
SPECIFICATION FOR GMS PIPES(G.I.), FITTINGS AND VALVES

1.0 GENERAL REQUIREMENTS

1.1 Definition

For the purpose of this specification, the following words and expression shall have the meanings hereby assigned to them, except where the context otherwise requires:

- (a) "Purchaser" means the Water Supply and Sanitation Division/Subdivision Office (WSSDO) of Department of Water Supply and Sewerage, Ministry of Physical Planning & Works, His Majesty's Government of Nepal.
- (b) "Manufacturer" means the firm or company who has been legitimately registered with the appropriate government agency to manufacture the pipes and fittings and includes his personal representative.
- (c) "Supplier" means the person or persons, firm or company including manufacturer, whose tender has been accepted by the purchaser and has agreed to supply the pipes and fittings as per the specifications provided hereunder.
- (d) "Contact" means the Condition of Contract, Specifications, Drawings, Priced Bill of Quantities, Tender and Agreement together with any Appendices and Addenda thereto.

1.2 Materials

The term materials shall mean all materials and articles of every kind, raw, processed or manufactured, which are used in manufacture of the Goods to be supplied under the Contract.

All materials shall be new and of the kinds and qualities described in the clauses hereof appropriate to the particular item and shall be at least equal to approved samples except that alternative materials may be accepted provided the Supplier has at the time of tendering:

- a) Drawn particular attention to the deviation from the Specification in his tender and provided particulars of the alternative material offered at the time of tendering; and
- b) Substantiated to the satisfaction of the Purchaser, that the material offered is equal or superior to the material specified for the use to which it is to be put and has obtained from the Purchaser approval in writing to its use. Where materials to be used for any component have not been laid down in the Specification, the manufacturer shall use only those materials in such compositions as have been proven in actual service to be the most suitable for the particular purpose.

1.3 Standards

All materials, workmanship and components shall, where applicable and unless otherwise stated in the Contract, comply with either:

- (a) with the relevant ISO, Nepal, Indian or British Standard current or Code of practice current on the date fixed for receipt of tenders, or
- (b) with other internationally accepted equivalent Standards or Codes of Practice which are equal or superior than the specifications.

Nepal Standard NS : 199 - 2046 published by Nepal Bureau of Standards and Metrology : or

Indian Standards IS : 1239 (Part I) - 1990 published by Bureau of Indian Standards, Manak Bhawan, New Delhi, India, or

British Standards BS 1387 : 1967 published by British Standards Institution (BS), British Standards House, London, England.

The acceptance of a tender based upon a Standard or Code proposed by the Supplier shall only signify the Purchaser's general approval to the use of such Standard or Codes and shall not make the Purchaser liable to accept a Standard or Code subsequently found to be inferior to that specified in the corresponding Standard or Code of Practice.

1.4 Test Certificates

Certificates in triplicate shall be provided by the Supplier for each valve, pipe and fittings supplied giving the process of manufacture and the results of the specified tests.

Similar certificates in triplicate shall be provided by the Supplier in respect of materials to be used in the manufacture of the valves, pipes and fittings giving the process of manufacture, chemical analysis (where relevant) and the results of the specified tests.

The material shall be suitably marked to enable them to be identified from references on the certificates.

1.5 Independent and Local Tests

The purchaser reserves the right to carry out any independent or local tests he may deem fit on the completed pipes and fittings or on any material provided under the Contract at any stage during the Contract including the guarantee period. In addition to any relevant clause in the General Conditions of Contract any materials, workmanship or completed pipes and fittings which are shown by such independent tests not to be in accordance with the Specification shall be rejected notwithstanding any previous certificate which may have been provided

1.6 Rejected Goods

Any materials delivered to Site, which are rejected by the Purchaser shall immediately be removed from the Site by, and at the expense of, the Supplier.

Any pipes and fittings, which have been rejected, shall be marked in a distinctive manner, which shall preclude any possibility of their use for the purpose for which they were supplied. Such pipes and fittings may be submitted for re-test following the correction of any defects, where such correction is permitted by the Purchaser.

2.0 GALVANIZED MILD STEEL, PIPES AND FITTINGS

2.1 Manufacture and Testing

Tube shall be made from tested quality steel manufactured by any approved process.

The manufacture and testing of all galvanized steel pipes and fittings shall comply with the current edition of NS, IS, BS or equivalent. Galvanized steel pipe shall be of the class specified in the Bills of Quantities.

Ends of pipes shall generally be screwed at both ends as per NS 199-2046, IS 554- 1975, BS 21 threads or equivalent or as requested by the purchaser. Ends of pipe specials and fittings shall be screw socketed suitable for screwing to NS 199-2046, IS : 554 - 1975 or BS : 21 threads or equivalent pipe threads. Where flanged pipe work is specified this shall be suitable for jointing with other flanged pipe work and valves.

2.2 Process of Manufacture

"Medium" and "Heavy" duty galvanized steel pipes and sockets shall be either welded or seamless as agreed to between the purchaser and the manufacturer.

2.3 Standard and Non Standard Lengths

The pipe shall be supplied in standard lengths of 6 meters each. Each pipe shall be provided with a corresponding size of one socket at one end and a plastic ring (cover) at the other end for protection of the threads of the pipes.

Non standard lengths shall be approximately 3 meters in length or as required by the purchaser. One socket to be provided with each pipe at one end and a plastic ring on the other end as mentioned above.

In both the cases, the local lengths for each class and diameter shall be the sum of the pipe lengths measured excluding the sockets.

2.4 Pipe Dimensions and Tolerances

The pipe wall thickness and outside diameter of the pipes shall comply with Section 2.4 of BS 1378 or equivalent.

The dimensions, weights and working pressures of Screwed and Socketed Galvanized Mild Steel Tubes (including sockets) shall be as per NS 199-2046.

2.5 Hydraulic Tests

Each pipe and fittings shall be tested at the place of manufacture to a hydraulic test pressure of 50 bar (MPa) without showing defects of any kinds, the pressure being maintained sufficiently long (in any case not less than three minutes) for proof and inspection.

2.6 Galvanizing

After hydraulic testing of each item has been completed, pipes, fittings and flanges shall be thoroughly rescaled, washed as required and then dipped in a bath of molten zinc, containing not less than 98.5% by weight of zinc at a temperature suitable to produce a complete and uniformly adherent coating of zinc. Where tubes are required to be galvanized, the zinc coating on the tubes shall be in accordance with NS 199-2046 or equivalent. Pipes and fittings, which are to be screwed shall be screwed after galvanizing has been completed.

2.7 Tests on Finished Pipes

The supplier shall arrange and carry out tests on the galvanizing in accordance with Appendix A of BS 1387 or equivalent. One pipe per batch of 500 pipes shall be sampled for this test.

The supplier shall also arrange and carry out bending and flattening tests on pipes above 50 mm nominal diameter in accordance with section 2.9 of BS 1387 or Section 14 of IS : 1239 (Part I) – 1990 and as per NS 199-2046. Two pipes per batch of 500 pipes shall be subjected to these tests.

2.8 Pipe Specials and Fittings

Galvanized mild steel pipe specials and fittings shall conform to the appropriate dimensions given either in NS 199-2046, BS 1387 or BS 1740 or IS : 1879 - 1987 or equivalent. The material used for the manufacture of malleable cast iron fittings shall conform any of the grade specified in IS : 2107 - 1977 or IS : 2108 - 1977 or equivalent. Outlets of fittings shall be threaded to dimensions and the tolerances as specified in IS : 554 - 1985 or equivalent. Fittings shall be galvanized to meet the requirements of IS : 4736 - 1986 or equivalent. Pressure test shall be as per section 13 of IS : 1879 - 1987 or equivalent. The dimension and weight of all fittings shall be as per the corresponding section of standards e.g. IS : 1879 - 1987 or equivalent. The ends of all pipe specials shall generally be screw socketed. If the supplier offers screw spigot ended pipe specials, a matching screw socket shall be provided for each end of the pipe specials. All standard lengths shall be supplied with one coupling and the price quoted shall include for this. The fitting shall meet an internal hydraulic pressure of not less than 2.1 MPa or an internal pressure of 1.05 MPa while the fitting is completely immersed in water or light oil.

2.9 Flanged Joints

Flanges shall be the boss screwed type in accordance with BS 4505 Table 16/4 or equivalent suitable for screwing to BS : 21 pipe threads or equivalent. Each flange shall be supplied with one set of jointing materials.

Each set of flange jointing materials shall be supplied complete with nuts, bolts, washers and joint rings with an additional 10% as spares. Body bolts and nuts shall be galvanized, joint rings shall be flat section 3 mm thick, medium rubber reinforced with two-ply flax fabric and complying with BS 5292 or equivalent and shall not extend beyond the bolt circle. Bolts and nuts shall be hexagonal and shall be in accordance with BS 4190 or equivalent.

2.10 Markings

Each standard length Medium Class galvanized pipe shall be marked with two blue bands 0 mm wide (one band at each end of the pipe) the nominal diameter, the length of pipe and the relevant manufacturing standard. Similarly for light class pipes except that the band colour shall be brown or yellow and that for heavy class red color band or as per NS 199-2046.

2.11 Protection Against Damage in Transit

Pipes and specials shall be protected with a suitable varnish through out their entire length. Straight pipes shall be bundled together into convenient lots (for transport) by rope or 105 WG wire or other suitable material in at least three places. Sockets and other small fittings shall be packed in strong wooden boxes.

The threads of all pipes shall be effectively covered with a good quality grease or other suitable compound and each pipe above 50mm diameter shall have a protecting ring affixed to the screwed spigot end. Rates should include for all packaging.

3.0 VALVES, STOP COCKS AND FERRULES

3.1 General

All valves shall be manufactured to an internationally recognized standard and full details concerning such standards shall be provided by the manufacturer for approval before manufacture commences. Where British or Indian Standards are quoted in this specification an equivalent internationally recognized standard is acceptable.

Cast iron shall have properties not inferior to those specified for Grade 14 of BS 1452 or equivalent and shall withstand the test pressure specified. All casting shall be carefully cleaned and dressed off. No stopping or plugging will be permitted in the case of holes or flaws appearing therein, and casting shall be made from first running.

Gunmetal and bronze shall be of such compositions as have been proved in actual service to be the most suitable for the particular purpose. If any casting, forging, bearing or other part should prove to be defective, the Purchaser shall have the power to reject it and the Supplier shall replace it at no extra expenses to the Purchaser.

3.2 Interchangeable Components

All similar equipment shall be strictly interchangeable as a whole and as regards their component parts.

3.3 Protection Against Climatic Conditions

Valves Supplied shall be of the appropriate grade and quality for and shall be adequately protected against the tropical climatic conditions. The Supplier shall take those conditions into account in deciding what grade, quality and protection is required. Cast iron and steel surface of all valves, hydrants and fittings shall be painted with at least two coats of approved bituminous paint. Failure to comply with the requirements of the above will result in rejection by the Purchaser. Valve bodies, protecting tubes, surface boxes and all other casting shall be coated in accordance with BS 5163 or equivalent, for tropical conditions. Where this is not applicable, they shall be thoroughly cleaned and given one coat of bituminous paint. Machined surfaces shall be covered by a suitable rust inhibitor, such as a high melting point grease of approved quality.

All submerged moving parts of the valves, or the pins and spindles etc of submerged moving parts, or faces etc in contact with them shall be of non-corrodible materials. Any parts that show signs of corrosion or wear during the Period of Liability shall be replaced by non-corrodible material of special quality for the purpose at no extra expenses to the Purchaser. Care shall be exercised in the choice of metals for use in the valves to reduce the effects of bi-metallic corrosion to a minimum. The foregoing shall apply also to the moving parts of valves exposed to the weather.

3.4 Works Tests

All valves shall be hydrostatically tested at the place of manufacture to the pressures specified and valves shall satisfactorily pass the specified tests before they are packed for delivery.

All valves shall be body tested to twice the working pressure stated in the Bill of Quantities. Seat tests to the working pressure stated in the Bill of Quantities shall be carried out on all sluice valves and stop valves.

All sluice valves and stop valves shall be subjected to "open end" test in accordance with BS 1218 or equivalent and each valve shall be subjected to three separate hydrostatic tests as follows:

a) Seat Tests

- (i) The tightness of seats shall be tested as follows: with the wedge closed and with the valve fixed at one end only the test pressure shall be applied to one face of the wedge, the other face being at atmospheric pressure. There shall be no visible leakage past the wedge at the hydrostatic test pressure (gauge) specified;
- (ii) The above procedure shall be repeated but with the valve fixed at the other end and with the pressure applied to that end of the valve.

b) Body Test

With the wedge open the test pressure (gauge) specified shall be applied to the whole body of the valve. There shall be no visible leakage. The test durations for all tests shall be as in the table below:

NOMINAL DIAMETER MM	MINIMUM TEST DURATION (MINUTES) FOR	
	BODY	SEAT (IF APPLICABLE)
50 and under	0.25	0.25
65 to 150	1	1
200 to 300	2	2

All valves shall be marked with cast-on or stamped lettering stating the body test pressure in meters head of water. The cost of testing shall be included in the contract rates.

3.5 Valves Generally

Valves shall have adequate provision for lubrication, shall cause the minimum of head loss in the open position and shall seal the water passage completely when set.

All valves shall be closed in a clockwise direction unless otherwise specified. Direction of closing to be shown on the hand wheel.

All valves shall be suitable for use with water in the temperature range 10° C to 70° C and for working pressure of 10 MPa (bar) or as otherwise specified.

Each flanged valve shall be supplied complete with nuts, bolts, washers and joint rings. Joint rings shall be of that section complying with BS 4190 or equivalent and shall not extend beyond the inner edges of the bolt holes. Bolts and nuts shall be hexagonal complying with BS 4190 or equivalent.

All materials which may come in contact with raw or potable water shall be free from toxic substances and shall not foster microbiological growth or give rise to taste, cloudiness or discoloration of the water with which they are or could be in contact.

Rubber used in valves shall be ethylene propylene rubber (EPDM or EPM) or styrene butadiene rubber (SBR) which complies with the above requirements, and is suitable for making a long term flexible seal and is resistant to mechanical, chemical or bacteriological attack leading to deterioration in flexible seal.

3.6 Flanges

Flanges for pipe work connections shall in all respect be in accordance with BS 4504 PN 16 or equivalent unless otherwise specified.

3.7 Sluice Valves

Sluice Valves shall conform generally to BS 5163/IS 14846/2000 or equivalent and shall but the inside non-rising screw wedge-gate type suitable for waterworks purposes.

The valve gates shall be double-faced cast iron made in one piece. The wedge seats (ring faces) and corresponding body seats shall be gunmetal, machined and having broad bearing surfaces securely fixed to machine recessed. The recesses for the spindle nuts shall be smooth and even so that on opening or closing the valve stresses are evenly distributed over the bearing areas.

The gate guides shall be cast integrally with the valve bodies.

The spindles shall be high tensile bronze, non-rising type and shall have machined square or acme threads. The spindles shall be truly circular throughout their lengths and be of such lengths that when the valves are closed the bottom ends of the spindles engage fully in the spindle nuts. The spindle collars or thrust plates shall be concentric and machined, suitable for the specified test pressure.

The spindle nuts shall be gunmetal and square or acme threaded to suit the spindles. The thickness and bearing areas of the shoulders of the nuts shall be adequate to resist operating thrusts.

Sluice valves shall be operated by tee key and shall be provided with a square iron cap. The rate shall include for provision of one tee key one meter long with each sluice valve.

Opening/closing indicators shall be provided and mounted on all valves of 200 mm diameter and above.

3.8 Bib Cocks

Bib cocks shall be of brass and shall be nominal 15 mm diameter con-forming to BS 1010 or IS : 781 - 1984 or equivalent. Inlets shall be male screwed suitable for jointing to 15 mm GI socket. Outlet shall be plain ended. Top shall be round turned crutch. The weight of 15 mm dia bib tap and stop tap shall be 0.40 kg.

3.9 Globe Valves

Globe Valves shall be gunmetal, rising stem, handwheel operated with screwed female ends; conforming to IS : 778 - 1984 Class I or equivalent

3.10 Gate Valves

Stop valves shall be gunmetal wedge gate valves, rising stem, hand-wheel operated with screwed female ends; conforming to IS : 778 - 1984 Class I or equivalent.

3.11 Ferrule Cocks

Ferrule cocks shall be of gunmetal square head of 15 mm internal diameter swivel balancing screw down ferrules with make inlet and single make outlet; conforming to IS : 10942-2000 or equivalent.

3.12 Air Valves

Single orifice air valve shall be of cast iron body, reliable in action and shall operate in such a manner that the balls of the valves cannot be held against the orifice by air pressure alone. Each air valve shall be supplied with an approved isolating device. The inlet shall be make screwed 15 mm diameter suitable for connection to a GMS riser pipe. Maximum operating pressure will be 100 meters head of water.

3.13 Marking and Packing

Each valve shall be indelibly marked with the diameter, weight and pressure rating and shall in addition carry a unique reference number to enable each item to be clearly identified to works fabrication records, works test certificates, delivery notes and the like.

All valves shall bear the authorized Standard mark cast on showing to which Standard specification they have been manufactured.

Whenever possible the identification marks except for the "Standard mark" shall be painted on the outside of the item but where there is insufficient smooth surface area to accommodate the identification marks they shall be put on rust proofed metal tags secured to the item with galvanized wire.

Flanges shall be protected with wooden discs attached by service bolts or other approved means. Service bolts shall not be incorporated in the works.

All items shall be properly prepared and packed for delivery and shipping. In particular, small items such as small valves, parts of operating gear, bolts, nuts, gaskets and other joint components shall be crated for delivery. Each crate shall contain a detailed packing list in a waterproof envelope. The outside of the crate shall bear a general description of the contents and identification mark relating it to the detailed packing list.

All valves and fittings shall be securely packed in crates or boxes for protection against damage during transit. The costs of packing shall be included in the contract rates. None of the packing will be returnable.

4.0 UNIONS

4.1 General

Unions shall either be brass or galvanized malleable iron, as specified in bill of quantities, manufactured in accordance with a recognized international standard. The manufacturer shall produce full details concerning the standards to which his goods are produced. All unions shall be suitable for joining GMS pipes manufactures to BS 1387 or IS : 1239(part I) - 1990 or equivalent with threads to BS 21 or equivalent.

4.2 Packing

Packing shall be as for valves.

5.0 FLEXIBLE/DETACHABLE COUPLINGS

Flexible/detachable joints are required for repairs to existing GMS pipes of medium class manufactured to BS 1387 or equivalent specification. They shall be similar to "Viking Johnson Couplings" without central register and shall be capable of withstanding a pressure of 250m head of water. They shall be supplied complete with all bolts and gaskets and shall be suitably protected against corrosion by an approved coating. Sizes required in the range of pipe sizes ND50 to ND100. Full details to be supplied for approval before manufacture.

6.0 FLOAT VALVE

Float valve shall be of heavy duty type for break pressure chamber and conforming to standard IS : 1703 - 1977 (horizontal plunger type or equivalent. The pressure rating shall be 14 Kg/cm² and male thread shall be as per corresponding standard.

7.0 NIPPLES

Nipple of various length as required by the Purchaser shall be manufactured of Medium/Heavy duty galvanized mild steel pipes conforming to IS : 1239 (part I) - 1990 or equivalent. Threads to conform with IS : 554 - 1975 or equivalent. The standard lengths are :

- 100 mm upto 25mm nominal bore
- 150 mm for 32 mm & 65 mm nominal bore
- 200 mm for 80 mm & 100 mm nominal bore

8.0 BRASS UNION

Brass union shall be used to join HDP pipe and equivalent G.I. Pipe. Dimensions for HDP pipes are as per : 4984 - 1995 equivalent and GI pipes as per IS : 1239 (part I) - 1990 or BS : 1387 - 1967 make threads or equivalent. Type of joint : Expansion joint consisting of :

- a. union body
- b. brass ring
- c. brass expansion plunge (for insertion into to HDP pipe)
- d. neoprene ring for insertion into union body &
- e. flat rubber coaster. Each set to be supplied assembled.

9.0 FLABGE SET (for HDP - GI Jointing)

Flange set to join HDP pipe as per IS : 4984 - 1995 or equivalent to IS : 1239 (part I) - 1990 or BS : 1387 GI pipe (make threads) shall consist of :

- a. female threaded flange
- b. plain unthreaded flange
- c. HDP flange adaptor
- d. heavy duty rubber gasket and
- e. nuts, bolts and washer (adequately lightened)

10. GI FLANGE

Flanges shall be female threaded to join GI pipe and valves etc and shall be drilled in accordance with BS : 4504 PN 16 or equivalent. The supply shall be complete with nuts, bolts and washers, all adequately tightened.

11. GI VALVE BOX

GI Pipe Boxes shall be manufactured according to sample made available or the Drawing and GI pipe used must be medium duty conforming to NS : 199 - 2046 or IS : 1239 (part) - 1990 or equivalent. As shown in the drawing one end of the GI pipe shall be fitted with end cap or one set of GI flange and GI blank flange complete with nuts and bolts. The bottom of the GI pipe shall be slotted to allow it to slip over the pipeline and locked into place with 300 mm long M.S. bar by passing through two 10 mm holes drilled near the base.

12. GI VALVE KEY

The Valve Box Keys shall be manufactured according to sample or drawing made available to the manufacturer. Valve Boxes Keys to be manufactured of light duty pipe conforming to Nepal Standard NS : 199 - 2046 or Indian Standard IS : 1239 (part I) - 1990 or equivalent. Other required reducers shall conform to IS : 1879 - 1987 or equivalent.

13. M.S. MANHOLE COVER AND FRAME

Manhole cover and frame shall be manufactured as per drawing or samples made available to the manufacturer.

Manhole Frame to be manufactured from 6 mm thick rolled steel 50 mm wide, 8 mm mild steel bar 100 cm long to be welded to the outside of the frame at 90 degree intervals. Lugs (2 nos) to be made as L sections 100 mm high, 50 mm wide to be manufactured from 5 mm thick rolled steel. Slot 15 mm x 25 mm to be drilled in each lug 10 mm from top of lugs. Bottom end of L section shall be welded at 90 degree to the middle of the outside of the frame.

Cover Frame to be manufactured from 5mm thick rolled steel 50mm wide. Framed to be circular 580mm outside diameter, 8mm mild steel bars 6 nos to be welded to the inside of the frame to form a regular square reinforcement mesh. Handles 2 nos. to be made from 10mm plain steel bar 100mm wide 50mm height to be welded to outside of frame. Lugs 2 nos. to be made from 5 mm thick rolled steel 50 mm wide 100 mm high with slot 15 mm x 25 mm drilled in each lug 10mm from top of each lug. Lugs to be welded flush to the outside of frame with bottom of lug in line with bottom of frame.

Manhole frame and Cover frame shall be painted with two coats of red oxide metal primer.

14. WATER METER

Water meters are generally used for measuring flows in the mains and house service connection. Domestic water meters are to be as per IS 779-1994 or NS 428-2058 or equivalent. Generally two types of meters semi positive and inferential are available in the market. Inferential water meter has the same accuracy as the semi positive type at higher flows; it passes unfiltered water better than a semi positive meter and is lower in cost. Over all dimensions and nominal capacities of water meters are presented in Table No...3.....

Table No. 3 Dimensions and Capacities of Water Meters

Nominal Size, mm	Overall length including nipple, mm	Over all Width maximum, mm	Over all height maximum, mm	Discharge, lph	
				Semi positive type	Inferential type
15	250	130	180	2000	2500
20	290	130	180	3400	3500
25	380	140	200	5500	5500
40	430	230	250	10000	16000
50	470	250	300	15000	23000

BUTT FUSION WELDING MACHINE are also called HDPE PIPE JOINTING MACHINE ,Polypropylene pipes thermo fusion welding equipment, hydraulic thermo fusion joining for polyethylene pipes and pipe fittings, HDPE Butt Welding Equipment,B utt Welders,butt fusion welder.

It is used to butt weld pipe and fittings such as elbow, tees, wye and flange necks without any additional equipment by simply adjusting the clamps` drag bar. It is suitable for welding plastic pipe and fittings made of HDPE, PP, PVDF. Removable PTFE coated heating plate with separate temperature control system. Electrical planning tool; Be made of lightweight and high strength material; simple structure, small and delicate user friendly; Low starting pressure ensures reliable welding quality of small pipes; Separate two-channel timer shows time in soaking and cooling phases; High-accurate and shockproof pressure meter in indicates clear readings.

This includes:*A machine body with 4clamps and 2hydraulic cylinders with fast couplings;*A Teflon coated heating plate with separate temperature control system;*A electrical milling cutter;*Hydraulic hoses with quick couplings;*Support for milling cutter and heating plate.

Technical Specifications:

- Welding Range (mm) : As specified in BOQ
- Welding Type: Butt Fusion
- Power Source: Electric
- Heating Plate Max. Temp. : 270⁰ C □ Temp. Deviation in Surface : ≤ ± 5⁰ C
- Working Voltage : 220 V 50 HZ

15. Technical Specifications

Bidders shall mention each and every proposed technical details as specified in the technical details.

15. General

15.1. General:

The submersible pump with the motor assembly offered shall be suitable to operate continuously throughout the operating range required. They shall be as per IS: 8034 or British Standard or equivalent international Standard and should meet ISO 9001:2008 /14001: 2004 standard. Materials used in the construction should be suitable to fulfil the required duty under the specified condition.

Typical materials to be used in pumps in construction given below are intended as a general guide. Bidders may propose other materials specification if they consider them better suited for the purpose, and guarantee their quality; durability and performance. Necessary catalogues/brochures and certificate of Origin and certificate standard of offered submersible pump shall be made available along with the bid. Label/Name plate indicating the information about the submersible pump and standard should be marked on the pump body.

15.2. Submersible Pump:

a. General:

The submersible pumps shall be single or multi-stage units, suspended from a supporting clamp & well cover, capable of taking the entire load of the pump & motor. The pumps shall be of the open line shaft type for lubrication with fluid being pumped and shall be supplied with threaded discharge case, joint coupling and key. It shall be of international standard ISO 9001/2000. **Efficiency of Pump should not be less than or equal to 70%**

b. Pump Bowls:

Pump bowl castings shall be free of blowholes, sand holes and other detrimental defects. The finished bowls shall be capable of withstanding a hydro static pressure equal to twice the rated head or 1.5 times the shut-off pressure, whichever is the greater. They shall be vitreous enamelled or baked epoxy coated to provide smooth surface and protection against abrasion and corrosion. It shall be of international standard ISO 9001/2000.

c. Impellers:

Impellers shall be made of best quality Bronze or Chrome Steel or Stainless Steel or Noryl Ppo shall be carefully machined and their Vanes shall be hand finished. The impeller shall be statically and dynamically balanced. They shall be fastened securely to the impeller shaft with keys, taper bugs, lock nuts, or set screws. It shall be of international standard ISO 9001/2000.

d. Pump and motor shaft:

Shaft shall be of high-terrible stainless steel. (Cr. Steel : AISI 410H:ASTM A276

15.3. Submersible Motor:

- a) **The motor** shall be of the squirrel -cage induction & water filled type suitable for across the line starting and shall be capable of reduced - voltage starting. It shall be capable of continuous operation under water at the conditions specified. Motor starting shall be star delta type. It shall be of International standard ISO 9001/2000. Thrust and up-thrust bearing shall be Michell type or equivalent with its resting segments having ball projection of ample capacity to carry the weight of all rotating parts plus the hydraulic thrust shall be incorporated into the pump driver. **Efficiency of Motor should not be less than or equal to 82%**
- b) **Motor Power cable** shall be manufactured under IS: 694, international standard or better standard with ISI properly insulated and shall be suitable for continuous operation of required pump. The cable shall be suitable for supported from the columns at several points with clamp or belts.

15.4 Control Panel:

The control panel shall be indoor & wall mounted of international standard or better standard with powder coated CRCA Sheet of 1.6 mm thickness and degree of protection: IP42 or equivalent. The control panel shall be incorporated with over load protective relay, single phasing preventer, Phase Sequence relay, start- stop push button, Voltmeter & Ammeter with selector switches & C/T coil, Indicator lamps to indicate TRIP, ON, LOW LEVEL / SINGLE PHASING / PHASE FAIL etc star- delta type starter with air break contactor, S/D Timer (Only if control panel is S/D type), TP MCB up to 15 HP / and above MCCB and shall be of suitable rating for the specified pump.

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Components System certification: ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007, ISO 27001:2005
Accredited for ISO/IEC 17025:2005 & Product Certification: BIS, IEC, UL, CE, CSA, CCC by ASTA, KEMA, CQC, CPRI & ERD

15.5 Spare Parts:

All necessary spares shall be made available when required for pump / motor and panel.

15.6 Characteristic curves:

The contractor shall submit, along with his tender, one copy of the characteristic curves or family of same model for the proposed pump plotted on graph. For the pump (or pump unit where overall efficiency is specified) the following characteristic curves shall be shown as ordinates plotted against the rate of flow l/s as abscissa for the complete range of flow for the pump.

1. Test certificates are mandatory for supplied pumps. So, at the time of supply it must be presented.
2. Total Head in Meters (feet)
3. Pump Efficiency (%)
4. **Pump Efficiency = 70 % or above, Motor Efficiency = 82% or above @ full load, Actual or Overall Efficiency = 57.40% or above.**

The curves shall be plotted in the units specified for the pump. The characteristics curve shall show the performance of the pump in full range of operation from zero to maximum discharge

capacity. The limits of the rate of flow at which the pump can successfully operate shall be indicated on each curve and shall be in accordance with the system head requirements.

15.7 TECHNICAL SPECIFICATION OF ELECTRIC SUBMERSIBLE PUMPS

Liquid Handled	:	Clear water/ permissible sand
Air Temperature	:	2 to 45 ⁰ C
Allowable solids	:	3000 PPM (MAX)
Sand Content	:	50 - 150 gm/m³
Humidity	:	100%

▪

▪ PUMP

Pump Bowl, Suction Casing	:	Close grained Cast Iron, discharge Casing and non-return valve
Impeller	:	Bronze / Chrome Steel / Stainless Steel/ NorylPPo
Pump Shaft	:	Stainless Steel
Casing- Wearing Ring	:	Bronze /Chrome Steel / Stainless Steel/ NorylPPo
Pump Bowl Bearing	:	Bronze / Chrome Steel / Stainless Steel/ NorylPPo
No. of Stage	:	As per required discharge & head
Pump Capacity	:	As defined in BOQ
Head Range	:	As defined in BOQ
Pump Efficiency	:	As defined in Specification

▪

▪ MOTOR

Power Rating	:	As per head & discharge at best efficiency point
Output	:	As per head & discharge at best efficiency point
Motor Efficiency	:	As defined in specification
Type	:	Submersible water filled
Voltage	:	400+ 10%, - 15%
Frequency	:	50HZ
Duty Type	:	Continuous
Rotor shaft /Bearing Sleeve for motor	:	Stainless Steel (Cr. Steel AISI 410H:ASTM A276)
Motor Lower and upper bearing bushes	:	Bronze
Motor Thrust bearing ring(Michell Type)	:	Graphite /Carbon with C. I. Housing
Motor Casing Component	:	Stainless Steel tubes
Overall Efficiency	:	As defined in specification

Quality

Submersible pump shall be of ISI, BIS, ISO 9001 or 9002 certified Document must be submitted with tender

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Standard

Documents without these papers will not be entertained what so ever.

Additional Specifications of Submersible Pumps than above mentioned.

Water from the bore holes are clean, non-aggressive water with a temperature between 5°C and 30°C without solid and/or fibers articles. However, some of the boreholes (Tube Wells) might contain slight solid materials (mud and/or silt) as well as high content of Ammonium (up to 120 mg/l) and Iron (up to 80 mg/l).

This specification covers technical requirements for the design, engineering and testing of the components of submersible pump sets to be installed in tube wells This also includes specification of assemblies, viz. pumping plant accessories and electric control panels.

General Specification

Pumps supplied shall be capable of satisfying the performance requirements in the relevant technical specification. However, the offered submersible pump must be energy effective and well perform in its duty. Low maintenance costs, reliability and trouble-free operation will be the prime consideration when selecting pumps.

Pumps shall be quiet in operation and free from vibration. Pump speed shall not exceed 2900 RPM. The pump should have the maximum efficiency at the specified duty point. Approximate power inputs are given in Schedule of Requirements; however, the minimum efficiency of the pump shall not less than 70%, and should meet the stipulated design discharge and head.

Pumps shall be designed to handle the described liquids and shall run unattended for long periods (15-22 hr./day). A corrosion resistant metal nameplate shall be permanently attached to the pump. Pumps shall have the characteristic of continuously rising head with decreasing capacity from rated capacity to shut-off, unless otherwise specified. Pumps shall have in-built dry-running protection and shall be started by motor control switch panels or electric starters as specified. Pump characteristic curves showing head/discharge, efficiency and power absorbed shall be submitted with the contractor's Tender.

General

The pump set in general shall confirm to IS: 8034 or equivalent British and other International standard. In case of the proposal for Indian Production the pump set shall bear ISI mark. The manufacturer shall be certified as per ISO 9001.

Components of Submersible Pumps

Submersible pump set shall be a compact unit made up of a submersible pump and a submersible motor with shafts connected by a sleeve and operates beneath the surface of water. This maintenance-free pump set is suspended vertically from raising main when installed.

Submersible Pumps

The submersible pumps shall be multistage centrifugal pumps with radial or mixed flow impellers. The casing of the radial flow impeller pumps shall be clamped together by flat steel hook bolts, whereas that of mixed flow impeller pumps by studs. Between the pump and the motor is the suction casing, a non-return valve shall be fitted to the pump discharge.

Submersible Motors

Submersible motors shall be water filled, water lubricated squirrel case type. The axial thrust generated by the pump is absorbed by a thrust bearing fitted at the bottom of the motor. The diaphragm below the thrust bearing compensates the overpressure which arises as a result of the thermal expansion of the water filled, when the temperature of the winding rises.

Bearings

The pump shall be provided with radial bearings. The motor has radial as well as axial thrust bearings. All the bearings shall be water lubricated and protected to a large degree against the ingress of sand by suitable structural elements.

Pump Set/Assembly Components

Submersible pump set shall have the following minimum components with the following specification:

1. a) Pump Bowl Assembly
2. b) Suction case with Strainer
3. c) Submersible motor
4. d) Submersible (electric) cable

Pump Bowl Assembly

The pump bowl Assembly shall have made of close-grained cast iron, free from blowholes, sand holes or other detrimental defects. The bowl unit shall be capable of withstanding a hydraulic pressure equal to twice the pressure at the rated capacity or 1.5 times the shot off head, whichever is greater. The

pump shall be equipped with replaceable bearing, whichever provided. The pump shaft shall be made of stainless steel. Impeller may be of enclosed or semi open type and shall be properly balanced. Impeller shall be made of bronze or Noryl i.e. modified PPO as per IS: 8034-1984 or equivalent British Standard. Each impeller shall be securely fastened to the shaft. The delivery outlet of the bowl assembly shall comprise of a spring loaded Non-Return valve. In the pump set/assembly, materials having higher grade or better performance may also be considered provided that there is a sufficient reason and documentary proof of the materials in the present operating conditions.

The bowl assembly shall bear a nameplate giving the following information:

- a) Manufacturer's name or trade-mark (if any)
- b) Model
- c) Serial No.
- d) No of stages
- e) Head, at specified point
- f) Discharge, as specified point g) Overall input, Max.

Suction Case with Strainer

The opening of the suction case for the entrance of the liquid shall be of proper size and shape to avoid eddy currents. The suction case shall be fitted with a strainer made of corrosion resistant material. Suitable sand guard shall be provided just above the suction case bearing to prevent the entry of foreign matter into the suction case.

Submersible Motor

Submersible Motor shall conform IS 9283-1979 or equivalent British Standard and squirrel case induction type suitable for operation on $415 \pm 10\%$ Volt A.C. with 50 HZ frequency. The motor should be water filled and water lubricated. The thrust bearing design is to be Mitchell type with self-adjusting thrust bearing design is to be Mitchell type with self-adjusting thrust pads resting on individual steel balls to absorb axial thrust under adverse conditions. The thrust bearing shall be of adequate size to withstand the weight of all rotating parts as well as the imposed hydraulic thrust. It shall have sufficient capacity to permit the pump to operate for short periods with discharge valve closed. The starter should be fully rewind able with special PVC insulated winding wire with overhang design to facilitate easy maintenance and repair; the starter stampings are to be suitably locked both in horizontal and circumferential directions to insure positive locking. The motor shall be protected by means of cable glands; rubber seals etc. from ingress of borehole water, sand and other foreign matters. The thrust bearing housing shall be provided with a drain plug to empty the pure water filled into the thrust bearing housing/motor. The rotor shaft shall be provided with a breathing attachment like bellows, diaphragm, etc. to compensate the volumetric variations due to the change in temperature. The motor (casing, shaft, bolts/nuts etc.) shall be made of corrosion resisting materials or suitably treated materials to resist corrosion under normal conditions. The motor should have at least 10% margin at duty point as well as should not get overloaded in the entire range of operation. The motor shall have following information.

1. a) Name of manufacturer
2. b) Motor rating (KW or HP)
3. c) Nominal speed

4. d) Rated current (A)
5. e) Rate V voltage (V)
6. f) Frequency (Hz)
7. g) Connection system
8. h) Type of duty (continuous)
9. i) Materials of casing, shaft, bolts/nuts

There shall be an indication to identify the motor with its pump. A suitable Coupling arrangement shall be provided to couple the pump set directly, which shall be capable of transmitting the total torque of the unit regardless of direction of the rotation.

Technical Specifications for Submersible Pump sets		
Sr.no	Motor Specifications :	
1	IS std for Submersible Motor	IS 9283 - 1995 (latest revision if any)
2	Motor Rating (KW / HP)	
3	Operating Voltage (Volt)	50 Hz +3%, -3% / 415 volt +10%,-15% volt
4	Starting method	Star delta
5	Power Supply	3 Phase AC Supply
6	Synchronous speed	2900 rpm
7	Stator body	Stainless steel
8	Stamping	Cold rolled non grain oriented low loss electrical silicon steel grade M45
		OR equivalent IS grade
9	Winding Type / Wire	Wet Type / PVC wire
10	No of Thrust bearing segment	Should be 5 nos
11	Thrust bearing segment MOC	ASTM A743 Gr.CA- 40A
12	Thrust bearing dia	Min. 96mm
13	Thrust bearing plate	Cr.steel + Carbon
14	Rotor Shaft	ASTM A276 Type 410(EN shaft with SS sleeve is not acceptable.)
15	Redial bearing bush	IS318 Gr.LTB- 4
16	No of bearing bush	At least 2 nos - Up side & 2 / 1 lower side

17	Thrust bearing & motor adaptor	CI IS 210 Gr.FG 200
18	Stud NUT	Stainless steel
19	Diaphragm	EPDM
20	Max Permissible Temp.	35 Centigrade (Ambient: 45 Centigrade)
Pumps Specifications :		
21	IS std for Submersible Motor	IS 8034 - 2002 (latest revision if any)
22	Stage casing	Close grained cast iron conforming to Gr.FG200 of IS :210
23	Suction casing with bush bearing	CI IS 210 Gr.210 FG200
24	Speed	2900 rpm
25	Max Permissible Temp.	35 Centigrade (Ambient: 45 Centigrade)
26	Impeller	12% Chrome Steel IS 3444 Gr.11 / NorylPpo (GFN2)
27	Pumps Shaft	ASTM A 276 Type 410
28	Coupling Sleeve	ASTM A 276 Type 410
29	Strainer	SS