

ROPE PUMP

Low cost pump series



TECHNICAL TRAINING
HANDBOOK ON ROPE
PUMP PRODUCTION,
INSTALLATION AND
MAINTENANCE

Rope pump manual

TECHNICAL TRAINING HANDBOOK ON ROPE PUMP PRODUCTION, INSTALLATION AND MAINTENANCE

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PRACTICA Foundation develops and disseminates low-cost appropriate technology in water and renewable energy in developing countries. We focus on technology that responds to local cultural contexts, can be locally produced and maintained, and supports existing markets.



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READERSHIP

This handbook can be used as a guide during training sessions for rope pump producers, installers, local trainers and quality controllers. It also serves as a reference for, NGOs, development agencies, and enterprises for the process of rope pump introduction. The handbook consists of three sections that can be read together, or used and printed separately for the various target groups.

NOTE

Technical terms and the way in which subjects are explained are based on the average expected educational level of the intended users. Sometimes, the use of complicated technical terms has been avoided to create better understanding. Please keep in mind that the objective of the handbook is to create better understanding of rope pump implementation, production and installation in practice, aimed at technical workers who may have a limited educational background.

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This module creates awareness on the technology and applicability of the rope pump as a family water pump and provides a road-map for implementation. It is meant for NGO's, governments and implementing organisations considering the implementation of a rope pump production and installation project.

Module 2

INSTALLATION AND MAINTENANCE

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Module 2 describes the installation and maintenance procedures of the rope pump. This module is a step-by-step explanation that makes use of cartoons to illustrate the process. It is designed to be used by technical staff responsible for installation of the pump and training of the users in operation and maintenance of the pump.

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Module 3 describes the detailed steps of production of the rope pump including illustrations of production. The production steps refer to the production drawings, making use of the appropriate welding jigs, of which the drawings are included. This module is designed to be used by rope pump production enterprises as well as a guide for production training courses.

ROPE PUMP

Module 1



THE ROPE PUMP

1. THE ROPE PUMP AS A LOW-COST FAMILY HANDPUMP

PUMPING WATER BY HAND

Drinking water handpumps are devices that use manual power to pump groundwater to the surface. There is a full range of different pumps available on the market, varying in pumping mechanism, depth range, price, quality, etc.

For selection of the best handpump for a specific situation, major selection criteria are:

- Water table; distinguishing between suction handpumps (0m to 7m) and lift handpumps (7m – 80m) with the type of lift pump again depending on the actual water table;
- Type of water source; pumping from a dug well, a tube well / bore hole or from surface water;
- Number of pump users; community handpumps versus family pumps;
- Local standards and norms;
- Desired system of operation and maintenance



CHARACTERISTICS OF THE ROPE PUMP

The rope pump or rope and washer pump is a lift handpump that combines a number of characteristics that makes the pump very suitable for fetching drinking water for small groups of users (family level) for water depths up to 35m. Those characteristics include:

- Low cost; due to the simple design and choice of materials and production methods, the production costs of the rope pump are low compared to other handpumps;
- Understandable technology; all parts of the pump are visible and the operation of the pump can be easily understood by producers, technicians and users;
- User-friendly; pumping by turning a handle is a simple

and convenient for both female and male users of different ages;

- Easy maintenance; regular maintenance only involves weekly lubrication of the rotating parts and tensioning of the rope, which does not require specific skills;
- Simple repairs; most repairs on the pump can be done by the users themselves or by a village level mechanic;
- Local production; the pump is designed in such a way that it can be produced by small workshops with basic skills in metal works, avoiding difficult importation of pumps or spare parts;

Other characteristics of the rope pump make it less suitable for use in specific situation. Those include:

- Open structure; at the discharge and return tube, the pump is open to the air and contamination of the rope is possible via contact by hand;
- Free outflow; due to the design of the rope pump, it is not possible to build up pressure on the delivery side, which makes the pump unsuitable to pump water to overhead tanks;
- No foot valve; each time when starting to pump, the raising main needs to be filled with water before water starts to flow. Especially for deeper wells, this takes extra effort;

The summarized performance figures of the rope pump are as follows:

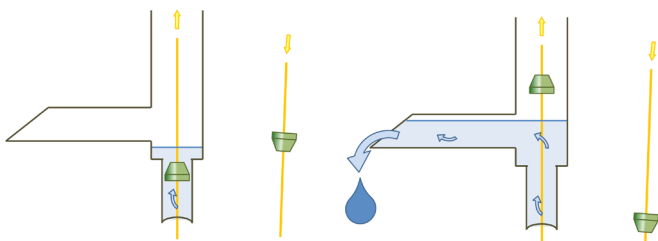
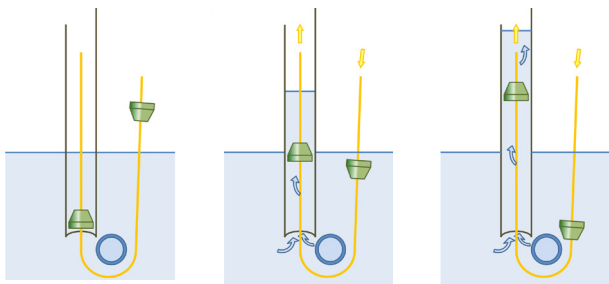
Discharge	@10m	35 l/min
	@20m	20 l/min
	@35m	10 l/min
Maximum depth		35 m
Input power		50W approx.
Output level		1 m above ground level
Borehole diameter minimum		75mm (or 3")
Application		1-10 households (up to to 50 users total)
Costs		€50 – € 150 approximately (based on model and country of production)

**based on an input power of 50W, which is the human power output that women and children can deliver for longer periods of time.*

HOW THE PUMP WORKS

The Rope pump consists of a wheel and an endless rope with small pistons, made of polyethylene or rubber that are attached to the rope at intervals of 1 meter. The pistons fit in the PVC pipe (called 'rising main') with a clearance of 1mm. The rope and pistons move freely down into the well. At the bottom, the rope is guided by a turning point (called 'guide box') into the rising main. The wheel and handle are attached to a rotating shaft mounted on a support structure on top of the well. The rope and pistons are moved by turning the wheel. The water is lifted by the pistons and discharged at the surface.

The Rope pump is a pump with a constant output, unlike the pulsating flow of piston pumps. The weight of the water column is equally carried by all pistons in the rising main, reducing the forces on the pistons. The maximum force on the rope is determined by the volume of the water column in the rising main, which depends on the water level and diameter of the raising main. The continuous flow not only reduces peak forces on the rope, but also maximizes the effective flow of water through a given tube diameter. Finally, the absence of peak forces and the gradual filling of the raising main contribute to good human ergonomics.



THE DIFFERENT ROPE PUMP MODELS

The manually operated rope pump

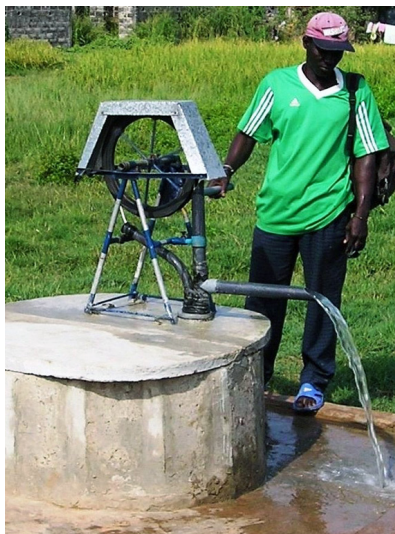
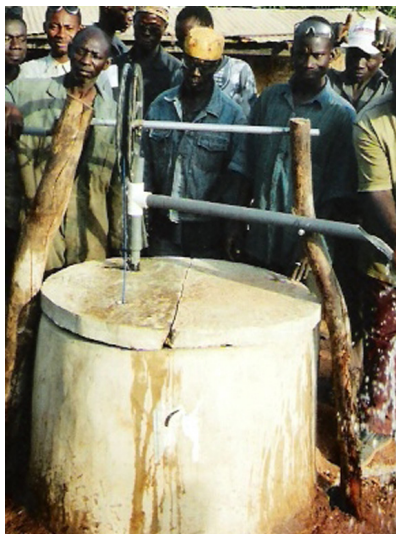
For the manually operated rope pump, a range of different designs is available. The designs have evolved from work on optimization, introduction and production in a large number of different countries, where the rope pump design has been modified to meet the specific conditions in those countries. The three commonly used models are:

- The pole model (or ultra low-cost model or PI model)
- The short-leg model (or dug well model, high frame model, earlier also referred to as AH model)
- The long-leg model (or borehole model, high frame model, earlier also referred to as AB model)

The most ergonomic pose and the optimal strength of the arm muscles is created when the axle of the pump is situated at elbow (belly button) height. As the cover of most existing hand dug wells is constructed higher than ground level and most of the borehole casings (tube wells) are cut off just above the ground, two different frame lengths of rope pumps are used.

The Pole model is constructed on wooden poles, which are sometimes already installed besides the hand dug well, and can be used on single household level. Although the Pole model is cheaper than the framed models, the construction is less stable which may result in reduced durability. It is for this reason that in this manual only the recommended long leg and short leg models are included.

Note: Although PRACTICA sees the need for locally appropriated rope pump designs, there are a number of critical parts in the rope pump of which the dimensions are optimized for durability, ease of production and cost price. It is strongly recommended not to alter any structurally or mechanically stressed parts or prescribed materials in the design as presented in this manual to avoid early failures of rope pumps in the field.



Other rope pump models

For higher yields, which is specifically required for small scale irrigation purposes, special rope pump models have been developed, including rope pumps powered by pedals, electric motors, gasoline and diesel engines, animal traction and wind mills. Although some of those models show great potential for cost-effective irrigation from water depths up to 30m, large scales successes are not documented to date.



2. WHAT ORGANIZATIONS MUST KNOW

THE CONTEXT IN WHICH THE ROPE PUMP CAN BE A SUCCESS

The rope pump is an affordable option for pumping water with, as all other handpumps, a specific area of application. Success or failure of the introduction of the rope pump heavily depends on the context in which the pump is going to be used and if the pump is going to meet the requirements for water pumping of its intended users.

The rope pump as a family pump

As a result of the simple and low-cost design, the rope pump is a pump that requires special care in operation and maintenance (see also module 2; installation & maintenance). It is for this reason that the rope pump is very suitable for water supply at family level and not recommended for use at communal wells.

Having a pump at family level is only relevant if families have access to water in the form of a hand dug well or (low-cost) bore hole. Especially in those areas where people have the tradition of digging their own family well, or in situations where people have access to low-cost (manual) drilling or digging, the costs of having a well and pump at family level can be within the reach of the (extended) family.

As the rope pump can also be used productively (animal husbandry, small scale irrigation), simultaneous focus on availability of (micro) credit can further help to make the rope pump affordable and increase the family income.



Local production

The rope pump is designed in such a way that it can be produced by local artisans. At the same time, installation and repair of the rope pump relies on local availability of parts and expertise, which is available at the place where the pump is produced. Rather than aiming for centralized production in the capital, localized production in regional towns guarantees availability of parts and services at this level.

Decentralized production by a number of different producers also helps to establish a healthy competition between producers, keeping the prices down. Negative effects of decentralized production are the challenges with quality control to make sure all producers meet the quality standards.

Market mechanisms

To guarantee continued availability of the rope pump on the local market, the use of traditional market mechanisms where supply, demand and price levels are matched, is the recommended approach; The rope pump has to be introduced as a 'self supply option' that people can purchase to improve their own water supply. Once a critical mass has been reached and the rope pump is accepted as a useful tool by families for drinking water supply or by farmers for small scale irrigation, demand will continue to exist. With the supply chain of local producers, retailers, and installers in place, the pump can be a commercial success which in itself is a guarantee for sustainability.

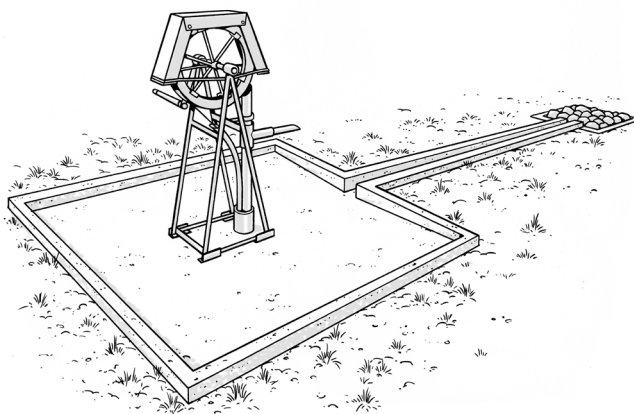
Key in the process of using traditional market mechanisms is to avoid free handouts of the pump or subsidized sales, as this will disturb demand as well as the image of the rope pump. For those potential users who lack access to cash, offering (micro) financing options at fair conditions can overcome cash problems, especially when productive use of the rope pump is promoted.

SAFE WATER AND SANITATION

When introducing the rope pump as a family pump, the hygiene aspects of installation and use are often not being taken care of; especially when making use of the local private sector, training of this sector should include training on hygienic installation practice. A good practice of installation of a rope pump should include:

- A sealed well with the sides higher than the surroundings to avoid run-off of pump water and rainwater into the well
- A concrete slab around the well where water can easily run off

- A soak pit filled with gravel where water can infiltrate back into the ground at least 2m away from the well



A JOINT VENTURE OF DIFFERENT ACTORS

Introduction of the rope pump as a family pump is often induced by non-governmental organizations (NGO's) with a focus on self-supply in drinking water or increasing income through agricultural production or other income generating activities which require water as an input. Due to the nature of the rope pump, additional focus needs to be a private sector development and promotion of small scale and low-cost technologies.

The implementing organization needs to play a key role in linking actors.

The roles of the different actors

For implementing a rope pump program, a number of different actors play key roles, all with specific roles and responsibilities:

The implementing organization is the organization noticing the need and demand for the rope pump in the field and mobilizing the other actors to start an introduction program. These are typically NGO's working on drinking water supply and/or income generating activities with a strong local presence in the implementation area.

A technical support partner with experience on rope pump programs like PRACTICA foundation can help to design the program and assist with the hands-on technical training courses for producers, installers and quality controllers.

Local producers can be small or medium sized metal workshops, vocational training centres or other organizations with the technical capacity to produce rope

pumps. Ideally, the rope pump production is set up as a profit making business so producers have the incentive to continue producing the rope pump after program funding is pulled out.

Retailers are the outlets where customers can buy a rope pump. In some cases, the producers are selling directly to end users whereas in other cases retailers buy in bulk from the producers. Retailers should be easily accessible for the end users and also sell spare parts.

Installers can be the producers, the retailers or independent pump mechanics who are trained in the installation (and repairs) of rope pumps.

(Micro) finance institution can play an important role in those situations where pumps are being used for productive purposes and where the cash to purchase a pump is not directly available. The implementing organization can help finance institutions to draft the terms and conditions for loans for rope pumps.

A quality control body often needs to be in place to check regularly on the quality of the rope pumps that are being produced by the different producers, as sales of sub-standard rope pump can easily give the rope pump a bad reputation.

The (local) government can have regulations and standards in place for handpump. When introducing a new type of pump, it has to meet these regulations and standards. This may imply that the government needs to be involved to alter the standards allow for low-cost family pumps like the rope pump.

3. GETTING STARTED / THE ROPE PUMP AS A BUSINESS

When considering the introduction of rope pumps in a specific country or region, the following steps can function as a lead for implementing organizations.

BEFORE CONSIDERING IMPLEMENTATION

Exploring the current water situation in the region

The rope pump as a low cost family pump requires specific hydrologic conditions to be successful, with the major one is access to water at family level. The first questions that need to be answered before considering introduction of the rope pump in a region are:

- Do people already have access to hand dug wells or boreholes at family level or can they afford to make a well in the near future?
- Does the groundwater that is easily accessible meet the local standards for drinking water?
- Does the water table in the region fit the operating conditions of the rope pump?

Exploring the market

The rope pump is primarily a 'self supply option' that should be purchased by the potential users. To be able to introduce the rope pump sustainably, potential users should not only have the financial means to pay for the pump, but should also see the added value of improved access to water through a hand pump. An exploration of the market is essential to check the demand for the product as well as the ability and willingness to pay for the pump. Questions that need to be answered are:

- Is there an existing market for handpumps for family use?
- What are the expected production costs and the sales price?
- What is the potential group of customers to target (rural or urban families, socio-economic status, etc.) and how much can those customers afford?
- What are the local (micro) financing options?
- What sales numbers can be expected?

Exploring opportunities for production, sales and maintenance

The rope pump relies on local production and local availability of spare parts and service providers like mechanics. When considering introduction of the rope pump in a specific area, the following questions need to be answered:

- Is there potential for local production like qualified metal workshops?

- Are the materials needed for production, installation, maintenance and repairs locally available or are there existing import channels that can be used?
- Are there qualified mechanics who can service and repair pumps at site?

PRODUCTION TRAINING

The option of production by local metal workshops is one of the advantages of the rope pump, however, it does require extensive training and follow-up before local metal workshops are able to produce the quality standard that is required. Module 3 of this manual provides a step-by-step manual for the production of rope pumps together with the technical drawings and material specifications, which has proven to be a useful tool in training workshops on rope pump production. As the technical educational background of many of the rope pump producers is very limited, hands-on training is essential to guarantee the production of high quality rope pumps.

PRACTICA usually works with a four week training course with groups of up to 16 students from different workshops, of which three weeks is a production course and one week installation course. A follow-up training is organized after the production of the first 10-20 pump or after 6 months, which takes place within the workshop of the producer.

Working with a number of different producers in one region introduces competition between the workshops, keeping the prices down. It also offers the opportunity to disqualify producers who deliver sub-standard quality without endangering the program.

INSTALLATION TRAINING

Installation of the rope pump on the well or borehole needs to be done by trained persons. This can be the staff from the trained production workshops or independent rope pump installers. In all cases, rope pump installers need to follow a training course to be able to install the pumps correctly. Poor installation of the pump can reduce the life span of the pump and can give additional problems during operation.

OPERATION AND MAINTENANCE TRAINING

Once in use, the rope pump requires careful operation and regular maintenance to continue working. Training of the users in operation and maintenance is essential in this. Responsibility for training in operation and maintenance is best handed over to the rope pump installers, who are in direct contact with the users and can use the newly installed pump as the object of training. In case private

enterprises are used for rope pump installation, a quality control mechanism needs to be in place to check on both installation quality as well as quality of the operation and maintenance training.



MARKETING AND ADVERTISEMENT

As the Rope pump is fairly unknown by most people at first introduction, it is recommended to bring the pump under the attention of the public and establish a connection between the potential buyers and the producing workshops. Proven means for marketing are: advertisements on radio, TV, newspaper and in magazines, distribution of flyers and placing demonstration models at strategic locations.

Branding and pricing

To be able to promote the rope pump in a national campaign, a uniform and recognized brand name for the rope pump can help, as well as calculating a standard price for the different rope pump models. The brand and price should be used by the trained and certified manufacturers. Note that the manufactures need profit to continue production, but be aware that the price will need to stay low enough to fit the budget of the potential buyers. By announcing the price during marketing campaigns, misuse of the monopoly position of the workshops in their region is avoided.

As a lot of potential users don't speak English, it is advised to choose a name in local language for the Rope pump.

Demonstration models

Seeing and trying is believing! Especially when people have little money to spend, they will not invest in a pump if they are not fully sure about the benefits as well as the quality. Also an attractive and sturdy appearance of the pump will help to convince potential customers.

Until a 'critical mass' is reached and the Rope pump fully accepted by the public, extensive promotion of the rope pump will be necessary. A high concentration of rope pumps in one area has proven to work more effectively than the same number of pumps in a large area.

Note that putting out demonstration models in public places will only work if the pumps are maintained and kept in a perfectly working condition. Non-functional pumps in public places will easily harm the image of the pump.

Responsibility for marketing

When responsibility for production is with the local private sector, the costs for marketing can often not be covered by the small and medium enterprises. Especially in the early phases of introduction of the new technology, it is recommended to support the producers in the marketing. When a critical mass is reached, responsibility for marketing should shift to the producers.

MONITORING AND QUALITY CONTROL

Part of effective quality control is monitoring of the pumps that are produced, sold and installed. This will make it possible to detect problems in time and to act accordingly. An effective system for monitoring is to work with certified producers and equip those producers with special tags for serial numbers as well as a logbook for administration or an internet-based administration tool. The data that can be recorded could include:

- Pump number
- Production date and sales date
- Name and address of the buyer
- Model
- Sales price
- Etc.



After the initial production period (6 months or 30 pumps), it is strongly recommended to evaluate the encountered problems with the producers and users of the pumps and conduct a follow-up training by an experienced trainer. Using field visit as a base, the rope pump producers can be trained in correcting occurring problems at existing pumps and future production.

ROPE PUMP

Module 2



INSTALLATION & MAINTENANCE

1. WHAT INSTALLERS MUST KNOW

This second module of the Rope pump handbook teaches entrepreneurs and technical trainers how to install and maintain a Rope pump on a hand dug well or tube well.

BEFORE YOU INSTALL A ROPE PUMP

Before you install a rope pump, there are some important things you need to know; What materials do you need, what preparations do you need to take, how to purchase parts and how to install a pump for safe drinking water? This first chapter will help you in all the preparations you need to take before you install a rope pump.

MATERIALS



Size of the raising main

The size of the PVC raising main depends on the static head. The static head is the water column which has to be pumped up. This water column is the distance between the water level in the well and the point where the water is discharged at the surface.

Tip!

The size of the PVC rising main depends on the depth of the water level in the well and NOT on the total depth of the well.

Why different sizes? If the water level in the well is high, the weight of the water column is low (short distance to bring the water up to the surface). In this case it is easy for the user to turn the wheel around. If the water level in the well is low, the weight of the entire water column is high and therefore pumping takes more effort. In this case it is difficult for the user to turn the wheel. To reduce the weight of the water column at greater depths, smaller PVC rising mains are used.

Static head (meter)	PVC outer diameter* (mm)	PVC outer diameter* (inch)
5-10	32	1" (33,4 mm)
10-20	25	¾" (26,7 mm)
20-35	20	½" (21,3 mm)

* PVC outer diameters may be different in each country or factory. PVC diameters are normally measured in mm, but sometimes only inch measures are given. The diameters in this table are indicative.

Buying the pipes

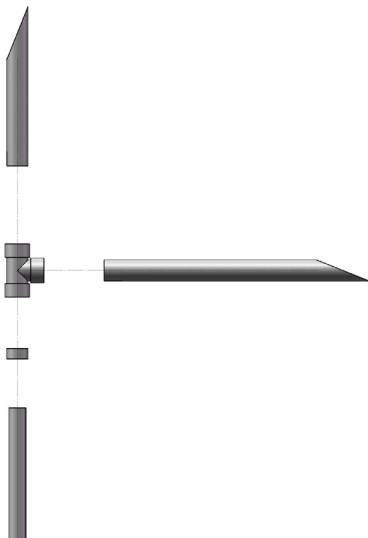
PVC pipes from different factories are often slightly different in size. The 'same looking' and coded pipes, reducers and T-pieces produced in one factory do not always fit pipes of other factories. Combining pipes from different origin may result in: breakage or disconnection of raising main, reducer and T-piece or, too much or too little clearance between the PE pistons and the raising main resulting in flow loss or pistons getting stuck in the raising main.

Tip!

Determine the most available sizes of PVC pipes at all places where pumps will be produced. Take this size as a standard for future piston production.

Other PVC parts: discharge point

The water is lifted by the rope and pistons which fit in the raising main. The raising main ends in a 'reducer', increasing the inner diameter with one or two 'pipe sizes'. The 'reducer' fits into a bigger T-piece, with an outlet and a top pipe attached to it. The water is carried up until the pistons arrive in the bigger top pipe, where the water can easily pass between the pistons and the pipe wall. The water is discharged through the outlet. To guide the flow of water in a jar or bucket an elbow can be attached.



Pistons

Pistons are made out of Poly Ethylene or rubber. Best option is to use the cone shaped Poly Ethylene (PE) pistons, which need to be produced by injection moulding. PE pistons give less friction in the pipes during operation of the pump, making it more attractive for users. But before PE piston production is present, rubber pistons can be used as an alternative.

Pistons should be made out of Poly Ethylene (PE) plastic. Other plastics will break or deform during operation. PE can be obtained as pellets (imported by a factory) or as recycled plastic. Pistons should be produced with a clearance between 0.5 and 1 mm between piston and pipe.

Tip!

Always take the pistons with you when you purchase PVC pipes to make sure that the pistons fit the inner diameter of the pipes.



PE pistons



PE piston mould and extruder



Rubber pistons made of car tire

Rope and pistons

Rope made of Poly Propylene (PP) gives the best results. This rope doesn't slip and doesn't stretch too much. The alternative is a rope made of Nylon, but this tends to slip and stretch more. The rope diameter should be 4 mm for the smallest piston size and 6 mm for the other two.

The pistons are strung on the rope and placed between two knots, which are roughly 8 cm apart. The distance between two pistons is 1 meter (not closer, because more pistons on the rope will create slipping of the pistons on the wheel).



PE piston on a rope



Rubber piston on a rope

All pistons have to point in the same direction. A PE piston always enters the PVC pipe first with the top the cone.

ERGONOMICS

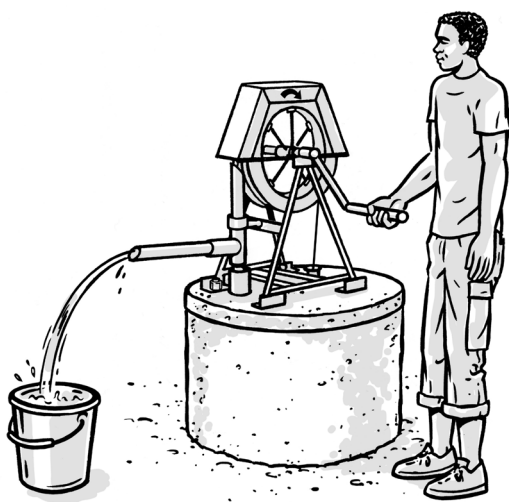
The only difference between the 'hand dug well' and 'tube well' Rope pump is the length of the frame. Most hand dug wells are finished with concrete rings above the ground level while most of the tube wells (drilled bore holes) are cut off just above the ground.



The most ergonomic pose for operation of the pump is when the axle of the pump is at the same height as the elbow of the user.

Tip!

In some cases hand dug wells are too high. In this case you can place a concrete step in front of the pump to reach the optimal pumping position.

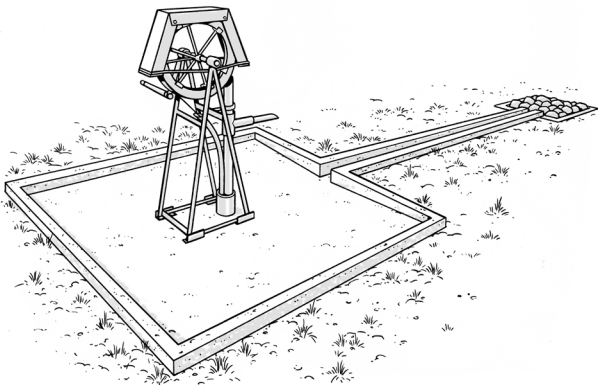


HYGIENE

The surrounding of a well is often wet. Contamination (dirt from the street and latrines) is carried to the well by users unnoticed and the well surrounding will become a breeding place for bacteria, algae and mosquitoes. To prevent that this contamination flows back into the well (with rain or pumped water), the top of the well has to be higher than the well surroundings. To protect the water in the well from being contaminated you can place a concrete well cover on top of the well.



Sunlight will disinfect the well surrounding as it dries up. To make drying of the well surrounding possible it is advised to construct a concrete apron around the well. A drain channel is dug to drain the water away from the well where it can infiltrate the soil in a so called soak pit.



NOTE

These are a few guidelines to help you during the installation of the rope pump. You can find more information on groundwater, hygiene, concrete apron and soak pit in the manual; 'Understanding Groundwater and Wells in manual drilling'.

WHAT TO BRING

Materials:

- Rising main (PVC pipes, length depending on depth of the well)
- T-piece (1)
- Reducer (1)
- Elbow (1)
- PVC tubing for outlet and top pipe (1,5m)
- PVC glue (1)
- Guide box (1)
- Pump (1)
- Rope with pistons (1).
- Concrete well cover (1)

Tools:

- 2 Spanners size 17 (for M10 bolts and nuts)
- Knife
- Pliers
- Hack saw
- Sandpaper
- Measuring tape
- Flaring tool (bottle)
- Thin rope
- Cigarette lighter
- Socket tool

The socket tool is a piece of wood, or PVC that is used to make sockets on the PVC pipes (see photo). The use of the socket tool is further explained in chapter 2 of this module.



2. HOW TO INSTALL A ROPE PUMP ON A HAND DUG WELL OR TUBE WELL

STEP 1 GETTING STARTED



Measure the depth of the well

Measure the exact depth of the hand dug well or tube well and the water level in the well. This will give you information on the total length and diameter of PVC pipes (raising main) needed.

The total length of the raising main is equal to the depth of the well + one extra meter.

Tip!

For measuring use a long rope or measuring tape with a small weight attached. Measuring with a rope can best be done when you make small knots at every meter.

STEP 2 PREPARING THE PVC RAISING MAIN

Make sockets on the PVC pipe

Make sockets on the end of each PVC pipe to connect the pipes;



Heat the end of a PVC pipe. Hold it just above a small fire or charcoal to make it soft. Do not hold the pipe in the fire, as this will burn the PVC.

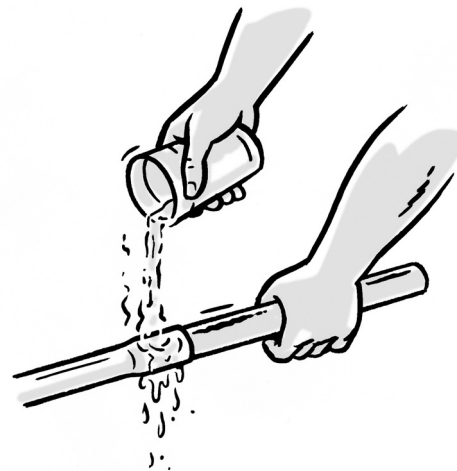
Tip!

Rotate the end of the pipe to heat it equally on all sites.

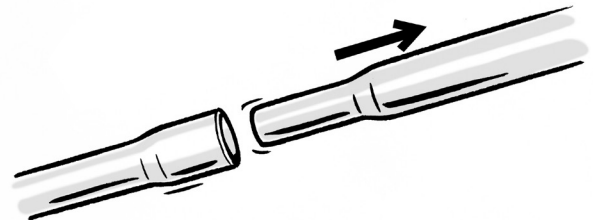
Push the 'socket tool' in the heated pipe.



Cool the pipe with water while you rotate the 'socket tool' in the pipe.

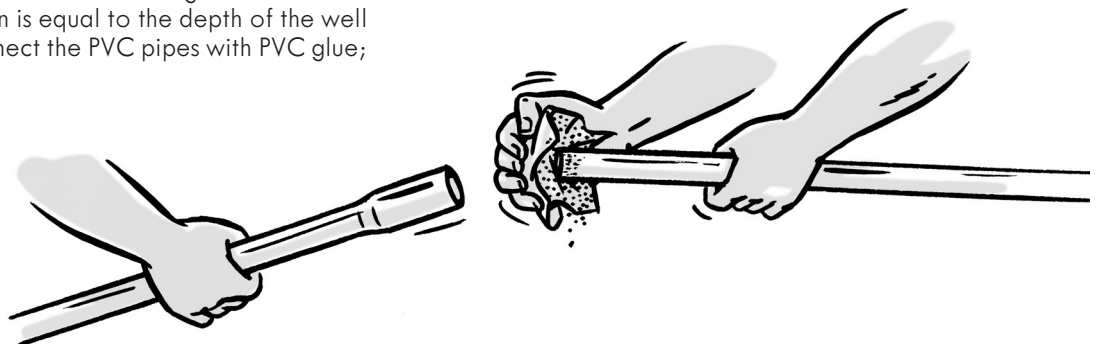


Remove the 'socket tool' from the socket.



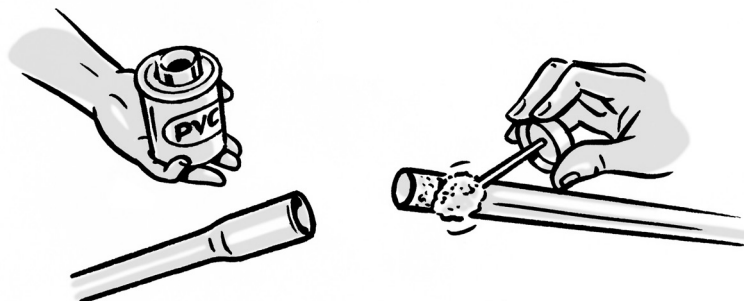
Connect the PVC pipes

Connect the PVC pipes to make the raising main. The total length of the raising main is equal to the depth of the well + one extra meter. Connect the PVC pipes with PVC glue;



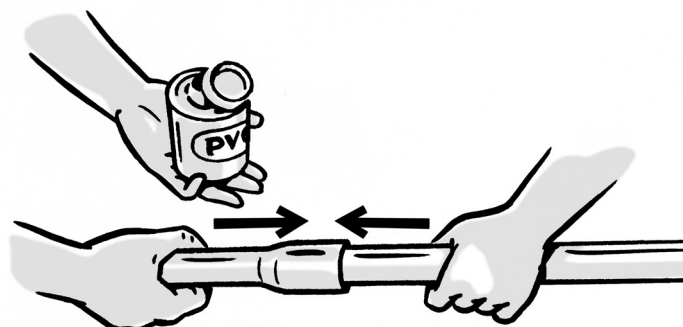
Sand (paper) the inside of the socket (female part) and the outside of the other PVC pipe (male part).

Put sufficient PVC glue on the PVC pipe (only on the male part).



Tip!
Do NOT put any glue on the inside of the socket (female part). Otherwise the male part will push the glue further inside the socket, creating a rim on the inside of the PVC pipe. This will block the pistons.

Push the end of the PVC pipe (male part) firmly in the socket. The pipes are now connected.



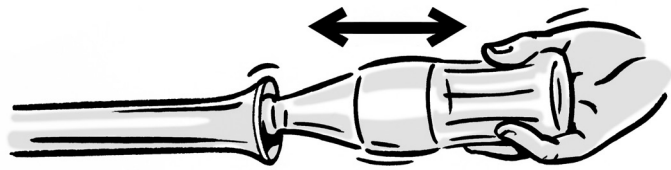
Connect the guide box

Make flares, place them in the guide box and glue the guide box to the raising main;

Heat the end of a PVC pipe.

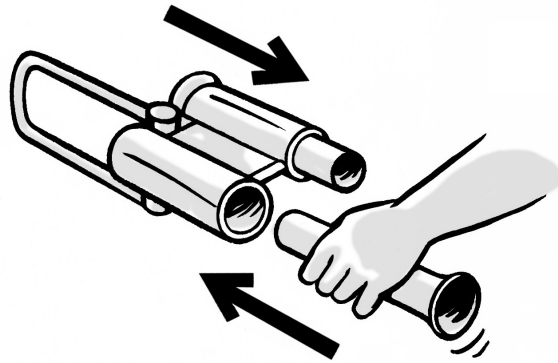


Push a bottle or a mould in the heated end of the pipe to make a flare (trumpet) and make the flare wider with your fingers.

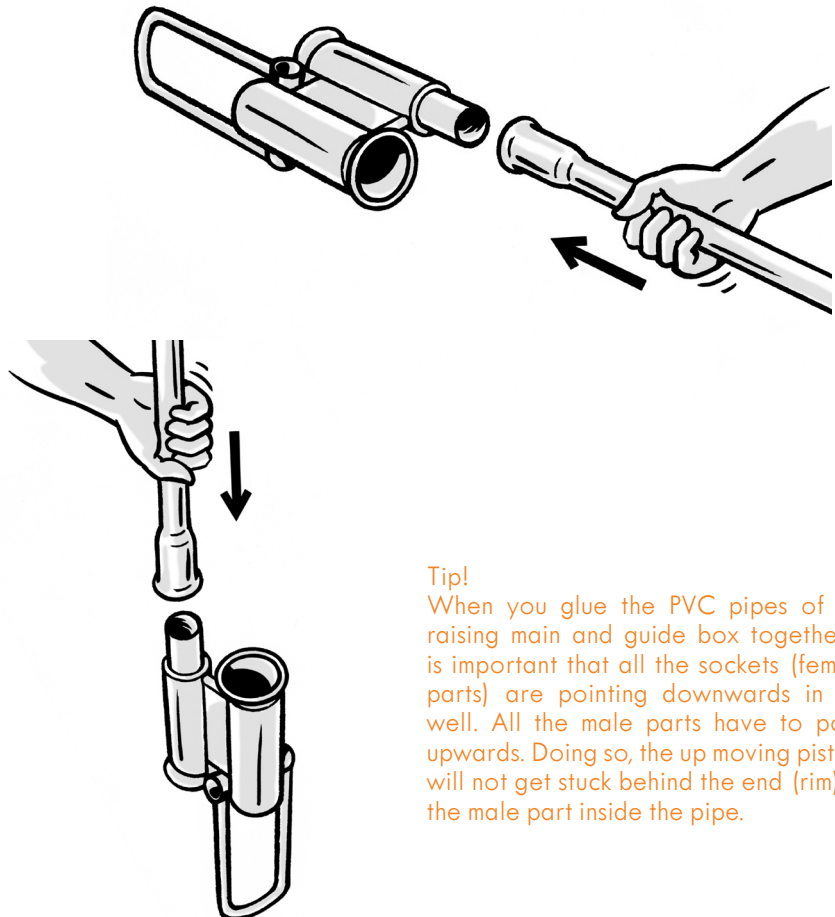


Tip!
Cool the PVC with water once the flare is shaped.

Place the flares in the guide box



Glue the guide box to the raising main.



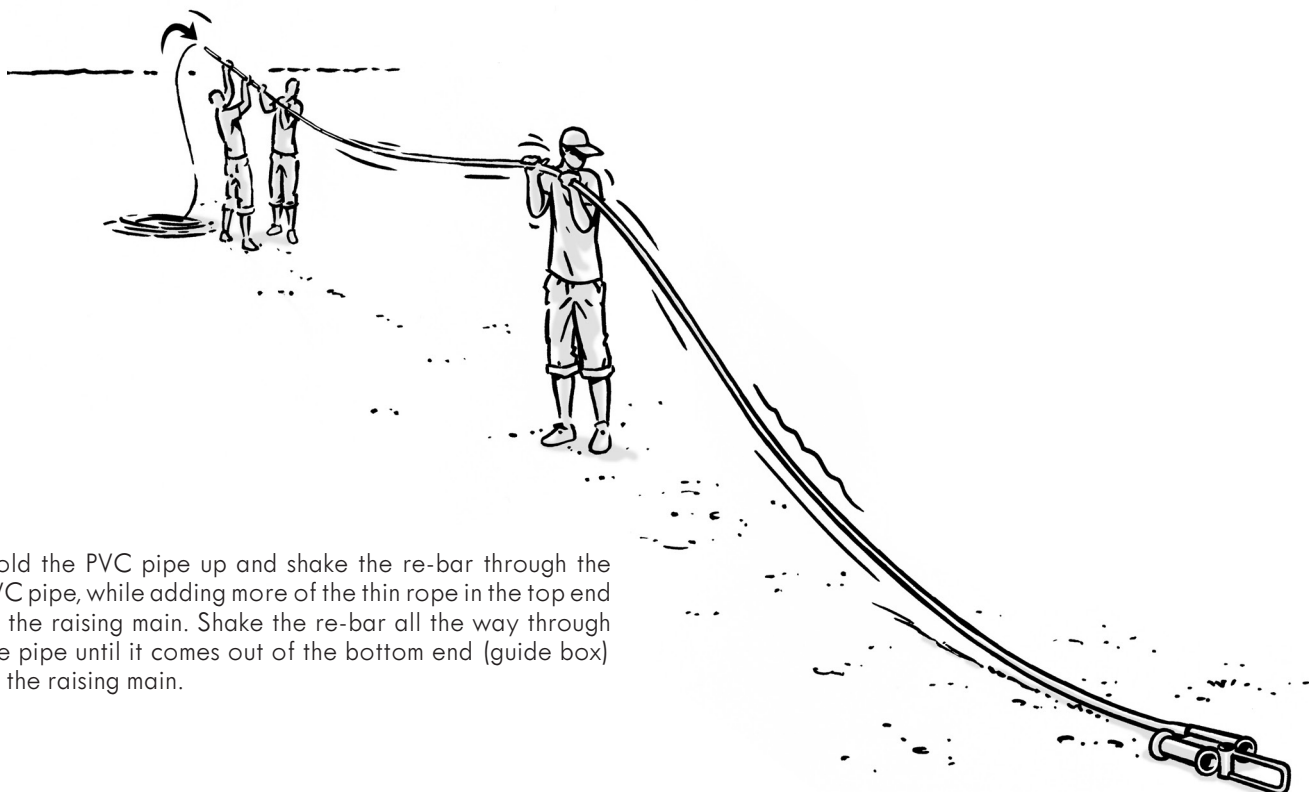
Tip!
When you glue the PVC pipes of the raising main and guide box together it is important that all the sockets (female parts) are pointing downwards in the well. All the male parts have to point upwards. Doing so, the up moving pistons will not get stuck behind the end (rim) of the male part inside the pipe.

STEP 3 PREPARING FOR INSTALLATION

Pull the rope through the raising main

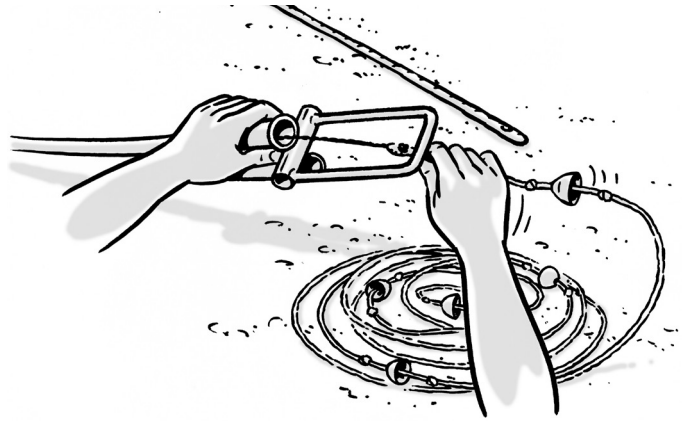


Attach a piece of re-bar to a thin 2mm rope and put the re-bar in the top end of the raising main.



Hold the PVC pipe up and shake the re-bar through the PVC pipe, while adding more of the thin rope in the top end of the raising main. Shake the re-bar all the way through the pipe until it comes out of the bottom end (guide box) of the raising main.

Disconnect the re-bar and tie the rope with the pistons to the thin rope.



Tip!
Make sure that the pistons are pointing in the right direction.



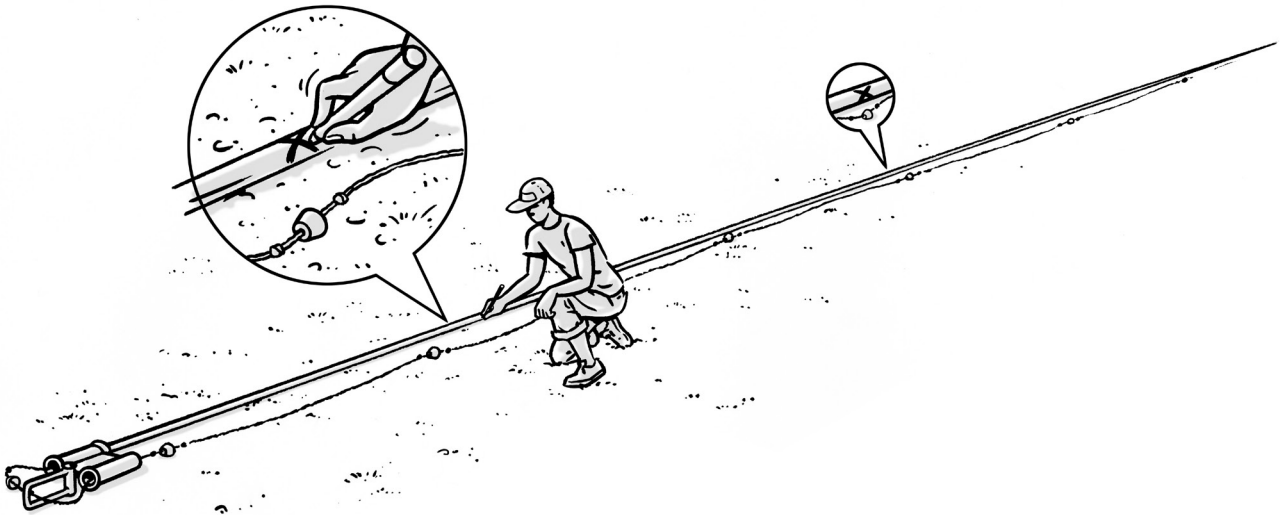
Pull the thin rope back on the top end of the raising main until the rope with the pistons has gone through.



Tip!
Tie both ends of the rope with the pistons to each other (temporarily) to prevent it from dropping in the well during installation.

Mark the raising main

Place marks on one side of the raising main about every three meters. Place the marks on the same side as where the rope catcher pipe of the guide box is situated.



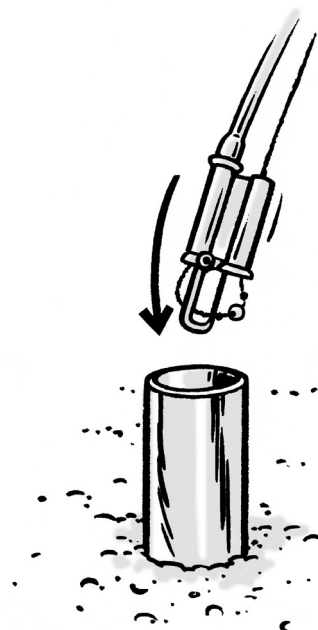
The marks are needed to prevent the rope from winding around the raising main during installation and to align the guide box and the pump after installation.

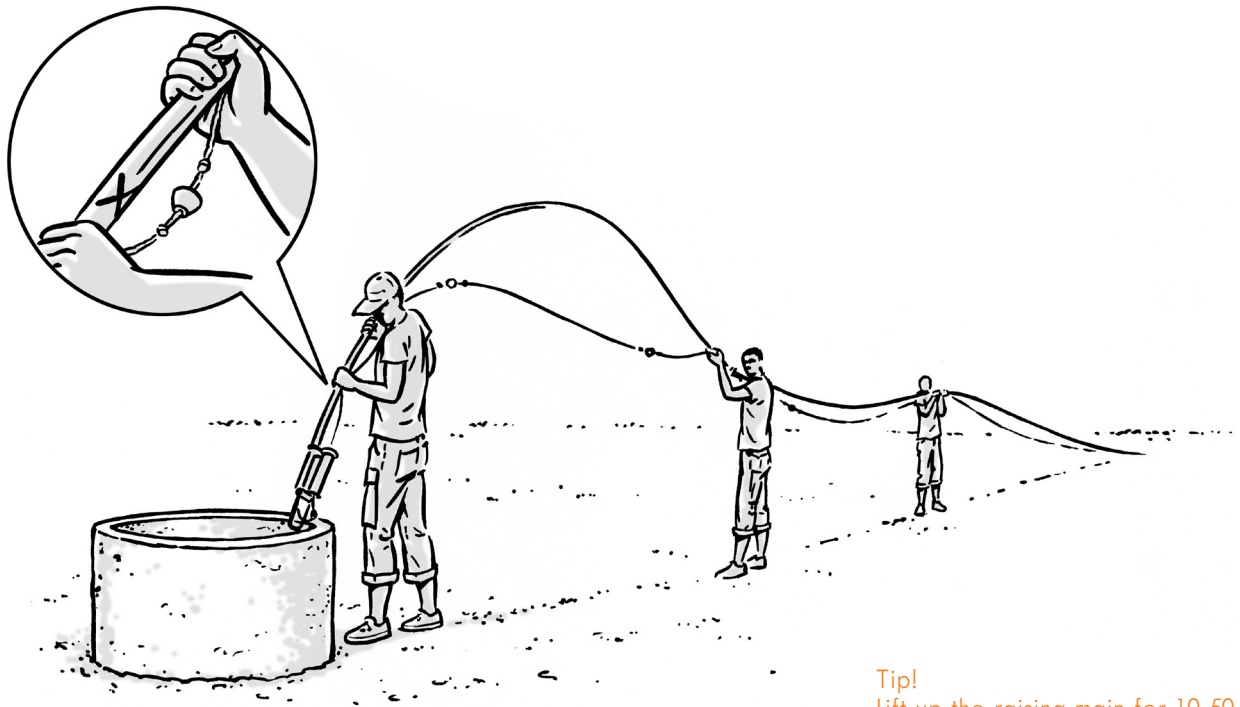
STEP 4 INSTALLING THE RAISING MAIN

Install the raising main in the well

Lower the guide box and the raising main in the hand dug well or tube well;

1. Lift up the raising main with several people.
2. Make a large bend in the raising main during installation to avoid cracks in the PVC pipes.
3. Keep the rope on one side of the raising main (watch for the marks on the pipe). Do not turn the raising main around to prevent the rope from winding around the raising main.

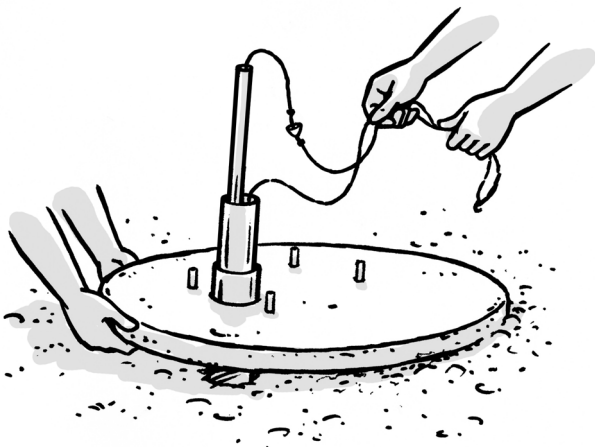




Tip!
Lift up the raising main for 10-50 cm when the guide box has reached the bottom. Do not install the guide box at the bottom of the well to avoid sediment (sand) from being pumped.

Install the concrete well cover

Place the well cover on top of the hand dug well or over the tube well and lead the raising main trough the well cover.

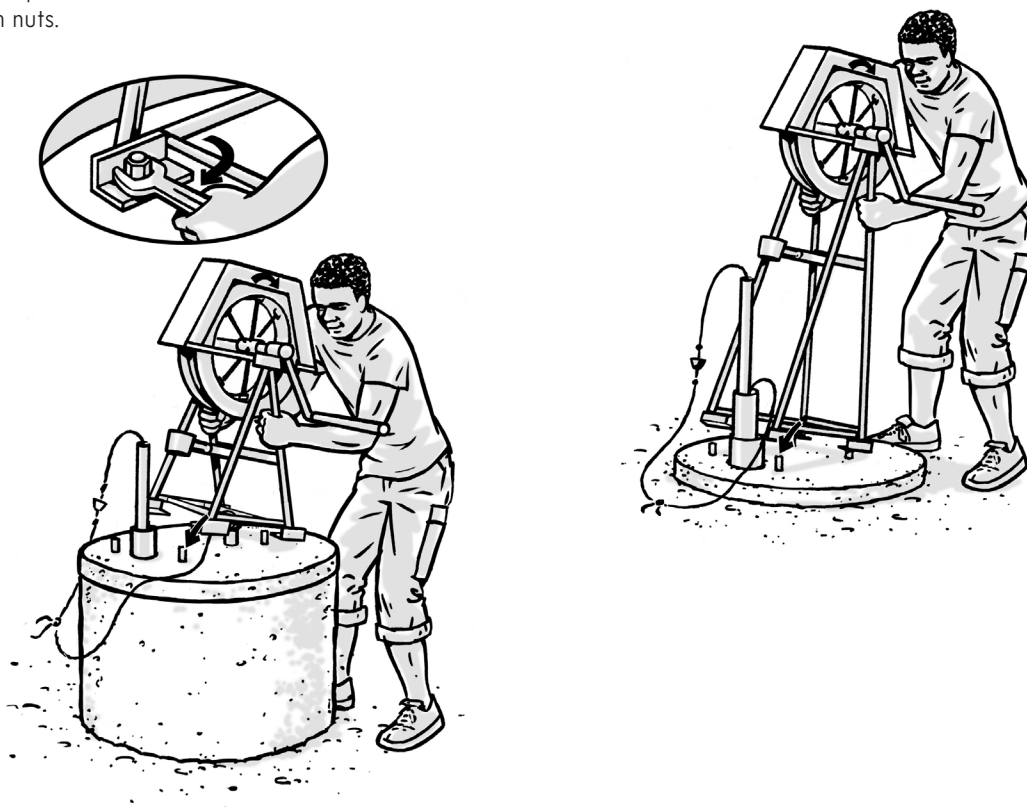


Tip!
Tie both ends of the rope with the pistons to each other (temporarily) to prevent it from dropping in the well during installation.

STEP 5 INSTALLING THE PUMP

Install the pump

Place the pump on top of the concrete well cover and secure the pump with nuts.

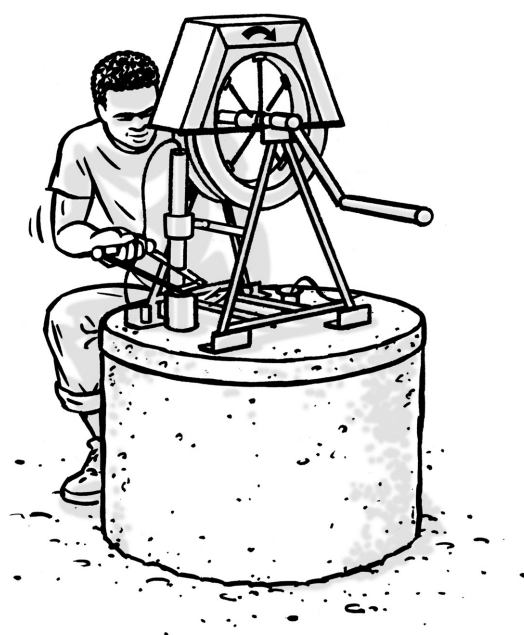


Cut the raising main

Take a hacksaw and cut the raising main to the right length;

1. Hold the bottom end of the raising main to prevent it from dropping in the well.
2. Cut the raising main to the right length;
 - for hand dug wells 10 cm above the concrete slab.
 - for tube wells 50 cm above the concrete slab.

Make sure that a bucket or jerry can will fit under the discharge point.

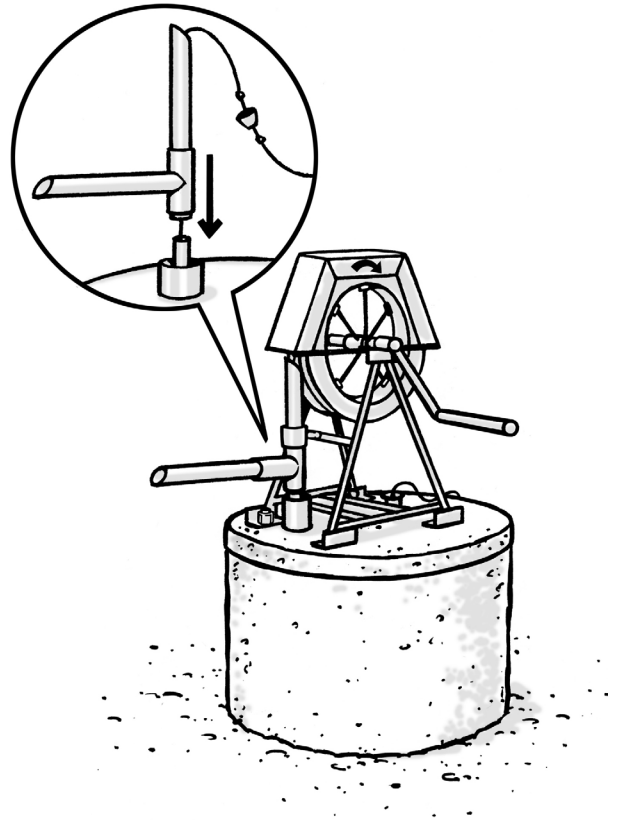


Tip!
Be very careful not to cut the rope. Hold the rope on one side of the raising main, while cutting the other side with a hacksaw. Do this all around the raising main.

Install the discharge point

Glue the parts of the discharge point together and glue the discharge point on top of the raising main.

Align the top pipe with the wheel (the rope may not touch the sides of the top pipe!) and tie the raising main holder with a bold.



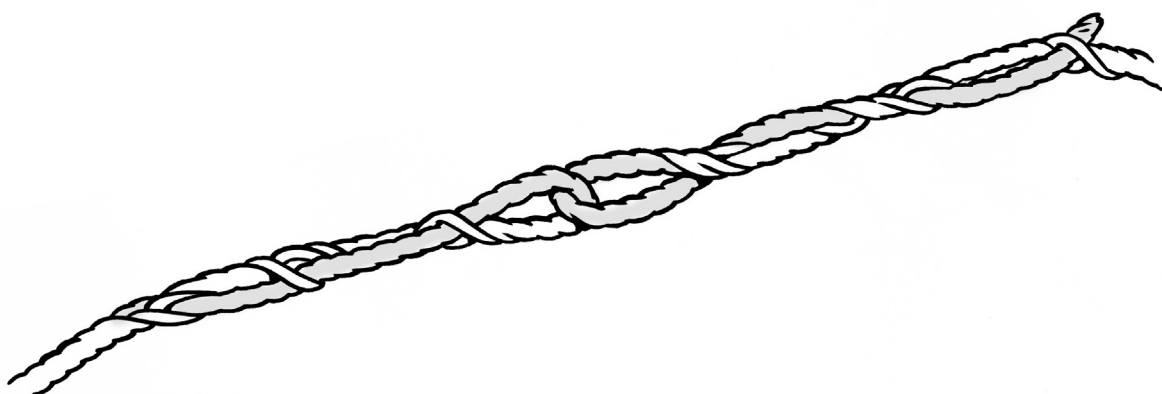
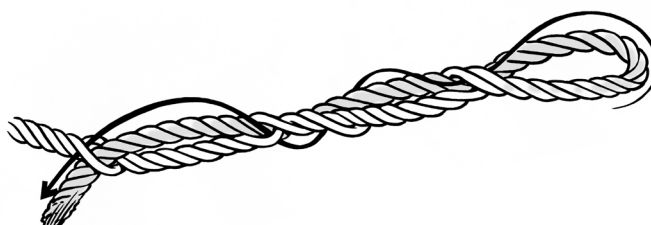
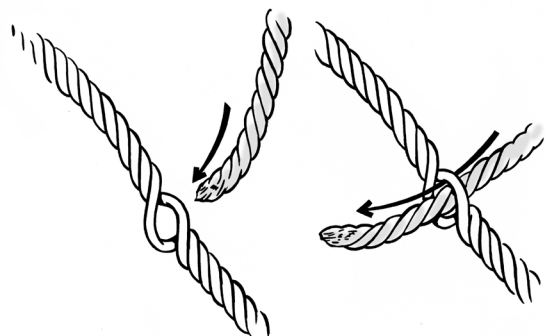
Connect the rope

Connect the two ends of the rope together;



Put the rope that comes out of the raising main over the wheel and take the rope that comes out of the well.

Make a loop;
Take one of the rope ends and
thread the rope three times back
through its own base.



Then pull the other rope end through the loop and make a second loop to connect the two rope ends.

Tip!
When you use nylon instead of PP rope, you have to seam the end of the loop to avoid the loop from getting loose (nylon tends to slip).

Tip!
Make sure that the total length of both loops is 30 cm or less to prevent slipping of the rope on the wheel.

STEP 6 TESTING THE PUMP

Test the pump

Turn the handle clockwise to test the pump.



Tip!
Only rotate the pump clockwise.
Do not rotate the pump in reverse direction, this will damage the pump.



Pump lock is closed when you stop pumping

Tip!
Use the pump lock when you stop pumping to prevent the pump from running in reverse direction.



Pump lock is open during pumping

3. HOW TO MAINTAIN YOUR PUMP

Maintenance

Do regular maintenance to keep the pump in good shape and guarantee a long life time.

Rope

Check the rope play every week and adjust when needed;

Take the rope between two fingers. Then turn your hand. If the turn can be completed between 90 and 180 degrees, the rope play is ok. When the rope is too tight, the pistons will get stuck in the guide box.

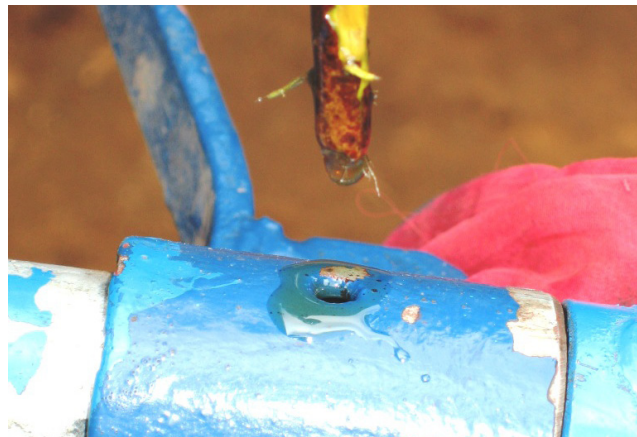


When you use nylon instead of PP rope, you have to seam the end of the loop to avoid the loop from getting loose (nylon tends to slip).



Bushings

Lubricate the bushings every week or when the bushings are running dry. If the bushings start to make a shrieking noise the need for oil is urgent. Add a few drops of new motor oil;



Tip!

Do not use old oil or cooking oil as this contains dirt, this will reach the opposite effect.

Potential repairs

Rope

When the rope shows a lot of wear, the rope has to be changed before it breaks. Tie the new rope (with pistons) to the old rope (make sure that pistons are running in the right direction) and pull the new rope through the PVC pipe. When you do so, it is not needed to take out the PVC pipes. A rope usually last for 6-12 months.

Pistons

When a well contains fine sand, the sand will wear out the pistons. When you notice a reduction of the output (less water, the pistons are leaking) you have to change the pistons. Pistons usually last for 2 years on average.

Paint

To avoid corrosion you need to paint parts again when they start rusting. Clean the parts with a steel brush and roughen it with sand paper. Then apply a primer paint. When the primer has dried, finish with regular paint. Allow the paint to dry in the shade, not in the sun.

Bushings

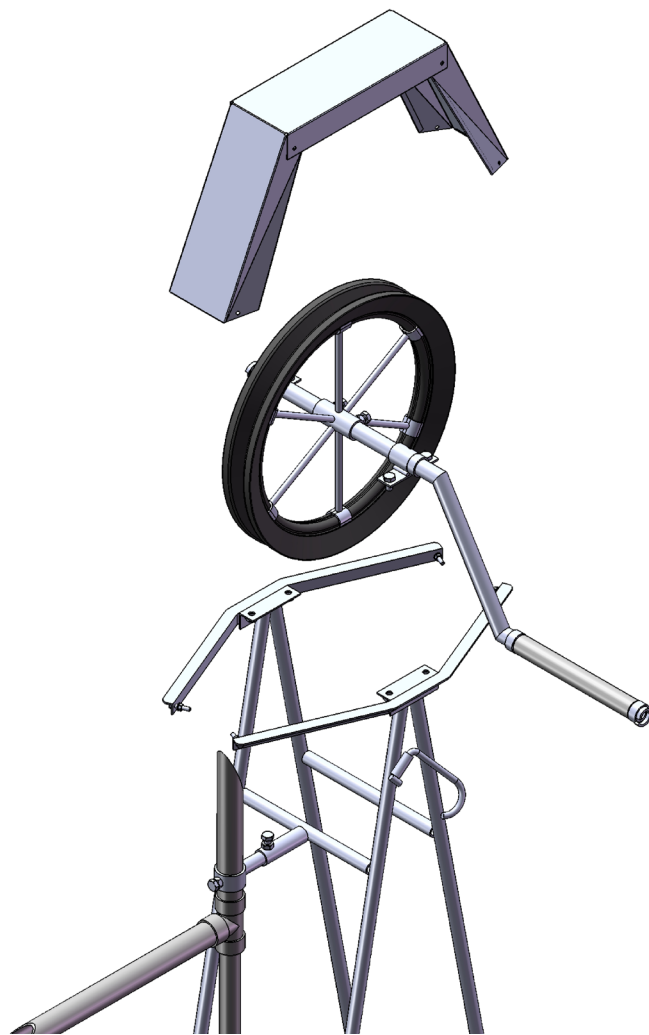
If bushings are worn out, dismantle and replace them.

PVC pipes

When a pump is placed in the sun, the sunlight will age the PVC parts causing cracks. Replace the PVC pipes when you see cracks.

ROPE PUMP

Module 3



PRODUCTION

1. Parts and material list

This third module of the Rope pump handbook gives a detailed description of the production of the rope pump, including a parts and materials list, the illustrated production steps of the pump parts, the technical production drawings of the pump and the technical production drawings of the welding jigs needed to produce the rope pump.

Parts and materials list

All the materials needed for the production of the rope pump are listed in the table below. Where needed, distinction is made between the long leg and the short leg version of the pump.

For the steel profiles, the total lengths of the different materials are given, not taking into account any losses due to cutting the materials. The same table can be used for cost price calculations of the rope pump.

item	size	quality	number
small items			
rivet	3mm	stainless steel or aluminium	4
washer	M6	GI	8
bolt	M6x30	GI	4
nut	M6	GI	4
bolt	M10x20	GI	8
nut	M10	GI	8
car tire	14"	used, sides still in good order	1
sheet metal			
sheet metal	1000 x 240 mm	GI, 0,6 – 1mm thickness	-
steel profiles			
2" GI pipe	120mm	GI, wall thickness 3,5 - 4mm	-
1½ " GI pipe	150mm	GI, wall thickness 3 – 3,5mm	-
1" GI pipe	420mm	GI, wall thickness 3 – 3,5mm	-
¾" GI pipe	1210mm	GI, wall thickness 3 – 3,5mm	-
½" GI pipe	4660mm (long leg) 3060mm (short leg)	GI, wall thickness 2,5 – 3,5mm	-
pipe Ø 16X2mm	40mm	GI or steel	-
Ø 10mm reinforcement bar	3094mm	steel	-
Ø 6mm reinforcement bar	120mm	steel	-
strip 25x3mm	312mm	steel	-
strip 30x3mm	310mm	steel	-
angle iron 40x40x2,5mm	320mm	steel	-
angle iron 30x30x2,5mm	210mm	steel	-
angle iron 20x20x3mm	1260mm	steel	-
PVC			
Ø 32mm PVC	250mm		-
Ø 50mm PVC	250mm		-

2. Workshop equipment and tools

For the production of the rope pump, the following workshop equipment and tools are recommended:

Power tools:

- Electric welding machine
- Electric grinding machine, bench model
- Angle grinder
- Drilling machine, bench model
- Hand drilling machine

Hand tools:

- Hand pop riveter for 3 mm rivets
- 2 Spanners 17 (For M10 bolts)
- Hack saw and blades
- Sheet cutter for sheet up to 1 mm
- Flat file
- Round file
- Pliers
- Set drill bits 3 mm to 12 mm
- Steel brush
- Hammers (normal, heavy and welding hammer)
- Workbench with vice
- Centre punch

Measuring tools:

- Measuring tape
- Tri-square
- Ruler
- Compass
- Scriber

Consumables

- Welding electrodes 2,5mm
- Paint (anti rust primer + gloss)
- Sandpaper
- Paint brush
- Painting tape
- Grease (to protect bolt threads during welding)

3. Steps of production

This section describes the production steps of the rope pump part by part. Part numbers relate to the numbers of the production drawings, which are included in the next section.

Part 1200; the wheel

The wheel moves the rope and pistons making use of a V-shape formed by two side pieces of a car tire. The wheel forms one sub-assembly with the two side pieces of the car tire.

1. Drawing the cutting line on the car tire - drawing 1201

- Mark a line on the side pieces of the tire using the compass



2. Cutting the car tire - drawing 1201

- Use a sharp knife or a hacksaw blade to cut out the two side pieces from the tire

3. The spokes – drawing 1202 and 1203

- Weld the spokes on the clamps
- Paint the inside and outside of the clamps with antirust primer



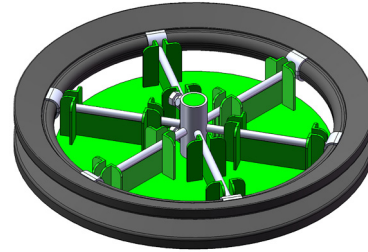
4. The hub – drawing 1204

- Drill the holes in the hub
- Weld the nuts to the hub (see drawing 1200 detail B)

Tip!
To protect the thread, cover the thread with grease and insert a bolt in the nut before welding the nut to the hub

5. The assembly – drawing 1200

- Insert hub, spokes and tire in the jig
- Align the nuts of the hub between two spokes
- Tag-weld spokes to the hub on two sides
- Remove the wheel from the jig
- Finalize welding of the spokes to the hub



6. Fixing the tire side pieces in the clamps

- To clamp the tire side pieces together, place one clamp on the vice or anvil and use a hammer to adjust the size of the clamp to the width of the two tire side pieces
- Adjust the other 5 clamps likewise

Part 1300; the bushing (sleeve bearing)

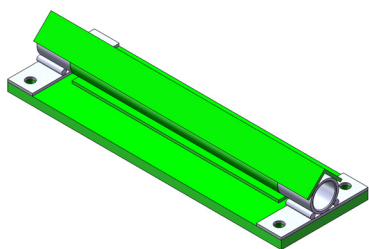
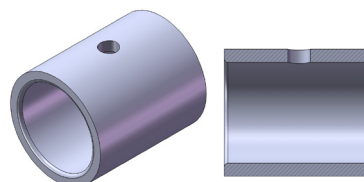
The bushing, sleeve bearing or slide bearing is the bearing that supports the axle and wheel. A thin oil film functions as lubricant. The oil is applied through the lubrication hole on the side of the bearing.

To make the sleeve bearing function properly and reduce wear to a minimum, following points are essential:

1. Sharp edges, seam and burr have to be filed until the inside and edge of the bushing show a smooth surface;
2. The bushing has to fit exactly round the axle with a maximum space of 0,5mm to keep the oil film present inside the bearing and reduce wear.
3. Wall thickness of the bearing needs to be a minimum of 3,0mm;
4. The two bearings on the pump need to be exactly in-line. When poorly aligned, the bushings will cut into the axle, resulting in a broken axle. The use of the welding jig is essential for the production of the bearing.

1. Preparation of the bushing - drawing 1302

- Remove all seams and burrs from the inside of the bushings using a file or a lathe machine.
- Bevel the edges of the bushing as indicated on the drawing



2. Welding bushing parts

- Place the bushing (part 1302) and base (part 1301) in the bearing welding jig and fix the base in the jig using 4 M10 bolts. Position the lubrication hole in the bushing at a 45° angle from the top
- Position the welding support (filler material – part 1303) and weld the bushings to the base



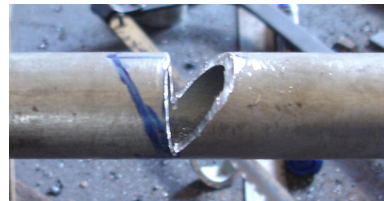
Part 1400; the crank

The crank transfers the human power to the wheel. Due to the changing forces, the crank can break easily when poorly made or when inferior materials are used.

Production of the crank can be done by bending the GI pipe in the desired shape. This can only be done with a bending tool. The production process as described in this manual is creating sharp bends by removing material, bending the pipe and welding to close the joints.

1. Making the cuts for bending

- Make the bending cuts in the pipe as indicated on drawing 1401. Make sure the cuts are positioned at a 180° angle to one another.



2. Bending and positioning the handle

- Bend the handle in the right form. Make sure that the bearing side and the handle side are parallel by drawing parallel lines on a workbench.

Tip!
For large scale production, make a jig for the handle to make sure the parts are parallel

3. Welding

- Weld the cuts together. Make sure the cuts are totally closed and take special care of this weld as it is a known weak point of the pump when the welds are not made well.

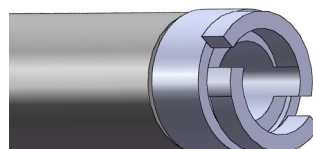


4. Fix stopper rings

- Place the two stopper rings on the handle and weld them in place on the places indicated in drawing 1400. 2 to 4 tag wells will be enough to keep the rings in place. Only tag-weld on one side of the ring as indicated in drawing 1400.

5. Make stopper cuts on the ends of the handle

- Make the stopper cuts on both sides of crank as indicated in drawing 1401. Pay special attention to the direction of the cuts on the handle side of the crank (see detail C in drawing 1401)



Part 2100; the frame

The frame can either be a long frame (drawing 2100-l) for installation of the rope pump on ground level or a short frame (drawing 2100-s) for installation on top of concrete rings of a hand dug well. The production steps of the two different models are the same and where different parts are used, these are indicated in the drawings with the addition of an l (long) or s (short).

The frame is made from Galvanized Iron (GI) pipes to reduce corrosion. The materials of the frame are thin and sensitive to deformation during welding, which causes a poor fit of the bushings on the pump and of pump on the well. Always use a welding jig and make short welds at the time to prevent deforming.

1. Positioning the parts

- Place parts 2103 and 2106 (pipes) in the frame welding jig and fix the parts in the jig.
- Tag-weld the parts in place.

2. Fixing the parts

- Remove the frame from the jig.
- Finalize the welds on the frame.

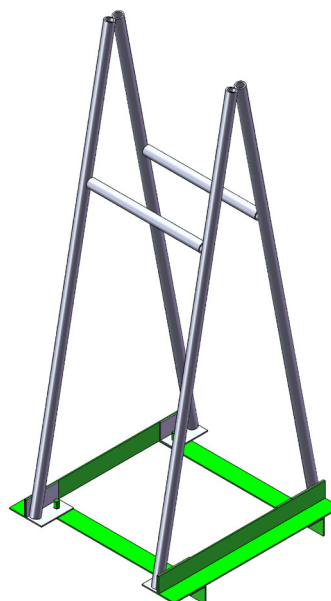
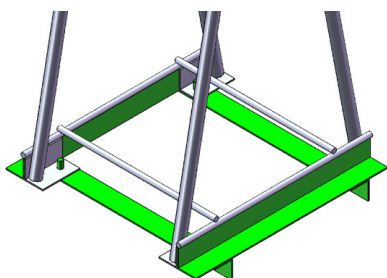
TIP!

Make short welds at a time to avoid deformation due to overheating of a welding spot



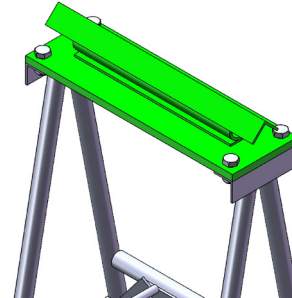
3. The base supports - drawing 2101 and 2102

- Place the 4 base supports in the base welding jig and fix the parts in the jig
- Place the frame on the base supports and weld in place.
- Weld the structural supports (parts 2104 and 2105) in place on the base supports and on the frame (all welding according to drawing 2100)



4. Bearing support – drawing 2107

- Bolt the bearing supports under the bearing jig with 4 M10 bolts.
- Place the jig on the frame.
- Weld the bearing supports to the frame (see drawing 2100 detail A).



5. Rising main support houlder - draw main support houlder.

- Weld the rising main support houlder to the frame as indicated in drawing 2100, detail B.

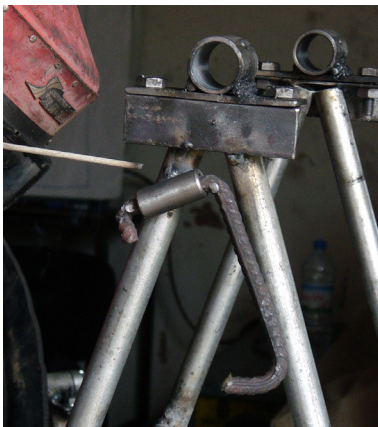
6. Cover support - drawing 2108

- Make the cover support according to the drawing, making a cut in the angle irons and bending those into shape.
- Close the cuts by welding and grind away excess welds.
- Weld the cover support to the bushing supports on the frame.



7. Rising main support - drawing 2200

- Weld a M10 nut to the rising main support
- Assemble the rising main support



8. Pump lock - drawing 2300

- Assemble the pump lock with hinge.
- Weld the pump lock with the hinge to the frame as indicated in drawing 2000, detail B. Make sure the pump lock is fixed on the correct side of the pump.

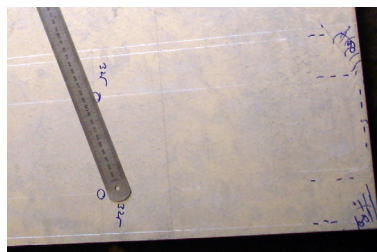
Part 1100; the cover

The cover prevents a water splash from the rope and also protects the rope from direct sunlight as the lifespan of rope will be reduced when exposed to direct sunlight.

As the cover is made of thin sheet metal, take special care of removing sharp edges.

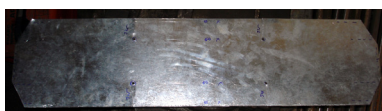
1. Drawing cutting and folding lines

- Measure and draw outside dimensions of the flat sheet, the cutting and folding lines and the cutting hole drill marks as indicated in drawing 1100-flat on the sheet metal.



TIP!

Draw multiple covers on the sheet before cutting to avoid wasting sheet metal.



2. Cutting the cover

- Cut the cover (s) from the sheet.

3. Drilling cutting holes and making the cuts

- Drill the 4 cutting holes in the flat cover on the indicated points. The holes prevent forming of sharp edges after folding. Now make the 4 folding cuts in the flat cover.



4. Folding edges

- Fold the small edges of the cover in a full 180° fold (flat).

Tip!

For folding long edges, use an angle iron to obtain straight folding lines.
Make a 90° fold first and hammer flat (180°).

5. Folding sides

- Fold the sides in a 90° angle.



6. finalizing cover

- Bring the cover in shape, using the set distance between the two sides.
- Drill the 4 holes (indicated in drawing 1100) and fix the cover with 4 rivets.

Part 3000; the guide box

The guide box guides the rope at the bottom of the well, where the rope and pistons make a turn around a metal pipe. The guidebox also holds a catcher pipe to catch the rope coming down into the well and is fixed to the rising main where the rope and pistons move up again.

The roundbar at the bottom of the guidebox prevents the rope getting stuck at the bottom of the well.

When installing the rope pump in a tube well, make sure to test if the guidebox will fit in the PVC casing of the tube well.

Refer to Module 2 for selection of the correct diameter of the rising main support (part 3002) and installation of catcher pipe and rising main in the guidebox.

1. Assembly

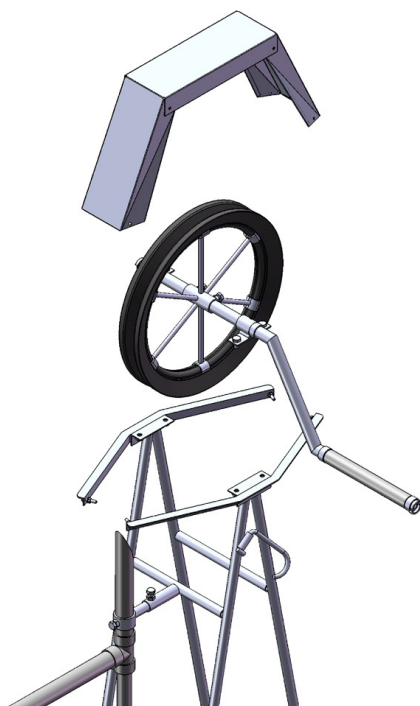
- Assemble the parts as indicated in drawing 3000



Assembly of the rope pump (drawing 0000)

1. Preparing the top assembly (drawing 1000)

- Slide the PVC handle (part 1403) over the handle side of the crank (part 1401)
- Slide over one stopper ring (part 1402)
- Bend the stopper lock on the handle side slightly open so it locks the stopper ring in place
- Slide bushing (part 1300), wheel (part 1200), bushing (part 1300) and stopper ring (part 1402) over the shaft side of the handle
- Bend the stopper lock on the shaft side slightly open so it locks the stopper ring in place
- Bolt the wheel to the shaft in the middle between the two bushings



2. Fixing the top assembly (drawing 0000)

- Bolt the two bushings of the top assembly to the bushing supports using 4 M10 bolts
- Tentatively, tag-weld the 4 M10 nuts to the bottom of the bushing support to prevent theft of the nuts

3. Installing the cover on the frame

- Install the cover on the frame and clamp the cover in place on the cover support
- Mark the positions of the fixing holes in the cover support on the cover.
- Drill the 4 fixing holes in the cover.
- Bolt the cover to the cover support with 4 M6 bolts



ROPE PUMP

Module 3

ROPE PUMP PRODUCTION DRAWINGS

A

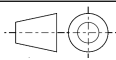
B

C

D

E

F



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL:
Part specific

TITLE:
Rope pump

DRAWN BY:
Erik den Toom

DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO. **0000**

SCALE: **1:10**

FORMAT: **A4**

PAGE NO. **1**

A

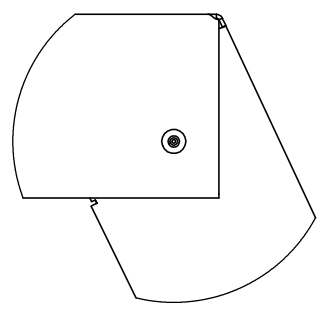
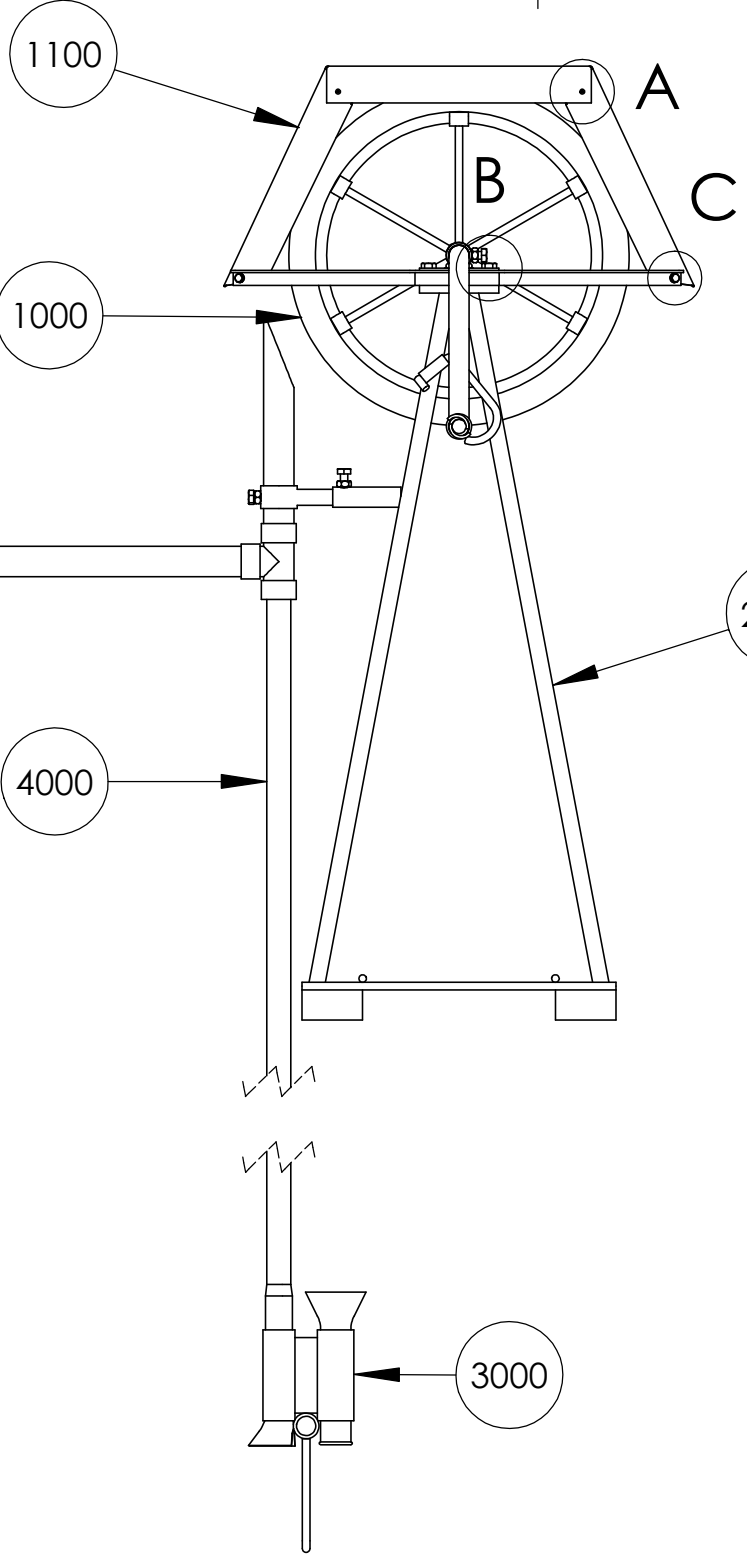
B

C

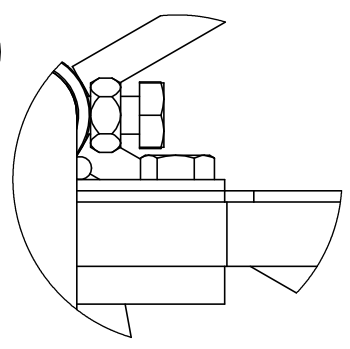
D

E

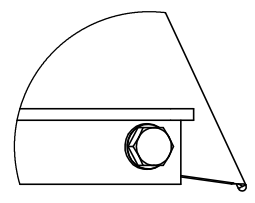
F



DETAIL A
SCALE 1 : 2



DETAIL B
SCALE 1 : 2



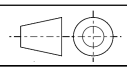
DETAIL C
SCALE 1 : 2

Pump cover: drill holes to match cover support, bolt together with M6 bolts and nuts.

Rivet cover together with 3mm rivets.

Bolt topside to structure with M10 bolts.

NO.	DESCRIPTION	QTY.
	rivet 3mm	4
	washer M6	8
	bolt M6 x 30	4
	nut M6	4
	bolt M10 x 20	4
1000	Topside	1
1100	Pump cover	1
2000	Frame	1
3000	Guide box	1
4000	Piping	1



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: Part specific

TITLE:
Rope pump

DRAWN BY:
Erik den Toom

DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO.
0000-BOM

SCALE:
1:10

FORMAT:
A4

PAGE NO.
2

A

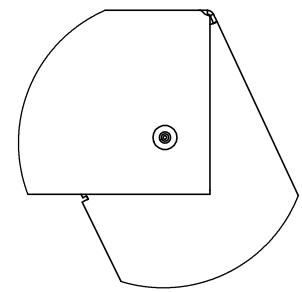
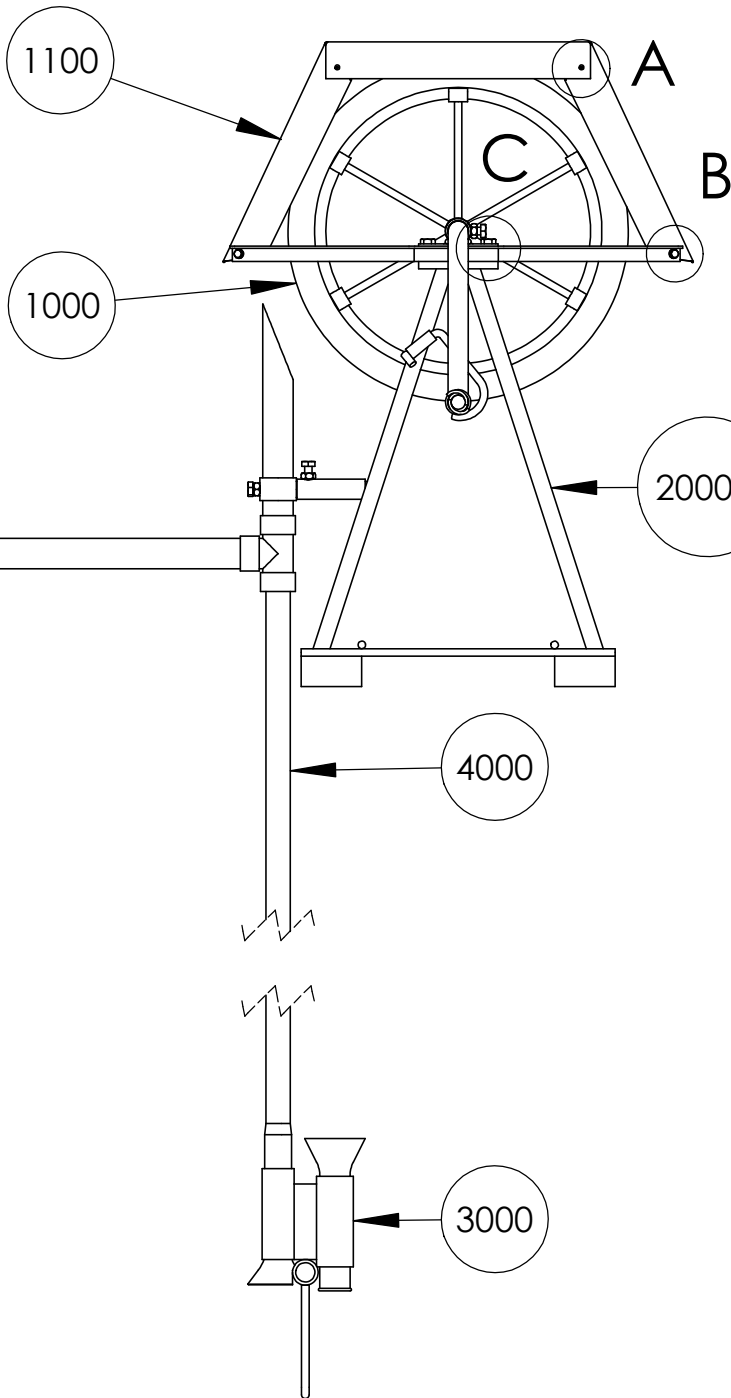
B

C

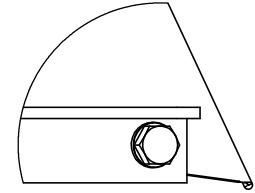
D

E

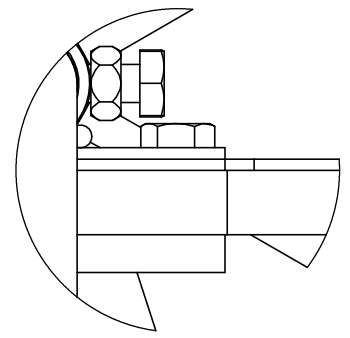
F



DETAIL A
SCALE 1 : 2



DETAIL B
SCALE 1 : 2



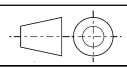
DETAIL C
SCALE 1 : 2

NO.	DESCRIPTION	QTY.
	rivet 3mm	4
	washer M6	8
	bolt M6 x 30	4
	nut M6	4
	bolt M10 x 20	4
1000	Topside	1
1100	Pump cover	1
2000-s	Frame short	1
3000	Guide box	1
4000	Piping	1

Pump cover: drill holes to match cover support, bolt together with M6 bolts and nuts.

Rivet cover together with 3mm rivets.

Bolt topside to structure with M10 bolts.



BASE MATERIAL: Part specific



TITLE: **Rope pump**

PROJECT: Rope pump

DRAWN BY: Erik den Toom

DATE: 31-7-2011

VERSION: Practica model - v1.0

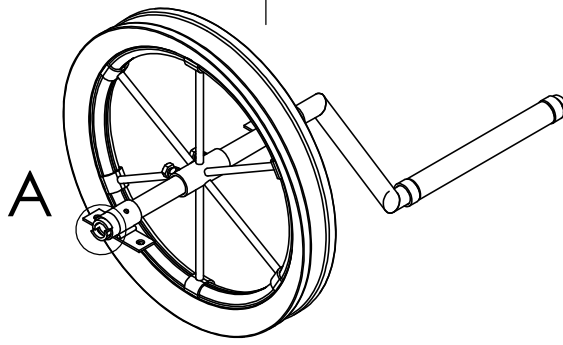
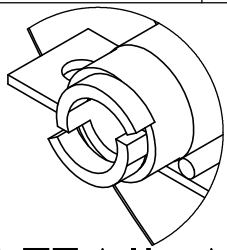
DWG NO. 0000-s

SCALE: 1:10

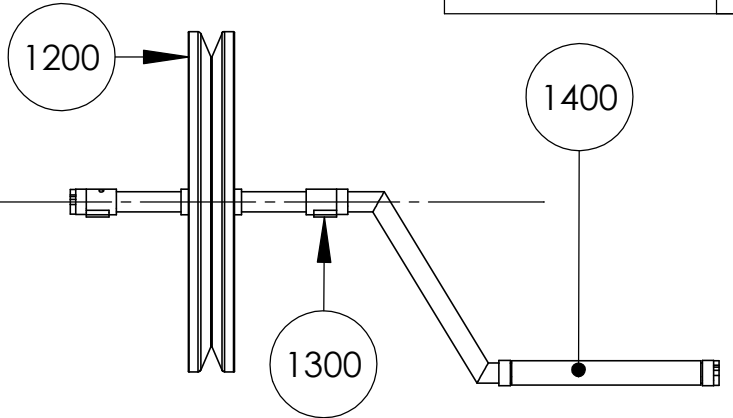
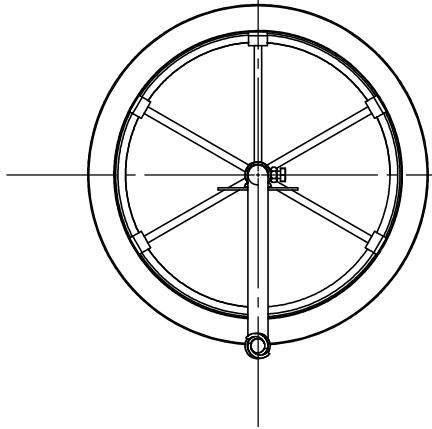
FORMAT: A4

PAGE NO. 3

DETAIL A
SCALE 1 : 2



1x

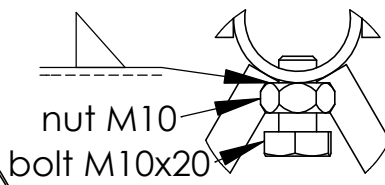
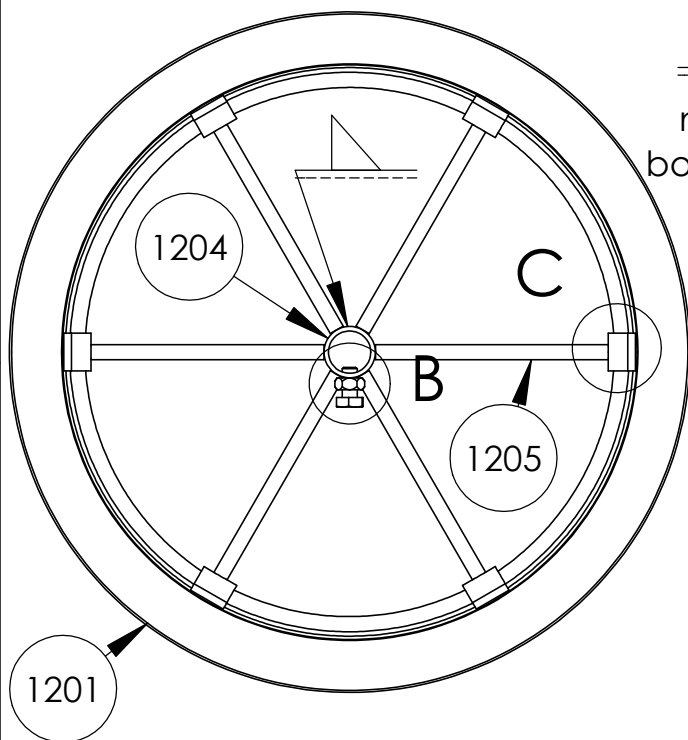


After assembly, bend shaft end to fix axle.

NO.	DESCRIPTION	QTY.
1200	Wheel	1
1300	Bushing	2
1400	Crank assembly	1

TITLE:	Topside
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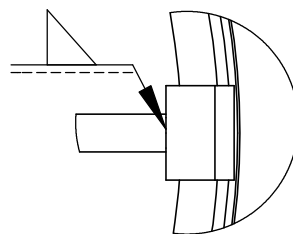
BASE MATERIAL:	Part specific	DWG NO.	1000	SCALE:	1:20
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DETAIL B
SCALE 1 : 2



1x




DETAIL C
SCALE 1 : 2

Use appropriate jig for welding!

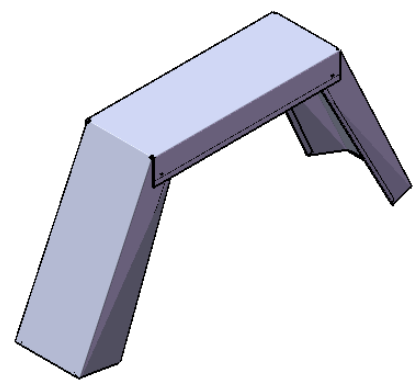
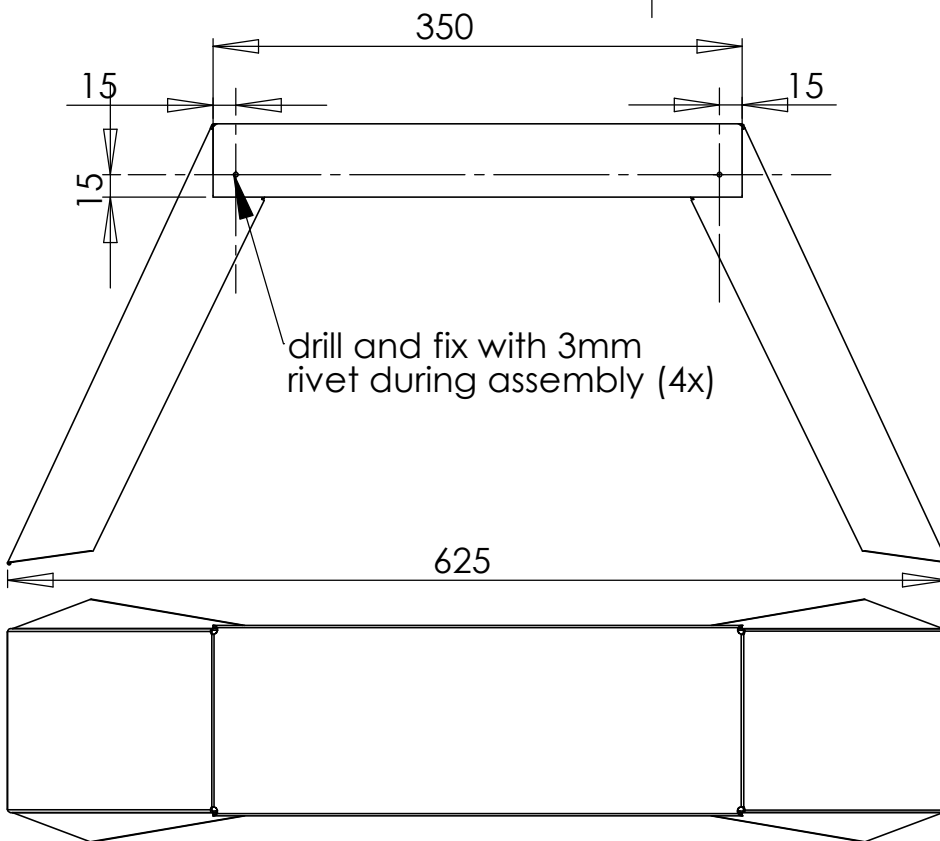
Weld two M10 nuts to the hub.

NO.	DESCRIPTION	QTY.
	nut M10	2
	bolt M10 x 20	2
1201	Tire rim	2
1204	Hub	1
1205	Spoke and Clamp	6


PRACTICA
 FOUNDATION
 PROJECT:
 Rope pump

BASE MATERIAL:	Part specific
TITLE:	Wheel

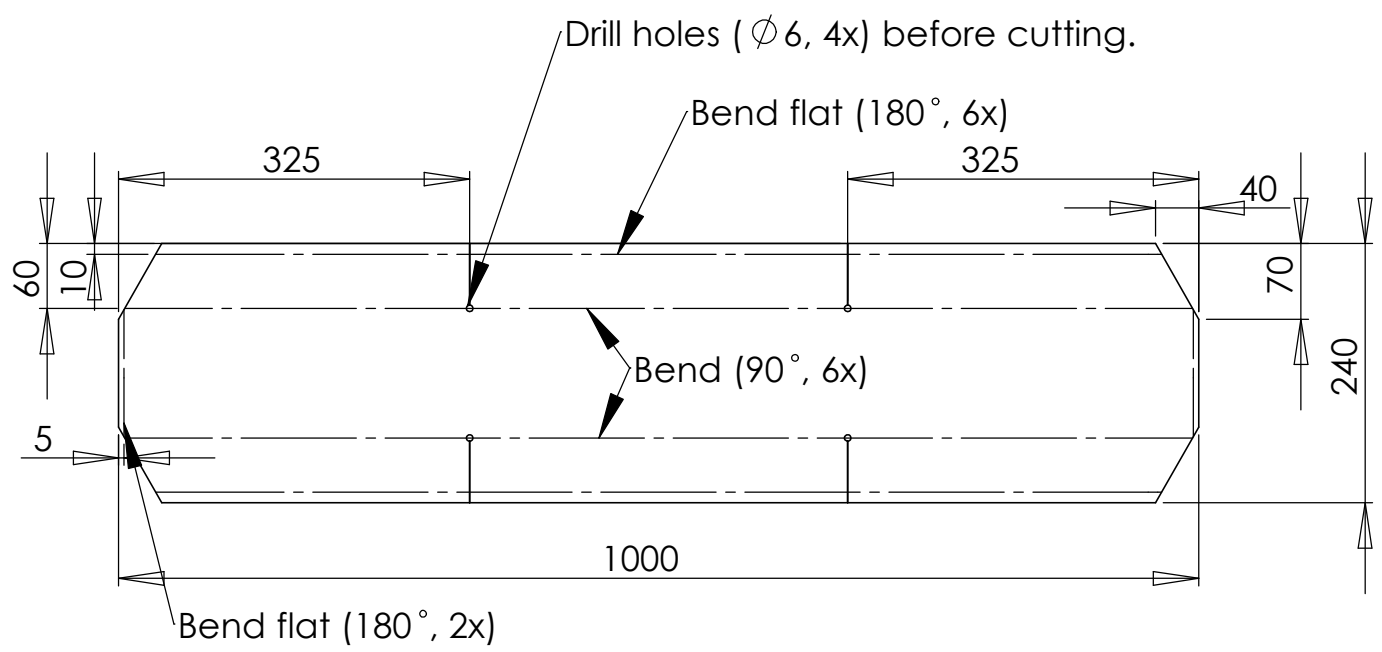
DRAWN BY: Rob Dedden	DATE: 31-7-2011	VERSION: Practica model - v1.0	DWG NO.	1200	SCALE:	1:5	FORMAT:	A4	PAGE NO.	4
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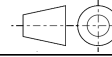


1x

TITLE: **Pump cover**

BASE MATERIAL: GI sheet metal 1000 x 240 x 0,6-1mm	DWG NO. 1100	SCALE: 1:5
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PRACTICA
 FOUNDATION
 PROJECT:
 Rope pump

BASE MATERIAL: GI sheet metal 1000 x 240 x 0,6-1mm
TITLE: Pump cover - flat

DRAWN BY: Erik den Toom	DATE: 31-7-2011	VERSION: Practica model - v1.0	DWG NO. 1100 - flat	SCALE: 1:7	FORMAT: A4	PAGE NO. 5
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1

2

3

4

A

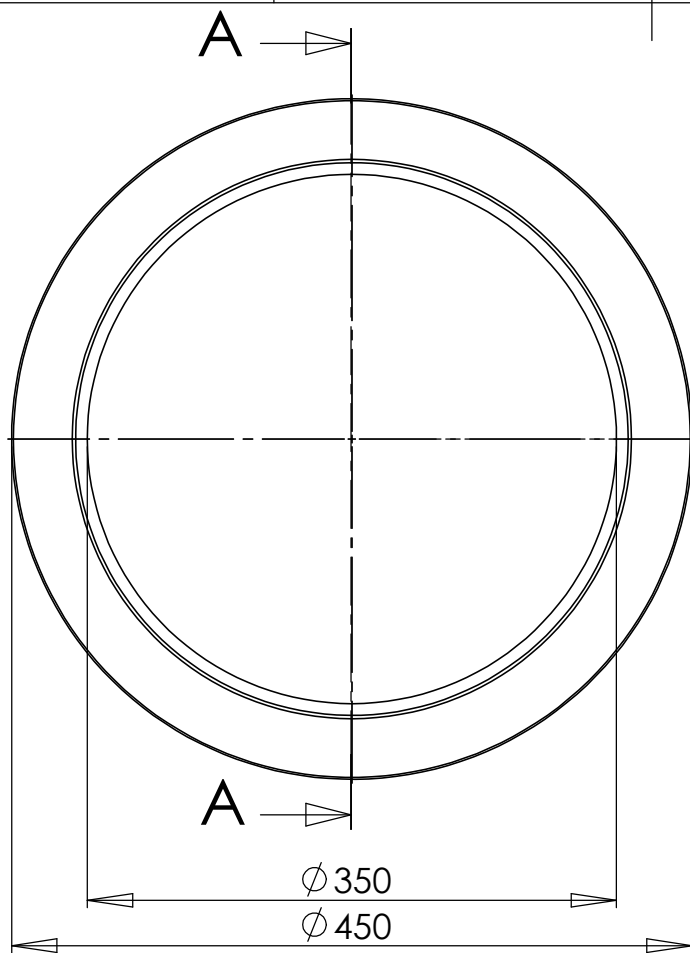
B

C

D

E

F



2x

SECTION A-A
SCALE 1 : 5

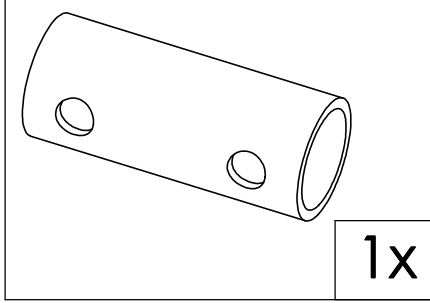
Make from 14" car tire.
Cut tread away so
only the side walls remain.

TITLE: **Tire rim**

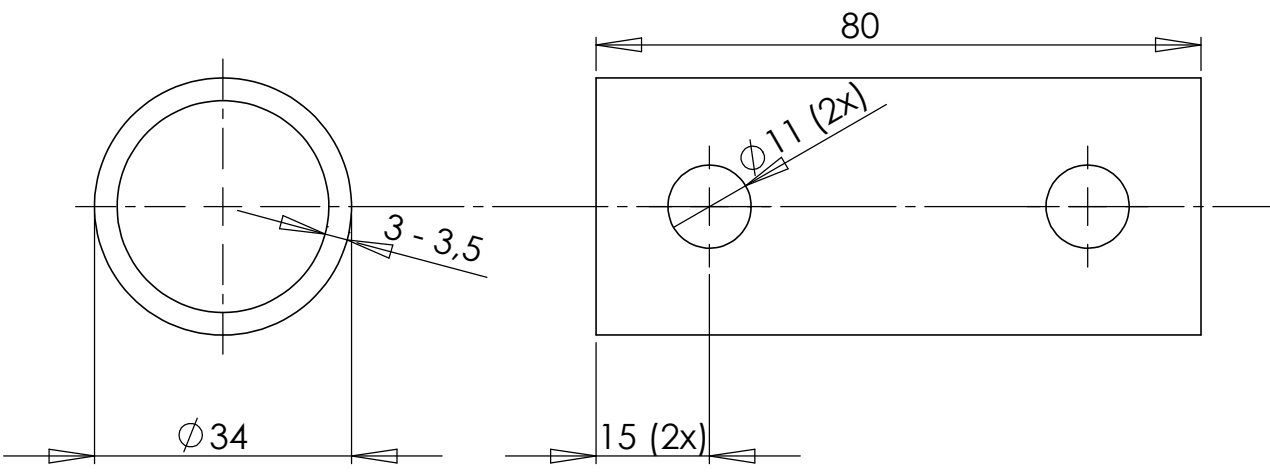
BASE MATERIAL: **Modified 14" car tire, $\phi 350$ x 450mm**

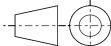
DWG NO. **1201**

SCALE: **1:1**



1x




PRACTICA
 FOUNDATION
 PROJECT:
 Rope pump

BASE MATERIAL: **GI pipe 1" x 80mm**

TITLE: **Hub**

DRAWN BY: **Rob Dedden**

DATE: **31-7-2011**

VERSION: **Practica model - v1.0**

DWG NO. **1204**

SCALE: **1:1**

FORMAT: **A4**

PAGE NO. **6**

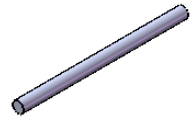
1

2

3

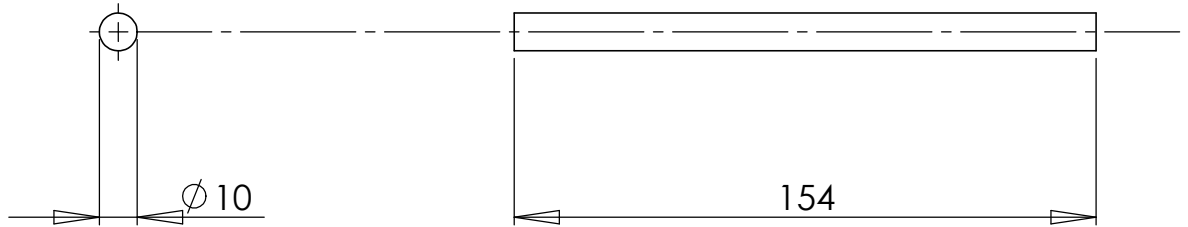
4

A



6x

B



C

TITLE:

Spoke

BASE MATERIAL:

Reinforcement bar 10 x 154mm

DWG NO.

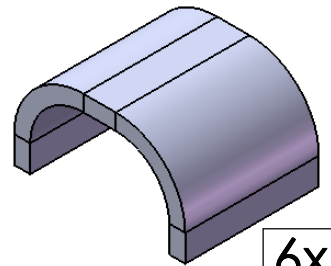
1203

SCALE:

1:2

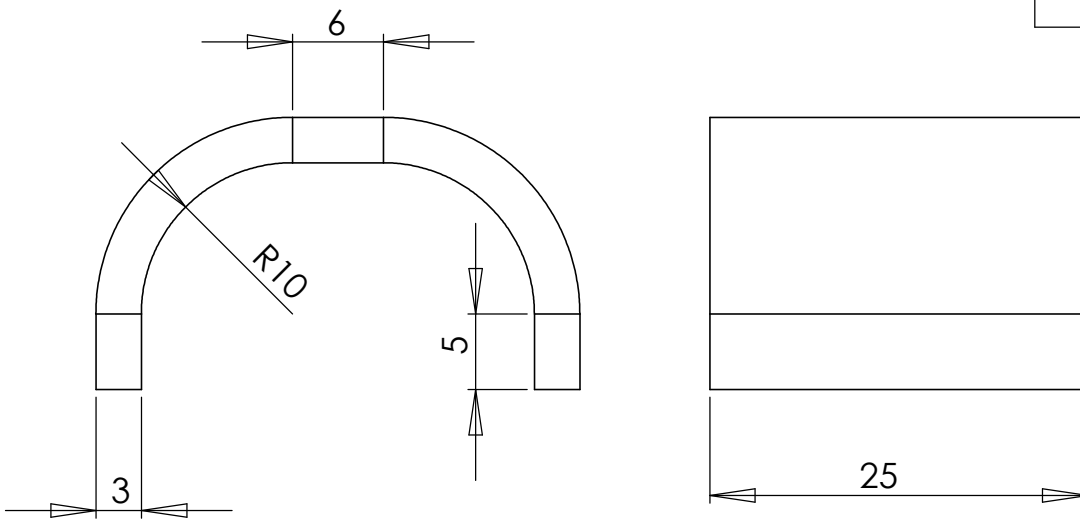
D

Bend tight around tire during assembly



6x

E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL:

Fe36 strip 52 x 25 x 3mm

TITLE:

Clamp

DRAWN BY:
Rob Dedden

DATE:
10-7-2011

VERSION:
Practica model - v1.0

DWG NO.

1202

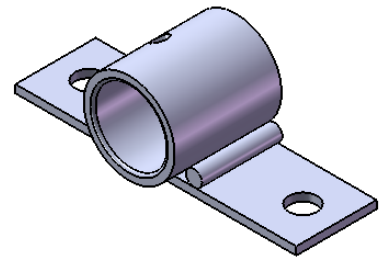
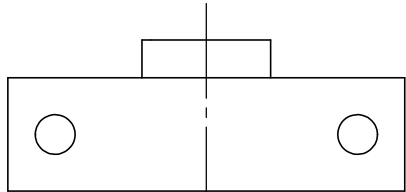
SCALE:

2:1

FORMAT:
A4

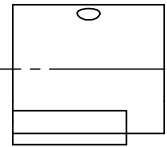
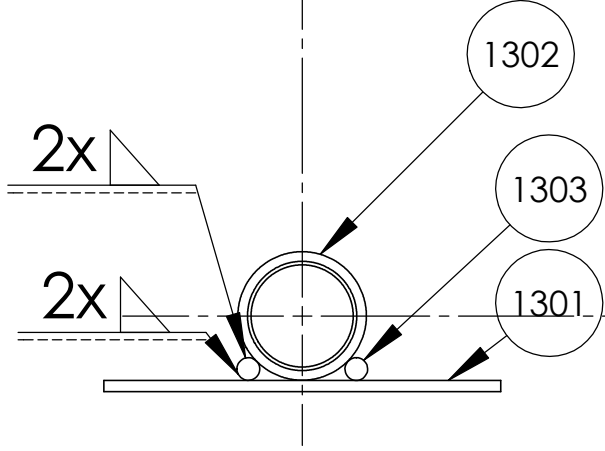
PAGE NO.
7

A



2x

B



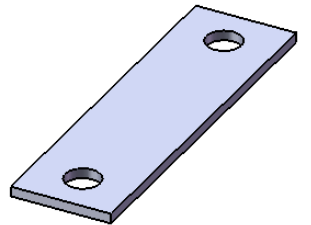
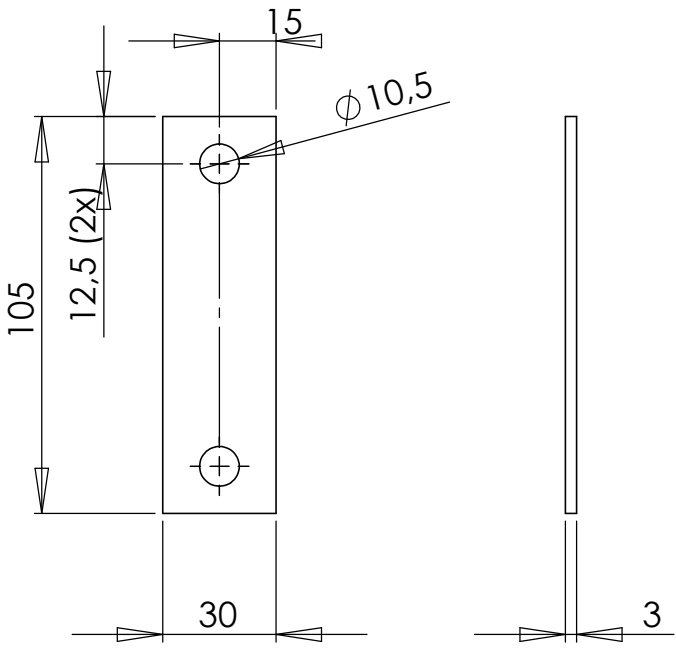
Use appropriate jig for welding!
 Weld bushing with lubrication hole slightly turned to the side

C

NO.	DESCRIPTION	QTY.
1301	Base	1
1302	Bushing	1
1303	Welding support	2

TITLE: Bushing	
BASE MATERIAL: Part specific	DWG NO. 1300 SCALE: 1:2

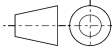
D



2x

E

F

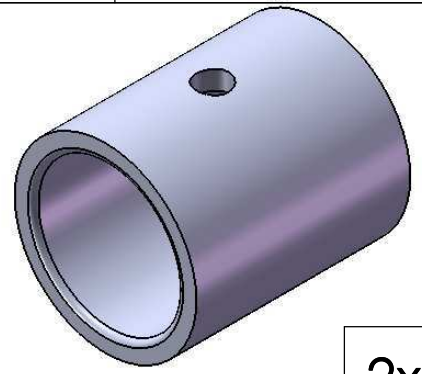
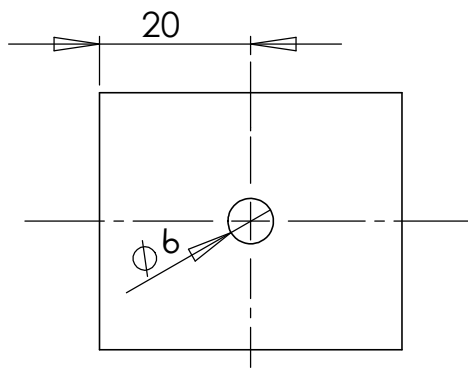


PRACTICA
FOUNDATION

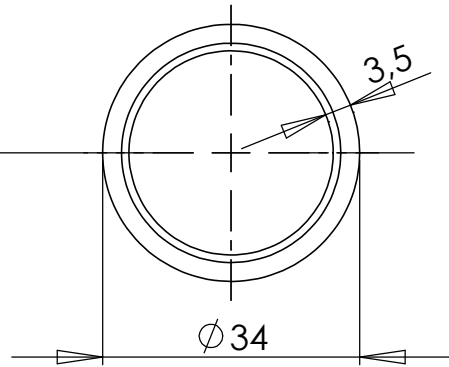
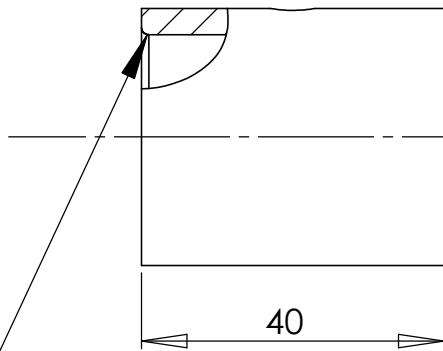
PROJECT:
Rope pump

BASE MATERIAL: Fe36 strip 105 x 30 x 3mm
TITLE: Base

DRAWN BY: Erik den Toom	DATE: 11-7-2011	VERSION: Practica model - v1.0	DWG NO. 1301	SCALE: 1:2	FORMAT: A4	PAGE NO. 8
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2x

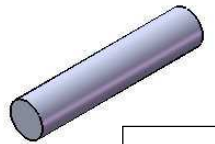
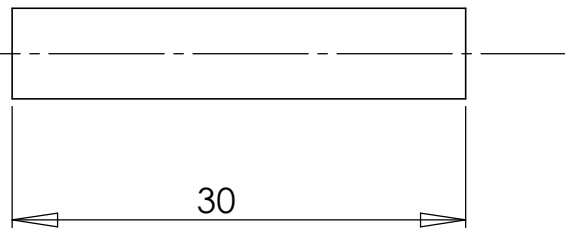
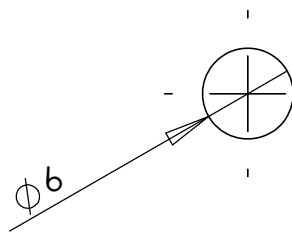


File away sharp edge on both sides

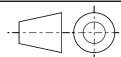
TITLE: **Bushing**

BASE MATERIAL: GI pipe 1" x 40mm, 3-3,5mm wall

DWG NO. 1302 SCALE: 1:1



4x



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: Reinforcement bar $\text{Ø}6 \times 30\text{mm}$

TITLE: **Welding support**

DRAWN BY:
Erik den Toom

DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO. 1303

SCALE: 2:1

FORMAT: A4

PAGE NO. 9

1

2

3

4

A

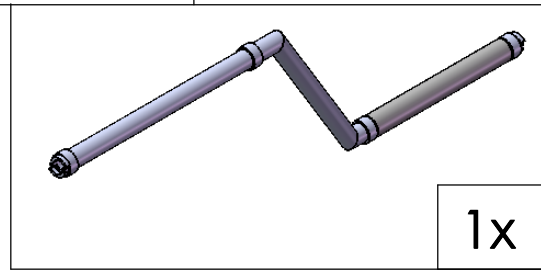
B

C

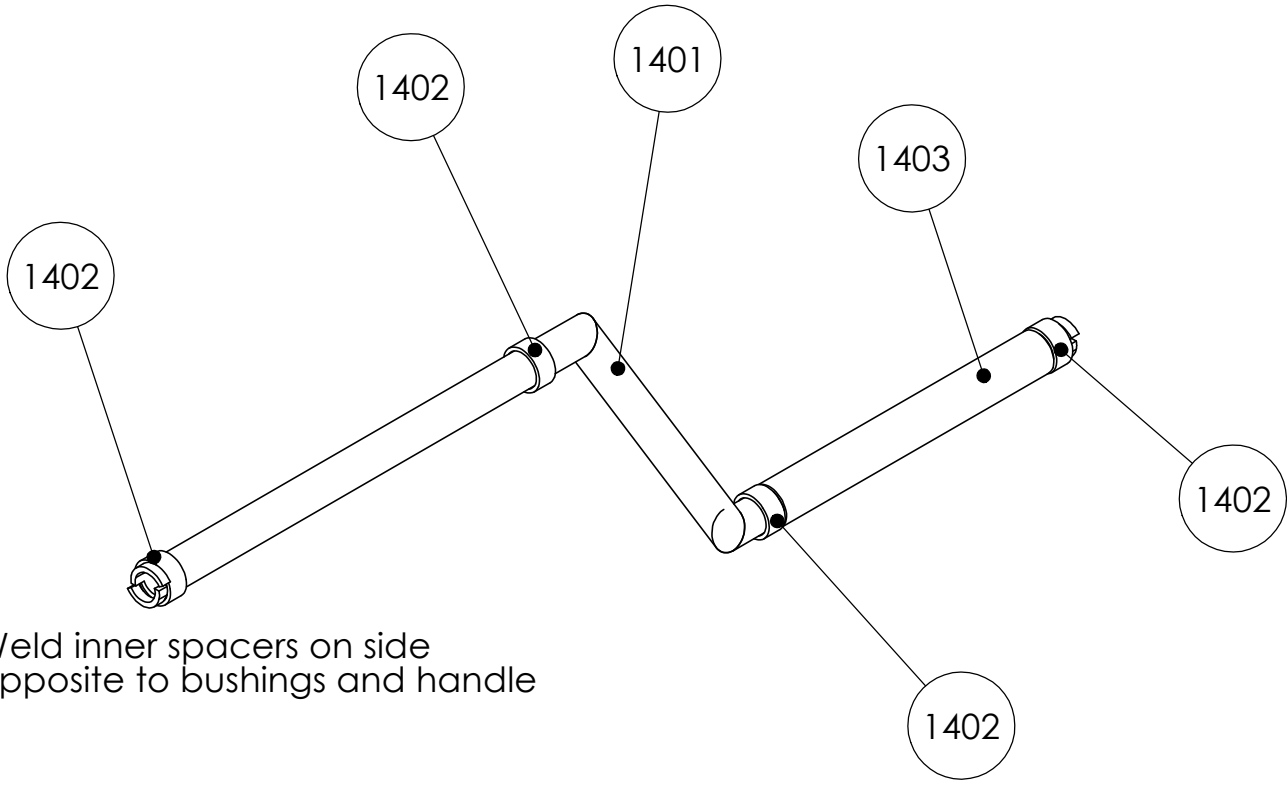
D

E

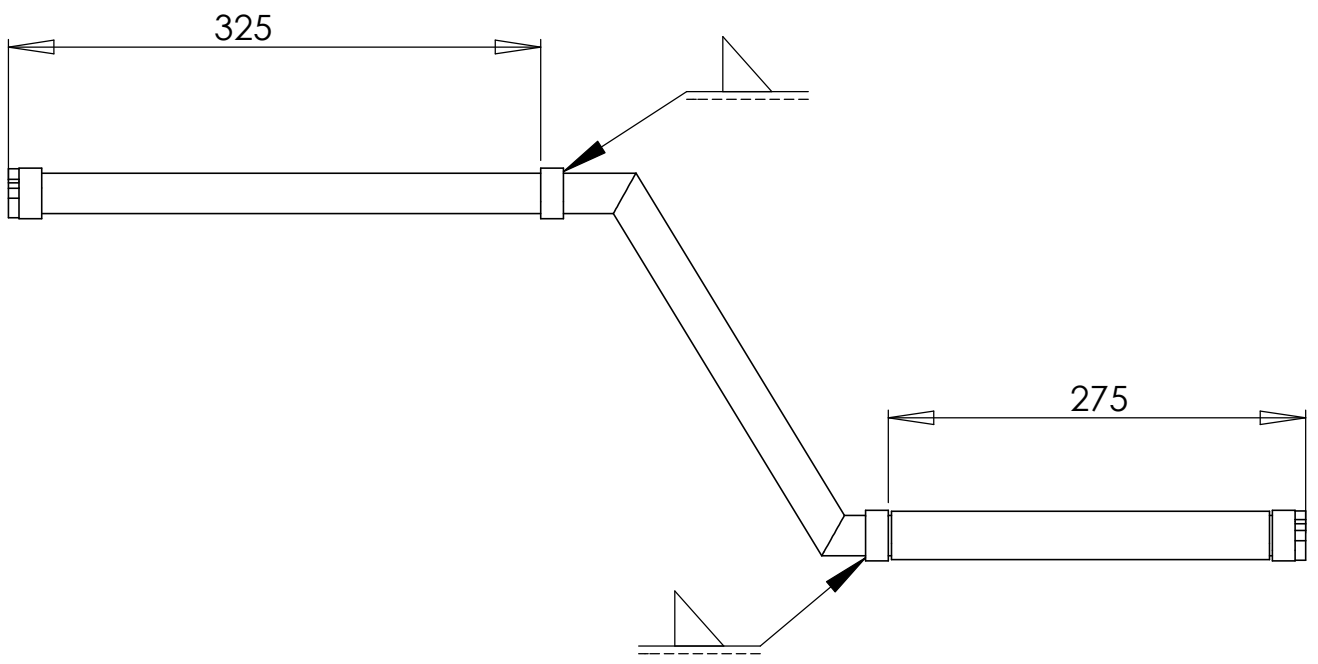
F

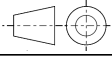


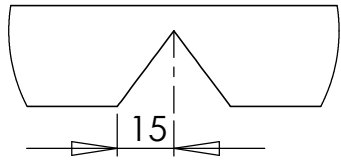
1x



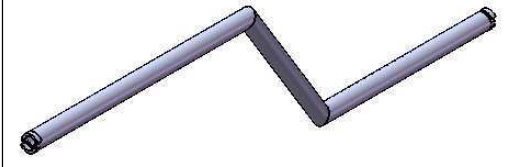
Weld inner spacers on side opposite to bushings and handle



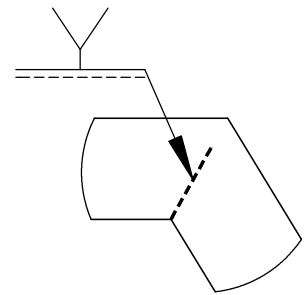
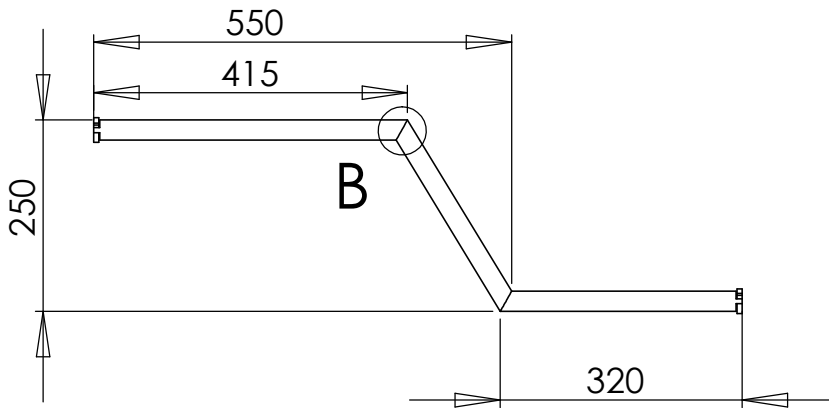
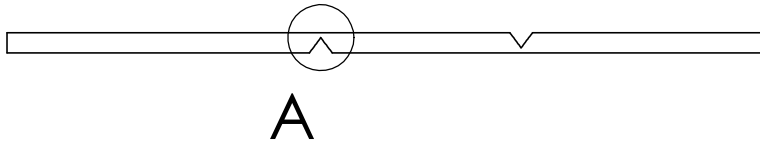
			 PRACTICA <small>FOUNDATION</small>		BASE MATERIAL: Part specific			
NO.	DESCRIPTION	QTY.	PROJECT: Rope pump		TITLE: <h1 style="margin: 0;">Crank assembly</h1>			
1401	Crank	1						
1403	Grip	1						
1402	Spacer	4						
DRAWN BY: Rob Dedden		DATE: 31-7-2011	VERSION: Practica model - v1.0		DWG NO.	SCALE:	FORMAT:	PAGE NO.
					1400	1:5	A4	10



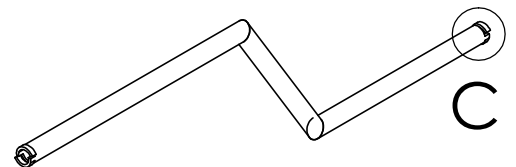
Cut until ~3/4 of diameter, bend and weld.



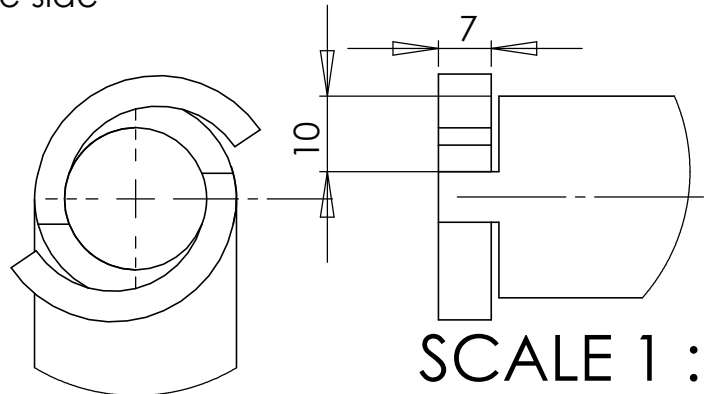
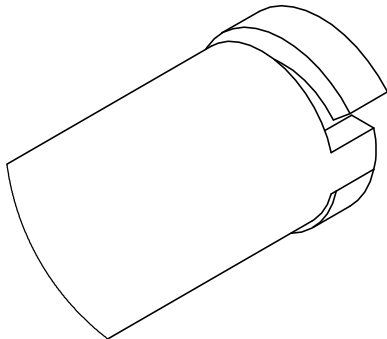
DETAIL A
SCALE 1 : 2



DETAIL B
SCALE 1 : 2

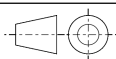


Note direction of lock on handle side



SCALE 1 : 1

DETAIL C
SCALE 1 : 1



BASE MATERIAL: GI pipe 3/4" (3-3,5mm wall) 1000mm

PRACTICA
FOUNDATION

TITLE: **Crank**

PROJECT:
Rope pump

DRAWN BY:
Rob Dedden

DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO.

1401

SCALE: 1:10

FORMAT: A4

PAGE NO. 11

1

2

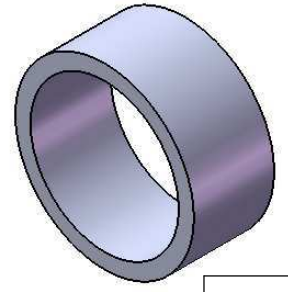
3

4

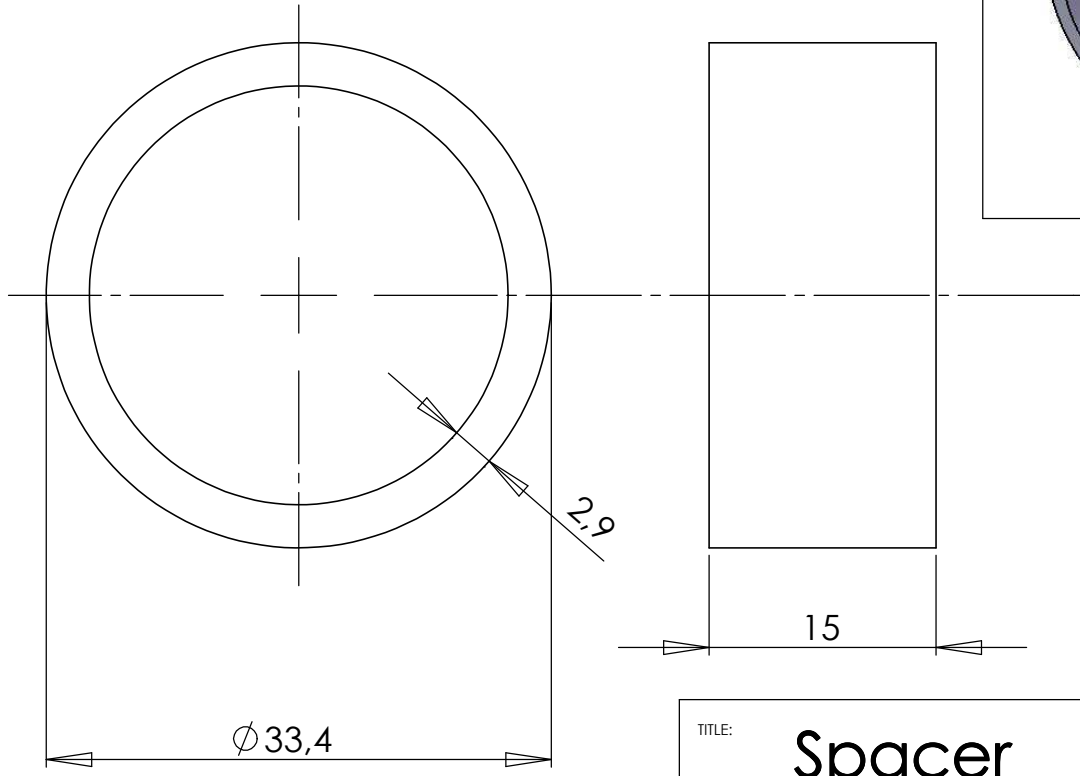
A

B

C



4x



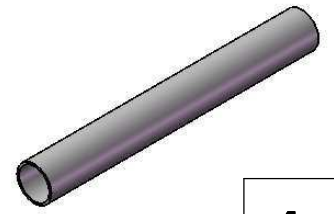
TITLE: **Spacer**

BASE MATERIAL: **GI pipe 1" x 15mm (XS)**

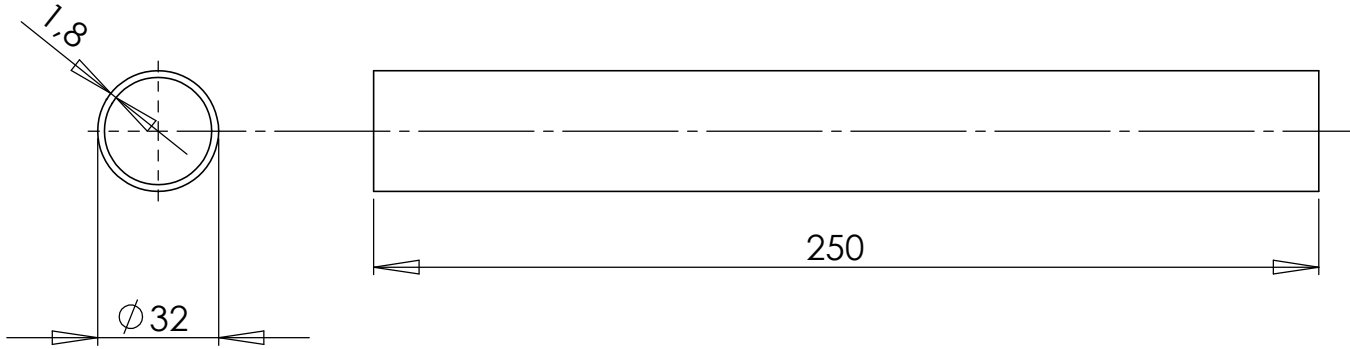
DWG NO. **1402**

SCALE: **2:1**

D

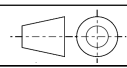


1x



E

F



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: **PVC Ø32 x 250mm**

TITLE: **Grip**

DRAWN BY:
Rob Dedden

DATE:
10-7-2011

VERSION:
Practica model - v1.0

DWG NO. **1403**

SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **12**

A

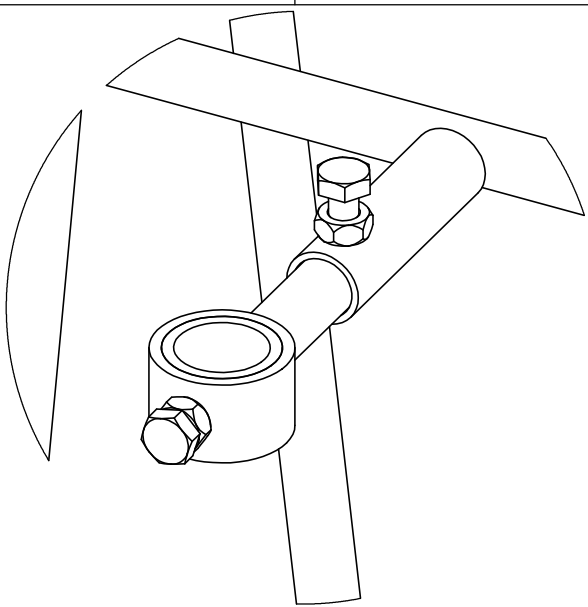
B

C

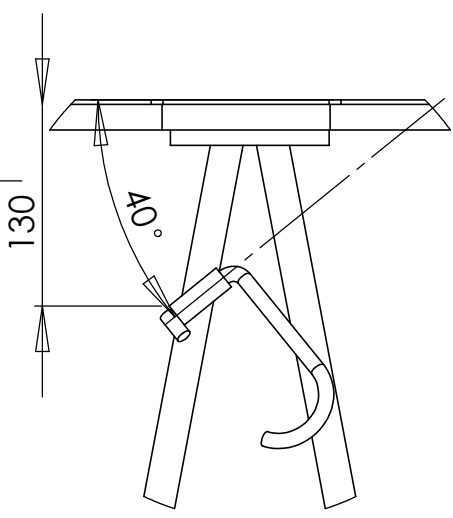
D

E

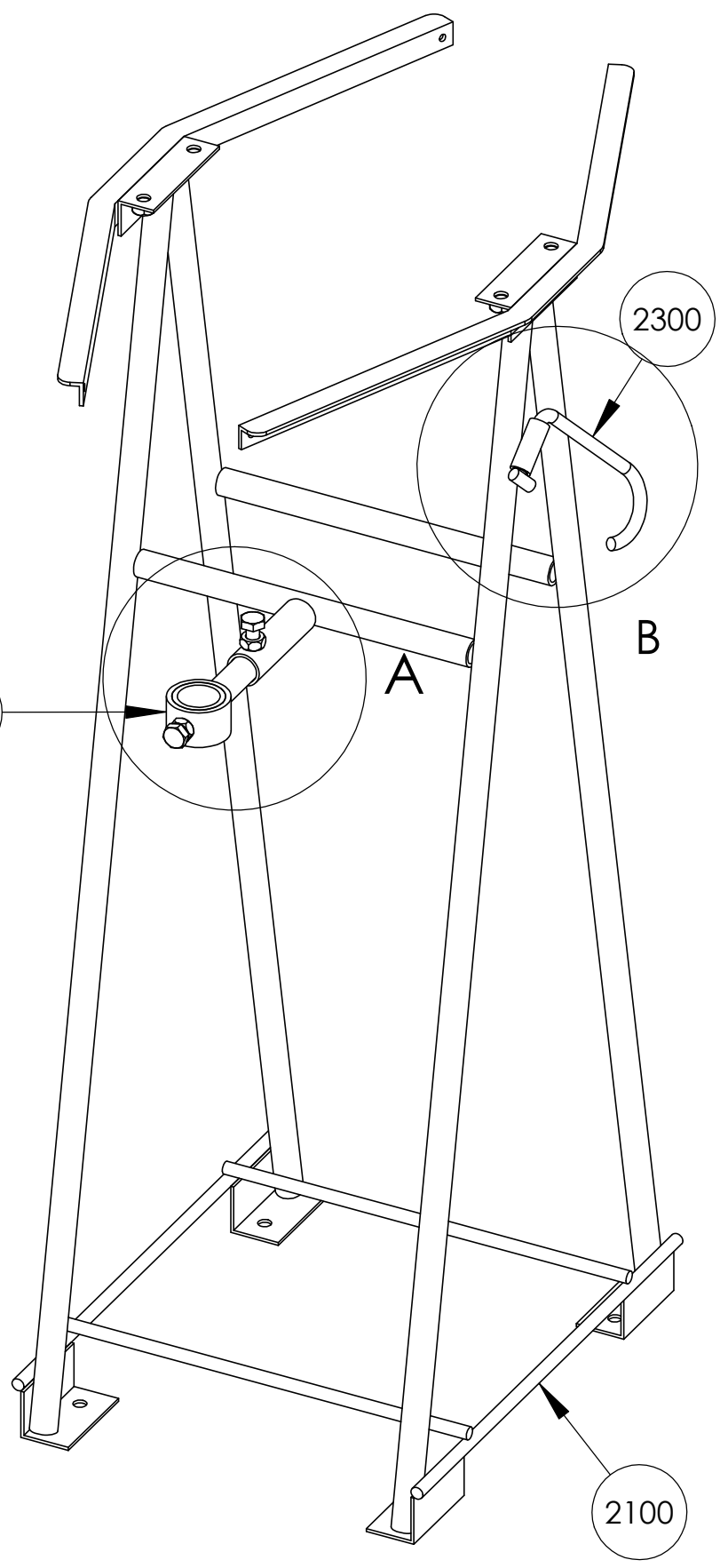
F



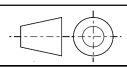
DETAIL A
SCALE 2 : 5



DETAIL B
SCALE 1 : 5



NO.	DESCRIPTION	QTY.
2100	Frame long or shot	1
2200	Rising main support	1
2300	Pump lock	1



PRACTICA
FOUNDATION

PROJECT:
Rope pump

VERSION:
Practica model - v1.0

BASE MATERIAL: Part specific	
TITLE: Frame	
DWG NO. 2000	SCALE: 1:1
FORMAT: A4	PAGE NO. 13

DRAWN BY:
Erik den Toom

DATE:
11-7-2011

1

2

3

4

A

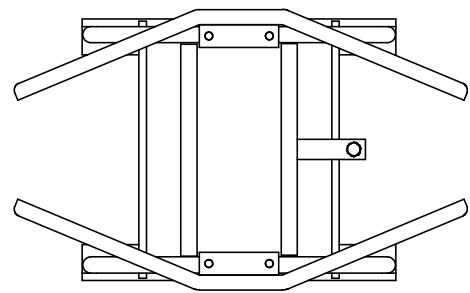
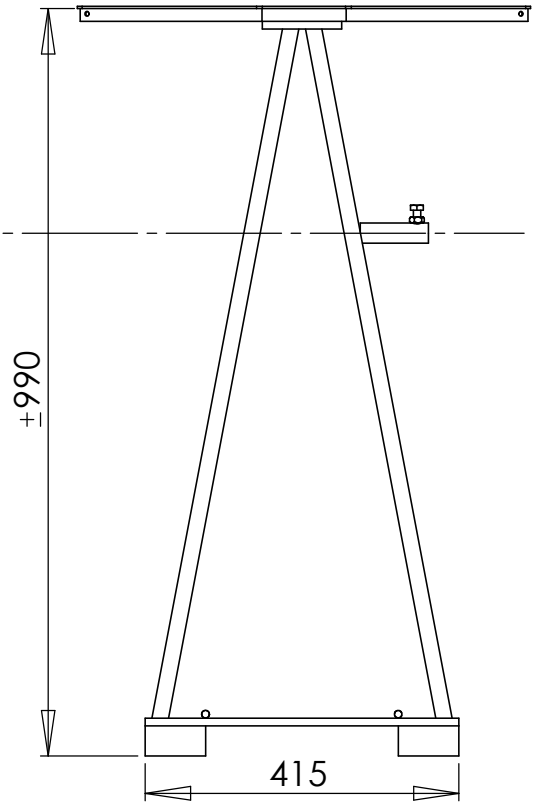
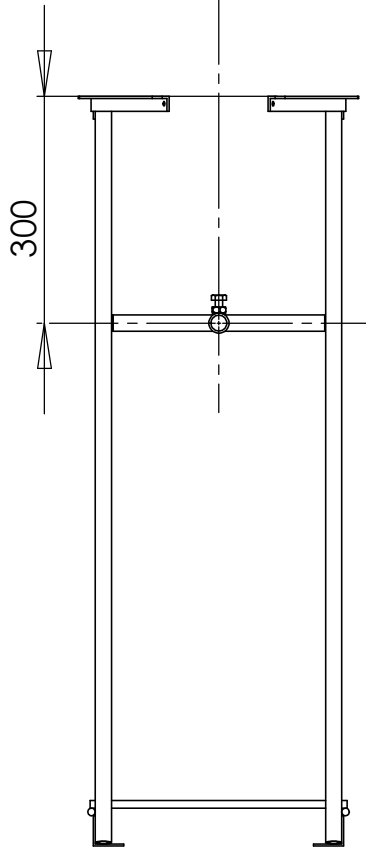
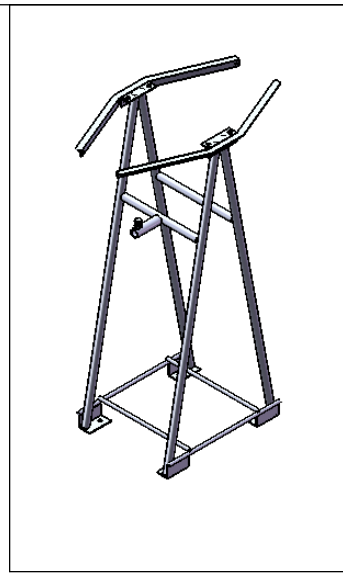
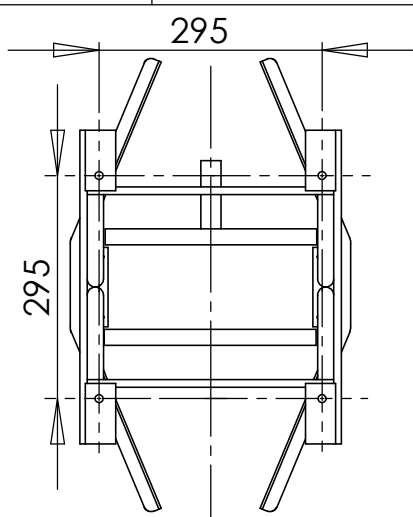
B

C

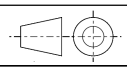
D

E

F



Dimensions are indicative.
use appropriate jig for welding!



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: Part specific

TITLE: **Frame long**

DRAWN BY:
Erik den Toom

DATE:
10-7-2011

VERSION:
Practica model - v1.0

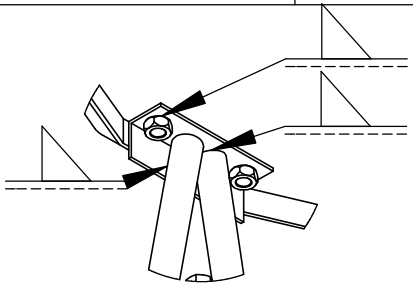
DWG NO.
2100-dims

SCALE: **1:10**

FORMAT: **A4**

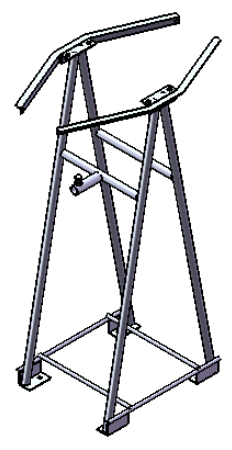
PAGE NO. **14**

A



Weld 2 M10 nuts to bottom of bushing support

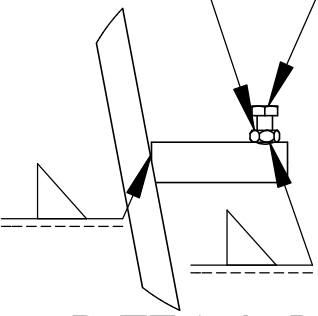
Use appropriate jig for welding!



DETAIL A SCALE 1 : 5

B

Nut M10
bolt M10

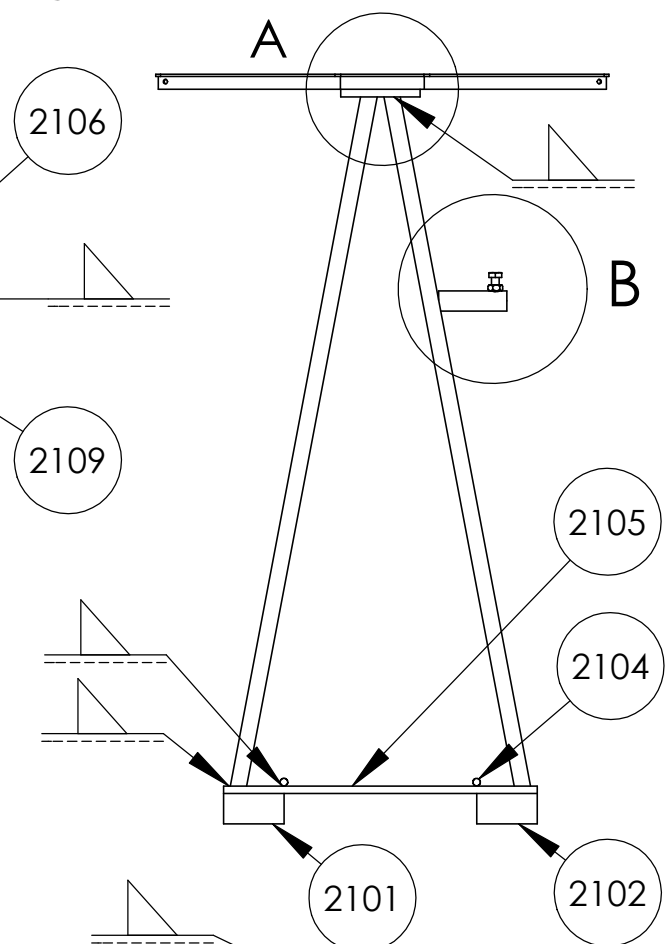
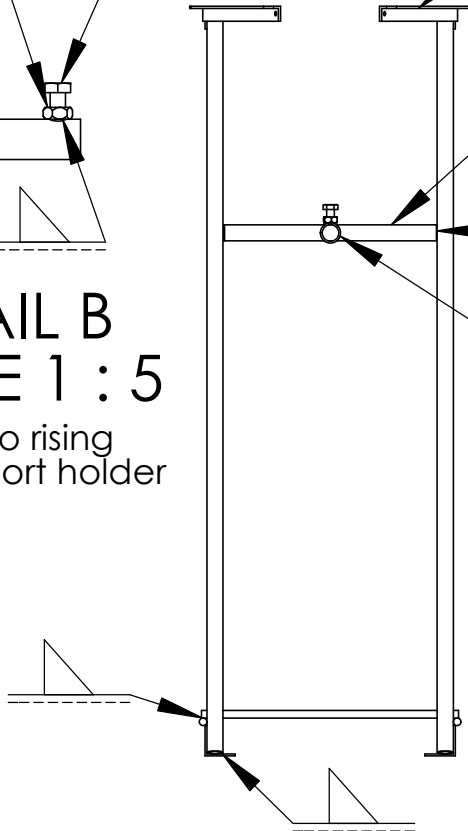


DETAIL B SCALE 1 : 5

Weld nut to rising main support holder

C

D



E

F

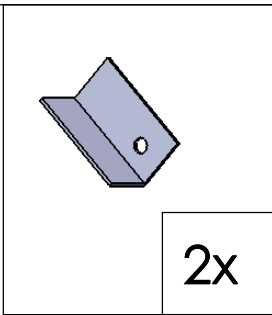
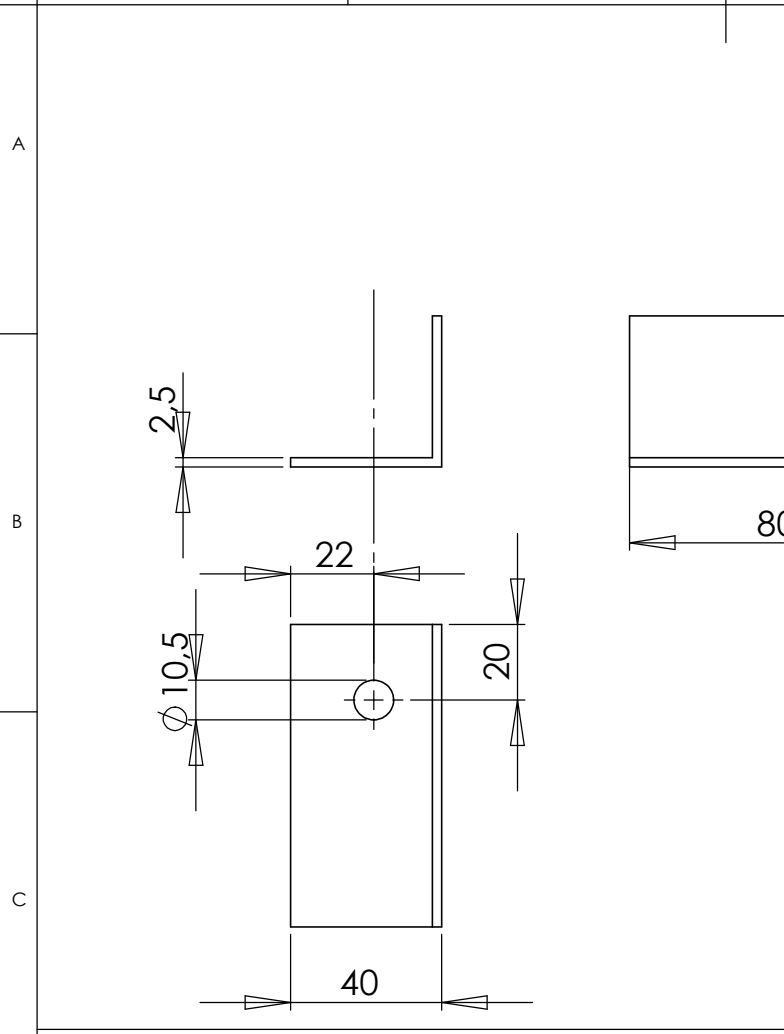
NO.	DESCRIPTION	QTY.
	nut M10	5
	bolt M10 x 20	1
2101	Base support 1	2
2102	Base support 2	2
2103	Main tube	4
2104	Structural support short	2
2105	Structural support long	2
2106	Cross tube	2
2107	Bearing support	2
2108	Cover support	2
2109	Rising main support holder	1

PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: Part specific

TITLE: **Frame long**

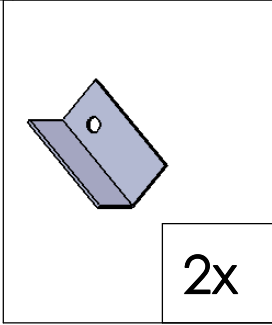
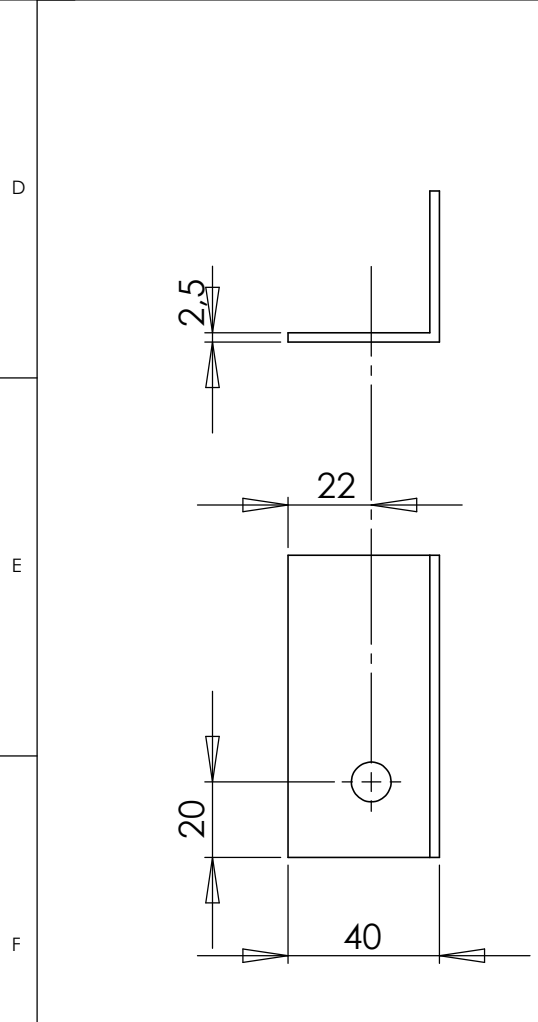


TITLE: **Base support 1**

BASE MATERIAL: **Fe35 angle iron 80 x 40 x 40 x 2,5mm**

DWG NO. **2101**

SCALE: **1:2**



Hole positions are different between supports 1 and 2.

PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: **Fe36 angle iron 80 x 40 x 40 x 2,5mm**

TITLE: **Base support 2**

DRAWN BY: Erik den Toom

DATE: 10-7-2011

VERSION: Practica model - v1.0

DWG NO. **2102**

SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **16**

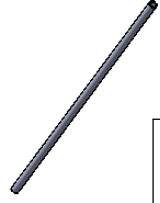
1

2

3

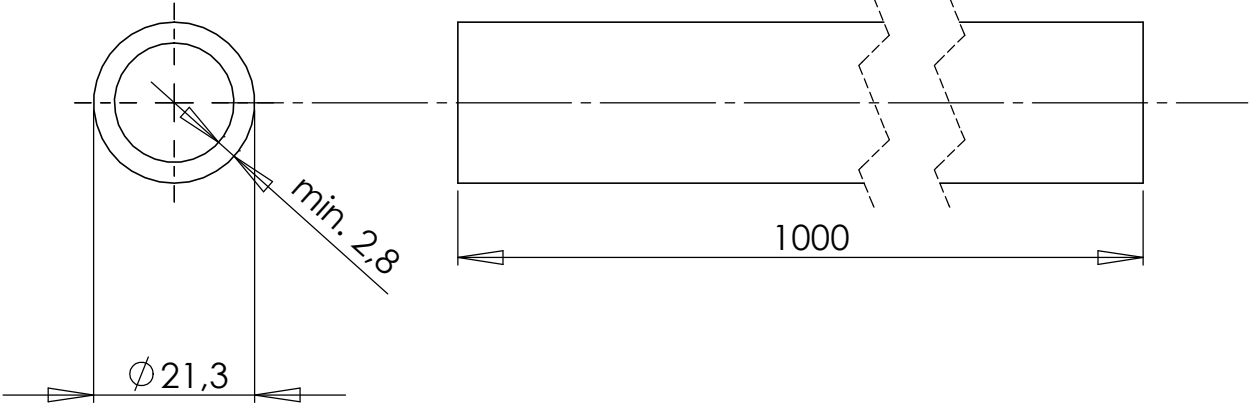
4

A



4x

B



C

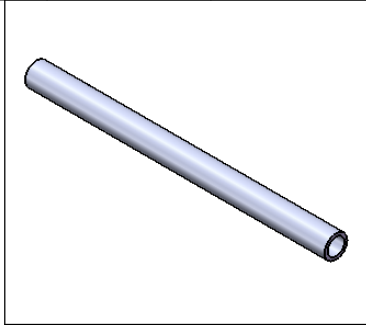
TITLE: **Main tube**

BASE MATERIAL: **GI pipe 1/2" 1000mm**

DWG NO. **2103**

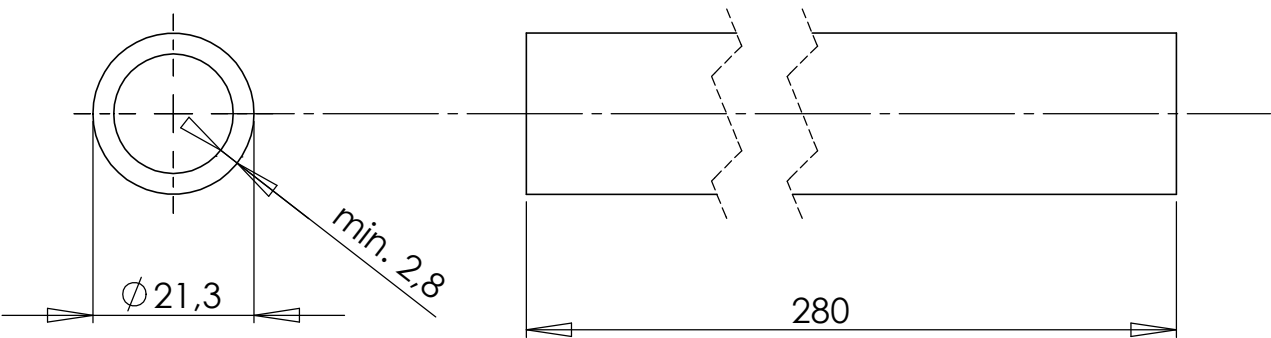
SCALE: **1:1**

D




2x

E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: **GI pipe 1/2" 280mm**

TITLE: **Cross tube**

DRAWN BY:
Erik den Toom

DATE:
11-7-2011

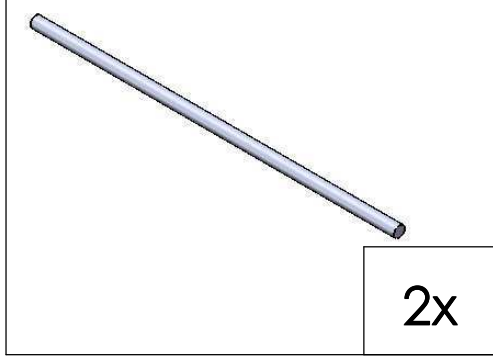
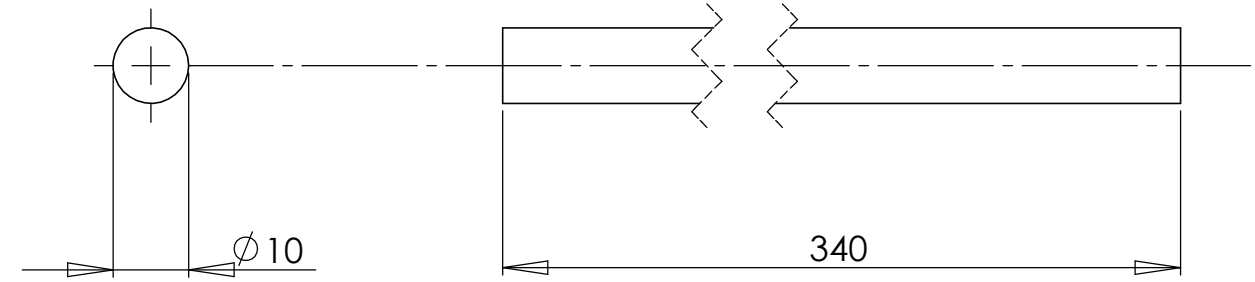
VERSION:
Practica model - v1.0

DWG NO. **2106**

SCALE: **1:1**

FORMAT: **A4**

PAGE NO. **17**



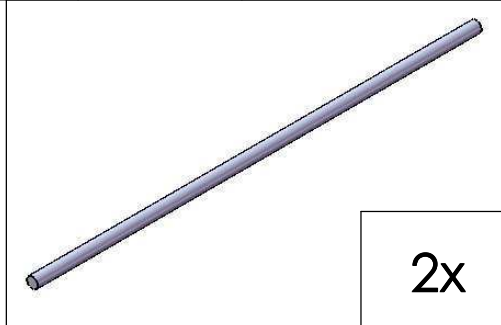
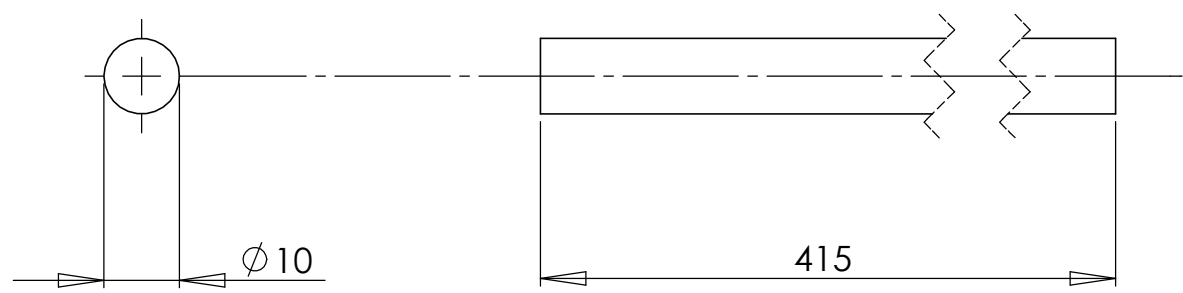
2x

TITLE: **Structural support short**

BASE MATERIAL: **Reinforcement bar \varnothing 10 x 340mm**

DWG NO. **2104**

SCALE: **1:1**



2x

BASE MATERIAL: **Reinforcement bar \varnothing 10 x 415mm**

TITLE: **Structural support long**

PRACTICA
FOUNDATION

PROJECT:
Rope pump

DRAWN BY:
Erik den Toom

DATE:
11-7-2011

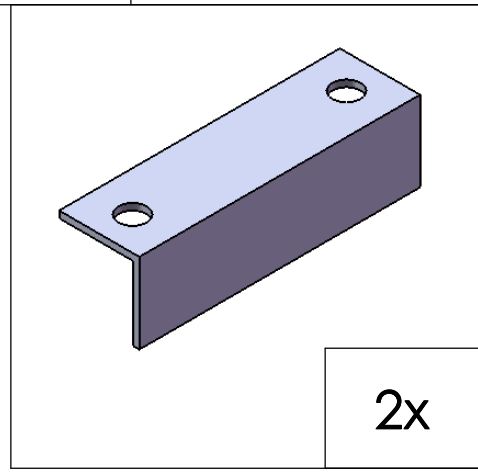
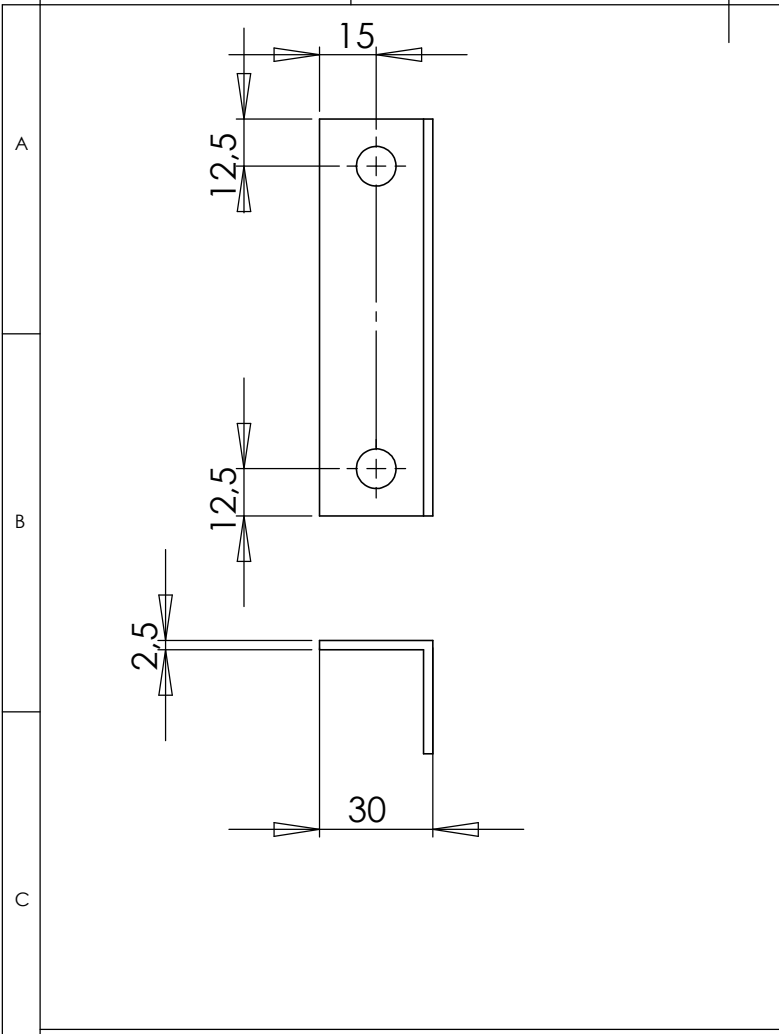
VERSION:
Practica model - v1.0

DWG NO. **2105**

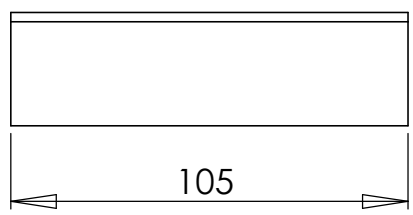
SCALE: **1:1**

FORMAT: **A4**

PAGE NO. **18**



2x

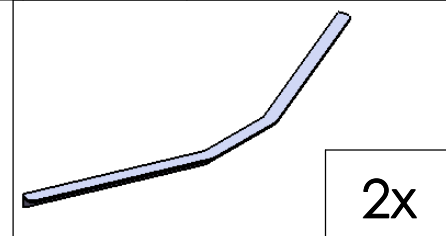
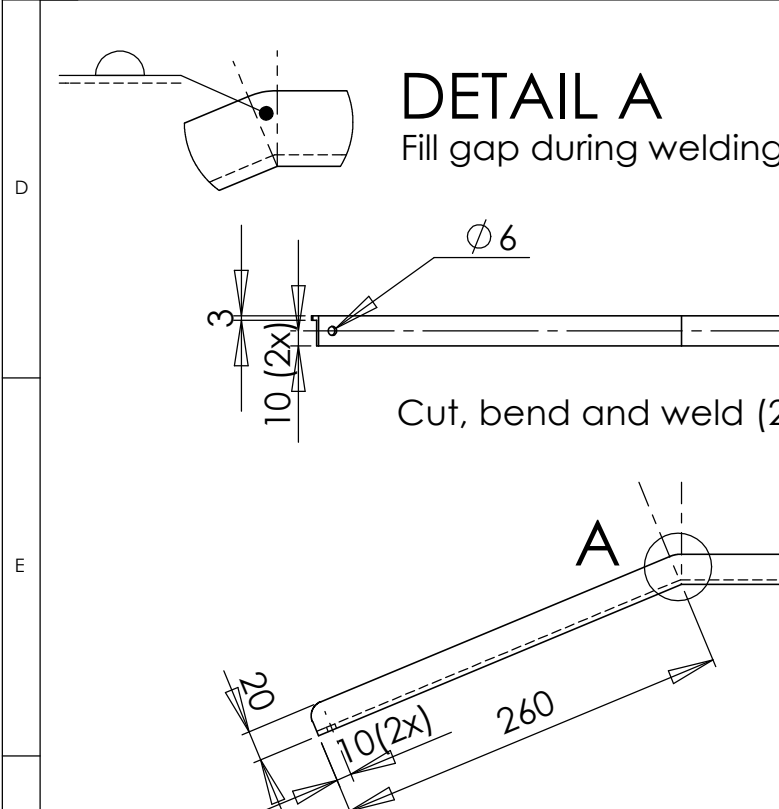


TITLE: **Bearing support**

BASE MATERIAL: **Fe36 angle iron 105 x 30 x 30 x 2,5mm**

DWG NO. **2107**

SCALE: **1:2**



2x

PROJECT:
Rope pump

BASE MATERIAL: **Fe36 angle iron 630 x 20 x 20 x 3mm**

TITLE: **Cover support**

DRAWN BY: Erik den Toom

DATE: 11-7-2011

VERSION: Practica model - v1.0

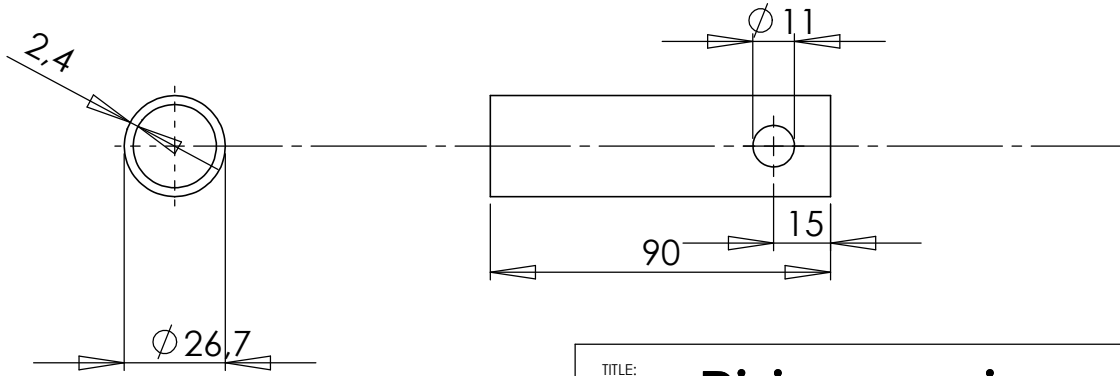
DWG NO. **2108**

SCALE: **1:5**

FORMAT: **A4**

PAGE NO. **19**

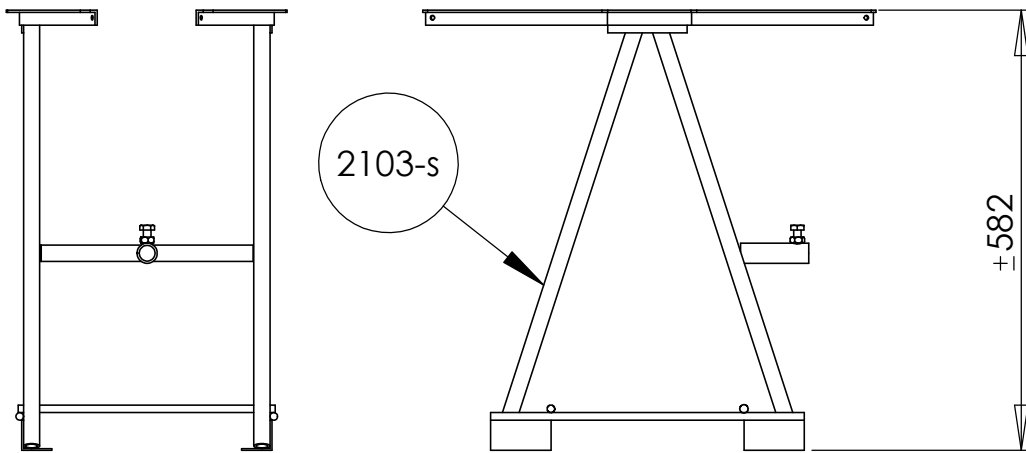
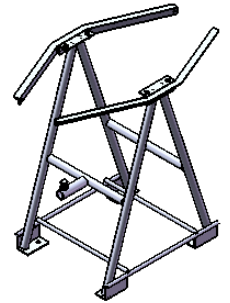
Pick inner diameter large enough so rising main support slider fits inside



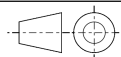
TITLE: **Rising main support holder**

BASE MATERIAL: **GI pipe 3/4" 90mm**

DWG NO. **2109** SCALE: **1:2**



The short frame is exactly the same as the long frame, unless otherwise specified.
Use appropriate jig for welding!



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: **Part specific**

TITLE: **Frame short**

DRAWN BY:
Erik den Toom

DATE:
11-7-2011

VERSION:
Practica model - v1.0

DWG NO. **2100-s**

SCALE: **1:10**

FORMAT: **A4**

PAGE NO. **20**

1

2

3

4

A

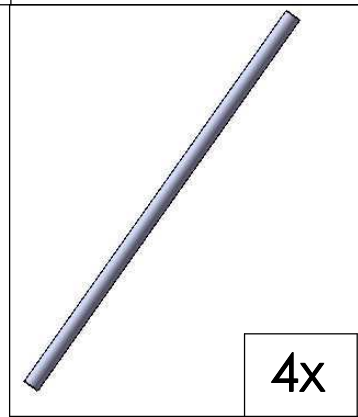
B

C

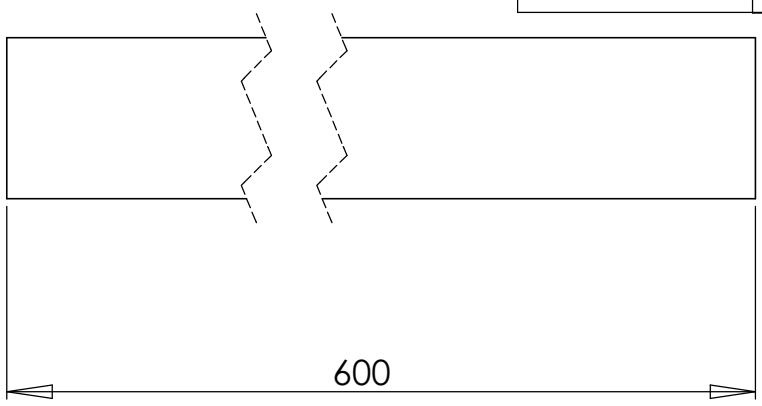
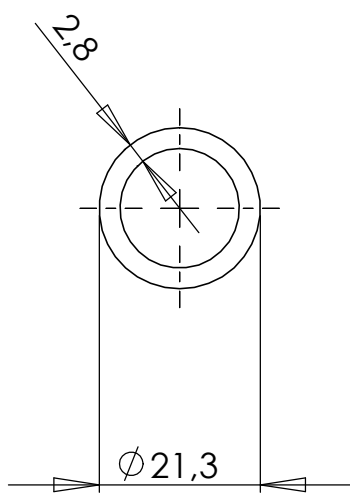
D

E

F



4x

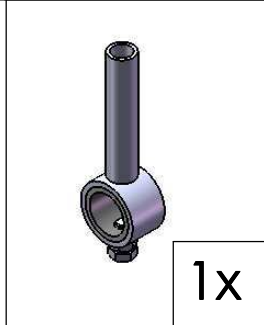


TITLE: **Main tube short**

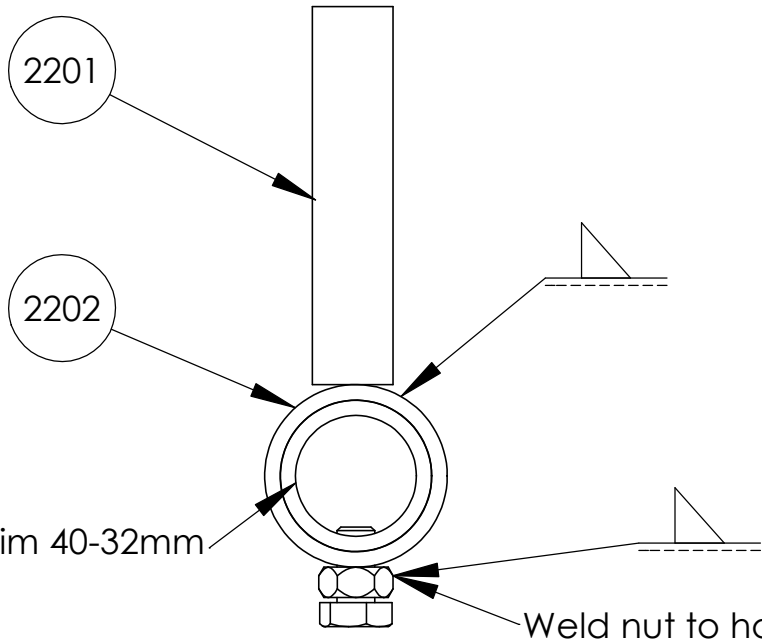
BASE MATERIAL: **GI pipe 1/2" 600mm**

DWG NO. **2103-s**

SCALE: **1:1**



1x



PVC adapter shim 40-32mm

Weld nut to holder

NO.	DESCRIPTION	QTY.
	nut M10	1
	bolt M10 x 20	1
	PVC adapter shim 40-32mm	1
2201	Slider	1
2202	Holder	1



PROJECT: **Rope pump**

BASE MATERIAL: **Part specific**

TITLE: **Rising main support holder**

DRAWN BY: **Erik den Toom**

DATE: **20-9-2011**

VERSION: **Practica model - v1.0**

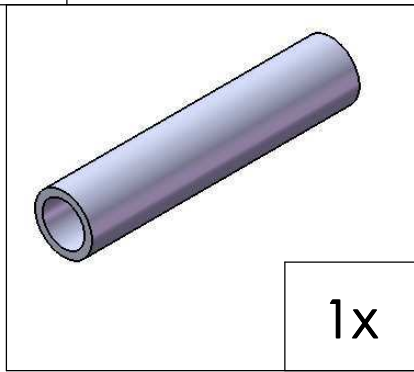
DWG NO. **2200**

SCALE: **1:2**

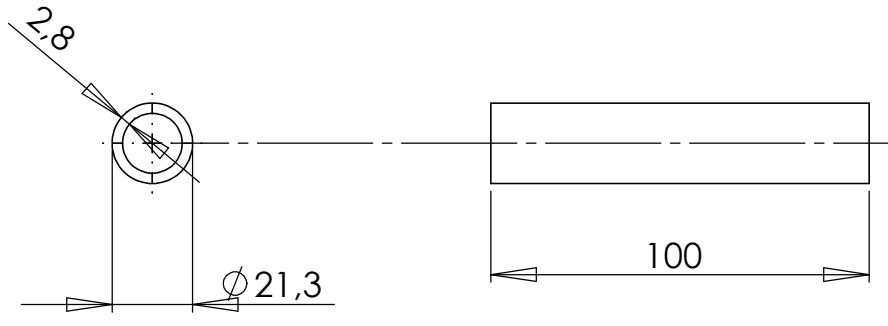
FORMAT: **A4**

PAGE NO. **21**

A



B

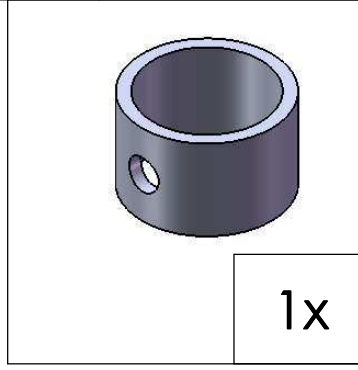
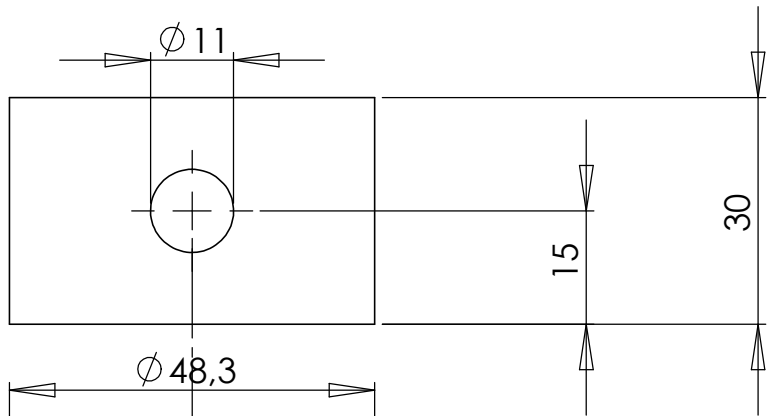


C

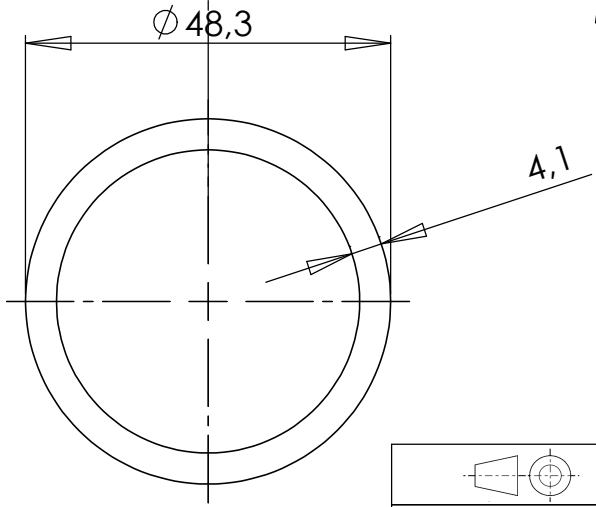
TITLE: **Slider**

BASE MATERIAL: GI pipe 1/2" 100mm	DWG NO. 2201	SCALE: 1:2
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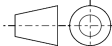
D



E



F



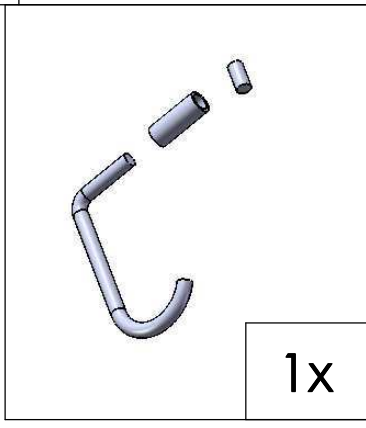
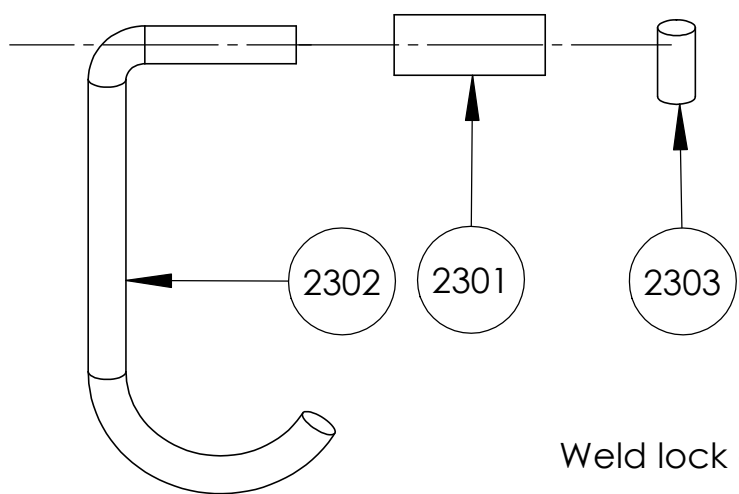
PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: GI pipe 1 1/2" x 30mm
TITLE: Holder

DRAWN BY: Erik den Toom	DATE: 11-7-2011	VERSION: Practica model - v1.0	DWG NO. 2202	SCALE: 1:1	FORMAT: A4	PAGE NO. 22
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A
B
C
D
E
F

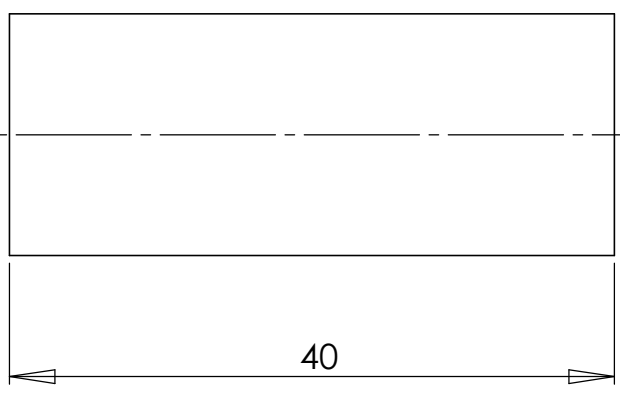
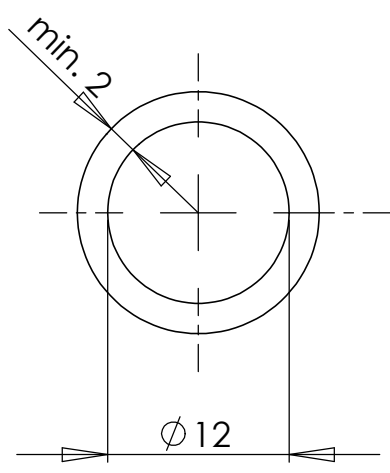
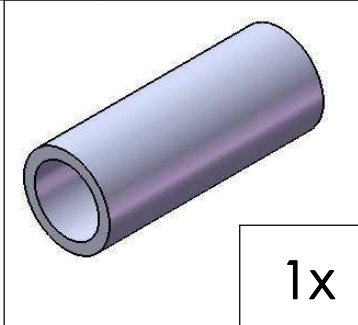


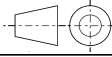
Weld lock end stop to lock after assembly

NO.	DESCRIPTION	QTY.
2301	Hinge	1
2302	Lock	1
2303	Lock end stop	1

TITLE: **Pump lock**

BASE MATERIAL: **part specific** DWG NO. **2300** SCALE: **1:2**




PRACTICA
 FOUNDATION
 PROJECT:
 Rope pump

BASE MATERIAL: **Fe/GI pipe 16 x 40mm**
 TITLE: **Hinge**

1

2

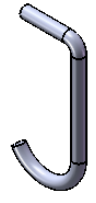
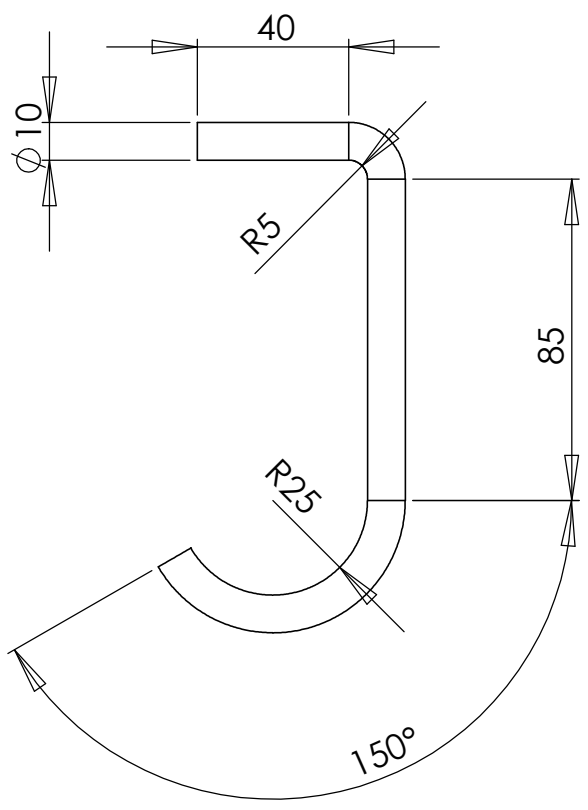
3

4

A

B

C



1x

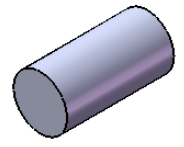
TITLE: **Lock**

BASE MATERIAL: **Reinforcement bar 10 x 240**

DWG NO. **2302**

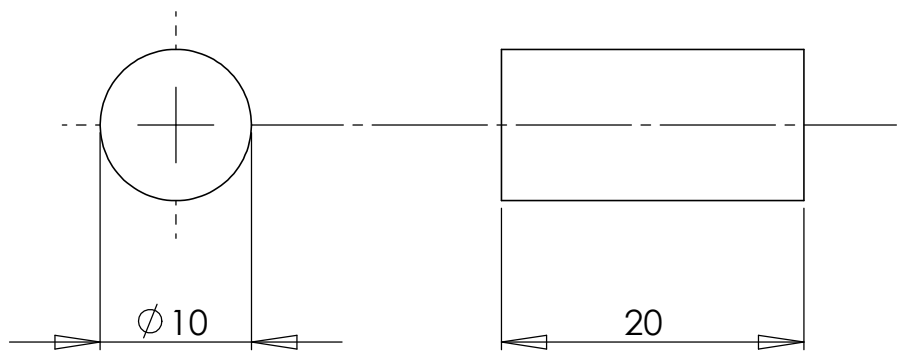
SCALE: **1:2**

D

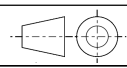


1x

E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL: **Reinforcement bar Ø 10 x 20mm**

TITLE: **Lock end stop**

DRAWN BY:
Rob Dedden

DATE:
11-7-2011

VERSION:
Practica model - v1.0

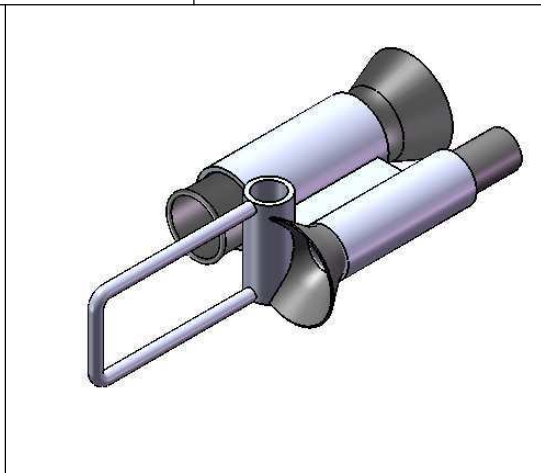
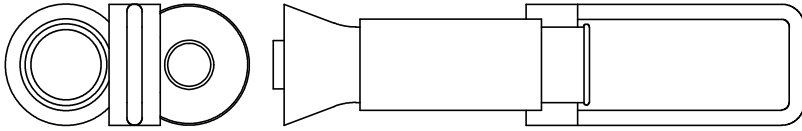
DWG NO. **2303**

SCALE: **2:1**

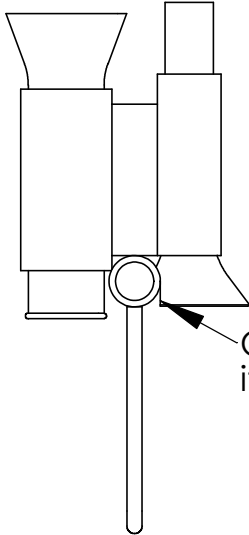
FORMAT: **A4**

PAGE NO. **24**

A



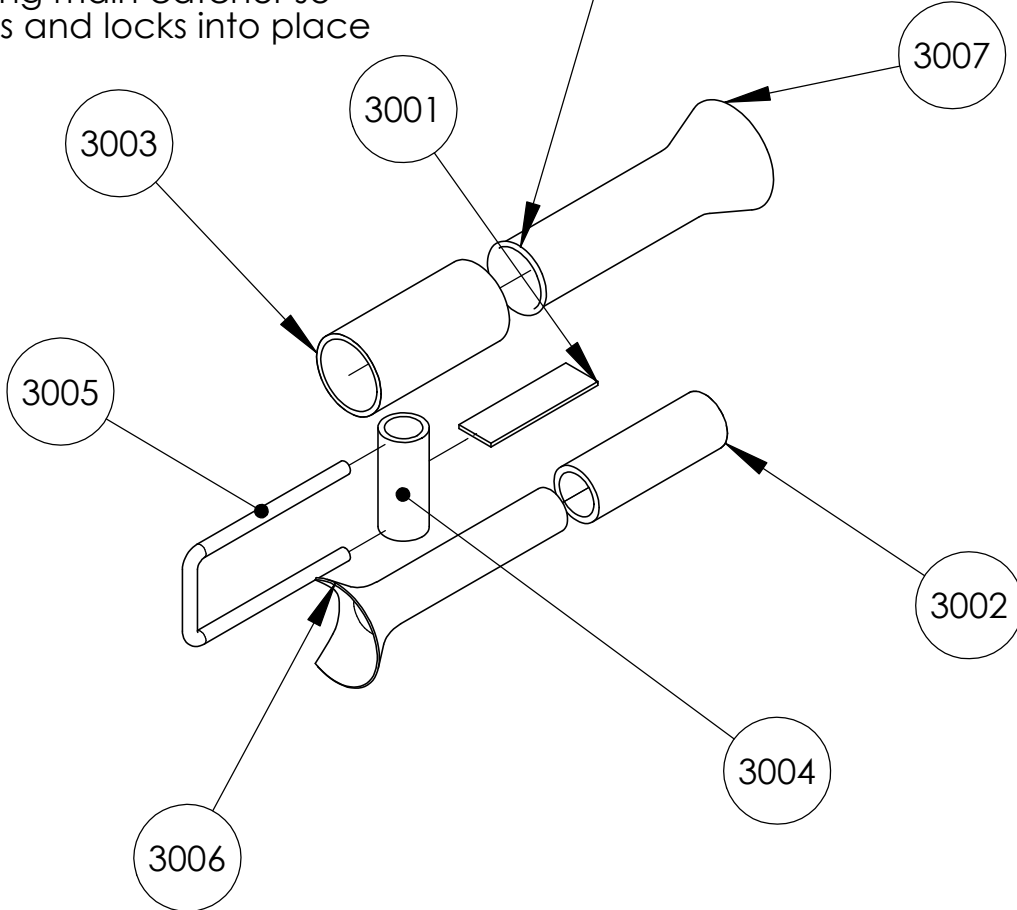
B



Cut rising main catcher so it snaps and locks into place

Heat and deform after assembly

C




D

E

NO.	DESCRIPTION
3001	Base support
3003	Rope catcher support
3002	Rising main catcher support
3004	Rope protection base
3005	Rope protection
3006	Rising main catcher pipe
3007	Rope catcher pipe

F



PROJECT:
Rope pump

BASE MATERIAL: **part specific**

TITLE: **Guide box**

DRAWN BY:
Rob Dedden

DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO. **3000**

SCALE: **1:5**

FORMAT: **A4**

PAGE NO. **25**

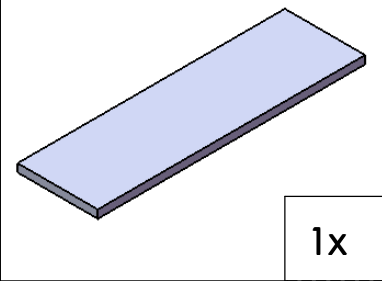
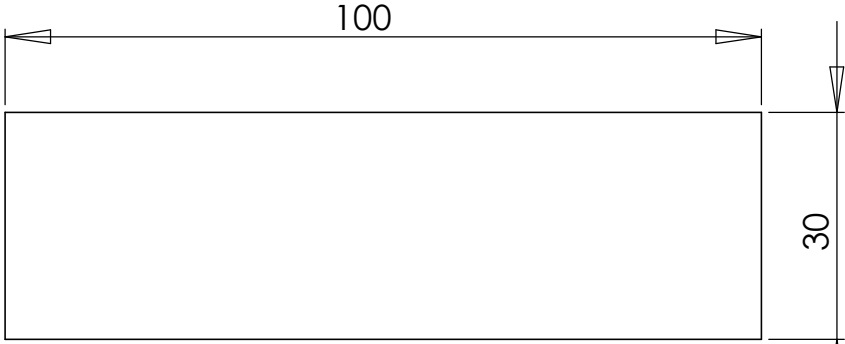
1

2

3

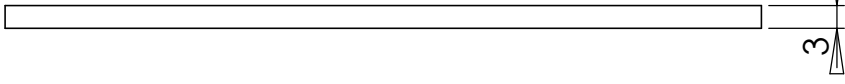
4

A



1x

B



C

TITLE: **Base support**

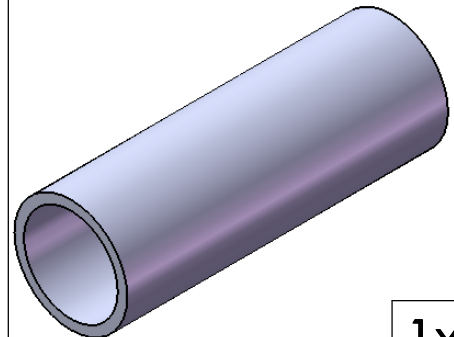
BASE MATERIAL: **Fe36 strip 100 x 30 x 3mm**

DWG NO. **3001**

SCALE: **1:2**

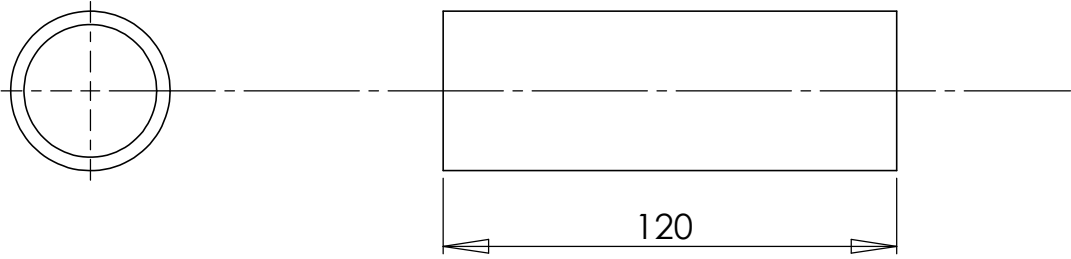
D

Choose pipe diameter according to selected rising main diameter.



1x

E



F

PROJECT:
Rope pump

BASE MATERIAL: **GI pipe, Ø variable x 120mm**

TITLE: **Rising main catcher support**

DRAWN BY: **Rob Dedden**

DATE: **31-7-2011**

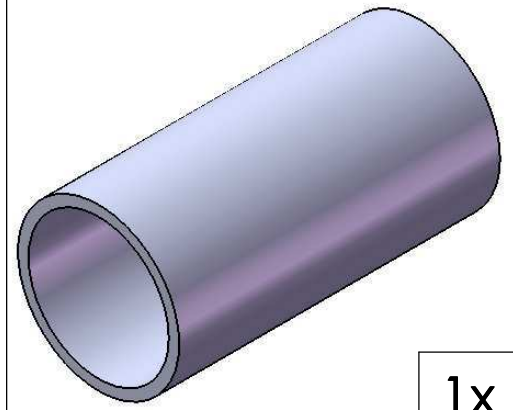
VERSION: **Practica model - v1.0**

DWG NO. **3002**

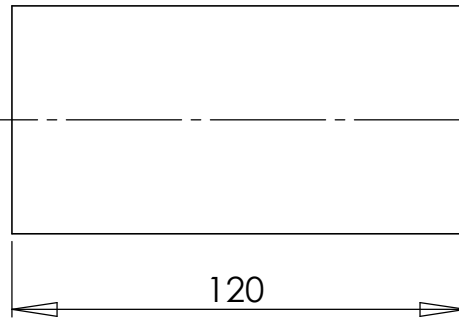
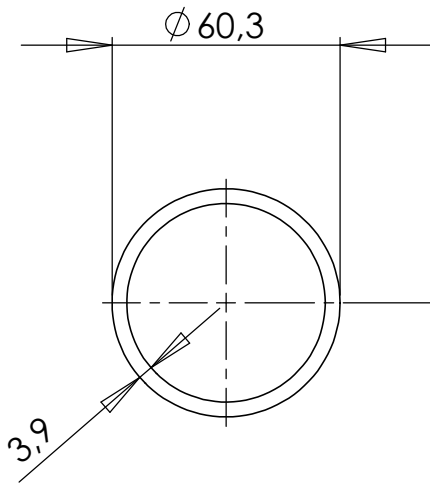
SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **26**



1x



TITLE:

Rope catcher support

BASE MATERIAL:

GI pipe 2" x 120mm

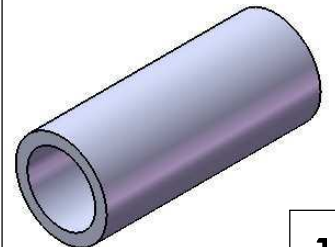
DWG NO.

3003

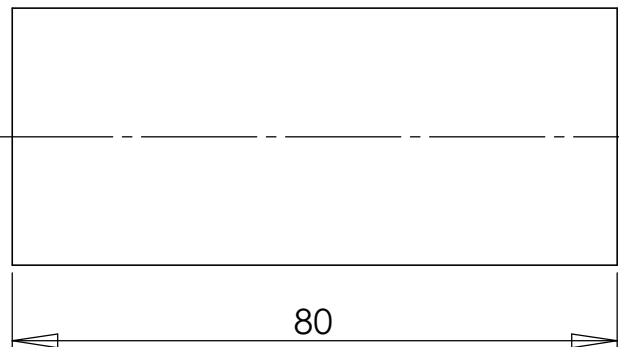
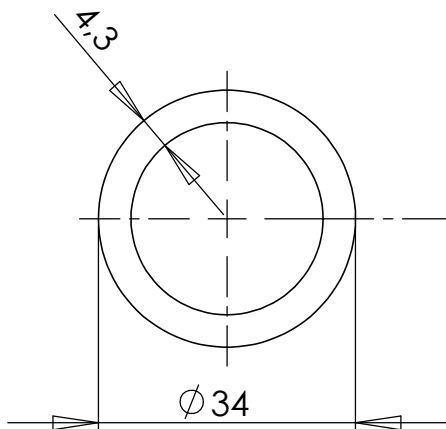
SCALE:

1:2

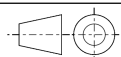
D



1x



E



PRACTICA
FOUNDATION

PROJECT:
Rope pump

BASE MATERIAL:

GI pipe 1" 80mm

TITLE:

Rope protection base

F

DRAWN BY:
Rob Dedden

DATE:
20-9-2011

VERSION:
Practica model - v1.0

DWG NO.

3004

SCALE:

1:1

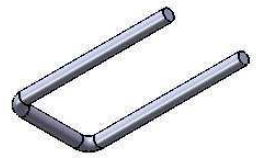
FORMAT:
A4

PAGE NO.

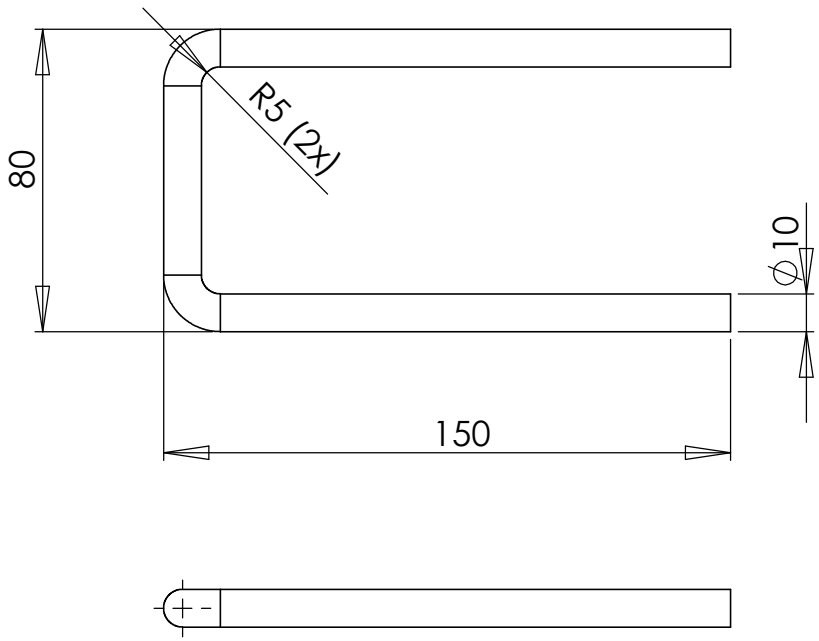
27

1 2 3 4

A
B
C
D
E
F

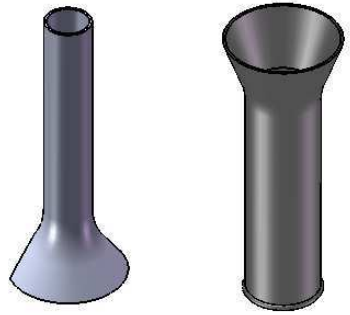
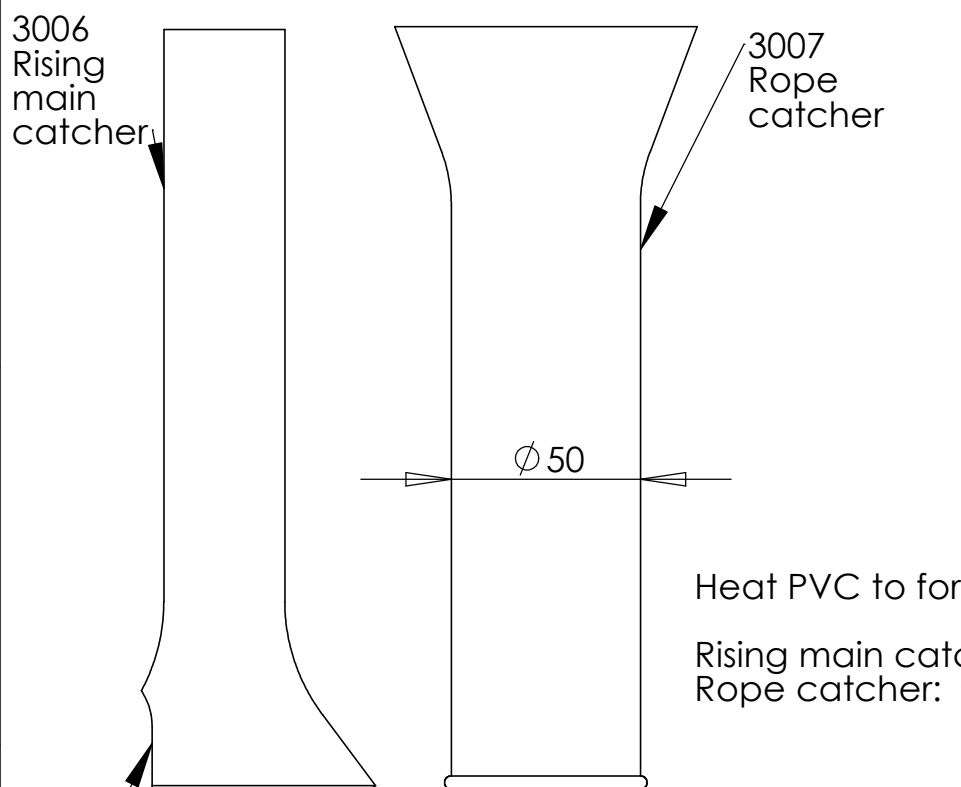


1x



TITLE: **Rope protection**

BASE MATERIAL: **Reinforcement bar \varnothing 10 x 400mm** DWG NO. **3005** SCALE: **1:2**



1x

Heat PVC to form conical end.
 Rising main catcher: \varnothing variable x 200mm
 Rope catcher: \varnothing 50 x 200mm

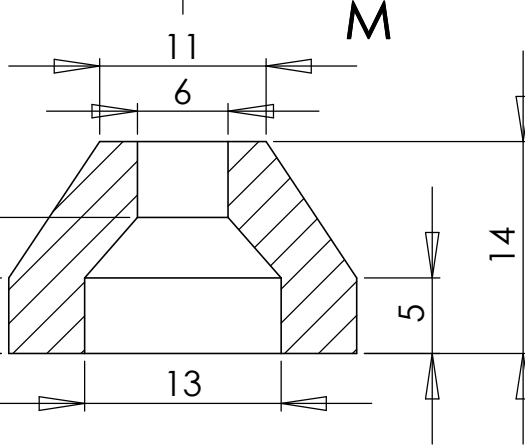
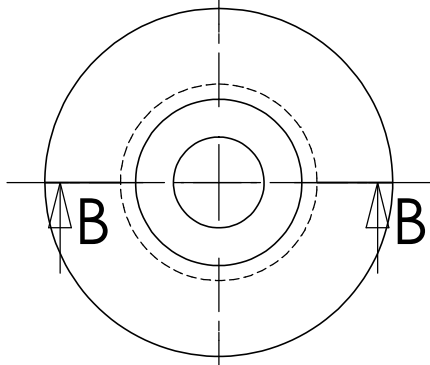


PROJECT:
Rope pump

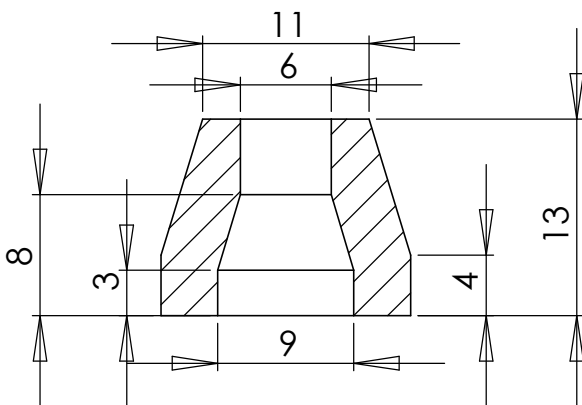
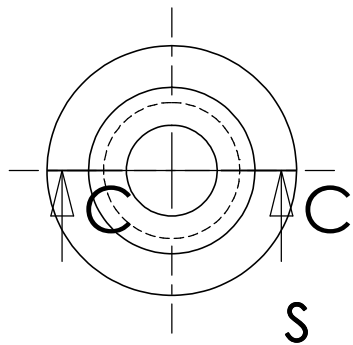
BASE MATERIAL: **PVC, sizes part specific**

TITLE: **Rising main catcher
Rope catcher**

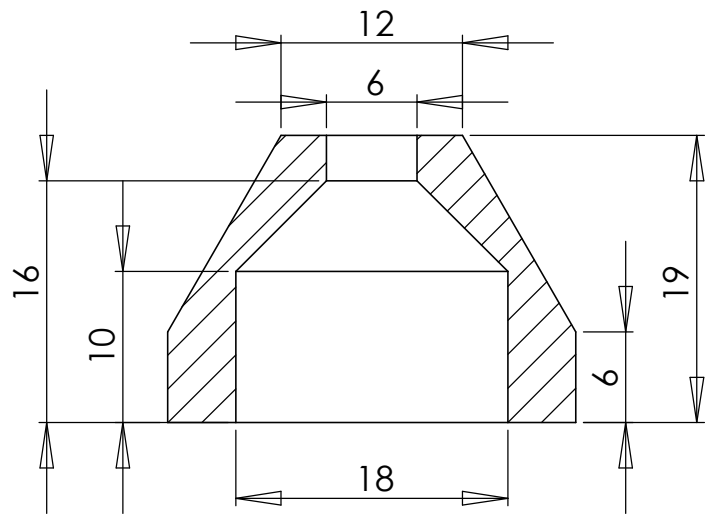
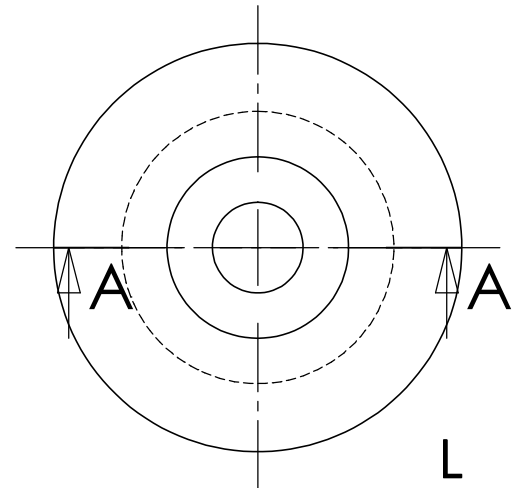
DRAWN BY: **Rob Dedden** DATE: **31-7-2011** VERSION: **Practica model - v1.0** DWG NO. **3006/7** SCALE: **1:2** FORMAT: **A4** PAGE NO. **28**



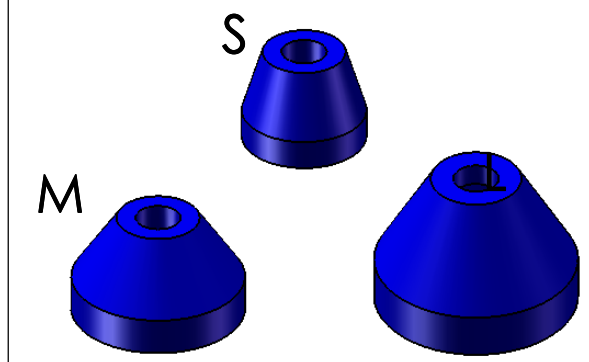
SECTION B-B
SCALE 2 : 1



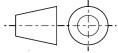
SECTION C-C
SCALE 2 : 1



SECTION A-A
SCALE 2 : 1



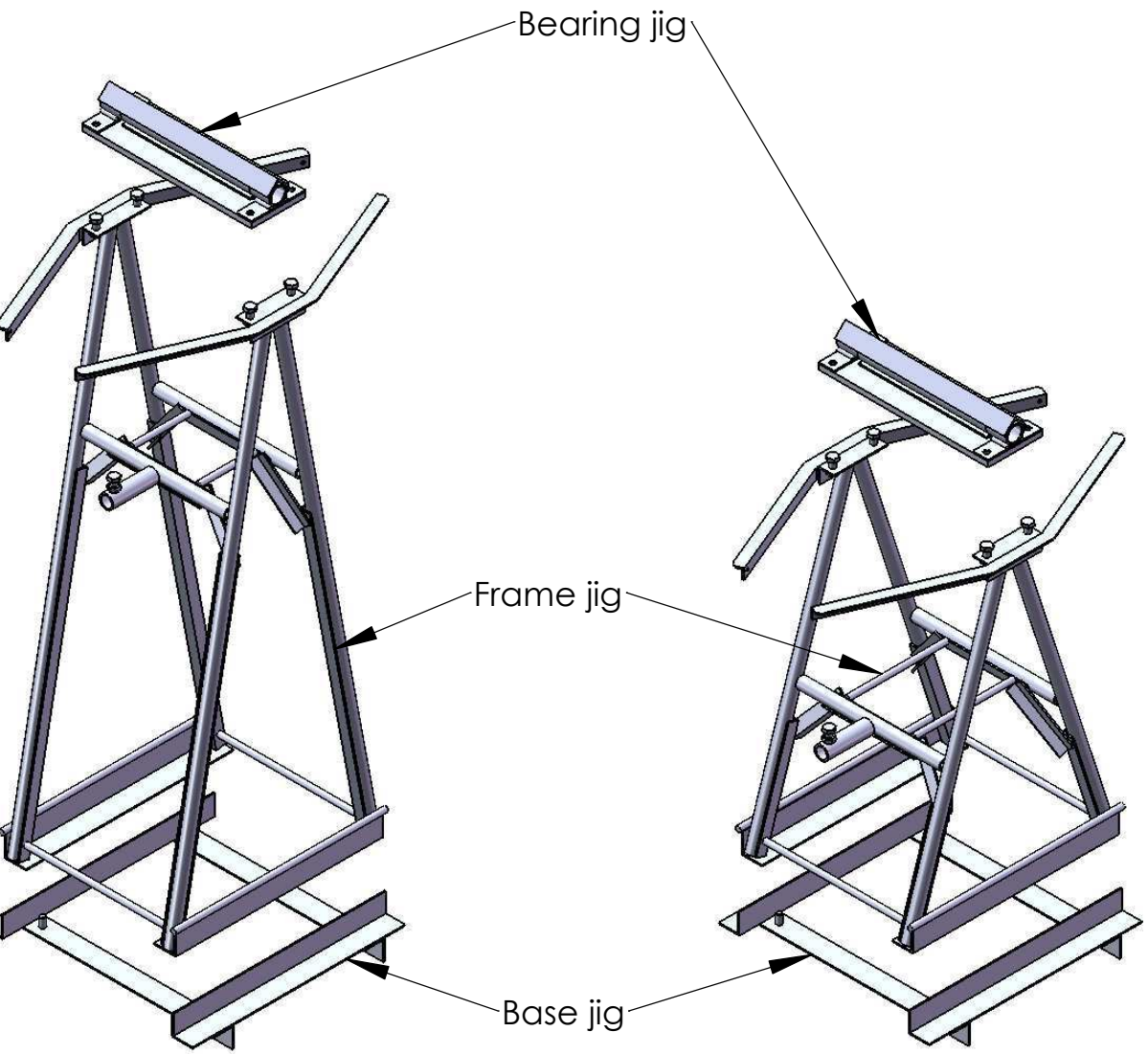
Note: Outer diameters are variable and depend on rising main holder size!

F	NO.	DESCRIPTION	 PRACTICA <small>FOUNDATION</small> PROJECT: Rope pump	BASE MATERIAL: Poly Ethylene (PE)			
	4006	Piston Large		TITLE: Pistons			
	4007	Piston Medium					
	4008	Piston Small					
DRAWN BY: Rob Dedden		DATE: 11-7-2011	VERSION: Practica model - v1.0	DWG NO. 4006/-7/-8	SCALE: 1:1	FORMAT: A4	PAGE NO. 29

ROPE PUMP

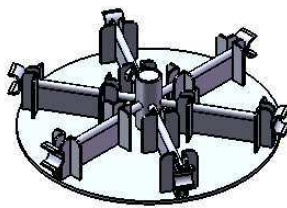
Module 3

WELDING JIGS PRODUCTION DRAWINGS

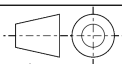


Frame jig (long)

Frame jig (short)



Wheel jig



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL:
Part specific

TITLE:
**Jigs Rope pump
Practica model**

DRAWN BY:
Rob Dedden

DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO. 0000

SCALE: 1:10

FORMAT: A4

PAGE NO. 1

1

2

3

4

A

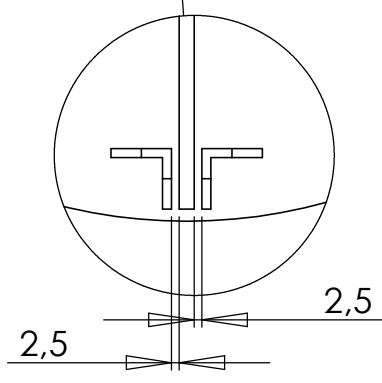
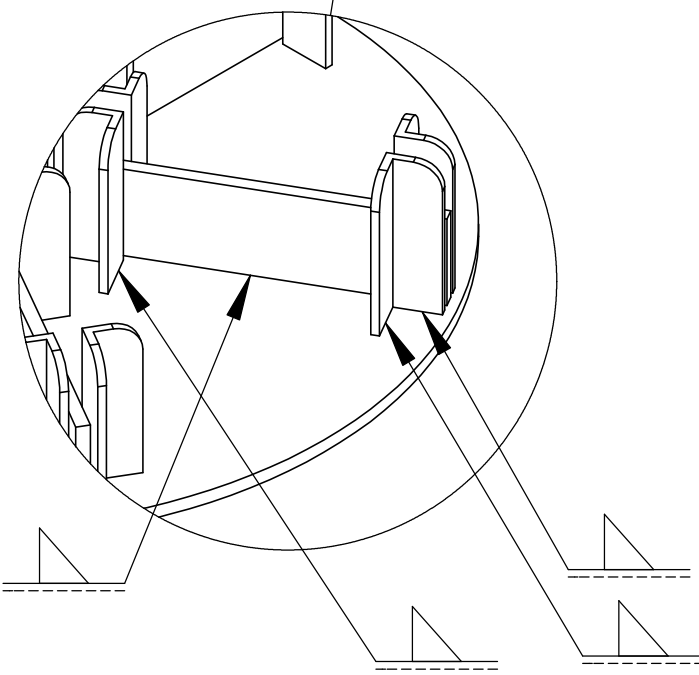
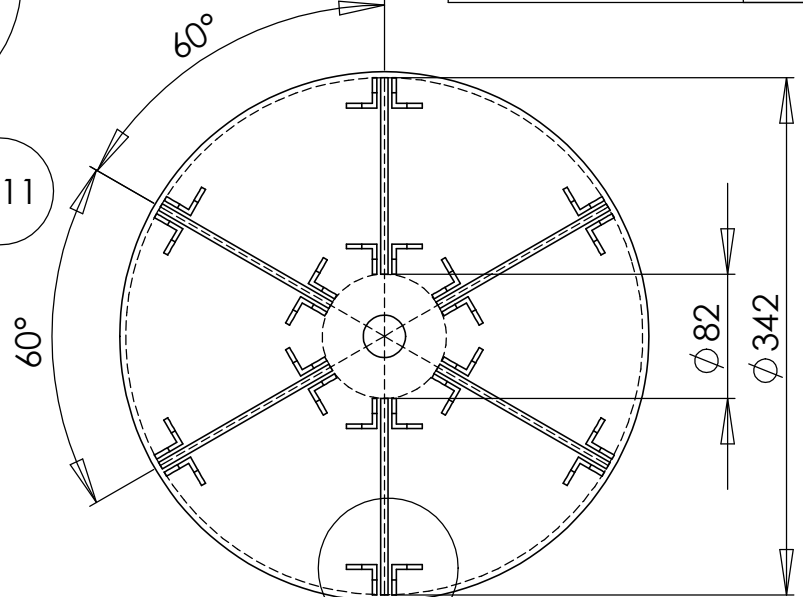
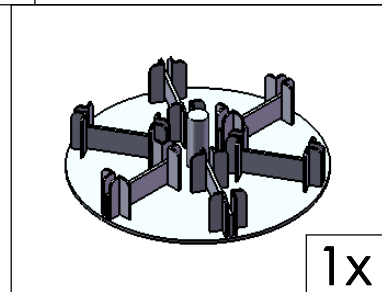
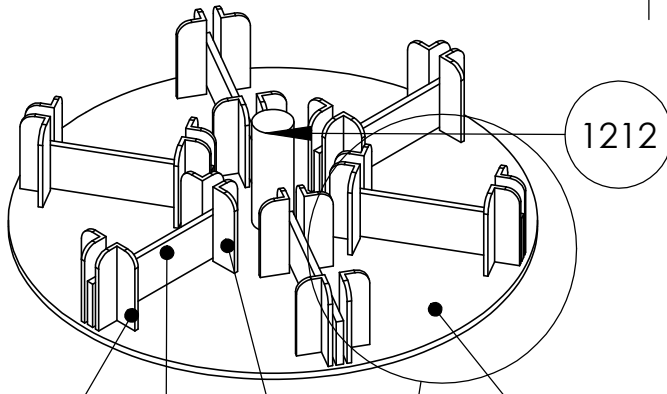
B

C

D

E

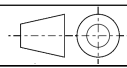
F



DETAIL A
SCALE 2 : 5

DETAIL B
SCALE 2 : 5

NO.	DESCRIPTION	QTY.
1200	Wheel	1
1211	Base plate	1
1212	Hub support	1
1213	Spoke support 1	6
1215	Spoke alignment	24



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL:
Part specific

TITLE:
Wheel jig

DRAWN BY:
Rob Dedden

DATE:
15-7-2011

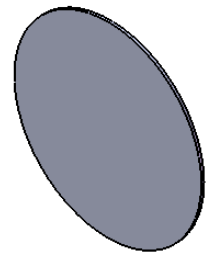
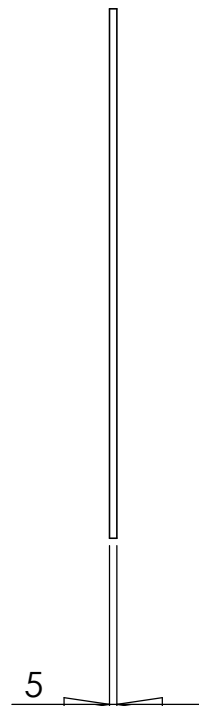
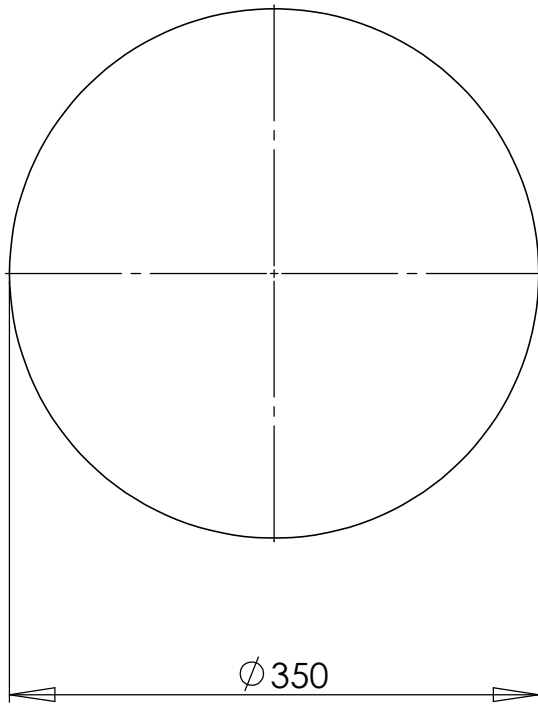
VERSION:
Practica model - v1.0

DWG NO. **1210**

SCALE: **1:5**

FORMAT: **A4**

PAGE NO. **2**



1x

TITLE:

Base plate

BASE MATERIAL:

Fe36 sheetmetal Ø350 x 5mm

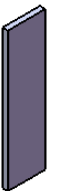
DWG NO.

1211

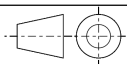
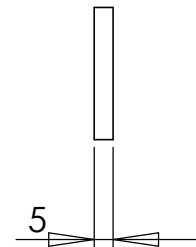
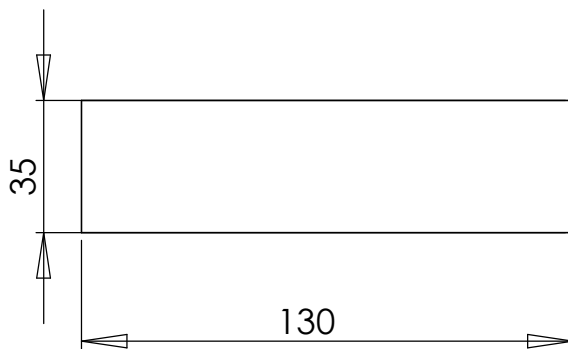
SCALE:

1:5

D



6x



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL:

Fe36 strip 130 x 35 x 5mm

TITLE:

Spoke support 1

DRAWN BY:
Rob Dedden

DATE:
15-7-2011

VERSION:
Practica model - v1.0

DWG NO.

1213

SCALE:

1:2

FORMAT:

A4

PAGE NO.

3

F

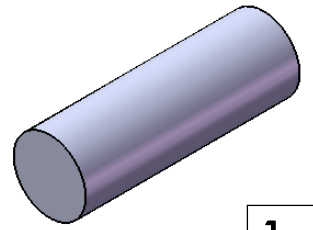
1

2

3

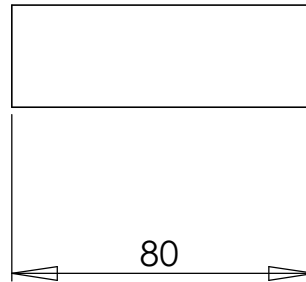
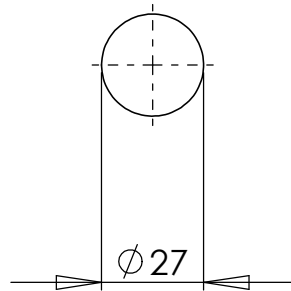
4

A



1x

B



C

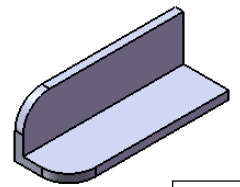
TITLE: **Hub support**

BASE MATERIAL: **Fe36 roundbar Ø27 x 80mm**

DWG NO. **1212**

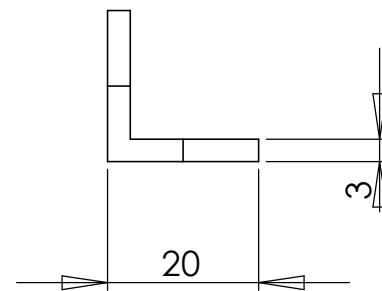
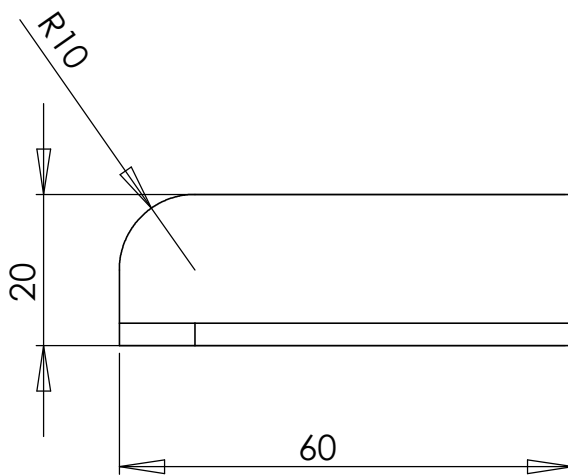
SCALE: **1:2**

D

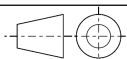


24x

E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Fe36 angle iron 60 x 20 x 20 x 3mm**

TITLE: **Spoke alignment**

DRAWN BY:
Rob Dedden

DATE:
15-7-2011

VERSION:
Practica model - v1.0

DWG NO. **1215**

SCALE: **1:1**

FORMAT: **A4**

PAGE NO. **4**

1

2

3

4

A

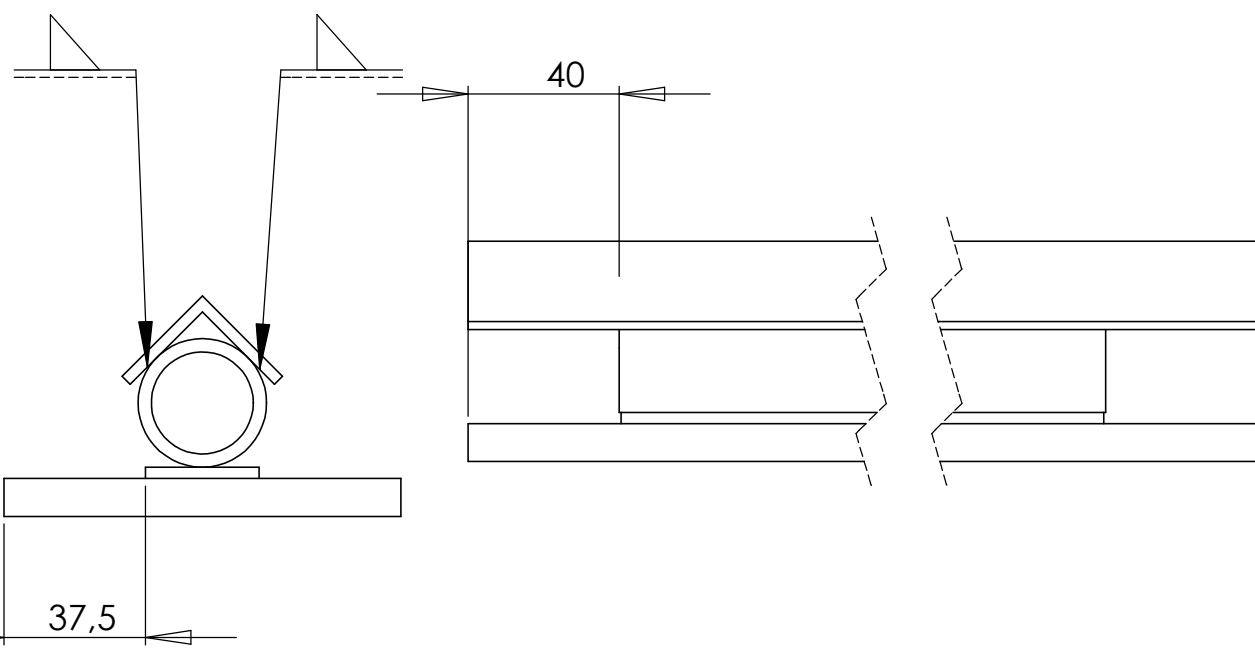
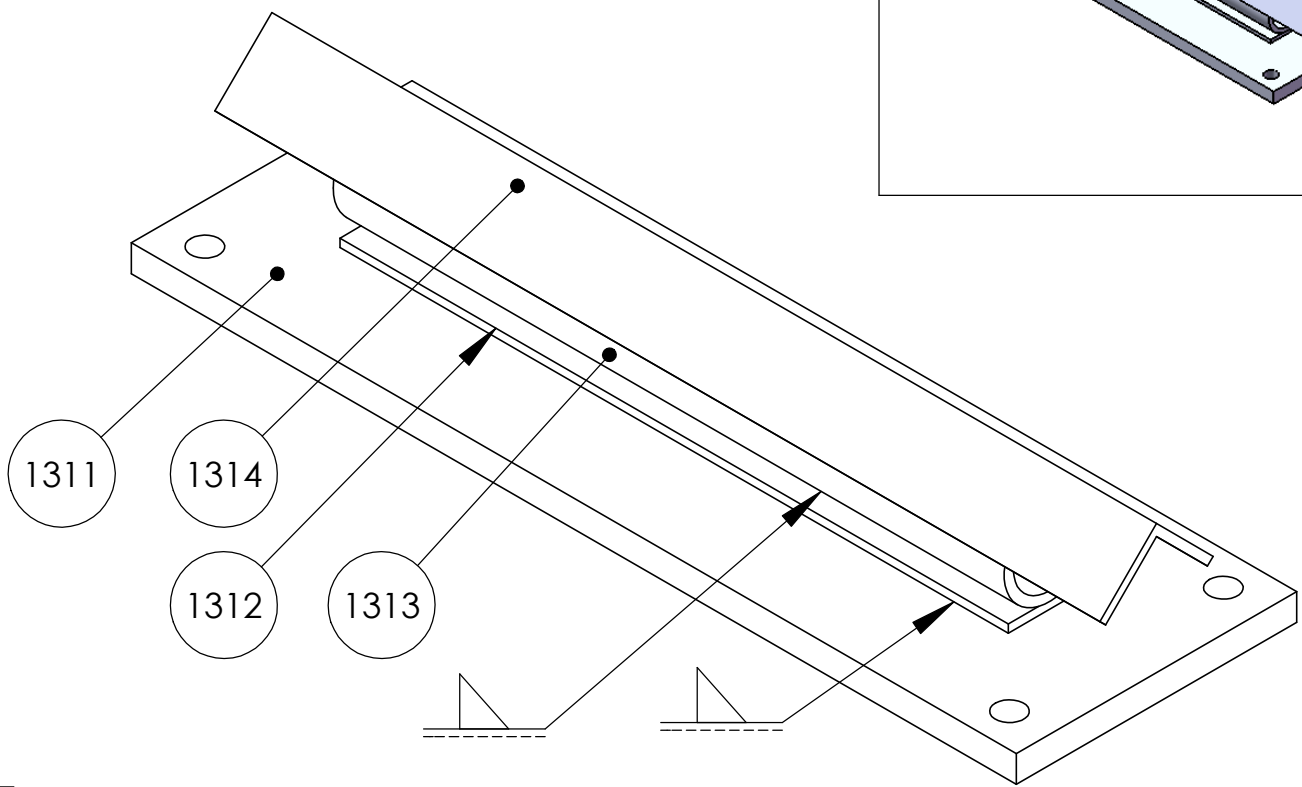
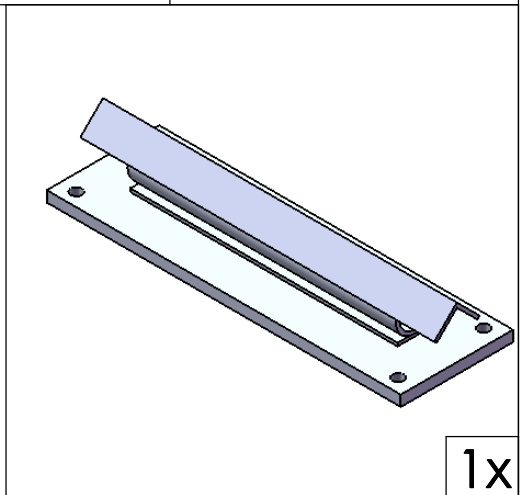
B

C

D

E

F



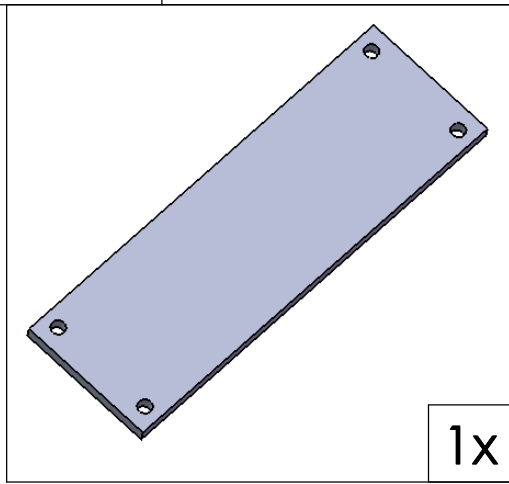
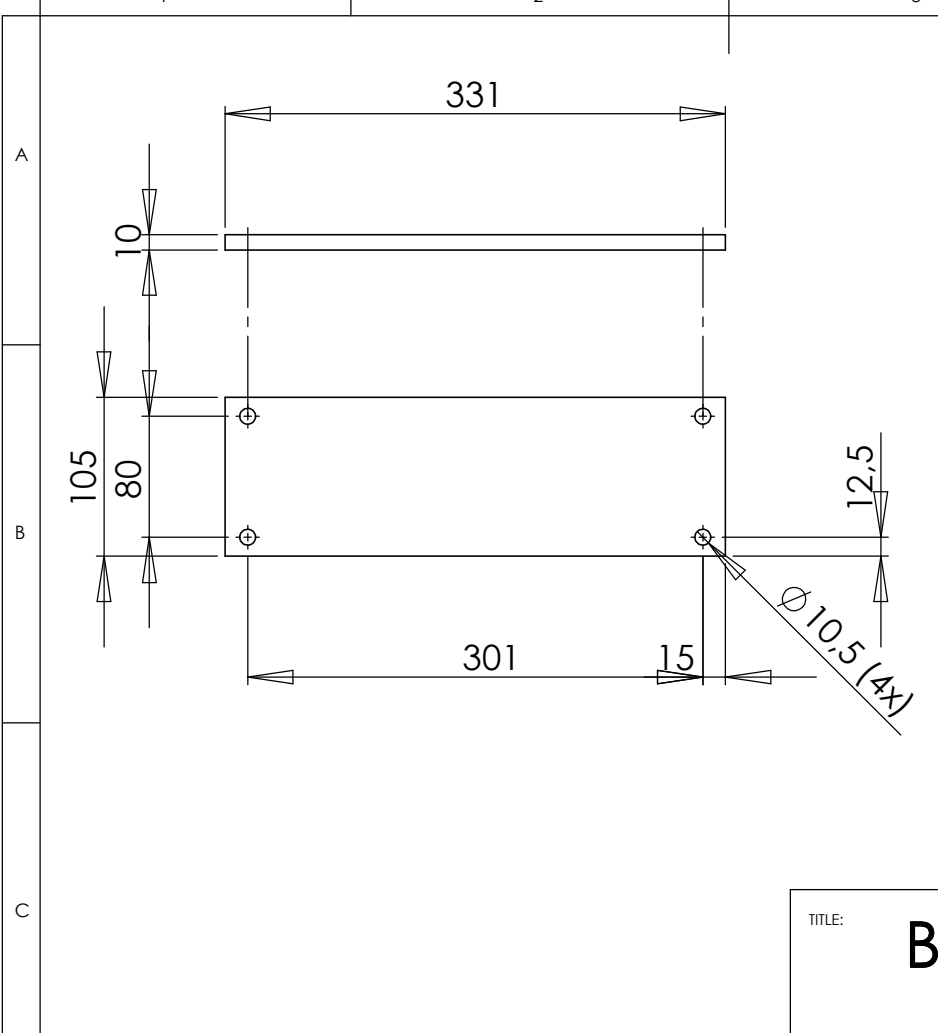
NO.	DESCRIPTION	QTY.
1311	Base slab	1
1312	Alignment shim	1
1313	Main pipe	1
1314	Top alignment	1
1300	Bushing	2



PROJECT:
Rope pump - Jigs

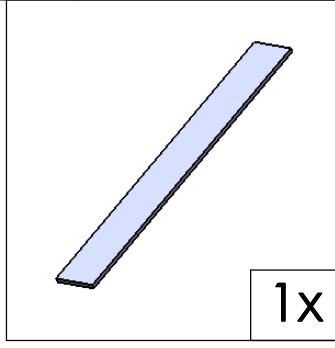
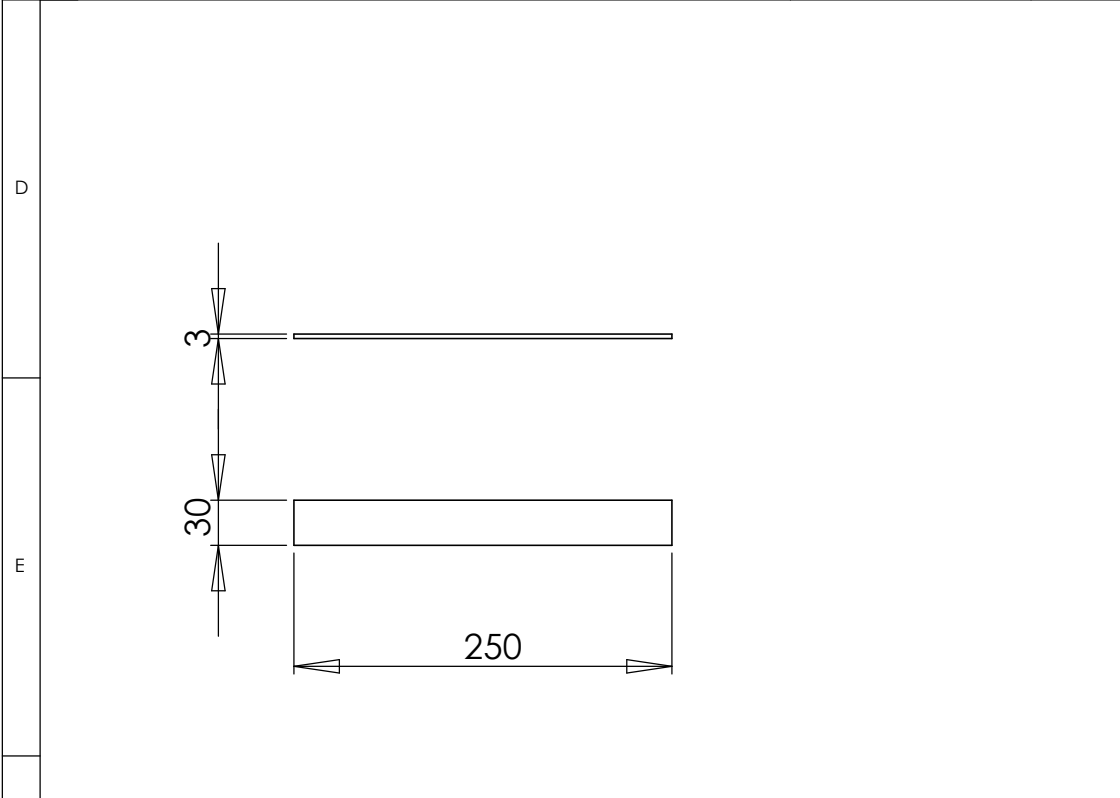
BASE MATERIAL: Part specific

TITLE: **Bearing jig**



TITLE: **Base slab**

BASE MATERIAL: **Steel plate 331 x 105 x 10mm** DWG. NO. **1311** SCALE: **1:5**



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Fe36 strip 250 x 30 x 3mm**

TITLE: **Alignment shim**

DRAWN BY: **Rob Dedden** DATE: **15-7-2011** VERSION: **Practica model - v1.0** DWG. NO. **1312** SCALE: **1:5** FORMAT: **A4** PAGE NO. **6**

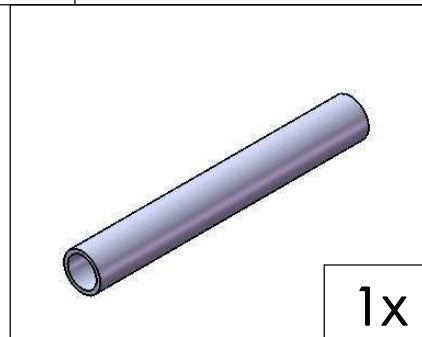
1

2

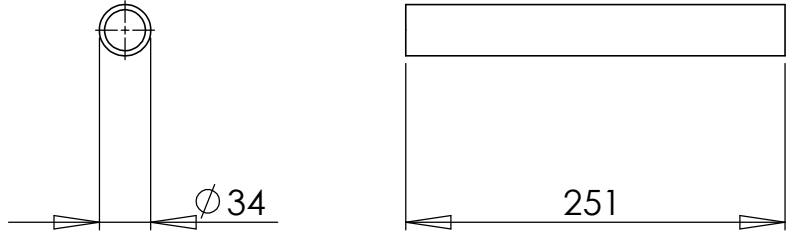
3

4

A



B

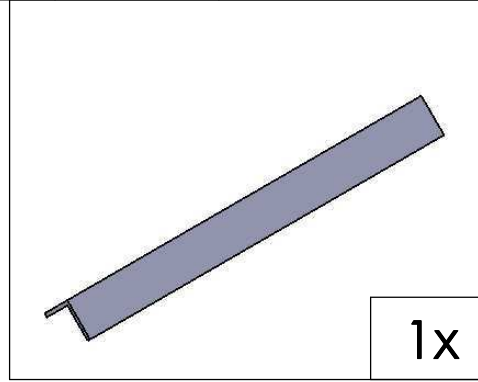


C

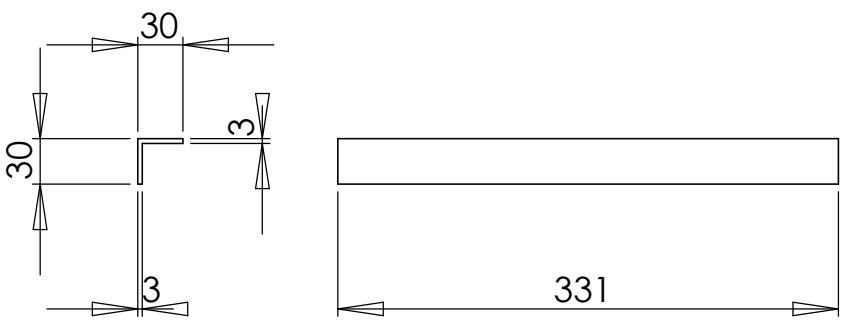
TITLE: **Main pipe**

BASE MATERIAL: GI pipe $\varnothing 34 \times 251\text{mm}$	DWG NO. 1313	SCALE: 1:1
---	---------------------	-------------------

D



E



F

PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Fe36 angle iron 331 x 30 x 30 x 3mm**

TITLE: **Top alignment**

DRAWN BY: Rob Dedden	DATE: 15-7-2011	VERSION: Practica model - v1.0	DWG NO. 1314	SCALE: 1:5	FORMAT: A4	PAGE NO. 7
-------------------------	--------------------	-----------------------------------	---------------------	-------------------	-------------------	-------------------

A

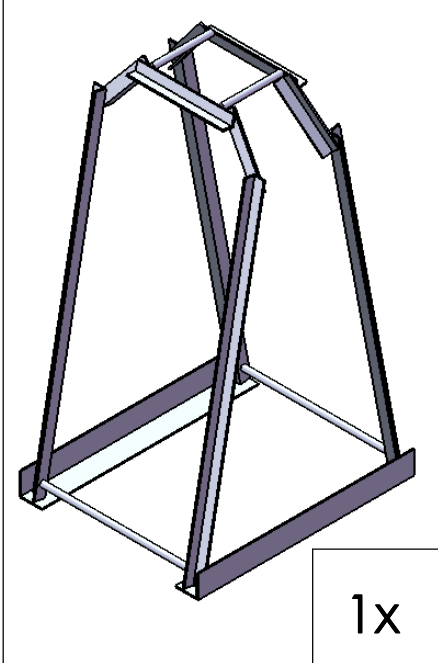
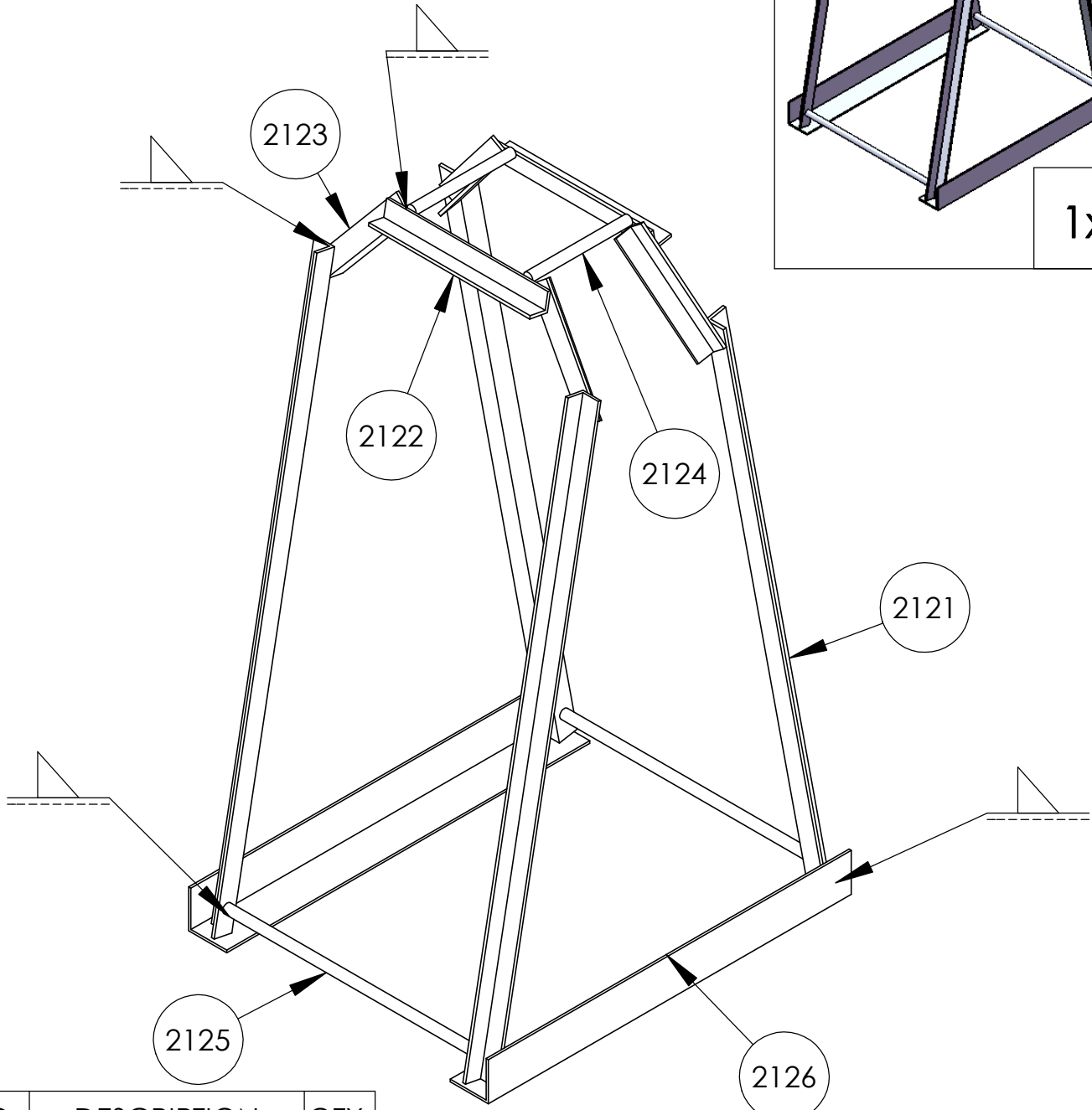
B

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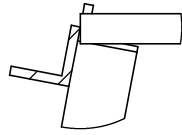


NO.	DESCRIPTION	QTY.
2121	Main tube alignment	4
2122	Cross tube alignment	2
2123	Cross tube alignment fixture	4
2124	Top reinforcement	2
2125	Lateral reinforcement	2
2126	Longitudinal reinforcement	2

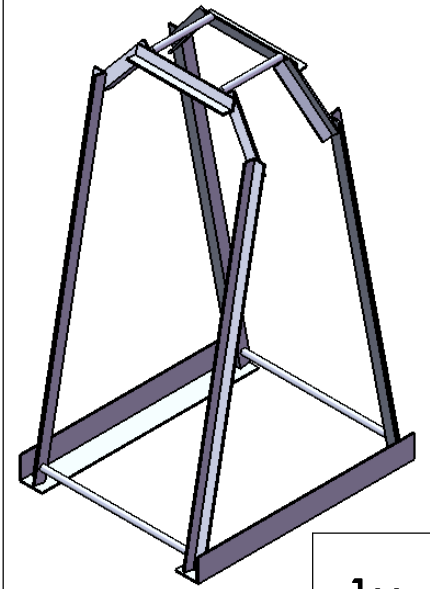
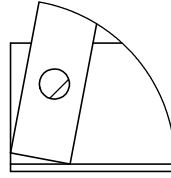

 PROJECT:
 Rope pump - Jigs

BASE MATERIAL: Part specific
 TITLE: **Frame jig**

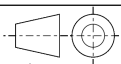
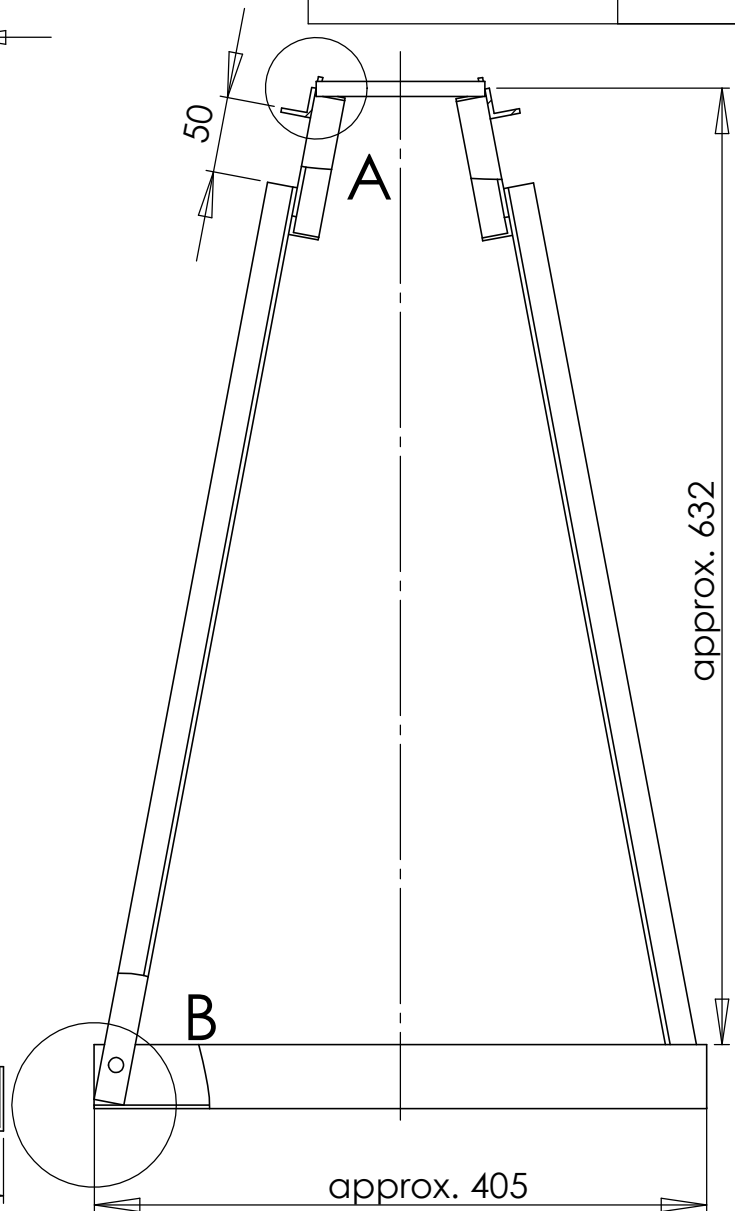
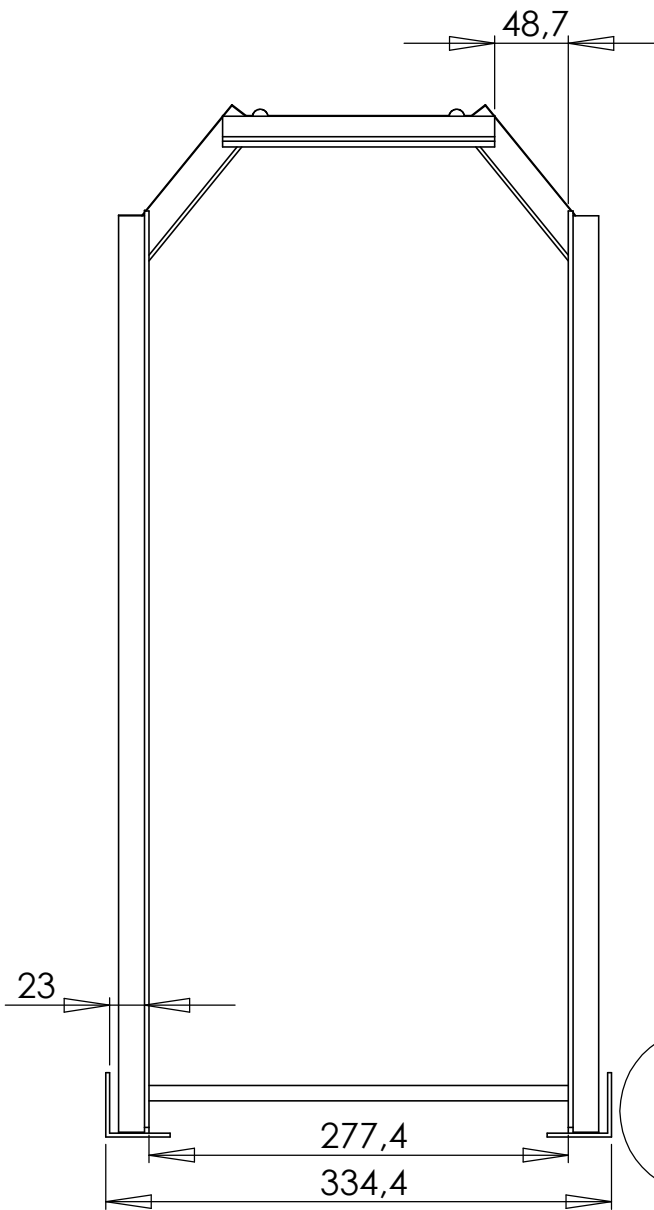
DETAIL A
SCALE 2 : 5



DETAIL B
SCALE 2 : 5



1x



BASE MATERIAL: Part specific

PRACTICA
FOUNDATION

TITLE: **Frame jig**

PROJECT:
Rope pump - Jigs

DRAWN BY:
Erik den Toom

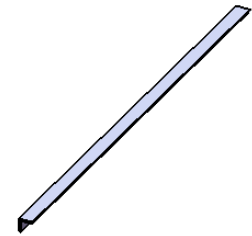
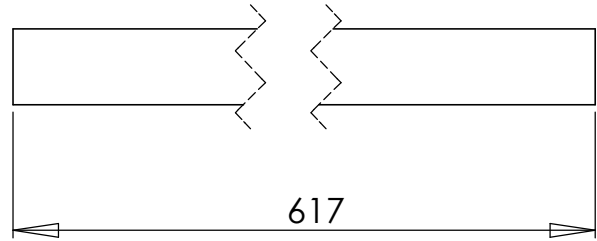
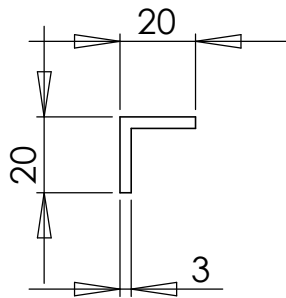
DATE:
31-7-2011

VERSION:
Practica model - v1.0

DWG NO. **2120**

SCALE: **1:5**

FORMAT: **A4** PAGE NO. **9**



4x

TITLE:

Main tube alignment

BASE MATERIAL:

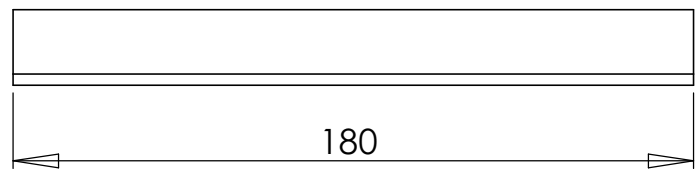
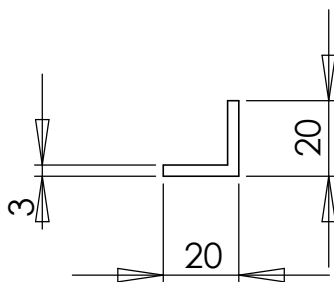
Fe36 angle iron 20 x 20 x 3 x 617

DWG NO.

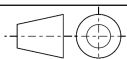
2121

SCALE:

1:2



2x



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL:

Angle iron 20 x 20 x 3 x 180mm

TITLE:

Cross tube alignment

DRAWN BY:

DATE:
15-7-2011

VERSION:
Practica model - v1.0

DWG NO.

2122

SCALE:

1:2

FORMAT:
A4

PAGE NO.

10

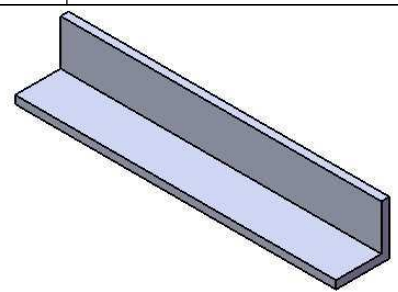
1

2

3

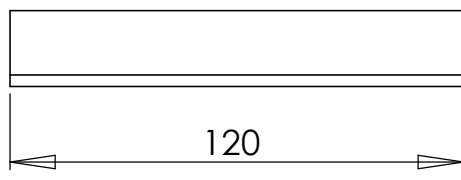
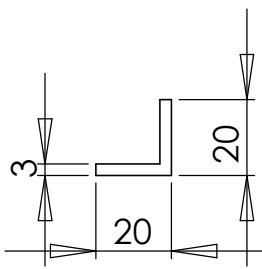
4

A



4x

B



C

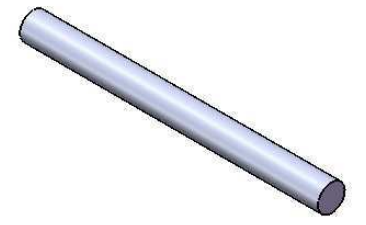
TITLE: **Cross tube alignment fixture**

BASE MATERIAL: **Fe36 angle iron 20 x 20 x 3 x 120mm**

DWG NO. **2123**

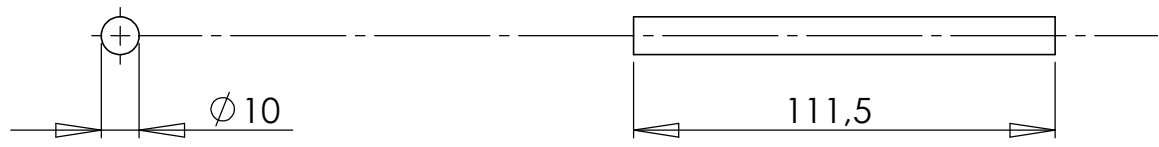
SCALE: **1:2**

D



2x

E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Reinforcement bar Ø10 x 111,5mm**

TITLE: **Top reinforcement**

DRAWN BY:
Erik den Toom

DATE:
15-7-2011

VERSION:
Practica model - v1.0

DWG NO. **2124**

SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **11**

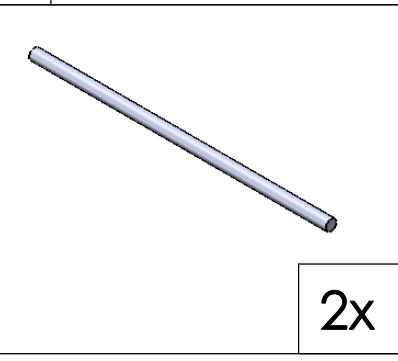
1

2

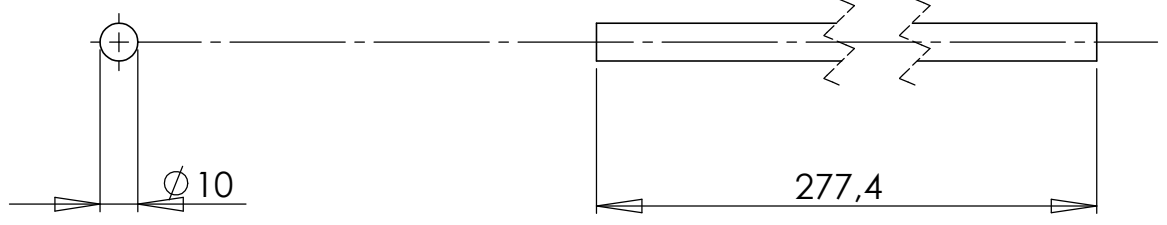
3

4

A



B



C

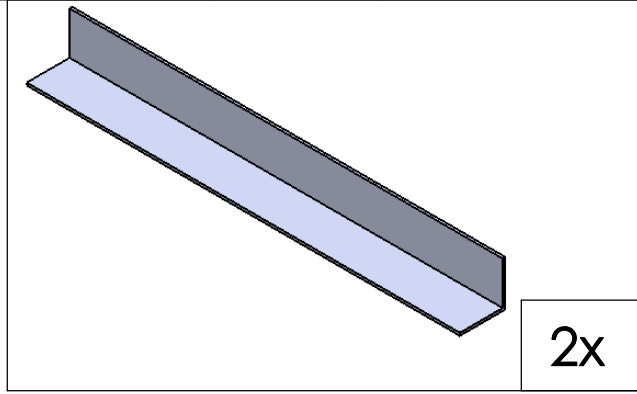
TITLE: **Lateral reinforcement**

BASE MATERIAL: **Reinforcement bar Ø10 x 277,4mm**

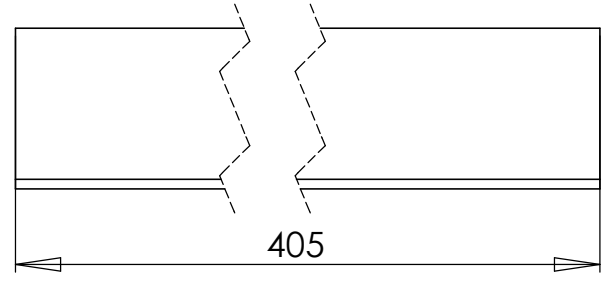
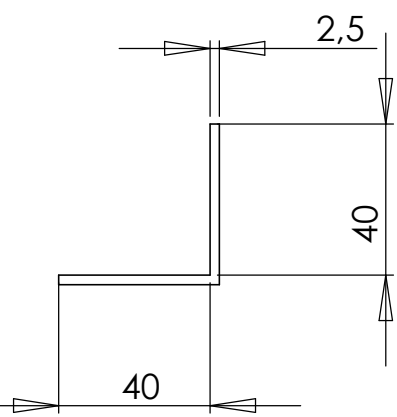
DWG NO. **2125**

SCALE: **1:2**


D



E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Fe36 angle iron 40 x 40 x 2,5 x 405**

TITLE: **Longitudinal reinforcement**

DRAWN BY:

DATE: **31-7-2011**

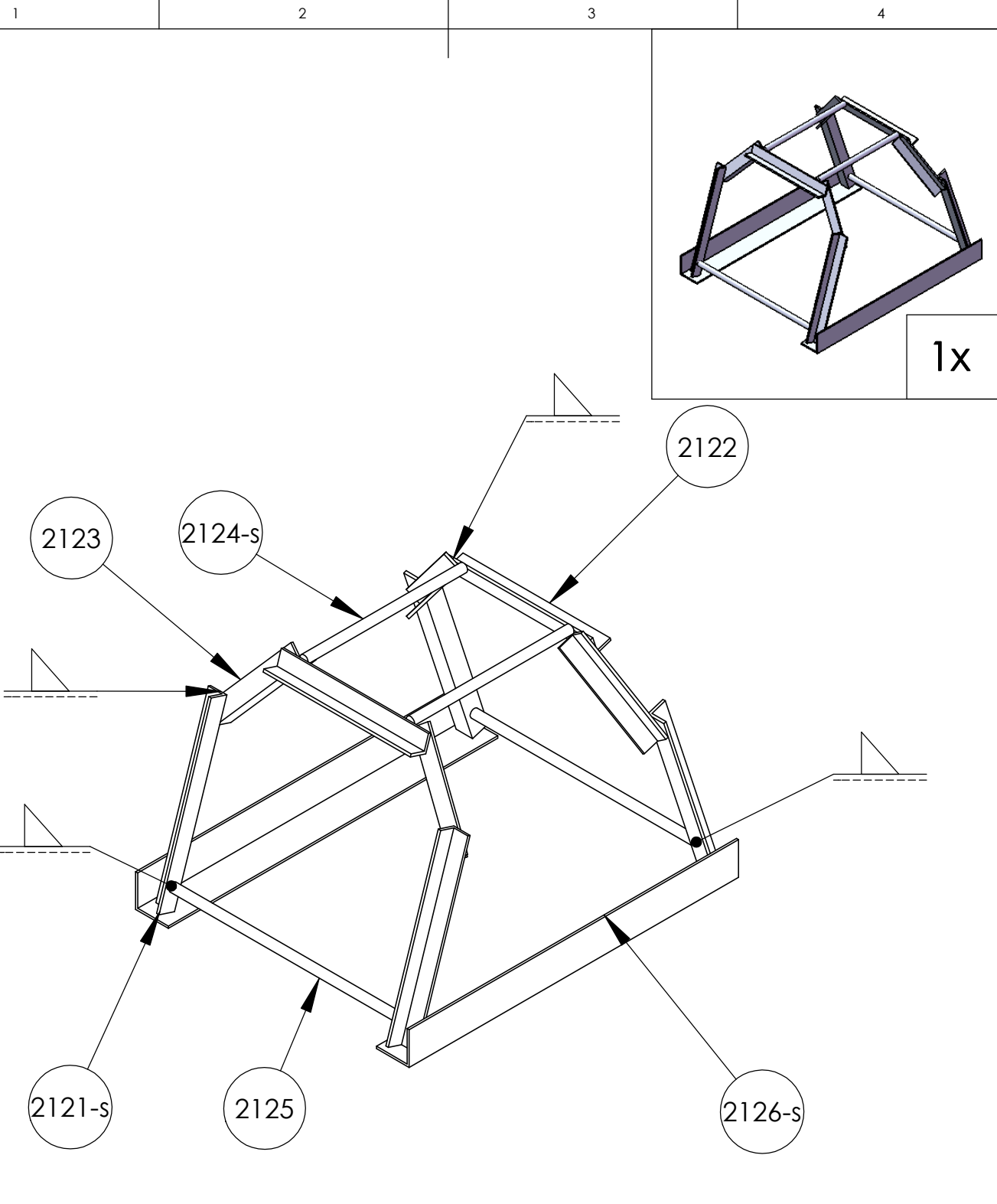
VERSION: **Practica model - v1.0**

DWG NO. **2126**

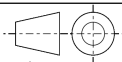
SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **12**



NO.	DESCRIPTION	QTY.
2121-s	Main tube alignment short	4
2122	Cross tube alignment	2
2123	Cross tube alignment fixture	4
2124-s	Top reinforcement short	2
2125	Lateral reinforcement	2
2126-s	Longitudinal reinforcement	2



BASE MATERIAL: Part specific

PRACTICA
FOUNDATION

TITLE: **Frame jig short**

PROJECT: Rope pump - Jigs

DRAWN BY: Erik den Toom

DATE: 31-7-2011

VERSION: Practica model - v1.0

DWG NO. **2120-s**

SCALE: **1:10**

FORMAT: **A4**

PAGE NO. **13**

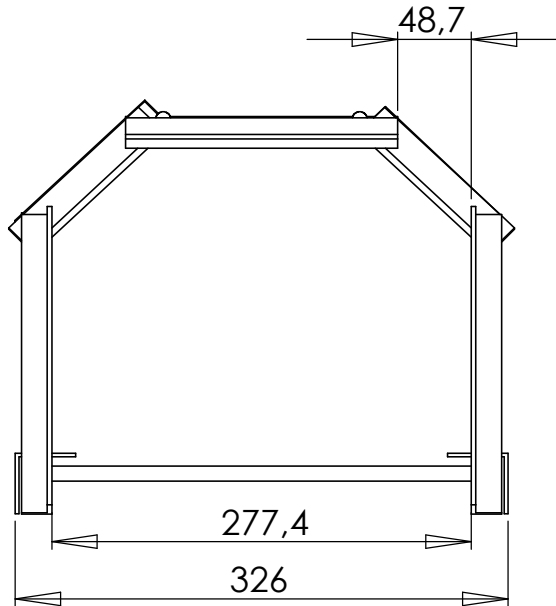
1

2

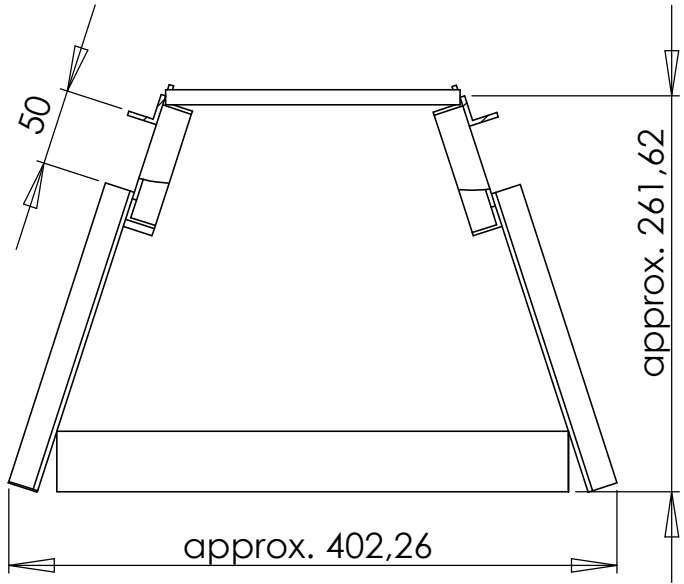
3

4

A



B



C

See drawings 2120 for alignment details.

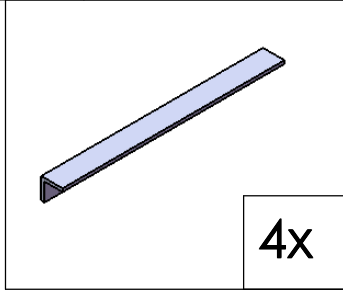
TITLE:	Frame jig short
--------	------------------------

BASE MATERIAL: **Part specific**

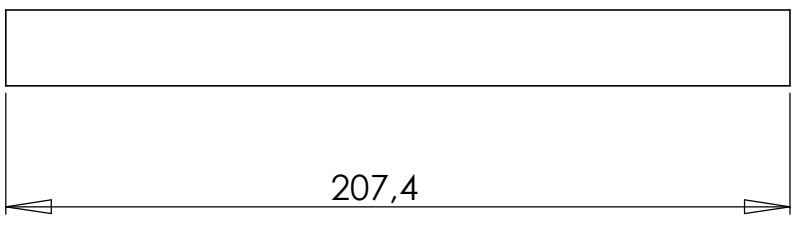
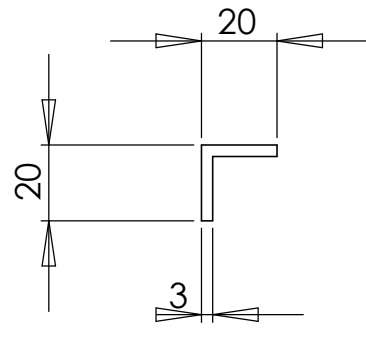
DWG NO. **2120-s**

SCALE: **1:5**

D



E



F

	BASE MATERIAL: Fe36 angle iron 20 x 20 x 3 x 207,5
	TITLE: Main tube alignment short
PROJECT: Rope pump - Jigs	

DRAWN BY: Erik den Toom

DATE: 15-7-2011

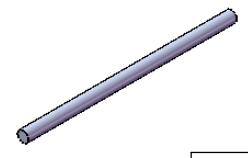
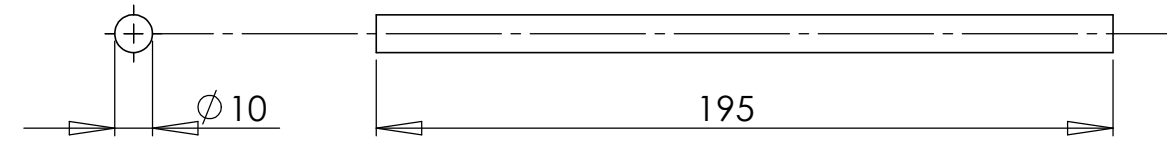
VERSION: Practica model - v1.0

DWG NO. **2121-s**

SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **14**



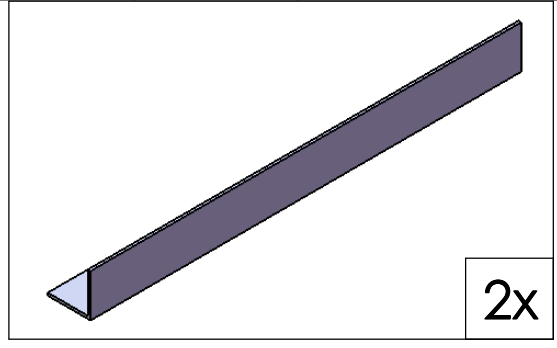
2x

TITLE: **Top reinforcement short**

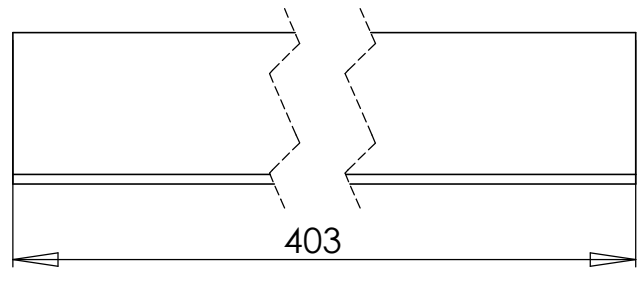
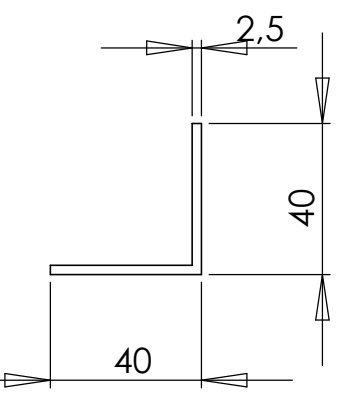
BASE MATERIAL: **Reinforcement bar Ø10 x 195mm**


DWG NO. **2124-s**

SCALE: **1:2**



2x




 PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Fe36 angle iron 40 x 40 x 2,5 x 403**

TITLE: **Longitudinal reinforcement**

DRAWN BY:
Erik den Toom

DATE:
31-7-2011

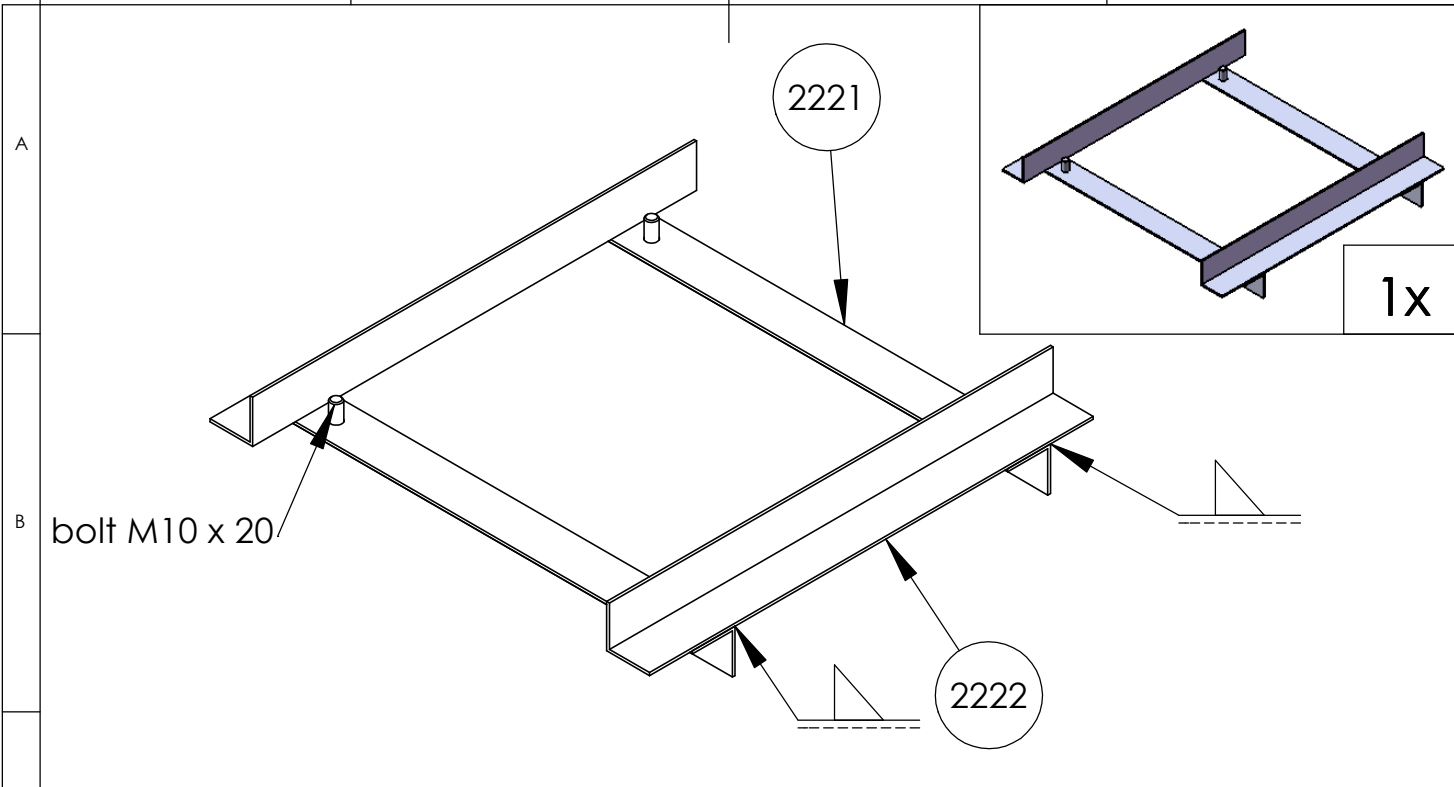
VERSION:
Practica model - v1.0

DWG NO. **2126-s**

SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **15**

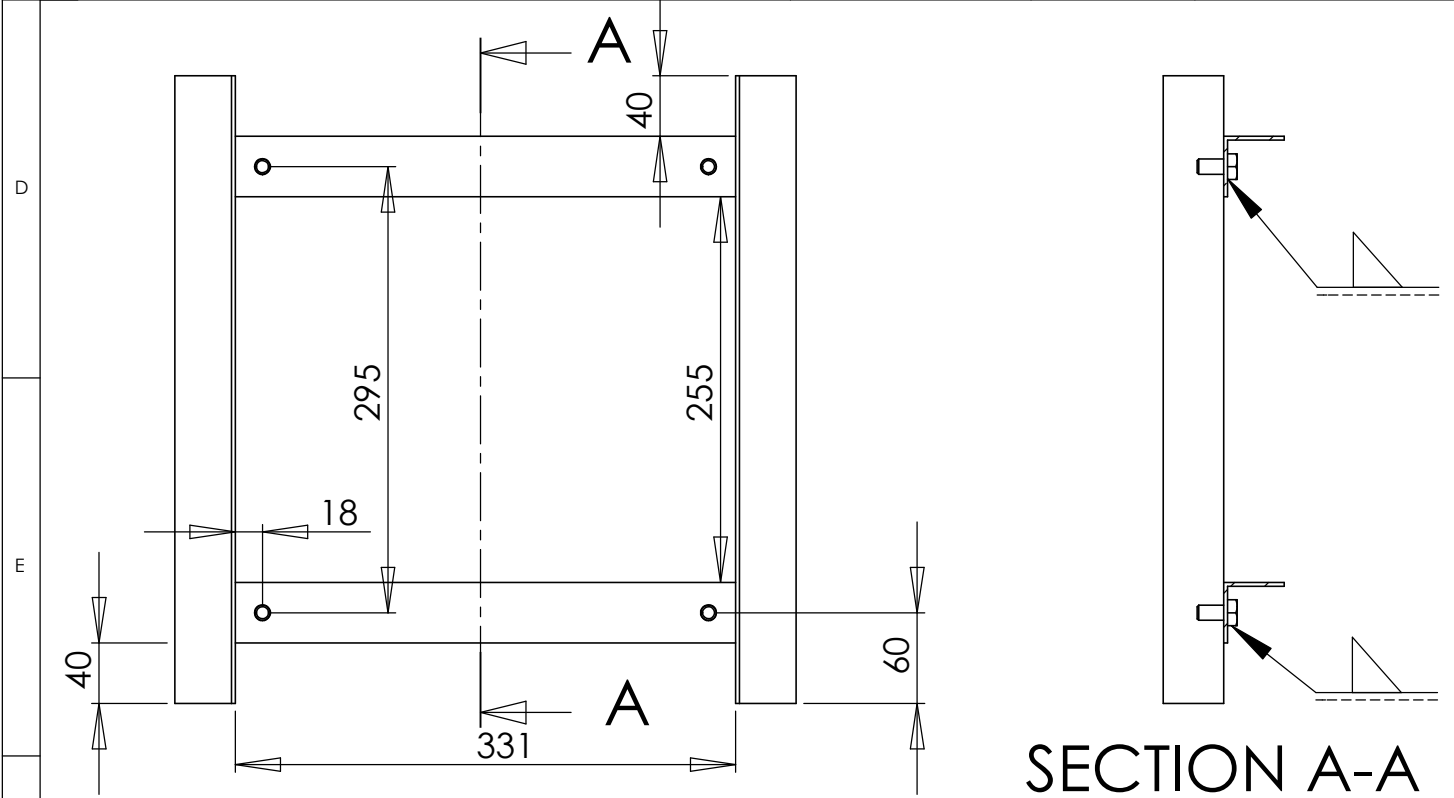


NO.	DESCRIPTION	QTY.
2221	Longitudinal support	2
2222	Lateral support	2
	bolt M10 x 20	4

Do not weld on the inside corners (near bolts)!

TITLE:	Base jig
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BASE MATERIAL:	Part specific	DWG NO.	2220	SCALE:	1:5
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SECTION A-A

F			BASE MATERIAL: Part specific			
	PRACTICA FOUNDATION		TITLE:			
	PROJECT: Rope pump - Jigs		DWG NO. 2220 SCALE: 1:5 FORMAT: A4 PAGE NO. 16			
DRAWN BY: Erik den Toom		DATE: 31-7-2011	VERSION: Practica model - v1.0			

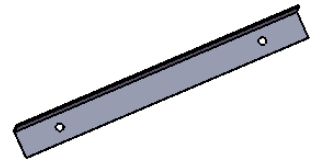
1

2

3

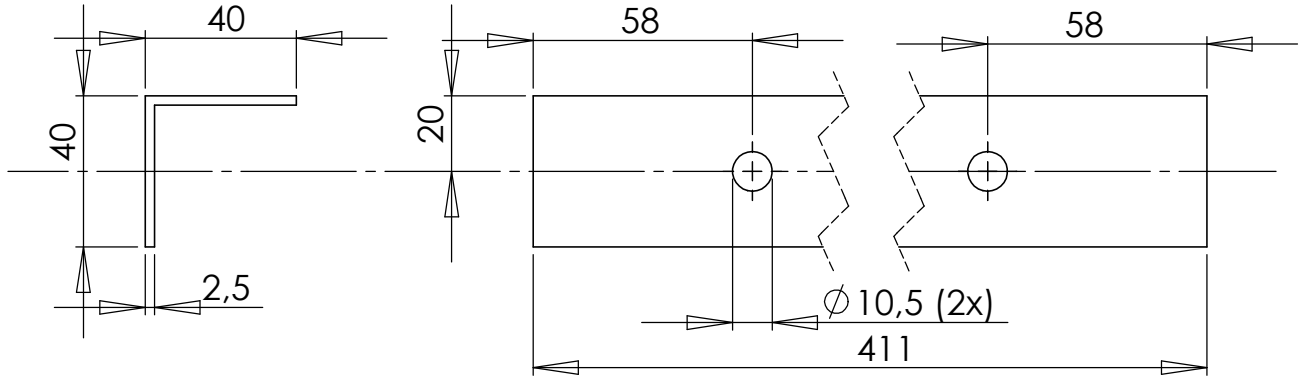
4

A



2x

B



C

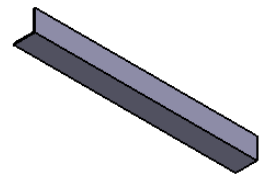
TITLE: **Longitudinal support**

BASE MATERIAL: **Fe36 angle iron 40 x 40 x 2,5 x 411**

DWG NO. **2221**

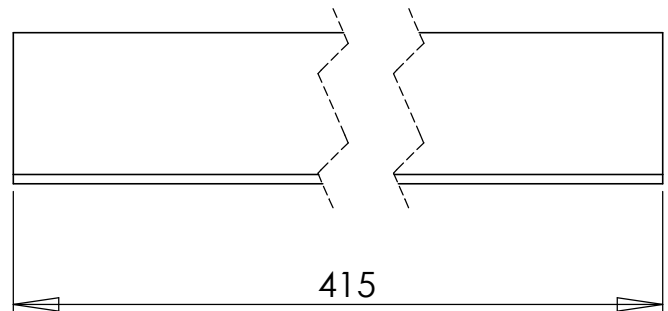
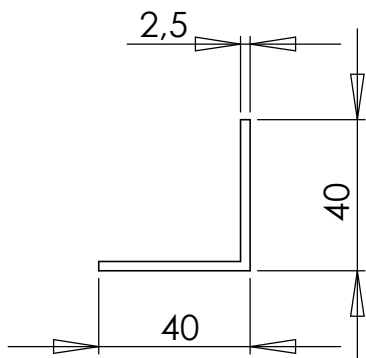
SCALE: **1:2**

D

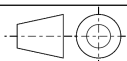


2x

E



F



PRACTICA
FOUNDATION

PROJECT:
Rope pump - Jigs

BASE MATERIAL: **Fe36 angle iron 40 x 40 x 2,5 x 415**

TITLE: **Lateral support**

DRAWN BY:
Erik den Toom

DATE:
15-7-2011

VERSION:
Practica model - v1.0

DWG NO. **2222**

SCALE: **1:2**

FORMAT: **A4**

PAGE NO. **17**