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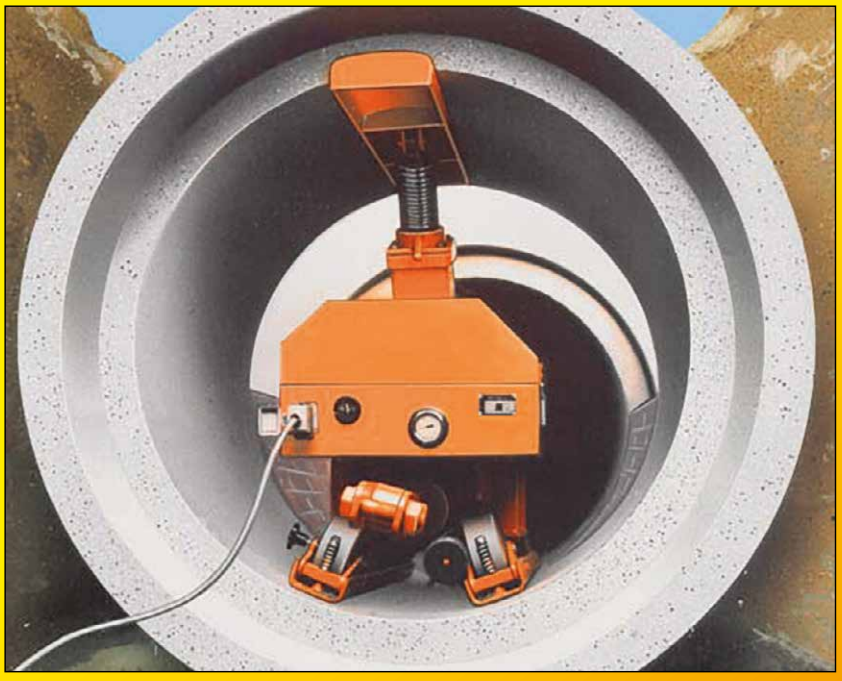

PIPE PULLER

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OPERATING MANUAL

03-2024

For use on the construction site.

Caution **Please refer to the operating instructions and safety regulations prior to operation!**

TABLE OF CONTENTS

1. Definitions

Danger stands for a dangerous situation. If it is not avoided, it will cause death or heaviest injuries.

Caution stands for a dangerous situation. If it is not avoided, it can cause light or minor injuries or material damages. It indicates incorrect use, too.

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2.1 Utilisation in line with Safety Regulations

- The Pipe Puller RZE must be used for pulling together reinforced concrete pipes only, according to DIN 4035 or similar to nom. width (800) 1.000 - nom. width 2.500, with an adaptor up to nom. width 3.000 mm.
- For pipes with a smooth inner surface, i.e. coated, a plastic covered centering component must be used. Do not use any other insert.
- Current Safety Regulations and the Regulations for the Prevention of Accidents must be respected.

Danger It is not allowed to

- pull pipes together which are made of non-reinforced concrete or any other material. **Safety hazard!**
- pull reinforced concrete pipes together where technical specifications do not comply with DIN 4035, i.e. resistance, inner surface thickness, or pull pipes together which are made of other materials,
- transport personnel: **safety hazard!**
- transport animals,
- break free, pull or drag loads.

2.2 Safety Guidelines

Although the Pipe Puller is technologically advanced in its construction, incorrect use may prove hazardous.

Caution The following must be respected:

- Initial training for staff should be provided by the manufacturer.
- Authorised personnel are only allowed to permit operators to use the equipment who have been fully trained in this respect.
- Only original spare parts may be used (pipe puller, pulling bar, polyester sling).
- Each operator must read the Operating Instructions and the Safety Instructions prior to operation of the equipment.
- Always work with safety in mind and avoid taking risks.
- Report damage and defects of the pipe puller to the relevant person immediately. Do not use the equipment until the damage has been repaired.
- Do not remove the model plate from the pipe puller. Replace illegible or damaged plates regulations.
- The individual protective gear must comply with safety regulations: safety clothes, safety helmet, protective gloves and shoes.

2.3 Safety Measures

- Only personnel who have been fully trained or instructed in its use can operate the equipment.
- At regular intervals, check that work is being carried out safely.

- Keep to the intervals specified for periodic tests.
- Store the Operating Instructions within easy reach of where the equipment is used.
- Do not allow the equipment to become dirty.
- The pipe puller must be protected against humidity. It must never be flooded: **short-circuit hazard!**
- The equipment must only be transported by a 3-strand rope suspension gear.

2.4 Duties of the Operator

Danger The following must be respected:

- The pipe puller, pulling bar and polyester sling must be in position to operate safely. The polyester sling may never be replaced by another lifting appliances, such as a rope or a chain: Danger!
- The operator must make sure that nobody remains in the hazardous areas, for instance between the pulling bar and the pipe puller or under the load during transportation: Danger
- The operator must be able to see the entire working area. If not, seek assistance
- The pipe puller may only be operated by personnel who are authorised to do so, and who have been properly trained in its use.

2.5 Visual and Functional Inspection

Caution .

- Prior to operation, the functioning and the working condition of the pipe puller, the polyester sling and the pulling bar must be examined. Should there be any defects which may affect the safety of the equipment, the pipe puller must only be used following repair.
- Tighten screws.
- Examine bolts.
- In case of splits, distortions or other defects found with the pipe puller, pulling bar or polyester sling, the equipment must be switched off immediately. **Safety hazard!**
- In case of distortions or defects in the rope suspension gear, it must be replaced immediately. **Safety hazard!**

2.6 Inspection

- Inspection prior to Initial Operation
  The authorised personnel must ensure that the pipe puller and all accessories are only operated once it has been checked by an expert and only if all defects have been repaired.

- Regular Inspections
  The authorised personnel must ensure that the pipe puller and all accessories are checked by an expert or by the manufacturer at least once a year.

- Special Inspections
  The authorised personnel must ensure that following damage or particular incidents, which may have affected the functioning of the equipment, as well as following repairs, the pipe puller and all accessories must be subjected to a special inspection by an expert.

- Recording
  The authorised personnel must ensure all inspections are recorded.
  We recommend all regular inspections and repairs are carried out by the manufacturer.

3. Specification

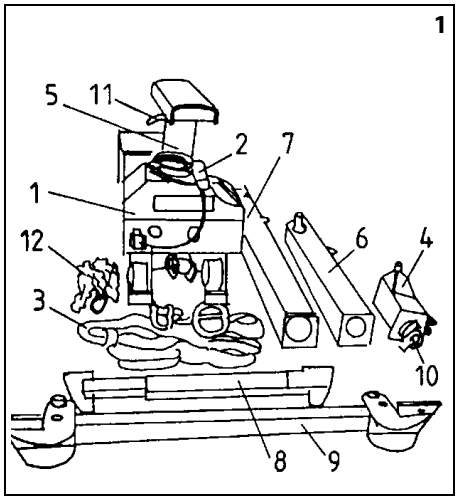
The Electro-Hydraulic Pipe Puller utilises the idea of pre-centering and pulling pipes by „push button control". All component parts are space-savingly packed onto a rubber-tyred carriage, which can be moved easily within the pipe. Simple operation and the latest technical specification guarantee easy and efficient working.

Specification:		
	Max. pulling force	16 (13) t
	for reinforced concrete pipes	(800) 1000 - 2500 mm
	with pipe inside diameter of	(800) 1000 - 2500 mm
		with adapter max. up to 3000 mm
	Max. working pressure	200 (150) bar
	Drive	electric power pack 2.0 kW / 12 V
	Battery	12 V / 160 Ah
	Control	10 m cable with pendant control
	Sling	Polyester sling, (4, 6 or 8 m length) and pulling bar

Delivered Unit

The delivered unit assembly consists of the following component parts (Fig. 1):

1	Standard equipment complete incl. electro-hydraulic installation and battery		(1)
1	10 m incl. control cable with pendant control and plug		(2)
1	Polyester sling, endless, loop and shackle		(3)
1	Support nom. width	800 - 1000	(4)
1	Support nom. width	1100 - 1500	(5)
1	Support nom. width	1600 - 2000	(6)
1	Support nom. width	2100 - 2500	(7)
1	Pulling bar nom. width	800 - 1400	(8)
1	Pulling bar nom. width	1500 - 2500	(9)
1	Spindle short nom. width	800 - 1000	(10)
1	Spindle long nom. width	1100 - 2500	(11)
1	Chain suspension gear (3-strand)		(12)



4. Transportation

The pipe puller is transported by a 3-strand rope suspension gear (12), which can be lifted at the 3 lifting points (13) (Fig. 2).When releasing the screw on the front wheels, the pipe puller can be moved easily.

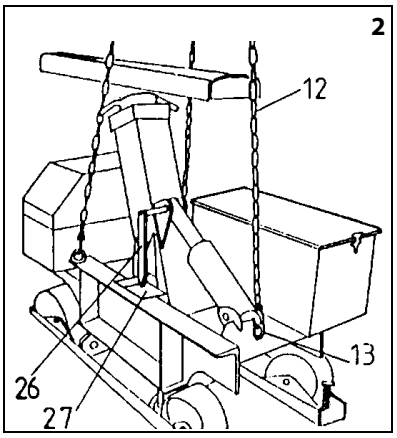
5. Initial Operation and Control

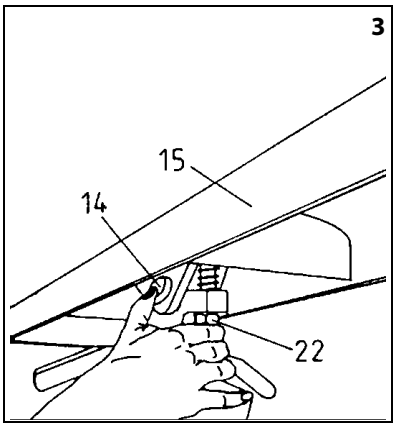
5.1. Pre-adjustment to Suit New Pipe Diameter

Generally, the pipe puller is mounted with the support (5), nom. width 1100-1500, and the long spindle - the pipe puller is ready for operation for this range of diameter.

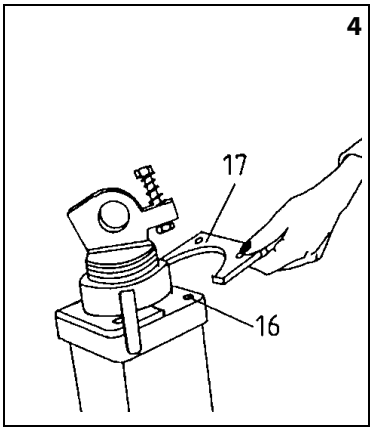
For the operation with a larger diameter, the support has to be exchanged as follows:

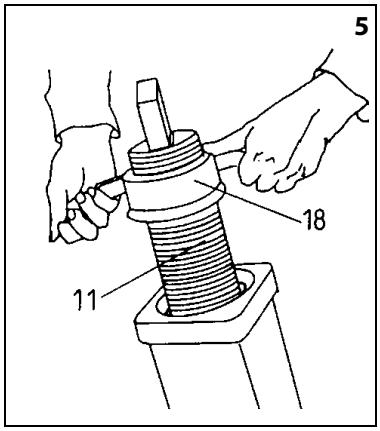
- Remove locking ring and bolt (14) (Fig. 3).
- Lift off the centering component (15) (Fig.3).
- Remove the 4 hexagonal head cap screws (16) at the head of the support and lift off both covering plates (17) (Fig. 4).
- Remove spindle (11) with the butterfly nut (18) from the support (Fig. 5).
- Remove locking ring and bolts (19) and the 4 hexagonal head cap screws (20) (Fig. 6).
- Remove support from the bearing shell.
- Place support of the nominal width desired into the bearing shell, mount hexagonal head cap screws (20) and bolts with locking ring (19).
- Introduce long spindle (11) with butterfly nut (18) into the new support and fix covering plate (17) by means of 4 hexagonal head cap crews (16).
- Stack up the centering component (15) and mount bolts and locking ring (14).

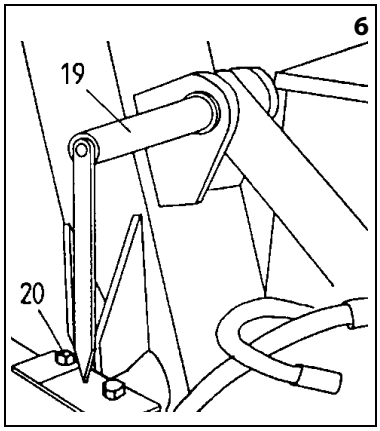




As far as smaller diameters are concerned (nom. width 800-1000), the support and the spindle have to be exchanged: the butterfly nut (18) has to be inserted into the short spindle before it is mounted.







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5.2 Adjustment of the Pipe Puller (without Polyester Sling)

- The pipe puller can only be operated when the battery is fully charged. Therefore, the battery (min 12 V) has to be regularly checked at the control panel (21) (Fig. 7). Depending on frequency of use, the battery has to be charged with a suitable battery charger.
- Connect the plug of the control cable (22).
- Completely extend pistons from both cylinders by means of the pendant control. Release the pendant control as soon as the pressure increases.
- With the 3-strand rope suspension gear (12), hang the pipe puller from the rings (specifically intended for this use) (see item 4), lift it into the pipe and align the pipe puller.

Caution The pipe puller must not hang from the support as this will cause damages to the end-switch.

- Normally the pipe puller is installed at the level of the socket end of the last but one laid pipe with the pulling cylinder facing outwards (Fig. 8).
- Adjust the height of the pipe puller by turning the butterfly nut (18) to suit the pipe diameter (Fig. 8). During the tensioning procedure, the pointer (26) must remain within the green area of the indicator panel (front view) (Fig. 2 and 6).

Dependent on size, pipe weight, pipe tolerance and socket end, different pulling forces are required.

Caution In order to keep damage to the pipe to a minimum, it must be seen that the clamping, as well as the pulling procedure, is started with minimum working pressure and only increased, if necessary:

Recommendation: Nom. width 800: approx 30 bars
Nom. width 2500: approx 150 bars

The working pressure must be adjusted by the pressure adjusting screw (23) (Fig. 7): when turning the pressure adjusting screw (23) clockwise, the pressure increases, when turning anti-clockwise, the pressure decreases. Before the new pressure adjusts itself, the pulling cylinder has to be slightly extended.

On reaching the adjusted maximum pressure the hydraulic installation will switch to no-load operation.

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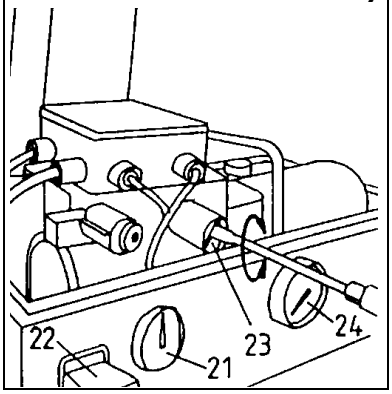

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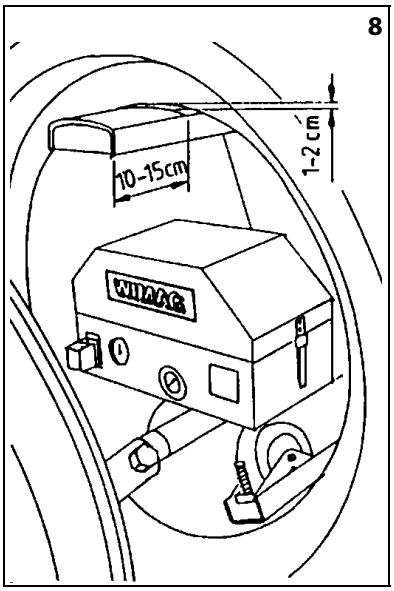

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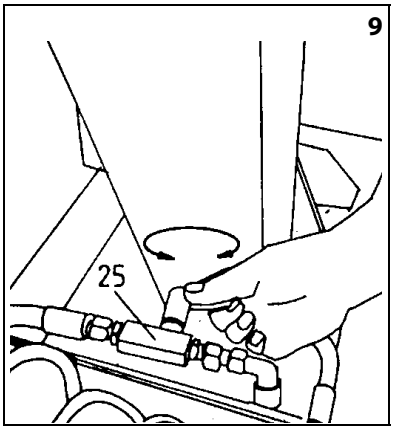


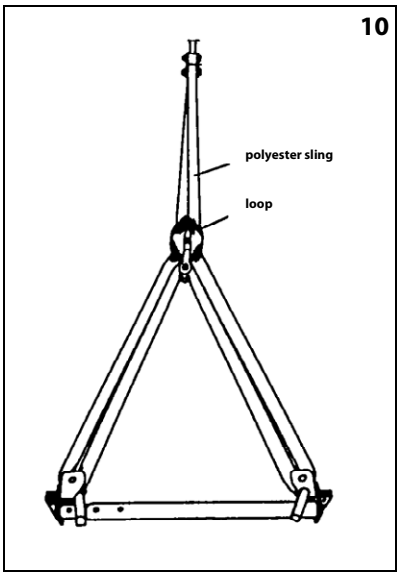
03-2024

After operation allow a cooling period of 10 minutes.
The temperature is controlled by an electric thermocouple.

Danger

During the tensioning procedure, it is important that the pipe puller tensions first and then the pulling cylinder runs in.
When releasing the pipe puller, extend the pulling cylinder first and then the clamping cylinder. If this procedure is not followed, do not operate the pipe puller. **Safety hazard!**

The throttle valve (25) is set by the manufacturer, guarded against twisting and may not be altered: **safety hazard** (Fig. 9) !



During the tensioning procedure of the pipe puller within the pipe, the angle of the support should be 10°-15° and the pointer (26) should be within the green area of the indicator panel (27) (Fig. 2 and 6). If the position of the support is too steep there is always the possibility that the pipe puller is wedged within the pipe and cannot be released further or that the support or the pipe is damaged. A limit switch, located on the clamping cylinder, switches off in case the position of the support is too steep.

5.3 Adjustment of the Pulling Bar (with Polyester Sling)

After adjusting the support of the pipe puller to suit the nominal width of the pipe and the maximum pressure (see 5.1 and 5.2), the first pipe can be easily and quickly pulled.

- Position the pipe puller into the pipe which has already been laid.
- Completely extend the pistons of both cylinders.
- Adjust the pipe puller vertically to the pipe axis, ensure that it will not roll away by stopping the wheels with the wheel-blocking device, and push button to hold it.
- Check the correct angle of the supports (see 5.2.) !
- Align the new pipe in front of the last laid pipe still supported by the lifting equipment until the clamping procedure has finished.
- Now adjust the corresponding pulling bar to suit the pipe diameter:
  Pulling bar 1: nom. width 800-1400
  Pulling bar 2: nom. width 1500-2500
- Align pulling bar within the socket end of the pipe to be laid and at the same height as the pulling cylinder. The pulling bar must safely sit close to the socket end.
- Fix polyester sling, loop and shackle according to Figures 10 and 11.
  Danger The polyester sling may never be replaced by another lifting appliances such as a rope or a chain: Danger
- Fix ends of the polyester sling to the pulling cylinder and the pulling bar (Fig. 12 and 13). By moving the loop towards the pipe puller the working length can be continuously shortened, by moving the loop towards the pulling bar the working length is extended.
- After adjusting the pipe puller, the polyester sling and the pulling bar the pulling operation can begin.

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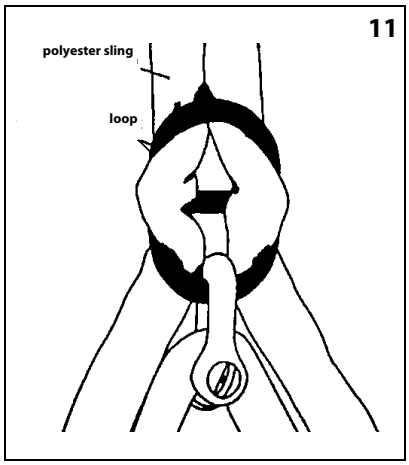

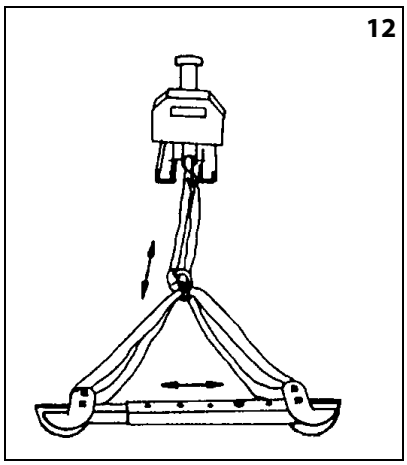

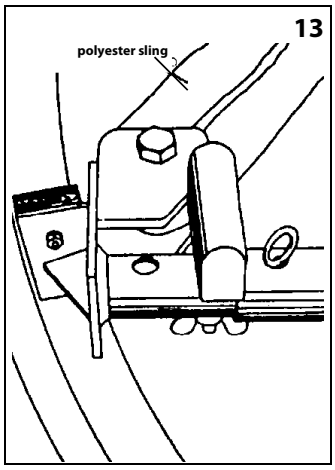

5.4 Pulling Operation

After having carried out items 5.1, 5.2 and 5.3, the actual pulling operation can begin.

- It is recommended to leave the pipe suspended during the pulling operation as the pipe can be aligned much easier to the laser beam and the pulling force required is much lower.

- Push the pipe puller into the pipe which has already been laid, far enough for the polyester sling to be slightly stretched. The pulling cylinder must be pulled out completely.

Caution **During the pulling operation no personnel are allowed to remain between the pulling bar and the pipe puller: Danger!** The operator must stand in front of the pipe to be pulled.

- The load transmission to the pipe which is to be laid is effected by means of a polyester sling and pulling bar. By operating the pendant control, the pipe puller is tensioned within the pipe and the new pipe is pulled home.
- Please ensure that the pointer (26) remains within the green area of the indicator panel (27), when the pipe puller is tensioned (Figures 2 and 6).
- Please also ensure that during the pulling operation, the pulling cylinder aligns with the pulling direction without any restriction.
- As the pipes come together to make the joint, the pressure will increase to a maximum of 150 bars. When the maximum has been reached, the pipe puller will switch to no-load operation. After pulling, the pipe can be laid down.
- The electric motor switches itself off when overheated in order to prevent overloading. After use, the motor requires cooling time which is five times longer than the operating time.
- As long as the length of the sling is adjusted in the correct way, the stroke of the cylinder necessary for one pulling operation is sufficient. Otherwise, the pulling operation has to be repeated by shortening the sling or by moving the pipe puller further into the pipe (secure wheels).

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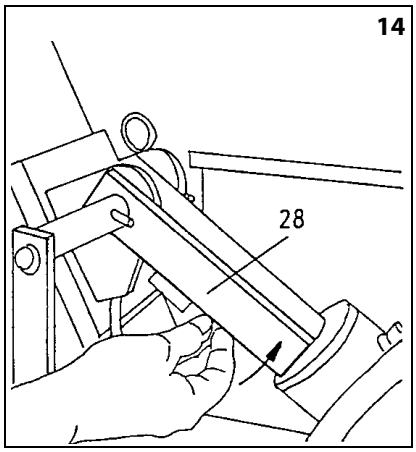
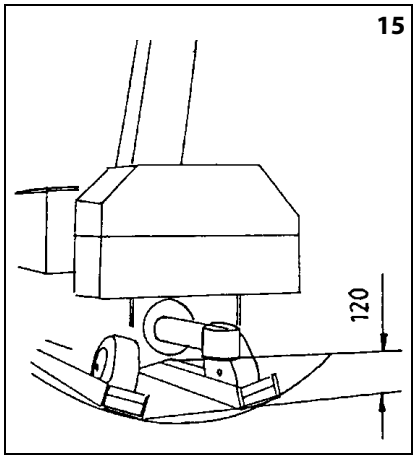
- Until the earth is replaced in the trench or the pipe is placed onto the ground during the pulling operation, there is always the possibility that the pipe which has already been laid can be pulled out again. This can be avoided by tensioning the pipe puller in the last but one laid pipe. A longer polyester sling may be used in this case, if necessary.
- When the pulling operation has finished, the pulling cylinder should be completely extended and the pipe puller totally released. Standing between the pipe puller and the pulling bar is forbidden at this stage: **safety hazard!** As soon as the maximum pressure has been reached, stop the operation immediately. Now the pipe puller can be moved into the next pipe and the pulling operation is repeated.
- If the cylinder has to be pushed in outside the pipe, for instance in the case of transporting, the limit stop must be turned upwards first (28) so that it can be supported by the clamping cylinder (Fig. 14).



6. Accessories

- The polyester sling can be supplied 4 m, 6 m or 8 m in length.
- Beneath the undercarriage, depending on the pipe size, there is at least a distance of approx. 120 mm left for the laser beam. Should there be insufficient room left for the laser beam, an undercarriage is available to enlarge the clearance height of 130 mm up to 250 mm.
  The pipe puller, however, can only be used for minimum nominal width of 1000 mm.
- For nominal pipe widths from nom width 2.500 - 3.000 mm, an adaptor can be supplied.
- A battery charger can be supplied.
- Centering component with rubber lining for coated pipes.



7. Maintenance

To guarantee perfect operation of your WIMAG Pipe Puller, you are requested to respect the following: all links are to be regularly cleaned and lubricated with grease. Careful handling increases the service life as well as the working safety.

The complete pipe puller unit, the hydraulic equipment and battery in particular, must be protected **against water (especially flooding) and humidity: short-circuit hazard !**

Maintenance work and tests may only be carried out by specialists. Should failures concerning safety be detected, they must be corrected before the pipe puller can be operated again.

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Inspection

When ?	Inspection Type ?
• After delivery of the equipment	Complete inspection
• Before each operation	Visual and functional inspection
• Dependent on operating conditions, at least once a year	Inspection by expert
• After repairs	Inspection by expert

Client´s Maintenance

What ?	How ?
• Hydraulic installation	Oil leakage and oil level inspection 1)
• Electrical installation	Cleaning of electrical connections
• Battery	Daily voltage inspection and charge if necessary, refill of battery water
• Spindles and links	Lubrication with grease
• Polyester sling	Damages, splits
• Pulling bars	Wastage
• Unacceptable wastage	Visual inspection
• Splits in welded joints	Visual inspection
• All movable parts, screws, nuts, bolts and safety elements	Functional and visual inspection, tightening and complete inspection
• Surface protection	Correct with colour coating

1) Check the hydraulic oil level regularly (with both cylinders pushed in completely) and, if necessary, refill with hydraulic oil, i.e. ARAL Vitam DE 10. When both cylinders are pushed in, the oil level must be approx. 2 cm below the opening.

Maintenance or inspection rate: on request, however,
- at least once a year
- after necessary repairs
- after inexpert handling

In order to guarantee the working safety of the pipe puller, it is recommended to direct all regular inspection and repairs to the manufacturer.

8. Repairs

- Repairs may only be carried out by qualified personnel or by the manufacturer.
- Only original spare parts may be used, otherwise the warranty will become invalid.
- Do not carry out any alterations or modifications.
- A special inspection must be carried out by an expert or a qualified personnel before the equipment can be operated again.

9. Troubleshooting

As with all technical devices, the pipe puller may develop failures. Please consult the following checklist in the first instance in order to find out whether the failure can be solved simply.

Problem	Solution
The engine will not start.	1. Check voltage on the voltmeter; charge the battery. 2. Check the trip line for damaged or broken cable. 3. Check whether the fuse in the fuse box needs replacing, and replace it, if necessary. 4. Check the heating switch and change it, if necessary.
The engine starts but the pulling and clamping cylinders will not move.	1. Check the oil level: when both cylinders are pushed in, the level should be approx. 2 cm below the opening. 2. Check the trip line for damaged or broken cable. 3. Test the magnetic coils on distribution valve for possible failure.
The engine starts, the pulling and clamping cylinders come out but they cannot be pushed back in (pipe puller can no longer be tensioned).	1. Check the end switch on the clamping cylinder (possibly by-pass it for a short amount of time). 2. Check trip line for damage. 3. Test magnetic coils on the distribution valve for possible failure.
The engine starts, the pipe puller tensions but the pulling cylinder cannot be pushed in.	1. Check the throttle valve (25) (Fig. 9): it must not be possible to turn it. If it is not adjusted, follow these instructions: • Open the throttle valve completely, • pull the pulling cylinder out completely, • push the pulling cylinder in and at the same time, close the valve (25) until the manometer reads 25 bars, • re-adjust throttle. 2. Check the end-switch, by-pass it temporarily if necessary.
The operating pressure can no longer be adjusted, the pipe exceeds 150 bars when the pulling cylinder is pushed in.	Check pressure adjusting screw (23) and change it, if necessary.

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10. Warranty And Liability

For many years, WIMAG pipe pullers have been successfully used for the laying of pipes. As many factors affect the pulling of pipes, e.g. reinforcement, pipe tolerance, socket end and adjusted maximum pressure, no guarantee is made for the laid pipes, or any damage which may occur through misuse of equipment.

It is within the responsibility of the customer to examine the pipes for damage before and after installation.

The warranty and the liability are no longer valid, if the equipment has not been assembled, installed, operated, checked and maintained according to these instructions.

Any doubts about instructions should be raised with the manufacturer prior to use.

Prior to every operation the user must ensure that

- the equipment is suitable for the intended operation,
- the functioning and the working condition of the equipment is examined,
- the loads are suitable to be handled.

- Failures are to be reported in writing to the supplier immediately, at the latest two weeks following delivery.
- It is forbidden for the client to repair failures or have them repaired by a third party, and then request to be reimbursed for the costs.
- According to the manufacturer's general contract conditions the equipment is under warranty for a period of six months from the invoice date. Wearing parts are not covered by the warranty.
- The manufacturer is not responsible for any damage occurring in the event of an installation error or insufficient training by a third party, negligence, misuse or excessive stress of the equipment.
- It is within the responsibility of the client to check prior to operation the functional condition of the equipment, the suitability of the pipes to be handled/laid as well as any damage to the pipes before and after transport/installation.
- The manufacturer does not take responsibility for any additional claims, for instance, the right to compensation for damage not caused to the equipment itself.

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03-2024

Inspection Sheet

Model	
Serial number	
Year of construction	
Contractor	
Date of first operation	

Inspection And Maintenance

Inspection prior to initial operation:	Date Signature of expert
Special inspection:	Date Signature of expert
Regular inspection:	Result: Date Signature of expert
Regular inspection:	Result: Date Signature of expert
Regular inspection:	Result: Date Signature of expert
Regular inspection:	Result: Date Signature of expert

EC Declaration Of Conformity
As Defined By Machinery Directive 2006/42/EC

We hereby declare that the design and the construction of the equipment mentioned hereafter complies with the following Directive.

This declaration will become invalid, if a modification of the equipment is carried out which has not been agreed with us as manufacturer.

The validity will also expire, if the equipment is not used as directed in accordance with manufacturer's relevant operating instructions.

Description:	**WIMAG Pipe Puller RZE**
Directives:	EC Machinery Directive 2006/42/EC of 17 May 2006
Harmonised Standards:	DIN EN 292 Part 1 and Part 2 (Safety of Machines)

As stipulated in Annex V of the EC Machinery Directive the following documents are available for inspection:

- Operating instruction
- Production drawings
- Production plans
- Static verification
- Certification of welding (DIN 18 800 Part 7)

The CE symbol is marked on the equipment.

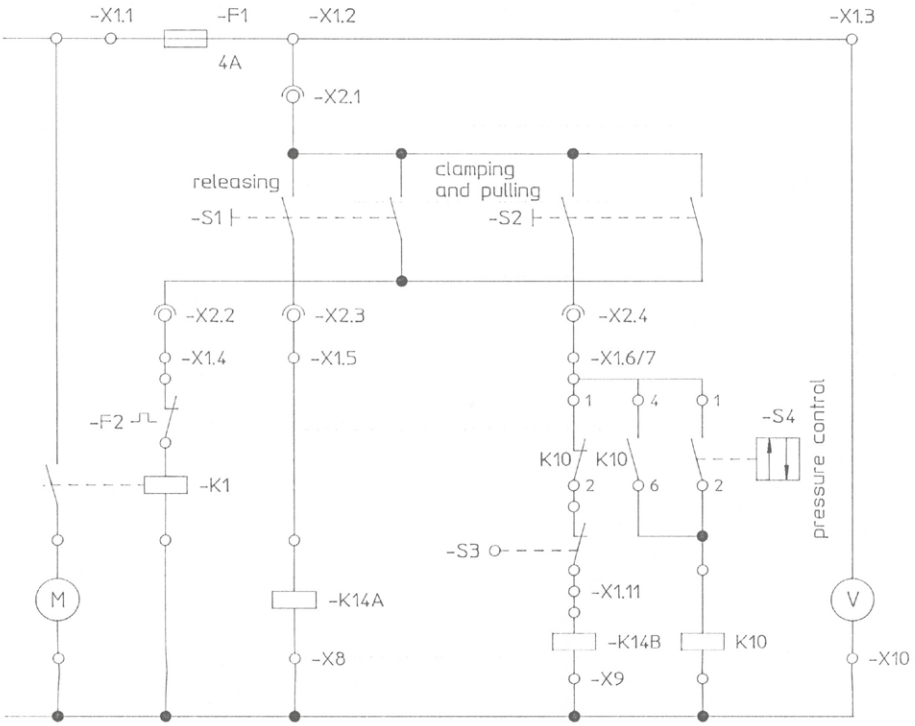
Obernburg, 29 December 2009

Gerhard Gressbach
(Dipl.-Ing.)

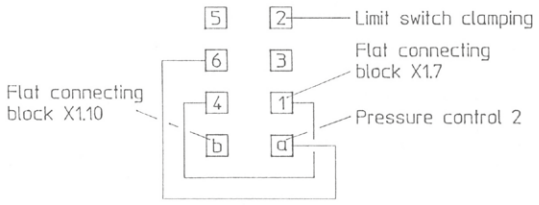
03-2024

► Pipe Puller

Electric Control System



Connection Relay IFR-2W



Circuit Diagram of Terminal Connections for Pipe Puller

	X1	
Line	X1.1	
	X1.2	
Voltmeter	X1.3	Control glass bulb X2.1
Relay for motor	X1.4	Control glass bulb X2.2
Magnetic valve (pulling)	X1.5	Control glass bulb X2.3
Pressure control 1	X1.6	Control glass bulb X2.4
	X1.7	Relay
Voltmeter	X1.8	Line
Magnetic valve (pulling)	X1.9	Magnetic valve (releasing)
	X1.10	Relay
Magnetic valve (releasing)	X1.11	Limit switch (clamping)

Diagram of Terminal Connections Control Box

	X2	
Control glass bulb black 1	X2.1	Flat connecting block X1.3
Control glass bulb black 2	X2.2	Flat connecting block X1.4
Control glass bulb blue	X2.3	Flat connecting block X1.5
Control glass bulb brown	X2.4	Flat connecting block X1.6

Parts List

-M	=	Driving motor
-K1	=	Starting relay
-F1	=	Precision fuse 4A
-F2	=	Thermo switch mounted on the motor
-S1	=	Button ("releasing")
-S2	=	Button ("clamping and pulling")
-S3	=	Limit switch at the hydraulic cylinder
-K14A	=	Magnetic valve ("releasing")
-K14B	=	Magnetic valve ("clamping")
-K10	=	Relay in the terminal box
-V	=	Voltmeter
-X1	=	Flat connecting block within terminal box
-X2	=	Control plug

03-2024

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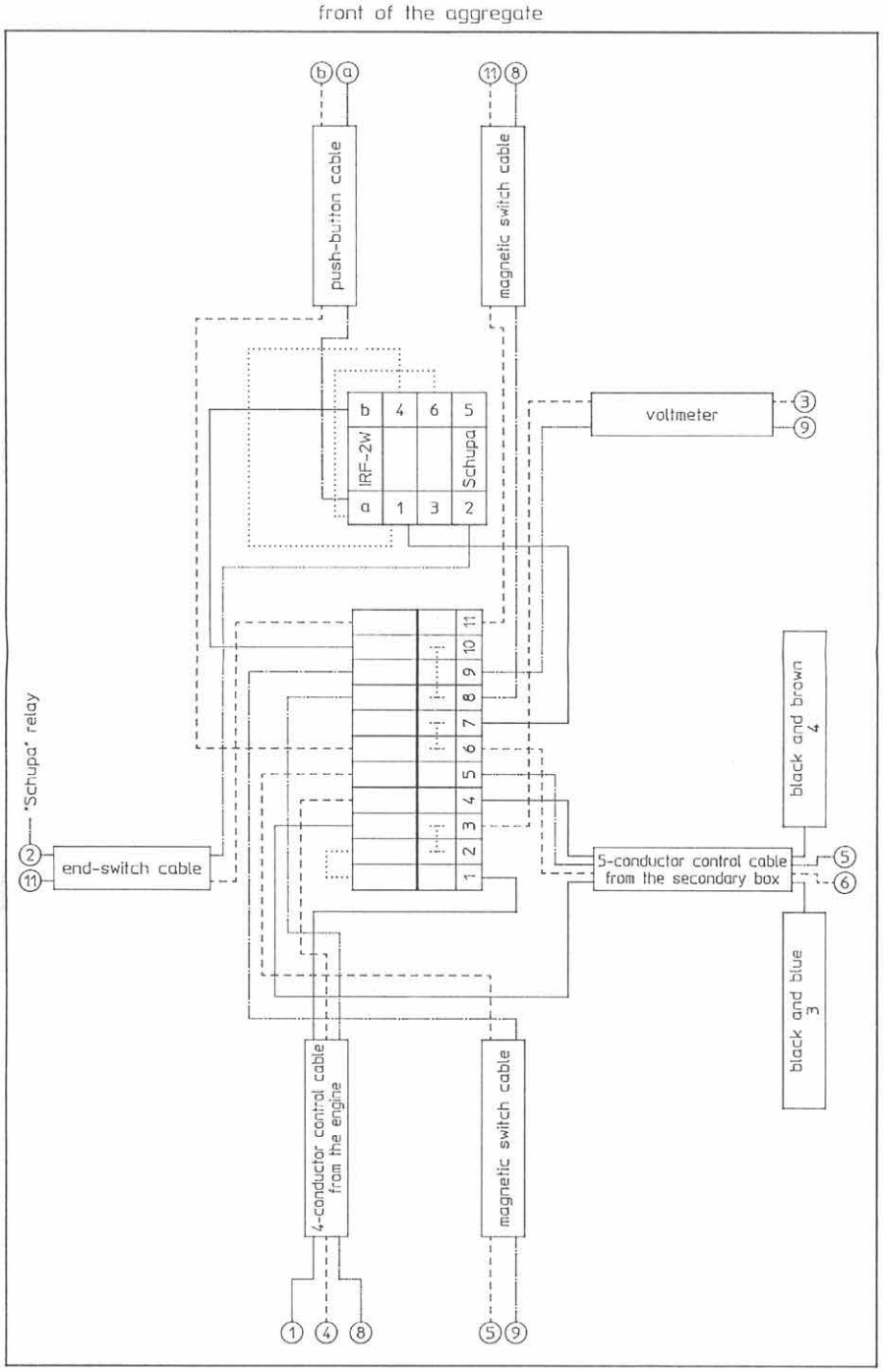
RZE-16 Diagram of Connections

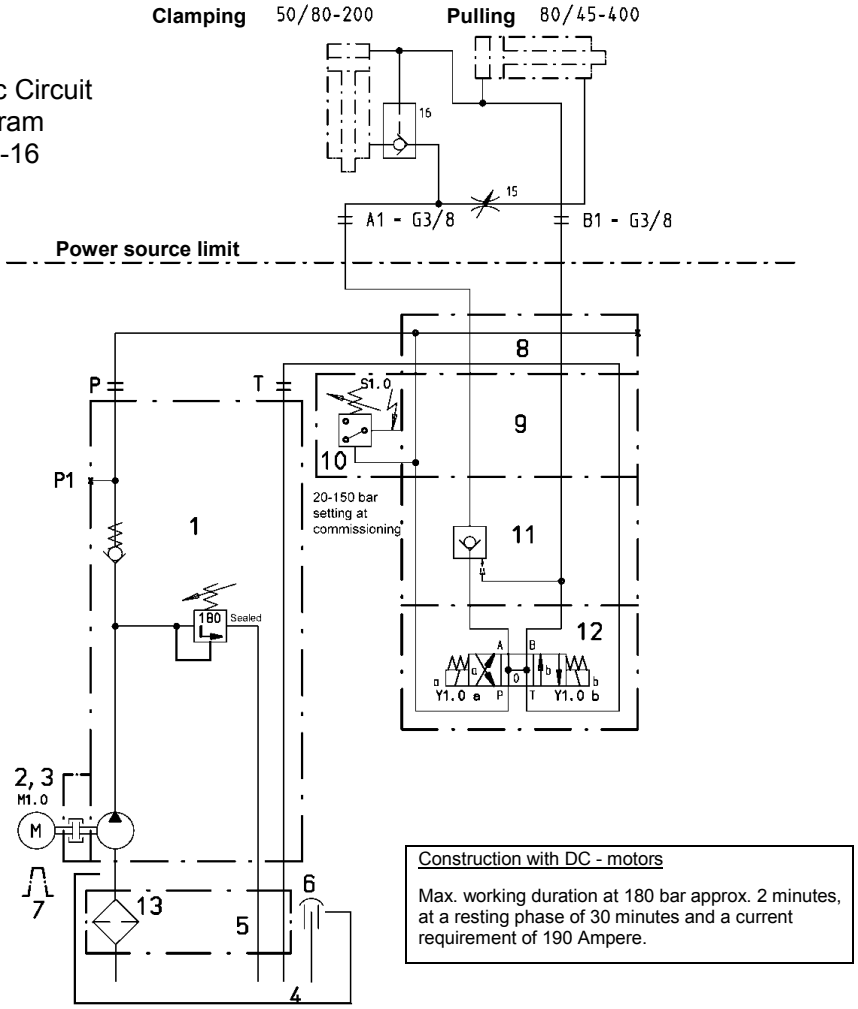


——— = black - - - - - = brown ——— = blue ····· = green (by-pass)

03-2024

► Pipe Puller

Hydraulic Circuit Diagram RZE-16



Construction with DC - motors

Max. working duration at 180 bar approx. 2 minutes, at a resting phase of 30 minutes and a current requirement of 190 Ampere.

Technical Data:

Flow capacity	Q = max.	4 l/min
Working pressure	p = max.	180 bar
Power	p = 2,0	kW
Tank volume	V = 5	Liter
Valve voltage	U = G12	Volt

03/06

Item No.	Unit	Description	Model Designation
1	1	Pump unit, adjusted at 200 bar and sealed	KL-3-ZP1,2-DB1/200
2	1	DC-Motor 1,6 kW, 12 V, protection type IP 54	
3	1	Starting relais 12 V	
4	1	Tank 5 l horizontal	BH 5
5	1	Tankset 5-8 / 1,2-7,8	KL 3 – MO
6	1	Oil filling plug	TSD 20
7	1	Fixing foot	ZT 7
8	1	Mounting end plate	PEM 80 – G 3/8
9	1	Subplate nominal size 6 for pressure switch	PZ 6/1
10	1	Pressure switch	DS – 502 / F – 150
11	1	Modular check valve nominal size 6	ZA 6 RE – A – 0 – 1 – 00
12	1	Directional control valve nominal size 6	WE 6 HG – F1M / G 24
13	1	Suction filter 3/8	

Warning notes and safety regulations for lead-acid batteries

Follow information on the battery, in the instructions for use and instructions for operating the vehicle.

Wear eye protection

Keep children away from acid and batteries.

Explosion hazard:
- A highly-explosive oxyhydrogen gas mixture occurs when charging batteries, therefore:

Fires, sparks, naked lights and smoking are prohibited:
- Avoid causing sparks when dealing with cables and electrical equipment
- Avoid short-circuits.

Corrosive hazard:
- Battery acid is highly corrosive, therefore
- Wear protective gloves and eye protection.
- Do not tilt battery, acid can escape from the degassing openings or vents.

First aid:
- Rinse off acid splashed in the eyes immediately for several minutes with clear water. Then consult a doctor immediately.
- Neutralize acid splash on skin or clothes immediately with acid neutralizer (soda) or soap suds and rinse with plenty of water.
- If acid is consumed, consult a doctor immediately.

Warning note:
- Do not place batteries in direct daylight without protection.
- Discharged batteries can freeze up, therefore store in an area free from frost.

Disposal:
- Hand in old batteries at a collection point. The notes listedt under item 1 are to be followed for transport. Never dispose of old batteries as domestic waste.

Instructions for using starter batteries

1. Storage and transport
- Unfilled starter batteries do not require any maintenance. Store in a cool dry place (free from frost).
- Recharge filled starter batteries when the acid dansity falls to a minimum of 1.210 kg/l (1.180 kg/l in the case of electrolyte 1.230 kg/l) (refer to item 4).
- Filled batteries are to be transported and stored uprigth otherwise acid can escape.
- During transport, secure batteries to prevent tipping over.

2. Commissioning

Batteries supplied unfilled, dry charged, are ready for operation after filling with battery acid without initial charging.
- When filling, the temperature of the battery and the acid should be at least 10° C.
- Remove sealing plugs.
- Fill the individual cells of the battery with sulphuric acid in accordance with VDE of density 1.280 kg/l (for tropical countries 1.230 kg/l) up to the max. acid leval mark or 15 mm above the upper edge of the plates.
- Allow batteries to stand for 15 minutes, tilt slightly several times and top up acid if required.
- Screw in sealing plugs securely or press in. Wipe off any acid splash.

Batteries supplied filled are ready for operation.

Note: If the battery does not provide an adequate starting performance as a result of too low temperatures or unfavourable storage conditions, recharge the battery (refer to item 4).

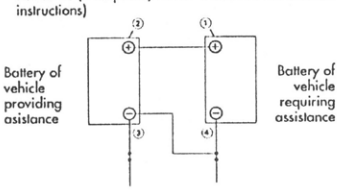
3. Installation in the vehicle
- Prior to installing and removing the battery, switch off the engine and all electrical equipment.
- Avoid short-circuits due to tools.
- When removing, first disconnect the negative pole (-), then the positive pole (+).
- Prior to installing the battery, clean the mounting area/battery carrier in the vehicle.
- Clamp battery rigidly.
- Clean battery pole and clamps and other fixings and lubricate slightly with acid-free grease.
- When installing, first connect positive pole (+), then negative pole (-).
  Check pole clamps for firm seating.

4. Charging outside the vehicle
- The battery should be removed for recharging. If the battery is recharged in the vehicle, it is essential to disconnect the battery cables. (If required, follow the vehicle manufacturer's instructions.)
- Batteries must only be charged with direct current (DC). Connect positive pole (+) of battery to positive pole (+) of charger and negative pole (-) of battery to negative pole (-) of charger.
- Only switch on charger after connecting it to the battery. When charging is complete, first switch off the charger.
- 1/10 of the capacity is recommended as the charging current (e.g. 44 Ah : 10 = 4.4 A charging current).
- The acid temperature must not exceed 55° C during charging. Interrupt charging if this temperature is exceeded.
- The battery is fully charged when the acid density and the charging voltage have stopped rising for 2 hours.
- After charging, check acid level and if required top up with desalinated or distilled water up to the max. acid level mark or 15 mm above the upper edge of the plates.
- Ensure adequate ventilation when charging.

5. Maintenance

The following instructions should be followed to achieve a long battery life:
- Keep surface of the battery clean and dry.
- Check acid level regularly and replenish with desalinated water or distilled water, if required. Never top up acid. In the event of considerable water, the regulator voltage should be checked by a specialist.
- Do not use any so-called improving agents.
- The state of charge of the battery can only be chekked by making an acid density measurement using an hydrometer. If the acid density is below 1.210 kg/l (or 1.180 kg/l in the case of electrolyte 1.230 kg/l) the battery is to be recharged (refer to item 4). At tihis acid density the battery must be protected against freezing down to -15° C (at 1.280 kg/l down to -70° C).

6. Jump Starting
- Only use standard jump leads (for example in accordance with DIN 72 553).
- Follow operating instructions for jump leads.
- Only connect batteries of the same nominal voltage.
- **Connecting:** Both vehicle engines switched off! First connect the two positive poles 1 and 2, then the negative pole of the charged battery 3, to a metallic part of the vehicle which has not been painted remote from the battery on the vehicle requiring assistance 4. (if required, follow vehicle manufacturer's instructions)



- Start the vehicle providing assistance, then start the engine of the vehicle requiring assistance for a maximum of 15 seconds.
- **Disconnect:**
  Disconnect cables in reverse sequence.

7. Taking out of Service
- Charge battery (refer to item 4) and store in a cool place.
- If battery is to remain in the vehicle, disconnect negative terminal.
- Check battery state of charge regularly (refer to item 5).

03-2024

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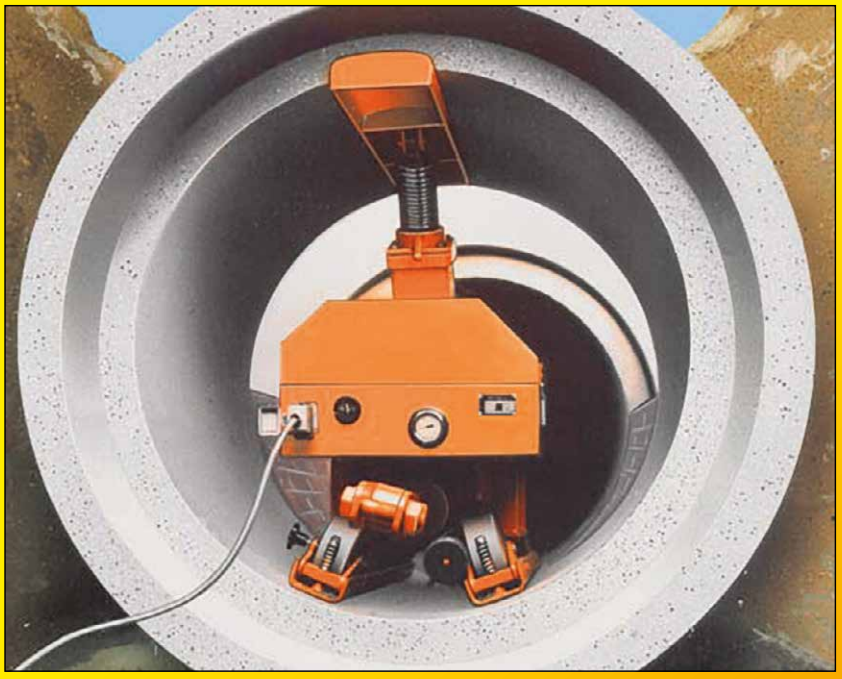

PIPE PULLER

OPERATING MANUAL

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03-2024