

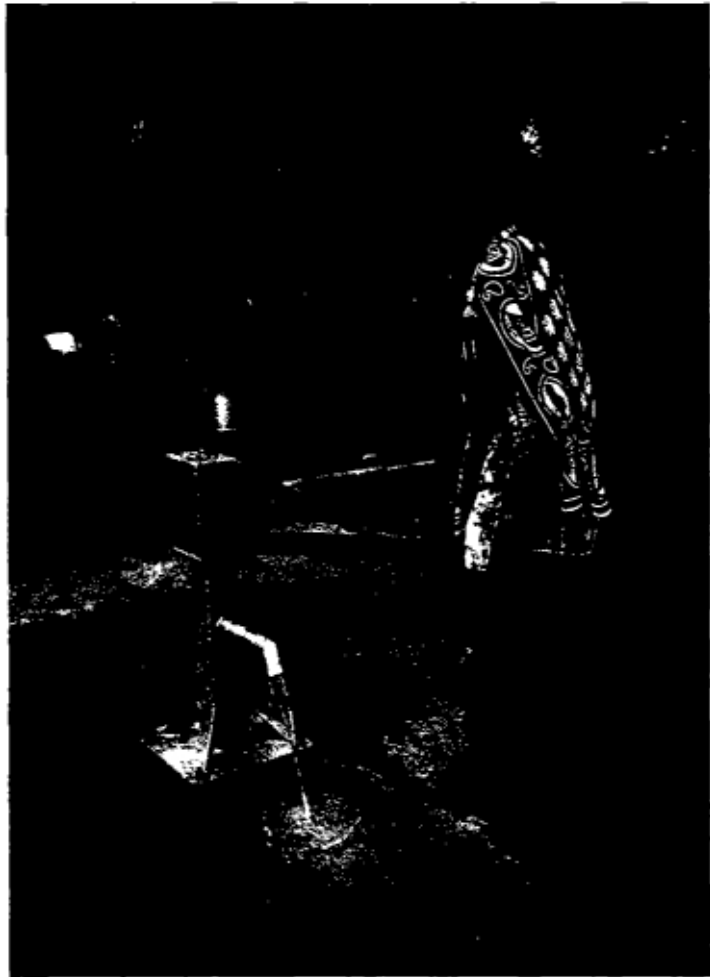
Low Cost Water Supply

for

Human consumption
Cattle watering
Small scale irrigation

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May 1984

Part 2:
Pumping Equipment

232.2-2238

Low Cost Water Supply

for

Human consumption
Cattle watering
Small scale irrigation

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Part 2:
Pumping Equipment

DHV

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The instruction manuals "Low Cost Water Supply"

Part 1 – Survey and Construction

Part 2 – Pumping Equipment

have been prepared by DHV Consulting Engineers

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CONTENTS	PAGE
1. HAND PUMPS FOR RURAL WATER SUPPLY	5
2. SWN RANGE OF PUMPS	11
3. PUMP HEADS	20
4. PUMP STANDS AND CONVERSION UNITS FOR SWN 80 AND SWN 81 PUMP HEADS	27
5. KANGAROO PUMPS	35
6. PUMP RISERS AND RODS	38
7. CYLINDER ASSEMBLY (UNIVERSAL)	43
8. INSTRUCTIONS FOR PUMP INSTALLATION	45
9. MAINTENANCE	63
10. LOCAL MANUFACTURING OF PUMPS	78



Community-owned, as strong as possible

1. HAND PUMPS FOR RURAL WATER SUPPLY

Ownership of the hand pump is a crucial aspect in selecting the best type of pump. Whereas *privately owned pumps* must be:

- as cheap as possible
- repairable by or on behalf of the owner (paid labour).

A completely different set of requirements apply to *by pumps that are owned and used by an entire community*. These pumps must be:

- as strong as possible
- repairable by the community.

In this case, certainly if spares are not available and maintenance cannot be ensured, the construction must be as maintenance free as possible.

In this brochure the emphasis is on *community-owned* pumps.

Hand pumps can be categorized in various ways:

A) According to their **application**:

a – *for drinking water*

only a small yield is required:

even the smallest hand pump can supply more than 500 l/hour, which is sufficient for a community of 250 people (see next page).

b – *for irrigation*

very large yield required:

in the dry season one acre of vegetables requires approx.

12000 l/day or approx. 1500 l/hour (at 8 hours' supply per day).

B) According to the **groundwater** and **discharge levels**:

a – *suction pump*

if groundwater level is at approx. 3 - 4 m below ground level

b – *lift pump*

for average depths, up to approx. 25 m.

standard pump; capacity depends on cylinder installed.

c – *deep well pump*

for depths to approx. 100 m.

heavy duty construction with counterweight; because of the limits to human force, cylinders larger than \varnothing 50 mm cannot be used.

d – *pressure pump*

for filling tanks

The yield of a hand pump with a stroke of 16 cm, at 2000 strokes per hour, is:

Cylinder Ø 4 " : 2.5 m³/h
Cylinder Ø 3 " : 1.4 m³/h
Cylinder Ø 2½" : 1.0 m³/h
Cylinder Ø 2 " : 0.6 m³/h

In general water is collected during two peak periods per day, e.g.:

6.00 - 9.00 in the morning

3.00 - 6.00 in the afternoon.

If the water has to be carried any distance to the home, a maximum of 20 litres/person/day is used.

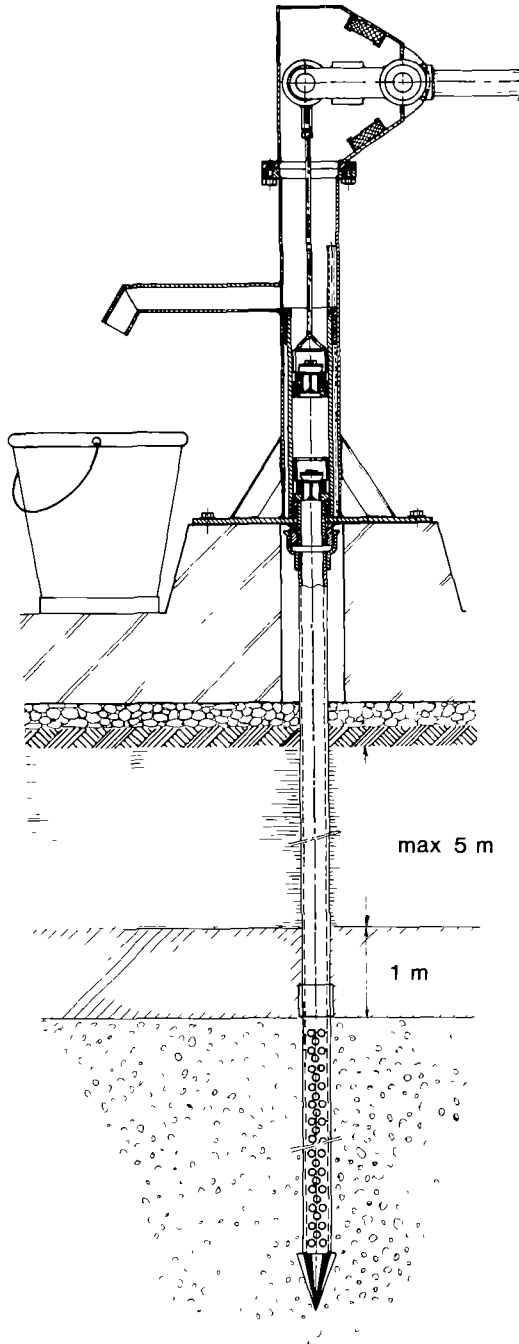
Thus a hand pump with a 4" cylinder, that provides approx. 15 m³ of water during the six pumping hours per day, is able to cater for 750 people, while even a pump with a 2" cylinder can provide water for 200 people.

However, in view of the great distances between clusters of houses in rural areas, an average of one hand pump for 250 people is a realistic assumption.



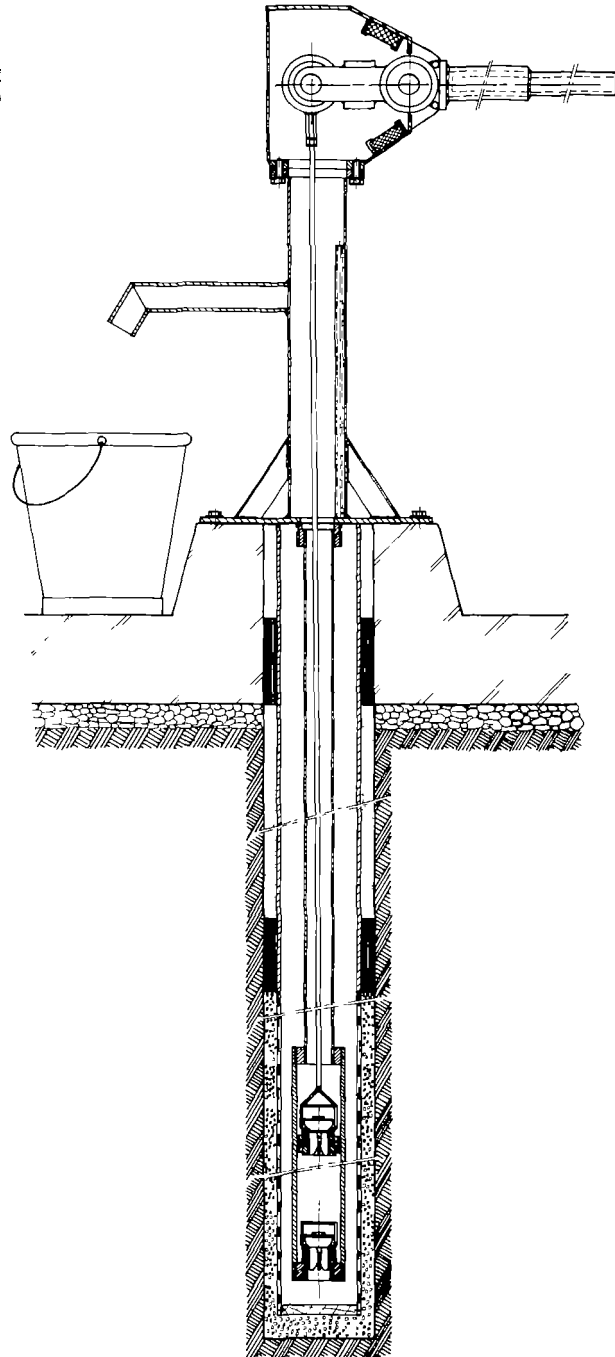
ONE HAND PUMP IS SUFFICIENT FOR APPROX. 250 PEOPLE

SUCTION PUMP VERSUS LIFT PUMP



SUCTION PUMP

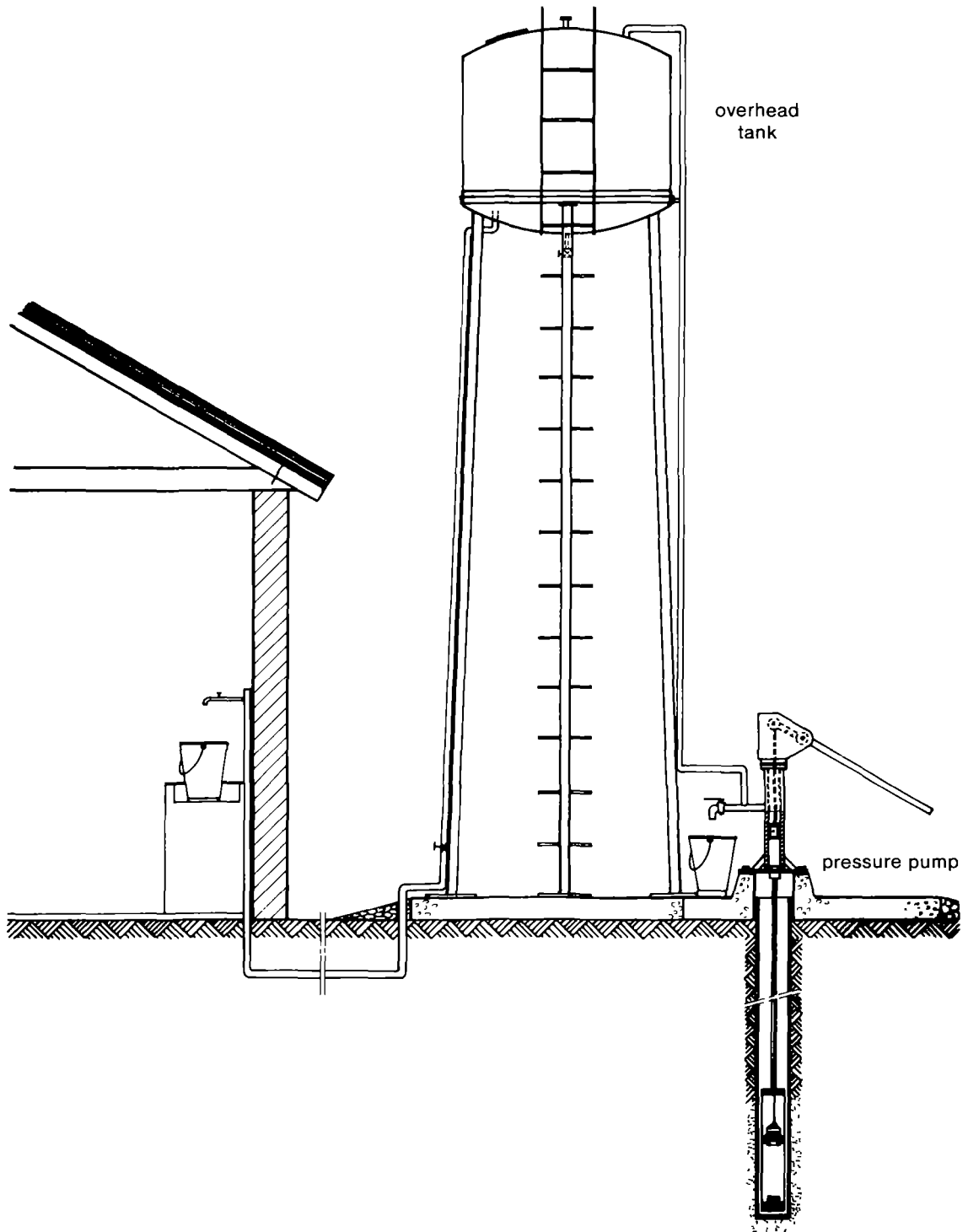
- advantage* - lower cost
- disadvantage* - priming required; may cause pollution
- cannot be used for deeper groundwater



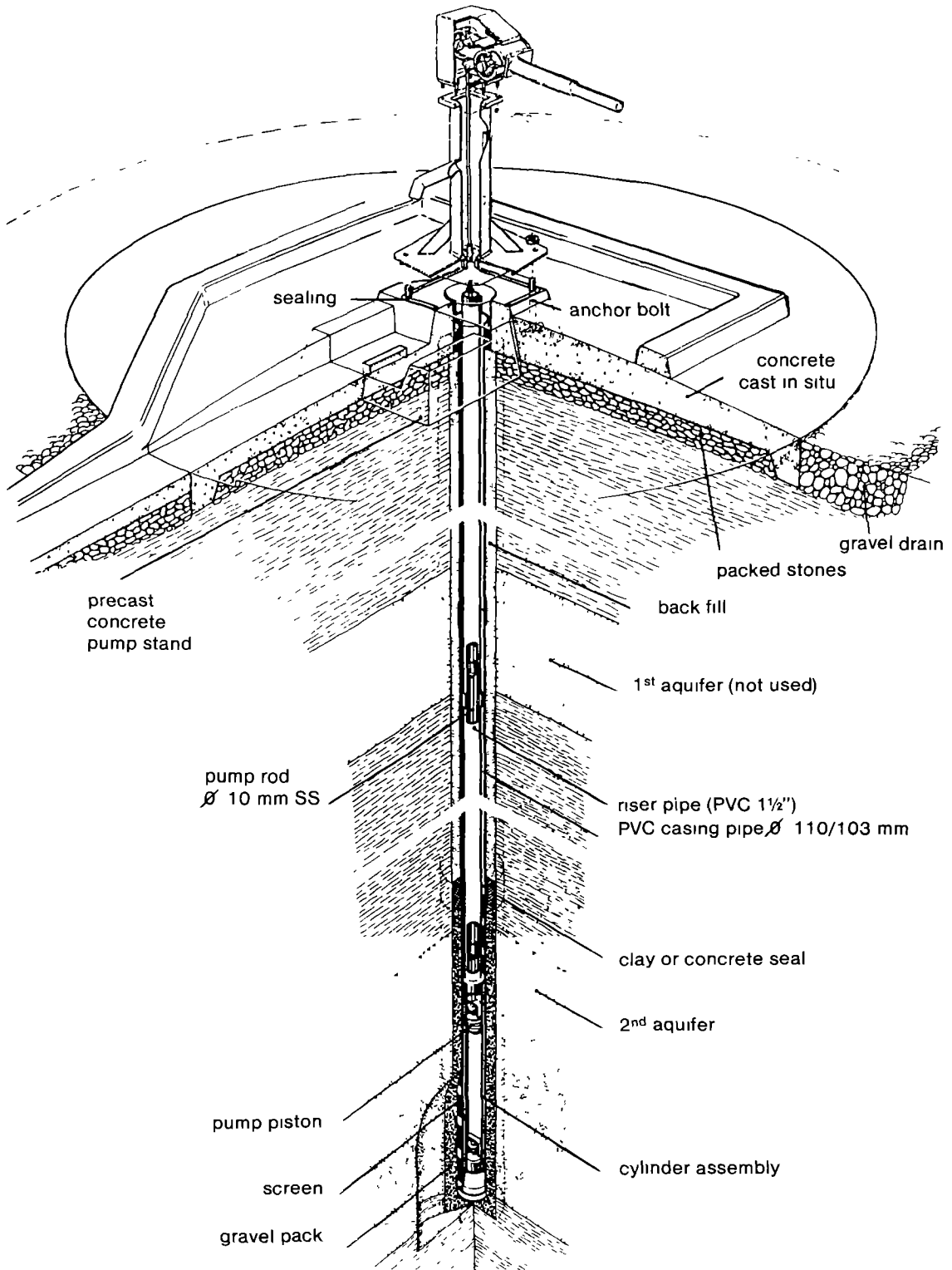
LIFT PUMP

- advantage* - no priming required
- can be used for shallow and deep aquifers
- disadvantage* - higher cost

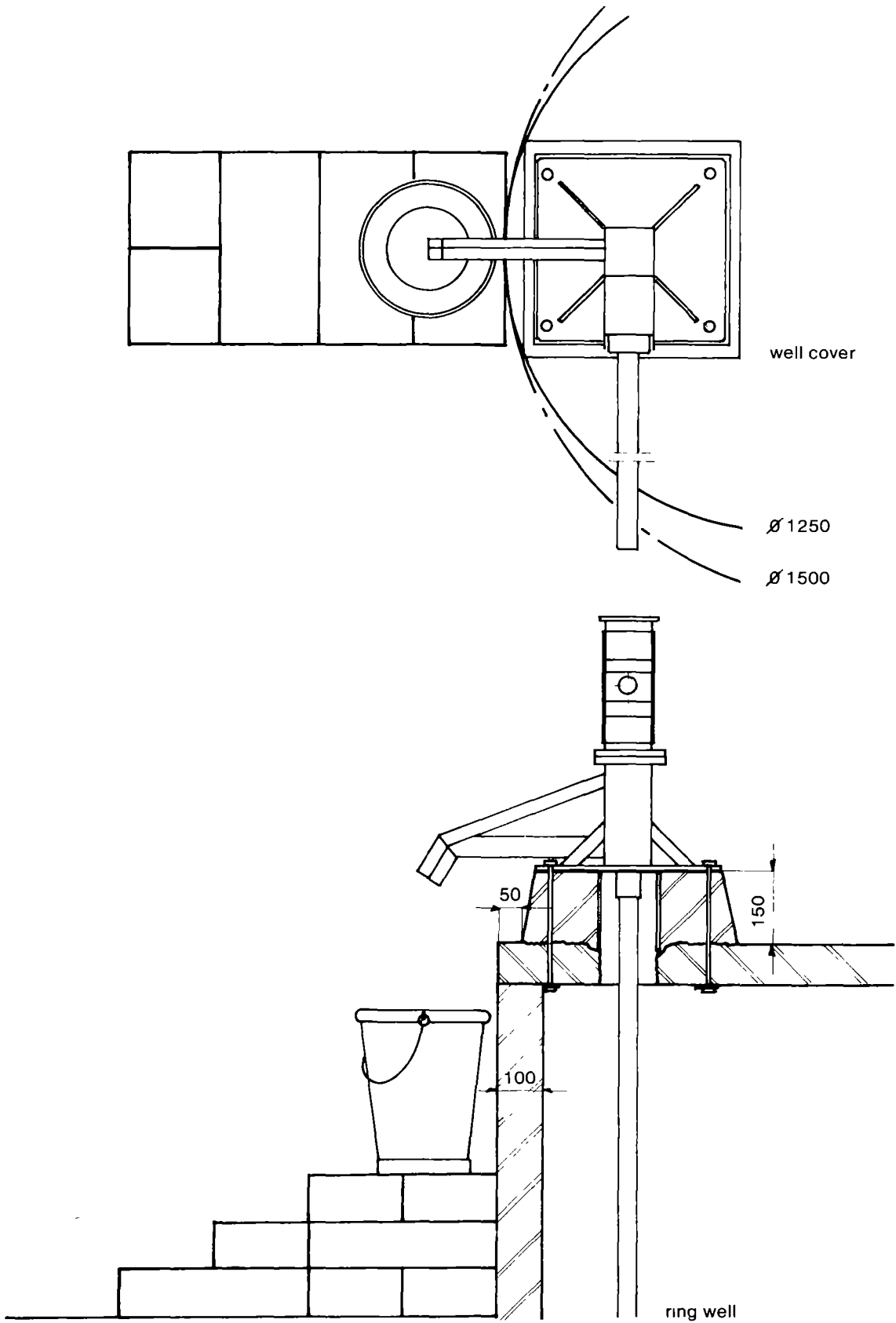
APPLICATION OF SWN PUMP AS PRESSURE PUMP



STANDARD ASSEMBLY OF A SHALLOW WELL FITTED WITH A HAND PUMP



HAND PUMP MOUNTED ON A RING WELL



2. SWN range of pumps

The SWN range of pumps covers:

- *hand pumps of the SWN 80/SWN 81 series*
- *a large-bore irrigation handpump*
- *footpumps of the Kangaroo series*

A schematic representation of the entire SWN range is given on pages 18 and 19.

All SWN 80/SWN 81 hand pumps, except when equipped with the suction pump conversion, and all Kangaroo foot pumps, use the same standard cylinders and pump rod/riser sets.

Only the irrigation hand pump and the SWN 80/SWN 81 hand pump in the suction pump conversion are not equipped with separate cylinders and pump rods. To these pumps only a suction pipe or hose is connected, whenever necessary.

The superstructure of a Kangaroo foot pump is supplied as a complete assembly, whereas that of the SWN 80/SWN 81 series is built up of a separate head and pump stand.

2.1. HAND PUMPS SWN 80/SWN 81

There are three different heads:

- SWN 80 head (for groundwater tables down to 40 m)
- SWN 81 head (applicable for deep aquifers also, up to 100 m)
- SWN 80 duplex (for use by two people simultaneously or as dewatering pump; see page 14).

The following pump stands are available for SWN 80/SWN 81 pump heads:

- regular pump stand (for tube wells)
- pump stand for ring well
- duplex pump stand (for SWN duplex head only)

For the regular pump stand there are two conversion sets available:

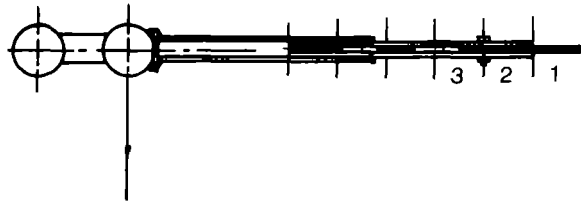
- conversion unit that turns the SWN 80/SWN 81 pumps into suction pumps
- conversion unit for adapting SWN 80/SWN 81 pumps to pressure pumps.

The maximum stroke length of a SWN hand pump is 16 cm, which, at a rate of approx. 1 stroke per 2 seconds, gives the following output, depending on the diameter of the cylinder used:

cylinder diameter	output (m ³ /hour)
4 "	2.5
3 "	1.4
2½"	1.0
2 "	0.6

With increasing depths of the groundwater table, the force to be exerted on the pump handle increases. Also the use of larger diameter cylinders requires a larger force. Thus, for deeper aquifers, only small-diameter cylinders can be used, unless counterweights are used to balance the larger forces.

Use of counterweight:



handle SWN 81
with counter weight

h \ c	4"	3"	2½"	2"
10	x	x	x	x
20		0	x	x
30		1	0	x
40			1	0
50				1
60				2
70				2
80				3
90				3
100				3

h = depths in meters
c = diameter cylinder
x = without counter weight
0 = counter weight cpl inside
1 = counter weight in 1st pos
2 = counter weight in 2nd pos
3 = counter weight in 3rd pos.

2.2. KANGAROO FOOT PUMPS

Two types of kangaroo foot pumps are available:

- Kangaroo Mk 1 (square cross-section)
- Kangaroo Mk 2 (circular cross-section)

Both types can be used for water tables down to 10 - 15 m.

The maximum stroke length of a Kangaroo pump is 40 cm, so that its output is two-and-a-half times that of an SWN hand pump, for the same cylinder diameter and pumping frequency (number of strokes per minute). Kangaroo pumps are therefore ideally suited for situations where the water demand is higher than normal, for instance when the water is not only used for domestic purposes but also for watering small horticultural plots or gardens.

The pumping motion of a Kangaroo pump is brought about by decompression of a spring that has first been compressed by foot (pushing the pump head down). The depth from which water can be pumped up in this way is limited to approximately 10 - 15 m (depends on body weight of user and diameter of cylinder used).

2.3. PUMP ROD/RISER ASSEMBLY

All SWN 80/SWN 81 pumps, except when the suction pump conversion unit is used, and all Kangaroo pumps, utilize identical pump rods, rising mains and cylinders. Pump rods are \varnothing 10 mm stainless steel rods, with hexagonal couplings. They are available in the following lengths:

0.75 m, 1.50 m, 2 m, 3 m and 4 m.

P.E. sleeves, fitted over the pump rods, protect the rising main against damage (e.g. the hexagonal nuts scratching against the P.V.C. riser pipe).

Rising mains can be made of various materials. Originally, especially galvanized iron pipes were used. However when:

- the pH of the water is rather low, or the water is otherwise aggressive, or
- the iron content is high, or
- the locally available galvanized iron pipes are of a poor quality, alternative pipe materials have to be selected.

The alternatives are:

- stainless steel (very costly)
- A.B.S. (often not locally manufactured)
- high-impact P.V.C.

Thick walled (48/36 mm) P.V.C. presently is the standard material for rising mains for SWN 80/SWN 81 and Kangaroo pumps. It has the advantage that it can be manufactured locally in almost any country.

2.4. CYLINDER ASSEMBLY

SWN 80/SWN 81 and Kangaroo pumps, except when fitted with the suction pump conversion unit (for SWN pumps only), utilize identical cylinder assemblies. These comprise a P.V.C. cylinder wall, a piston with a neoprene piston cup seal, and foot valve and heart valve assemblies of corrosion-free materials. In well executed wells (yielding sand-free water) the wear of the neoprene piston cup seal against the P.V.C. cylinder wall is negligible, resulting in a useful life of the cylinder of many years without any maintenance or replacement of parts.

Cylinders are available in four sizes, resulting in the following outputs (at 2000 strokes per hour):

cylinder diameter	Output (m ³ /hour)	
	SWN handpumps	Kangaroo pumps
2"	0.6	1.6
2½"	1.0	2.5
3"	1.4	3.5
4"	2.5	6.3

For deeper wells cylinders are available in a deep-well modification, where the top and bottom of the cylinder wall are reinforced with stainless steel bands.

2.5 SPECIAL PUMP TYPES

A. SWN 80 duplex pump

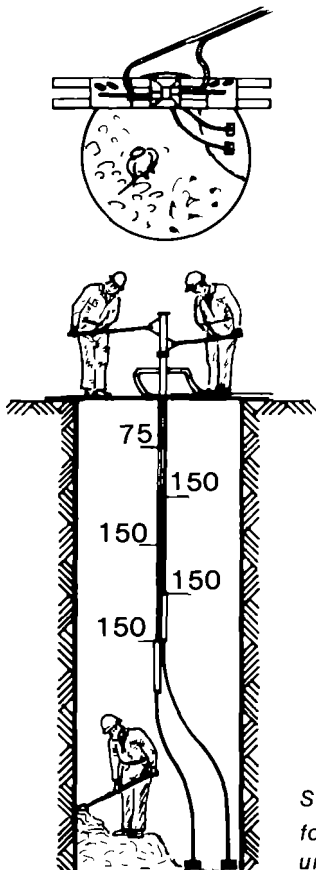
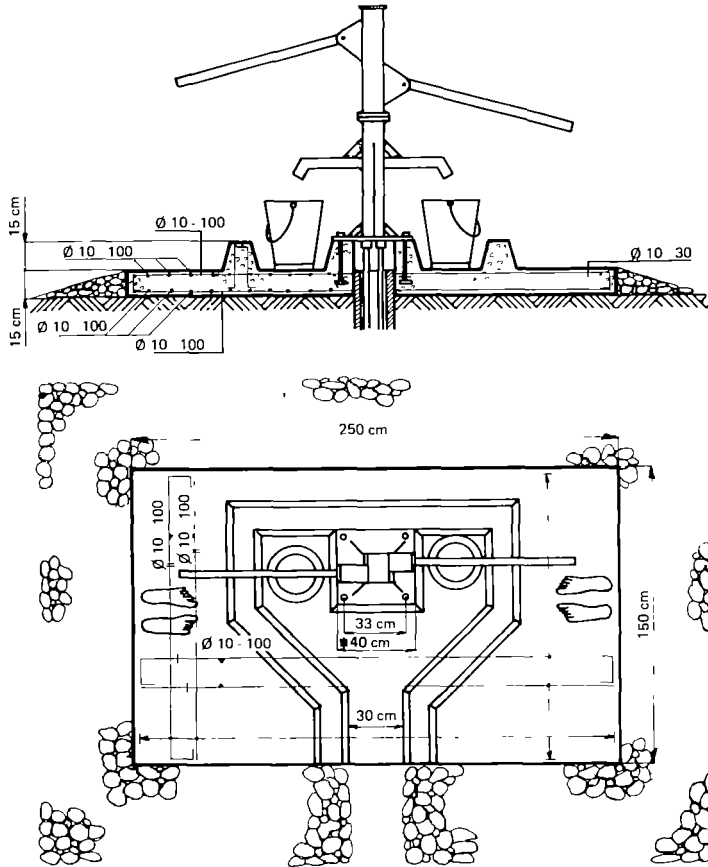
The SWN 80 duplex pump is a combination of two SWN 80 pumps, using a special double pump head and pump stand, and thus allowing two people to use the same well simultaneously.

This pump can be installed on wells with a minimum diameter of 125 mm; in that case two Ø 50 mm deep well cylinders are used, in a staggered position (see figure on next page).

The SWN 80 duplex pump can also be used as a dewatering pump for dug wells in rural water supply projects.

In that case a two metres long 1½" suction hose is fitted underneath each cylinder, with strainers placed at the lowest point on the bottom of the well.

Typical installation of SWN 80 duplex pump for rural water supply



SWN 80 duplex pump for dewatering wells under construction

As hand digging of wells may go on for weeks, the well, which will be filled with groundwater during the night, has to be emptied every morning.

A double pump will considerably reduce the waiting time for the diggers in the morning while later on one pump can generally cope with the inflow.

During construction of the well, as its depth grows, every 1.5 m a new riser and rod are fitted just above the cylinder. By installing the cylinders at different levels, dewatering of the well can be carried out without interruption.

With the SWN 80 duplex pump dewatering can be carried out with the following diameters:

- 4" (100 mm) to 10 - 15 metres
- 3" (75 mm) to 20 - 25 metres
- 2½" (63 mm) to 30 - 35 metres
- 2" (50 mm) to 40 - 50 metres

B. IRRIGATION PUMP

The critical point in the maintenance of shallow wells and hand pumps is in fact the provision of sufficient funds. The general scarcity of funds in rural areas has led to a shift in concept, from centralized maintenance to decentralized maintenance, laying the responsibility at village or ward level (V.L.O.M. concept).

Continued and purposeful efforts on the part of the local authorities are required to motivate villagers to contribute financially.

It is felt that the motivation for local maintenance and repair can be considerably increased if the well can function also as an economic unit, generating a certain income.

Hand pump water supplies may be used for small scale irrigation of vegetable gardens or horticultural plots, for cattle watering, etc.

Limited irrigation of cassava, pumpkins, bananas, sugar cane, etc. is possible within a radius of 10 - 15 m from the pump.

A single family could thus improve its food supply considerably.

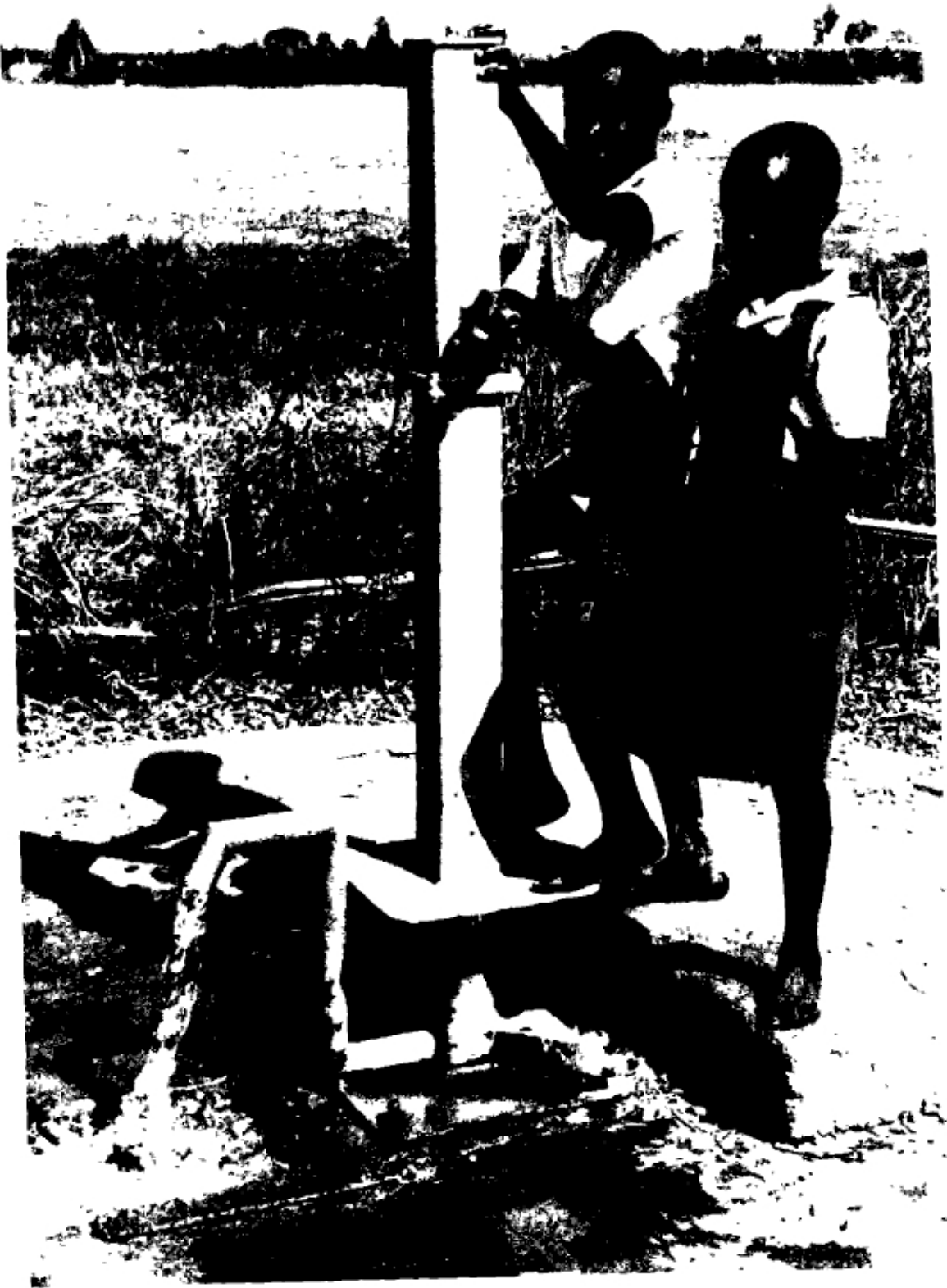
Because of their large output, Kangaroo pumps can be used for this purpose, provided that the groundwater table is not below 10 - 15 m.

A special irrigation pump is also available. It is a suction pump, thus applicable only when the groundwater table is not below 7 m.

It has a piston with a diameter of 180 mm, thereby yielding approx. 4 litres per stroke. The pump can be mounted on a well (with a suction pipe descending into the well) or on the bank of a river or pond (with a flexible suction hose connected to the side of the pump).



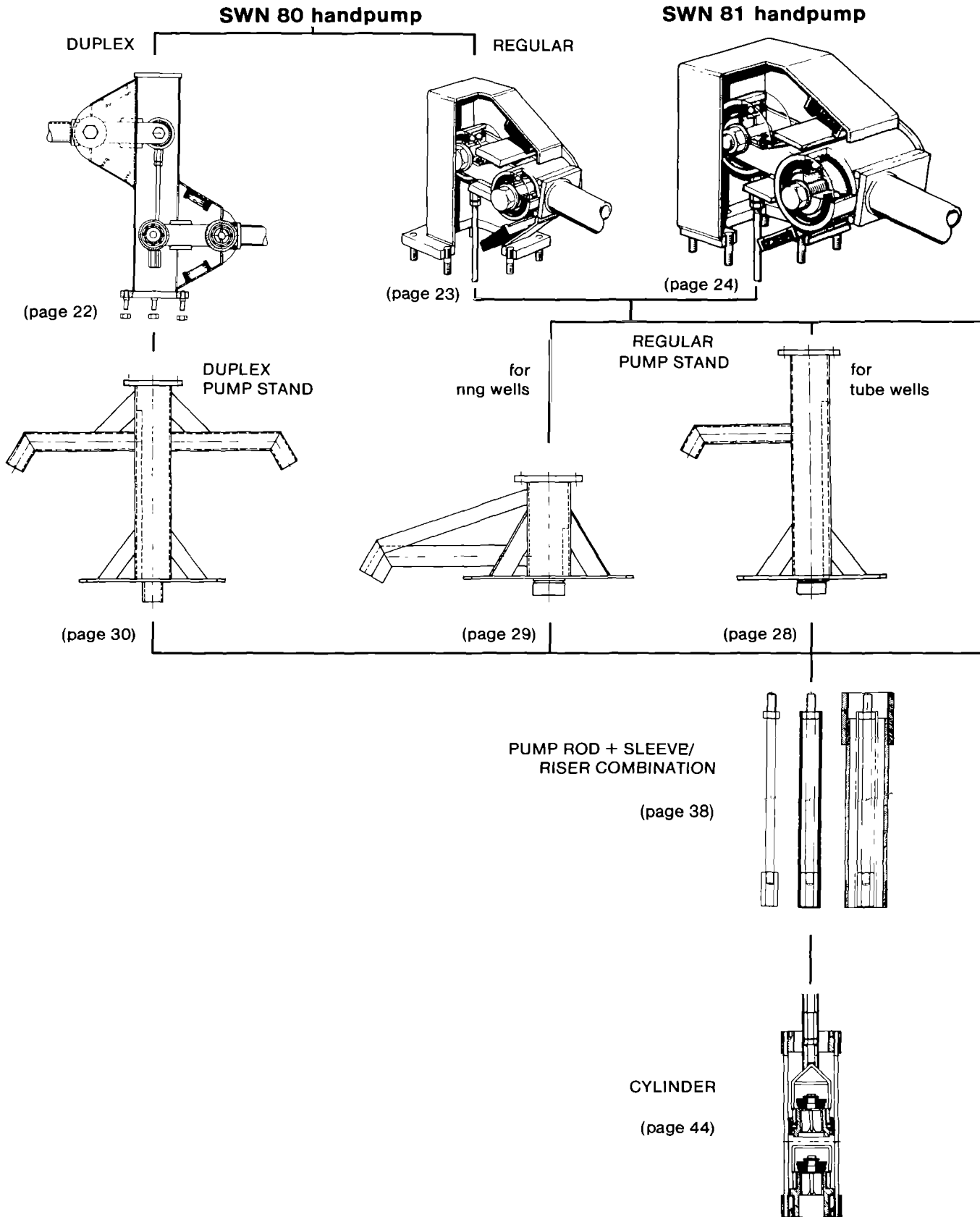
SWN irrigation pump used for irrigation of vegetable plots



Kangaroo Mk 1

THE CENTRI-
FUGAL WATER SUPPLY AND
PUMP (MK1)

2.6 OVERVIEW OF SWN PUMPS (HAND AND FOOT PUMPS)



KANGAROO foot pump

Mk 1
(square)

Mk 2
(round)

**IRRIGATION
handpump**

PUMP STAND

for
pressure
pump

for
suction
pump

(page 34)

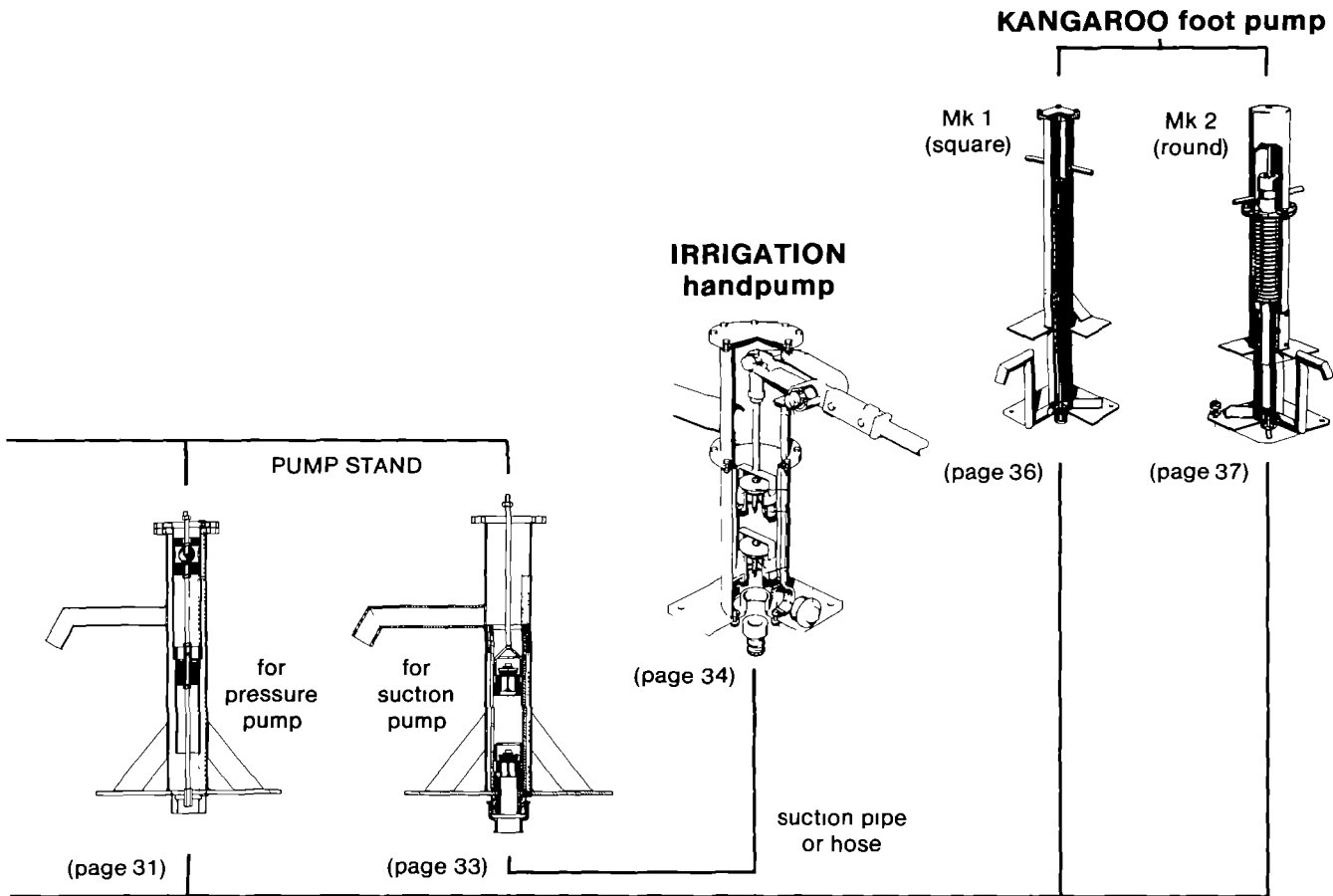
(page 36)

(page 37)

(page 31)

(page 33)

suction pipe
or hose



3. PUMP HEADS

3.1 SWN 80 PUMP HEADS

For water tables down to 40 metres maximum.

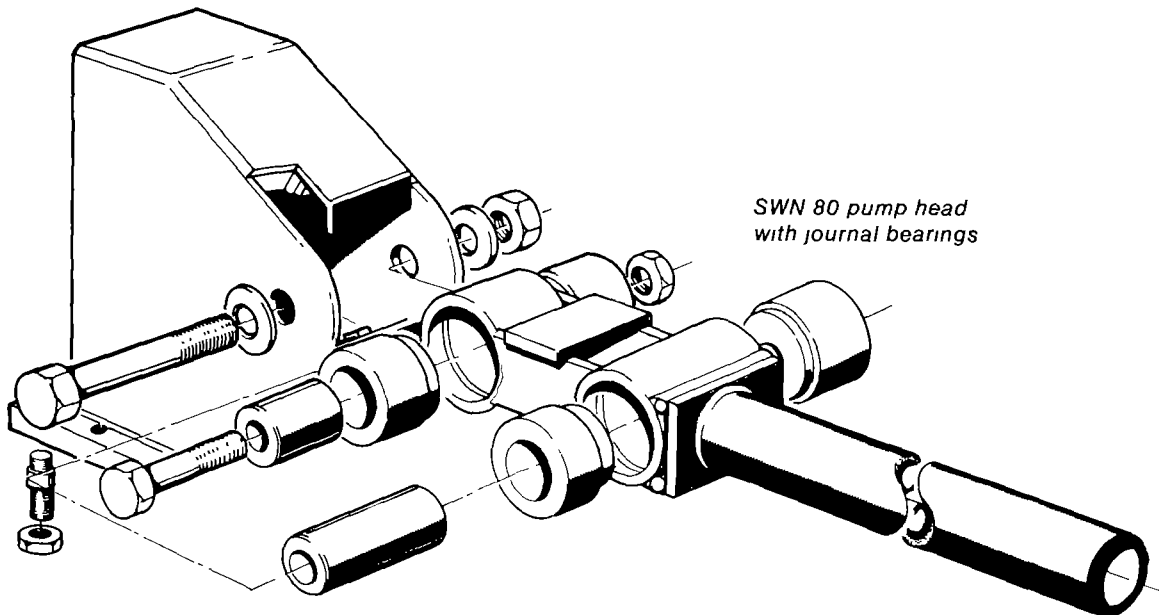
The bearing house is suitable for both ball bearings and journal bearings.

When ball bearings are used, they are oversized to guarantee a long lifetime of the pump head.

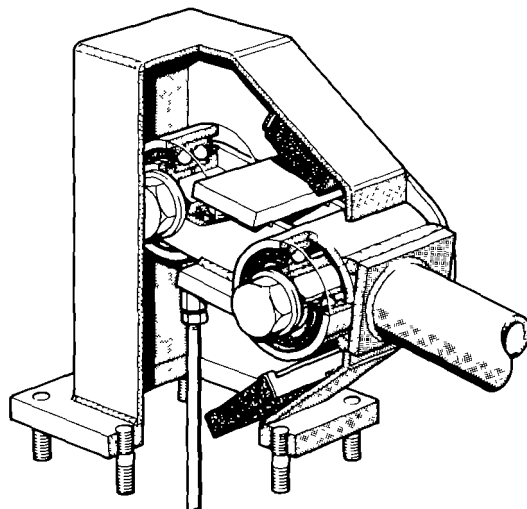
When journal bearings are used, these consist of polyacetal bushings on stainless steel shafts.

These bearings will last for approximately 5 years without any maintenance.

Later on both types of bearings may be replaced by locally made, oil soaked, hard wooden bushings.

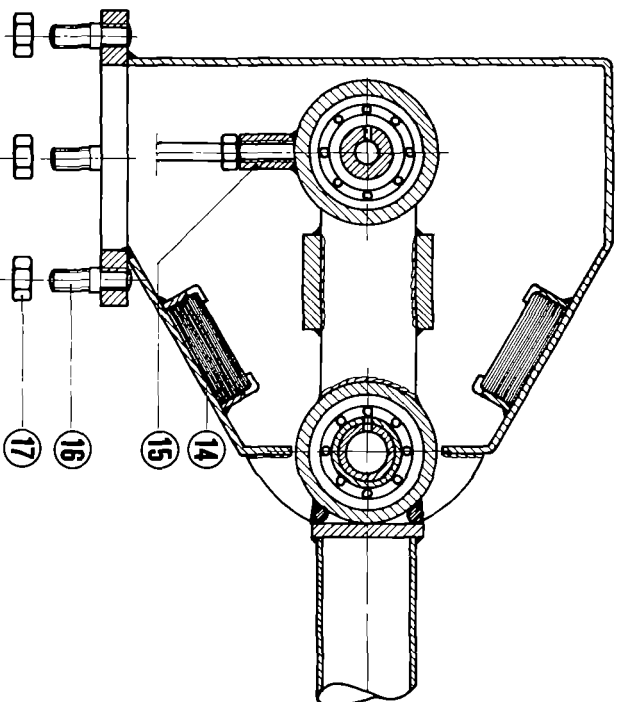
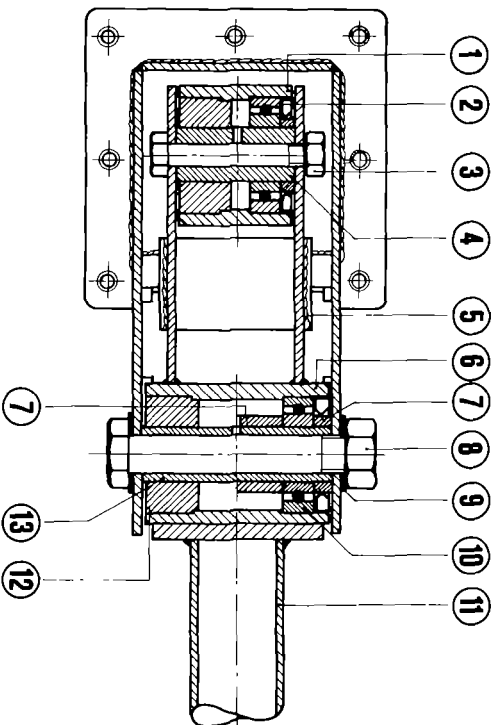


*SWN 80 pump head
with journal bearings*



*SWN 80 pump head
with ball bearings*

**Section through SWN 80 pump head,
showing both bearing options**

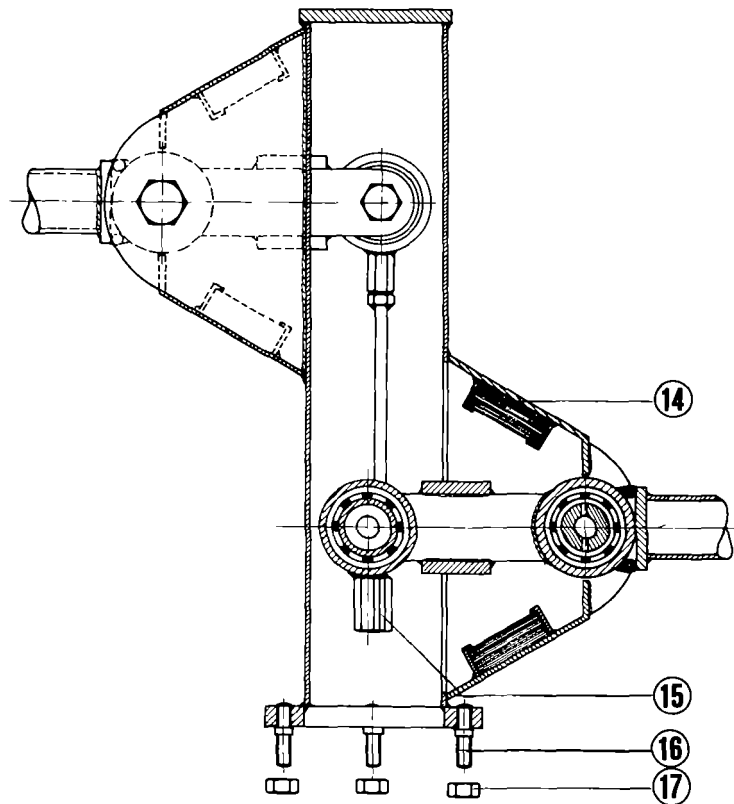
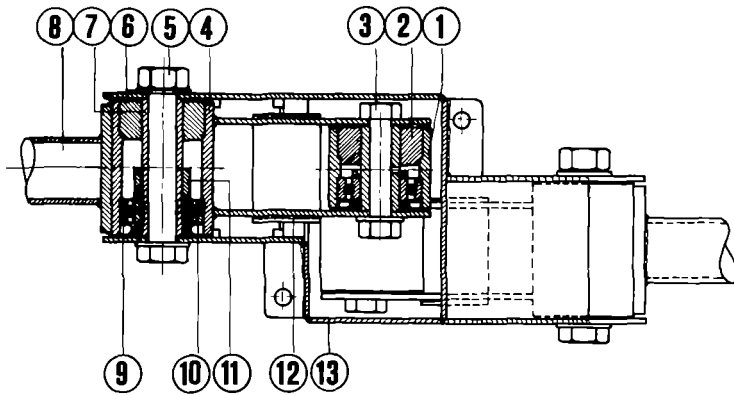


NO.	DESCRIPTION
1	rod end bearing
2.	ball bearing + sealing
3	bolt and nut M16
4.	rod end shaft
5.	stroke limiter
6.	bearing housing
7.	spacer + sealing
8.	bolt and nut M20
9.	washer M20
10	ball bearing
11.	handle assembly
12.	journal bearing
13.	main shaft
14.	rubber pad
15	pump rod connector
16.	(hex nut M10)
17.	stud M12 nut M12



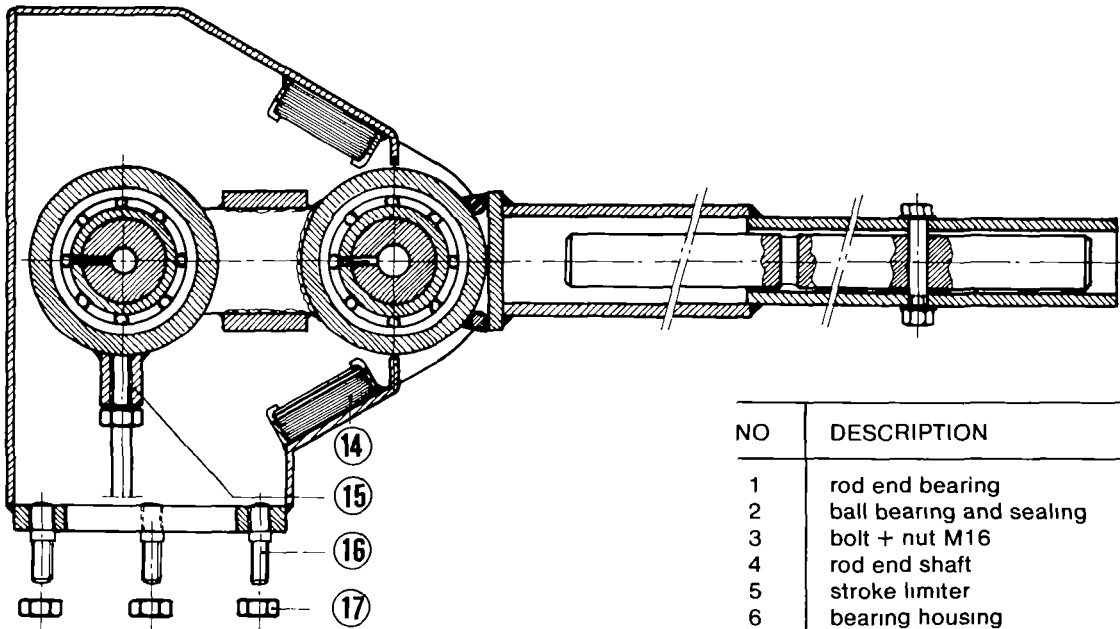
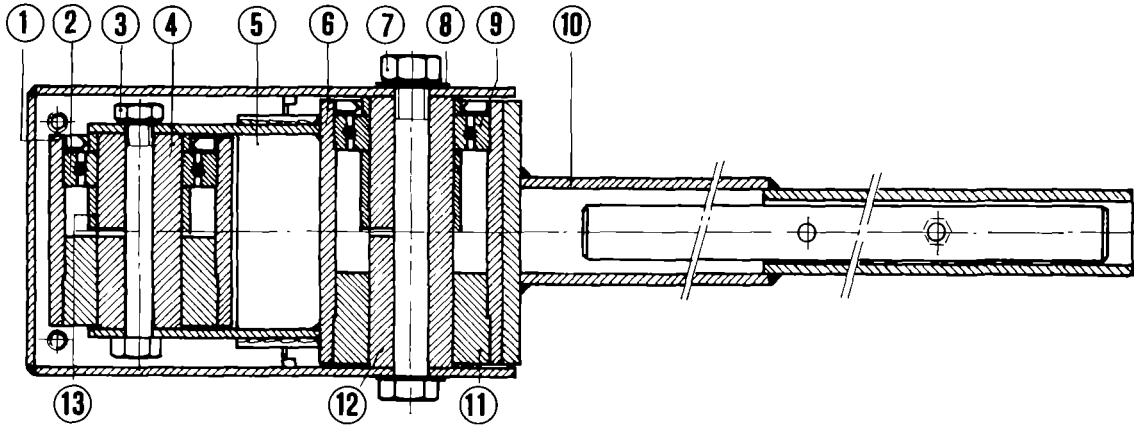
3.2 SWN 80 DUPLEX PUMP HEAD

This pump head is a combination of 2 standard SWN 80 pump heads. It is available with ball bearings or journal bearings, as desired.



NO.	DESCRIPTION
1.	rod and bearing housing
2	journal bearing
3.	bolt and nut M16
4	bearing housing
5.	bolt and nut M20
6.	washer M20
7.	main shaft
8	handle assembly
9	ball bearing
10	sealing
11.	spacer
12	stroke limiter
13	pump head structure
14.	rubber pad
15.	pump rod connector (hex nut M10)
16	stud M12
17.	nut M12

Section through SWN 81 pump head, showing both bearing options



NO	DESCRIPTION
1	rod end bearing
2	ball bearing and sealing
3	bolt + nut M16
4	rod end shaft
5	stroke limiter
6	bearing housing
7	bolt + nut M20
8	washer M20
9	ball bearing
10	handle assembly
11.	sleeve bearing
12	main shaft
13	bush
14.	rubber pads
15	pump rod connector (hex nut M10)
16	stud M12
17	nut M12

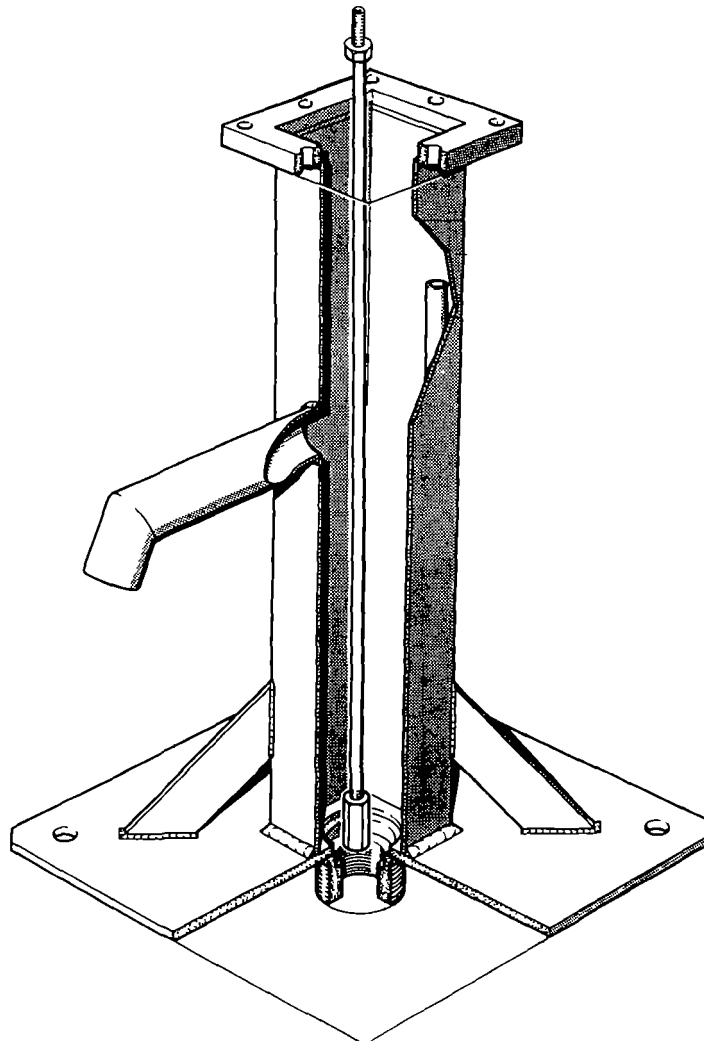


SWN 81

4. PUMP STANDS AND CONVERSION UNITS FOR SWN 80 AND SWN 81 PUMP HEADS

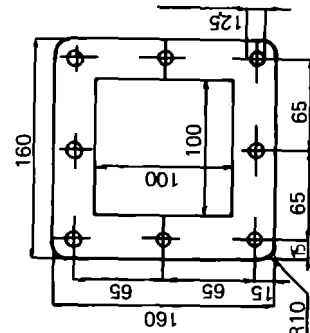
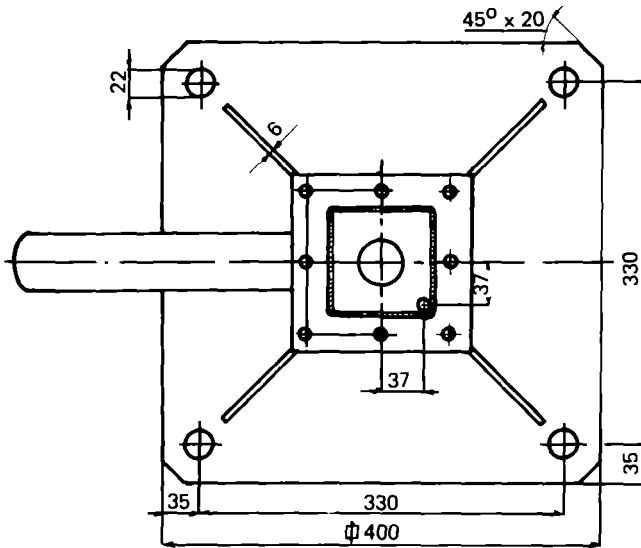
- regular pump stand for SWN 80/SWN 81 pumps on tube wells (page 28)
- pump stand for SWN 80/SWN 81 pumps on ring wells (page 29)
- special pump stand for SWN 80 duplex pumps (page 30)
- conversion unit for pressure pump for SWN 80 and SWN 81 (page 31)
- conversion unit for suction pump for SWN 80 and SWN 81 (page 33)

All pump stands are hot-dip galvanized.

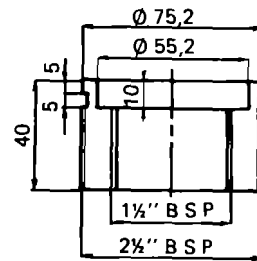
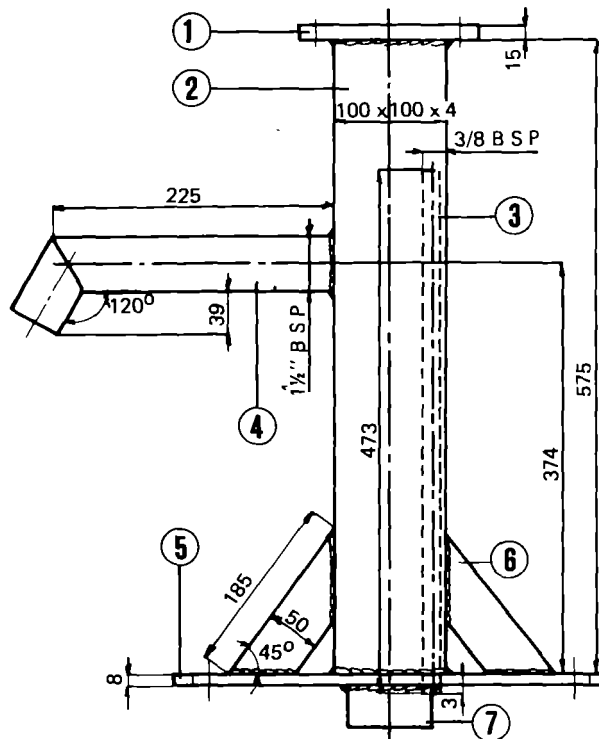


4.1 REGULAR PUMP STAND FOR SWN 80 and SWN 81 PUMPS

For mounting SWN 80 or SWN 81 pumps on tube wells.
(may also be used on ring wells).



① flange

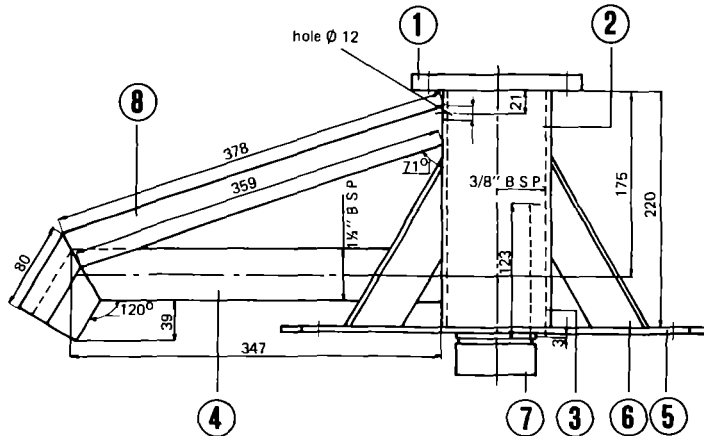
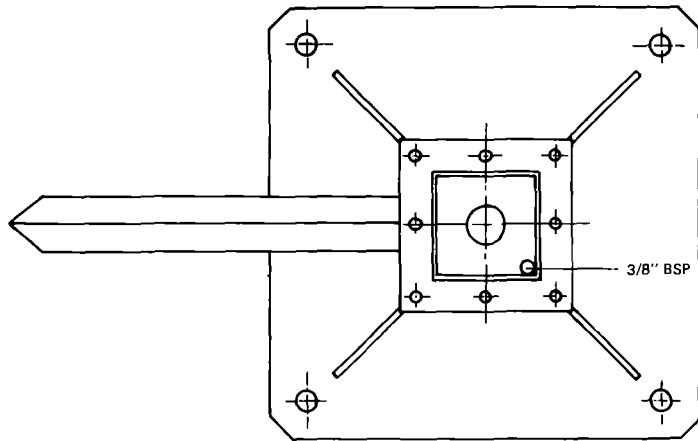


⑦ socket

NO	DESCRIPTION
1.	flange
2.	column
3.	vent pipe
4.	spout
5.	base plate
6.	support
7.	socket

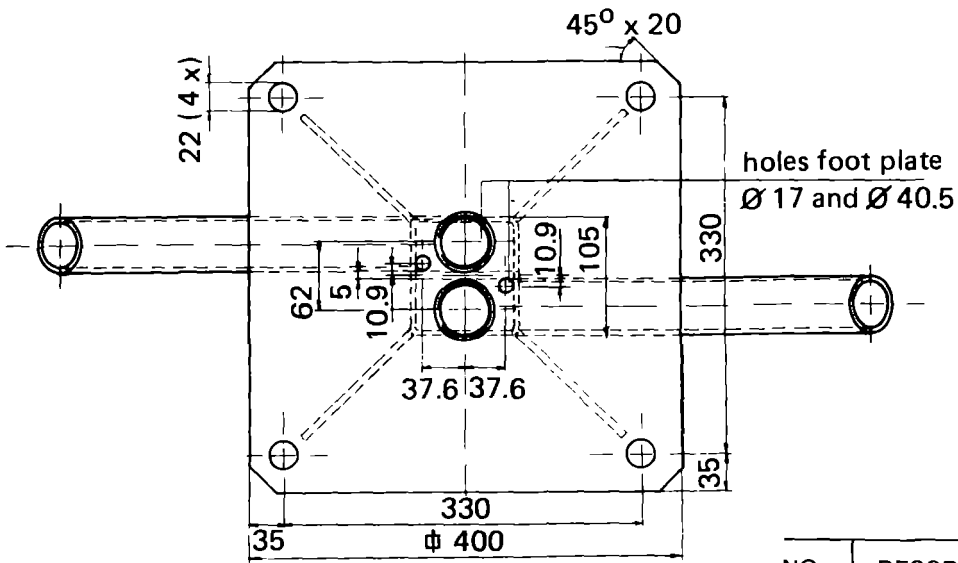
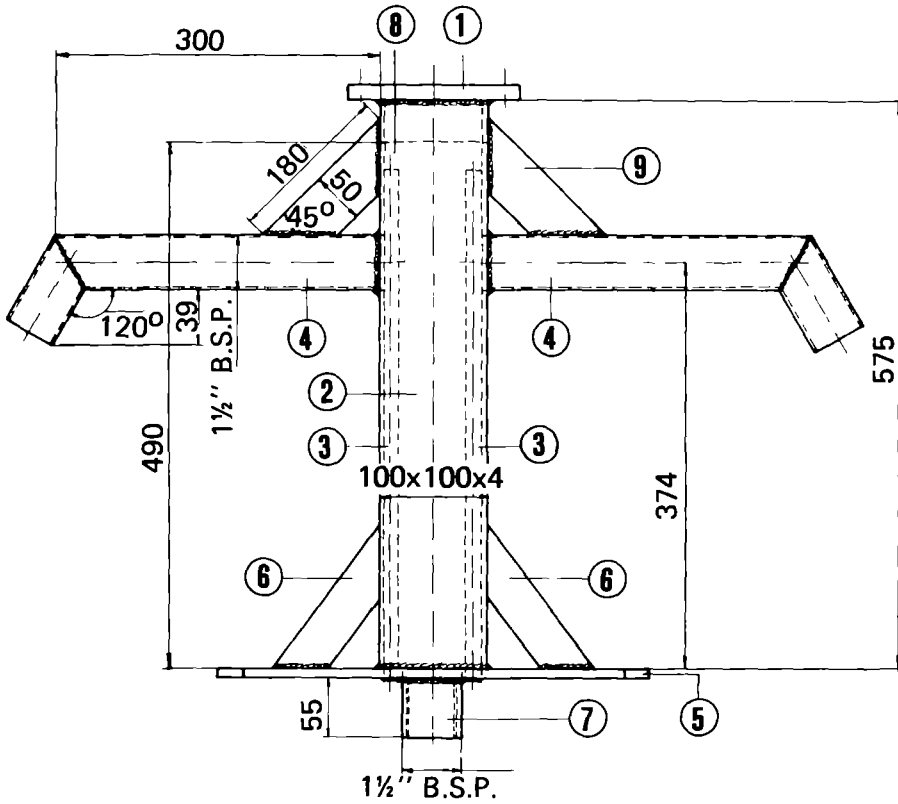
4.2 RING WELL PUMP STAND FOR SWN 80 and SWN 81 PUMPS

These pump stands are used on ring wells when the spout would otherwise be too high above the buckets etc. that have to be filled.
 In other situations the pump stand of page 28 can be used also on ring wells.



NO	DESCRIPTION
1	flange
2	column
3	vent pipe
4	spout
5	base plate
6	support
7	socket
8	spout support

4.3 PUMP STAND FOR SWN 80 DUPLEX PUMP

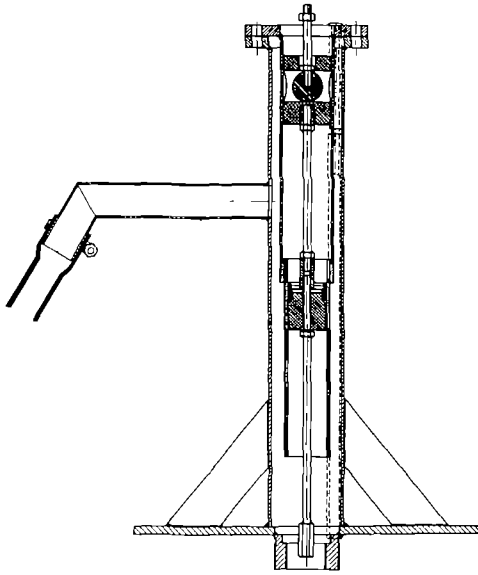


NO.	DESCRIPTION
1.	flange
2.	column
3.	vent pipe
4.	spout
5.	base plate
6.	support
7.	socket
8.	partition wall
9.	spout support

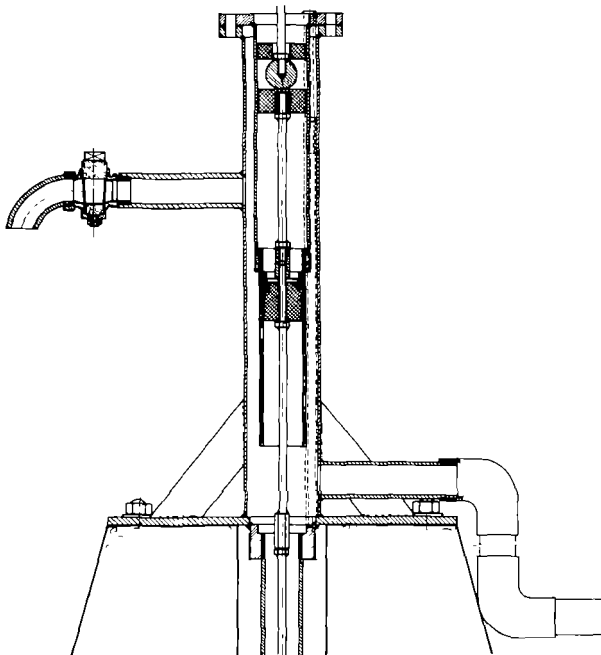
4.4 CONVERSION UNIT (PRESSURE PUMP) FOR SWN 80/SWN 81 PUMPS

By bolting this conversion unit between the regular pump stand and the pump head, an SWN 80 or SWN 81 pump can deliver water under pressure, e.g. to an overhead water tank (see also page 8).

The spout of the regular pump stand will have to be modified locally, to accept additional pressure piping (see sketches below).

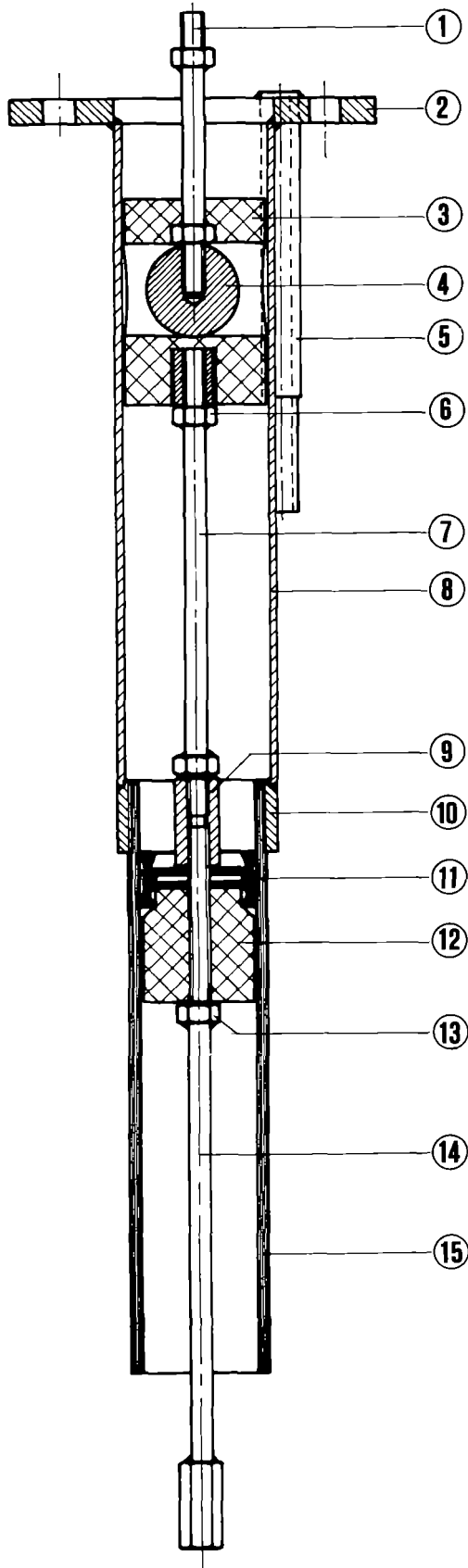


*Option
Hose clamped on pump spout*



*Option
Pump stand modified
- stop cock in spout
- connection for pressure piping
to bottom of pump stand*

Insertion unit for pressure pump



NO	DESCRIPTION
1	pump rod (\varnothing 10 mm stainless steel)
2	flange
3	guide block
4	ball joint
5	vent pipe
6	counter nut M10
7	pump rod
8	guide tube
9	hex nut M10
10.	socket
11	piston sleeve
12	plunge body
13	counter nut M10
14	pump rod
15.	cylinder wall

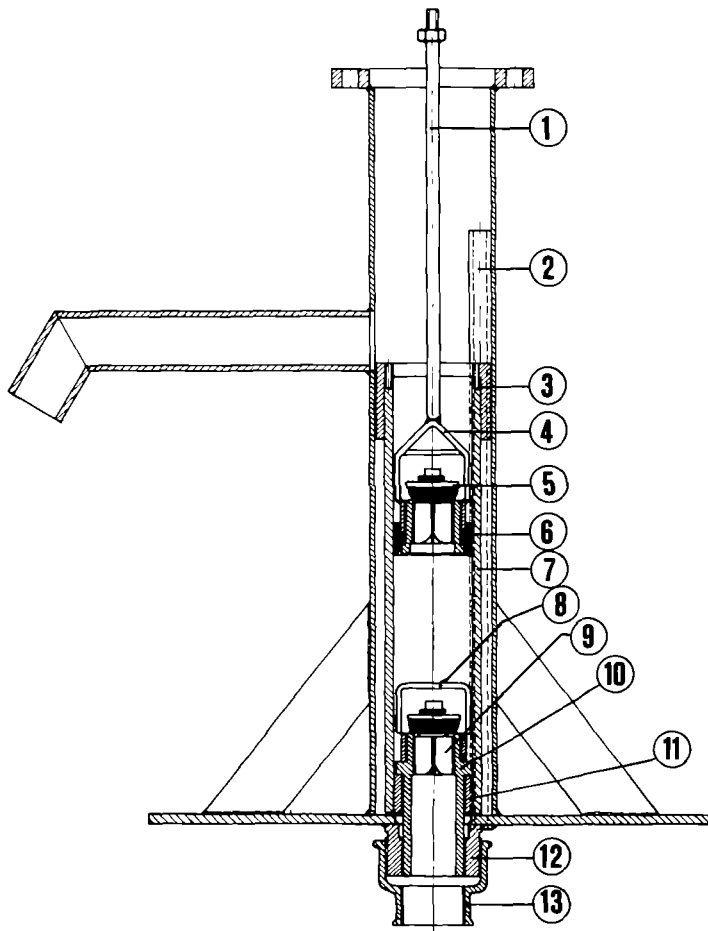
4.5 CONVERSION UNIT (SUCTION PUMP) FOR SWN 80/SWN 81 PUMPS

By screwing this conversion unit into the regular pump stand (page 28)

SWN 80 and SWN 81 pumps are transformed into suction pumps.

For this modification no additional pump rods, rising mains and cylinder are required, but only a suction pipe that has to be screwed into the socket at the bottom plate of the pump stand.

Normally, the conversion unit will be fitted inside the pump stand at the factory.

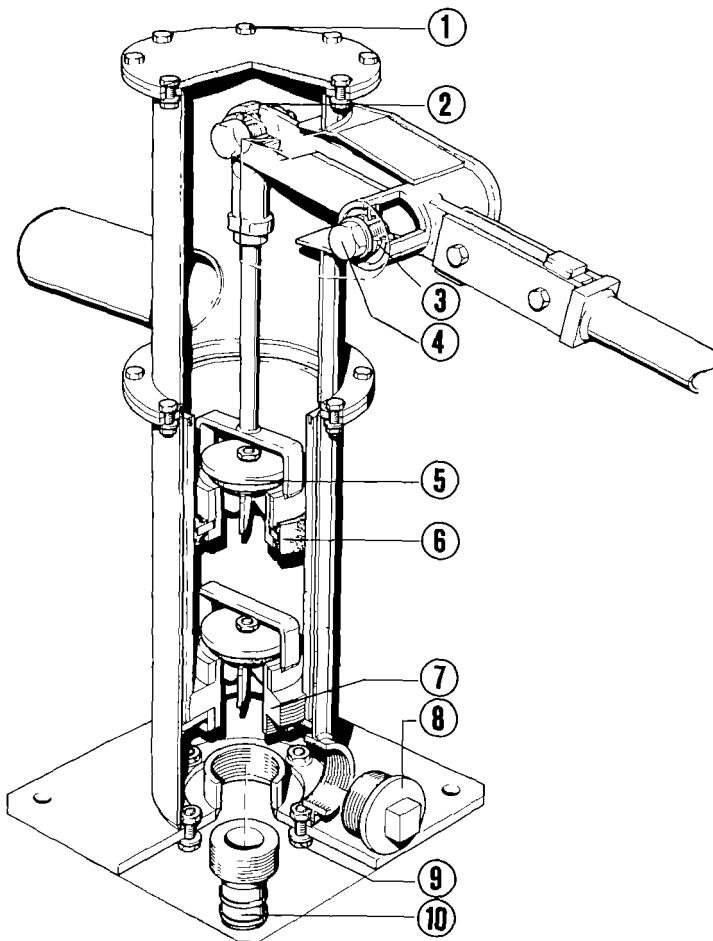


NO	DESCRIPTION
1	pump rod (\varnothing 10 mm stainless steel)
2	vent pipe
3	plug
4	valve stop/plunger body
5.	poppet valve assembly
6	cup seal
7	cylinder wall
8	valve stop
9.	poppet valve assembly
10	foot valve body
11.	plug
12	socket
13	reducer

4.6 SWN IRRIGATION PUMP

This pump, with an output of 4 litres per stroke, can be used in 2 situations:

- *on top of a well:*
 - screw plug (no. 8) closed and a 3" suction pipe connected to the socket in the base plate
- *on the bank of a river or pond:*
 - socket in foot plate closed by screwing the 3" plug (no. 8) into it; 3" suction pipe connected to the socket just above base plate.
Alternatively, a special (reinforced) 3" suction hose can be connected to this socket, using the special hose connector (no. 10).



NO	DESCRIPTION
1	bolts and nuts M10
2	rod and spherical bearing
3.	ball bearing
4.	pivot bolt M20
5	poppet valve assembly
6	cup seal
7	valve seat
8	screw plug (3" gas thread)
9.	bolts and nuts M10
10.	hose connection

5. KANGAROO PUMPS

Kangaroo pumps are operated by foot: the pump hood is pressed down and returns to its original position under the influence of a spring.

This spring was compressed during the downwards movement of the pump hood.

Because the force that can be exerted on the pump is limited to the body weight of the user, the pump operates with shallow groundwater only.

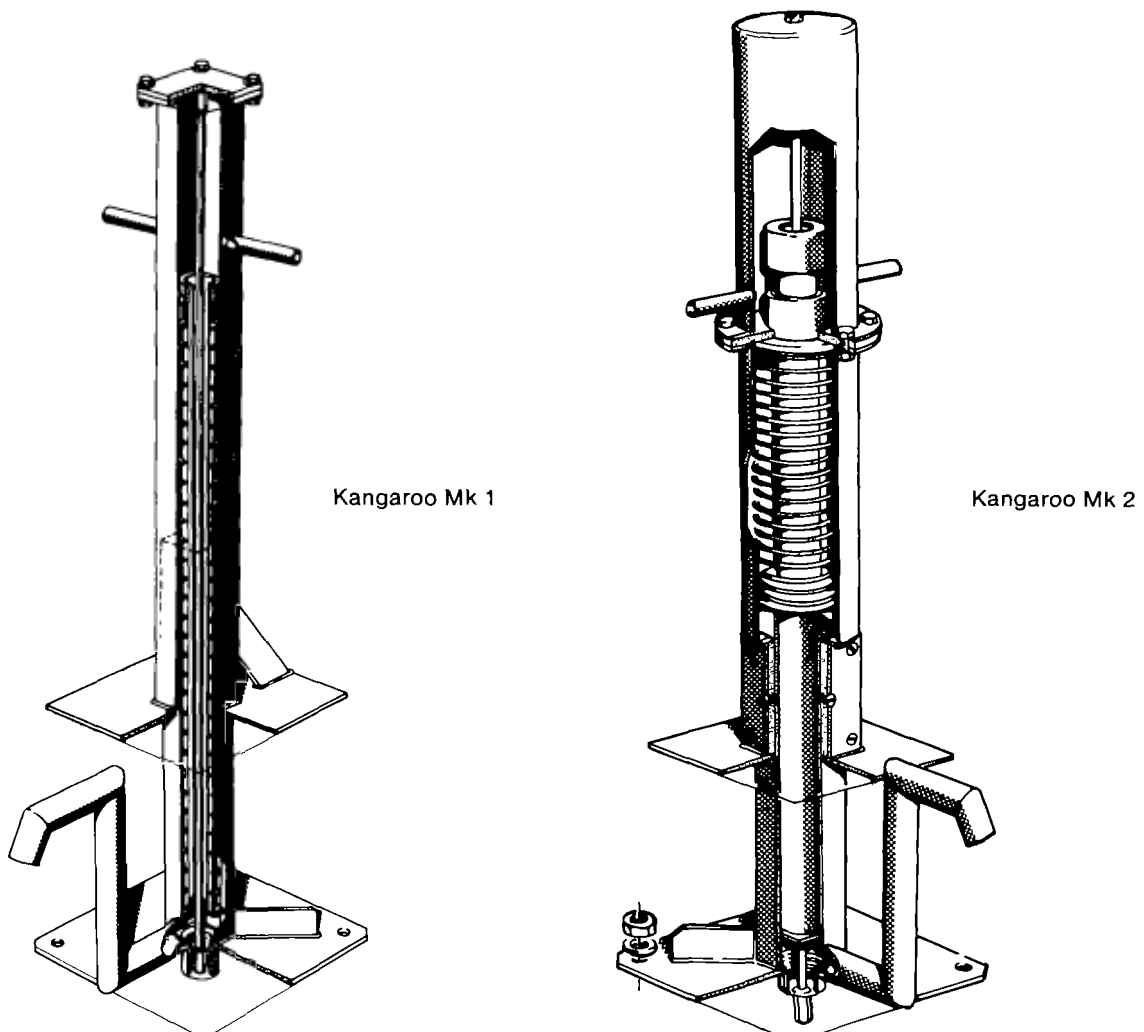
The maximum depth from which it can lift water with a 2" cylinder, is 10-15 m.

The great advantage of this pump is its lack of rotating or pivoting parts and its long stroke (about 400 mm) with the resulting high yields: 1.6-6.3 m³/hour, depending on the cylinder diameter.

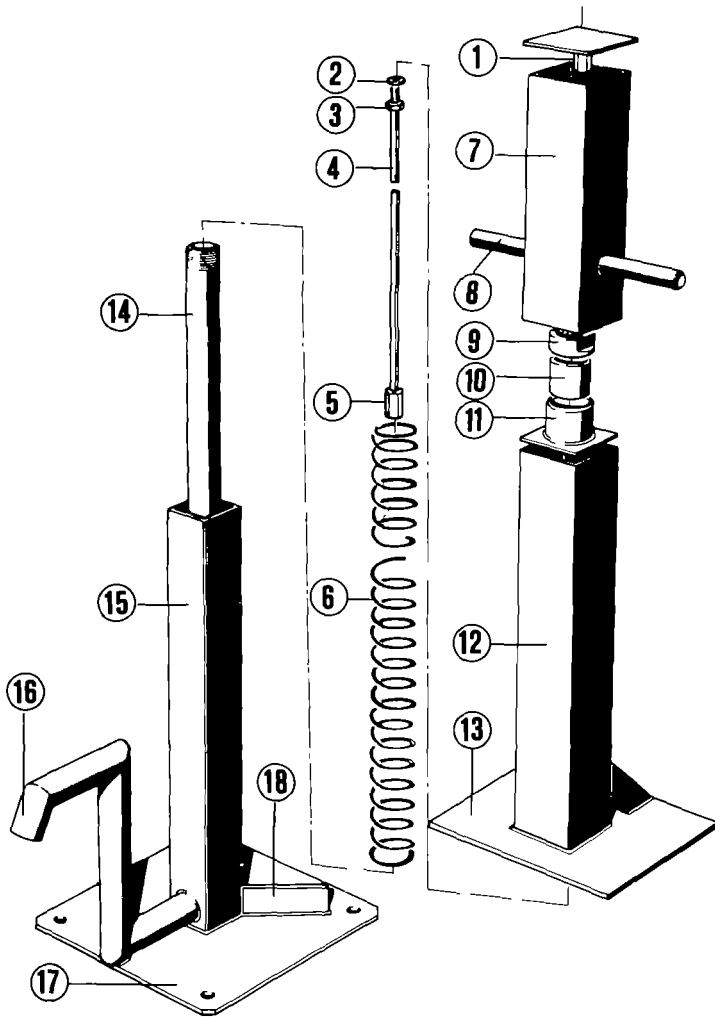
With a 4" cylinder the pump is most suitable for irrigation purposes, when the groundwater is not below 5 m.

Kangaroo pumps are available in 2 types:

- Kangaroo Mk 1 (square cross section) (page 36)
- Kangaroo Mk 2 (a heavy-duty pump with a circular cross section) (page 37).

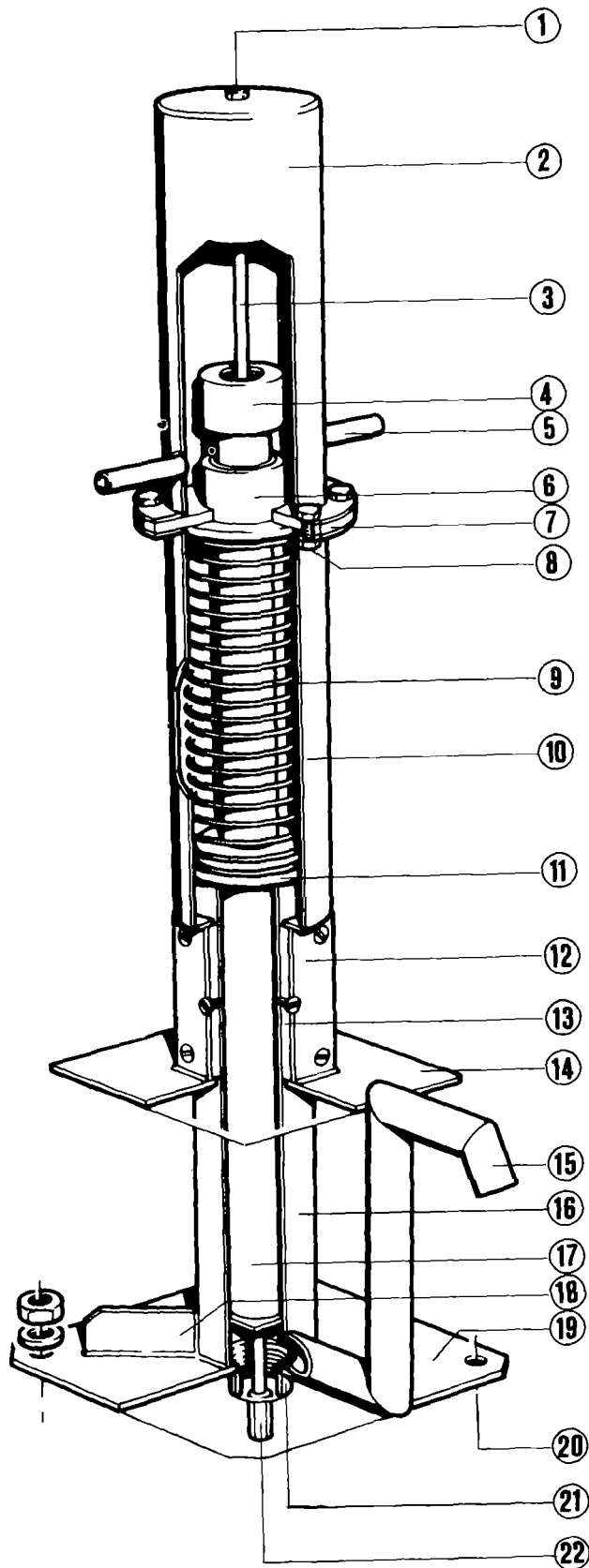


5.1 KANGAROO MK 1 PUMP (square cross section)



NO	DESCRIPTION
1	hex nut M10
2	washer
3	nut M10
4	pump rod
5	hex nut M10
6	compression spring
7	pump hood, upper part
8	handle
9	stroke limiter
10	guide bush
11	flange piece
12	pump hood, lower part
13	foot plate
14	column
15	steel tube
16	spout
17	base plate
18	pump stand brace

5.2 KANGAROO MK 2 PUMP (circular cross section)



NO	DESCRIPTION
1.	lock nut
2.	upper part of pump hood
3.	pump rod
4.	stroke limiter
5.	handles
6.	spring cap
7.	flange
8.	bolts and nuts (M10 x 30)
9.	compression spring
10.	lower part of pump hood
11.	spring cap
12.	steel tube
13.	lining of self-lubricating plastic material
14.	foot plate
15.	spout
16.	steel tube
17.	seamless steel pipe
18.	pump stand brace
19.	base plate
20.	hole
21.	threaded drop pipe connection
22.	threaded pump rod connector

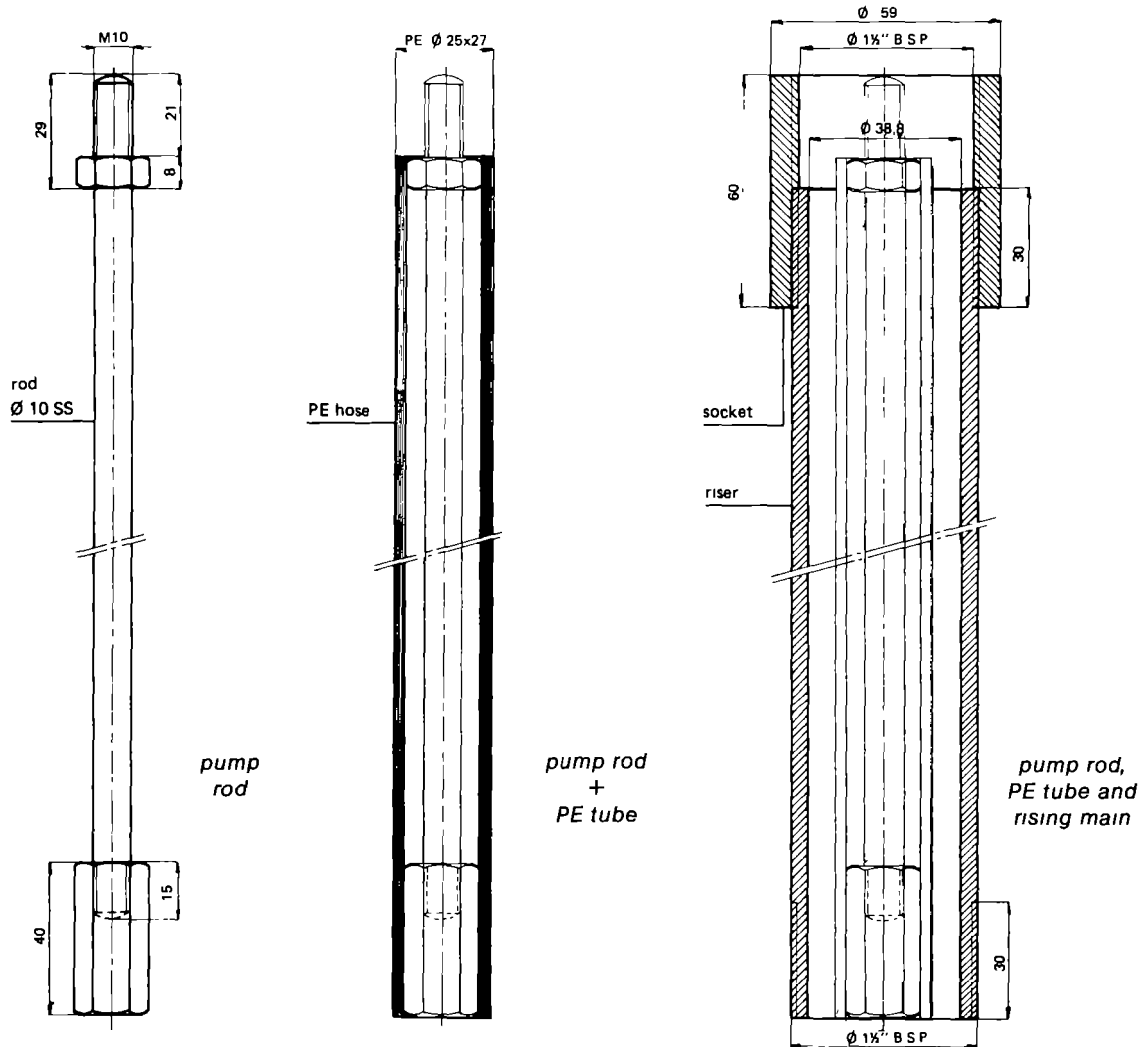
6. PUMP RISERS AND RODS

Pump rods and risers are standardized for all SWN 80, SWN 81 and Kangaroo pumps (except suction type pumps).

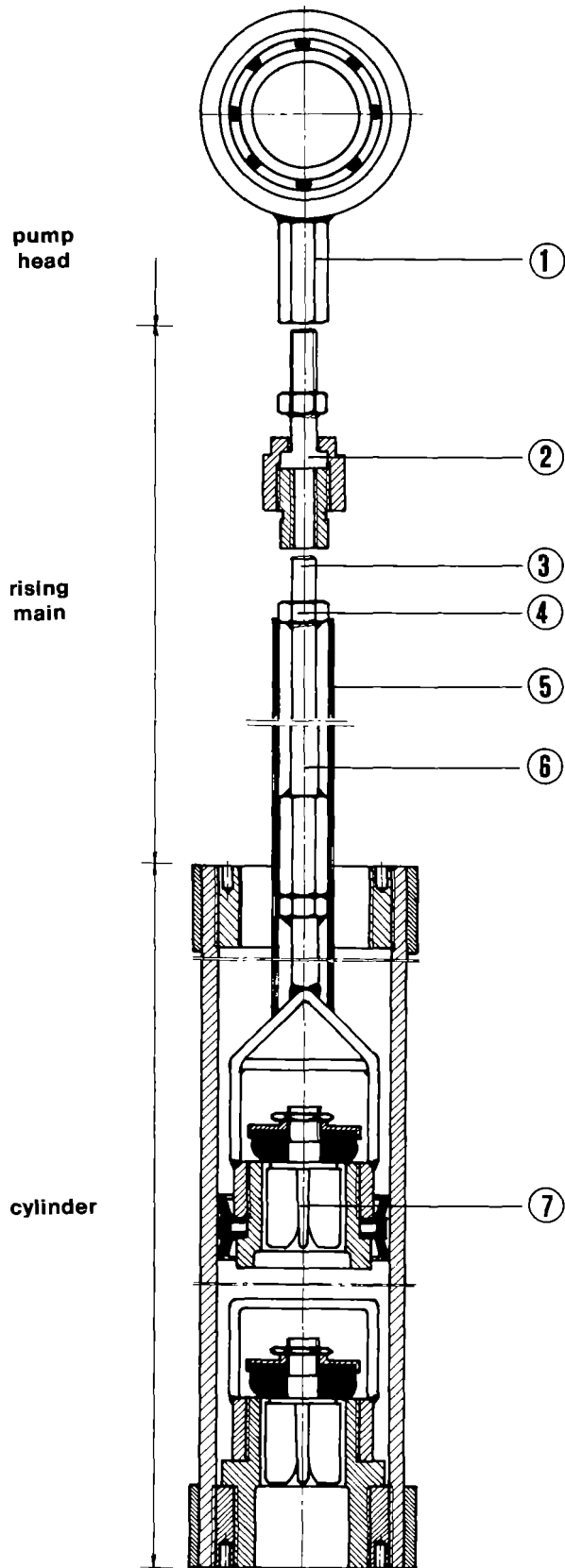
The pump rods are of stainless steel and have a diameter of 10 mm. They are jointed by stainless steel hexagonal connectors, nuts (M10).

Pump rods are fastened to the pump rod connector in the pump head and to the piston assembly in the cylinder. The figure on page 39 shows this for an SWN 80/81 pump.

PE tube is pushed over the pump rods to prevent them from scratching the riser pipe. Riser pipes are thick-walled P.V.C. pipes (48/36 mm diameter).



*Schematics for jointing pump head,
pump rod and cylinder*



NO.	DESCRIPTION
1.	pump rod connector (hexagonal long nut, M10)
2.	pump rod swivel (optional)
3.	threaded M10 (stainless steel)
4.	counter nut M10 (stainless steel)
5.	PE hose/pipe
6.	stainless steel pump rod, 10 mm dia
7.	piston assembly

6.1 PUMP RISERS/RODS

Pump rods, PE tube and P.V.C. rising main are available in standard lengths only.

Standard lengths are:

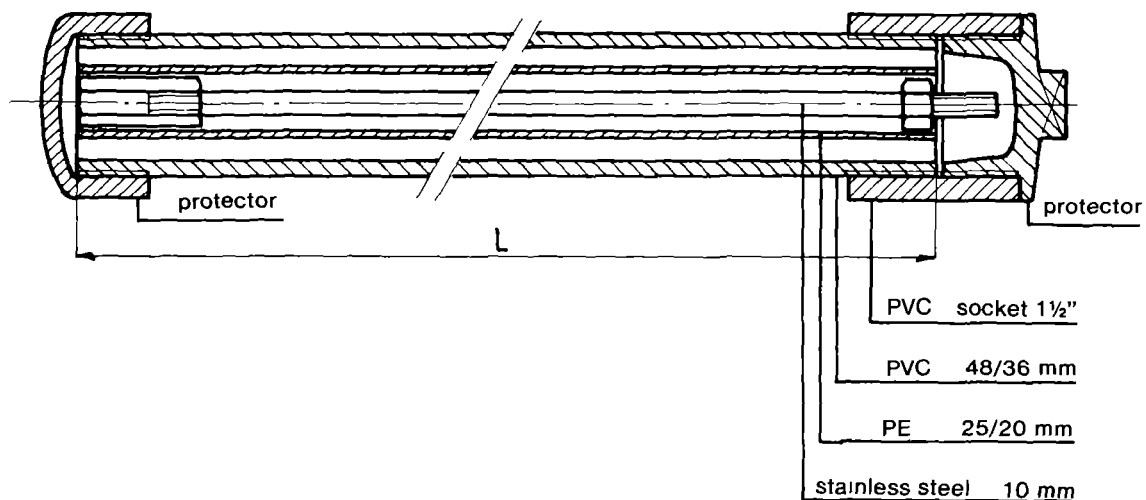
- 0.75 m
- 1.50 m
- 2.00 m
- 3.00 m
- 4.00 m

The required numbers and lengths of pump rods etc. can be found on the next page.

Pump rods with PE covering hose and rising mains are available in standard sets, as illustrated below.

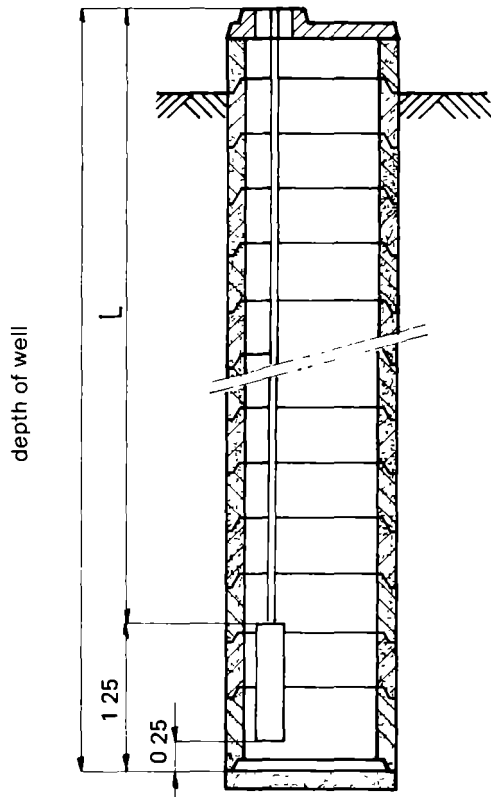
Only for the connection of the pump riser/rod assembly and the pump head itself, separate pump rods are available:

- 0.75 m for use with standard pump stand (page 28)
- 0.375 m for use with short pump stand for rising wells (page 29) and for standard pump stand with pressure pump modification (page 31).

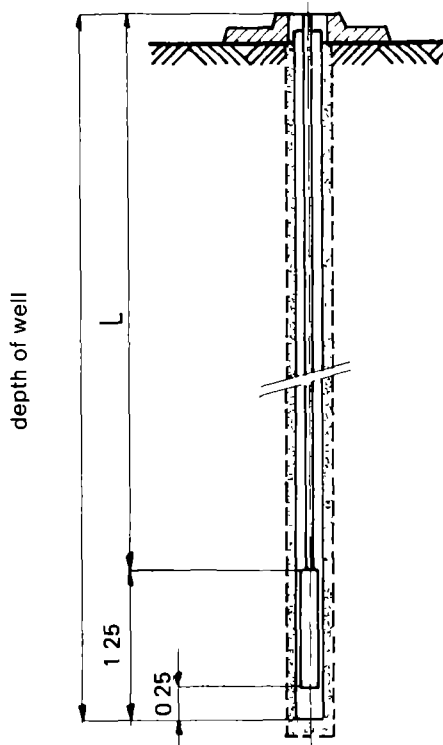


SWN riser/rod set

6.2 REQUIRED NUMBER OF RISER/ROD ASSEMBLIES FOR A SPECIFIC WELL DEPTH



dug well



tube well

For the standard cylinders of 1 meter length (page 44), the required total length of pump rod/rising main assemblies is found by deducting 1.25 m from the total well depth (calculated from well bottom to top of well cover).

This calculation can be made for both dug wells and tube wells.

The required number and type of pump riser/rod sets is shown in the table below:

depth of well	riser-rod length in metres					depth of well	riser-rod length in metres				
	4	3	2	1.5	0.75		4	3	2	1.5	0.75
2.00					1	17.00	3	1			1
2.25						17.50	3		1	1	1
2.50						18.00	4				1
2.75				1		18.50	3	1		1	1
3.00						19.00	3	1	1		1
3.25			1			19.50	4			1	1
3.50				1	1	20.00	4		1		1
3.75						21.00	4	1			1
4.00			1		1	22.00	5				1
4.25		1				23.00	4	1	1		1
4.50						24.00	5		1		1
4.75			1	1		25.00	5	1			1
5.00		1			1	26.00	6				1
5.25	1					27.00	5	1	2		1
5.50			1	1	1	28.00	6		1		1
5.75		1		1		29.00	6	1			1
6.00	1				1	30.00	7				1
6.25		1	1			31.00	6	1	1		1
6.50		1		1	1	32.00	7		1		1
6.75	1			1		33.00	7	1			1
7.00		1	1		1	34.00	8				1
7.25	1		1			35.00	7	1	1		1
7.50		1		1	1	36.00	8		1		1
7.75		1	1	1		37.00	8	1			1
8.00	1		1		1	38.00	9				1
8.25		1	1			39.00	8	1	1		1
8.50		1	1	1	1	40.00	9		1		1
8.75	1		1	1		41.00	9	1			1
9.00		1	1		1	42.00	10				1
9.25		2				43.00	9	1	1		1
9.50	1		1	1	1	44.00	10		1		1
9.75		1	1	1		45.00	10	1			1
10.00	2				1	46.00	11				1
10.50		1	1	1	1	47.00	10	1	1		1
11.00	1	1	1	1		48.00	11		1		1
11.50	2		1	1	1	49.00	11	1			1
12.00	2		1		1	50.00	12				1
12.50	1	1	1	1	1	55.00	12	1	1		1
13.00	2	1			1	60.00	14		1		1
13.50	2		1	1	1	65.00	15	1			1
14.00	3				1	70.00	17				1
14.50	2	1		1	1	75.00	17	1	1		1
15.00	2	1	1		1	80.00	19		1		1
15.50	3			1	1	85.00	20	1			1
16.00	3		1		1	90.00	22				1
16.50	2	1	1	1	1	100.00	24		1		1

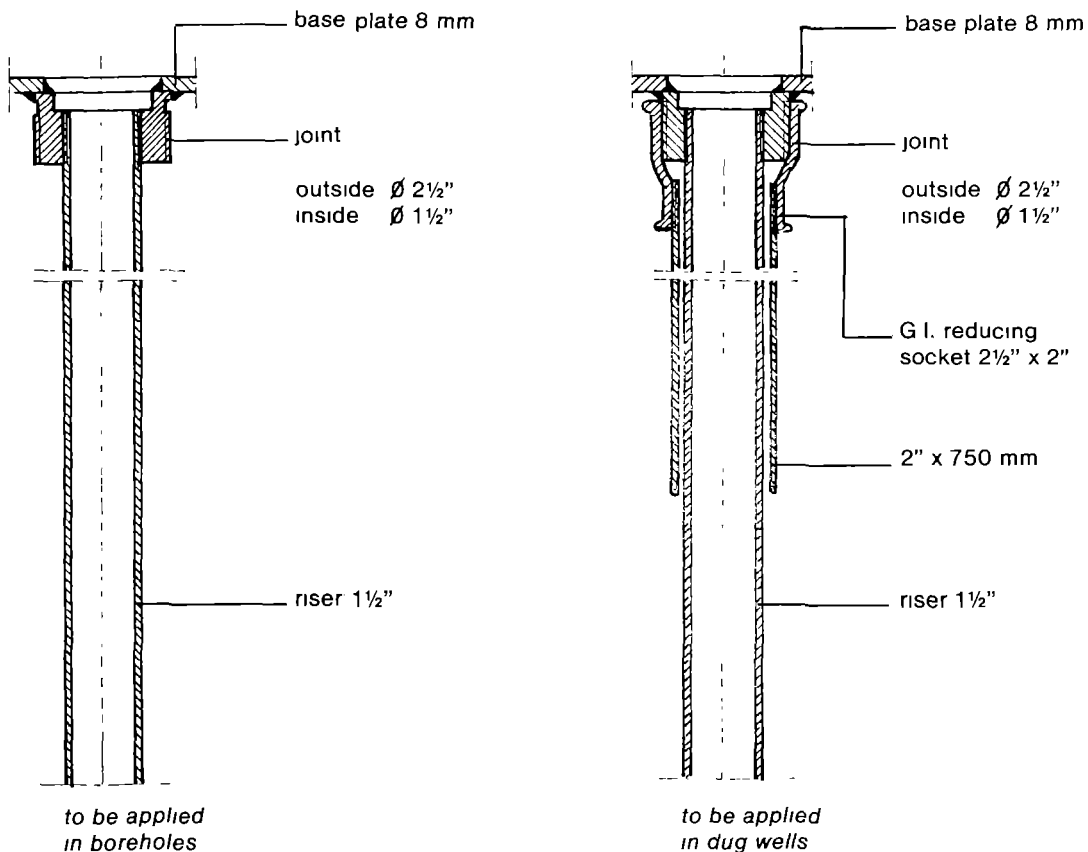
6.3 ANTI SWINGING DEVICES FOR RISER PIPE

In certain cases a riser pipe installed in a large-diameter well may break due to a swinging motion of the pipe that is generated by the process of pumping itself.

Swinging of cylinders and riser pipe can be reduced, also for large-diameter wells, by increasing the stiffness of the riser pipe itself.

This can be achieved by installing a larger-diameter pipe around the uppermost pipe section.

In order to allow the connection of the various pipes and reducers shown in these figures, all new SWN hand pumps are equipped with a special fitting that is threaded internally ($1\frac{1}{2}$ " BSP) and externally ($2\frac{1}{2}$ " BSP).

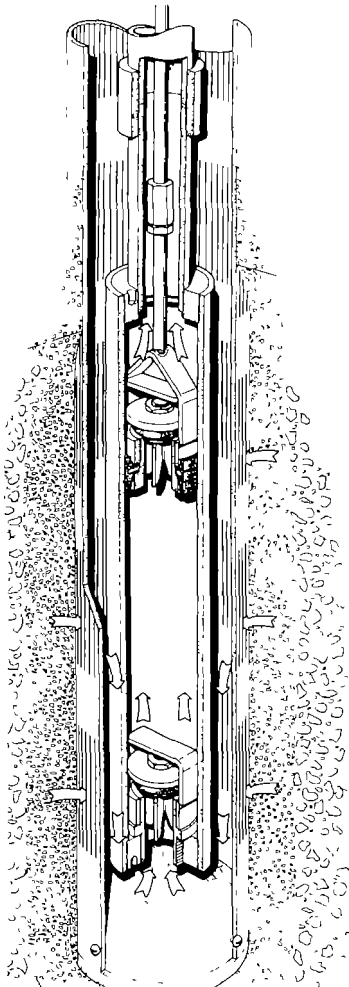


7. CYLINDER ASSEMBLY (UNIVERSAL)

Universal cylinder assemblies are used for all SWN 80/SWN 81 and Kangaroo pumps (except the suction pumps).

The cylinders are typically 1.00 meter long and are available in 4 sizes:

nominal cylinder size	internal cylinder wall diameter	wall thickness
2"	50.2 – 50.5 mm	5.5 mm
2½"	63.2 – 63.5 mm	6.5 mm
3"	75.2 – 75.5 mm	9.0 mm
4"	100.2 – 100.5 mm	5.5 mm



Cylinder assemblies are composed of 3 main components:

- cylinder wall (with top and bottom plugs)
- piston assembly
- foot valve assembly.

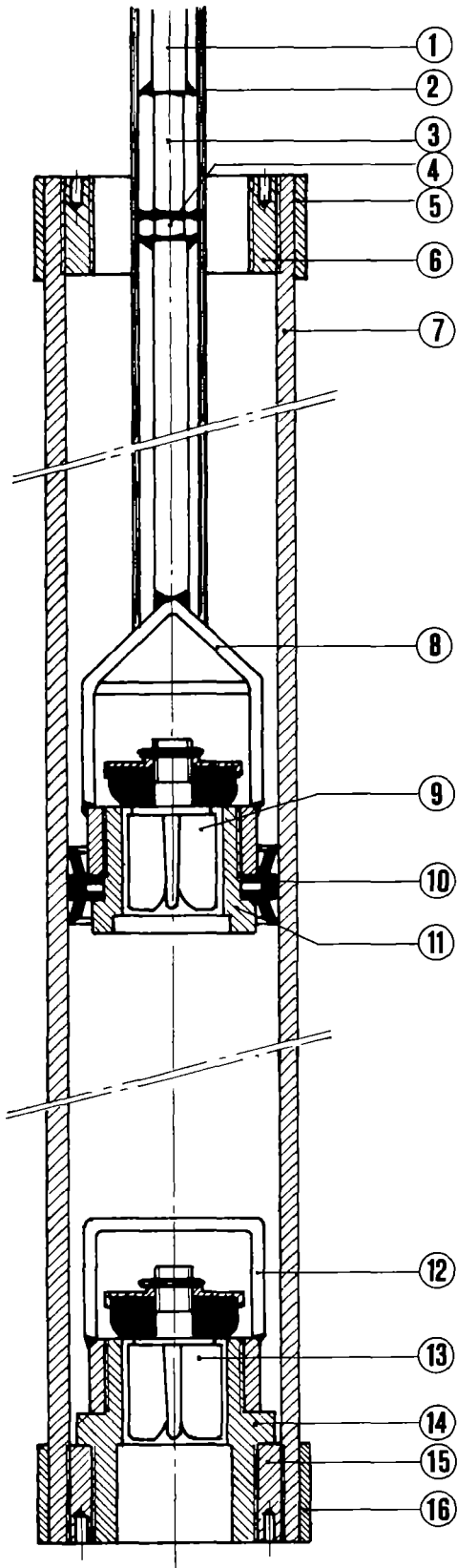
The cylinder wall is made of thick-walled P.V.C. and the other assemblies are also made of corrosion free materials: stainless steel, nylon, neoprene rubber and brass.

The piston has a heavy-duty, double acting piston sleeve of acrylonitrile butadiene rubber, as found in the hydraulic system of heavy earth moving equipment. Even after years of intensive use virtually no wear of the piston sleeve or the cylinder wall will take place, provided that the well itself has been well constructed and developed, so that it yields sand-free water.

For deep aquifers the cylinder assemblies are available also in a 'deep well' version, with stainless steel reinforcing bands around the ends of the cylinder (as shown on the next page).

Open-worked drawing of cylinder assembly in filter pipe of tube well

CYLINDER ASSEMBLY

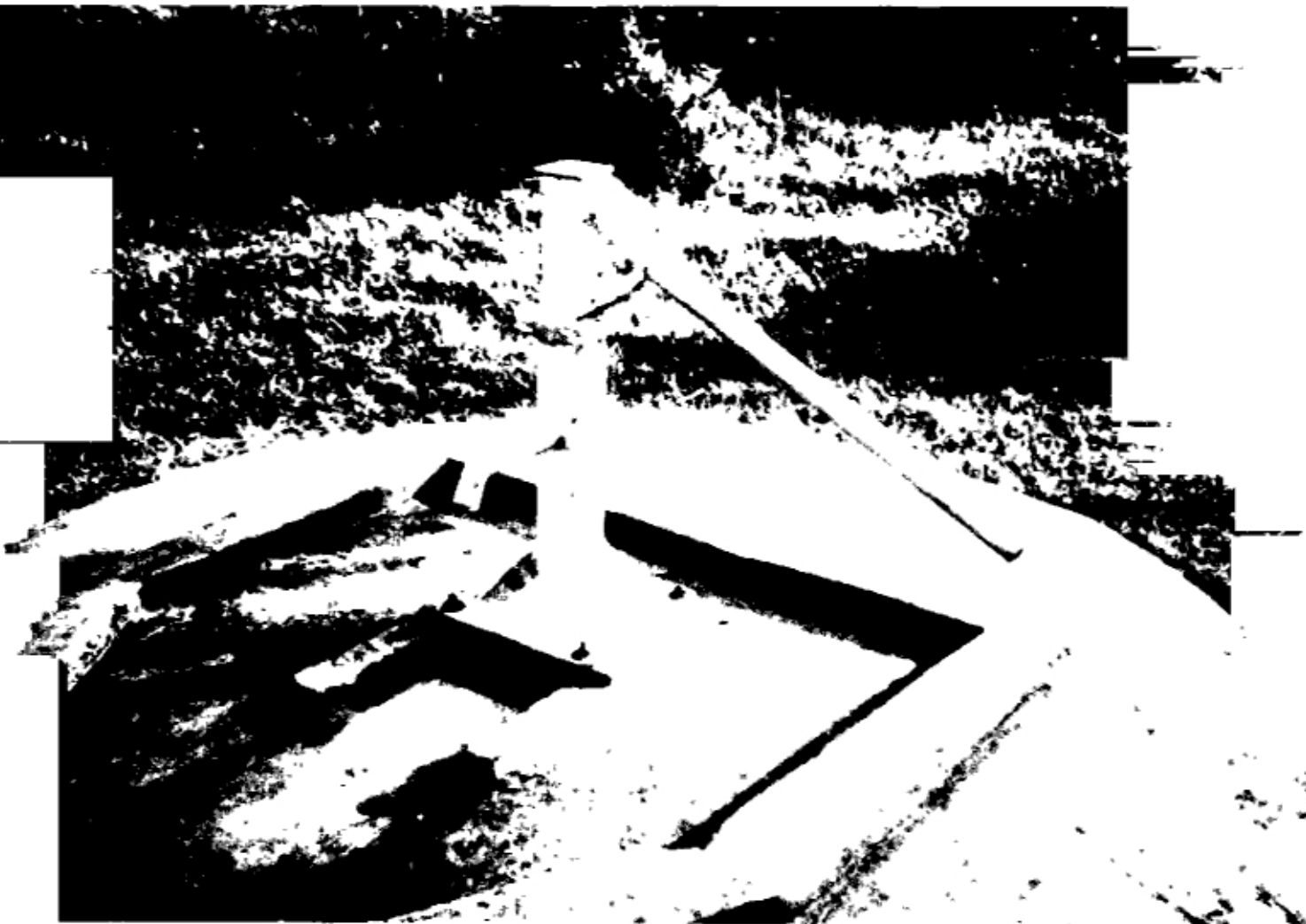


NO	DESCRIPTION
1	pump rod (\varnothing 10 mm stainless steel)
2	PE tube (\varnothing 25/20 mm)
3	hexagonal nut (M10, stainless steel)
4	counter nut (M10, stainless steel)
5	reinforcing band (stainless steel, for deepwell cylinders only)
6	plug (PVC)
7	cylinder wall (thick-walled PVC, see previous page for dimensions)
8	valve stop/plunger body (stainless steel)
9	poppet valve assembly (rubber/brass)
10	cup seal with double-acting piston sleeve
11	piston valve body (nylon)
12	valve stop (stainless steel)
13	poppet valve assembly (identical to that in piston)
14	foot valve body (nylon)
15	plug (PVC, identical to plug in top of cylinder)
16	reinforcing band (stainless steel, identical to that around top of cylinder)

8. INSTRUCTIONS FOR PUMP INSTALLATION

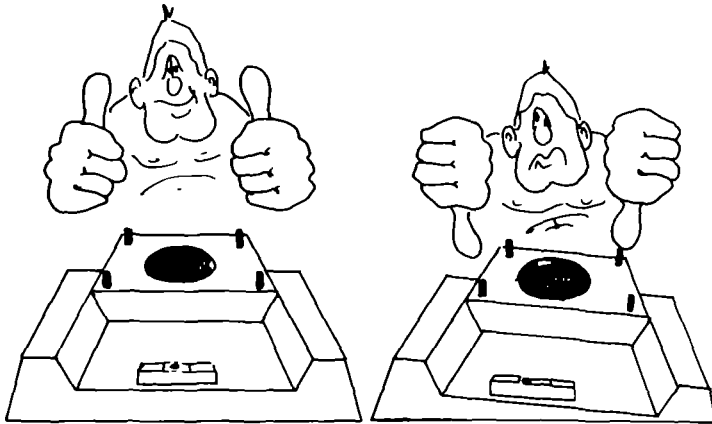
Instructions for the installation of hand and foot pumps are given in 7 sections:

- A. Installation of underground part (cylinder + rising main), for SWN 80/SWN 81 and Kangaroo pumps.
- B. Installation of SWN 80 or SWN 81 pump.
- C. Installation of SWN 80 duplex pump.
- D. Installation of SWN 80 or SWN 81 pump with pressure pump conversion unit.
- E. Installation of SWN 80 or SWN 81 pump with suction pump conversion unit.
- F. Installation of Kangaroo Mk 1 or Mk 2 pump.
- G. Installation of irrigation pump.

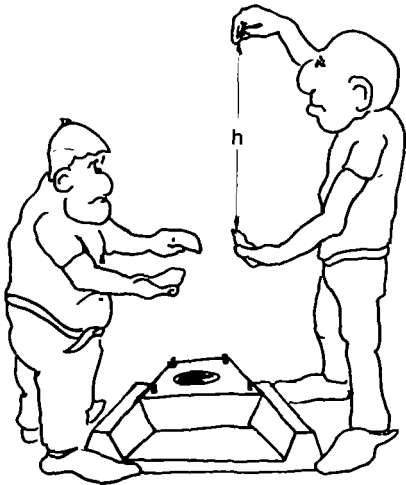


SWN 80

8. A. INSTALLATION OF UNDERGROUND PART
(for SWN 80, SWN 81 and Kangaroo pumps; not for suction pumps)



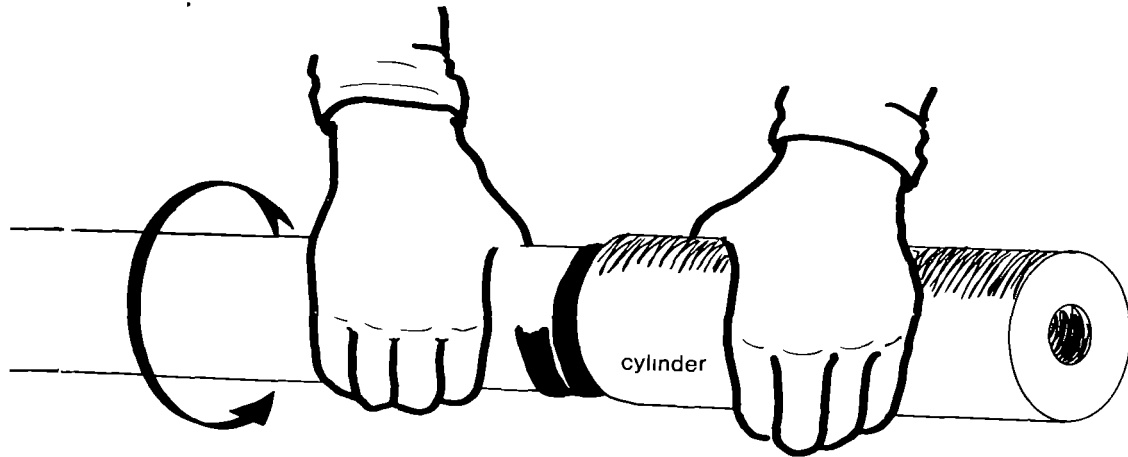
A.1
Check that the pump base is flat and level, and the anchor bolts are solidly embedded in the concrete.



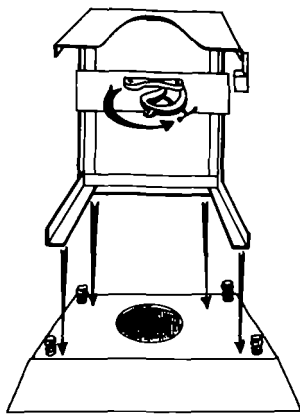
A.2
Measure the total depth (h) of the well, between the top of the pump base and the bottom of the well, by means of a rope.
Determine the number of riser-rod elements according to the instructions on page 41.



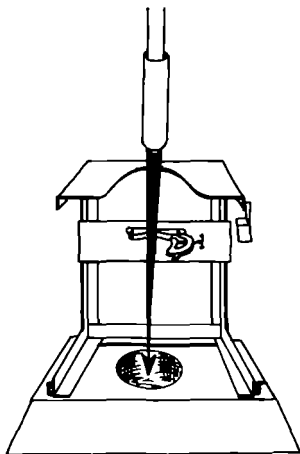
A.3
Check the performance of the cylinder in a bucket of water.



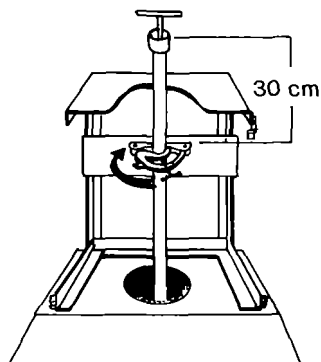
A.7
Connect the riser to the cylinder by hand as far as the end of the thread connection.

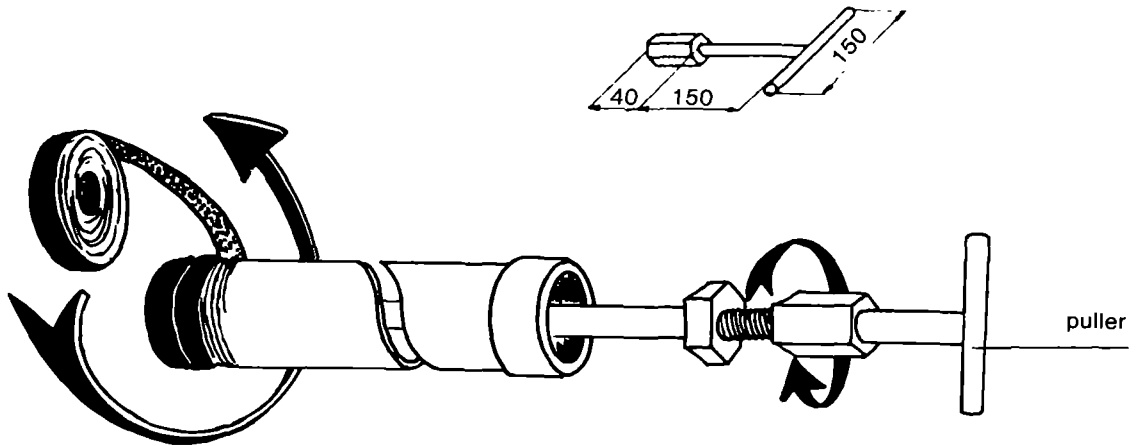


A.8
Place the installation jack over the well and open the clamp.

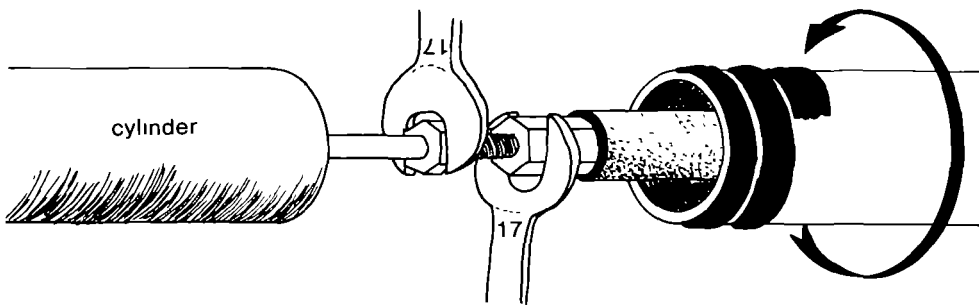


A.9
Lift the cylinder with the riser-rod element vertically over the well and lower it until the top of the riser is about 80 cm above ground level. Close the clamp.

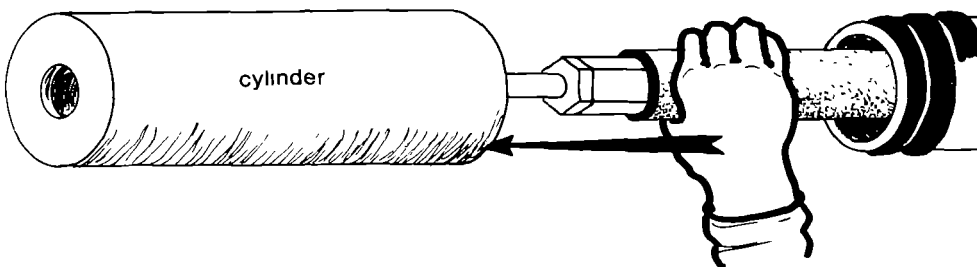




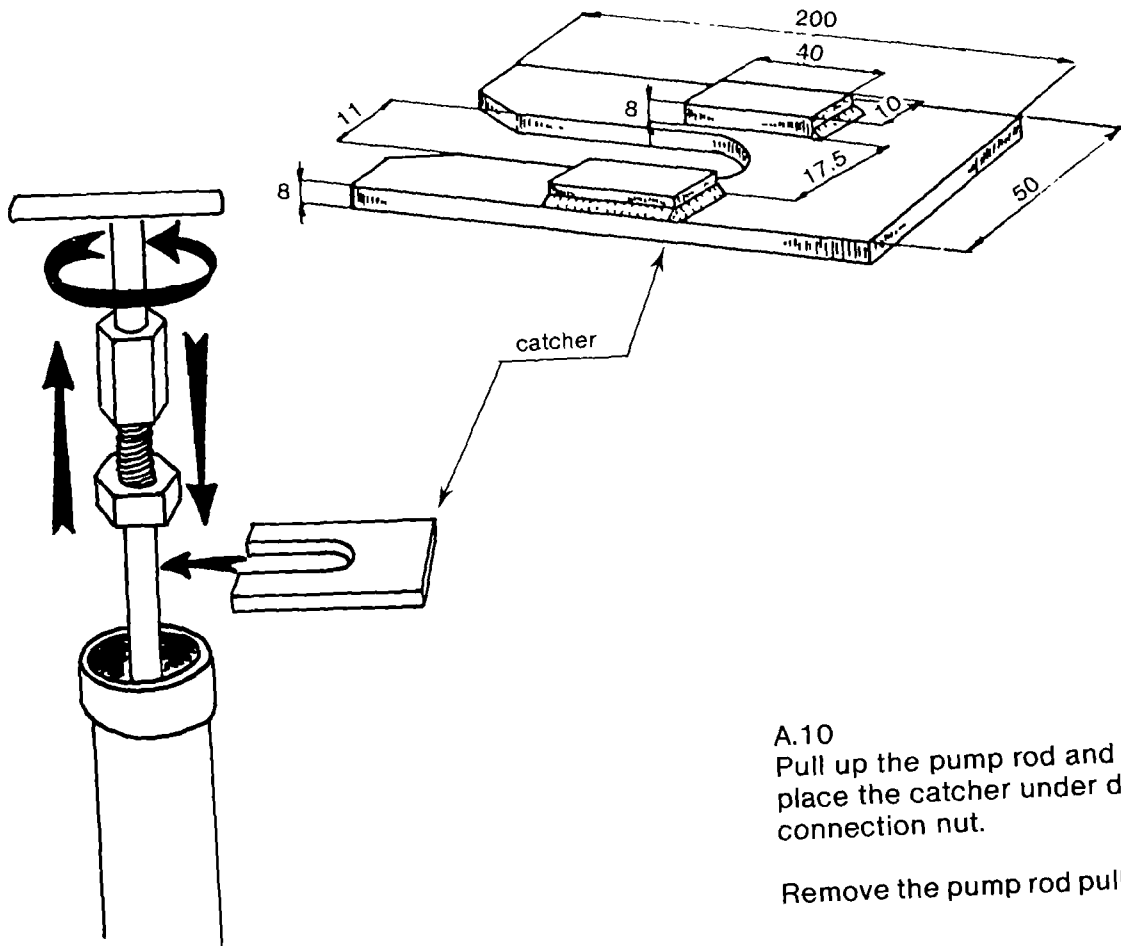
A.4
Remove the thread protectors from the first riser-rod element. Put a good sealing material (teflon tape) on the thread and screw the pump rod puller onto the pump rod on the other side of the riser pipe.



A.5
Connect (in horizontal position) the pump rod of the riser-rod element to the piston rod of the cylinder. Use two spanners no. 17.

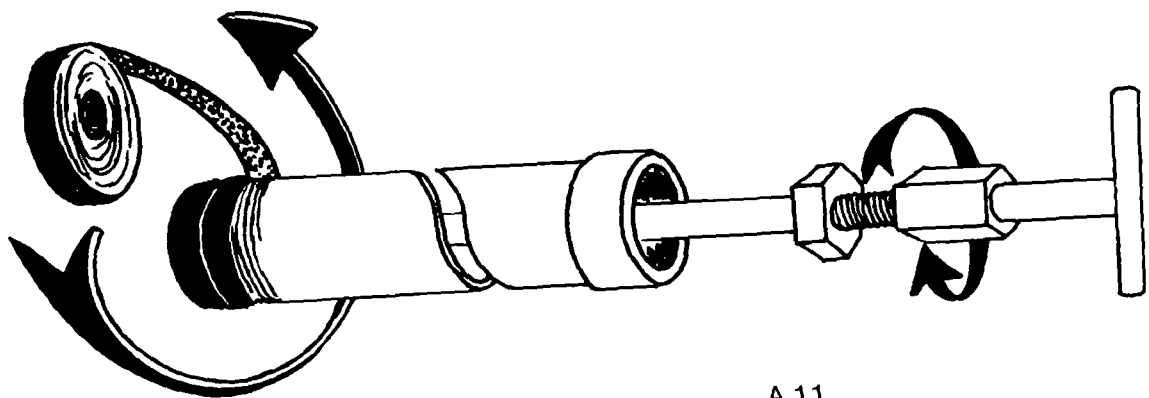


A.6
Slide the PE tube over the pump rod connector till it hits the piston.

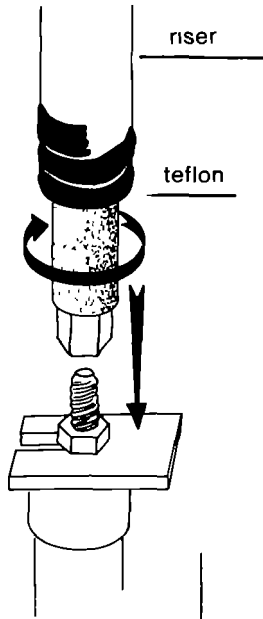


A.10
Pull up the pump rod and place the catcher under the connection nut.

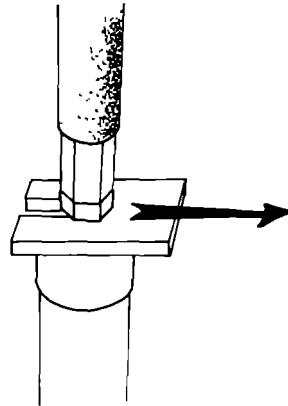
Remove the pump rod puller.



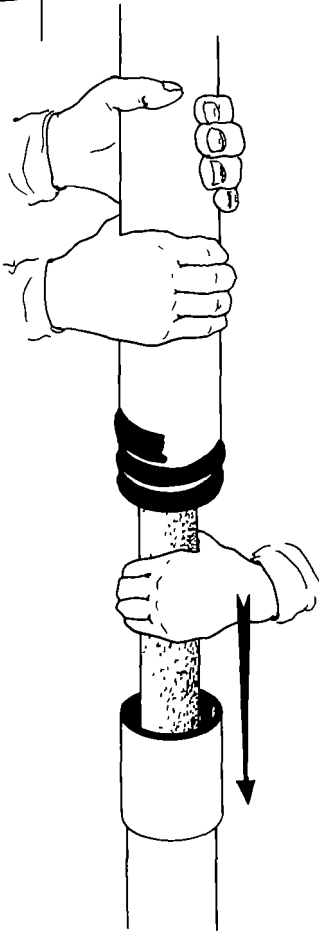
A.11
Remove the thread protectors from the next riser-rod element and put a sealing material (teflon tape) on the threaded end. Place the pump rod puller on the pump rod on the other side of the riser.



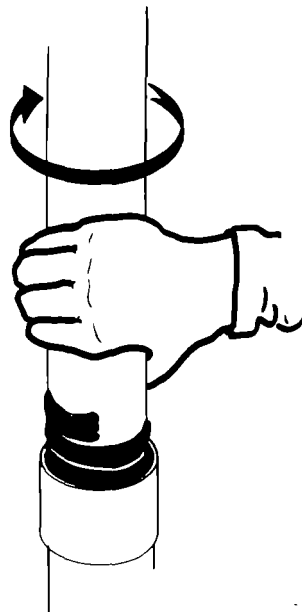
A.12
Lift the next riser-rod element vertically above the previous one and connect the pump rods with 2 spanners no. 17.



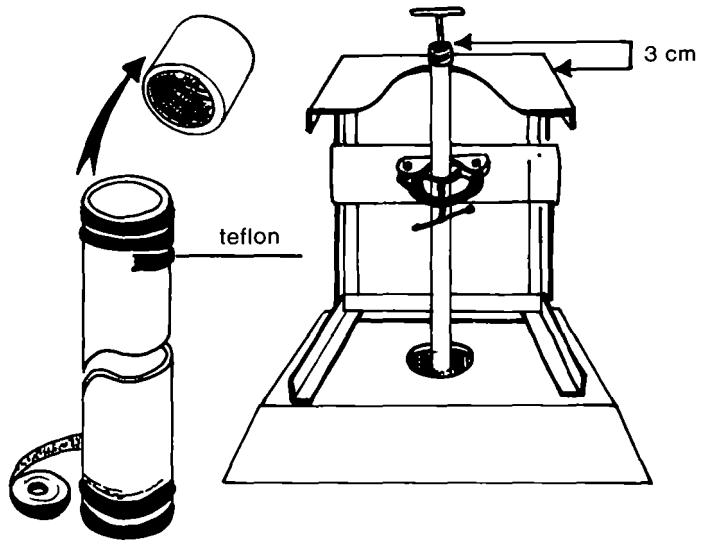
A.13
Remove the pump rod catcher and slide down the PE protecting tube.



A.14
Connect the risers in the PVC socket and be sure that the combination is vertical during this operation.



A.15
All following riser-rod elements must be installed in the same way; repeat the previous steps, starting from A.11.

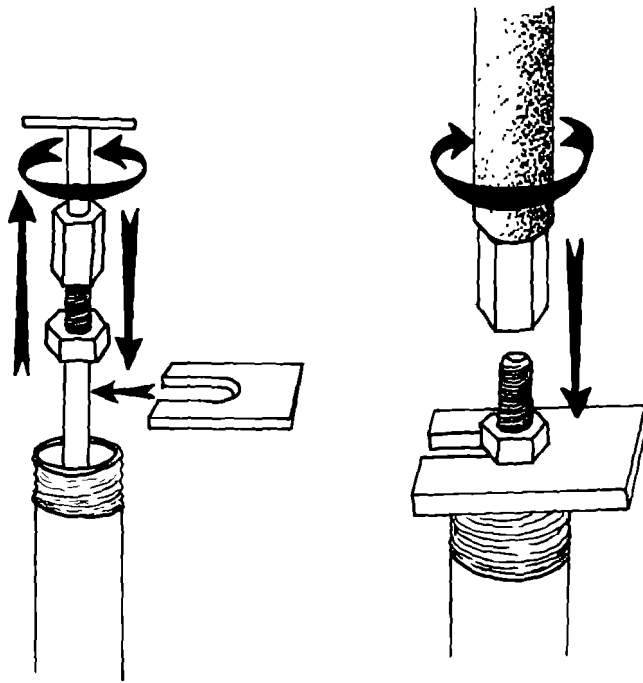


A.16
Remove the 1½" socket from the last riser and put a sealing material on the threaded end.

Lower the element as described before to about 3 cm above the top plate of the installation jack.

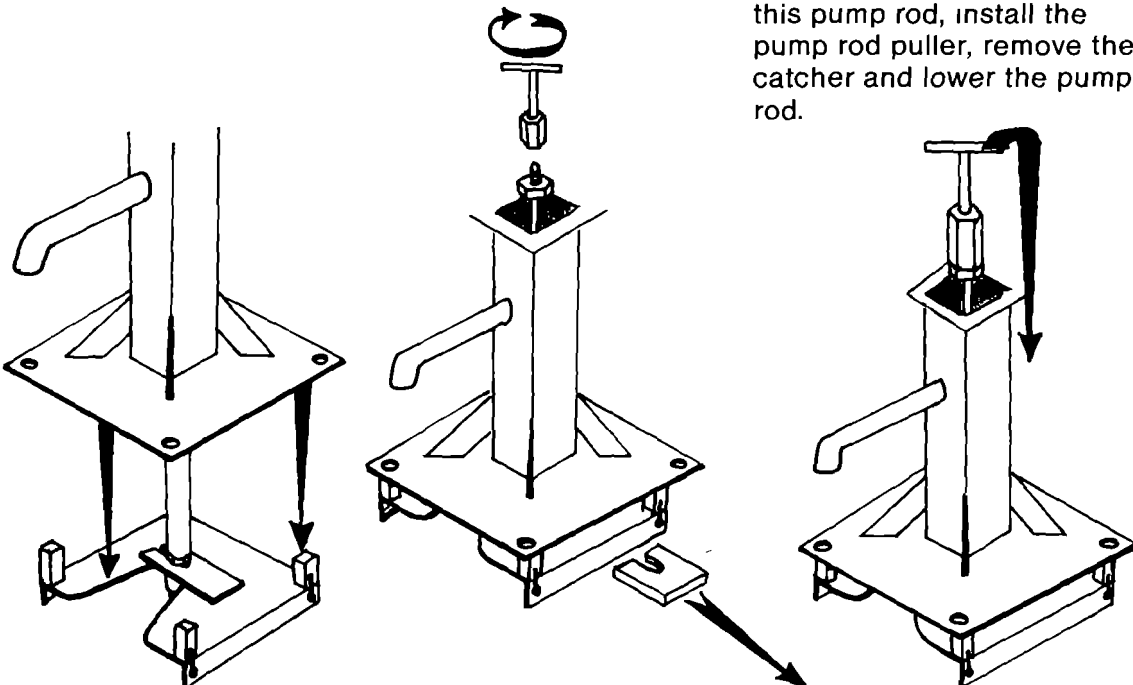
**8. B. INSTALLATION OF SWN 80/SWN 81 PUMP
(not for suction pumps)**

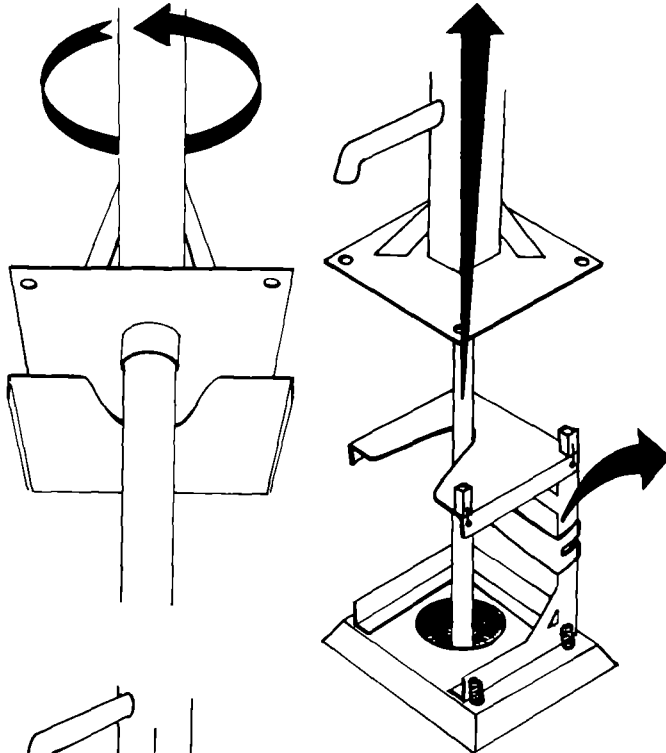
B.1
First install underground part
(steps A.1 through A.16)



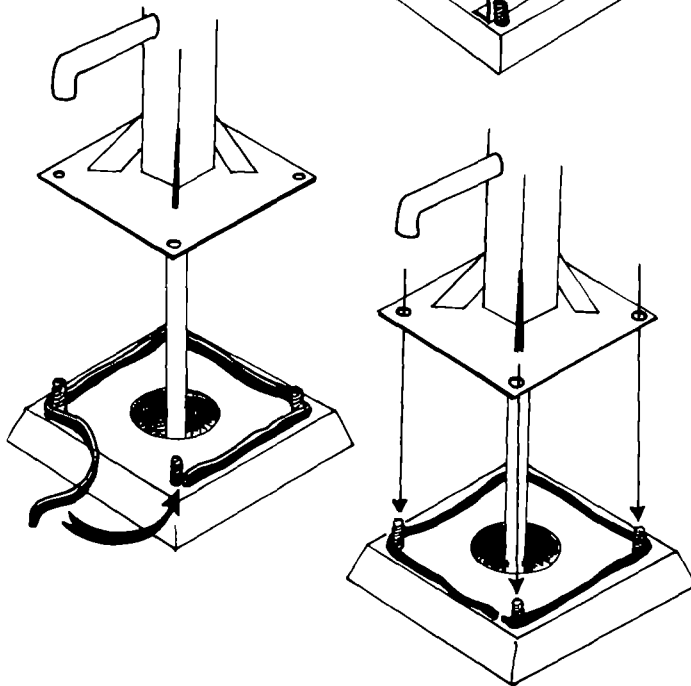
B.2
Lift the pump rod puller,
place the catcher, remove
the puller and install a pump
rod of 75 cm (37.5 cm if the
special, short pump stand for
ring wells (page 29) is used).

B.3
Place the pump stand over
this pump rod, install the
pump rod puller, remove the
catcher and lower the pump
rod.



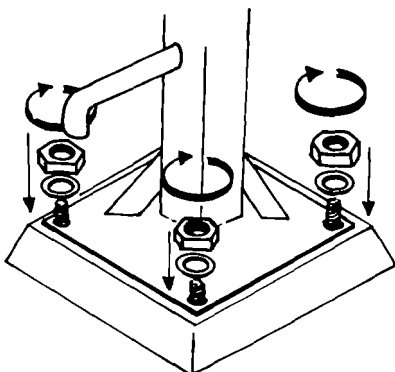


B.4
Connect the riser to the pump stand. Keep the foot plate parallel to the top plate of the installation jack during this operation.



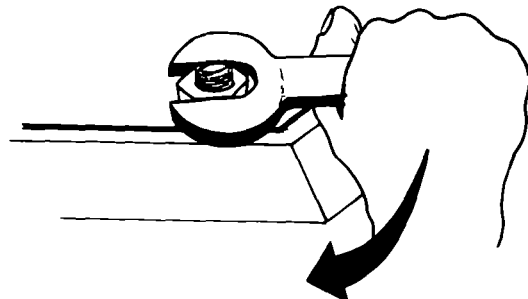
B.5
Lift the riser-rod/cylinder combination and remove the jack.

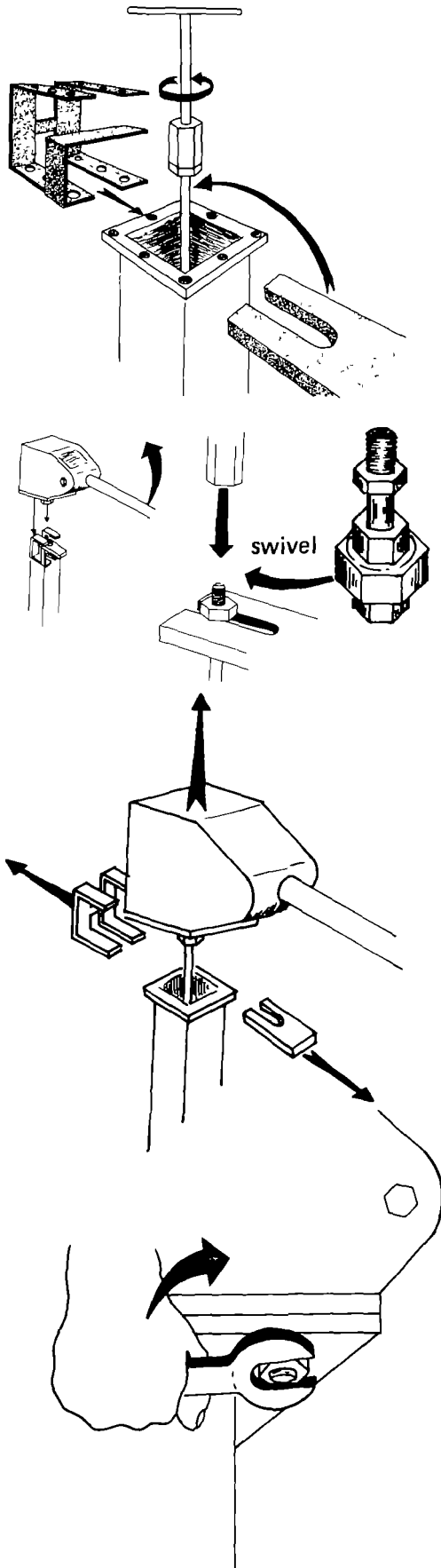
Put a sealing strip on the outside edge of the pump base. Lower the foot plate over the anchor bolts.



B.6
Tighten the nuts firmly.

Do not forget the washers!



**B.7**

Pull up the pump rod, place the mounting shackle, put the catcher underneath the connection nut and remove the puller.

B.8

Put the SWN 80 or 81 pump head on top of the mounting shackle.

Move the handle up until the pump rod connector in the pump head (long hexagonal nut) touches the pump rod.

Connect the pump rod to the pump rod connector.

(Optional) Install the swivel between pump rod and pump rod connector.

B.9

Remove the catcher, lift the pump head, remove the mounting shackle and clean the flanges.

B.10

Lower the studs in the holes of the flange of the pump stand.

Tighten the M12 nuts very firmly.

8. C. INSTALLATION OF SWN 80 DUPLEX PUMP

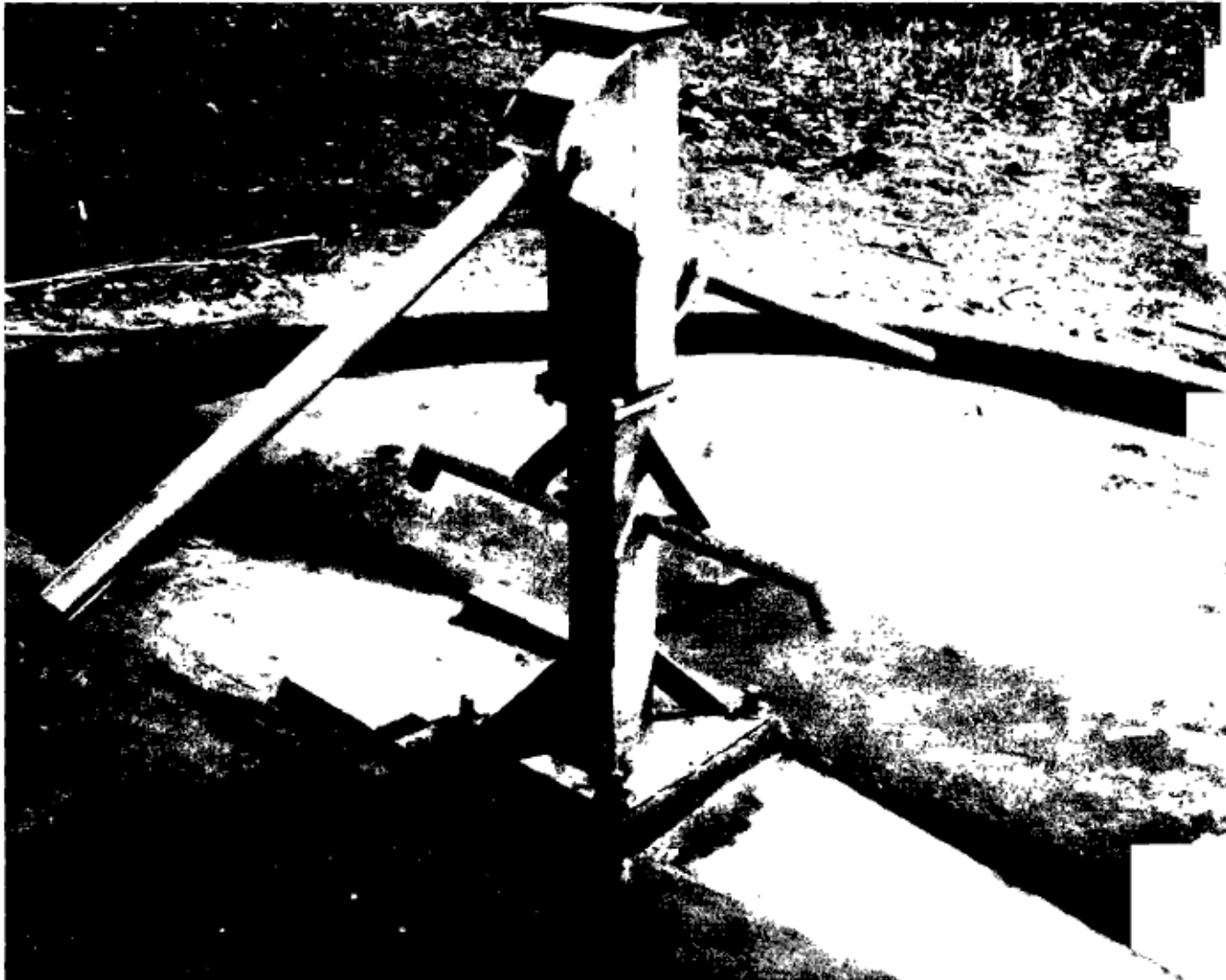
C.1

Install 2 cylinder/rising main combinations according to steps A.1 through A.16. Note that the rising mains must have different lengths: The longer rising main must be at least 1 m longer than the shorter one.

C.2

Place SWN 80 duplex pump stand and pump head, and assemble according to the instructions for single SWN 80/SWN 81 pumps, (steps B.1 through B.10) but in this case with one pump rod at either side of the partition in the special SWN 80 duplex pump stand.

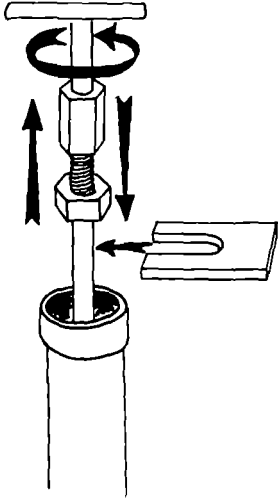
Duplex pump



8. D. INSTALLATION OF SWN 80 or SWN 81 WITH PRESSURE PUMP CONVERSION UNIT

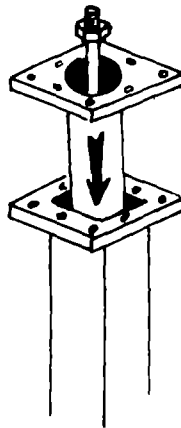
D.1

Install the cylinder/rising main assembly according to steps A.1 through A.16.



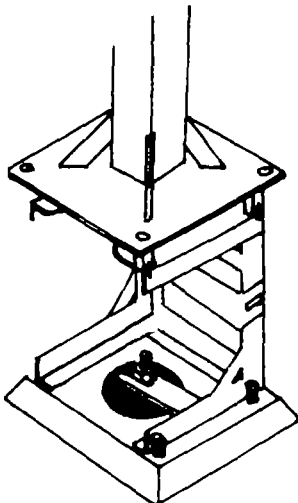
D.2

Lift the pump rod puller, place the catcher and remove the puller.



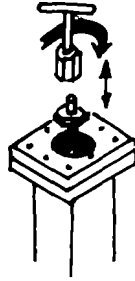
D.3

Attach a 37.5 cm long pump rod to the underside of the piston in the pressure pump conversion unit.

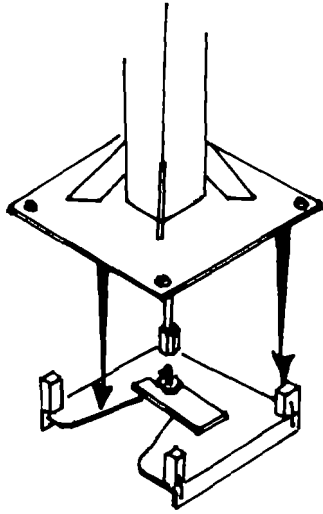


D.4

Lower the conversion unit into the pump stand and place both on top of the installation jack.

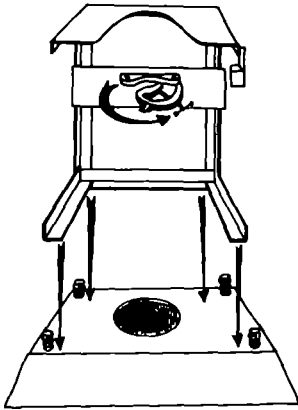


D.6
Continue installation of the SWN 80/SWN 81 pump head according to instructions B.4 through B.10.



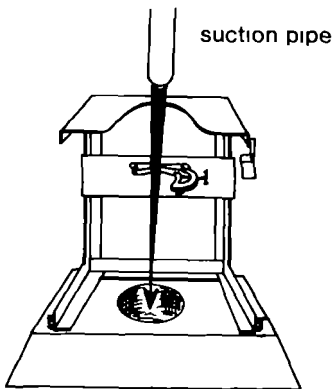
D.5
Screw the pump rod puller onto the uppermost pump rod of the pressure pump conversion unit. Then push it down and connect the lower pump rod of the conversion unit with the uppermost pump rod of the rising main.

8. E. INSTALLATION OF SWN 80/SWN 81 PUMP WITH SUCTION PUMP CONVERSION UNIT



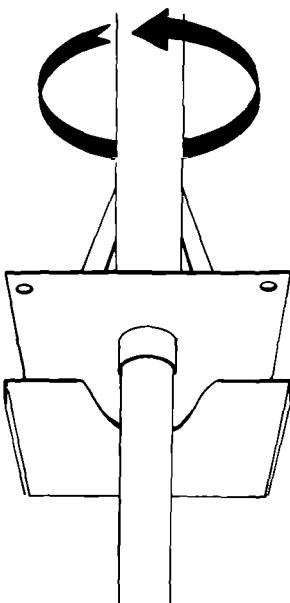
E.1

Place the installation jack over the well and open the clamp.



E.2

Lower suction pipe into the well upto approx. 3 cm above the top plate of the installation jack.



E.3

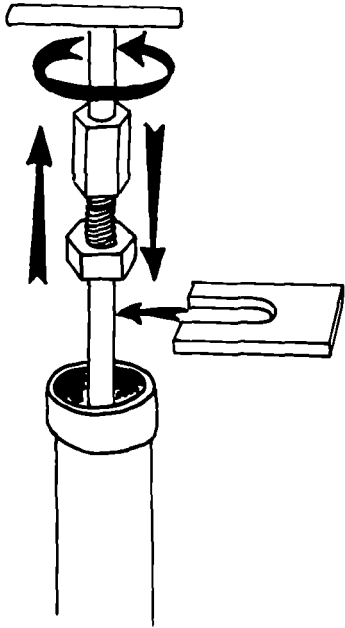
Place the pump stand with built-in suction pump conversion unit on top of the installation jack.

Connect the suction pipe to the pump stand. Keep the foot plate parallel to the top plate of the installation jack during this operation.

E.4

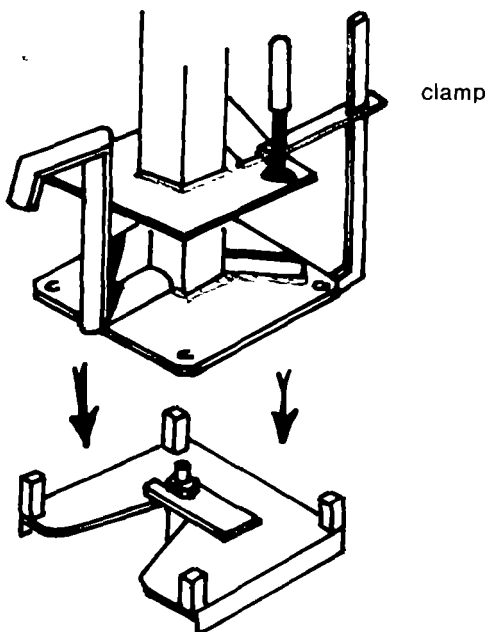
Continue pump installation according to instructions B.5 through B.10.

8. F. INSTALLATION OF KANGAROO PUMP (Mk 1 or Mk 2)



F.1
Install the cylinder/rising main assembly according to steps A.1 through A.16.

F.2
Lift the pump rod puller, place the catcher and remove the puller.

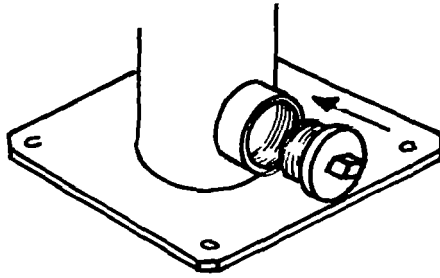


F.3
Place the Kangaroo pump, with the foot plate fixed in the "down" position, on the installation jack and connect the pump rods of pump head and rising main assembly, by turning the pump head clockwise. Keep the foot plate parallel to the top plate of the installation jack during this operation. Use the pump rod swivel.

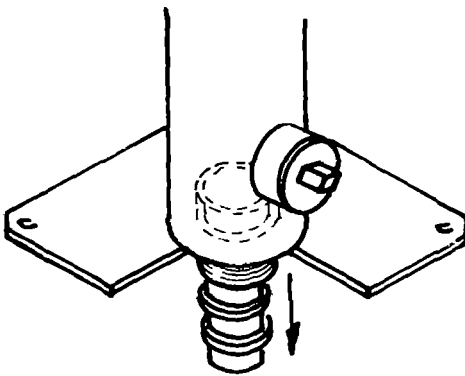
F.4
Finish installation of the Kangaroo pump by following instructions B.4 through B.6.

8. G. INSTALLATION OF IRRIGATION PUMP

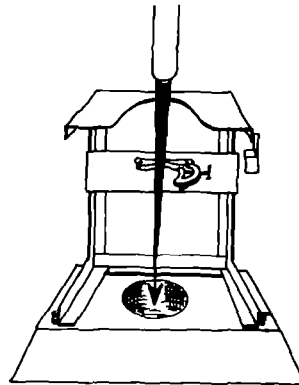
G.1 *If the pump is mounted on top of a well:*



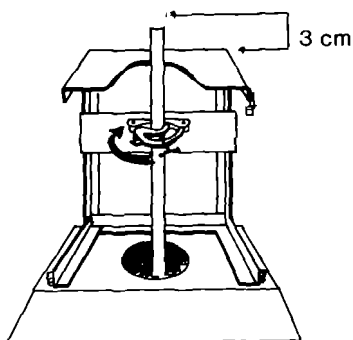
G.1.1
Close the socket at the side of the pump by screwing the 3" plug into it (using teflon tape).



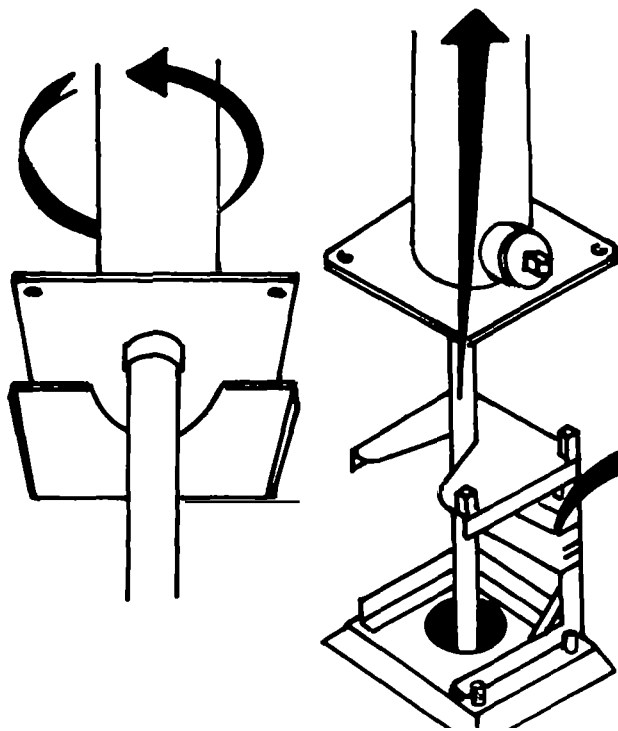
G.1.2
Remove the hose connector, if present (see page 34).



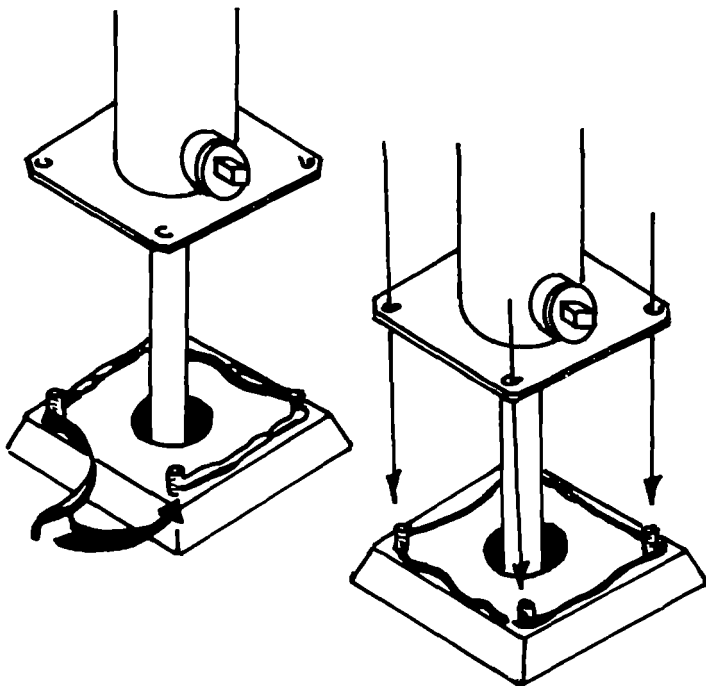
G.1.3
Place the installation jack over the well and open the clamp.



G.1.4
Lower suction pipe into the well up to approx. 3 cm above the top plate of the jack.

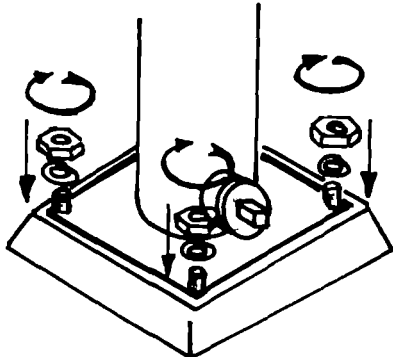


G.1.5
Place the irrigation pump on top of the installation jack and connect the suction pipe to the pump. Keep the foot plate parallel to the top plate of the installation jack during this operation.



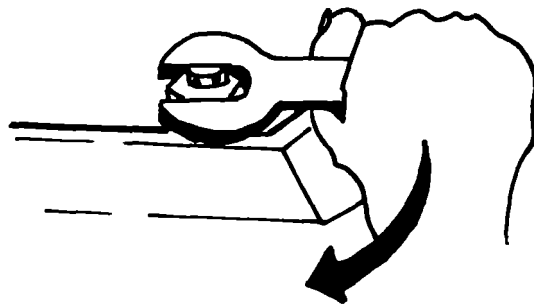
G.1.6
Lift the pump/riser combination and remove the jack.

Put a sealing strip on the outside edge of the pump base. Lower the foot plate over the anchor bolts.

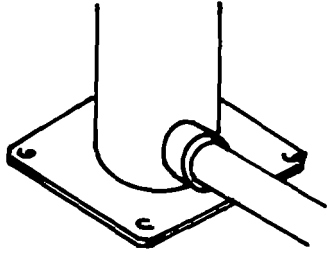


G.1.7
Tighten the nuts firmly.

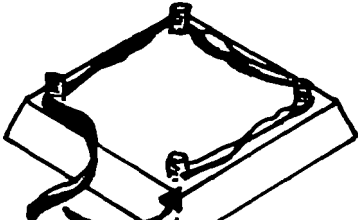
Do not forget the washers!



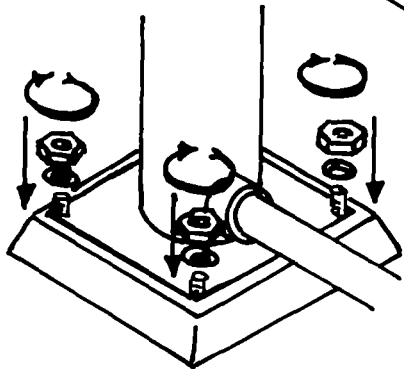
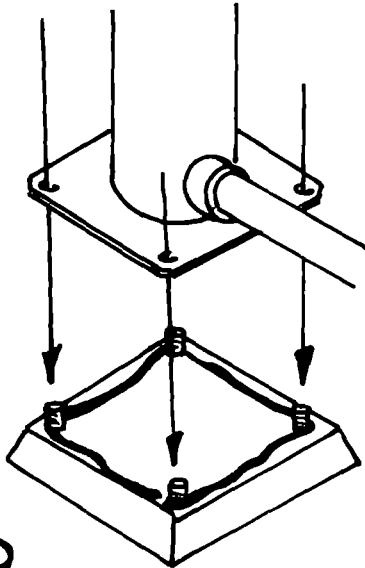
G.2 *If the pump is to be used for fetching water from a river or pond:*



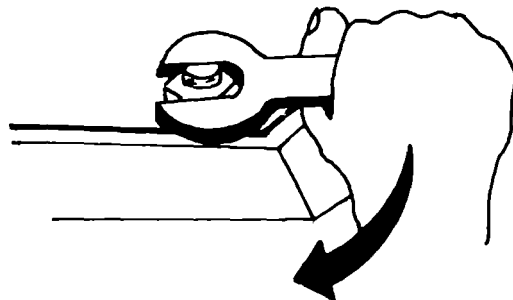
G.2.1
Close the socket at the bottom plate by screwing the 3" screw plug into it from the inside, using teflon tape as a seal.



G.2.2
Lower the pump over the anchor bolts and tighten the nuts firmly. Do not forget the washers.



G.2.3
Fix the hose connection in the socket at the side of the pump, and seal with teflon tape.



9. MAINTENANCE

9.1 GENERAL

In developing countries the maintenance of a rural water supply system is mostly a greater problem than its construction.

This is undoubtedly the case when maintenance has to be carried out by a central body and no spares or skill are available at village level.

Sufficient budget is a prerequisite, however maintenance costs can be kept down to a minimum by:

1. Building structures and using equipment that require little or no maintenance at all.
2. Ensuring that the spare parts are locally available.
3. Laying the responsibility for maintenance at the lowest (= user's) level.
4. Training suitable maintenance personnel.
5. Establishing workshops for:
 - carrying out major repairs
 - local manufacturing of spares
 - assembling of pumps.



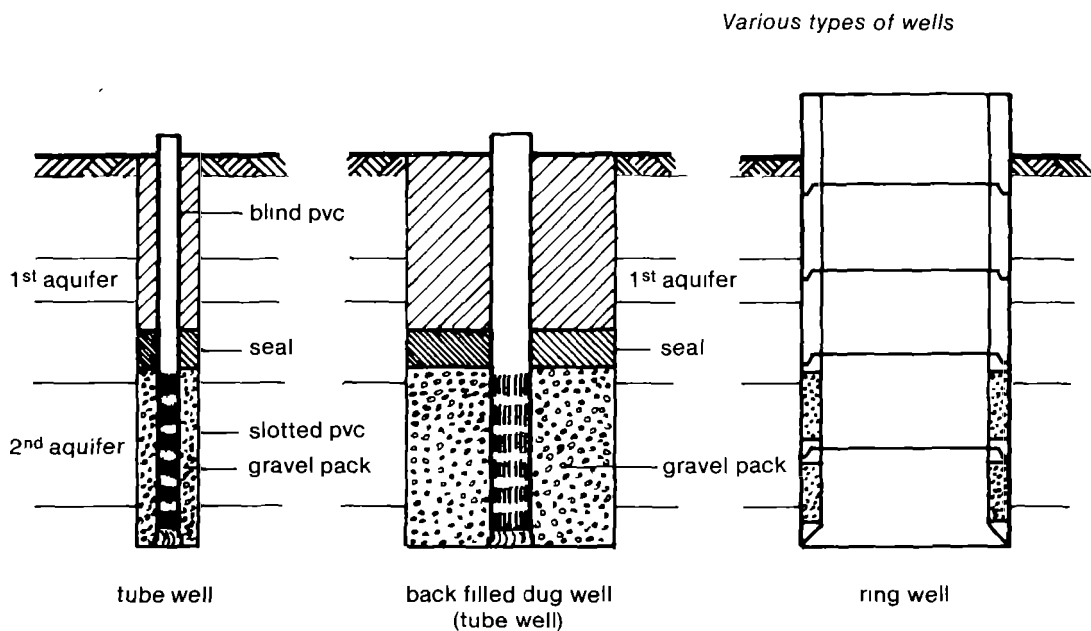
9.2 REQUIRED MAINTENANCE ON WELLS FITTED WITH SWN HANDPUMPS

9.2.1 THE WELL

1. Drilled wells

The first shallow aquifer, often linked to open pits or pools, will normally have been sealed off.

As the pump water is then taken from the second or third aquifer, the chance of contamination of the groundwater is negligible.



If the well has been properly developed by surging, enabling the particles of the filterpack to be positioned around the P.V.C. filter correctly, even fine sand will not enter the well.

This ideal situation is rare and almost all wells have to be regenerated after some time. The very fine particles will enter through the slots or – even worse – may stick into the slots thus causing clogging at a later stage.

Water with a high iron content will eventually cause iron oxide incrustation around the slots of the PVC filter.

The filter has to be cleaned by means of a special brush and chemicals to remove all incrustation and sand particles from the slots. Then the dislodged sediment has to be removed from the bottom of the tube where it will have collected.

It is advisable to have this cleaning work done every 2 years, when the superstructure of the well is overhauled and the pump removed.

2. *Back-filled dug wells (tube wells)*

As this construction allows the installation of a much wider diameter PVC screen of 160/147 mm instead of the 110/103 mm screen to be installed in drilled wells, the total filter opening of this 160/147 mm PVC pipe is 50% greater.

The application of a gravel pack also reduces the chances of fine particles entering the slots.

The possibility of incrustation due to a high iron content in the water will remain the same for this construction. The PVC screens from backfilled dug wells also require regeneration during the general overhaul of the well every 2 years.

3. *Ring wells*

The ring well can hardly be seen as a low cost construction due to its high building costs and the tremendous costs for manufacturing and transporting of the concrete rings.

As fine particles may clog even porous concrete rings, it is essential that ring wells are provided with a well-executed gravel pack, to prevent sand from reaching the concrete rings.

Every 2 years the well must be emptied completely by means of a deep-well pump. All sediments must be removed and afterwards the well must be disinfected.

9.2.2 THE SUPERSTRUCTURE

1. *Pump foundation (well cover)*

Some cast-in anchor bolts may get loose if the concrete foundation has not been cured long enough or has dried out in the sun during its curing time.

Sometimes this may be rectified by applying a special adhesive to fix the anchor bolt firmly back in the concrete. Mostly, however, the bolt has to be cut out and cast in again.

This is a really difficult job, requiring much skill, accuracy and patience. If these qualities are not to be expected it may be better to replace the whole pump foundation.

Furthermore it may happen that, when the soil underneath the foundation has not been well compacted, the foundation of a tube well may sink more than its surrounding slab or, as with a ring well, that the slab may sink more than the well. In both cases a crack will appear.

A bituminous compound forced into this crack will prevent polluted water from entering the well.

The SWN 80, for shallow/medium depth wells, and SWN 81 pump head, for deeper wells, are both fitted with either ball bearings or journal bearings. The SWN hand pumps with ball bearings are supplied with heavy oil seals, preventing grease from leaking out and water from entering the bearing house.

A ball bearing system is not suitable for local production as the fitting and the alignment of ball bearings is an extremely precise operation.

Therefore, in the last years, SWN has concentrated on the journal bearing system with arnrite or polyacetal as bearing material.

This greasy; fatty material does not require maintenance at all. It just has to be replaced when it has been completely finished.

Polyacetal bearings used in SWN pump heads are over-dimensioned and will last for many years.

Later on they can be replaced by other journal bearings, including wooden or nylon bearings, which may be manufactured locally.



SWN 81

9.3 LEVELS OF MAINTENANCE

As long as the hand pump and the well are not completely maintenance-free and as long as no spares or facilities are available at village level, maintenance will have to be organized and will have to be carried out.

Maintenance can be carried out at the following levels:

1. BY THE USERS

This is the normal attention that is paid to the well and the pump by the users. Ample information on stickers, posters and brochures must be available at village level.

2. BY THE PUMP ATTENDANT

The users of a pump may choose a responsible person, an older man or woman, living quite near the pump, who will carry out daily supervision and some minor repairs.

3. BY THE MECHANIC

A group of villages may appoint one of its mechanics, a local blacksmith or bicycle-repair man as pump mechanic. If necessary, he can be trained at a central workshop.

Assuming:

- that he needs two days a year to keep a pump working in proper condition
- that he will be working 200 days a year,

the pump mechanic will be able to maintain a total number of 100 wells, serving approximately 25 000 people.

For a rural population of between 50 and 100 people per square km his area (100 pumps) will be maximum of 400 km² (20 x 20 km).

4. AT THE SUB-WORKSHOP

Within the area of 10 mechanics (1000 wells, 250 000 people, 4000 km²) a sub-workshop-cum-store could be established.

The activities of the sub-workshop are purely commercial.

5. AT THE CENTRAL STORE (-CUM-WORKSHOP)

The central store supplies pumps, equipment and spares to the sub-workshop on a commercial basis.

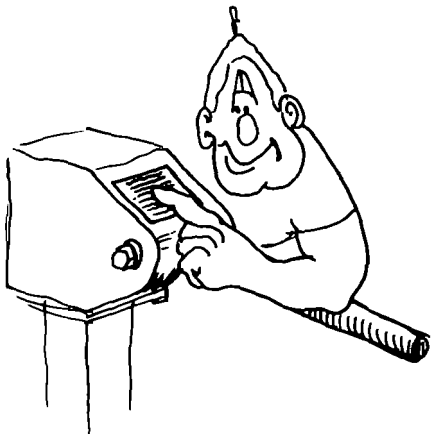
The central workshop is in charge of:

- manufacturing spares
- assembling/manufacturing pumps and equipment
- training pump mechanics.

9.3.1 Maintenance by the users

Proper functioning of a well depends mainly on the behaviour of the users.

SWN pumps will serve many years as long as their users observe the following instructions:



ATTENTION

- MOVE HANDLE SLOWLY, OVER FULL STROKE
- DO NOT BANG HANDLE AGAINST STOP
- EMPTY BUCKETS IN GUTTER ONLY
- KEEP ALL NUTS AND BOLTS TIGHT
- KEEP PUMP AND SURROUNDINGS CLEAN
- DON'T LET CHILDREN PLAY AROUND WELL
- KEEP CATTLE AWAY FROM WELL
- USE SPILL WATER FOR IRRIGATION

The importance of clean water and hence the necessity to keep the pump in proper working condition should be regularly explained to the users.

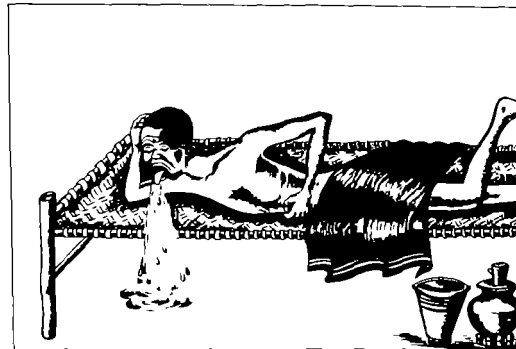
Therefore it is advisable to construct the well near the school.

As agriculture is one of the subjects of a primary school, the well offers a good opportunity for the school to build its own small irrigation scheme, in which each child must maintain its own part.

In addition, the necessity of sound maintenance can be brought to the attention of all villagers by means of stickers, posters, brochures, advertisements, T-shirts, etc.



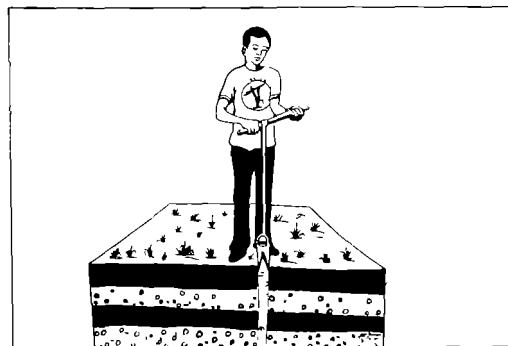
1 clean drinking water affects people's health



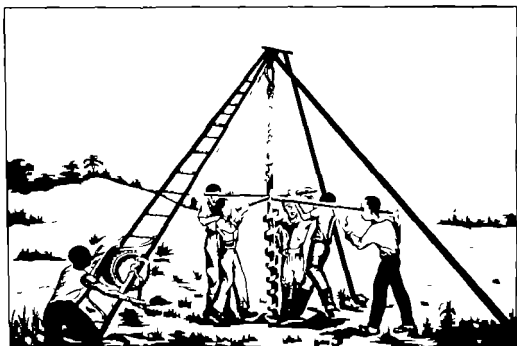
2 results of drinking polluted water



3 information to the people by the surveyor



4 survey of groundwater



5 village participation in well construction



6 instruction to the village people

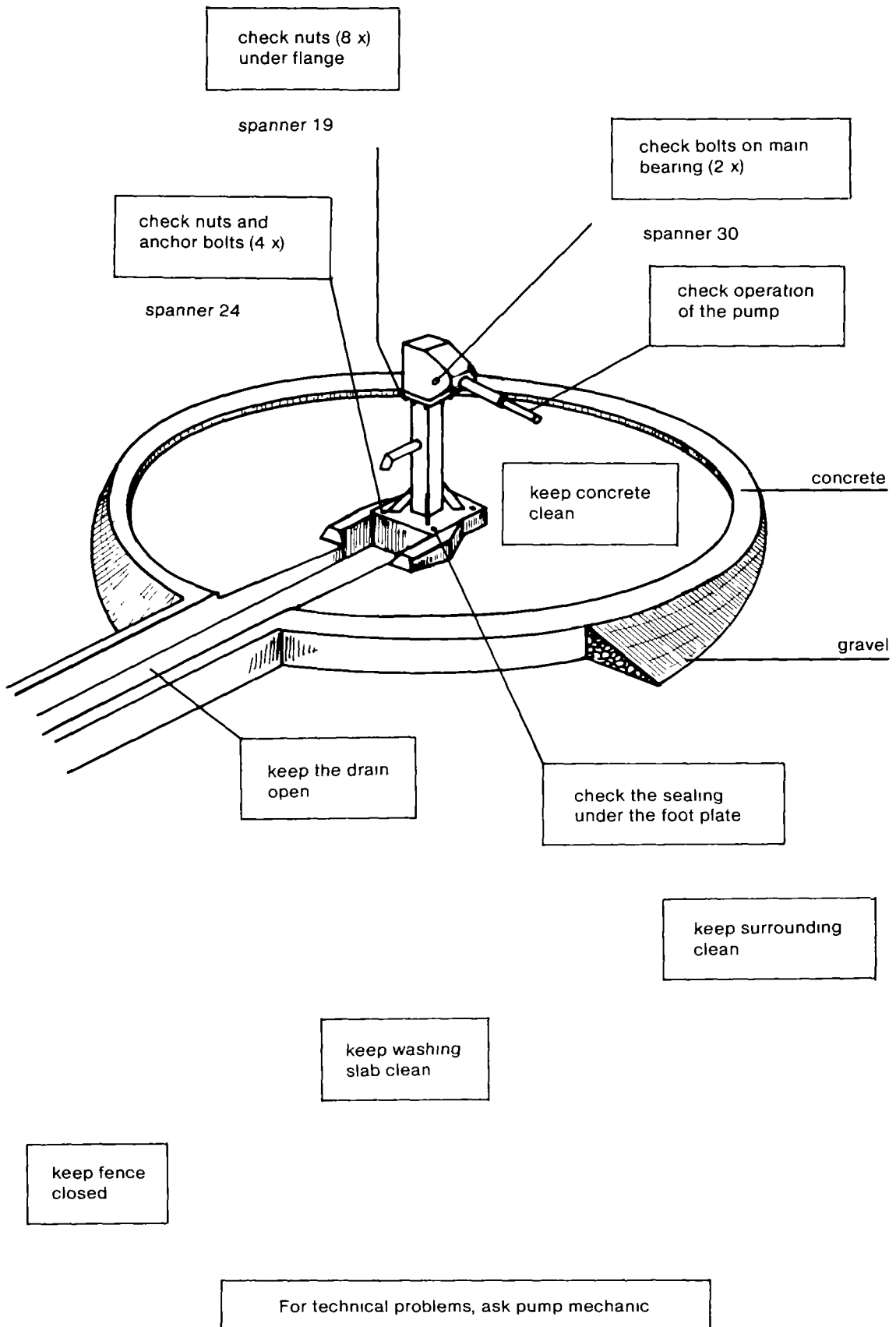


7. cleaning of the well site is essential



8 fences and irrigation, both necessary

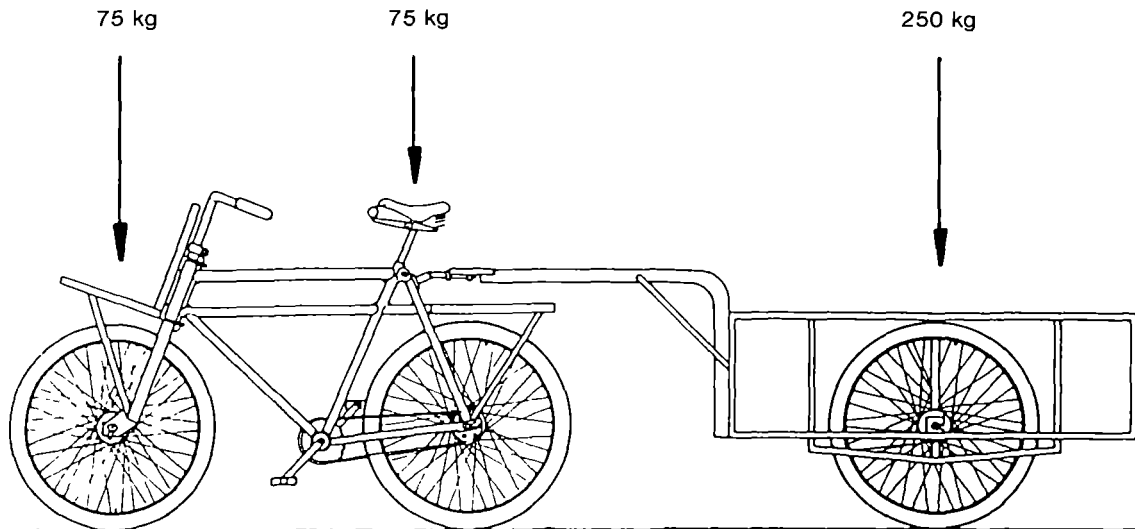
9.3.2 Activities of the pump attendant



9.3.3 Maintenance by the mechanic

The mechanic, who serves approx. 100 wells in an area of 20 x 20 km, should have his own means of transport.

As the use of a motor-car is absolutely unrealistic (the operation and maintenance costs would by far exceed the maintenance costs of all the pumps together) the mechanic can do his job using his own carrier bicycle and trailer.



This heavy bicycle combination is suitable to carry approx. 400 kg; 1 or 2 pump stands, some cylinders, a number of riser-rod elements and necessary tools.

Regularly, at least twice a year, the mechanic will visit all the wells in his area. He will arrange contracts with the villages for his activities, which guarantees a more or less regular income.

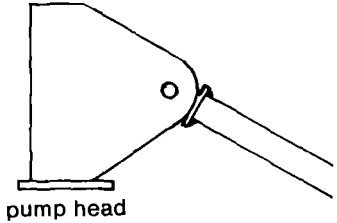
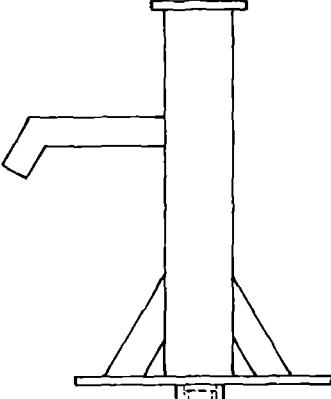
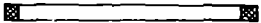
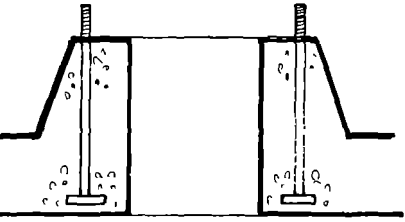
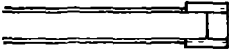
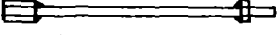
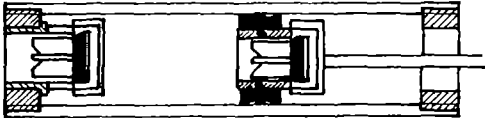
Each time repairs are necessary, cost estimates are given to the villages.

The village will make the payment as arranged by mutual agreement on the basis of 'no cure, no pay', as well as 'no payment: then no spares and no repairs'.

The mechanic should have the following tools and materials at his disposal:

2 open end spanners no 17	bearing grease	2 kg
2 open end spanners no 19	oil	0.5 kg
2 open end spanners no 24	teflon tape	25 m
2 open end spanners no 30	compri tape	25 m
1 pipe wrench 1½"	cement	5 kg
1 bahco 14"	paint	2 kg
1 assembly jack with clamp	nut M16 + washers	10 x
2 pump rod pullers		
2 pump rod catchers		
1 grease gun with nipple		
key for cylinders		
4", 3", 2½" and 2"		

STANDARD ACTIVITIES OF THE MECHANIC

part	problem	activity
 <p>pump head</p>	handle broken bearing out of order	replace pump head and take it to the workshop for repair
 <p>pump stand</p>	leaking column cracks in foot plate	have plate welded by a blacksmith and reinstall it
 <p>sealing strip</p>	sealing strip dried up	put on a new sealing strip
 <p>pump base</p>	anchor bolts loose concrete cracked	cut out the cracked parts and pour fresh concrete
 <p>PVC riser 1½"</p>	riser worn out or leaking, thread or socket broken	replace with another riser see that the PE protection pipe is on the rod
 <p>∅ 10 mm rod, SS</p>	broken	replace with another rod
	cylinder does not function	replace the cylinder and have it repaired at the workshop

9.3.4 Maintenance at the sub-workshop

The sub-workshop is run on a commercial basis and undertakes:

- Repairs which cannot be done in the villages, e.g. welding.
- Distribution (selling) of spares to the villages.
- Training of mechanics and pump attendants.

A sub-workshop has sufficient workshop capacity and storage to cope with the maintenance requirements of 500 - 1000 hand pumps.

For such a sub-workshop a container could be used in which the following provisions should be made:

- a sun roof
- work bench and vice
- spare parts store (locked)
- tool-box (locked)

A second container could be used for all materials which cannot be stored outside, such as:

- bags of cement
- P.V.C. casing and filters
- P.V.C. cylinders
- P.V.C. risers

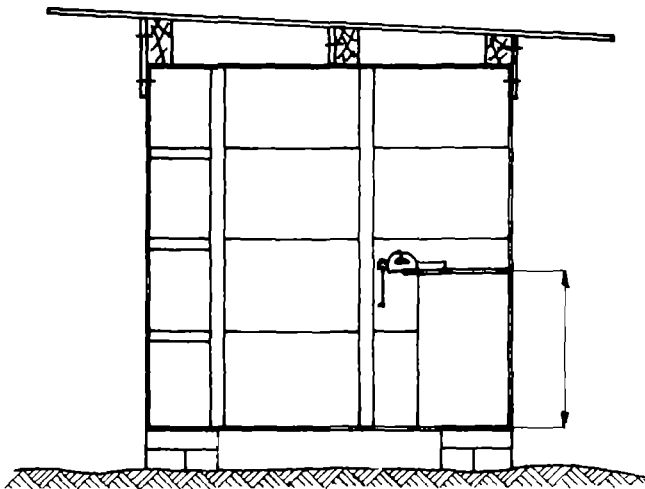
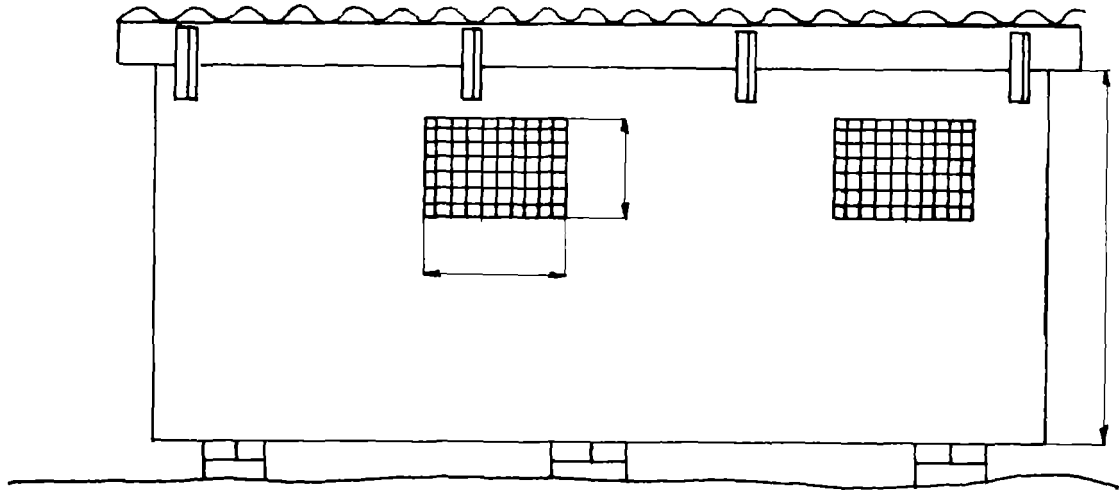
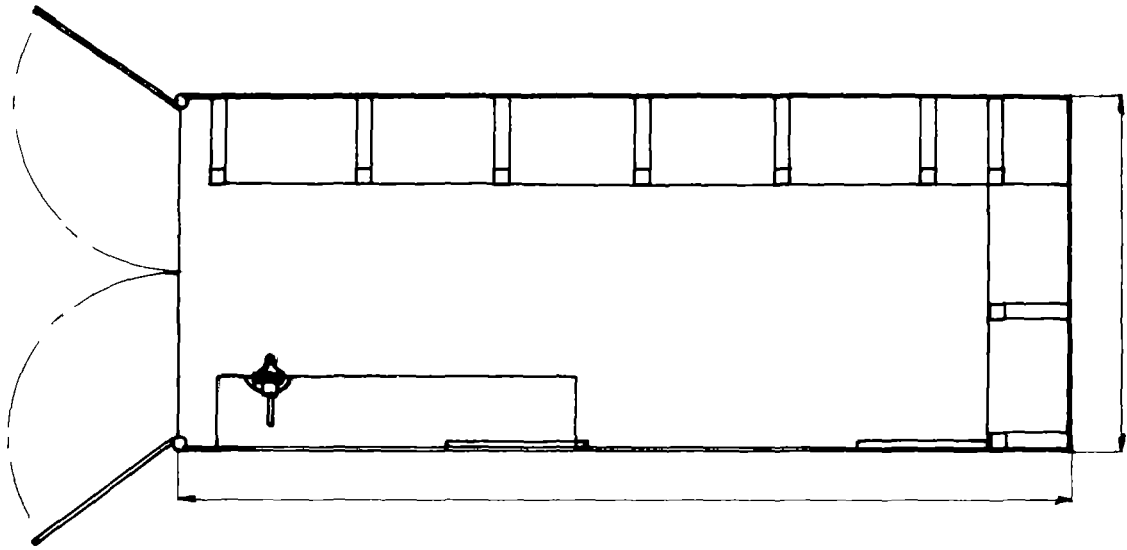
As the estimated lifetime of an SWN pump will be approx. 10 years, some 50 - 100 pumps (or 10%) would have to be replaced in the area of the sub-workshop every year.

Sufficient storage capacity as well as burglar-proof system are, therefore, basic requirements.

With regards to the selling of the spare parts, firm agreements will have to be made about, the price, a regular adjustment of prices and the minimum stock to be kept.

Kangaroo Mk 1





Typical lay-out of simple sub-workshop (container)

9.3.5 Maintenance at the central store (-cum-workshop)

The central workshop is responsible for importing and distributing equipment and spares.

It supplies information about prices and delivery times and assists in the training of mechanics and storekeepers.

The central workshop undertakes the local production of pumps and equipment.

Local production is considered to be the most important contribution to the development of self-sufficiency in spares.

Most developing countries try and start to set up local manufacturing units during the period they have to rely on importation of pumps and construction equipment from abroad.

The advantages of local manufacturing are:

- larger supply of spares
- creation of training facilities
- improved repair facilities
- reduction of costs
- saving of foreign currency
- importation can be restricted to that of raw materials and half products.

Local production can be split up into the following phases:

Phase 1: Assembling

In this phase local personnel is trained and the availability of materials on the local market as well as the import applicable procedures are investigated.

Phase 2: Production

The equipment is assembled from locally made or locally available parts and importation is kept to a minimum.

Due to their simple construction SWN pumps are extremely suitable for local assembling and production.

Apart from the standard hand tools the following workshop equipment will be necessary for a production rate of 100 pumps per month:

<i>Equipment</i>	<i>Estimated price</i>
1 lathe c-c 2 m	\$ 15.000
1 lathe c-c 1 m	\$ 10.000
1 drill, column type	\$ 4.000
1 sawing machine	\$ 3.000
1 plate cutter	\$ 2.000
1 thread cutter	\$ 2.000
1 pipe slotter	\$ 2.000
3 welding transformers, each	\$ 750
1 grinder	\$ 500

10. LOCAL MANUFACTURING OF PUMPS

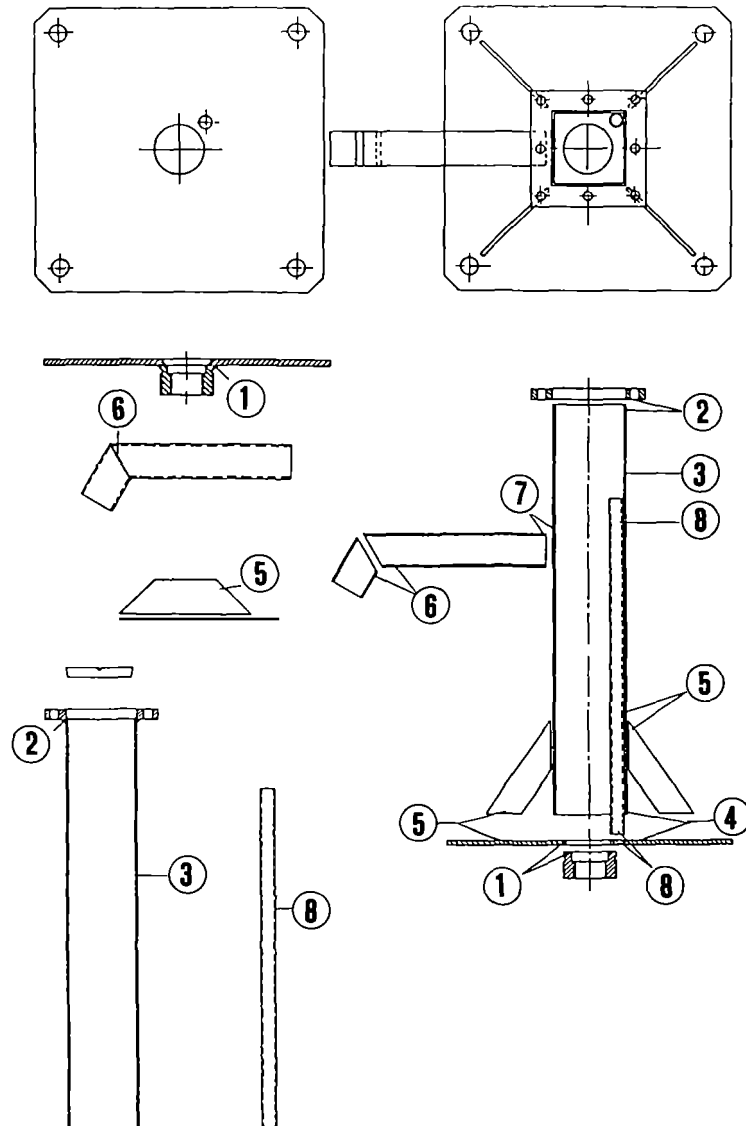
In stead of readily assembled pump heads and pump stands, the following can be delivered as parts that have to be assembled locally:

- *pump stand for SWN 80 and SWN 81 pumps*
- *SWN 80 pump head*
- *SWN 81 pump head*
- *Kangaroo Mk 1 pump*



Locally manufactured pump stands

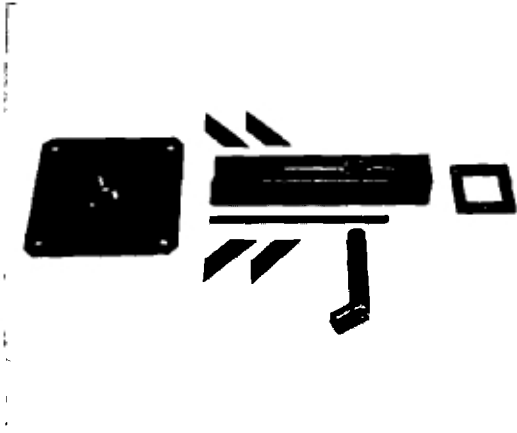
10.1. PUMP STAND



WELDING SEQUENCE

- 1 Weld the thread connector to the base plate (internal and external welding)
- 2 Weld the flange to the standpipe (internal and external welding)
- 3 Fix the standpipe with flange in the lathe Use a special plug to centre the pipe Flatten and smooth the flange
- 4 Spot weld the standpipe to the base plate and the supports to the standpipe and to the base plate Keep standpipe and base plate perpendicular to each other
- 5 Weld standpipe, supports and base plate completely
- 6 Weld the spout parts together
7. Weld spout to standpipe
- 8 Spot weld the top of the vent to the standpipe, then weld the bottom of the vent to the underside of the base plate
- 9 Clean thoroughly, degrease and paint with a good-quality zinc compound

WELDING SEQUENCE OF SWN 80/SWN 81 PUMPSTAND



All parts of the SWN pump stand



Welding jig



145 Amperes



Put connector on centre of base plate



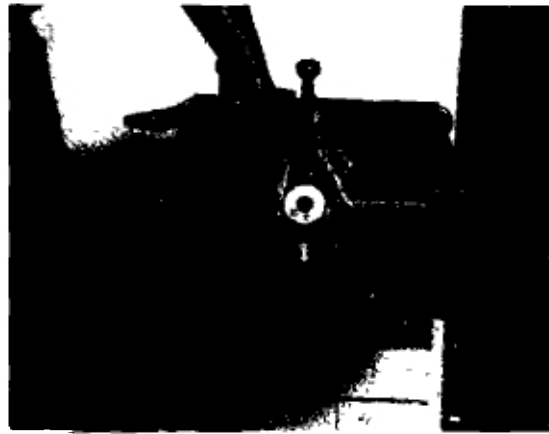
Apply thread protector. Keep in place with extra weight



Spot weld connector



Turn over base plate



Place brass thread protector



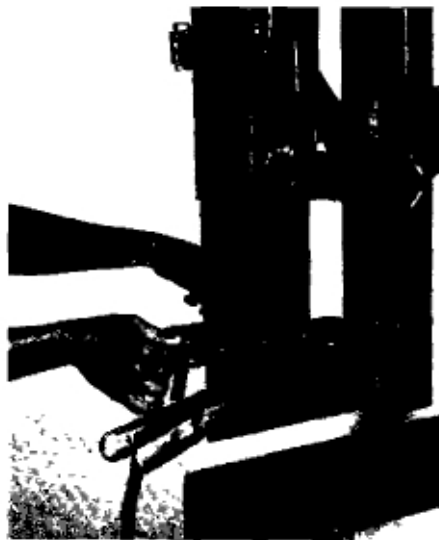
Weld connector completely, at the top



Put base plate and tube in the jig



Spot weld tube to base plate



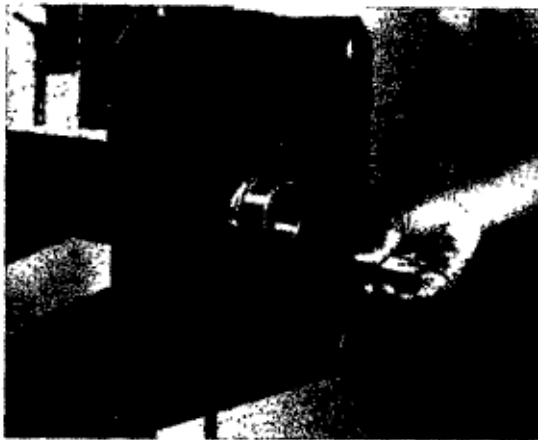
Turn jig upside down, place flange on two brass spacers and bolt it to jig



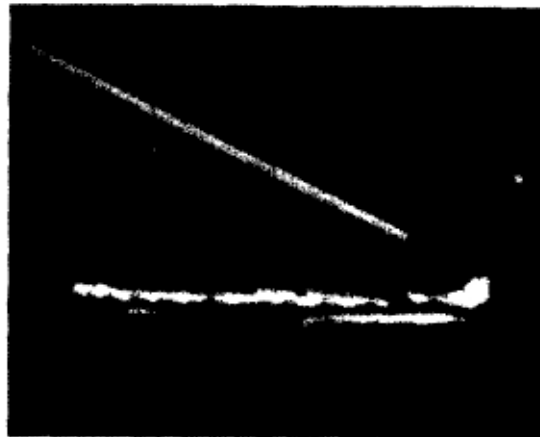
Spot weld flange to tube



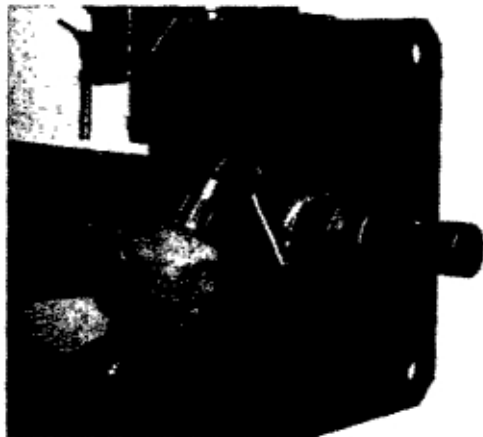
Turn jig horizontal and spot weld spout to tube



Insert vent pipe



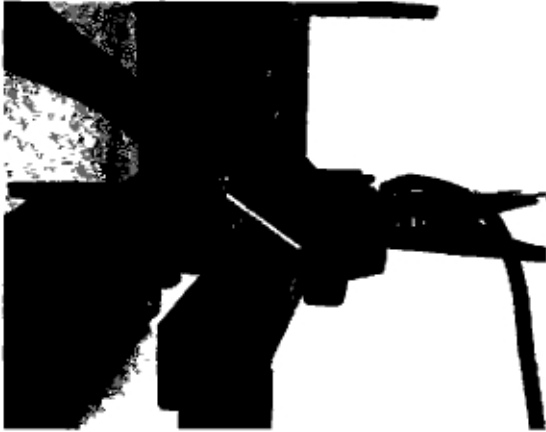
Weld vent pipe into tube



Weld vent pipe to base plate



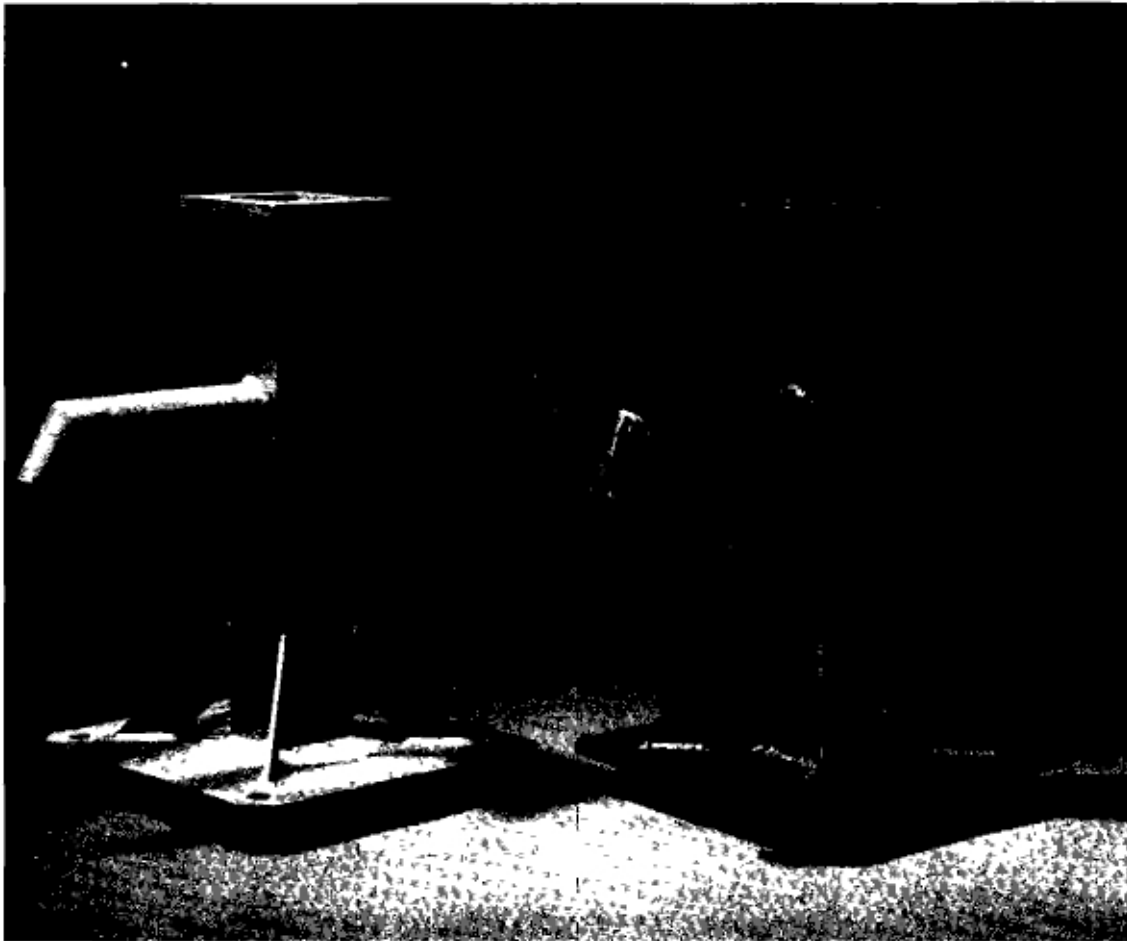
Weld the flange completely



Spot weld supports to base plate and column

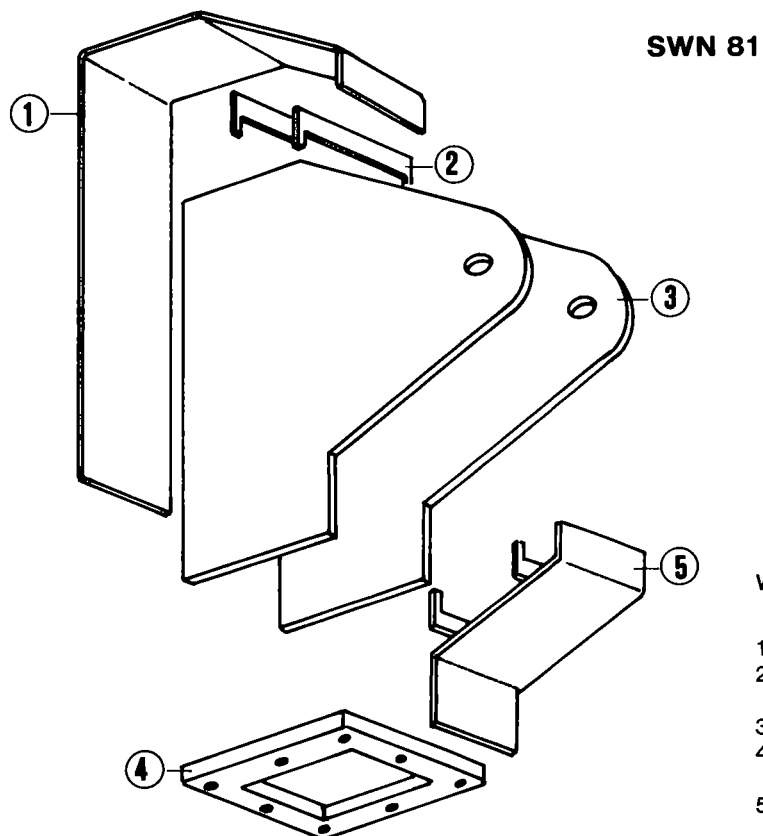
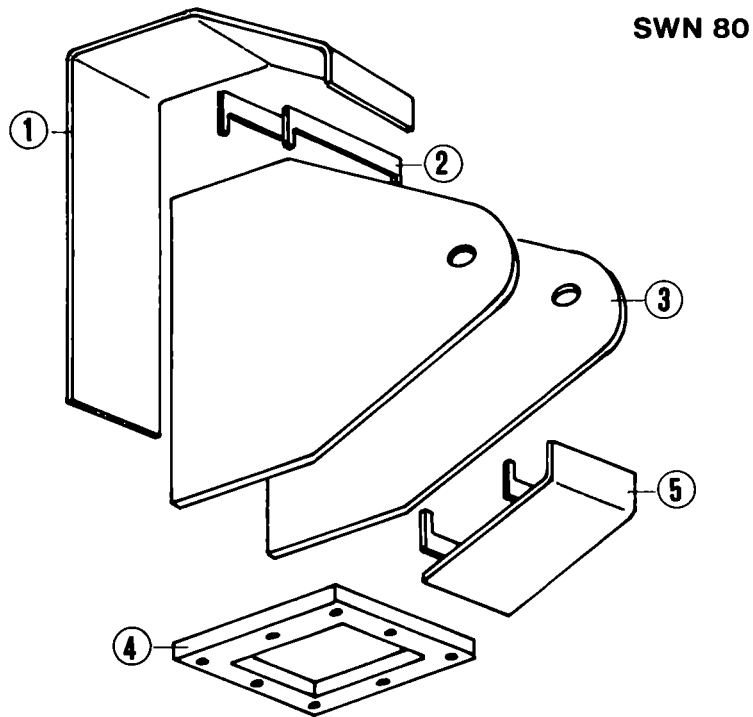


Finish all weldings, clean them with hammer and brush



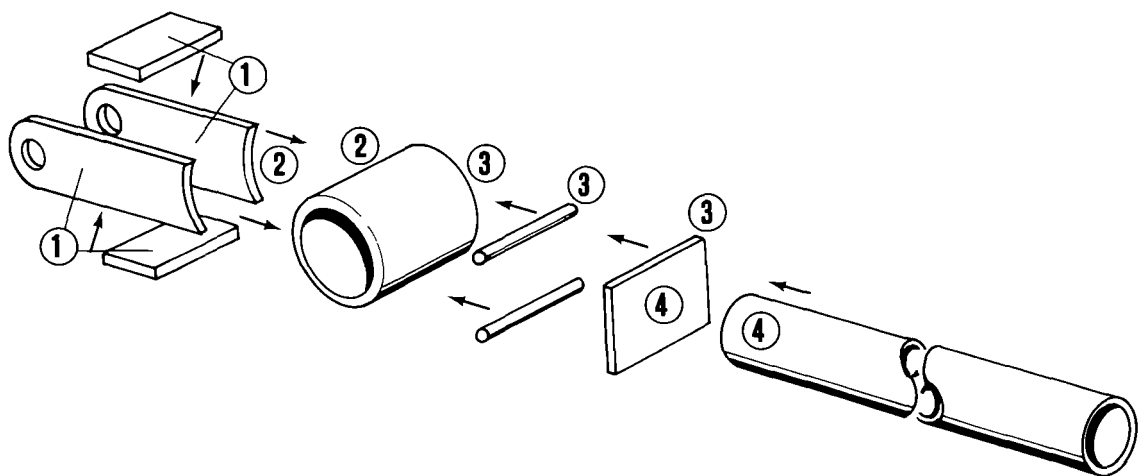
Paint with zinc compound (right: before; left: after)

10.2 PUMP HEAD

**WELDING SEQUENCE**

- 1e support strips to upper part
- 2e support strips to bottom part
- 3e side plates to upper part
- 4e flange to upper part and side plates
- 5e bottom part to side plates and flange

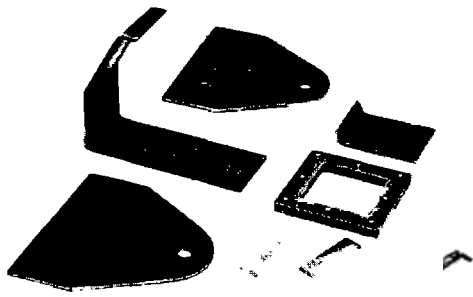
HANDEL SWN 80



WELDING SEQUENCE HANDEL
SWN 80

- 1e stroke limiter to strips
- 2e bearing housing to strips
- 3e connection bars and strip
to bearing housing
- 4e handle to connection strip

WELDING SEQUENCE OF PUMP HEAD



All parts of SWN 80 pump head



Put bottom part of pump head in fixed part of small welding jig



Put support strips in movable part of welding jig



Lower movable part of jig, and spot weld



..... support strips to bottom part of pump head



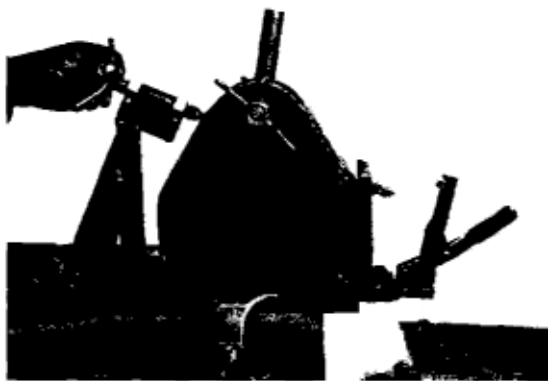
Finish welding of support strips



Put bottom part of pump head in place



Spot weld bottom part to side plates



Adjust screw until upper part of pump head is tight against side plates



Spot weld remaining part to side plates



Check that angle between pump head and flange is 90 degrees



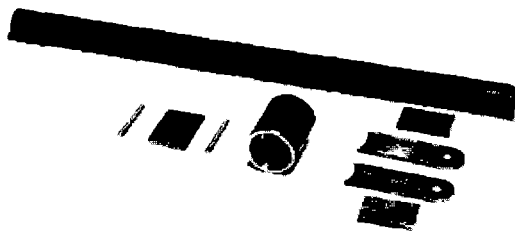
Repeat this at the other side



Finish all welds of the pump head



Paint with zinc compound (left, before; right, after)



Component parts of the handle



Put stroke limiter in place, in third welding jig



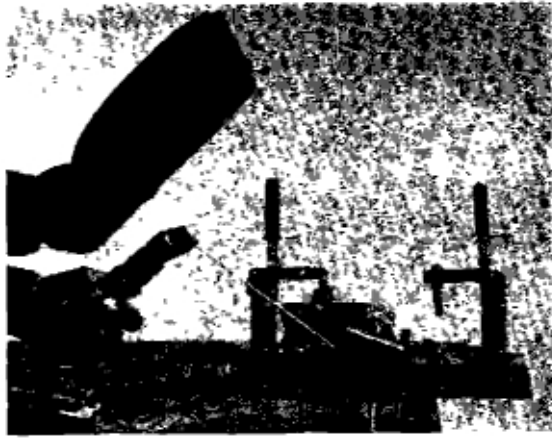
Put two strips in place and secure with pin



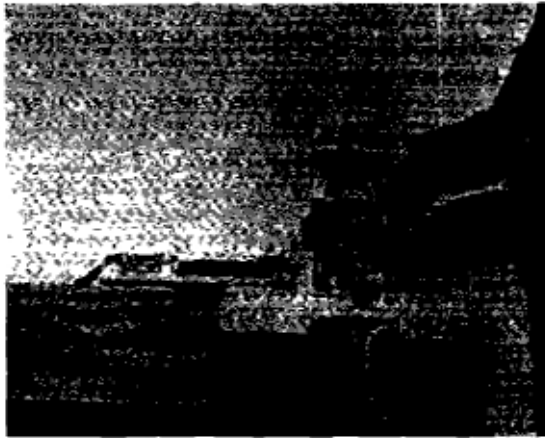
Clamp down the strips, and spot weld to stroke limiter



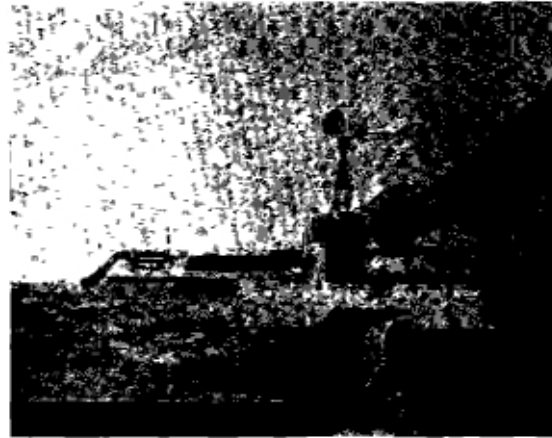
Turn assembly 180° degrees, position second stroke limiter and clamp assembly down on top of it



Spot weld assembly to second stroke limiter



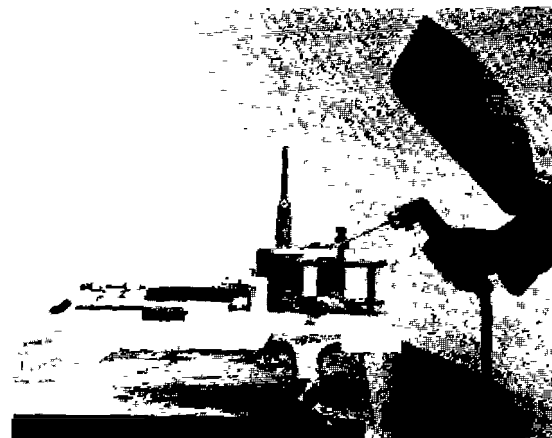
Position and secure bearing housing in jig



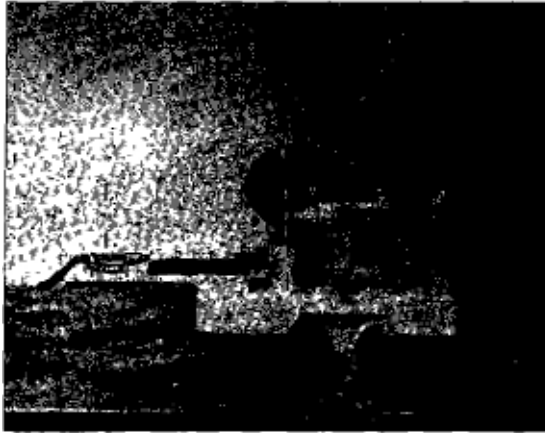
Put strips/stroke limiter assembly in place



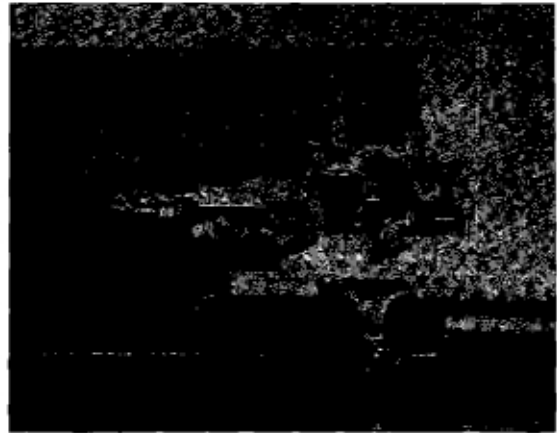
Spot weld assembly to . . .



. . . bearing housing



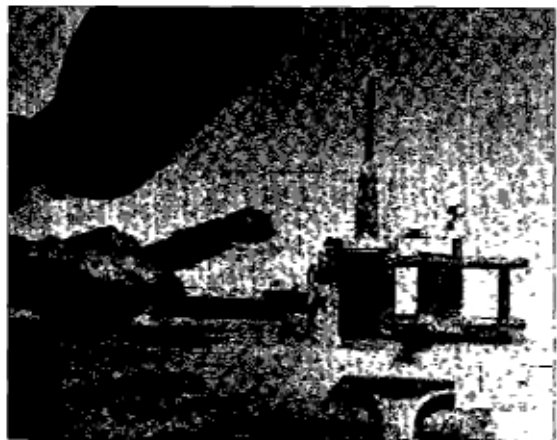
Insert handle connection strip and reinforcement bars in jig



Fix them in position with clamps



Spot weld strip and bars to each



..... other and to bearing housing

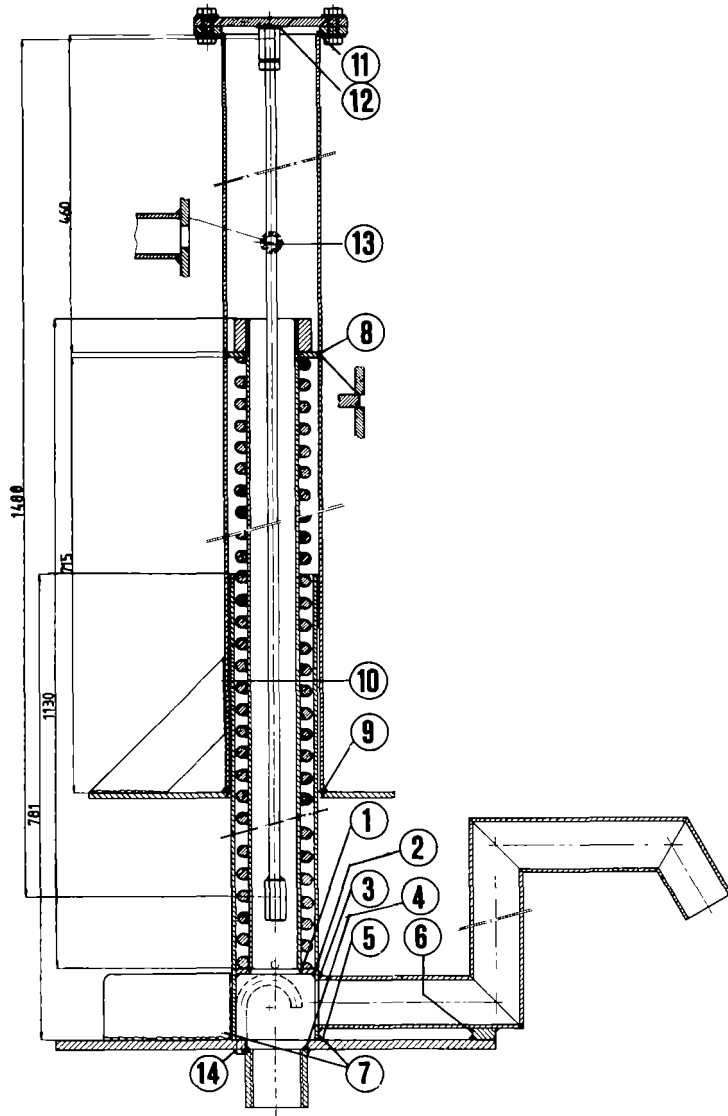


Finish all welds



Paint with zinc compound and insert bearing assemblies (At front: before; at back: after)

10.3 KANGAROO PUMP Mk 1



WELDING SEQUENCE

1. bottom spring compartment to riser
2. bottom spring compartment to inner tube
3. spout to inner tube
4. connector to base plate
5. inner tube to base plate
6. prop between base plate and spout
7. supports to base plate and inner tube
8. flange between upper and lower part of outer tube
9. foot plate to outer tube
10. supports to foot plate and outer tube
11. flange to outer tube
12. nut to cover plate
13. handle to outer tube
14. vent pipe to base plate

11/11/11

