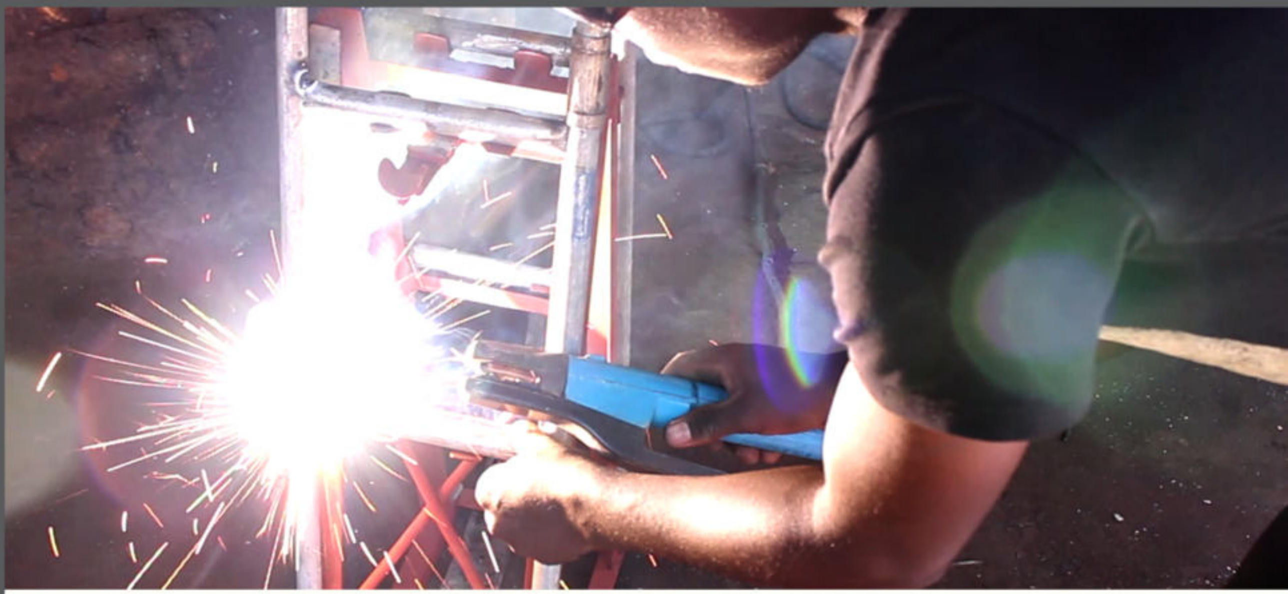
SMART Centres

Rope pump

Model 1



www.smartcentregroup.com

The SMART Centre Group

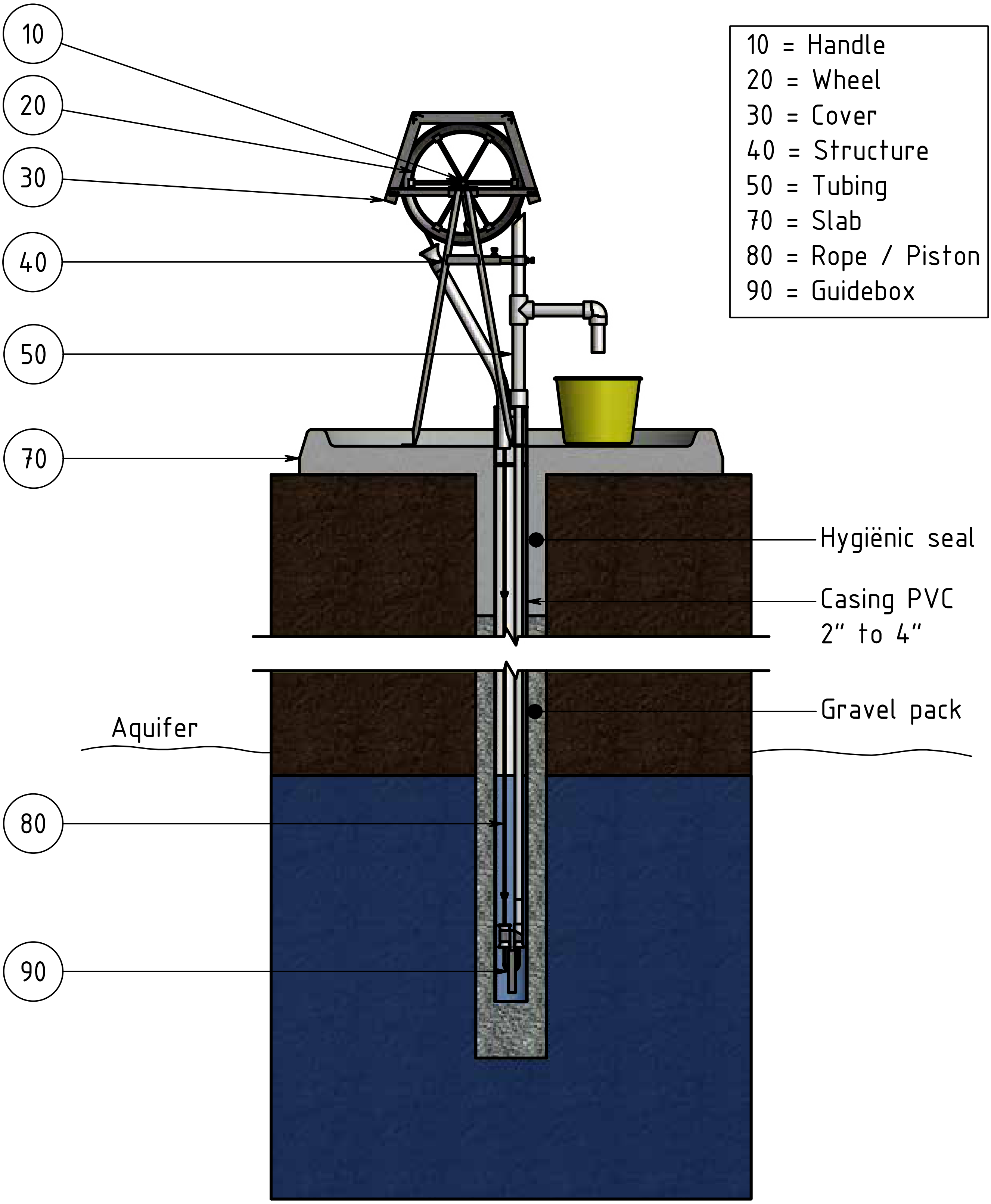
SHIPO Rope pump   Model 1

Background

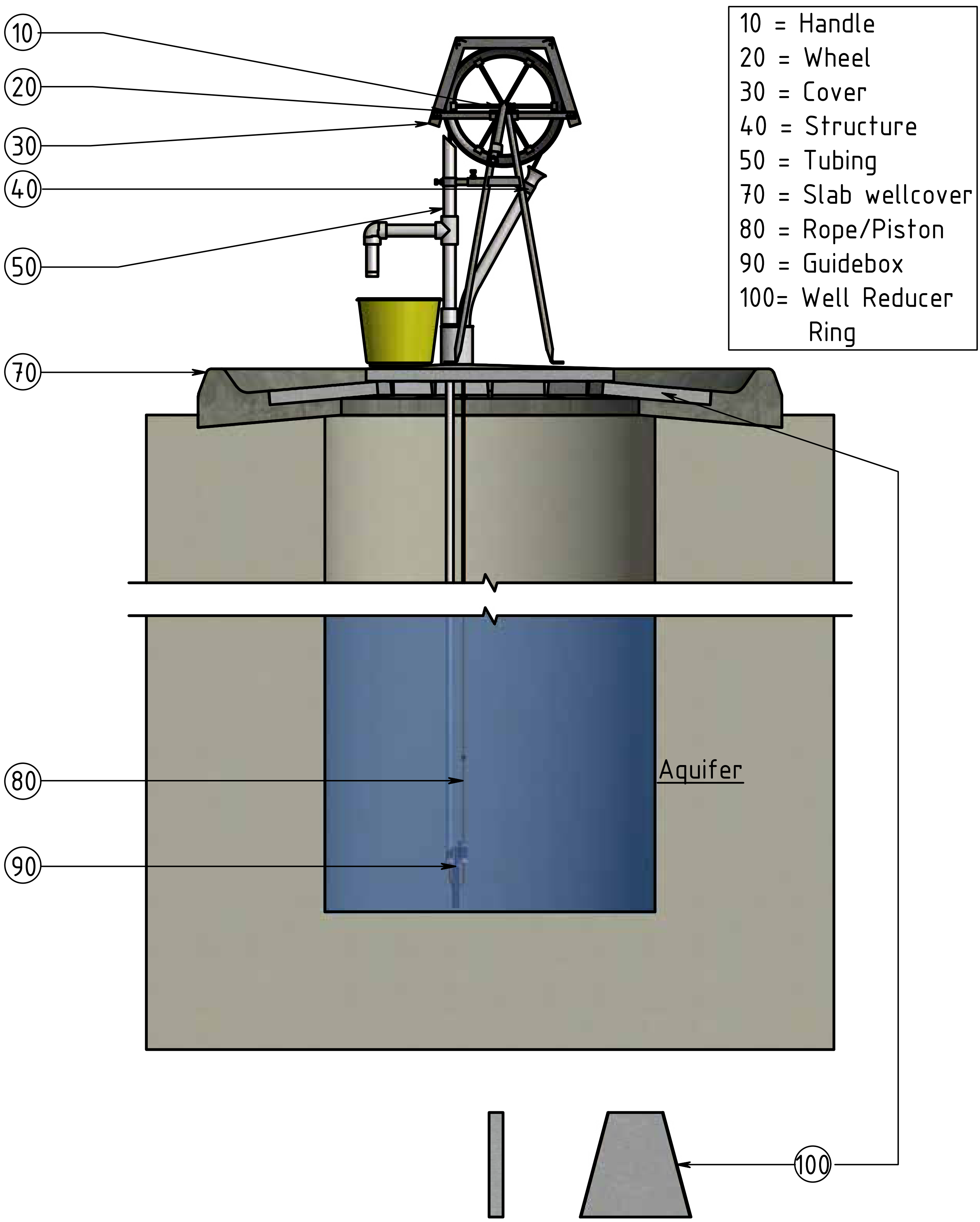
The Rope pump is an ancient technology that, with new materials and designs, now is a very effective and low cost pump option for water supply and irrigation that is used by families and small communities. It can be produced with locally available materials in local metal workshops. Compared to other low cost hand pumps, the Rope pump has a high pump capacity and can pump from wells of 1 to 35 meters deep. It can be produced in any country and is very simple to install (no black box). **If properly produced, installed and maintained**, over 90% of the pumps remain functional, even many years after installation. Because of these features, the Rope pump has a high potential for Self-supply. An example is Nicaragua, where over 70,000 Rope pumps were installed. Two reasons for its success in this country were (a) technical improvements that made the pump more effective and attractive and (b) the private sector that took interest in production and sales. The pump became a commercial product so there was a "profit based sustainability". In Nicaragua the shift from imported piston pumps to locally produced Rope pumps decreased the cost for rural water points by 60%. Close to 20% of the pumps are used for communal wells and 80% for Self-supply (domestic use, cattle watering, small scale irrigation). Due to these pumps, the total accumulated income at family level in the last twelve years was 100 Million US$. This is explained by the fact that families with a Rope pump earn an average 220 US$ more per year than families using a rope and a bucket. Using a Rope pump saves time, results in less health related cost (water is cleaner since it is not re-contaminated by the bucket) and can provide water for income generating activities such as livestock or garden irrigation.

The improved models of Rope pumps were introduced in 2004 in Africa based on the models from Nicaragua. Currently, there are an estimated 40.000 Rope pumps in Africa of which 20,000 in Ethiopia and 10.000 in Tanzania. Pump introduction in several countries were not successful due to both technical and introduction errors. Improvements have been made in the SHIPO SMART Centre in Tanzania and lateron in Malawi. The drawings and pictures in this document are based on experiences in Ethiopia, Tanzania and Malawi and promoted by SMART Centres in 5 countries. The group of SMART Centres is coordinated by MetaMeta.
Information in this manual maybe used with mentioning of the source. To guarantee a good quality it is strongly recommended to follow a production and installation training in one of the SMART Centres. See www.smartcentregroup.com

25-9-2016
Authors H. Holtslag, J. Mc. Gill, R. Haanen



Roughness:	Dimensional tolerance:	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1 : 20 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag	Creation Date: 21-6-2014 Approved Date: 26-6-2014
MÉTA META	Parts: Installed on a Borehole	Part number:	Sheet size: A4



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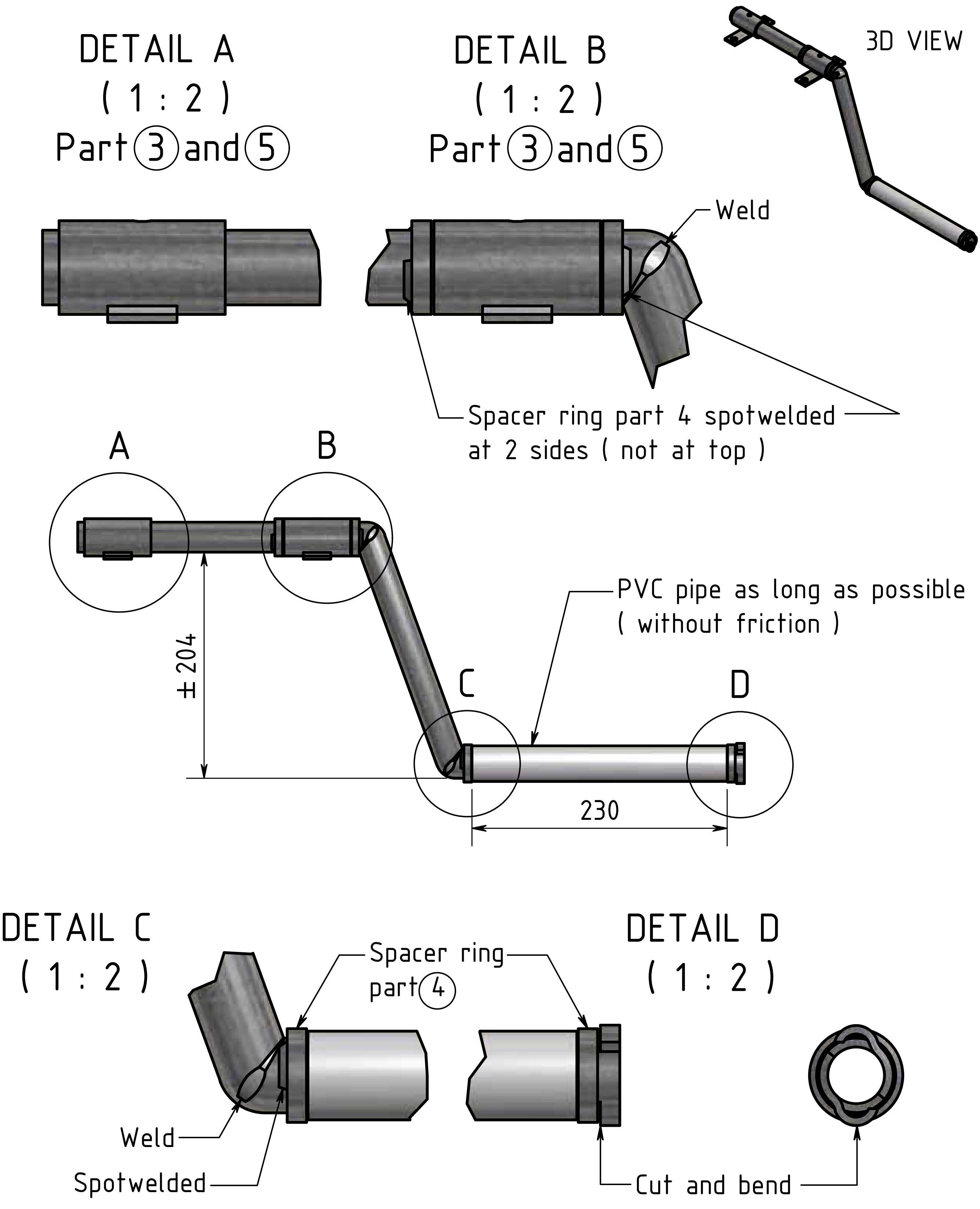
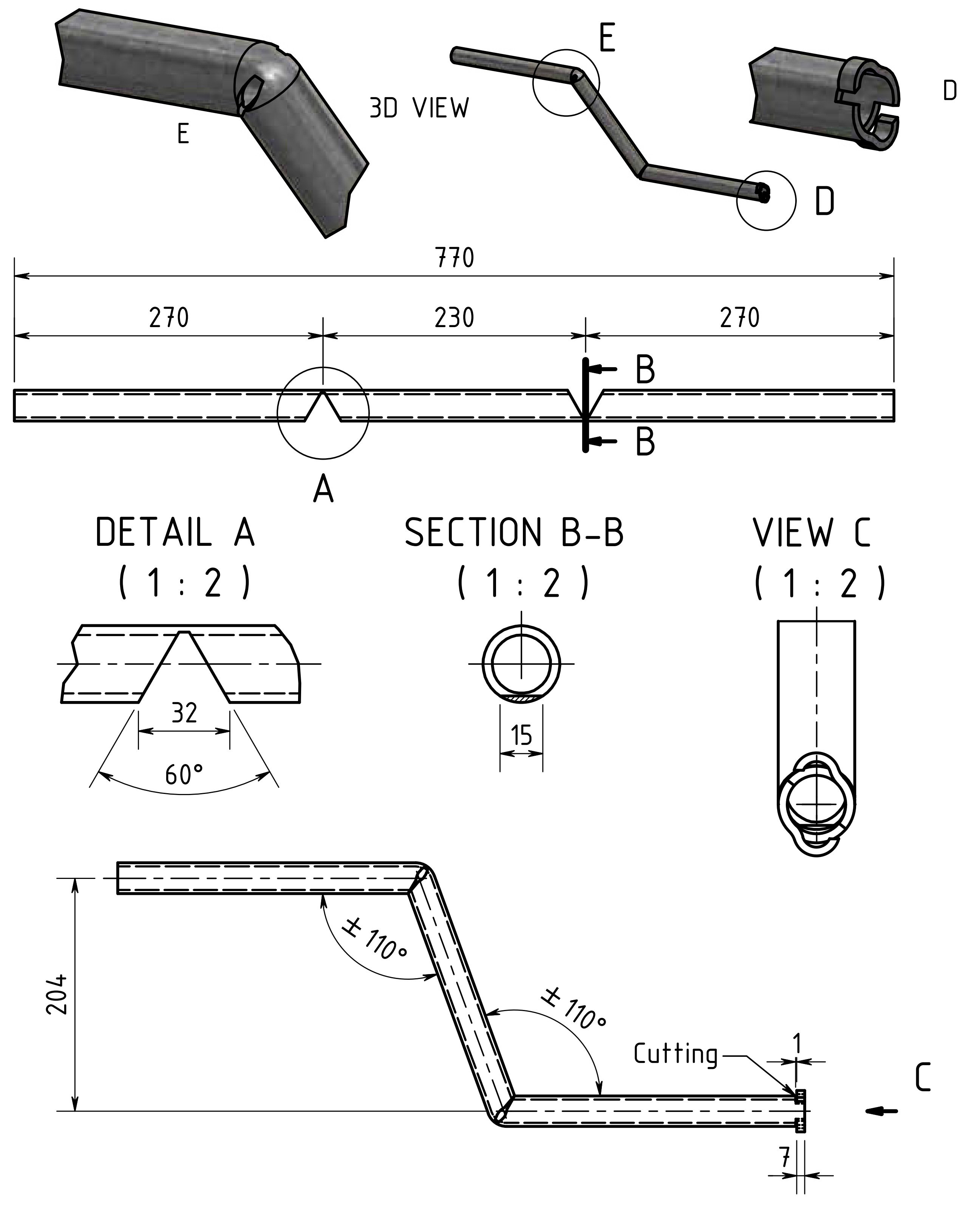
Projection:	Scale: 1 : 20 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag
		Creation Date: 21-6-2014 Approved Date: 26-6-2014
MÉTA META	Parts: Installed on a Dug Well	Part number:
		Sheet size: A4



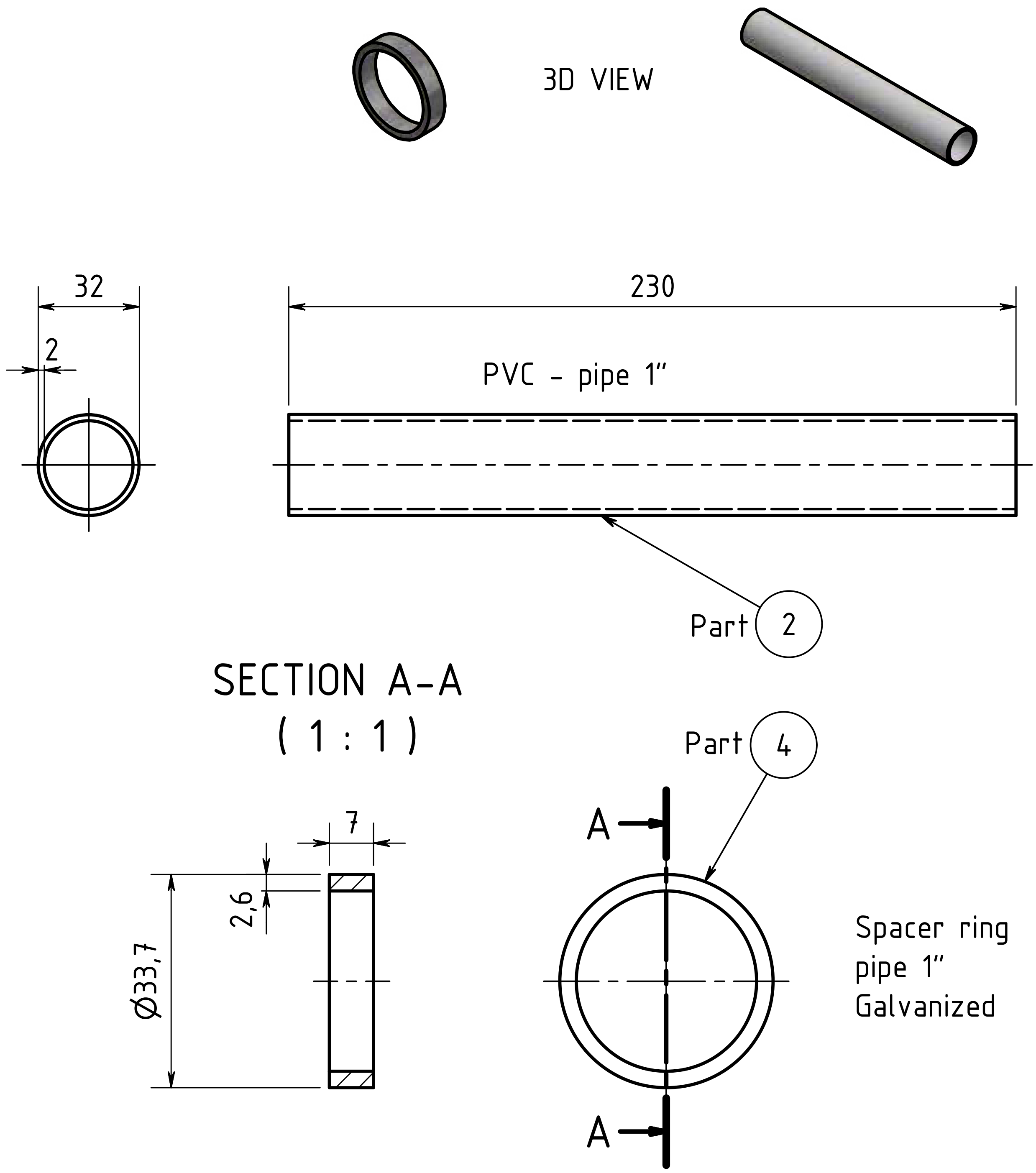
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1:2 1:5 / Unit : mm	Drawing by: AvdHeuvelSR / Approved by: H. Holtslag	Creation Date: 19-6-2014 / Approved Date: 26-6-2014
MÉTA META	Parts: Handle - Assembly	Part number: 10	Sheet size: A4



1	1	Pipe 27 x 2,6 mm Length 770 mm	S 235 JRH	Part 10-1	1,398 kg
ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS

PARTS LIST

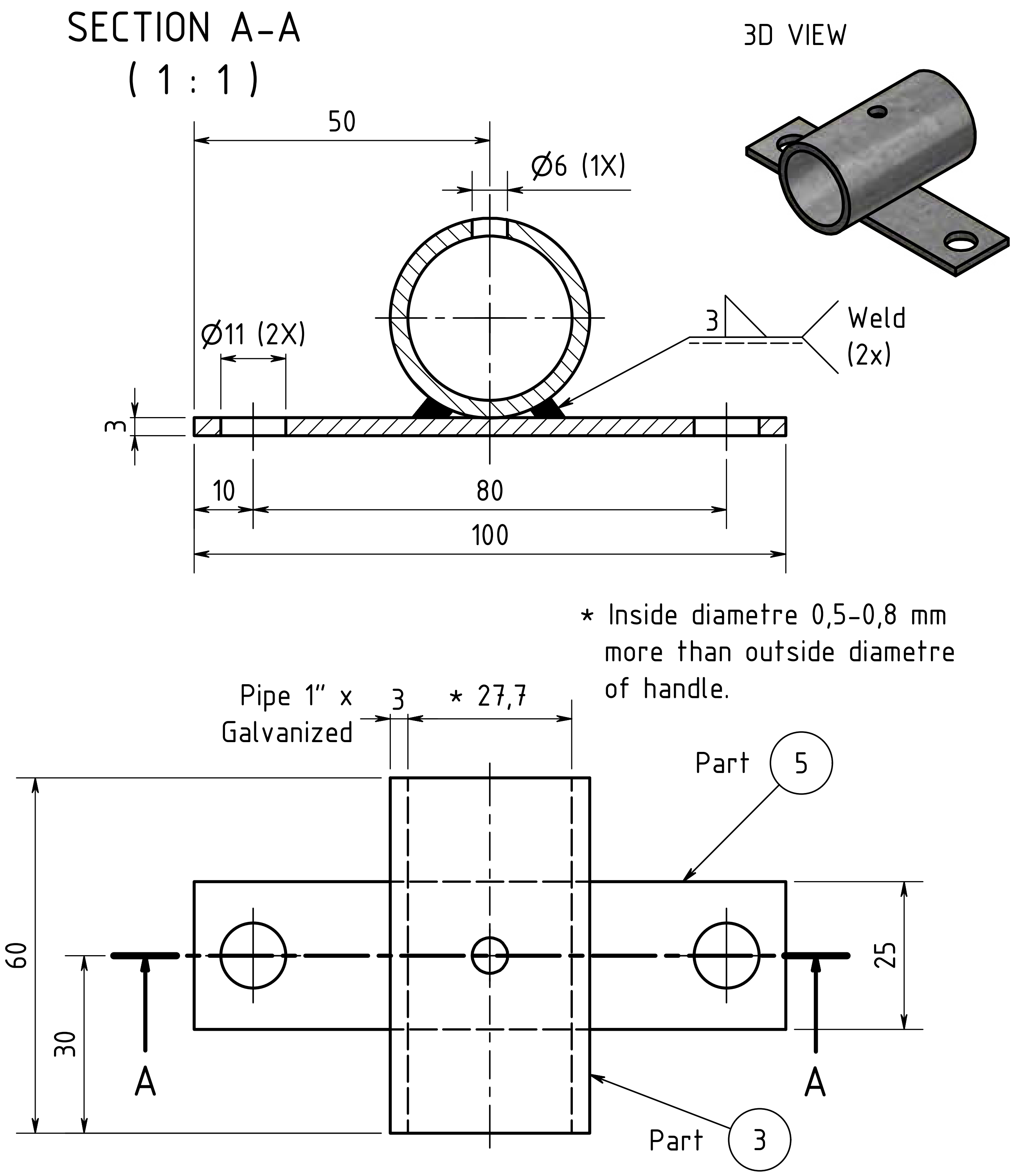
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1:2 1:5 / Unit : mm	Drawing by: AvdHeuvelSR / Approved by: H. Holtslag	Creation Date: 18-6-2014 / Approved Date: 26-6-2014
MÉTA META	Parts: Handle - Galvanized	Part number: 10-1	Sheet size: A4



ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS
4	4	Pipe 33,7 x 2,6 mm Length 7 mm	S 235 JRH	Part 4	
2	1	Pipe 32 x 2 mm Length 230 mm	PVC	Part 2	0,061 kg

PARTS LIST

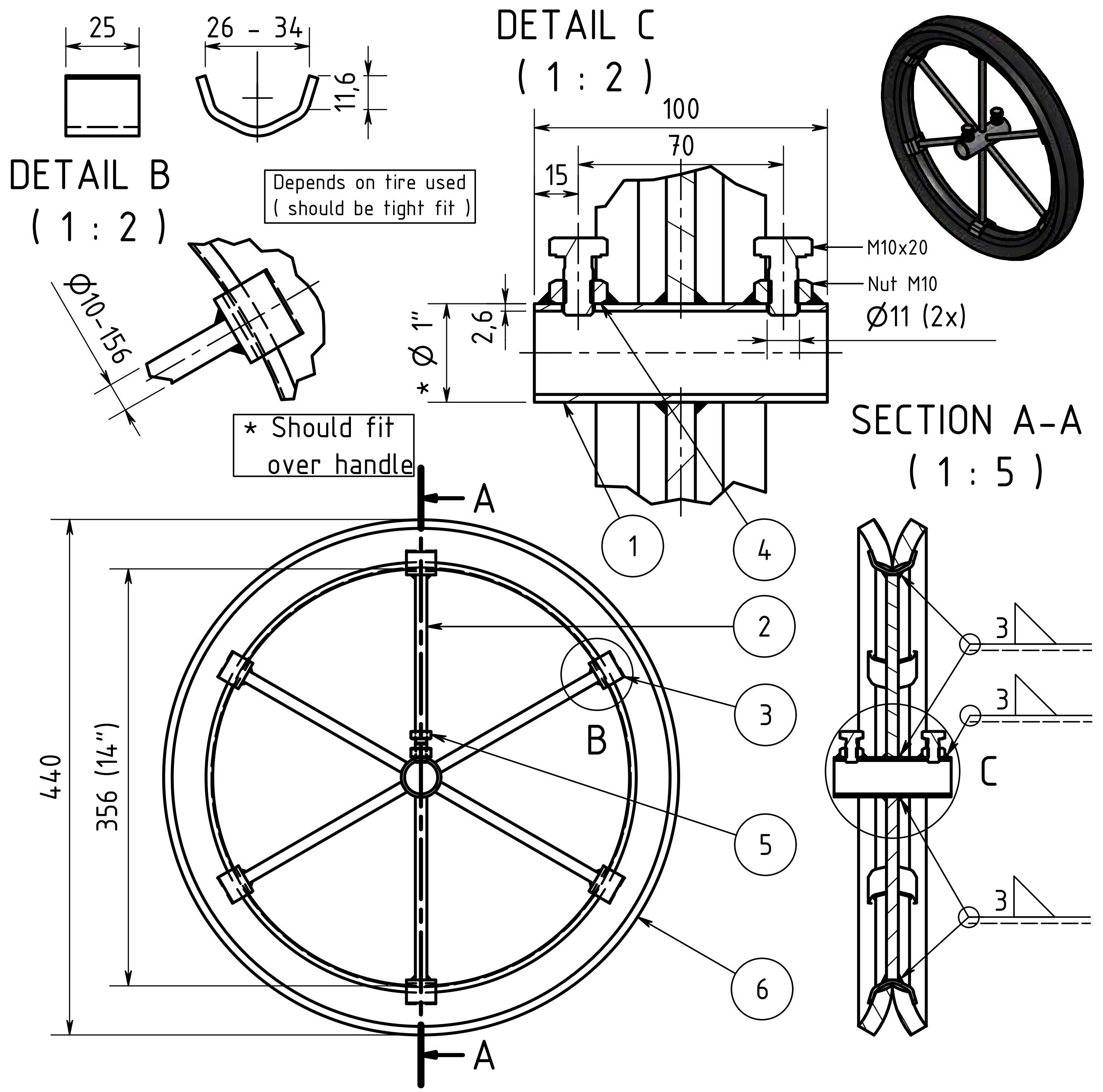
Roughness:	Dimensional tolerance:	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1:1 1:2	Drawing by: AvdHeuvelSR	Creation Date: 19-6-2014
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014
MÉTA META	Parts: Handle, PVC pipe and Spacer ring	Part number: 10-2 10-4	Sheet size: A4



3	2	Pipe 1" x 2,6 mm Length 60 mm	S 235 JRH Galv.	Part 3	0,136 kg
5	2	Flat bar 25 x 3 mm Length 100 mm	S 235 JR	Part 5	0,054 kg
ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS

PARTS LIST

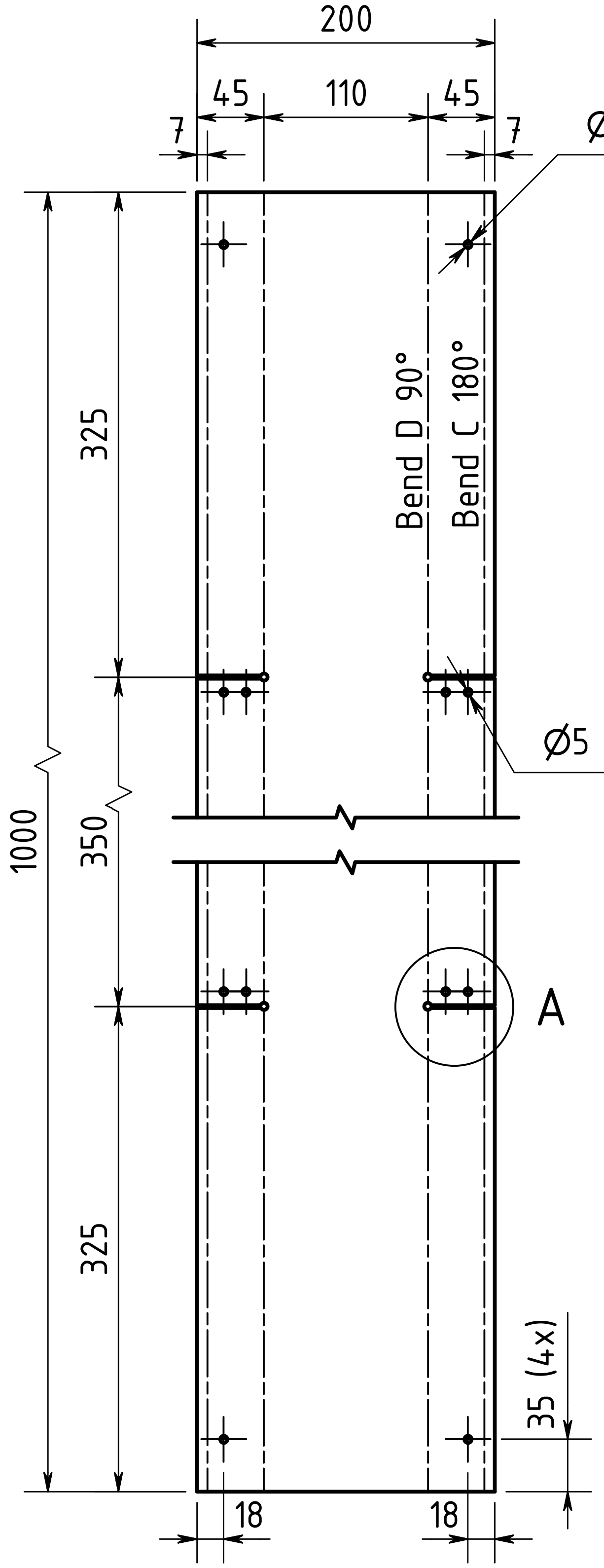
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1
Projection:	Scale: 1 : 1 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag
		Creation Date: 19-6-2014 Approved Date: 26-6-2014
MÉTA META	Parts: Bushing - Assembly	Part number: 10-3 10-5
		Sheet size: A4

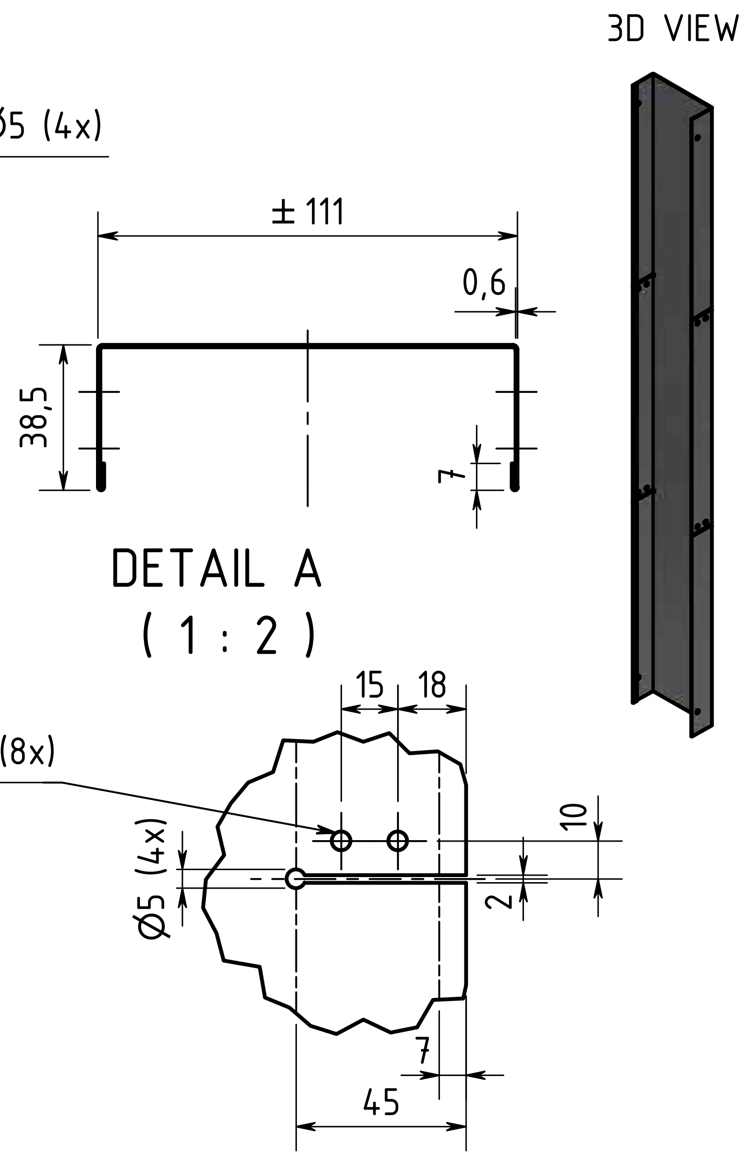


5	2	Bolt M10 x 20 mm	Steel 8.8 Galvanized	Part 5	0,024 kg
6	1	Wheel rim 14"	Car tire 14"	Part 6	1,320 kg
3	6	Flat bar 25x3mm Length 55/64mm	S 235 JR	Part 3	0,035 kg
2	6	Round 10 mm Length 156 mm	S 235 JR	Part 2	0,096 kg
4	2	Nut M10	Steel 8.8 Galvanized	Part 4	0,012 kg
1	1	Pipe 1" x 2,6 mm Length 100 mm	S 235 JRH Galv.	Part 1	0,195 kg
ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS

PARTS LIST

Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1
Projection:	Scale: 1:2 1:5 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag
Creation Date: 19-6-2014	Approved Date: 26-6-2014	
MÉTA META	Parts: Wheel - Assembly	Part number: 20-1 to 20-6
Sheet size: A4		





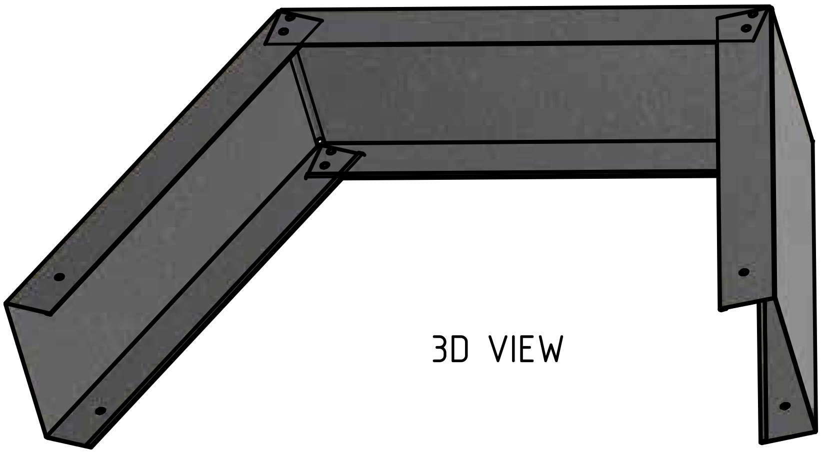
Production:

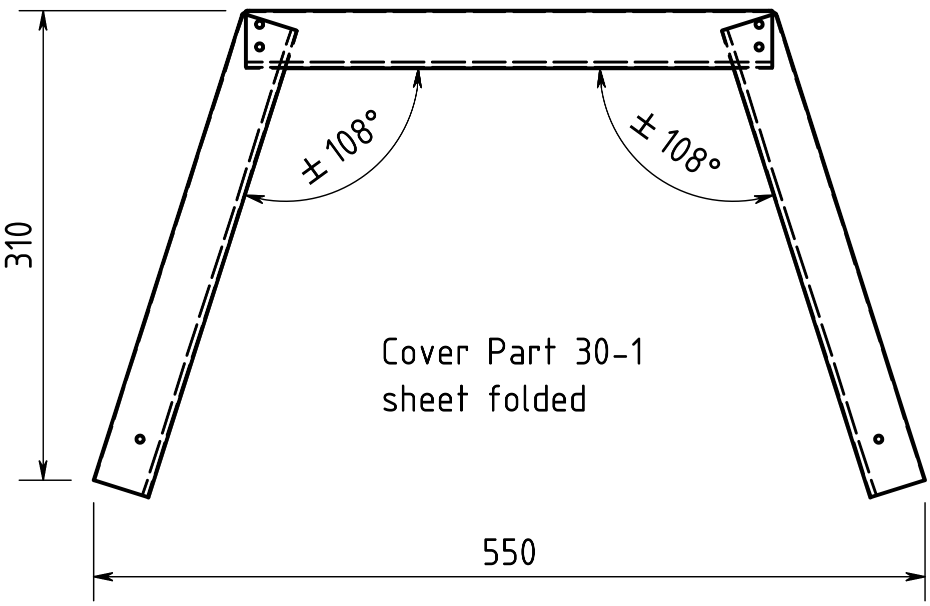
1) mark holes etc. using a jig
2) drill holes and cut at, detail A
3) bend at (C) 180°
4) bend at (D) 90°
5) mount in pump, drill additional holes
6) mounts rivets Ø5
7) case of bolt, use galvanized bolt M6x15mm

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS
1	1	Galvanized sheet 1000x200x0,6mm	Steel	Part 30-1	0,940 kg

PARTS LIST

Roughness:	Dimensional tolerance: ISO 2768-1-f /-2-H	Title/Name: ROPE PUMP Model 1
Projection:	Scale: 1:2 1:5 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag
Creation Date: 19-6-2014	Approved Date: 26-6-2014	
MÉTA META	Parts: Cover	Part number: 30-1
Sheet size: A4		



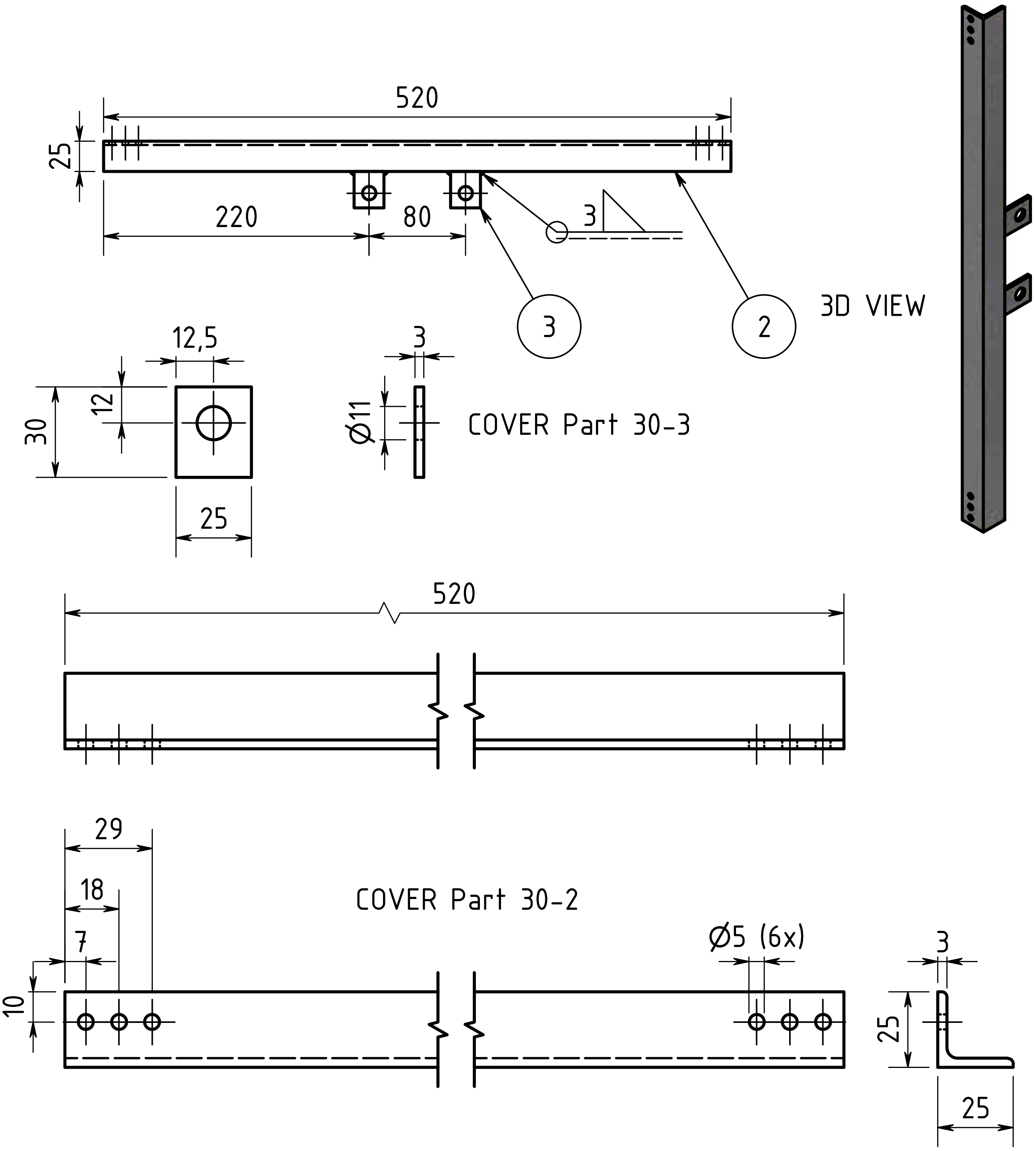


ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS
1	1	Galvanized sheet 1000x200x0,6mm	Steel	Part 30-1	0,922 kg

PARTS LIST

Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1
Projection:	Scale: 1 : 5 / Unit : mm	Drawing by: AvdHeuvelSR / Approved by: H. Holtslag
		Creation Date: 19-6-2014 / Approved Date: 26-6-2014

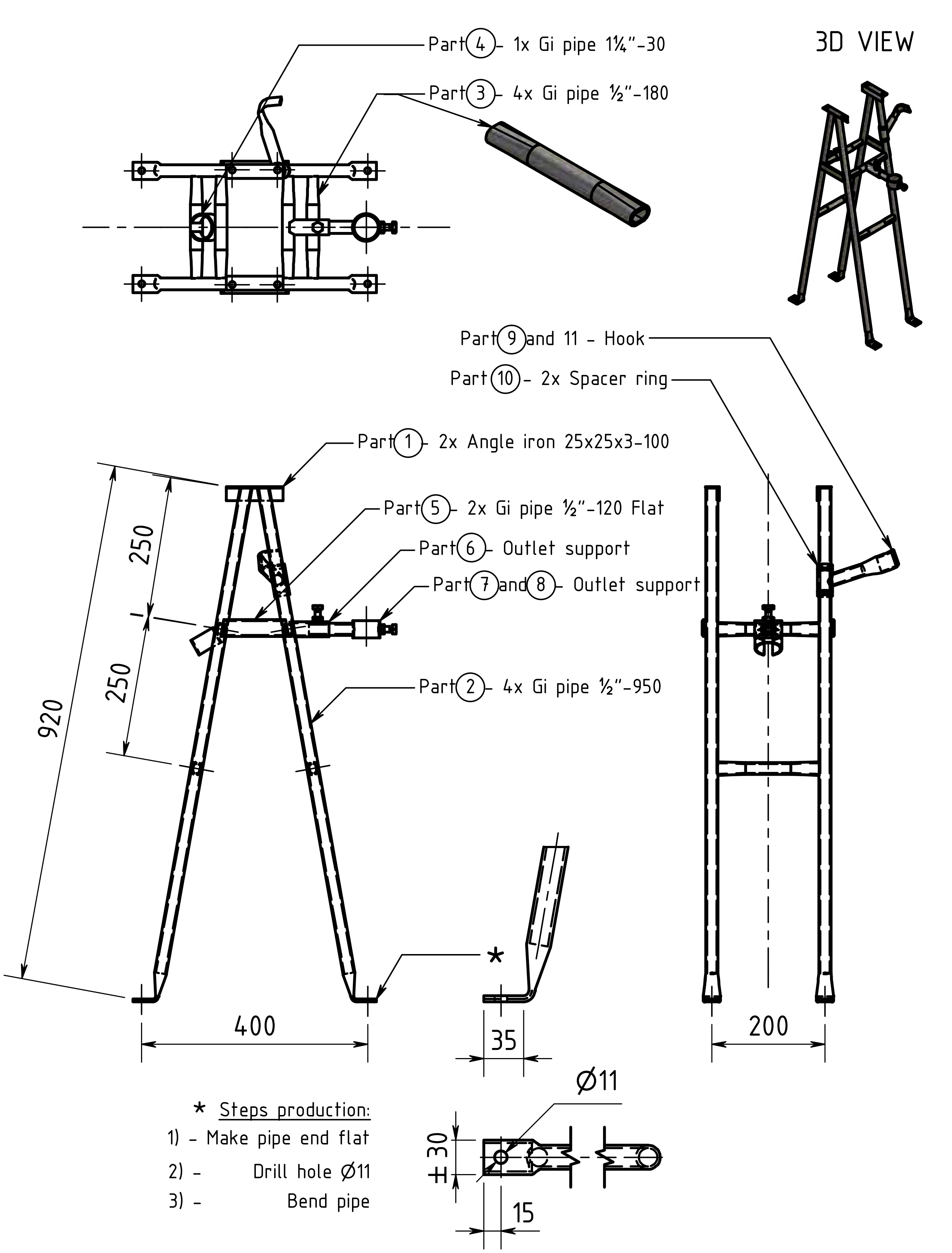
Parts: Cover	Part number: 30-1	Sheet size: A4



ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS
3	4	Flat bar 25 x 3 mm length 30 mm	S 235 JR	Part 30-3	0,015 kg
2	2	Angle profile 25 x 25 x 3 Length 520 mm	S 235 JRG 2	Part 30-2	0,579 kg

PARTS LIST

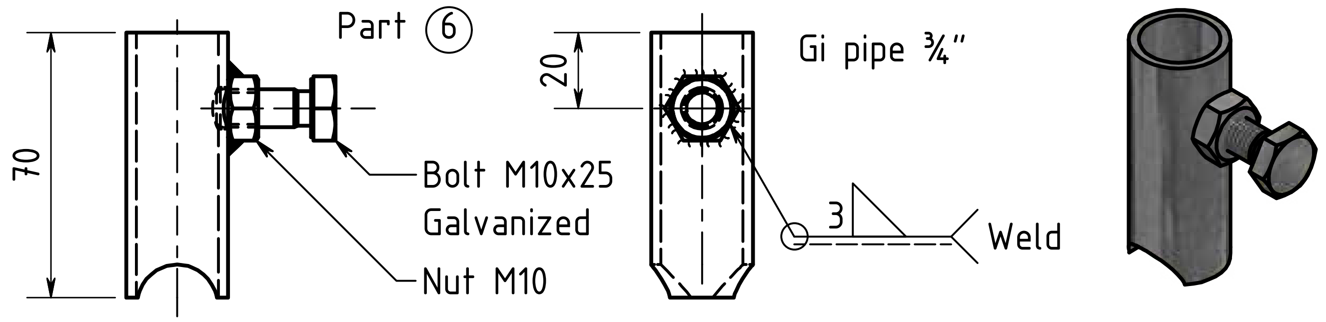
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1:2 1:5	Drawing by: AvdHeuvelSR	Creation Date: 19-6-2014
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014
MÉTA META	Parts: Cover support - Assembly	Part number: 30-2 30-3	Sheet size: A4

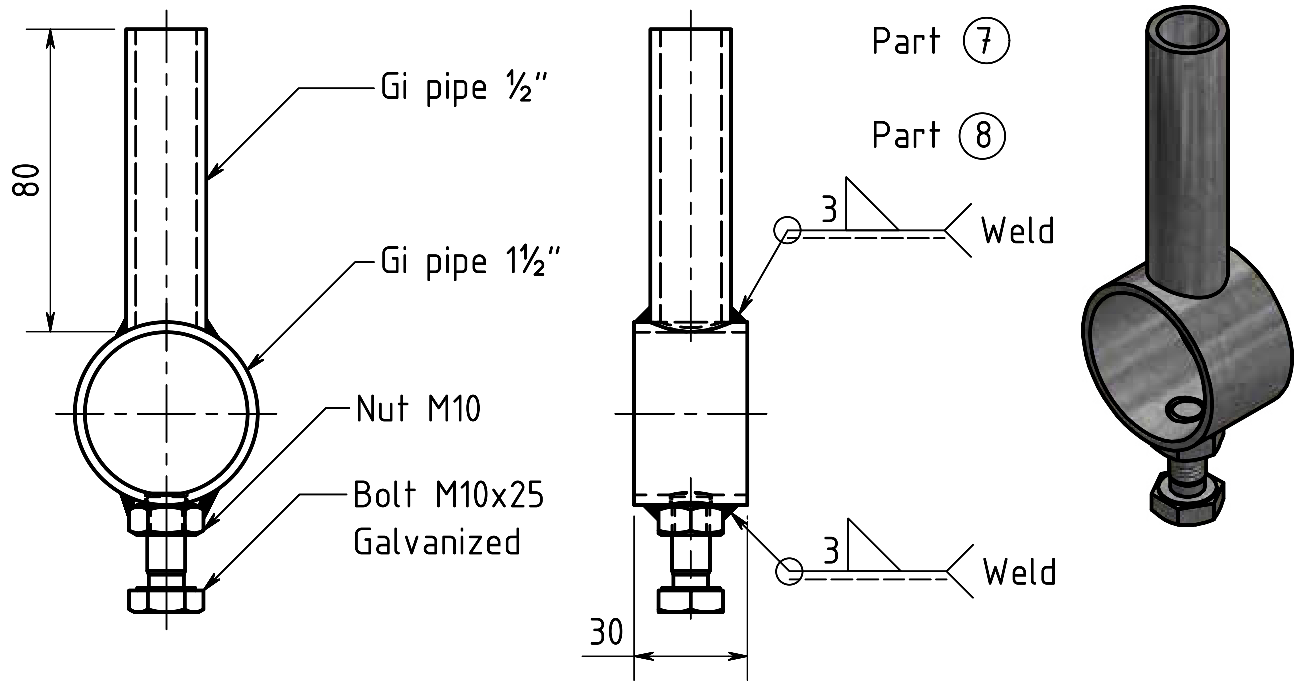


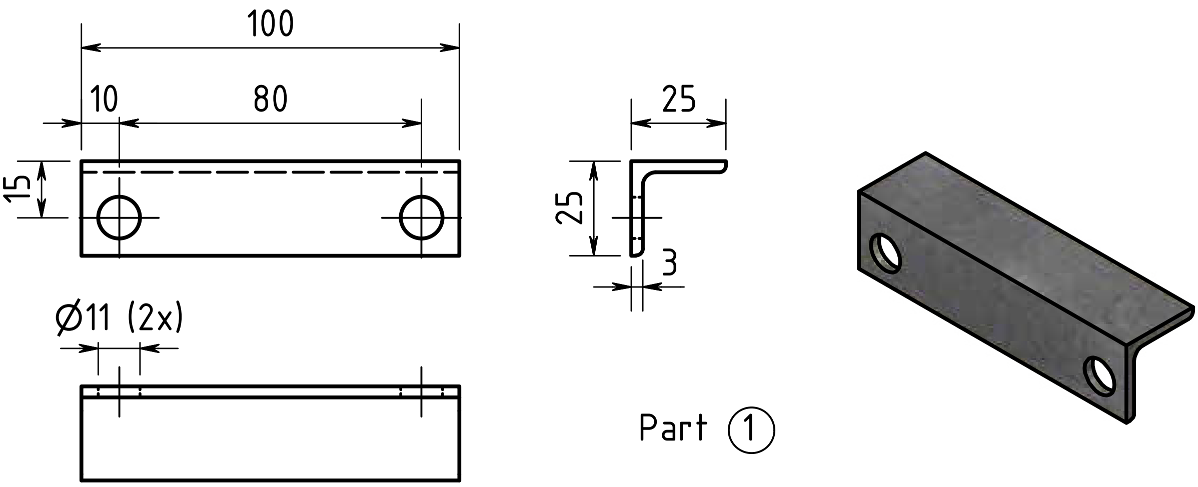
* Steps production:

1) - Make pipe end flat
2) - Drill hole Ø11
3) - Bend pipe

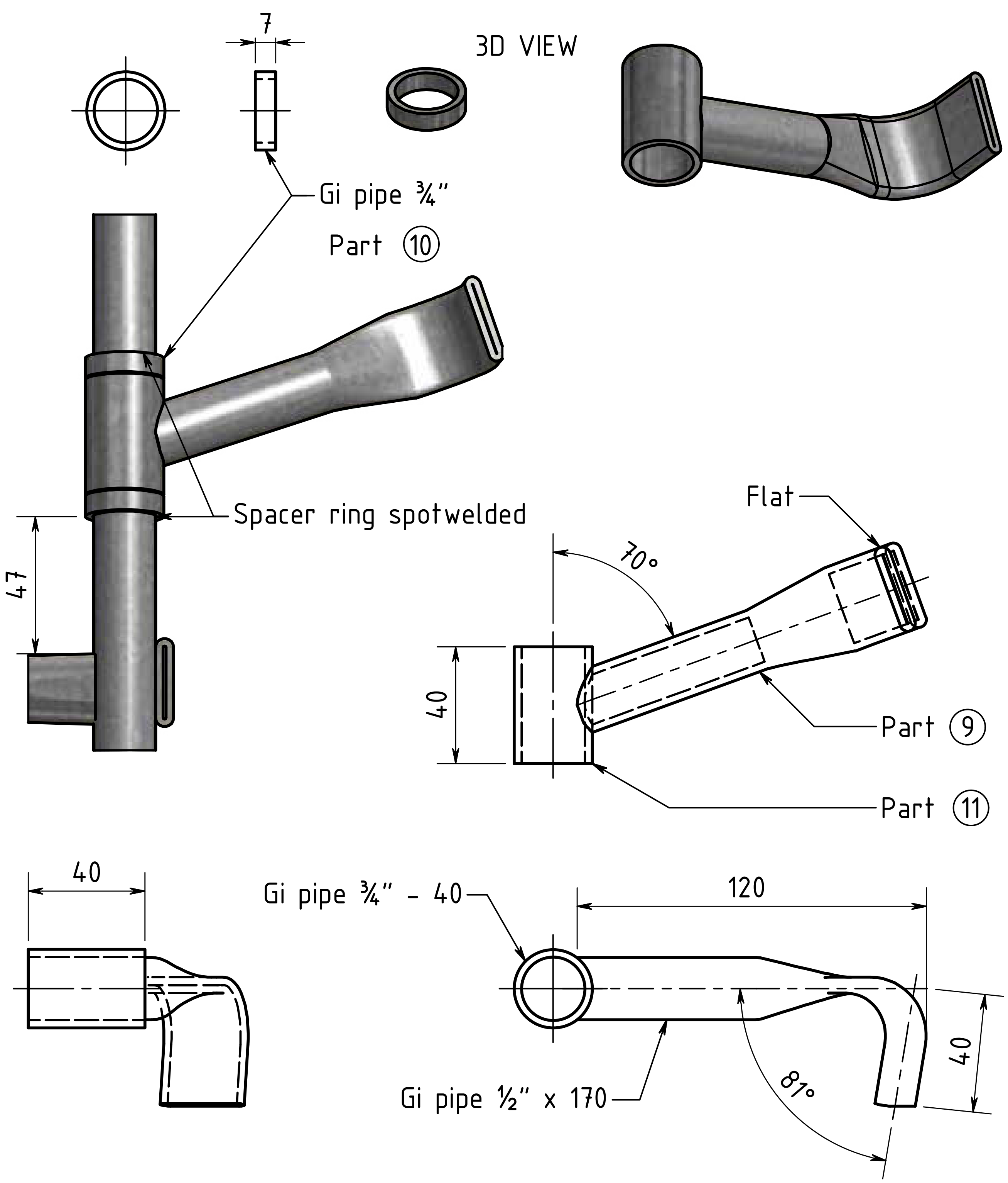
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1:5 1:10	Drawing by: AvdHeuvelSR	Creation Date: 20-6-2014
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014
MÉTA META	Parts: Structure - Assembly	Part number: 40	Sheet size: A4







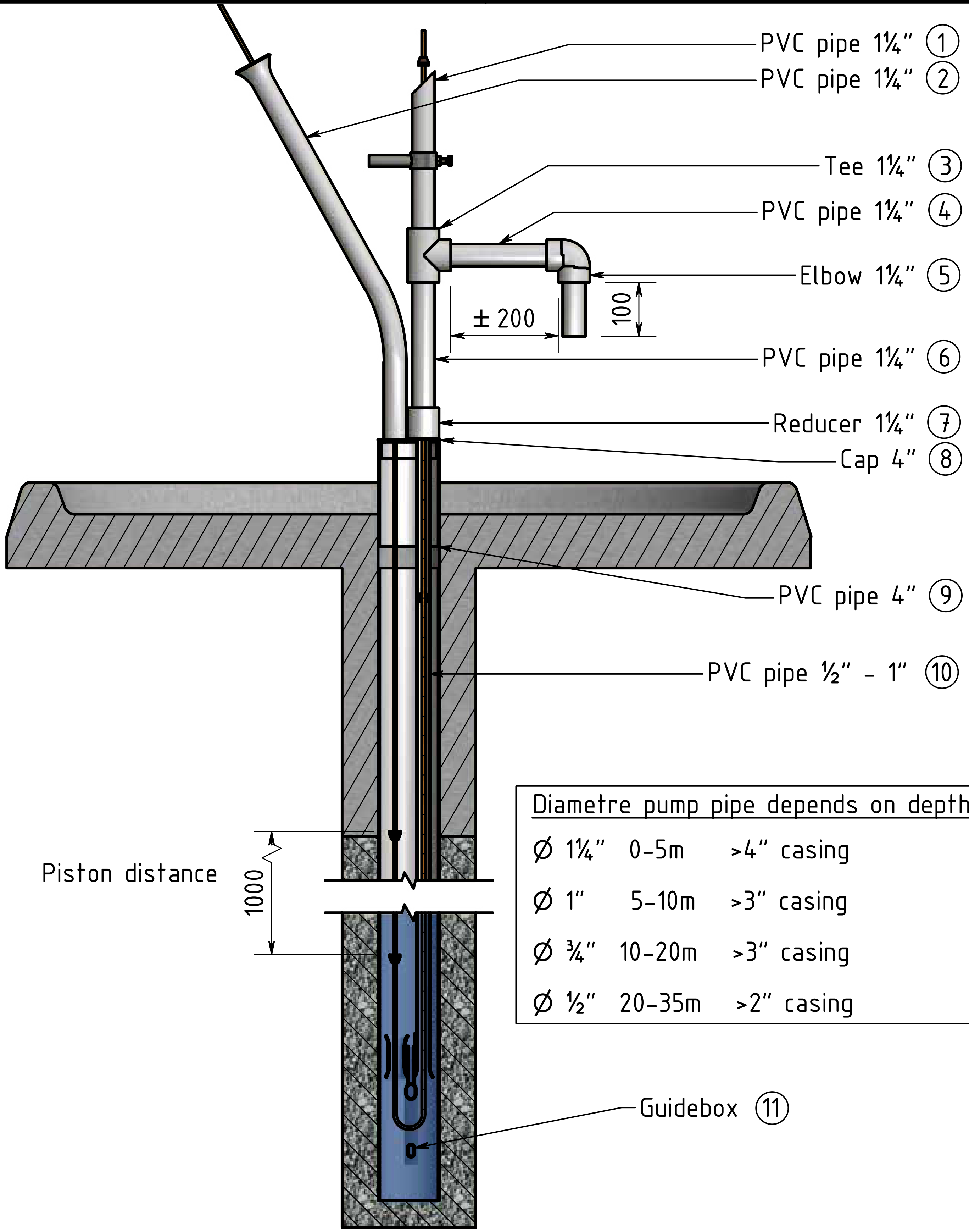
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP M0del 1	
Projection:	Scale: 1 : 2	Drawing by: AvdHeuvelSR	Creation Date: 20-6-2014
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014
META	Parts: Structure - Parts	Part number: 40 -1-6-7-8	Sheet size: A4



10	2	Pipe 26,9x2,6mm Length 7mm	S 235 JRH Galv.	Part 40-10	0,011 kg
9	1	Pipe 21,3x2,6mm Length 170mm	S 235 JRH Galv.	Part 40-9	0,206 kg
11	1	Pipe 26,9x2,6mm Length 40mm	S 235 JRH Galv.	Part 40-11	0,062 kg
ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER	MASS

PARTS LIST

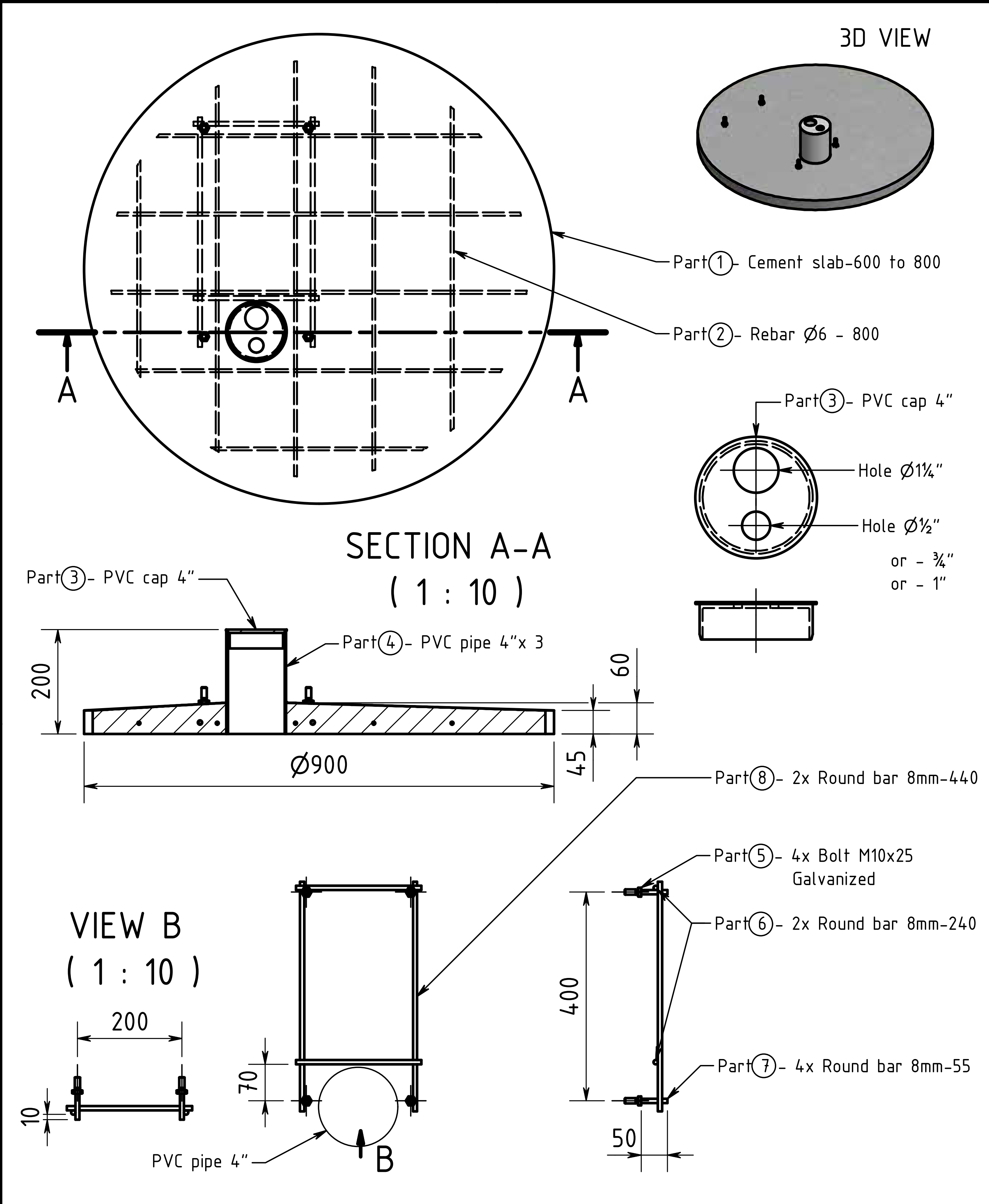
Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1	
Projection:	Scale: 1 : 2 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag	Creation Date: 20-6-2014 Approved Date: 26-6-2014
	Parts: Structure - Blocking system	Part number: 40 -9-10-11	Sheet size: A4



Diametre pump pipe depends on depth

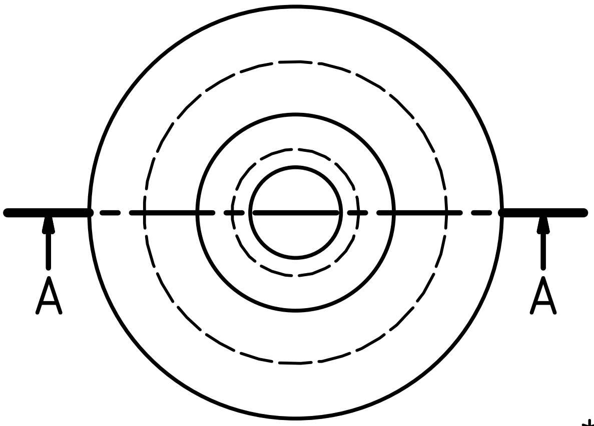
Ø 1¼"	0-5m	>4" casing
Ø 1"	5-10m	>3" casing
Ø ¾"	10-20m	>3" casing
Ø ½"	20-35m	>2" casing

Roughness:	Dimensional tolerance:	Title/Name: ROPE PUMP Model 1		
Projection:	Scale: 1 : 10	Drawing by: AvdHeuvelSR	Creation Date: 21-6-2014	
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014	
MÉTA META	Parts: Tubing - Assembly	Part number: 50	Sheet size: A4	



Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP Model 1+2		
Projection:	Scale: 1 : 10	Drawing by: AvdHeuvelSR	Creation Date: 21-6-2014	
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014	
MÉTA META	Parts: Slab / Wellcover - Assembly	Part number: 70-1 to 8	Sheet size: A4	

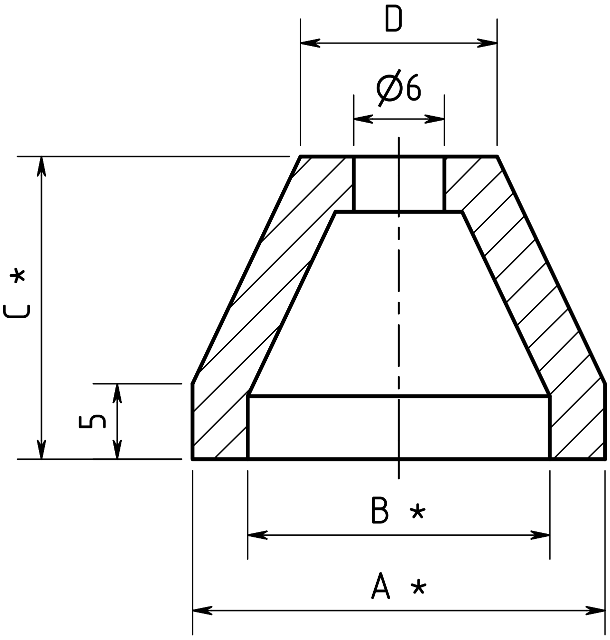
3D VIEW



* Size depends on pump pipe
diametre inside.

Pipe	A *	B **	C **	D
½″	15,3	11	13	11
¾″	20,3	13	15	12
1″	27,3	20	20	13

SECTION A-A
(2 : 1)



* Tolerance ± 0,2 ** Tolerance ± 0,5

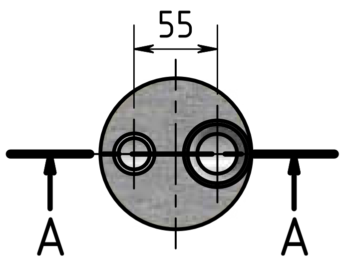
Based on pipes ½″ OD = 20 ID = 16
¾″ OD = 25 ID = 21
1″ OD = 32 ID = 28

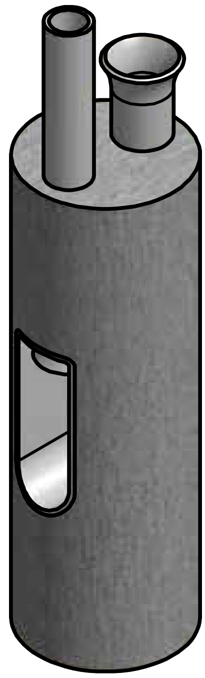
OD Outside diametre
ID Inside diametre

Roughness:	Dimensional tolerance: ISO 2768-1-f / -2-H	Title/Name: ROPE PUMP	
Projection:	Scale: 2 : 1	Drawing by: AvdHeuvelSR	Creation Date: 23-6-2014
	Unit : mm	Approved by: H. Holtslag	Approved Date: 26-6-2014
MÉTA META	Parts: Piston	Part number: 80	Sheet size: A4

* This guidebox is for ¾"
For pump pipes of 1"and ½"
pump pipe + return pipe
are different ½" - ¾"
1" - 1¼"

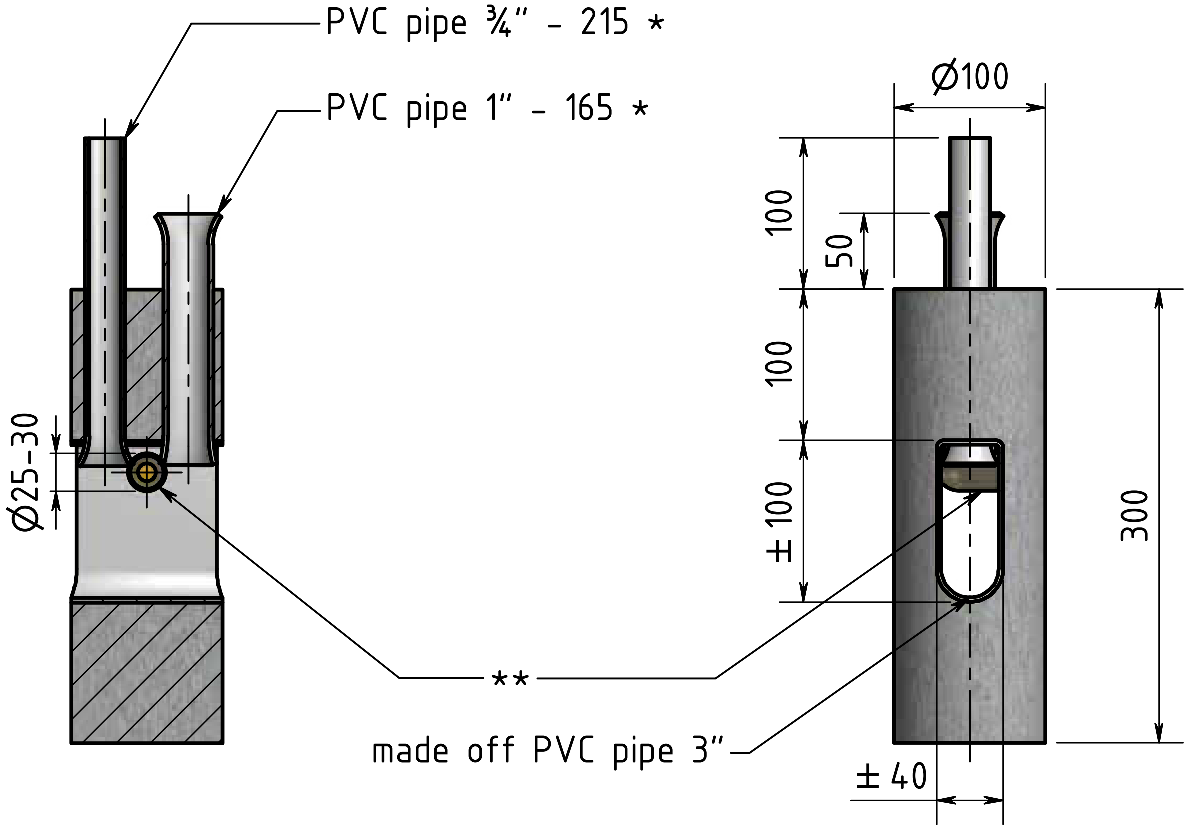
** Use small glass bottle
or Galv. pipe ¾"





3D VIEW

SECTION A-A
(1 : 5)



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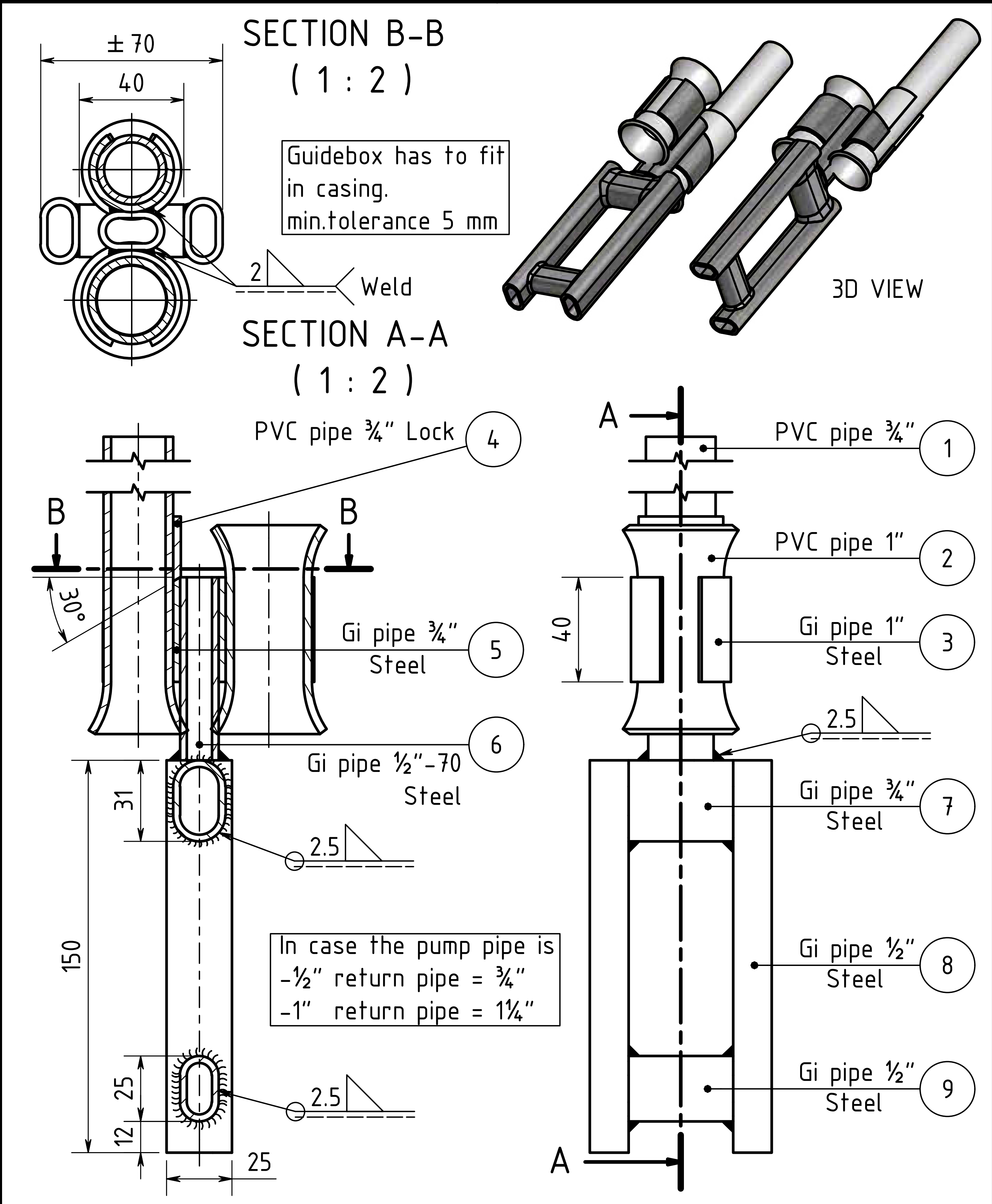
Projection:	Scale: 1 : 5 Unit : mm	Drawing by: AvdHeuvelSR Approved by: H. Holtslag	Creation Date: 25-6-2014 Approved Date: 26-6-2014
MÉTA META	Parts: Guidebox Cement ¾"	Part number: 90	Sheet size: A4



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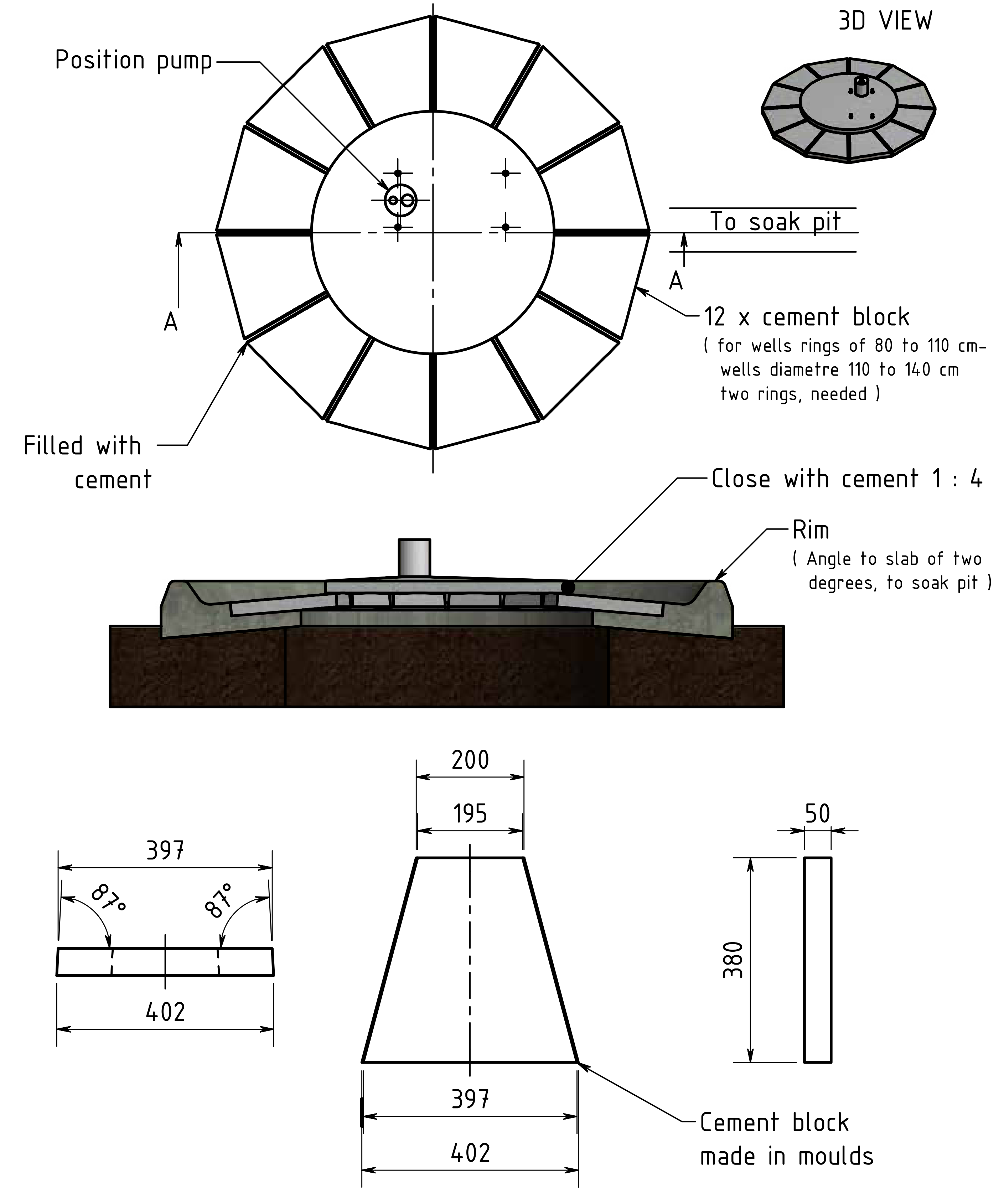
Projection:	Scale: 1 : 2 / Unit : mm	Drawing by: AvdHeuvelSR / Approved by: H. Holtslag	Creation Date: 17-6-2014 / Approved Date: 26-6-2014

MÉTA META	Parts: Guidebox - Assembly	Part number: 90-1 to 9	Sheet size: A4



Roughness:	Dimensional tolerance:	Title/Name: ROPE PUMP Model 1
Projection:	Scale: 1:10 1:20 / Unit : mm	Drawing by: AvdHeuvelSR / Approved by: H. Holtslag

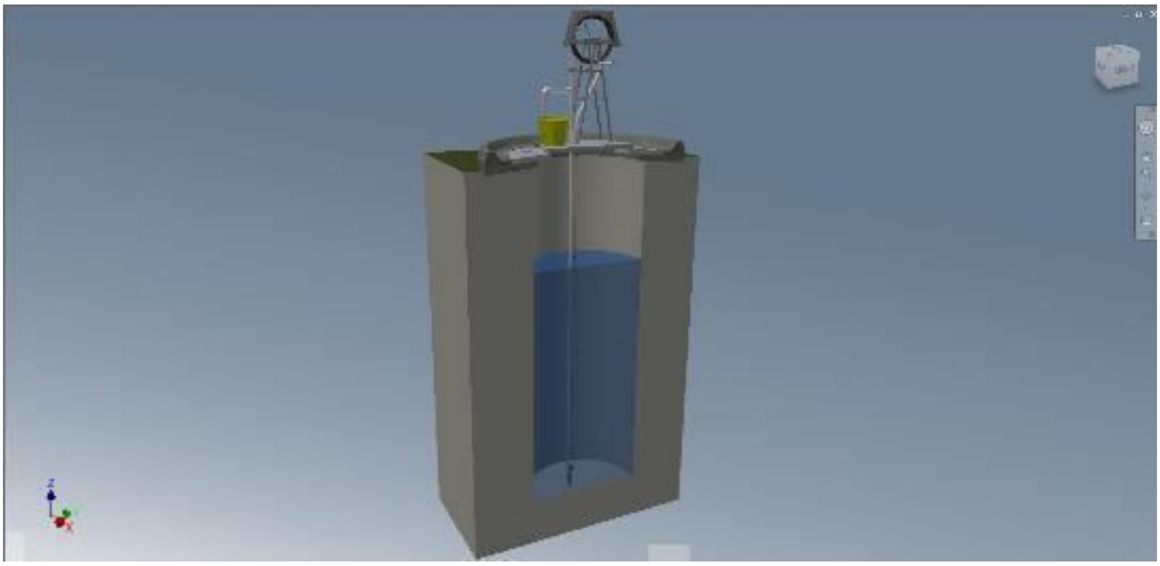
Creation Date: 20-6-2014
Approved Date: 26-6-2014

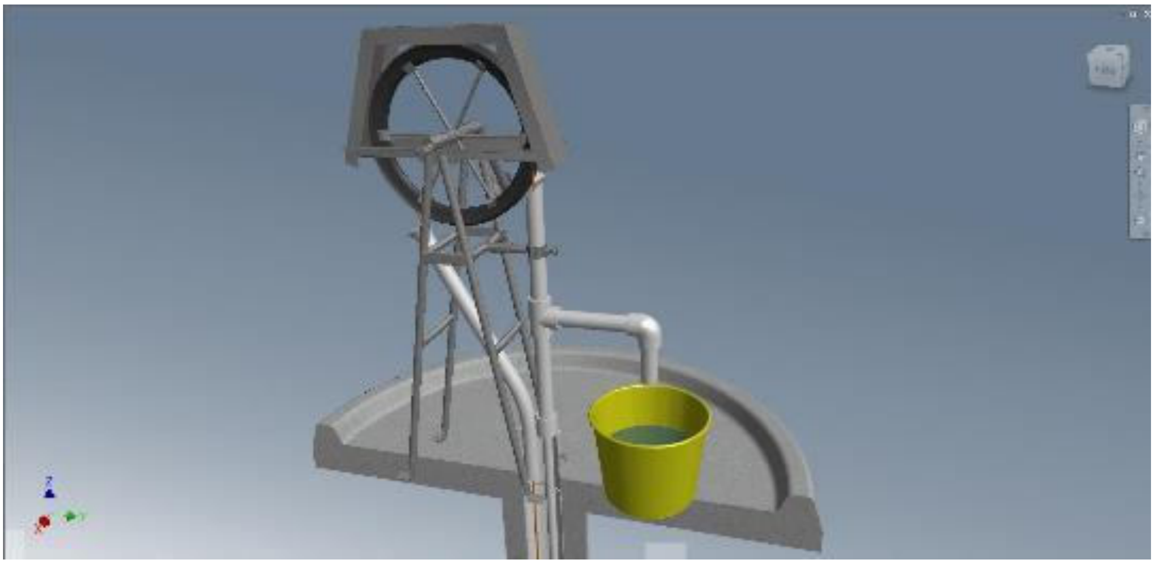
Parts: Well Reducer Ring

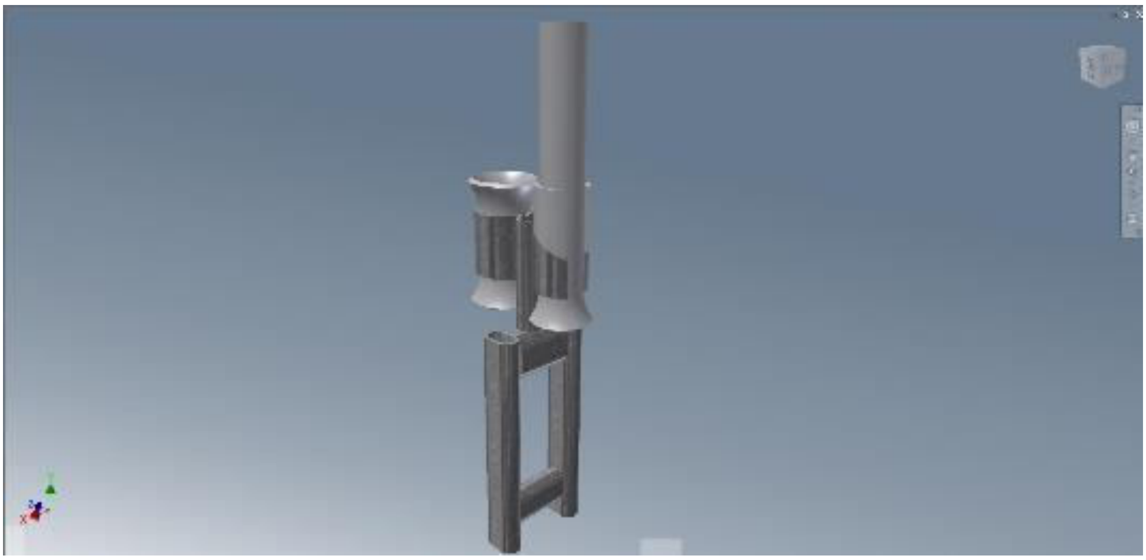
Part number: 100

Sheet size: A4

3 D Images of Rope Pump, Model 1







Recommendations on technical aspects

The recommendations are with objectives (a) to improve quality and durability of the Rope pumps and (b) reduce the cost of the Rope pumps to increase the potential uptake in the Self-supply market. Use one size prefabricated slab of 90cm and **well reducer rings** eventually with prefabricated tapered blocks. This will drastically improve quality of the well head, increase hygiene and combined with standardised slabs can reduce cost of installation.

No 10 Handle/ bushings

- Clearance between bushing and pipe of handle 0.5 to 0.8 mm. So difference between outside diameter of handle and inside diameter bushing maximum 0.8 mm. This is important for alignment and good lubrication. If the bushing has more clearance, the diameter should be reduced by cutting out a slot.
- Make the diameter of the oil hole 6 mm and put the oil hole on top. This makes oiling of bushings much easier for users. Eventual rain that enters in the oil hole is not a problem and even an advantage since rain will clean the bushings.

No 20 Wheel

- Make clamps long enough to be able to close them when rope starts slipping.
- Use only galvanized bolts. Also spokes can be made of ½”Galvanized pipe and the clamps of ¾”galvanized pipe, wall thickness 2.5 mm.

No 30 Wheel cover

- Use galvanized sheet, thickness of minimum 0.6 mm
- In case of 0.6 mm thickness, bend the rims to make the cover stronger. If sheet of 1 mm is used bending is not needed.
- Drill holes in part where the sheet is bend to avoid cracking of the sheet.
- The wheel cover supports can be made of Angle iron 25x25x3mm or Gi Pipes of ½”.
- For mounting the cover support use 3 pop rivets of round 5 mm.

No 40 Pump structure

- Make a narrow structure, dimensions of base 200 x 400 mm. This will reduce the cost of material and is less work since bending of the wheel cover support is not needed
- Use the system of bended legs; advantage more flexibility in the mounting of the pump in case the distance between the bolts in the well slab (well cover) are not 100% exact.
- Have the handle at the height of the belly button of the person pumping, so the height of the handle should be 80 to 90 cm. Make the legs of the new models 95 cm, so the height of the handle will be around 90 cm, (the leg at the low end is bent).

No 50 Tubing / PVC pipes and parts

- Pump pipes with the same in and outside diameter. Work on a supply chain of **standardized PVC pump pipes.**
- Proposed dimensions are mentioned in the table below (see also Annex 1). In general wall thickness of all pipes should be 2 mm.
- Pump outlet pipes of 1 ¼” so they fit in jerry cans.
- Make a smooth entrance on PVC pipes. Make so called trumpets on pipes in guide boxes and return pipe. To make this, a jig (Trumpet tool).

No 60 Cap / casing

- Make the caps and the 4 inch pipes in such a way that water cannot flow back into the wells.
- The holes in the cap for the pump pipe and return pipe should have a tight fit with the pipes.

No 70 Slab/ well cover

In field surveys it appeared that a major problem with the Rope pumps is low quality of well covers, pump installation so water leaking back in the wells.

- To improve this always make a well ring on which a slab can be mounted.
- It is suggested to use slabs with a diameter of 90 cm. to reduce risk of breakage, transport ease of removal by users. The logic of using a small, 90 cm slab is that it can be thin like 5 cm and still has the same strength than a slab of 120 cm which has to be 6 to 7 cm to make it strong enough. The small slab is much easier to transport less risk to break and it is also easier for families to remove in case of well cleaning.
- Use a well reducer ring made of bricks or prefabricated concrete blocks. This reduces the diameter of the top of the well (well ring) to 80 cm so with a slab of 90cm the well can be covered.
- The use of manholes is strongly discouraged because of water leaking back in the well. Manholes are often poorly constructed as was observed in field visits. In general experiences is that when there is a problem with the pump, people tend to go back to the rope and bucket and remain using the bucket which is “back to zero”.
- Use strong thickwalled (3 mm) 4 inch pipe. In case it is not available and the cheaper thinwalled 4 inch pipe is used, make it stronger by using a double piece of pipe. This will make the 4 inch pipe more resistant to damage.
- Bolts used to mount the pumps should be welded well to the reinforcement bar structure. Use galvanized bolts M10x 25 mm.

No 80 Rope /Pistons

- Pistons can be Rubber or HD PE injected
- Make the diameter of the pistons 0.5 - 0.8 mm smaller than the inside diameter of the pump pipe. With a larger diameter, the pump efficiency goes down. Smaller tolerances will result in friction especially in the smaller pumps pipes of ¾” and ½” since PVC pipes are not always exactly round and the same diameter.
- **It is strongly suggested to use standardized PVC pipes and standardized pistons.**

No 90 Guide box

- For smaller casings (2 and 3 Inch) guide boxes can be made of galvanized tube, do not use black steel pipes. See also drawings.
- Where possible use concrete guide boxes. The cost will be the same or lower than metal guide boxes, but will avoid corrosion in water with low PH. For deeper hand dug wells, the weight of the cement guide box will help to keep the pump pipe straight.
- The metal and concrete guide boxes should be 5 mm smaller than the inside diameter of the casing.

Well head / Apron

In some areas a problem in Rope pumps is the low quality of the well heads. Pumps are to low or too high (lack of a platform), well covers are not straight or broken. There is often no hygienic seal so with rains well rims are collapsing and water can flow into the well. It is essential to have good quality well heads**.** Suggestions are;

- **Install a well ring on top** of which the slab is mounted, this to avoid water leaking back in the wells. If this ring is at the same time a reducer ring, the diameter of the well cover can reduce.
- Use Bricks or tapered prefabricated blocks for the well reducer ring. This can become the activity of well diggers and/or local masons. Make the inside diameter of the well ring 80 cm plus / minus 5 cm which allows the diameter of the well cover to be 90 cm, which is still small and easy to transport.
- For wells of 90 - 110 cm use one well ring and reduce hole to 80 cm.

- For wells of 110 to 130 cm diameter use 2 rings of blocks.
- Install the well reducer ring a bit 'conical' and put a few wires around the ring. The conical shape will avoid water leaking back in the well and is stronger, more resistant against breaking than a flat rings.
- Put some basic reinforcement in the well blocks like 5 pieces of 40 cm black wire which will hardly increase the cost but will avoid braking of the blocks.
- Make an apron around the slab to seal the well and avoid leaking and a soak away to avoid at all times water pools near the well.
- At some pumps the soak away is used as a drinking place for cattle. It is strongly suggested to avoid this since the leak water from slab and apron is contaminating the well. To give water to cattle it is much better to make a separate drinking place.
- Promote / train well diggers to make wells with maximum diameter of 90 cm. Calculations indicate that, compared to wells of 120 cm , a 90cm well reduces 80% in volume of material to take out so reduction of labour. Also with the small diameter only one well ring is needed.

Pump models
Based on experiences, 3 pump models are recommended.

Model 1 (improved Rope pump model)
- The Model 1 is standard with bushings
- As an option it can be made with ball bearings. If ball bearings are used good quality and sealed bearings are needed. Also a grease pump should be included in the pump. Selling a pump without a grease pump will cause problems.
- An Allan key should also be provided as a requirement with the pump with ball bearing.
- In case of ball bearings, use 2 bolts to fix the handle to avoid it will get loose.
- The total additional costs for a model with ball bearings is estimated at 80US$.

Model 2 (economy model)
- This model is very basic without any bolts in the pump structure, no cover, a handle of ½" no return PVC pipe. It is completely made of Galvanized pipes so no or little corrosion
- As an additional parts a well cover and a return pipe can be sold.
- The total cost (material and labour) of Model 2 is some 30% lower than Model 1.

Model 3 (pole model)
- This Model is the most basic low cost Rope pump model mounted on poles.
- It consist of a handle with bushings and a wheel which is mounted with bolts on the handle. By placing the poles in an angle, the length of the handle is reduced.
- This model is some 30% cheaper than Model 2 with the advantage that it can be installed without a well cover. So if families do not have much money or do not want to take a loan , this can be a first step model. Lateron when they have more funds, a well cover can be installed or they can opt for a Model 2 pump.

Lower cost models
With new low cost pump models and improved quality of pumps and well head, Rope pumps have a large potential to scale up Self-supply.

		
Model 1 Ball bearings optional	Model 2 (economy model) Wheel cover Optional	Model 3 (Pole model)

Suggestions for minimum quality for Rope pumps

All models fit on both hand dug wells and boreholes. The pump model no. 1 is fit for small communities and all 3 models are fit for Self-supply in households. The recommendation on the minimum quality are summarized below.

Parts	Suggestions Model 1 (improved model)	Suggestions model 2 & 3 (economy & pole model)
Wheel cover		
-sheet cover	0,6 mm Galvanized sheet	Wheel cover is optional
-Sides	Bent rim if less than 1 mm	
-Mounting	Bolts M6 or pop rivets ∅ 5mm, 2 at each connection	
- Bolts cover to Support	M6 x 15 galvanized or M10	
-Cover Support	12mm rebar or 20x20x2 mm Angle iron or Gi pipe ½”	
Wheel		
- Diameter	14”	14”
-Number of spokes	6	4, with clamps in between
- Material of spokes	Rebar ∅10 mm or galv. Pipes	Rebar ∅10 mm or galv. Pipes
-Tire quality	Good quality, straight, soft rubber	Good quality, straight, soft rubber
- Bolts /Nuts	M10x25 Galvanized	Optional if uses bolts than M10x25 Galvanized
Handle		
Pipe	∅ ¾” Galvanized steel pipe. Wall thickness min. 2,2 mm	½” Galvanized steel pipe. Wall thickness min. 2 mm
Handle grip	1” PVC pipe, Wall thickness 2 mm	¾” PVC pipe, wall thickness 1.5 mm
Bushing	1”, wall thickness 2,5-3mm Galvanized steel pipe	¾”, wall thickness 2,2 – 2,5mm Galvanized steel pipe
Clearance	0,5- 0.8 mm	0,5-0,8 mm
Length bushing	60 mm	60 mm
Bushing strip	Strip 25x3 mm	NA

Diameter of the oil hole	∅ 6	∅6
Welding / Painting		
All welded parts	Clean weld slack, Paint with anti oxide +gloss paint	Clean weld slack, Paint with anti oxide +gloss paint
Pump structure		
-Pipes	½" Galvanized steel pipe Wall thickness 2 mm	½" Galvanized steel pipe. Wall thickness 1.6 mm
Bushing support	Angle iron 25x25x2 Angle iron	NA
Block system	Hook of Rebar or Gi pipe	NA or Gi Pipe
Outlet pipe and return pipe support	Make of ring of Gi pipe	NA or ring of Gi pipe
Name plate	Aluminium . Data incl. Producer, Tel No, Ser. No	Aluminium . Data incl. Producer, Tel No, Ser. No
Rope/ pistons	1m distance, 0,5-0.8 mm clearance	1m distance. 0,5-0.8 mm clearance
Pump PVC parts		
Pump Pipe diam	Outside diam. - Inside diam.	Outside diam - Inside diam
1 – 10m 1"	32mm- 28 mm	32mm- 28 mm
10- 20m ¾"	25mm- 21 mm	25mm- 21 mm
20- 35m ½"	20mm- 16 mm	20mm- 16 mm
Outlet pipe		
-Outlet pipe 1 1/4"	Outside diam - Inside diam 40mm- 36 mm	Outside diam - Inside diam 40mm- 36 mm
-Tee 1 1/4"	Good quality, tight fit with reducer	Good quality, tight fit with reducer
-Reducer 1 1/4" - 1"		
-Reducer 1 1/4" - ¾"		
-Reducer 1" - ½"		
- Elbow 1 1/4"		
- Return pipe	Poly Pipe or PVC pipe. 1 size bigger than pump pipe	Poly Pipe, PVC pipe. 1 size bigger than pump pipe
Well head. Cover, Apron, Soak pit		
Well cover	Diameter 90 cm Reinforced with rebar min dia 8mm distance 15 cm PVC pipe 4 Inch length 15 -20cm	Diameter 90 cm Reinforced with rebar dia 6 mm distance 15 cm PVC pipe 4 Inch length 15 -20cm
PVC Cap, cover	Round or Flat top Cap	Round top Cap
Top of casing above Ground level	20 cm	NA
Top of Casing to Apron	10cm	NA or 10 cm
Diameter apron	1 – 1.8m	1 - 1,8 m
Dist. apron to soak pit	3 -5m	3 -5m
Outlet Pump	Opposite soak pit	Opposite soak pit
Apron slope to soak pit	0-5cm	5 cm
Apron height	5-10 cm	5 – 10 cm

Recommendations on non technical aspects

Besides technical aspects, there are also a number of non technical aspect which are essential for a successful dissemination of Rope pumps like.

1. Make several models and prices so customers can choose
2. Rope pumps are simple but "Simple is not easy". For any producer it is essential to realise, **bad pumps = bad image = less sales;**
3. The dissemination of free pumps via NGOs and is distorting the development of a sustainable Supply chain;
4. Make examples (gold) models for each pump producer including a set of production jigs.
5. Improve the quality by certifying or approving the producers who make good quality.

6. Good quality is in the interest of governments and certification should be effected by a governmental body. Until there is such a body the SMART Centres can give and endorsement.

Operation/ Maintenance / repairs

1. Daily maintenance. Users need to adjust the rope and oil the bushings in time otherwise the result is poor pump functioning and worn out bushings. (In Nicaragua Rope pumps of 20 years old still have the original bushings because they are oiled every week);
2. Repeated training in maintenance maybe needed
3. Most important maintenance the rope (should not be too tight, not be too loose) and weekly oiling of bushings with new oil!!;
4. Promote the custom of maintenance by a slogan like "No oil - No pump"
5. A pump installation needs to include a (laminated) maintenance sheet and a 0.3 l bottle with new oil (10W 40). Do not use grease or used oil!;
6. In general users can not do repairs like adding a piece of PVC pipe, welding broken parts etc. In each area there should be technicians who can do this work on a commercial base;
7. Technicians can be of pump producing companies, pump installers or metal workshops who can do repairs as one of their activities.
8. **It should not be done by NGOs or local government, since this will prevent a sustainable commercial supply chain from building up!!**
9. NGOs and governments should rather invest their water funds in awareness training of the local private sector, quality control, building up supply chains, evaluation, and enabling funding options for instance micro credits, monitoring etc.

Training

1. In general many problems are caused by a lack of knowledge of both users and caretakers. Serious investment in long term and follow up training of production quality, installation, maintenance and repairs, organisation of maintenance, (ej Circuit riders) are recommended .
2. One option to guarantee knowledge and training in the long term, is a National WASH training centre where all knowledge is concentrated and which has the capacity for trainings. Then smaller training centres can start later on in the regions. Examples of such training centres are the so called SMART Centres in Tanzania and Malawi.

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Information on Rope pumps www.ropepumps.org

Different pumps

	
Model 1 Narrow structure, Ball bearings, Bend legs. Improved model	Model 1 Wide structure, Ball bearings, bottom reinforcement. JICA model
	
Model 1 Bushings, Bend legs. Pump pipe and return pipe via the 4 inch pipe. Improved model	Model 2 Economy model, Bottom structure
	
Model 2 Economy model, bend legs	Model 3 Mounted on poles

Photos Details Page 1

	
Problems with cover of sealed model	Corrosion of bolts, trumpet on return pipe poor quality
	
Heavy Guide box. New models use 60% less metal and are galvanised materials	Lack of oiling resulting in broken handles
	
To much clearance in bushing resulting in extra wear	Use of ball bearing but low quality. If ball bearing are used than sealed models with grease nipple

Page 2

	
Problems in Pump installation	Return pipe not sealed, PVC parts broken, Pipe end cap is cut and has large holes so water leaks back in well.
	
Lack of apron so water leaking back in well	Lack of soak pit so water around the well
	
Large diameter outlet pipe so pipe does not fit into the jerrycans. Suggestion to reduce diameter outlet pipe to 1 ¼”	Pump high since it is mounted on a parapet. In this case short base model should have been used or a platform should be installed.

page 3

	
Preparing well cover	Finished well cover
	
Aligning the outlet support	Producing well cover with M10 Galvanized bolts
	
Mounting of Rope pump Model 2. A frame, economy model. Instead of welding angle iron and rebar, legs are bend and have a hole so less material and less welding	Jigs and tools Incl. socket and trumpet tools, end caps, cement guide block.

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Making cement guideblock	
	
Making demonstration	Installing pole model pump
	
Making well ring reducer with bricks	Inside diameter is 80Cm

page 6

	
Using a mould to producing concrete blocks for a well ring	Special tapered blocks to make a well ring
	
Families/masons in Ethiopia trained in making blocs with moulds	Well reducer ring made of tapered blocks
	
Well cover with Manhole. Water can leak back in well since there is no rim around the hole.	The manhole makes the well cover weak. Like in this case there is a crack cracked in the corner so another source for leaking water in the well.

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The inlet of the return pipe is not good. It requires a nice smooth entrance, a so called trumpet which can be made with a trumpet tool.	Here the well cover is not sealed on the well rim.
	
The outlet pipe of 1 ¼ " it fits in jerrycans	Pump model 2 used for productive use. Here the pump is used for irrigation of a garden of 300 m2
	
Here a hose is connected to the outlet to transport water to the garden on the other side of the house	Here water is pumped for cattle. The cattle drink from a separate drinking bucket away from the pump.

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Pump with ball bearings. In this case also supply a grease pump	Lubrication of bushings. The oil hole should be on top
	
Wheel with 4 Spokes of GI pipe. Clamps in between are missing	Here clamps are installed but length is not good
	
Bad example of a Soakpit, The pit with stones was blocked and a new hole for cattle was made. This results in contaminated water.	Good example of a Soakpit, all water goes to the pit. The pit is filled with stones so no water is visible so not drinking of cows, no mosquitos etc.