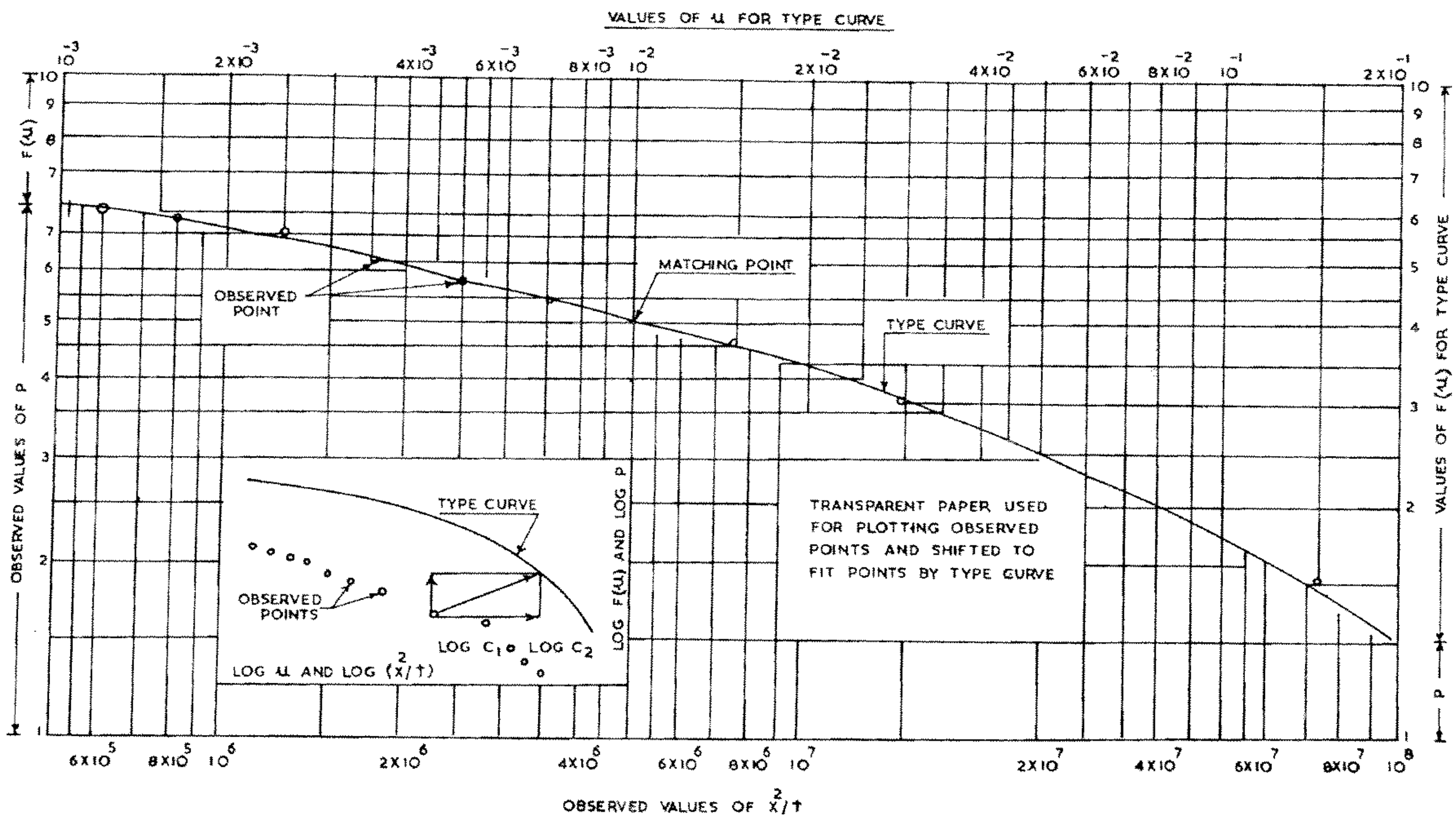
N	N x 10^{-7}	Nx10^{-6}	Nx10^{-5}	Nx10^{-4}	Nx10^{-3}	Nx10^{-2}	Nx10^{-1}	N
10	11	12	13	14	15	16	17	18
1.0	15.54	13.24	10.94	8.6333	6.332	4.038	1.823	2.194x10^{-1}
1.5	15.14	12.83	10.53	8.228	5.927	3.637	1.465	1.000x10^{-1}
2.0	14.85	12.55	10.24	7.094	5.639	3.355	1.223	4.890x10^{-2}
2.5	14.62	12.32	10.02	7.717	5.417	3.137	1.044	2.491x10^{-2}
3.0	14.44	12.14	9.837	7.585	5.235	2.959	0.9057	1.305x10^{-2}
3.5	14.29	11.99	9.683	7.381	5.081	2.810	0.7942	6.970x10^{-3}
4.0	14.15	11.85	9.550	7.247	4.948	2.681	0.7024	3.779x10^{-3}
4.5	14.04	11.73	9.432	7.130	4.831	2.568	0.6253	2.073x10^{-3}
5.0	13.93	11.63	9.326	7.024	4.726	2.468	0.5598	1.148x10^{-3}
5.5	13.84	11.53	9.231	6.929	4.631	2.378	0.5034	6.409x10^{-4}
6.0	13.75	11.45	9.144	6.842	4.545	2.295	0.4544	3.601x10^{-4}
6.5	13.67	11.37	9.064	6.762	4.465	2.220	0.4115	2.034x10^{-4}
7.0	13.60	11.29	8.990	6.688	4.392	2.151	0.3738	1.155x10^{-4}
7.5	13.53	11.22	8.921	6.619	4.323	2.087	0.3403	6.583x10^{-5}
8.0	13.46	11.16	8.856	6.555	4.259	2.027	0.3106	3.767x10^{-5}
8.5	13.40	11.10	8.796	6.494	4.199	1.971	0.2840	2.162x10^{-5}
9.0	13.34	11.04	8.739	6.437	4.142	1.919	0.2602	1.245x10^{-5}
9.5	13.29	10.99	8.685	6.383	4.089	1.870	0.2387	7.185x10^{-5}

APPENDIX 5.5



Type Curve

APPENDIX 5.6
YIELD TESTS FOR WELLS

GENERAL

Pumping tests are made on wells to determine their capacity and other hydraulic characteristics and to obtain information so that permanent pumping equipment can be intelligently selected. Preliminary tests of well drilled as test holes are sometimes made to compare the yielding ability of different water bearing formation or different locations in same formation. This information is then used as a basis for selecting the best site for a supply well and the aquifier in which it should be completed.

MEASUREMENTS

The measurement that should be made in testing wells include the volume of water pumped per minute or per hour, the depth to the static water level before pumping is started, the depth to the pumping level at one or more constant rates of pumpage, the recovery of water level after pumping is stopped and the length of time the well is pumped at each rate during test procedure.

PUMPING PROCEDURE

The pump and power unit used for testing a well should be capable of continuos operation at a constant rate of pumpage for several hours. It is important that the equipment be in good condition for an accurate test, since it is not desirable to have a shut down during the test. If possible, the test pump should be large enough to test the well beyond the capacity at which it will eventually be pumped, but this may not be always practicable under field operations.

In the pumping test, the pump is fixed close to the well and water is pumped out. The quantity of water pumped is measured using a circular orifice meter or a V notch. The water discharging from the V notch chamber should be let away in a channel, so that water pumped out does not find its way back into the well through the soil. As water from the well is pumped out, there will be stage when water level remains fairly constant, without any further increase in drawdown. The pumping rate in this position is the yield from the well for that head of depression or drawdown.

Aquifer performance test results for a typical case are given below:

AQUIFER PERFORMANCE TEST RESULTS

Site I	189.6	-	204.2 m
Site II	213.6	-	246.2 m

Test carried out on 11.2.75 using an air compressor of 7.1 kg/cm^2 capacity; static water level 4.41 m below measuring point which is 0.82 meter above ground level.

Time since pump started (t) min	Time since pump stopped (t') min	t/t'	Drawdown S(m)	Residual drawdown Rd(m)	Yield (m³/min)
1	2	3	4	5	6
1			6.55		
9			12.34		
11			11.81		
12			10.86		
14			12.62		
16			10.54		
18			10.63		
20			10.68		
22			10.78		
24			10.84		
26			10.87		
28			10.77		
30			10.65		
32			10.56		
34			10.45		
36			10.43		
38			10.60		
40			10.66		
42			10.43	240 litres/minute	
44			10.27		
46			10.36		
48			10.61		
50			10.56		

Time since pump started (t) min	Time since pump stopped (t') min	t/t'	Drawdown S(m)	Residual drawdown Rd(m)	Yield (m³/min)
1	2	3	4	5	6
52			10.24		
54			10.22		
56			10.37		
58			10.49		
60			10.26		
62			10.04		
67			10.18		
72			10.49		
77			10.47		
82			10.35		
87			10.30		
92			10.21		
97			10.12		
102			10.83		
117			10.40		
132			10.22		
147			10.04		
162			10.38		
192			10.36		
200			9.99		
202	2	101		5.44	
203	3	67.6		4.41	
204	4	51.0		4.26	
205	5	41.0		4.16	

Time since pump started (t) min	Time since pump stopped (t') min	t/t'	Drawdown S(m)	Residual drawdown Rd(m)	Yield (m^3/min)
1	2	3	4	5	6
206	6	34.3		3.67	
207	7	29.57		3.75	
208	8	26.0		3.65	
209	9	23.2		3.57	
210	10	21.0		3.50	
211	11	19.19		3.43	
212	12	17.66		3.36	
213	13	16.33		3.38	
214	14	15.28		3.30	
215	15	14.33		3.27	
216	16	13.50		3.24	
217	17	12.76		3.23	
218	18	12.11		3.22	
219	19	11.52		---	
220	20	11.0		3.215	
221	21	10.52		3.21	
223	23	9.69		3.20	
224	24	9.33		3.19	
225	25	9.0		3.18	
226	26	8.69		3.17	
227	27	8.47		3.16	
228	28	8.14		3.15	
229	29	7.89		3.14	
230	30	7.66		3.13	

Time since pump started (t) min	Time since pump stopped (t') min	t/t'	Drawdown S(m)	Residual drawdown Rd(m)	Yield (m^3/min)
1	2	3	4	5	6
231	31	7.45		3.13	
232	32	7.25		3.11	
234	34	6.88		3.10	
236	36	6.55		3.09	
238	38	6.26		3.07	
240	40	6.00		3.03	
242	42	5.76		3.01	
244	44	5.54		2.97	
246	46	5.34		2.94	
248	48	5.16		2.90	
250	50	5.00		2.87	
252	52	4.84		2.83	
254	54	4.70		2.80	
256	56	4.57		2.77	
258	58	4.44		2.74	
260	60	4.33		2.70	
262	62	4.22		2.62	
267	67	3.98		2.61	
272	72	3.77		2.54	
277	77	3.59		2.47	
282	82	3.43		2.41	
287	87	3.29		2.36	
292	92	3.17		2.26	
297	97	3.06		2.19	

Time since pump started (t) min	Time since pump stopped (t') min	t/t'	Drawdown S(m)	Residual drawdown Rd(m)	Yield (m^3/min)
1	2	3	4	5	6
302	102	2.96		2.17	
307	107	2.86		2.10	
312	112	2.78		2.01	
322	122	2.63		1.88	
332	132	2.51		1.76	
342	142	2.40		1.70	
352	152	2.31		1.48	
362	162	2.24		1.35	
372	172	2.16		1.17	
382	182	2.09		1.05	
392	192	2.04		0.90	
402	202	1.99		0.78	
422	222	1.90		0.58	
442	242	1.82		0.45	
462	262	1.76		0.36	
482	282	1.70		0.29	
492	292	1.68		0.25	
512	312	1.64		0.21	
542	342	1.58		0.16	
572	372	1.53		0.12	
602	402	1.49		0.10	
632	432	1.46		0.08	
662	462	1.43		0.07	
692	492	1.40		0.06	

Time since pump started (t) min	Time since pump stopped (t') min	t/t'	Drawdown S(m)	Residual drawdown Rd(m)	Yield (m^3/min)
1	2	3	4	5	6
722	522	1.38		0.05	
752	552	1.36		0.05	
782	582	1.34		0.04	
812	612	1.32		0.04	
1402	1202	1.16		0.004	
1462	1262	1.15		---	

Using the recovery formula;

$T = 264Q/\Delta s$

Where,

Q is the discharge from the aquifer m^3 per minute under given condition of test and Δs is the residual drawdown between two values of t/t' which are one log cycle apart.

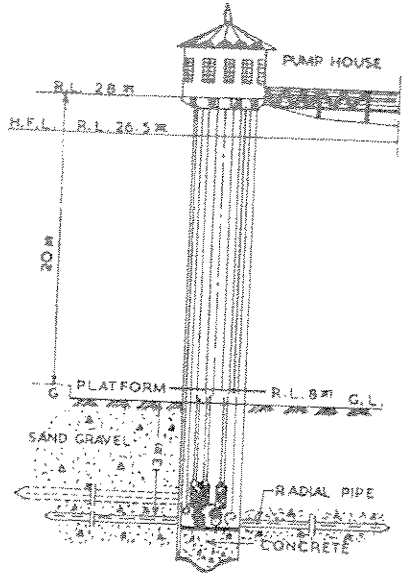
By plotting t/t' along the logarithmic scale and residual drawdown Rd along the arithmetic scale in a semi-log co-ordinate paper, the value of Δs is obtained from the graph which is 0.98.

$T = 264 \times 0.240/0.98$ cubic meters/meter/day

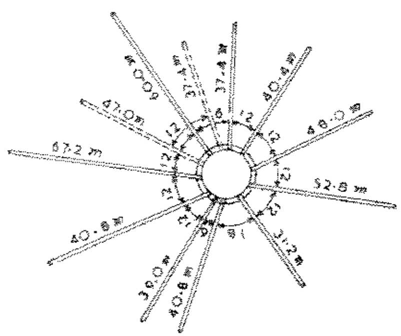
or $T = 0.0449$ cubic meters/meter/minute.

It may be noted that the t/t' plotted against residual drawdown Rd in a semi-log co-ordinate paper, in this particular case, give a very steep straight line plot so that the value of Rd works out 0.98. The high value of residual drawdown is indicative of poor recharge into the well. This was obviously due to the fact that sand nearly 4 % by volume was pumped out as the air compressor continued to lift out water. It is apparent that the strainers were filled with sand and so was the well assembly. Therefore, the test results have to be viewed with a great degree of reservation as far as the true character of the aquifer is concerned.

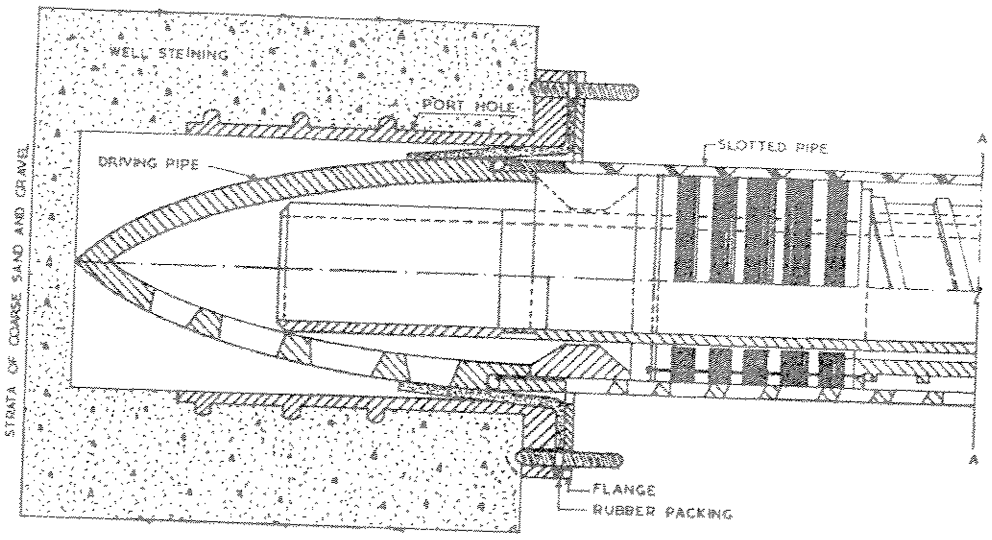
APPENDIX 5.7

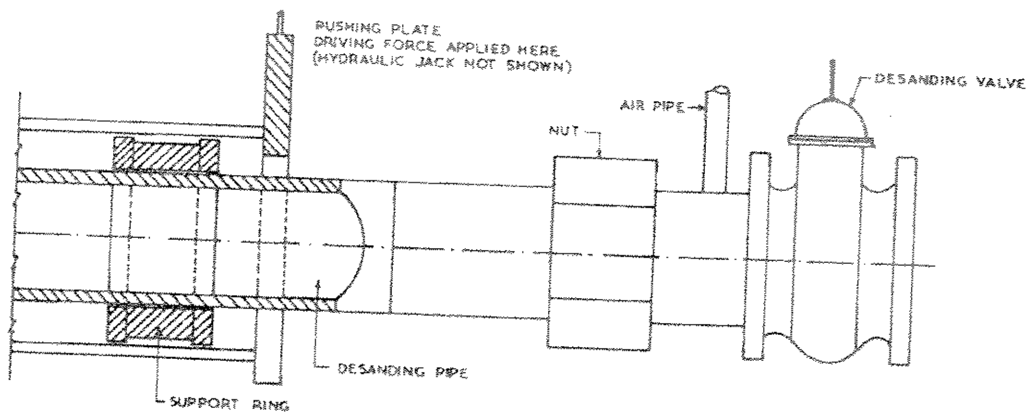


SECTIONAL ELEVATION



PLAN OF RADIALS





ARRANGEMENT FOR DRIVING HORIZONTAL SLOTTED PIPE

RADIAL COLLECTOR WELL

APPENDIX 5.8

DISINFECTION OF NEW OR RENOVATED WELLS,TUBEWELLS AND PIPELINES

DISINFECTION OF WELLS

New wells as well as those after repairs have to be disinfected by heavy doses of chlorine. The doses applied are generally of the order of 40 to 50 mg/l of available chlorine and bleaching powder is usually employed.

DUG WELLS

1. After the casing or lining is completed, the procedure outlined below may be carried out before the cover platform is placed over the well:
   (i) Remove all equipment and materials including tools, platforms etc. , which do not form a permanent part of the completed structure
   (ii) Wash the interior walls of the casing or lining with a strong solution of the bleaching powder (50 mg/l chlorine) using a steel broom or brush to ensure thorough cleaning
   (iii) Pump the water from the well until it is perfectly clear and remove the pumping equipment that was temporarily set up for this purpose .

2. Place the cover over the well and pour the required amount of bleaching powder solution in to the well through the manhole or pipe opening just prior to inserting the pump cylinder and drop-pipe assembly. The bleaching powder added should give a dose of 50 mg/l. of chlorine in the volume of water in the well. Care should be taken to distribute the chlorine solution over as much of the surface of the water as possible to obtain proper mixing of the chemical with well water, which may be facilitated by running the solution into the well through a hose or pipeline as the line is being alternatively lowered and raised.
3. Wash the exterior surface of the pump cylinder and drop pipe with bleaching powder solution giving 50 mg/l of chlorine when the assembly is being lowered into the well.
4. Allow the chlorine solution to remain in the well for not less than 24 hours.
5. After 24 hours or more have elapsed , the well should be flushed by pumping the water to waste, till the residual chlorine is brought to 1mg/l.

TUBEWELLS

1. When the well is tested for yield ,the test pump should be operated until the well water is as clean and free from turbidity as possible.
2. After the testing equipment has been removed, pour the required amount of bleaching solution into the well slowly just prior to installing the permanent pumping equipment. The

dose of chlorine should be maintained at 50mg/l. Mixing of the chemical with well water may be facilitated by running the solution into the well through a hose or pipeline as the line is being alternatively raised and lowered.

3. Wash the exterior surface of the pump cylinder and drop pipe with bleaching powder solution before positioning
4. Allow the chlorine solution to remain in the well for not less than 24 hours
5. After 24 hours or more have elapsed, the well should be flushed by pumping the water to waste till a residual of 1 mg/l of chlorine is obtained. In the case of deep wells having a high water level, it may be necessary to resort to special methods of introducing the disinfecting agent in to the well so as to ensure proper mixing of chlorine throughout the well .

Similar procedure is adopted when troubles due to iron bacteria are noticed in the tube wells particularly when they come out as stringy masses along with the water.

DISINFECTION OF PIPELINES

When a section of water main is laid or repaired it is impossible to avoid contaminating the inner surface with dirt, mud or water in the trench while the pipes are being fixed into place. Contamination may also occur by accident, negligence or malice; adequate surveillance during working hours and the plugging of open ends after the day's work will reduce these risks. It should be assumed however that the pipe is contaminated despite all the precautions taken to prevent the entry of foreign matter. Secondly the main must be disinfected before it is put into service.

To obtain good results from disinfection and to avoid the hazards of subsequent obstructions and damage to valves, all foreign objects and material should be removed before hand by swabbing and flushing to clean the pipeline. Packing and jointing material should be cleaned and disinfected immediately before use by immersion in a 50 mg/l of chlorine solution for at least 30 minutes.

The presence of hydrants, air valves, gate valves and other openings in and around the section to be disinfected facilitate the injection and extraction of water for flushing and disinfection. Recently developed plastic foam swabs are also useful in the disinfection of mains. As they are displaced by water pressure, these swabs wipe clean the inner surface of the pipe. They can isolate the section to be disinfected from the rest of the main and prevent the loss of the disinfected solution.

Chlorine compounds are the most commonly used disinfectants for water mains. Strength of the disinfecting solution should be much higher than that normally used for water chlorination.Under normal conditions a strength of 10 mg/l is recommended for a contact period of 12-24 hours. Application for 24 hours is necessary when the chlorine has to penetrate through organic matter coating the inner surface. In emergencies, when it is not possible to leave the section of the main out of service for a long time, the period of contact can be shortened by proportionately increasing the strength of the solution. Thus for a contact period of 1 hour the strength of solution varies between 120 and 240 mg/l. When strong solutions are used particular attention should be paid to thorough removal from the main after completion of disinfection as illness and discomfort may result from using highly chlorinated water and the corrosive action of the chlorine may damage pipes, valves, hydrants and house hold plumbing and fixtures.

PROCEDURE FOR APPLICATION

Chlorine gas may be injected directly under the section of the main by a dry-feed chlorine or supplied with a special gas diffuser or silver tube and attached to a hydrant or other opening by means of specially plugged valve. After the section has been thoroughly flushed, the entire valve is partly shut to bring water pressure below 1.70 Kg/cm^2.

At the hydrant or opening where the water is discharged, the flow rate is measured to determine the rate at which chlorine gas needs to be delivered. To obtain a concentration of 10 mg/l in the section to be disinfected, the chlorine gas input rate should be 0.9 Kg/24 hours for every litres per second of flow. The valve of the chlorine cylinder is opened and adjusted so that the dial shows the required rate of chlorine flow.

To ensure that the chlorine concentration remains at 10 mg/l throughout the period of contact, the strength of the injected solution should be at least twice as high. A table below shows the amount of disinfectants required for pipes of various diameters in order to provide a chlorine concentration of about 20 mg/l

QUANTITY OF DISINFECTANTS REQUIRED TO PROVIDE CONCENTRATION OF 20 mg/l IN A 100 m PIPE LENGTH

Dia of pipe mm	Quantity in litres in which disinfectant has to be dissolved 10 × litre	Bleaching Powder (25% available chlorine) gm	Calcium Hypochlorite (70% available chlorine) gm	Sodium Hypochlorite (5%available chlorine) litres
75	46	37	13	0.16
100	81	65	23	0.33
150	183	146	53	0.73
200	325	260	92	1.30
250	507	405	145	2.03
300	730	584	210	2.92
400	1298	1040	368	5.20

The volume in litres of the disinfecting solution required for 100 m of pipe can be expressed by $V= 0.08\ d^2$ where d is the diameter of the pipe in mm.

As soon as the odour of chlorine is detected in water discharged from the main, water samples are taken to determine the chlorine content. When chlorine content reaches a value of 20 mg/l at the other end of the section being disinfected, the discharge hydrant is closed and the flow of the water and chlorine gas are stopped. The water is allowed to stand in the main for 12-24 hours and the chlorine content should be ensured to be not less than 10 mg/l at the end of the period. The mains should be thoroughly flushed with treated water until the water is cleared. Samples for bacteriological tests should be taken everyday during the 3 days following disinfection to ascertain that the water is satisfactory in quality.

A similar procedure is used for feeding a mixture of chlorine gas and water by means of a solution feed chlorinator; special rubber hose should be fitted to the plug valve and the silver tube diffuser. A booster pump may be required to provide pressure at least 3 times higher than that in the main, in order to ensure satisfactory injection of the solution.

When calcium hypo-chlorite or chlorinated lime is used for disinfection of a section of a main, the easiest method of application is to inject a strong chlorine solution by means of a portable chlorinator. If the intake valve is kept partly open, a small flow of water can enter the pipe to assist in the dispersion of the chemical. The discharge hydrant or valve is shut off when the odour of chlorine is detected in the water flowing out and the section of the main is allowed to fill. The intake valve is regulated so that the required amount of disinfecting solution is injected before the pipe is completely full.

When there is no chlorinator or pump to inject the disinfection solution, the intake valve is shut off after the flushing operation and the section is allowed to drain dry. Then the discharge hydrant or valve is shut off thus leaving the section to be disinfected, isolated from the rest of the main. The disinfecting solution is slowly poured through a funnel or a hose into an intermediate hydrant, valve or opening made for this purpose until the section is completely filled. Precaution should be taken to allow air trapped in the pipe to escape; where there is no air valve or other orifice by which the air can be released, one or more service connections could be detached or a hole could be drilled in the top of the pipe.

If the section to be disinfected is short, weighed quantities of calcium hypochlorite or chlorinated lime in powder form may be placed at regular intervals inside the pipes while they are fixed into place. When water is introduced later, the powder will mix with it and produce strong solution of chlorine. The disadvantage is that the powder will be flushed to the far end of the section even when water is admitted slowly and no uniform distribution of disinfectant is possible.

While disinfecting solution remains in two pipes, the valves and hydrants in the section of the main should be operated to ensure that all surfaces come into contact with the disinfectant. The valves at either end of the treated section should remain shut during the whole period of contact to prevent the loss of disinfecting solution.

APPENDIX 6.4

HYDROSTATIC TEST PRESSURES FOR PIPES

S No.	Pipe IS: No.	Usual dia in mm	Class	Test Pressure at works		Maximum working pressure at Field	
				Kg/cm² = 10 m of water	Period in second.	Kg/cm²	Period
1	2	3	4	5	6	7	8
1	Spun Iron pipe IS:1536-1989 & 3114-1985	80,100,125, 150-50-500, 600,700,750, 800,900,1000, 1050	LA A B	35 35 35	15 20 25	12 18 24	
2	Cast iron pipe IS:1537-1976	80,100,125, 150-50-500, 600,700,750, 800-100-1200, 1500	A-dia(mm) Upto 600 600-1000 1000-1500 B-dia(mm) Upto 600 600-1000 1000-1500	20 15 10 25 25 20 15		Not less than two-thirds of the works test pressure maintained for the field test pressures are less, the period of test should be atleast 24 hours, the test pressure being gradually raised at the rate of 1 kg/cm²/min	
3	A.C Pressure Pipes IS: 1592-1980	50,65,80,100, 125, 150-50-500, 600	5 10 15 20 25	5 10 15 20 25	30 30 30 30 30	Maximum working pressure will be half the test pressure in each case	
4	R.C Pipes IS: 458-1988	80,100,150, 250-50-500-100-1200	P_1	2		For use on gravity mains only-working pressure not to exceed two-third of test pressure.	
	R.C. Pipes (Cont.)	80,100,150, 250-50--500-600, 700, 800, 900, 1000,	P_2	4		For use in pumping mains working pressure not to exceed half the test pressure	
		80,100,150,250, 300,350,400,500	P_3	6			

		600,700,800,		
5.	Steel cylinder R.C Pipes IS:1916-1963	200-50-500, 600,700,900 1100,1200-200-1800	1 2 3 4 5 Spl.	5 10 15 20 25
6	Prestressed concrete Pipes IS: 784-1978	80,100,125,150-50-500-100-1200-200-1800		1.5 times design pressure
7	Electrically Welded steel pipes IS : 3589-1987	200-2000	1 2 3 Spl.	15 20 25
8	M.S Tubes : 1239 (Part I) 1982	6-100 6-150 6-150	Light Medium Heavy	50 50 50

APPENDIX 6.5

DESIGN FOR ECONOMIC SIZE OF PUMPING MAIN

PROBLEM:- Design an economic size of pumping main, given the following data:

1)	Water requirements	Year	Discharge
	Initial	1989	5 MLD
	Intermediate	2004	7.5 MLD
	Ultimate	2019	10 MLD
2)	Length of pumping main	7000m	
3)	Static head for pump	50m	
4)	Design period	30 years	
5)	Combined efficiency of pumping set	60%	
6)	Cost of pumping unit	Rs. 2000 per kw	
7)	Interest rate	10 %	
8)	Life of electric motor and pump	15 years	
9)	Energy charges	Rs. 1 per unit	
10)	Design value of 'C' for C.I. pipes	100	

Solution		1st 15 years	2nd 15 years
1	Discharge at installation	5 MLD	7.5 MLD
2	Discharge at the end 15 years	7.5 MLD	10.0 MLD
3	Average discharge	5+7.5/2 =6.25 MLD	7.5+10.0/2 =8.75MLD
4	Hours of pumping for discharge at the end of 15 years	23	23
5	Average hours of pumping for average discharge	(23/7.5)× 6.25 = 19.17	(23/10)×8.75 =20.12

6. K.W required at 60% combined efficiency of pumping set

$$\frac{7.5\times10^{6}\times H_{1}\times100\times24}{60\times60\times24\times102\times60\times23}=KW_{1} \qquad \frac{10\times10^{6}\times H_{2}\times100\times24}{60\times60\times24\times102\times60\times23}=KW_{2}$$

$1.48H_1 = KW_1$ $\qquad$ $1.972H_2 = KW_2$

KW required = $(Q \times H)/102 \times 1/\eta \times 24/X$

Where,

Q = Discharge at the end of 15 years in 1ps

H = Total head in m for dischgarge at the end of 15 years

η = Combined efficiency of pumping set

X = Hours of pumping for discharge at the end of 15 years

7. Annual cost in Rs. of electrical energy @ Rs. 1 per unit (KWX average hours of pumping × average days per year × 1.00)

$= KW_1 \times 19.17 \times 365.24 \times 1.00$

$= 7001.65\ KW_1$

$KW_2 \times 20.12 \times 365.24 \times 1.00$

$= 7348.63 KW_2$

8. Pump Cost Captilised

$P_n = C = P_o (1 + r)^n$

$P_o = C/(1+r)^n$

Where,

P_o = Initial (1989) Capitalised investment

C = Amount needed after 15 years, that is, in 2004 to purchase the second stage Pumping set.

r = Rate of compound interest

= 10% per year

n = No. of years = 15

$P_o = C/(1+0.1)^{15} = C/4.177$

9. Energy Charges Capitalised

$C_c = C_R\ \{(1-(1+r)^{-n})/n\}$

For values n =15 and r =10%

$C_c = 7.606\ C_R$

(C_c) 1st stage = 7.606 (C_R) 1st stage and

(C_c) 2nd stage =7.606 (C_R) 2nd stage

Present (1989) energy charges (C_P) for second stage capitalised value

i.e. for (C_c) 2nd and stage in 2004

$C_p = (C_c)$2nd stage/4.177

10. Table I, II,III show the calculations to arrive the most economical pumping main size for the given data

TABLE I

TABLE SHOWING VELOCITY AND LOSS OF HEAD FOR DIFFERENT PIPE SIZE

Sl. No.	Pipe size in mm	Frictional head loss per 1000m		Velocity in m/s		Total head in 'm' for 7000 m pipe lengths including 50 m of static head					
						1st stage flow			2nd stage flow		
		1st stage flow of 7.5 MLD	2nd stage flow of 10 MLD	1st stage flow of 7.5 MLD	2nd stage flow of 10 MLD	Frictional loss m	Other losses	Total	Frictional loss m	Other losses	Total
1	2	3	4	5	6	7	8	9	10	11	12
1	300	8.00	14.50	1.25	1.68	56.00	5.60	111.60 say 115.00	101.50	10.15	161.05 say 165.00
2	350	3.80	6.70	0.88	1.00	26.6	2.66	78.26 say 80.00	46.90	4.69	101.59 say 105.00
3	400	2.00	3.40	0.72	0.87	14.00	1.40	75.40 say 75.00	23.80	2.38	76.18 say 80.00
4	450	1.10	1.95	0.56	0.75	7.70	0.77	58.47 say 60.00	13.65	1.37	65.02 say 65.00
5	500	0.66	1.15	0.45	0.66	4.62	0.46	55.08 say 55.00	8.05	0.80	58.85 say 60.00

2962 UA&E/97—41A

TABLE II

TABLE SHOWING KILOWATTS REQUIRED AND COST OF PUMP SETS FOR DIFFERENT PIPE SIZE

		1st stage flow of 7.5 MLD		2nd stage flow of 10 MLD			
Sl.No.	Pipe size in mm	H_1 total head loss in mm	KW required (rounded to nearest ten including 50% standby	Cost of pump @ Rs. 2000 per KW (Rs. in thousands)	H_2 total head in mm	KW required (rounded to nearest ten including 50% standby	Cost of pump @ Rs. 2000 per KW (Rs. in thousands)
1	2	3	4	5	6	7	
1	300	115	260	520	165	330	660
2	350	80	180	360	105	210	420
3	400	75	170	340	80	160	320
4	450	60	140	280	65	130	260
5	500	55	130	260	60	120	240

Note : Assuming other losses = 10% of frictional loss

2962 UA&E/97—41B