



Ministry of Water, Irrigation and Electricity  
and  
Japan International Cooperation Agency (JICA)

# **Strategies for Maintaining the Quality of Rope Pumps for Manufacturing, Installation and Maintenance Services**

**October 2016**  
**WAS-RoPSS Project**



## **Strategies for Maintaining the Quality of Rope Pumps For Manufacturing, Installation and Maintenance Services**

### **1 Premises**

The rope pump technology is a low cost technology, which is introduced in rural Ethiopia, in particular to improve water supply at household level. The government of Ethiopia has placed Self-supply as a sub-component of rural WASH and has been promoting low cost technologies in water supply, including rope pumps.

The technology was introduced more than ten years ago, and being improved by various stakeholders. In the meantime, the quality of rope pumps has been an issue, as some sub-standard quality rope pumps were found in the market, which often contributes to bad reputation of the technology itself.

Project for Rural Water Supply, Sanitation and Livelihood Improvement through Dissemination of Rope Pumps for Drinking water (WAS-RoPSS Project, which is a bilateral cooperation project of Japan International Cooperation Agency (JICA) and Ministry of Water, Irrigation and Electricity (MoWIE) has been working on promotion of the rope pump technology since 2013, and found through its ground experiences the importance of maintaining quality standards of rope pump units as well as the installation works, in order to further disseminate the technology in the country.

For maintaining quality standards of rope pump manufacturing and installation, proper technical transfer, internal quality control within the workshop / service providers, and proper service provision to the customers are the essential elements to keep the technology healthily alive and grow its own market. This small paper provides small hints to keep the quality standards of the rope pump. It is hoped that these hints will contribute to better recognition of and further expansion of the rope pump markets.

### **2 Intended Targets of this Paper**

It is hoped that this strategy paper is used for the following targets;

- ✓ Government officers and development partners who are intending to disseminate the rope pump technology

- ✓ Rope pump manufacturers and installers
- ✓ Rope pump trainers and assessors of the rope pump technology (Center of Competencies)
- ✓ Individuals and organisations who are interested in the rope pump technology and quality control

### **3 Materials and Tools Introduced in this Paper**

There are some key materials and tools, related to the quality of rope pump manufacturing and installation.

#### **3.1 Minimum standard specifications of rope pump parts**

The definitions and minimum requirements for materials and methods of processing of each part of a steel-framed rope pump are determined as the national standards. Ethiopian Standards Agency (ESA) has approved the minimum standard specifications as **National Standard ES 3968:2016** and all rope pumps in Ethiopia have to be conformed to the ESA standards.

These standards have been agreed among the major rope pump stakeholders, including manufacturers, promoters and the representatives of MoWIE, after collecting and studying the existing rope pump models in Ethiopia.

#### **3.2 Technical Manual “Rope Pump – A Manufacturing, Installation, Operation and Maintenance Manual”**

**Rope Pump – A Manufacturing, Installation, Operation and Maintenance Manual** (July 2015) is a technical manual to introduce all necessary technical information in rope pump manufacturing, installation, operation and maintenance. The manual includes a number of illustrations and photos to explain practical processes and particularly useful for rope pump manufacturers and installers.

This manual is under preparation from the previous volume of the manual, produced in 2006 by MoWIE in collaboration with development partners. In addition, many information and new drawings are added for this edition, in collaboration with WAS-RoPSS Project, while thorough consultations have been done with various national and international rope pump specialists,



manufacturers and users.

### **3.3 Checklists**

There are two checklists produced mainly for internal quality control of rope pump manufacturing and installation; “**Rope Pump Manufacturing Checklist for Quality Control**” and “**Rope Pump Installation Checklist for Quality Control**”. The critical points for quality inspection of the products or the construction works are listed on the respective checklist.

The checklist for rope pump manufacturing was improved and updated based on “the Rope Pump Specification & Check Point List”, developed by the previous JICA Project, WAS-CAP<sup>1</sup> in 2010. New photos and points to be checked were added from the experiences of the WAS-RoPSS Project in consultation with the major rope pump manufacturers and Technical and Vocational Education and Training College (TVETC) trainers. The checklist for installation was newly made by the WAS-RoPSS Project, as it is very critical to check the quality of installation works for sustainability of water supply facilities fitted with rope pumps.

### **3.4 Operation and Maintenance Sheets**

A set of simple Operation and Maintenance (O&M) Sheets (A4 x 6 pages) were produced with illustrations and simple explanations to show essential techniques to operate and maintain a rope pump.

This was designed to be distributed to each user for them to use for their daily use and regular maintenance of the pump. It is expected that these simple techniques of O&M are taught to the users when a technician installs a rope pump on the users' well.

### **3.5 Price Calculation Tool**

The rope pumps prices can be calculated with this tool, by putting the present material costs, and calculating according to the required quantities.

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<sup>1</sup> The Water Sector Capacity Development Project in Southern Nations, Nationalities and People's Region (SNNPR) in the Federal Republic of Ethiopia, a JICA-supported technical cooperation project from 2008 to 2011.

This tool was developed to help the rope pump manufacturers who need to properly set sale prices of rope pump units. It is important for the sale prices to be in balance considering the economic status of the potential customers, who are often poor rural dwellers, and the sustainability of the production.

### **3.6 Trainers Guide – Rope Pump Manufacturing, Installation, Operation and Maintenance Training**

“Trainers Guide” was designed and produced for the trained rope pump trainers, in particular TVETC instructors for systematic and effective rope pump technology transfer. It contains the proposed contents and methods of training with a good amount of exercises, as well as the suggested time schedule.

This trainers guide was tested and proven through the experiences of 12 TVETC instructors in SNNPR through the WAS-RoPSS Project activities. It is hoped that this Trainers Guide is disseminated to other TVETCs in and out of Southern Nations, Nationalities and People’s Region (SNNPR).

### **3.7 List of Unit of Competencies**

The lists of units of competencies for rope pump manufacturing and installation are provided separately, with the critical and essential Unit of Competencies (UCs) required for manufacturing and installation of rope pumps respectively.

Both lists were developed by the trained TVETC instructors, manufacturers and deans of the TVETCs in SNNPR, in consideration of accommodation of the current rope pump manufacturers and installers in practice. Certificate of Competency (COC) test kits are prepared by the Center of Competencies (COC) Office in SNNPR for the very first COC tests for rope pump technology in the country. It is hoped that these lists are utilized by rope pump trainers and promoters of rope pump technology for maintenance of quality rope pump unit production and installation works.

## **4 Strategies in Maintaining the Quality of Rope Pump Units**

### **4.1 Conforming with National Standards**

It is important for a rope pump manufacturer to produce rope pumps

conformed to the minimum requirements set as the national standards (ES 3968:2016), as the set of minimum standards was made to keep the required quality of the products.

A sub-standard product should be rejected in the market, while the quality of the products shall be internally controlled by the manufacturers, as well as the consumers as far as possible.

#### **4.2 Promoting Internal Quality Control by Manufacturers**

Internal inspection of the products should be exercised and the manufacturers should have a system of internal quality control. Producing and selling of quality products often contribute to the good reputation of the technology as well as the manufacturer, and further expansion of the market of the respective products.

**Rope Pump Manufacturing Checklist for Quality Control** can be used for this purpose. The methods and techniques of inspection could be improved by trainings. Some public institutions such as **Metal Industry Development Institute (MIDI)** provide trainings on metal work inspection.

#### **4.3 Promoting Customer Services**

A rope pump is often a marketable product, exchanged with money payment by a customer. Customer satisfaction is therefore a very important factor for a good selling of products.

A manufacturer / retailer therefore should give good services to the customer, bringing his/her satisfaction as much as possible. For example by providing proper operation and maintenance training to the customer during installation. Good aftersales services also play a big role in customers' satisfaction, for example checking by phone the condition of the pump after it has been installed, offering warranty on the quality of manufacturing and offering maintenance services when needed.

One critical factor may be the pricing. A manufacturer / retailer should give reasonable price to the product, which should satisfy the customers' needs and satisfaction, while ensuring the sustainability of manufacturing/retailing

business of him/herself.

A tool for rope pump price calculation can be used for this purpose.

## **5 Strategies in Maintaining the Quality of Rope Pump Installation Works**

### **5.1 Promoting Utilisation of Trained Installers: Village Technicians**

It is critical to install a rope pump in a proper way onto the well, on top of having a good quality pump itself. Rope pump installation requires specific skills and proper installation should be done by the trained personnel, such as Village Technicians.

Improper installation may end up with malfunctioning of the pump and may contribute to the bad reputation of the technology. It is therefore highly recommended that a rope pump is installed by the trained technicians.

The trained technicians can be identified by the Certificate of Competencies (COC), which is explained in the latter section of this paper (see Section 6.2).

### **5.2 Promoting Internal Quality Control by Installers**

It is very important that a rope pump is installed by appropriate technical personnel. It is also equally important that those selected personnel are able to check the quality of installation and top work by themselves, before their works are handed over to the users.

**Rope Pump Installation Checklist for Quality Control** can be used for this purpose. The methods and techniques of inspection could be improved by trainings. There are the trained TVETC instructors in SNNPR to help maintaining and update their techniques.

### **5.3 Promoting Customer Services and Continuous Maintenance by VTs and Users**

Customer services are often a critically important issue in business. In order for a Village Technician to sustain with his/her business in service giving to rope pump installation and repair, he/she needs to consider customer services, such as after-installation inspection, periodical checking and

promotion of preventive maintenance. It is also important to educate the users in simple maintenance, including regular oiling at the bushing part and checking of rope tensions for better reputation and sustainability of the technology.

## **6 Strategies in Securing the Human Resources in Rope Pump Manufacturing and Installation**

### **6.1 Training in System**

It is important to develop and maintain the human resources who have sufficient knowledge and skills in manufacturing and installation of rope pumps, in order to expand the dissemination of the rope pump technology.

A system in human resource development is in place in some Poly Technic Colleges, such as Wolayita Sodo, Arba Minch, Wolkite and Hawassa. There are trained trainers of rope pump technology, who are actively engaged in extending the technical transfer, whose efforts are highly supported by the Regional TVET Bureau. It is hoped that these attempts will be expanded to all over the region and beyond.

Since the TVET system is an already-established system of technical and vocational education and training, and there are professional trainers within the system, integration of the rope pump technology in TVET should be an effective and efficient way to extend the technical transfer of rope pump technology. In addition, the TVET system is well-linked with the assessment of skilled manpower and certification, COC, which is reliable system to measure the capabilities of the skilled person in an objective way.

### **6.2 Certification System**

In order to ensure the proper transfer of the knowledge and skills, assessment of the acquired knowledge and skills is done in an objective way. TVET Bureau of SNNPR came up with a systematic and objective measurement of the knowledge and skills in rope pump manufacturing as well as rope pump installation through the COC system.

“List of the Required Units of Competencies in Rope Pump Manufacturing”  
and “List of the Required Units of Competencies in Rope Pump Installation”

provide the information on the requirements for each subject. COC testing package was developed by the COC Office of SNNPR and the first tests were conducted in April 2016.

It is highly recommended that any organisations or individuals who are intending to procure rope pumps or promote rope pumps should consider utilizing the personnel who have COC of the required UCs.

It should be noted that a “trained” person does not always mean a “capable / skillful” person, unless he/she proof that he/she is practically capable in manufacturing and installing rope pumps. Utilising the COC system is to objectively judge if the person is CAPABLE in manufacturing and/or installation.

### **6.3 Private Sector Business Development and Ethics of Service Providers**

Quality of rope pumps or rope pump fitted wells should necessarily be associated with quality of services, but not only with quality products. The products should be delivered to the customers with reasonable prices and services, including appropriate technical information and education on how to operate and maintain the products. Those services should be ethically sound and user-friendly. Provision of good services may in turn increase the reputation of service providers and contribute to the sustainability and even to the future expansion of the business.

#### **List of Tools**

- 1. Ethiopian Standard ES 3968:2016 (Minimum Requirements of Rope Pump Parts Specifications)**
- 2. RP Manual**
- 3. Checklists**
- 4. Operation and Maintenance Sheets**
- 5. RP Price Calculation Tool**
- 6. Trainers Guide**
- 7. List of UCs**

# ETHIOPIAN STANDARD

# ES 3968:2016

First edition  
22-04-2016

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## Rope Pumps

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**ES 3968:2016****Foreword**

This Ethiopian Standard has been prepared under the direction of technical committee for fluid system and heat transfer engineering (TC 48) and published by the Ethiopian Standard Agency (ESA).  
“the Project for Rural Water Supply, Sanitation and livelihood Improvement through Dissemination of Rope Pumps (RPs) for Drinking Water (WAS-RoPSS Project)” which is under implementation by the Ministry of Water, Irrigation and Electricity (MoWIE).



## Rope Pumps

### 1. Scope

- 1.1 In this Ethiopian Standard, terminology is explained and standards are given for basic dimensions and materials for the main parts of the Rope Pump with a steel RP structure. This standard excludes:
- Any equipment attached to the RP such as modifications made for hand dug wells or drilled wells (for example modification of return pipe).
  - The specification of the equipment covering the wells (e.g. well cover, apron, drain channel and soak away pit).
  - Rope pump structures made of other materials (for example Pole Model; Rope pump with wooden pole structure).



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**ES 3968:2016**

## 2. Normative reference

The following standards, or equivalent standards, are indispensable for application of this Ethiopia Standard . All standards are subject to revision, and only the latest edition (including any amendments) of the standards shall be applicable.

BS EN 10255:2004	Non-alloy steel tubes suitable welding and threading- Technical delivery conditions.
ES ISO 65:2002	Carbon steel tubes suitable for screwing in accordance with ISO7/1.
ES ISO 4014:1999	Hexagon head bolts-Product grade A and B.
ES ISO 4033:2013	Hexagon nuts, style 2 - Product grade A and B.
ES ISO 724:2003	ISO general purpose metric screw threads-Basic dimensions.
CES 40	Galvanized Steel Sheets (Plain and Corrugated)-Specifications.
ES ISO 657-1:2007	Equal-leg angles.
ES ISO 1035-3:2007	Flat bars.
ISO 1452-3	Plastics piping systems for water supply and below and above-ground drainage and sewerage under pressure- Un-plasticized poly vinyl chloride (PVC-U)- Part2: Pipes, Part 3 Fittings.
ES 547-2:2000	Steel for the ribbed of concrete – Part2: Ribbed bar.
ES ISO 1051:2005	Rivet shank diameter.
ES ISO 3834-1:2006	Quality requirements for welding- Fusion welding of metallic materials- Part 1: Guidelines for selection and use (Identical with ISO 3834-1: 1994).
ES ISO 3834-2:2006	Quality requirements for welding- Fusion welding of metallic materials- Part 2: Comprehensive quality requirements (Identical with ISO 3834-2: 1994).
ES ISO 3834-3:2006	Quality requirements for welding- Fusion welding of metallic materials- Part 3: Standards quality requirements (Identical with ISO 3834-3: 1994).
ES ISO 3834-4:2006	Quality requirements for welding- Fusion welding of metallic materials- Part 4: Elementary quality requirements (Identical with ISO 3834-4: 1994).
ES ISO 9606-1:2006	Approval testing of welders- Fusion welding- Part 1: Steels (Identical with ISO 9606-1: 1994).
ES ISO 6520-1:2006	Welding and allied processes- Classification of geometric imperfection in metallic materials- Part 1: Fusion welding.
ES ISO 17637:2006	Non-destructive testing of welds-Visual testing of fusion-welded

joints.

ES ISO 3452-2008 Non-destructive testing –Penetrant testing Part 1: General principles (Identical with ISO 3452-1: 2008).

### 3.1 Terms and Definitions

The terms and definitions to explain the Rope pump and related subjects.

#### 3.11

##### **rope pump**

The Rope pump is a lift hand pump that is using manual power to lift water.

#### 3.12

##### **Operating condition**

Status in which the Rope pump is ready to operate.

#### 3.13

##### **normal operation stance**

Stance in which the operator can rotate the handle in an ergonomic way.

#### 3.14

##### **right side of rope pump**

Right side from the center of the Rope pump at front view, with the handle (See Fig.1 and 2)

#### 3.15

##### **left side of rope pump**

Left side from the center of the Rope pump at front view (See Fig.2& 3)

#### 3.16

center axis of Rope Pump

#### 3.17

##### **structure width**

Length between the centers of the legs at front view (See Fig.5)

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**3.18****structure base length**

Length between the centers of the legs at side view (See Fig.4)

**3.19****structure height**

Height from the ground to the bushing support (See Fig.5)

**3.20****height of the handle**

Height from the center of the bushing to the ground (See Fig.5)

**3.21****static water level**

The level of the (ground) water when (ground) water was not lifted (natural water level at rest).

**3.22****static head**

The elevation difference between the pump discharge point and static water level.

**3.23****water column in the well**

This is the height of water in the well, between the bottom of the well and the static water level.

**3.24****water column in the pump**

This is the distance between the water level in the well and the point where the water is discharged (outlet of the pump).

**3.25****well Cover**

Cover, made of concrete or other hard materials, to cover the well and to install the pump on.

**3.26****apron**

Concrete surface for collecting excess water and guiding excess water to drainage.

**3.27****drainage channel**

Channel to collect water from the apron and guide to the soak away pit.

**3.28****soak away pit**

Pit filled with boulders to let the water infiltrate in the soil, to avoid reproduction of mosquitos and flies.

**3.29****hand dug well**

Well that was manually dug.

**3.30****drilled well (borehole)**

Well that was mechanically or manually drilled, with casing and screen pipes in confined or unconfined groundwater.

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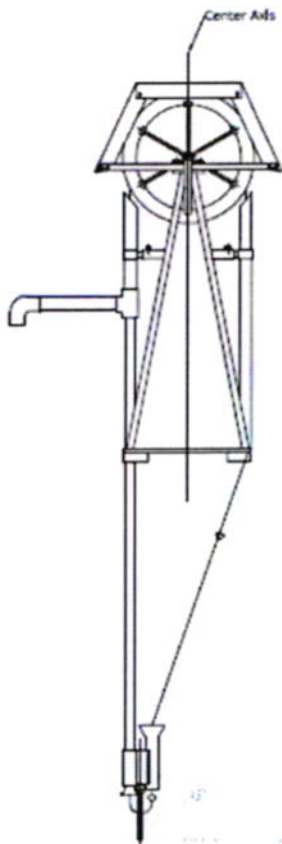


Fig.1 Side View (Right)

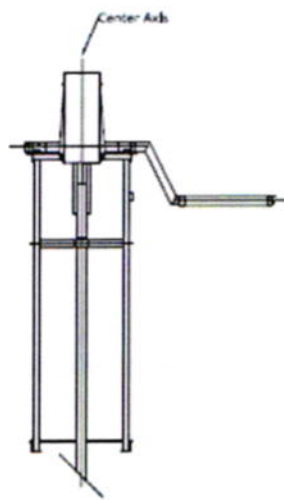


Fig.2 Front View

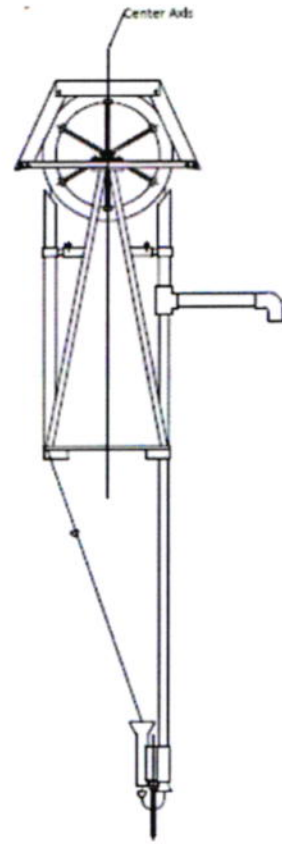


Fig.3 Side View (Left)

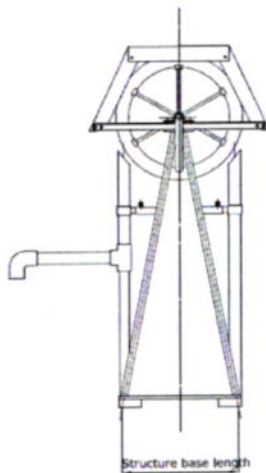


Fig.4 Structure base length

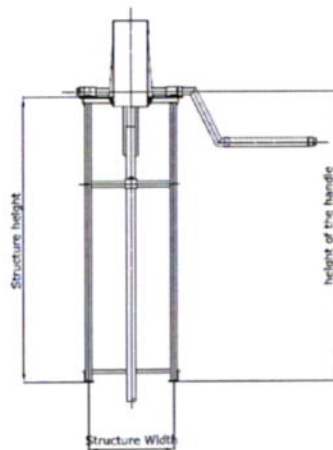


Fig.5 Structure width, Structure height, and height of the handle

### 3.4 Main Parts of Rope Pump

Terms	Definitions	Number in drawing
Wheel cover	The wheel cover will protect the rope from sunlight and to reduce contamination of the rope and pistons.	1
Wheel cover support	Connection between the wheel cover and the structure.	2
Wheel	The wheel will rotate the rope.	3
Handle	The handle transfers human power to the wheel.	4
Bushing	A part for fixing the handle on the structure.	5
Structure	the structure is the main body of the pump, supporting the other pump parts.	6
Riser pipe support	A part for fixing riser pipe.	7
Return pipe support	A part for fixing return pipe.	8
Pump lock	A part for avoiding accidents due to turning back of the handle when handle is released.	9
Guide box	A part to guide the rope smoothly into the riser pipe at the bottom of the well.	10
Discharge pipes and fittings	All PVC parts on the top of the riser pipe to form the outlet of the pump.	11
Riser pipe	Pipe for lifting groundwater from the well.	12
Return pipe	Pipe for guiding the rope back into the well.	13
Piston	PE (Poly Ethylene) product to lift the water in securing the water column in the riser pipe.	14
Rope	PE or Nylon rope for setting pistons at regular intervals and lifting the water.	15

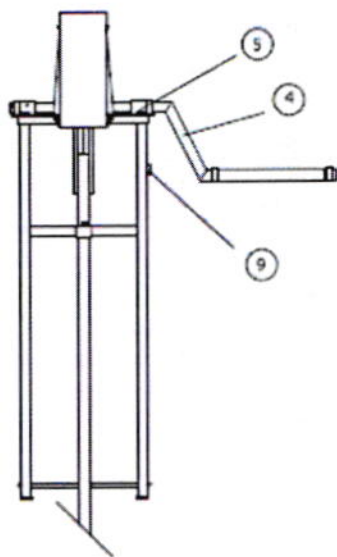


fig. 6 Main parts of Rope pump.

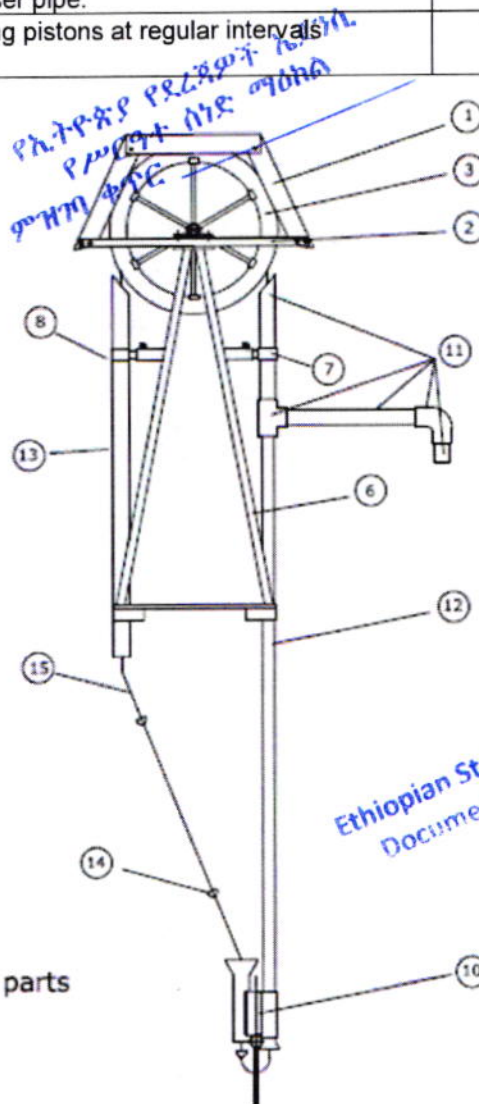


Fig.10 Rope Pump's parts

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## 4. Component and Parts

### 4.1 Component

A Rope pump consists of the parts and materials shown in Table 4.1.

### 4.2 Parts

The parts of the Rope Pump shall be manufactured with the materials listed in Table 4.1. The materials will have the quality of the recommended standards or other standards equivalent to the recommended standards. The material for the wheel rims shall not be specified in this standard.

Table 4.1 Main Parts, Materials and related Standards

Classification	Parts Name	Subparts Name	Material*	Recommended Standards	
Wheel	Wheel Cover		Galvanized Iron sheet	CES 40	
			Pop Rivet	-	
	Wheel cover support		Angle Iron	ES ISO657-1:2007	
	Wheel Wheel	rim		Rubber	-
		Wheel hub		Galvanized Iron Pipe (GIP)	BS EN 10255:2004
				Bolt and nut	ES ISO 4014:1999 ES ISO 4033:2013
		Wheel spoke		Ribbed bar or GIP	ES 547-2:2000 BS EN 10255:2004
Wheel clamp		Flat iron	ES ISO 1035-3:2007		
Handle	Handle	Handle shaft	GIP	BS EN 10255:2004	
		Handle grip	uPVC	ISO 1452-2	
Bushing	Bushing	Bushing	GIP	BS EN 10255:2004	
		Bushing strip	Flat iron	ES ISO 1035-3:2007	
Structure	Structure	Pipes	GIP	BS EN 10255:2004	
		Bushing support	Angle Iron	ES ISO657-1:2007	
	Bolt and nut		ES ISO 4014:1999 ES ISO 4033:2013		
	Riser pipe support		GIP	BS EN 10255:2004	
	Return pipe support		GIP	BS EN 10255:2004	
	Lock		Ribbed/Round bar	ES 547-2:2000	
Riser pipe			uPVC	ISO 1452-2	
Return pipe			uPVC	ISO 1452-2	
T-piece, reducer, elbow			uPVC	ISO 1452-3	

\*all materials used for construction of the pump should be new, free of rust and cracks.



## 5. Minimum specifications (including performances, features and dimensions)

### 5.1 Producing Items

#### 5.1.1 Main Dimensions

The main dimensions of the Rope pump (structure width, base length and height) will not be applied for standardization in this document, as there are many different steel model Rope pump designs manufactured in Ethiopia by different manufacturers. Only the dimensions of a number of main parts will be standardized (see section 5.2).

#### 5.1.2 Manufacturing and assembling

For manufacturing of the Rope pump, it is important to use welding jigs. Parts which have been manufactured with the welding jigs are all identical and are in line with each other. This means that all parts will always fit to all pumps that have been manufactured. This is especially important when pump parts have to be replaced in future.

Measurement tools shall be used for checkups and good working of the pump, after assembly of all the parts on the pump.

#### 5.1.3 Welding work

Welding works shall be made with fillet welding in accordance with Ethiopian standards listed in "2. Normative Reference".

#### 5.1.4 Painting

Painting shall be done to the welded parts, non-galvanized parts and damaged galvanization to prevent rusting.

Prior to painting, welding slack, grease and rust shall be removed and sandpapered. Painting shall be done twice: first painting with antirust primer and secondary paint (gloss paint) for final painting. Painting can be done in any color. Painted structure shall be dried in shade after every painting. Paint should only be diluted with official diluent, if needed.

#### 5.1.5 Bolts and Nuts

All the bolts and nuts to be used for the rope pumps shall be rust-resistant (galvanized or stainless steel).

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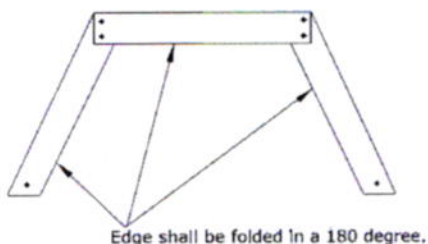
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**ES 3968:2016****5.1.6 External Appearance of Rope Pumps**

Galvanized and/or painted surface shall be free from faults such as exposed original material, peel, rust, cracks and other defect.

**! Please note:**

The dimensions (thickness, length and width) of the materials in the following paragraphs are minimum to be used. In case materials are not available, thicker materials can be used. Materials which are thinner than the indicated thickness should NOT be used. The same applies for the length and width of the materials.

**5.2 Wheel cover and Wheel****5.2.1 Wheel cover**

Galvanized iron sheet with the thickness of 0.5mm is recommended for the wheel cover. The edge of the metal sheet shall be folded in a 180 degree fold to avoid being injured due to sharp edges. Recommendable bent rim is 10mm.

Fig. 7 Wheel cover

Bended parts of the metal sheet shall be connected with 1 (one) or 2 (two) rivets. Recommendable diameter of the rivet is 5 mm.

Wheel cover shall be fixed to the wheel cover support with M6 x 15mm bolts and nuts.

**5.2.2 Wheel cover support**

Recommendable material for wheel cover support is angle iron with size of 20 mm x 20mm x 2mm or ribbed bar with diameter of 12mm.

**5.2.3 Wheel**

Wheel consists of wheel rims, wheel hub, spokes, and clamps. The inner diameter of the wheel shall be 14" (±350 mm) or equivalent.

The material of the wheel rims shall be rubber. The wheel shall be V-shaped. The V-shape will 'hold' the rope during pumping.

The rubber rims shall be closed tightly in order to avoid the rope from getting stuck in between the rims. The rubber rims are made of a car tire. Alternatively a moulded rubber wheel of one piece can be used.

The hub shall have holes at the right and left sides to accommodate bolts and nuts. Recommendable material for the hub is GIP with diameter of 1", Class B or equivalents, and length of 100mm. Nuts shall be welded onto the hub for adjusting the wheel on the handle. Recommendable bolts and nuts to be attached to the hub are M10 x 20 mm.

Spokes, clamps and hub shall be welded with using the tools such as welding jigs in order to keep same angles between spokes. The wheel with 6 (six) spokes is recommendable. The angle between the spokes shall be 60 degrees. The recommendable material for spokes is ribbed bar with the diameter of 8 mm or 1/2" GIP, Class B or equivalents.

The connection between wheel rim and clamp shall be made tightly.

Wheel hub, spokes and clamps (including the inside of the clamp) shall be painted for anti-rusting before assembling.

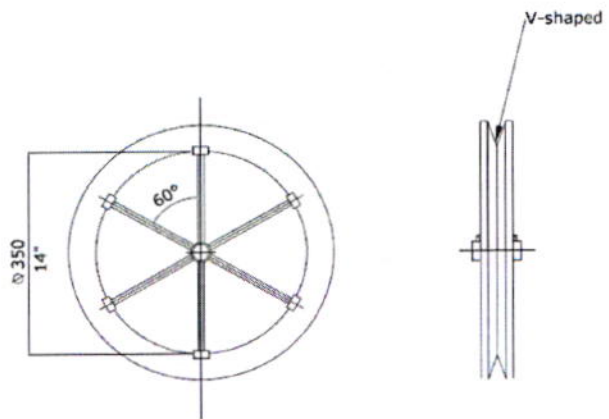


fig. 8 Wheel

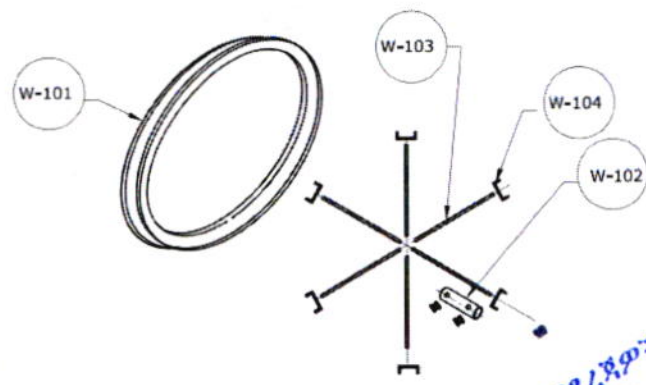


fig. 9 W-101 Wheel rims  
W-102 Wheel hub  
W-103 Spokes  
W-104 Clamps

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ES 3968:2016

### 5.3 Handle and Bushings

#### 5.3.1 General

The handle will rotate the wheel. The handle shall be fixed with the bushings onto the bushing supports which are part of the pump structure.

#### 5.3.2 Handle

Handle shall consist of handle shaft, stopper rings and grip.

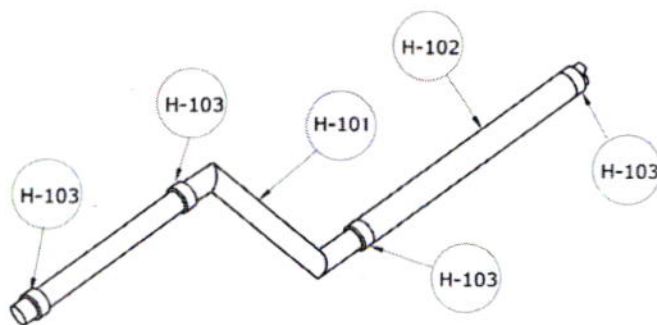


Fig. 10 H-101 Handle shaft, H-102 Handle grip, H-103 Stopper rings

Recommendable material for handle shaft is GIP with OD 26.9mm (3/4"), Class B or equivalents.

The bushing side and grip side of the handle shall be parallel. The handle can be made by cutting and welding the pipe or by bending, using bending machine. Regardless of cutting/welding and mechanically bending, the handle part shall be strong enough for daily progressive works.

In case the handle is made by cutting and welding, the cuts shall be totally closed by welding. The handle is one of the critical parts of the pump; the welding should be of high quality.

Stopper rings\* shall be attached onto the handle to avoid moving. Recommendable material for the rings is GIP OD 26.9mm (3/4"), Class B or equivalents. Pipe ends of the handle shall have a stopper lock\* or cutter pin\* to avoid grip moving.

The handle grip shall be attached to the handle shaft for a convenient grip. Recommendable material for handle grip is uPVC pipe with outer diameter of 32mm, PN6.

\* Stopper rings, cutter pin and stopper lock will not be standardized in this application.

**5.3.3 Bushings**

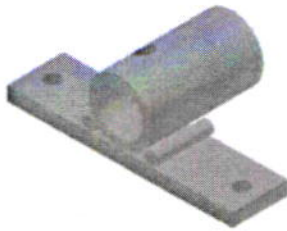


Fig.11 Bushing

Bushings shall be equipped onto the both sides of the structure to support the handle, and fixed in-line on the structure. Bushing consists of flat iron and galvanized iron pipe. Recommendable material for bushing is GIP with OD 33.7mm (1"), Class B or equivalents.

The diameter of the bushing has to be enough to fit the handle, including the clearance between the pipe and handle. Total clearance of 0.5 mm to 1 mm between bushing and handle shaft is recommended. If needed, the bushing can be cut and welded to reach the desired clearance. In this case, be aware that the bushing will stay perfectly circular (not oval) shaped. Recommended bushing length is 55mm or more.

Recommended material for bushing is flat iron with size of 30mm x 3 mm.

The pipe for bushing has one hole for greasing, with recommendable diameter of 6mm. The edge of the pipe shall be beveled, and the inside of the pipe shall be free from any seams and burrs not to damage the handle.

The bushing is fixed onto the bushing supports on the structure with bolts.

Ball bearing can be used instead of bushing.

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**5.4 Structure**

The structure shall consist of structure pipes, bushing supports, riser pipe support, return pipe support, leg supports, leg bases and pump lock.

**5.4.1 Structure Pipes**

The structure pipes shall be assembled, using special tools such as welding jigs in order to keep right form.

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The width of most structures in Ethiopia varies between 260mm and 310mm, and structure base lengths vary between 370mm and 400mm. Therefore the structure width and lengths are not standardized in this application.

Recommendable material for structure pipes is GIP with OD 21.3mm (1/2"), Class B or equivalents.

## ES 3968:2016

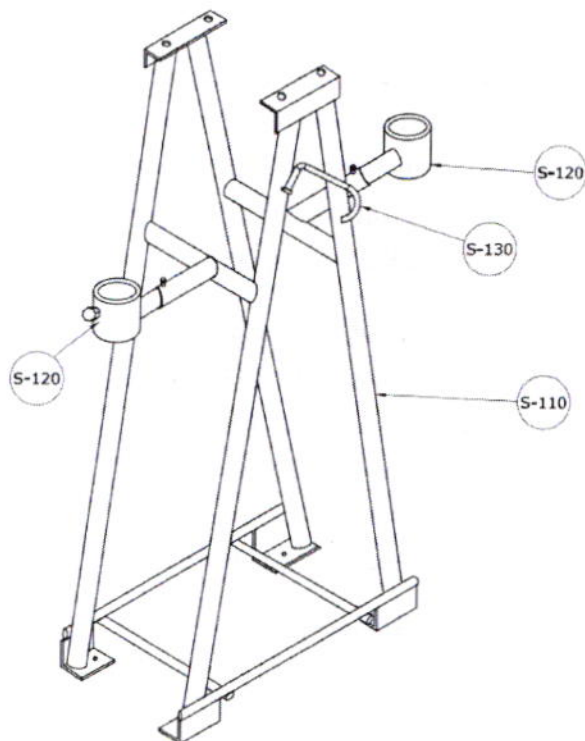


Fig. 12 S-110 Structure pipes, S-120 Raising and return pipe support, S-130 Pump lock

#### 5.4.2 Bushing support

The bushing support is an angle iron on top of the structure. The bushing support has two holes to accommodate connection with the bushings. Recommended material for the bushing supports is angle iron 30mm x 30mm x 3mm.

#### 5.4.3 Leg support and leg bases

Leg supports and leg bases can be welded on the structure, but these are not standardized.

#### 5.4.4 Riser pipe support and return pipe support

Riser pipe support and return pipe support are welded on the structure. The riser pipe support shall hold the tanker and riser pipe to prevent from falling into the well. The return pipe support shall hold return pipe which guides the ropes back into the well.

The material for the supports shall be GIP. The raising and return pipe holder shall be a ring of GIP 1 ½", Class B or equivalent. The support shall be adjustable (for example by using slider pipe with nut and bolt, but this adjustable part of the support is not standardized in this application).

**5.4.5 Pump Lock**

Pump lock shall be welded to the structure in order to avoid accidents due to turning back of the handle when handle is released. Pump lock shall be welded away on the structure in a way that it can hook the handle. The material for the pump lock shall be ribbed with a diameter of 8mm.

**5.5 uPVC pipes and fittings**

**5.5.1 Riser pipe**

Recommended material for riser pipes is uPVC pipes made with ISO standard or equivalent. Recommendable outer diameters by the standards are listed in below table.

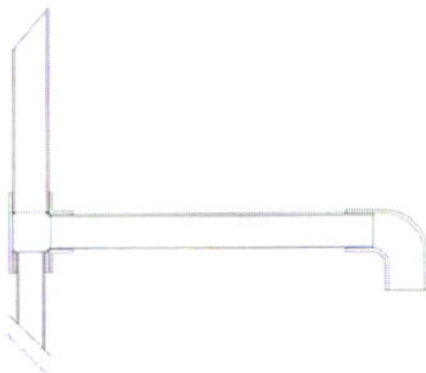
Static Head (m)	uPVC(ISO) outer diameter (mm)
0-10	32mm
10-20	25mm
20-25	20mm

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The inner diameter depends on the permissive pressure and pipe size. Recommended permissive pressure is PN6 or more.

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**5.5.2 Discharge pipes and Fittings**



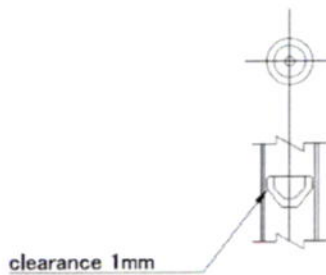
All uPVC parts on the top of the riser pipe form the outlet of the pump. This includes: T-piece, reducer, elbow, tank or pipe and outlet pipe. It is very important that all uPVC parts and pipes on a pump are of the same standard to make sure that all parts have a perfect fit.

Fig. 13 Discharge pipes and Fittings

**5.6 Pistons and Ropes\***



## ES 3968:2016



Pistons shall be attached to the rope at intervals of 1 m in order to carry (ground) water. Pistons shall be made of Polyethylene (PE). The total clearance between the inner diameter of the riser pipe and piston shall be maximum 1 mm.

Rope made of Polypropylene (PP) or Nylon with a diameter of 4mm for riser pipes with OD 20mm and 6 mm for riser pipes with OD 25mm and 32mm is recommended. The pistons are kept in place on the rope between two knots.

\* The clearance between the pistons and the riser pipe will be standardized, but the material for the pistons and for the rope are not standardized in this application.

### 5.7 Guide box



The guide box is a part to guide the rope smoothly into the riser pipe at the bottom of the well.

The guide box is not standardized in this application as there are different guide box designs manufactured in Ethiopia. No major problems have been observed with these guide boxes till date.

Fig.17 Guide box



## 6. Inspection Methods

Inspection test related to the welding work shall be conducted for the structure in accordance with the following methods. Below-mentioned test shall be conducted by qualified personnel or personnel with a certification in this field by an authorized body.

### 6.1 Visual Test for Welding

Prior to liquid penetration test, visual test shall be conducted in accordance with Ethiopian Standard. Test shall be conducted for the whole pump.

### 6.2 Liquid Penetration Test (Non Destructive Test) for Welding Work

If there is any doubt on the quality of welding during the visual test, a liquid penetration test can be conducted for the structure. In that case the test shall be conducted in accordance with Ethiopian Standard. The samples for testing shall be selected by random sampling.

### 6.3 Measuring dimensions and checking standards for materials

In this document dimensions of parts and standards for materials are given. These standards and dimensions shall be checked. Accurate measuring can be done, for example with a caliper or measuring tape. Materials standards can be checked by measuring and checking the indicated standard on the material.

Although this is strongly recommended to maintain quality of the product, the measuring methods will not be standardized in this application

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**Ethiopian Standards Agency**

## **Organization and Objectives**

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010. ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1970.

*ESA's objectives are:-*

- ❖ Develop Ethiopian standards and establish a system that enable to check whether goods and services are in compliance with the required standards,
- ❖ Facilitate the country's technology transfer through the use of standards,
- ❖ Develop national standards for local products and services so as to make them competitive in the international market.

## **Ethiopian Standards**

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government organizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.

Orders For all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch (Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed in from our website.

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**International Involvement**

ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the international Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM). It is a founding member of the African Regional Organization for standardization (ARSO).

### **More Information?**

*Contact us at the following address.*

*The Head Office of ESA is at Addis Ababa.*

☎ 011- 646 06 85, 011- 646 05 65

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✉ 2310 Addis Ababa, Ethiopia



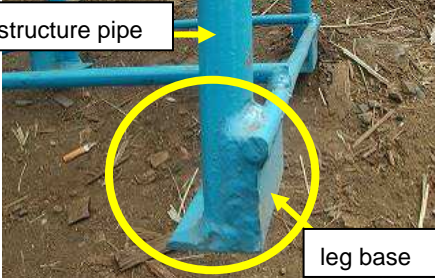

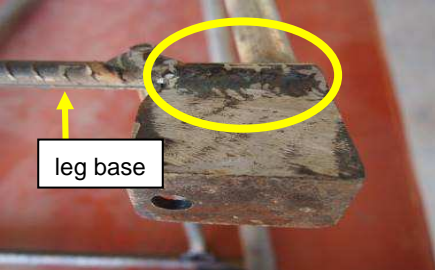
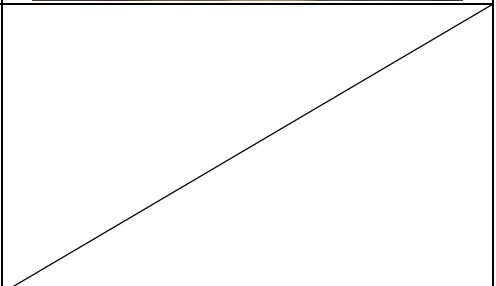
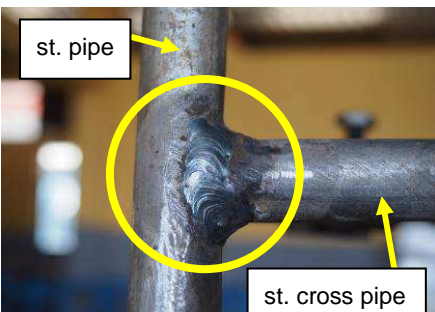
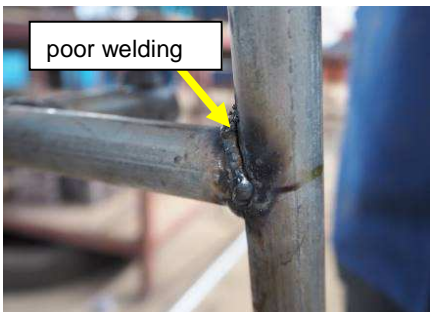
E-mail: [info@ethiostandards.org](mailto:info@ethiostandards.org),

Website: [www.ethiostandards.org](http://www.ethiostandards.org)





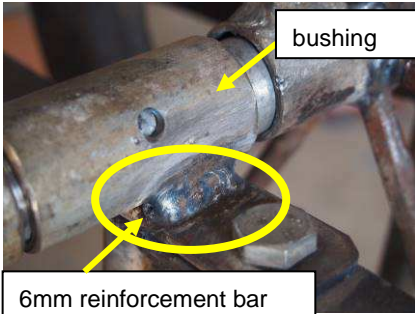
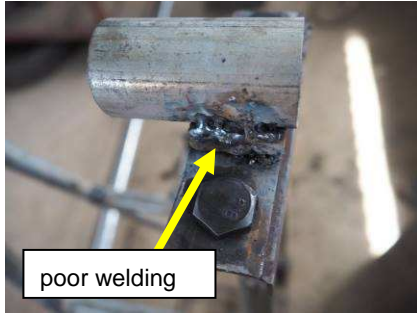
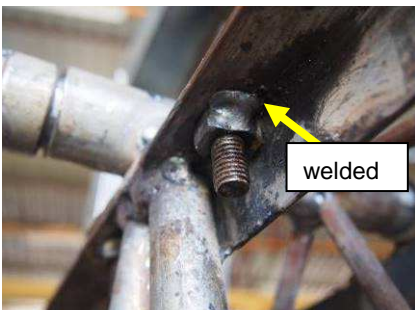

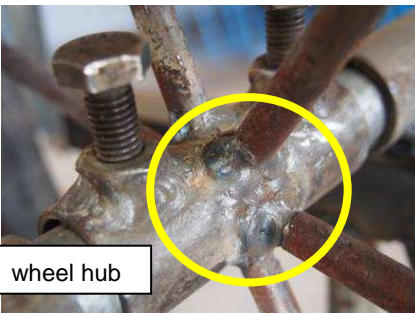



Standard Mark

**Rope Pump MANUFACTURING checklist for quality control**




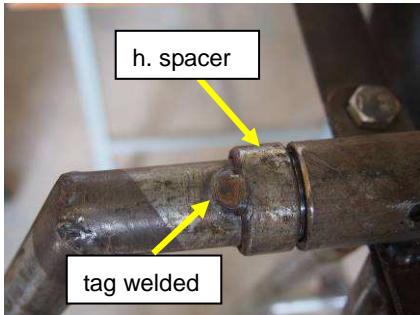


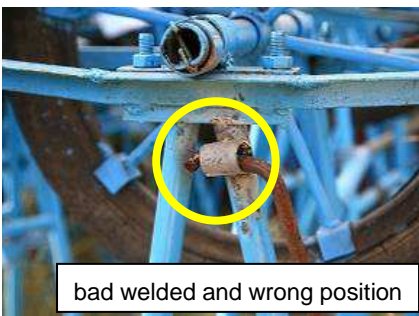
Description	Good sample	Bad sample
<b>A Welding</b>		
<b>General</b>		
1 Check if welding jigs are used for welding of the main parts (wheel, structure frame and bushings)		
2 Check if the pump parts are not deformed due to welding (heat).		
<b>A1 Structure</b>		
3 Check if the leg base angle iron is properly welded with the structure pipe.		
4 Check if the leg support is properly welded with the leg base.		
5 Check if the structure cross pipes are properly welded with the structure pipes.		



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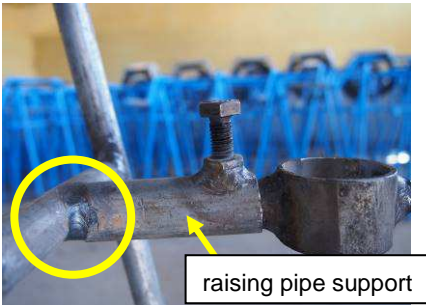
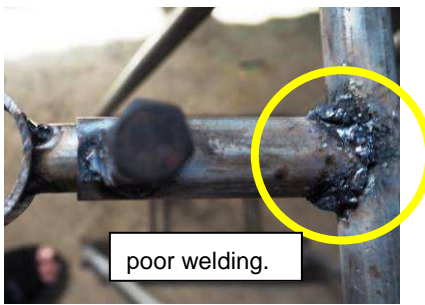

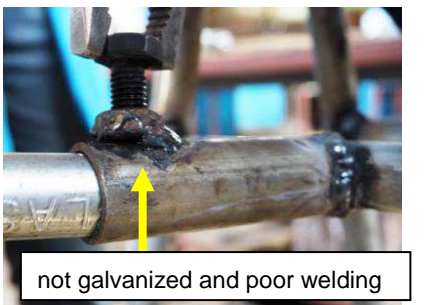

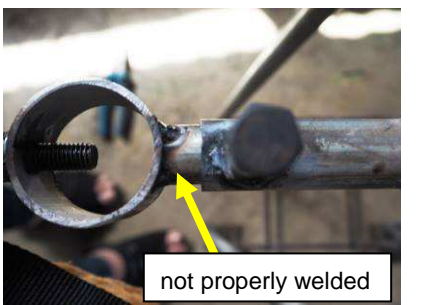
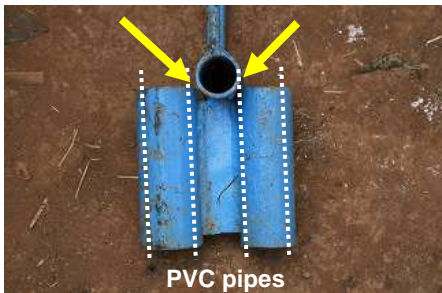
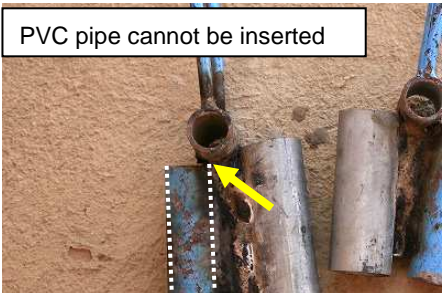
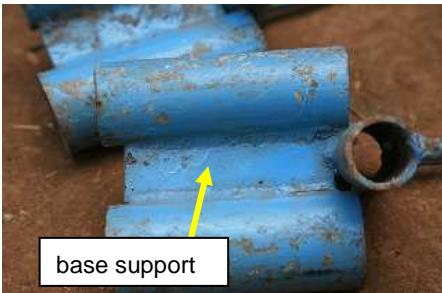

	Description	Good sample	Bad sample
<b>A2</b>	<b>Bushing</b>		
6	Check if the bushing supports (angle iron) are properly welded with the upper part of the structure pipes.		
7	Check if the bushing is properly welded with the bushing base (flat iron) and welding support (6mm reinforcement bar). Check if the seam is filed out and located at the top of the bushing.		
8	Check if the bushing support (angle iron) is properly welded with the M10 galvanized nuts.		
<b>A3</b>	<b>Wheel</b>		
9	Check if the wheel hub is properly welded with the spokes. Check if the spokes are centered on the wheel hub.		
10	Check if the wheel hub is properly welded with the M10 galvanized nuts.		

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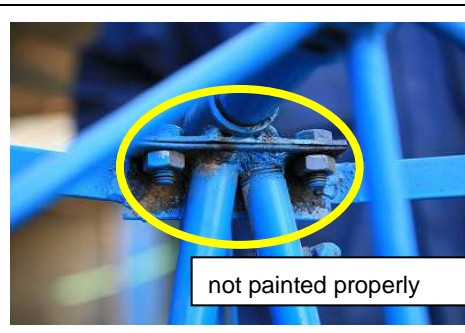
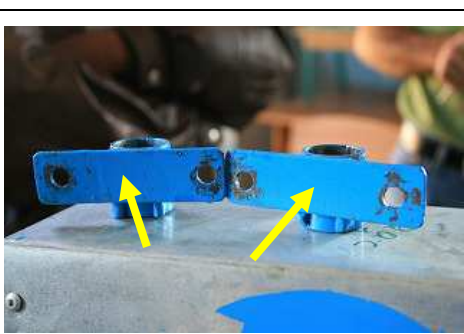

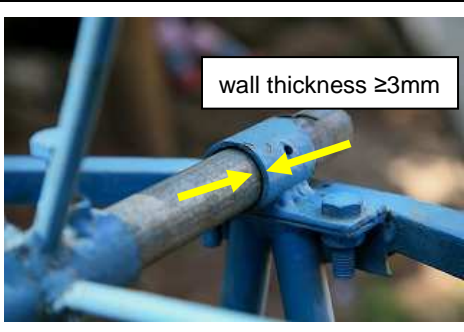
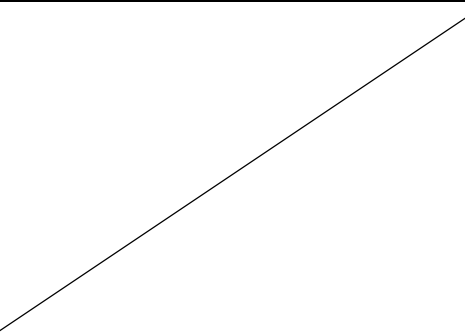
	Description	Good sample	Bad sample
11	Check if the wheel clamps are properly welded with the spokes.		/
<b>A4 Handle</b>			
12	Check if the handle bend is properly welded or bended.		
13	Check if the handle spacer is properly welded (strong tag welded on the outside).		
<b>A5 Pump lock</b>			
14	Check if the pump lock hub is properly welded with the structure pipe.		
<b>A6 Wheel cover support</b>			
15	Check if the wheel cover support is properly welded to the structure (there are different rope pump models, please check the drawing).	/	/



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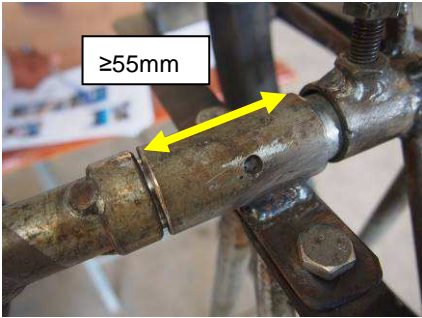
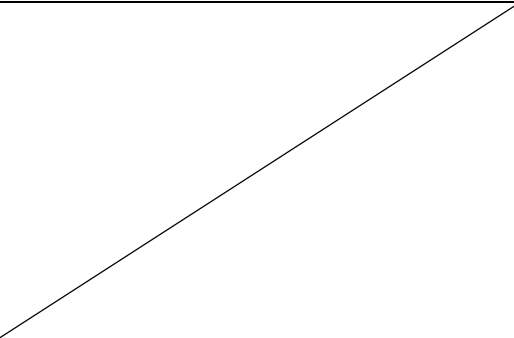
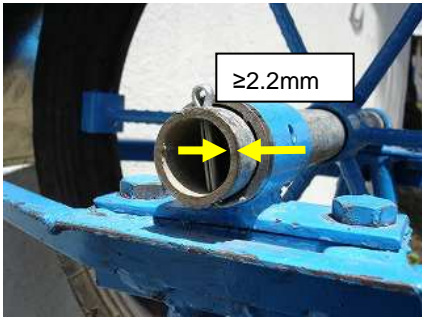
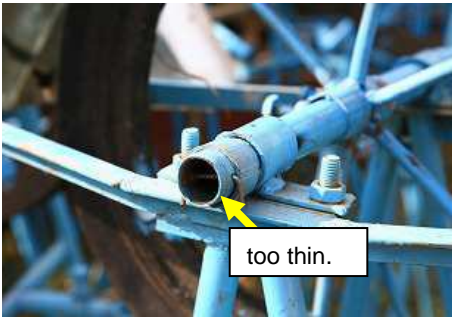
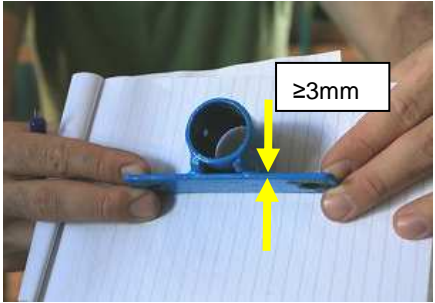
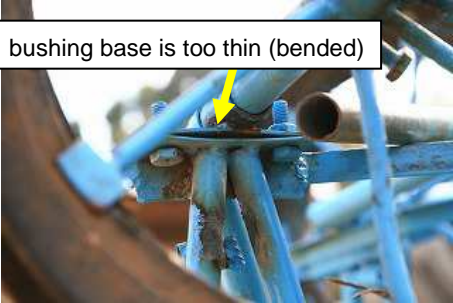

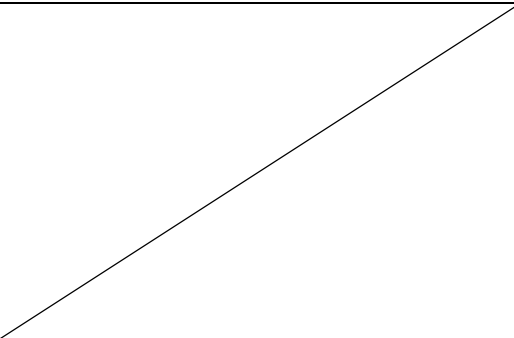
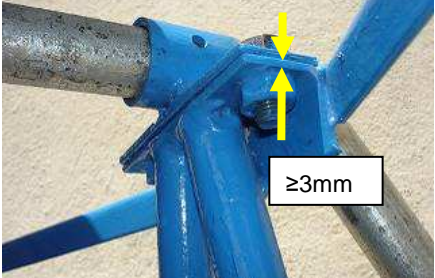

	Description	Good sample	Bad sample
<b>A7 Raising and return pipe support</b>			
16	Check if the raising pipe and return pipe supports are properly welded horizontally to the structure cross pipes.		
17	Check if the galvanized M10 nuts are properly welded with the raising pipe and return pipe holder supports.		
18	Check if the pipe holders are properly welded with the pipe holder sliders at exactly 90 degree.		
<b>A8 Guide box (Turning point)</b>			
19	Check if the raising pipe support and the rope catcher pipe support are welded to the rope protection base in a way that the PVC pipes can be inserted easily.		
20	Check if the base support is properly welded with the raising pipe support and rope catcher pipe support.		

Rope pump manufacturing check list for quality control, 4rd Edition June 2016

	Description	Good sample	Bad sample
<b>B Painting</b>			
21	Check if welding slag and sharp edges have been removed before painting. Check if all the parts (at least all the parts that are not galvanized and welded) are with antirust before painting the primary paint.		
22	Check if the spoke clamps are painted with antirust before assembling.		 <p>no antirust on the inside of the clamp, the inside starts to rust</p>
23	Check if the bushing support is properly painted.		 <p>not painted properly</p>
24	Check if the backside of the bushing base is painted and dried before assembling.		
25	Check if all pump parts have been properly painted (at least all the parts that are not galvanized and welded).		
<b>C Dimensions of critical parts</b>			
<b>(the dimensions of all other pump parts can be found in the technical drawings)</b>			
<b>C1 Thickness of materials</b>			
26	Check if thickness of the bushing is <b>3mm</b> or more (check if the handle fits the bushing).		


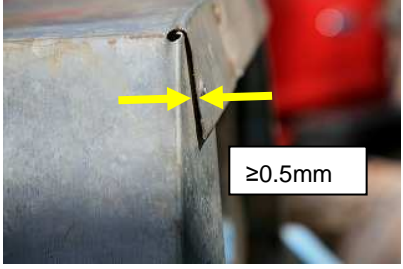


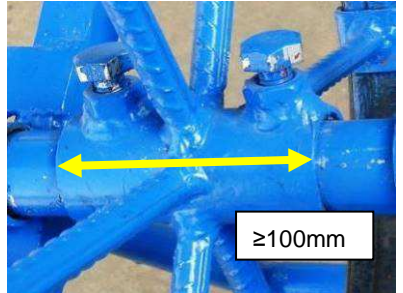


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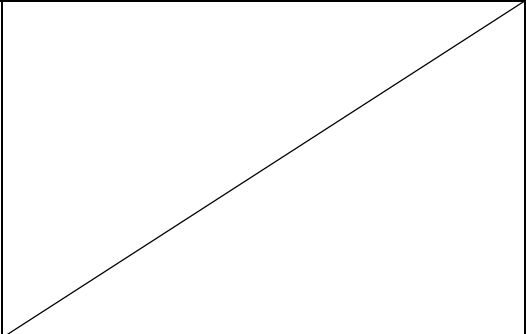

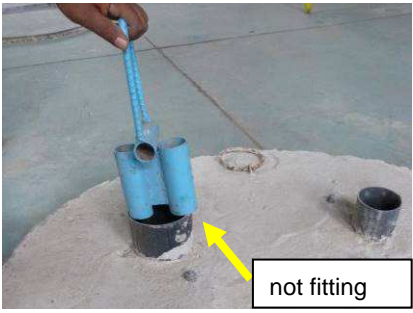

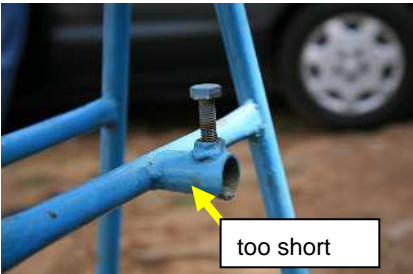

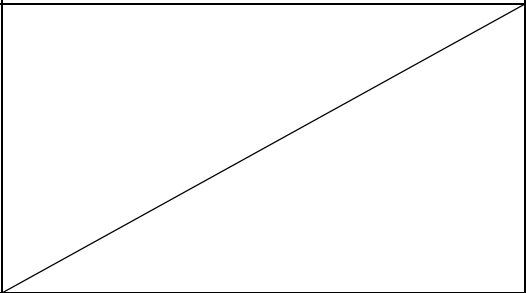
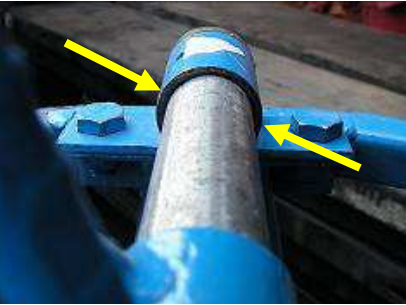

	Description	Good sample	Bad sample
27	Check if the length of the bushing is <b>55mm</b> or more		
28	Check if the thickness of the handle is <b>2.2mm</b> or more.		
29	Check if the thickness of the bushing base is <b>3mm</b> or more.		
30	Check if the thickness of the spoke clamps are according to the drawings.		
31	Check if the thickness of the busing support is <b>3mm</b> or more.		




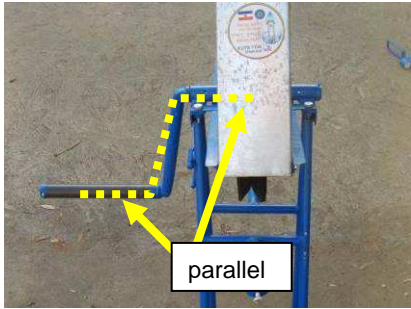
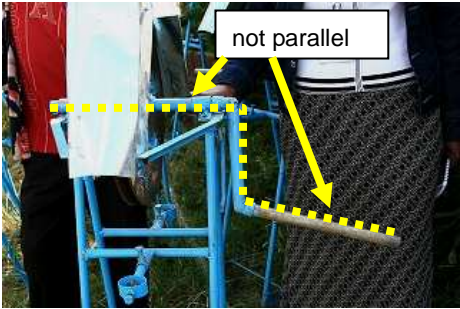


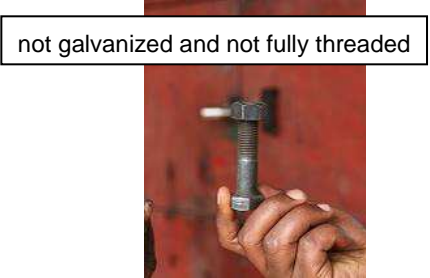
Rope pump manufacturing check list for quality control, 4rd Edition June 2016

	Description	Good sample	Bad sample
32	Check if the diameter of the spokes is <b>8mm</b> or more (according to the drawings).		
33	Check if the thickness of the cover sheet metal is <b>0.5mm</b> or more and is galvanized.		
<b>C2 Length and diameter</b>			
34	Check if the distances between the two holes (center to center) on the leg angle iron are according to the drawings.		
35	Check if the spoke lengths are equal for all spokes, according to the drawings.		
36	Check if the length of the hub is <b>100mm</b> or more. Check if the thickness of the hub is 3mm or more (check if the handle fits inside)		

Rope pump manufacturing check list for quality control, 4rd Edition June 2016

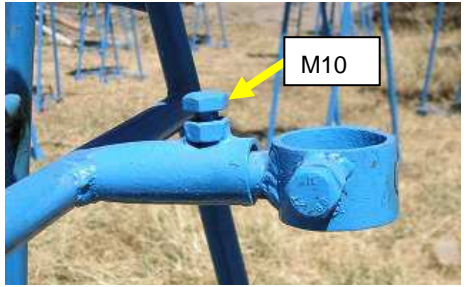



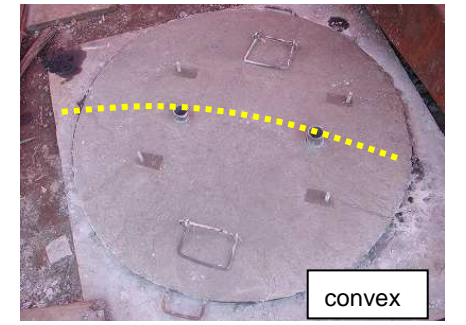
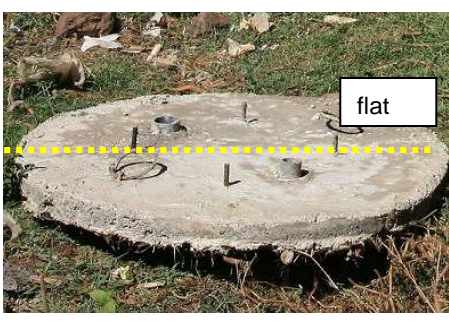
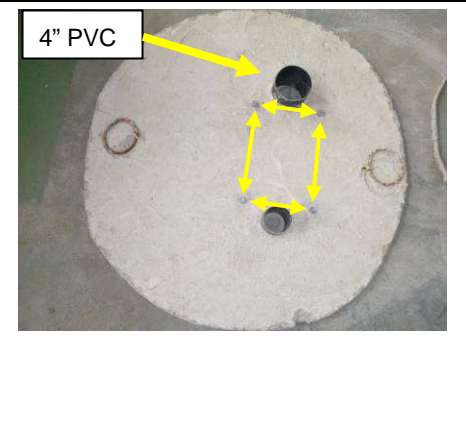
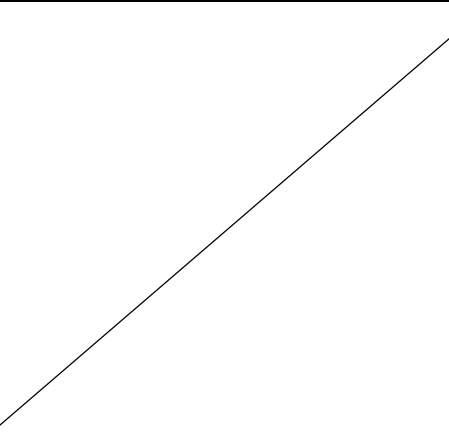

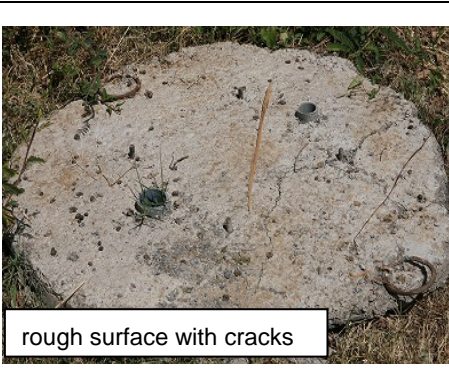
	Description	Good sample	Bad sample
37	Check if the diameter of the car tire is approx. 14". Check if the outer diameter of the wheel rubber is according to the drawing.		
38	Guide box: check if the guide box fits in the PVC pipe of the well cover (check if the dimensions of the guide box are according to the drawings, depending on the model).		
39	Check if the lengths of the raising and return pipe supports are according to the drawing.		
40	Check if the lengths of the raising and return pipe sliders are according to the drawing.		
<b>D Alignment</b>			
41	Check if the bushing is aligned with the handle. Check if the total clearance between handle and bushing is <b>between 0.5 and 1mm</b>		

Rope pump manufacturing check list for quality control, 4rd Edition June 2016


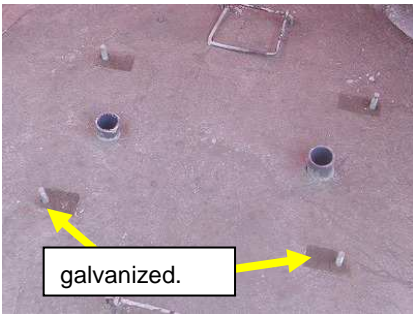





	Description	Good sample	Bad sample
42	Check if the wheel is properly aligned (no wheel distortion).		/
43	Check if the angles of the handle are according to the drawing. Check if the handle grip is parallel to the axle.		
44	Check the alignment of the pump as a whole (is it straight and are all four legs touching the ground?)		/
<b>E Materials</b>			
45	Check if all pipes used for the manufacturing of the structure frame, the handle, the bushings, the wheel hub and the guide box are GI pipe (Galvanized Pipes), class B.		
46	Check if all the material used are free of any damage.		
47	Check if the bolts and nuts are galvanized and fully threaded.		



Rope pump manufacturing check list for quality control, 4rd Edition June 2016

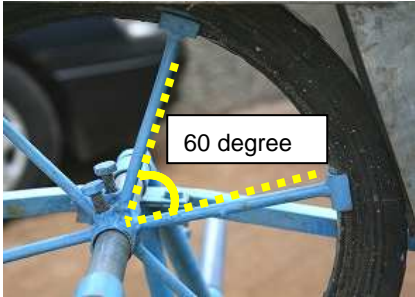


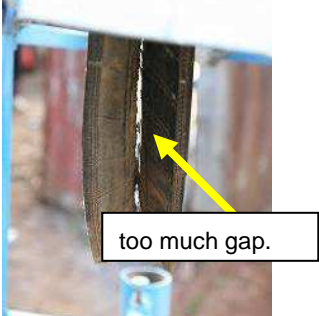

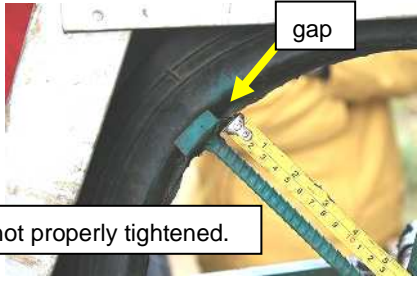

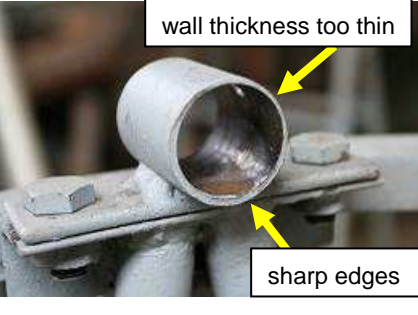
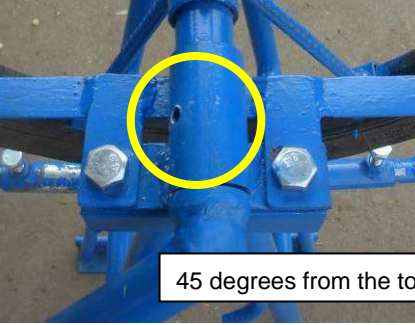

	Description	Good sample	Bad sample
48	Check if the sizes of bolts and nuts for the main body are M10 and for the cover are M6 (length according to the drawings). Check if all bolts and nuts are galvanized.		
49	Check if the wheel rubbers have no damage and distortion.		
<b>F Concrete well cover and reducer blocks</b>			
50	Check if the shape of the well cover is convex to allow water to flow off. Check if the diameter of the well cover is according to the drawing.		
51	Check if the distance between the anchor bolts and the distances between the PVC pipes are according to the drawings. Check that bolts and PVC pipes are pointing straight upwards. Check if the diameter, length and quality of PVC pipes are according to the drawings. A 4" PVC pipe is recommended.		
52	Check if the surface of the well cover is smooth. Check if the mix ratio for concrete is according to the drawing, check if the sand is free of silt and organic impurities, this can only be done if you are present during the manufacturing process).		

Rope pump manufacturing check list for quality control, 4rd Edition June 2016





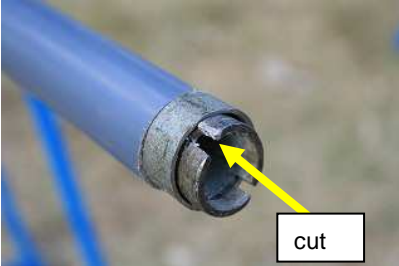



	Description	Good sample	Bad sample
53	Check if the well cover is made by use of a mold. Check that concrete is kept wet during curing.		/
54	Check if the anchor bolts are galvanized and fully threaded.		
55	Check if the diameters of the re-bars and distances between the re-bars are according to the drawings. Check if locations of the well cover handles are according to the drawings.		
56	<b>The use of reducer blocks is not mandatory. If they are used following need to be checked.</b> Check if the surfaces of the reducer blocks are smooth. Check if the mix ratio for concrete is 1 cement : 2 sand : 3 gravel (check if the sand is free of silt and organic impurities).		/
57	Check if the reducer blocks are made by use of a mold. Check that concrete is kept wet during curing.		/



Rope pump manufacturing check list for quality control, 4rd Edition June 2016


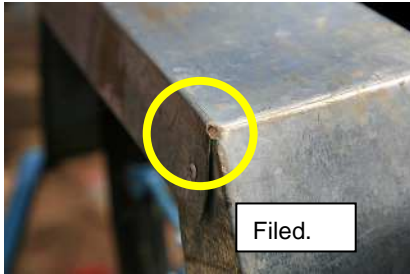
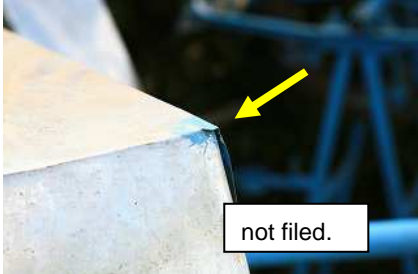



	Description	Good sample	Bad sample
<b>H Miscellaneous</b>			
58	Check if the angles between the spokes are equal (60 degree). Check if the wheel has at least six spokes.		
59	Check if the contact of two wheel rubbers is closed.		
60	Check if the connections between spoke clamps and wheel are tight.		
61	Check if the bushing is properly chamfered/ filed (no sharp edges).		
62	Check if the oil hole is on top or max 45 degrees from the top to allow easy lubrication. Check if the diameter of the hole is 6mm.		

Rope pump manufacturing check list for quality control, 4rd Edition June 2016

	Description	Good sample	Bad sample
63	Check if the rotation of handle is smooth (the handle rotates by itself when it is upper side).		/
64	Check if the wheel does not touch the wheel cover (to be able to move freely).		/
65	Check if the horizontal displacement of handle is small enough, according to the drawings.		
66	Check if the stopper cut at the end of the handle grip is bended in the right direction to avoid it from 'cutting' into the hand of the user.		
67	Check if the pump lock moves easily.		/
68	Check if the raising pipe and return pipe supports are smoothly adjustable.		/

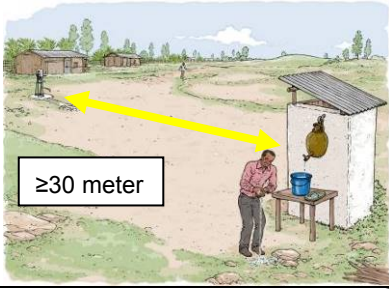
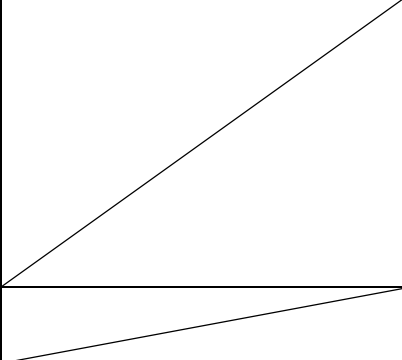






Rope pump manufacturing check list for quality control, 4rd Edition June 2016




	Description	Good sample	Bad sample
69	Check if the raising pipe and return pipe holder positions are at the middle of the structure cross pipes.		/
70	Check if the corners of the wheel cover are filed (to avoid sharp edges).		
71	Check if the bolts are able to tighten and loosen easily for bushing plate, handle, hub and raising pipe support (no welding sparks or damage on the threads).	/	
72	Check if the aluminium or sheet metal name plate is attached to the pump (at least mentioning the name of the manufacturer, serial number, date of production and contact details).		/
73	Check if the operation direction arrow is fixed in the right direction		/



**Rope Pump INSTALLATION checklist for quality control**


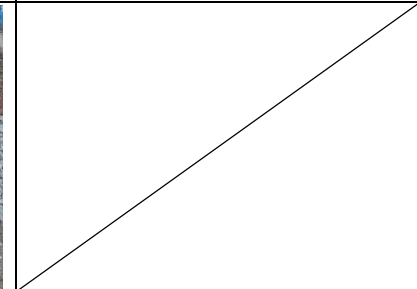

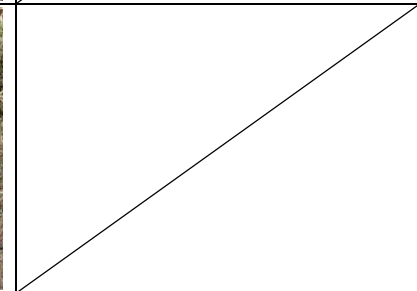





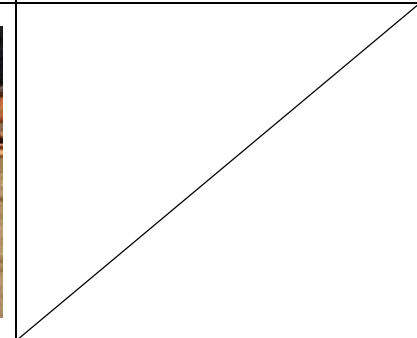


	Description	Good sample	Bad sample
<b>A</b>	<b>Site selection and preparations of the well before installation</b>		
<b>A1</b>	<b>Hygiene and site selection</b>		
	<p>Before the Rope pump is installed on a well, please be aware of following hygiene aspects:                      The presence of a toilet/latrine is a serious threat to the water quality in the well. If the toilet is near the well, the well water may be contaminated with bacteria from the toilet. Therefore it is strongly recommended to:</p>		
1	<p>Locate the well at a distance of 30 meters or more from the toilet (including a toilet from the neighbor),</p>	 <p>≥30 meter</p>	
2	<p>Locate the well upstream (or uphill) of the toilet,</p>		
3	<p>Check if the installer has informed the client about the hygiene aspects mentioned above.</p>		
<b>A2</b>	<b>Preparations of the well before installation</b>		
	<p>Before the Rope pump is installed on a well, it is important that the well itself is of good quality. It is important that:</p>		
4	<p>The well will not dry up during dry season. The well should be deep enough to hold at least 50 centimeter of water during the dry season. If the well is not deep enough, it should be deepened BEFORE INSTALLATION of the Rope pump,</p>	 <p>deepening the well</p>	 <p>dry well, not deep enough</p>
5	<p>The well should be a 'non-collapsing' well. If the bottom of the well consists of collapsing sand, the well will collapse again after deepening and the Rope pump will not work. The pump cannot be installed on a collapsing well unless the bottom of the well is reinforced, to prevent the well from collapsing.</p>		 <p>well collapse, the wall of the well has collapsed</p>

Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016











	Description	Good sample	Bad sample
6	Check if the installer has informed the client about the well requirements mentioned above.		
7	Check if the installer has measured the water level in the well (and asked the client what the water level of the well is during dry season).		
8	Check if well cleaning and/or deepening of the well is done.		
<b>B Construction of the top works</b>			
<b>B1 Preparations before construction of the top works</b>			
9	Check if the installer has measured the diameter and depth of the well.		
10	Check if all construction materials are present on the site: cement, sand (without silt and organic impurities), gravel, stones, reducer blocks and well cover.		
<b>B2 Construction of the top works (checklist to be checked DURING construction)</b>			
11	Check if the top soil around the well is removed to a minimum depth of 20 centimeters.		
12	Check if the soil is compacted and the surface is levelled before placing the gravel/stones.		



Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016







	Description	Good sample	Bad sample
13	Check if the gravel/stones have been compacted (make sure there is enough gravel, because the final level of the reducer blocks should be slightly higher than the well surroundings).		
14	Check if the mix ratio for concrete is 1 cement: 2 sand: 3 gravel. Check if the mix ratio for mortar is 1 cement: 3 sand.		
15	Check if the reducer blocks are for max ¼ above the HDW (¾ on the concrete) and that the blocks are sloping to the outside of the well.		
16	Check if the space between the reducer blocks is equally divided.		
17	Check if the concrete is kept wet during curing. For curing times please the Module 2 of the Rope pump manual*		
18	Check if the concrete well cover is placed on the centre of the well (the overlap of the well cover on the reducer blocks should be equal on all sides).		

Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016


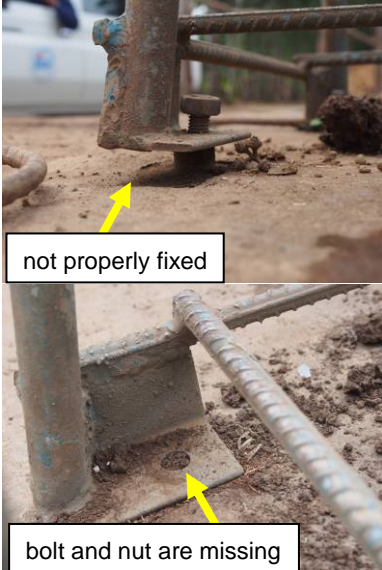



	Description	Good sample	Bad sample
19	Check if all the top works (apron and drainage channel) are plastered with mortar.		
20	Check if there is a levelled stand for the water container or bucket (not blocking the drain channel).		
21	Check if the apron, drainage channel and soak away pit (filled with stones) are constructed in such way that water CANNOT leak back into the well (the drain channel should be constructed in such way that water will drain away from the well to the 'lowest part' of the well surrounding).	 water will drain away from the well	 no drain channel, water can easily leak back into the well
<b>C Installation of the Rope pump</b>			
<b>C1 Materials (checklist to be checked during or after installation):</b>			
22	PVC pipes and fittings: All pipes and fittings should be of the same standard (ISO, DIN or equivalent, pressure class PN6) to allow proper fit.		 no fit, too much clearance
23	Pistons: Should be made out of PE (Poly Ethylene) and should fit the PVC pipes with a maximum clearance of 1mm.	 maximum clearance of 1 mm	 too much clearance
24	Rope: Should be made of PP (Poly Propylene) or Nylon, diameter 4mm for 1/2" (20mm) PVC pipes and 6mm for 3/4" (25mm) and 1" (32mm) PVC pipes.		



Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016




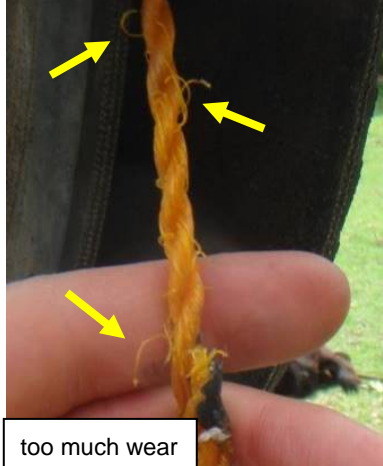

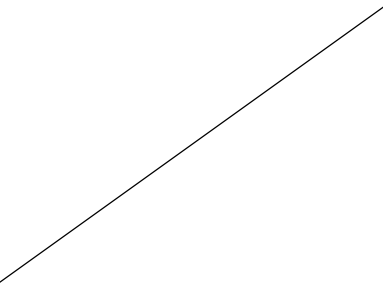




	Description	Good sample	Bad sample
25	Check if the diameter of the PVC raising pipe is correct in relation to the depth of the static water level (in dry season) in the well.	/	/
<b>C2 Installation (checklist to be checked during or after installation):</b>			
26	Check if all the PVC pipes (above well cover) and fittings are well connected with each other (and no play, damage or cracks can be observed).	 <p>no damage, play or cracks, PVC pipes are well connected</p>	 <p>fittings not well connected, PVC pipes, reducer and T do not fit</p>
27	Check if the outlet is high enough to fit the bucket or jerry can.		 <p>outlet too low</p>
28	Check if length of the tanker is ok (there should not be any water flow out of the top of the tanker, only some water may splash out).		 <p>tanker too short</p>

Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016




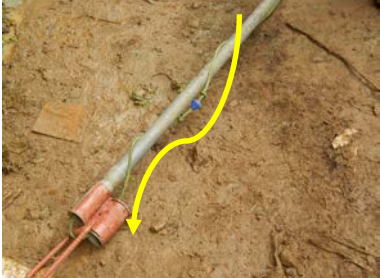

	Description	Good sample	Bad sample
29	Check if the pump is properly fixed (nuts tightened, no play) on the well cover.	 <p data-bbox="644 629 1026 703">Pump is properly fixed on the well cover</p>	 <p data-bbox="1066 472 1273 517">not properly fixed</p> <p data-bbox="1066 763 1337 804">bolt and nut are missing</p>
30	Check if all other bolts and nuts are tightened (especially the wheel and the raising and return pipe holders).	/	 <p data-bbox="1050 1106 1409 1140">bolt is missing, tanker has shifted</p>
31	Check if the wheel is aligned with the raising pipe (rope should enter the raising pipe in the middle).	 <p data-bbox="644 1487 1026 1520">rope enters pipe in the middle</p>	 <p data-bbox="1066 1252 1193 1285">not aligned</p>



Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016





	Description	Good sample	Bad sample
32	Check if the rope tension is ok.	 <p data-bbox="651 770 1018 846">if you can turn your hand like this, the rope tension is ok</p>	 <p data-bbox="1091 465 1222 506">too loose</p> <p data-bbox="1295 801 1394 833">too tight</p>
33	Check if there is any wear on the rope.	 <p data-bbox="660 1281 759 1312">no wear</p>	 <p data-bbox="1059 1294 1238 1326">too much wear</p>
34	Check if the direction of all pistons is ok. Check the distance between the pistons (approx. 1m). Check the distance between the knots (approx. 8cm).	 <p data-bbox="660 1393 791 1424">approx. 8cm</p>	
35	Check if the loops are made well and if the rope end is melted and seamed. The total length of the loop should not be more than 30 centimeters.		 <p data-bbox="1139 1904 1414 1935">loop end was not melted</p>
36	Check if the rope is slipping on the wheel.		

Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016

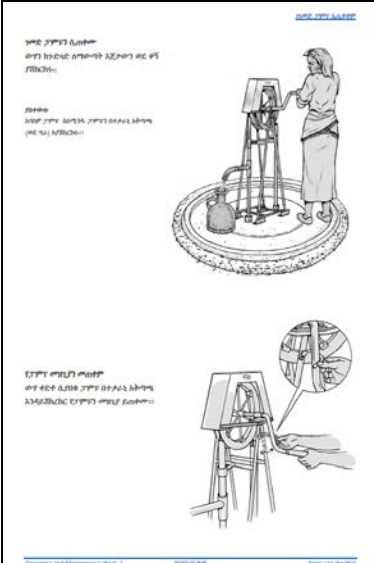




	Description	Good sample	Bad sample
37	Check if the rope with the pistons can move smoothly. No obstruction should be noted. If you can feel any obstruction of the rope and pistons while operating the pump, it needs further investigation.	/	/
38	If the reason for obstruction cannot be found above the well cover, the pump needs to be taken out of the well for further inspection. Reasons for obstruction may be:	/	/
	<ul style="list-style-type: none"> <li>a problem at the guide box (broken flairs, rope wound around the guide box).</li> </ul>		
	<ul style="list-style-type: none"> <li>a problem with the rope being wound around the raising pipe.</li> </ul>		
	<ul style="list-style-type: none"> <li>a problem with the sockets. Check the direction of the sockets (towards the well) or the presents of any rim of glue inside the sockets.</li> </ul>	 <p style="text-align: center;">sockets pointing towards the well</p>	/
	<ul style="list-style-type: none"> <li>a problem with the connection of the pipes, check if all pipes have been properly connected and glued</li> </ul>	/	/



Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016

	Description	Good sample	Bad sample
39	Check if the holes in the PVC cap(s) are properly made to fit the raising and return pipes (water may not leak back into the well).		
40	Check if the guide box is installed 10-50 centimeters above the bottom of the well. This can easily be done by checking the depth of the well. Then count the pistons to calculate the length of the rope and subtract 2.5 meter (rope above the well). Then divide by 2, to have an indication on the depth of the guide box.	/	/
41	Check if the bushings have been lubricated (recommended is new motor oil).		 <p data-bbox="1066 1173 1417 1205">not lubricated, axle shows wear</p>
<b>D Operation and maintenance</b>			
42	Check if the installer has given operation and maintenance training to the client (how to operate the pump, use of the pump lock, how to lubricate, how to tighten bolts and nuts, how to adjust rope tension, how to install a new rope and how to connect the rope and how to align the wheel with the raising pipe).	/	/

Rope pump installation check list for quality control, 3<sup>rd</sup> Edition August 2016

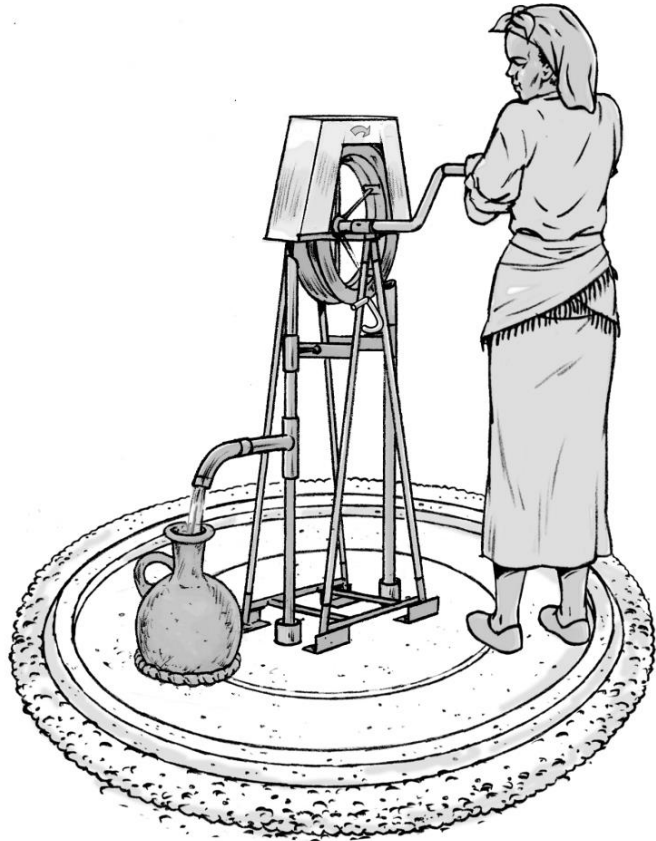
	Description	Good sample	Bad sample
43	Recommended: check if the installer has provided the client with one full set of ‘operation and maintenance sheets’.		
44	Check if the installer has given any additional advices to the client, for example:		
	<ul style="list-style-type: none"> <li>Advise for fencing (to avoid access of animals damaging the well, the pump and parts and for better sanitation).</li> </ul>		
	<ul style="list-style-type: none"> <li>Grassing around the well (to protect erosion of the well head surroundings).</li> <li>Flood diversion canal when needed.</li> </ul>		

**ገመድ ፓምፕን ሲጠቀሙ**

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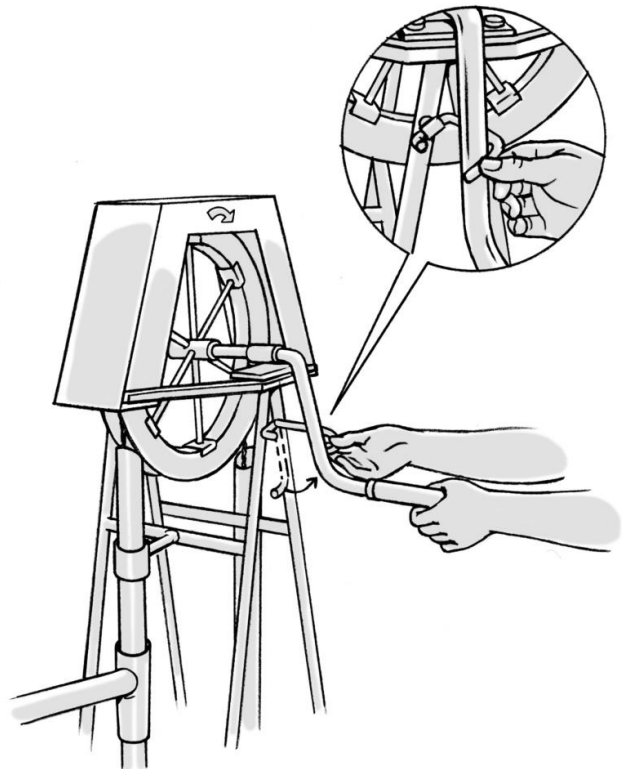
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**የፓምፕ መዝጊያን መጠቀም**

ውሃ ቀድቶ ሲያበቁ ፓምፑ በተቃራኒ አቅጣጫ እንዳይሸከረከር የፓምፑን መዝጊያ ይጠቀሙ።



**የገመድ ፓምፕን ዘይት ማጠጣት**

በየሳምንቱ ወይም በሽንጉ የመድረቅ ሁኔታ ሲያሳይ የፓምፑን በሽንግ ዘይት ማጠጣት አለብን። የፓምፑ በሽንግ ዘይት በሚፈልግበት ጊዜ የተለየ ድምፅ(ብረት ከብረት ጋር ሲፋተግ የሚሰማ ድምፅ) ያሰማል።

ዘይት ሲጨመር በሽንጉ ላይ ባለው ቀዳዳ የተወሰኑ አዲስ የሞተር ዘይት ጠብታዎችን ይጫምሩ።



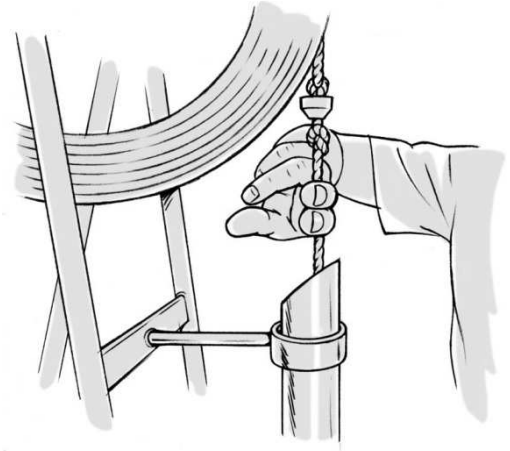
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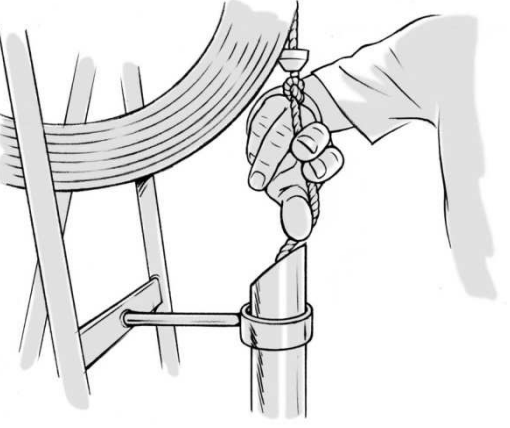


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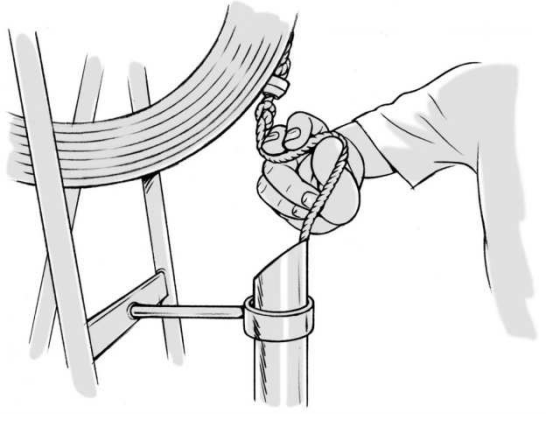
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በምስሉ ላይ እንደተመለከተው ገመዱን በሁለት ጣቶች መያዝ



ከዚያ አውራ ጣትን በገመዱ አቅጣጫ ማዞር....



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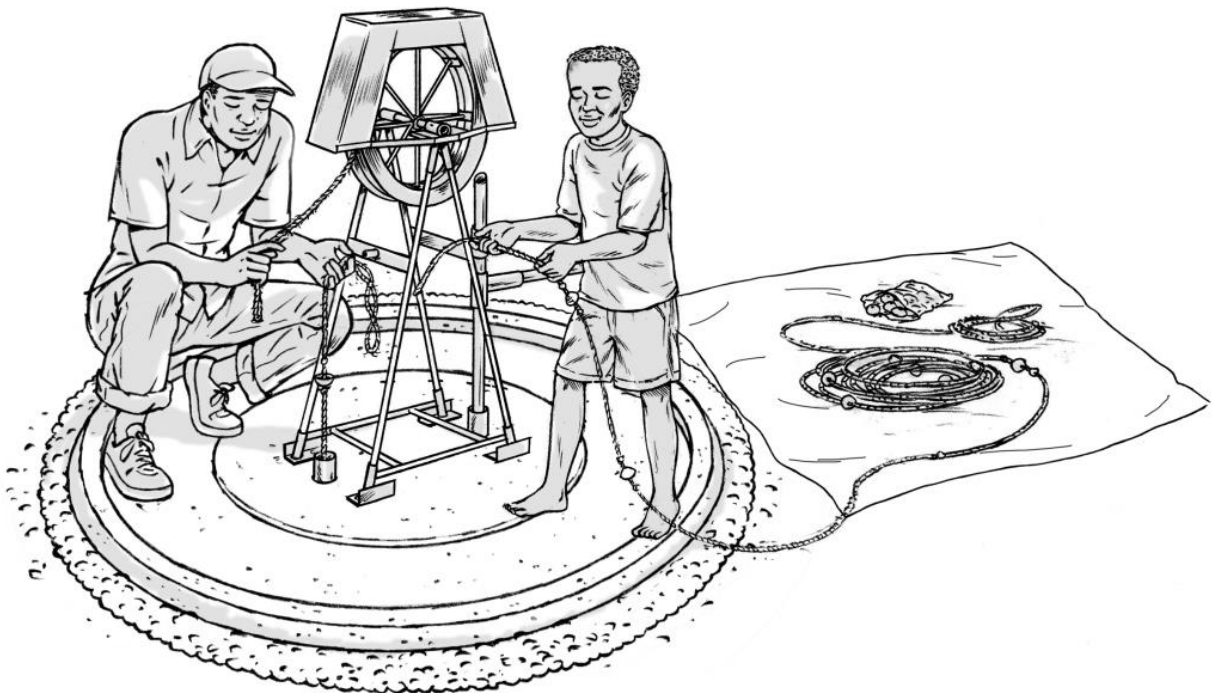
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1. አዲሱን ገመድ በመቋጠርና ፒስተን በማስገባት ማዘጋጀት
2. አሮጌውን ገመድ ማላቀቅ
3. አዲሱን ገመድ የአሮጌው ገመድ ጫፍ ላይ ማሰር
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5. በውሃ መሳቢያ ያህል በኩል የሚመጣውን አሮጌ ገመድ አላቆ መጣል
6. በመጨረሻም አዲሱ ገመድ ሙሉ በሙሉ መግባቱን ሲረጋግጥ አሮጌውን ገመድ አላቆ የአዲሱን ገመድ ሁለቱን ጫፎች አንድ ላይ ማሰር

**ያስተውሉ**

በዚህኛው ዘዴ የፒሺሲ ያህል ገመዶችን ከጉድጓድ ማውጣት አያስፈልግም።



**ያስተውሉ**

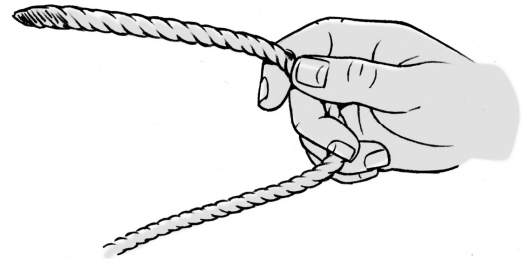
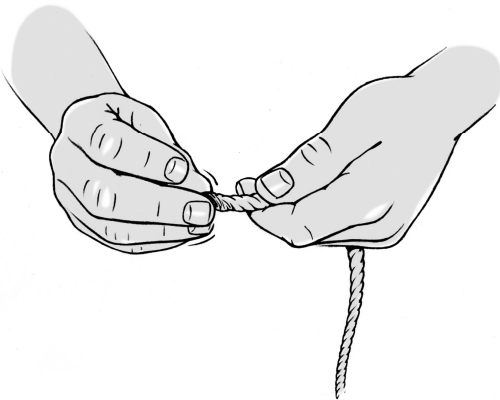
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**ገመድን መልሶ ማገናኘት**

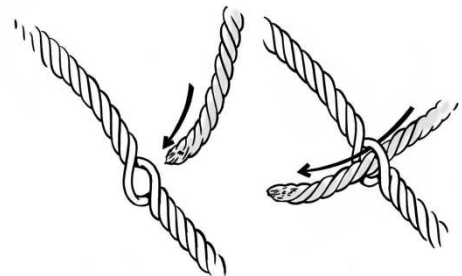
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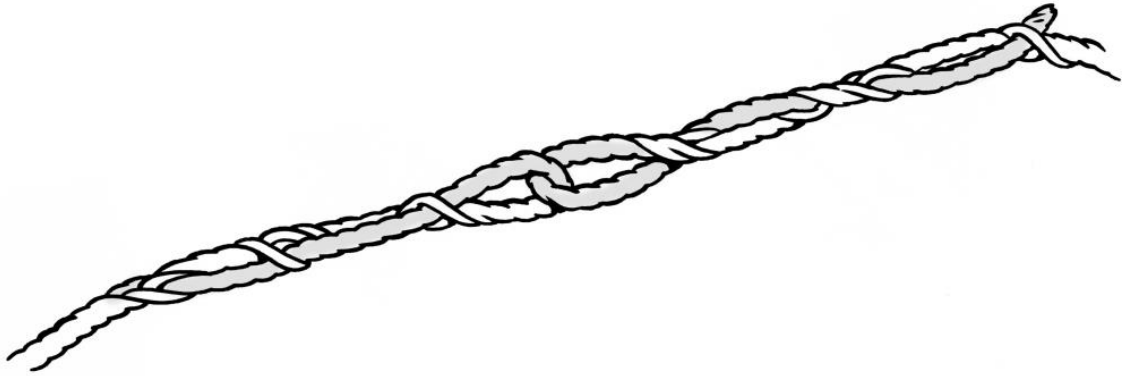


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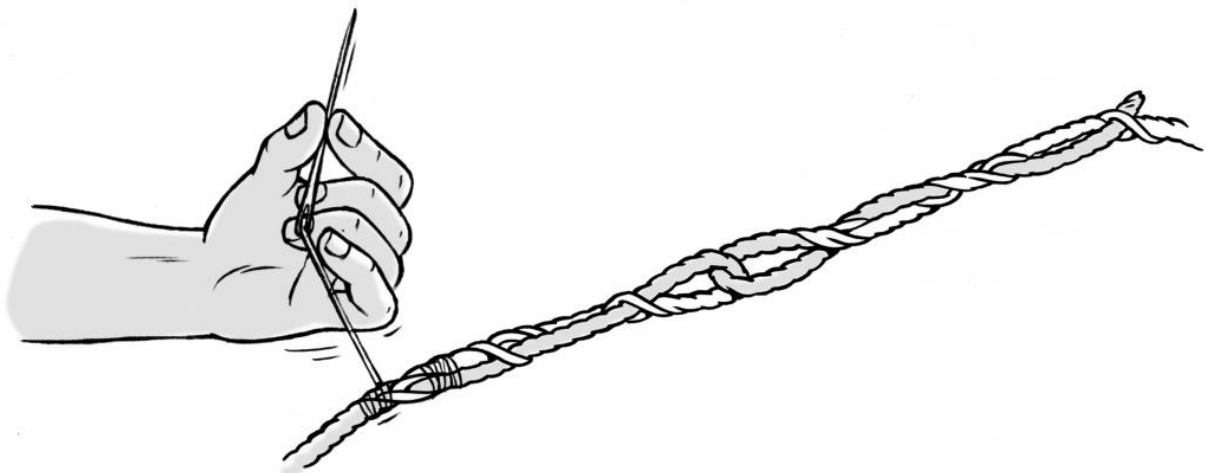




በመጨረሻም የገመዱን ጫፍ በተዘጋጀው ቀለበት (ሉፕ) ውስጥ በማጠላለፍ ሌላ ሁለተኛ ቀለበት በመስራት ሁለቱን የገመድ ጫፎች ማገናኘት



ቀለበቶቹ እንዳይላሉ ሲባል የቀለበቹን ጫፎች በመርፌ መስፋት፣ ምክንያቱም የናይሉን ገመድ የመንሸራተት ባህሪ ስለለው።



**ያስተውሉ!**

ገመዱ ዊል ላይ እንዳይሸራተት የሁለቱ ቀለበቶች ጠቅላላ ርዝመት 30 ሳ.ሜ ወይም ከዚያ ያነሰ መሆኑን ያረጋግጡ።

## BILL OF QUANTITIES PER UNIT (2014 MODEL ROPE PUMP)

Table-1: Material Cost

Description		Material	(1) Original Quantity	(2) Unit	(3) Pcs	(4) Total Quantity (1) x (3)	(5) Unit price (i.e. price of 2)	Total Price (4) x(5)	
C-1 Wheel Cover	Cover 1000mm x 240mm	GI sheet, t=0.6mm	0.24	m2	1	0.24			
	Pop rivet	Pop rivet, 5mm	1	pcs	4	4			
	Bolt and nut	Bolt and nut, M6	1	pcs	4	4			
W-1 Wheel	Wheel rim	Rubber Wheel, Dia.350mm x 50mm	1	pcs	2	2			
	Wheel Hub	GIP OD33.7mm (Dia.1")	0.1	M	1	0.1			
	Bolt and nut	Bolt and nut, M10	1	pcs	2	2			
	Spokes	Re-enforcement bar dia 10mm	0.154	M	6	0.924			
	Clamps	Flat iron 25mm x 3mm	0.062	M	6	0.372			
H-1 Handle	Handle Shaft	GIP OD 26.9mm (Dia.3/4")	0.84	M	1	0.84			
	Handle Grip	uPVC pipe PN16 OD32mm ID27.2mm (Dia. 1-1/2")	0.24	M	1	0.24			
	Handle Spacer	GIP OD33.7mm (Dia.1")	0.01	M	4	0.04			
	Cutter pin	Cutter Pin	1	Pcs	1	1			
S-1 Structure	Wheel Cover Support	Cover Support	Angle Iron 20mm x 20mm x 2mm	0.57	M	2	1.14		
		Cover & Bushing	Flat iron 30mm x 3mm	0.063	M	4	0.252		

Description		Material	(1) Original Quantity	(2) Unit	(3) Pcs	(4) Total Quantity (1) x (3)	(5) Unit price (i.e. price of 2)	Total Price (4) x(5)
	Connection							
Handle Bushing	Bushing Base	Flat iron 30mm x 3mm	0.11	M	2	0.22		
	Bolt and nut	Bolt and nut, M10	1	pcs	4	4		
	Bushing	GIP OD33.7mm (Dia.1")	0.06	M	2	0.12		
	Welding Support	Round bar dia 6mm	0.03	M	4	0.12		
Structure Frame	Structure Pipe	GIP OD21.3mm (Dia.1/2")	0.95	M	4	3.8		
	Structure Cross Pipe	GIP OD21.3mm (Dia.1/2")	0.218	M	2	0.436		
	Handle Bushing Support	Angle Iron 30mm X 30mm X 3mm	0.11	M	2	0.22		
	Leg Base 1	Angle Iron 34mm X 40mm X 3mm	0.07	M	2	0.14		
	Leg Base 2	Angle Iron 34mm X 40mm X 3mm	0.07	M	2	0.14		
	Leg Support 1	Re-enforcement bar dia 10mm	0.26	M	2	0.52		
	Leg Support 2	Re-enforcement bar dia 10mm	0.4	M	2	0.8		
Riser & Return Pipe Support	Holder Support	GIP OD 26.9mm (Dia.3/4")	0.085	M	2	0.17		
	Riser Pipe Holder	GIP OD48.3mm (Dia.1 1/2")	0.03	M	2	0.06		
	Riser Pipe Slider	GIP OD 21.3 mm (dia 1/2 " )	0.085	M	2	0.17		
	Bolt and nut	Bolt and nut, M10	1	pcs	4	4		



Description			Material	(1) Original Quantity	(2) Unit	(3) Pcs	(4) Total Quantity (1) x (3)	(5) Unit price (i.e. price of 2)	Total Price (4) x(5)
G-1 Guied box	Base support		Re-enforcement bar dia 10mm	0.075	M	1	0.075		
	Raising pipe support		GIP OD 40.3 mm (dia 1 1/4 ")	0.04	M	1	0.04		
	Rope catcher pipe support		GIP OD 48.3 mm (dia 1 1/2 ")	0.04	M	1	0.04		
	Rope protection base		GIP OD 21.3 mm (dia 1/2 ")	0.05	M	1	0.05		
	Rope protection		Re-enforcement bar dia 10mm	0.4	M	1	0.4		
	Raising pipe		uPVC pipe PN16 OD32mm ID27.2mm (Dia. 1")	0.11	M	1	0.11		
	Rope catcher pipe		upvc pipe PN 16 OD 40 mm ( dia 1 1/4 ")	0.06	M	1	0.06		
	Pump Lock	Lock	Round bar dia 10mm	0.19	M	1	0.19		
		Pump Lock Hub	GIP OD21.3mm (Dia.1/2")	0.04	M	1	0.04		
		Pump Lock End	GIP OD21.3mm (Dia.1/2")	0.01	M	1	0.01		
Others	Paint	Secondary paint	Paint, Tin	0.07	L	1	0.07		
		Antirust	Paint, Tin	0.07	L	1	0.07		
	Name Plate	120mm x 30mm	Aluminum sheet	0.0036	m2	1	0.0036		
		pop rivet	pop rivet, 5mm	1	pcs	2	2		
<b>SUB-TOTAL MATERIAL COST FOR ONE ROPE PUMP</b>									

Table-2: Summary of RP Price

NO	DESCRIPTION	PRICE	REMARK
A	<b>Sub -total material cost for one rope pump</b>		Forwarded from Table-1
	Consumable material for one rope pump <ul style="list-style-type: none"> <li>• Electrode</li> <li>• Cutting disc</li> <li>• Grinding disc</li> <li>• Hack saw blade</li> <li>• Electric/power cost</li> <li>• Other</li> </ul>		
B	<b>Sub –total cost for consumable materials</b>		
	Labor cost <ul style="list-style-type: none"> <li>• Welder</li> <li>• Assistance</li> <li>• Painter</li> <li>• Supervisor cost</li> <li>•</li> </ul>		
C	<b>Sub- total cost for labor</b>		
D	<b>Administration cost</b>		
E	<b>Total cost = A+B+C+D</b>		
F	<b>Profit</b>		
G	<b>Total With Profit (E+F)</b>		
H	<b>VAT (15% of G) or TOT</b>		
I	<b>GRAND TOTAL FOR ONE ROPE PUMP PRODUCTION (G+H)</b>		
J	<b>GRAND TOTAL FOR 10 ROPE PUMP PRODUCTION</b>		

# TRAINERS GUIDE

FOR TRAINERS



## ROPE PUMP

A MANUFACTURING, INSTALLATION,  
OPERATION AND MAINTENANCE TRAINING







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Photos	Arjen van der Wal / IDEA

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## PREFACE

Improvement of water supply is one of the highest priority issues for the water sector in Ethiopia. Self-supply is an important component of rural water supply to achieve the national goal. In the Self-supply policy of the government, dissemination of low cost technologies is an essential element. It is important for the rural population to have a range of technology options available for improvement of their own water supply facilities.

The Rope pump technology is considered as one of the main technologies for Self-supply as it is cost effective, simple to operate and maintain and available in local markets.

The Rope pump technology has a high potential to be manufactured and installed by local service providers in rural towns and villages for enhancing local production and dissemination. Technical and Vocational Education and Training Colleges (TVETCs) play an important role in transferring this technology to local service providers as well as the promoters of the technology.

This volume provides guidance to qualified Rope pump trainers, who have already taken a Training of Trainers (ToT) course on the Rope pump technology, containing subjects on how to organize effective training in manufacturing, installation, maintenance and operation of Rope pumps. I hope that the Rope pump technology will be widely transferred and utilized for better life of rural people in the country.

Mr. Atnafu Asfaw, Deputy Bureau Head and Human Resource Development Core Process Owner, TVET Bureau, Southern Nation, Nationalities and People's Region



## READERSHIP

This Trainers guide has been developed to assist qualified trainers (trainers and teachers who completed the Training of Trainers course (ToT)), who want to provide a manufacturing or installation and maintenance training to Rope pump manufacturers or Rope pump installers. This Trainers guide describes different training courses to train groups up till 16 trainees.

**Chapter 1** of this Trainers guide will give an overview of the different training courses and the location, materials and equipment needed for the training, including preparations that need to be done, prior to the training. It also describes the selection criteria for the trainees and their skills needed to be able to follow the training.

**Chapter 2** highlights different training methodologies and practical examples that have proven to create better understanding of the training subjects by the trainees. Chapter 2 also explains how you can use this manual as a trainer and gives a summary of all subjects that can be part of the training.

**Chapter 3** gives a day by day description of all the different training sessions that have been developed to provide a full manufacturing and installation training. For the installation training only a selection of sessions can be made. These day by day descriptions will help you as a trainer, guiding you through the training subjects and sessions of this training.

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# CHAPTER 1 INTRODUCTION and REQUIREMENTS

## 1.1 INTRODUCTION

This Trainers guide has been developed to assist qualified trainers (trainers and teachers who completed the Training of Trainers course (ToT)), who want to provide a manufacturing or installation and maintenance training to Rope pump manufacturers or Rope pump installers. This trainers guide describes different training courses to train groups up till 16 trainees.

**Chapter 1** of this Trainers guide will give an overview of the different training courses and the location, materials and equipment needed for the training, including preparations that need to be done, prior to the training. It also describes the selection criteria for the trainees and their skills needed to be able to follow the training.

**Chapter 2** highlights different training methodologies and practical examples that have proven to create better understanding of the training subjects by the trainees. Chapter 2 also explains how you can use this manual as a trainer and gives a summary of all subjects that can be part of the training.

**Chapter 3** gives a day by day description of all the different training sessions that have been developed to provide a full manufacturing and installation training. For the installation training only a selection of sessions can be made. These day by day descriptions will help you as a trainer, guiding you through the training subjects and sessions of this training.

This manual describes 3 different training courses:

### **The full manufacturing and installation training (basic)**

- Duration\*: 5 weeks;  
3 weeks manufacturing and 2 weeks installation and maintenance training.
- For who: Metal workshop entrepreneurs or employees with proven welding and measuring skills who have never been trained to manufacture Rope pumps and want to start manufacturing Rope pumps.
- Number of trainees: 8 trainees when the training is provided by 1 trainer. Up to 16 trainees when the training is provided by a trainer assisted by a training assistant.
- Objectives of the training: To train metal workshop entrepreneurs in manufacturing and installation of good quality Rope pumps.



### **The installation training**

- Duration\*: 2 weeks
- For who: Installers of pumps, such as metal workshop technicians, pump technicians, dealers, village technicians and users.
- Number of trainees: 8 trainees when the training is provided by 1 trainer. Up to 16 trainees when the training is provided by a trainer assisted by a training assistant.
- Objectives of the training: To train pump installers on good quality installation, operation and maintenance of the Rope pump, including the ability to provide operation and maintenance training to the pump user.

### **The manufacturing and installation training (advanced)**

The advanced manufacturing and installation training is a refresher training. This training will focus on the quality of the manufactured pumps and/or the introduction of improved parts and models.

- Duration\*: Variable, depending on content (about 2 weeks; 1 week manufacturing and 1 week installation and maintenance, based on content and needs).
- For who: Metal workshop entrepreneurs who have been trained to manufacture Rope pumps before.
- Number of trainees: 8 trainees when the training is provided by 1 trainer. Up to 16 trainees when the training is provided by a trainer assisted by a training assistant.
- Objectives of the training: To train and update manufactures on quality issues and certification procedures and/or improved parts and models. Also to evaluate quality of manufacturing and manufactured pumps and to provide refresher training on the quality of manufacturing and installation skills of the metal workshop entrepreneurs.

#### **\*Please note**

The duration (number of weeks) for the manufacturing and installation training given in this manual is the minimum amount of time needed to provide a complete training. Based on the needs of the trainees extra days can be added to the training.

### **Follow-up training**

After one of the training courses above is provided, it is essential to provide follow-up training, at the location of the metal workshop of the manufacturer and/or the location of the installed pumps in the field. Please see Chapter 2, page 24 for more information.





## 1.2 WHAT IS NEEDED

### The manufacturing training (basic)

For the manufacturing training up to 16 trainees the following location, workshop equipment and tools are recommended:

#### Location

A classroom with white board or black board and a metal workshop, with sufficient work benches (1 per 2 trainees).

#### Equipment and tools\*

Please find below a list of tools and equipment needed for the training. This list is made for groups up till 16 trainees. For smaller groups with 8 trainees or less, the quantity of tools and equipment needed 'for each trainee' remains the same, but the quantity of tools and equipment needed 'for the whole group' may be reduced.

#### **Power tools (220 V or 380 V):**

• Electric welding machine	1 per 2 trainees
• Electric grinding machine, bench model	1 for the whole group
• Portable grinder	2 for the whole group
• Drilling machine, bench model	2 for the whole group
• Portable drilling machine	1 for the whole group

#### **Quantity needed:**

#### **Hand tools:**

• Hand pop riveter for 5 mm rivets	1 for the whole group
• Spanners size 17 (2)	1 set per 2 trainees
• Spanner size 10 (1)	1 per 2 trainees
• Hack saw and blades	1 for each trainee, 4 blades each
• Sheet cutter for sheet up to 1 mm	1 for the whole group
• Flat file	1 for each trainee
• Round file	1 for each trainee
• Pliers	1 for each trainee
• Set drill bits 3 mm to 12 mm	4 sets for the whole group
• Steel brush	4 for the whole group
• Hammers (normal + heavy)	2 of each for the whole group
• Slack hammer (welding hammer)	1 per 2 trainees
• Rubber hammer	2 for the whole group
• Workbench with 2 vices	1 per 2 trainees
• Centre punch	1 for each trainee



**Measuring tools:**

- Measuring tape
- Calliper
- Tri-square
- Steel ruler
- Compass
- Scriber

**Quantity needed:**

- 1 for each trainee
- 2 for the whole group
- 1 for each trainee
- 1 for each trainee
- 4 for the whole group
- 1 for each trainee

**Consumables:**

- Welding electrodes 2.5mm 2 package for each trainee
- Paint (anti rust primer + secondary paint) 5 liter of each for whole group
- Sandpaper (specification: grade 0) ½ meter for each trainee
- Paint brush 8 for the whole group
- Painting tape 8 roles for the whole group
- Grease (to protect bolt threads during welding) 1 can for the whole group

**Health and Safety!**

- Coverall (fire resistant) 1 for each trainee
- Gloves (normal gloves and welding gloves) 1 for each trainee
- Safety glasses 1 for each trainee
- Welding helmet (or hand held shield) 1 for each trainee
- Ear protection 1 for each trainee
- Safety shoes 1 for each trainee

**Full set of welding jigs:**

During the training a set of 4 different welding jigs are used to produce a Rope pump. After the training each trainee (or group of trainees from the same enterprise) will bring home a full set of welding jigs for manufacturing Rope pumps at their workshop. One set of welding jigs consist of:

- Bushing Jig
- Frame Jig
- Base Jig
- Wheel jig

**\*Please note:**

The amount of tools and equipment needed for the training mentioned in this manual are the minimum amounts of tools and equipment needed to be able to provide the training in an efficient way.



### Materials

In module 3 of the manufacturing, installation, operation and maintenance manual you will find a **parts & materials list** for the construction of a single Rope pump, specified per pump part and a **purchase list** showing the total quantity of materials that are needed.

The amount of materials needed for the training will depend on the number of pumps that will be made. In the first week, groups of 4 trainees each will produce a pump, in the second week, groups of 2 trainees each will produce a pump, and in the third week each individual trainee will produce a pump.

In case of 8 trainees this will result in: 2 pumps in the first week, 4 pumps in the second week and 8 pumps in the third week. Total amount of materials needed: for 14 pumps.  
In case of 16 trainees: 4 pumps in the first week, 8 pumps in the second week and 16 pumps in the third week. Total amount of materials needed: for 28 pumps.

As this is a training, some materials will serve as training material to practice or some materials will be wasted. It is therefore always good to purchase some extra materials (for 2-4 pumps).

### The manufacturing, installation, operation and maintenance manual

For the manufacturing training, please use module 3 as training manual for the trainees. Module 3 describes in detail steps for manufacturing for all parts of the Rope pump. It includes a step by step description and photos, for each of the pump parts, a technical drawing package of the pump and technical drawings of the welding jigs and will show the use of welding jigs needed for manufacturing.

### Other preparations to be done prior to the training

1. Construction of a demonstration pump: A Rope pump on a drum constructed and painted as a demonstration model. This pump will be used at the first days of training (and kept as the master example during the training). Or have a Rope pump installed on a well in the compound of the training facility.
2. Construction of welding jigs: a full set of 4 welding jigs for each of the trainees (or group of trainees working at the same enterprise), accurately made, all identical, painted in grey or red anti-rust primer (see page 11, 'Full set of welding jigs').
3. Printing: A hardcopy of the Manufacturing, Installation, Operation and maintenance manual for each trainee.



## The installation training

For the installation training the following locations, tools and materials are recommended:

### Location

A garden with a (fake) well(s), or a suitable field location with a number of wells, where you are allowed to organise the training and practice the installation, operation and maintenance of the Rope pump.

### Tools and materials

Module 2 of the manufacturing, installation, operation and maintenance manual includes a list of tools and materials (section 'what to bring') needed for the installation of the Rope pump. Multiply the amount of materials needed by the amount of pumps that will be installed during the training. The amount of tools listed is sufficient for at least 4 trainees. For larger groups, please multiply.

### The manufacturing, installation, operation and maintenance manual

For the installation training, please use module 2 as training manual for the trainees. Module 2 describes the installation, operation and maintenance of the Rope pump. This module is showing the installation process of the Rope pump models step by step. Instructive illustrations will explain each step in the construction of the apron and the installation of three Rope pumps: The 2014 model installed on a hand dug well, the pole model installed on a hand dug well and the 2014 model installed on a drilled well (borehole).

### Other preparations to be done prior to the training

1. Construction of Rope pumps: Rope pump models (2014 model and pole model); 1 of each model for each group of 4 trainees, needed to practice installation (see chapter 3, days 20-23, page 49).
2. Printing: A hardcopy of Module 2 of the manufacturing, installation, operation and maintenance manual for each trainee.
3. Pre-fabricated concrete well covers and reducer blocks (for several wells); 1 full set for demonstration and 1 full set for each group of 4 trainees (see chapter 3, day 19, page 48).





### **The full manufacturing and installation training (basic)**

For the full manufacturing and installation training (basic), items needed are listed in the above sections 'manufacturing training' and 'installation training'.

### **The manufacturing and installation training (advanced)**

For the advanced manufacturing and installation training, the same equipment and tools are needed. The materials needed will depend on the pumps that will be made or demonstrated during the training.

## **1.3 SELECTION AND REQUIREMENTS FOR THE TRAINEES (ENTREPRENEURS)**

### **The manufacturing training**

A Rope pump manufacturing training is developed to be provided to entrepreneurs and employees of metal workshops, who want to start manufacturing of the Rope pump. It is essential that the selection of trainees for the training is carefully done.

The manufacturing training is NOT a skills training. The trainee should already have good quality metal work skills (such as welding and measuring skills). In the training he/she will learn how to manufacture a new product, the Rope pump, using his/her skills.

If trainees have not sufficient welding and measuring skills, the pumps they are going to manufacture in future will be of a poor quality. Therefore, making a good selection of trainees who have the skills to follow the training is essential. The selection should be based on their metal work skills.

Important selection criteria are:

- High quality welding skills
- Accurate measuring skills
- Drilling, grinding and cutting skills
- Ability to read technical drawings

As many manufacturers have no official degree in welding it is important to check their welding and measuring skills during the selection process. Part of the selection process is a visit to their metal workshop to see the quality of the products they are producing. Even more important is to check on their measuring and welding skills, by providing them with a practical task, to test the quality of their measuring and welding skills. This task could include providing them with a technical drawing of a task that needs measuring, cutting, drilling and welding skills.



### **The installation training**

The installation training is developed to be provided to pump installers, such as metal workshop technicians, pump technicians, dealers and village technicians. Making a good selection of trainees who have the skills to follow the training is essential. The selection should be based on their skills.

Important selection criteria are:

- Measuring skills
- Cutting skills
- Ability to read

These skills can be simply tested by asking them to measure the depth of the water level in a well and the depth of the well. In addition, give them a task to measure and cut a piece of PVC pipe with a given length and diameter. It is also important that the trainee is physically strong enough to perform the installation (able to lift a concrete well cover).

### **Business skills**

For entrepreneurs who are running a business already, selection criteria on business skills are not required, as the entrepreneurs have already proven to have the skills by running their businesses. For employees of those entrepreneurs (metal workshop employees) only technical skills are required as a selection criteria. Also for installers, having business skills is not essential. However, for people who want to start a business it is wise to include selection criteria on entrepreneurship and business skills.

## **1.4 REQUIREMENTS FOR THE TRAINER**

The trainer/teacher who will provide the manufacturing or installation training should have received a Training of Trainers course.

## **1.5 HEALTH AND SAFETY!**

Although a set of health and safety clothes is being provided to the trainees, it is important to train them why and how to use them. Many metal workshop trainees have not learned the importance of eye and ear protection and are working without it, creating permanent damage to their eyes or severe hearing loss over time. It is therefore very important to include health and safety measures in the training (see chapter 3 days 1-4, page 25, for an example of health and safety sessions). A list of health and safety clothes to be provided to each of the trainees is listed in paragraph 'What is needed', page 11, of this chapter.



## CHAPTER 2 TRAINING METHODOLOGY and SUMMARY

### 2.1 INTRODUCTION

A training is successful when knowledge is transferred to the trainee and the trainee has really understood the subject and has proven that by, for example, carrying out practical tasks that are performed correctly. The success of the training largely depends on the skills of trainees to be trained (see chapter 1 page 14, selection of entrepreneurs), the training methodology that is used by the trainer and the (interactive) way of communication between the trainer and the trainees. This chapter highlights different training methodologies and practical examples that have proven to create better understanding of the training subjects by the trainees. It also explains how you can use this manual as a trainer and gives a summary of all subjects that can be part of the training.

This chapter will focus on different training methodologies that apply to the full manufacturing and installation training (basic). For the other two training courses, the installation training and the advanced training, a selection of the described training methodologies can be made.

### 2.2 TRAINING METHODOLOGIES

#### Training manual for the trainees

For the training sessions described in this Trainers guide, the manufacturing, installation, operation and maintenance manual is used as training manual for the trainees. Each of the trainees should receive a hardcopy of the manual, which he/she will take home after the training. The manual consist of 3 modules; Module 1 gives general information on the Rope pump and its applicability as a self-supply hand pump. Module 2 describes the installation, operation and maintenance of the Rope pump. And module 3 describes in detail steps for manufacturing for all parts of the Rope pump, including a package of technical drawings.

#### Learning by doing

In the first week, after the introduction to the Rope pump, the trainees are divided in groups of 4-5 trainees per group. Every day a new part(s) is explained by the trainer. The groups are then invited to build each part, part by part, using their measuring and metal work skills. The trainer will make observations, but will not interfere too much if



dimensions are not measured accurately. This is part of the methodology; at the end of the first week all the parts have been produced by each group. Each group is then invited to make the final assembly of the pump. After assembly it is very likely that some of the pumps will not function or that parts will not fit. The trainees have now seen and experienced (learning by mistake) the importance of proper measuring and precise work!

### **The use and importance of welding jigs**

In the second week the trainees are divided in groups of two, preferable an experienced trainee will team up with a less experienced trainee. This allows the less experienced trainee to learn from his team mate. Each of the groups will now manufacture a pump using the welding jigs. The use of welding jigs and accurate measurement is well explained by the trainer and during manufacturing of the parts the trainer is now actively coaching the groups. At the end of the second week the groups are invited to assemble the pump. Most likely all the pumps will work well and parts will fit. Then parts will be exchanged between the different pumps. Most likely all parts are interchangeable. The trainees have now seen and experienced the importance measuring and use the use of welding jigs for standardized production of parts.

In the third week each trainees will individually manufacture all parts of the Rope pump using accurate measuring and the welding jigs.

### **Coaching**

In the second and especially the third week the role of the trainer will shift from teaching more to coaching. Different from teaching, where the trainer provides training sessions to the trainees, coaching focusses more on providing individual support to the trainee while he/she brings the lessons he/she has learned into practice. When you as a trainer are coaching a trainee it is important not to correct a trainee immediately when a mistake is observed. Rather than telling the trainee that he/she made a mistake and how to correct it, a good coach will start asking questions to the trainee. By asking different questions to the trainee, the trainee may start to realize that he/she made a mistake during construction. The questions will help the trainee to analyse the problem.

Then, when the trainee has understood that he/she made a mistake, again by asking questions you will guide the trainee in finding a solution. You will not give the solution. The questions will help to facilitate the 'thinking process' of the trainee, guiding him until the trainee comes to the solution of the problem by him/her-self. The trainee has now





identified the mistake he/she made and came up with a solution for the problem. The only thing what you did as a coach was guiding him/her in the right direction with your questions.

When you observe a trainee who is going to make a mistake during the construction of a pump, it is sometimes better to let it happen, before you come in as a coach. This will allow the trainee to make mistakes in a protected environment. These mistakes are then corrected by himself while you as a trainer are coaching the trainee. It is always better for mistakes to happen during the training in presence of the trainer, instead of after the training in the workshop of the trainee.

When you observe that a specific mistake is made frequently by many of the trainees, it is a signal for you as a trainer that some things have not been understood trainees. In that case it may be better to stop individual coaching and call all trainees together for a class room session, coaching the whole group.

### **Lecture or question wise learning?**

Training sessions are best understood by trainees if they (have to) participate in the training session. Rather than giving a lecture ('one way traffic' from teacher to the trainee), it is much better to make a session interactive. This is best done by asking relevant questions to the trainees while you are teaching. In this way the trainee will be involved in the session since he/she needs to answer questions. The trainee will be challenged to analyse what you are teaching and to raise his/her finger if it wasn't understood.

Coaching and question wise learning may require a different mind-set, as a lot of teachers are used to give training by lecture. As a trainer you can try and investigate if coaching and question wise learning are methodologies that work for you as a trainer.

### **The power of practical examples, tasks and white (or black) board drawings**

When difficult subjects are discussed during a training session, the trainer may observe that his session is not understood by the trainees. Especially when subjects are abstract or difficult to understand by the trainees it is important to visualize a problem or subject for the trainees. Some examples:

1. Visualize the problem: It is difficult for trainees to understand why a Rope pump needs 3 different PVC pipe sizes, to lift water from different groundwater levels.



The size of the pipe depends on the level of the groundwater and not on the depth of the well. This can be easily made visible through demonstrating the difference between lifting water below, and above the groundwater level. Use an oil barrel filled with water to show that lifting a bucket under the water table is very easy, it only becomes difficult after the bucket with water is lifted out of the water in the oil drum. By visualizing the problem (trainees can try) at the surface, the session is much better understood.

2. Use of whiteboard drawings: For example a Health and Safety session on hearing protection. The session on hearing protection will be understood when the trainees understand the importance of it. What does irreversible hearing damage mean? This is simply made visible with a whiteboard drawing, by making a cross section of the ear, showing what is happening when irreversible hearing damage is taking place. By seeing what is happening, trainees will understand the reasons for using hearing protection better.
3. Practical tasks: Theory sessions like teaching business skills, may be abstract and boring to the trainees. Rather than having a long lecture, it is much better to practice each session through practical tasks. For example, making a cost calculation. Make a cost calculation together with the trainees. Let trainees think about the costs of a Rope pump, what is included. The trainer will facilitate by making a cost calculation on a white board, based on the answers of the trainees. This requires that the trainees really need to think and participate in the session.

### **How to use this Trainers guide as a trainer**

The above mentioned training methodology is will allow the trainee to make mistakes, learn from the mistakes and improve his skills during manufacturing. To help you as a trainer to provide this training well, and tread all subjects in the given time, this Trainers guide is developed. In the next paragraph you will find a rough summary of the training schedule. In the next chapter you will find a day by day description of the training, describing the practical activities, tasks and theory lessons per day.

Please note that this is a guideline and time table to help you through the training. Keep in mind that this guide (for example the order of theory lessons) or time table can be changed based on your observations during the training. Skills or lessons that are well understood by the trainees will go quicker, but for lessons that are difficult for the trainees you may need more time. Leading is that at the end of the training you have



provided all of the content to the trainees, but speed and order of the lessons will your observations as long as the above training methodology is respected.

### **2.3 TRAINING PROGRAM**

The training program provided in this trainers guide is made for the full manufacturing and installation training (basic). It describes all sessions that can be implemented during this training, ensuring a complete and high quality training.

For the other two training courses described in this guide, the installation training and advanced manufacturing training, a selection of subjects that are relevant for the specific training can be made. For example, for the installation training, only the last two weeks (week 4 and 5) described in this guide will apply.

For the advanced training course a selection of training methodologies and sessions can be made depending to the content of the course. When new pumps or updates of pump parts are given, it is always recommended that each individual trainee will at least manufacture one full pump by himself during the training. In this way the trainer is able to observe if the training is well understood.

### **2.4 OUTCOMES OF THE TRAINING**

After the training the trainee will be able to manufacture a good quality Rope pump, with accurate dimensions and good quality materials. The trainee will be able to work and use equipment and tools in a safe way. He will be able to do quality control on the manufactured pumps and make corrections if needed. He will be able to calculate an accurate price for the Rope pump, do his own marketing and provide good after sales services to the client. He will be able to install the Rope pump on a hand dug well or manually drilled well (borehole) and to provide operation and maintenance training to the user.



## 2.5 TRAINING PROGRAM SUMMARY

The training program below is a summary of the training, please see chapter 3 for a detailed day by day description of the training.

Week 1, page 25

Week	Day	Training subject	Description of the activity
1	1	Opening & introduction	Opening of the training and introduction of stakeholders, teacher(s) and trainees.
		Explanation of training	Explanation and summary of the training, content, duration and schedule.
		Introduction to the Rope pump	First introduction & demonstration of a working Rope pump and theory on its history in Ethiopia, its working, different models, quality of manufacturing and installation and how this reflects to the content of this training.
		How to use the Rope pump manual	Explanation on the Rope pump manual and how to read the technical drawings and materials lists.
		Health & Safety	First introduction to Health & Safety measures.
		Creating groups	Make groups of 4-5 trainees per group.
		Distribution of H&S clothes	Distribution of Health & Safety clothes.
		Introduction to metal workshop/classroom	Introduction to the metal workshop/classroom, equipment, tools & materials.
		Distribution of tool sets	Distribution of toolsets and responsibilities (who is responsible, where to store).
		Measuring	Short session on measurement tools and importance of accurate measuring.
	Material use	How to make costs effective use of standard length(s) of pipe, sheet iron, etc.	
	Part 1, the wheel	Theory about the wheel, all its parts, important issues and order of work. Groups work on the construction of the wheel.	
	2	H&S session: eyes	Explain what happens in the eye when you look in a welding flame, the damage done to your eye, and how to prevent damage of the eye.
		Part 1, the wheel	Continuation groups constructing the wheel.
		Part 2, the structure	Theory about the structure, all its parts, important issues and order of work. Groups work on the construction of the structure.
	3	H&S session: ears	Hearing loss, beeping ears, irreversible damage done and how to prevent hearing damage.
		Part 2, the structure	Continuation groups constructing the structure.
		Part 3, the handle	Theory about the handle, all its parts, important issues and order of work. Groups work on the construction of the handle.
		Part 4, the bushings	Theory about the bushings, all its parts, important issues and order of work. Groups work on the construction of the bushings.
	4	H&S session, cuts & heat	Sharp edges on the pump parts, hot after welding and how to prevent damage from cuts & heat. Continuation groups constructing the bushings.
		Part 5, the pump cover	Theory about the pump cover, all its parts, important issues and order of work. Groups work on the construction of the bushings.
		Part 6, the guide box	Theory about the guide box, all its parts, important issues and order of work. Groups work on the construction of the guide box.
		Assembly	All groups assemble (or try to) their pump. Evaluate the pump assembly of each group and identify and explain to each of the groups what the reasons of failure are, and how to overcome them.
	5	Introduction of the welding jigs	Introduce welding jigs and explain the working of the jigs, why they are used, the importance of interchangeable parts, standardized parts, quality of work, etc.
		Parts standardisation	Introduce the standardisation criteria, as agreed on the standardisation meetings, the importance of standardisation, and standardisation in relation to certification.
		Painting (theory)	Lesson on painting, why and how chamber, anti rust paint (also inside spokes), painting, dilution of paint, drying and colour use (which colour?).
		Painting (practise)	Each group will now paint their pump.



Week 2, page 34

Week	Day	Training subject	Description of the activity
2	6	Evaluation	Evaluation of the first week and explanation about the second week
		Creating groups	Create groups of 2, one experienced and one less experienced person per group.
		Welding jig wheel	Explain the wheel jig, how it is used and order of work,
		Part 1, the wheel	Groups work on the construction of the wheel.
	7	Welding jigs structure	Explain the structure jigs, how they are used and order of work
		Part 2, the structure	Groups work on the construction of the structure.
	8	Part 3, the handle	Groups work on the construction of the handle.
		Welding jig bushings	Explain the bushing jig, how it is used and order of work
		Part 4, the bushings	Groups work on the construction of the bushing.
	9	Part 5, the pump cover	Groups work on the construction of the pump cover.
		Part 6, the guide box	Groups work on the construction of the guide box.
		Assembly	Groups work on the assembly of the pump
		Evaluation by group	Trainer will evaluate the assembly with each group individually
		Evaluation in class	Trainer and trainees will finally evaluate the manufacturing and assembly of the pumps produced in the second week. Each group will do quality control.
	10	Painting	Groups work on painting of the pump
		Business skills	Session on price calculation: price of the materials, consumables, electricity, water, workshop rent, profit (how much), final price calculation of a Rope pump.
Name plates/tags and logbook of selling's		Importance of name plates, quality tags, keeping records (logbook of selling's), including location.	
Quality		Quality follow up and Quality control internal and external and certification.	
Marketing & visibility		Marketing strategies, how to reach your client.	

Week 3, page 40

Week	Day	Training subject	Description of the activity
3	11	Evaluation	Evaluation of the second week and explanation about the third week
		Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
	12	Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
		Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
	13	Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
		Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
	14	Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
		Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
	15	Individual pump manufacturing	Each of the trainees will this week manufacture a pump individually.
		Quality control	After assembly of the pumps the trainees will do quality control on the pump.
Refreshing session		Refresh and repeat sessions of the first three weeks on demand of the trainees.	
		Evaluation	Evaluation of the third week and explanation about the last week





Week 4, page 43

Week	Day	Training subject	Description of the activity
4	16	Theory on Rope pump installation	Theory on the installation of the Rope pump.
		PVC and pistons	Describe the importance of the same sizes of PVC and the fitting of the pistons.
		Rope and tension	Explain the working of the rope and the tension it should have.
		Practice: loop	Practice, let trainees make connect a short piece of rope by making a loop.
		Practice: pistons on rope	Demonstrate and practice by trainees how to put the pistons in the rope.
		Frequently made mistakes in past	Show some of the frequently made mistakes in the past in Ethiopia of pumps that were installed in a wrong way and the consequence for their working.
		Ergonomics	Session on ergonomics of the user, pump height and convenient use.
		Hygiene and well surroundings	Session on well hygiene, how to construct an apron, the well cover, drain channel and soak pit. Lesson on bacteria, pollution and disinfection.
		JICA2014, pole and borehole models	Show in manual the installation procedure of the JICA2014, pole and borehole models, indicate the differences (module 2).
		Technical assessments	How to do technical assessments; what are the well requirements for the installation of a rope pump (when is a Rp feasible and when not feasible?).
	Prepare for site visit and installation	Prepare all items to bring to the field (or garden) for installation.	
	17	Theory on construction of the well cover	Theory on concrete well cover and production of well cover with moulds (which moulds are there).
		Demonstration well cover construction	Demonstration on the construction of the well cover.
		Practice well cover	Let the trainees practice individually, making one well cover each.
	18	Theory on construction of reducer blocks	Theory on reducer blocks and production of reducer blocks with a mould.
		Demonstration reducer blocks constr.	Demonstration on the construction of reducer blocks.
		Practice reducer blocks	Let the trainees practice individually, making one or two reducer blocks each.
	19	Demonstration apron	Full demonstration on the construction of an apron: cleaning and deepening of the well, installing the reducer blocks, the apron, drain channel and soak pit.
		Practice apron	Let the trainees practice the construction of the apron in groups of 4.
	20	Demonstration of installation process JICA2014 model	Full demonstration of an installation of the JICA2014 model, including raising main, guidbox, installation of pump and raising main, t-piece, tanker and outlet, connection of rope and pumping (including O&M training for the user).
Practice installation JICA2014 model		Let the trainees practice (each individual needs to do at least one good quality installation, including O&M training). Let the trainees do quality control on each others pump installation and functioning, after each pump is installed.	



Week 5, page 50

Week	Day	Training subject	Description of the activity
5	21	Practice installation JICA2014 model	Let the trainees practice (each individual needs to do at least one good quality installation, including O&M training). Let the trainees do quality control on each others pump installation and functioning, after each pump is installed.
	22	Demonstration of installation process pole model	Full demonstration of an installation of the pole model.
		Practice installation pole model	Let the trainees practice (each individual needs to do at least one good quality installation, including O&M training). Let the trainees do quality control on each others pump installation and functioning, after each pump is installed.
	23	Practice installation pole model	Let the trainees practice (each individual needs to do at least one good quality installation, including O&M training). Let the trainees do quality control on each others pump installation and functioning, after each pump is installed.
		Optional demonstration pump on drilled well	demonstration of installation of the 2014 model on a drilled well (borehole).
		Alternative measurements	Session on alternative measuring (for clients who do not have the tools); length of arm to shoulder is 1 meter, 1 el is 50cm, 1 finger is 10cm, etc.
	24	Quality control installation	Visit a pre-installed pump. The pump is purposely installed with 5 frequently made installation mistakes! Let trainees identify the problems.
		O & M	Operation & Maintenance. Discuss all the operation & maintenance issues of the Rope pump again and stress the importance of providing operation and maintenance training to clients!
		Practice O&M training	Let trainees again provide O&M training to each other (practical task) and/or to clients in the village, who have a rope pump (if any is available).
		Client visit(s)	Field visit to a Rope pump user(s) (who has been using the Rope pump for at least several months). Let the trainees interview the user of the pump.
		Evaluation	Evaluation of the training with the trainees.
		Closure	Official closure of the training, issuing participation papers.

## 2.6 FOLLOW UP TRAINING

After the initial manufacturing period (6 months or 20 pumps), it is needed to evaluate the encountered problems with the manufacturers and users of the pumps and conduct follow-up training or coaching (done by an experienced trainer). Using field visits as a base, the Rope pump manufacturers can be trained in correcting occurring problems at existing pumps and future production. Coaching is repeated until the manufacturer is producing good quality pumps. Then the manufacturer can apply for certification.

## 2.7 CERTIFICATION

All trainees will receive a participation paper at the end of the training, however they will not be a certified producer after this training. Therefore the trainees first need to produce pumps in their own work shop. Follow-up training; First these pumps will be checked by the trainers, and when needed refreshment training is done by the trainer in the metal workshop of the trainee. Once the trainee performs good quality manufacturing and installation of the Rope pump, he can apply for certification. Only when the manufacturer (trainee) passed the quality inspection he will be issued a certificate. From that moment on he will be a certified Rope pump manufacturer. Please see Module 1 of the manufacturing, installation, operation and maintenance manual; 'Monitoring and quality control', page 17, for further information on certification, monitoring and quality control.



## CHAPTER 3 DAY BY DAY DESCRIPTION of the ACTIVITIES

### WEEK 1

#### DAY 1

---

**Training subject:**                    **Opening and introduction**

Description of the activity:

Opening of the training and introduction of stakeholders, teacher(s) and trainees.

---

**Training subject:**                    **Explanation of the training**

Location:                                    Classroom

Description of the activity:

Explanation and summary of the training, what will the trainees gain from it, content of the training, duration, training schedule, daily starting, break and finishing times, expectations from trainees and participation paper\*.

\*trainees who do not follow the whole training course cannot receive a participation paper.

---

**Training subject:**                    **Introduction to the Rope pump**

Location:                                    Classroom, inside/outside

Items needed:                            Demonstration model of Rope pump (installed in training compound or a demonstration model welded on a drum.



Demonstration model on a drum.

Description of the activity:

First introduction and demonstration of a working Rope pump and theory on its history, history in Ethiopia, its working, different models, lessons learned in Ethiopia, quality of manufacturing and installation and how this reflects to the content of this training.



Training methodology:

Demonstrate the Rope pump and let all trainees observe and use the pump. Show a simulation explaining the working of the pump, if available. For example a computer animation or a miniature Rope pump with transparent raising pipe t-piece and outlet.

---

**Training subject:                      How to use the Rope pump manual**

Location:                                      Classroom

Items needed:                                Distribute hardcopies of the Rope pump manufacturing, installation, operation and maintenance manual to the trainees.

Description of the activity:

Explanation on the Rope pump manual, the different modules, especially module 3, how to read the technical drawings and materials lists. Address the conversion of thinking in centimeters to millimeters to be able read the technical drawings.

Training methodology:

For the explanation of how to read the material list and technical drawings, develop a few practical exercises to practice reading of the material list, the drawing numbers and the dimensions given in the technical drawings.

---

**Training subject:                      Health and Safety**

Location:                                      Classroom

Items needed:                                1 set of health and safety clothing and protection measures.

Description of the activity:

First introduction to Health and Safety measures, working safe during the training use of Health and Safety clothes and reasons why.

Training methodology:

Specific attention to ear and eye protection. Repeat these session later during the training (in between activities) each time when unsafe work is observed in the group.

---

**Training subject:                      Creating groups**

Description of the activity:

Make groups of 4-5 trainees per group.



Training methodology:

Count the trainees from 1 to 4 (or 5) randomly to avoid that only the best trainees team up with each other.

---

**Training subject: Distribution of Health and Safety clothes**

Items needed: Health and Safety clothes and protection measures.

Description of the activity:

Distribute the Health and Safety clothes to all trainees individually.

---

**Training subject: Introduction to metal workshop/classroom**

Location: Metal workshop/classroom

Description of the activity:

Introduction to the metal workshop/classroom, equipment, tools and materials. Show the trainees all equipment and tools in the workshop. Explain the rules and regulations in the workshop, workshop store, where to find facilities such as water, electricity, wash room, etc.

---

**Training subject: Distribution of tool sets**

Items needed: Tools and equipment, (see chapter 1, 'What is needed', tools and equipment).

Description of the activity:

Distribute the toolsets and discuss responsibilities (who is responsible, where to store).

---

**Training subject: Measuring**

Location: Classroom/metal workshop

Items needed: Set of measuring tools, calibre, measuring tape, tri-square.

Description of the activity:

Short session on measurement tools and importance of accurate measuring. Address again the conversion of thinking in centimeters to millimeters.

Training methodology:

Ask trainees to demonstrate the use of: a calliper, a measuring tape and a tri-square (explain it is not a slack hammer and show the photo to illustrate why) or develop a practice task to practice using the measuring tools.







damaged tri-squares, used as slack hammer.

---

**Training subject:**                      **Material use**

Location:            Classroom/metal workshop

Description of the activity:

Session on how to make costs effective use of standard length(s) of pipe, sheet iron, etc.

Training methodology:

Develop a short practical task to practice for example cost effective use of a ½" GI pipe, calculating how many parts and which parts can be cut from a single pipe length.

---

**Training subject:**                      **Part 1, the wheel**

Location:                                  Classroom/metal workshop

Items needed:                              Whiteboard/blackboard, demonstration model of pump to show the wheel.

Description of the activity:

Theory about the wheel, all its parts, important issues and order of work. After the theory session each groups will work on the construction of a wheel.

Training methodology:

See chapter 2: Learning by doing.

---

**DAY 2**

---

**Training subject: Health and Safety session: eyes**

Location: Classroom

Items needed: Whiteboard/blackboard, safety glasses

## Description of the activity:

Refer to an observation you made in the workshop: people looking into the welding flame. Explain what happens in the eye when you look in a welding flame (what do you feel, sand in your eyes?), the damage done to your eye, and how to prevent eye damage.

## Training methodology:

If you feel comfortable draw a cross section of the eye and show what happens when you look into the welding flame.

---

**Training subject: Part 1, the wheel**

Location: Metal workshop

## Description of the activity:

Continuation of each groups constructing a wheel.

---

**Training subject: Part 2, the structure**

Location: Classroom/Metal workshop

Items needed: Demonstration model of pump to show the structure.

## Description of the activity:

Theory about the structure, all its parts, important issues and order of work. Also explain the lock and the raising and return pipe holders. After the theory session each groups will work on the construction of the structure.

## Training methodology:

See chapter 2: Learning by doing.

---



**DAY 3**

---

**Training subject: Health and Safety session: ears**

Location: Classroom

Items needed: Whiteboard/blackboard, hearing protection

## Description of the activity:

Refer to an observation you made in the workshop: people grinding without hearing protection. Make jokes that you don't hear them! What do you observe: hearing loss, beeping ears, irreversible damage done which is noticed once it is too late! How to prevent hearing damage.

## Training methodology:

Explain them the working of the ear and how irreversible damage is done.

---

**Training subject: Part 2, the structure**

Location: Metal workshop

## Description of the activity:

Continuation of each group constructing the structure.

---

**Training subject: Part 3, the handle**

Location: Classroom/Metal workshop

Items needed: Demonstration model of pump to show the handle.

## Description of the activity:

Theory about the handle, all its parts, important issues and order of work. After the theory session each groups will work on the construction of the handle.

---

**Training subject: Part 4, the bushings**

Location: Classroom/Metal workshop

Items needed: Demonstration model of pump to show the bushings.

## Description of the activity:

Theory about the bushings, all its parts, important issues and order of work. After the theory session each groups will work on the construction of the bushings.

---



**DAY 4**

---

**Training subject:** **Health and Safety session: cuts and heat**

Location: Classroom

Items needed: Example of Rope pump with sharp edges.

## Description of the activity:

Refer to an observation you made in the workshop: people leaving sharp edges on pump parts (well cover, handle), hot after welding (let group members know!), how to prevent damage from cuts and heat.

---

**Training subject:** **Part 5, the wheel cover**

Location: Classroom/Metal workshop

Items needed: Demonstration model of pump to show the wheel cover.

## Description of the activity:

Theory about the pump cover, all its parts, important issues and order of work. Explain how to calculate cost effective use of the material: how many pump covers can I cut from one sheet metal? After the theory session each groups will work on the construction of the pump cover.

---

**Training subject:** **Part 6, the guide box**

Location: Classroom/Metal workshop

Items needed: Demonstration model of pump and example of the guide box.

## Description of the activity:

Theory about the guide box, all its parts, important issues and order of work. After the theory session each groups will work on the construction of the guide box.

---



**DAY 5**

---

**Training subject:**                    **Assembly**  
Location:                                Metal workshop/classroom

Description of the activity and training methodology:

Let each group assemble their own pump, if parts do not fit, do not correct them. After all groups have assembled (or tried) their pump, call all trainees back to the classroom. Evaluate the pump assembly of each group, let other groups comment on the assembly of each group before you do this as a teacher: Other groups, what do you observe on this pump. Do not lecture, but let others identify. Then let them think about solutions. Finally identify and explain to each of the groups what the reasons of failure are, and how to overcome them (with all groups listening).

---

**Training subject:**                    **Introduction of the welding jigs**  
Location:                                Classroom  
Items needed:                         1 set of welding jigs

Description of the activity:

Following the lesson of above, introduce the welding jigs briefly and relate each of the jigs to the problems above. Explain the working of each of the jigs, why they are used, which of the above problem they solve, the importance of interchangeable parts, standardized parts, quality of work, etc.

Training methodology:

Do not yet demonstrate the working of the jigs with cut materials, this will be done next week.

---

**Training subject:**                    **Parts standardisation**  
Location:                                Classroom

Description of the activity:

Introduce standardisation criteria, the importance of standardisation, and standardisation in relation to certification. Please see the manufacturing, installation, operation and maintenance manual, module 1, page 10, 'Standardisation of critical parts' for more information.





---

**Training subject:            Painting (theory)**

Location:                      Classroom

## Description of the activity:

Lesson on painting, why and how chamfer and degreasing, anti-rust paint (also inside the spokes), painting, dilution of paint, drying in the sun yes/no, colour use (which colour?),etc. please see the manufacturing, installation, operation and maintenance manual, module 3, page 101, 'Painting', for more information.

---

**Training subject:            Painting (practice)**

Location:                      Metal workshop

## Description of the activity:

Each group will now paint their pump.

---



**WEEK 2****DAY 6**

---

**Training subject: Evaluation**

Location: Classroom

Description of the activity:

Evaluation of the first week and explanation about the second week

---

**Training subject: Creating groups**

Description of the activity:

Create groups of 2 trainees per group.

Training methodology:

Preferable an experienced trainee will team up with a less experienced trainee. This allows the less experienced trainee to learn from his team mate.

---

**Training subject: Wheel Jig**

Location: Classroom

Preparations: Cut all materials for the wheel, for a demonstration of the jig.

Items needed: Prepared materials for the wheel + Wheel Jig.



Wheel Jig.

Description of the activity:

Explain the wheel jig, why and how it is used (show how it is used; demonstrate by entering the cut materials in the jig, in the right order), and order of work, tag welding; which tag welds first, what will happen when you tag weld on one side only (deforming of the spokes due to shrinking of material: heat-cold), how to avoid this, when and how to do the final welding (without deforming).

Training methodology:

Refer for use to the manufacturing manual, module 3.



---

**Training subject: Part 1, the wheel**

Location: Metal workshop

Description of the activity:

Groups work on the construction of the wheel, using the welding jig.

---

**DAY 7**

---

**Training subject: Welding jigs structure**

Location: Classroom

Preparations: Cut all materials for the structure, for a demonstration of the jigs.

Items needed: Prepared materials for the structure + Frame Jig &amp; Base Jig.



Frame Jig.

Description of the activity:

Explain the structure jigs, why and how they are used (show how they are used; demonstrate by entering the cut materials in the jig, in the right order, which jig first,...), and order of work, tag welding; which tag welds first, what will happen when you tag weld on one side only (deforming of the frame due to shrinking of material: heat-cold), how to avoid this, when and how to do the final welding (without deforming).

Demonstrate the Frame Jig and Base Jig.

Training methodology:

Refer for use to the manufacturing, installation, operation and maintenance manual, module 3.



---

**Training subject: Part 2, the structure**

Location: Metal workshop

Description of the activity:

Groups work on the construction of the structure using the structure welding jigs.

---

**DAY 8**

---

**Training subject: Part 3, the handle**

Location: Metal workshop

Description of the activity:

Explain the handle and order of work, related to mistakes made in the first week (frequently mistake: the two bends not 180 degrees opposite each other).

Groups work on the construction of the handle.

---

**Training subject: Bushing Jig**

Location: Classroom

Preparations: Cut all materials for the handle, for a demonstration of the jig.

Items needed: Prepared materials for the handle + Bushing Jig.



Bushing Jig.

Description of the activity:

Explain the bushing jig, why and how they are used (show how they are used; demonstrate by entering the cut materials in the jig, in the right order, which jig first,...), and order of work, tag welding and how to do the final welding.

---

**Training subject: Part 4, the bushings**

Location: Metal workshop

Description of the activity:

Groups work on the construction of the bushing.

---

**DAY 9**

---

**Training subject: Part 5, the pump cover**

Location: Metal workshop

Description of the activity:

Groups work on the construction of the pump cover.

---

**Training subject: Part 6, the guide box**

Location: Metal workshop

Description of the activity:

Groups work on the construction of the guide box.

---

**Training subject: Assembly**

Location: Metal workshop

Description of the activity and Training methodology:

Groups work on the assembly of the pump.

---

**Training subject: Evaluation by group**

Location: Metal workshop

Description of the activity and training methodology:

Trainer will evaluate the assembly with each group individually.





---

**Training subject: Evaluation in class**

Location: Classroom

Description of the activity and training methodology:

Trainer and trainees will finally evaluate the manufacturing and assembly of the pumps produced in the second week, each group is asked to identify the difficulties/challenges they have faced during the week, and how they solved it. Each of the groups will do quality control on the pumps of the other groups (is practising of internal quality control).

---

**DAY 10**

---

**Training subject: Painting**

Location: Metal workshop

Description of the activity:

Groups work on painting of the pump.

---

**Training subject: Business skills**

Location: Classroom

Description of the activity:

Session on price calculation: price of the materials, consumables (electrodes, grinding discs, etc.), electricity, water, workshop rent, profit (how much), final price calculation of a rope pump. Advantages and disadvantages of prices too high or too low.

Training methodology:

Develop a practical calculation task to calculate a full price of a Rope pump.

---

**Training subject: Name plates/tags and logbook of sellings**

Location: Classroom

Items needed: Show example of logbook, name plates and quality tags.

Description of the activity:

Explain the importance of name plates, quality tags, keeping records (logbook of selling's), including location, etc.



---

**Training subject: Quality**

Location: Classroom

## Description of the activity:

Quality follow up, visit pumps in the field! Keep contact with users and/or village technicians. Quality control internal and external, guarantee to the customer (6 months, 1 year?), certification, etc. Selection of materials: different qualities (wall thickness) of materials. Official quality inspections and how to qualify for certification.

---

**Training subject: Marketing and visibility**

Location: Classroom

## Description of the activity:

Marketing strategies, how to reach your client: Visibility of the metal workshop (open your doors, have a demonstration model of the Rope pump in front of your workshop, bill board with picture). Seek contact with village technicians who can act as a dealer for you (paying commission to them), make arrangements with them for maintenance, etc.

## Training methodology:

Give examples of, demonstration pumps in the village (on strategic locations), and come back after 3 months to collect (or sell) the pump. Welding pump on a drum (like demo model in class) and go to bazar, demonstrate on the weekly market, etc.

---



## **WEEK 3**

### **DAY 11**

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**Training subject:**                      **Evaluation**

Location:                                      Classroom

Description of the activity:

Evaluation of the second week and explanation about the third week.

---

**Training subject:**                      **Individual pump manufacturing**

Location:                                      Metal workshop/classroom

Description of the activity:

Each of the trainees will this week manufacture a pump individually, using all the lessons learned from the first weeks. The trainee will make use of the welding jigs.

During the whole week the trainer will keep an eye on the progress made by each trainee. Each trainee should have a pump ready and painted by the end of the week. The pump should be in perfect condition as the trainee will bring this pump (and the welding jigs) to his workshop, where the pump will serve as an example model.

Training methodology:

The trainer will continuously walk around and provides coaching on demand or when he observes that coaching is needed. Coaching will be done individually, but when the same frequently made mistakes are observed with several trainees, the trainer will call all trainees together for a session together, either in the metal work shop or class room.

---



**DAY 12**

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**Training subject:** Individual pump manufacturing

Location: Metal workshop/classroom

Description of the activity:

Each of the trainees will this week manufacture a pump individually.

**DAY 13**

---

**Training subject:** Individual pump manufacturing

Location: Metal workshop/classroom

Description of the activity:

Each of the trainees will this week manufacture a pump individually.

**DAY 14**

---

**Training subject:** Individual pump manufacturing

Location: Metal workshop/classroom

Description of the activity:

Each of the trainees will this week manufacture a pump individually.



**DAY 15**

---

**Training subject: Individual pump manufacturing**

Location: Metal workshop/classroom

Description of the activity:

Each of the trainees will this week manufacture a pump individually.

---

**Training subject: Quality control**

Location: Classroom

Description of the activity and Training methodology:

After assembly of the pumps the trainees are invited to do quality control on each other's pump. The outcomes of this will be discussed with all of the trainees in a classroom session. Repeat the lesson on internal quality control. Evaluation of the made mistakes (inventory by trainer) and solutions for the made mistakes (solutions provided by trainees) are discussed. Also address how to produce larger quantities while maintaining quality of the pumps.

---

**Training subject: Refreshing session**

Location: Classroom/Metal workshop

Description of the activity:

Refresh and repeat sessions of the first three weeks on demand of the trainees or based on the personal observation by the trainer. Which lessons are not yet fully understood.

---

**Training subject: Evaluation**

Location: Classroom

Description of the activity:

Evaluation of the third week and explanation about the last week.





**WEEK 4****DAY 16**


---

**Training subject: Theory on Rope pump installation**

Location: Classroom

## Description of the activity:

Theory on the installation of the Rope pump. Explain the three sizes of pipes and depths, demonstrate the weight of a bucket below and above the water, do different exercises (tasks): draw cross section of pump, ground level and groundwater level, indicate the depth of the pump and groundwater (realistic example. Ask the trainees which size of PVC is needed. Do the same again with a very deep well, but shallow groundwater, most likely you will get different answers. Keep continuing these exercises until trainees are giving the correct answers.

## Training methodology:

Demonstrate that lifting under the water table can be done without force (by an oil barrel filled with water, lifting a bucket up from the bottom with one finger, then lift the full bucket out of the water, at the point that the bucket comes above the water level, it becomes too heavy to lift with one finger. Let trainees try. Now relates this example to the depth of the groundwater, 3 sizes of pistons, etc.

---

**Training subject: PVC and pistons**

Location: Classroom

## Description of the activity:

Describe the importance of the same sizes of PVC and the fitting of the pistons (show some examples of correct fit, too wide or too narrow (no fit)). Make sure that all trainees know the standardized pipe sizes, including their suppliers.

## Training methodology:

Show the problem of the different PVC pipes and pistons. Make one good fitting and make one bad fitting. Show the consequences. Talk about quality of pipes (wall thickness).



---

**Training subject:                      Rope and tension**

Location:                                  Classroom

Description of the activity:

Explain and demonstrate the working of the rope and the tension it should have (explain why).

---

**Training subject:                      Practice: loop**

Location:                                  Classroom

Items needed:                          PP or Nylon rope, diameter 6mm and 4mm.

Description of the activity:

Explain how to make a loop (see module 2).

Training methodology:

Practice, let trainees make a connection on a short piece of rope by making a loop. Let them pull to see if the rope holds.



Trainees testing the loop.

---

**Training subject:                      Practice: pistons on rope**

Location:                                  Classroom

Items needed:                          Rope and pistons

Description of the activity:

Demonstrate and practice by trainees how to put the pistons in the rope (explain the distance between pistons (why 1 meter?), distance between knots, etc).

---

**Training subject: Frequently made mistakes in past**

Location: Classroom

## Description of the activity:

Show some of the frequently made mistakes in the past in Ethiopia of pumps that were installed in a wrong way and the consequence of their working.

## Training methodology:

Show photos of frequently made mistakes?

---

**Training subject: Ergonomics**

Location: Classroom

## Description of the activity:

Session on ergonomics of the user, pump height, convenient use and height of outlet.

---

**Training subject: Hygiene and well surroundings**

Location: Classroom

## Description of the activity:

Session on well hygiene, how to construct an apron, the well cover, drain channel and soak pit. Lesson on bacteria, indicator algae, frogs, garbage, sources of pollution, drying in the sun (is disinfection), disinfection and deepening of the well before installation (when to be done, water level dry season, dirt, silt, etc.), etc.

## Training methodology:

Apron: showing installation procedure module 2 and section on hygiene.

Let trainees guess sources of pollution: "which sources of pollution do you know?"

---

**Training subject: JICA2014 and pole models**

Location: Classroom

## Description of the activity:

Show in manual, module 2, the installation procedure of the JICA2014 model, the pole and a 2014 model installed on a drilled well (borehole). Indicate the differences.



---

**Training subject:                      Technical assessments**

Location:                                      Classroom

Description of the activity:

How to do technical assessments; what are the well requirements for the installation of a rope pump (when is a Rope pump feasible and when not feasible?).

---

**Training subject:                      Prepare for site visit and installation**

Location:                                      Metal workshop/classroom

Description of the activity:

Prepare all items to bring to the field (or garden) for installation. Prepare and impregnate wooden poles for pole model, collect PVC pipes, pumps, glue, tools, etc. (see the section 'What to bring' in module 2 of the manual).

---

**DAY 17**

---

**Training subject:                      Theory on construction of the well cover**

Location:                                      Metal workshop

Description of the activity:

Theory on concrete well cover and production of well cover with moulds (which moulds are there). Explain design, thickness, reinforcement bar, etc.

---

**Training subject:                      Demonstration well cover construction**

Location:                                      Metal workshop/location for curing

Description of the activity:

Demonstrate the construction of the well cover. Practical sessions: welding reinforcement bar for cover (for 2014 model and pole model) and making the well cover (with concrete). Leave them to dry for 1 week in the compound. Also address how to produce larger quantities while maintaining quality of the pumps.



---

**Training subject: Practice well cover**

Location: Metal workshop/location for curing

Description of the activity:

Let the trainees practice individually, making one well cover each.

---

**DAY 18**

---

**Training subject: Theory on construction of reducer blocks**

Location: Metal workshop

Description of the activity:

Theory on reducer blocks and production of reducer blocks with a mould. Explain design, thickness, reinforcement bar, etc.

---

**Training subject: Demonstration reducer blocks construction**

Location: Metal workshop/location for curing

Description of the activity:

Demonstrate the construction of well reducer blocks (reinforced concrete). Leave them to dry in the compound.

---

**Training subject: Practice reducer blocks**

Location: Metal workshop/location for curing

Description of the activity:

Let the trainees practice individually, making one or two reducer blocks each.





**DAY 19**

---

**Training subject:                      Demonstration apron**

Location:                                      Field or garden with hand dug well

Description of the activity:

Full demonstration on the construction of an apron: cleaning and deepening of the well, installing the reducer blocks, making the apron, drain channel and soak pit (then let dry for 1 day)

---

**Training subject:                      Practice apron**

Location:                                      Field or garden with hand dug well

Description of the activity:

Let the trainees practice the construction of the apron as above in groups of 4. Let the aprons dry for one day.

---



**DAY 20****Training subject: Demonstration of installation process JICA2014 model**

Location:	Field or garden with hand dug well
Preparations:	For the installations during this week, use pre-fabricated concrete well covers and reducer blocks.
Items needed:	Pre-fabricated concrete well covers and reducer blocks.

## Description of the activity:

Full demonstration of an installation of the 2014 model, including preparation of the raising pipe, guide box, glue, installation of pump, installation of raising pipe, t-piece, tanker and outlet, connection of rope and testing of the pump (including operation and maintenance training for the user).

## Training methodology:

For the connection and flaring of the PVC pipes, demonstrate how to make a socket tool and flares.

**Training subject: Practice installation 2014 model**

Location:	Field or garden with hand dug well
-----------	------------------------------------

## Description of the activity:

Let the trainees do a technical assessment of the well. Then let the trainees practice installation (each individual needs to make a socket tool and do at least one good quality installation, without any mistakes, including operation and maintenance training). Let the trainees do quality control on each other's pump installation and functioning, after each pump is installed.



**WEEK 5****DAY 21**

---

**Training subject:** Practice installation 2014 model

Location: Field or garden with hand dug well

Description of the activity:

Let the trainees do a technical assessment of the well. Then let the trainees practice installation (each individual needs to do at least one good quality installation, without any mistakes, including operation and maintenance training). Let the trainees do quality control on each other's pump installation and functioning, after each pump is installed.

---

**DAY 22**

---

**Training subject:** Demonstration of installation process pole model

Location: Field or garden with hand dug well

Description of the activity:

Full demonstration of an installation of the pole model, including preparation of the raising pipe, guide box, glue, installation of pump, installation of raising pipe, t-piece, reducer, tanker pipe and outlet, connection of rope and testing of the pump.

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**Training subject:** Practice installation pole model

Location: Field or garden with hand dug well

Description of the activity:

Let the trainees do a technical assessment of the well. Then let the trainees practice installation (each individual needs to do at least one good quality installation, without any mistakes, including operation and maintenance training). Let the trainees do quality control on each other's pump installation and functioning, after each pump is installed.

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**DAY 23**

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**Training subject: Practice installation pole model**

Location: Field or garden with hand dug well

## Description of the activity:

Let the trainees do a technical assessment of the well. Then let the trainees practice installation (each individual needs to do at least one good quality installation, without any mistakes, including operation and maintenance training). Let the trainees do quality control on each other's pump installation and functioning, after each pump is installed.

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**Training subject: Optional demonstration of 2014 model on a drilled well**

Location: Field or garden with drilled well (borehole)

## Description of the activity:

Demonstration of installation of a 2014 model on a drilled well (borehole).

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**Training subject: Alternative measurements**

Location: Field or garden/classroom/metal workshop

## Description of the activity:

Session on alternative measuring (for clients who do not have the tools); length of arm to shoulder is 1 meter, 1 el (elbow to finger) is 50cm, 1 finger is 10cm, etc.

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**DAY 24**


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<b>Training subject:</b>	<b>Quality control installation</b>
Location:	Field or garden well with pre-installed pump
Preparations:	A Rope pump installed on a well, a day before the session. The pump is purposely installed with 5 installation mistakes: Rope too tight, pistons in wrong direction, no oil in bushings, wrong position of the raising pipe holder, wheel not centered.

## Description of the activity:

Visit a pre-installed pump. The pump is purposely installed with 5 installation mistakes! Go with the trainees to the pump and let them identify by themselves whether the pumps are installed correct (is practicing internal quality control on the quality of installation). Repeat session on the frequently made mistakes and how this influences the working of the Rope pump.

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<b>Training subject:</b>	<b>Operation and maintenance</b>
Location:	Field or garden well with installed pump

## Description of the activity:

Operation and maintenance. Discuss all the operation and maintenance issues of the Rope pump again and stress the importance of providing operation and maintenance training to clients!

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<b>Training subject:</b>	<b>Practice Operation and maintenance training</b>
Location:	Field or garden well with installed pump

## Description of the activity:

Let trainees again provide Operation and maintenance training to each other (practical task) and/or to clients in the village, who have a rope pump (if any is available).

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<b>Training subject:</b>	<b>Client visit(s)</b>
Location:	Field

## Description of the activity:

Field visit to a Rope pump user(s) (who has been using the Rope pump for at least several months). Let the trainees interview the user of the pump, trainees will have an impression of what clients/users see as advantage/disadvantage of the pump.





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<b>Training subject:</b>	<b>Evaluation</b>
Location:	Classroom
Preparations:	Evaluation forms
Items needed:	Evaluation forms

Description of the activity:

Evaluation of the training with the trainees and filling in of the evaluation forms by the trainees.

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<b>Training subject:</b>	<b>Closure</b>
Location:	Classroom

Description of the activity:

Official closure of the training, issuing participation papers.

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### List of Required Units of Competencies for Rope Pump Manufacturing

#### Basic Metal Works Level 1

UC ID Number	Competency
MNF MFA1 01 0311	Interpret working drawing and sketches
MNF MFA1 02 0311	Perform bench work
MNF MFA1 03 0311	Cut and join steel metal
MNF MFA1 07 0311	Perform routine metal arc welding
MNF MFA1 04 0311	Use workshop machines for basic operations
MNF MFA1 11 0311	Apply quality standards

\*Need to consider the Rope Pump Manufacturing Checklist for Quality Control

### List of Required Units of Competencies for Rope Pump Installation

#### Structural Construction Works Level 1

UC ID Number	Competency
CON SCW1 01 0211	Carry-out measurements and simple calculations
CON SCW1 02 0211	Use construction hand and power
CON SCW1 04 0211	Perform bench work
CON SCW1 05 0211	Prepare surfaces for construction work
CON SCW1 06 0211	Setting out profile set-up for building works
CON SCW1 07 0211	Carry out chiseling stone
CON SCW1 08 0211	Handle carpentry and joinery materials
CON SCW1 11 0211	Lay paving
CON SCW1 12 0211	Lay masonry unit
CON SCW1 13 0211	Prepare and mix mortar and concrete
CON SCW1 14 0211	Cast and level concrete work

#### Installation Construction Work Level 1

UC ID Number	Competency
CON ICW1 01 0910	Carry-out measurements and simple calculations
CON ICW1 02 0910	Use construction hand tools
CON ICW1 04 0910	Perform bench work
CON ICW1 05 0910	Prepare surfaces for construction work
CON ICW1 10 0910	Installing, servicing and maintaining water supply system and components

\*Need to consider the Rope Pump Installation Checklist for Quality Control