STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF MAINTENANCE EQUIPMENT FOR WATER SUPPLY FACILITIES
IN
THE HASHEMITE KINGDOM OF JORDAN

January, 1995

Japan International Cooperation Agency

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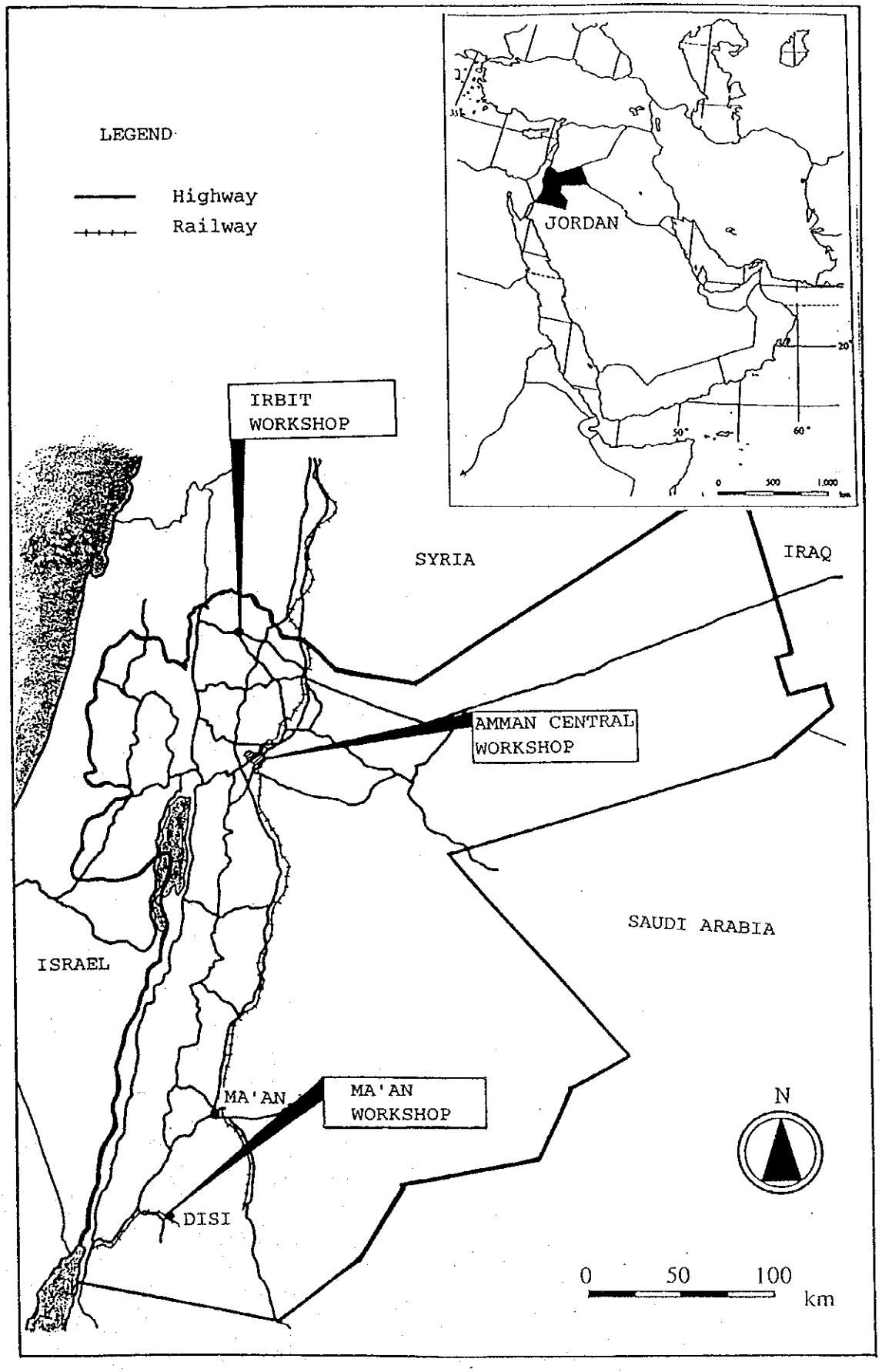
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Chapter 1 Background of the Project

1-1 Background of the Request

(1) National Land and Natural Conditions

The Hashemite Kingdom of Jordan (hereinafter referred to as Jordan) is bordered by Israel to the west, Syria to the north, Iraq to the north-east and Saudi Arabia to the east, and to the south of the country is the Gulf of Aqaba, the country's sole gateway to the sea. The national land area is approximately 89,000 sq. km.

The geography of the country is broadly divided into the mountain belt that runs north to south in the west, and the flat desert belt in the east, and 80% of the national land is either desert or waste land. The peak altitude in the western mountain belt is 1,600 m above sea level, and the national capital, Amman, is situated in the northern part of the mountain belt in an undulating hilly area. To the west of the mountain belt lies the Jordan Valley, through which the Jordan River flows. The Jordan River originates in Lake Tiberius, which is the main source of water for Israel, and it flows north to south into the Dead Sea. The Jordan River basin is a fertile farming area. The lowest altitude point is 400 m below sea level.

The capital, Amman, is situated on high land at an altitude of approximately 800 m belonging to the western mountain belt, and the temperature difference there between morning and evening is as much as around 15℃ due to its inland location. Summer lasts from May to October and the average temperature then is 23℃, however, this climbs to more than 30℃ in the months of July and August, and the air is dry. Winter lasts from December to February and the average temperature then is 9℃ with occasional snow.The annual rainfall in Jordan is 400 mm in the mountain regions, 200 mm in the Jordan Valley and 50 mm in the desert regions.

(2) National Economy

Following the renouncement of the Jordan West Bank in July 1988, the country's economic prospects became blurred and the value of the currency plunged due to the escape of capital abroad and the selling off of Jordan dinar assets and so on. Against such a background, the Government of Jordan made use of the IMF's Structural Adjustment Facility from 1989 and completed medium term structural adjustments by 1993. However, the Structural Adjustment Facility ceased to function properly due to the Gulf War of 1990, and at the recommendation of the IMF, the Government of Jordan launched the seven year Economic Structure Adjustment Plan.

Regarding national development planning, the Five Year Development Plan (1993-1997) was announced on November 18, 1993. This plan lays emphasis on the development of social infrastructure and aims to realistically deal with the country's economic stagnation. It is also designed to complement the Economic Structure Adjustment Plan. The sectors targeted by the plan are public health, education, water supply, power and roads etc., however, as a result of a rapid increase in the population following the return of people working abroad and so on, the necessity for social infrastructure development is growing and the degree of urgency regarding the securing of water supplies is particularly high.

(3) Outline of the Sector

Ground water is relied on to provide 80% of the water supply in Jordan, and because the ground water sources are dispersed all over the country, deep well (between 200 m and 400 m in depth) pumping facilities and facilities for the long distance transfer of water to the consumers in the cities are necessary. Moreover, due to the fact that Amman, the national capital, is situated in the hilly mountain area, water distribution facilities there are complicated. For this reason, the energy consumed in water transfer and distribution is large, and much manpower and money is needed to manage and maintain the water transfer and distribution facilities.

As a result of hasty construction of facilities, done without first conducting proper water analysis to respond to the growing demand for water caused by the population increase, the facilities are inefficient and lack a balance between supply and demand. Moreover, although the water supply diffusion rate currently stands at 97%, most of the water supply facilities were constructed between the late 1960s and the 1980s and deterioration is advancing. In addition to this, the vehicles and equipment needed to maintain the said facilities are also deteriorated and in short supply, meaning that immediate improvement of the maintenance system is required.

(4) Background of the Project

The water supply diffusion rate of 97% in Jordan is the highest level within the developing countries, however, past policy placed too much emphasis on water source development and facilities construction without giving enough consideration to the effective and efficient running of the water supply utility. In view of this, a basic policy for the proper running of the utility in both financial and technical terms was compiled, and the operation and maintenance of water supply facilities has been made a priority issue within this. In view of the fact that deterioration is advancing in the water supply facilities, which were largely constructed between the late 1960s and the 1980s, the maintenance of such facilities has in reality become an urgent issue.

However, the Water Authority's Central Workshop, which was established in 1974 for the purpose of carrying out water supply facility maintenance, has witnessed a marked deterioration in its facilities and equipment. The workshop possesses a large number of vehicles for construction purposes, however, 90% of those have been in use now for more than five years and 50% have been in use for more than 10 years. Consequently, the procurement of parts from the vehicle makers cannot be expected and overhauls and other major maintenance and repair jobs have to be performed by the workshop's own staff.

In view of this situation, the Government of Jordan compiled a plan for expansion and improvement of the Central Workshop based on the results of the Feasibility Study carried out by the British Overseas Development Administration in 1990. The Government of Jordan is, at its own expense, rebuilding the Central Workshop in the Ain Gazar area in the north east part of Amman, and it is advancing improvement of the existing branch workshops in the Irbit area in the north of the city and the Ma'an area in the south. Regarding the procurement of repair and maintenance equipment which the Government is unable to secure the funds for, the Government of Jordan requested the Government of Japan to provide grant aid.

1-2 Outline of the Request

The requested items are as follows.

No.	Equipment	Q'ty	Site		
			A	B	C
A-1	Crank shaft grinding machine	1	1		
2	Cylinder boring machine	1	1		
3	Cylinder honing machine	1	1		
4	Valve seat boring machine	1	1		
5	Align boring machine	1	1		
6	Surface grinding	1	1		
7	Con-rod boring and grinding	1	1		
8	Electronic balancer machine	1	1		
9	Lathe with intermittent feed	1	1		
10	Riveting machine	1	1		
11	Shaping machine	1	1		
12	Radial drill machine	1	1		
13	Upright drilling machine	1	1		
14	Bench drilling machine	3	1	1	1
15	Slotting Machine	1	1		
16	Arbor press (heavy duty type)	1	1		
17	Arbor press (heavy duty type)	2		1	1
18	Electrical portable drill	2		1	1
19	Lathe Machine	1	1		
20	Hydraulic cylinder service stand with cylinder checker	1	1		
21	Overhead crane	1	1		
22	Hydraulic shop press	1	1		
23	Garage jack	2		1	1
24	AC arc welder	3	1	1	1
25	Electrical grinder (bench)	5	3	1	1
26	Gas welder	2		1	1
27	Tractor support(front)	1	1		
28	Tractor support(rear)	1	1		
29	Mobile floor crane	2		1	1
30	Gantry crane 5 ton	3	1	1	1
31	Roller and idler press power	1		1	
32	Parts washer	4	2	1	1
33	Hand truck	8	5	2	1
34	Roller collar remover	3	1	1	1
35	Cylinder head hydraulic test	1	1		
36	Valve spring tester	4	2	1	1
37	Jib crane, wall type	2	2		
38	Eccentric valve seat grinder	4	2	1	1

A:Central Workshop, B:Irbit Workshop, C:Ma'an Workshop

No.	Equipment	Q'ty	Site		
			A	B	C
39	Universal trolley	7	5	1	1
40	Hand tool and cutting tools	3	1	1	1
41	Personal computer	5	5		
42	Printer	5	5		
43	Software	5	5		
44	Portable electric drills	5	3	1	1
45	Portable electric disc grinder	5	3	1	1
46	Portable air compressors	4	2	1	1
47	Arc Welder	3	1	1	1
48	Hydraulic press (100 ton)	1	1		
49	Portable hydraulic crane	2	2		
50	Garage jack	2	2		
51	Garage jack	2	2		
52	Piston heater	3	1	1	1
53	Radiator cap tester	3	1	1	1
54	Volt amp tester	3	1	1	1
55	Cylinder gauge	5	3	1	1
56	Cylinder gauge	5	3	1	1
57	Compression gauge	4	2	1	1
58	Battery hydrometer	3	1	1	1
59	Metal crack detector	4	2	1	1
60	Valve lifter and compressor	5	3	1	1
61	Engine stand	6	4	1	1
62	Engine stand	6	4	1	1
63	Bearing puller set	11	6	3	2
64	Gear puller set	6	3	2	1
65	Parts rack	10	8	1	1
66	Work bench	11	8	2	1
67	Tool cabinet	14	10	2	2
68	Portable electrical sander	6	2	3	1
69	Portable electrical polisher	6	2	3	1
70	Portable electrical belt sander	4	2	1	1
71	Headlight tester	1	1		
72	Measuring small tools	4	2	1	1
73	Battery tester	4	2	1	1
74	CO2 Automatic welding machine	3	1	1	1
75	Gas welding with cutting kits	5	3	1	1
76	Computerized wheel balancer	1	1		
77	Wheel alignment equipment	1	1		
78	Wheel alignment equipment	1	1		
79	Tier changer for cars	3	1	1	1

A:Central Workshop, B:Irbit Workshop, C:Ma'an Workshop

No.	Equipment	Q'ty	Site		
			A	B	C
80	Motor vehicles testing equipment (engine analyzer)	1	1		
81	Roller brake tester for cars and	1	1		
82	Two post electro-hydraulic lift	2	2		
83	Four post electro-hydraulic lift	4	2	1	1
84	Lubrication equipment (mobile type for grease)	4	2	1	1
85	Pneumatic pumps	4	2	1	1
86	Central compressor unit	1	1		
87	Battery chargers	4	2	1	1
88	Car washing equipment (High	4	2	1	1
89	Complete repairing unit for fuel injection pump	1	1		
90	Paint drying unit spray unit,	1	1		
91	Fork lift (2 ton)	1	1		
92	Fork lift (5ton)	1	1		
93	Gantry crane 5 ton	3	3		
94	Clamp meter	5	3	1	1
95	Multi-meter	5	3	1	1
96	Megger digital earth tester	3	3		
97	Hydraulic terminal clipper	4	2	1	1
98	Rotation detector	3	3		
99	Major megger insulation tester	2	2		
100	Electric pipe threading machine	2	2		
101	Digital manometer	2	2		
102	Infrared thermometer	3	1	1	1
103	Insulation tester	3	3		
104	Cable fault detector	1	1		
105	Pump capacity and rating tester (flow pressure meter)	1	1		
106	Spot welding set	2	2		
107	Offset pattern heavy duty wrench	4	2	1	1
108	Turbo charger tester	2	2		
109	Hand tools	5	3	1	1
110	Pipe wrenches (heavy duty) in	5	3	1	1
111	Open ended wrenches in sets	5	3	1	1
112	Deep offset box wrenches in sets	5	3	1	1
113	Socket sets	5	3	1	1
114	L Shaped hex. keys in sets	5	3	1	1
115	Hand drill and drills	5	3	1	1
116	Tap and die set	3	3	1	1
117	Screw drivers	5	3	1	1

A:Central Workshop, B:Irbit Workshop, C:Ma'an Workshop

No.	Equipment	Q'ty	Site		
			A	B	C
118	Screw extractors in sets	5	3	1	1
119	Bearing pullers in various sizes	6	4	1	1
120	Bench vises	5	3	1	1
121	Files and files cards	5	3	1	1
122	Retaining rings (circlip)	5	3	1	1
123	Long nose pliers	5	3	1	1
124	Diagonal cutters	5	3	1	1
125	Side cut pliers	5	3	1	1
126	Grip jaw pliers	5	3	1	1
127	Rubber hammer	5	3	1	1
128	Brass hammer	5	3	1	1
129	Hand saw	5	3	1	1
130	Pistol oiler	5	3	1	1
131	Injection system tester	2	2		
132	Pump assembly and disassembly	4	2	1	1
133	Motor assembly and disassembly	4	2	1	1
134	Pipes elevator	12	12		
135	Tongue chain wrench	5	5		
136	Utility chain wrench	1	1		
B-1	Mobile workshop for vehicle	1	1		
2	Mobile workshop for pump	1	1		
3	Recovery unit 5 t	1	1		
4	Recovery unit 25t	1	1		
5	Cargo truck with crane	5	5		

A:Central Workshop, B:Irbit Workshop, C:Ma'an Workshop

Chapter 2 Contents of the Project

2-1 Objective of the Project

The Project aims to aid the effective and efficient running of the water supply utility in Jordan by improving the capacity for maintaining the water supply facilities. In specific terms, the Project aims to make improvements to the Central Workshop and the two branch workshops in the north and south of Amman which are responsible for repairing and maintaining the water supply facility maintenance vehicles and pumps.

2-2 Contents of the Project

2-2-1 Implementing Agency and Operation Setup

The implementation and operation agencies for the Project are as follows.

1) Main Government Agencies

The Ministry of Water and Irrigation has overall control of the water related administration, and its subordinate agencies are the Water Authority and the Jordan Valley Authority. The Water Authority is in charge of water supply, industrial water and sewerage works, and the Jordan Valley Authority conducts irrigation water works. The assistance counterpart agency is the Ministry of Planning.

2) Operation and Implementation Agency

The Water Authority, which is the operation and implementation agency for the Project, possesses a work force of 6,685 (1992), 75% of which works on the site management of water supply facilities in the regional branches. The breakdown of the work force according to duties is as follows:

Engineers	: 335,
Managers	: 1,335,
Specialists	: 3,345,
Maintenance staff	: 1,670.

Moreover, the Central Workshop is under the control of the Workshop and Maintenance Department of the Water Authority, and possesses a staff of 405.

2-2-2 Operation and Maintenance Plan

Regarding the utilization and the operation and maintenance of the provided equipment, the staff of the existing Central Workshop will carry out these activities at the new Central Workshop. As for technical levels, the degree of knowledge among the staff concerning the latest machine tools and car inspection machines is sufficient

with some members possessing more than 20 years of experience working in Germany and so on as machinists. Moreover, regarding the repair parts for old model vehicles and pumps, these are processed and manufactured with machine tools and the technical level in this area too is high.

It is therefore judged that no problems exist regarding the utilization and the operation and maintenance of the equipment.

2-3 Study of the Request

2-3-1 Basic Conditions

The Project implementation is conditional upon the completion of the construction of the new Central Workshop prior to the provision of the equipment. According to the plans of the Jordan side, construction in the Ain Gazar area is scheduled to start in early 1995 and be completed the same year with ground levelling lasting two months and actual construction seven months. The construction schedule of nine months is a safe side estimation, however, periodic checks of the state of progress are necessary.

2-3-2 Equipment

The Project equipment is mainly intended for the new Central Workshop, and the branch workshops are to be provided mostly with tools. The requested equipment is wide ranging and will be used for the maintenance and repair of water supply facilities and equipment (submersible pumps, transfer pumps, power distribution and control panels, motors and so on) as well as equipment for the maintenance and repair of vehicles and construction machinery that is used for maintaining the water supply facilities. The equipment is required in order to enhance the functions of the Central Workshop.

1) Machine Tools

The engine blocks, cylinder heads, crank shafts and cam shafts etc. are specialized items of equipment for repairing and processing the component parts of dismantled engines, and the lathes and drills are for various processing purposes.

2) Equipment for Vehicle Maintenance and Repair

This equipment is used for the repair of parts after the use of cranes etc. when vehicles and heavy vehicles are divided into their component frames and bonnets etc.

3) Vehicle Inspection Equipment

This equipment is used for maintenance inspections of vehicle undercarriages and engines etc. and also the testing of vehicles after the inspections.

4) Repair and Work Vehicles

These vehicles are essential for the hauling of the light and heavy objects contained in the Central Workshop and are mobile repair vehicles that enable emergency repairs to be made to broken down outside work vehicles. When vehicle damage is so great that movement is impossible, wrecker cars will haul the broken down vehicles to the Central Workshop.

5) Equipment for Submersible Pump and Motor Maintenance and Repair

The provision of this equipment will enable the mechanization of submersible pump, transfer pump and motor repairs and processing, solve poor insulation troubles in motors, secure the safety of work and raise processing precision levels.

6) Personal Computers

Specific methods of use were not specified in the request document, however, specifications that generally apply locally have been selected as a result of examining the purposes of use in the surveys.

7) Tools and Other Items

This category refers to the auxiliary tools etc. necessary for performing the work described in 1) through 5) above.

2-4 Equipment Specifications

The equipment specifications are as indicated below.

No	EQUIPMENT	Q'ty	SPECIFICATIONS
A-1	Crank shaft grinding machine	1	Distance between center : 2,000 mm
2	Cylinder boring machine	1	Boring diameter : 35-300mm
3	Cylinder honing machine	1	Honing diameter : 25-250mm
4	Valve seat boring machine	1	Max. admitted cylinder head length : 950 mm
5	Align boring machine	1	Max. length of block : 1,800mm
6	Surface grinding	1	Grinding length × width : 1,200 × 360mm
7	Con-rod boring and grinding machine	1	Boring range : 20-160 mm
8	Electronic balancer machine	1	Max. appricable length : 2,500mm
9	Lathe with intermittent feed	1	Turning diameter : 150-1,000mm
10	Riveting machine	1	Capacity(max.) : 5,000 kg
11	Shaping machine	1	Max. stroke length : 500mm
12	Radial drill machine	1	Max. distance column surface to spindle center : 1,250mm
13	Upright drilling machine	1	Swing : 550mm
14	Bench drilling machine	3	Capacity : 23mm
15	Slotting Machine	1	Ram stroke : length(max.) : 250mm
16	Arbor press (heavy duty type)	1	Capacity : 100ton
17	Arbor press (heavy duty type)	2	Capacity : 50ton
18	Electrical portable drill	2	Capacity, steel : 13mm
19	Lathe Machine	1	Distance between centers : 2,500mm
20	Hydraulic cylinder service stand with cylinder checker	1	Working torque : Max. 4,000kgf·m
21	Overhead traveling crane	1	Capacity : 5ton
22	Hydraulic shop press	1	Capacity : 100ton
23	Garage jack	2	Capacity : 20ton
24	AC arc welder	3	Max. Secondary current : 300A
25	Electrical grinder (bench)	5	Grinding wheel diameter : 305mm
26	Gas welder	2	Rogulators, Torches & others (13 items/set)
27	Tractor support(front)	1	Pressing force : 20ton
28	Tractor support(rear)	1	Neccessory accessoris of A-27, Adaptor Measuring Tool & Others
29	Mobile floor crane	2	Lifting capacity : 1ton
30	Gantry crane 5 ton	3	Capacity : 5000kg
31	Roller and idler press power unit	1	Pressing force : 100ton
32	Parts washer	4	Automatically operated, Max. washable weight : 250kg
33	Hand truck	8	Load capacity : Max. 300kg
34	Roller collar remover	3	Cylinder capacity : 10ton
35	Cylinder head hydraulic test stand	1	Test pressure : 0-20kgf/cm2
36	Valve spring tester	4	Capacity : 250kg
37	Jib crane, wall type	2	Capacity of jib.: 2ton
38	Eccentric valve seat grinder	4	Capacity (Valve seat) : 30-65mm
39	Universal trolley	7	Capacity : 2ton
40	Hand tool and cutting tools	3	Socket wrench set & others, 41 items/set
41	Personal computer	5	CPU : 486DX2 66MHz
42	Printer	5	Dot matrix printer
43	Software	5	Windows, Word processor, Spread sheet & Database
44	Portable electric drills	5	Capacity, steel : 13mm
45	Portable electric disc grinder	5	Wheel(OD×ID) : 150×22mm
46	Portable air compressors	4	1.5Kw, 9.9kg/cm2, 200L/min.
47	Arc Welder	3	Max. Secondary current : 350A
48	Hydraulic press (100 ton)	1	Capacity : 100ton
49	Portable hydraulic crane	2	Lifting capacity : 2000kg
50	Garage jack	2	Capacity : 10ton
51	Garage jack	2	Capacity : 20ton
52	Piston heater	3	Temperature range : 0-300℃

No	EQUIPMENT	Q'ty	SPECIFICATIONS
53	Radiator cap tester	3	Pressure range : 0-2kgf/cm2
54	Volt amp tester	3	Voltage(AC & DC) : 0-±500V
55	Cylinder gauge	5	Range : 50-100mm
56	Cylinder gauge	5	Range : 100-150mm
57	Compression gauge	4	Scale : Max. 25kgf/cm2
58	Battery hydrometer	3	Gravity scale : 1.00-1.30
59	Metal crack detector	4	Test frequency : 10Hz-10MHz
60	Valve lifter and compressor	5	Opening range : Wider than 50-220mm
61	Engine stand	6	Service capacity : 5ton
62	Engine stand	6	Service capacity : Within 2ton
63	Bearing puller set	11	Capacity(I.D.) : 40-150mm
64	Gear puller set	6	Capacity(applicable bearing diameter : Creater than 0-170mm
65	Parts rack	10	No. of shelves : 5
66	Work bench	11	Dimensions (L×W×H) : Approx. 1800×750×740mm
67	Tool cabinet	14	Type : 4 shelves
68	Portable electrical sander	6	Wheel (OD×ID) : 180×22mm
69	Portable electrical polisher	6	Capacity : 180mm(7")
70	Portable electrical belt sander	4	Belt size : W×L : 20×520mm
71	Headlight tester	1	Photometer range : 0-80,000cd
72	Measuring small tools	4	Caliper, Micrometer & others, 54 items/set
73	Battery tester	4	Battery applicable : 12V, 20-200AH
74	CO2 Automatic welding machine	3	Rated welding current : 350A
75	Gas welding with cutting kits	5	Regulators, Torches & others (13 items/set)
76	Computerized wheel balancer	1	Appricable wheel dia. : 10-26inch
77	Wheel alignment equipment	1	Computerized measuring system wheel range : 10-22.5inch
78	Wheel alignment equipment	1	Additional attachment of A-77, for Heavy-duty vehicles
79	Tier changer for cars	3	Wheel size applied : 14-28in.
80	Motor vehicles testing equipment (engine analyzer)	1	Computerized total engine test and data management system
81	Roller brake tester for cars and trucks	1	Max. capacity of axle weight : 10,000kg
82	Two post electro-hydraulic lift	2	Lifting capacity : 5ton
83	Four post electro-hydraulic lift	4	Capacity : 5ton
84	Lubrication equipment (mobile type for grease)	4	Delivery of lubricant : 1200kg/min.
85	Pneumatic pumps	4	Applicable oil container : 200L. drum
86	Central compressor unit	1	Motor output : 11Kw
87	Battery chargers	4	DC output : 12 & 24V, Max. amp. 130A
88	Car washing equipment (High pressure washer)	4	Capacity (discharge) : 1600L/h
89	Complete repairing unit for fuel injection pump	1	Drive motor power : 15Kw
90	Paint drying unit spray unit, masks	1	Spray gun, Infrared rays, stands & others (9 items/set)
91	Fork lift (2 ton)	1	Max. pay load : 2,000kg
92	Fork lift (5ton)	1	Max. pay load : 5,000kg
93	Gantry crane 5 ton	3	Capacity : 5ton
94	Clamp meter	5	AC & DC current range : 0-1,000A
95	Multi-meter	5	AC & DC voltage : Max. 750V
96	Meager digital earth tester	3	Earth resistance range : Shall be able to measure 0.01-19.99kΩ
97	Hydraulic terminal clipper	4	Applicable range JIS : Greater than JIS 8-325mm2

No	EQUIPMENT	Q' ty	SPECIFICATIONS
98	Rotation detector	3	Voltage range : Measuring range shall be 200-450V
99	Major meager insulation tester	2	Test voltage/Resistance range : 5,000V / 0-10,000MΩ
100	Electric pipe threading machine	2	Threadable gas pipe size : 1/4 - 2in.
101	Digital manometer	2	Pressure range : Shall be able to measure 0-20 bar
102	Infrared thermometer	3	Measuring temperature range : Shall be able to measure -50 - 1,000℃
103	Insulation tester	3	Rated voltage : Max. 500V
104	Cable fault detector	1	Max. measuring distance : 15,000m
105	Pump capacity and rating tester (flow pressure meter)	1	Applicable pump size (Bore dia.) : 4″, 5″, 6″ & 8″
106	Spot welding set	2	Max. secondary short current : 7,000A
107	Offset pattern heavy duty wrench	4	Nominal size : 8″, 10″, 14″ & 18″ each 1 pc/set
108	Turbo charger tester	2	Scale : -1 - +1kgf/cm2(-760 - +760mm Hg)
109	Hand tools	5	Socket wrench set & others, 41 items/set
110	Pipe wrenches (heavy duty) in sets	5	Nominal size : 10″, 18″ & 48″ each 1 pc/set
111	Open ended wrenches in sets	5	Opening : 8-26mm, 6 pcs/set
112	Deep offset box wrenches in sets	5	Opening : 10-26 mm, 6 pcs/set
113	Socket sets	5	1/2″ Sq. drive, 10-32 mm, 13 pcs with handles
114	L Shaped hex. keys in sets	5	Contents : 2-12 mm, 9 pcs/set
115	Hand drill and drills	5	Capacity(steel) : 6.5 mm
116	Tap and die set	3	Contents : M3-M20, 28-Taps & 26 Dics
117	Screw drivers	5	Insulation voltage : 1,000V
118	Screw extractors in sets	5	Bolt extracting capacity : 6.5-16 mm
119	Bearing pullers in various sizes in sets	5	30ton, Hydraulic pullers with electric hydraulic pump
120	Bench vises	5	Jaw width : 150 mm
121	Files and files cards	5	Engineer's files (5 pcs/set) & Sand papers
122	Retaining rings (circlip) pliers	5	12 kind/set
123	Long nose pliers	5	Nominal size : 160 mm
124	Diagonal cutters	5	Nominal size : 175 mm
125	Side cut pliers	5	Nominal size : 175 mm
126	Grip jaw pliers	5	Opening/Length : 18 mm/130 mm
127	Rubber hammer	5	Weight : approx. 450g (1 lb)
128	Brass hammer	5	Weight : approx. 450g (1 lb)
129	Hand saw	5	Cutting blade length : 250 or 300 mm
130	Pistol oiler	5	Capacity : 0.25 L
131	Injection system tester	2	Pressure gauge : Measuring range shall be wider than 0~400 kgf/cm2
132	Pump assembly and disassembly station	4	Alignment tester & others, 6 items/set
133	Motor assembly and disassembly station	4	Coil winding machine & others, 5 items/set
134	Pipes elevator	12	Applicable pipe size : 4″, 5″, 6″, 8″
135	Tongue chain wrench	5	Grippable pipes nominal size : 1~12″
136	Utility chain wrench	1	Grippable pipes nominal size : 1~8″
B-1	Mobile workshop for vehicle service	1	Chassis : 4×4, GNW 8,500 kg
2	Mobile workshop for pump maintenance	1	Chassis : 4×4, GNW 8,500 kg
3	Recovery unit 5 t	1	Rated capacity : 5 short ton
4	Recovery unit 25t	1	Rated capacity : 25 short ton
5	Cargo truck with crane	5	3 ton capacity carge truck (4×4) with 3 ton crane

Chapter 3 Project Evaluation

3-1 Project Effect

Improvement of the water supply situation in Jordan is a matter of urgent concern and the following effects can be expected from the Project for workshop improvement, which is one area of the above mentioned issue.

1) Faster and more precise repair of broken down vehicles and pumps.

2) The introduction of a periodic inspection and preventive maintenance system and the resulting reduction of break downs.

3) Improved safety levels due to better working environments.

4) The above effects will lead to improved operation and maintenance and contribute to more effective and efficient running of the water supply utility by reducing water leaks and allowing energy for water distribution to be conserved.

3-2 Recommendations

1) Regarding the operation and maintenance of the Project equipment, it is considered that no problems exist in terms of the technical capacity, the manpower and the budgets of the implementing agencies. However, it is judged that improvements need to be made on the management side in order to ensure the effective utilization and organized operation of the equipment.

For this reason, it is considered that the development of workshop managers through the dispatch of specialists from Japan is a suitable measure. Moreover, it has been confirmed that the Jordan side requested the dispatch of specialists during the site verification surveys.

2) It can be expected that implementation of the above will lead to improved maintenance, fewer water leaks and conservation of energy for water distribution. However, more effort is required on the technical and operation fronts in order to resolve the issue of unaccounted water consumption, which accounts for more than 50% of the water supply. Furthermore, it is necessary to advance surveys of ground water quantities and also water analysis in future, in order to ensure the effective utilization of the precious water sources.