

CHAPTER NO. 30

SPECIFICATION NO. 30.1—Sanitary Installations ; Drainage
and Internal Water Supply

GENERAL

(i) The general specifications as contained in chapter no. 28 for water supply and chapter no. 29 for sewerage and drainage shall be applicable to this as well.

(ii) For all structural work, the Punjab P.W.D. Specifications, Volume I, 1960 shall apply and form a part of this specification.

(iii) All damage done to floors, walls, etc., during the process of fixing of sanitary installations, internal water supply and house drainage shall be restored to its original condition and the cost of the same is included in the rates, unless otherwise specified by the Engineer-in-charge of the work.

(iv) Unless otherwise specified, all the sanitary works and components shall conform to I. S. I. standard and subsequent modifications made from time to time.

(v) All octroi, terminal tax or other municipal taxes, shall be paid by the Contractor on all tools, plant and materials imported or taken delivery of by him including all goods and materials delivered to him free on rail and those transported by him into the town from outside and he shall be entitled to no reimbursement for any payments made on account of such octroi or terminal tax charge. Provided, however, that in respect of fittings such as manhole covers, penstocks, step irons, etc., for which only a rate covering carriage and fixing is payable to the Contractor, the octroi or terminal tax, if any, leviable on such fittings shall not be paid by the Contractor.

If any fresh octroi, terminal tax or other tax shall be levied, or any existing octroi, terminal tax or other tax shall be enhanced after the date of the Contractor's tender the same shall be paid by the Contractor and no extra allowance shall be given to him by reason of such fresh or enhanced octroi terminal tax or other tax having been levied.

General.

Local taxes.

SPECIFICATION NO. 39.2—Indian type water closet suites

(A) WATER CLOSET SUITES

Indian type water closet suites

Closet.

(i) The closet shall be of Bombay Potteries and Tiles Ltd., Kuria, Bombay or other approved Indian manufacture and shall bear the mark of the firm manufacturing it and shall comply in all respects to I. S. I. specifications no. IS—2556 (Part III)—1967 revised. It shall be of white glazed earthenware "Wash down type" unless otherwise specified. The size of the closet shall be 27" (680 mm), 25" (630 mm), 23" (580 mm) or as specified. It shall have the flushing horn (inlet) in the front unless it is not possible to accommodate cistern to suit this design. (Closet of fireclay or vitreous china with integral foot treads and similar to shanks Orrisa or Doultons Punjab or Bombay Potteries Sun Brand, Orissa pattern shall be provided in superior establishment where specified but at additional cost according to the type and make of the closet provided). It shall have 4" (100 mm) E. L. C. H. C. I. Trap "P" or "S" type as required, with effective seal and 2" (50 mm) vent arm if required.

Fixing.

(ii) The water closet pan shall be sunk in floor, sloped towards the pan in a workman like manner, care being taken not to damage the pan in the process of fixing. If damaged in any way, it shall be replaced by the Contractor at his own cost. It shall be fixed on proper concrete base taking care that the cushion is uniform, even and without having any hollows, between the concrete base and the pan. A pair of foot rests shall also be provided.

Joint.

(iii) The joint between the pan and the trap shall be made with cement mortar 1:1 [90 lbs. (50 kg) of cement and one cubic foot (0.35 cum) of approved washed sand] and shall be leak proof.

Flushing.

(iv) The flushing of water closet pan shall be done by 'pull and let go' flushing cistern of a valve less siphonic type conforming to I. S. I. Specification No. IS—774—1964. The cistern shall be of shanks NOMOS Indian make, unless otherwise specified and shall be of best 'Cast Iron' mosquito proof, of 3 Gallons (15 Litres) capacity together with cover, lever, G.I. chain and pull (C.P. brass chain with pottery pull shall be provided in superior establishment, where specified but at additional rate). $\frac{1}{2}$ " (15 mm) ball valve with copper float and necessary unions and couplings, etc., for connection with inlet, outlet, overflow and scour pipes.

Brackets.

(v) The cistern shall be fixed on a pair of C. I. or R. S. cantilever brackets which shall be firmly embedded in the wall.

SPECIFICATION NO. 30.2—Indian type water closet suites

(vi) The cistern shall be provided with $\frac{3}{8}$ " (20 mm) diameter G. I. overflow pipe with filling which shall terminate into a brass perforated mosquito proof cap and at 6" (15 cm) above floor level of the W. C. room or as required by the engineer-in-charge.

Overflow.

(vii) The outlet flush pipe from the cistern shall be of $1\frac{1}{4}$ " (32 mm) diameter. Telescopic galvanized inside and outside steel pipe which shall be connected to the W. C. pan by means of cement or putty joint and with $1\frac{1}{4}$ " (32 mm) lead extension pipe piece, if required at size (which shall however be payable extra). The flush pipe shall be fixed to wall by using holder bat clamps.

Flush pipe.

(viii) Inside of cistern and its internal fittings shall be painted with priming coat of red oxide and 3 coats of approved black bitumastic paint, and outside of the cistern, brackets, overflow and flush pipes, etc., shall be painted with priming coat of red oxide and finished with 3 coats of non-yellowing white enamel or other approved shade paint to match with the painting of the surrounding walls.

Painting.

(ix) (a) Closet set in white glazed earthenware pan type :—
The measurement shall be recorded in numbers.

Measurement.

(b) Indian type "Orissa" or "Orya" water-closet suite.—
The measurement shall be recorded in numbers.

(x) The rates covers the cost of:—

Rates.

(a) Closet set in white glazed earthenware pan type.—

1. White glazed earthenware W. C. pan "wash down type" size 23" (580 mm), 25" (630 mm) or 27" (680 mm) as specified with a pair of footrests.
2. Four inch (100 mm) H.C.I. 'P' or 'S' trap with or without vent arm as required.
3. Three Gallons (5 Litres) capacity mosquito proof Cast iron flushing cistern 'NOMOS' (Indian make) or E.L.C.O. or as specified, with $1\frac{1}{2}$ " (40 mm) outlet, $\frac{1}{2}$ " (12.5 mm) ball cock, G.I. pull and chain; $\frac{3}{8}$ " (20 mm) G.I. overflow pipe with specials and clamps up to 6" (15 mm) above floor level of W. C. room, and mosquito proof couplings for outlet and overflow pipes, etc.
4. R. S. or C. I. painted brackets.
5. $1\frac{1}{4}$ " (32 mm) diameter telescopic 18 gauge galvanised inside and outside steel flush pipe with clips.

SPECIFICATION NO. 30.2—Indian type water closet suites

6. Cost of red lead; white lead; gaskin; cement; sand and grit, etc., required for installation of closet-suite.
7. Cost of special scaffolding, tools and plant, ropes, etc., required for installation.
8. Carriage of materials to the site of work and stacking including protection and breakage in transit, if any.
9. Labour for installation of W.C. Suite complete including excavation; cutting of floors; making holes in wall, etc., and making wood the same to its original condition including cost of the same.
10. Making cement joint: of W.C. pan, and 4" (100 mm) H. C. I. trap including cost of materials.
11. Painting of flushing cistern and all other fittings with non-yellowing white enamel paint or other approved shade enamel paint on outside and black bitumastic-stand coat paint on inside of flushing cistern complete with cost of paint and labour.
12. Testing of the W. C. suite and pipes.

Extra payable.

(xi) Extra shall be payable according to the rates in the schedule of rates for the following:—

1. 1½" (32 mm) lead extension pipe.
2. Lead inlet connection to flushing cistern.
3. C. P. brass chain with pattern pull if provided in place of G. I. chain and pull.
4. Lead joint of 2" (50 mm) Vent arm where provided.

(b) Indian type "Orissa" or "Orya" Water Closet Suite.—The rate covers the cost of all items as fully specified in para (a) above closet set in the white glazed earthenware pan type except that the water closet shall be best Indian make Indian type "Orissa" or "Orya" as required.

SPECIFICATION NO. 30.3.—European Type Water Closet-suites

(i) The closet shall be of best Indian make as specified and shall comply in all respects to I.S.I. Specifications No. I.S.—2556 (PART II)—1967 revised unless otherwise specified, and shall bear the mark of the firm manufacturing it. It shall be of wash down type with a flushing rim on top and in earthenware, white glazed inside and outside, and or absolutely non-absorbent material. (Closets of fireclay or vitreous china shall be provided in superior establishment, where specified but at an additional cost according to the type and make of the W.C. pan provided). It shall have no sharp angle but on the contrary rounded corners so that every part can easily be cleaned. It shall be with an integral 'P' or 'S' trap with sufficiently effective seal not less than 2" (50 mm) in depth and with or without vent as specified.

Closest.

(ii) The seat and lid shall be of well seasoned teak wood varnished or mahogany polished, with rubber buffers conforming to I.S.I. Specifications No. I.S.—2548—1967 (revised) and shall be fixed in position by using C.P. brass hinges and screws. (English made solid drawn black or white plastic hygienic seat with lid and rubber buffers and C.P. brass adjustable hinges and screws shall be provided in superior establishment, where specified but at additional cost according to the type and the make of the seat specified).

Seat.

(iii) The joint between the trap of the W. C. and soil pipe shall be made with cement mortar 1 : 1 [90 lbs. (50 kg) of cement and one cubic foot (0.035 cum) of approved washed sand] and shall be leak proof.

Joint.

(iv) The flushing of the water closet pan shall be done by 'PULL and let go' flushing cistern the specification of which will be the same as that of flushing cistern required for the Indian type W.C.

Flushing.

(v) The other specifications, viz., for brackets, overflow, flush pipe and painting, etc., shall however be the same as that required for Indian type water closet.

(vi) Flushing cistern complete with cover shall however be provided in superior establishment, where specified but at additional cost according to the type and the make of the cistern provided. It shall be of Shanks, Doultons, Twyfords or of a reputed English or Indian manufacture as specified and shall bear the mark of the firm manufacturing it.

Low level.

It shall be earthenware, white glazed inside and outside or fireclay or vitreous china as specified, with lead valveless syphon fittings, $\frac{1}{2}$ " (15 mm) ball cock with copper float, white porcelain enamelled flush bend, supporting brackets, and necessary C.P. fittings such as flushing handle,

SPECIFICATION NO. 30.3—European Water Type Closet-suites

unions and couplings for connections with inlet, outlet and overflow pipes. The porcelain enamelled flush bend from the cistern shall be connected to the W.C. by means of India rubber adaptus joint of suitable make to be approved by the engineer-in-charge and shall be absolutely watertight.

(vii) The measurements shall be recorded in numbers.

(viii) The rate covers the cost of :—

Measurement

1. Supply of wash down closet set in white glazed earthenware with 'P' or 'S' trap and with or without vent as required by the engineer-in-charge.

Rates.

2. Seat and lid in polished teak wood or mahogany 1" (25 mm) thick with C.P. brass hinges and rubber buffers to the approval of the engineer-in-charge.
3. Three gallons (15 litres) capacity mosquito proof C. I. flushing cistern "NOMOS" or E.L.C.O. (India make) or as specified, with 1½" (40 mm) outlet, ½" (15 mm) ball cock, G.I. pull and chain, ¾" (20 mm) G.I. overflow pipe with specials and clamps up to 6" (15 cm) above floor level complete with brass mosquito proof cap.
4. R. S. or C. I. brackets.
5. 1½" 32 mm diameter telescopic galvanised inside and outside, steel flush pipe with clips.
6. Mosquito proof couplings for outlet and overflow pipes.
7. Cost of red lead, white lead, gaskin, cement, sand and grit, etc., required for installation of closet suite.
8. Cost of special scaffolding tools and plant, ropes, etc.
9. Carriage of materials to the site of work and stacking including protection and breakage in transit, if any.
10. Labour for installation of W. C. suite complete including excavation, cutting of floors, making holes in walls etc., and making good the same to its original condition including cost of the materials.
11. Making cement joint of W. C. trap with soil pipe including cost of materials and joint between vent and vent pipe, if required.
12. Painting of flushing cistern and all other fittings with non-yellowing white enamel paint or other approved

SPECIFICATION NO. 30.3—European Type Water Closet suites

shade enamel paint on outside and black bitumastic stand coat paint on inside of flushing cistern complete with cost of paint and labour.

13. Testing of the W.C. suite and pipes.

(ix) Extra shall be payable according to the rates in the Schedule of rates for the following:— **Extra payable.**

1. 1½" (32 mm) lead extension pipe if required.
2. Lead inlet connection to flushing cistern.
3. C.P. brass chain with pottery pull if provided in place of G.I. chain and pull.
1. 1½" (32 mm) lead extension pipe, if required.

SPECIFICATION NO. 30.4—Anglo Indian Type Water-Closet-suite

(i) The Anglo Indian water closet shall be pedestal closet with raised treads and integral 'P' or 'S' trap with or without vent as specified of best approved Indian manufacture conforming to I. S. I.—Specifications No. I. S.—2556 (PART II)—1967 Revised. The closet shall be provided with a seat and lid conforming to I. S. I.—Specifications No. I S—2548—1967 (Revised) suitable for use with Anglo Indian type closet, and made of well seasoned teak wood, varnished or mahogany polished with rubber buffers and shall be fixed in position by means of C. P. brass hinges and screws.

(ii) All other specifications will be similar to that for European type water closets.

SPECIFICATION No. 30-5—Lavatory Suites

(i) The basin shall be of best Indian make as specified and shall comply in all respects to I—S—I—Specifications No. IS—2556 (PART IV)-(1957 Revised), unless otherwise specified and shall bear the mark of the firm manufacturing it. It shall be of slotted pattern and in earthenware white glazed inside and outside and of absolutely non-absorbent material. (Basins of vitreous china shall be provided in superior establishment where specified, but at an additional cost according to the type and make of the basins provided). It shall have no sharp angles but on the contrary rounded corners so that every part can be easily cleaned. The size of the basin shall be 25"X18", 22"X16" (630 mm X 450 mm, 550 mm X 400 mm) or as specified.

Basins.

(ii) The basins shall be supported on a pair of R. S. or C.I. cantilever brackets conforming to I—S—I—Specification No. IS—775—1962, embedded or fixed in position by means of wooden cleats and screws. These brackets shall be painted to the required shade as specified under the sub-head "water closet". The wall plaster on the rear shall be cut to overhang the top edge of the basin.

Fixing.

(iii) Each lavatory basin shall be provided with a pair of $\frac{1}{2}$ " (15 mm) C.P. pillar taps for hot and cold water supply or one number pillar tap as required, $1\frac{1}{2}$ " (32 mm) C.P. brass waste of standard pattern with C.P. brass chain and $1\frac{1}{2}$ " (32 mm) diameter rubber plug and $1\frac{1}{2}$ " (32 mm) diameter C.P. brass bottle trap and union unless otherwise specified with C.P. outlet pipe to wall, (which will be paid extra in case of English "ESCO" traps only), which shall be connected to $1\frac{1}{2}$ " (32 mm) diameter flush pipe. In case one tap is required the second tap hole shall be plugged with china plug.

Fittings.

The fittings shall be of the genuine make as that of the basin, with which these are to be used or as specified.

The bottle trap shall have a seal not less than $1\frac{1}{2}$ " (40 mm) and shall be with a detachable cleaning cup.

C.P. Sawn neck pillar taps with swivel joint shall, however be provided in superior establishment, where specified, but at an additional cost according to the type and make of the tap provided.

Indian make fittings of a reputed manufacture may be provided, as specified.

(iv) The waste pipe shall be of $\frac{1}{2}$ " (6 mm) diameter G.I. with necessary G.I. elbows embedded in wall or lead waste pipe weighing 7.00 lbs. (3.47 kg) per yard (metre) with suitable plumber wiped joint up to floor level. It shall discharge into an open drain or a floor trap leading to a gully trap, or direct into gully trap on G.F. and shall be connected to a waste pipe stack

Waste Connection

SPECIFICATION NO. 30.5—Lavatory Suites

on the upper floors. The cost of this is not included in the rates of lavatory basins but is payable as per schedule of rates separately.

Puff pipe.

(v) Each lavatory basin shall be provided with a $\frac{3}{8}$ " (20 mm) diameter G.I. puff pipe terminating with a brass perforated cap screwed on it, on the outside of the wall or connected to an antisiphonage stack. When the waste pipe discharges freely into a channel or floor trap and is of short length without any bends, no puff will be necessary.

The cost of puff pipe shall however be payable separately as per actual measurements of the G.I. pipe used. C.P. brass bottle trap and union may not be provided where surface drains or floor traps are placed directly under lavatory basins and waste discharged into it vertically. The rate payable for the lavatory suite in this case shall however be reduced accordingly.

Measurement.

(vi) The measurements shall be recorded in numbers.

Rates.

(vii) The rate covers the cost of:—

1. Lavatory in white glazed earthenware of size as specified.
2. R.S. or C.I. brackets for buildings into wall.
3. $1\frac{1}{4}$ " (32 mm) C.P. brass waste with O.P. brass chain and $1\frac{1}{4}$ " (32 mm) diameter rubber plug.
4. $1\frac{1}{4}$ " (32 mm) C.P. brass bottle trap and union with C.P. pipe to wall and wall flange.
5. Pair of $\frac{1}{2}$ " (15mm) chromium plated screw down pillar taps with Jam nuts or couplings. In case one No. C.P. pillar tap is required, the rate will be reduced accordingly and the second tap hole will be plugged with china plug without any extra cost.
6. Carriage of materials to site of work including protection and breakage in transit or during installation.
7. Labour for installation including excavation, cutting of floors, making holes in walls, etc., and making good the same to its original condition including cost of the same.
8. Cost of red lead, white lead, gaskin, cement, sand and grit, etc., required for installation.
9. Cost of special scaffolding, tools and plant and ropes, etc.
10. Painting of R.S. or C.I. brackets and G.I. pipe and specials or lead pipe from bottle trap to wall or up to floor level with

SPECIFICATION NO. 30.5--Lavatory Suites

non-yellowing white enamel paint or other approved shade enamel paint including cost of paint and labour for painting.

(viii) Extra shall be payable according to the rates in the schedule of rates for the following :--

Extras.

1. 1½" (32mm) internal diameter G.I. waste pipe or lead waste pipe as required.
2. ¾" (20 mm) internal diameter G.I. puff pipe with a brass perforated cap.

(ix) The rates provided in the schedule of rate for the lavatory suite as detailed above shall be reduced accordingly for any of the fittings not provided or as not required at site according to the rates given in the schedule of rates.

SPECIFICATION NO. 30.6—Sinks

1. PLAIN EDGE AND LABORATORY

Sinks.

(i) The sink shall be of best Indian make unless otherwise specified and shall bear the mark of the firm manufacturing it. White glazed clay sinks shall conform to I—S—I Specifications No. IS—2556 (Part V), 1967 revised and shall be with outlet and weir overflow in centre at end. The size of the laboratory sink sinks shall be (500 mm × 350 mm × 150 mm), (450 mm × 300 mm × 150 mm), (400 mm × 250 mm × 150 mm) and that of plain edge sinks 750 × 450 × 200 600 × 450 × 200 or as specified. R.C.C. sink in mosaic or stainless steel shall be of best approved Indian make.

Fixing.

(ii) The sink shall be supported on a pair of R.S. or C.I. cantilever brackets conforming to I—S—I Specifications No. IS—775—1962 embedded or fixed in position by means of wooden cleats and screws. These brackets shall be painted to the required shade as specified under the head "Water Closets". The wall plaster on the rear shall be cut to overhang the top edge of the sink.

Fittings.

(iii) Each sink shall be provided with $1\frac{1}{2}$ " (40 mm) C.P. brass waste of standard pattern with C.P. brass chain and $1\frac{1}{2}$ " (40 mm) rubber plug, and $1\frac{1}{2}$ " (40 mm) diameter C.P. brass bottle trap and union with C.P. outlet pipe to wall (which will be paid extra in case of English "ESCO" trap only); which shall be connected to $1\frac{1}{2}$ " (40 mm) diameter waste pipe. The fittings shall be of the genuine make as that of the sink with which these are to be used or as specified. The bottle traps shall have a seal not less than $1\frac{1}{2}$ " (40 mm) and shall have a detachable cleaning cap.

Waste Connections-

(iv) The waste pipe shall be of $1\frac{1}{2}$ " (40 mm) diameter G.I. with necessary G.I. elbows embedded in wall or lead waste pipe weighing 9.00 lbs. per yard (4.46 Kg. per metre) with suitable plumber wiped joint up to floor level. It shall discharge into an open drain or a floor trap leading to a gully trap, or direct into gully trap on G.F. and shall be connected to a waste pipe stack on the upper floors. The cost of this is not included in the rates of sinks, but is payable separately at the scheduled rates.

Puff Pipe.

(v) Each sink shall be provided with $\frac{3}{4}$ " (20 mm) diameter G.I. puff pipe terminating with a brass perforated cap screwed on it, on the outside of the wall or connected to an antisiphonage stack. When the waste pipe discharges freely into a channel or floor trap and is of short length without any bends, no puff will be necessary. The cost of this shall, however, be paid separately as per actual measurements of the G.I. pipe used.

(vi) C.P. Bottle traps and unions may not be provided where surface drains or floor traps are placed directly under the sinks and waste discharged into it vertically. The rate payable for the sink in this case will be reduced accordingly.

SPECIFICATION NO. 30-6—Sinks

2. LABORATORY SINKS

(i) The sink shall be of best Indian manufacture, unless otherwise specified, and shall bear the mark of the firm manufacturing it. It shall be of white fireclay with outlet and with or without weir overflow in centre at end. The size of the sink shall be as specified.

Sinks

(ii) The sink shall be fixed in laboratory tables or in other working platforms of wood or masonry work, in a workmanlike manner.

Fixing

(iii) Each sink shall be provided with a suitable waste of acid proof material and loose grating in outlet, which shall however be of the genuine make as that of the sink, or as specified, with which it is to be used.

Fittings

(iv) The waste pipe shall be of $1\frac{1}{2}$ " (32 mm) diameter heavy weight lead waste pipe weighing 16 lbs. per yard (3.94 kg/metre) with suitable plumber wiped joint, up to floor level. The cost of this is however not included in the rate of sink, but is payable separately as per schedule of rates.

Waste Connection

DRAINING BOARDS

The draining boards shall be of well seasoned teak wood with fluted surface and back and side skirting and front beading finished with bees wax. The size of the board shall be (750 mm × 450 mm × 40 mm), (600 mm × 450 mm × 40 mm) minimum $18" \times 1\frac{1}{2}"$ or as specified. The skirting shall be 3" to 4" (75 mm to 100 mm) high with edge rounded off.

One end of the board shall rest on the sink and the other end shall be supported on R.S. or C.I. cantilever brackets as specified for the sinks. The cost of the brackets is however included in the rate for this item.

4. (a) R.C.C. SINK IN MOSAIC

The measurements shall be recorded in numbers.

Measurements.

(b) STAINLESS STEEL SINKS

The measurements shall be recorded in numbers.

(c) WHITE GLAZED PLAIN EDGE AND LABORATORY SINKS

The measurements shall be recorded in numbers.

SPECIFICATION NO. 30-6—Sinks

5. (a) R.C.C. SINK IN MOSAIC

Rates

The rates cover the cost of:—

- (i) R.C.C. sink in mosaic of size as specified.
- (ii) R.S. or C.I. brackets.
- (iii) 1½ inch (40 mm) C.P. brass waste with C.P. brass chain and rubber plug.
- (iv) Cost of cement, sand and grit, etc., required for installation.
- (v) Labour for installation of sink and brackets including making holes in walls, etc., and making good the same to its original condition including cost of the same.
- (vi) Painting of R.S. or C.I. brackets with non-yellowing white enamel paint or other approved shade enamel paint including cost of paint and labour.
- (vii) Cost of special scaffolding, tools and plant, etc.
- (viii) Carriage of materials to the site of work and stacking including protection, breakage in transit, if any.
- (ix) Testing of installation.

(b) SINK OF STAINLESS STEEL

- (i) Stainless steel sink of size as specified in Schedule of rates, Part III.
- (ii) Other items same as provided in (a) above for R.C.C. sink.

(c) WHITE GLAZED PLAIN EDGE AND LABORATORY SINKS

- (i) White glazed sinks of specified size.
- (ii) Other items, same as given in (a) above for R.C.C. sinks.

Extra Payable.

6. Extra items such as supplying and fixing waste pipe, chromium plated trap, puff pipe and draining board shall be payable as per items of schedule of rate.

SPECIFICATION NO. 30.7—Urinals

I. LIP TYPE URINALS

(i) The urinal shall be of a reputed Indian make and of flat back or angle back, lipped front, 430mm × 340mm high respectively 18" high in white glazed earthen-ware and shall comply in all respects conforming to I—S—I Specifications No. I.S—2556 (Part vi)—1967 revised. (The urinals of Shanks Doultons, Twyfords or of a reputed English manufacture shall be provided in superior establishment where specified but at an additional cost according to the type and make of the urinal provided).

Urinal

(ii) The urinal basin shall be fixed on wall by means of wooden plugs embedded in wall and screws of proper size.

Fixing.

(iii) The flushing of urinal shall be done by an automatic flushing cistern of a val eless syphon type conforming to I.S.I. Specifications No. I.S—774—1954 and shall be of best cast iron, mosquito proof, of the capacity as tabulated below, and necessary unions and couplings for connections with inlet, outlet, and overflow pipes, etc. It shall be supported on a pair of brackets as specified in clause (v) under sub-head 'Indian Type W.Cs.'. The cistern shall be connected to urinal basin by means of standard size galvanized steel flush pipe with C.P. brass wall clip and union.

Flushing.

The joint between the urinal basin and flush and waste pipes shall be made by means of putty or white lead mixed with chopped hamp.

(iv) Painting of cistern and other fittings such as brackets, and flush pipes, etc., shall be done as specified in clause 1 (viii) under the sub-head 'Indian Type W. Cs.'.

Capacity of
Flushing Cistern

(v) The urinal will be provided with a suitable type of Dead 'P' trap and 1½" (32 mm) diameter heavy weight lead waste pipe 7 lbs per yard, 3.47 kg/metre up to floor trap which shall however be paid for separately at the rates given in the schedule rates.

(vi) The capacity of flushing cistern and size of flush pipe for a number of urinals in a range of more than one urinal will be as follows:—

No. of Urinal in a range	Capacity of flushing cistern	Size of flush pipe	
		Main	Distribution
1	5—Litres	½" (20mm)	½" (15mm)
2	5—Litres connected to both urinals		
3	2—Litres connected to all the urinals	1" (25mm)	½" (15mm)
4	Two Nos. of 5—Litres cistern each connected to 2 urinals each		
			As for two urinals

SPECIFICATION NO. 30-7—Urinals

(vii) In case of cistern having more than 5 Litres capacity, a peet cock shall also be provided.

Measurements

(viii) The measurements shall be recorded in numbers.

Rates

(ix) The rate covers the cost of:—

1. Flat back lipped or angle back urinal basin, 18" high (430mm × 3450 mm) respectively in white glazed earthenware (to the approval of the engineer-in-charge).
2. (5 Litres) capacity mosquito proof Indian make C.I. automatic flushing cistern complete with inlet screwed $\frac{1}{2}$ " (15 mm) B. S. pipe make and necessary unions and couplings for inlet and outlet.
3. Pair of R.S. or C.I. brackets.
4. Standard size galvanised inside and outside steel flush pipe with clips and unions.
5. Cost of red lead, white lead, gaskin, cement, sand and grit, etc. required for installation.
6. Cost of special scaffolding, tools and plant, ropes, etc.,
7. Carriage of materials to the site of work, stacking including protection and breakage in transit, if any.
8. Labour for installation of urinal basin, flushing, cistern, R. S. or C.I. brackets, flush pipe, etc., complete including excavation, cutting of floors, making holes in walls, etc., and making good the same to its original condition including cost of the same.
9. Making joint between the urinal basin and flush and waste pipes by means of putty or white lead mixed with chopped hamp.
10. Painting of flushing cistern and all other fittings with non-yellowing white enamel paint or other approved shade enamel paint on outside and superior black bitumastic paint on inside of flushing cistern complete with cost of paint and labour.
11. Testing of installation and setting right the defects to the satisfaction of the engineer-in-charge.

SPECIFICATION NO. 30-7—Urinals

(x) Extra over and above the rate shall be payable according to the rates in the schedule of rates for the following:—

Extra Payable.

1. Providing and fixing per set, lead 'P' trap and $1\frac{1}{4}$ " (32 mm) lead waste pipe up to floor level and plumber joint.
2. Providing marble backs and partitions in the different range of urinals.

II. STALL URINALS

(i) These shall be provided in superior establishment where specified but at cost worked out according to the type and make of the urinals proposed to be provided.

General

(ii) The urinal stall shall be of best Indian make unless otherwise specified and shall bear mark of firm manufacturing it. It shall be of white glazed fire clay, $3\frac{1}{2}$ (114) mm feet high, 2 feet (460 mm) wide and 11" (255 mm) inch projection from wall, with 6 inch (15cm) white glazed fireclay fluted tread and outlet.

Urinals.

(iii) The flushing of the urinal stall shall be done by an automatic flushing cistern of a valveless syphon type. The cistern shall be of white glazed fireclay and of same manufacturing as that of the urinal stall with which it is to be used or as specified. It shall be complete with all necessary fittings and white porcelain enamelled iron brackets, which shall be embedded in or fixed to walls by means of wooden plugs and screws. The unions and couplings for connections with inlet, outlet and overflow, etc., shall be of best quality C.P. brass. The cistern shall be connected to the stalls by means of a standard size C.P. copper flush pipe and spreader bolted to the stall complete with C.P. union and clips, etc.

Flushing.

(iv) The urinal stall shall be fixed on walls by setting in cement sand mortar 1:2 [i.e. 90 lbs. (50 kg) cement and 2 cft. (0.07 cum) of washed sand].

Fixing.

(v) The capacity of flushing cistern and the size of flush pipe for a number of urinal stalls in a range will be as specified for Lip type Urinals above. In case of cistern having more than one gallon's (5 Litres) capacity, a cock peck shall be provided.

(vi) Each stall shall be provided with a suitable sized C. P. brass hinged outlet grating with flange, lock nut and shank, etc., or a C.P. brass hinged outlet grating with glass enamelled iron outlet connector as desired by the engineer-in-charge and a painted or galvanized iron 'P' or 'S' trap glass enamelled inside.

SPECIFICATION NO. 30-7—Urinals

III. SLAB URINALS

- General.** (i) These shall be provided in superior establishment, where specified and at cost to be determined according to the type and make of the slab urinals proposed to be provided.
- Urinal.** (ii) The slab urinals shall comprise of urinal slabs, end screens, divisions, floor channel, etc., and shall be of a reputed English or best Indian manufacture as specified and shall bear the mark of the firm manufacturing it. These shall be of white glazed fireclay. The urinal slab shall be 3 $\frac{1}{2}$ " (1000 mm) feet high, and (600 mm) 200mm overall length. The end screens shall be 3'-6" (1000 mm) high and of 12" (360 mm) projection. The divisions shall be of 9" (225mm) projection.
- Fixing.** (iii) The urinal slabs, end screens and divisions shall be fixed on walls and the floor channel in the floor by setting in cement sand mortar 1:2.
- Flushing.** (iv) Flushing of urinal slabs shall be done by an automatic flushing cistern as described for urinal stalls.
- (v) Each set of slab urinals shall be provided with a C.P. brass hinged grating and a 'P' or 'S' trap as described for stall urinals.

SPECIFICATION NO. 30.8---Bath Tubs

(i) These shall be provided in superior establishment, where specified and at cost to be determined according to the type and make of the bath tubs proposed to be provided.

(ii) The bath tubs shall be Shanks, Doultons, Twyfords or of a reputed English or best Indian manufacture as per I.S. 3489—1966 and shall bear the mark of the firm manufacturing it. It shall be in white porcelain enamelled inside and painted outside with detachable feet. The size of bath tub shall be 5½' or 6' long as specified.

Bath Tubs.

(iii) Each bath tub shall be provided with a pair of 3/4" (20 mm) C.P. Pillar taps for hot and cold water supply, 1½" (40 mm) C.P. combine waste and 1¼" (32 mm) C.P. overflow with a rubber plug and C.P. brass chain and a 1½" (40 mm) C.P. brass bottle trap and unions, etc., complete in all respects.

Fittings.

The fittings shall be the genuine English make as that of the bath tub with which these are to be used or best Indian make as specified.

(iv) The bath tub shall be properly connected to a waste pipe stack and antisiphonage pipe unless it discharges with open end into a floor trap or in a channel.

Waste connection.

(v) Each bath shall be provided with English make or best Indian make white porcelain enamelled iron one side and one end panel where specified, the rate for which will be paid separately as per schedule of rates.

SPECIFICATION NO. 30.9—Toilet Requisites

- CP Brass rose shower.** (1) The C.P. brass rose shower shall be of a best quality Indian make with 1/2" (15 mm) or 3/4" (20 mm) inlet. The size shall be 6", (150 mm) 5" (125 mm) or 4" (100 mm) diameter or as specified.
- Toilet paper Holder.** (2) The toilet paper holder shall be of:—
- (i) Best Indian make in white ware of a built in type and fixed into wall by setting in with 1:2 cement sand mortar.
- (ii) Chromium plated or toilet paper holder of best Indian make with C.P. brass screws and rawl plugs fixed into wall with C.P. brass screws.
- Towel Rails.** (3) The towel rails shall be of best Indian make or as specified. It shall be made of 30"X1" (750 mm × 25 mm) diameter or 24"X3/4" (600 mm × 20 mm) diameter C.P. brass pipe with C.P. brass brackets fixed with rawl plugs and C.P. screws as specified.
- Glass Shelf** (4) The shelf shall be of best quality Indian make with edges rounded off. The size of the shelf be 24"X5", (600 mm × 125 mm) × 21" X 5" (525 mm × 125 mm) or as specified. The shelf shall have C.P. brass guard rail with rubber washers on positions resting on glass plate and C.P. brass brackets which shall be fixed with C. P. brass screws to wooden plugs firmly embedded in the wall.
- Soap Dish.** (5) The soap dish shall be of best Indian make unless otherwise as specified. It shall be in white ware and of built in type. It shall be fixed into wall with C.P. brass screws or by setting it with cement sand mortar 1:2.
- Mirror.** (6) The mirror shall be of Belgium or best Indian make as specified with bevelled edges. The size of the mirror shall be 24" X 18", (600mm × 450mm) 22"X16" (550mm × 450mm) or as specified. It shall be mounted on asbestos sheet ground and shall be fixed in position by means of 4 Nos. C.P. brass screws and washers over rubber washers and rawl plugs embedded in the wall. C. P. brass clamps with C.P. brass screws may be an alternative method for fixing if desired by the engineer-in-charge.
- Adjustable Towel rail.** (7) The adjustable towel rail shall be of best Indian make unless otherwise specified. It shall be made of 16"X5/8" (400 mm × 16 mm) diameter C.P. brass brackets fixed with rawl plugs and C. P. brass screws as specified.
- Adjustable sprayers.** (8) The adjustable sprayers shall be of Shanks, Doultons Twyford's or of a reputed English manufacture unless otherwise specified. It shall be in C.P. and adjustable to set at an angle of 60 degrees with ball swivel joint for use at shoulder height. These shall be provided in superior establishments where specified and at cost to be determined according to the type and make proposed to be provided.

SPECIFICATION NO. 30.9—Toilet Requisites

(9) Oxidized gas taps shall be of best Indian make with one way, two way, three way or four way as required and shall conform to I—S —I Specifications to the approval of the engineer-in-charge.

Oxidized
gas taps.

(10) Chromium plated coat and hat hooks shall be of best Indian make (similar in shape and equivalent to Shanks No. 8034) conforming to I—S—I Specifications as required. These shall be fixed into wall with C.P. brass screws and rawl plugs, etc.

C.P. Coat and
Hat hooks.

(11) (a) C.P. brass rose shower.—The measurement shall be recorded in numbers.

Measurements.

(b) Toilet paper holder.—The measurements shall be recorded in numbers.

(c) Towel rails.—The measurements shall be recorded in numbers.

(d) Glass shelf.—The measurements shall be recorded in numbers.

(e) Soap dish.—The measurements shall be recorded in numbers.

(f) Mirror.—The measurements shall be recorded in numbers.

(g) Adjustable towel rail.—Oxidized gas taps and C.P. coat and hat hooks.

(h) The measurements shall be recorded in numbers .

Rates .

(12) The rates cover the cost of:—

(a) C.P. brass rose shower

(i) Best Indian make C.P. brass rose shower with $\frac{1}{2}$ " (15 mm) or $\frac{3}{4}$ " (20 mm) i/d inlet as required.

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

(iii) Labour for fixing with the inlet pipe including making joint.

(iv) Cost of special scaffolding, tools and plant, ropes, etc.

(v) Protection of existing works from damage and setting right the same to its original condition.

(vi) Testing the same.

(b) Toilet paper holder

The rate covers the cost of:—

(i) Best Indian make C.P. toilet paper holder or in white ware as specified.

SPECIFICATION NO. 30.9—Toilet Requisites

- (ii) C.P. brass screws and rawl plugs.
- (iii) Carriage to site of work, stacking including protection and breakage in transit, if any.
- (iv) Cutting and making holes in walls and making good the same to original condition, fixing rawl plugs into wall with C.P. brass screws and fixing C. P. toilet paper holder with C. P. brass screws. Toilet paper holders in white ware shall be fixed into wall by setting with 1:2 cement sand mortar.
- (v) Cost of special scaffolding, tools and plant, ropes, etc.
- (vi) Protection of existing works from damage and setting right the same to its original condition.

(c) Towel rails

The rate covers the cost of:—

- (i) Best Indian make towel rail of C.P. brass pipe as specified.
- (ii) Two C. P. brass brackets, rawl plugs and C. P. brass screws.
- (iii) Carriage to site of work, stacking including protection and breakage in transit, if any.
- (iv) Cutting holes in wall and making good the same to its original condition; fixing rawl plugs with C. P. brass screws and fixing brackets with C .P. brass screws.
- (v) Cost of special scaffolding, tools and plant, ropes, etc.
- (vi) Protection of existing works from damage and setting right the same to its original condition.

(d) Glass shelf

The rate covers the cost of:—

- (i) Best Indian make glass shelf of size as specified.
- (ii) C.P. brass brackets and guard rails, rawl plugs and C.F. brass screws.
- (iii) Carriage of materials to site of work, stacking including protection and breakage in transit, if any.

SPECIFICATION NO. 30.9 Toilet Requisites

- (iv) Cutting holes in walls and making good the same to its original condition, fixing rawl plugs with C.P. brass screws and fixing glass shelf.
- (v) Cost of special scaffolding, tools and plants, ropes, etc.
- (vi) Protection of existing works from damage and setting right the same to its original condition.

(e) Soap dish

The rate covers the cost of:—

Soap dish

- (i) Best Indian make soap dish in white ware.
- (ii) Carriage to site of work, stacking, including protection and breakage in transit, if any.
- (iii) Fixing in wall with C.P. brass screws and rawl plug including cost of plug and screws.
- (iv) Cutting holes in walls and making good the same to its original condition.
- (v) Cost of special scaffolding, tools and plant, ropes, etc.
- (vi) Protection of existing works from damage and setting right the same to its original condition.

(f) Mirror

The rate includes the cost of:—

Mirror.

- (i) Belgium or best Indian make mirror with bevelled edges of the size and type as specified.
- (ii) Asbestos sheet, C.P. brass screws and washers, rawl plugs and rubber washers.
- (iii) Carriage of materials to site of work, stacking including protection and breakage in transit, if any.
- (iv) Cutting holes in wall and making good the same to its original condition.
- (v) Fixing asbestos sheet on rawl plugs with C.P. brass screws, fixing rubber washers and mounting glass on asbestos sheet.
- (vi) Cost of special scaffolding, tools and plant, ropes, etc.
- (vii) Protection of existing works from damage and setting right the same to its original condition.

SPECIFICATION NO. 30.9—Toilet Requisites**(g) Adjustable towel rail**

The rate includes the cost of:—

- (i) Best Indian make towel rail equivalent to shanks manufacture No. 631—A of C.P. brass pipe $16'' \times \frac{1}{8}''$ (400 mm \times 16 mm) diameter.
- (ii) Rawl plugs and C.P. brass screws.
- (iii) Carriage of materials to site of work, stacking including protection and breakage in transit, if any.
- (iv) Cutting holes in walls and making good the same to its original condition.
- (v) Fixing rawl plugs with C.P. brass screws and fixing towel rail.
- (vi) Cost of special scaffolding, tools and plant, ropes, etc.
- (vii) Protection of existing works from damage and setting right the same to its original condition.

(h) Oxidized gas taps

The rate includes the cost of:—

- (1) Best Indian make oxidized gas tap including carriage to the site of work.
- (2) Labour for fixing including cost of jointing material.
- (3) Testing of joint.

(i) C.P. coat and hat hook

The rate includes the cost of:—

- (1) Best Indian make Chromium plated coat and hat hook (similar in shape to shanks No. 8034) including carriage to the site of work.
- (2) Cost of rawl plugs and chromium plated brass screws including carriage to site of work.
- (3) Cutting holes in walls and making good the same to its original condition including cost of materials.
- (4) Labour for fixing rawl plugs with C.P. brass screws and fixing C.F. coat and hat hook with C.P. brass screws.

SPECIFICATION NO. 30.10—General

All water pipes for connections, flushing, cisterns, lavatory, basins, and bath tubs shall be through heavy lead pipe connection pieces, with stop cocks conforming and equivalent to JCSWR or I—S—I specifications unless otherwise specified. The size of the lead pipe connection and stop cock will depend upon the size of water connection. All pipes shall be neatly fixed at a distance of $\frac{1}{2}$ " (15 mm) from the finished surface of walls with necessary number of holder bats provided and secured into walls in cement sand mortar 1:2 to a depth of not less than $4\frac{1}{2}$ " (11 cm). Threads of G.I. pipes shall be used in making such joints. Unions of approved pattern shall be provided at places where required to facilitate disconnection of pipes when necessary. These lead pipe connections and stop cocks shall however be payable extra.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

1. MATERIALS

Pipes and fittings.

(i) All pipes and fittings shall be of heavy cast iron and manufactured by M/s Eastern Light Casting Co., Ltd., or of any other reputed firm conforming to I.S.I. specifications No. I.S. : 1729—1964. They shall be of the clear internal diameter specified of uniform thickness, smooth and with strong and deep sockets free from flaws, air bubbles, cracks, holes and other defects. They shall not be brittle but shall allow of ready cutting, chipping or drilling. They shall be coated with Dr. Angus Smiths Composition or other equivalent substance at the manufacturers works. The access door fitted shall be of proper design so as not to form any cavities in which filth may accumulate. Doors shall be provided with $\frac{3}{8}$ " (3 mm) thick rubber insertion packing and when closed and bolted they shall be water-tight.

The thickness and weight of C.I. pipes shall not be less than that shown below:—

(a) When used as drain pipes.

Internal diameter	Thickness of metal not less than	Weight per 9' 274 (mm) length including Socket and braded spigot or flanges, the socket not less than $\frac{3}{8}$ " (10 mm) thick
3" (75 mm)	(8 mm)	98 lbs (44.45 kg)
4" (100 mm)	(10 mm)	157 lbs (71.20 kg)
6" (150 mm)	(10 mm)	225 lbs (102.05 kg)

(b) When used as soil, waste (I.S. : 1729—1964) or vent pipes:—

Internal diameter	Thickness of metal not less than	Weight per 1800 mm (5.91 feet long) including socket and braded spigot or flanges, the socket not less than 6 mm (1/4" thick.) Not less than
50 mm	5 mm	11.41 kg. (25.15 lbs)
75 mm	5 mm	15.52 kg. (36.42 lbs.)
100 mm	5 mm	21.67 kg. (47.77 lbs.)
150 mm	5 mm	31.92 kg. (70.37 lbs.)

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

(ii) Antisiphonage pipes shall be H.C. I. pipes. The main antisiphonage pipe shall be of 2" i/d (50 mm).

Antisiphonage
pipes.

(iii) Lead used for caulking of joints of C.I. soil pipes and fittings shall be pure soft pig or bar lead free from all impurities conformig to I.S.I. Specifications No. I.S. : 27—1956.

Lead for Joints.

(iv) Cast iron traps with C.P. brass hinged grating with frame are to be used unless otherwise specified. They shall correspond in weight to the extra heavy C.I. pipes specified and shall be self cleansing design provided with 1" (25 mm) G.I. puff pipe where the length of the waste is more than 5' (150 cm) or when the floor traps are connected to a waste stack with bends. The puff pipe shall however be payable extra. Where required the floor traps will be set in C.C. 1:2:4 under and round the floor trap. The cost of this cement concrete is included in the rate for this item.

Floor Traps.

No trap with lesser depths of seal than given in the table below should be used:—

Drinking fountain	1 inch (25 mm)
Lavatory basin	1½ inch (32 mm)
Domestic sink	1½ inch (40 mm)
Domestic wash tub	2 inches (50 mm)
Hotel and canteen siaks	2 inches (50 mm)

Water seal should conform with the following :—

In the two pipes system if the internal diameter of the trap is 2½" (65 mm) or more, it should have 2 inches (50 mm) seal. If the trap is of less than 2½" (65 mm) diameter, it should have 1½" (40 mm) seal.

In the case of one pipe and single stack system if the internal diameter of the trap is 2½ inch (65 mm) or more it should have 2 inches (50 mm) waterseal. If the internal diameter of the trap is less than 2½ inches (65 mm) it should have 3 inches (75 mm) water seal.

(2) CONSTRUCTION WORK

(i) (a) All pipes to be fixed on external walls, in duct or in chase shall be secured firmly from their socket with M.S. or heavy flat iron clamps fixed in the wall to a depth of not less than 6" (15 cm) leaving a clearance not less than 1½ inch (40 mm) from the face of wall except in the case of lead pipes which may be close to the structure. The cost of these clamps is however payable extra.

Fixing.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

For pipe work inside the buildings, the following type of fixing for the pipes are permissible:—

For cast Iron pipes.

1. Ears cast on pipe sockets.
2. Cast iron, malleable iron or M.S. holder bats of the building in type.
3. Similar holders with ears for nailing or screwing to the structure.
4. Purpose made straps.

For Asbestos made cement pipes.

1. Galvanised mild steel straps attached to cast iron boxes having ears for nailing or screwing to face of structure as required.
2. Galvanised mild steel brackets with spikes for driving into brick work.
3. Galvanised mild steel holder bats of the building in type.
4. Similar holder bats with ears for nailing or screwing to the structure as required.

Accesses

Accesses must be provided at the following points in the pipe work:—

- (1) Water closets, bed pan washers, slope sinks, urinals, etc., near the trap.
- (2) Waste pipes from ablutionary fittings and sinks.
 - (a) No special access is needed with the exception of sinks unless the connections are long.
 - (b) All pipes shall be carried up to the full diameter with as few bends and offsets as possible and shall terminate about 2'—3' (68.5 cm) above roof level, and surmounted by cowls of approved design. However if the terrace on roof is accessible then the pipe should be carried at least 6' above the roof level.
 - (c) H.C.I. Heel Rest Bend supported by a pad of 1:2:4 cement concrete (450 mm × 450 mm × 225 mm) shall be fixed at the base of each pipe, stack. The cost of which will be paid for extra.
 - (d) Below the level of the highest sanitary fittings in each stack, all junctions and bends shall be provided with C.I. inspection doors fitted with brass stud bolts.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

(ii) (a) Joints in C.I. pipes and fitting shall be lead caulked joints made with a gasket of hemp yarn and molten lead.

Joints.

The amount of lead and hemp yarn in each joint shall be not less than the following :—

Diameter	Lead for soil	Lead for Drain	Hemp Yarn
2" (50 mm)	2.0 lbs. (0.91 kg)	2.5 lbs. (1.13 kg)	0.125 lbs. (0.057 kg)
3" (75 mm)	2.5 lbs. (1.13 kg.)	3.5 lbs. (1.59 kg)	0.170 lbs. (0.077 kg)
4" (100 mm)	3.0 lbs. (1.36 kg)	4.5 lbs. (2.04 kg)	0.170 lbs. (0.077 kg)
6" (150 mm)	Nil	6.5 lbs. (2.95 kg)	0.200 lbs. (0.09 kg)

All joints shall be perfectly air and water tight.

(b) Joints of W.I. pipes and fittings shall be screwed joints with threads of standard gauge. All cut ends of pipes shall have the burr removed. Screw joints shall be made up with thick paste of white and red lead mixed.

(c) Joints between iron and vitrified pipe shall be made with neat cement mortar.

(d) Joints of lead pipes (whether for water-supply, soil, waste or vent) shall be solder wiped joint.

(e) Joints between lead pipe and W.I. pipe fittings shall be made with heavy brass soldering ferrules screwed to iron pipe fittings.

(f) Joints between lead pipe and C.I. pipe shall be made with heavy brass soldering ferrules or flanged thimbles. The ferrule or thimble will be passed over the end of the lead pipe and securely soldered thereto at its upper end while at the other end the lead is well dressed over it. It will then be inserted in the socket and caulked with the lead in the usual manner. All soldering ferrules shall be of heavy cast or else of brass pipe of iron pipe size.

Where it is required to joint lead pipes to the spigot end of the C.I. pipes or fittings, the joints shall be made with brass sockets. The socket shall be caulked to the iron pipe and jointed to the lead pipe by a solder wiped joint. Where the C.I. pipe or fitting is flanged, heavy brass flow flanges shall be used and bolted to the flanges. The floor flange shall be jointed to the lead pipe by a solder wiped joint.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

Floor Traps.

(iii) All traps shall be perfectly true and level. No fixture shall have more than one trap and the trapped waste from a fixture shall not connect with the inlet side of house side of trap of an adjoining fixture.

Vent pipe shall be connected with the arm of the trap at a point not less than 3" (75 mm) and not more than 12" (300 mm) from the highest part of the trap and on that side of the water seal which is nearest to the soil pipe. The connection with the soil pipe shall be made in the direction of the flow in such manner that the discharge shall not enter the vent pipe.

Waste Connection.

(iv) Waste from lavatories, floor traps, sinks and baths shall separately discharge over G.T. on the G.F. and shall be separately connected to waste stack on the higher storeys unless specified to the contrary.

Painting.

(v) All the exposed H.C. I. pipe and fittings shall be painted to match the colour of the surroundings or as approved by the engineer-in-charge so that the external surface of stacks of waste and soil pipes with their vents and antisiphonage connection shall present a neat and good appearance. The cost of painting is payable extra.

Cutting and making good the walls.

(vi) Where possible holes should be left but if any cutting and making good the walls, floors and ceilings or any other portion of buildings is necessary it shall be done in a manner so as to cause the least possible damage. All such work as well as replacement and making good shall be done in a workman like manner and to the entire satisfaction of the engineer-in-charge. The cost of cutting holes and making them good is however included in the rates of pipes and specials and nothing extra will be paid on this account.

(a) H.C.I. Pipes

Sleeve pipe.

(vii) Wherever plumber pipes pass through floors, ceilings, walls of position, the pipes shall be encased in short sleeve pipes where necessary to prevent damage to plaster, etc., the holes and air channels shall be properly closed and the pipes provided with. The cost of sleeve pipe is however payable extra.

Testing.

(viii) On completion of the work, soil, waste and anti-pipes shall be tested by smoke under pressure at the contractor's expense. No work will be taken over unless the whole of the installation shall have stood the full test. The cost of testing, etc., is, however, included in the rates for pipes and fittings.

Measurements.

(ix) The measurements shall be recorded in ft.. (R./metres) along the centre line or axis of the pipe line. The length of specials and fittings shall be excluded.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

- (b) H.C.I. specials for soil, waste, vent or antisiphonage pipes M.S. or heavy flat iron clamps, H.C.I. floor traps; Nahani traps and W.C. connectors

(c) Jointing H.C.I. Pipes and Specials

(x) The rates cover the cost of :—

- (1) Supplying H.C.I. pipes including carriage to site of work and stacking including protection and breakage in transit, if any.
- (2) Labour for stringing out along the trenches or vertically along walls, in duct or in chase.
- (3) Labour for laying in trenches or vertically along walls, in duct or in chase to correct alignment and gradients with tools required for laying the pipes.
- (4) Cutting pipes and specials and chipping or filling the cut surface to a uniform finish.
- (5) Cost of special scaffolding, tools and plant, ropes, etc.
- (6) Cleaning pipes from inside and providing temporary plugs to ends of pipe lines to keep the pipes clean.
- (7) Cutting and making good the walls, floors, ceilings or any other portion of building including cost of materials.
- (8) Protection of existing works from damage and cost of setting right the damages.
- (9) Testing the pipe lines and specials.
- (10) Cost of lead jointing, fixing clamps and painting shall be payable extra according to the rates in the schedule of rates.

Rates.

Extra payable.

(b) Specials for Soil waste, vent or antisiphonage pipe

The rate includes the cost of :—

- (1) Supply H.C.I. specials including carriage to site of work and stacking including protection and breakage in transit, if any.

SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes and Specials

- (2) Labour for stringing out and laying to correct alignment and gradient.
- (c) Cutting and chipping or filling the cut surface to a uniform finish.
- (4) Cost of special scaffolding tools and plant and ropes, etc.
- (5) Cleaning the specials from inside and providing temporary plugs to keep the pipe lines clean.
- (6) Cutting and making good the walls, floors, ceilings or any other portion of building including cost of materials.
- (7) Protection of existing works from damage and cost of setting right in the damages.
- (8) Testing of specials.
- (9) Cost of lead jointing, M.S. clamps, painting and C.C. pads shall be payable extra according to the rates, in the schedule of rates.

Extra Payable.

The rate covers the cost of :—

(c) Lead caulked joints

- (1) Supply of jointing materials, lead, yarn, bolts, nuts, etc. including carriage to site of work.
- (2) Labour for making joint including all tools, etc.
- (3) Cost of fuel for melting lead.
- (4) Testing of pipes and specials for leakage.
- (5) Relaying defective joints.

(d) M.S. or heavy flat iron clamps

The rate includes the cost of :—

- (1) Supplying M.S. or heavy flat iron clamps, cement and sand, etc.
- (2) Carriage of materials to site of work.
- (3) Labour for cutting hole and making good the same to its original condition.
- (4) Fixing M.S. or heavy flat iron clamp.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

- (5) Painting with best bitumastic solution or non-yellowing white enamel paint or other approved shade enamel paint as required including cost of paint.
- (6) Cost of all temporary works, special scaffoldings, tools and plant, etc.
- (7) Protection of existing works from damage and cost of setting right the damages.

(e) Floor traps and Nahani traps

The rate includes the cost of :—

- (1) Supply floor traps or Nahani traps including carriage to site of work, stacking including protection and breakage in transit, if any.
- (2) Labour for laying to correct alignment and gradient.
- (3) Cutting and chipping and filling the cut surface to a uniform finish.
- (4) Cost of special scaffolding, tools and plant, etc.
- (5) Cleaning the traps from inside and providing temporary plugs to keep the same clean.
- (6) Cutting and making good the walls, floors, ceilings, etc. including cost of materials.
- (7) Protection of existing works from damage and cost of setting right the same to its original condition.
- (8) Laying cement concrete 1:2:4 in bed and sides of trap as required including cost of concrete.
- (9) Testing of specials.
- (10) Cost of lead jointing, fixing clamps and painting shall be payable extra according to the rates in schedule of rates.

Extra payable.

**(f) Four inch (100 mm) internal diameter H.C.I. water closet
connectors (plain)**

The rate includes the cost of :—

- (1) Supplying connectors including carriage to site of work and stacking including protection and breakage in transit if any.

**SPECIFICATION NO. 30.11—Heavy Cast Iron Pipes
and Specials**

- (2) Labour for stringing out and laying to correct alignment and gradient.
- (3) Cutting and chipping or filling the cut surface to a uniform finish.
- (4) Cost of special scaffolding, tools and plant and ropes, etc.
- (5) Cleaning the connector from inside and providing temporary plug to keep the pipe line clean.
- (6) Cutting and making good the walls, floors, ceilings or any other portion of building including cost of materials.
- (7) Protection of existing works from damage and cost of setting right the damages.
- (8) Testing of the connector.
- (9) Cost of lead joint, M.S. clamps and painting shall be payable extra according to the rates in the schedule of rates.

Extra Payable.

SPECIFICATION NO. 30.12—Lead Pipes and Fittings

(a) Lead pipes shall conform to I.S.P. 404-1962 (revised). These shall be used only for short branch soil, waste or vent connections. All such lead pipes shall be the best quality drawn pipe of equal substance throughout and shall weigh not less than that shown below :—

For soil, waste
or Vent pipe.

<i>Diameter</i>	<i>Weight</i>
1½" (32 mm)	.. 7.00 lbs. per yard. (3.28 kg. per metre)
1½" (40 mm)	.. 9.00 lbs. per yard. (2.95 kg. per metre)
2" (50 mm)	.. 12.00 lbs. per yard. (5.07 kg. per metre)
3" (75 mm)	.. 17.10 lbs. per yard. (7.48 kg. per metre)
4" (100 mm)	.. 22.80 lbs. per yard. (9.88 kg. per metre)

(b) For water supply connections, the weight shall not be less than :—

For water
supply fittings.

<i>Dia of pipe</i>	<i>Not less than</i>
½" (15 mm)	.. 7.00 lbs per yard. (3.13 kg. per metre)
¾" (20 mm)	.. 9.00 lbs. per yard. (4.24 kg. per metre)
1" (25 mm)	.. 12.50 lbs per yard. (6.11 kg. per metre)
1½" (32 mm)	.. 16.00 lbs per yard. (7.50 kg. per metre)

When not supported on bearers all lead pipes shall be supported by strong lead tacks at least 1½" (40 mm) wide soldered on to the pipe at suitable intervals. All joints of lead pipes (whether for water supply, soil, waste or vent) shall be wiped solder joints.

(c) Sheet lead for flashing shall be of at least 6 lbs. (30 kg.) weight per square foot. (square metre)

Lead flashing

(d) The measurements shall be recorded in rft. sr/metre) along the centre line or axis of the pipe line.

Measurements.

(e) The rate covers the cost of :—

- (1) Supply of lead pipe including carriage to site of work.
- (2) Cost of materials used in jointing.
- (3) Labour for laying to correct alignment and gradient.

SPECIFICATION NO. 30.12--Lead Pipes and Fittings

- (4) Labour for fixing and jointing.
- (5) Cleaning the pipe from inside.
- (6) Painting with non-yellowing white enamel paint or other approved shade enamel paint as required including cost of paint.
- (7) Cutting holes in walls, roofs, etc. ; and making good the same to its original condition.
- (8) Cost of all temporary works and tools and plant.
- (9) Testing pipe line from leakage and relaying defective pipes.

SPECIFICATION NO. 30.13—Internal Drainage Works

All internal drainage works shall be carried out in accordance with the specifications for such class of work as contained in chapters No. 29 and 30.

1. The drain pipes shall be laid in straight lines in both vertical and horizontal direction except otherwise directed in writing by the engineer-in-charge.
2. The drain should only be laid under any of the buildings when specially permitted by the Engineer-in-charge.
3. The following conditions should be observed while laying these drains :—
 - (i) Cast iron pipes should be used.
 - (ii) The drains should be laid in straight lines and at one gradient.
 - (iii) Means of access should be provided at both the ends immediately outside the building.
 - (iv) No branches should be connected with the portion of the drain under the building except otherwise permitted by the engineer-in-charge in writing.
4. The execution of drainage work shall not be commenced until the full supply of pipes and specials required is available and in case of deep trenches, adequate timber should also be kept at the site for timbering of unexpected patches of bad ground that may be encountered.
5. (a) All gully traps shall be of stone-ware or heavy cast iron as specified.

Gully Traps.

 - (b) The stoneware gully traps shall be made of hard burnt stoneware of dark grey colour, thoroughly salt glazed inside and outside, perfectly sound, free from cracks and other imperfections of glazing and of standard nominal diameter and other dimensions.
 - (c) The heavy cast iron gully traps shall be made of good quality cast iron, clean moulded, accurately made and of uniform thickness and free from any blow holes or other imperfections. The weight of H.C.I. gully traps shall not be less than 16 lbs. (7.25 kg.) and the total depth shall not be less than 12 inches (300 mm).
 - (d) The minimum depth of water should not be less than 6 inches (150 mm) and with a minimum seal of 2 inches (50 mm).
 - (e) Each gully trap shall have one cast iron grating 6 inches (150 mm).

SPECIFICATION NO. 30-13—Internal Drainage Works

by 6 inches (150 mm) and one water tight C.I. cover and frame 12"×12" (300 mm × 300 mm) inside dimensions.

(f) All gully traps shall be fixed on cement concrete foundations 2"×3" square and 4 inches thick. The mix for the concrete will be 1:4:8. The jointing of gully⁷ outlet to the branch drain shall be done in a manner similar to the one employed for jointing the stoneware pipes. After fixing and testing the gully and branch drain, a brick masonry chamber 12"×12" (300 mm×300 mm) (inside) in 1st class brick in cement mortar 1:5 shall be built with 4½ (10.25 cm) inches thick walls round the gully trap from the top of the bed concrete, up to ground level. The space between the chamber walls and the trap shall be filled in with cement concrete 1:4:8. The upper portion of the chamber that is above the top level of the trap shall be plastered inside with cement mortar 1:3 finished with a floating coat of neat cement. Cement concrete 1:2:4 coping shall be provided around C. I. frame and completed as per standard design and specifications for such class of work.

The corners and bottom of the chamber shall be rounded off so as to slope towards the grating. The exposed surfaces of the C.I. castings shall also be painted with 3 coats of best black bitumastic paint.

6. (a) Manholes or inspection chambers should be provided at the following places —

- (i) All changes of directions.
- (ii) All changes of gradients.
- (iii) At the head of each length of the sewer.
- (iv) At all junctions and other places directed by the engineer-in-charge.

Manholes and
Inspection
Chamber.

Manholes Covers.

(b) The covers shall be with double seal of tough homogeneous cast iron of heavy or light type as specified. After the completion of the work, the manhole covers must be sealed by means of thick motor grease and the exposed surface of the frame and cover should be painted with 3 coats of black bitumastic paint.

Foot Rates.

(c) These shall be of malleable iron of approved design embedded in masonry work in cement mortar at least 9 inches, (21.5 cm) while the brick work is in progress. These shall be galvanised or painted with coal tar and shall be fixed one foot (30 cm) apart vertically and 9 inches (21.5 cm) centre to centre horizontally.

Gully traps and masonry inspection chambers

Measurements.

7. The measurements shall be recorded in numbers.

SPECIFICATION NO. 30-13—Internal Drainage Works

Gully traps

8. The rate covers the cost of—

Rates.

- (i) Supplying and fixing in position best Indian make gully trap of required size, H.C.I. grating 6"×6" (150 mm×150 mm) and C. I. cover and frame including carriage to the site of work and breakage in transit, if any.
- (ii) Construction of gully chamber with cement concrete foundations as per standard design and specifications for such class of work including cost of materials.
- (iii) Painting of H.C. I. grating and C. I. cover and frame with 3 coats of best black bitumastic paint.
- (b) (i) Supplying and fixing in position best Indian make C.I. manhole cover and frame weight not less than 1 cwt. (52 kg.) including carriage to the site of work and breakage in transit, if any.
- (ii) Construction of brick masonry inspection chamber of required size complete as per design and specifications for such class of work including cost of materials.
- (iii) Painting of C. I. manhole cover and frame with 3 coats of best black bitumastic paint.

Brick masonry
Inspection
Chamber.

SPECIFICATION NO. 30-14—Internal Water Supply

1. Cast Iron, Galvanized Iron or M. S. Pipelines.—All works relating to cast iron, galvanized iron and M. S. pipelines shall be executed according to specifications for such class of work as contained in chapter No. 28.

Tanks

2. Mild Steel Storage Tanks.—All tanks upto 1950 litres capacity shall be made from $3/16"$ (3.15 mm) thick (as specified) best quality mild steel plates fixed to frame work consisting of $1\frac{1}{2}" \times 1\frac{1}{2}" \times \frac{1}{2}"$ (40 mm \times 40 mm \times 6 mm) angles except for 100 gallons (450 litres) tanks and below which shall be without angle iron frame, mild steel plates shall be fixed to frame by means of drilling and fixing iron rivets of proper size, white lead shall be applied to the joints before rivetting. Welding may be done if permitted by the engineer-in-charge but shall however be allowed only on inside. These shall be as per I. S. : 804—1967.

Each tank shall be provided with 16" (400 mm) diameter mosquito proof cover and frame with locking arrangements as approved by the E.I.C. The cover shall be well fitted but not air tight. The size of the tank shall be as specified with a minimum free board of at least 6" (150 mm) above full supply level.

Fittings.

3. Each tank shall be provided with G.I. flanges at least $\frac{1}{2}"$ (15 mm) or $\frac{3}{8}"$ (20 mm) for inlet and outlet, 1" (25 mm) for overflow and $1\frac{1}{2}"$ (40 mm) for scour pipe arrangement complete with $1\frac{1}{2}"$ (40 mm) G. I. scour pipe which shall terminate into a socket and a plug. G. I. overflow pipe will be fitted with brass mosquito proof cap of approved design with 0.05" (1.25 mm) diameter perforations at the bottom. All joints between the tank and fittings shall be leak proof made by flanges washers and other proper fittings. The overflow pipe shall be fixed in a manner that the distance from the top edge of the tank to the overflow level of the pipe is not less than twice the internal diameter of the pipe. If the capacity of the storage tank does not exceed 800 gallons, (3900 litres) the overflow pipe should be arranged as a warning pipe so that the overflow discharges in a conspicuous position where it is readily seen.

However, if the capacity of the storage tank exceeds 800 gallons (3900 litres) and there are difficulties in arranging the overflow pipe as a warning pipe, an additional warning pipe of not less than 1" (25 mm) dia may be provided to indicate when the water in the tank reaches the level not less than 2 inches (50 mm) below the overflow level of the overflow pipe.

SPECIFICATION NO. 30.14--Internal Water Supply

If the capacity of the storage tank is more than 800 gallons (3000 litres) and consists of different tanks of 400 gallons (1500 litres) each, these tanks should be arranged in such a manner and so interconnected that each tank can be isolated for cleaning and inspection without interfering with the supply of the water. This should be done by providing a common header pipe to which each tank is connected and from which the distributing pipes branch off. Each branch into and out of the header pipe shall be provided with stop valve. Each of the tanks shall have its own float valve, overflow pipe and draining valve to facilitate the cleaning.

In large storage tanks, the outlet should be at the end opposite the inlet to avoid stagnation of water and if two or more tanks are coupled together in series with head pipes, the inlet should be in the first tank and the outlet in the last tank. High pressure ball valve with copper float shall be provided at the inlet of the tank.

The rate for the tank does not include the cost of valve and labour charges for its fixing.

4. Inside of tanks shall be painted with 3 coats of approved black bitumastic stand coat paint, and outside of tanks shall be painted with a priming coat of red oxide and finished with three coats of bitumastic grey or other approved shade paint as desired by the engineer-in-charge.

Painting.

5. (i) No interconnection or cross-connection whatsoever between a pipe or fittings should be made where two sources of water supply exist unless especially authorised in writing by the Executive Engineer. The provision of reflux or non-return valve is not a permissible substitute for complete absence of connection. Where stand by arrangement for water supply have been made from another source, the water from both the sources should be delivered into the storage tanks and discharged by a pipe into the air at a height above the top on the edge of the tank equal to twice its nominal bore and in no case less than 6" (150 mm).

Prevention of contamination of Water supply.

(ii) No piping should be laid in or through any sewer or drain or the manhole temporarily or connected in the ground or with the pipes contaminated by sewage.

(iii) The pipe work should be laid in such a manner that there is no possibility of flow towards the source of supply from any cistern or appliance flowing siphonage or otherwise.

SPECIFICATION NO. 30-14—Internal Water Supply

(iv) Where piping has to be laid across recently disturbed, ground continuous longitudinal supports should be provided and not merely supporting piers at intervals.

Precautions.

6. The pipes outside the building should be laid under ground with cover of not less than 2'-6" (3.5. cms). As far as practical the underground surface pipes should be laid at right angles to the main and in straight lines to facilitate the location for repairs. The stop valve should be provided in the service pipes in an accessible position inside the premises as near as practical to the point of entry of the pipe so that the same may readily be available in case of any troubles and repairs. Where it is necessary for a pipe to pass through the wall or floor, a sleeve should be fixed therein for laying of the pipe and to allow freedom for expansion and contraction of the pipe.

Testing.

7. When the service is complete it should be carefully charged with water, allowed all the air to escape to avoid all shock and water hammer. The service should be inspected in working condition of pressure and flow. When all taps are closed the service should be absolutely water tight.

(a) Providing and fixing automatic brass Valves

Measurements.

8. The measurement shall be recorded in numbers.

(b) Fixing of M.S. storage tanks and pressed steel

Storage tanks

The measurements shall be recorded in numbers.

Rate.

9. The rate covers the cost of :—

(a) Providing and fixing automatic brass ball-valve

(i) Supplying automatic brass valve of the required size.

(ii) Carriage to site of works including protection and breakage in transit if any.

(iii) Tools and plant, etc., required for fixing.

(iv) Labour for fixing including cost of jointing material.

(v) Testing including replacement of defective ball-valves.

SPECIFICATION NO. 30-14—Internal Water Supply

(b) Fixing M. S. Storage Tanks

The rate covers the cost of :—

- (i) Carriage of M. S. storage tanks from stores of the Engineer-in-charge to the site of work.
- (ii) Supplying $\frac{1}{2}$ " (15 mm) or $\frac{3}{8}$ " (20 mm) (or as specified) internal diameter flanges for inlet and outlet, one inch (25 mm) for overflow and $1\frac{1}{2}$ " (40 mm) for scour pipes, one inch (25 mm) perforated mosquito proof for overflow and plug for scour pipe including carriage to the site of work.
- (iii) Cost of jointing materials such as white lead, hemp yarn, oil, rivets, bolts and nuts, rubber insertion, etc., including carriage to site of work.
- (iv) Cost of bricks, cement and sand, etc., for constructing masonry supports including carriage to the site of work.
- (v) Labour for hoisting the tanks and laying in correct position.
- (vi) Labour for fixing inlet, outlet, scour and overflow and making pipe connections as specified.
- (vii) Labour for constructing masonry pillars complete with cement plaster as required by the engineer-in-charge.
- (viii) Cutting holes in walls, roofs, ceiling, etc., and making good the same to its original condition including cost of materials.
- (ix) Tools and plants, ropes, etc., required for the job.
- (x) Cost of all temporary works as given in the specifications.
- (xi) Testing the tank under water pressure.
- (xii) Relaying the defective joints and pipe connections.

The extra shall be payable as per items of the schedule.

Extra payable

(c) Fixing in position pressed steel storage tanks

The rate includes the cost of :—

- (i) Carriage of pressed steel storage tank from store of the Engineer-in-charge to the site of work.
- (ii) Supplying brass perforated cap for overflow and plug for scour pipe including carriage to site of work.

SPECIFICATION NO. 30.14—Internal Water Supply

- (iii) Cost of jointing materials such as white lead, hemp yarn, oil, rivets, bolts and nuts, rubber insertion, etc., including carriage to site of work.
- (iv) Cost of bricks, cement and sand, etc., for construction of masonry supports including carriage to the site of work.
- (v) Labour for hosing the tank, assembling and laying in correct position.
- (vi) Labour for constructing masonry pillars complete with making pipe connections.
- (vii) Labour for construction masonry pillars complete with cement plaster as specified and required by the Engineer-in-charge.
- (viii) Cutting holes in walls, roofs, ceilings, etc., and making good the same to its original condition including cost of materials.
- (ix) Tools and plant, ropes, etc., required for completion of the job.
- (x) Cost of all temporary works as given in the specifications.
- (xi) Testing the tank under water pressure.
- (xii) Relaying the defective joints and pipe connections.

Extra payable.

The extra shall be payable as per items of the schedule.

(d) Cutting chase in brick walls in cement or in floor

Measurements.
Rate.

1. The measurement shall be recorded in numbers.
2. The rate includes the cost of:—
 - (i) Supplying cement, sand, bajri, etc., at the site of work.
 - (ii) Labour for cutting chase of the required size as required.
 - (iii) Making good the chase to its original condition in every respect.
 - (iv) Cost of all temporary works and tools and plant.

(e) Dismantling H.C.I. soil pipes, H.C.I. specials, lead caulked joints of H.C.I. pipes and specials and heavy flat iron clamps

Measurements.

1. The measurement shall be recorded in numbers.

SPECIFICATION NO. 30.14—Internal Water Supply

2. The rate covers the cost of:—

Rates.

Dismantling H.C.I. soil pipes and specials and lead caulked joints

- (i) Cost of materials such as fuel wood, kerosene oil, etc. for melting lead caulked joints including carriage of materials to the site of work.
- (ii) Labour for dismantling.
- (iii) Carriage of all dismantled materials from the site to the stores of the engineer-in-charge and stacking.
- (iv) Cutting holes in walls, roofs, ceiling, etc., and making good the same to its original condition including cost of materials.
- (v) Cost of tools and plant.

Cutting chase in brick walls or in floors and making good the same shall be payable extra as per rate in the schedule of rates.

Extra payable.

(f) Dismantling heavy flat iron clamps

The rate includes the cost of:—

- (i) Cutting holes in walls, roofs, ceilings, etc., and making good the same to its original condition.
- (ii) Labour for dismantling.
- (iii) Carriage of materials from the site of work to the store of engineer-in-charge and stacking.
- (iv) Cost of tools and plant.