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Model Standard Operating Procedure For the Piping of Water for Pharmaceutical Use

Please note- points mentioned in this documents are what we follow generally but not necessary every time. Please provide your project detail for our confirmation

CARBON STEEL/ MILD STEEL

A. GENERAL

1. All piping material purchased shall be supported with material test certificates and identification mark. After piping material received at site, it shall be subjected to random chemical and mechanical test before it is taken for use. Material not conforming to standard shall be rejected.

2. Before installation of pipe, pipes shall be made clean from inside by light hammering. Ends shall be closed with cloth / PVC caps to avoid foreign particle to go inside. No rags or paper bags shall be used for the same.

3. On pump suction line reducer if any shall be of eccentric type and installed to allow full drainage.

4. After completion of piping, each line shall be hydro tested to 1.5 times the working pressure of the piping using clean water.

B. LAYOUT, CUTTING AND FITTING

1. Machine cut bevels are preferred. however, smooth flame -cut bevels with proper grinding are acceptable.

2. Proper gap between the joints shall be maintained during tack welding by providing spacers. This would ensure the full penetration of welds. The recommended gaps are: 1.5 mm weld gap for pipe smaller than 150 mm diameter.

3 Tack welds should be small and should penetrate fully to the bottom of the welding groove. The tack welds that are not fully penetrated shall be grind off. Every tack weld

shall be cleaned of scales, slag, flux, etc before welding additional beads. Every tack weld shall become a part of the finished weld after full welding is done.

C. BENDING

1. Completed bends shall have smooth surfaces and shall be free of spots and wrinkles.

2. Hot bending shall be done with the pipe filled up with sand. Minimum radius shall be three times the pipe diameter. Hot bend shall be allowed to cool naturally before the sand is removed.

3. Cold bending is not allowed for pipe diameters of 50 mm and above. If good quality bends with a radius of three times the pipe diameter are not possible, higher radius shall be made with the prior approval of Consulting Engineer/ Owner.

4 Flattening at any cross-section shall not exceed 3 % of the outside radius . Also the minimum pipe thickness after bending shall not be less by 10 % of the nominal thickness.

D. WELDING

1. Welders and welding procedures shall be qualified in accordance with the requirements of the latest edition of ASME section IX and IS - 817 for IBR/non -IBR piping. Both horizontal and vertical qualifications shall be shown on qualification papers.

2. Electric arc welding process shall be used.

3. After each run of welding, slag shall be removed and through inspection and rectification of this run should be done before the next welding run is started. Welding of full thickness penetration shall be ensured.

4. Finished welds shall project minimum 1.5 mm but not more than 3 mm from the outer surface of the pipe.

5. After completion of the welding, slag and metal spatters shall be thoroughly removed.

6. Overlap or undercut on weld is not permitted.

7. Except for fitting or forming purposes, do not ground the welding.

8. Weld repairs must be made by removing the defective weld metal by grinding or by other mechanical means.

9. D. P. test will be carried out in steam piping of 10 % of the total weld joints.

10. 10% radio graphic examination shall be carried out in case of IBR piping. The welder used for IBR piping shall be IBR approved. The IBR piping drawing shall be got prepared and approved from IBR authority by contractor.all expense for approval purpose will be by owner.

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STAINLESS STEEL

A. GENERAL

2. All piping material purchased shall be supported with material test certificates & identification mark. After piping material received at site, it shall be subjected to random chemical & mechanical test before it is taken for use. Material not conforming to standard shall be rejected.

3. All piping material shall be stored in the clean place to avoid the material to become dirty.

4. Before installation of pipes, pipes shall be made clean from inside by light hammering. Ends shall be closed with cloth / PVC caps to avoid foreign particle to go inside. No rags or paper bags shall be used for the same.

5. All pipe lines shall be laid such that it should be easily drainable i.e all lines shall be provided slope of 5 mm / meter with direction indication on pipeline.

6. Piping system installed shall be readily cleanable.

7. Incase of SS316L loop no dead leg exceeds three pipe diameter in any end of pipe/tapping. All valves for tapping shall have Zero dead leg.

8. Pure Steam line laid in process area shall be fully drainable.

9. Vent and filters location shall be drainable and at place where maintenance can be carried out easily.

10. All exposed wall / rack piping in the process area has clearance for cleaning and wipe down.

11. Piping shall run vertical as far as possible.

12. On pump suction line, reducer if any shall be of eccentric type & installed to allow full drainage.

13. After completion of piping each line shall be Hydro tested using clean DM water at 1.5 times the Design pressure of the piping, or 1.5 times the loop pump discharge pressure which ever is higher.

14. Pickling of SS piping

a. Remove oxide films i.e discolouration by pickling solution by mixing 1000 ml HCL (Sp.gr.1.19), 100 ml Nitric ACID (Sp.gr.1.4) and 1000 ml water. A suitable inhibitor such as Hexamethylence tetramine shall be used. The pickling solution is allowed for about 10 minutes.

b. The treated surface is then cleaned thorouly first with water and then with very dilute caustic soda solution. final rinsing is done by water.

15. All SS-316L piping shall be electropolished to 0.4 RA and externally polished to 180 grid.

16. All Pendants shall be externally Matt polished to 180 grid.

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B. FABRICATION

1. Machine cut bevels are preferred. However, edges beveled with a file or grinder followed by cleaning with a stainless steel wire brush are acceptable.

2. Proper gap between the joints shall be maintained during tack welding by providing spacers. This would ensure the full penetration of welds.

3. Tack welds should be small and should penetrate fully to the bottom of the welding groove.

4. Completed bends shall have smooth surfaces and shall be free of spots and wrinkles.

5. No hot bending is permitted.

6. Cold bending is not allowed for pipe diameters of 50 mm and above. If good quality bend with a radius of three times the pipe diameter are noted possible, higher radius of five times the pipe diameter shall be made with the prior approval of Consulting Engineer /Owner

7. Flattening at any cross-section shall not exceed 3 % of the outside radius . Also the minimum pipe thickness shall not be less by 10% of nominal thickness.

8. S.S. tubing work for gases shall be carried out with SS compression fittings using SS ferrules. Tube shall be bent using tube bender machine where ever required.

C. 1 WELDING- SS-304 PIPING

1. Welders and welding procedures shall be qualified in accordance with the requirements of the latest edition of ASME section IX or IS-817. Both horizontal and vertical qualifications shall be shown on qualification papers.

2. Argon Arc welding shall be used. Electric welding shall be used only with the approval of Consultant /Owner.

3. Pipes up to 2mm thick may be welded without any root gap. Pipes of wall thickness between 2 and 4.76 mm may be welded with a root gap of 1/2 the wall thickness . And pipes above 4.76 mm thick shall be bevelled.

4. Welding of full thickness penetraton shall be ensured.

5. Finished welds shall project minimum 1.5 mm but not more than 3 mm from the outer surface of the pipe.

6. Over-lap or under -cut on weld is not permitted.

7. After completion of the welding, slag and metal spatters shall be thoroughly removed. Only stainless steel chipping tools and wire brushes are permitted.

8. The area of 50 mm on both the sides of welding shall be cleaned with halogen -free solvent.

9. Except for fitting purposes, do not ground the welding.

10. Weld repairs must be made by removing the defective weld metal by grinding or other mechanical means.

11. Permanently welded backing rings are not permitted.

12. All ss-304 pipe joints shall be 10% radiographed as per ASME section IX.

C. 2 WELDING- SS-316L PIPING

All SS-316L electro polished tubes / pipes shall be welded using orbital welding m/c. documentation should be done for all weld joint.
All joints shall be 100% Boroscopically examined where ever boroscope is not possible radio graphy shall be carried out.

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G.I.PIPING

A.1 APPLICABLE CODES AND SPECIFICATIONS

The following codes, standards and specifications are made a part of this specification. All standards, specifications, codes of practices referred to herein shall be the latest edition including all applicable amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern.

IS:1239 Mild Steel Tubes and Mild Steel Tubulars fittings.

IS:3589 Electrically welded steel pipe for water, gas and sewage (220 mm to 2000 mm nominal Diameter).

A.2 MATERIALS

All materials, fittings, fixtures and appliances shall be of the best quality conforming to relevant Indian Standards and shall be procured from approved manufacturers. Unless specifically allowed by the Engineer, the contractor shall submit samples of fittings and fixtures which shall be retained by him for comparison when bulk supplies are received at the site. Ultimate choice lies completely with the Engineer.

The materials brought to the site, shall be stored in a separate secured enclosure away from the building materials. Pipe threads, sockets and similar items shall be specially protected till final installation. Valves and other expensive items shall be kept under lock and key. Fragile items shall be checked thoroughly when received at the site and items found damaged shall not be retained/used at the site.

A.3 PIPES AND PIPE FITTINGS

Under scope of this specification, pipes and pipe fittings may be of any or a combination of the following Types :

a) Steel pipes – G.I. / IS-1239, IS-3589,

b) Wrought iron - Galvanised - IS-1239, Is-3589

B Related works

All works, like earthwork, masonry, concrete, steel work, cutting holes, chases, repairs and rectifications associated directly with installation of piping systems shall come under the scope of Contractor unless specifically excluded.

C INSTALLATION OF CONCEALED PIPING

Where desired by the engineer or shown on the drawings the pipes shall be concealed in masonry or concrete of the structure. The plumbing contractor must coordinate with the building Contractor for leaving the chases, openings, conduits as necessary. However, the Contractor shall rectify if required the chases, openings and conduits, supplement and make good after laying and testing of the concealed pipelines.
All concealed G.I. piping shall carry Anit corrosive treatment consisting of a coat of coal tar and wrapping with Bitumen Impregnated hessian cloth & cover the chase in 1:3 mortar including covering with chicken mesh.

The piping shall be hydro tested before covering.

D G.I. Pipe lines Laying

In addition to fulfilling the functional requirements, all pipelines shall be laid true to line, plumb and level. Any deviation shall need approval of the Engineer. Meticulous care shall be taken to avoid chances of airlock and water hammer.

Pipes shall be laid on continuous unyielding surface or on reliable supports at least one near each joint and spacing as directed by the Engineer. The support must be strong, neat and shall have provisions for securing the pipes in every direction and easy maintenance. Pipes shall be encased or concealed in masonry or concrete if shown on drawing or directed by the Engineer. All pipe works shall be so laid, fixed and maintained as to be and to remain completely water-tight, thereby avoiding waste of water, damage to property and the risk of contamination of the water being conveyed.
No piping shall be laid or fixed so as to pass into or through any sewer, scour outlet or drain or any manhole connected therewith.

d.1) Underground Piping

Underground piping shall be laid at such a depth that it shall not be damaged by traffic and other loads and frost, where applicable.
The size and depth of the trench shall be as approved by the Engineer. Backfilling shall be done with selected fine earth, unless otherwise permitted, in 150mm layers and carefully consolidated. Special care shall be taken while filling in the vicinity of the pipe to avoid damages. Before backfilling the laid pipe shall be fully tested and approved.
Once a joint has been screwed up it shall not be backed off unless the threads are reclined and new compound applied. G.I. union / flanges shall be used as per direction of engineer for easy dismantling / maintenance of G.I. pipelines vent shall be provided at suitable location to avoid air locking.

d.2) Protection

Open end of each pipe shall be protected during installation by suitable covers or plugs so that the ends, threads, socket are not damaged and no foreign material finds its way into the pipeline. Fitting & Fixtures liable to be misused or stolen during the construction phase shall be fitted only before testing & handing over.

d.3) Jointing of Flanged & Screwed Pipes

Jointing of pipes shall be completely leak proof and durable. Instruction of the manufacturer shall be followed unless desired otherwise by the Engineer. However, usually recommended practices are stated below for guidance:

a) Flanged joints:
Flanged joints shall be made by jointing rings of good quality, smooth and hard compressed fibre board of thickness not less than 1.5 mm and of such width as to fit inside the circle of bolt. Diagonally opposite bolts shall be tightened in pairs and in stages so that degree of all bolts in a joint are similar. Damaged gaskets shall be replaced.

b) G.I. piping shall be joined only by screwed joints. Screwed joints shall be carefully tightened. Care shall be taken to remove any burr from the ends of the pipes. Jointing shall be done by using PTFE (Teflon) tape or good quality sealent.

E TESTING AND ACCEPTANCE

a) Inspection before installation

All pipes, fittings and appliances shall be inspected, before laying and shall be sounded to disclose cracks. Any defective item shall be clearly marked as rejected and forthwith removed from the site.

b) Testing of Pipes after laying

After laying and jointing, the line shall be slowly and carefully charged with water, so that all air is expelled from the vent. Allowed to stand full of water for a few days, if time permits, and then tested under pressure. The test pressure shall be 1.5 times design press. or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump, or in the case of long mains or mains of a large diameter, by a power driven test pump, provided that the pump is not left unattended. In either case due precaution shall be taken to ensure that the required test pressure is not exceeded. Pressure gauge shall be accurate and shall preferably have been recalibrated before the test. The pump having been stopped, the test pressure shall maintain itself without measurable loss for at least five minutes. The end of the main shall be closed by fitting a water-tight expanding plug and the plug shall be secured by struts to resist the end thrust of the water pressure in the mains.

c) Testing of service pipes and fittings

The service pipes shall be slowly and carefully charged with water, allowing all air to escape and avoiding all shocks or water hammer. The service pipe shall then be inspected under working conditions of pressure and flow. When all draw-off taps are closed, the service pipes shall be absolutely watertight. All piping, fittings and appliances shall be checked for satisfactory support and protection from damage, corrosion and frost.

d) Trenches

Unless particular items are included in the Schedule, no separate measurement shall be made for lead, lift, dewatering, dressing, storing, backfilling, consolidation etc. that may be required in this connection.

e) Pipe Works

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No separate measurement shall be made for specials, supports and fixtures, cutting chases, holes and rectification unless specially indicated in the Schedule of Items. if the specials are separately indicated in the schedule, the measurement for these shall be over and above the measurement of the pipe work as mentioned below.

The pipes of different nominal bores shall be measured separately.

The pipe work shall be measured in length exclusive of sockets, specials, fittings, etc. in position.

f) Fittings and Fixture
Measurement for fittings and fixtures where applicable shall be in number. No separate measurement shall be made for anchors unless included in the Schedule.

g) Chases, holes
No measurement shall be made for cutting chases, holes etc. Unless it is specifically indicated in the schedule of rates.

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UPVC PIPING

A. GENERAL

1. Before installation of pipes , pipes shall be made clean from inside by light hammering. Ends shall be closed with cloth / PVC caps to avoid foreign particle to go inside. No rags or paper bags shall be used for the same.

2. After completion of piping , each line shall be hydro tested to 1.5 times the working pressure of the piping using clean water.

B. LAYOUT, CUTTING AND FITTING

B.1 CUT PIPE : Cut pipe square. As joints are sealed at the base of the fitting socket. An angled cut may result in joint failure. Acceptable tools include miter saw, mechanical cut off saw or wheel cutter. Wheel type cutters must employ a blade designed for plastics.

B.2 REMOVE BURR AND BEVEL : Remove all burr from inside and outside of pipe with a knife-edge, file, or deburring tool. Chemfer (bevel) the end of the pipe 10^0-15^0.
CLEAN : Remove surface dirt, grease, or moisture with a clean dry cloth.

B.3 DRY FIT : With light pressure, pipe should go one third to one half of the way into the fitting socket. Pipes and fittings that are too tight or too loose should not be used.

B.4 APPLICATOR : Use an applicator that is one half the pipe diameter. Too large an applicator will force excessive cement into the inside of small diameter fittings. Too small an applicator will not apply sufficient cement to large diameter systems.

B.5 SOLVENT CEMENT : Apply a full even layer of solvent cement to the outside of a pipe and medium layer of cement to the inside of a fitting.

B.6 JOIN PIPE AND FITTINGS : Assemble pipe and fitting socket till it contacts socket bottom. Give pipe a quarter turn. Hold pipe and fitting together until the pipe does not back out. Remove excessive cement from the exterior. A properly made joint will show a continuous bead of cement around the perimeter.

C. TESTING PRESSURE

Prior to testing, safety precautions should be instituted to protect personnel and property in case of test failure.

Conduct pressure testing with water. Do not use air or other gases for pressure testing.

The piping system should be adequately anchored to limit movement. Water under pressure exerts thrust forces in piping systems. Thrust blocking should be provided at change of direction, change in size and at dead ends.

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SPECIFICATIONS FOR PIPING ERECTION, SUPPORTING, TESTING AND CLEANING.

A. ERECTION OF PIPING

1. All piping shall be erected as shown in the drawings and as per this specification, applicable codes and good engineering practice.
2. Piping shall be erected in place without excessive force.
3. Gaskets between the flanges shall be tightened uniformly by tightening the bolts uniformly.
4. Piping to and from the equipments including rotary equipments shall be carried out only after these equipments are leveled.
5. Valved drains and valved plugged vents shall be provided at all the lowest points and the highest points respectively, irrespectively of whether it is shown in the drawings or not.
6. Valves shall be installed in such a way that they are easily approachable.
7. Lift check valves shall be installed in horizontal piping only. Swing check valves can be installed in vertical lines. All the check valves should be installed with arrow in the direction of flow.
8. In case of control valves proper upstream and downstream clearances as recommended in the drawings shall be maintained.
9. Minimum clearance of 25 mm between the outer surfaces of the pipelines shall be maintained. This clearance is to be considered after insulation, if any.
10. Bolts used shall be of proper size and length.
11. All the drain pipes shall have minimum 1 : 200 slope, unless otherwise given.
12. All lined piping such as lead lined, rubber lined, teflon lined, glass lined, etc shall be assembled as per drawings.
13. Teflon tape or sealent shall be used for tightening of G.I. piping.
14. While basic layouts may be available in the drawings provided by the Consultant / Owner, the detailed BOQ shall have to be made by the contractor and got approved from the Enginner.
15. Special attention shall be given by the Contractor to economy. Summetry in layout is very important. Fittings meant for operation shall be located and oriented to allow easy reach and operation, Maintenance, repairs and replacements of pipes, fittings and fixtures must be conveniently possible. All material shall be installed in most workmen like manner by skilled workers.

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A1 UNDER GROUND PIPING Requiring anticorrosive tape wrapping

1. Outside surfaces of pipes shall be thoroughly cleaned of soil, rust, and foreign materials by scrapping and wire brushing. Oil and grease shall then be removed by a solvent degreaser.

2. 3 mm thick anticorrosive tape of *coatek* or equivalent make shall be used for wrapping & coating of U/g pipes. Wherever asked for Tape primer quantity used shall be minimum 250 gm/sq. meter

3. Care shall be taken to avoid scratches during drying and installation.

4. Minimum depth of under ground piping shall be 600 mm.

5. Where the pipe rests on rock it may be bedded on a layer of fine selected material or concrete to avoid local point support.
The trench shall be so treated by gradient and fitting in the area that it does not act as a drainage channel.

B. ERECTION OF ROTATING EQUIPMENTS

1. Rotary equipment's may be received as separate driver and driven parts.

2. Contractor shall carefully check the orientation of foundations, elevations , locations of the anchor bolts, supporting structures , hole diameters, etc. well in advance so that timely action can be taken . Minor rectifications like chipping of foundations etc. shall be carried out by the Contractor after obtaining the Owners approval.

3. Contractor shall set- up liners for proper leveling, place the base plate on the liners and set anchor bolts. Provisional alignment of base plate should be done and anchor bolts should then be fixed by pouring morter in foundation pockets. Contractor shall assemble the complete equipment and align for grouting. Alignment should be rechecked after grouting.

4. Base plates should leveled on four corners for the directions of shaft and right angle to shaft.

5. While aligning, adjustments shall be carried out to the coupling and not the shaft. During alignment, the deflection and face deviation of the driving and the driven shaft shall be separately measured and should be within allowable limits as specified by the supplier. After completing the alignment, it should be ensured that the shaft rotates smoothly and freely by hand.

6. Alignment should be rechecked after the connection of piping. Any misalignment induced by the piping connections shall be corrected by adjusting the piping.

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C. PIPING SUPPORTS

1. Piping supports, anchors, guides ,etc shall be constructed as per the drawings.

2. Absolutely no welding shall be done on the lined piping such as rubber lined, leadlined, teflon -lined, glass lined, etc. Standard bracket type supports shall be fabricated for these lined piping.

3. Three mm rubber pad shall be used between the clamp and the non-metalic pipes such as PVC, Polypropylene, FRP, Glass etc.

4. Adequate supports for the metallic piping shall be provided as per drawing and depending on site conditions. Consult Site Engineer in case of clarifications or adequacy of supports.

5. Steam piping shall be provided ' T' shoe supports of about 250mm. Long. T size shall be more then insulation thickness.

D. TESTING & INSPECTION of EQUIPMENTS / PIPING

1. Running test of motor , pumps, fans etc shall be performed with no load to ensure that the vibrations , sound and temperature of equipment are not abnormal .

2. After running test of motor, the motor and the driven unit shall be coupled. Due care should be taken to check the direction of rotation.

3. Assembled rotary unit shall then be run on no load to ensure that the vibrations, sound and temperature are not abnormal.

4. Hydraulic test of all the stationary equipments shall be taken. . Pumps are tested running them on water. Fans, blowers, compressors, etc are tested on air.

5. Contractor shall carry out above testing to the satisfaction of Site in charge and their signature shall be obtained on the test certificates.

6. The work will be inspected by representative of owner. Contractor shall be responsible for all errors of fabrication & for correct fitting of piping. Any repair shall be carried out by Contractor free of cost.

7. All piping shall be hydraulically /pneumatically tested for the test pressure given in the piping specification. The test pressure shall not be less than 1.5 times design press. for hydraulic and pneumatic test.

8. The pressure gauge shall be calibrated and certified by competent party before test is conducted.
9. Underground piping, insulated piping and inaccessible piping shall be tested before installation.

10. All the repaired piping shall be retested after repairs.

11. Piping system may be tested in section by blanking and properly tagging. However complete system shall also be tested for the final approval .

12. Test reports shall be written in a separate note book and shall be certified by the site engineer immediately after the test.

* **TEST PROCEDURE**

1. Before testing, the piping system shall be isolated from the equipments , in-line instruments, etc by blank-offs. The blank offs must be of "Flagged" type , must be removed after the test and the in-line equipments/ instruments be reinstalled.

2. During the start-up of the testing , the entrapped air must be removed from the highest system point and the flange connections be adequately tightened.

3. Hold time of the testing shall be sufficient to allow careful inspection of all the joints and shall not be less than ten minutes , During the hold time, if the pressure remains constant, the tested piping section shall be approved.

E. CLEANING OF PIPING

E.1 CLEANING OF FABRICATED PIPING.

1. All the burrs, welding slag and weld spatters shall be removed by suitable mechanical means. After the completion of fabrication and mechanical cleaning, all the fabricated piping shall be thoroughly flushed with water to remove all the foreign materials such as soil, loose scales, oil film, sand, cement, etc. Adequate precaution should be taken to avoid collection of foreign materials from main lines to smaller branch lines during flushing.

2. Before installation, all the valves shall be properly inspected for foreign materials contaminators. Clean the valves first by wiping with clean /dry lint less cloth and then by clean lint less cloth moisture with clean trichloroethylene for metallic valves or dilute sulfuric acid for polypropylene /PVC valves.

E.2 CLEANING OF ERECTED PIPING

1. All the equipments, in-line instruments, steam traps, etc. shall be isolated before cleaning. All the blank - offs shall be removed after the completion of cleaning.

2. Strainer baskets shall be removed before cleaning and replaced immediately after cleaning.

3. Connect lower point of the system to open drain and flush with water until clean of dirt and scale.

F. MISCELLANEOUS STEEL

All bolts, anchor bolts , nuts, lock washers, supports and other miscellaneous items not furnished by equipment supplier or by Owner or otherwise called for in this specification shall be supplied by the Contractor . Before installing the equipment, the Contractor shall verify location of bolts, and if any discrepancy exits , he shall notify Owner.

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G. TEMPORARY SCREENS

Temporary screens of 20 mesh shall be installed in the suction lines of all the rotary equipments and at the inlet of all the delicate equipments like glass

and glass lined equipments. These screens shall be removed after the operation becomes normal and the distance pieces, if any, shall be installe

H. GROUTING

H.1 Grouting of anchor bolts, holes, pockets and under base plates or under equipments have been broadly classified into two categories.

(a) Non Shrinking Grout (b) Ordinary Grout.

(a) NON-SHRINKING GROUT

Non - shrinking grout consists of :
One part of ordinary portland + One part of clean dry well graded sand + one part of ferro grout or similar additive approved by the Engineer - in -charge + minimum amount water just enough to make placeable.

Non shrinking grout shall be generally used for grouting the following equipments:

* All vertical tanks / towers / exchangers
* All horizontal vessels / exchangers
* Vaccum pump,centrifugal

(b) ORDINARY GROUT

Ordinary grout consists of :
One part of portland cement + two parts of clean , dry well graded sand + minimum amount of water just enough to make the mix placeable.

Ordinary grout shall be generally used for grouting the following equipments.

* All structural frame work.
* All other miscellaneous foundations.

The grouting material shall solidly fill the spaces to be grouted and permanently retain original volume so that the base plates are held firmly in the set position. The amount of water used in the mixture shall be kept to a minimum just enough to make the mixture peaceable and for the grout to have a consistency too stiff for the grout to flow. The top of the foundation shall be clean and free of all laitance, locate particles, oil, grease etc shall be wetted thoroughly leaving no puddles prior to grouting. All tapped pockets shall be repaired using ordinary grout. Under no account shall neat cement be used for grouting.

H.2 PLACEMENT

* All anchor bolt holes shall be completely filled with grout.

* The finished surface shall be floated smooth and shall slope away from the base plates. (Approx. 1:25)

* After the initial set is over, the grout shall be kept thoroughly wet for a minimum period of 5 days.
* During grouting , care shall be taken to ensure that the base plate level and the alignment is not disturbed and that no honey -combing takes place in the grout.

I. MEASUREMENTS

a. All structural steel work shall be measured by Length, weights being calculated on the basis of standard weights of sections used. No allowances shall be made for welding or for bolts, rivets etc. The rate shall include painting of the structural steel work wherever required with one coat of red oxide primer.

b. The size of piping for measurement shall be nominal diameter for G.I. & M.S. piping. The length shall be measured along the centerline in running meter. Excluding all valves, fittings and piping specials which will be paid in number as per BOQ and actual measurement. The rate shall include painting of C.S piping with one coat of red oxide primer. For SS tubes the diameter considered shall be outside diameter.

c. The erection weight of equipment specified are indicative and for reference only the unit of measurement for equipments shall be item wise/ package wise. Variation in weight shall not be considered increase or reduction in the rate.

d. All surplus material left out after completion of job will be taken back by contractor. Payment shall be made only for actual erected material.

The payment done for supply of such a surplus material will be adjusted in the bill/final bill.

J. HOT INSULATION SPECIFICATION FOR PIPING & TANK (STEAM & CONDENSATE PIPING)

1. Hot insulation material shall be Lloyd / UP Twiga make compact mineral wool machine made mattresses as per I.S 3690. The density of wool shall be 100 Kg/cum. The material shall be suitable for 540 deg. C
2. Wool mattresses shall be backed by G.I wirechiken mess made from 22 SWG GI wire.
3. The binding wire shall be 20 SWG soft annealed G.I Wire.
4. Support rings shall be 25x3 mm size M.S material.
5. Self-tapping screw shall be 10 no size 12 mm long cadmium plated steel.
6. The insulation shall be cladded with 24 SWG aluminum sheeting of hard quality ASTM - B 209 alloy 1060 temper H-14.
7. Bituminous coated felt sheet shall be used with all aluminum sheeting joints, circumferential as well as longitudinal to seal the joints to make it water proof.
8. All flanges & valves shall be provided with removable box cover of 24 SWG Aluminum sheet
9. Minimum over lap of Aluminum cladding shall be 20mm.
10. The multi layer insulation shall be avoided.
11. Wooden support in two pieces shall be provided on each pipe supports. Length of wooden block shall be minimum 100mm. or M.S. Tee section of suitable size cut from ms beam of 200x100 and 250mm. Minimum length shall be provided.

12. Measurement of insulation shall be in running meter in case of piping.. Each valve insulation shall be measured as equivalent to two meter of pipe insulation. Each elbow, tee shall be measured 1.5m of pipe insulation.

K. HOT INSULTAION FOR S.S.PIPING and OTHER THEN STEAM / CONDENSATE SERVICE.

1. The insulation material used for s.s.piping shall be chloride free preferably armacell or equivalent for temp. up to 90^0c. & The cladding shall be of 24swg Alu. Sheet. Cover insulation in production area shall be SS 304 -24swg.with outer surface Matt finished and cover shall be welded.

L. COLD INSULTAION

1. The cold insulation shall be carried out using PUF sigment coverd with 24swg Alu. Sheet. / Armacell or equivalent material for temp. 40 to 90^0C with 24swg Alu. Cladding.

M. SPECIFICATION OF PAINTING OF PIPING AND EQUIPMENTS.

Prior to apply of primer on the surfaces to be paint, surface shall be cleaned properly with wire brush, sand paper or caustic depend upon the dirty ness of surfaces.
After cleaning of surface one coat of red oxide paint shall be applied and allow the surfaces to dry.