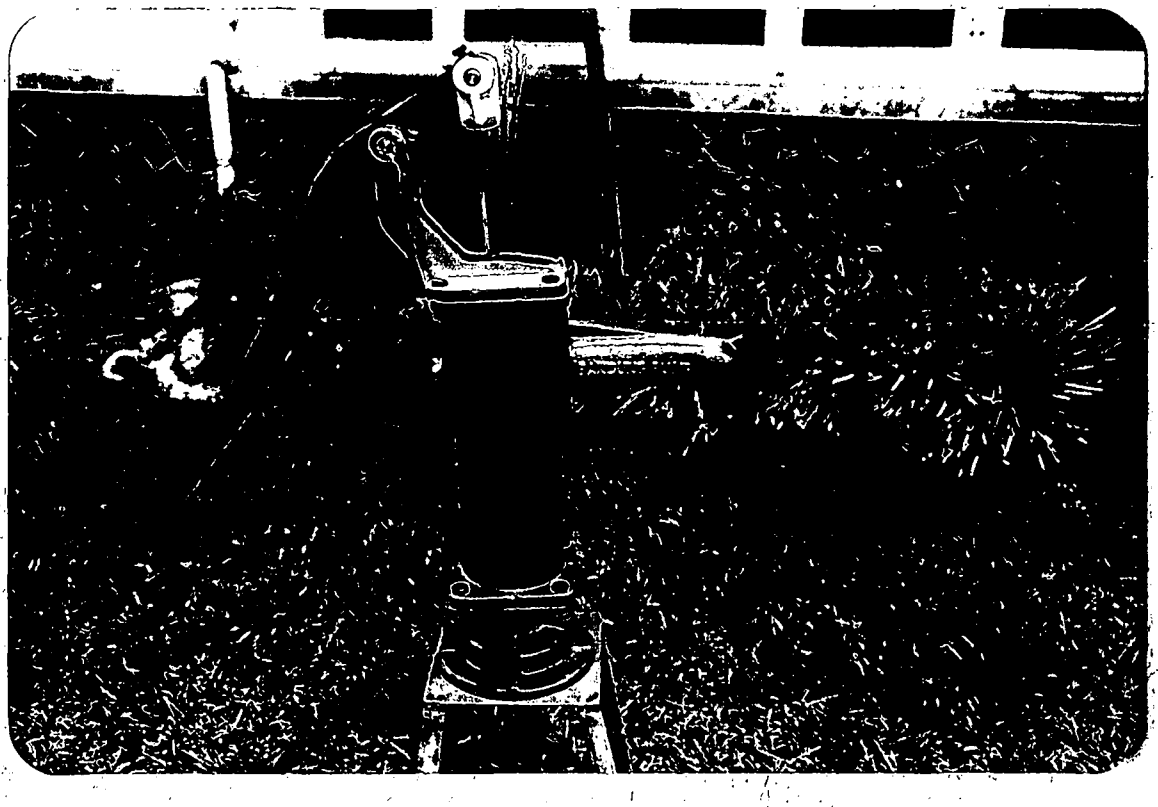
GOVERNMENT OF INDONESIA
MINISTRY OF PUBLIC HEALTH
DIRECTORATE GENERAL OF
COMMUNICABLE DISEASES CONTROL

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

WEST JAVA RURAL WATER SUPPLY

PROJECT OTA 33/J-7



PROVINCIAL HEALTH SERVICE
DIRECTORATE C D C
JALAN PROF. EIJKMAN 45 BANDUNG

I W A C O B. V.
HEAD OFFICE: P.O. BOX 183
ROTTERDAM

INFORMATION ABOUT

THE "BANDUNG" SHALLOW WELL HANDPUMP

COLLECTED BY: ING. RON VAN KERKVOORDEN
PROJECT OFFICE: JALAN SEDERHANA 7 TROMOL POS 59 TILP. 83717 BANDUNG INDONESIA

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GOVERNMENT OF INDONESIA
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WEST JAVA RURAL WATER SUPPLY PROJECT OTA 33/J-7

BANDUNG PUMP

Design memorandum for a shallow well hand pump for community use in Indonesia

November 1978

PROVINCIAL HEALTH SERVICE
DIRECTORATE CDC
JALAN PROF. EIJKMAN 45 BANDUNG

IWACO B.V.
HEAD OFFICE : P.O. BOX 183
ROTTERDAM

PROJECT OFFICE : JALAN SEDERHANA 7 TROMOL POS 59 TILP. 83717 BANDUNG INDONESIA

WEST JAVA RURAL WATER SUPPLY PROJECT

OTA - 33 / J - 7

Office : Jalan Sederhana 7
Bandung

Technical Report : 505

B A N D U N G P U M P

Design memorandum for a shallow well hand pump for community use in Indonesia

November 1978

Provincial Health Service
Directorate CDC
Jl. Prof. Eijkman 45
Bandung

Consultant :
IWACO B.V.
Head Office : P.O. Box 183,
Rotterdam , The Netherlands

C O N T E N T S

MAIN FEATURES OF BANDUNG PUMP

1. Strong and durable construction suitable for community use in rural areas.

2. Dimensions and operational charateristics adapted to the stature and physical strength of Indonesian users.

3. Spareparts such as cup seal, valves and cylinder liner widely available on the Indonesian market (Dragon type).

4. Casting and machining can be done in Indonesia with sufficient quality.

5. Easy maintenance (only 2 different sizes of simple spanners required).

6. Easy installation and rugged foundation. Closed pump cap to prevent pollution of the well.

7. Relatively low cost price *)

*) Expected cost price around Rp 15,000 (price level before 15 November 1978).

= ± $ 24,- 00

Design memorandum "BANDUNG PUMP"

1. INTRODUCTION

In the rapidly developing rural water supply activities in Indonesia there will be an increasing demand for simple and cheap suction type hand pumps (shallow well pumps). Presently no such pumps are made in Indonesia which are suitable for community use. Most frequently used so far is the Dragon type pump (or Lucky pump) of Japanese design which is also manufactured locally in several places. This pump is provided with a force connection and is consequently of a rather complicated design. Some simple pump types (such as the Godok) are made in Indonesia, but they are not considered strong enough for the heavy requirements of community use. Furthermore, some foreign made pumps are imported (such as the Dempster) on an ad-hoc project basis. There is thus apparently a need for a handpump which can meet with the following requirements :

a. Suction type handpump of simple design (shallow well type).
b. Strong and durable construction suitable for community use.
c. Possibility for manufacture in Indonesia by a number of manufacturers.
d. Limited and simple maintenance requirements.
e. Possibility to obtain those parts which require frequent replacement easily on the Indonesian market (such as cups, valves and cylinder liners).
f. Easy operation by the Indonesian people, including women and children.
g. Cheaper than the Dragon type pump of comparable good manufacture.

After a carefull study of the existing pump types as developed or proposed in different countries of the world, the conclusion was drawn that none of those fully suited the requirements. Consequently an attempt was made to design such a pump.

The design as presented herein is based on (experience with) existing pump types and the available literature (see Annex 1). No attempt has been made to experiment with new constructions or materials, but rather to compile the best properties of several pump types in one design, and to adapt it to the prevailing Indonesian market conditions.

The above mentioned requirements need some further clarification as set forth in the next paragraph.

2. EVALUATION OF CRITERIA

2.1. Pump type

The pump type shall be a simple suction hand pump. Since there is no requirement to force the water to higher levels, the top of the pump need not to be sealed, but just to be protected against possible contamination.

2.2. Construction

Community use often implies heavy usage. For example, assuming a use during 6 hours per day and 40 pump strokes per minute, the yearly number of pump strokes exceeds 5 million. Apart from parts which can be easily replaced, the pump should be able to withstand this use during many years. A cast iron or steel pump body was thus selected. It shall be possible to anchor the pump to a concrete or wooden base, to avoid the pump breaking from the riser pipe.

2.3. Local manufacture

In Indonesia sufficient capabilities are available for reasonable quality casting and machining work. Availability of raw materials is no major problem. The fabrication of rubber or plastic parts is possible within reasonable quality limits. The design shall be adapted to reasonable limits of these possibilities.

2.4. Maintenance requirements

Regular maintenance which is unavoidable in any case, should be minimized and shall be possible with simple tools (only a few spanners) and without special skill.

2.5. Replacement parts

Since the new pump will (in the beginning) be made in limited quantities only, the distribution of spareparts will be a major problem. Spareparts for the Dragon type pump are widely available

on the Indonesian market and for the most part are also manufactured in Indonesia. The new pump is therefore designed in such way that for parts which need most frequent replacement (cup seals, bottom and plunger valves, cylinder liner), Dragon type spareparts can be used.

2.6. Operation

Easy operation is given full attention. The average demand of a family in rural areas is assumed at about 0.3 m3. With a pump capacity of about 1 to 2 m3/h this requires daily 10 to 20 minutes of pumping for one or more of the family members. During this time an average person can be expected to deliver a power of about 50 Watt or 0.07 HP.

It has been observed that people prefer on hand pumps a stroke length of the handle of 40 to 50 cm, depending on the size of the user, and a level at the middle of the stroke of about 65 to 70 cm above the ground. If the operation is relatively light, movement will be done with the arm only. For heavy operation also the body may be used (back movement) or the body only (stiff arm operation). This makes little difference in the required level of the handle. Normally, a frequency of 40 to 60 strokes per minute is found convenient and a force on the handle of 10 kgf is considered normal in Indonesia.

2.7. Price

The newly proposed pump should be considerably cheaper than the prevailing Dragon type pump, assuming a same level of quality of casting and machining. It will be more expensive than other makes of simple pumps, which, however, are not suitable for community use. In this way it is expected that the new pump will find its own place on the market in addition to existing pump types.

3. ERGONOMICS/MECHANICAL ASPECTS

With the selection of Dragon type of cylinder the diameter of the plunger and cylinder is given and is about 9.6 cm. Assuming a maximum lift of 6 m the discharge is about 1.4 m3/h or 23 l/min. (see Annex 2).

The static force on the plunger at 6 m lift is about 40 kgf. Dynamic forces resulting from acceleration of water masses and mechanical parts and hydraulic headlosses in the suction pipe and the pump are relatively small and therefore neglected. In order to limit the force on the handle to 10 kgf the advantage must be 1:4. Given a stroke of the handle of 40 cm, the average travel of the plunger will be about 10 cm (which is much less than on most existing handpumps), resulting in a displacement of 0.7 liters per stroke. To obtain the possible discharge of 23 l/min, the frequency of strokes will have to be $\frac{23}{0.7\ (1-S)} = 37$ per minute (assuming the slip S at 0.1).
This is close to the desired frequency (see par. 2.6.). At lower values for the lift, the discharge of the pump can be higher (see Annex 2) and so is the number of pump strokes.

With the stroke length and advantage thus determined and the required level of the handle over the ground given, the main data are established required for a design adapted to the physical characteristics of the users. (see Fig. 1)

4. FURTHER DESIGN CONSIDERATIONS

4.1. Spout

The spout should be long enough to reach the opening of a "kendi" (Indonesian type of water jar). Preference is given to a vertical (downward) outflow of the water. The Dragon type pumps have a more or less horizontal spout which has the disadvantage that the direction of the outflowing water depends on the force of pumping which makes it difficult to fill kendis.

4.2. Pumpcap

The pumpcap is designed to be strong enough to transmit the forces excercised on the fulcrum by the handle. Because the pumprod has some lateral movement, the opening in the pumcap is closed with a sliding plate to prevent contamination of the inside of the pump.

4.3. Cylinder liner

The pump body has been designed to accept either the standard Dragon type steel cylinder liner or a PVC liner. The prototypes are fitted out with a PVC liner. These linershave tc be made at special order because of the non-standard pipe size. However, this liner can be relatively easily and cheaply made.
In case the PVC cylinder liner does not prove satisfactory under certain circumstances or can not rapidly be obtained, the usual Dragon type liner can be used.

4.4. Pump Base

One of the most common shortcomings of available pumps is that they can not be properly mounted on the foundation. The result is that the pump may easily break off from the suction pipe. The proposed pump is designed with a base which can be easily and solidly anchored to either a concrete or wooden foundation.

Furthermore the pump base accepts a well casing of up to 4 inch diameter thus preventing any waste water from entering in the well. (See figure 2).

4.5. Bearings

In accordance with available research data the bearings are designed in such way that the force on the projected bearing surface is not more than 7 kgf/cm2. This requires a projected surface of 7 cm2 for the fulcrum bearing. Lubricating holes are provided.

4.6. Casting and machining

A precondition was that manufacturing of the pump could be done to sufficient quality standards in available foundries and machine shops in Indonesia.
The pump is designed in such way that the moulds are as simple as possible and casting will not pose any problems.
All flanges have the same bolthole circle so that they can be drilled accurately with only one jig. This will improve the possibility to interchange parts between pumps, and ensures that replacement parts will fit easily. Attention is given to the fact that machining is limited as far as possible and can be done with a minimum of handling.

4.7. Pump height

The pump has been designed in such way that when mounted on a concrete block of about 20 cm height, most Indonesian users will find operation convenient. In case a different height is required (e.g. if the pump is mostly used by children) this can be achieved by adapting the dimensions of the foundation block.

4.8. Maintenance

Only 2 different sizes of bolts and nuts are being used throughout the pump, so that all maintenance can be done with the very minimum of tools. The pump containts no components which require adjustments or special tools.

Parts which need more or less frequent replacement (cup seal, valves, cylinder liner) are of the same dimensions as those of the Dragon type pump and already widely available in the Indonesian market.

5. PROTOTYPE/PRICE

By November 1978, five prototypes of the proposed pump were manufactured and field testing with one or two pumps will start soon. Since the pump does not contain any new elements which are not yet used or tested elsewhere, no major defects are expected to show during testing .

The total weight of the pump is about 23 kg, and it is expected that the pump can be commercially produced for a price between Rp 15,000 and Rp 18,000 (pre - November 15, 1978 price level). This would compare favourably with the price of Rp 30,000 for the good quality Dragon type pump.

Detailed workshop drawings are available upon request from the OTA - 33 project office. Moulds used for the manufacture of the prototypes are available at the OTA - 33 project office.

6. ACKNOWLEDGEMENT

Particular reference should be made to the active assistance of Ir. Sri Hardjoko Wirjomartono of the mechanical engineering department of I.T.B. and the staff and personnel of M.I.D.C. (Metal Industry Development Centre) in developing the proposed pump. Ir. Hardjoko has been helpful in giving comments on the mechanical aspects. M.I.D.C. was actively involved in adapting the design to Indonesian casting and machining capabilities, in preparing the workshop drawings, in checking and improving the moulds and in machining the prototypes.

Annex 1.

LITERATURE *).

(1). " Hand pumps ", Technical Paper No. 10, International Reference Centre for Community Water Supply, The Hague, July 1977.

(2). Several reports of the Battelle Memorial Institute, Columbus Laboratories, concerning the Development of a shallow well pump for the Agency for International Development.

(3). The New No. 6 Handpump, UNICEF, Bangladesh.

(4). Report on the Bangalore pump.

(5). Documentation and brochures of numerous suppliers of hand and footpumps.

*). See also bibliography in (1).

TABLE 1.

Pump discharge depending on total lift.

LIFT (in m)	DISCHARGE m^3 / h	l / min
7	1.2	20
6	1.4	23
5	1.7	28
4	2.1	35
3	2.8	46
2	4.1	69
1	8.3	140

Notes :

1) Pump discharge $Q = (1 - S) \frac{N . \eta}{\rho . g . H}$ m^3/s

in which S = Slip of pump, assumed at 0.1.
N = power of pump operator, assumed at 50 watt (0.07 HP).
η = total pump efficiency, assumed at 0.5.
ρ = specific density of water : 1000 Kg/m^3.
g = acceleration of gravity : 9.8 m/sec^2
H = pumplift in m.

2) Pumplift H is vertical distance between water level in well and outlet of spout.

3) Dynamic head losses in suction pipe are not conside ed. It is assumed that they are covered by the pump effi - ciency.

Annex 3.

LIST OF CONSTRUCTION DRAWINGS BANDUNG PUMP.

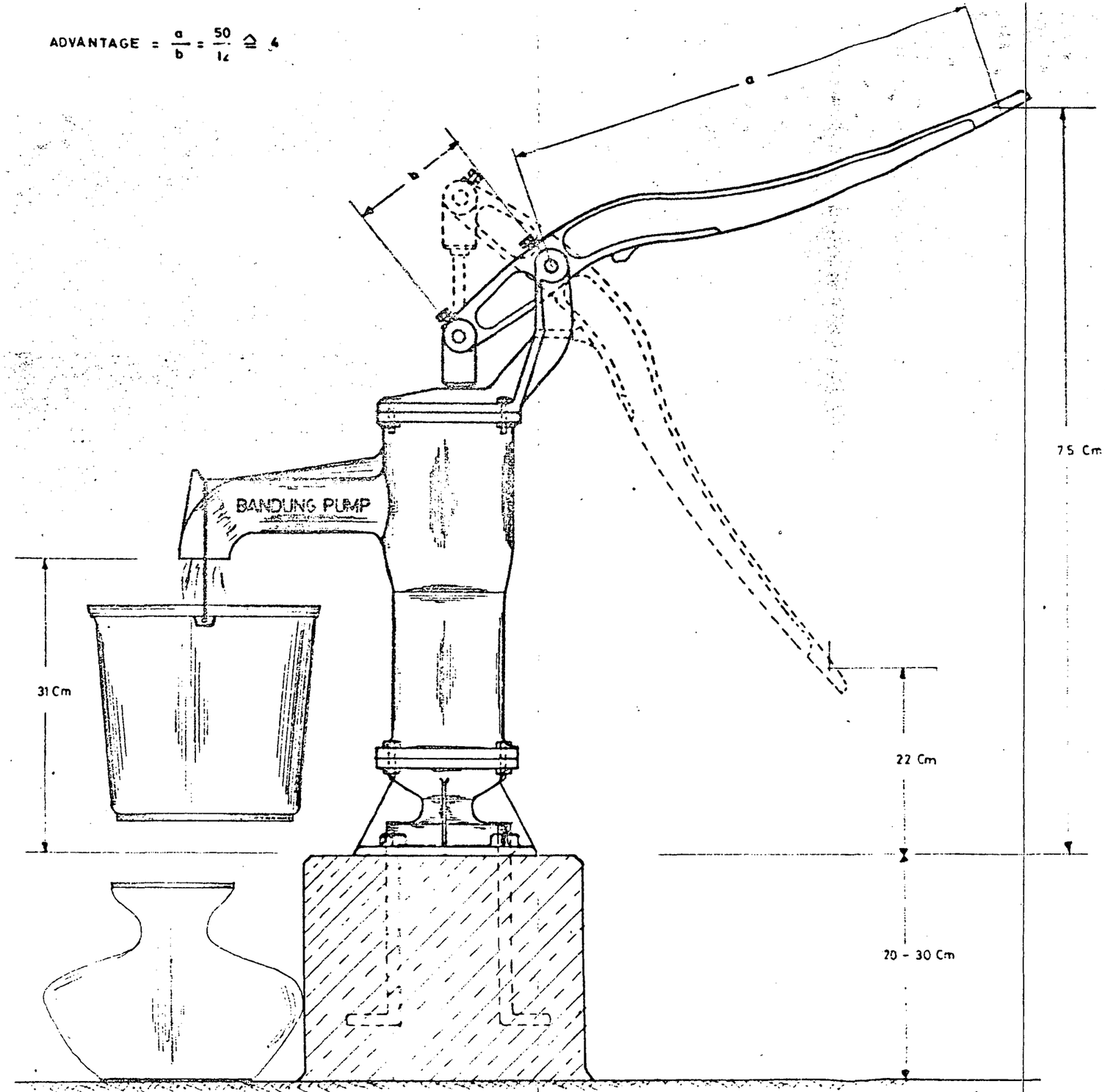
No.	Name
505 - 01	Bandung Pump.
505 - 02	Body base.
505 - 03	Gasket.
505 - 04	Body.
505 - 05	Cylinder liner.
505 - 06	Plunger rod.
505 - 07	Pump cap.
505 - 08	Handle.
505 - 09	Pin.
505 - 10	Plunger rod bracket.
505 - 11	Anchor bolt.
505 - 12	Valve seat.
505 - 13	Dust cover

Note : A set of casting moulds is available at the OTA - 33 project office.

Annex 4.

Prototype of Bandung Pump.

ADVANTAGE = $\frac{a}{b} = \frac{50}{12} \cong 4$



GOVERNMENT OF INDONESIA	RURAL WATER SUPPLY WEST JAVA PROYEK AIR MINUM PEDESAAN JAWA BARAT
	SCALE approx 1 : 5
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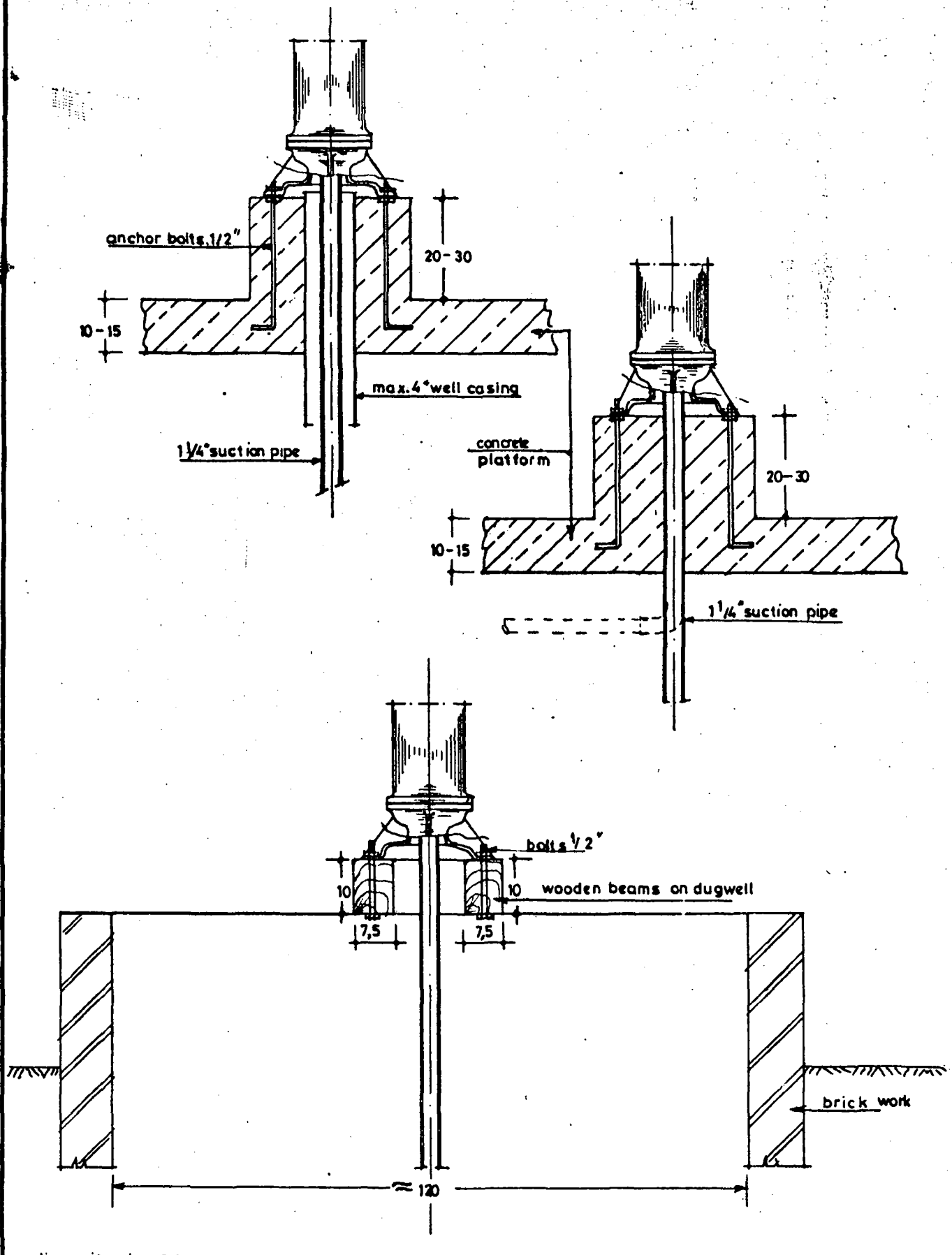
	APPR.

BANDUNG PUMP



dimensions in cm

GOVERNMENT OF INDONESIA MINISTRY OF HEALTH DIRECTORATE OF HYGIENE AND SANITATION	**RURAL WATER SUPPLY WEST JAVA** **PROYEK AIR MINUM PEDESAAN JAWA BARAT** PROJECT OFFICE: JALAN SEDERHANA 7 – BANDUNG		**OTA 33**
KABUPATEN	SCALE 1 : 10	**FOUNDATION POSSIBILITIES BANDUNG PUMP**	
KECAMATAN	DRAWN A.Sadjo.S		
DESA	DATE 5 - 12 - 78		
CONSULTANT: **IWACO B.V.** - BOX 183 - ROTTERDAM	APPR.	REPORT NO.	FIG. NO. 2

2

GOVERNMENT OF INDONESIA
MINISTRY OF PUBLIC HEALTH
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DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

WEST JAVA RURAL WATER SUPPLY PROJECT OTA 33/J-7

NOTE ON THE NUMBER OF CONSUMERS PER HANDPUMP

BY
IR. A.R. MANUEL

PROVINCIAL HEALTH SERVICE
DIRECTORATE C D C
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BANDUNG - OCTOBER 1979

REPORT NO. 560-1

GOVERNMENT OF INDONESIA
MINISTRY OF PUBLIC HEALTH
DIRECTORATE GENERAL OF
COMMUNICABLE DISEASES CONTROL

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

WEST JAVA RURAL WATER SUPPLY PROJECT

OTA - 33/J - 7

NOTE ON THE NUMBER OF CONSUMERS PER HANDPUMP

BY
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DIRECTORATE C D C
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I W A C O B. V.
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BANDUNG - OCTOBER 1979

PROJECT OFFICE : JALAN SEDERHANA 7 TROMOL POS 59 TILP. 83717 BANDUNG INDONESIA

In rural water supply programmes often guidelines are used for the number of people that can be served by one hand (or foot) pump. Since the power of the person operating the pump is limited, the quantity of water that can be pumped per minute is limited also. This quantity is smaller, when the water table is lower; in other words when the lift is greater. In Table 1 the number of consumers is given based on the following assumptions :

- power of pump operator (consumer) : 50 Watt (0.7 Hp) (1 operator assumed).
- total hours of pumping per day : 6 hours.
- consumption per capita : 40 liters per day.

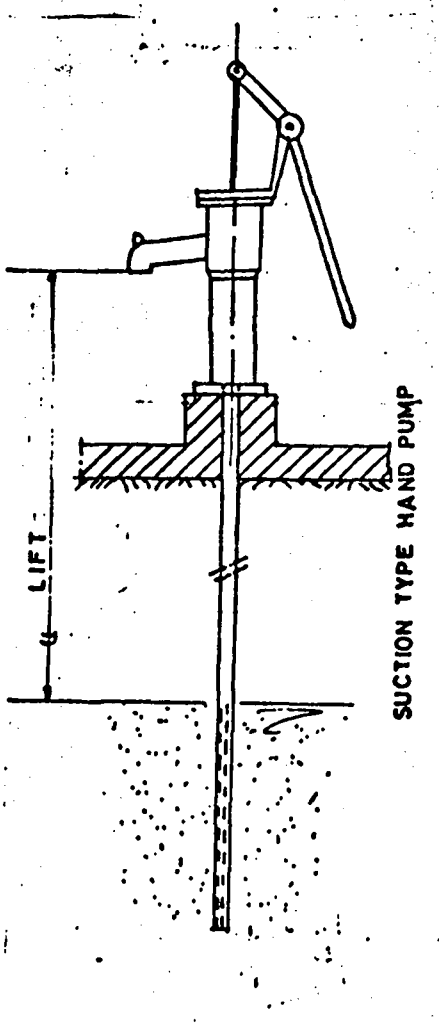
The calculations are explained in the Annex.
Table 2 gives some more information that can be derived from the same assumptions.

From Table 1 it becomes clear that there can not be one criterium for the number of consumers per handpump. For shallow well pumps 200 consumers per pump is often used, which is on the safe side.

However, for deep well pumps the number should be (much) lower, depending on the lift. With a lift of 25 m for example, only 50 people can be served by one handpump under the assumed conditions.

Table 1

Lift in meter	Number of people served
1	500 *
2	500 *
4	340
6	230
8	170
10	140
12	110
15	90
20	70
25	50
30	45
40	30
50	25

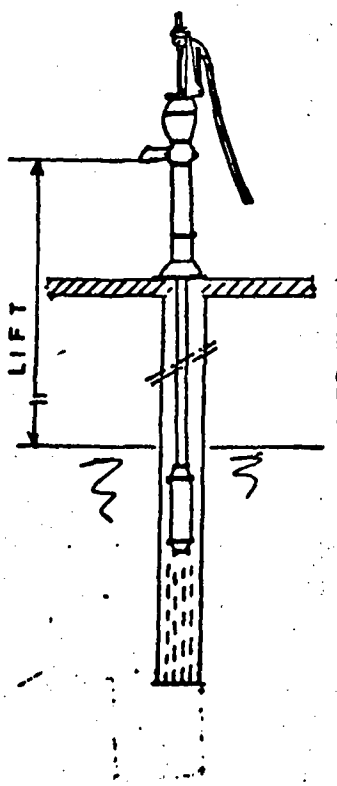


* Theorically more people could be served but practical operation limits their number to about the given figure.

N.B. In case the number of hours of operation or the per capita consumption is different the number of people served can be adjusted on a proportional basis.

Table 2

Lift in meter	Average flow * (l/s)	Max. cylinder diameter **	Type of pump
1	0.93	4"	Suction or shallow well type
2	0.93		
4	0.63		
6	0.42		
8	0.31	3"	Lift
10	0.25		
12	0.21	2"	or deep well type
15	0.17		
20	0.13		
25	0.10		
30	0.08	1½"	
40	0.06		
50	0.05		



LIFT TYPE HAND PUMP

* This is the average flow during pumping. In case of a bore hole (deep well), this should also be the safe yield of the well.
In case of a dug well, the daily average should be taken. In this case with 6 hours pumping per day, the well yield shall be 6/24 = 1/4 of the given figures.

** The diameter is based on a max. load on the plunger of 50 kgf. With the usual mechanical advantage of about 1:5, the force on the handle is then about 10 kgf. This handle force should be considered as a maximum for Indonesian users.

ANNEX

1. Pump discharge

$$Q = \frac{N.\eta}{\rho g H} \quad \text{.....(1)}$$

in which :

Q = discharge in m3/s

N = power of operator (assumed at 50 Watt)

η = total pump efficiency (assumed at 0.5)

ρ = specific density of water (1000 kg/m3)

g = gravity acceleration (9.8 m/sec2)

H = pump lift in m

2. Number of population to be served

From equation (1) the number of consumers can be calculated as follows :

$$n = 370 \frac{N.\eta.h}{H.C.} \quad \text{.....(2)}$$

in which :

n = number of consumer for one pump

N = power of operator in Watt

η = total pump efficiency

h = number of pumping hours per day

H = lift in m

C = per capita consumption in liters per day

GOVERNMENT OF INDONESIA
MINISTRY OF HEALTH
DIRECTORATE OF HYGIENE AND SANITATION
WEST JAVA RURAL WATER SUPPLY PROJECT

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

OTA - 33

WEST JAVA RURAL WATER SUPPLY PROJECT

TECHNICAL SPECIFICATIONS AND BIDDING DOCUMENTS FOR THE SUPPLY OF ORDINARY SUCTION TYPE HANDPUMPS

IWACO, December 1978

Project Office: Jl.Sederhana 7
BANDUNG
Head Office : P.O.Box 183, ROTTERDAM

ADVIESBUREAU VOOR WATERVOORZIENING
IWACO B.V.
INTERNATIONAL WATER SUPPLY CONSULTANTS

GOVERNMENT OF INDONESIA
MINISTRY OF HEALTH
DIRECTORATE OF HYGIENE AND SANITATION
WEST JAVA RURAL WATER SUPPLY PROJECT

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

OTA - 33

WEST JAVA RURAL WATER SUPPLY PROJECT

TECHNICAL SPECIFICATIONS AND BIDDING DOCUMENTS FOR THE SUPPLY OF ORDINARY SUCTION TYPE HANDPUMPS

IWACO, December 1978
Project Office: Jl.Sederhana no. 7
BANDUNG
Head Office: P.O. Box 183, ROTTERDAM

ADVIESBUREAU VOOR WATERVOORZIENING
IWACO B.V.
INTERNATIONAL WATER SUPPLY CONSULTANTS

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PART I - GENERAL CONDITIONS

PART II - TECHNICAL SPECIFICATIONS

PART III - BIDDING DOCUMENTS

PART IV - FIGURES AND DRAWINGS

FIG. 1 BANDUNG PUMP

D R A W I N G S

505 - 01 ASSEMBLY
505 - 02 BODY BASE
505 - 03 GASKET
505 - 04 BODY
505 - 05 CYLINDER LINING
505 - 06 PLUNGER ROD
505 - 07 PUMP CAP
505 - 08 HANDLE
505 - 09 PIN
505 - 10 PLUNGER ROD BRACKET
505 - 11 ANCHOR BOLT
505 - 12 VALVE SEAT
505 - 13 DUST COVER

PART 1

GENERAL CONDITIONS

PART 1 - GENERAL CONDITIONS

I.1. INTRODUCTION

WEST JAVA RURAL WATER SUPPLY PROJECT is a project in the framework of the Project Aid Agreement between the Government of Indonesia and the Government of the Netherlands. The project will be co-financed by the Government of the Netherlands.

I.2. APPROVAL BY THE GOVERNMENT OF THE NETHERLANDS

The Government of Indonesia has received a loan from the Government of the Netherlands toward the West Java Rural Water Supply Project, and it is intended that proceeds of this loan will be applied for payments under the Contracts for which this Invitation to Bid is issued. Payments by the Government of Indonesia will be made only upon approval by the Government of the Netherlands in accordance with the terms and conditions of the Project Aid Agreement and will be subject in all respects to the terms and conditions of that Agreement.

I.3. INVITATION TO BID

The Directorate General of Communicable Diseases Control, on behalf of the Government of the Republic of Indonesia, invites Suppliers to bid on the furnishing of :

- 300 (Three hundred) ordinary suction type handpumps, in these specifications called "Bandung Pump".

The pumps shall be furnished according to Section II : TECHNICAL SPECIFICATIONS and the Drawings, which are part of this Invitation to Bid.

I.4. BID SUBMISSION

The Bid shall consist of five (5) copies each of the following documents :

- Bids made on the prescribed forms.
- Shop drawings
- Standards to which the goods the Supplier proposes to furnish do comply
- Delivery schedules
- Manufacturer information
- Manufacturer experience
- Manufacturer's warranty

The five (5) copies shall consist of one (1) copy marked original and four (4) photo copies.
If there is any discrepancy the original will prevail over the copies.
The Bid documents shall be handed over personally in a sealed enveloppe before ..... to :

Government of the Republic of Indonesia
Ministry of Public Health
Directorate of Communicable Diseases Control
.....
.....

I.5. BID PRICES

The Bid prices shall be stated in Indonesian Rupiahs and shall be firm and binding for a period of one hundred twenty (120) calender days from the above mentioned date of submission.

I.6. SHOP DRAWINGS

All shop drawings needed to manufacture the Bandung Pump are attached to this Invitation to Bid.
In case the Supplier has remarks to these drawings he is obliged to add a complete set of shop drawings with his Bid in five fold regarding the Bandung Pump.
The shopdrawings for the FC pump shall be submitted by the Supplier in five fold with the Bid anyway. The latter mentioned shop drawings include : drawings, manufacturer's brochures, parts lists, graphs and operating instructions.

I.7. STANDARDS

The Supplier shall clearly state the standards to which the goods he proposes to furnish do comply.
If the Supplier proposes to furnish goods which meet internationally accepted standards, not referred in these TECHNICAL SPECIFICATIONS but at least equivalent to those specified herein, he shall submit with his Bid the copies of these standards.

I.8. DELIVERY SCHEDULE

Both the Bandung Pumps and the FC pumps, in total three hundred (300) pumps, shall be delivered to the Government stores of the Provincial Health Service, Jalan Pasteur 25, Bandung, within 120 days after the receipt of the Notice to Proceed.
The pumps may be delivered in batches, with a minimum of 150 pumps per batch.
Two weeks in advance of every shipment written notice shall be given to the above mentioned Service.
The Supplier shall indicate in his Bid the way of shipment and the number of batches.

I.9. MANUFACTURER INFORMATION

The Supplier shall indicate, opposite each item listed in form B, the name and location of the manufacturer of the equipment or material proposed to be furnished.
The Supplier shall list the items in accordance to the components of the goods proposed.

I.10. MANUFACTURER EXPERIENCE

The Supplier shall complete form C giving information on manufacturer's experiences since 1972.

I.11. MANUFACTURER'S WARRANTY

The words "MANUFACTURER'S WARRANTY" mean a written assurance by the Supplier as sole and only responsible, that materials found to be damaged or defective or failing to meet the requirements of the "TECHNICAL SPECIFICATIONS" even if such materials are supplied by his subcontractor or agent, will be replaced or repaired or otherwise corrected at his own expense. Unless otherwise specified a Manufacturer's Warranty is not secured by a Bond or other Surety.

I.12. NOTICE TO PROCEED

This notice to proceed will be granted after the approval mentioned in 1.2 "APPROVAL BY THE GOVERNMENT OF THE NETHERLANDS". The Supplier and/or manufacturer(s) shall not do any work under this Invitation to Bid prior to the issue of the Notice to Proceed.

I.13. INSPECTION AND TESTING

Each item of the Delivery Schedule shall, upon delivery, be accompanied by a Supplier's Test Certificate stating that the item furnished conforms in all respects to the TECHNICAL SPECIFICATIONS.

All materials and equipment furnished under this Invitation to Bid shall be subjected to inspection by the Employer, or his representative(s). Such inspection may include mill, plant, shop or warehouse inspection as required and all information and assistance shall be furnished by the Supplier and his manufacturers to the Employer or his representative(s).

The Supplier shall give the following information to the Employer in writing :

- when the pumps will be cast
- which foundry will cast
- where the foundry is located
- how many pumps will be cast

I.14. PROTOTYPE

Eaoh foundry, casting pumps under this Contract, shall submit one completely assembled, but untreated prototype pump to the Employer for approval, prior to proceed.

The Supplier may request for the loan of either a sample pump or the wooden patterns, to make the prototype(s) of the Bandung pump.

Both sample pump and wooden patterns are owned by the OTA-33 project. They should be returned immediately after use in good condition to the OTA-33 project.

I.15. GUARANTEES

The Supplier shall guarantee, that all supplies furnished by him under this Invitation to Bid are free of defects in material and workmanship for a period of one year following the date of issue of the certificate of completion of the furnishing.

I.16. INSURANCE

The Supplier shall insurance all goods for full Bid value, and in the currency in which payment is to be made for the goods. Insurance shall provide full reimbursement in the event goods are lost, stolen or damaged prior the acceptance by the Government at the Government stores.

I.17. PAYMENTS

Every payment will be made directly to the Supplier by the Indonesian Government in Indonesian currency.

The payments will be done as follows :

a. Following receipt of the Notice to Proceed, the Supplier may, at his option, request an advance payment of up to ten percent (10 %) of the total bid price, excluding the costs of transport.
Within thirty (30) calendar days after receipt of the request the Government will issue an authorization to pay.

b. Upon delivery of each batch of goods to the designated storage area, the Engineer will inspect the goods on behalf of the Employer and if found to be in compliance with all requirements, he will issue a Certificate of Preliminary Acceptance of the Government.
Within thirty (30) calendar days after the written request by the Supplier for payment the Government will issue an authorization to pay eighty percent (80 %) of the value of the goods (including costs of transports) contained in the batch concerned.

c. After delivery of the last batch of goods the Engineer will issue a Certificate of Completion of the Furnishing.
Within thirty (30) calendar days after issue the final payment of all amounts due to the Supplier will be made.

PART II

TECHNICAL SPECIFICATIONS

PART II - TECHNICAL SPECIFICATIONS

II.1. GENERAL

The pumps shall be grey cast iron handpumps of the shallow well type.
Initially they will be erected within they OTA-33 project area by a civil contractor.
The pumps shall be supplied completely assembled and painted, packed in cardboard boxes or wooden cases, with a maximum of two pumps per packing.
Each pump shall be accompanied with a manual.
Spare parts shall be supplied in cardboard boxes. The contents of each box, such as name of the part and quantity, shall be clearly indicated with paint or felt pen on the box.

II.2. MATERIAL REQUIREMENTS

II.2.1. GENERAL : All parts shall show homogeneous structures. The use of fillings in any part or any material, in order to create a smooth surface is not accepted.
The surface of any part or material shall be as flat and straight as possible.
None of the materials shall endanger the health of the water consumers.
Even under the most unfavourable circumstances, the water drawn off the pump shall not contain lead or other toxic substances in quantities which are injurions to health, or have objective taste or smell.

II.2.2. CAST IRON : The pig iron to be used as a component for grey cast iron, shall meet the specifications mentioned in table 1 as much as possible, while the coke shall meet the requirements of table 2.

Silicon	Carbon	Manganese	Sulphur	Phosphorus
2.50 - 2.75	4.10 - 3.85	0.50 - 1.25	0.05 max	0.30 - 0.50
2.76 - 3.00	4.05 - 3.70	0.50 - 1.25	0.05 max	0.30 - 0.50
3.01 - 3.25	3.90 - 3.65	0.50 - 1.25	0.05 max	0.30 - 0.50
3.26 - 3.50	3.85 - 3.60	0.50 - 1.25	0.05 max	0.30 - 0.50

Table 1. Specifications for foundry pig iron (values given in percentages)

Fixed carbon	Volatile matter	Ash content	Sulphur content
88.0 min	1.0 max	12.0 max	1.0 max

Table 2. Specifications for foundry coke (weight by percentages)

All cast iron parts shall have a hardness within the range of 160 - 220 Brinell Hardness Numbers after casting. This may be checked at any location of a part.
The tensile strength shall be 18 - 25 kg/mm^2.

II.2.3. STEEL : Steel to be applied for pins shall be either cold drawn (or ground) bar or non - magnetic stainless steel type 304.
The Supplier is obliged to include both materials in his bid.
The plunger rod shall be made of either 5/8" cold drawn bar (assen staal) or St 37- St 42.
Pipes to be used for handles shall be at least medium class mild steel tubes
The anchor bolts shall be made of St. 37.
Bolts and nuts shall have the ordinary trade quality and shall be galvanized.
Due to deterioration of the taste of the water pumped, greasing of the threaded parts inside the pump is not allowed.
The anchor bolts may not be protected with paint or grease.

II.2.4. G.I. PIPES : The pipes, 1½" nominal internal diameter, shall be medium class galvanized iron pipes, with a nominal length of 6 m^1 and provided with two threaded ends.
For jointing the pipes 1¼" threaded, galvanized double sockets shall be delivered as indicated in Form A.1.

II.2.5. RUBBER : Gaskets, valves and plunger cups shall be made of natural rubber, with a hardness of 30 - 50 shore.
The rubber shall resist mildew fungus and other biological attacks, as well as cyclic wetting and drying.
Besides, it must be readily available on the Indonesian market.
Particularly the disc valves shall have completely flat surfaces.
The rubber applied for the plunger cups shall have a long life and a low friction coefficient. Yet flexible enough to fill cylinder wall irregularities.

II.2.6. PLASTIC : Valve covers or spiders shall be made of plastic as is usually installed in the local made Dragon type handpump.
In case pvc cylinder linings and/or valve seats are used, these shall be made of unplasticized polyvinyl choride.

II.3. MANUFACTURER'S INSTRUCTIONS

The Manufacturer shall draft instructions for the assembly, installation, lubrication and maintenance of the pumps.
A simple step by step schedule for lubrication and maintenance (daily, weekly, monthly and yearly) shall be drawn up in the Indonesian language.
These Instructions shall be submitted with the Bid.

II.4. BANDUNG PUMP

II.4.1. GENERAL : The Bandung Pump has been designed in close cooperation with MIDC and ITB Bandung. It is free to any Supplier to use this design at any moment, even if there is no supply under this Invitation to Bid.

II.4.2. PERFORMANCE REQUIREMENTS :

The pumps shall be manufactured according to the Drawings and machined within the limits as indicated in these drawings. They shall be sturdy and suitable for intensive use in village water supply systems. The pumps shall withstand rough handling during at least 5 years of operation with a minimum of maintenance.
Pumps with misaligned bearings will be rejected.
Each pump shall be supplied with four (4) anchor bolts.
The pumps shall be painted with a two-layer system. The first layer shall be red lead primer (90 - 10). The finishing gloss paint shall be applied in 2 coats in colour (s) to be indicated by the Employer. Prior to paint, the major burs shall be removed by grinding.

II.4.3. SPECIAL REQUIREMENTS

II.4.3.1. Body base

It is optional to the Supplier to provide this part with either a PVC seat or a brass seat.
This seat shall be press fitted in the cast iron body base.

II.4.3.2. Pump body

On both sides of the spout the name "Bandung Pump" shall be cast with clear letters.
The body shall be provided with a steel cylinder liner (The usual dragon type liner can be used).
The sleeve, which is put into the body from the bottom, shall be centered with a portland cement - sand mortar (volume parts 1 : 1) as is indicated in the Drawings.

II.4.3.3. Pump cap

The pump cap will have to seal the top of the pump body against potential contamination. For that purpose the slot, to allow the lateral movement of the plunger rod in the cap, shall be covered with a small plate, as shown in the Drawings.

II.4.3.4. Handle

The handle shall be burr free and as smooth as possible.

II.4.3.5. Plunger rod bracket

The down stroke of the plunger is limited by means of the bracket, which touches the two reinforcement ribs on the pump cup.

II.4.3.6. Plunger

The plunger to be installed in the Bandung pump is in accordance with the plunger as used in the local made Dragon pump.
For that purpose the work shop drawings for these parts are not included in this document.
The plunger check valve seat in the cap holder shall be well machined.

II.5. REPAIR AND MAINTENANCE TOOLS :

The Supplier shall supply toolsets for repair and maintenance of the pump.

Each toolset shall be properly packed seperately in a firm wooden box provided with handles and padlocks.

Each set shall consist of :

1 pc pocket measuring tape (5 m)
1 " hammer (200 gr)
1 " sledgehammer (1000 gr)
1 " adjustable spanner (length 12", month width $1^{3}/_{8}$")
1 set double open end spanners (5/16" - 7/8")
1 pc cold chisel (length 250 mm, bit width 25 mm)
1 " hacksaw (suitable for saw blades length 12" width $\frac{1}{2}$")
10 pcs saw blades (24 teeth/inch)
2 " pipewrenches for pipes up to 2"
1 pc oilcan
5 ltr lubrication oil

PART III

BIDDING DOCUMENTS

(to be completed and submitted by the Bidder)

BIDDING SHEET (Bandung Pump) FORM A.1.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1.	Handpumps with cold drawn pins	300	ea	.....	.....
2.	Additional : for stainless steel pins	-	-	.....	.....
3.	Anchor bolts, with two nuts	1200	ea	.....	.....
4.	1¼" g.i. pipes	400	6 m'	.....	.....
5.	1¼" g.i. sockets	400	ea	.....	.....
6.	Transports	....	batch	.....	.....
7.	SPARE PARTS/TOOLS				
7.1.	plunger cup	50	ea	.....	.....
7.2.	plunger valve	25	ea	.....	.....
7.3.	suction check valve	25	ea	.....	.....
7.4.	pvc cylinder lining	50	ea	.....	.....
7.5.	pins (cold drawn)	50	ea	.....	.....
7.6.	pins (stainless steel)	50	ea	.....	.....
7.7.	gasket	50	ea	.....	.....
7.8.	plunger rod	25	ea	.....	.....
7.9.	plunger rod bracket	25	ea	.....	.....
7.10	anchor bolts with two nuts	100	ea	.....	.....
7.11	complete set of bolts and nuts sufficient for 1 pump	25	set	.....	.....
7.12	toolsets (see II.5.4.)	10	set	.....	.....
....	.....	....	....	.....	.....
....	.....	....	....	.....	.....

TOTAL BID PRICE (excl. item 2 and 7.6)	.....	A
TOTAL BID PRICE (excl. item 7.5)	.....	B

..... = to be completed by the Bidder.

Note : all prices shall include profit , taxes, etc , and be quoted in Indonesian Rupiah.

MANUFACTURER INFORMATION

(The Supplier shall indicate the name and location of the Manufacturer of each component of the pump, what ever it may be) FORM : B

ITEM	MANUFACTURER (name and location)

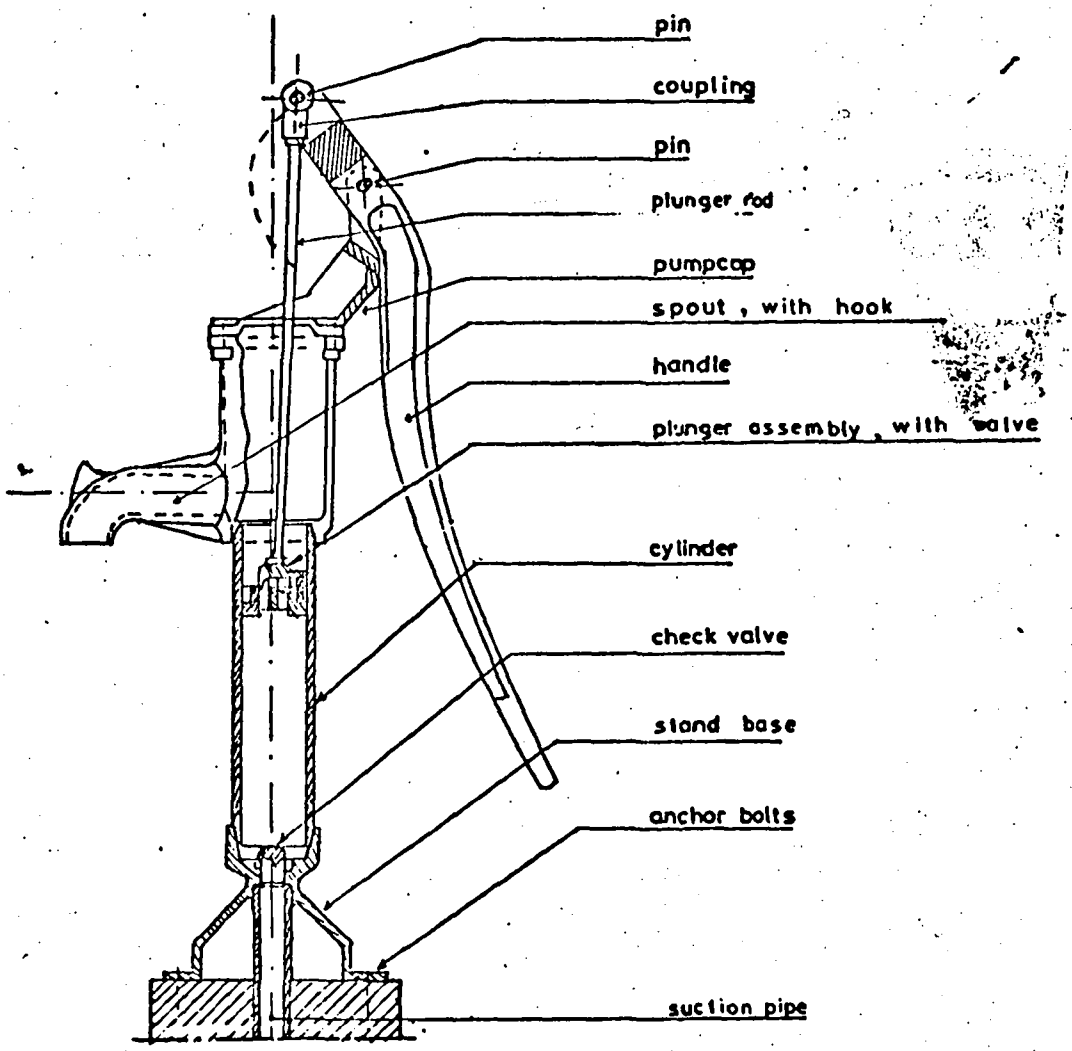
MANUFACTURER EXPERIENCE

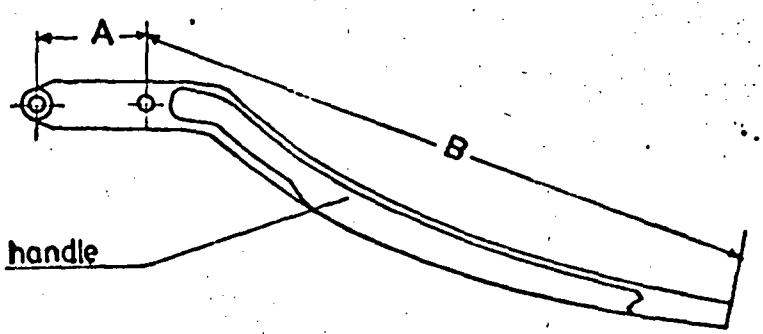
Manufacturer shall give in the following list a complete statement of all handpumps manufactured by him since 1972. FORM : C

YEAR	NUMBER OF HANDPUMPS	TYPE OF HAND PUMP	SUPPLIED TO

PART IV

F I G U R E S





MECHANICAL ADVANTAGE = A : B

GOVERNMENT OF INDONESIA MINISTRY OF HEALTH DIRECTORATE OF HYGIENE AND SANITATION	RURAL WATER SUPPLY WEST JAVA PROYEK AIR MINUM PEDESAAN JAWA BARAT PROJECT OFFICE JALAN SEDERHANA 7 - BANDUNG	OTA 33
technical specifications for the supply of handpumps	SCALE DRAWN A.SADJO. S DATE 18-7-1977 APPR. rpf	HAND PUMP SUCTION TYPE
CONSULTANT: IWACO B.V. - ROTTERDAM		DR. NO. 1

GOVERNMENT OF INDONESIA
MINISTRY OF HEALTH
DIRECTORATE OF HYGIENE AND SANITATION
WEST JAVA RURAL WATER SUPPLY PROJECT

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

OTA - 33

WEST JAVA RURAL WATER SUPPLY PROJECT

EVALUATION REPORT ON TENDERS

for the supply of ordinary suction type handpump.

final version

IWACO, 4 July 1979
Project office: Jl.Sederhana 7,
BANDUNG
Head office : P.O.Box 183, ROTTERDAM

ADVIESBUREAU VOOR WATERVOORZIENING
IWACO B.V.
INTERNATIONAL WATER SUPPLY CONSULTANTS

GOVERNMENT OF INDONESIA
MINISTRY OF HEALTH
DIRECTORATE OF HYGIENE AND SANITATION
WEST JAVA RURAL WATER SUPPLY PROJECT

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

OTA - 33

WEST JAVA RURAL WATER SUPPLY PROJECT

EVALUATION REPORT ON TENDERS

for the supply of ordinary suction type handpumps

final version

IWACO, 4 July 1979
Project office: Jl.Sederhana no.7
BANDUNG
Head office: P.O.Box 183, ROTTERDAM

ADVIESBUREAU VOOR WATERVOORZIENING
IWACO B.V.
INTERNATIONAL WATER SUPPLY CONSULTANTS

C O N T E N T S

1. Preface

1.1. General

The West Java Rural Water Supply Project is a project in the framework of the Project and Agreement between the Government of Indonesia and the Government of the Netherlands. International Water Supply Consultants IWACO B.V. have been appointed as to provide consultants services for the West Java Rural Water Supply Project.
As a part of these services the consultants had to prepare Tenderdocuments for the Supply of Suction Type Handpumps.

The Preliminary Tenderdocuments were submitted on May 22nd, 1978.

The Final Tenderdocuments were submitted for tendering on May 23th, 1979.

1.2. Invitation to bid

A tender for the procurement of above mentioned suppliers was adopted by placing an announcement at the office of the Directorate Hygiene and Sanitation in Jakarta.
Invitations to bid were written in the Indonesian language.

1.3. General briefing of prospective bidders

An explanatory meeting was held for prospective bidders at the Directorate Hygiene and Sanitation office in Jakarta on June 15th, 1979; 7 prospective bidders were recorded to have received the Tenderdocuments as can be seen in Annex 1.

2. Bid proposals

2.1. Closing date for receipt of Bids

The closing date for submission of Bids and date for opening the Bids was June 23th at 10.00 a.m. local time in the office of Directorate Hygiene and Sanitation Jalan Percetakan Negara I, Jakarta.

2.2. Opening of Bids

Present at the opening of the Bids were members of the tender-committee, the Chief of Directorate Hygiene and Sanitation, representatives of the consultants and representatives of the following suppliers :

a. P.T. Gunung Mujil.
b. C.V. Budi Kentjana.
c. P.T. Mastoodon Lubssi.
d. P.T. Borimex.

Altogether 4 sealed packages were submitted before 10.00 a.m.

All envelopes of the proposals were inspected and all complied with the requirements.
Envelopes were opened and Bid prices were read.
A copy of each proposal will be given for evaluation to the representatives of the consultant.
Each copy was signed by the Chief of Directorate Hygiene & Sanitation and the Chairman of the tender committee.

2.3. Principles of evaluation

Successively all proposals were subjected to the following evaluations :

a. Administrative evaluation, including Bid Bond evaluation

and evaluation of delivery time-schedule.

b. Technical evaluation.

c. Financial evaluation.

Evaluations were based on the conditions and requirements described in the Tender Documents, for the supply of hand-pumps.

3. Remarks about the bid documents of the handpumps (Bandung type)

3.1. P.T. Mastoodon Lubssi (Bidder 1)

3.1.1. On page 19 FORM A.1. (Bidding sheet Bandung type handpump) of the tender is given a total bid price of Rp. 15.692.500,- but after checking, the total bid price must be Rp. 15.442.500,- According to the Bidding sheet FORM A.1. of the tender documents, the Bidder must give 2 (two) bid prices, bid price A (for cold drawn pins) and bid price B (for pumps with stainless steel pins).

3.1.2. On page 20 FORM A.". (Bidding sheet handpump with force connection) of the tender, the Bidder is given only 1 (one) total Bid price, what according the tender documents the Bidder must give 2 (two) bid prices, bid price A and bid price B, for the two different types of pins.

3.1.3. On page 20 FORM A.". (Bidding sheet handpump with force connection) of the tender, the items 7.1. - 7.7. must be listed by the Bidder according the tender documents item II 5.3.8. " spare - parts ".

3.1.4. Advice to the tender committee :
Let the Bidder consolidate the above mentioned differences in a letter.

3.2. P.T. Borimex (Bidder 2)

3.2.1. Page 20 FORM A.". of the tender,
item 1 : for the total cost of the force connection pumps is written Rp. 9.150.000,- But given the quantity of 300 and the unit price of Rp. 30.000,- the total costs must be Rp. 9.000.000,- This calculation difference influences only the total price for pumps with cold drawn pumps.

3.2.2. Item 7.1. - 7.7.
Esteemed the Unit-Price and the total cost, the quantity of the spare parts for the handpump with force connection is taken equal to the quantity of the spare parts for the Bandung type pump.

3.2.3. The total Bid Price (excl. item 2 and 7.6.) for the handpumps with force connection will change from Rp. 15.583.750,- into Rp. 15.433.750,- because the total costs of the handpumps (item 1) will change. (pumps with cold drawn pins)

3.2.4. Advice to the tender committee :
Let the Bidder explain the above mentioned differences in a letter.

3.3. C.V. Budi Kencana (Bidder 3).

3.3.1. On the Bidding sheet (Handpumps with force connection) FORM A.2. of the tender, the item 7.1. - 7.7. must be listed by the Bidder according item II 5.3.8. " spare parts " of the tender documents.

3.3.2. Advice to the tender committee :
Let the Bidder explain the above mentioned differences in a letter.

3.4. P.T. Gunung Mujil (Bidder 4).

3.4.1. On Bidding sheet (Bandung pump) FORM A.1. of the tender is given a total bid price for A Rp. 16.432.500,- and for B Rp. 16.438.750,- but after checking the calculations the total bid price for A must be Rp. 16.439.500,- and for B Rp. 16.445.250,-

3.4.2. On Bidding sheet (Bandung pump with force connection) of the tender, the item 7.1. - 7.7. must be listed by the Bidder according item II. 5.3.8. " Spare parts " of the tender documents.

3.4.3. **Advice to the tender committee :**

Let the Bidder explain the above mentioned differences in a letter.

4. Comparison tables of offers

4.1. General

In the following tables are compiled the data from the bidding sheets in order to get a quick comparison of the different offers.

4.2 Table 1 Bid evaluation (Bandung type hand pump)

Bid Price	Bidder 1 P.T. Mastoodon Lubssi	Bidder 2 P.T. Borimex	Bidder 3 C.V. Budi Kentjana	Bidder 4 P.T. Gunung Mujil
Bandung pump Total cost	300 x Rp. 29.500,- = Rp. 8.850.000,-	300 x Rp. 30.000,- = Rp. 9.000.000,-	300 x Rp. 34.000,- = Rp. 10.200.000,-	300 x Rp. 35.000,- = Rp. 10.500.000,-
Additional	-	300 x Rp. 31.500,- = Rp. 9.450.000,-	-	-
G.I. pipes sockets etc.	Rp. 5.500.000,-	Rp. 4.965.000,-	Rp. 4.258.000,-	Rp. 3.840.000,-
Spare Parts	Rp. 712.500,-	Rp. 1.445.250,-	Rp. 1.281.500,-	Rp. 1.329.000,-
Toolsets	Rp. 380.000,-	Rp. 600.000,-	Rp. 800.000,-	Rp. 800.000,-
Total Bid Price (excl. item 2 and 7.6.)	Total Price Acc. the tender Rp. 15.692.500,- After checking : Rp. 15.442.500,- ========== */ Only one price is given !!!	Rp. 15.848.750,-	Rp. 16.509.500,-	*/ Rp. 16.432.500,- After checking : Rp. 16.439.000,- ========== */
Total Bid Price (excl. item 7.5.)		Rp. 16.361.250,- incl. the additional price	Rp. 16.515.750,-	Rp. 16.438.750,- After checking Rp. 16.445.250,- ==========

*/ See par. 3.1.

*/ See par. 3.4.

4.3. Table 2 Bid Bond evaluation (handpumps)

Description	Bidder 1	Bidder 2	Bidder 3	Bidder 4
	P.T. Mastoodon Lubssi	P.T. Borimex	C.V. Budi Kencana	P.T. Gunung Mujil
Bid Bond issued by	Bank Negara Indonesia 1946	Bank Bumi Daya	Bank Bumi Daya	Bank Negara Indonesia 1946
Expiring date Bid Bond	120 days after closing date of Bid	120 days after closing date of Bid	120 days after closing date of Bid	120 days after closing date of Bid

4.4. Table 3. Administration evaluation (Handpumps)

No.	Requirements	Bidder 1	Bidder 2	Bidder 3	Bidder 4
		P.T. Mastoodon Lubssi	P.T. Borimex	C.V. Budi Kentjana	P.T. Gunung Mujil
1.	Bids made on prescribed form	Conform tender documents	Conform tender documents	Bandung pump conform ten.doc. pump with f.c. not conf. ten. doc.	Bandung pump conform ten.doc. pump with f.c. not conf. ten. doc.
2.	Shop drawings	Only manufacturer brochures	Only manufacturer brochures	Not conform tender documents	Not conform tender documents
3.	Standards to which the goods the supplies proposes to furnished comply	Not specified	Not specified	Not specified	Not specified
4.	Latest delivery of goods after effective date of notice to proceed	120 days	120 days	120 days	120 days
5.	Manufacturer information	Conform tender documents	Not conform tender documents	Conform tender documents	Not conform tender documents
6.	Manufacturer experience	Not since 1972 but since 1977	Not since 1972 but since 1977	Not since 1972 but since 1977	Not conform tender documents
7.	Manufacturer warranty	Not presented completely	Not presented completely	Not presented completely	Not presented completely

5. Choice of materials and spareparts

5.1. Linings of handpumps

Just after the receipt of the offers it was advised by ITB not to use PVC linings in the handpumps as not yet enough experience has been gained with this type of lining within Indonesia. First tests do not seem to be favourable. Besides that, as steel liners with enamel protection are readily available on the market the number of spare liners can be considerably lower that originally estimated. Instead of 450 spare liners, it is proposed to have only 50 spare liners per 300 handpumps. This reduction has consequences for the total prices of the spareparts.

5.2. Quality of pins of handpumps

The quality of the stainless steel pins is higher than the quality of the cold drawn pins as this does not give a significant higher unit price per pump it is recommended to order pumps with stainless steel pins.

As the offer from P.T. Mastoodon Lubssi offers both stainless steel pins and cold drawn pins (see remarks under par. 3.1.2.) a price reduction of their offer of Rp 12,500 shall be applied if this offer is adapted to supply spare stainless steel pins only.

5.3. Spareparts for handpumps

5.3.1. Spareparts for handpumps (Bandung type).
The lists with type and quantity of spareparts was given in tenderdocuments. However, as the quantity of liners is reduced to 50 (see para. 7.1.) only the total price for the spareparts of the separate suppliers this means a reduction as given in table 9.

Table 4 : Price decrease for spare liners of Bandung pump.

Bidder	Price decrease
1. P.T. Mastoodon Lubssi	Rp. 400,000
2. P.T. Berimex	Rp. 825,000
3. C.V. Budi Kencana	Rp. 760,000
4. P.T. Gunung Mujil	Rp. 800,000

6. Summary and recommenfations

The prices for handpumps do not vary much and the proposed manufactures are supposed to be capable to reach a high standard of quality. As the testing and its costs according to the specifications are included in the Bid price it can be supposed that a good quality will be supplied.

After the university testing at ITB, it was adviced not to use PVC linings in the handpumps as not yet enough experience is available in Indonesia with PVC linings. As the normal type of lining being steel with enamel protection is easy available in Indonesia, it is recommended to supply for each type of pump only 50 linings as spare.

As the price for the use of stainless steel pins in the handpumps do not much influence the total unit price per pump, it is recommended to order handpumps of which the pins consist out of stainless steel.

In a number of Bids the calculations had to be adapted as calculations were noted. As these did not much influence the over all differences among the Bidders neither extra explatory meetings nor retendering seems to be justified.

Taking the foregoing into consideration we come to a price comparison as given in table A.

Table A, comparison of (adapted) offers

Bidder / Subject	PT.MASTOODON LUBSSI	PT.BORIMEX	CV. BUDI KENCANA	PT.GUNUNG MUJIL
Dragon type pump (A)	14.816.250	14.983.750	14.320.250	13.675.250
Bandung pump (B)	15.030.000	15.536.250	15.755.750	15.645.250
Total	29.846.250	30.520.000	30.075.000	29.320.500
B % higher, than A	1,5 %	3,7 %	10 %	14,4 %

Price in Indonesian Rupiahs.

Bandung July 4th 1979.

Note

As in the tender also other goods had to be supplied (asbestos roofsheets) the lowest Bidder for the total packat was PT. Borimex to whom the contract became awarded.

In this first tender both Dragon type handpump and Bandung pump had to be supplied (both 300 pieces of coch type). From the prices given in the tender-documents can be noted that the Bandung pump was slightly higher in price (1.5 % to 14.4%). However bearing in mind that the Bandung pump never had been produced berore, so mouldings tools and machinery had to be made or adapted, this higher price is acceptable. As soon as some series of Bandung handpumps are produced the price of these handpumps most probably will drop to a lower level than the price of the Dragon type handpump.

At present quates for a Bandung pump a price of ± Rp. 22.500,- and for a Dragon pump a price of Rp. 22.500,-

Bandung November 1980.

Dragon pump = F.C. pump (force connection

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GOVERNMENT OF INDONESIA
MINISTRY OF PUBLIC HEALTH
DIRECTORATE GENERAL OF
COMMUNICABLE DISEASES CONTROL

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

WEST JAVA RURAL WATER SUPPLY PROJECT

OTA - 33 / J - 7

ENDURANCE TEST OF THE BANDUNG PUMP

PROVINCIAL HEALTH SERVICE
DIRECTORATE C D C
JALAN PROF. EIJKMAN 45 BANDUNG

IWACO B.V.
HEAD OFFICE : P.O. BOX 130
ROTTERDAM

PROJECT OFFICE : JALAN SEDERHANA 7 TROMOL POS 59 TILP. 83717 BANDUNG INDONESIA

Annex 1

List of Prospective Bidders

1. P.T. Mitah Murni Corporation.
2. P.T. Ika Mataram.
3. C.V. Budi Kentjana.
4. R.T. Mastoodon Lubssi.
5. P.T. Borimex.
6. P.T. Daya Baru Agung.
7. P.T. Gunung Mujil.

INSTITUT TEKNOLOGI BANDUNG
DEPARTMENT OF MECHANICAL ENGINEERING
BASIC MECHANICAL ENGINEERING LABORATORY, SELECTIVE AGRICULTURAL MECHANIZATION & SOLAR ENERGY LABORATORY
P.O. BOX 481, PHONE 82051 - 5 EXTENSION 247
TELEX 28262 DTCITB BD. BANDUNG - INDONESIA

PRELIMINARY

ENDURANCE TEST of the BANDUNG PUMP

August 1979.

Executed by :

Bertus van Heugten
Djoko Suharto
Tulus Djunaedi

Test Report submitted to

The West Java Rural Water Supply Project
OTA-33, Jl. Sederhana 7, P.O. Box 59
Bandung - Indonesia.

SUMMARY.

During May, June and July 1979 two shallow well pumps of the so-called "BANDUNG PUMP" have been tested in the Basic Mechanical Engineering, Agricultural Equipment and Solar Energy Laboratory of the Depart - ment of Mechanical Engineering of the Bandung Institute of Technology. The pumps, which were fitted with two different liners (a PVC and an enamel coated liner), have been put through an endurance test of 4,5 million pump cycles at 80 strokes per minute with a 102 mm stroke. These number of strokes is equivalent to approximately two years of pumping at a rate of 5.000 liters per day. During the test period of about 1.000 hrs the wear of the main parts such as cup seals, liners, valves and the bearings as well as the pump capacity at different pumping speeds have been recorded. The test results show among others that the combination of enamel coated liner with a good quality rubber cup seal withstands 4,5 million pump cycles with only very limited wear of the cup seal. The combination of PVC liner and rubber cup seal showed to be inferior, since the wear of the cup seal is not acceptable at all. Wear of the bearings is acceptable in particular if lubricated periodically. The performance of the valves and other parts was satisfactory in all cases. Except one sliding plate on the opening in the pumpcap, which broke immediately after starting the testrun, no mechanical failures or brakedowns took place.

I. OBJECTIVE

The main objective of the work is to test the endurance strength of the Bandung Pump as it was stated in the agreement No.: 107/DSP-01/79. In this case the Basic Mechanical Engineering, Agricultural Equipment and Solar Energy Laboratory agreed to do the following tests :

- Endurance test in which the following variables will be recorded: working hour or the number of cycles; wear of liners, the pins of the mechanism, cupseals and other parts; endurance strength of the mechanism.
- Measurement of the power consumption and the capacity of the pumps at a fixed head and stroke.

II. TIME SCHEDULE

The two complete pumps arrived in the laboratory on 12th of May 1979, one of which was fitted with an enamel coated liner and the other with a PVC liner. The testrun started on 21th of May and from 25th of May testing was conducted 24 hours per day without disruptions except for measurements. The number of cycles reached was as follows :

5 - 31 - 1979	1 million
6 - 10 - 1979	2 million
6 - 20 - 1979	3 million
6 - 28 - 1979	4 million
7 - 4 - 1979	4,5 million

As was agreed with the principal the testrun was brought to a conclusion after 4,5 million cycles.

III. PUMP TESTSTAND DESCRIPTION

For the two pumps a teststand has been built (see figures 1, 2, 3 and 4). A DC electromotor with continuous variable speed operated the pumps by means of crankshaft mechanism and connecting rod, which was connected to the pumphandle at 50 cm from the fulcrum bearing. This arrangement corresponds with a fixed plunger stroke of 10,2 cm. The driving mechanism with the pumps was placed on a 8 meter platform. The two suction pipes were hanging in two "suction" drums situated about five meter lower in such a way that a fixed suction head of 5 meters was created. The output of the pumps was connected by PVC pipes to another two drums on the platform and plastic tubes from these drums to the suction drums closed the water circuit. For capacity measurements the suction drums were provided with transparant U-tubes in order to measure the water level in the drums. For the exact registration of the number of cycles, every pump was connected with a digital counter.

IV. TESTING AND MEASURING PROCEDURE

Approximately after every 300.000 pumpstrokes the following measurement and observation were carried out :

a. determination of the pump capacity at 30, 40, 50, 60, 70 and 80 strokes per minute. This has been done by closing the outlet valves of the drums on the platform and measuring the time (using stopwatch) needed to pump 10 cm height of water out of the suction drums.

b. determination of the electric power input (Volt, Amperes) of the direct current electromotor for each pump at 40, 60 and 80 strokes per minute.

c. dismantling of the pumps and measuring successively :

- the diameter of the cup seals when still mounted in the plunger assemble to guarantee its circular shape. A slide gauge was used for this purpose.
- the inside diameter of the liner in about the middle of the stroke. Every time the diameter has been measured at the same place because of the shape of the liners is not entirely cylindrical. An inside measuring device with measuring clock and outside micrometer was used.
- the maximum diameter of the pin bearing holes (4 in each pump) by means of an inside micrometer and the outside diameter of the pins.

d. visual inspection of the whole pump and in particular the valves, valve seats, seal and bolt connections.

V. LIMITATIONS OF THESE TESTS

For a good interpretation of the test results the following limitations have to be taken into account :

- the head during the whole testrun, in this case almost the same with the suction head, was fixed at 5 meters.
- water as supplied by the Bandung water company (PAM) was used in a closed circuit pump system at a water temperature of about 28^{o}C.
- the durability testrun has been conducted at an increased pump speed of about 80 strokes per minute, about twice the speed as used manually. Forces on pump parts are for this reason higher than during normal use.
- because of continuous, day and night, running of the pumps, corrosion was limited.
- the pumps were running at a fixed plunger stroke of 102 mm.

VI. TESTRESULTS

VI.1. Pump with PVC liner.

Tests showed that *this* combination of *this* particular PVC liner and *this* particular rubber plunger cups is not a good one. Eventhough wear of the PVC liner is almost zero (not measurable), the wear of the cups is unacceptable. After about 300.000 pumpstrokes the cup diameter is decreased from 100 mm until about 96 mm while the diameter of the liner is about 98 mm (Figure 5). Figure 6 shows that at low speeds of 30, 40, or 50 strokes/minute, output of the pump is zero or very low. Also priming of the pump is very difficult and only possible at very high speeds which can not be performed manually.

During pumping the forces on the handle have not been measured but the friction between the cup and liner was supposed to be high because of the worn out rubber was covering the liner and so increased the wear of the cup (rubber on rubber). To what extent the wear of the cup was influenced by the roughness of the PVC has not been measured.

VI.2. Pump with enamel coated liner

This combination of rubber plunger cup with enamel coated liner proved to be far better. Even after 4.500.000 pump - strokes the wear of the rubber cup was almost zero (unmeasurable), just like the wear of the enamel coated liner.

Figure 7 shows the output of the pump in liter/stroke versus the number of strokes at 40, 60 and 80 strokes per minute. From this graph, it can be concluded that at low speed of 40 strokes/minute the capacity of the pump just decreased about 15%.

Figure 8 shows the capacity and the hydraulic efficiency of the pump at different speeds. As can be seen, this efficiency is higher than 100% at pump speeds of higher than 52 strokes per minute because of mass forces which push the water up even when the plunger is coming down.

VI.3. Wear of the bearings.

Figure 9 shows the diameter in the cast iron of the piston rod bearing as well as the fulcrum bearing. After a running in period of about half a million strokes the diameter increase is very little provided that the bearings are lubricated properly. After 2,5 million cycles the bearings of one of the pumps were cleaned and not lubricated while the bearings of the other pump was oiled every 100.000 strokes as before. It needs no explanation how important the oil is for this combination of stainless steel pins in cast iron bearings. The test was carried out at an increased speed of 80 strokes per minute and the forces on the bearings are higher and so the wear will be much less in practice. In this case, the wear of the stainless steel pins was negligible.

VI.4. V a l v e s.

There were no problems with the plunger valve as well as the check valve. The black rubber check valve, used in the pump with the enamel liner, survived 4,4 million strokes (see figure 10) and had to be turned up.

Valves are made heavier by putting steel wire inside. In the beige coloured rubber valves (Rp. 750/set) the positioning of the steel in the center of the valve showed out to be better than in the black rubber ones.

VI.5. Plunger cups.

The pumps were delivered with cups of an unknown brand. In the enamel coated liner the wear of this cup was negligible even after 4,5 million cycles. In the pump with PVC liner the cup has been replaced several times by KAWAMOTO cups (Rp.600 each) and cups of an unknown brand (Rp. 250 each). The last mentioned ones were far inferior than the first. Figure 11 shows, for example, a cup of unknown brand after 8.000 pump-strokes in the PVC liner pump.

VI.6. Power requirement.

By measuring the voltage and the amperage of the DC electro-motor an indication of the power requirements at different pump speeds has been determined. At a head of 5 meter and a plunger stroke of 102 mm the following power requirements were measured :

strokes/minute	power requirement
40	30 Watt
60	80 Watt
80	120 Watt

VI.7. Force on the handle.

The static force on the handle was measured with a spring dynamometer and showed to be about 80 Newton.

VI.8. Other findings.

The sliding plate on top of one of the pumps broke after 6000 pumpstrokes. After replacement these plates survived the test period without any problems.

No other brakedowns took place. Bolt connections, pump rod, pump base, pump cap and handle withstood the 4,5 million cycles on the teststand.

Figure 1.

Test stand with suction pipes.

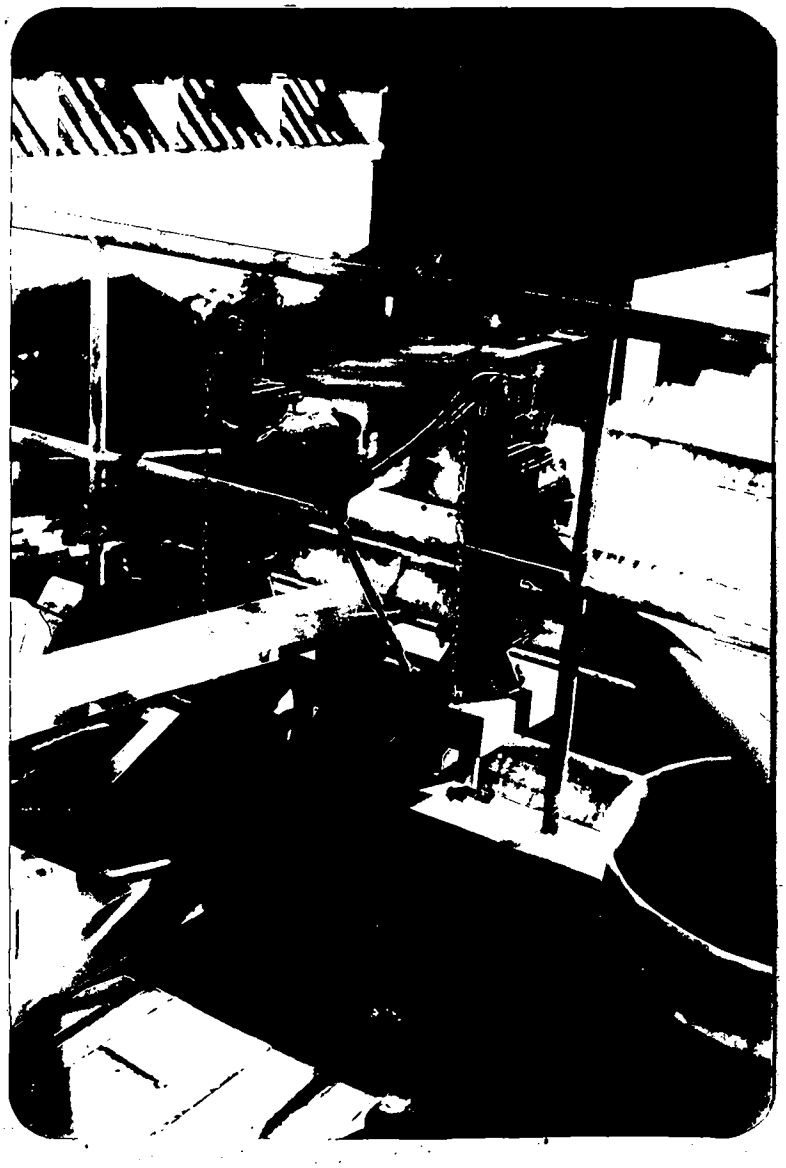
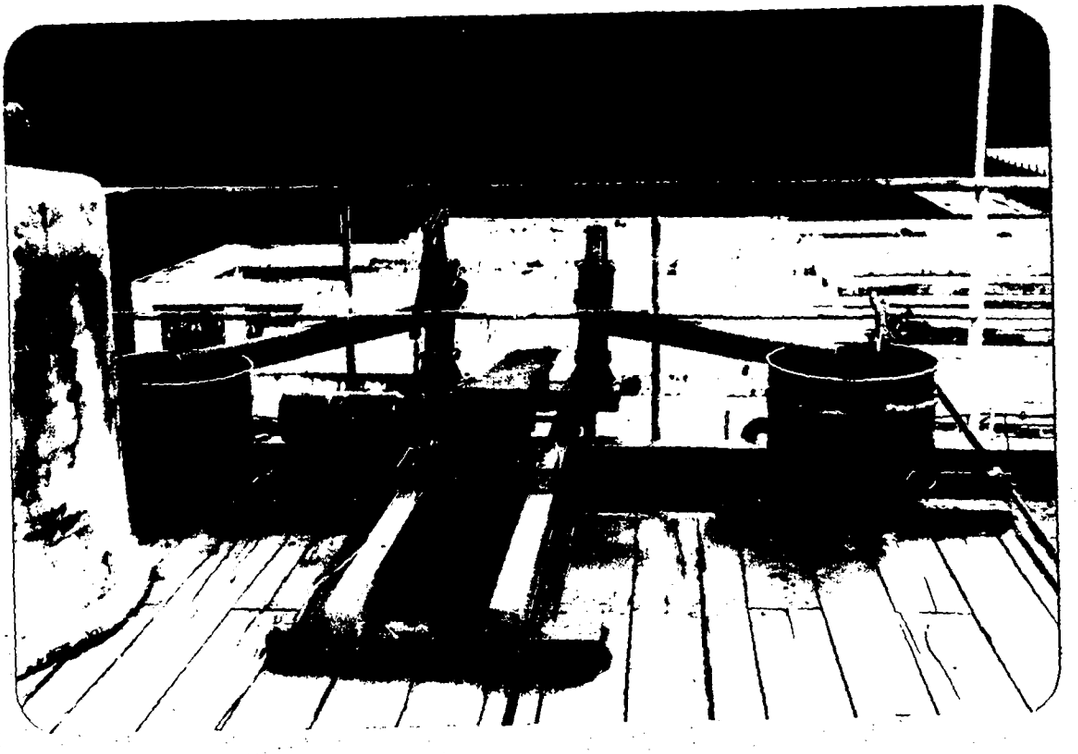


Figure 2.

Close-up of the tested pumps.

Figure 3
Side view of the teststand.



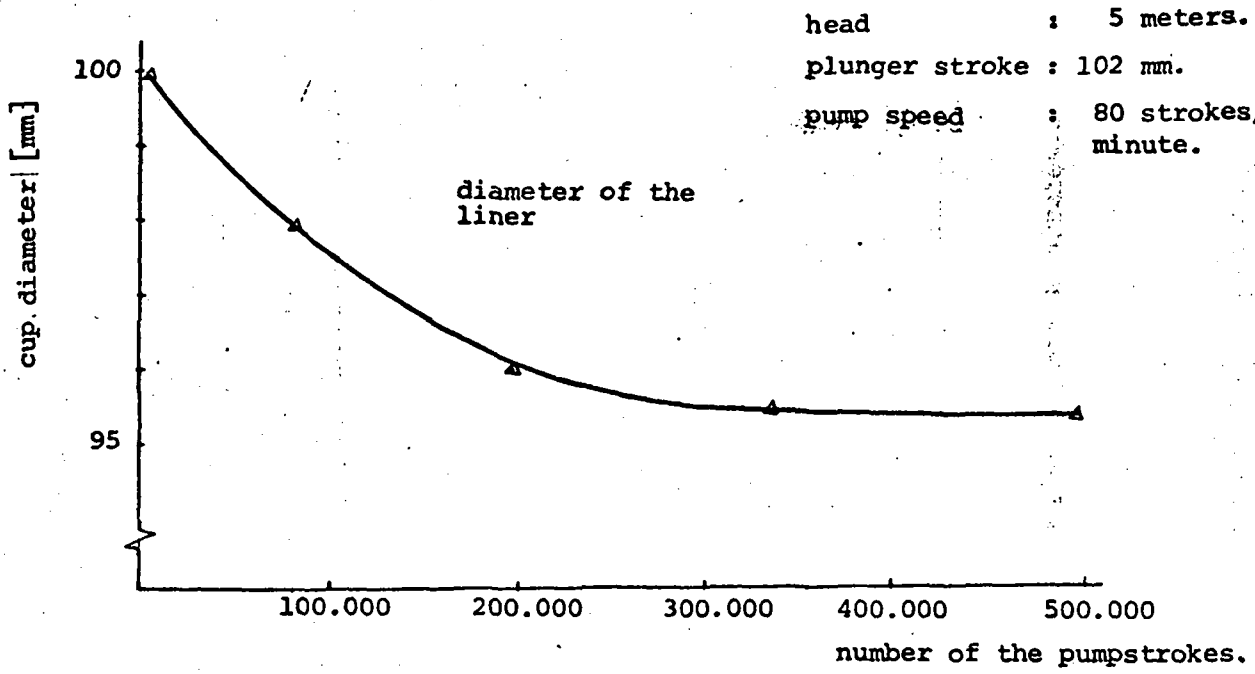


Figure 5. Wear of rubber cup in PVC liner.

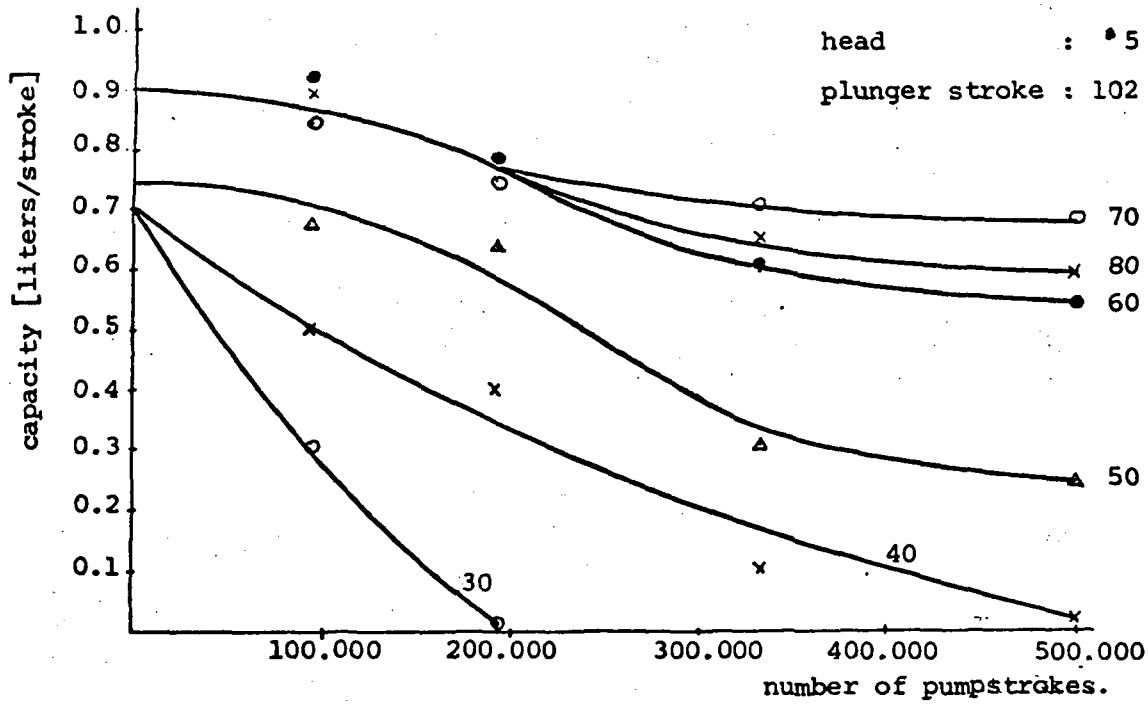


Figure 6. Capacity of the pump with PVC liner at 30, 40, 50, 60, 70 and 80 strokes/minute.

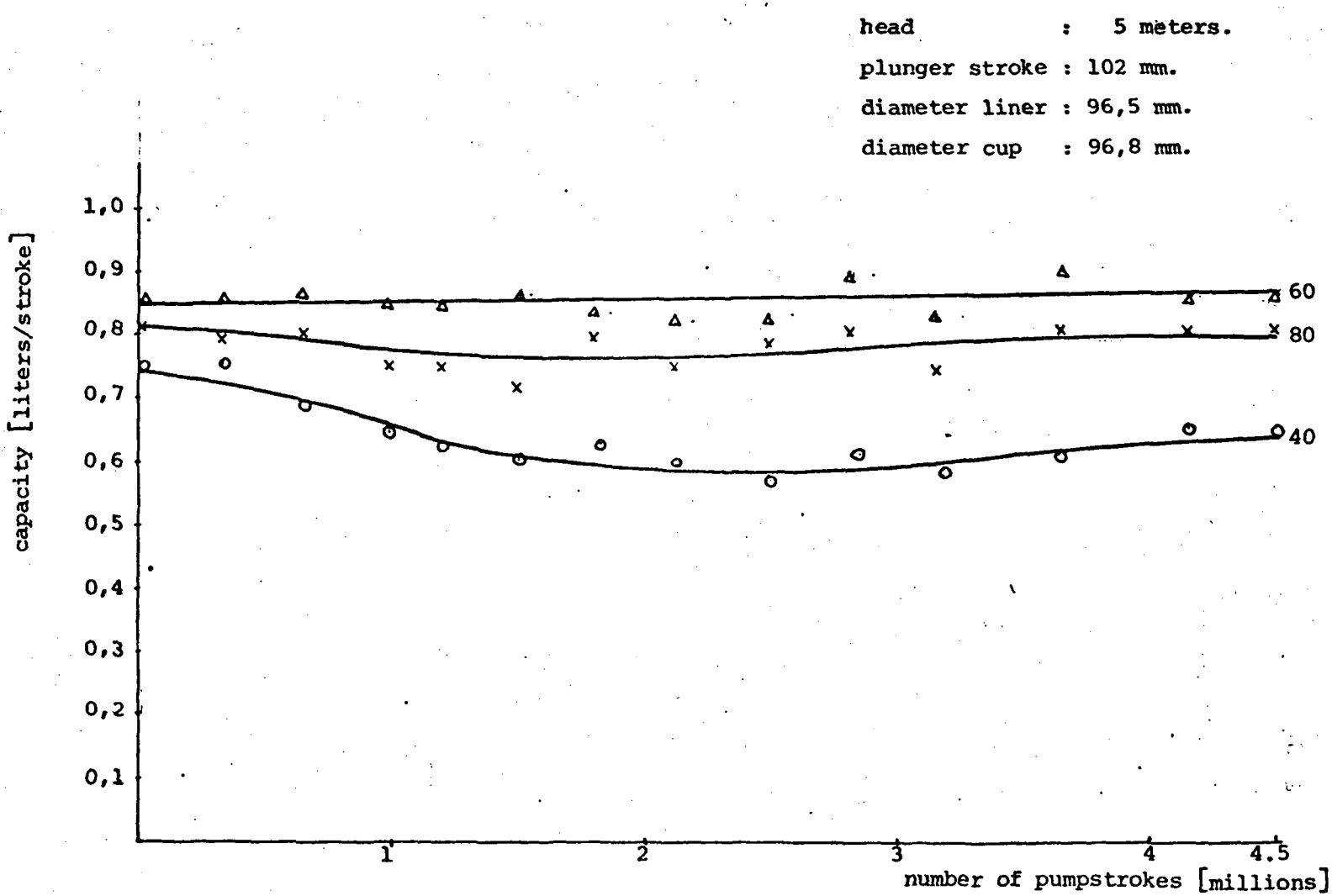


Figure 7. Capacity of the pump with enamel coated liner at 40, 60 and 80 strokes/minute.

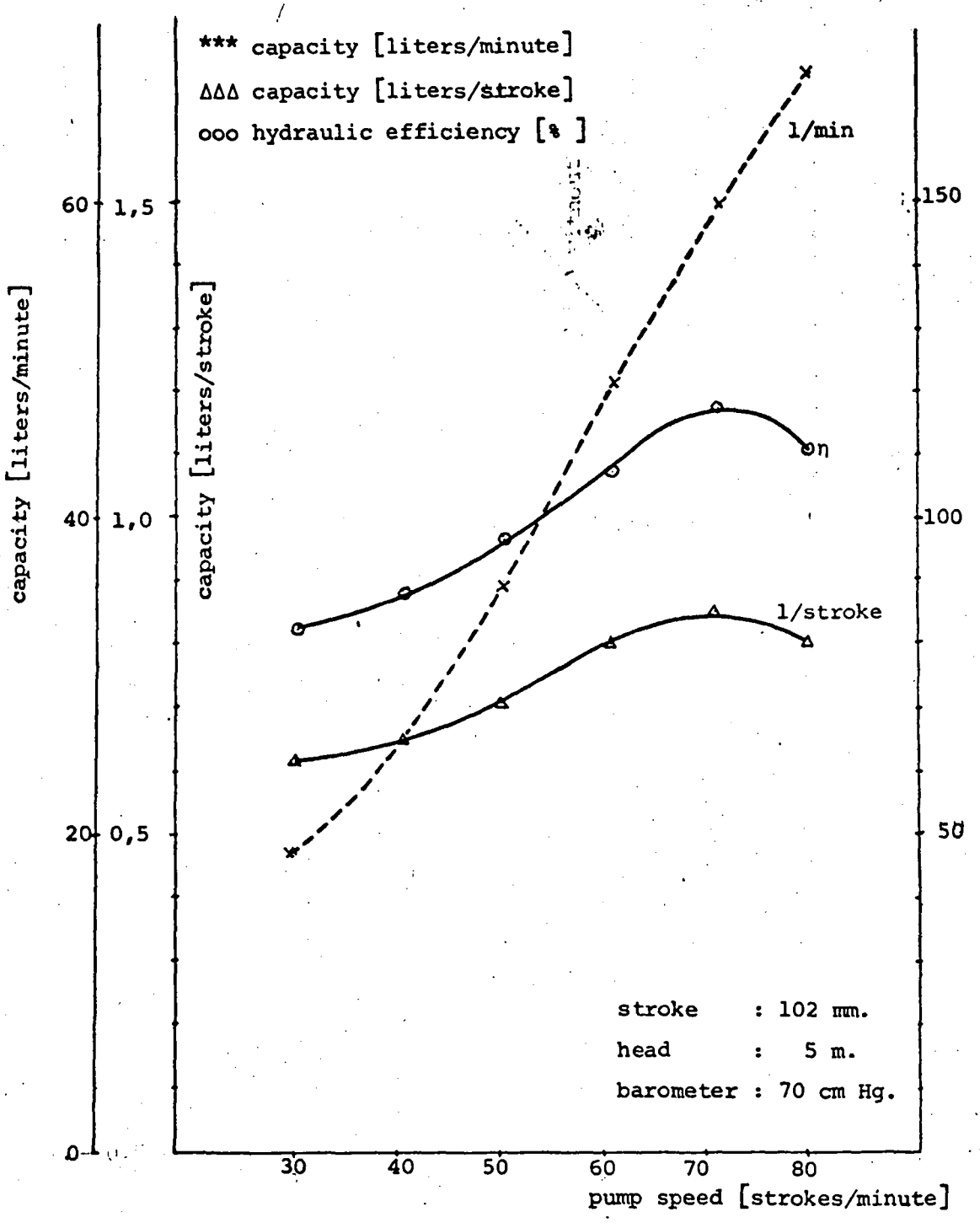


Figure 8. Capacity of the pump with enamel coated liner at different speeds.

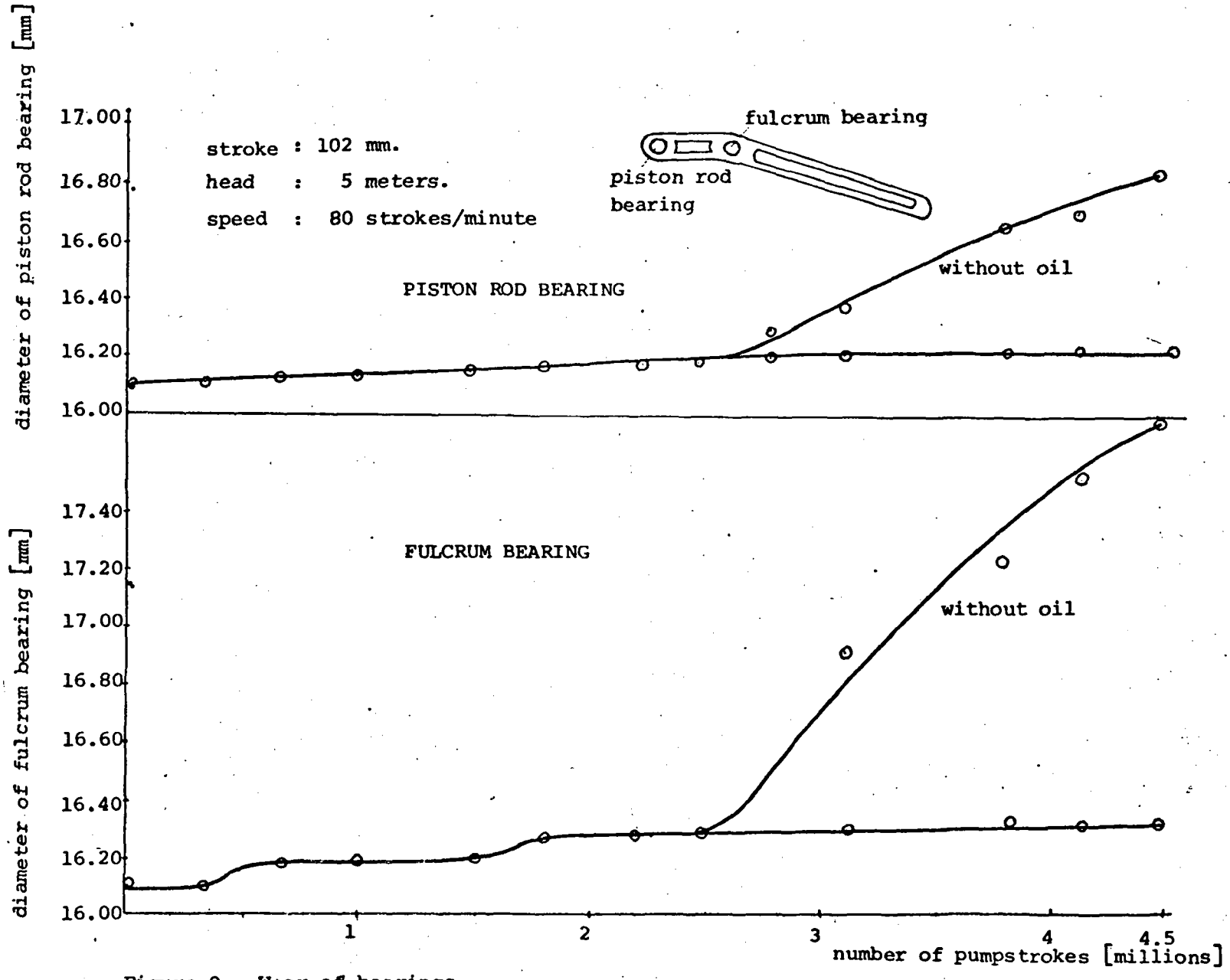


Figure 9. Wear of bearings.

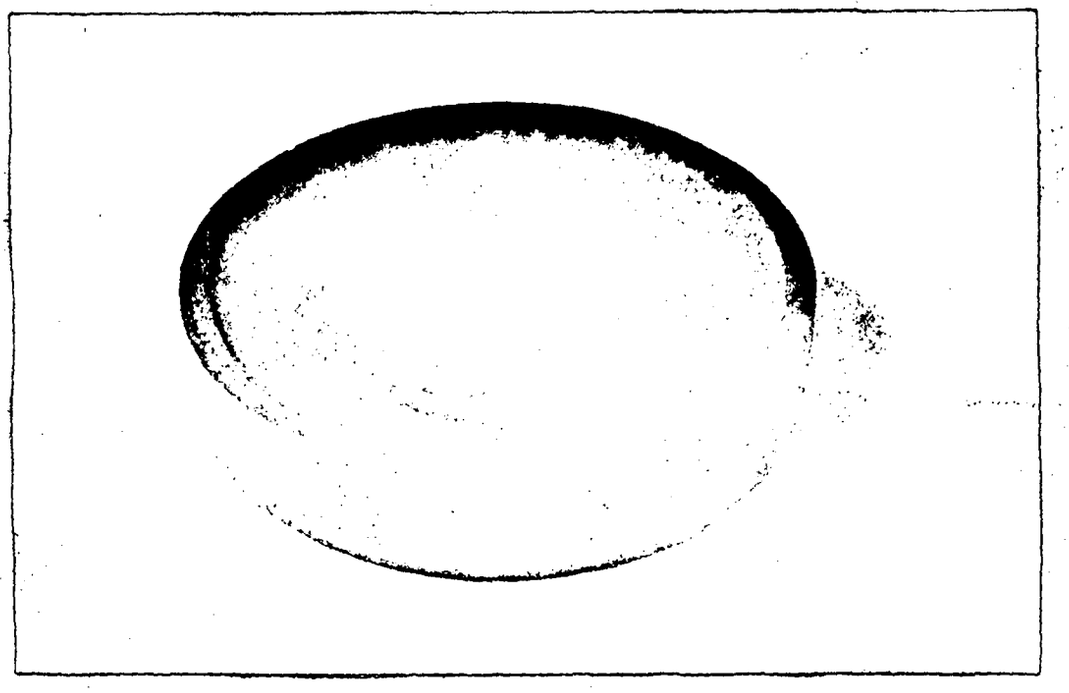


Figure 10. Check valve after 4,4 million strokes.

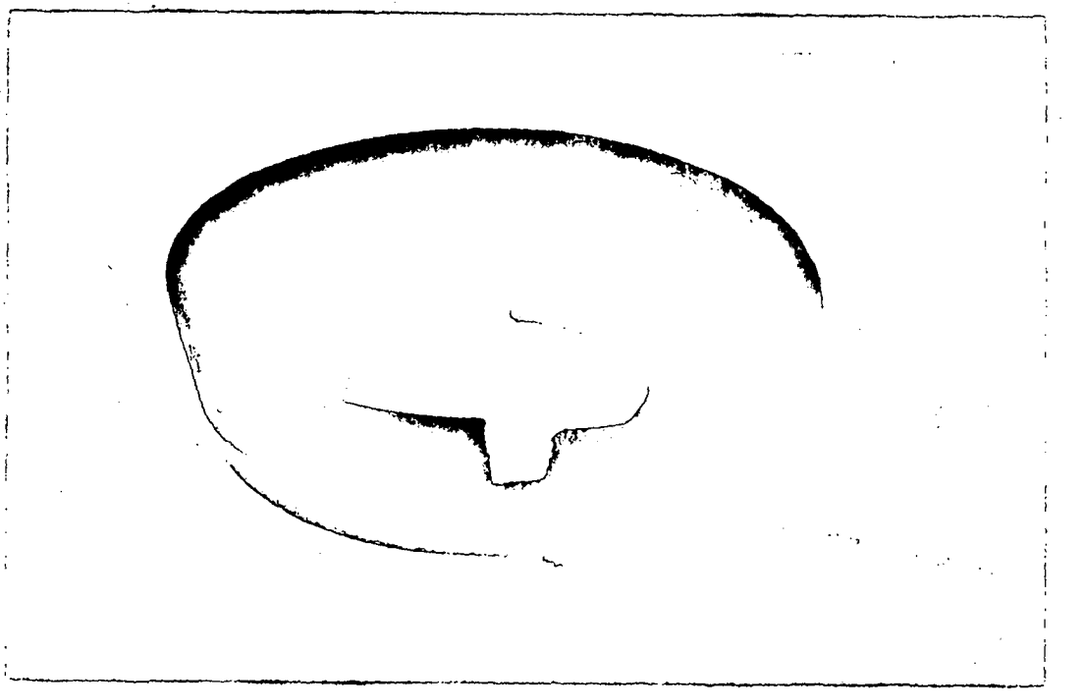


Figure 11. Cup after 8.000 strokes in the pump with PVC liner.

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DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

WEST JAVA RURAL WATER SUPPLY PROJECT

OTA - 33 / J - 7

TEST RESULT OF THE BANDUNG PUMP

PROVINCIAL HEALTH SERVICE
DIRECTORATE C D C
JALAN PROF. EIJKMAN 45 BANDUNG

IWACO B.V.
HEAD OFFICE : P[illegible]
ROTTE[illegible]

DEPARTEMEN PERINDUSTRIAN
BADAN PENELITIAN DAN PENGEMBANGAN INDUSTRI
BALAI PENELITIAN BAHAN-BAHAN
(MATERIALS TESTING INSTITUTE)
Jalan Sangkuriang No. 14 Telp. 82027 - 82028 Bandung
Alamat kawat : bpb. Tromol pos 32
Laboratorium untuk : bahan logam; bahan kimia; bahan organik; bahan bangunan; barang teknik.

PENGUJIAN No. / Report Nr. : S 9/80/128 D. Bandung, 17 Juli 19 80

Bahan/Barang / Material : Contoh Pompa Air.

DIBUAT UNTUK / Excecuted for : C.V. MALABAR
Jalan Halteu Andir 30
Bandung, dan P.T. WICO
Jalan Asia Afrika 9A Senayan Jakarta.

Contoh diterima tanggal / Sample received on : 14 Juli 1980.

HASIL PENGUJIAN
TEST RESULT

U R A I A N

Telah diterima sebuah pompa air merk " BANDUNG PUMP" dengan permintaan untuk diuji kemampuannya.

HASIL PENGUJIAN

I. Tekanan hidrastatik

Pompa tidak bocor/pecah pada tekanan hidrostatik 4 kg/cm2.

II. DAYA HISAP

Tekanan vacum dalam pompa mencapai - 590 mm Hg.

III. KAPASITAS

Pada panjang langkah 129 mm dan kecepatan 20 - 25 langkah permenit memberikan kapasitas sebagai berikut :

KEDALAMAN (m)	KAPASITAS (cc/langkah)	EFFISIENSI (%)
0.6	1450	156
3.0	1203	129
6.0	1048	113
7.0	966	104
8.0	947	102

IV. KESIMPULAN

Kemampuan pompa merk " BANDUNG PUMP" yang diuji memenuhi persyaratan SII untuk pompa air tangan dangkal.

Kepala Balai Penelitian Bahan-Bahan,

DEPARTEMEN PERINDUSTRIAN BANDUNG

M.JT/st.

DEPARTEMEN PERINDUSTRIAN
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Alamat Kawat bpb. Tromol Pos 32

Laboratorium untuk : bahan logam; bahan kimia; bahan organik; bahan bangunan; barang teknik

PENYELIDIKAN No. : S 9/79/101 - C. Bandung, 1 Nopember 19 79
Report Nr. :

Bahan / Barang : Pompa Air.
Material :

DIBUAT UNTUK : Dinas Kesehatan Prop. DT I Jabar Direktorat P3M
Executed for : Jalan Prof. Eyckman 43 Bandung, menurut suratnya No. 2/0873-5/79, tanggal 15 Oktober 1979.

Contoh diterima tanggal : 11 Oktober 1979.
Sample received on :

HASIL PENYELIDIKAN
TEST RESULT

Uraian

Telah diterima 1 (satu) buah contoh pompa air merek Bandung Pump dalam keadaan belum dicat. Atas permintaan pengirim contoh telah dilakukan pengujian2 berdasarkan Technical Specification dari pengirim contoh.

Hasil pemeriksaan:

Bagian2 pompa dilepas kemudian dilakukan pemeriksaan2.

1. Bagian Logam.

1.1. Pemeriksaan visual.

Secara visual, bagian2 yang dituang dibuat dari besi tuang kelabu, permukaannya terlihat rata dan tidak terlihat adanya cacat2 tuangan. Pada permukaan badan pompa terdapat sedikit liang2 renik, bagian2 lainnya cukup baik.
Bagian badan pompa (silinder) dipasang sebuah silinder berlapis email dan direkat dengan semen. Lapisan email terlihat cukup halus, tidak terdapat bagian email yang menyerpih.
Bahan pin dari baja stainless non magnetik.
Batang plunger dari batang baja diameter 16,0 mm (5/8"), dikerjakan mesin cukup halus, tidak dilapis chrom.
Batang handle dari besi tuang.

1.2. Percobaan patah (fracture test).

Bagian2 pompa yang dibuat dari tuangan dipecahkan kemudian diperiksa kendaan bidang patahannya. Bidang2 patahannya pada umumnya memperlihatkan butir2 cukup halus, berwarna kelabu yang menunjukkan jenis besi tuang kelabu dan tidak terdapat cacat2 tuang.

1.3. Percobaan kekerasan Brinell.

Bagian2 yang dibuat dari besi tuang semuanya ada 8 bagian, menunjukkan nilai kekerasan Brinell : 200 - 260.
Bahan pin menunjukkan nilai kekerasan Brinell 270 - 280.
Batang plunger menunjukkan nilai kekerasan Brinell 140 - 150.

Catatan : Percobaan kekerasan Brinell dilakukan dengan peluru diameter 2,5 mm, beban 187,5 kg dan waktu 15 detik.

2. Bagian karet :

Bagian2 yang dibuat dari karet mempunyai sifat2 mekanik sebagai berikut :

		Segar	Direndam dalam air : 3x24 jam	Dipanaskan 70° C 3x24 jam
Kekerasan	(Duro A) :	71 - 73	71 - 75	72 - 78
Kuat tarik	(kg/mm2) :	0,532	0,613	0,623
Regang putus	(%) :	180	207	140
Keausan	(m^3/kgm) :	7,21	8,24	8,63
Masa jenis	(g/cm^3) :	1,37		

Klep karet permukaannya rata, terdapat sedikit cacat cetakan.

3. Bagian dari plastik.

Bagian2 yang terbuat dari plastik terbuat dari low density poly-ethylene.

KESIMPULAN:

Berdasarkan hasil2 pemeriksaan tersebut diatas, maka contoh pompa air merek Bandung pump. bagian2 logamnya dapat dinyatakan memenuhi syarat2 yang diminta, dengan perhatian bahwa permukaan bagian badan pompa mengandung liang2 renik (porosities) da batang plungernya tidak dilapis dengan chrom.

DEPARTEMEN PERINDUSTRIAN
BANDUNG
BALAI PENELITIAN BAHAN-BAHAN

Kepala Balai Penelitian Bahan2,

Ir. J. Kusnadi
NIP. 090001692

mdj/sm.

GOVERNMENT OF INDONESIA
MINISTRY OF PUBLIC HEALTH
DIRECTORATE GENERAL OF
COMMUNICABLE DISEASES CONTROL

GOVERNMENT OF THE NETHERLANDS
MINISTRY OF FOREIGN AFFAIRS
DIRECTORATE OF INTERNATIONAL
TECHNICAL ASSISTANCE

WEST JAVA RURAL WATER SUPPLY PROJECT

OTA - 33 / J - 7

PUMP FACTORIES

PROVINCIAL HEALTH SERVICE
DIRECTORATE C D C
JALAN PROF. EIJKMAN 45 BANDUNG

IWACO
HEAD OFFICE
ROTTERDAM

PROJECT OFFICE : JALAN SEDERHANA 7 TROMOL POS 59 TILP. 83717 BANDUNG

PUMP FACTORIES

Up to now the "Bandung Pump" used in the West Java Rural Water Supply Project OTA-33/J-7 are produced by 2 factories.

1) Pump factory : Batur - Jaya
   Address : Batur Ceper - Klaten
   Central - Jaya

   The factory produced 300 peces type "Bandung Pump" for the OTA-33 project.
   For the test result of the "Bandung Pump" executed by the Balai Penelitian Bahan-bahan (see chapter 6).
   Several Bandung Pump are installed in rural areas and the utility after an average using time of 1½ year looks good.

2) Pump factory : CV. Malabar
   Address : Jalan Halteu Andir 30
   Bandung - Jabar

   For the test results of the "Bandung Pump" executed by the Balai Penelitian Bahan-Bahan Bandung (see chapter 6).

At present the same type of pump (Bandung Pump) is produced under other or even without any brand name by C.V. Malabar.

PRODUCTION OF THE SHALLOW WELL
"BANDUNG" HANDPUMP AT THE PUMP
FACTORY " BATUR JAYA "
BATUR CEPER - KLATEN
CENTRAL - JAVA

Photo's By :

Dr. Ir. Sri Hardjoko Wirjomartono
Mechanical Engineering Department
Institut Technologi Bandung.