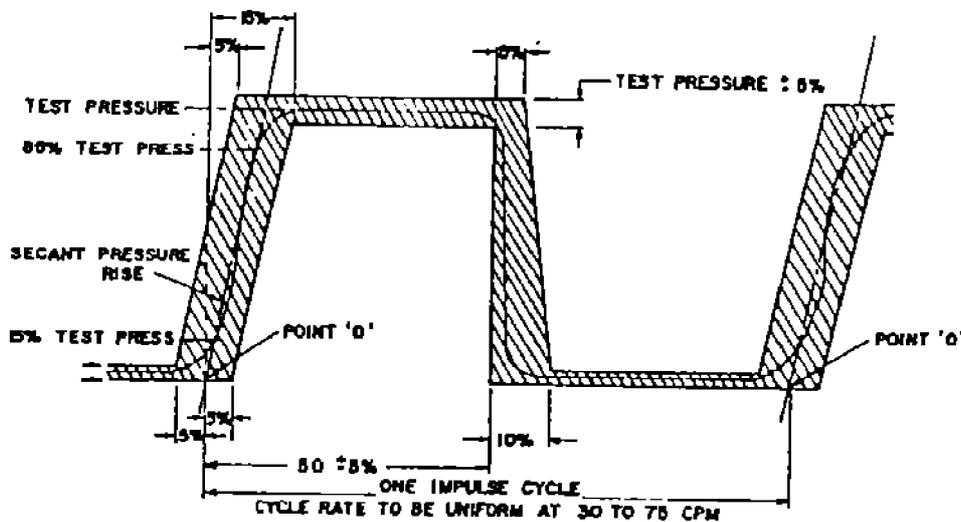
Conditioned assemblies shall have one end fitting attached to the lead from a source of 50 Hz sinusoidal, 37.5 kV (rms) electricity. This lead shall be suspended by dry fabric strings so that the hose hangs free, at least 600 mm from any extraneous objects. The lower end of the hose shall be connected to ground through a 1000-1000000 Ω resistor, keeping the resistor near the end of the hose. A suitable a-c voltmeter shall be connected across the resistor, using a fully shielded cable with the shielding well grounded. Thirty seven and one-half kV shall be applied to the specimen for 5 min. and a current reading taken. This current shall not exceed the value specified.

10.3.12 Resistance to vacuum test

The hose shall not blister nor show any other indication of failure when subjected to the specified vacuum for a period of 5 min. Where practicable, one end of the hose shall be equipped with a transparent cap and electric light to permit visual examination for failure. Where the length or size of the hose precludes visual examination, failure shall be determined by inability to pass through the hose a ball or cylinder 6.4 mm less in diameter than the bore of hoses of 12.7 mm nominal inside diameter and larger. For hoses under 12.7 mm nominal inside diameter, a ball or cylinder 3.2 mm smaller in diameter than the bore shall be used.

10.3.13 Cubical expansion test

Cubical expansion tests shall be run in accordance with the current issue of ASTM D 380.



POINT 'O' - The intersection of the Secant Pressure Rise with 0 pressure. Pressure rise rate. The slope of the secant pressure rise expressed in psi per second.

SECANT PRESSURE RISE:

The straight line drawn through two points on the pressure rise curve; one point at 15% of the test pressure and the other at 85% of the test pressure.

Fig. 10.1

10.4 Retests and Rejection

In the event of failure of one or more samples to meet any of the tests specified, the material shall be resampled and retested. Twice the number of specimens designated under initial test procedure shall be selected from the lot in question for such retests, and failure of any of the retested samples shall be cause for rejection.

11. HOSE FITTING

Hydraulic hose fittings shall be conformed to SAE J 516 latest edition.

12. CLEANING ACCESSORIES

12.1 General

12.1.1 The accessories shall be designed for the maximum operating pressure of the pressure generator plus 10%.

12.1.2 Vendor shall submit flow rate chart of nozzles as a function of pressure in his proposal.

12.1.3 Instruction manual shall include full directions for use of the nozzle flow chart and the nozzle sheets.

12.1.4 Nozzles shall have an index as well as a part number.

12.1.5 Unless otherwise specified as a minimum following accessories shall be included in Vendor's proposal:

Guns, round and flat jet nozzle, tube and pipe cleaning nozzles, rotating nozzles in one or two planes, oscillating nozzles, control valve (foot operated is preferred), special hoses.

12.2 High Pressure Gun

12.2.1 Guns shall be of high-quality precision tools which, if properly applied, will always function to user full satisfaction.

12.2.2 Gun shall be easy to opening and closing.

12.2.3 Guns shall have a protection frame and a reliable safety lock which prevents an unintended operation of the trigger.

12.2.4 The high-pressure guns shall be designed for max. operating pressure plus 10%.

12.2.5 Guns shall be designed to be safe, when several spraying units connected with the same pressure to operate at the same time, no dangerous reaction forces occur in one or more guns when one spraying gun is opened or closed.

12.2.6 Gun shall be designed to make sure that there is no sudden recoil as long as the trigger is pulled slowly.

12.2.7 Gun shall be designed for different jetting purposes.

12.3 Lances

Rigid and flexible lances shall be supplied suitable for the inner cleaning of pipes from 10 mm diameter. Depending upon the various applications the lances shall be applied in connection with spray guns and foot-operated valves.

12.4 Pressure Regulator

An automatic unloader valve or pressure regulator shall be installed. The automatic unloader or pressure regulator shall be flanged-mounted and provide stepless adjustment of the operating pressure from 0 to maximum. A separate safety valve to permit overloading shall be installed.

12.5 Footvalve

12.5.1 Footvalve shall be of high-quality precision products which, if properly applied, shall always function to user-full satisfaction.

12.5.2 Footvalve shall be designed to suit for a maximum permissible operating pressure.

12.5.3 When required the footvalve shall be designed for sea-water application.

12.5.4 Footvalve shall be so designed to switch on pressure generator and start spraying operation by pressing the footvalve.

12.5.5 Full design characteristics and operation condition of footvalve shall be stated in the proposal and instruction manual.

12.5.6 Full instruction of disassembling and repair and assembling of the footvalve shall be submitted by manufacturer.

13. VENDOR'S DATA

Vendor's data including Vendor's proposal, drawings, etc., shall be in accordance with IPS-M-PM-400.

14. GUARANTEES AND WARRANTIES

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor agrees to the guarantees and warranties specified in items 1 through 3.

- 1)** All equipment and component parts shall be warranted by the Vendor against defective materials and faulty design/workmanship for 1 year after being placed in service.
- 2)** If any malperformance or defects occur during the guarantees and warranties period, the Vendor shall make all necessary alterations, repairs, and replacements free of charge, free on board factory. Field labor charges, if any, shall be subject to negotiation between the Vendor and the Purchaser.
- 3)** The equipment shall be guaranteed for satisfactory performance at all operating conditions specified on the data sheet.

15. PREPARATION FOR SHIPMENT

15.1 Equipment shall be suitably prepared for the type of shipment specified. The preparation shall be suitable for outdoor storage.

15.2 Preparation for shipment shall not be made until all testing and inspection of the equipment has been accomplished and the equipment has been approved by the Purchaser. Minimum preparation shall include that specified in 15.3 through 15.10.

15.3 All exterior surfaces with the exception of machined surfaces shall be given a coat of the manufacturer's Standard paint.

15.4 All exterior machined surfaces shall be coated with a suitable rust preventive.

15.5 The interior of the equipment (including auxiliaries) shall be sprayed or flushed with a suitable rust preventive which is removable by solvent.

15.6 All flanged openings shall be provided with metal closures of 5 millimeters minimum thickness, with rubber gaskets and at least four full-diameter bolts.

15.7 All threaded openings shall be provided with steel caps or solid-shank steel plugs of metallurgy equal to or better than that of the pressure casing. In no case shall nonmetallic plugs (such as plastic) be used.

15.8 Lifting points and lifting lugs shall be clearly identified.

15.9 Equipment shall be identified with a serial number and the Purchaser's item number. All material shipped separately shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number for which it is intended.

15.10 Packing for piston rods and plungers shall be removed from the stuffing boxes and shipped separately.

APPENDIX A (continued)

DATA SHEETS

Water Jet Cleaning
Machine Data Sheet

Job No. Item No.
Purchase Order No.
Requisition No.
Inquiry No.
Page of
Date Revision

WORK TO BE CLEANED	
<input type="checkbox"/> Tube of (Heat Exchanger) : LD. Min. mm. MAX. mm. Length Min. m. MAX. m.	
<input type="checkbox"/> Pipe LD. Min..... mm. MAX. mm. Length Min. m. MAX. m.	
<input type="checkbox"/> Tank LD. Min..... mm. MAX. mm. Length Min. m. MAX. m.	
<input type="checkbox"/> Filter	<input type="checkbox"/> Screen
<input type="checkbox"/> Hull of ship	<input type="checkbox"/> Rust & Paint of structure
<input type="checkbox"/> Processed parts of machine	<input type="checkbox"/> Descaling in steel works
	<input type="checkbox"/> Jet Cutting
OPERATING CONDITIONS	
<input type="checkbox"/> Water :pH	
<input type="checkbox"/> Pumping Temperature (°C) : Max. Min.....	
<input type="checkbox"/> Sp. Gr. @ pT.....	
<input type="checkbox"/> Vapor pressure @ pT (Kpa abs)	
<input type="checkbox"/> Viscosity @ pT (m Pa.s).....	
<input type="checkbox"/> Ambient Temp. (°C) Nor..... Max..... Min.....	
<input type="checkbox"/> Electrical area hazard: Class.....Group..... Division.....	
<input type="checkbox"/> Location: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Heated <input type="checkbox"/> Unheated	

(to be continued)

APPENDIX A (continued)

DATA SHEETS

Water Jet Cleaning
Machine Data Sheet

Job No. Item No.
Purchase Order No.
Requisition No.
Inquiry No.
Page of
Date Revision

PERFORMANCE DATE:		HOURS RUN:	
At Rated Conditions:		Pump Type	Serial No.
<input type="checkbox"/> NPSH Required (KPa)			
<input type="checkbox"/> Rated rpm		<input type="checkbox"/> Maximum rpm	
<input type="checkbox"/> Piston speed (m/min)			
<input type="checkbox"/> Stroke mm			
<input type="checkbox"/> Volumetric efficiency (%)			
<input type="checkbox"/> Hydraulic kw		<input type="checkbox"/> Brake kw	
<input type="checkbox"/> Brake kw		<input type="checkbox"/> relief valve setting	
<input type="checkbox"/> Working pressure (KPa)			
<input type="checkbox"/> Inlet Pressure (KPa)			
<input type="checkbox"/> Safety valve setting pressure			
Remarks:			
.....			
.....			

(to be continued)

APPENDIX A (continued)

DATA SHEETS

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Machine Data Sheet

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PUMP MATERIALS (TO BE COMPLETED BY MANUFACTURER)	
PART	ASTM No.
Cylinder
Liner
Plunger
Valves/valve seats
Gland
Throat bushing
Packing
Lantern ring
Bolting
Other
Remarks:.....
.....
.....

(to be continued)

APPENDIX A (continued)

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POWER FRAME (TO BE COMPLETED BY MANUFACTURER)	
Maximum frame rating: Kw @..... rpm	Power end lubrication: Type.....
Maximum pressure rating (Kpa gage)	Oil pump:.....
Crankshaft material	Main.....
No of main bearings.....	Auxiliary.....
Type of main bearings.....	Driven by.....
Internal gears ? <input type="checkbox"/> Yes <input type="checkbox"/> No.	Type
Gear ratio.....	Size.....
Gear service factor	Specifiication
	Oil piping material.....
REMARKS:.....	

(to be continued)

APPENDIX A (continued)

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PRIMER MOVER	
DIESEL ENGINE:	
MANUFACTURER:	
<input type="checkbox"/> Type	<input type="checkbox"/> Serial No.
<input type="checkbox"/> Performance.....kw	<input type="checkbox"/> rpmmin ⁻¹ <input type="checkbox"/> Cooling.....
<input type="checkbox"/> Starter.....	<input type="checkbox"/> voltage..... (v) <input type="checkbox"/> Capacity..... (Ab)
<input type="checkbox"/> Fuel consumption	<input type="checkbox"/> Tank cap..... (Ltr.)
ELECTRIC MOTOR DRIVER:	
<input type="checkbox"/> Manufacturer.....	<input type="checkbox"/> Size
<input type="checkbox"/> Type.....	<input type="checkbox"/> Enclosure
<input type="checkbox"/> Frame number.....	<input type="checkbox"/> Mounted by.....
<input type="checkbox"/> OutPut..... (kw)	<input type="checkbox"/> rpm..... min ⁻¹
<input type="checkbox"/> Volts.....	<input type="checkbox"/> Phase..... Hz
Remarks:	
.....	
.....	