UNITED NATIONS

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Report on Advisory mission to Indonesia on accelerated local manufacture of handpumps for rural water supply

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This report was prepared by the principal mission member Mr. H.V. Krishnaswamy, a consultant engaged by ESCAP for this purpose. The opinions expressed here are entirely those of the consultant and they do not reflect the views of ESCAP-United Nations. The statistics cited in the report were obtained by the consultant through his discussions with the country representatives he met during his mission to the country.

This report is issued without formal editing.

CONTENTS

/3.4 Handpump

1. INTRODUCTION:

1.1 Background information:

1.1.1 Almost all the developing countries in Asia and the Pacific regions, not to mention the countries of the African region, have, for decades, adopted the handpumps - both for shallow and for deepwells - as one of the facilities in their Rural Water Supply Programmes, for drinking and domestic needs of the rural millions, The importance of handpump in providing the basic necessity of drinking water for the village and rural communities, is getting the increasing attention of planners all over the world. Serious efforts have been planned by the Governments in achieving the goals of the International Drinking Water Supply and Sanitation Decade (IDWSSD) programmes. Various United Nations bodies have also been involved in IDWSSD in assisting developing countries for the achievement of these goals.

1.1.2 The Inter Agency Task Force for Water in Asia and the Pacific,Bangkok, at its meeting, opined that there perhaps was a need to accelerate the manufacture of handpumps for implementing rural water supply schemes in some regional developing countries and requested ESCAP to initiate a project to assess the handpump requirements and production capacities in these countries and to assist and advise, if necessary in increasing production of handpumps.

1.1.3 The ESCAP Secretariat responded to this request by organising a roving advisory mission to selected member countries which indicated their willingness to accept the Mission to conduct a survey with emphasis on handpump manufacture and covering other points relating to handpump on procurement, quality control, installation and maintenance.

1.1.4 The Mission visited Indonesia, among other, from October 14, 1985 to October 18, 1985.

1.2 TERMS OF REFERENCE OF THE MISSION:

The Terms of Reference of the Mission, are attached to this report as Annex I.

/1.3 COMPOSITION

1.3 COMPOSITION OF THE MISSION:

The Mission comprised of the following member:

Mr. H.V. Krishnaswamy, Consultant, ESCAP, Bangkok

The Mission was jointed by:

Mr. M.Z. Karim, UNICEF, Jakarta

Mr. S.P. Mathur, WHO, Jakarta

1.4 PROGRAMME OF VISITS:

The Mission prepared a standard format for the collection of information during the visit to Jakarta, Indonesia.

The itinerary of the Mission was as follows:

14 October 1985	Morning	Meeting at Directorate General of Rural Development (DGRD) attended by representatives of concerned Government Agencies, UNICEF and WHO
	Afternoon	Visit to handpump manufacturer M/s. P.T. Daya Baru Agung
15 October 1985	Morning	Jakarta to Bundung by train
	Afternoon	Visit to handpump manufacturer M/s. Turbindo, West Java. Halt at Bandung
16 October 1985	Morning	Visit to MIDC and B4T Meeting with concerned Officers
	Afternoon	Bandung to Jakarta by train
17 October 1985	Morning	Jakarta to Solo by flight. Meeting with concerned Officers Visit to Batur Jaya
	Afternoon	Visit to Kabupaten - SRAGEN Meeting Visit to handpump sites. Halt at Solo
18 October 1985	Morning	Solo to Jakarta by flight
	Afternoon	Final meeting with concerned Ministries, UNICEF and WHO at DGRD Office

/1.5 PROCEDURE

1.5 PROCEDURE ADOPTED BY THE MISSION:

At each place visited, a joint meeting was held with representatives of agencies concerned, to explain the objectives of the Mission as well as to collect relevant data. As the time of each visit was brief, the information gathering was through discussions at the joint meetings at which the agencies dealing with rural water supply programmes were represented. On the last day, the Mission had a final joint meeting with the representatives of concerned Ministries in the office of the Directorate General of Rural Development.

1.6 SCOPE OF THE MISSION:

1.6.1 In carrying out the Mission, the members concentrated on problem areas in handpump technology. These were not limited to technical aspects of the handpumps but included procurement procedures, manufacture, installation and maintenance of handpumps, all of which are inseparable links in the ultimate objective of handpumps giving continuous supply of potable drinking water to rural people. At the same time, due attention was given to any successful experience of the country which might be used to advantage by other developing countries in the region.

1.6.2 The Mission did not limit itself to the present contract of the components of the programme but used a comprehensive approach.

1.7 ACKNOWLEDGEMENTS:

1.7.1 The Mission members are sincerely grateful to all the officials who co-operated with them, answered patiently their questions and provided the required information. They also deeply appreciate all the kindness, courtesies and the warm hospitality extended to them, which made their stay in the country a delightful experience.

2. GENERAL VIEWS AND RECOMMENDATIONS:

2.1 CURRENT PRACTICE:

2.1.1 The Ministry of Health is responsible for construction of facilities both shallow well and deepwell with handpumps, for rural water supply schemes.

/2.1.2 In REPELITA IV,

2.1.2 In REPELITA IV (five year plans), construction of deepwell handpumps has been given a big boost by nearly 6 times that of REPELITA III. The shallow well handpumps in REPELITA IV is nearly half of what was provided for in REPELITA III.

2.1.3 In the manufacturers' works, quality control assurance and quality control methods are not compulsorily adopted. Jigs and fixtures are not used to the required degree. Records are not kept for rejected/accepted items. Endurance test and performance test on handpumps do not appear to be carried out.

2.1.4 The handpump is a machine and like any other machine, requires to be kept clean and parts periodically inspected for formation of rust, loose bolts and nuts and also for replacement of missing parts in time to prevent major breakdown. At the same time, the handpump is a special type of machine, unlike others in a covered machine shop, open to the rigours of weather and subjected to rough handling and continuous use by unskilled rural folk without any trace of technical knowledge or competence. Therefore, it is all the more necessary to treat the handpump as an extraordinary machine and proper maintenance is of utmost importance. Also training programme on installation and maintenance of handpump, on a regular basis, at the level of village caretakers and supervisors and engineers, is a must. There does not appear to be any code of practice for installation and maintenance of handpumps - shallow well and deepwell - at the national level, applicable uniformly throughout the nation.

2.2 RECOMMENDATIONS:

After reviewing the status and the need for a more comprehensive approach on handpump technology in Indonesia, the Mission recommends the following points.

2.2.1 At the moment it appears that there is not much need to accelerate the capabilities of manufacturing handpumps, as the manufacturers have indicated that their production capacities are much higher than the present demand as well as the projected demand, under REPELITA IV for the years 1984-1989.

/2.2.2 Existing

2.2.2 Existing facilities and trained manpower with MIDC and B4T appear to be presently adequate but need upgrading especially by way of establishing handpump testing facilities of more practical nature. At present activities of these departments related to handpump, are very limited and contracts are taken from buyer or producer on specific jobs only on payment basis. B4T has tested only 13 handpumps last year. There is a need to operationalise routine testing to ensure quality assurance.

2.2.3 No research and development (R & D) activities on handpumps presently exist. There is a need for setting up R & D activities in MIDC and testing facilities in B4T.

2.2.4 Although there is a capacity with the manufacturers to produce quality handpumps, they are unable to do so because of selling price factor. It is recommended that the pricing policy may be reviewed to ensure procurement of good quality pumps.

2.2.5 A close look is needed into the existing S.I.I. Specifications for handpumps especially in case of deepwell handpumps.

2.2.6 The quality control should be more vigorously persued and insisted upon at the manufacturers' shops.

2.2.7 There is a need for the preparation, at national level, of Codes of Practice for installation and maintenance of shallow well and deepwell handpumps, giving step-by-step procedures with diagramatic sketches.

2.2.8 Standardised handpump training programmes for persons at various levels who are involved in the implementation of handpump schemes, should be periodically conducted.

2.2.9 The Mission notes that a national workshop specifically on the subject of the handpumps, can be valuable.

/3. REPORT ON

3. REPORT ON INDONESIA:

3.1 General information:

3.1.1 About the country:

3.1.1.1 The country of Indonesia consists of as many as 13,500 islands. Administratively it is divided into 27 provinces (Regencies), 247 Kabupatens (Districts) and 3,350 Kecamatans (Sub Districts). Kecamatans are further divided into desas (Villages) and Kampungs (Hamlets). As per the estimates made in 1983, the total population is about 160 million, out of which 120 million (75 per cent) live in rural areas.

3.1.1.2 Indonesia has broadly four types of ground water terrains - (a) Pre-tertiary and tertiary terrains in which intensely folded crystaline and sedimentary rocks have low permeability and generally low potential; (b) Limestone terrains in which solution channeling has produced zones of secondary porosity locally of high potential, but generally hard; (c) Volcanic terrains, mostly of quarternery age in which highly productive confined aquifers of good quality occurs along the lower flanks where rainfall is generally high; and (d) Alluvial and coastal plains composed of thick quarternery sediments in which aquifers consist of thin gravel and sand layers inter-clated between clay layers.

3.1.1.3 In Indonesia it is estimated that roughly 1,250 million cubic metres of ground water per day is available, of which about 70 per cent is in relatively less densely populated areas of Irian Jaya and Kalimantan, and which is more than enough quantity to meet the rural water supply demand. However, more extensive and acurate ground water investigation will be required to assess the total ground water potentiality of the country. To cover the entire country, about 130 sheets of hydrogeological maps are needed, but so far, about 10 sheets only have been published.

3.1.2 General habits of the local people in respect of utilisation of water for drinking and other domestic purposes:

In the rural and semi urban areas of Indonesia, dugwells utilising shallow ground water is still the most popular method to meet the requirements of water for drinking and domestic needs.

/3.2 Rural Water

3.2 Rural Water Supply Schemes:

3.2.1 General:

3.2.1.1 The Government of Indonesia has given top priority to the improvement of water supply and sanitation services during the past three Five Year Development Plans called REPELITAs from 1964 to 1984. Until REPELITA II, little provision was made by the Government in its regular provincial development budgets (DIP) for the rural water supply. From beginning of REPELITA II in 1974, under a special Presidential decree, funds were provided directly to the local governments called INPRES Rural Water Supply Programme.

3.2.1.2 When the Ministry of Health, Government of Indonesia (MOH/GOI) was formulating its National Health System (Sistim Kesehatan Nasional - SKN), the Government of Indonesia joined the member states of the United Nations in planning its National Drinking Water Supply and Sanitation Decade Programme, 1981-1990. The target was set to provide 60 per cent of the rural population with safe drinking water by the end of the water decade i.e. by 1990. Construction of shallow well and deepwell handpump facilities was considered a major solution to achieve this planned decade target.

3.2.1.3 In Indonesia, budget for the construction of handpump facilities is a fixed lumpsum and not related to actual depth/diameter of the well drilled. The budget for shallow well handpump is about Rp.90,000 (US$ 90) and for deepwell handpump is Rp.420,000 (US$ 420). This budget is inclusive of all costs, including transportation of pipes, construction materials for well and platform, cost of handpump and labour cost. It is the responsibility of the local Governments to implement the INPRES rural water supply programme and provide dependable water supplies to rural communities. The Central Government's involvement is mainly related to general planning, allocation of funds and some technical assistance.

3.2.1.4 Based on the data of the nation-wide water survey carried out in 1975-78 by the Ministry of Health with the assistance of UNICEF, it was roughly estimated that 46.6 per cent

/and 20.0 per cent

and 20.9 per cent of the population can be served respectively by shallow well handpumps and deepwell handpumps. The use of shallow well and deepwell handpumps are concentrated in the three Jawa Provinces out of the total 27 Provinces in Indonesia. The number of handpumps installed in these three Provinces are:

	Shallow well Handpump:	Deepwell Handpump:
Jawa Barat (West)	60,359	3,246
Jawa Tengah (Centre)	60,990	3,975
Jawa Timur (East)	60,069	4,210
Total for 3 Provinces:	181,418	11,431
Total installed in 27 Provinces:	340,082	31,411

It will be seen that 53 per cent of shallow well handpumps and 36 per cent of the deepwell handpumps installed throughout the 27 Provinces, are in the three Provinces of Jawa.

3.2.2 Procurement of handpumps by Government Agencies:

3.2.2.1 The Ministry of Health/Government of Indonesia gave a high priority for the construction of shallow well handpump facilities. This is because of its low cost, easy planning and execution. Accordingly, in REPILITA II and III, the construction cost of shallow well handpump and deepwell handpump facilities was 81.9 per cent and 7.1 per cent respectively of the budget for Rural Water Supply sub-sector.

3.2.2.2 Three Ministries of the Indonesian Government are mostly responsible for the Rural Water Supply and Sanitation Sector. They are (i) The Ministry of Health (DEPKES) for rural areas; (ii) the Ministry of Public Works (DEPPU) for development in urban and semi-urban areas, and (iii) the Ministry of Home Affairs (DEPDAGRI) which looks after the operation and maintenance of the water supply and sanitation facilities. Recently DEPKES has been identified as an agency mainly responsible for controlling water quality

/aspects in

aspect in rural, urban and semi-urban schemes. A bulk of the well drilling programmes of the Ministry of Health is to drill smaller diameter boreholes (maximum depth of about 25 M) suitable for hand pumps. In addition, deepbore holes are also drilled to a limited extent. INPRES programmes are channelised through Department of Home Affairs. The Ministry of Health procures deepwell handpumps which reach villages through Districts and Sub-Districts. The Shallow well handpumps are purchased at District level and reach villages through Sub-Districts. The Ministry of Home Affairs procure shallow well and deepwell handpumps at District level. The other Central Government Agencies involved are (1) National Development Planning Agency (BAPPENAS) which carried out overall planning and programming and allocates funds for water supply and sanitation projects through the Government's annual development budget: (2) Ministry of Finance which channels funds from local and foreign sources to the executing agencies, and (3) Directorate of Environmental Geology, Ministry of Mines and Geology, which is responsible for the administration of groundwater resources of the country.

3.2.2.3 The total handpumps installed in Indonesia from the commencement, under the Government programme alone, is as follows:

	Shallow well Handpumps:	Deepwell Handpumps:
REPELITA I (1969-1974)	2,882	-
REPELITA II (1974-1979)	81,621	3,061
REPELITA III (1979-1984)	243,000	25,000
Provincial Development Budget	12,579	3,350
	340,082	31,411

/To other

The other type of facilities constructed during REPELITA I, II and III are:

	Numbers:
Piping	1,510
Artesian well	445
Spring protection	2,725
Rain water collection	26,876
Dug well	18,153
Infiltration gallery	11
Slow sand filters	4
Simple filtration	123
Fe filter	23
Total:	49,870

The total shallow well and deepwell handpump facilities provided were 371,493. It will be seen that the provision of shallow well and deepwell facilities approximately constitutes 88 per cent of the total of all facilities put together. This is because of the importance given to shallow well handpumps and deepwell handpumps.

3.2.2.4 Other procurement sources are International Aiding Agencies like UNICEF and WHO. Till recently, all pumps procured from these agencies, were imported deepwell handpumps, and sent to project areas for implementation. Recently UNICEF has made a beginning in encouraging manufacturers in Indonesia by purchasing shallow well handpumps from a local agency.

3.2.2.5 Shallow well handpumps are also procured by private agencies and consumers. There are hardly any instances of bulk procurement of deepwell handpumps by this source. Statistics in respect of quantity of deepwell handpumps procured by private agencies and consumers, do not appear to be available.

/3.2.3 Future plans

3.2.3 Future plans involving handpumps for Rural Water Supply Schemes:

3.2.3.1 The Government of Indonesia has targeted, in REPELITA IV for the years 1984-1989, to construct shallow well and deepwell facilities involving handpumps totalling 175,000 Nos. and 150,000 Nos. respectively. The year-wise break down is as follows:

Year of REPELITA IV:	Shallow well Handpumps:	Deepwell Handpumps:	Total:
1984-85	25,000	20,000	45,000
1985-1986	30,000	25,000	55,000
1986-87	35,000	30,000	65,000
1987-1988	40,000	35,000	75,000
1988-1989	45,000	40,000	85,000
	175,000	150,000	325,000

Out of 27 Provinces, the 3 Provinces of Jawa viz: Jawa Barat, Jawa Tengah and Jawa Timur envisages the installation of the following number of shallow well hand pumps and deepwell handpumps:

	Shallow well Handpumps:	Deepwell Handpumps:
Jawa Barat	16,060	22,500
Jawa Tengah	18,776	16,000
Jawa Timur	30,000	20,250
	64,836	58,750

This means that the three Jawa Provinces cover 37 per cent of total shallow well handpumps and 40 per cent of deepwell handpumps.

The other types of facilities envisaged for implementation during REPELITA IV are:

	Numbers:
Piping	700
Artesian well	340
Spring protection	1,400
Rain water collection	40,000
Dug well	22,500
Infiltration gallery	570
Slow sand filter	870
Total:	66,380

Total of all facilities including handpumps is, therefore, 391,380 Nos. The handpumps totalling 325,000 represents as much as 84 per cent of all facilities for REPELITA IV. This again stresses the continued importance given by the Government for shallow well and deepwell handpumps in rural water supply schemes for REPELITA IV.

The population coverage for the rural water supply schemes by means of arious facilities, has steadily increased from 18 per cent at the end of REPELITA II to 33 per cent at the end of REPELITA III, and to 55 per cent planned for the end of REPELITA IV.

It will be seen that in REPELITA IV, construction of deepwell handpump has been given a big priority, and targets for construction has been increased by nearly 6 times that of REPELITA III. Shallow well handpumps have shown a declining trend from that of REPELITA III. In REPELITA III the shallow well handpumps provided were 340,082 Nos. whereas in REPELITA IV the target is reduced to 175,000 Nos. only. As against this, deepwell handpump has been given a big boost from 25,000 in REPELITA III to 150,000 in REPELITA IV.

3.2.3.2 In REPELITA III, construction of deepwell was introduced as drilling of wells in some areas was not possible with simple drilling equipment and also shallow well handpumps were provided in considerable number. But targets for the construction of deepwells could be increased from 25,000 in REPELITA III to 150,000 in REPELITA IV mainly because, among other factors, the introduction of more sophisticated trailer mounted drilling rigs and training of required manpower. Accordingly, the construction of shallow well handpump is reduced to 175,000 numbers in REPELITA IV.

3.2.3.3 UNICEF and UNDP aid assisted projects are supplied with imported types of India Mark II deepwell handpump, Korat 608 deepwell handpump and Dragon Kawamoto type of shallow well handpump.

3.2.3.4 Since the beginning of handpump programme in Indonesia, in-depth studies have not been made for evaluating the pump performance. Some studies on the performance of handpump facilities constructed in the UNICEF assisted projects were undertaken in the past. It has been observed that 80-90 per cent of the pumps were in use. Recently collected data of the INPRES programme

by the UNDP/WHO assisted project in South Sulawesi Province indicated that in 23 regions, 55 per cent of shallow well handpumps and 25 per cent of deepwell handpumps were not functioning. The break down of handpumps has been a major problem in many of the programmes.

3.3 HANDPUMPS USED IN INDONESIA:

Handpumps are used in rural water supply programmes of Indonesia both for shallow well and deepwell constructions.

3.3.1 SHALLOW WELL HANDPUMPS:

3.3.1.1 A number of makes and types of shallow well handpumps are used by the Governmental agencies, private bodies and individuals. The most popular handpump is the "Dragon" type of suction cum force pump. The design of this pump originated from "Dragon Kawamoto" designed and manufactured in Japan. Shallow well handpumps are installed to draw water from a depth upto seven metres of static water level. The different brands of shallow well handpumps are 'TASAKO', 'BATUR JAYA', 'YAMATO', 'TOSANA' and others.

3.3.2 DEEPWELL HANDPUMPS:

3.3.2.1 In the Government programmes, the deepwell handpumps used are BARUNA type of handpump, based on 'Dempster' pump originally designed and manufactured in U.S.A. Here again different brand names are used by manufacturers like 'BARUNA', 'OWIGUNA', 'SUMEER BANYU','PODALIM' and others.

3.3.2.2 Recently a new deepwell handpump design has been introduced which is suitable for village level operation and maintenance. This design uses the pump cylinder of the same diameter as that of the riser pipe cum casing of the bore hole, which enables the piston assembly parts or bottom valve to be replaced easily by pulling out the connecting rod after opening the lid cover of the pump. Pump cylinders installed at depths of 20 metres could be repaired by the villagers in less than an hour by using simple tools. This pump is being used in the INPRES funded programmes.

3.3.3 ROLE OF MIDC AND B4T IN HANDPUMP TECHNOLOGY:

3.3.3.1 Metal Industries Development Centre (MIDC):

MIDC was set up by Indonesian Government at Bandung in 1970 with technical co-operation from the Belgian Government.

/The general

The general objective of MIDC is to contribute to the promotion, upgradation and rehabiiitation of the metal industries throughout the country. The specific objective of MIDC is to improve production processes, especially by transferring technological knowledge to the metal industries. MIDC comes under Department of Industry.

3.3.3.1.2 The Centre has several divisions including machine shop, foundry shop, model and prototyping shop, welding and construction shop, and heat treatment equipment, apart from quality control equipment, division for training and seminars, and library.

3.3.3.1.3 MIDC gives advice on request only, to handpump industries for producing good quality handpumps. MIDC is involved only when either purchaser or producer of handpumps approaches them and the services are offered for a price. MIDC has advised on methodology and foundry process for handpump production. These assignments are time bound and only when requested and at a price paid by the requestor.

3.3.3.1.4 Though Rural Water Supply Schemes are important to the Indonesian Government, MIDC has no budgets or plans or programmes on handpumps for quality assurance or for quality control methods. MIDC has allocated funds only for heavy industry development like heat exchangers, pressure vessels, machine tools, etc.

3.3.3.1.5 UNICEF had engaged MIDC to prepare a report on quality procedures and production of handpumps for UNICEF programmes. Based on this report, UNICEF went for bidding and selected one local producer of shallow well handpumps marketing by brand name 'TASAKO' which was under the supervision of MIDC. 3,900 shallow well handpumps were purchased and installed in UNICEF project. While the preliminary reports are encouraging, the final assessment is yet to be made.

3.3.3.1.6 The Mission observed in MIDC machine shop, a testing rig for the performance of handpumps for their output. The testing rig was only a laboratory model with suction head of one metre only for 24 strokes per minute cycle. Site conditions were not simulated.

/3.3.3.2 Metal

3.3.3.2 Metal testing centre name BALAI BESAR BAHAN DAN BARANG TLKNK, otherwise called B4T at Bandung. This Government centre deals with testing of building materials, metals, chemicals minerals, etc. They had undertaken testing of 13 shallow well handpumps and 2 deepwell handpumps in the previous year. This centre undertakes testing only when a manufacturer or a purchaser refers B4T on payment basis.

3.4 HANDPUMP MANUFACTURING FACILITIES IN INDONESIA:

3.4.1 Under the policy of the Government of Indonesia, shallow well handpumps are manufactured by the weak economic group with limited capital inputs and limited facilities. In order to promote the local industries, procurement of these pumps are the responsibility of the local Governments. The manufacturers of deepwell handpumps do not come under weak economic group.

3.4.2 The selected manufacturers of handpumps in Indonesia and their capacities are as follows:

/Name of manufacturer:

Name of manufacturer:	Production capacity of hand pumps per year (in numbers):	Brand name:
1. P.T. Daya Baru Agung, Jakarta		
Deepwell handpumps	25,000	BARUNA
Shallow well handpumps	2,400	
2. P.T. DWI Warna Jaya Raya, Jakarta		
Deepwell handpump	6,000	DWIGUNA
3. P.T. Borimex, Jakarta		SB (SUMBER
Deepwell handpump	9,000	BANYU)
4. P.T. Wigo, Jakarta		
Deepwell handpump	6,000	PODALIN
5. P.T. Mastoodon Lubssi, Jakarta		
Shallow well handpumps	24,000	YAMATO
6. C.V. Cipta Karya, Surabaya		
Shallow well handpumps	22,800	TASAKO
7. Pinda Tosana Unit Kalimas, Surabaya		
Shallow well handpump	5,200	TOSANA
8. Batur Jaya, Klaten		
Deepwell handpump	24,000	BATUR JAYA
Shallow well handpumps	240,000	BCS, IKADA
9. Turbindo, Bandung		SAMI
Deepwell handpumps		PODALIN
Shallow well handpumps	5,200	HURRICANE
Total:	369,600	BANDUNG

The Mission visited the factories of M/s. P.T. Daya Baru Agung, Jakarta, M/s. Turbindo Industrial Pumps and Turbine, Bandung, and M/s. Batur Jaya, Klaten.

/3.4.3 P.T. Daya

3.4.3 P.T. Daya Baru Agung, a family concern, manufactures under brand name 'BARUNA' both shallow well handpumps and deepwell handpumps of Dempster type. They have a cast iron foundry of capacity 200-300 tonnes per month. Their production capacity is 2000-2500 deepwell handpumps and 200 numbers shallow well handpumps per month. They also manufacture automobile spare parts. Though they supply handpumps mainly to Government projects, about 10 per cent is supplied to private market. Imported items are leather washers from U.S.A., and connecting rods and bearings from Japan. Production personnel look after the quality aspects. No facility exists for testing castings. The Mission was given to understand that the orders for handpumps from the Governmental Agencies and private bodies fell short of their production capacity.

3.4.4 Turbindo, an individual owned company, manufactures shallow well and deepwell handpumps as well as axial, centrifugal and turbine pumps. Different types of deepwell handpumps under brand names 'SAMI' 'PODALIN' and 'HURRICANE' and shallow well 'BANDUNG' are made here. Capacity is 5,200 of all types of handpumps per annum. They do not have any quality control personnel or system. Owner's experience in the line controls quality, the Mission was given to understand.

3.4.5 Batur Jaya is set upon a co-operative basis involving over 110 small foundries/industries in and around Klaten. What are produced in these small units as parts of the handpumps including cast iron parts, are brought in and assembled at Batur Jaya factory where central machining facilities are available. They manufacture shallow well handpumps under various brand names 'BCS', 'IKADA', 'BANDUNG', 'YAMATO' and 'DRAGON' and deepwell handpumps 'BATUR JAYA' of Dempster design. They supply to Government agencies and also private parties. Their capacity, as was made to understand to the Mission members, is 20,000 shallow well handpumps and 2,000 deepwell handpumps per month. But they are selling only about 12,000 to 15,000 pumps per month, due to lack of orders. The quality of parts are checked by MIDC wherever specified. They do not use any jigs and fixtures. The manufacturer made it clear that they make three qualities of handpumps depending upon the price they get. They get a fixed price of 17,000 Rupiah per handpump for Government orders, at which price, they said, good quality cannot be expected. Because of price going down, they admitted the quality of manufacture

/is also

is also going down. They clarified that for a good quality pump, they must at least get 50 per cent more in price. They produce, about 20 per cent of 1st quality, 20 per cent of 2nd quality and 60 per cent of 3rd quality handpumps, which is approximately the purchase pattern from different sources.

3.4.6 Based on the information given to the Mission by Batur Jaya about its capacity for production of handpumps and based on the available data about the selected handpump manufacturers given in 3.4.2 the installed production capacity of handpumps (both shallow well and deepwell) is about 369,600 numbers per annum. The production details of other handpump manufacturers are not available.

3.5 HANDPUMP REQUIREMENT VERSUS MANUFACTURING CAPACITY IN INDONESIA:

3.5.1 The shallow well and deepwell handpump requirements, as envisaged in the REPELITA IV for Indonesia, and as detailed in 3.2.3.1 is 55,000 numbers in 1985-86 increasing to 85,000 for 1988-1989, for Government sponsored Rural Water Supply Schemes. The capacity currently available with handpump manufacturers in the country, as detailed in 3.4.2 is over 300,000 numbers per year. The conclusion, therefore, is that the capacity adequately exists with the present manufacturers for production of handpumps to meet the present and future requirements of the Government of Indonesia, as well as of private buyers.

3.6 PRESENT PRACTICE AND SITUATION IN VARIOUS LINKAGES OF HANDPUMP TECHNOLOGY FROM DESIGN, PROCUREMENT, MANUFACTURE UPTO MAINTENANCE:

3.6.1 The shallow well handpump generally used is the 'DRAGON' type. The commonly used deepwell handpump is 'BARUNA' type of Dempster design. All these pumps are indigenously manufactured. Different manufacturers use different brand names for the handpumps produced by them.

3.6.2 The Ministry of Health is the Government agency responsible for construction of shallow well and deepwell facilities with handpumps for rural water supply schemes.

/3.6.3 The National

3.6.3 The National standards institution of Indonesia called 'STANDARD INDUSTRI INDONESIA' (SII) has brought out specifications for shallow well handpump and deepwell handpump, which are followed by the Government agencies in their purchases for handpumps.

3.6.4 The MIDC and B4T have good infrastructural facilities and capabilities to give a concerted direction in assuring quality production of handpumps at the manufacturers shops, as well as to undertake testing of handpumps for proving their design features. But MIDC and B4T do not undertake any of these roles on their own as they do not have any funds, of their own. The activities of these departments related to handpump are very limited. They carry out assignments as and when approached by the buyer or producer for payment of services to be rendered by them. Further, the most disconcerting feature is that this one-time transaction of consultancy/ advice is not followed up for further production either by the buyer or producer. Therefore, there is no way of ensuring that the good results of advice given by MIDC or B4T are strictly followed by producer continuously on all the orders received by him.

3.6.5 In foundry technology for handpump manufacture, Indonesia is very practical even though it may not be sophisticated.

3.6.6 The manufacturers admit that the quality of pumps is not of desired level due to the selling price of the pump. The price for handpump paid by Government agencies is not adequate enough to produce good quality pumps.

3.6.7 In the handpump manufacturers' workshops, quality assurance/quality control checks may be made more vigorous. Jigs and fixtures are not used to the required degree. Records are not kept for rejected/accepted items. Endurance test and performance test on handpumps do not appear to be carried out.

/3.6.8 Maintenance of

3.6.8 Maintenance of handpumps has been a big problem. There is high percentage of breakdown of pumps in the field. It was reported tc the Mission that maintenance of handpumps had been very poor. The maintenance has to be taken care of by the local community who complain of non-availability of funds. During the inspection by the Mission, of a few handpumps installed at site, the following observations were made:-

- Handpumps not properly fixed to the foundation so much so the whole pump was not firm and was shaking;
- Sand particles were seen coming with pumped water;
- The above-ground parts of the handpump had wear and tear effects;
- The handle was kicking back, great efforts were required to start pumping;
- Some of the bolts and nuts were loose and some were missing;
- The pump was not truly vertical. In one of the pumps, top cap itself was missing;
- As the handle was broken in one of the pumps, local people had replaced the same with wooden handle.

3.6.9 The common problems relating to handpumps, encountered at site were:

- All moving parts were found to be poorly matched;
- Tolerances and fits were excessive allowing the handle and fulcrums to wobble sideways.

3.6.10 Among the parts of the pumps, the most used for replacement are the leather cup, handle, pin on head of pump, bolts and nuts and rubber seal.

4. RECOMMENDATIONS:

The comments and recommendations this Mission is making is based on what the Mission is able to observe and discuss with different agencies involved in procurement and production of handpumps, during the short visit. Therefore, the recommendation is based not on any indepth study of the handpump production or other activities connected with handpumps.

These recommendations have been discussed among members of the Mission and the officials of the Government of Indonesia and presented as follows:

/4.1 The manufacturers

4.1 The manufacturers have indicated that their production capacities were much higher than the present demand and that they had not faced any problems in the past to meet this demand. Further, the facilities, equipment and skills seemed adequate enough to meet the targetted REPELITA IV and water decade demand by the Government agencies for implementing rural water supply programmes. At the moment, it appears that there is not much need to accelerate the capabilities of manufacture of handpumps.

4.2 Though the existing S.I.I. specifications for shallow well and deepwell handpumps are exhaustive, the Mission suggests that the following points may be looked into in-depth:

- Grades for cast iron parts of handpumps have to be specified. Proper grades which offer higher elongation should be selected.

- Malleable iron would also be suitable for handle, fulcrum link and top body.

- Piston seals should be out of Nitrile rubber instead of leather, for longer life.

- Cold drawn steel of minimum 13 per cent elongation should be used for flat and round bars, to prevent failures at threads.

No design can be perfect. It would be observed, through on-going monitoring by field staff and feed-back from site personnel, that weaknesses and shortcomings even in a well-designed pump are discovered, which require improvements to present design and requiring continued field testing. The changes may become necessary to make the pump more durable, strudy, easier to operate, install and or maintain.

The Mission therefore recommends that a close look is needed into the existing design of handpumps with a view to improve on design of parts and joints, based on the feed-back information received continuously from the field.

4.3 No research and development activities on handpumps presently exist. There is an urgent need in Indonesia, a country beset with different types of problems relating to water resources, to set up Research and Development (R & D) activities on handpumps and also testing facilities.

/4.3.1 The Research

4.3.1 The Research and Development activities may cover the following points:

4.3.1.1 Inadequate pump design on critical items like (a) highly stressed fulcrums and handles, frequently made worse by poor alignment and tolerances, (b) fasteners (bolts and nuts) poorly made, (c) bearing surfaces too small, (d) plunger cups improperly sized, (e) cylinder being too rough, (f) valve seats and (g) design features of parts to discourage theft.

4.3.1.2 To create awareness in the community towards their participation and involvement in the installation and day-to-day maintenance of handpumps.

4.3.1.3 Proper storing of pump parts at manufacturers' shops and at site.

4.3.1.4 Low production costs.

4.3.1.5 Quality assurance and quality control in production of handpumps.

4.3.2 The handpump testing facilities may cover the following points:

4.3.2.1 Test to measure the performance of a handpump: This is to determine the relationship between working frequency, lift, capacity, manpower and efficiency and to verify if the indexes of actual performance conform with the design requirement. The site conditions should be simulated here.

4.3.2.2 Endurance test of a handpump: This is to examine reliability, wearbility and economical index for the parts of the specimen handpump.

4.3.2.3 Test of human engineering for handpumps: This is to measure the maximum capacity generated by operators at a short period of time, the pump performance and the human body loading index at a continuous operating period for different kinds of pumps and different methods of operation.

/4.3.3 Existing

4.3.3 Existing facilities and trained manpower with MIDC and Metal Testing Centre B4T at Bandung, appear to be presently adequate. The Mission recommends that R & D activities of handpumps, as a national centre, be located at MIDC, and that handpump testing facilities be located at B4T, by suitably upgrading the existing facilities at these places. These centres could play a very important role by monitoring all pumps developed or manufactured mostly in Indonesia, but in the neighbouring developing countries as well.

4.4 The activities of MIDC and B4T related to handpumps, are very limited. They take up only on contract basis for specific jobs. B4T has tested only 13 samples of handpumps in 1984 on request and payment basis. The Mission recommends that there is a need to operationalise all production and testing of handpumps to be routed through MIDC and B4T to ensure quality, assurance.

4.5 Although there is a capacity with the manufacturers to produce quality handpumps, they are unable to do so because of selling price factor. It is recommended that the pricing policy may be reviewed to ensure procurement of good quality pumps.

4.6 The Mission recommends the following points to be particularly looked into, during the manufacture of handpumps.

4.6.1 The manufacturer should have a separate quality control wing with personnel exclusively manning this wing, independent of production personnel, and answerable directly to the Chief Executive. This department must maintain complete documentary records separately for accepted/rejected parts and should be responsible for checking and ensuring quality standards from raw material stage right upto final assembly of handpumps. Buyer should insist on manufacturers to prepare quality assurance manuals and quality control procedures during manufacture and inspection which should also cover documentation procedures. Required checking gauges and measuring instruments should be used by the manufacturer.

4.6.2 The manufacturer should be insisted upon by the buyer to use the jigs and fixtures at the manufacturers' shops, in order not only to increase the production rate but make it possible to use less skilled labour, to improve dimensional accuracy, to improve assembly and for interchangeability of parts.

/4.6.3 The chemical

4.6.3 The chemical composition of pig iron used for casting will be within an acceptable range to facilitate good casting. The recommended chemical composition is:

- Carbon : 3.2 per cent to 3.5 per cent
- Silicon : 2.1 per cent to 2.3 per cent
- Manganese : 0.6 per cent to 0.9 per cent
- Phosphorous : 0.2 per cent maximum

High phosphorous content can cause brittleness and has low resistance to impact which can cause breakage, and is difficult to machine resulting rougher cylinder wall and poorer tolerances. Therefore phosphorous content is especially critical. A periodic chemical analysis of the pig iron should be provided by the supplier and verified by chemical analyser before the pig iron is accepted.

4.6.4 Foundry coke should also be purchased to specifications. The recommended specification is:

		Weight by per cent:
- Fixed carbon	:	88.0 minimum
- Volatile matter	:	1.0 minimum
- Ash content	:	12.0 maximum
- Sulphur content	:	1.0 maximum

The caloric content should average 2500 million BTU per short ton. Coke should be covered in storage and protected from moisture.

4.6.5 Brinel hardness of the casting should be from 179 to 229 BHN. The tensile strength of the casting produced should be 14 tons per square inch (24 Kg. per sq. mm.)

4.6.6 The grade, type, size and distribution of graphite flakes and the structure of the matrix shall correspondingly be Grade 14, Type I, and size 3-5.

Distribution and Micro Structure : A, lamellar/pearlite, Ferrite, if present, shall not exceed 10 per cent.

/4.6.7 The manufacturer

4.6.7 The manufacturer of castings shall issue test certificates with every batch of their supply and also test bars for tensile, transverse and impact tests. The test certificate shall indicate

- Delivery challan and date
- Purchase order number and quantity
- Part number and description
- Heat number/batch number, quantity per heat, heatwise chemical composition, tensile, hardness, transverse values on representative samples. The hardness values should indicate the number of samples checked from each heat/batch and the location of hardness testing
- Micro-structure report
- Identification for each heat/batch.

4.6.8 Final inspection details to be looked into on the castings are:

- Visual inspection
- Dimensional checks
- Casting defects like blow holes, cracks, rough castings
- Hardness
- Chemical composition
- Tensile strength
- Transverse and impact tests

4.6.9 It should be ensured that the valve seats must be smoothly finished and without blemish. The fabrication of valve assembly parts should be done with care for satisfactory operation. It should be ensured that the cast iron cylinder inside wall (in which the plunger operates) smoothness should be almost that of extruded brass cylinder. This increases longer life for cup washers.

4.6.10 Plunger rods should be from mild steel rods and not from flats.

4.6.11 Tolerances should be minimised at all pinned connections not only to prevent excessive wear at those points but also to reduce wear and damage to other parts that may result from poor alignment and wobbling.

/4.7 The Mission

4.7 The Mission recommends the following points to be noted for installation and maintenance of handpumps.

4.7.1 A Code of Practice for installation and maintenance of standardised shallow well and deepwell handpumps should be prepared, at the national level, giving step-by-step procedures with diagramatic sketches. Proper formats should be maintained giving statistical data of installation and maintenance of each handpump. This information is crucially important not only from statistical point but to get feed-back information for research for continual improving the design aspects and standards of hand pumps.

4.7.2 Lack of feed-back from maintenance to engineering and procurement personnel, inadequate record keeping, little analysis - for example - of the most common failures - all these factors dwarf the research and development of handpumps. The recommended maintenance information manual is given in Annex II - Sheets 1 to 8.

4.7.3 Proper storage of pumps and components is a must. Proper painting, protection of machined portions against rust and protection of leather against mildew are necessary.

4.8 The Mission recommends the following points to be noted for training programmes on handpumps.

4.8.1 The training programme for installation and maintenance of handpumps should be regularly conducted by the agency responsible for the implementation of the Rural Water Supply Schemes. The programmes should broadly cover:

- Education of the local people on the importance of handpump in their day-to-day life
- Training in actual pump installation and dismentling in the field with step-by-step procedures. This is an excellent means of 'on-site' training
- Instructing in how the handpump works, the more common causes of failures, and their corrections
- Importance of Public Health in the construction of platforms and maintaining clean surroundings around the pump.

/4.8.2 The training

4.8.2 The training should make available the samples of handpumps used locally, with tools to dismantle and reassemble them. A collection of broken or worn-out parts is also useful for demonstration purposes.

4.8.3 The training should be imparted to the village caretaker as well as to the local supervisors and engineers of the Government agency who is responsible for installation and maintenance of handpumps.

4.9 The Mission notes that a national workshop on the subject of 'The State of the art and application of handpumps in rural water supply schemes', would be valuable at this juncture. The variety of handpumps produced in Indonesia using mostly the age old iron foundry methods, the importance given by the Government of Indonesia in implementing the REPELITA IV and also to the commitment to International Drinking Water Decade, and the existing metal testing centre could all be in depth discussed at this National Conference. Further, the participation of different developing countries in the National Conference, could help exchange experiences in research, manufacture, testing, application, installation and maintenance of handpumps.

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ANNEX I

Advisory mission on accelerated local manufacture of hand pumps for rural water supply

TERMS OF REFERENCE

The mission will carry out its activities within the framework of the following terms of reference:

(a) To visit selected countries and, within each country, to visit the relevant hand pump manufacturing facilities as recommended by the concerned national government agency. The duration of the visit in each country shall be between five and seven days inclusive of international travel involved.

(b) To carry out detailed discussion with concerned government agencies and with the management of each manufacturing facility visited about overall national hand pump requirements (both short - and medium-term) and the existing production capability both at the national level and at the level of the individual plants visited by the mission. Also to discuss the nature and extent of production problems both nationally and at the specific plant level.

(c) At each manufacturing facility visited, to discuss any problems related to technical, management and manufacturing processes. Also, to discuss plans and potential for plant upgrading, increased production and improved quality including financial implications.

(d) To recommend appropriate changes for improvements in technical, management and manufacturing methods and in quality control.

(e) To recommend appropriate measures to increase production of hand pumps and spare parts.

(f) To recommend appropriate measures to improve occupational health, and also safety features in each manufacturing facility visited.

/(g) To identify

(g) To identify elements and scope for appropriate technology transfer and for technical co-operation among developing countries in the region.

(h) To prepare a consolidated report for each country visited with specific recommendations for each plant visited. The report should be prepared within one month of completion of the visits.

****

ANNEX II

WATER SUPPLY - INFORMATION CHARTS ON HANDPUMPS

RECOMMENDED MAINTENANCE INFORMATION MANUAL

FORM 1 : WELL AND PUMP CHART

(A) REFERENCE:

A1. Identification Code [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
State District Serial No.

A2. Water Point Location
(a) Taluk _____ (b) Village _____

A3. Form completed by _____ (b) Date _____

A4. Form checked by _____ Date _____

(B) WELL CONSTRUCTION :

B1. Well Type : Drilled / Dug

B2. Static Water Level : (a) Below G.L. _____
(b) Date _____

B3. Yield of well _____ Litres/minute

B4. Depth of well _____ Metres

B5. Remarks : _____

_____

Sheet 2

(C) WATER QUALITY:

(a) Conductivity _____

(b) pH _____

(c) Total solids _____

(d) Total iron _____

(e) Chloride _____

(f) Sulphates _____

(g) Salinity _____

(h) Any other information _____

(D) PLATFORM CONSTRUCTIONS:

D1. Attach sketch

D2. Position of end of handle from operation level

(a) Top of stroke _____ mm

(b) Bottom of stroke _____ mm

D3. Drainage _____

D4. Remarks _____

_____

_____

Sheet 3

(E) PUMP

E1. Manufacturer ..... Pump Description .....

E2. Installation (a) Date .....
(b) Time taken .....
(c) Installed by:
(Agency)

E3. Dimensions:

	Material	Diameter	Unit length	No. of length
(a) Rising main				
(b) Rods				
(c) Cylinder				

E4. Placement of cylinder
(from G.L.) ..... m.

E5. Pump lever ratio .....

E6. (a) Max stroke ..... mm.

(b) Max swept volume..... .. litres

E7. Seal Material .....

E8. Any problem encountered during or immediately after installation ?

Yes No

Specify .....

.....

Sheet 4

E9. Observed faults of
Pump (Manufacturing defects) .....

E10. Remarks .....

.....

(F) HABITAT :

F1. Approximate population
of village/Habitat :

F2. No. of House holds :

F3. Source of water supply in
the area:

(a) Drilled Well/Dug well
with hand pumps :

(b) Taps

(c) Power pumps :

F4. Estimated population
using this pump :

F5. Village pump caretaker(s) Yes No

F6. Remarks .....

.....

Sheet 5

FORM 2 - SITE INSPECTION

State | District | Serial No.

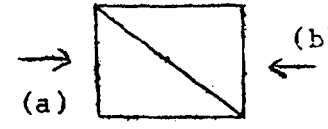
Form completed by:.....

Date	Static water level	Well depth	Performance*	Volumetric efficiency**	Condition of		Preventive Maintenance (Details)	Cause for Break down	Repairs carried out
					Pump	Surroundings			

* No. of strokes to give 12 litres rate of pumping. Rate of pumping:

** Actual discharge in litres in 40 strokes ÷ 12.66 (a) 40 strokes per minute

(b) 60 strokes per minute



Sheet 6

FORM 3 REPAIR AND MAINTENANCE REPORT

A. Reference :

A1. Identification code: ☐☐ State ☐☐☐ District ☐☐☐☐☐☐ Serial No.

A2. Form completed by ..... A3 form checked by .....

Date .....

B. Sequence of Events :

B1. Reason for intervention : Breakdown ☐

Poor performance ☐

Scheduled maintenance ☐

B2. Nature of failure .....

.....

B3. Dates (a) Failure occurred .....(b) Failure reported.....
(c) Failure inspected.....(d) Repair completed.....

B4. Failure reported (a) By whom .....(b) To whom.....

B5. Failure inspected (a) By whom .....(b) Action taken .....

Sheet 7

C. Repair (Specify on site or in workshop)

C1. Description of Repair

C2. Parts replaced(Description and Qty.)

C3. Tools used for repairs (specify standard and special tools)

C4. Time taken to do repairs (man hours)

C5. Repair carried out by

(a) Engineer/Supervisor .....nos.

(b) Skilled man power .....nos.

(c) Unskilled .....nos.

C6. Assistance from Villager: Yes/No

If Yes specify type of assistance .....

C7. Type of vehicle used .....

C8. Total distance travelled
by vehicle for completing repairs .....

C9. Description of corroded, worn, damaged or broken parts
(add sketch or photograph if necessary) .....
.....
.....

C10. Remarks .....
.....
.....

Sheet 8

A. REFERENCE

A1. Identification code [ ] [ ] [ ] State District Serial No.

A2. Form completed by:..... Date:.....

A3. Form checked by: ..... Date:.....

A4. Date of Repair .....

B. MAINTENANCE COST :

B1. Cost of part replaced (as reported in Form 3, C2)

Qty.	Part replaced (from form 3, C2)	Unit cost	Total Cost
	Total cost of parts		

B2. Transportation cost: .....

B3. Direct labour charges.....

B4. Indirect cost (overheads).....

B5. Total cost (B1.+B2.+B3.+B4.).....

ANNEX III

INDONESIA - PERSONS MET

I. FROM THE GOVERNMENT OF INDONESIA:

1) Mr. Mardzono Marsam, Head, Directorate of Rural Infrastructure, DGRD, Ministry of Home Affairs
2) Mr. T. Abdul Mannan, DGRD
3) Mr. A. Malintak, DGRD
4) Mr. H. J. Darlin, DGRD
5) Mr. I.G. Suratidjo, DGRD
6) Dr. E. D. Sjarief Sjamsoeri, Ministry of Foreign Affairs
7) Mr. M. Nuryanto, Ministry of Industry (M.I.)
8) Mr. W. P. Sibarani, M.I.
9) Mr. Shamsir Razak, M.I.
10) Mr. Sukamto, Ministry of Health (M.H.)
11) Mr. M. Rusyid Sta, M.H.
12) Mr. Dailami, M.H.
13) Mr. Togap Siagian, Ministry of Home Affairs
14) Mr. D. Soepardi Haroen Al Rasjid, Director, MIDC
15) Mr. Aslam B Djanun, MIDC
16) Mr. Wibisarto, MIDC
17) Mr. D. Soepard Har, MIDC
18) Mr. Suprapto, B4T
19) Mr. Muh Subrgio, B4T
20) Mr. Soegijamto, B4T
21) Mr. Pedij Tanuatmga
22) Mr. Rusyid, DEPRES
23) Mr. H. Soemanto
24) Ir. NY. KOES Hartiyah D.S.

/II. HANDPUMP

II. HANDPUMP MANUFACTURERS:

1) M/s. P.T. Daya Baru Agung, Jakarta
2) Mr. IIN Mulyana, M/s. Turbindo Industrial Pumps and Turbines Ltd.
3) Mr. H.M. Husnun HS, Chairman, Batur Jaya
4) Mr. Moh, Bilal Hassan, Vice Chairman I, Batur Jaya
5) Mr. Margono, Vice Chairman II, Batur Jaya

III. UNITED NATIONS ORGANISATIONS:

1) UNICEF - Mr. M. Zahirul Karim
2) WHO - Mr. E. Pancaroglu
   - Dr. S.P. Mathur
   - Mr. D. Niti Pavachon

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