COMMUNITY WATER SUPPLY AND SANITATION PROGRAMME

POKHARA

MINISTRY OF PANCHAYAT AND LOCAL DEVELOPMENT
REGIONAL DIRECTORATE
WESTERN DEVELOPMENT REGION

STANDARDISATION

OF

WATER SUPPLY ELEMENTS

ESTIMATES AND DESIGNS FOR FISCAL YEAR 2043/44

COMMUNITY WATER SUPPLY AND SANITATION PROGRAMME

POKHARA

MINISTRY OF PANCHAYAT AND LOCAL DEVELOPMENT
REGIONAL DIRECTORATE
WESTERN DEVELOPMENT REGION

STANDARDISATION

OF

WATER SUPPLY ELEMENTS

ESTIMATES AND DESIGNS FOR FISCAL YEAR 2043/44

2044 = 1987

CONTENTS

DESIGN GUIDELINES

Future Design Demand

To arrive at the Future Demand we have to multiply the present demand with the following factors:

1. **Growth Factor** related to the predicted growth of the population.

Growthrate 1981 (National census): 2.6%.

Assuming that the family planning efforts by HMG will have a certain measure of success, then the population growthrate will decrease. The following, fairly arbitrary, assumptions therefore lead to the overall growthfactor: F_g

$F_{g\ 10}$: First ten years, assumed annual growthrate of 2.6%

$F_{g\ 20}$: Second ten years, assumed annual growthrate of 2.0%

The total growthfactor will then become:

$$F_g = F_{g10} * F_{g20} = 1.026^{10} * 1.020^{10} = 1.29 * 1.22 = \mathbf{1.57 = F_g}$$

2. **Consumption Increase.** In twenty years time a lot can change. The change in hygienic pattern and possibly in improvement of economic conditions may lead to an increase in the daily water consumption per person. Since a few years the Central Public Health Engineering and Environmental Organisation of the Ministry of Housing and Public Works in New Delhi, India has advised its chief engineers in the states to increase the daily design water consumption per head from 10 gallons to 15 gallons, i.e. from 45 to 70 liters. Such an increase we, in Nepal, can at present not afford ourselves. All the same an increase from 45 to 60 per person per day in twenty years time seems reasonable. This leads to another factor, due to the increase of the consumption: F_c

$$F_c = 60/45 = \mathbf{1.33}$$

3. **Wastage and Leakage** .One unavoidable fact of life in a water supply scheme is the wastage and leakage of water. Obviously, through design, maintenance and tapstand supervision one can hope to reduce the spilling of water. However experiences in other countries show that it is necessary to calculate with a factor for wastage and leakage. Assuming this leakage to be only 10% of the total daily demand leads to a factor: F_l.

$$F_l = \mathbf{1.1}$$

Taking all the various factors into account, we can calculate the total future demand in the following way:

FUTURE DEMAND(FD)= $F_g * F_c * F_l *$ **PRESENT DEMAND(PD)**

or FD = 1.57 *1.33 * 1.1 *PD =2.3 PD

The increase factor then totals : $F_{tot} = 2.3$

4. Peakfactor

For closed systems the following water consumption pattern is assumed (reference 3.1.5 of 1980 standardisation on storage tank sizing).

Hours of the day	Consumption in % of daily demand
5.30 a.m. - 8.30 a.m.	40%
8.30 a.m. - 4 p.m.	20%
4.p.m. - 7 p.m.	35%
7 p.m. - 5.30 a.m.	5%

This consumption pattern is based on assumptions and not on actual studies. All the same the daily pattern of activities in the hill districts supports this assumed consumption pattern sufficiently to justify the above division. Taking however these figures not too rigidly, one can say that during the morning and evening hours about 75% of the daily consumption has to be supplied. This amount then has to be supplied in about five to six hours. Thus, we have to also calculate the distribution in such a way that it actually **can** deliver the required quantity. This means that a peakfactor has to be introduced for periods of high demand.

- Assuming that 75% of the daily demand has to be supplied in six hours, we can obtain the peakfactor through the following:

  F_p=24 hrs/6 hrs * 0.75 = **3.0**

  or, the distribution system has to be calculated for a maximum flow of 3.0 * $Q_{average}$.

In the case of an **open system** the following peakfactor can be assumed as :

F_p = **2.0**

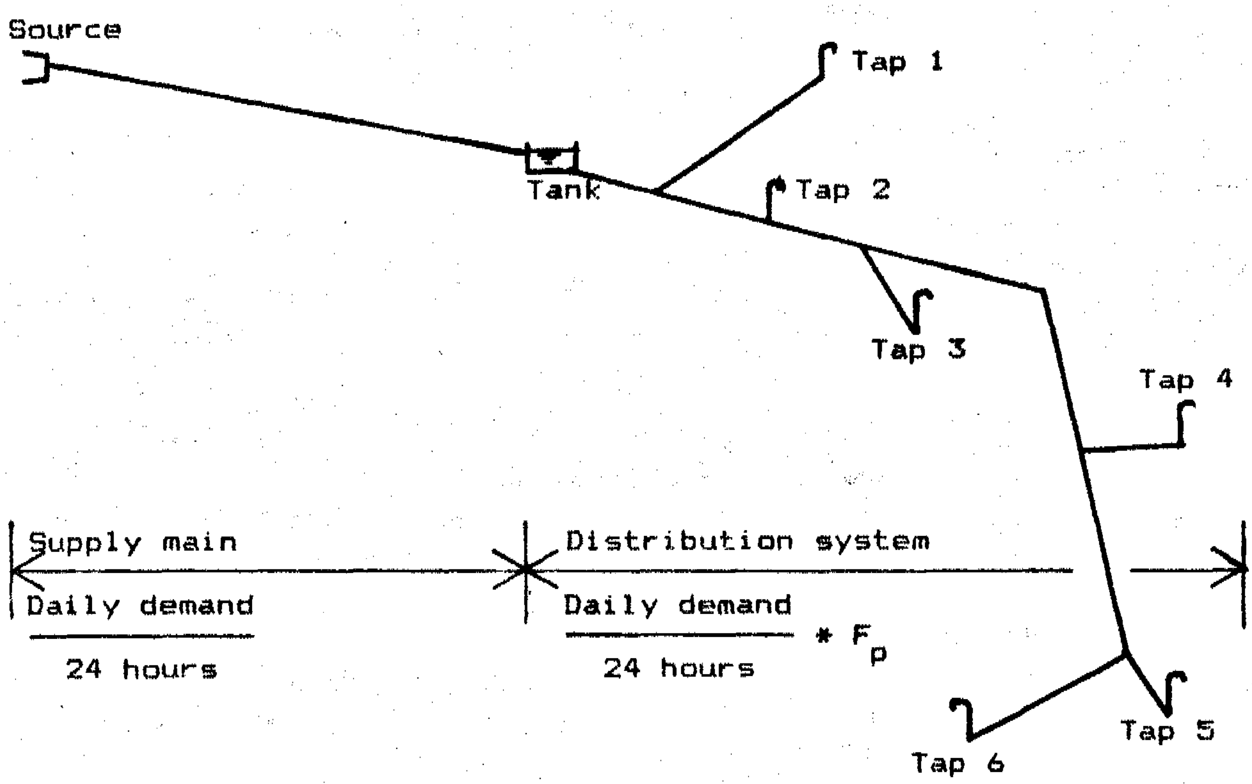
N.B. To avoid unnecessary wastage this factor is reduced in comparison to the factors used in a closed system.
Note that it is common practice in our office to design closed systems as these can be operated more reliably.However a small system not longer than 5 km including the distributionsystem could be designed as an open system.

The following example illustrates the working of the above factors:

TAP NUMBER	HOUSES	POPULATION 4)	WATERCONSUMPTION 2043 1)	WATERCONSUMPTION 2063 2)	FLOW (l/s)	PEAKFLOW (l/s) 3)
Tap 1	23	161	7245	16663	0.19	0.57
Tap 2	12+school	84+100st	3780+1000 5)	8694+2000 6)	0.10+0.02	0.32
Tap 3	30	210	9450	21735	0.25	0.75
Tap 4	16	112	5040	11592	0.13	0.40
Tap 5	28	196	8820	20286	0.23	0.69
Tap 6	19+healthpost	133	5985+ 500 7)	13765+2000 8)	0.16+0.02	0.50
				Total (l/s)	1.10	3.23

Notes.
1) Daily consumption 2043: 45 liters per person/day
2) Daily consumption 2063 : total of 2043 multiplied by F_{tot}:2.3
3) Peakflow = Q * F_p = Q * 3.0
4) Population:seven inhabitants per household is assumed
5) School: 10 l per student per day
6) Doubling of total consumption in the school in 20 years
7) Health Post : 500 l per day (2043)
8) Health Post : 2000 l per day (2063)

In the case of 6) and 8) an average water consumption during the day is assumed, or a peakfactor of 1.0 (F_p = 1.0)



Calculation of reservoir size (roughly):

Tank outflow[1] $Q * F_p * 3 * 3600 = 3.24 * 3.0 * 3600 = 34992$

Tank inflow $Q * 3 * 3600 = 1.10 * 3.0 * 3600 = 11880$

Tanksize required = 23112 l

or 23.1 m^3

A reservoir of 23 m^3 will thus be sufficient.

If we decide to build a reservoir for the first ten years only a tank of 12 m^3 is sufficient as is shown in the following calculation.

Tank outflow Q_{10}[2] $* F_p * 3 * 3600 = 0.75 * 3.0 * 3 * 3600 = 24300$

Tank inflow $Q * 3 * 3600 = 1.10 * 3 * 3600 = 11880$

Tank size required = 12420 l

or 12 m^3

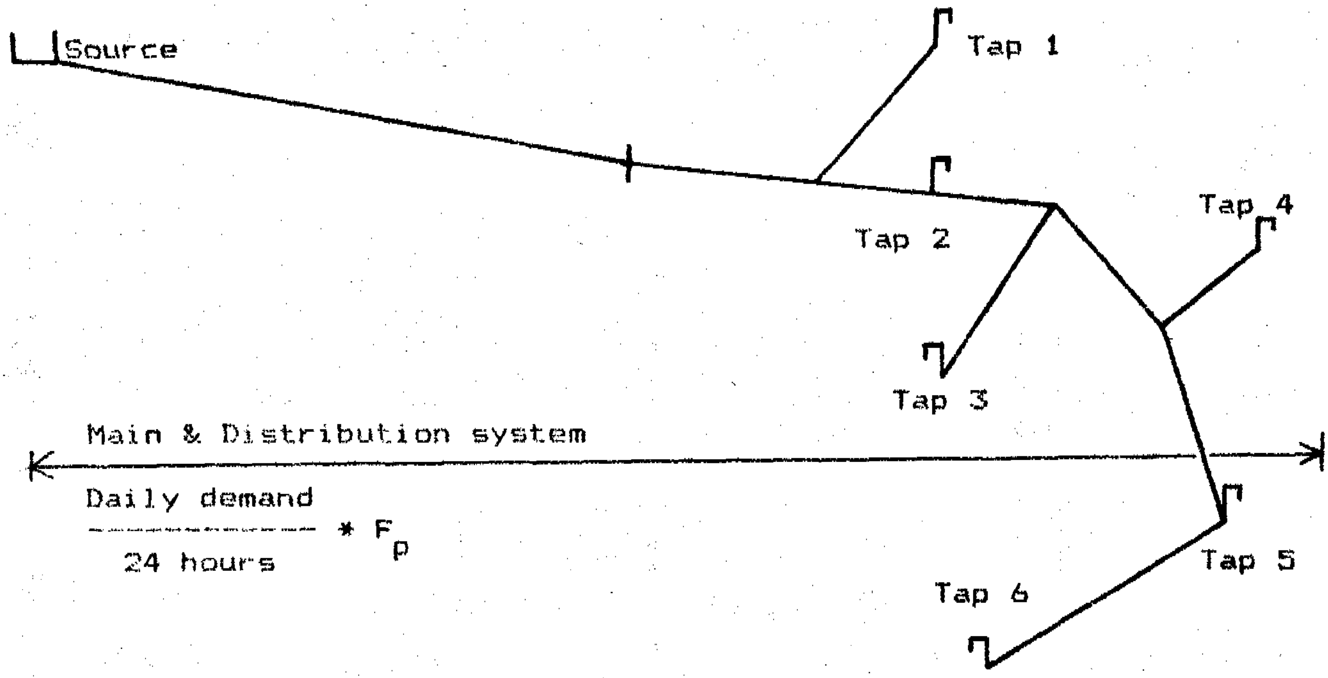
NOTES:

1) inflow versus outflow during the three peak hours
2) Q_{10}: demand in l/s in 10 years : 0.75 l/s (see annex I)
3) It is assumed that the reservoir tank is completely full at 5.30 a.m. and completely empty three hours later, at 8.30 a.m.

4) A second tank of 11 cu.m. can be built after 10 years to cover the demand of the second ten year of the service life of the system. Such an approach is not only financially attractive because of the reduction of the cost of initial investment and interest, but also provides the opportunity to place the tank nearer to the place where increased consumption is to be expected.

The same situation for an **open system** leads to a slightly different calculation ($F_p = 2.0$).

TAP NUMBER	HOUSES	POPULATION	WATERCONSUMPTION 2043	2063	FLOW (l/s)	PEAKFLOW (l/s)
Tap 1	23	161	7245	16663	0.19	0.38
Tap 2	12+school	84+100st	3780+1000	8694+2000	0.10+0.02	0.22
Tap 3	30	210	9450	21735	0.25	0.50
Tap 4	16	112	5040	11592	0.13	0.26
Tap 5	28	196	8820	20286	0.23	0.46
Tap 6	19+healthpost	133	5985+500	137665+2000	0.16+0.02	0.34
				Total (l/s)	1.10	2.16



N.B. 1) It should be noted that it is cheaper to lay a slightly larger pipe now if so required, than to lay an extra or bigger size pipe in ten years time.

2) Consequently, pipeline systems should be designed for the predicted flow of twenty years ahead. Additional tanks or intakes can be built after ten years at little extra cost. Through such a procedure we decrease the initial investment in cash and time, thus possibly enabling the project to serve more project communities.

3) In special cases, when there are for instance no alternative watersources around to augment the present inadequate supply the responsible engineer can decide to assume a future consumption per day of 45 l only. (instead of 60). In such a case, (F_{tot}) equals 1.73.

4) High peak flows at tapstands will sometimes require more than 1 tap to discharge the flow. Although this at present may not be feasible in all cases it should still be kept in mind that this flow may need to be delivered in the near future. Thus, the distribution pipe line needs to be calculated for this flow and adequate provisions at the tapstand need to be incorporated right at the design time.

General Notes on the Standardization 2043/44

Last year the 2041/42 standardisation was revised due to the introduction of standard norms and measurement book in the process of preparation & contruction work of the community water- supply and sanitation projects.

The major change in that revision was the introduction of quantity of different items of work instead of materials. This year changes in the different structures have been included. Furthermore for each structure a breakdown of the materials is given in order to facilitate the work of cost estimation.

In addition to the estimates given in the next pages, the following general notes should be observed:

- Each project should receive 3 m wiremesh 1mm and 3m wiremesh 4 mm for sieving cement and sand respectively. After use this wiremesh can be used for preparation of tanks, BPT etc. and for sanitation. This wiremesh should be added to the estimate.

- **Tools**
  The tool list provided in pages 9 through 11 are guidelines. Depending on the circumstances it is possible to change the quantities given. However a brief explanation in writing will be required why the changes are necessary.

- **Catchment**
  For the stream and spring catchment only the collection chamber and valve chamber have been standardized. During detail survey, the overseer or engineer has to make a sketch of the spring, Kholsi or Khola. On the basis of this sketch additional structures for the spring or stream catchment should be designed. These should be estimated separatly and added to the estimate of the catchment.

- **Village contribution**
  The village contribution for stones, gravels and trenchdigging and earthwork of vorios units of the projectshould be calculated according to the standard Norms sent by Ministry of Panchayat and Local Development, Pulchowk.

- **Sanitation**
  School/Healthpost latrines are to be included in the estimate on the basis of one room per students, or users in the case of a healthpost.

  As a rule the following can be used to derive the number of rooms of a set of latrines:

School less than 100 students	-	1 room
Health Post	-	1 room
School 100-200 students	-	2 rooms
Big Health Post	-	2 rooms
School 200-300 students	-	3 rooms
School 300-400 students	-	4 rooms

More than 4 rooms will not be provided in a school. In very large school a separate 1 pit box latrine can be provided the teachers.

It should be noted that although a set of latrine is included in the estimate, these will only be built when the headmaster, the school committee or the health-post-incharge have specifically asked for their construction in writing. Until such a request is received no latrines are to be constructed.

For the latrines a new standardisation is underway and will be printed later in a separate booklet. Until then the standardisation used up to now will be valid.

- Design

The design of a system is to be made according to the note on this subject dated September 1982. A diversion from these design rules is only allowed after the approval of the Project Manager.

The present design procedure is as follows:

Phase	Done by	Checked by
Survey calculations	overseer	engineer
Profile (draft)	overseer	engineer
Design (draft)	engineer	Project Manager
Profile/design drawing(final)	overseer	engineer
Estimate	overseer	engineer
Technical approval	Project Manager	
Approval	Director	

- Original File

The original file should contain the following informations:

- preliminary survey report
- survey calculation sheets
- calculation of (peaks) flow for each tap
- hydraulic calculation sheets
  In case more than one possibility was calculated, indicate clearly which one was selected.
- sketch and quantity estimate of additional structures for spring or stream catchment.
- map like sketch of the supply area indicating easily recognisable points(temple, bridge, peepal tree)
- blueprint of final design with profile and HGL and flowdiagram of system. (indicating flows only)
- relevant correspondence.

ANNEX I

Calculation of Q_{10}

Q_{10} is the daily demand in l/s after ten years
Q_{10} can be calculated in the same way as the Q_{20} of 1.10 l/s mentioned earlier. It can also be calculated in a slightly simpler way. But then we have to redefine some of our assumptions. It was stated that

$$F_{tot} = F_g * F_c * F_l$$

If we want to use the same formula for the first ten years, we only have to rewrite the formula as follows:

$$F_{tot} = F_{g10} * F_{c10} * F_l = 1.29 * 1.11 * 1.1 = 1.58$$

F_{g10} = 1.29 (refer to 1. Growth Factor)
F_l : leakage and wastage are not assumed to change
F_{c10} : an increase of 45 to 50 liter per person per day is assumed in ten years, or F_{c10} = 1.1

The daily demand after ten years can now be calculated as follows:

$$Q10 = \frac{F_{tot\ 10}}{F_{tot}} * Q_{20} = \frac{1.58}{2.30} * 1.10 \text{ l/s} = 0.75 \text{ l/s}$$

Reduced Increase Factor F_{tot}

As mentioned on page 5, note 3) in special cases it might be necessary to reduce the assumed future consumption. There are two possibilities to do so.

1) The future consumption per day and person is assumed as 45 l only instead of 60 l. The total increase factor becomes then:
   $F_{tot} = F_g * F_c * F_l = 1.57 * 1.0 * 1.1 = 1.73$

2) According to National Census in some districts the population growthrate is not 2.6% but as low as 0.5% (Syangja & Palpa). This is due to population drain. In these cases **if necessary** the total increase factor can be reduced by taking in count the individual growth factors (population) of the districts.

Districts:	Growthrate:	Growth Factor:	Total Increase Factor
Normally	see side 1	1.57	1.57*1.33*1.1 =2.30
Syangja, Palpa	0.5 %	1.1	1.10*1.33*1.1 =1.61
Gulmi, Parbat	1.0 %	1.22	1.22*1.33*1.1 =1.78
Lamjung	1.5 %	1.35	1.35*1.33*1.1 =1.98

Note: These reduced increase factors may be used only in special cases. In ordinary cases the factor F_{tot}=2.3 has to be applied

Guideline

on Issuing of Tools to CWSS-Projects

Tools provided by HMG

	Description	Unit	5 km	10 km	>10 km	Remarks
1.	Shovel	pc	4	6	8	
2.	Pick Axe	pc	5	8	10	
3.	Steel Pan	pc	5-10	5-10	5-10	
4.	Sledge Hammer 10 lbs.	pc	1	2	2	According to masonry work
5.	Sledge Hammer 8 lbs.	pc	2	2	3	
6.	Sledge Hammer 1/2 lbs.	pc	5	5-10	5-10	According to masonry work
7.	Stone Cutting Hammer	pc	4	4-8	4-8	According to masonry work
8.	Stone Chisel 6"	pc	2	3	4	
9.	Stone Chisel 12"	pc	2	3	4	
10.	Stone Chisel 24"	pc	2	3	4	
11.	Building Trowel	pc	5	5-10	5-10	According to masonry work
12.	Pointing Trowel	pc	3	4	6	According to masonry work
13.	Finishing Trowel	pc	3	4	5	According to masonry work
14.	Mason String	bdl	1	1	1	
15.	Steel Brush	pc	6	8	10	
16.	Soft Brush	pc	1	1	1	
17.	Smooth Steel File	pc	1	2	2	
18.	Concrete Chisel 8"	pc	1	1	1	
19.	Kerosene Jerrican 10 ltr	pc	2	2	2	
20.	Kerosene	ltr	20	40	60	
21.	Lantern	pc	1	1	1	
22.	Crow Bar 3'	pc	2	3	4	
23.	Crow Bar 4'	pc	1	2	3	

Guideline

on Issuing of Tools to CWSS-Projects

Tools provided by UNICEF

	Description	Unit	5 km	10 km	>10 km	Remarks
1.	Tool Box (empty)	pc	1	1	1	
2.	Tool Box Lock	pc	1	1	1	
3.	Heating Plate	pc	1	1	1	
4.	Teflon Cover	pc	2	3	4	
5.	Thermochrome Crayon	pc	10	15	20	
6.	Blow Torch	pc	1	1	1	
7.	Hemp	-	-	-	-	
8.	Putty Compound	-	-	-	-	
9.	Teflon Tape	roll	-	-	-	According to GI pipe-line
10.	Geberit Knife	pc	1	2	2	
11.	Pipe Wrench 14"	pc	1	1	1	
12.	Pipe Wrench 18"	pc	1	1	1	
13.	Pipe Wrench 24"	pc	1	1	1	According to GI pipe size
14.	Pipe Wrench 36"	pc	1	1	1	According to GI pipe size
15.	Hacksaw Frame	pc	1	1	2	
16.	Hacksaw Blade	pc	10	15	20	
17.	Adjustable Spanner	pc	2	2	2	

Guideline

on Issuing of Tools to CWSS-Projects

Tools issued on MAG-Form

The following tools will be provided to the WSS-Technician upon submission of a MAG-form. After the project is completed or any time earlier when the tools may not be needed anymore, these tools have to be returned to the store by the technician.

	Description	Unit	Quantity	Remarks
	HMG-Material			
1.	Plumb Bob Line	pc	1	
2.	Steel Scissors	pc	2	only required when ferro-cement tanks or ferrocement constructions are built (applies to items 2 and 3)
3.	Rammer	pc	1	
4.	Wood Chisel	pc	1	
5.	Carpenter Saw	pc	1	
6.	Triangular File	pc	1	
	UNICEF-Material			
1.	Combination Pliers	pc	3	< 4 if much ferrocement-work
2.	Mason Square	pc	1	
3.	Nail Removing Hammer	pc	1	
4.	Spirit Level	pc	1	< only if project is more than 10 km long
5.	Heating Plate	pc	1	

Summary of: -Catchment (only Collection Chamber and Valve Chamber)
-Interruption Chamber (I.C.)
-Break Pressure Tank (BPT.)

Description	Unit	Collection Chamber	I.C.	BPT.
Quantities of Different Work				
1. Earth Work Excavation	m3	3.96	1.80	3.95
2. Dry Stone Soling	m3	0.49	0.22	0.58
3. P.C.C. Work (1:2:4)	m3	0.83	0.30	0.64
4. P.C.C. for Precast Slabs	m3	0.085	0.043	0.085
5. R.C.C. Work (1:2:4)	m3	0.084	--	0.11
6. R.R. Masonry (1:4)	m3	2.31	1.19	2.30
7. Formwork for P.C.C.	m2	1.96	0.96	2.10
8. 1/2"(12.5mm) Plaster (1:4)	m2	8.92	4.56	8.62
9. Barbinding R.C.C.	kg	3.71	--	5.40
10. Fencing Work	m	30.0	--	--
Fittings				
1. G.I. Pipe 2"	m	1.4	2.0	0.5
2. G.I. Nipple 2"	pc	1	--	--
3. G.I. End Cap 2"	pc	1	1	1
4. Gate Valve 2"	pc	1	--	--
5. Flange Set 63mm-2" or Brass Union 63mm	pc	1	--	--
6. G.I. Strainer 2" or HDP Strainer 63mm	pc	1	--	--
7. HDP Pipe 63mm (Exomate)	m	10	10	10
The following items according to pipe-line diameter:				Inlet/Outlet
8. G.I. Pipe	m	--	0.7	0.7 / 0.6
9. G.I. Elbow	pc	--	1	-- / --
10. G.I. Nipple	pc	--	--	-- / 2
11. G.I. Union	pc	--	--	-- / 1
12. Brass Union	pc	--	1	1 / 1
13. Gate Valve	pc	--	--	-- / 1
14. Ball Valve	pc	--	--	1 / --
15. G.I. Reducer up to Diameter of Ball Valve:			pc	1 / --

Summary of: -Catchment (only Collection Chamber and Valve Chamber)
-Interruption Chamber (I.C.)
-Break Pressure Tank (BPT.)

	Description	Unit	Collection Chamber	I.C.	BPT.
Quantities of Material					
1.	Stones (Blocks)	m3	2.80	1.40	2.92
2.	Stones (Bond)	m3	0.30	0.14	0.30
3.	Aggregate 5-10mm	m3	0.11	0.04	0.10
4.	Aggregate 10-20mm	m3	0.22	0.08	0.20
5.	Aggregate 20-40mm	m3	0.52	0.18	0.43
6.	Sand	m3	1.61	0.91	1.95
7.	Cement	bgs	14.70	6.50	13.60
8.	Big Slab Frame 80/80cm	pc	2	1	2
9.	Nut & Bolt Set	pc	4	2	4
10.	Rebar 6mm	kg	0.9	---	1.2
11.	Rebar 10mm	kg	2.9	---	4.5
12.	Binding Wire	kg	0.04	---	0.05
13.	Polythene Sheet (90cm)	m	2.0	1.0	2.0
14.	Barbed Wire	kg	50.0	---	---
15.	Wood for Fencing	m3	0.19	---	---
16.	Wood for Formwork	m3	0.10	0.05	0.11
17.	U-Hooks	pc	77	---	---
18.	Nails	kg	0.50	0.25	0.53
19.	Skilled Labour HMG	MD	20.8	9.9	19.6
20.	Unskilled Labour HMG	MD	21.0	8.7	18.5
21.	Unskilled Labour Village	MD	6.3	2.9	6.3

Summary of: -Valve Chambers: Tap Connection
Main Valve
Cleaning Out
Air Valve

Description	Unit	Tapconnection	Mainvalve	Cleaning out	Airvalve
Quantities of Different Work					
1. Earth Work Excavation	m3	1.73	1.73	1.73	1.73
2. Dry Stone Soling	m3	0.22	0.22	0.22	0.22
3. P.C.C. Work (1:2:4)	m3	0.16	0.16	0.16	0.16
4. P.C.C. for Precast Slabs	m3	0.043	0.043	0.043	0.043
6. R.R. Masonry (1:6)	m3	1.24	1.24	1.24	1.24
7. Formwork for P.C.C.	m2	0.96	0.96	0.96	0.96
Fittings					
1. G.I. Nipple 1/2"	pc	2	--	--	--
2. G.I. Union 1/2"	pc	1	--	--	--
3. Brassunion 20mm	pc	1	--	--	--
4. Stopcock 1/2"	pc	1	--	--	--
5. HDP Pipe 63mm (Exomate)	m	--	--	10	--
The following items according to pipe-line diameter:					
6. G.I. Nipple	pc	--	2	2	2
7. Brass Union	pc	--	2	2	2
8. Gate Valve	pc	--	1	1	--
9. HDP Tee	pc	--	--	1	--
10. G.I. Reducing Tee 3/4"	pc	--	--	--	1
11. Air Valve	pc	--	--	--	1

Summary of: -Pipeline (1 meter)
-Tapstand (Bazar-Type)
-Tapstand incl. connection chamber (Bazar Type)

	Description	Unit	Pipe-line 1 m	Tapstand Bazar-type	Tap incl. conn.-chamber
Quantities of Different Work					
1.	Earth Work Excavation	m3	--	1.50	3.23
2.	Dry Stone Soling	m3	--	0.45	0.67
3.	P.C.C. Work (1:2:4)	m3	--	0.21	0.37
4.	P.C.C. for Precast Slabs	m3	--	--	0.043
5.	R.R. Masonry (1:6)	m3	--	1.32	2.56
6.	Formwork for P.C.C.	m2	--	--	0.96
7.	1/2"(12.5mm) Plaster (1:4)	m2	--	8.09	8.09
8.	Trenchdigging	m3	0.50	--	--
9.	Earth Filling	m3	0.50	--	--
Fittings					
1.	G.I. Pipe 1/2"	m		5.20	5.20
2.	G.I. Elbow 1/2"	pc		2	2
3.	G.I. Socket 1/2"	pc		1	1
4.	Brasstap 1/2"	pc		1	1
5.	G.I. Nipple 1/2"	pc		--	2
6.	G.I. Union 1/2"	pc		--	1
7.	Brassunion 20mm	pc		--	1
8.	Stopcock 1/2"	pc		--	1
9.	HDP Pipe 63mm (Exomate)	m		10.0	10.0

Summary of: -Valve Chamber
-Tapstand (Bazar-Type)
-Tapstand incl. connection chamber (Bazar Type)

Description	Unit	Valve-chamber	Tapstand Bazar-type	Tap incl. conn.-chamber
Quantities of Material				
1. Stones (Blocks)	m3	1.50	1.80	3.30
2. Stones (Bond)	m3	0.15	0.18	0.33
3. Aggregate 5-10mm	m3	0.02	0.02	0.04
4. Aggregate 10-20mm	m3	0.04	0.05	0.09
5. Aggregate 20-40mm	m3	0.11	0.11	0.22
6. Sand	m3	0.83	1.15	1.98
7. Cement	bgs	4.00	5.00	9.00
8. Big Slab Frame 80/80cm	pc	1	--	1
9. Nut & Bolt Set	pc	2	--	2
10. Plain Wire 3.5mm	kg	--	0.10	0.10
11. Polythene Sheet (90cm)	m	1.00	--	1.00
12. Wood for Formwork	m3	0.05	--	0.05
13. Nails	kg	0.24	--	0.24
14. Skilled Labour HMG	MD	9.3	11.5	20.8
15. Unskilled Labour HMG	MD	7.3	9.7	17.0
16. Unskilled Labour Village	MD	2.8	2.4	5.2

Summary of: -Ferrocement Tanks 2.5 / 5 / 10 / 20 cubic meter

	Description	Unit	2.5 m3 Tank	5 m3 Tank	10 m3 Tank	20 m3 Tank
	Quantities of Different Work					
1.	Earth Work Excavation	m3	13.31	18.02	27.97	45.52
2.	Dry Stone Soling	m3	1.19	1.70	2.56	3.92
3.	P.C.C. Work (1:2:4)	m3	0.59	0.80	1.18	1.79
4.	P.C.C. for Precast Slabs	m3	0.07	0.07	0.07	0.07
5.	R.C.C. Work (1:2:4)	m3	0.14	0.14	0.14	0.14
6.	R.R. Masonry (1:6)	m3	3.74	3.55	3.70	3.95
7.	Dry Stone Masonry	m3	0.24	0.24	0.24	0.24
8.	Formwork for P.C.C.	m2	1.28	1.28	1.28	1.28
9.	1/2"(12.5mm) Plaster (1:2)	m2	19.68	28.64	45.70	71.70
10.	1/2"(12.5mm) Plaster (1:3)	m2	19.68	28.64	45.70	71.70
11.	1/2"(12.5mm) Plaster (1:4)	m2	8.35	10.14	13.76	18.90
12.	3mm Cement Punning	m2	9.07	13.50	21.69	34.57
13.	Barbinding R.C.C.	kg	11.06	11.06	11.06	11.06
14.	Barbinding Fe-Tank	m2	9.68	14.16	22.69	35.69
15.	Formwork Fe-Tank	m2	9.68	14.16	22.69	35.69
16.	Snowcem Painting	m2	3.30	5.38	9.29	15.27
17.	Fencing Work	m	18.0	20.0	26.0	30.0
18.	Earth Filling	m3	3.19	4.62	7.00	10.51

Summary of: -Ferrocement Tanks 2.5 / 5 / 10 / 20 cubic meter

Description	Unit	2.5 m3 Tank	5 m3 Tank	10 m3 Tank	20 m3 Tank
Fittings					
1. G.I. Elbow 2"	pc	7	7	7	7
2. G.I. Elbow 1/2"	pc	1	1	1	1
3. G.I. Nipple 2"	pc	5	5	5	5
4. G.I. Nipple 1/2"	pc	1	1	1	1
5. G.I. Tee 1/2"	pc	1	1	1	1
6. G.I. Union 2"	pc	1	1	1	1
7. G.I. Equal Tee 2"	pc	1	1	1	1
8. G.I. Brass Union 63mm or Flange Set 63mm-2"	pc	2	2	2	2
9. G.I. Gate Valve 2"	pc	2	2	2	2
10. G.I. End Cap 2" (see note!)	pc	2	2	2	2
11. G.I. Reducer 2"-1/2"	pc	1	1	1	1
12. G.I. Bracket 2"	pc	2	2	2	2
13. G.I. Bracket 1/2"	pc	1	1	1	1
14. G.I. Pipe 2"	m	8.45	9.05	10.15	11.55
15. G.I. Pipe 2" (Support pipe)	m	1.9	1.9	2.1	2.3
16. G.I. Pipe 1/2" (Aeration)	m	1.65	1.65	1.80	2.00
17. G.I. Pipe 1/2" (Brackets)	m	1.50	1.50	1.50	1.50
18. HDP Pipe 63mm (Exomate)	m	10.00	10.00	10.00	10.00

Note: Item 10. G.I. End Caps 2" are used only during construction. They must not be included in the material order because they can be taken from the cleaning out of other structures during the construction.

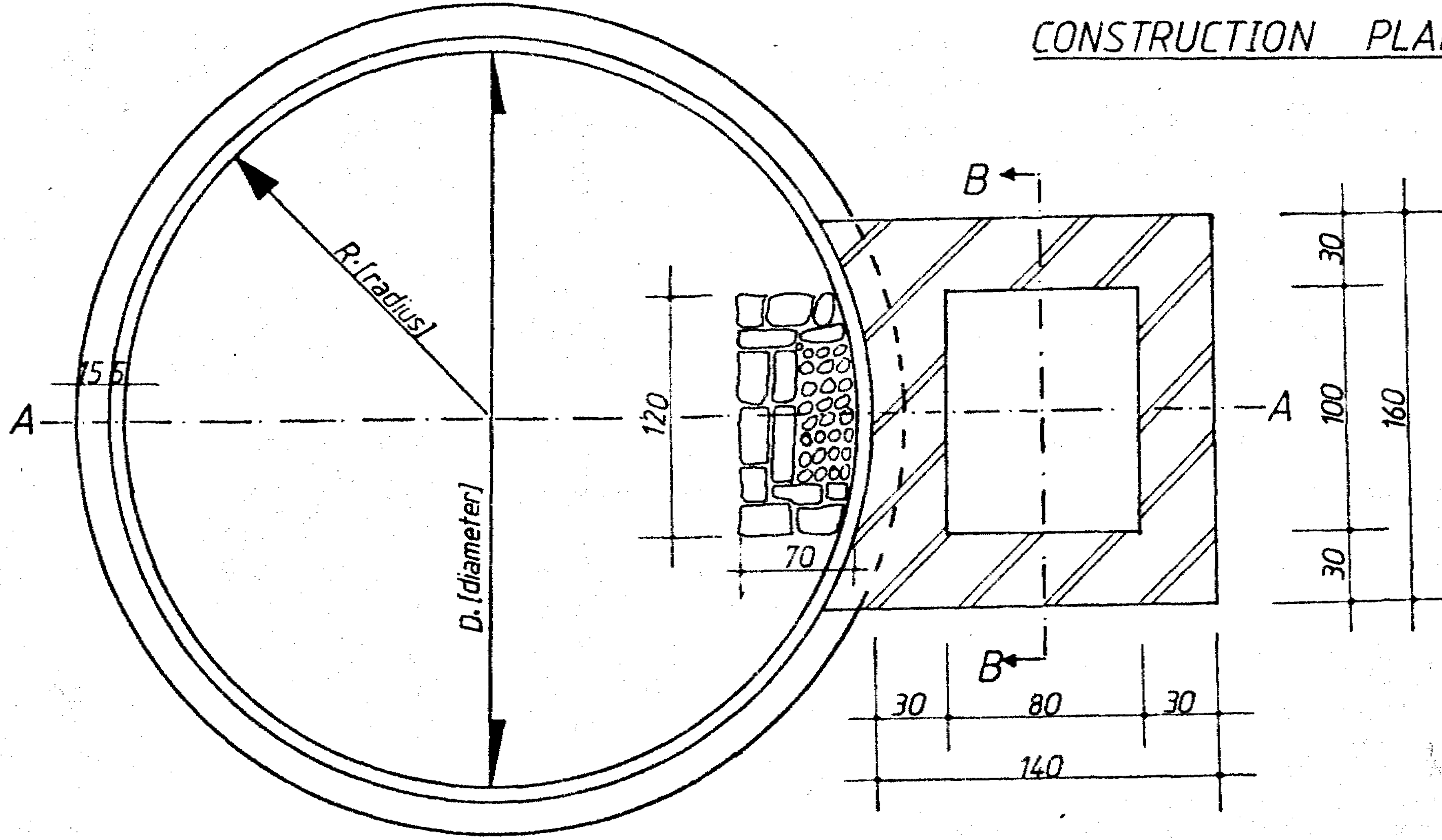
Summary of: -Ferrocement Tanks 2.5 / 5 / 10 / 20 cubic meter

	Description	Unit	2.5 m3 Tank	5 m3 Tank	10 m3 Tank	20 m3 Tank
Quantities of Material						
1.	Stones (Blocks)	m3	5.20	5.50	6.50	8.10
2.	Stones (Bond)	m3	0.52	0.60	0.65	0.81
3.	Aggregate 5-10mm	m3	0.09	0.11	0.15	0.22
4.	Aggregate 10-20mm	m3	0.19	0.23	0.32	0.45
5.	Aggregate 20-40mm	m3	0.43	0.54	0.74	1.05
6.	Sand	m3	3.57	4.50	5.52	7.61
7.	Cement	bgs	21.0	25.3	34.5	48.8
8.	Small Slab Frame 60/60cm	pc	1	1	1	1
9.	Big Slab Frame 80/80cm	pc	1	1	1	1
10.	Nut & Bolt Set	pc	4	4	4	4
11.	Rebar 6mm	kg	3.0	4.1	6.0	8.5
12.	Rebar 10mm	kg	35.1	48.1	70.1	100.1
13.	Plain Wire 3.5mm	kg	20.0	30.0	48.0	75.0
14.	Chicken Wire Mesh (90cm)	m	20.00	35.00	50.00	70.00
15.	Binding Wire	kg	5.10	5.60	7.10	8.10
16.	Bamboo	Nos	6	8	10	12
17.	Polythene Sheet (90cm)	m	13.4	17.6	23.6	30.1
18.	Snowcem	kg	1.65	2.70	4.65	7.65
19.	Barbed Wire	kg	30.0	33.5	43.5	50.0
20.	Wood for Fencing	m3	0.12	0.13	0.17	0.19
21.	Wood for Formwork	m3	0.07	0.07	0.07	0.07
22.	U-Hooks	pc	46	51	67	77
23.	Nails	kg	0.82	0.82	0.82	0.82
24.	Skilled Labour HMG	MD	50.0	54.7	67.4	86.8
25.	Unskilled Labour HMG	MD	43.8	50.1	64.4	86.0
26.	Unskilled Labour Village	MD	23.1	21.5	48.7	78.7

DRAWINGS

CONSTRUCTION PLAN

①



TANK CAPACITY	R(m)	D(m)
2·5 m^3	0·80	1·60
5 m^3	1·10	2·20
10 m^3	1·50	3·00
20 m^3	2·00	4·00

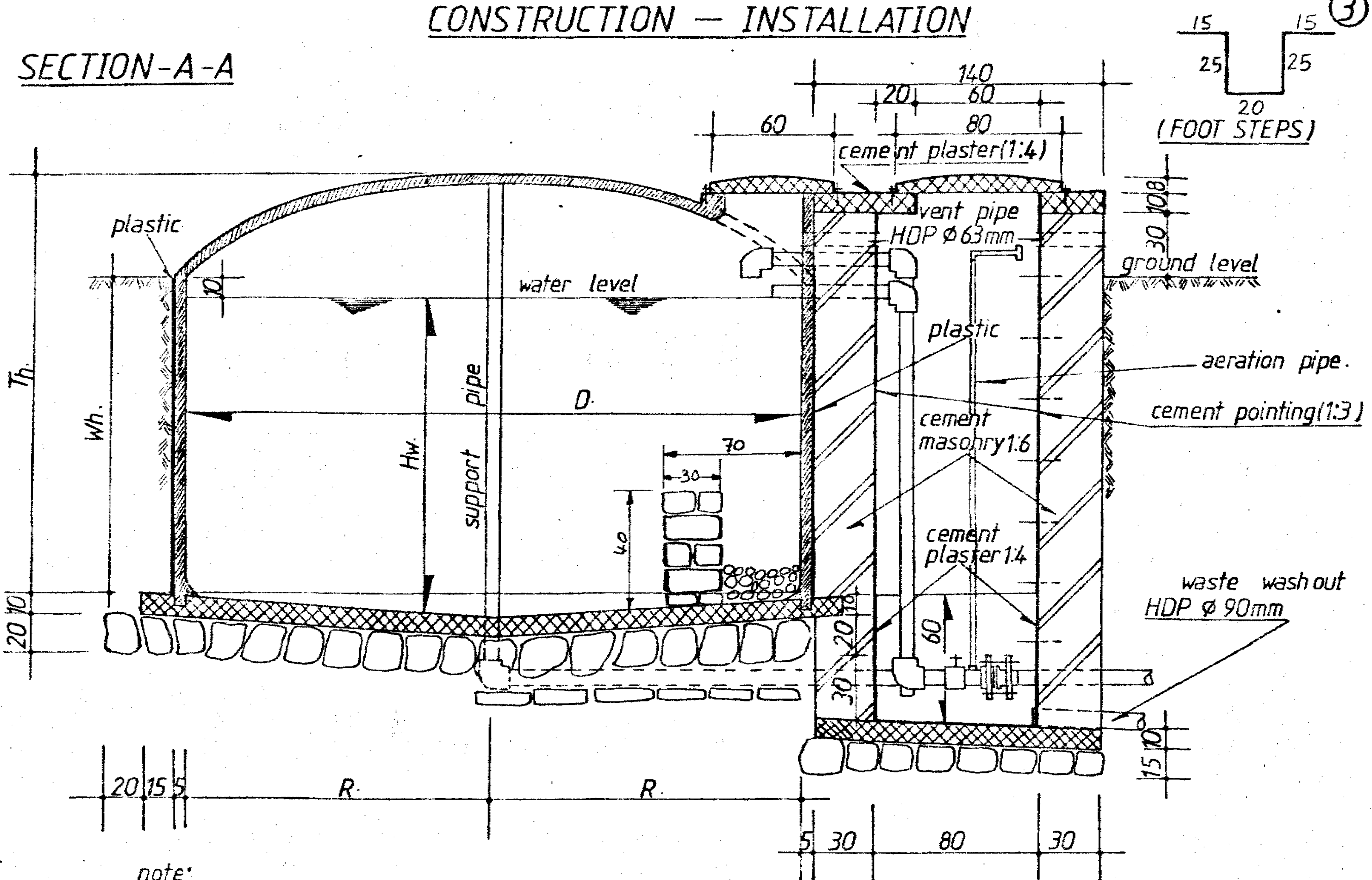
G.S

TANK'S HEIGHT

TANK CAPACITY	Hw. (height up to water level)	Wh. (wall height)	Th. (total height)
2.5 m^3	1.30m.	1.40m.	1.80m.
5 m^3	1.30m.	1.40m.	1.80m.
10 m^3	1.45m.	1.55m.	2.05m.
20 m^3	1.65m.	1.75m.	2.25m.

CONSTRUCTION — INSTALLATION

SECTION-A-A

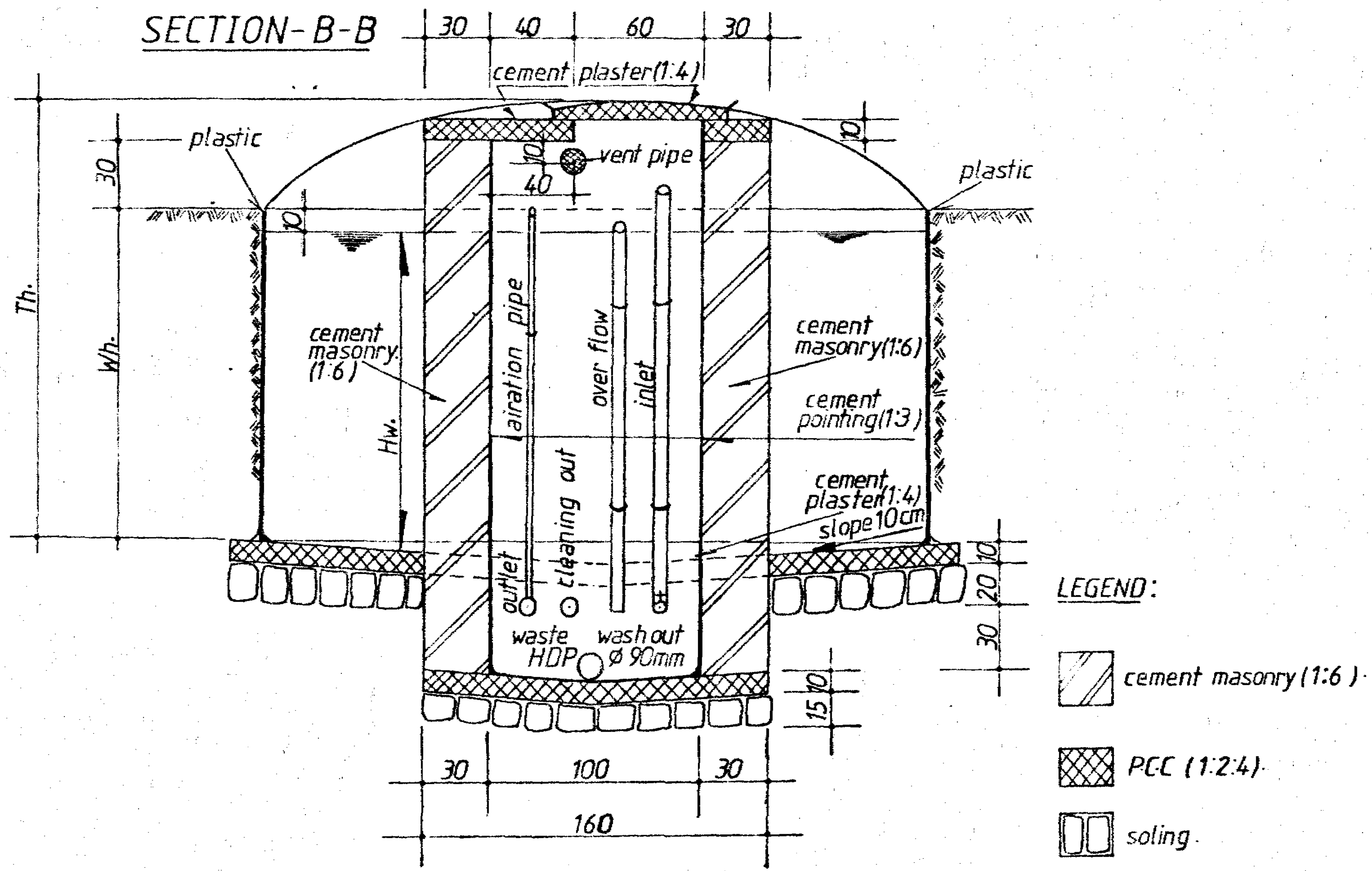


note:
punning should not be done in dom roof.

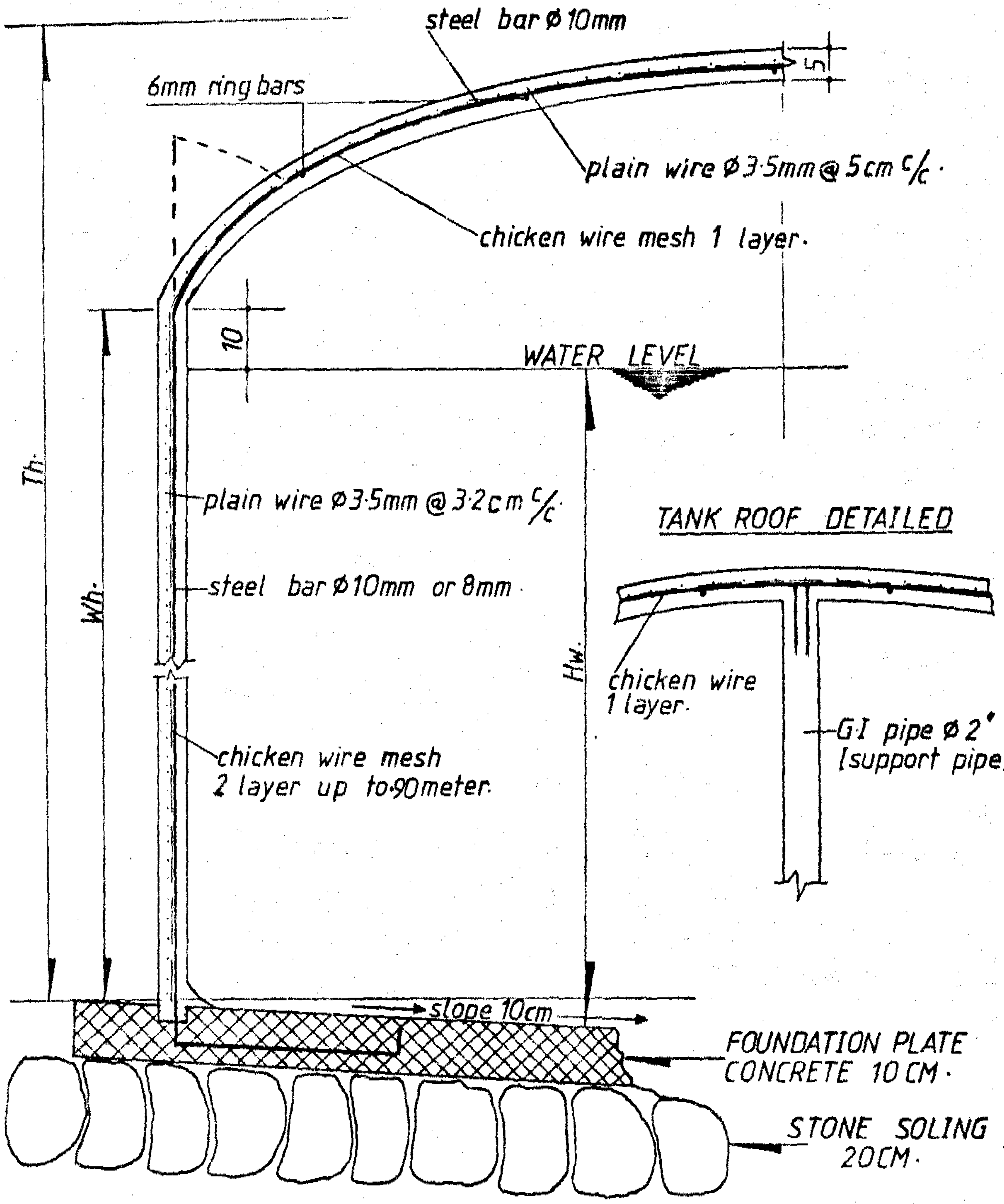
G.S

CONSTRUCTION INSTALLATION

SECTION-B-B



TANK — SECTION



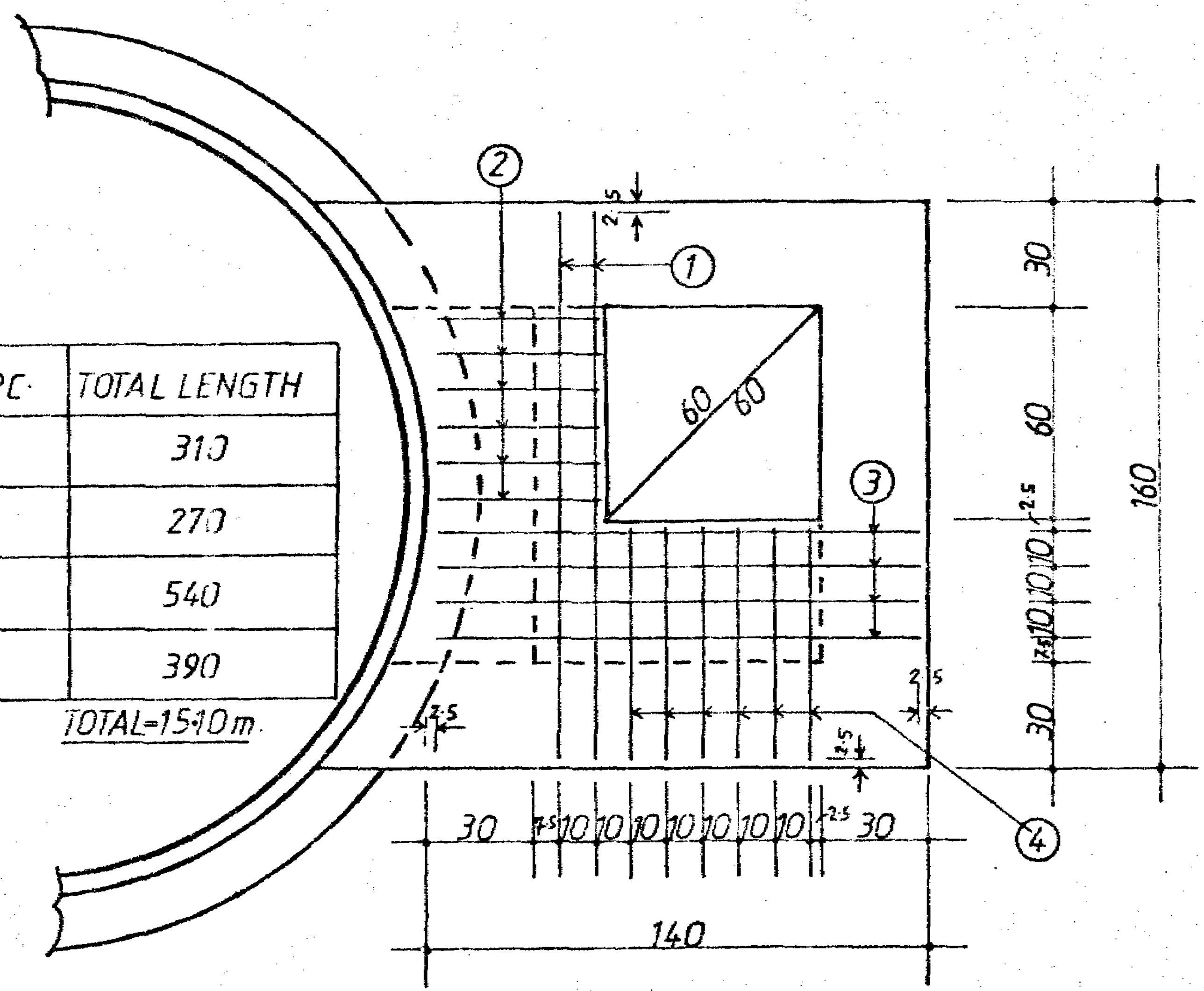
WALL REINFORCEMENT C

ROOF " D

OPERATION CHAMBER SLAB REINFORCEMENT

POS	ø	L·/PC·	FORM	TOTAL PC·	TOTAL LENGTH
1	10 mm	155	——	2	310
2	6mm	45	——	6	270
3	10 mm	135	——	4	540
4	6mm	65	——	6	390

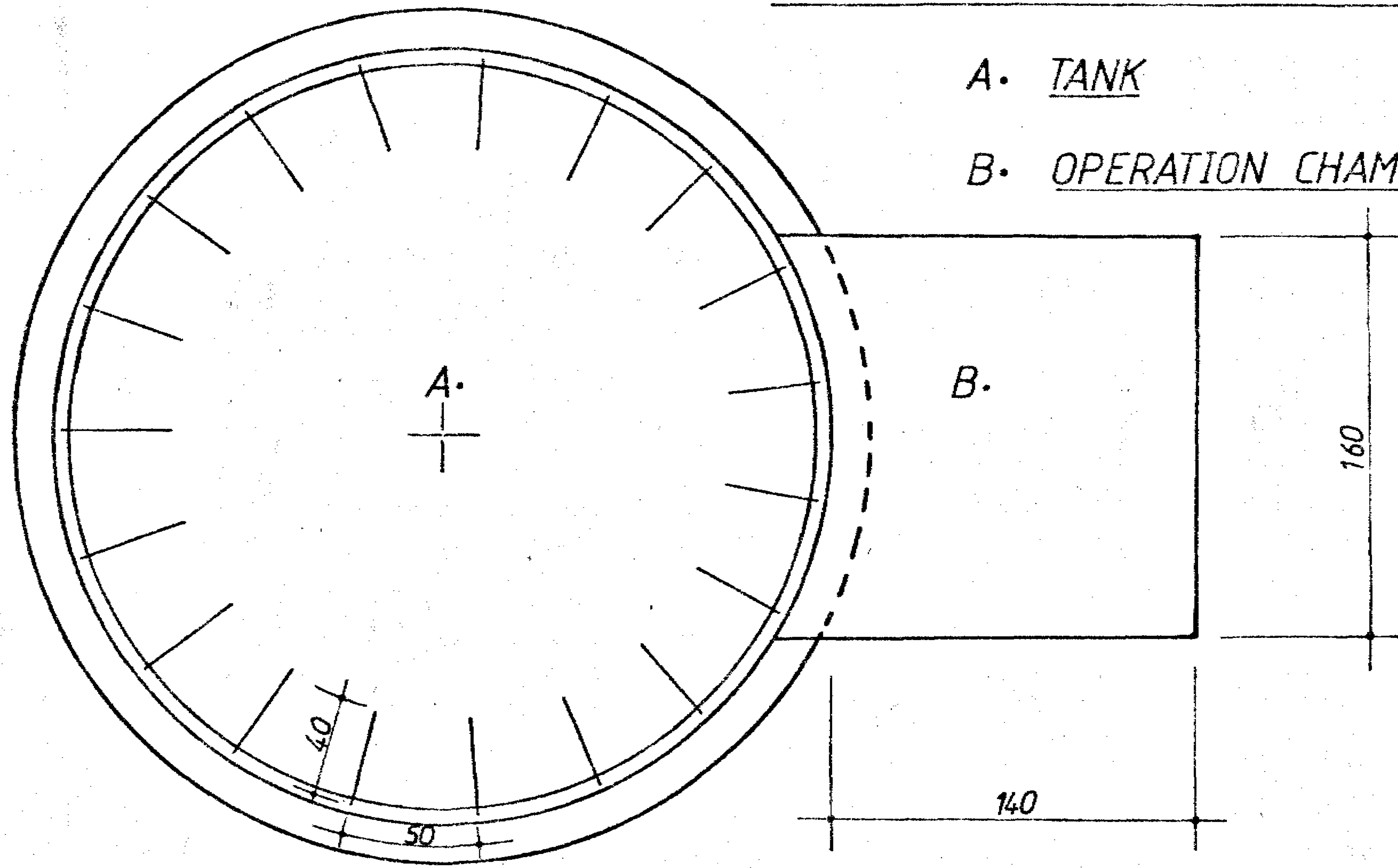
TOTAL=1510 m.



REINFORCEMENT FOUNDATION PLAN

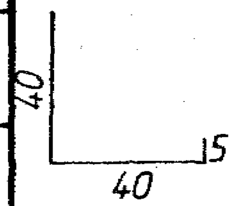
A. TANK

B. OPERATION CHAMBER



REINFORCEMENT - TABLE

TANK FOUNDATION (A)

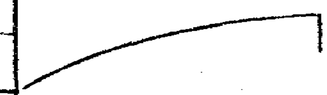
TANK CAPACITY	STEEL BAR ø	LENGTH / PC	FORM	TOTAL QUANTITY	TOTAL LENGTH
2.5 m^3	10 mm	85cm		10 PC	850 cm
5 m^3	10 mm	85 cm		14 PC	1190 cm
10 m^3	10mm	85cm		19 PC	1615 cm
20m	10mm	85 cm		25 PC	2125 cm

TANK WALL (C)

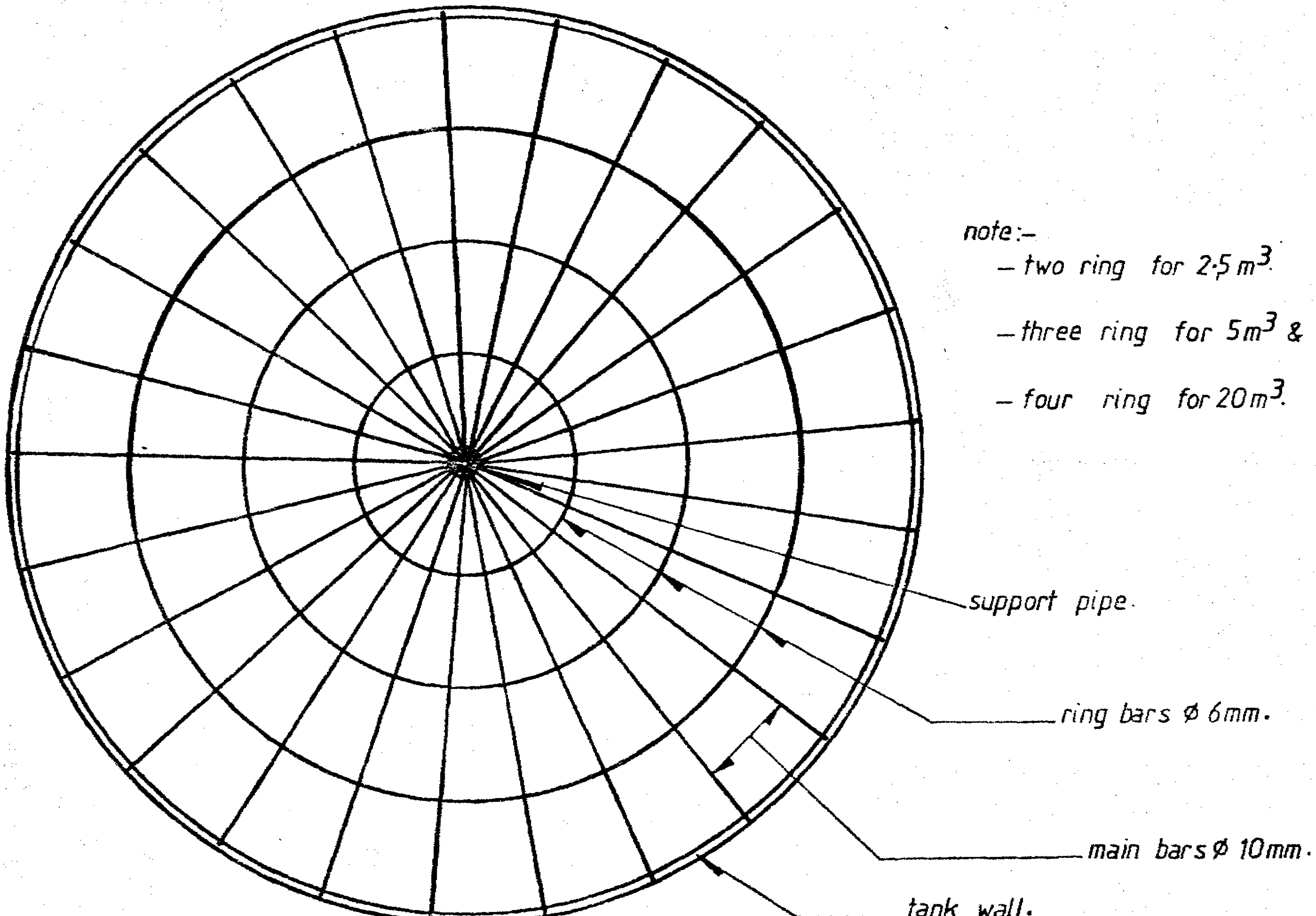
TANK CAPACITY	STEEL BAR ø	LENGTH / PC	FORM	TOTAL QUANTITY	TOTAL LENGTH
2.5 m^3	10mm	185 cm		10 PC	1850 cm
5 m^3	10 mm	185 cm		14 PC	2590 cm
10 m^3	10mm	210 cm		19 PC	3990 cm
20 m^3	10mm	230 cm		25 PC	5750 cm

REINFORCEMENT-TABLE

TANK ROOF

TANK CAPACITY	STEEL BAR Ø	LENGTH PC	FORM	TOTAL QUANTITY	TOTAL LENGTH	
2·5 m^3	10 mm	160 cm		2 PC	320 cm	
		90 cm		6 PC	540 cm	8·60m
5 m^3	10 mm	220 cm		2 PC	440 cm	
		110 cm		10 PC	1100 cm	15·40m
10 m^3	10 mm	300 cm		2 PC	600 cm	
		160 cm		10 PC	1600 cm	
		150 cm		5 PC	750 cm	29·50m
20 m^3	10 mm	400 cm		2 PC	800 cm	
		210 cm		10 PC	2100 cm	
		200 cm		11 PC	2200 cm	51·00m

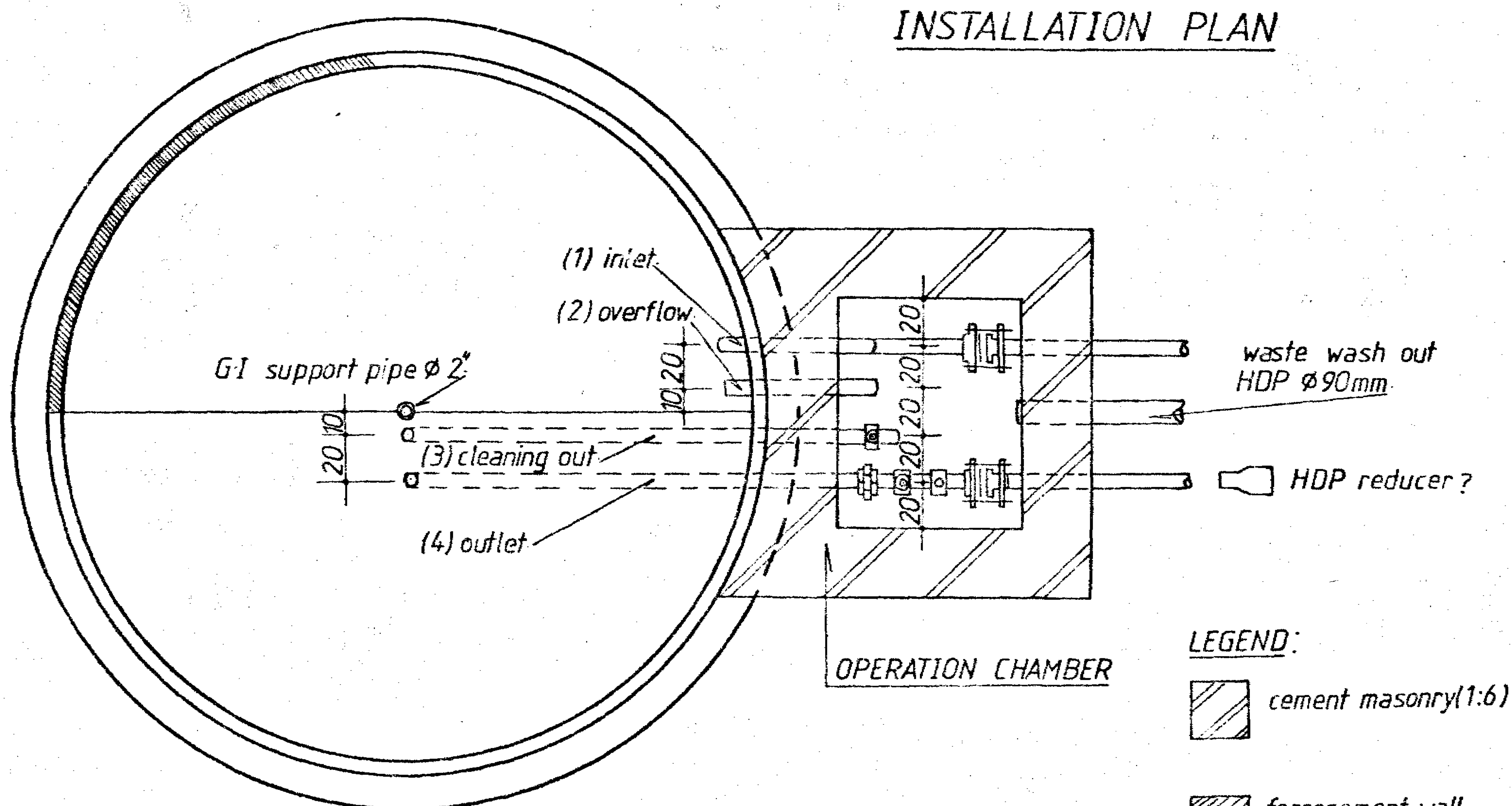
DOM ROOF REINFORCEMENT



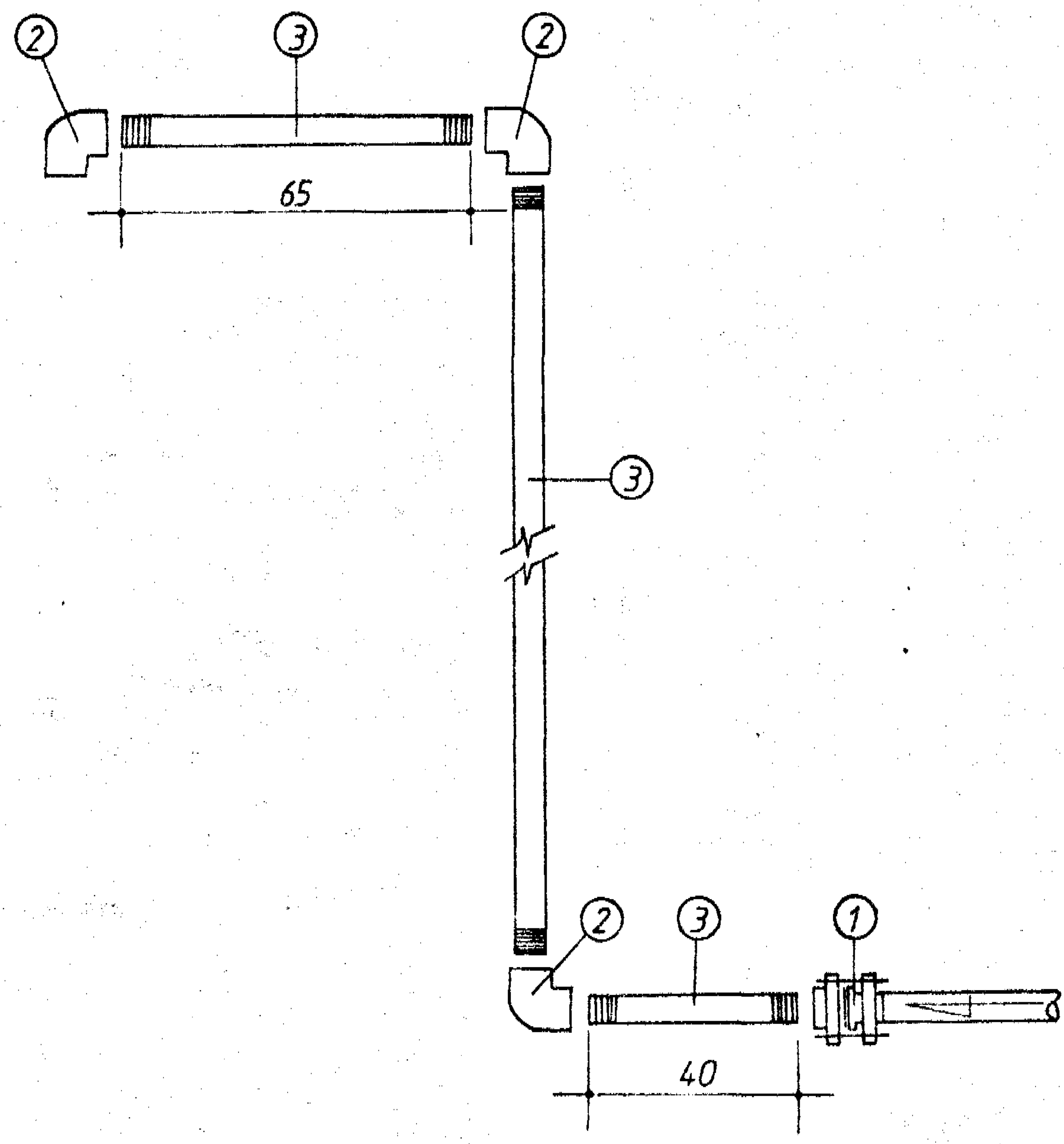
note:-
- two ring for $2{\cdot}5\,m^3$.
- three ring for $5m^3$ & $10m^3$.
- four ring for $20m^3$.

Gsh2

INSTALLATION PLAN

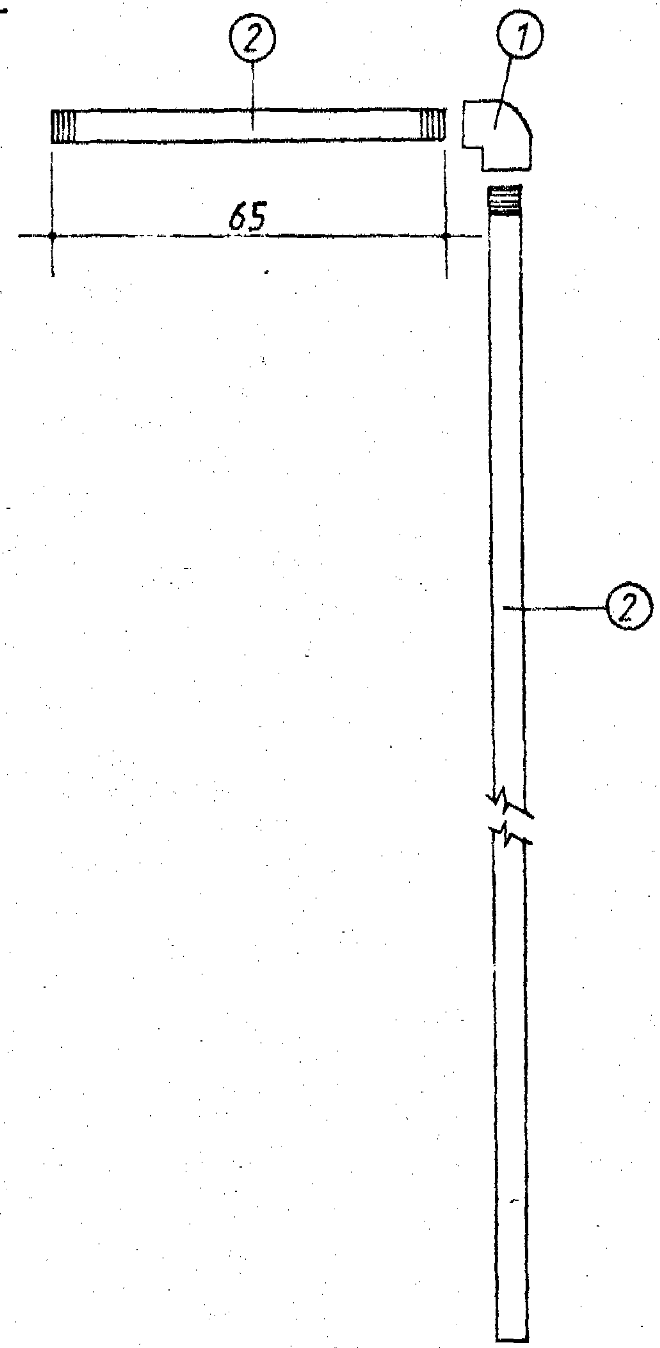


1. INLET



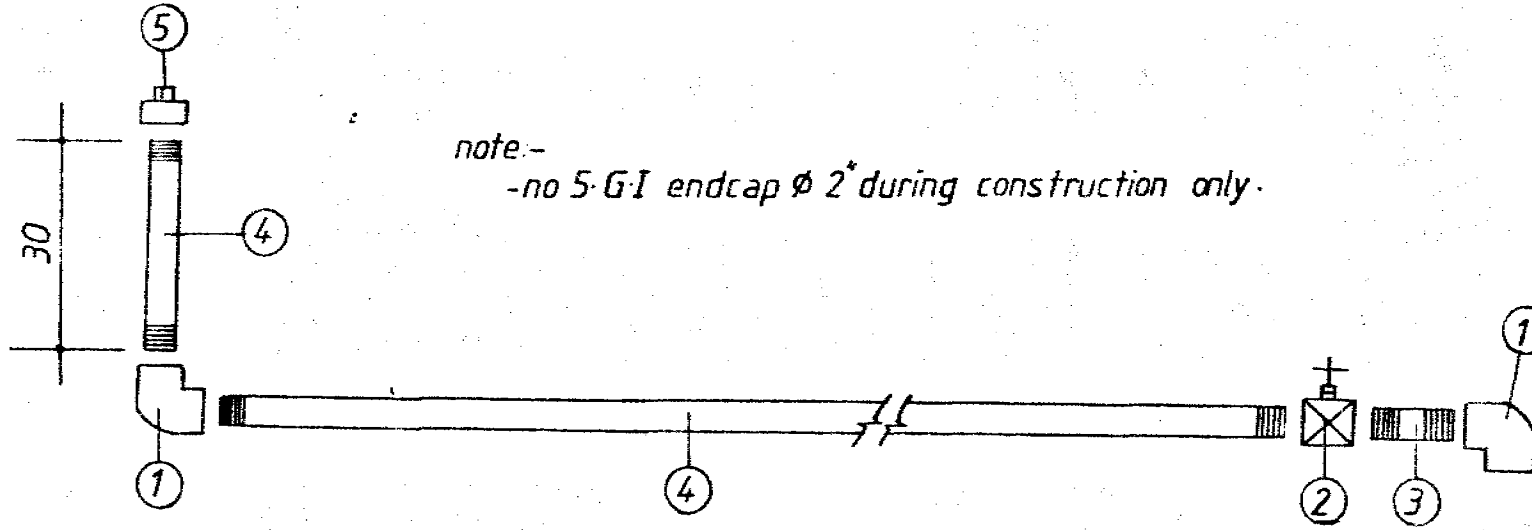
NO	FITTINGS REQUIRED	TANK CAPACITY			
		$2{\cdot}5m^3$	$5m^3$	$10m^3$	$20m^3$
1	FLANGE SET	1 PC	1 PC	1 PC	1PC
2	G·I ELBOW ø 2"	3 PC	3 PC	3 PC	3 PC
3	G I PIPE ø 2"	2·85m	2·85m	3·00m	3·20m

2. OVERFLOW



NO	FITTINGS REQUIRED	TANK CAPACITY			
		$2.5m^3$	$5m^3$	$10m^3$	$20m^3$
1	G.I ELBOW ø 2"	1PC	1PC	1PC	1PC
2	G I PIPE ø 2"	2.30m	2.30m	2.45m	2.65m

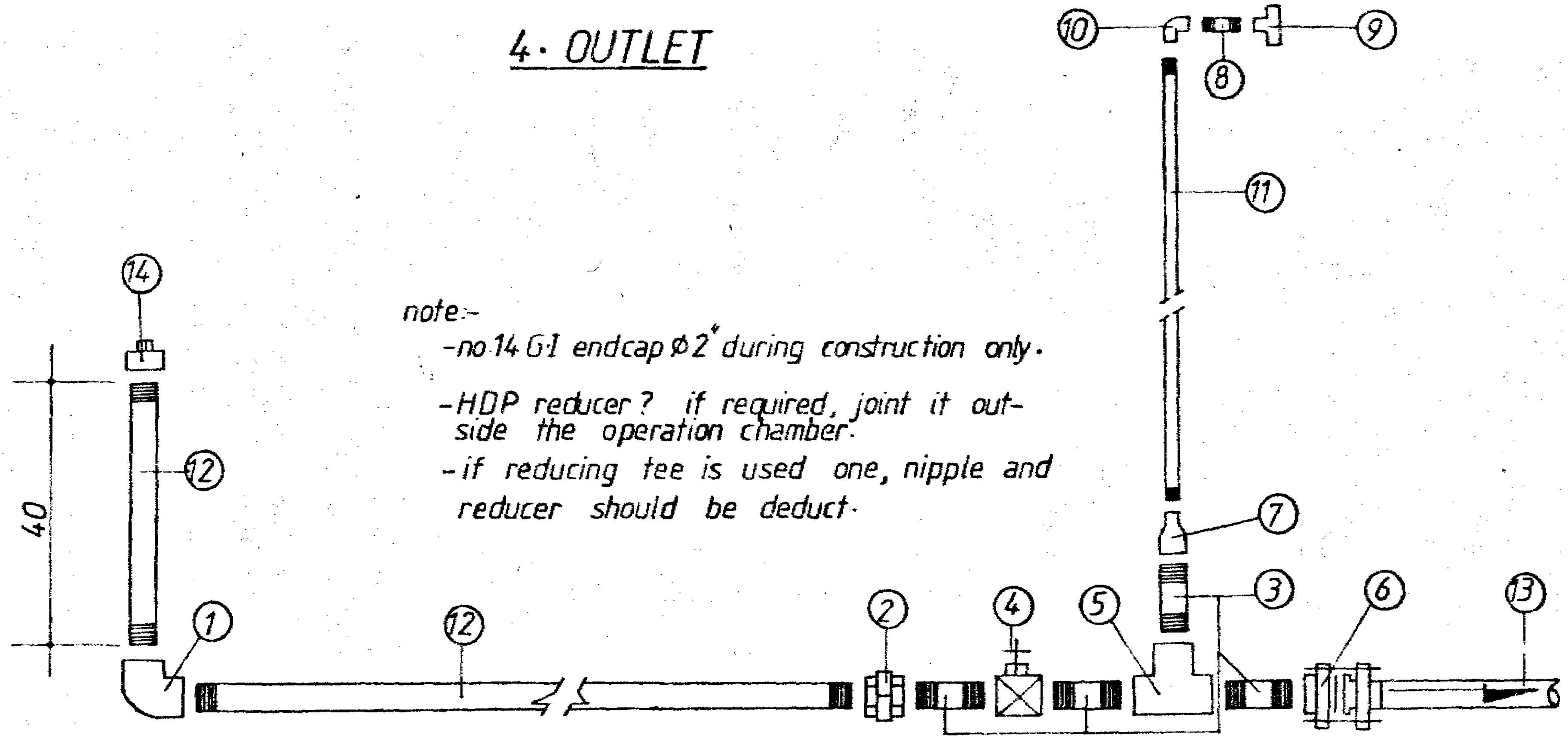
3. CLEANING OUT



note:-
-no 5 G.I endcap Ø 2" during construction only.

NO	FITTINGS REQUIRED	TANK CAPACITY			
		$2.5m^3$	$5m^3$	$10m^3$	$20m^3$
1	G.I ELBOW Ø 2"	2PC	2PC	2PC	2PC
2	GATE VALVE Ø 2"	1PC	1PC	1PC	1PC
3	G.I NIPPLE Ø 2"	1PC	1PC	1PC	1PC
4	G.I PIPE Ø 2"	1.60m	1.90m	2.30m	2.80m

4· OUTLET

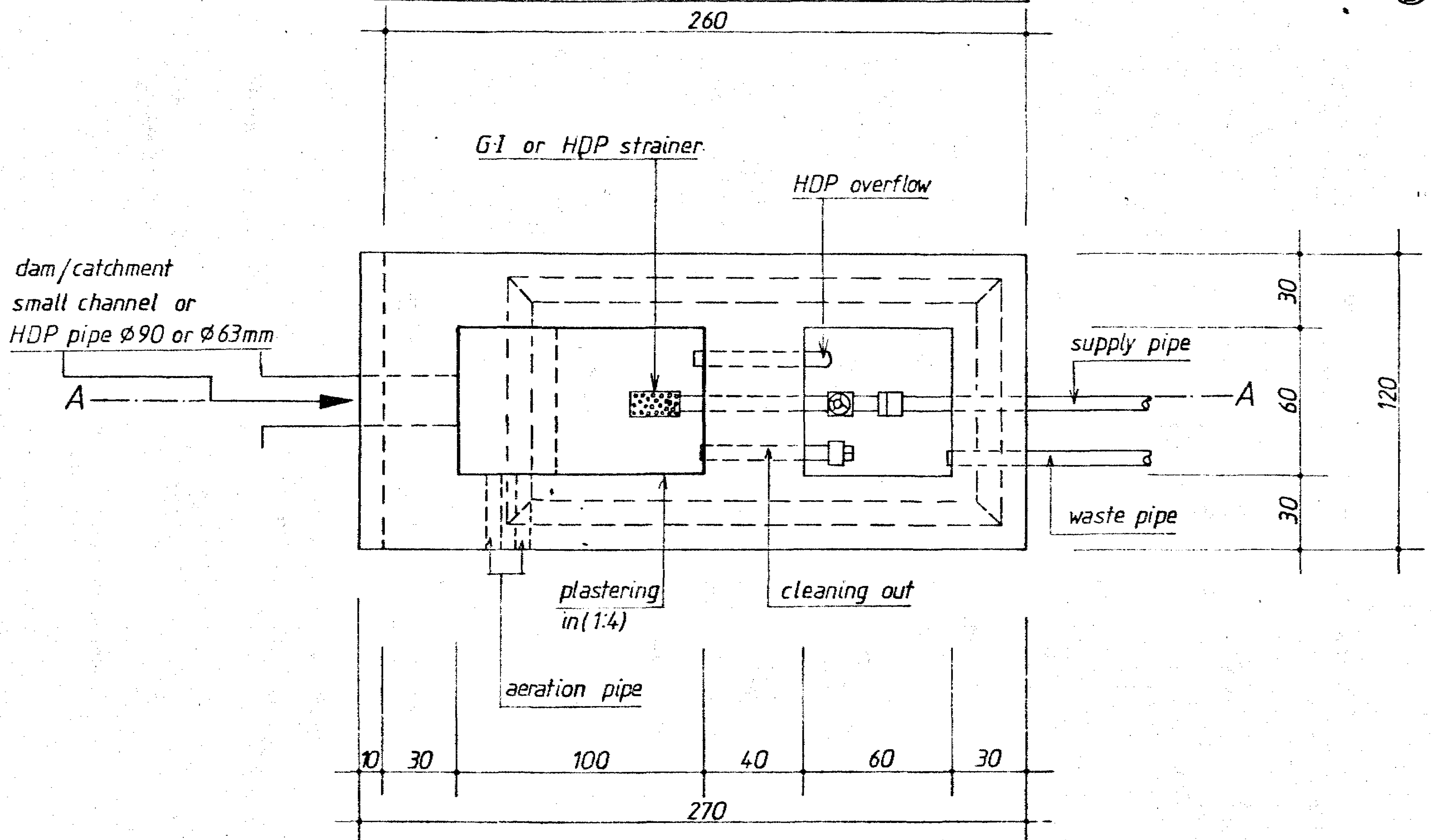


note:-
- no 14 G·I endcap ø 2" during construction only.
- HDP reducer? if required, joint it outside the operation chamber.
- if reducing tee is used one, nipple and reducer should be deduct.

NO·	FITTINGS REQUIRED	TANK CAPACITY			
		2·5m3	5m3	10m3	20m3
1	G·I ELBOW ø 2"	1PC	1PC	1PC	1PC
2	G·I UNION ø 2"	1PC	1PC	1PC	1PC
3	G·I NIPPLE ø2"	4PC	4PC	4PC	4PC
4	GATE VALVE ø2"	1PC	1PC	1PC	1PC
5	G·I TEE ø 2"/REDUCING TEE ø 2"-1/2"	1PC	1PC	1PC	1PC
6	FLANGE SET ø 63mm	1SET	1SET	1SET	1SET

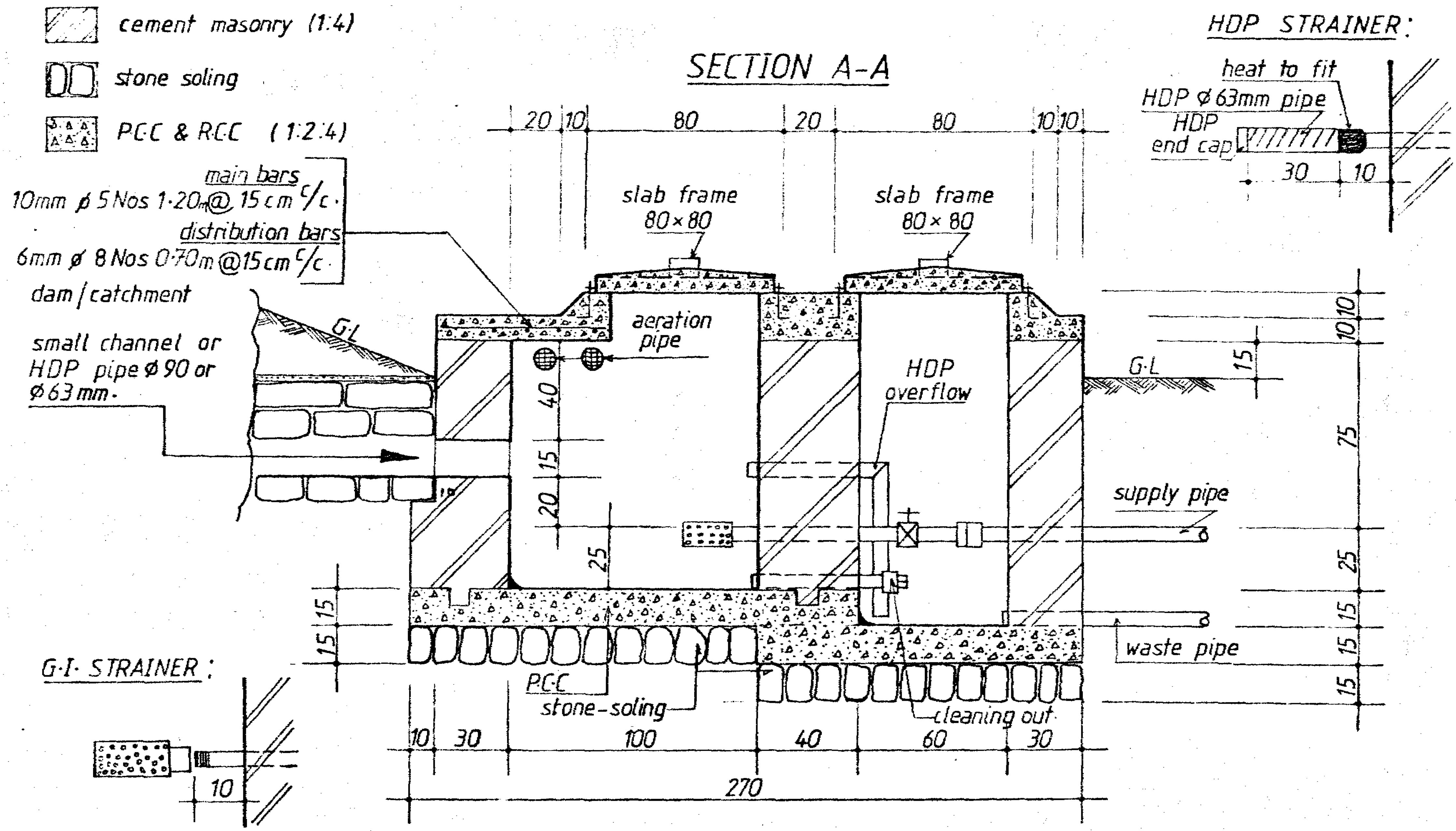
NO·	FITTINGS REQUIRED	TANK CAPACITY			
		2·5m3	5m3	10m3	20m3
7	G·I REDUCER ø 2"-1/2"	1PC	1PC	1PC	1PC
8	G·I NIPPLE ø 1/2"	1PC	1PC	1PC	1PC
9	G·I TEE ø 1/2"	1PC	1PC	1PC	1PC
10	G·I ELBOW ø 1/2"	1PC	1PC	1PC	1PC
11	G·I PIPE ø 1/2"	1·65m	1·65m	1·80m	2·00m
12	G·I PIPE ø 2"	1·70m	2·00m	2·40m	2·90m

COLLECTION CHAMBER & VALVE CHAMBER



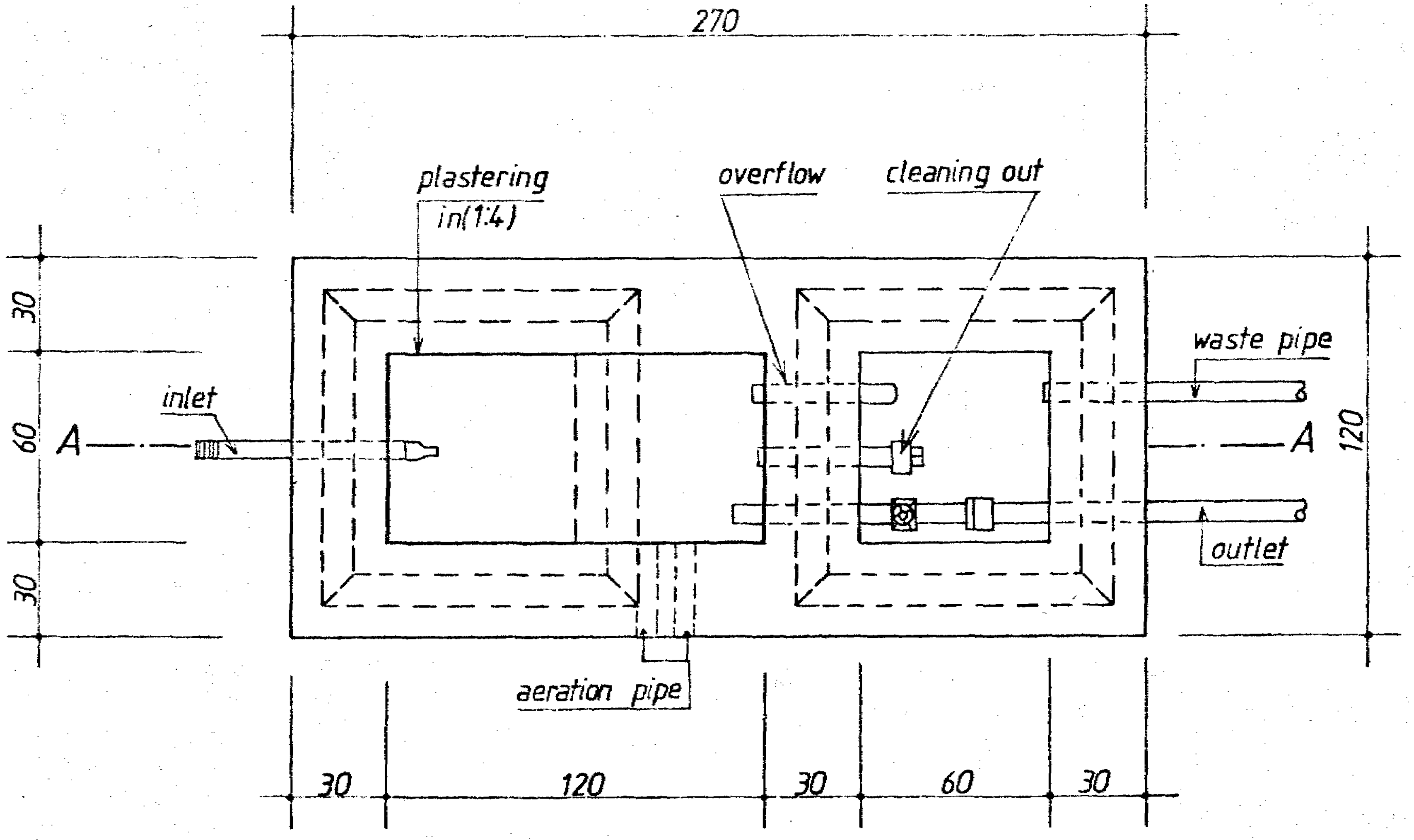
PLAN

COLLECTION CHAMBER & VALVE CHAMBER

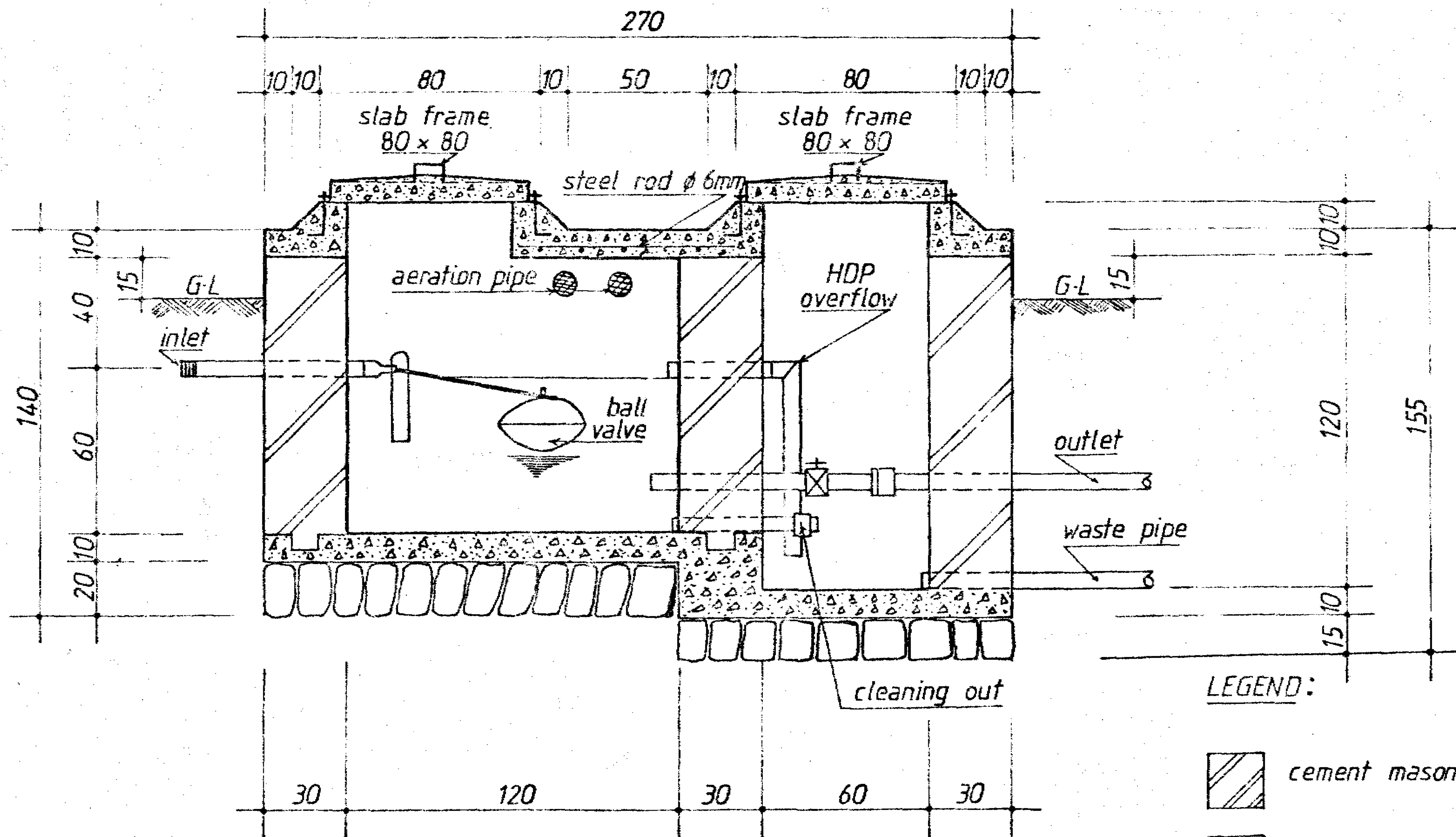


BREAK PRESSURE TANK

PLAN



BREAK PRESSURE TANK SECTION A – A



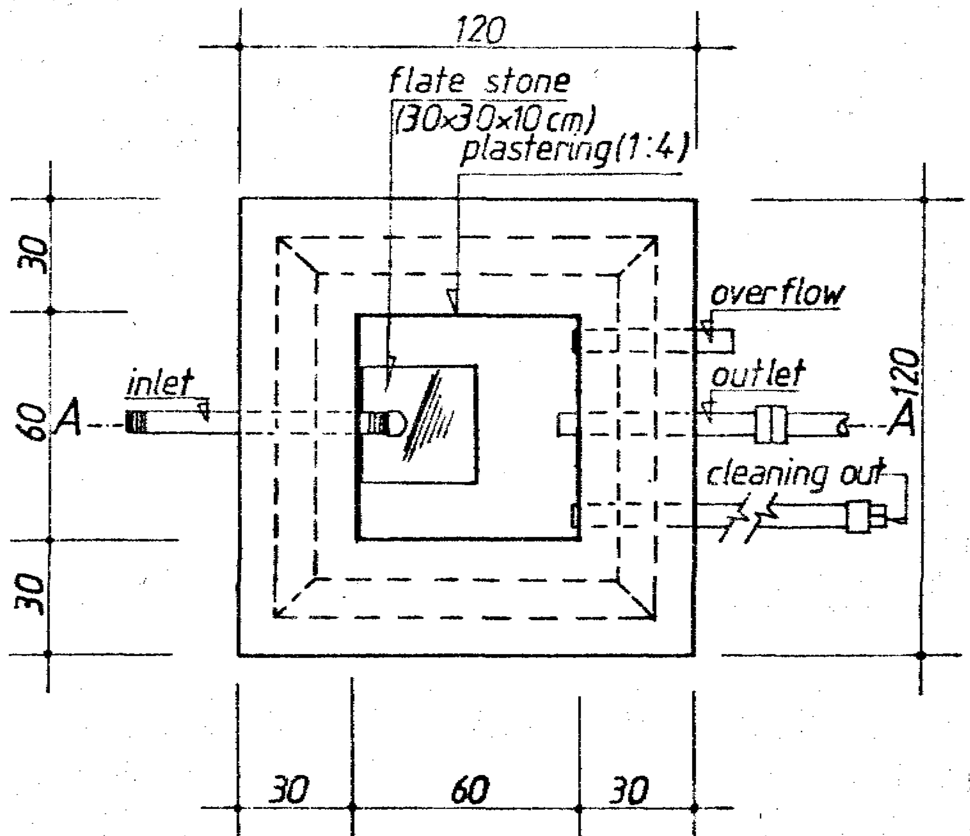
LEGEND:

(hatched)	cement masonry (1:4)
(dotted)	PCC & RCC (1:2:4)
(stones)	soling (hard core)

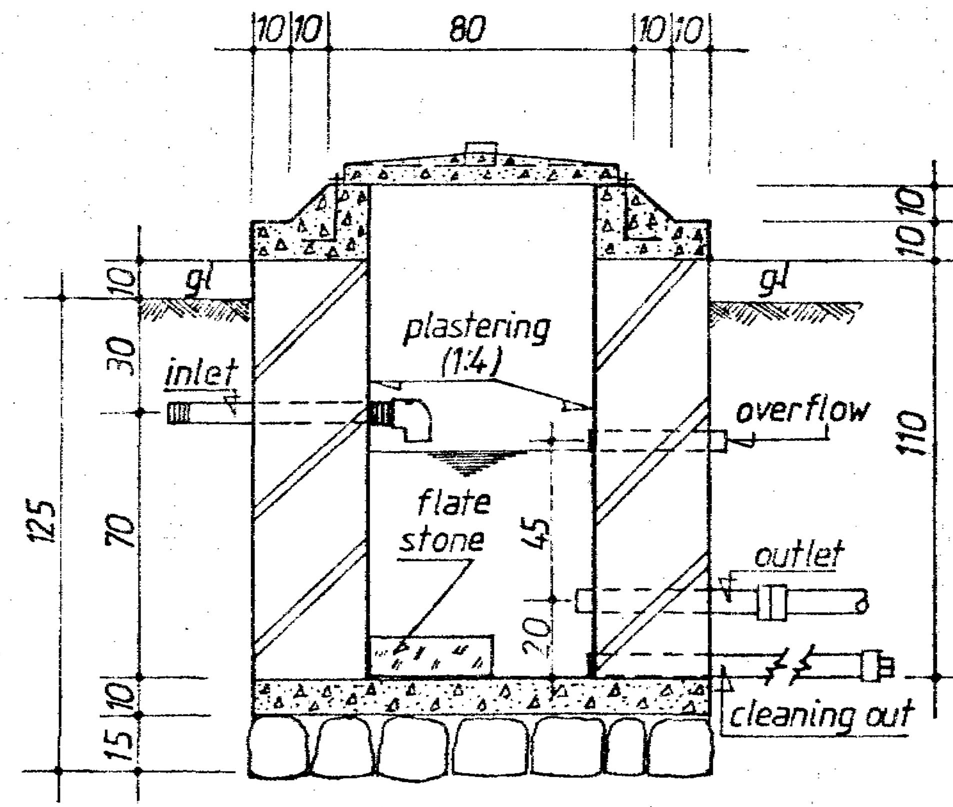
4.5.

INTERRUPTION CHAMBER

PLAN



SECTION A-A

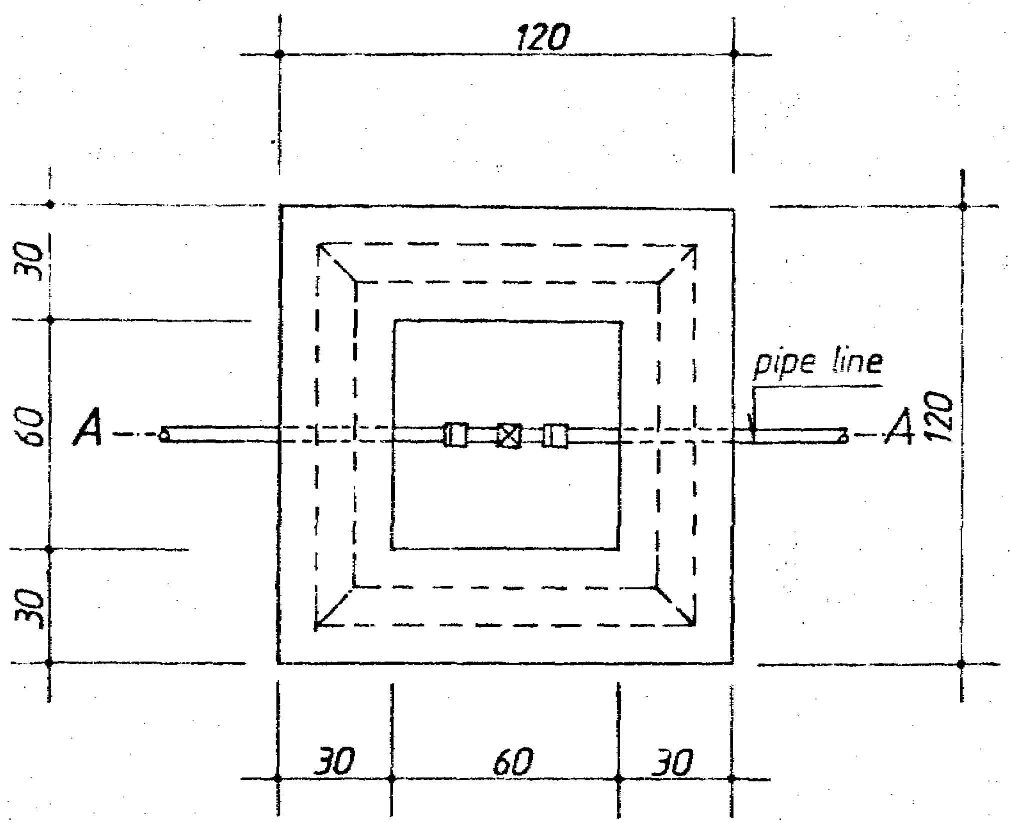


LEGEND:

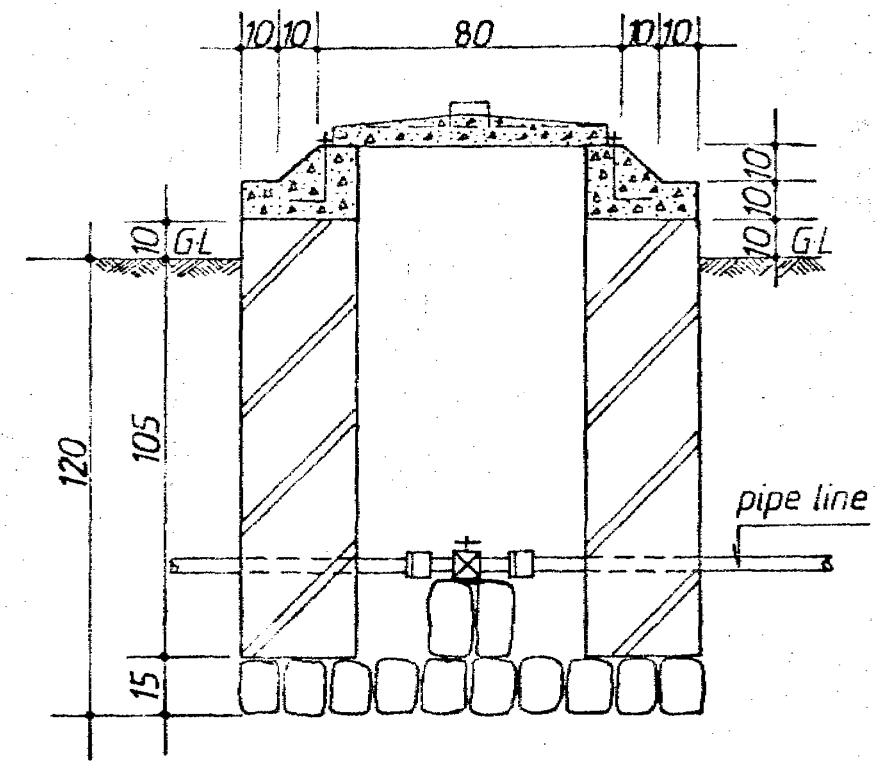
- cement masonry (1:4).
- P.C.C (1:2:4).
- stone soling.

VALVE-CHAMBER

PLAN



SECTION A-A

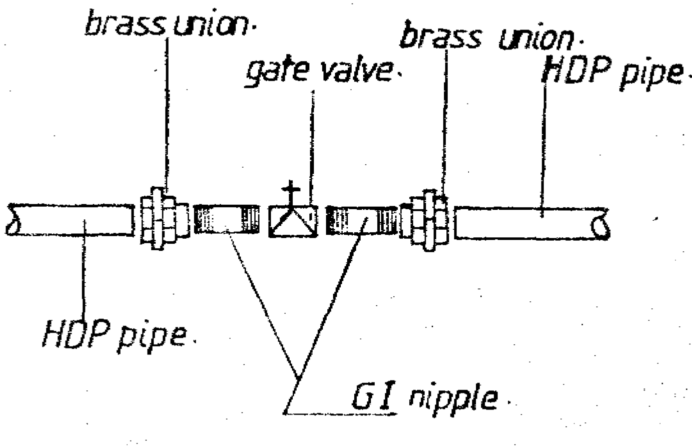


LEGEND:

cement masonry (1:6).

PCC (1:2:4).

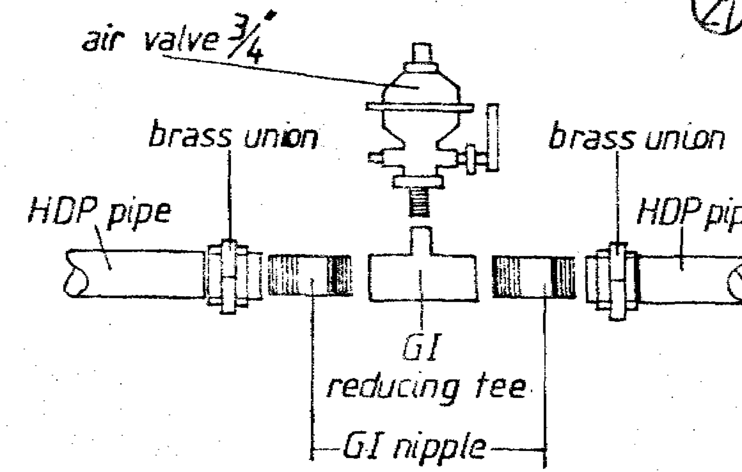
stone soling.



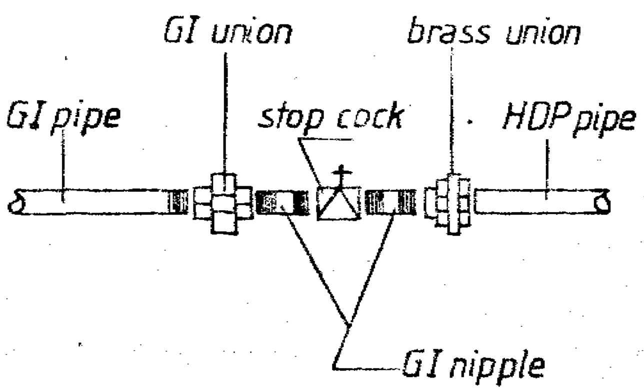
MAIN VALVE

DETAILS:

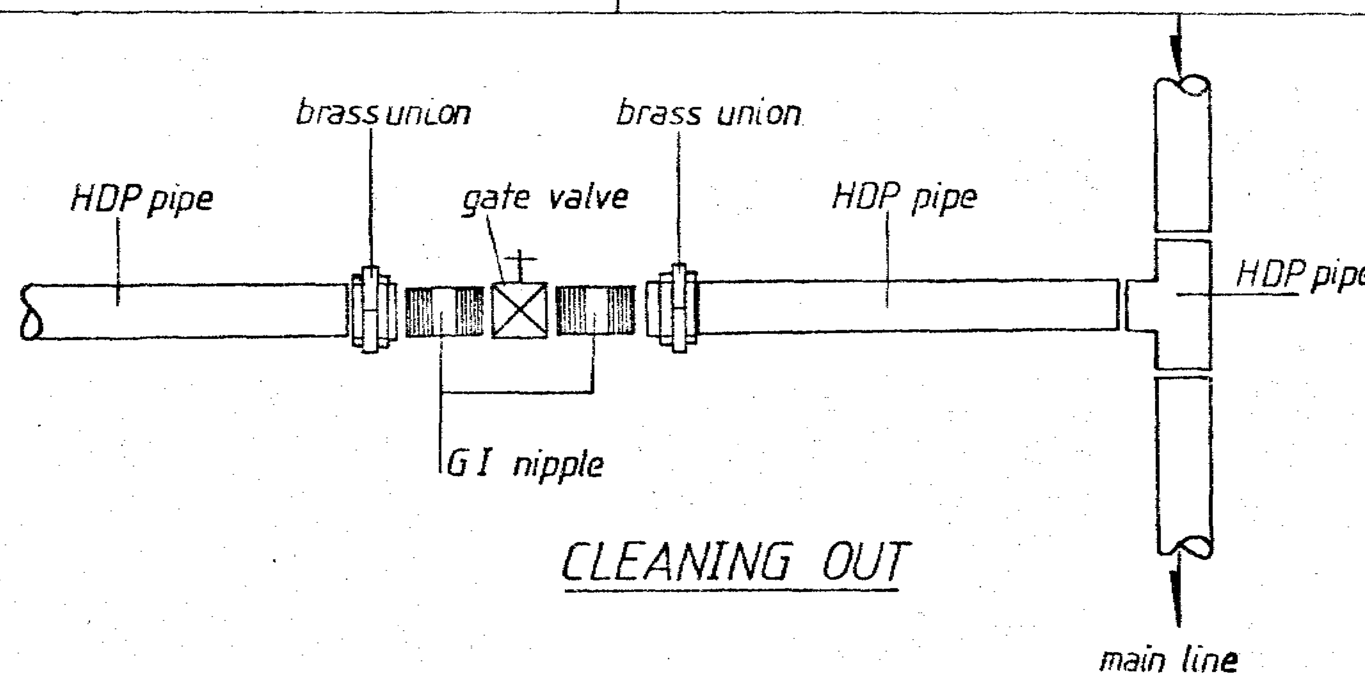
FITTINGS AND VALVES INSIDE THE VALVE - CHAMBER



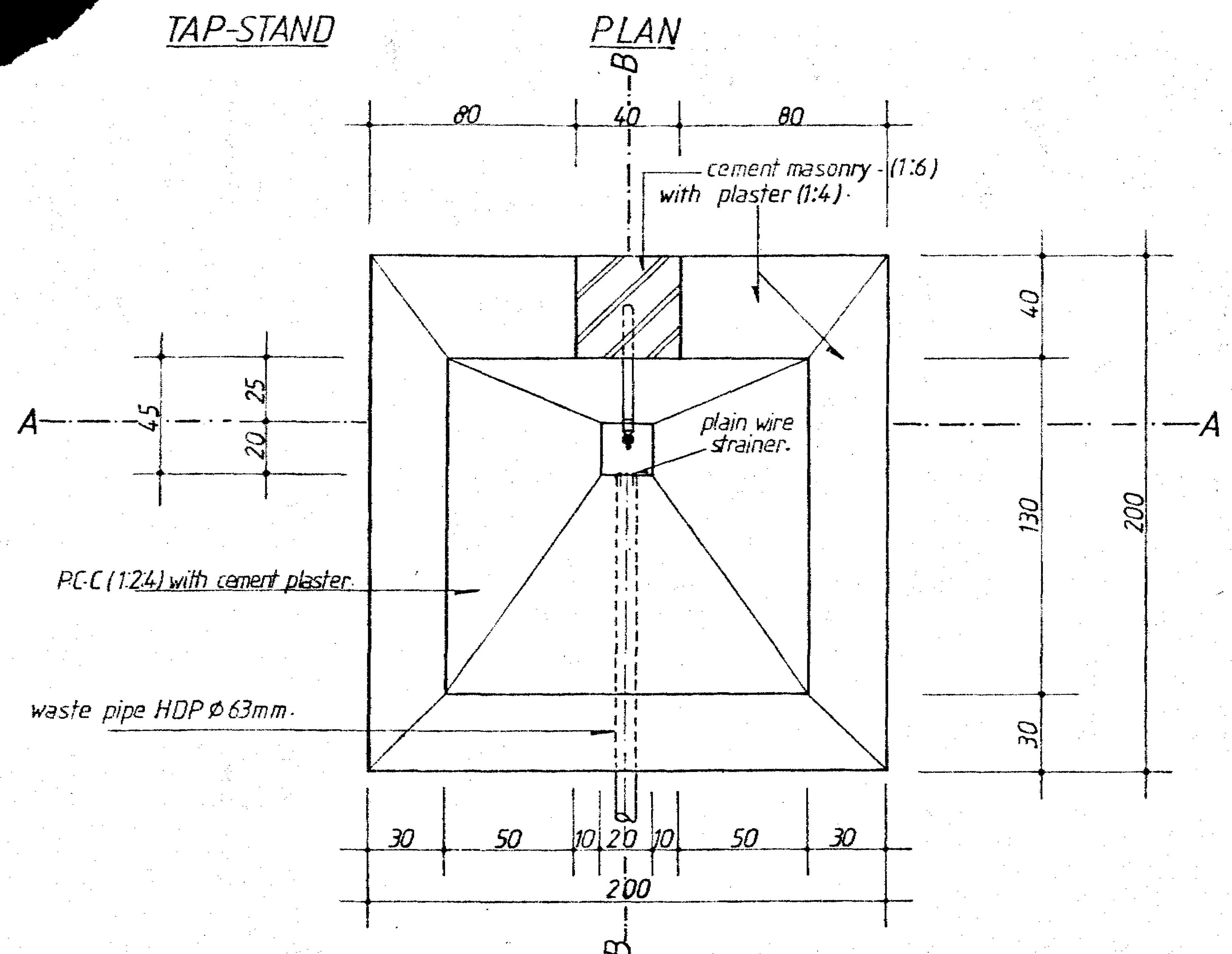
AIR VALVE



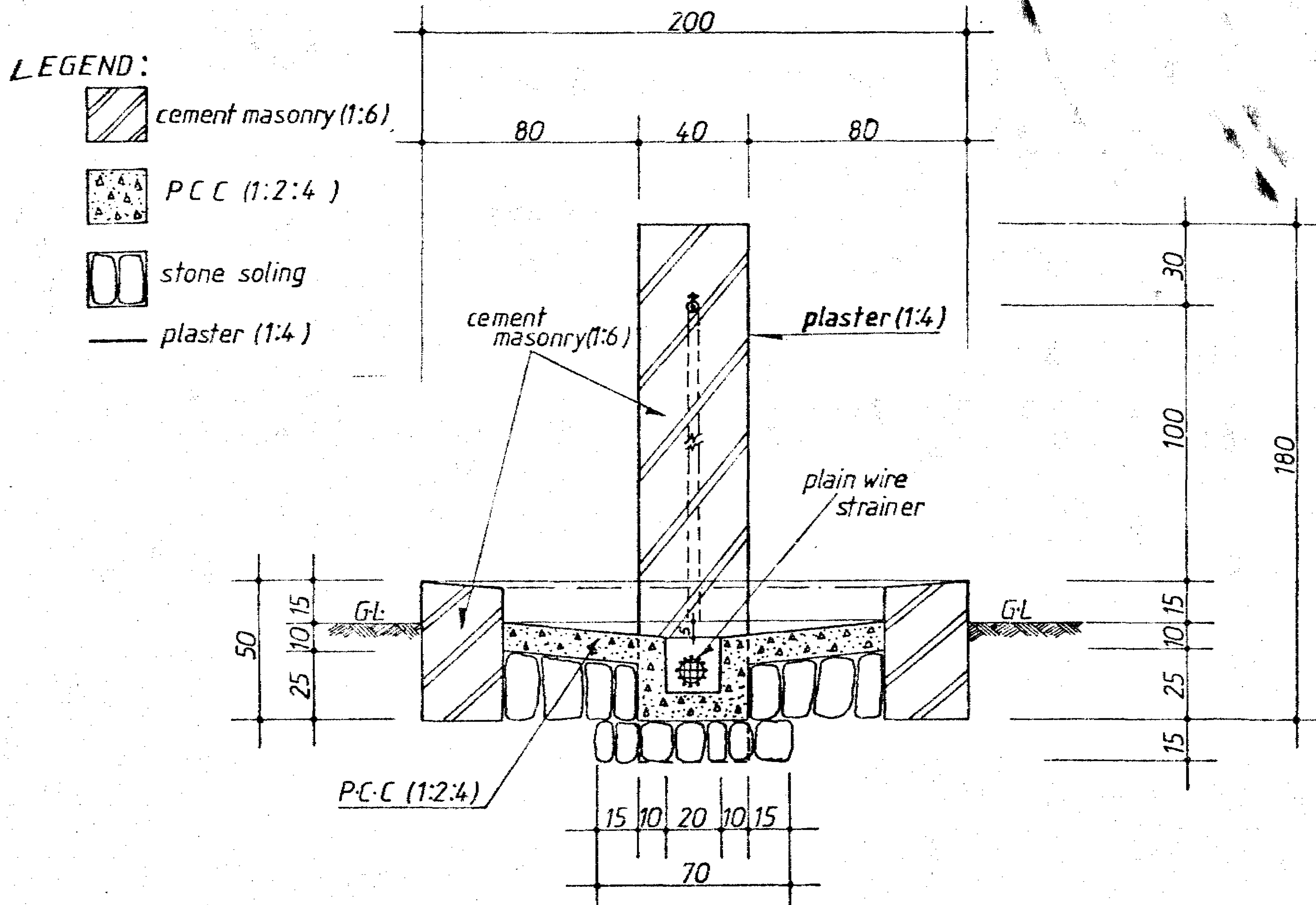
TAP CONNECTION CHAMBER



CLEANING OUT


TAP-STAND
PLAN
cement masonry - (1:6)
with plaster (1:4).
plain wire strainer.
P.C.C (1:2:4) with cement plaster.
waste pipe HDP ⌀ 63mm.
80
40
80
40
130
30
200
45
25
20
30
50
10
20
10
50
30
200
A
A
B
B

TAP-STAND SECTION A-A



TAP-STAND   SECTION B-B