UNITED NATIONS

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

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

Bangkok - Thailand
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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.

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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 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 by assisting developing countries for the achievement of these goals.

1.1.2 The Inter Agency Task Force on water for Asia and the Pacific Bangkok, at its meetings, opined that there possibly was a need to accelerate the manufacture of handpumps for implementing rural water supply schemes in the ESCAP regional developing countries and requested ESCAP to initiate a project to assist these countries on assessment of handpump requirements and to improve and if necessary increase and/or accelerate their production.

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

1.1.4 The Mission visited Rangoon, Burma from October 21, 1985 to October 25, 1985.

/1.2 TERMS OF

1.2 TERMS OF REFERENCE OF THE MISSION:

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

1.3 COMPOSITION OF THE MISSION:

The Mission comprised of the following member:

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

1.4 PROGRAMME OF VISITS:

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

The itinerary of the Mission was as follows:

21 October 1985	Morning	Discussions with National Project Engineer, WHO
	Afternoon	Call on Resident Representative, UNDP
22 October 1985	Afternoon	Discussion with Project Officer (Water Supply), UNICEF
23 October 1985	Morning	Discussion with Director, Rural Water Supply Division (RWSD), Agricultural Mechanization Department Visit to handpump manufacturing plant
	Afternoon	Call on WHO Programme Co-ordinator and Representative to Burma. Discussion with Senior Industrial Development Field Advisor, UNIDO
24 October 1985	Morning	Discussion with Assistant Director, Environmental Sanitation Division, Department of Health.
	Afternoon	Discussion with Deputy Director, RWSD and Project Officer, UNICEF
25 October 1985	Morning	Discussion and roundup meeting with Director, RWSD
	Afternoon	Discussion with WPC&R, WHO

/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 member concentrated on problem areas in handpump technology. These were not limited only to technical aspects of the handpumps but included procurement proccdures, 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 member is sincerely grateful to all the officials who co-operated with him, answered patiently his questions and provided the required information. He also deeply appreciates all the kindness, courtesies and the warm hospitality extended to him, which made his stay in the country a delightful experience.

2. GENERAL VIEWS AND RECOMMENDATIONS:

2.1 CURRENT PRACTICE:

2.1.1 Rural Water Supply Division of the Agricultural Mechanisation Department is the main Government Agency to monitor and implement the Rural Water Supply Programmes. Environmental Sanitation Division (ESD) of the Department of Health also shares a portion of the responsibility in providing water supply to rural health and educational institutions.

/2.1.2 RWSD

2.1.2 RWSD has recently started the only shallow well handpump manufacturing plant in the country in Rangoon in Tractor Repair Shop of Agricultural Mechanisation Department. Deepwell handpump is not manufactured.

2.1.3 The pump design has still not been fully decided. Specification and standardisation, therefore, have not been done, on a national level.

2.1.4 In the handpump production centre, 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.

2.1.5 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 Burma, the Mission recommends the following points.

/2.2.1 The

2.2.1 The manufacture of shallow well handpump based on "Bangladesh New No. 6' handpump has just passed the experimental stage. This is just the time to see if there are any modifications in design and if specifications are required to suit local conditions with regard to use of local materials at cheaper cost.

2.2.2 The deepwell handpumps are still imported and the Government of Burma has no plans to manufacture the same in the near future. The Mission recommends that one or two handpumps for shallow well and deepwell use should be designed and developed to suit the country needs, if necessary, taking the assistance of Rangoon Institute of Technology for the use of as much as possible, local materials for the pump parts.

2.2.3 The Rural Water Supply Division (RWSD) are presently manufacturing handpumps in Tractor Repair Shop belonging to Agricultural Mechanisation Department, whose men and machinery only are used. The Mission recommends that RWSD should have a separate handpump workshop with men and machineries, for the production of 200 handpumps per month.

2.2.4 The Mission suggests a plant layout for handpump manufacture, as given in Annex III.

2.2.5 The quality control should be more vigorously persued and insisted upon in the handpump workshop.

2.2.6 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.

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

/3. REPORT ON

3. REPORT ON BURMA

3.1 GENERAL INFORMATION:

3.1.1 ABOUT THE COUNTRY:

The Socialist Republic of the Union of Burma has 14 States with 314 Townships, 288 Towns, 13,729 Hamlets and 65,312 villages. The total area is about 261,223 square miles. As per 1983 statistics, the population of Burma is 35.314 Million with the national average population growth rate of 2.02. The urban population is 8.45 Million or 23.95 per cent, and the rural population is 26.86 million, or 76.05 per cent. The uneven rainfall and topography divides the country into four major national regions, the northern and western hilly region, the lower deltaic region, the coastal region and the central dry zone. The dry zone area comprises 3 divisions out of the total 14 divisions in the whole country. In dry zone area, the water table is about 15 metres below ground level. There are some places in dry zone area where water table goes down to 50 metres. In the lower Burma zone, the water table is about 3 to 4 metres and the lowest is about 10 metres.

3.1.2 GENERAL HABITS AND PREFERENCES OF THE LOCAL PEOPLE IN RESPECT OF UTILISATION OF WATER FOR DRINKING AND OTHER DOMESTIC PURPOSES:

3.1.2.1 Open dug wells with bucket and rope are the main source of drinking water to the villagers. After Rural Water Supply Division was formed in 1952-1953, 4" dia. tube wells with handpumps have been drilled to supply ground water to the people. People also use tube wells with handpumps as source of water for drinking and other needs in the rural areas.

3.1.2.2 Shallow well handpumps are required in Irawaddy, Rangoon and Pegu divisions comprising 12.8 million people. Deepwell handpumps are required in Sagaing, Magwe, Mandallay divisions comprising 11.5 million people. In other areas, the source of drinking water is rain water collection, impounding reservoirs and springs.

/3.2 RURAL WATER

3.2 RURAL WATER SUPPLY SCHEME:

3.2.1 GENERAL:

3.2.1.1 During the country's rehabilitation stages after the second world war, water supply section was given an almost equal emphasis among the other sectors of rehabilitation and reconstruction. In rural areas where the service coverage was almost none, open dug well system was introduced and implemented, but without appreciable achievement of the objective due to, probably, mismanagement. During the late 50's and whole of 60's, a forward leap was made in the rural water supply sector when tube wells were drilled and handpumps installed in the rural areas of the water scarcity regions of the Country. During the early and mid 70's, there was a steady progress in the development of rural water supply. Further development of rural water supplies in the dry zone areas of upper Burma, using power pumps came into effect during the late 70's with external technical and financial assistance as well as increased local input. Sanitation in rural areas had been neglected for long and almost no progress had been achieved in the past. Only in the late 70's plans were formulated for the development of rural sanitation programmes and the implementation came into effect in the early 80's, with external technical and financial assistance and increased local input.

3.2.1.2 By end 1982, the number of systems and population coverage in successful operation for rural water supply was as follows:

	Type:	Number:	Population served:
1)	Tube Wells with handpumps	1,714	76,787
2)	Tube Wells with power pumps	2,700	466,020
3)	Protected dug wells (year round supply)	73,663	2,637,135
4)	Springs (only 50 per cent considered potable)	17,650	3,325,260
	Total	95,727	6,502,202

/Population

Population served was 6,502,202 which is 23 per cent of 1982 rural population of 27,808,000 as against 14 per cent reported at the commencement of the decade in December 1980.

3.2.1.3 According to the Country report prepared and approved in January 1980, the national target of 50 per cent coverage was set for the provision of safe and clean water supply and adequate sanitation by the end of the decade 1981-1990, and 100 per cent by the year 2000.

3.2.2 PROCUREMENT OF HANDPUMPS BY GOVERNMENT AGENCIES:

3.2.2.1 Rural Water Supply Division (RWSD) of the Agricultural Mechanisation Department under the Ministry of Agriculture and Forests, formed in 1952-1953, is the main agency for the formulation and implementation of Rural Water Supply Schemes. Environmental Sanitation Division (ESD) of the Department of Health under the Ministry of Health, also shares a portion of the responsibility in providing water supply to rural health and educational institutions and nearby communities. ESD is also involved in planning and implementation of simple and small water supply systems for the rural community to supplement the efforts of the RWSD to meet the national target.

3.2.2.2 From 1952 to 1976, about 6000 wells were drilled in Lower Burma, outside Dry Zone i.e. in Rangoon, Irrawaddy and Pegu Divisions, and also in Upper Burma Dry Zone i.e. Sagaing, Magwe and Mandalay. Out of these 6000 wells, about 4000 wells were fitted with deepwell handpumps, imported under "Colombo Plan". The imported pumps were of different makes and from different countries and included "LUKO", "MYER", "ORJAN" makes from England and "RED JACKET" from America. About 2% to 3% of these pumps still appear to be in working condition. Parts of many pumps which have failed have since been replaced with locally available and made parts. Around 1973 the Government of Burma directly imported from England about 400 handpumps for deepwell purposes. These pumps were "CLIMAX" wheel pump to draw water from the depths of 120 feet to 150 feet,

/and "GODWIN"

and "GODWIN" wheel pump to draw water from the depths of 80 feet to 100 feet. The Mission was informed that many of these pumps are still working. From 1977 onwards till 1985, through the assistance of UNICEF, the Government has imported 50 Nos. shallow well handpumps of Bangladesh Pump No. 6, and 629 numbers India Mark II deepwell handpumps. While Pump No. 6 have been erected, India Mark II pumps are kept in stock for utilisation in erection programme.

3.2.2.3 So far about 6500 deepwell handpumps (earlier, handpumps for deepwells only were used) in the entire country, all of which are imported, have been installed.

3.2.2.4 Private bodies do not buy any handpumps in Burma.

3.2.3 FUTURE PLANS INVOLVING HANDPUMPS FOR RURAL WATER SUPPLY SCHEMES:

3.2.3.1 National targets to meet the International Drinking Water Supply and Sanitation Decade 1981-1990, have been framed by the Government. The plans envisage new construction of shallow wells and deepwells with handpumps by RWSD as follows:

S.No.	Period:	Shallow well handpumps:	Deepwell handpumps:	Total:
1)	Plan IV			
	1982-83 to 1985-86	4,000	400	4,400
2)	Plan V			
	1986-87 to 1989-90	10,000	-	10,000
	Total	14,000	400	14,400

3.2.3.2 The plan also envisages to rehabilitate 1710 existing tubewells with handpumps drilled between 1952 and 1962 in Pegu, Rangoon and Irrawaddy divisions, during the Plan period 1982-83 to 1985-86.

3.2.3.3 The Rural Water Supply Schemes envisaged by ESD also covers construction of shallow well handpumps numbering 800 in Plan IV and 2400 Nos. in Plan V, totalling 3,200 numbers.

/3.2.3.4 The total

3.2.3.4 The total handpumps, as per Plans layout, to be installed from 1982 to 1990 are summarised below:

		Total:
a)	New handpumps as per RWSD Plans	14,400
b)	Rehabilitation of existing wells	1,710
c)	New handpumps as per ESD Plan	3,200
	Total ;	19,310

3.3 HANDPUMPS USED IN BURMA:

3.3.1 All handpumps used so far in Burma in rural areas have been imported. Over 6500 handpumps have been installed in about 20 years ending with 1976. Power pumps were used from 1976 in rural areas.

3.3.2 50 numbers Bangladesh Pump No. 6 and 629 Nos. India Mark II deepwell handpumps have already been imported from 1977 through the assistance of UNICEF. Another 220 Nos. India Mark II handpumps are being procured.

3.3.3 The design service level used is a minimum of 10 gallons per day per person for domestic needs.

3.3.4 In Lower Burma (Rangoon, Irrawaddy and Pegu divisions) tube wells with power pumps will be provided to villages whose population exceeds 800 persons. One shallow handpump tube well is to cover 100 persons, and one deep tube well with handpump is to cover 150 persons. In the Dry Zone, because of the greater depths and large population coverage, one pump per village will be used.

3.4 HANDPUMP MANUFACTURING FACILITIES IN BURMA:

3.4.1 There are no handpump manufacturers in Burma, except a recent venture by RWSD to produce shallow well handpumps.

3.4.2 In 1978/79, about 2 to 3 prototype hand pumps called "PENDULUM" pumps were fabricated locally and installed for depths of 100 feet. No further progress seems to have been made in development or manufacture of this pump.

/3.4.3 The Plans

3.4.3 The Plans were formulated by the Government, about two years back, to explore the possibility of establishing a manufacturing unit of handpumps in the country. The RWSD was entrusted for this task in co-operation with UNICEF. Basic design studies of the type of handpump to be manufactured were carried out. Experimental pump units were fabricated and tested. The design of the prototype pump was taken basically from New No. 6 Pump of Bangladesh, with modifications in the lower check valve having a cast brass instead of a leather flap, and also adopting a perforated plate with the movable cup washer, instead of'pop-up' valve and a fixed cup washer which is in the New No. 6 design. Modifications also are made in introducing a fulcrum joint of the handle assembly to the main body, instead of a fixed type. Another major deviation from the Bangladesh New No. 6 Pump is in adopting the seamless steel pipe of 4" inside diameter for cylinder, instead of a cast iron body of New No. 6 Pump.

3.4.4 All the raw materials for this new pump to be manufactured locally, are imported except for minor items like flat bars for linkages and upper part, cast iron plug, 1/2" connecting rods, 1/8" thick M.S. sheet for plunger disc; and bronze lower and upper valves.

3.4.5 The Agricultural Mechanisation Department has got a workshop in Rangoon for maintenance and repair of tractors. The handpump factory is located in a small area in this workshop. The production has started a couple of months back only. The pumps produced in Burma has not been named yet. The Mission was given to understand that this workshop is capable of manufacturing about 200 pumps per month.

3.5 HANDPUMP REQUIREMENT VERSUS MANUFACTURING CAPACITY IN BURMA

The shallow well and deepwell handpump requirements, as envisaged in Plans IV and V, as detailed in 3.2.3.4, is about 19,310 for a period of 8 years upto 1990 or about 2400 Nos. per annum. The capacity of the only Government workshop recently started is assessed at 2400 Nos. per annum. However, the deepwell handpumps are not manufactured and therefore the required quantity needs to be imported.

/3.6 PRESENT

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

3.6.1 The Government has set a target of 50 per cent of the rural population for supply of safe drinking water by 1990. This target envisages construction of shallow well and deep tube wells with handpumps, totalling 19310 by 1990.

3.6.2 Handpumps were not manufactured in the Country till about a few months back when the Government has commenced production of Shallow well handpumps in a workshop situated in Tractor Repair and Maintenance Shop, Rangoon. The responsibility for production is entrusted to RWSD.

3.6.3 The pump produced is Bangladesh New No. 6 Pump with some modifications. Almost all raw materials and components of pumps are imported. Very few items are locally made.

3.6.4 Handpumps break down frequently. The common complaints relate to leather cup and failure of connecting rod. The repairs are done by RWSD free of service but maintenance cost is paid by the community.

3.6.5 In the handpump manufacturer's shop visited by the Mission, the following observations were made:

- Little attention to quality control
- No records are kept to show the rejected/accepted components
- Jigs and fixtures are not generally used
- checking of physical or chemical properties of raw materials used, are not done.

3.6.6 The design of pump being taken up for manufacture locally, has, the Mission was informed, not been fully developed.

/3.6.7 Targets

3.6.7 Targets for IV Plan (1982-1986) has not been implemented. This needs to be carried over to V Plan (1986-1990) in addition to fulfilling the targets of V Plan or further carry forward to VI Plan. The Mission was given to understand that the reasons for the same were due to shortage of manpower and lack of workshop facilities for RWSD which is responsible for implementation of the targets.

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 in-depth study of the handpump production or other activities connected with handpumps.

These recommendations have been discussed with the Director, RWSD, and presented as follows:

4.1 The manufacture of shallow well handpumps has just passed the experimental stage and has not reached the stage of mass production. If there are any modifications in the design aspect, this is just the time to look into and incorporate the changes to come out with national, sturdy, dependable handpump. The manufacture of a deepwell handpump has not started because it is not in the programme.

4.2 Design and standardisation of one or two handpumps each for shallow well and deepwell use, should be brought about, after making an in-depth study into the possibility of using as many as locally available materials or materials likely to be available, for making components of handpumps. For instance, good timber is available locally in plenty which could be used for some parts of the pumps which are presently imported. This would help, besides saving foreign exchange, in reducing the down-time of pumps when pumps break down as replacement with local materials is faster and cheaper.

/Studies

Studies should be made to lower the cost using maximum local resources and products. The services and expertise of Rangoon Institute of Technology could be utilised for this purpose. Some of the handpumps which have been developed and proven in the field in some of the neighbouring countries, could also be studied for local development in Burma.

4.3 The handpumps are, presently manufactured by RWSD in a portion of the Tractor Repair Shop belonging to Agricultural Mechanisation Department. Men, machines and the building are borrowed and they do not belong to RWSD. This Mission recommends that RWSD should have a separate independent premises to locate the handpump factory besides having their machineries and workmen with the required staff members, in view of the fact that pump production will be a permanent feature. The factory should have a capacity to produce 200 handpumps per month.

The Mission suggests a plant layout as given in Annex III.

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

4.4.1 The manufacturer should have a seperate 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 manual 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.

/4.4.2 The

4.4.2 The manufacturer should be insisted upon by the buyer to use the jigs and fixtures at the manufacturers' shop, 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.

4.4.3 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.

4.4.4 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.

4.4.5 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).

/4.4.6 The grade,

4.4.6 The grade, type, size and distribution of graphite flakes and the structure of the matrix shall be as per table below:

Grade 14 Type I: Size 3-5.
Distribution "A" and Micro Structure - Lamellar/pearlite.
Ferrite, if present, shall not exceed 10 per cent.

4.4.7 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
- Mrcro-structure report
- Identification for each heat/batch

4.4.8 Final inspection details to be looked into on the castings are

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

/4.4.9 It should

4.4.9 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.

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

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

4.5 The Mission recommends the following points to be noted for installation and maintenance of handpumps:

4.5.1 A code of practice for installation and maintenance of standardised shallow well and deep well 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 continually improving the design aspects and standards of handpumps.

4.5.2 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.

4.5.3 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.

/4.6 The Mission

4.6 The Mission recommends the following points to be noted for training programmes on handpumps:

4.6.1 The training programmes 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 dismantling 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.

4.6.2 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.

4.6.3 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.

4.7 The Mission suggests a plant layout of handpump manufacturing unit for Burma, as given in Annex III which also gives a rough indication of investment cost.

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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.

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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.

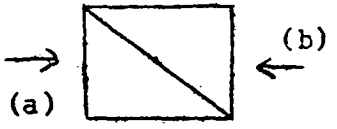
Form completed by:.....

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

MANUFACTURE OF SHALLOW WELL HANDPUMPS

IN BURMA

INVESTMENT COST FOR A FACTORY WITH PRODUCTION CAPACITY

OF 200 NUMBERS SHALLOW WELL HANDPUMPS PER MONTH

I. Land requirement:

A plot of 25,000 square feet of land would suffice. As the cost of the land depends on the location of the factory depending on the choice of the Government of the Socialist Republic of the Union of Burma, the cost of land is excluded from this estimate.

II. Building cost:

An industrial shed measuring 60'-0" wide by 100'-0" long (6000 Square Feet) would be required. The cost of 6000 Sq. Ft. of normal shed with ridge type roof, would be 180,000 U.S. Dollars at an estimated cost of 30 U.S. Dollars per Sq. Ft.

III. Machinery requirement and approximate cost:

	Machine:	Number	Approximate cost in U.S. Dollars:
1.	Heavy duty lathe 8'-0"	one	6,000
2.	Graded lathe 4'-0"	one	7,000
3.	Drilling machine 1" (geared)	one	3,000
4.	400 Amps welding machine	two	2,000
5.	Power band saw 5" cap	one	1,200
6.	Band Saw blade welding machine	one	800
7.	Bench vice	three	450
8.	Pipe vice	two	300
9.	Bench Grinding machine	one	250
10.	Angle Girder 9" dia.	two	600
11.	Gas cutting equipment	one	800
12.	Measuring instruments		2,000

13.	Tools, files, drills, cutting tools, reamers, tool holders, etc.,	5,000
		29,400
	Say	30,000
	Add: 5 per cent for contingencies	1,500
	C/o	31,500
	Erection of equipment @ 15 per cent	4,725
		36,225
	Foundation cost of machineries	3,000
		39,225

Say 40,000 U.S. Dollars.

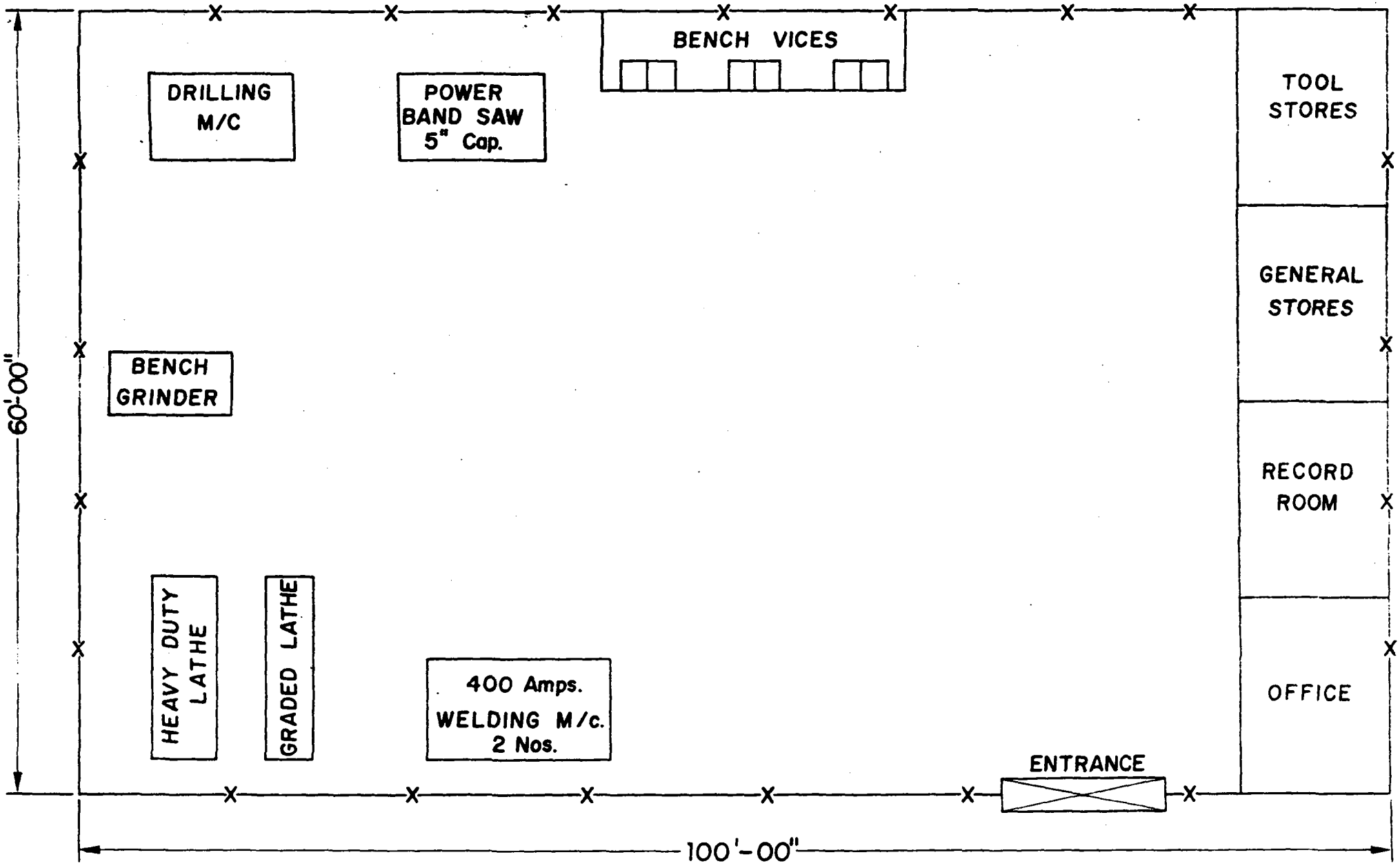
Total cost (excluding land cost)

Building	180,000 U.S.D.
Machineries	40,000 U.S.D.
Total:	220,000 U.S.D.

IV. Factory Plan for manufacture of 200 handpumps is enclosed in page 31

V. Man Power requirement:

(1)	One works superintendent	- Degree in Mechanical Engineering with 8 years experience in fabrication
(2)	One supervisor	- Diploma in Mechanical Engineering with 8 years experience in production
(3)	Four turners	- 5 years experience on lathe
(4)	Two drillers	- 3 years experience on Drilling Machines
(5)	Three welders	- 3 years experience
(6)	Six fitters	- 3 years experience
(7)	One engineer/supervisor in charge of quality control	- Diploma in Engineering with 8 years experience in Quality Control Department
(8)	Two inspectors	- Fitter Trade Certificate with 3 years experience
(9)	Ten unskilled workers	
(10)	Two clerks	



SUGGESTED PLANT LAYOUT FOR MANUFACTURE OF SHALLOW WELL HAND PUMPS IN BURMA

ANNEX IV

PERSONS MET

I. BURMESE GOVERNMENT OFFICIALS:

Agricultural Mechanisation Department, Ministry of Agriculture and Forests

(1) U Khin Maung, Director, Rural Water Supply Division, AMD.
(2) U Sann Maung, Deputy Director, Rural Water Supply Division, AMD.
(3) U Naung Maung, Head of Workshop No. 1 Base Workshop, AMD.
(4) U Sein Than, Assistant Director, Rural Water Supply Division
(5) Mr. Myo Nyein, Drilling-in-Charge, Rural Water Supply Division
(6) U Myint, Assistant Director (Environmental Sanitation), Department of Health
(7) U Win Aung, Assistant Sanitary Engineer, Environmental Sanitation, Department of Health

II. UNDP/WHO/UNICEF

(1) Mr. Erling Dessau, Resident Representative of UNDP
(2) Dr. J. Galea, Programme Co-ordinator and Representative, WHO
(3) U Aung Kywe, National Engineer, WHO
(4) U Ngwe Thein, Programme Officer (Water Supply) UNICEF
(5) Mr. Jerzy B. Gorski, Senior Industrial Development Field Adviser, UNIDO.

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