इंटरनेट मानक

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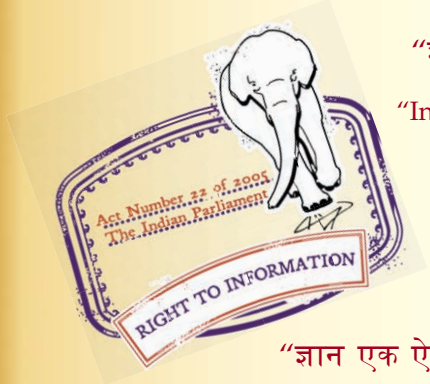
IS 12918 (1990): Guide for Removal of Iron from Water for Rural Drinking Water Supply (Chemical Treatment Method) [CHD 13: Water Quality for Industrial Purposes]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 12918 : 1990
(Reaffirmed 1999)

Indian Standard

GUIDE FOR REMOVAL OF IRON FROM WATER FOR RURAL DRINKING WATER SUPPLY (CHEMICAL TREATMENT METHOD)

भारतीय मानक

ग्रामीण पेय जल पूर्ति के लिए पानी में से लोहा निकालने की मार्गदर्शिका (रसायनिक उपचार पद्धति)

UDC 628·162·1 : 628·1·033 (–202)

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1990

Price Group 2

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards on 30 March 1990, after the draft finalized by the Environmental Protection Sectional Committee had been approved by the Chemical Division Council.

The presence of iron in water is objectionable owing to production of discoloration, turbidity, deposit and taste. Iron bearing water has an astringent, metallic or bitter taste.

Provision of water treatment plant for rural areas and isolated small and medium size colonies posses certain problems, on account of small quantity of water required, difficulty for site execution adopting usual courses of tendering, supervision, etc. In order to make available, clean water, to such rural population a water treatment method, simple to operate is needed.

Indian Standard

GUIDE FOR REMOVAL OF IRON FROM WATER FOR RURAL DRINKING WATER SUPPLY (CHEMICAL TREATMENT METHOD)

1 SCOPE

1.1 This standard prescribes guidelines for removal of iron by chemical treatment method from water for rural drinking water supply, dependent on hand pumps.

2 REFERENCES

2.1 The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.1 For the purpose of this standard, definitions given in IS 7022 (Part 1) : 1973 and IS 7022 (Part 2) : 1979 shall apply.

4 METHODS OF TREATMENT

4.1 The principle by which iron is removed from water consists substantially of its precipitation by oxidation and removal of free carbon dioxide by aeration, followed by separation of the suspension by sedimentation and/or filtration. Aeration may suffice for the preliminary precipitation but, when the amounts of free carbon dioxide and iron are high or relatively soluble and complex compounds of iron are present, the addition of chemicals is necessary. Sedimentation tanks, for removal of the bulk of the precipitates prior to filtration, are usually required when the amount of iron in the water is high. Iron removal attachable hand pump is desirable when raw water iron (Fe^{++}) exceeds 1 mg/l. Aeration, sedimentation and filtration is normally effective up to 20 mg/l.

5 DESIGN CONSIDERATIONS

5.1 The water treatment plants are designed to contain aeration, settling and filtration to remove iron and turbidity. The rural water supply is effected generally by means of hand pumps and power pumps. So the plant intended to serve such population should have the required ranges to suit its needs.

5.2 Hand Operated Aeration/Filtration Unit

In this process the raw water is passed over a series of coke-marble/calcite beds and then filtered through sand filters. In this method, after sometimes a catalytic oxidation bed is formed which facilitates the removal process. The unit can be worked by an elevated hand pump. Raw water containing 1 to 6 mg/l of Fe^{+2} and 0·1 to 0·3 mg/l of Mn^{+4} can be treated by this method at the rate of 200 litres per hour. A schematic sketch of the process is given in Fig. 1.

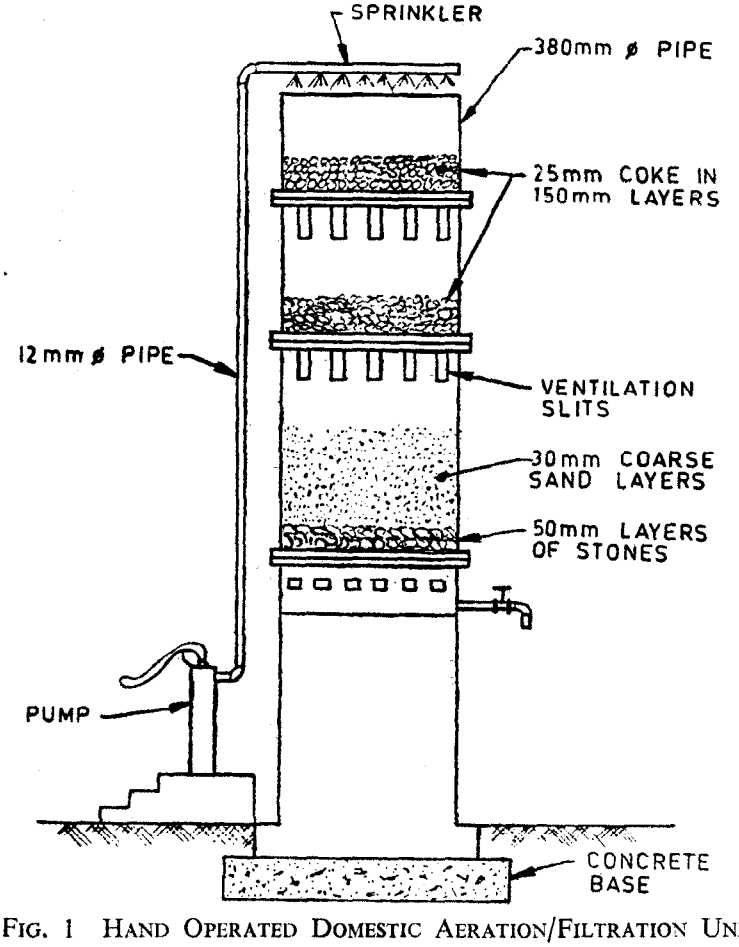


FIG. 1 HAND OPERATED DOMESTIC AERATION/FILTRATION UNIT

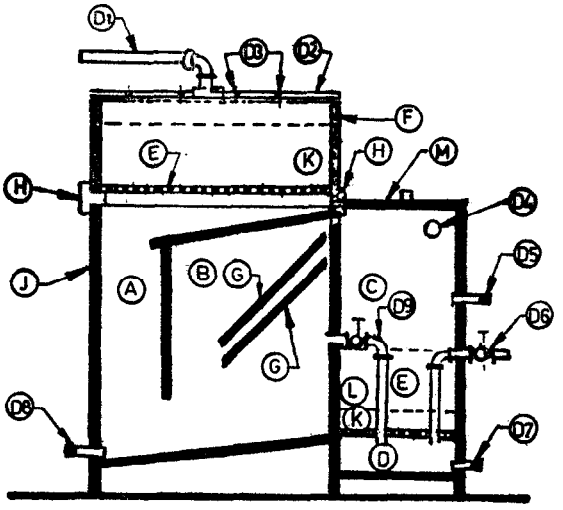
6 HAND PUMP ATTACHABLE IRON REMOVAL PLANT

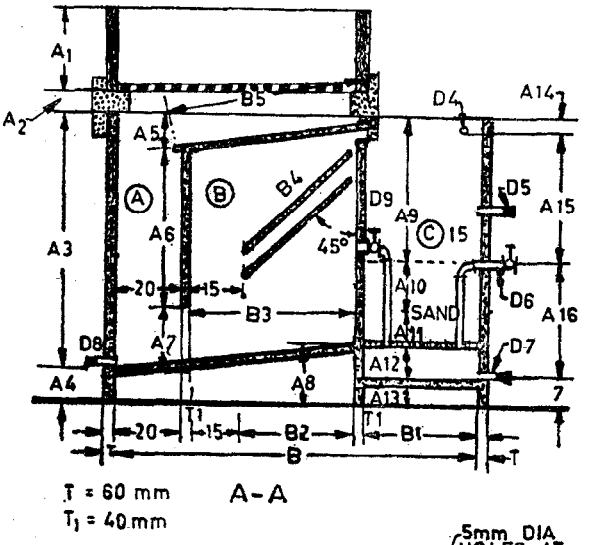
6.1 This is suitable for rural areas where the number of people to be served is small and low density of population makes piped distribution costly. The hand pump water rains over aeration media from sprayer. The water while percolating through aeration media is enriched in dissolved oxygen. The carbon dioxide concentration decrease and the ferrous iron is oxidised to ferric form. The aerated water trickles over the horizontal baffle plate and enters the sedimentation tank where flocculation occurs due to turbulance. Over 90 percent precipitate settles and the settled water rises through plate settlers and flows into the filter. The filter removes any unsettled iron. The iron content in the treated water is reduced to below 0·3 mg/l with raw water concentration ranging from 1 mg/l to as high as 40 mg/l.

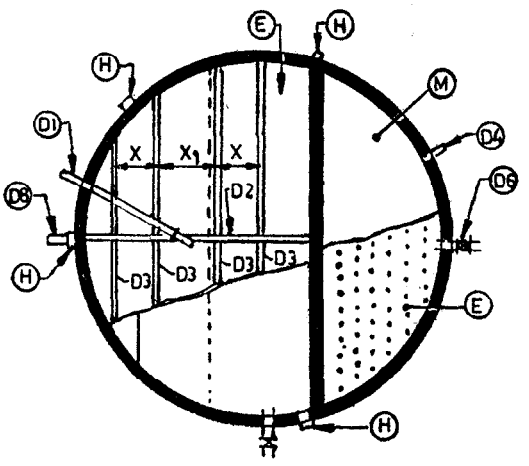
The recommended design details for different sizes of iron removal plant which can provide iron free water to a population of 125, 250, 275, 325 or 500 at the rate of 40 litre per capita per day (lpcd) are given in Table 1 and Fig. 2. Table 2 indicates the dimensions for different capacity of iron removal plant, when read in conjunction with Fig. 2.

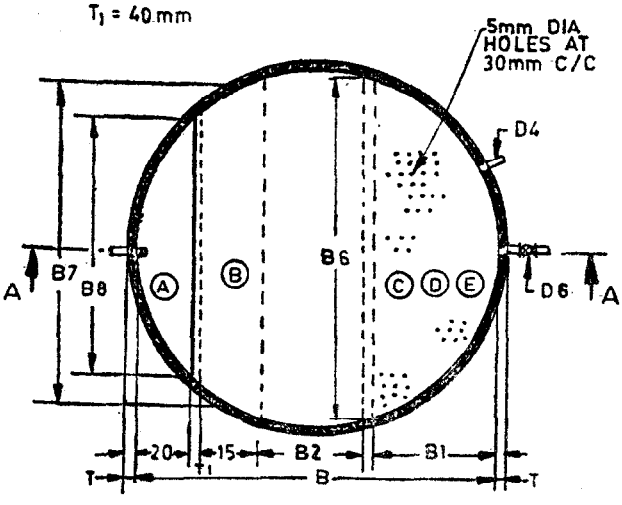
Table 1 Design Details for Different Sizes of Iron Removal Plant

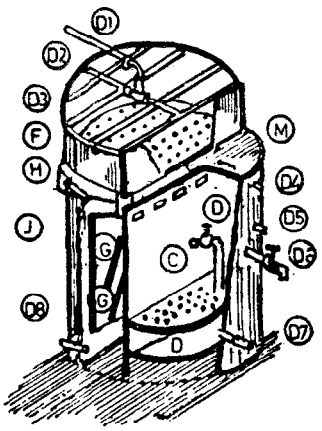
Design Characteristics	Hydraulic Loading in m^3/h			
	0·5	1·0	1·5	2·0
Plant				
Diameter, mm	1 050	1 350	1 600	1 800
Height, mm	1 300	1 600	1 900	2 100
Aeration Chamber				
Depth, mm	300	300	300	300
Diameter, mm	1 050	1 350	1 600	1 800
Effective width, mm	700	850	1 000	1 100
Aeration Medium				
Gravel/stone size, mm	10-40	10-40	10-40	10-40
Volume of media, l	120	190	260	320
Depth, mm	200	200	200	200
Collection Chamber				
Depth, mm	550	800	1 000	1 100
Settling Chamber				
Width, mm	500	650	800	900
Area, $10^4 \times mm^2$	60	95	130	160
Capacity, l	400	900	1 500	2 000
Detenrion period, min	48	54	60	60
Filter Chamber				
Width	350	500	600	700
Filter area, $10^4 \times mm^2$	25	48	68	91
Filtration rate, m/h	2	2·1	2·2	2·2
Filter Sand				
Size, mm	0·8-1·4	0·8-1·4	0·8-1·4	0·8-1·4
Depth, mm	200	250	300	300
Volume, l	50	120	200	270
Support Gravel				
Size, mm	6-20	6-20	6-20	6-20
Depth, mm	50	100	100	100
Volume, l	13	48	68	90











Parts of the Unit

A	Collection Chamber	*H*	Spacer-cum-Supports	*D3*	PVC Laterals
B	Settling Chamber	*J*	Main Body	*D4*	G I Overflow Pipe
C	Filter Chamber	*K*	Gravels	*D5*	G I Backwash Effluent
D	Filter Water Chamber	*L*	Sand	*D6*	G I Treated Water Pipe
E	Perforated Bottom	*M*	Cover with Handle	*D7*	G I Backwash Pipe
F	Spray & Aeration Chamber	*D1*	PVC Feeder Pipe	*D8*	G I Sludge Drain Pipe
G	Plate Settlers	*D2*	PVC Header Pipe	*D9*	G I Connection to Backwash Inlet

FIG. 2 HAND PUMP ATTACHABLE IRON REMOVAL PLANT

Table 2 Dimensions for Different Sizes of Iron Removal Plant
(*Clause* 6.1)

All dimensions in millimetres.

Characteristics		Hydraulic Load in m^3/h			
		0·5	1·0	1·5	2·0
A1	Depth of aerator	320	320	320	320
A2	Ventilation	80	80	80	80
A3		800	1 100	1 400	1 600
A4		100	100	100	100
A5		50	80	100	120
A6		550	800	1 100	1 100
A7		200	230	320	400
A8		180	200	220	250
A9		450	650	900	1 100
A10	Sand depth	200	250	300	300
A11	Gravel depth	50	100	100	100
A12	Filtrate chamber	100	150	150	150
A13		50	50	50	50
A14		50	80	80	80
A15	Water head	400	570	820	1 020
A16		330	480	530	530
B	Plant diameter	1 050	1 350	1 600	1 800
B1	Filter width	350	500	600	700
B2		350	500	650	750
B3	Settling chamber width	500	650	800	900
B4	Plate settler	500	710	920	1060
B5	Baffle plate	520	680	830	930
B6		1 000	1 300	1 550	1 750
B7		1 000	1 190	1 350	1 430
B8		820	960	1 040	1 130
X		150	180	210	230
X1		100	120	140	160
D1	Feeder pipe	37	50	75	75
D2	Header pipe	25	37	50	50
D3	Lateral pipe	12·5	25	25	25
D4	Over flow	25	25	25	25
D5	Backwash outlet	50	75	100	100
D6	Treated water tap	25	37	50	50
D7		37	50	75	75
D8	Slidge scour	37	50	75	75
D9	Valve for backwash purpose	37	50	75	75

ANNEX A
(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
7022 (Part 1) : 1973	Glossary of terms relating to water, sewage and industrial effluents, Part 1
7022 (Part 2) : 1979	Glossary of terms relating to water, sewage and industrial effluents, Part 2
8035 : 1976	Specification for shallow well hand pumps
9301 : 1984	Specification for deepwell hand pumps

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