

CHAPTER NO. 28

WATER SUPPLY

SPECIFICATION NO. 28.1—General

The general specifications as contained in 29.1 shall be applicable to this as well.

SPECIFICATION NO. 28.2—Excavation for pipe lines

1. **Alignments of trenches and cover.**—The lines of trenches for all pipelines are to be carefully set out to the alignment of the pipelines. The trenches shall be carefully trimmed as to sides and bottom so that the pipelines, when laid (except where the trench is cut into rocky ground) shall rest on the natural bed of the trench throughout their full lengths, shallow joint holes being left for the joints where necessary. Where pipelines are to be laid in the ground in the plains the depth of cover, i.e., the normal distance from ground level to the top of the pipelines in cases of trunk and distribution mains shall be kept at about 2'—9" and never less than 2'—6" clear; except when for any special reasons the Engineer-in-charge shall direct in writing to the contrary. In the hills the depth shall normally be 3'—0" and never be less than 2'—8" unless for any special reasons the Engineer-in-charge may find it impracticable to do so. In special cases, for example where the sub-soil is heavily impregnated with corrosive substances, pipelines may occasionally have to be laid on the surface, if traffic and other conditions permit. In such cases the pipes shall be supported on dwarf blocks of cement concrete, brick or stone masonry, where necessary, in the opinion of the Engineer-in-charge at intervals not exceeding about 8 to 10 feet.

In the case of pipelines laid round and about Head Works, Reservoirs, Filter beds, pumping stations and other similar works, the pipelines shall be laid at such depths as are required to suit the works to which they are intended to be connected, as shown on the detailed and working drawings thereof.

2. **Length of trenches to be kept open.**—Unless otherwise directed or permitted, not more than 100 feet length of any trench in built up areas of 300 feet in open country in advance of the end of the pipeline already laid shall be open at any time and all work shall be done in open trench or excavation. No tunnelling shall be done except with the written consent of the Engineer-in-charge.

3. **Timbering of pipe trenches.**—Where necessary, the contractor shall support the sides of the pipe trench and other excavation by suitable timbering and the trench sides shall be close timbered wherever the Engineer-in-charge may so desire. Ordinarily timber shall be removed as the work proceeds and the trenches filled up after due test but it may be necessary in certain cases to leave a certain portion of the timbering in the ground in which case the contractor shall be paid for the cost of such timbering at the rate provided in the contract schedule of rates but if necessity for leaving in the timber has, in the opinion of the Engineer-in-charge, arisen from carelessness or neglect or lack of skill on the part of the contractor,

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the timber so ordered by the Engineer-in-charge to be left in the trench shall not be paid for.

The kind and quality and dimension of the timber used shall at all times be subject to the approval of the Engineer-in-charge. The contractor shall furnish and maintain such planking, poling boards and wooden braces or struts as may be required to support the sides of excavation and to prevent any movement of the ground.

The Engineer-in-charge may order additional supports to be put in at the expense of the contractor and the compliance with such orders will not relieve the contractor of his responsibility for the sufficiency or otherwise of such supports. Great care shall be taken to prevent voids occurring outside the poling boards but if voids are formed they shall be immediately filled and rammed to the satisfaction of the Engineer-in-charge.

4. Removal of Timber.—The operation connected with the removal of timbering shall not endanger the pipelines already laid and other structures, buildings or property whether public or private. The right of Engineer-in-charge to order poling boards and struts, etc., to be left in shall not be construed as creating any obligation on his part to issue such orders but the non-exercise of his right to do so shall not relieve the contractor from any liability in respect of damage to persons or property occurring from or upon the work of laying the pipelines, occasioned by negligence or otherwise arising out of a failure on the part of the contractor to leave in place in the trench sufficient timbering to prevent any caving in or moving of the ground adjacent to the bank of the trench.

5. Shoring up of Buildings.—The rates included in the schedule of rates for pipe laying work are inclusive of all work required for shoring up of the buildings along or near the trench which are likely to be endangered by the execution of the work.

6. Opening out trenches.—In excavating the trenches the road metalling, soling or brick pavement, kerbing, turf, etc., shall be placed on one side and shall be preserved for reinstatement when the trench is filled up. The surface of all trenches through private property shall be restored and maintained to the satisfaction of the owner and if he is dissatisfied, to the satisfaction of the Engineer-in-charge.

The contractor shall grub up and clear the surface over the trench but the cutting of any live fence or trees in the line of trench shall be done with the approval of the Engineer-in-charge.

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7. Removal of water from pipe trenches.—The contractor shall provide and carry out as part of the contract all pumping, bailing out or removing of water accumulated in the trench during the execution of work in such a manner as will neither cause injuries to the public health or to private property and no extra shall be payable for such work.

8. Width of trenches.—The maximum widths of trenches for measurement purpose shall be taken as shown on the diagrams following :—

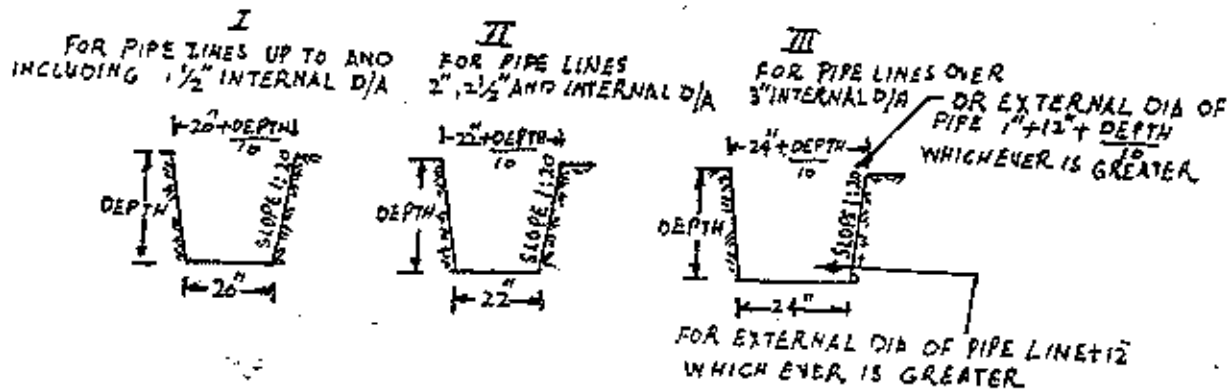


FIG. 28.2

If the actual widths of trenches are less than shown on the diagrams above, the actual volume of excavation only shall be measured and paid for. If the actual widths are greater than those shown on the diagram above, the widths to be measured for calculation of volume of excavation to be paid for shall be in accordance with the above diagrams.

9. Depth of trenches.—The trenches shall be dug to such depths as the Engineer-in-charge or his authorised subordinate may direct from time to time but the normal cover shall be not less than $2\frac{1}{2}$ feet subject to observation made in 28.2. The bottom of the trench shall be properly trimmed off to prevent a perfectly plan surface and all irregularities shall be levelled. Where rock and large stones or boulders are encountered, the trench shall be trimmed to a depth of at least 3 inches below the level at which the bottom of the barrel of the pipe is to be laid and filled to a like depth with stone broken to pass through a $\frac{1}{2}$ " screen and well-rammed to form a fair and even bed for pipes. Joint holes shall be excavated to such dimensions as will allow the joints to be well and thoroughly caulked. Joint holes shall be paid for on the basis of actual measurement subject to the maximum dimensions being to the approval of the Engineer-in-charge of the work.

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Where sluice valves, air valves, etc., are to be fixed in the ground the depth shall be such as to leave the top of spindle caps not less than 6" below the surface of the road.

In case the contractor excavates any trench in good ground to a greater depth than that required, the extra depth will have to be filled up at the contractor's expense, with such material as the Engineer-in-charge may direct.

10. Refilling of trenches.—After the pipes have been laid, jointed and tested and proved to be water-tight, the trenches shall be refilled in the manner described below.

The first foot of filling material immediately above and around every pipe shall consist of the finest selected material. No lumps of material shall be put round the pipe or thrown into the trench until the same has been protected in the manner described above.

After the first one foot of material has been placed in position the remainder of the material is to be put in and rammed in layers not exceeding 6" at a time and sufficient water shall be used in addition to aid the consolidation of the trenches.

The refilling in 6" layer should be carried on up to 6" below G.L./R.L. It should then be flooded and consolidated. After this having been done, the trenches or the excavation should be restored to its original condition and opened to use.

After trenches have been filled to their original surface, all surplus material shall be removed by the contractor. Some of the earth may be kept for use to restore any subsequent settlements, but it shall be properly stacked and protected at convenient points, so as not to cause any interference to traffic or any kind of inconvenience or nuisance to the public. Before the final bill is paid, the contractor shall make good promptly at his own expense any settlement that may occur in the surface of the roads, foot paths, yard, gardens, etc., whether public or private, caused by the trenches or other excavation not having been properly filled up and consolidated and he shall be liable for any accidents caused thereby. He shall also repair and set right at his own expense, any damage done to property and such work shall be carried out to the full satisfaction in all respects of the owner thereof.

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11. Restoration of surfaces.—All berms and other unpaved surfaces shall be restored in as good a condition as before disturbance or the execution of the work and any deficiency in the filling materials resulting from theft or any other cause whatsoever shall be made good by the contractor at his own cost.

In the case of the paved surfaces, these shall be restored in as good a condition as before disturbance after making good the deficiency of the material, but shall be paid at relevant rates provided in the schedule. In the case of roads the operations may be divided in 2 portions to facilitate the immediate resumption of traffic. In the first instance the trenches shall be compacted with hand rollers and the soling laid so that it may conform to the finished formation level of the road. After the further compaction has occurred with movement of traffic, the requisite thickness of road metal shall be provided, compacted and finished with such surface dressing as may be prescribed. The soling may be removed and relaid to accommodate the road metal, etc., if necessary.

In other details the excavation shall conform to the general specification of earth-work.

Measurement

12. The measurement of excavation shall be taken by multiplying, the length, and width of trenches as permissible,— vide para 8 above with the depth of the trenches.

Rates.

13. The rates for excavation up to various depth of pipe lines shall cover :—

- (i) Providing and setting out sight rails, boning roads, Bench walls aligning the sewers, etc.
- (ii) Dressing the sides and bottom of the trenches to correct sections, dimensions levels, alignments and templates.
- (iii) Providing maintenance and removal of timbering to trenches according to poling board frame type system, where included in rate including shoring to protect existing shoring to protect existing structures, etc.
- (iv) Diversion of traffic including fixing and maintenance of sign and caution boards, providing and maintenance of night signals.
- (v) Providing and maintaining access to houses.

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- (vi) Providing and watching fencing to trenches to avoid accidents.
- (vii) Refilling of trenches in 6" layers, and watering restoration of settlement and restoring the unpaved surfaces to original condition.
- (viii) Removal of surplus spoils up to a lead of one mile and dressing the same.
- (ix) Removal of stumps, roots and all other incumbrances and hard materials such as Kankar excluding full grown trees, etc.
- (x) Pumping out the rain, storm or water from any other sources, collected in the trenches except the sub-soil water.
- (xi) Cost of all temporary works as given in the specifications no. 28-1 General.

14. Extra over and above the rates shall be payable according to the rates in the Schedule of rates for the following — Extra Payable.

- (i) For cutting metalled or cement concrete roads.
- (ii) For restoration of roads surfaces. This rate includes the cost of deficient materials also.
- (iii) For excavation under sub-soil water level.
 - (a) This extra rate also includes the extra cost involved in providing steel sheet, shuttering, removal and lowering of sub-soil water.
- (iv) For disposal of surplus spoil beyond one mile.

SPECIFICATION NO. 28-3—Cast Iron Pipe Lines

Materials

1. (a) Pipes and specials.—Unless otherwise specified the cast iron pipes and shall either be spun or vertically cast. These shall conform to B.S.S. 1211-1958 and B.S.S.-1938 or to relevant I.S.S.

In distribution systems in Plains, class B pipes having a working pressure of 200 ft. head of water shall be used. For Rising mains and distribution system in hills, pipes of the required class depending upon the working heads shall be used. Class B shall be used up to 200 ft. of working head, while class C and D shall be used for 300 and 400 ft. head of water respectively.

(d) Sluice Valves, Reflux valves, Fire hydrants, Air Valves—Unless otherwise specified these shall be according to the relevant B.S.S. or I.S. specifications.

The sluice valves shall conform to the following test pressures.

2" to 6" = 800 ft. head of water.

7" to 12" = 700 ft. head of water.

(c) Surface Boxes.—The surface boxes required for providing easy access to various controls shall be made of best gray cast iron having a close grained tough casting, free from blow holes and other imperfections, strictly conforming to standard design of the Public Health Branch. The covers and the frames of the surface boxes are to be coated with bitumenous composition applied by heating them when new and before any rust has appeared on them and dipping them while hot into the heated composition. The covers and frames shall be clean moulded, accurately made and fitted in a workman like manner, the surface being smooth and even so that there shall be no rocking of the covers.

(d) Lead.—The lead used for jointing the pipes shall have a purity of 99.9% and in other qualities shall conform to B.S.S. or I.S. specifications.

(e) Yarn.—Best quality hemp yarn having long staples shall be used for joints.

(Normally these materials are arranged by the Department through the Director General Supplies and Disposal, or Controller of Stores Punjab)

2. Laying of pipes, specials and valves.—The pipes shall be lowered singly (or in pairs if the Engineer-in-charge shall so direct in writing)

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into the trench and each pipe, before being laid, shall have all sand and dirt carefully removed from the inside in a manner that the coating is not damaged. The pipes shall be slung and struck with a hammer and also carefully examined to see that they are free from cracks and other defects and after they are laid in the trench a strong plug shall be provided and fixed to each open end of the pipeline in order to keep them free from all extraneous matter. The pipes shall be properly driven home and jointed together and shall be properly bedded throughout their whole length. All pipes shall be laid perfectly straight from bend to bend except where the Engineer-in-charge shall deem it necessary that the pipes may be laid on the sweep according to the curvature table given in Table No. 2 of this specification. Pipe laying and jointing shall proceed from one end of each pipe line but if such pipe line is intended to be laid on slopping ground, the starting point shall be at its lower end and the pipes shall be laid up hill with socket ends leading.

Where found necessary by the Engineer-in-charge, the contractor shall be required to provide and erect sight rails to enable the line to be laid to correct lines, levels and gradients.

All tool marks on the sockets and also other marks and patches on the pipes shall be painted with pitch or tar to be provided free of cost by the Engineer-in-charge before earth-filling is done. Cost of labour in painting tool marks on sockets, etc., is included in the rates to be paid for jointing work, and no extra will be allowed.

All sluice valves, air valves, hydrants and vertical branches shall be fixed perfectly vertical in all cases. All horizontal branches and tees shall be fixed perfectly horizontal.

3. Socketted joints.—The socket joints of the pipes and specials castings shall be made with lead and best hemp spun yarn. The joints shall be made by forcing the spigot end of one pipe into the socket end of the preceding one, a gasket of spun yarn being then driven and caulked into the bottom of the joint to keep the pipes concentric. The gaskets shall either be driven in complete rings, the length of yarn to form each ring being carefully measured and cut before hand to ensure a good fit or, better still a spiral coil of spun yarn shall be inserted. In the former case care shall be taken that the joints of the successive rings do not coincide. Each ring shall be packed with a thin steel yarning tools and then lightly hand-caulked to ensure the yarn is solidly packed. No short pieces of yarn forming less than a complete ring shall be used.

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The yarn shall be caulked to such a depth as to leave clear the following depths measured from the faces of the sockets given in the table No. 1 below for the lead joints.—

TABLE No. 1

Internal diameter of pipe	Finish depth of lead joint	Weight of spun yarn per joint in lbs.	Weight of lead per joint in lbs.
1	2	3	4
Inches	Inches		
3	1½	0.25	4.1
4	1½	0.38	5.2
5	1½	0.44	6.3
6	1½	0.50	7.9
7	1½	0.56	9.1
8	1½	0.63	10.8
9	1½	0.69	12.0
10	2	0.75	15.0
12	2	1.06	17.3
14	2	1.38	20.0
15	2	1.50	21.50
16	2	1.63	22.60
18	2½	2.07	31.7
20	2½	2.25	37.0
21	2½	2.38	38.60
22	2½	2.50	42.20
24	2½	2.66	46.0

The lead for the joint shall be melted in a suitable lead pot in a special grade or "devil" or over a furnace provided close to the joint. The outer end of the socket shall then be closed either by means of a thoroughly kneaded clay gasket stiffened with a core of yarn in the case of small pipes or by a hinged iron ring or by a clip or asbestos composition ring fitted on the spigot against the face of the sockets.

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and pulled up tight by the thumb screw at the top of the pipe a small "pond" about 5 or 6 square inches in area by about 1 inch in depth being formed in the clay at the summit of pipe with an outlet into the top of the joint. The molten lead shall then be run into the joint either from a metal ladle or directly from the lead pot to completely fill up the joint in one operation. Care shall be taken to have sufficient molten lead in the pot for each joint before starting the operation. All partially filled joints shall be taken out or melted out and the whole joint shall be refilled completely with lead at one running. To ensure that the joint is completely filled with lead the "pond" at the summit of the pipe shall be kept filled to the brim in course of pouring for molten lead.

The internal surface of the clay gasket or metal or asbestos ring shall be beveled off to leave a uniform fillet or lead projecting on the face of the socket all round to the extent of not less than $1\frac{1}{4}$ ".

Before making any joints, care shall be taken to remove all thick bituminous material or coal-tar from the spigot and from the inside of the socket. Both shall be thoroughly cleaned and dried before the joint is made.

After the lead has solidified in the joint, the clay gasket or the ring shall be removed and the joint caulked by hammering up the face of the lead uniformly with a series of at least three special caulking chisels, the thickness of the caulking edges of which shall vary from a little than $\frac{1}{8}$ ", to just under the width of the lead joint. The finished face of the lead joint shall be set back by caulking, not less than $1/16$ th of an inch inside the face of the pipe socket.

Each caulking chisel shall be kept perfectly true on the edge and the surface of the working face shall be formed at an angle of about 80° to 85° to the back of the tool.

The finished face of each lead joint shall be smooth and uniform all round and shall not show any tool marks.

The caulking hammer shall be of steel with hexagonal or octagonal face, weight $1\frac{1}{2}$ lbs. to 2 lbs. with a short wooden handle.

The molten lead shall not be poured under water or when the trench is wet to guard against explosion that may occur due to splitting of lead while pouring. In such conditions, lead joints shall be made with lead

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wool. The lead wool shall be placed in the socket in complete rings, the length of lead wool to form each ring being measured carefully so as to ensure a good fit. Each ring shall be caulked with caulking tools. A number of such rings shall be laid one over the other and caulked in similar manner till such time that forms a solid joint. While caulking care shall be taken that the various rings of lead wool form one mass with each other, which shall be ensured by keeping the caulked surface in rough condition. The rate payable in this type of joint shall be the same and nothing extra shall be payable.

4. Flanged joints.—These shall be made using 1/8" rubber insertion jointing discs accurately cut. The bolts of the joints are to be tightened up systematically and uniformly in such a manner that the tension in all the bolts shall be similar and there shall be no tendency to distortion. No bolts shall be stressed beyond elastic limit and no spanners other than standard pattern shall be allowed nor shall any appliance for lengthening the leverage of any spanner be permitted. All flanges with their bolts shall be painted with 2 coats of pitch or tar to be provided free of cost by the Engineer-in-charge before the earthfilling is done.

5. Bends.—All bends shall be properly fixed and secured in the trench so that no risk of movement thereof is involved due to the thrust of the water. For this purpose a block of cement concrete (1:4:8 with brick stone aggregate) length about 2 ft., depth equal to the diameter of the pipe and the width being that of the excavation on that side of the bend, shall be provided on the outer side of each bend. Care shall be taken to ensure that each lead joint or flanged joint is fully exposed so that it can be checked up caulked or re-caulked easily without interference due to the concrete blocks.

6. Testing.—As soon as a suitable length, say between 400 yards and half of a mile depending upon the circumstance of each case has been laid and jointed it shall be subjected to a working head of 200 feet head of water or such additional head as shall be laid down for each contract with a boiler test pump to be supplied by the contractor and all defective and leaking joints shall be set right without any extra payment.

The defective pipes and specials shall be replaced with new ones and the usual charges for cutting and jointing shall only be admissible. Nothing extra shall be payable for difficult or small extent of the work.

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TABLE NO. 2

Showing minimum radii of circles of curvature to which B.S. specifications spigot and socketted, Cast iron pipes with plain sockets for run and caulked lead of various diameters should be laid

Internal diameter of pipe		Laying length	Radius of circle of curvature
Inches		Feet	Feet
3		9	216
4		9	216
4		12	288
5		9	252
5		12	336
6		9	252
6		12	336
7		9	290
7		12	387
8		9	329
8		12	438
9		9	367
9		12	490
10		9	406
10		12	540
12		9	490
12		12	653

7. Stringing out C.I. pipes in trenches etc.—(a) The measurement shall be recorded in R. ft. along the centre line or axis of pipe line.

Measurement.

(b) Cutting, Jointing, Fixing, of ferrules connection.—The measurement for these items shall be recorded in numbers.

(c) Fixing of sluice valves, fire hydrants, Air valves flap valves, and fixing of surface boxes for these.—The measurement for these items shall be recorded in numbers.

8. The rate covers the cost of:—

Rates

(a) Stringing out C.I. pipes in trenches:—

(i) Carriage from store to site of work and stacking including protection, breakage in transit if any.

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- (ii) Labour for stringing out along the trenches.
- (iii) Labour for laying in trenches to correct alignment and gradients with tools required for laying the pipes.
- (iv) Cost of special scaffolding, tools and plant, ropes, etc.
- (v) For cleaning pipes from inside.
- (iv) Protection of existing works, from damage and cost incurred to repair the damage carried to the existing structures, poles, sewerer, pipe lines, etc., belonging to Government or private individuals.
- (vii) Cost of all temporary works as given in specification no. 28-1.

(b) Jointing

- (i) Carriage of jointing materials, lead, yarn, bolts nuts, etc., from the store to site of work.
- (ii) Labour for making joints including all tools, etc.,
- (iii) Cost of fuel for melting lead.
- (iv) Testing of pipes for leaking under water pressure.
- (v) Relaying defective joints.
- (vi) Providing temporary bulks heads to keep the pipes clean from rain water or otherwise.
- (c) Cutting.
- (i) Labour for cutting of pipes.
- (ii) Chipping or filling the surface to a uniform finish.
- (iii) Cleaning the pipes.

(d) Ferrule connection

- (i) Carriage of materials from store to site of work.
- (ii) Excavation for making connection and refilling the trench and restoration to original condition.
- (iii) Drilling and taping of C.I. main.
- (iv) Fixing and adjusting the ferrule.
- (e) Fixing sluice valves, fire hydrants, air valves flap valves, etc.

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- (i) Carriage from stores to site of work.
 - (ii) Extra labour involved for fixing.
 - (iii) Testing under water pressure.
- (f) Fixing surface Boxes for sluice valves, etc.
- (i) Carriage from store to site.
 - (ii) Cost of materials required for fixing, i.e., cement, sand, etc., schedule.
 - (iii) Labour for fixing and setting in position.

9. Extra rates shall be payable as provided in the schedule.

Extra Payable.

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**SPECIFICATION No. 28.4—Galvanised Iron or Mild Steel Pipe
lines with Screw Joints**

Materials.

1. (a) Pipes.—Unless otherwise specified, the medium quality Galvanised Mild Steel continuous weld tubes to I.S.S. 1239-1958, screwed both ends to I.S. 554-1955 pipe-threads or class B Galvanised Mild steel continuous-weld Tubes to B.S. specification no. 1387 shall be used.

(b) Pipe specials.—Unless otherwise specified, the galvanised malleable iron pipe specials according to relevant Indian Standard Specifications shall be used.

(c) Water fittings.—Unless otherwise specified all brass fittings including valves, stop cocks, ferrules, taps, etc., shall conform to relevant I.S.I. of B.S. Specifications.

2. Jointing screwed joints.—All screwed joints, both internal and external shall be examined before jointing, to ensure that the threads are perfect for the full depth of the joints. If there be any flaw, the threads shall be lightly gone over with the stocks and dies of the correct type to suit the threads, before they are jointed. The screwed ends of the pipes or specials to be jointed, shall be very lightly tapered so that as the joint is screwed up, the threads shall bind together more and more lightly to ensure water tightness. The jointing work shall be so arranged in the case of every joint that the two ends of the pipes or specials jointed thereby shall be equidistant from the middle of the socket and shall have a space of not more than about a quarter of an inch between them in the centre of the socket. Before any joint is made all burrs from the ends of the threaded joints shall be removed. A very few very thin strands of best quality country cotton yarn smeared over carefully with genuine Red lead shall be carefully wound in the grooves of the threads from end to end of the joints, if the screwed joint is a little slack, in order to ensure tightness. For this purpose, hemp or jute or any material other than that described above shall on no account be allowed to be used. A paste of genuine red and white lead mixed shall be lightly smeared over the threads to act as a lubricant and to make up for imperfections in the threads when the pipes are screwed up.

Red and white lead paste is made by mixing together genuine dry red with genuine moist white lead and then thinning it out into a paste with ~~boiled~~ boiled linseed oil.

These joints shall be screwed up tightly with pipe fitter's tongs or pipe wrenches to ensure that each and every joints shall be perfectly water-tight. The test head of water.

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Lines with Screw Joints**

No red and white lead paste or cotton yarn shall project outside the ends of the joints.

3. **Flanges.**—In the case of pipe lines laid in open country whether in trenches or on the surface, flanged joints shall be provided at intervals of not more than 300 feet. The flanges shall be screwed on to the pipes in the same manner and using the same jointing composition as already described for screwed joints so as to be water tight. All flanges shall be screwed home and the ends of the pipe projecting in front of the flange faces shall be neatly cut off, filed and made perfectly smooth and not to project ahead of the faces of the flanges so as not to interfere with the accuracy of the joints. Each flanged joint shall be made by inserting an accurately cut disc of tough multiply rubber insertion about $\frac{1}{8}$ " thick, of approved quality between the flanges. The inner diameter of this disc shall be $\frac{1}{8}$ " larger than the bore of the pipe and its outer diameter $\frac{1}{16}$ less than the outer flange diameter. The bolt holes in the rubber insertion as well in the flanges shall be drilled to template. The bolts and nuts for all flanged joints shall consist of standard mild steel, hexagonal, round and hexagonal. The bolts shall be pulled up gradually and evenly by the use of standard spanner, so as to ensure a perfect joint. They shall, however, not be overstrained by using spanners with un-due leverage.

4. **Long screws and unions.**—Ground union coupling of a type to be approved by the Engineer-in-charge shall be inserted where required to suit the exigencies of each particular pipeline. The same applies to long screws with back nuts. It shall be clearly understood that in both these cases the joints shall be carefully made and shall be fully water tight under the test head.

5. **Bends, Tees and other specials.**—Bends, tees, reducers and other specials shall be provided and jointed at points required by Engineer-in-charge.

All changes in direction shall be effected by means of bends wherever practicable, and the use of elbows shall be restricted only to cases where there is no room for bends. In such cases moreover only round "elbows" will be allowed. Square elbows are positively forbidden to be used.

When any change of direction is at an obtuse angle, springs or special easy bends shall be used. In any special case, however, where in the opinion of the Engineer-in-charge it is not possible to provide a bend or bends, the pipe shall be bent very carefully, taking the utmost care not to

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Mild Steel Pipe-lines with Screw Joints**

9. Sleeve pipes—Every pipe line laid through any walls, floors, ceiling or roofs shall be arranged to pass through sleeve pipes of ample diameter embedded therein to enable pipelines to pass easily and freely therein. The length of every such sleeve pipe shall be of the full width or thickness of the wall and in the case of roof, ceiling or floor, shall be at least $1\frac{1}{2}$ " longer than the thickness thereof and shall project to that extent above the upper surface thereof unless the Engineer-in-charge shall order to the contrary. Every sleeve pipe shall consist of a single length of Indian Standard Water quality wrought iron or steel pipe or otherwise of a steel or wrought iron pipe not less than $1\frac{1}{4}$ " thick to the approval of the Engineer-in-charge.

10. Laying of G.I. Pipes in trenches or inside buildings—The measurement shall be recorded in R. ft. along the centre line or axis of the pipeline.

Measurement.

The rate covers the cost of :—

11. (a) Laying of G.I. pipes in trenches or inside buildings ;—

Rate.

- (i) Carriage of materials from store to site of work.
- (ii) Cost of material used in Jointing, i.e., white lead, yarn, etc.
- (iii) Labour for laying in trenches to correct alignment and gradients.
- (iv) For cleaning the pipes.
- (v) Rent of all Tools and Plants required for laying.
- (vi) Labour for fixing and jointing.
- (vii) Testing pipeline for leakage under water pressure.
- (viii) Cost of all temporary works as given in the specification No. 28.1 general.

The rate covers the cost of :—

Rates.

(d) Fixing flanged joints and jointing union couplings on G.I. or W.I. pipe lines :—

- (i) Carriage of all materials such as bolts, nuts, washers, couplings, etc., from store to site of work.
- (ii) Cost of material used in Joint and not supplied free of cost, i.e., white lead yarn, etc.
- (iii) Labour for fixing and making the joint.

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- (iv) Testing the joint under water pressure.
- (v) Relaying the defective joint.
- (vi) Cost of all temporary works as given in the specification no. 28.1 general

Extra Payable.

The extra shall be payable as per items of Schedule of Rate.

- (c) Cutting holes in walls and fixing M.I. holder bats
 - (i) Carriage of material to site of work, such as cement, sand, holder bats, etc.
 - (ii) Labour for cutting holes.
 - (iii) Labour for making the cut surface to its original condition in every respect.
 - (iv) Cost of material such as cement, sand, bricks, water, paint and tools, etc.
 - (v) Cost of all temporary works as given in the specification no. 28.1 general
- (d) Fixing and jointing G.M. Peet valves, stop cocks, bib taps, ball valves, C.P. brass shower rose, water meters, Peet valves, bell mouths and stop cocks surface boxes, etc.—
 - (i) Carriage of material from store to site of work.
 - (ii) Cost of jointing material such as white lead, hemp yarn, oil, etc.
 - (iii) Labour for jointing and fixing of P.V., stop cocks, etc.
 - (iv) Cost of cement, sand for fixing, P.Vs. and stop-cocks surface boxes.
 - (v) Labour for fixing and setting of P.Vs. and stop-cocks surface boxes.
 - (vi) Testing of joints for leakage under water pressure.
 - (vii) Cost of all temporary works as given in the specification no. 28.1 general

Rate.

The rate covers the cost of :—

- (e) Dismantling lead caulked joints of C.I. pipes, flanged joints sluice

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valves, fire hydrants, air valves and surface boxes of S.Vs,
F.Hs. etc.,

- (i) Carriage of all dismantled materials to stores, from site of works.
- (ii) Labour of dismantling.
- (iii) Cost of materials such as fuel wood, kerosene oil for melting lead caulked joints.
- (iv) Cost of all temporary works as given in the specification no. 28.1 general.