Performance of PVC Riser Pipes with India Mark II Hand Pumps

Results from field trials February 1988 to March 1992

A Research & Development Report by :

Maintenance Division
Danida Project Directorate
Danida assisted Rural Water Supply Project
Bhubaneshwar, Orissa

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Acknowledgements

The work of the UNICEF/World Bank hand pump testing project at Coimbatore around 1986 and the hand pump installations in central Sri Lanka constructed by M/s. Kampsax-Kruger, Denmark, under a Danida assisted project for the National Water Supply & Drainage Board, Sri Lanka, provided the design concepts and practical basis for attempting limited field trials with PVC riser pipes on India Mark deep well hand pumps in the Danida assisted Rural Drinking Water Supply Project in coastal Orissa during 1988-89. Specific acknowledgement is due to W. K. Journey of World Bank, and to S. W. Ericksen, F. G. Yallop both of Kampsax-Kruger for their assistance, sharing of experiences and access to data.

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Bhubaneswar
July 1992

Raj Kumar Daw
Maintenance Adviser

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1. Summary :

1.1 Phase I of the Danida assisted Rural Drinking Water Supply Project in coastal Orissa was implemented during August 85 to March 88. During this period, approximately 1650 tube wells with hand pumps were constructed in 3 blocks of Chandbali, Delang and Rajkanika out of the 20 blocks of the project area in coastal Orissa. **Fig. 1** shows a map of the project area.

1.2 Concurrent with the construction of these tube wells with hand pumps, a decentralised hand pump maintenance system was established in the 3 blocks and a functionality study was carried out to establish the user-perception of completed hand pump installations. By 1987, the functionality study and the maintenance system indicated that pumps were falling into disuse due to deterioration of water quality in the wells. Offensive odour, unacceptable colour and taste were common features observed in the water from these wells.

1.3 While detailed studies in areas of hydrochemistry, microbiology, hydrogeology, etc. were expected to explain the nature and origin of the problems related to deterioration of water quality, indications were available from other projects with similar water quality problems that the use of non-corrodible pump components could retard, if not prevent, the process of such water quality deterioration.

1.4 It was, therefore, agreed in 1987 that field trials should be initiated in the Orissa project after developing the necessary non-corrodible pump components. Past experience elsewhere in India and abroad were examined and designs were formulated based upon favourable results reported from a Danida assisted project in central Sri Lanka. The initial designs formulated at this project in 1987, provided for two main departures from the Sri Lankan designs.

1.5 The first design change was the provision of a **"Bottom Support"** to counteract the phenomenon of "notch failure" by allowing riser pipes to rest of the bottom of the well using a telescopic adjusting mechanism in the lowermost pipes of riser assembly. The second change was to introduce **moulded PVC pipe couplers** cemented to PVC pipe ends instead of double ended pipe sockets with rubber sealing rings at each pipe joint used in Sri Lanka. The general configuration of the bottom supported installations is shown in **Fig. 2.**

1.6 Prototypes of all necessary components were manufactured locally in Orissa. During early 1988, hand pumps on 4 problem wells in Delang block Puri district, were converted to use 40 mm ND PVC riser pipes with double ended machined pipe sockets and with moulded sockets cemented to pipe ends . Rubber sealing rings in the sockets, pipe and rod centralisers, galvanised bright steel pump rods and the IM 2 cylinder with modified end caps to suit 40 mm ND PVC pipe were also used. The installation details are given in **Table 1.**

Table 1 : Details of sites for initial trials of PVC riser pipe

Village	Well Regn. No.	Date of PVC Riser Instl.	Remarks
1. Gualipada	13122411208	6th Feb. 88	Double ended sockets
2. Sujanpur	13122404502	18th Feb. 88	Cemented & moulded sockets
3. Sujanpur	13122404503	8th Feb. 88	Cemented & moulded sockets
4. Beraboi	13122408901	20th Apr. 88	Double ended sockets

1.7 Data on the content of iron and chlorides in water from these wells, pump maintenance histories and static water level measurements, before and after conversion to PVC pipes were collected till Aug 89 and complied into a report.

1.8 The conclusions that emerged from data analysis for the period Feb 88 - Aug 89 were :

1. The designs adopted from Sri Lanka for PVC riser pipes and other components were found feasible. The telescopic bottom-support design and a few other items needed further refinement such as rod centralisers. The use of the bottom support mechanism did not show up as clear advantage.

2. Moulded pipe couplers cemented to pipe ends, as a jointing system, failed.

3. Scaling, corrosion (and consequent water quality deterioration) was observed on cast iron and galvanised iron components like the cylinder and galvanised bright steel pump rods of the below-ground assembly.

4. Consistent with the observations of scaling and corrosion, iron content changed unpredictably and reflected directly in observable changes in user

response to water quality. Users' reports on deterioration of water quality were generally accompanied by measurable increases in iron content. Similarly water quality generally improved after any well cleaning or pump maintenance activity and was supported by lower values of iron content.

5. Static water level measurements indicated that the use of deep-well, or even low-lift pumping configurations were unnecessary. A suction pump application would have suited the four wells.

1.9 Having arrived at the above conclusions, the following actions were taken :

1. Suitable design modifications were made to the PVC riser pipe assembly to improve material quality and manufacturing standards. Designs of machined double ended pipe sockets and threaded pipe ends were finalised in PVC and of sealing rings in nitrile rubber. Rod centraliser material was changed from an SS-HDPE combination to polyacetyl, an engineering plastic.

2. Stainless steel pump rods were introduced in future installation to lower the occurrence of scaling and corrosion and to observe the effects on deterioration of water quality.

3. Observations of components of the bottom support mechanism indicated that it had not prevented vertical movement of the riser pipe assembly. This raised a question about the need for a bottom support at all, especially if the cylinders could be installed at 9 m to 12 m below ground level rather than 27 m to 30 m below ground level in the deep well configuration.

4. Further trials were conducted with the above improvements on problem wells only after systematic treatment and redevelopment of such wells. A total of 26 problem wells in Delang block including the first 4 sites, were treated and redeveloped with compressed air.

5. IM 2 hand pumps were reinstalled in low-lift configuration on these rehabilitated wells using 9 m (3 pieces) of 40 mm ND PVC riser pipes, IM 2 cylinders with modified caps and stainless steel rods. Some of the PVC riser pipes were installed without the bottom support arrangement,i.e., with the cylinder hanging, as shown in **Fig. 3**.

6. Since favourable performance had already been observed in the project with the IM 2 pump in a suction mode, called the IM 2 Solid Link pump, this pump was introduced on a larger scale on rehabilitated wells. This configuration is shown in **Fig. 4.**

7. Existing non-corrodible below-ground systems like that of the Tara Direct Action pumps was adapted with the IM 2 pump's above-ground mechanism in low-lift configurations. This eliminated other corrodible elements such as the IM 2 cylinder. This system is illustrated in **Fig. 5.**

1.10 Therefore, during the period 1990-92, when additional well rehabilitation work was undertaken in Delang block, all reinstallation pumps were either of three types illustrated in **Figs. 3, 4 and 5** and described below :

1. **IM 2 PVC SS** : This used the IM 2 pump with centralised stainless steel rods, the IM 2 cylinder with modified caps, installed at 9 m to 12 m below the water tank in low lift application with a light T bar handle, with 40 mm ND PVC riser pipes with centralisers. Most of these installation were in a "hanging" configuration, through trial with bottom supported installations continued.

2. **IM 2 SL** : This used the IM 2 Solid Link head and handle, a modified IM 2 cylinder located in the pump pedestal just below the water tank and 6 m to 9 m length of PVC suction pipe, generally of 32 mm ND.

3. **IM 2 Tara** : This used the IM 2 pump head with light T bar handle, modified store tank, grommet flange, grommet (later adapted to cone flange and rubber cone), Tara pump's PVC riser pipes and cylinder of 50 mm ND and Tara pump piston modified to use centralised SS pump rods.

1.11 This report confines itself to an assessment of the performance of the IM 2 pump using 40 mm ND PVC pipes with BS & SS pump rods and with or without bottom support. Since the eventual pump emerging favourably from the trails is the IM 2 PVC SS, the detailed specifications of its components that are not available in the current of the IM 2 pump (IS 9301:1990) are provided in **Annexure 3.**

1.12 Separate documentation is available on the results of trials with the IM 2 Tara and IM 2 SL configurations.

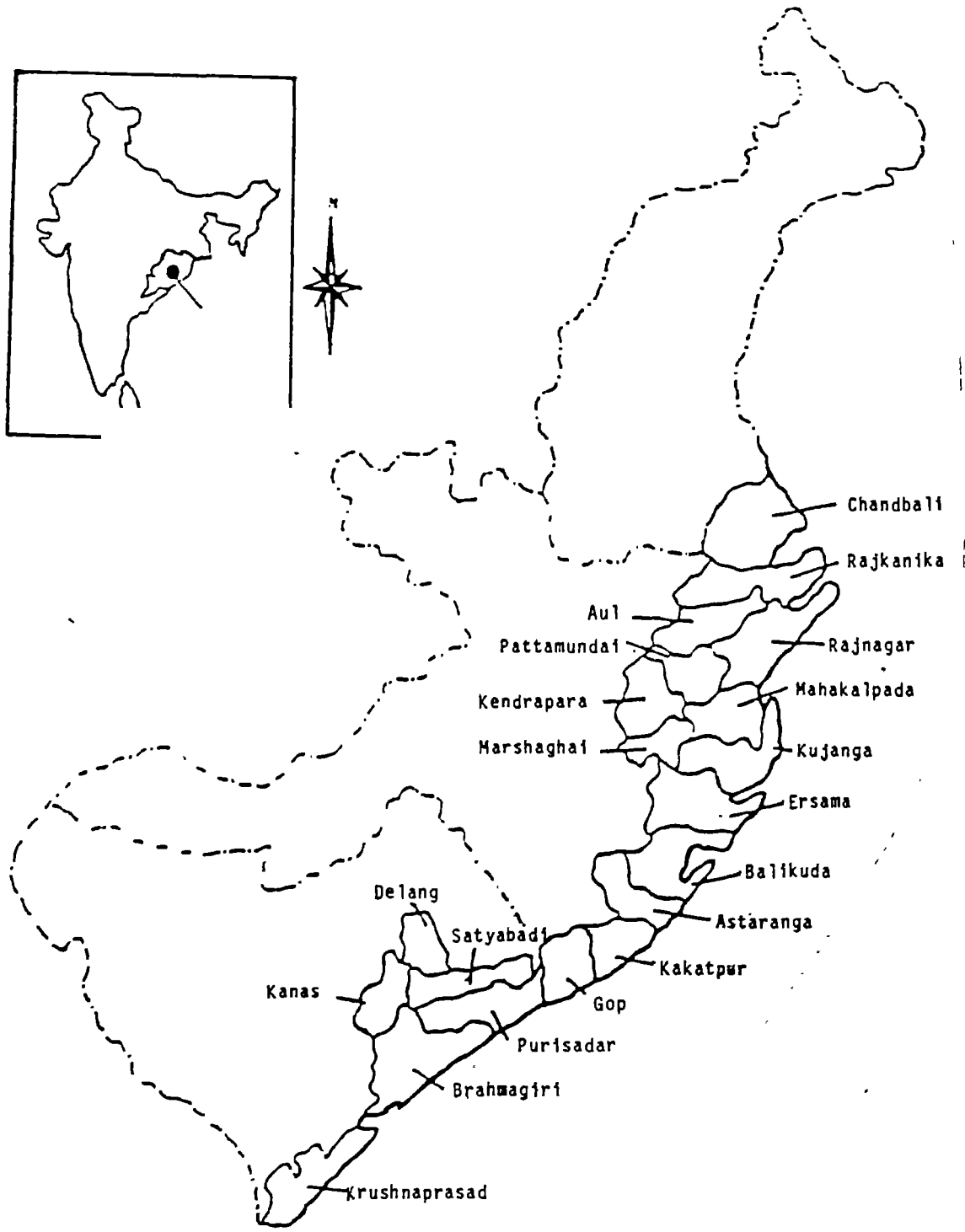


Fig. 1 : Map of the Project Area of the Danida assisted Orissa Rural Drinking Water Supply Project

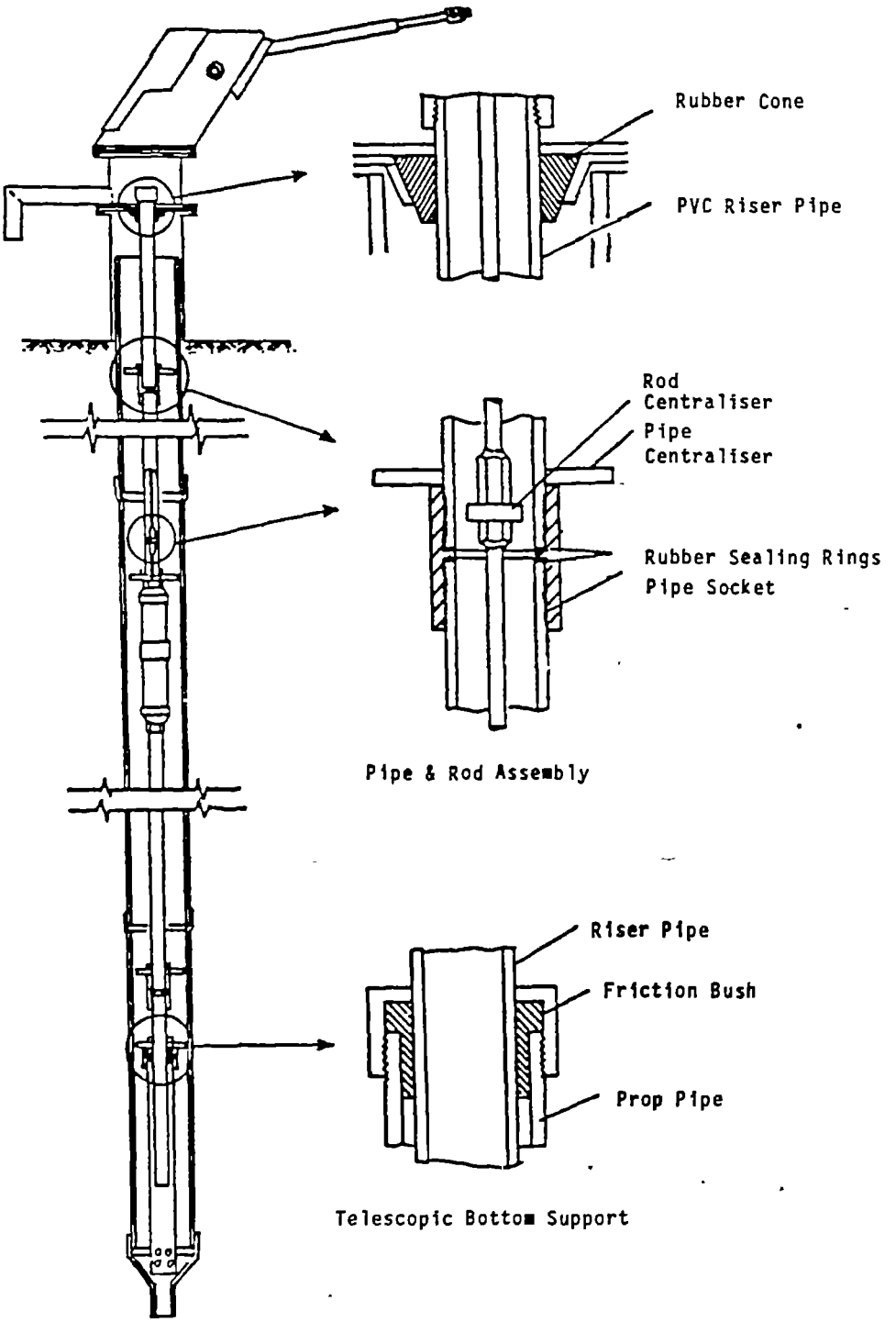


Fig 2 : India Mark II hand pump with bottom supported PVC riser pipes

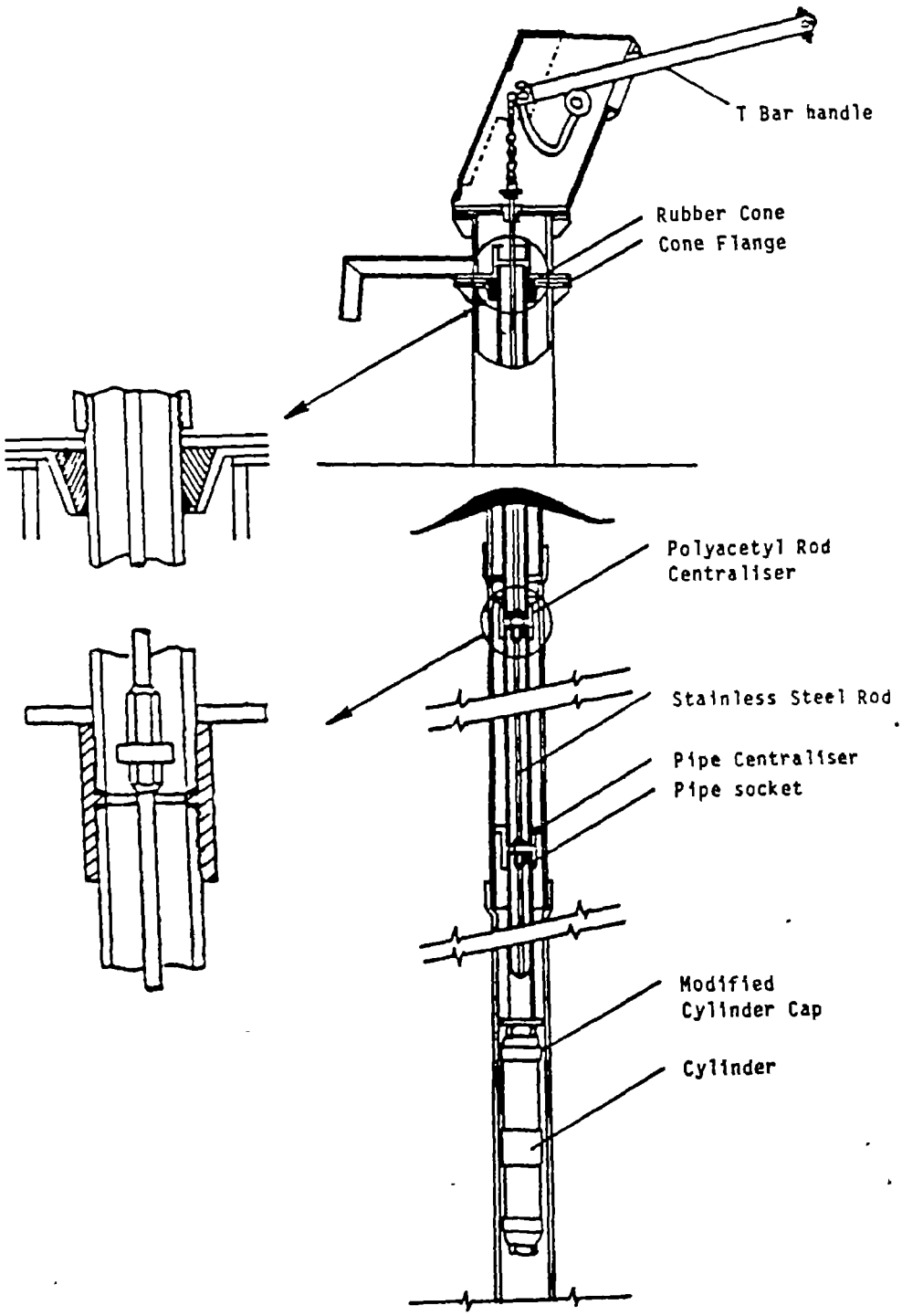


Fig. 3 : India Mark II hand pump with PVC riser pipes in Low Lift application & no bottom support

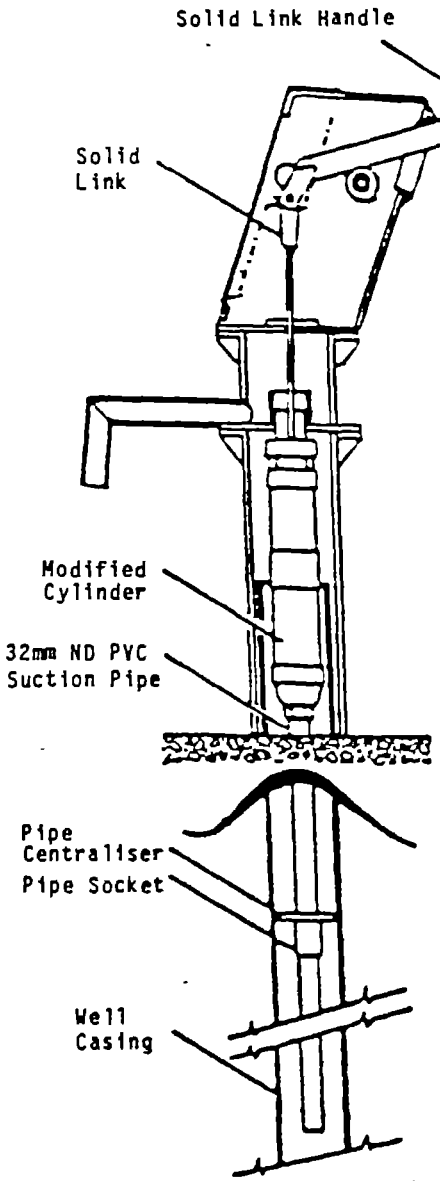


Fig. 4 :
India Mark II Solid Link Suction Pump

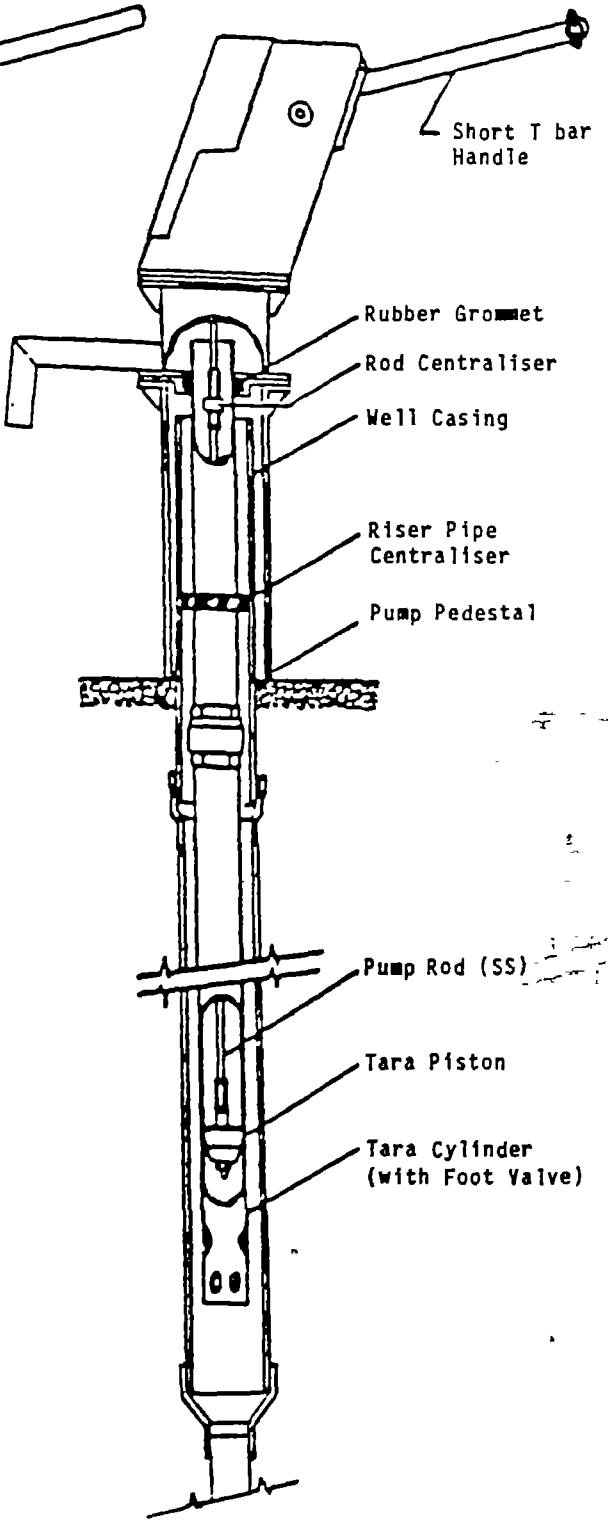


Fig. 5 :
India Mark II pump using Tara pump's PVC riser pipes

2. Specific Conclusions:

2.1 **Numbers of Installations** : A total of 87 pumps using PVC riser pipes were installed on 70 wells. On 55 wells, PVC riser pipes installed once, on 13 sites they were installed twice, and on 2 sites they were installed 3 times. Installations were discontinued or reinstalled mainly in keeping with rehabilitation of wells or to incorporate design changes.

2.2 **Types of Pumps & their continuity :**

16 pumps were installed with galvanised Bright Steel rods. 7 of these pumps were with bottom support and all 7 were discontinued. 9 were installed without bottom support,of which 5 were discontinued and 4 were still continuing by 31.03.92.

71 pumps were installed with Stainless Steel rods. 56 were without bottom support of which 52 were continuing on 31.03.92 and 4 were discontinued. 15 had been installed with bottom support of which 5 had been discontinued and 10 were continuing.

2.3 **Oldest Pumps** : The oldest pumps by 31st March, 1992 were:

872 days	PVC-BS pump without bottom support, discontinued.
777 days	PVC SS pump with bottom support, discontinued.
887 days	PVC-BS without bottom support and continuing.
1032 days	PVC SS without bottom support and continuing.

2.4 **Interrelation between Continuity, Bottom Support and Maintenance**

1. In the total of 87 pumps, with an average age of 507 days, 20 pumps needed repairs, 67 did not need repairs.

2. In the 22 pumps installed with bottom supports, with an average age of 652 days, 9 pumps needed repairs, 13 did not need repairs.

3. In the 65 pumps installed without bottom supports, with an average age of 458 days, of which 11 needed repairs, 54 did not need repairs.

2.5 Maintenance & Repair Needs

1. All the installations were kept under the regular preventive maintenance system of the project. This probably kept the overall repair needs very low.

2. 77% of the pumps did not need repairs for an average installed life of 16.9 months.

3. The bottom support mechanism did not play any significant part in reducing the need for repairs.

4. The most common repair/replacement event was that of replacement of nuts and bolts in the above-ground assemblies of the pumps. Still, all these events totalled 23 instances, which spread over 20 pumps over 16.9 months, was insignificant.

5. There was only one breakdown, due to the uncoupling of a pump rod.

6. Most below-ground repair needs were limited to replacement of cylinder components and were of the nature of rectification of poor performance reports.

7. There was no case of riser pipe failure due to uncoupling or breakage of joints or perforation of pipes.

3 Overall conclusions:

3.1 The particular configuration of PVC riser pipe tried is a very viable alternative to GI riser pipes with India Mark II pumps. So far its maintenance needs have been exceptionally low. However, the age of the installations is not very much and the effects of ageing of plastic as an inherent drawback may not have yet begun to show. Consequently, while the results have been encouraging so far, the monitoring of the installations must continue of a longer period of time.

3.2 The use of PVC riser pipes have been tried in "low lift" configurations with 9 m to 12 m of riser pipes. While this is an adequate application in coastal Orissa, with a high water table, the performance of PVC riser pipes in the deeper water table conditions may not be the same. In such deep water table conditions, the vertical movement of the riser pipe string will be much more pronounced and the installation depth of the cylinder will be of the order of 30 m below ground level. The need for a bottom support mechanism, which has not been satisfactorily developed so far, would be more relevant in the deep water table situations. In order to find a suitable combination of materials and design for deep water table wells, systematic development and trials will be necessary before large scale application is attempted. However, it must be remembered that the Danida assisted drinking water project in central Sri Lanka has over 2500 IM 2 pump installations using 40 mm ND PVC riser pipes and with cylinders at 30 m bgl. Therefore, there need not be any doubt about the viability of the basic design.

3.3 The search for non-corrodible riser mains originated from the search for a solution for the problem of water quality deterioration. The use of PVC pipes and SS rods have so far provided only a partial solution since a suitable cylinder element is not yet available to replace the standard IM 2 cylinder. To that extent, only part of the objective of the research has been fulfilled. On the other hand, it is clear that the standard IM 2 cylinder still provides a focus for the action of corrosion and consequent water quality deterioration. Therefore, if the development of 40 mm ND riser pipes were viewed as an intermediate step to somewhat retard the process of water quality deterioration. The search for a completed non-corrodible below-ground pumping assembly becomes even more important and this is where future efforts must lie. In this regard, the use of 50 mm ND PVC pipes of Tara direct action pumps, adapted to the IM 2 becomes very important. Also, the development work on the "PVC-OTC" concept with a 63.5 mm diameter piston also warrants priority.

4 Current Status of 40 mm ND PVC Installations:

4.1 **Table 2** below presents a summary of the status and age of pumps using centralised 40 mm ND PVC riser pipes, with galvanised bright steel pump rods (as per IS:9301) or stainless steel rods, in hanging configuration or using telescopic bottom supports.

Table 2 : Status of Pumps with PVC Riser Pipes as of 31.03.92

Sl. No.	Installation Type	Total Nos. Instl.	Interrupted Installations by 31.03.92				Installations continuing upto 31.03.92			
			Nos. Instl.	Age in days			Nos. Instl.	Age in days		
				Old -est	Most Recent	Avg.		Old- est	Most Recent	Avg.
1	PVC Risers, BS Rods, w/o Bottom Support	9	5	872	47	404	4	887	333	743
2	PVC Risers, BS Rods, with Bottom Support	7	7	559	62	349	-			
3	PVC Risers, SS Rods, w o Bottom Support	56	4	628	23	331	52	1032	179	432
4	PVC Risers, SS Rods, with Bottom Support	15	5	777	602	717	10	993	252	831
5	**Totals**	**87**	**21**	**872**	**23**	**446**	**66**	**1032**	**179**	**444**

* Note: A total of 87 pumps using PVC riser pipes were installed on 70 wells. On 55 wells, PVC riser were installed once, on 13 sites they were installed twice, and on 2 sites they were installed 3 times.

4.2 As will be seen from the table above :

1. **Pumps with galvanised BS Rods** : A total of 16 pumps (9+7) were installed, of which 7 were with bottom support and all 7 of these were discontinued. Of the 9 pumps installed without bottom support, 5 were discontinued and 4 were still continuing by 31.03.92.

2. **Pumps with SS Rods** : A total of 71 (56+15) pumps were installed with SS rods. 56 of these were without bottom support of which 52 were continuing on 31.03.92 and 4 were discontinued. 15 had been installed with bottom support of which 5 had been discontinued and 10 were continuing.

3. **Oldest–discontinued** : The oldest discontinued pump was a PVC–BS pump with an age of 872 days and without bottom support. In comparison the oldest discontinued PVC SS pump was 777 days and with bottom support.

4. **Oldest–continuing** : The oldest continuing pump by 31.03.92 was a PVC–BS with out botttonm suppport pump with an age of 887 days. In comparison the oldest continuing PVC SS pump was 1032 days old by 31.03.92 and was without botttom suppport.

5. **Average Ages** : Average ages for discontinued pumps ranged from 331 days to 717 days and for continuing pumps from 432 days to 831 days.

4.3 The detailed list of sites, from which Table 2 above has been compiled is given as **Annexure 1**. This annexure gives the following information:

1. Identification of each site by registration number.
2. Date of installation of PVC riser pipes.
3. Date of removal, if the pump was discontinued or reinstalled (e.g. after removal of bottom support, change of pump rods or after rehabilitation).
4. Type of pump rod used.
5. Length of riser pipes below which bottom supports were installed.
6. Age of the pump in days from their date of installation to their date of discontinuation or on 31.03.92 if they continued.
7. Whether a pump needed repairs or not.

4.4 The summary data that emerges from **Annexure 1** are presented in **Tables 3, 4** and **5** showing the interrelation between the criteria of continuity of installations, presence of bottom support and maintenance need. **Table 6** gives the age days distribution of the pumps.

Table 3 : Summary of Continuing & Discontinued Pumps

Sl. No.	Status of Installations by 31.03.92	Total Nos. of Pumps	Average Age in days	Needed repairs ?	
				Yes	No
1.	Pumps continuing	66	526	10	56
2.	Discontinued	21	446	10	11
3.	Total	87	507	20	67

Table 4 : Summary of Pumps with Bottom Support

Sl. No.	Status of Installations by 31.03.92	Total Nos. of Pumps	Average Age in days	Needed repairs ?	
				Yes	No
1.	Pumps continuing	10	831	3	-
2.	Discontinued	12	502	6	6
3.	Total	22	652	9	13

Table 5 : Summary of Pumps without Bottom Support

Sl. No.	Status of Installations by 31.03.92	Total Nos. of Pumps	Average Age in days	Needed repairs ?	
				Yes	No
1.	Pumps continuing	56	472	7	49
2.	Discontinued	9	370	4	5
3.	Total	65	458	11	54

Table 6 : Age days distribution for all pumps & pumps needing repairs

Sl No.	Age group ranges – days	Numbers of Pumps			Not needing Repairs		Needing Repair	
		Total	Discont	Cont	Discont.	Cont	Discont.	Cont.
1.1	≤ 100 days	5	5		4		1	
1.2	> 100 & ≤ 200 days	16	2	14	2	13		1
1.3	> 200 & ≤ 300 days	5		5		5		
1.4	> 300 & ≤ 400 days	23		23		22		1
1.5	> 400 & ≤ 500 days	2	2		1		1	
2.1	> 500 & ≤ 600 days	5	5		2		3	
2.2	> 600 & ≤ 700 days	4	3	1	1	1	2	
2.3	> 700 & ≤ 800 days	3	3		1		2	
2.4	> 800 & ≤ 900 days	4	1	3		2	1	1
2.5	> 900 & ≤1000 days	17		17		11		6
3.1	>1000 & ≤1100 days	3		3		2		1
4	Total nos.	87	21	66	11	56	10	10
5	Average age – days	507	446	526	315	472	556	828

4.4 From **Tables 3, 4, 5** and **6** it is seen that :

1. There were 87 pumps, with an average age of 507 days by 31.03.91.

2. Of these 87 pumps, 20 needed repairs, 67 did not need repairs. In effect, 77% of the pumps did not need repairs or an average installed life of 16.9 months.

3. 22 pumps with bottom supports had an average age of 652 days, of which 9 pumps needed repairs, 13 did not need repairs.

4. 65 pumps without bottom supports had an average age of 458 days, of which 11 pumps needed repairs, 54 did not need repairs.

5. Therefore, 59% (13 out of 22) pumps with bottom supports did not need repairs for an installed average life of 21.7 months and 83% (54 out of 65) without bottom supports did not need repairs for an average installed life of 15.3 months.

5. Maintenance Needs:

5.1 All the installations were placed under the regular maintenance system of the project, i.e. preventive maintenance visits by village based mechanics were made to the pumps once a month. Therefore, the general lack of repair needs should not be equated to the lack of maintenance needs. In fact, it is probably because of a regular preventive maintenance system that the overall repair needs may appear very low.

5.2 **Table 7** gives the summary of the components that needed replacement or repair along with the number of occurrences of each kind of repair/replacement, the average, maximum and minimum interval between occurrences. The detailed repair needs data for every pump is presented in **Annexure 2.**

5.3 As is evident from Table 3, of the 87 pumps, 20 needed repairs, 67 did not need repairs. That is only 23 % of the pumps needed repairs and replacements for an average installed life of 16.9 months.

Table 7 : Details of Components repaired or replaced with age of occurrence

Sl. No.	Component Replaced or Repaired	No. of Occurr-ences	Occurrence interval in days		
			Average	Max	Min
1	**Above-ground Components**				
1.1	Head nut/bolt missing, replaced	12	243	467	43
1.2	Head nut/bolt damaged, replaced	4	356	782	159
1.3	Head Insp. cover damaged, replaced	3	295	13	23
1.4	Insp. cover bolt damaged, replaced	2	265	429	101
1.5	Insp. cover bolt rusted, replaced	1	86		
1.6	Handle axle nut missing, replaced	1	82		
1.7	Water tank nut/bolt damaged, replaced	3	231	159	279
	Below-ground Components				
2.1	Rod SS uncoupled, repaired	1	202		
2.2	Rod centraliser damaged, replaced	2	284	408	159
2.3	Upper valve guide worn out, replaced	2	441	474	408
2.4	Upper valve rubber seating damaged, replaced	2	350	469	231
2.5	Piston cup washer damaged, replaced	1	131		
2.6	Piston cup washer worn out, replaced	1	517		
2.7	Cylinder sealing ring damaged, replaced	1	469		
2.8	Lower valve leakage, compl. assembly replaced	2	303	474	131

5.4 From **Table 7**, the following conclusions emerge :

1. Apart from three cases of Inspection Cover replacement, all above-ground maintenance events were replacement of nuts and bolts at different locations. However, replacement of nuts and bolts, totalled 23 instances, which, for 20 pumps aged 16.9 months, is still quite low.

2. In the below-ground repair needs group there was one breakdown only, due to the uncoupling of a rod.

3. Most below-ground repair needs were limited to replacement of cylinder components and were of the nature of rectification of poor performance reports.

4. Significantly, there was not one case of riser pipe failure by joint breakage, uncoupling of joints or perforation of pipes.

Annexures

Annexure 1 : List of sites of IM 2 PVC installations as on 31st March 1992

G P & Village	Regn. No.	Instl. Date	Removal Date	Rod Type	Bot. Supp. below	Age by 31.3.92	Needed Repairs
G P : Abhayamukhi Ramachandrapur							
Indipur Deuli	13122506413	21/11/89	Contn.	BS		881	
G P : Arisol							
Arisol	13122405502	20/07/89	05/09/91	SS	9m	777	
Arisol	13122405507	17/05/90	Contn.	SS		684	
Jajpur	13122311802	05/11/89	Contn.	BS		877	Yes
Nuagan	13122311302	19/05/90	02/11/91	SS		532	Yes
G P : Beraboi							
Beraboi	13122408901	20/04/88	18/08/89	BS	30m	485	
		18/08/89	12/04/91	SS	9m	602	Yes
		12/04/91	Contn.	SS		354	
Beraboi	13122408903	14/04/91	Contn.	SS		352	
Beraboi	13122408904	13/04/91	Contn.	SS		353	
Beraboi	13122408905	17/04/91	Contn.	SS		349	
Damapur	13122408601	18/07/89	10/05/91	SS	9m	661	Yes
		10/05/91	Contn.	SS		326	
Damapur	13122408602	10/05/91	Contn.	SS		326	
Jokanarua	13122409401	30/03/91	Contn.	SS		367	
Jokanarua	13122409402	30/03/91	Contn.	SS		367	
Manipur	13122408401	23/04/91	Contn.	SS		343	
Odataraboi	13122409101	08/11/89	30/04/91	BS	9m	538	Yes
		30/04/91	Contn.	SS		336	
Odataraboi	13122409102	08/11/89	03/05/91	BS		541	
		03/05/91	Contn.	BS		333	
Odataraboi	13122409103	30/04/91	Contn.	SS		336	
Pirhapatana	13122409701	06/04/91	Contn.	SS		360	
Pirhapatana	13122409702	07/04/91	Contn.	SS		359	
Praharajapur	13122409601	31/03/91	Contn.	SS		366	Yes
Praharajapur	13122409602	31/03/91	Contn.	SS		366	
Praharajapur	13122409603	03/04/91	Contn.	SS		363	
Praharajapur	13122409604	03/04/91	Contn.	SS		363	
Praharajapur	13122409605	02/05/91	Contn.	SS		334	
Rencha	13122409301	29/03/91	Contn.	SS		368	
Rencha	13122409302	11/11/89	26/03/91	BS		500	Yes
		26/03/91	Contn.	SS		371	
Rencha	13122409304	16/07/89	Contn.	SS		989	
Rencha	13122409305	10/11/89	23/03/91	BS		864	Yes
Rencha	13122409305	23/03/91	Contn.	SS		374	
Udayapur	13122408801	11/04/91	Contn.	SS		355	
G P : Dhankera							
Biramukundapur	13122506304	23/06/89	Contn.	SS		1012	
Biramukundapur	13122506305	03/06/89	Contn.	SS		1032	Yes
Biramukundapur	13122506307	01/12/89	19/04/90	SS		139	
Biramukundapur	13122506309	18/06/89	Contn.	SS		1017	

Annexure 1 : List of sites of IM 2 PVC installations as on 31st March 1992

G P & Village	Regn. No.	Instl. Date	Removal Date	Rod Type	Bot. Supp. below	Age by 31.3.92	Needed Repairs
G P : Godiput Matiapada							
Godiput Matiapada	13122400204	11/08/89	Contn.	SS		963	
G P : Gualipada							
Bolakana	13122408501	12/07/89	Contn.	SS	9m	993	Yes
Bolakana	13122408502	13/07/89	Contn.	SS	9m	992	
Gualipada	13122411208	06/02/88	18/08/89	BS	24m	559	Yes
		18/08/89	08/05/91	SS		628	
Humara	13122410403	23/07/91	Contn.	SS	15m	252	
Machapada	13122411004	23/07/91	Contn.	SS	15m	252	
Panchupala	13122408702	11/11/89	Contn.	BS		871	
G P : Jenapur							
Govindpur	13122412202	20/06/89	06/08/89	BS		47	
		06/08/89	29/08/89	SS		23	
		29/08/89	Contn.	SS		945	
G P : Munida							
Alata Belapada	13122408205	11/07/89	Contn.	SS		994	
Munida	13122407101	09/06/89	10/08/89	BS	27m	62	
		10/08/89	Contn.	SS		964	Yes
Munida	13122407102	09/06/89	10/08/89	BS	27m	62	
		10/08/89	Contn.	SS		964	Yes
G P : Sri Purushottampur							
Bilashpur	13122411402	20/08/89	04/10/91	SS	9m	775	Yes
		04/10/91	Contn.	SS		179	
Bilashpur	13122411403	28/09/91	Contn.	SS		185	Yes
Bilashpur	13122411404	20/08/89	01/10/91	SS	9m	772	Yes
		01/10/91	Contn.	SS		182	
G P : Sauria							
Ganagapur	13122407301	03/10/91	Contn.	SS		180	
Ghanipur	13122403304	03/10/91	Contn.	SS		180	
Sauria	13122403601	12/09/91	Contn.	SS		201	
Sauria	13122403602	12/09/91	Contn.	SS		201	
Sauria	13122403603	10/06/89	07/08/89	BS		58	Yes
		07/08/89	Contn.	SS		967	
Sauria	13122403608	24/09/91	Contn.	SS		189	
Sauria	13122403609	25/09/91	Contn.	SS		188	
Sauria	13122403610	24/09/91	Contn.	SS		189	
Sauria	13122403611	13/09/91	Contn.	SS		200	
Sauria	13122403612	14/09/91	Contn.	SS		199	
Sauria	13122403613	14/09/91	Contn.	SS		199	
Sauria	13122403614	27/09/91	Contn.	SS		186	
Sauria	13122403615	27/09/91	Contn.	SS		186	
Sauria	13122403616	25/09/91	Contn.	SS		188	
Sauria	13122403617	11/09/91	Contn.	SS		202	

Annexure 1 : List of sites of IM 2 PVC installations as on 31st March 1992

G P & Village	Regn. No.	Instl. Date	Removal Date	Rod Type	Bot. Supp. below	Age by 31.3.92	Needed Repairs
G P : Sujanapur							
Ankula	13122406635	21/08/89	Contn.	SS	9m	953	
Delang Kothabad	13122406303	14/08/89	Contn.	SS	9m	960	
Delang Kothabad	13122406305	16/08/89	Contn.	SS	9m	958	Yes
Patanapur	13122406231	21/07/89	Contn.	SS	9m	984	
Ratanapur	13122404631	25/07/89	Contn.	SS	9m	980	Yes
Ratanapur	13122404632	23/07/89	Contn.	SS	9m	982	
Sujanapur	13122404572	18/02/88	17/08/89	BS	27m	546	
		17/08/89	Contn.	SS		957	Yes
Sujanapur	13122404573	08/02/89	17/08/89	BS	27m	190	
		17/08/89	Contn.	SS		957	

Annexure 2 : Details of Repairs to pumps with PVC Riser Pipes, as of 31.03.92

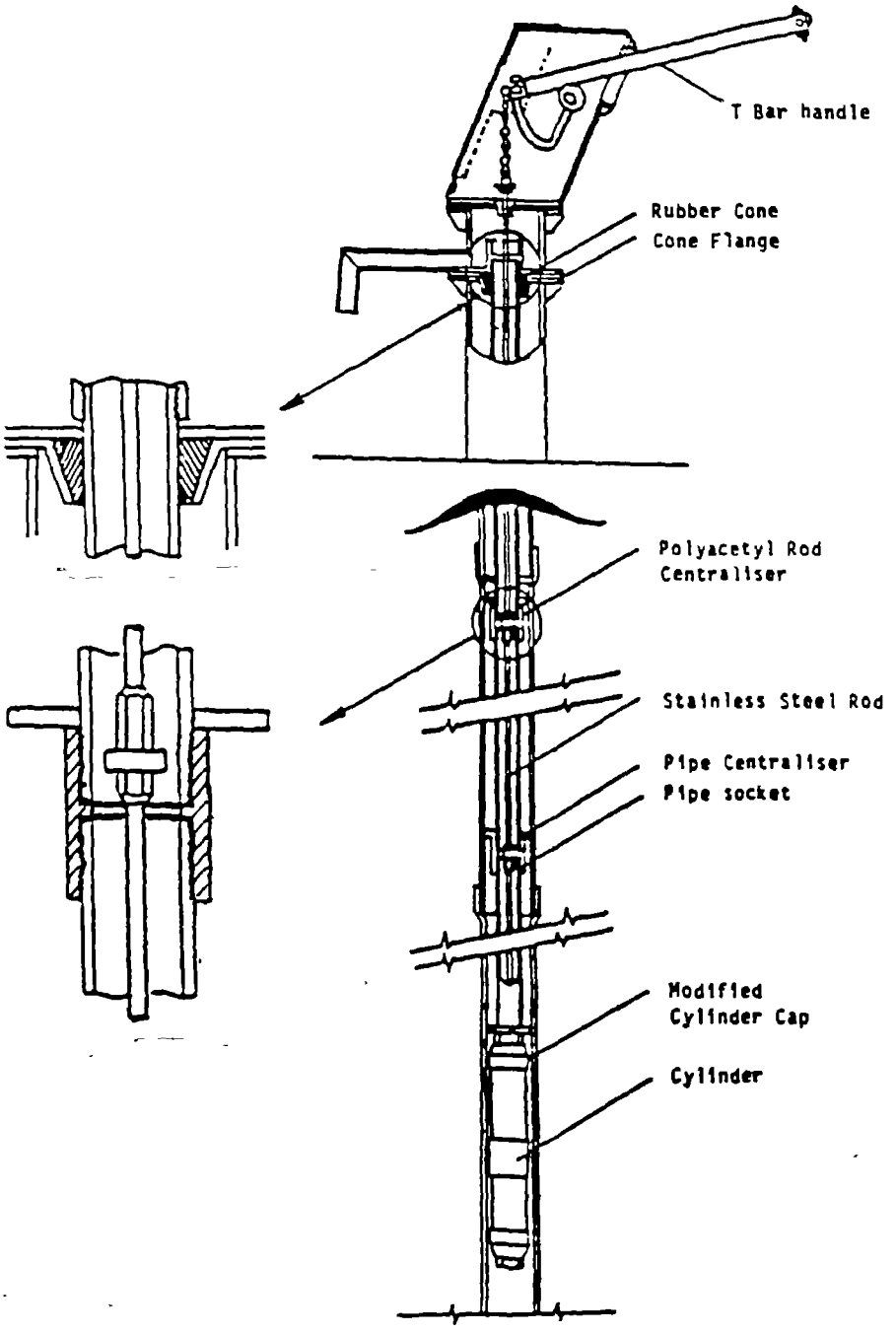
G P & Village	Regn. No.	Instl. Date	Removal Date	Rod Type	Bot. Supp. below	Age by 31.3.92	Details of Repairs Date	Age days	Class AG/BG	Details
G P : Arisol										
Jajpur	13122311802	05/11/89	Contn.	BS		877	18/12/90	408	BG	Rod Centraliser replaced, Upper Valve Guide worn, replaced
Nuagau	13122311302	19/05/90	02/11/91	SS		532	07/12/90	202	BG	Rod joint uncoupled, repaired Break down ?
G P : Berabol										
Berabol	13122408901	18/08/89	12/04/91	SS	9m	602	10/09/89	23	AG	Insp Cover replaced.
							12/11/89	86	AG	Head nut/bolt missing, replaced
							30/05/90	285	AG	Head nut/bolt missing, replaced.
Damapur	13122408601	18/07/89	10/05/91	SS	9m	661	30/05/90	316	AG	Head nut/bolt missing, replaced.
Odatarabol	13122409101	08/11/89	30/04/91	BS	9m	538	27/06/90	231	BG	Upper Valve Rubber Seating replaced
Praharajapur	13122409601	31/03/91	Contn.	SS		366	21/06/91	82	AG	Handle Axle nut missing, replaced
Rencha	13122409302	11/11/89	26/03/91	BS		500	21/03/90	130	AG	Head nut/bolt missing, replaced
Rencha	13122409305	10/11/89	23/03/91	BS		872	21/03/90	131	BG	Cup Washer replaced, Lower Valve leakage, completed I.V assembly replaced.
							18/04/90	159	BG	Rod Centraliser replaced.
							18/04/90	159	AG	Water Tank & Head nuts/bolts damgaged, replaced.
							24/06/90	226	AG	Head nut/bolt missing, replaced.
G P : Dhankera										
Biramukundapur	13122506305	03/06/89	Contn.	SS		1032	25/07/91	782	AG	Head nut/bolt damaged, replaced.
G P : Gualipada										
Bolakana	13122408501	12/07/89	Contn.	SS	9m	993	21/10/89	101	AG	Inspection Cover bolt missing, replaced.
Gualipada	13122411208	06/02/88	18/08/89	BS	24m	559	18/05/89	467	AG	Head nut/bolt missing, replaced.
G P : Munida										
Munida	13122407101	10/08/89	Contn.	SS		964	21/04/90	254	AG	Head nut/bolt missing, replaced.
							16/05/90	279	AG	Water Tank nut/bolt replaced.
							19/06/90	313	AG	Head nut/bolt missing, replaced.
Munida	13122407102	10/08/89	Contn.	SS		964	16/05/90	279	AG	Head nut/bolt missing, replaced
							21/04/90	254	AG	Water Tank nut/bolt replaced
							09/01/91	517	BG	Cup Washer worn, replaced

Annexure 2 : Details of Repairs to pumps with PVC Riser Pipes, as of 31.03.92

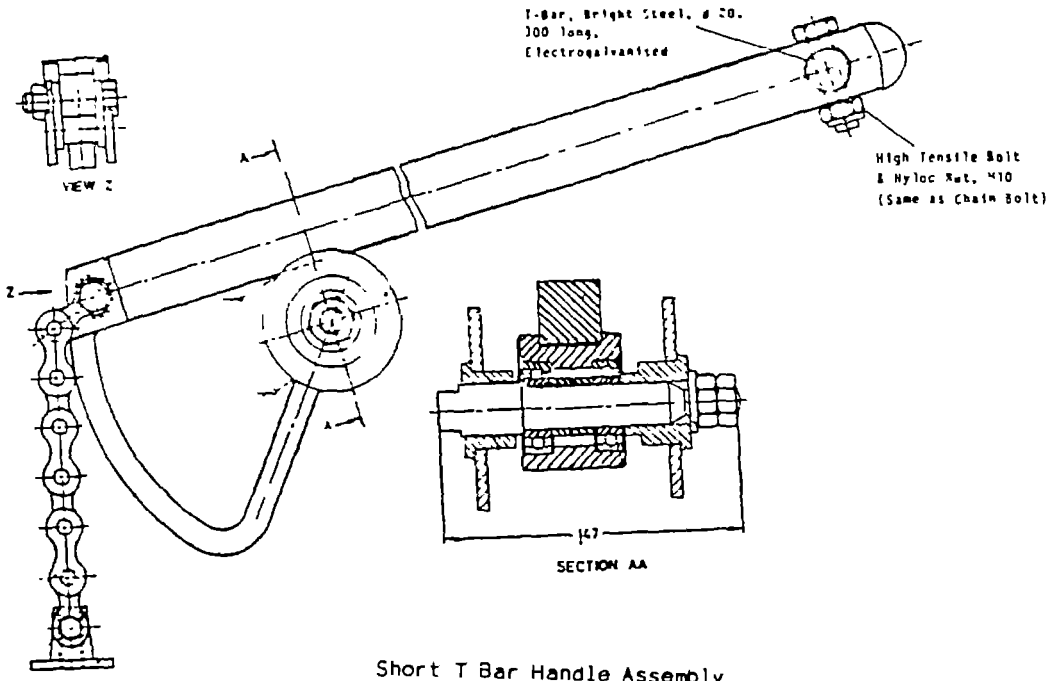
G P & Village	Regn. No.	Instl. Date	Removal Date	Rod Type	Bot. Supp. below	Age by 31.3.92	Details of Repairs Date	Age days	Class AG/BG	Details
G P : Sri Purushottampur										
Bilashpur	13122411402	20/08/89	04/10/91	SS	9m	775	22/02/90	186	AG	Head nut/bolt missing, replaced.
Bilashpur	13122411403	28/09/91	Contn	SS		185	23/12/91	86	AG	Inspection Cover bolt rusted replaced
Bilashpur	13122411404	20/08/89	01/10/91	SS	9m	772	21/07/90	335	AG	Head nut/bolt missing, replaced.
							25/04/90	248	AG	Inspection Cover replaced.
G P : Sauria										
Sauria	13122403603	10/06/89	07/08/89	BS		58	23/07/89	43	AG	Head nut/bolt missing, replaced.
G P : Sujanapur										
Delang Kothabad	13122406305	16/08/89	Contn.	SS	9m	958	21/04/91	613	AG	Inspection Cover replaced
Ratanapur	13122404601	25/07/89	Contn.	SS	9m	980	21/02/90	211	AG	Head nut/bolt damaged, replaced
							21/04/90	270	AG	Head nut/bolt damaged, replaced.
Sujanapur	13122404502	17/08/89	Contn.	SS		957	20/10/90	429	AG	Inspection Cover bolt replaced.
							29/11/90	469	BG	Cylinder Sealing Ring damgaged replaced. Upper Valve Rubber Seating replaced.
							04/12/90	474	BG	Lower Valve Complete replaced. Upper Valve Guide replaced.

Annexure 3

Specifications of components of IM 2 PVC SS pump

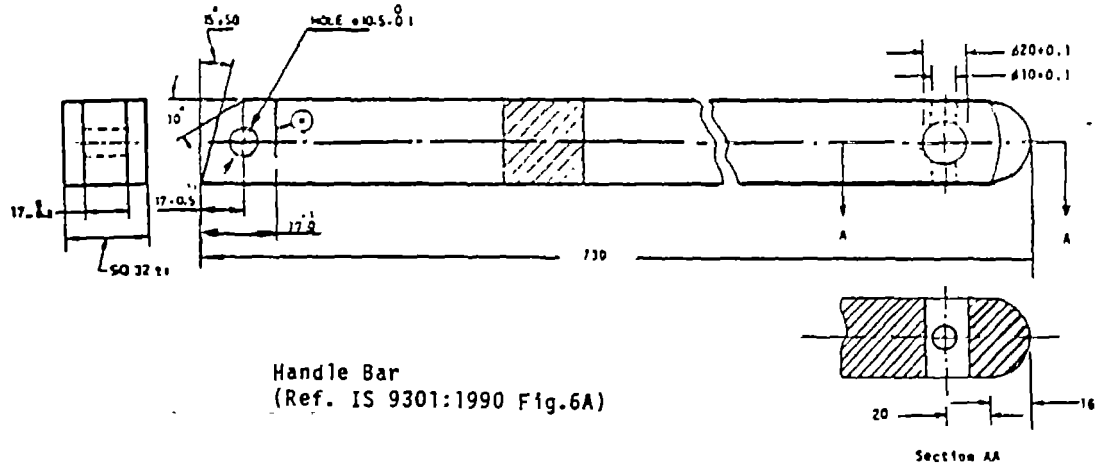


India Mark II hand pump with PVC riser pipes in Low Lift application

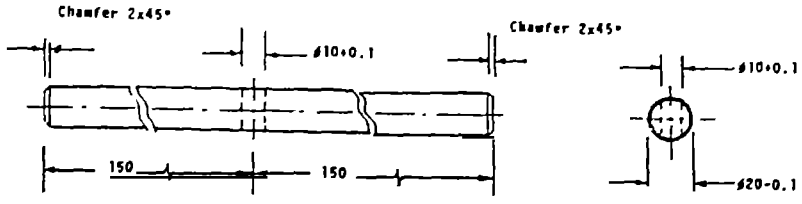


Short T Bar Handle Assembly
(Ref. IS 9301:1990 Fig.5)

Note: Electrogalvanised as per IS 1573:1986
service condition No.4



Handle Bar
(Ref. IS 9301:1990 Fig.6A)

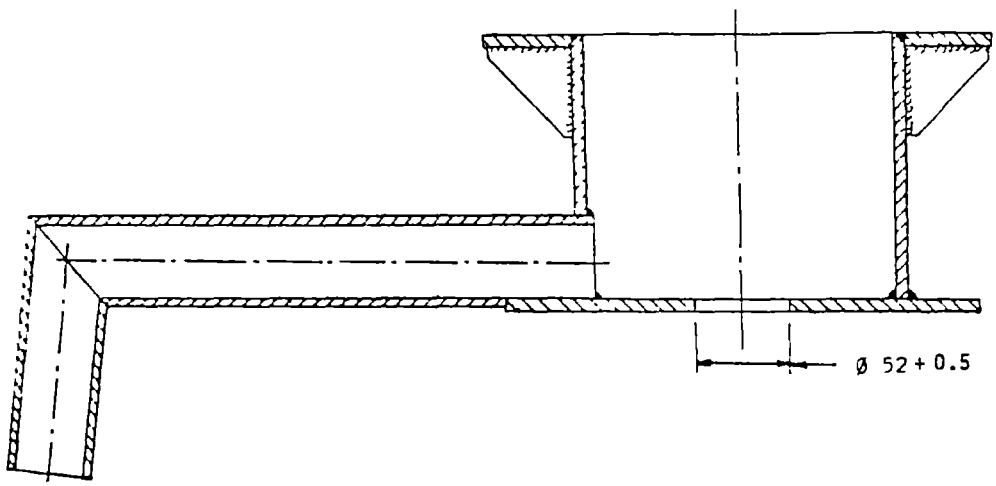


T Bar

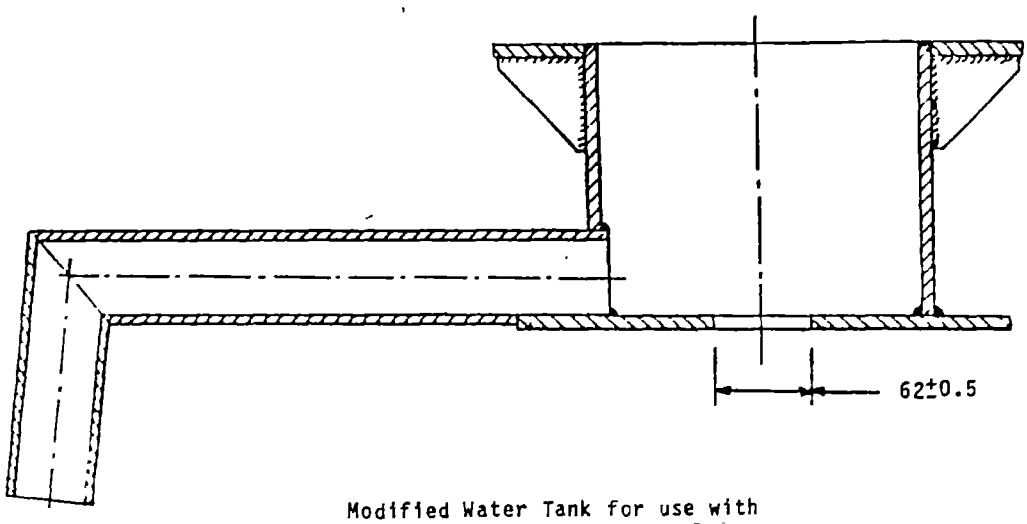
Notes : 1. Material:Bright Bar of Type A conforming to Grade 2 or 3 of IS 9550
2. Electrogalvanised according to IS 1573:1986 service condition No. 3

All dimensions in mm

Short T Bar Handle

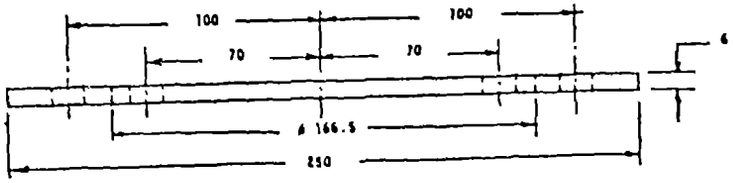


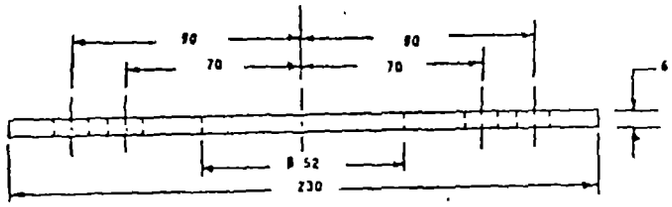
Modified Water Tank for use with 40 mm ND
PVC Riser Pipe

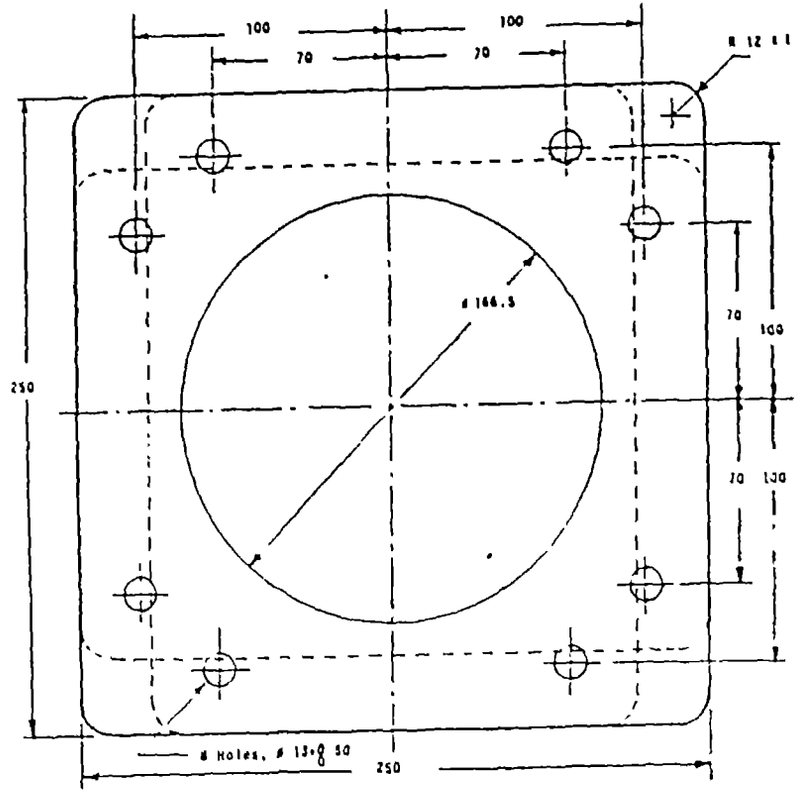


Modified Water Tank for use with
50 mm ND PVC Riser Pipes of Tara Pumps

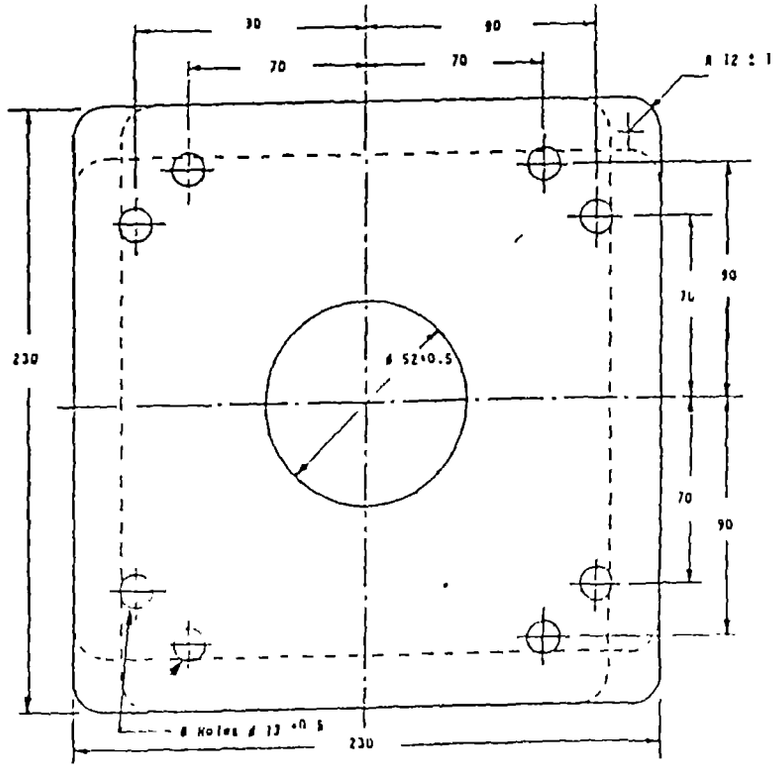
All dimensions in mm







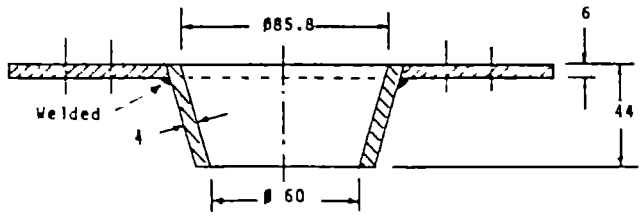
Tank Top Flange



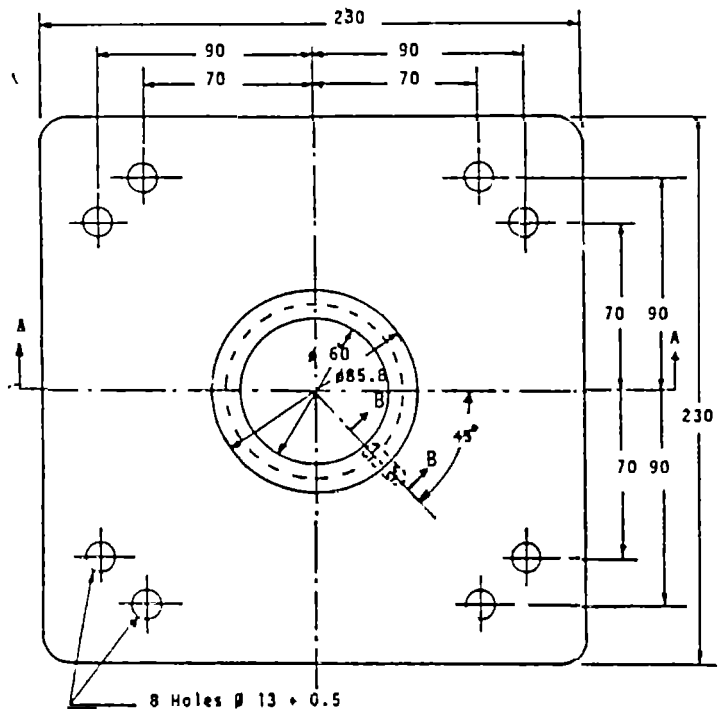
Tank Bottom Flange

All dimensions in mm

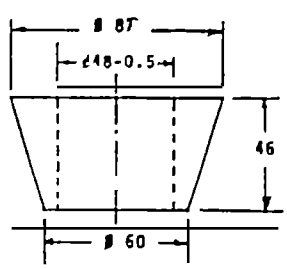
Water Tank Assembly & Parts for 40 mm ND PVC Pipe

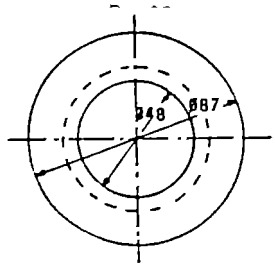


Section AA

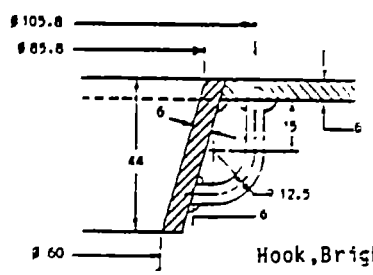


Cone Flange
(Hot dip galvanised as per IS 4759:1984)





Nitrile Rubber Cone (Ref. IS 9301:1990
Pg.23 for physical properties of
Nitrile Rubber)

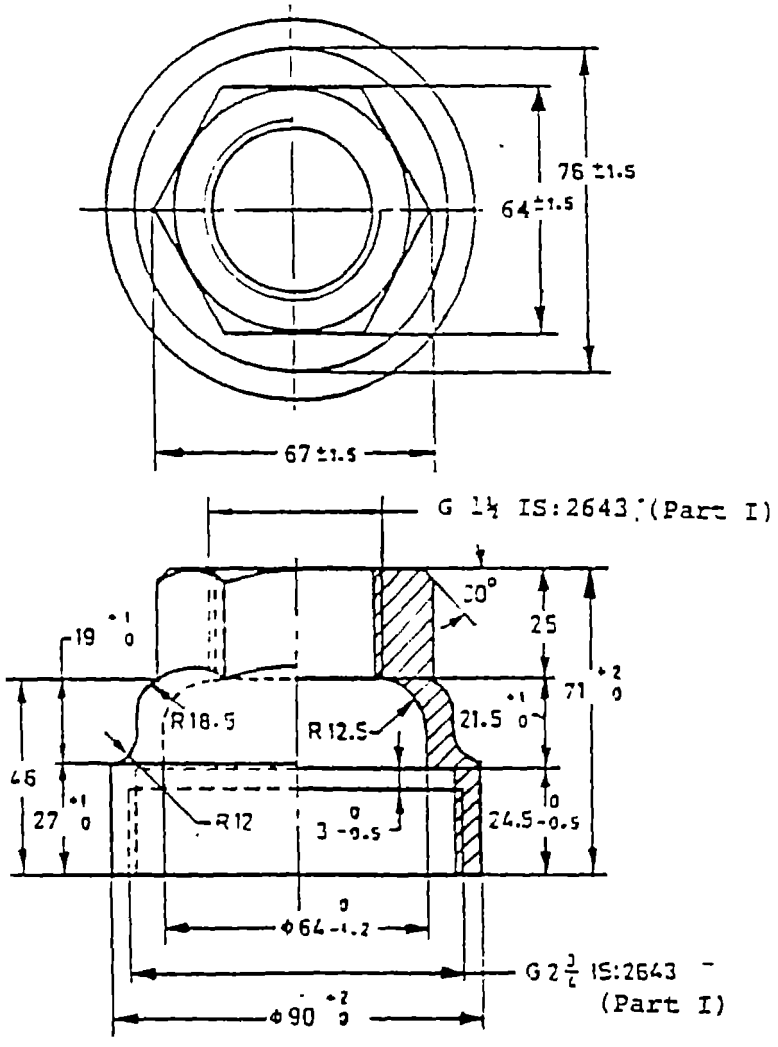


Hook, Bright bar, Ø 6

Section BB
Detail of Hook for
Nylon-Retaining Rope

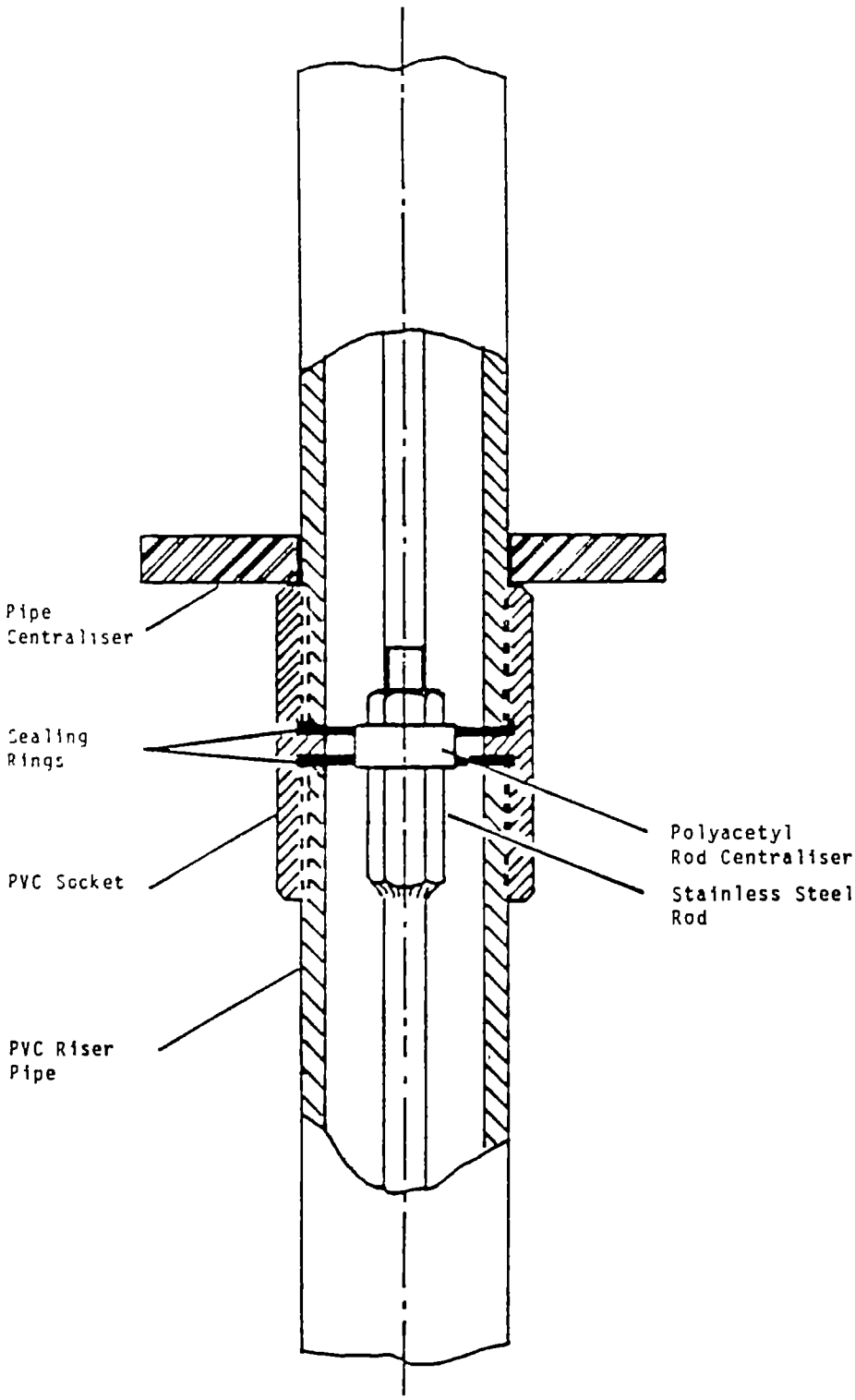
All dimensions in mm

Cone Flange & Cone for 40 mm ND PVC Pipe

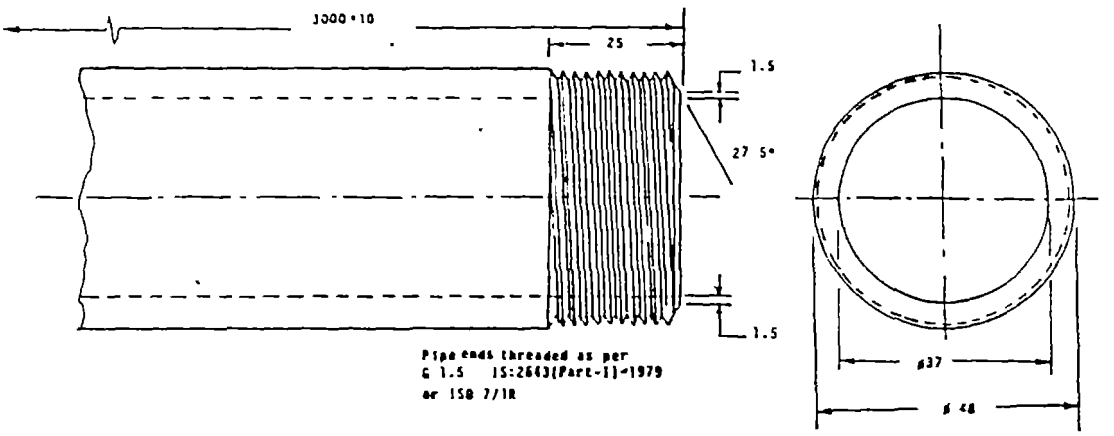


All dimensions in mm

Reducer Cap for 40 mm ND PVC Pipe
(Ref. IS 9301:1990, Fig.13A)

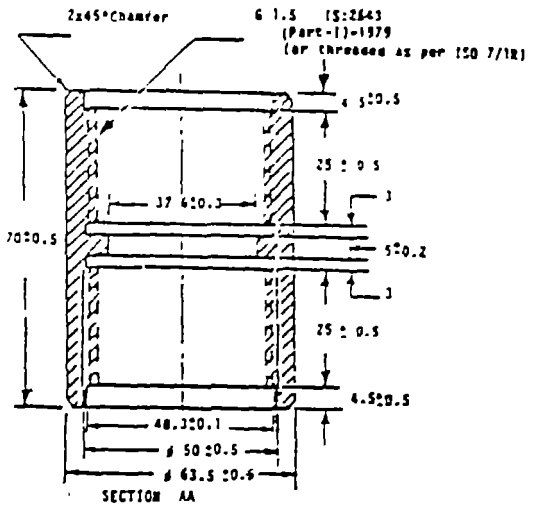


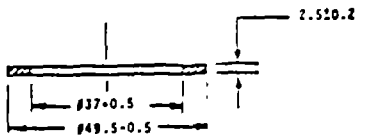
Riser Pipe and Pump Rod Assembly for India Mark II Hand Pump using PVC Pipes, Stainless Steel Rods and Centralisers



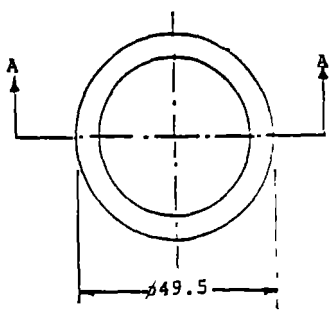
PVC Pipe as per schedule 80, ASTM-D-1785-83
O D. 48.26 mm ± 0.15
Out of Roundness 0 3
Wall Thickness 5 08 + 0.61

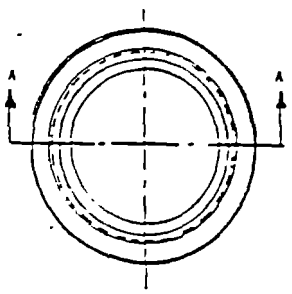
40 mm ND PVC Riser Pipe





Section AA



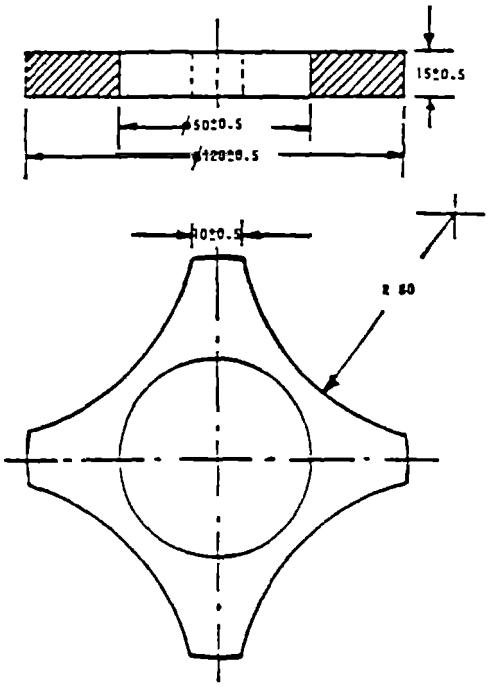


Nitrile Rubber
Sealing Ring
(Ref. IS 9301:1990, Pg.23 for physical properties of Nitrile Rubber)
Shore Hardness : 80

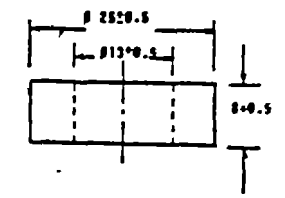
PVC Socket (Moulded/Machined)
for 40 mm ND PVC Riser Pipe

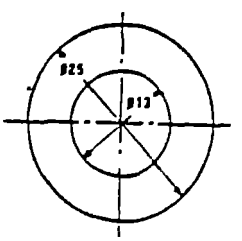
All dimensions in mm

Parts for Riser Pipe and Pump Rod Assembly



Polypropylene Pipe Centraliser
for 40 mm ND PVC Riser Pipe

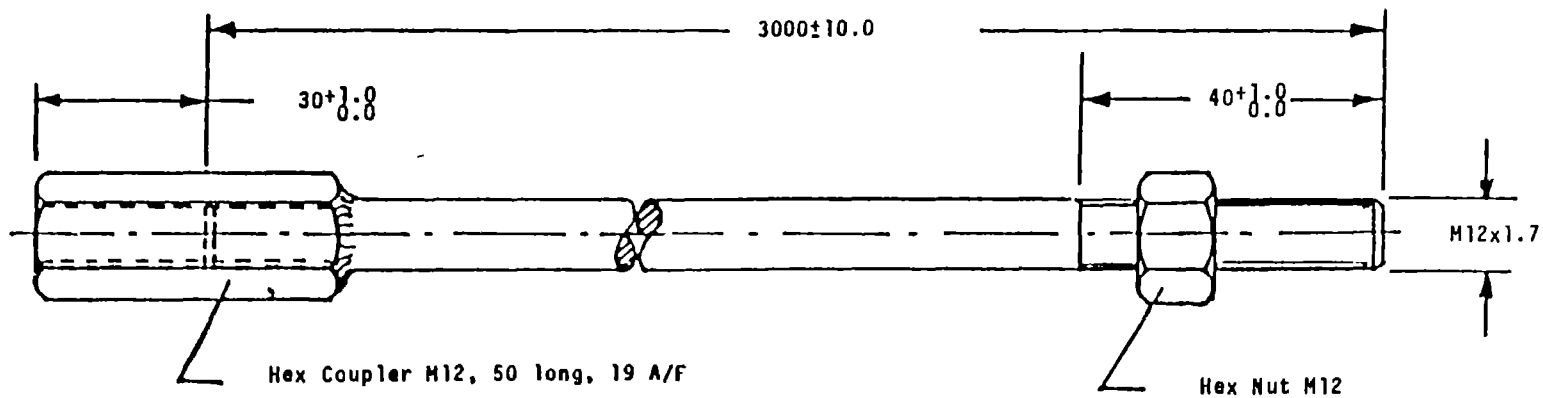




Polyacetyl Rod Centraliser

All dimensions in mm

Parts for Riser Pipe and Pump Rod Assembly



All dimensions in mm

Stainless Steel Connecting Rod , AISI 304 (AISI 316 for better corrosion resistance)

Parts for Riser Pipe and Pump Rod Assembly