



BAUER

FOR A GREEN WORLD

OPERATING MANUAL

for

RAINSTAR

Series E 11 – E 51



Version: I - 2013

Rainstar
E 11 - E 51
English

Introduction

Thank you for buying **BAUER RAINSTAR** !

The present **manual** is a very important document that describes how to operate and **BAUER RAINSTAR E**.

This manual describes the system as detailed as possible. If you need still more information, please contact your dealer or turn directly to **BAUER** in Voitsberg/Austria.

Please note that the content of this manual neither constitutes part of nor alters in any way any previous or existing agreement, promise or legal relationship. **BAUER's** commitment is based solely on the respective purchase contract which also contains the complete and only valid warranty agreement. Said contractual warranty is neither extended nor limited by the content of this manual.

All information contained in the present manual is based on the latest product details available at the time of printing.

BAUER reserves the right to change without notice without assuming any liability!

BAUER RAINSTAR E is designed for highest performance safety and reliability provided it is operated in accordance with the present operating instructions.

Therefore you should study this manual thoroughly before starting your **BAUER RAINSTAR E** !

Strictly observe all instructions pertaining to system handling, operation and service!

On this condition, **BAUER RAINSTAR E** will operate to your satisfaction for many years!



Non-observance of this manual may cause personal injury or damage the equipment!

This manual is to be considered an integral part of **BAUER RAINSTAR E**. Suppliers of both new and used systems are advised to put down in writing that they delivered the manual together with the system.

Please make this manual available to your staff. State the pump type and serial number of your **BAUER RAINSTAR E** in all inquiries, correspondence, warranty problems, or parts orders.

We wish you a lot of success with **BAUER RAINSTAR !**



Product details

Type designation: RAINSTAR

Type number: Baureihe E 11 , E 21 , E 31 , E 41 , E 51

Serial number¹:

Dealer:

Name:

Adresse:

ph./fax:

Date of shipment:

Manufacturer:

Röhren- und Pumpenwerk **BAUER** Ges.m.b.H.
Kowaldstr. 2

A - 8570 Voitsberg/Austria

Tel.: +43 3142 200 – 0

Fax: +43 3142 200 –320 /-340

www.bauer-at.com

e-mail: sales@bauer-at.com

Owner or operator:

Name:

Address:

ph. / fax:

Note: Please make a note of the type and serial number of your RAINSTAR and accessories. Be sure to specify these details every time you contact your dealer.

¹In all warranty claims and correspondence relating to this machine it is essential to specify the full serial number group including all letters. This applies to both the machine and the components concerned. We cannot emphasise this point often enough.

General Safety Instructions

Symbols and terms



The CE symbol that has to be affixed on the machine by the manufacturer outwardly demonstrates compliance of the machine with the directives for machines and other relevant EU directives.



WARNING!

This "Warning" symbol refers to important safety instructions in this manual. Whenever you see this symbol be aware of possible injury hazards. Read the note following the symbol very carefully and inform the other operators accordingly.

CAUTION

Non-observance of this instruction may cause damage to or destroy the machine or individual components.

NOTE

It is very important to observe this note or condition!

Qualified operators are persons who on account of their training, experience and instruction as well as their knowledge of relevant standards, rules, precautions to be taken for accident prevention, and prevailing operating conditions, have been authorised by the person in charge of plant safety to perform the respective tasks required, and in doing so are able to recognise and avoid potential hazards. Among other things, knowledge of first-aid procedures is also required.

Product liability

As defined by the product liability law every farmer is also an entrepreneur!

According to §9 PHG (Product Liability Law), liability for damage to corporeal things caused by defective products is expressly excluded. This exclusion of liability also applies to parts not manufactured by BAUER itself but purchased from external suppliers.

Duty to furnish information

Even if the customer passes on the machine later-on he is obliged to hand the operating manual on to the new receiver, too. The receiver of the machine must be instructed with reference to the mentioned regulations.

Intended use

- BAUER RAINSTAR is built exclusively for normal agricultural applications (intended use).
- Any use beyond this normal use is considered non-conforming. Manufacturer is not liable for damage resulting from such non-conforming use, the sole liability for damage from non-conforming use is with the user.
- Intended use also includes compliance with the manufacturer's operating, maintenance and service instructions.
- The BAUER RAINSTAR may be used and operated only by persons who are familiar with the device and aware of the hazards involved.
- All rules for accident prevention as well as any other generally valid specifications and regulations relating to safety, work medicine and traffic law must be strictly observed.
- Unauthorised modifications on the machine release the manufacturer from liability for damage resulting therefrom.

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1 GENERAL INSTRUCTIONS FOR SAFETY AND ACCIDENT PREVENTION

Check the operational safety of the machine before every start-up.

1. In addition to the instructions contained in this manual, all specifications generally valid for safety and accident prevention must be observed!
2. The warning and instruction signs affixed to the machine give very important instructions for safe operation. Observing them serves your own personal safety!
3. Never put the machine into operation unless all guards and safety devices are completely mounted and in their proper working position!
4. Acquaint yourself with all equipment components and controls as well as their respective functions before starting to work. It is too late when the device is already running!
5. The operator's clothes should fit tightly. Avoid wearing loose clothes!
6. When handling slurry always keep in mind that the gasses produced are highly toxic and extremely explosive in combination with oxygen. Therefore, open fires, light tests, sparking and smoking are strictly forbidden!
7. Utmost care is required with regard to gasses in slurry and dung channels at open valves to the preliminary pit, before the main pit, or at cross channels. The same applies to mixing and withdrawal points when mixers or pumps are running!
8. When handling slurry always ensure sufficient ventilation!
9. Keep the machine clean to avoid fire hazards!

Tractor-driven machines

1. Before starting inspect the area around the machine (Children) ! Make sure your view is unrestricted!
2. Riding on the machine during transport is forbidden!
3. Couple the machine according to instructions and fasten it only at the specified points!
4. Be especially careful when coupling the machine to the tractor or uncoupling it!
5. Always adjust the supports in the proper position when coupling or uncoupling the machine (stability)!
6. Always mount balancing weights properly at the points provided!
7. Observe restrictions pertaining to axle load, total weight, and transport dimensions!
8. Inspect and mount all items required for transport such as lighting, warning signals and possible safety devices!
9. Mounted or trailed machines as well as balancing weights influence road behaviour, steering and braking capacity. Therefore make sure that proper steering and braking are possible!
10. Consider the projection and/or centrifugal mass of the machine when driving in curves!
11. It is forbidden to stay in the working range of the machine while it is operating !
12. Keep out of the turning and swivelling range of the machine!
13. Only operate hinged hydraulic frames when nobody is in the swivel range!
14. Externally powered machines (e.g. hydraulic) bear a crushing and shearing hazard!
15. Nobody is allowed between the tractor and the implement unless the tractor is secured by the parking brake and /or wedges under the wheels!
16. Hinged supports must always be folded up and secured before driving away!
17. Secure the machine and the tractor against rolling!

Tractor-mounted machines

1. Before a machine is linked to or detached from the three-point linkage, the control device must be shifted to a position in which unintentional lifting or lowering is impossible!
2. When using the three-point linkage the linkage parameters of both tractor and attached machine must correspond, if not, they have to be matched accordingly!
3. The three-point linkage bears crushing and shearing hazards!
4. When operating the external control of the three-point linkage never step in-between tractor and the machine!
5. When the machine is in the transport position make sure that the tractor's links are always properly secured on the sides.
6. When driving on the road with the machine lifted the control lever must be locked against lowering!

Trailed machines

1. When a machine is coupled to the drawbar make sure that the coupling point provides sufficient flexibility!

Power take-off (applies only to PTO driven machines)

1. It is not allowed to use any other types of PTO drive shafts except the ones prescribed by the manufacturer!
2. Drive-shaft guard tube and guard cone as well as the PTO guard – also on the machine side - must be mounted and in good working order!
3. When using a PTO drive shaft always observe the specified overlap in transport and working position!
4. Never connect or disconnect the PTO drive shaft unless the PTO is stopped, the engine turned off, and the ignition key pulled out!
5. Make sure the drive shaft is always connected and secured properly!
6. Attach the safety chain to keep the drive shaft guard from rotating with the shaft!
7. Before you turn on the PTO make sure that the selected tractor PTO speed corresponds with the permissible implement speed!
8. Before starting the PTO make sure that nobody is standing in the danger zone of the machine!
9. Never turn on the PTO when the engine is turned off or during a transport drive!
10. When working with the PTO nobody is allowed near the turning PTO or drive shaft!
11. Warning! The PTO shaft may continue turning due to its centrifugal mass after the PTO has been turned off! Keep clear of the machine during this time and do not touch until the PTO shaft stands absolutely still!
12. For cleaning, greasing, or adjusting the PTO driven implement or drive shaft, PTO and engine must be switched off and the ignition key pulled out!
13. Place the disconnected drive shaft on the provided support!
14. When drive shaft has been removed put the guard on the PTO shaft!
15. If a defect occurs repair it immediately before starting to work with the machine!

Hydraulic system

1. Hydraulic system is under high pressure!
2. When connecting hydraulic cylinders and motors, make sure the hydraulic hoses are connected as specified!
3. Before coupling the hydraulic hoses with the tractor's hydraulic system make sure that the entire hydraulic system is pressureless both on the tractor and implement side !
4. Inspect the hydraulic lines at regular intervals and replace them immediately in case of defects or ageing. Replaced hoses must comply with the technical specifications of the implement manufacturer!
5. When looking for leaks use only suitable equipment because of the injury hazard involved!
6. Liquids emerging under high pressure (hydraulic oil) may penetrate the skin and cause serious injuries! An injured person must see a doctor immediately! Danger of infection!
7. Before working on the hydraulic system the machine must be lowered, the system depressurised and the engine turned off!

Electric-driven implements

1. All work beyond normal maintenance of the implement should be performed only by a professional electrician!
2. Defective or broken plugs and sockets must be replaced by a professional electrician!
3. Never pull a plug out of the socket at the flexible electric cord!
4. Extension cables for power supply should be used only temporarily! Never use such lines permanently as a substitute for the required fixed installations!
5. Flexible lines laid across traffic areas on the farm must have at least 5 m ground clearance!
6. Always turn off the power supply before you do any work on the machine!
7. Check all electric lines for visible defects before you put the machine into operation! Replace defective cables and do not start the machine before that!
8. Never use electric-driven implements in damp situations or locations exposed to fire hazard unless they are adequately protected against moisture and dust!
9. Covering electric motors may cause heat concentration with high temperatures which could destroy the operating equipment and cause fires!



Hand-operated devices (valves)

1. Because of the slurry gasses produced in the lines, no slurry is allowed to remain in closed pipelines – bursting hazard!
2. Lay the pipelines with sufficient inclination and make sure that the selected closing order of valves allows all lines to be drained completely!
3. Protect the valves against unauthorised handling!
4. If a valve gets jammed do not apply force! Use only the operating levers supplied with the implement!
5. Observe the permissible maximum operating pressure of valves and pipelines when pumps are operated!
6. Service only when the tanks are empty!

Maintenance

1. Never perform any maintenance, service or cleaning work or fault elimination steps unless the drive is turned off and the engine is standing still!
2. Check proper fit of all nuts and bolts regularly and tighten them, if necessary.
3. If maintenance work is required on the lifted machine always secure it by means of appropriate supports!
4. When exchanging tools with cutting edges always use proper tools and wear safe protective gloves.
5. Dispose of oil, grease and filters according to local laws and regulations!
6. Always turn off power before working on the electric system!
7. Before electric welding on the tractor and mounted machines the generator and battery cables must be disconnected!
8. Spare parts must meet manufacturer's minimum technical specifications! This is the case for instance with original spare parts for instance!

2 GENERAL

BAUER products are designed and manufactured carefully, subject to a system of continuous quality control. BAUER RAINSTAR models E 11, E 21, E 31, E 41, E 51 are turbine-driven machines designed for fully mechanised and labour-saving irrigation. Individual pipe sets are no longer laid down by hand; system set-up, repositioning, and operation are all done with the tractor only.

BAUER RAINSTAR is a universal machine suitable of covering fields of varying lengths and widths. There is no need for supervision while the system is operating.

Strict observance of all operating and service instructions in this manual is the basic prerequisite for many years of trouble-free operation. Therefore please make sure that all operators on your staff are familiar with the instructions given in this manual.

The model number as well as the serial number (Vehicle identification number) are stamped into the nameplate. In addition, the serial number is stamped into the frame of the undercarriage. Please state these data in all your inquiries, correspondence, warranty matters and parts orders.

We warrant according to our General Terms of Sale.

3 SAFETY PRECAUTIONS FOR RAINSTARS SERIES E 11-E51

1. Read this manual before you put the system into operation for the first time.
2. Never handle the PE-pipe near the device or the device itself during pull-off or retraction.
3. During PE-pipe rewind with the tractor's PTO or during pipe pull-off, always make sure that the shifting lever is in the proper position. Moreover, the maximum permissible speed must not be exceeded.



WARNING!

Danger by improper handling!

4. Never service or set any part of the system (except speed settings) while it is operating.
5. Keep clear of all moving parts.
6. Never expose any moving parts by removing protective elements.
7. Keep a safe distance from the sprinkler during operation.
8. Be careful in case of high connecting pressure!
9. Make sure that the water jet from spray nozzles does not hit public roads.
10. The RAINSTAR is licensed for transport in agricultural operation only. For transportation on public roads all applicable traffic requirements must be strictly adhered to.



WARNING!

For safety reasons it is not allowed to transport the RAINSTAR by pulling it with a fork-type drawbar (OPTIONAL) and the toolbar!

11. When loading the machine on a trailer note that the water remaining in the pipe shifts the system's centre of gravity upward.
12. When driving in curves with the RAINSTAR loaded on a trailer the permissible maximum driving speed is considerably reduced dependent on the position of the RAINSTAR's centre of gravity!
13. Always ensure that the locks and stops are secured according to the machine's general conditions for transport.
14. Before starting to irrigate near electric power lines you should contact your local power supply company regarding safe distances that have to be allowed.
15. Maximum permissible speed: 10 km/h

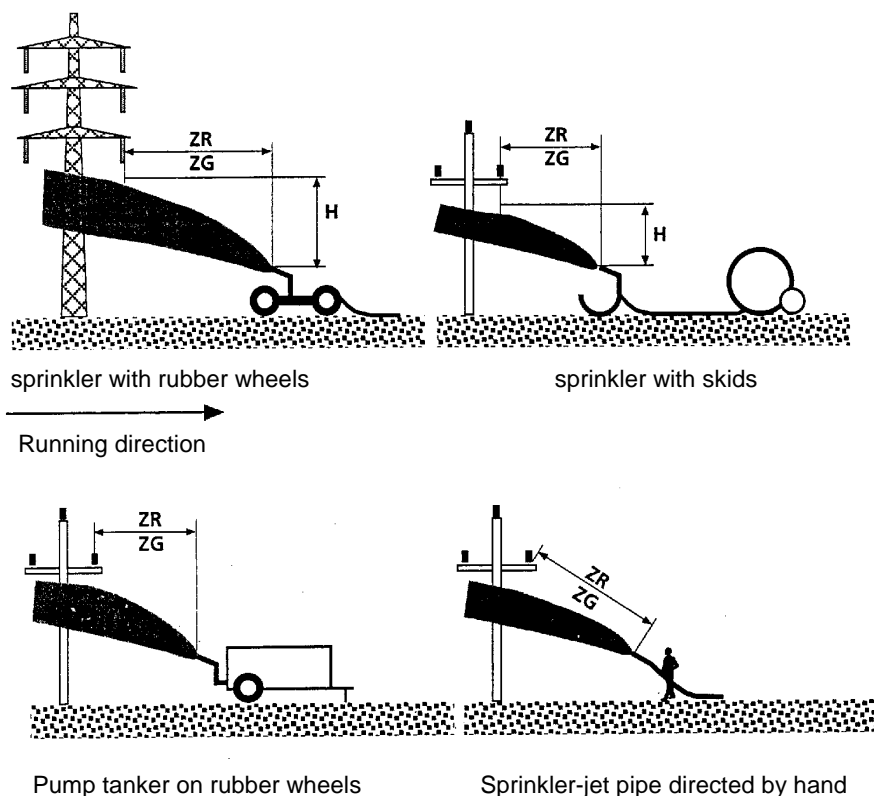
Safety distances **Z** from electric lines at:

I_R = **Z_R** e. g.: with drinking water, ground water (e. g. well)
 or running water (e.g. stream)

S_l = **Z_G** e.g.: with liquid manure or slurry

H = minimum distance between sprinkler upper edge and conductor cable
 When crossing beneath an electric line

The safety distance, when crossing an electric line, is reached, if the distances per the below chart are kept. The water beam may touch the conductor cable, but may not be higher than the conductor cable.



Attention: Do not spray slurry on insulators and masts !

		Safety distance Z in m, measured on the ground							
Type and operation mode of the sprinkler		With rubber wheels or directed by hand With metal or synthetic pipes				With skids or stationary/fixd With metal cart and metal pipes			
		Nozzle diameter in mm or. Flow in m³/h							
		26 mm \triangleq 50 m³/h		36 mm \triangleq 100 m³/h		26 mm \triangleq 50 m³/h		36 mm \triangleq 100 m³/h	
Jet type		Spray	Full	Spray	Full	Spray	Full	Spray	Full
Up to 1.000 V H = 1 m	ZR	1	5	1	5	1	5	1	5
	ZG	1	8	1	8	1	8	1	8
Up to 30.000 V H = 2,5 m	ZR	3	9	5	21	3	7	4	9
	ZG	5	11	7	23	5	9	6	11
Up to 110.000 V H = 3 m	ZR	3	12	5	24	3	9	4	15
	ZG	5	14	7	26	5	11	6	17
Up to 220.000 V H = 4 m	ZR	4	14	6	26	4	12	6	22
	ZG	6	16	8	28	6	14	8	24
Up to 380.000 V H = 5 m	ZR	5	16	7	26	5	14	6	22
	ZG	7	18	9	28	7	16	8	24

The indicated safety distances in the above chart are valid for a nozzle diameter of 26 mm or 36 mm at an operating pressure of 5 bar. **For higher operating pressures the safety distances have to be increased by 2 m.** The safety distances are not valid when normed jet pipes, like they are used by fire brigades, are being used.

When applying polluted water or slurry, note that a conductive layer can build up on the insulators. **Therefore do not spray on the insulators.!** Flashovers and insulator damage can otherwise cause power failure.

If metal sprinkler pipes are laid parallel to a high voltage power line, this can lead, even without irrigating, to a perceptible contact voltage because of the electric influence. Touching the pipes is not dangerous, but can be unpleasant and painful. This is why it should be avoided to lay metal pipes parallel to high voltage lines or only over the shortest distances possible. When using synthetic pipes, you will not encounter any of these problems.

Note ! Do not put pipe line pieces into a vertical position in the range of high voltage lines ! Only transport them horizontally

4 DESCRIPTION

The RAINSTAR is a universal irrigation machine for varying lengths and widths of fields and best suited for sprinkling cereal crops, field crops, root crops, and horticultures as well as any kind of grassland.

The main components of the RAINSTAR are a two-wheel undercarriage on which is mounted the turntable swivelling through 270°, and the reel with the special PE-pipe, the multifunctional compact gearbox and the TVR 60 turbine, and the high-rise cart that is ideal particularly for high crops, with the BAUER wide-range gun.

The material of the PE-pipe corresponds to the latest findings of the art. One end of the pipe connects to the reel drum and to the water supply through its axle. The other end of the pipe is coupled with the high-rise cart. The cart's track width is infinitely adjustable (see Technical Data).

The heart of the RAINSTAR is the TVR 60 turbine. This is a full-flow turbine mounted in a flow-promoting position directly on the reel. They are nearly insensitive to soiled water and offer maximum efficiency. The drive shaft is made of stainless steel. The regulating flap inside the turbine is coated with a wear-proof rubber lining.

The lifetime lubricated drive shaft bearing is sealed by a maintenance-free mechanical seal.

The TVR 60 turbine is designed for water flow rates from 20 to over 120 m³/h and features a wide control range. Impeller speeds range from 150 to 650 rpm.

The cart retraction speed is infinitely variable. It is adjusted by means of the ECOSTAR and can be read from the display. Depending on the available water flow and connecting pressure, it may vary between 8 and 150 m/h. The connecting pressure at the machine should not exceed 11 bar.

Power is directly transmitted from the turbine to the change-speed gearbox and the chain drive onto the reel. A band brake prevents fast reverse rotation of the reel in the final shut-off position, when the PE-pipe is stretched.

The band brake as well as gearwheels in the oil-filled change-speed gearbox act as a brake and prevent the PE-pipe windings on the reel from loosening during pipe pull-out.

For safety reasons the drive is fitted with an emergency stop and a reversing stop as well. With this emergency stop device the drive can be stopped immediately by hand.



WARNING!

Never remove the drive cover before you have turned off the water supply to the machine and slackened the stretched PE-pipe.

To slacken the stretched PE-pipe move the gear shift lever downward carefully (see proper procedure on page 13).

A winding carriage moved by a helically grooved spindle ensures that the PE-pipe is wound up properly on all layers. To keep the retraction speed constant on all layers independent of the pipe length still lying on the field, the RAINSTAR is equipped with an ECOSTAR 4000 S.

At the end of the irrigation strip the automatic drive shut-off is actuated by rods.

If the machine is equipped with an overpressure-actuated shut-off valve the water supply to the machine is shut off simultaneously.

If a low-pressure operated shut-off valve is mounted, the pumping unit is shut off.

After shut-off the rear hydraulic machine supports can be withdrawn. In doing so the cart is raised automatically into the transport position. Without any further preparations the RAINSTAR can be transported to its next setting-up position immediately. Pull off or lay down the PE-pipe again, connect the water supply, and the machine is ready for the next run.

When driving on public roads the reel must be turned into the driving direction and secured with the lock bolt. The PE-pipe must be fully wound up on the reel and the cart lifted. The jack and both rear machine supports must be withdrawn to their uppermost position.

On public roads the drawbar and coupling ring must be hitched to the tractor's yoke and secured with the pin. The maximum permissible driving speed of 10 km/h must be observed. For increased safety against overturning in curves we recommend to set the maximum possible track width.

On principle, it is possible to transport the machine between hydrants in the field with the cart lifted on the side. In this configuration the driving speed must always be adapted to the existing conditions and should never exceed 5 km/h. You must also take into consideration that this type of transport requires a wider driving lane.



5 PUTTING INTO OPERATION

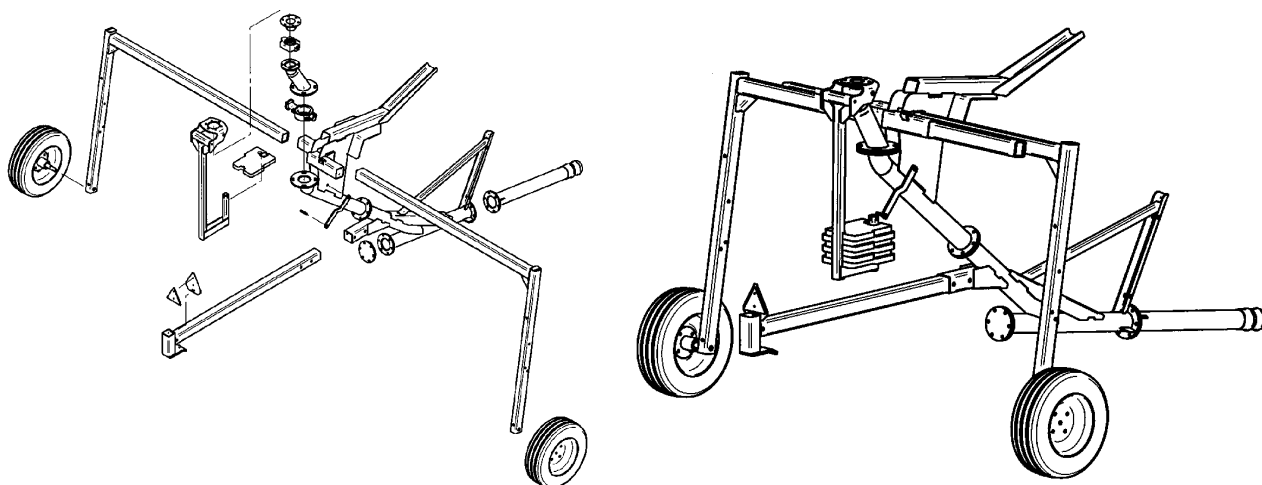
Before and during the first start-up grease all bearings, chains and guide parts of the winding mechanism. Use normal ball bearing grease for all bearing assemblies with grease nipples, and a viscous and durable type of grease for chains, guide rods and joints.

Tighten the wheel nuts before the first operation and check the tires for the specified pressure (see technical Data).

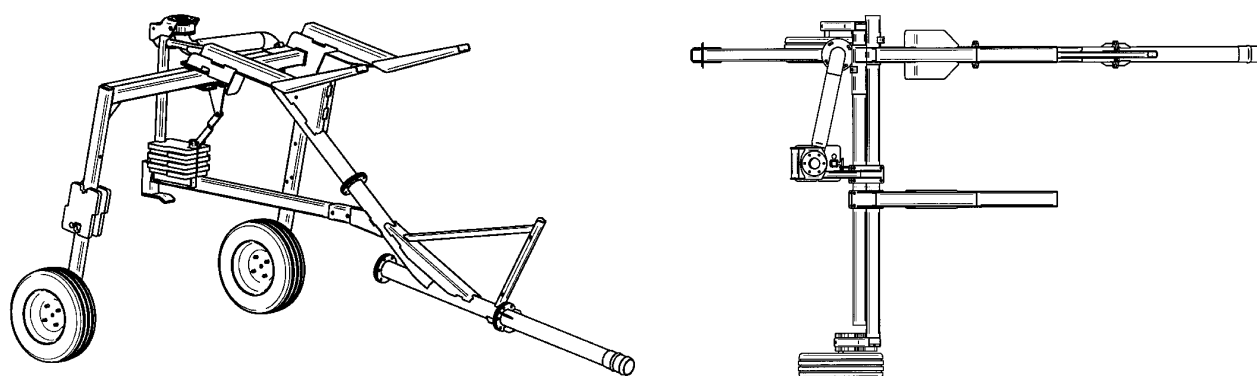
Tighten also the connecting bolts, the connection of the turntable side member on the undercarriage, the ball race on the undercarriage, and the fastening of the hitch eye, according to the "Service and Maintenance" table.

5.1 STEPS TO BE CARRIED OUT ONCE OR FROM TIME TO TIME

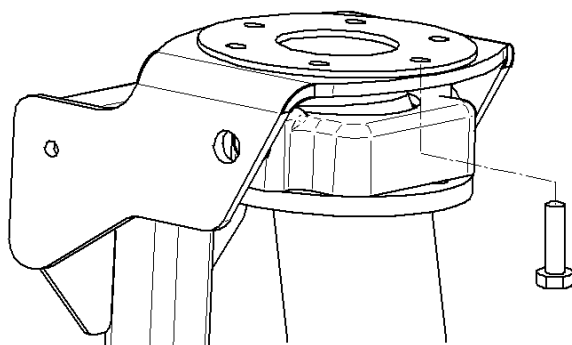
5.1.1 SYMMETRIC WHEEL CART ASSEMBLY PER SKETCH



5.1.2 ASYMMETRIC WHEEL CART ASSEMBLY PER SKETCH



Note: If you use a blow-out device, the stop valve has to be mounted between cart flange and sprinkler pendulum tube.



Note : front bolt for fastening the sprinkler to be mounted from below (way of the pendulum)



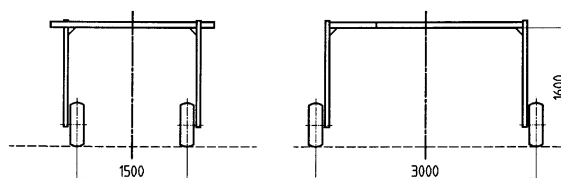
Set the required track width on cart and undercarriage depending on the existing type of crop.



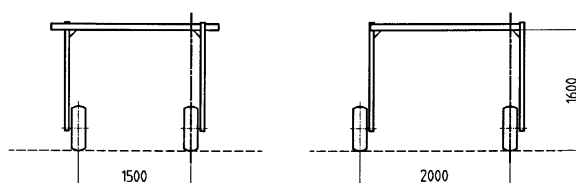
Place the appropriate number of balancing weights on the balancing pendulum of the cart.

The number of weights required depends on cart track width setting, nozzle diameter, and nozzle pressure.

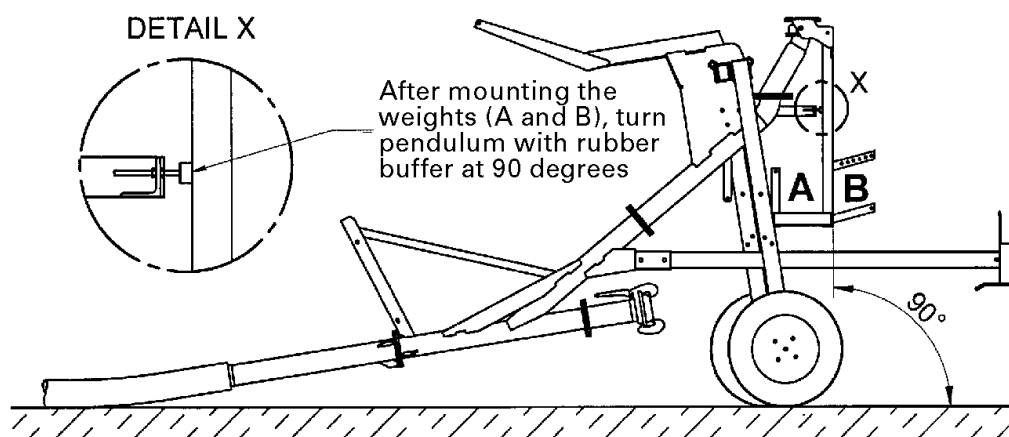
Symmetric wheel cart



Asymmetric wheel cart



5.2 TABLE FOR CONCRETE WEIGHTS REQUIRED ON SYMMETRIC CARTS



		Nozzle pressure in bar							
		3,0		4,0		5,0		6,0	
Position		A	B	A	B	A	B	A	B
Nozzle Ø in mm	26	3	1	3	1	3	1	3	2
	28	3	1	3	1	3	2	3	2
	30	3	1	3	1	3	2	3	3
	32	3	1	3	2	3	3	3	3
	34	3	2	3	2	3	3	3	4
	36	3	2	3	3	3	4	3	4
The number of required weights is for track 1500 to 2800 mm									

Note: When using an asymmetric wheel cart, additional 2 weights have to be mounted on the wheel carrier opposite the inlet (PE pipe) in addition to the weights specified above!



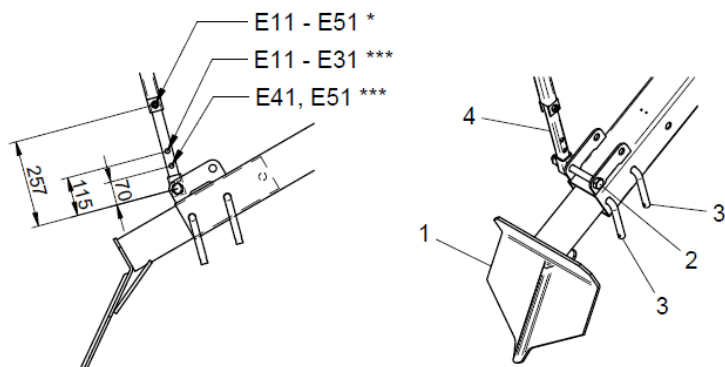
Set the sector on the wide-range sprinkler (ar. 220° for full track width). Further instructions see in manual for sprinkler. The VARI-ANGLE can be adjusted to the existing wind conditions by adapting the trajectory angle.

5.3 MOUNTING THE MACHINE SUPPORTS

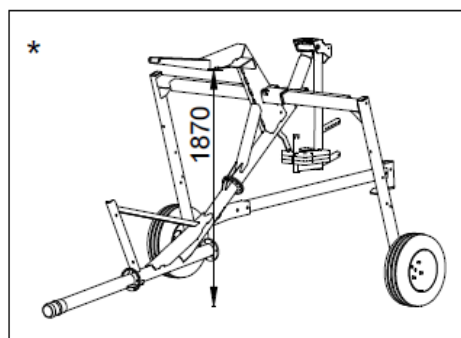
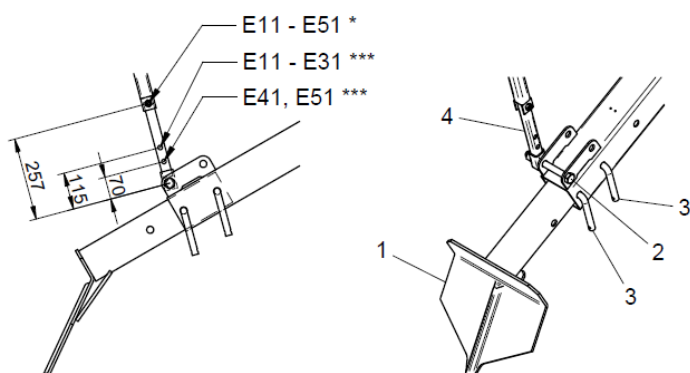
Set up the RAINSTAR on level ground in an all-round horizontal position.
The right and left machine supports are shipped in a wooden crate.

Mount the supports on the machine as described below:

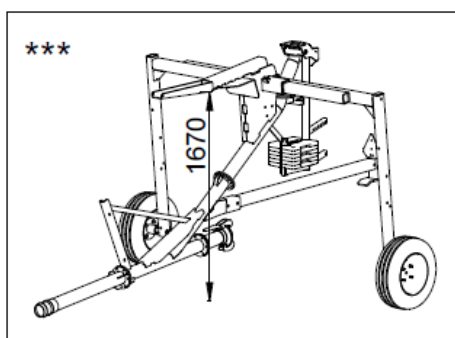
Mount the two anchoring shields (1), which are shipped loose, on both support legs according to the drawing with the lock bolt (3). Fasten the lower support brace (4) with the bolt (2).



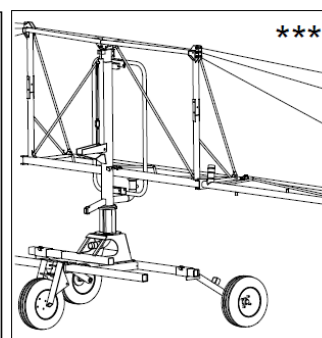
In special situations, e.g. if the path on which the RAINSTAR sits is slightly inclined, the anchoring shield can be mounted extended by 120 mm.



Version from 2013



Version to 2012



The new design of the anchoring shield (1) with a round connection part allows to swivel it by 180 degree by taking off the lock bolt (3). This means a higher ground clearance, which makes transportation easier.

Before mounting the right support, take off the cover (15).

Put the pre-mounted right support leg into engagement with the guide (5) and fasten it to the turntable side frame (7) with the bolt (6) (per the drawing).

Mount the support lift (8) in the turntable side frame with the bolt, turn up the fork and screw it with the bolt (9).

Proceed the same way with the left machine support.

5.4 MOUNTING AND ADJUSTING THE CART LIFT

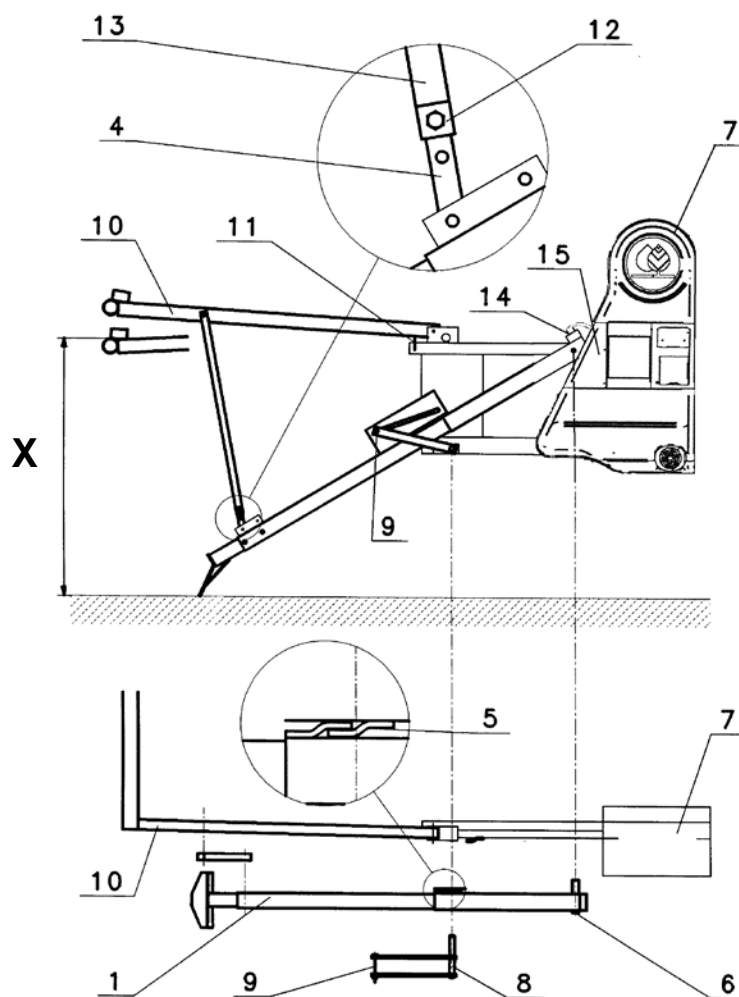
Mount the cart lift (10) according to the sketch . (Stop brackets pointing upward).

Move the cross beam height **X** , adjust the set screw (11) and secure them.

Mount both square washers (12) on the lower braces (4). (see Section 5.3)

Push the upper brace (13) over the lower brace (4).

Lift the cart lift bracket (10) and screw it with the braces in such a way that it can swivel.



X *	X ***	Typ
1750mm / 69 inch	1550mm / 61 inch	E11-E51
1850mm / 73 inch	1650mm / 65 inch	E11-E51 / 4W
1850mm / 73 inch	1650mm / 65 inch	E11-E51 / 4WB

X *, X *** see section 5.3



ATTENTION

Check setting dimension of cart lift bracket when mounting the machine

5.5. OPERATING MODE I: PE-PIPE PULL-OFF

5.5.1. TRANSPORT OF MACHINE TO SET-UP POSITION



During transport the reel should be turned into the driving direction and secured with the lock bolt. Cart, jack, and both rear support legs must be lifted or retracted. For lateral PE-pipe pull-off, set up the RAINSTAR on the headland at right angles to the selected irrigation strip and detach it from the tractor



Adjust the undercarriage in a level position with the jack.

When positioning the RAINSTAR make sure that the machine's vertical axis of rotation is in the middle of the driving lane or centered between two crop rows.



For lateral pull-off remove the lock bolt, turn the reel into the direction of the driving lane and secure it again with the lock bolt.



Couple both hydraulic hoses with the hydraulic system on the tractor and extend the supports.



WARNING!

The standard RAINSTAR equipment does not include a control unit (Optional). After coupling the hoses the tractor's hydraulic system for extending or retracting the supports must therefore be changed over accordingly. If this is not possible, you have to exchange the two hoses.

For maximum stability the machine supports should be fully extended to their end position.



WARNING!

During this procedure the operator's position should be outside the supports.

On very hard soil the supports have to be lowered or extended into holes dug into the ground for this purpose.



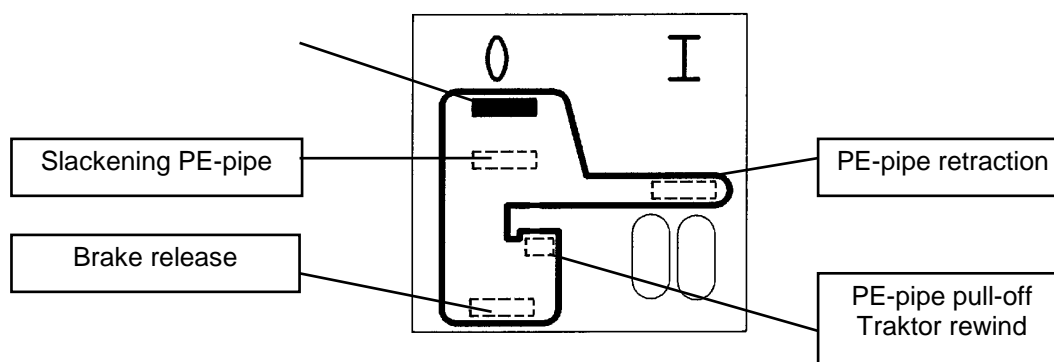
5.5.2. LOWERING THE CART



When the supports are being extended the cart is automatically lowered into the "PE-pipe pull-off" position.

Then depressurise the tractor's hydraulic system and uncouple the hydraulic hoses.

SWITCHING POSITIONS OF THE SHUT-OFF LEVER

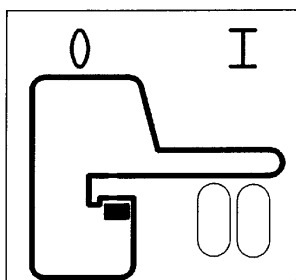


5.5.3. PE-PIPE PULL-OFF



Move gear shift lever into the "PE-pipe pull-off" position. A spring presses the lever up and locks it.

In case of loose pipe winding (first operation or unit transport with lever in wrong shut-off position – not in transport position 0) be sure to avoid overwinding. In case of an emergency, the loose pipe windings have to be pushed into the correct position to the winding mechanism with the command devices. It is necessary to carefully and slowly pull out the PE pipe while at the same time position the PE pipe correctly.





Pick up the double draw-out hook with the toolbar and pull the cart into the field.

The standard wheel cart or the asymmetric wheel cart need not be lifted.

Pull-off speed: Do not exceed 5 km/h !

Do not stop abruptly, but slow down gradually at an intermediate stop or at the end of the pull-off.

CAUTION!

If the PE-pipe is to be pulled off in a wide bow, make sure that it is pulled in a straight line of about 80 to 100 m first (90° angle to the reel) and then in a wide bow.



WARNING!

If the PE-pipe has been exposed to the sun for a longer period or if its surface temperature rises above 35 °C you must let water run through the pipe to cool it off before the unwinding or retraction procedure.

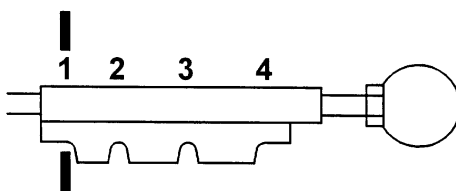


Couple the pressure hose, open water supply.

Move the gear shift lever into the correct position.

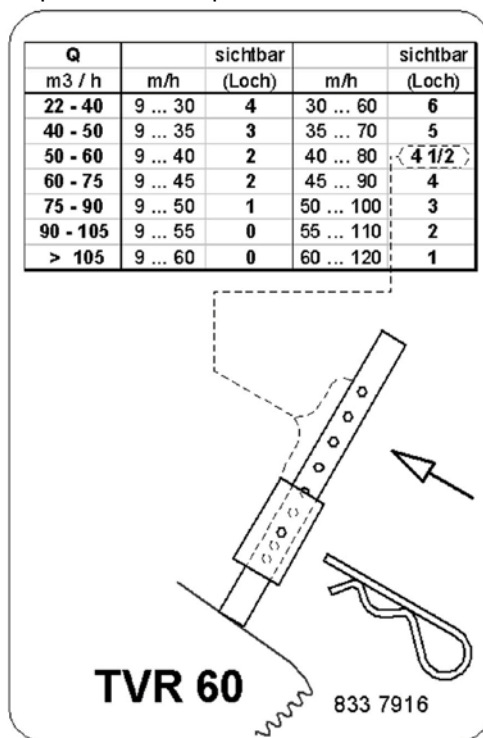
TVR 60

1	8	--	20	m / h
2	16	--	32	m / h
3	28	--	50	m / h
4	> 45			m / h



5.5.4. LIMITER FOR TURBINE REGULATION OF TVR 60 TURBINE

Before system start-up, the control range of the TVR 60 turbine must be limited according to the following chart. Please take discharge and retraction speed from the performance chart.



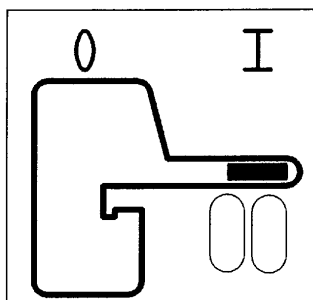
If discharge or retraction speed change substantially, the limiting bolt must be readjusted.



When the full operating pressure has been reached and clear water is discharged at the sprinkler's nozzle in a full jet without air bubbles, push the gear shift lever to the "PE-pipe retraction" position.

Shifting should be done at low turbine speed!

DO NOT USE FORCE



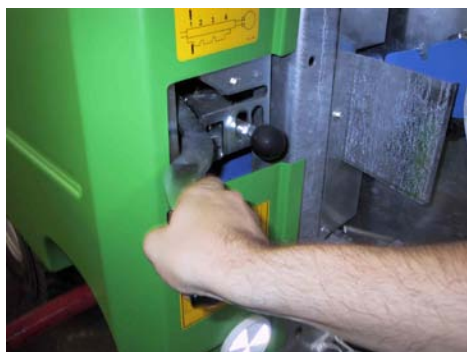
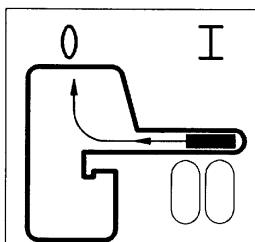
WARNING!

If the PE-pipe is stretched – SLACKEN IT!

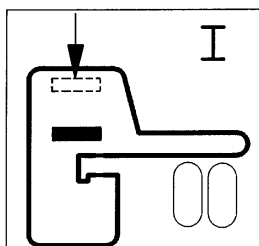
Proper procedure:



Pull the shut-off lever into the shut-off position



... and slacken the PE-pipe by carefully pressing the shut-off lever downward.



CAUTION!

Switching into the gear speeds 1 to 4 is only possible when the turbine is rotating!

CAUTION!

Move the gear shift lever into the desired position and set back the shut-off lever to the "PE-pipe retraction" position.

The reel starts to rewind the PE-pipe.

5.5.5. SPEED ADJUSTMENT WITH ECO-STAR 4000 S

Set the required retraction speed with the keys in the operating mode of ECO – Star 4000 S. You can readjust the retraction speed any time while the machine is operating.



See Retraction Speed Control with ECO-Star

Further procedure:

At the end of the irrigation run the drive is shut off by rods.



After retraction of the PE-pipe the machine supports can be carefully withdrawn with the tractor's hydraulic system. In doing so the cart is lifted into the transport position automatically.

In case the RAINSTAR gets misaligned or pulled aslant during PE-pipe rewind it has to be realigned. For this purpose you need to slacken the PE-pipe first.

Proper procedure:

1. Close the water supply to the RAINSTAR. The PE-pipe slackens only partially by the turbine that acts like a hydraulic brake



2. Pull the shut-off lever into the shut-off position and push it downward slowly and carefully...



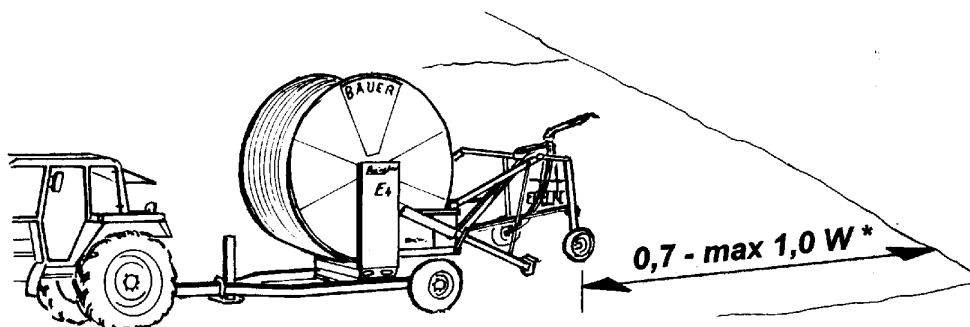
... to **slacken the PE-pipe** (see also page 12 "proper procedure").

3. Readjust the machine and prop it up adequately.
4. Open the water supply again.
5. Move gear shift lever into the desired position.
6. PE-pipe rewind continues.

5.6. OPERATING MODE II: LAYING DOWN THE PE-PIPE

In addition to the pull-off method the PE-pipe can also be laid down on the ground. This method is mostly used in situations where heavy soil makes it impossible to pull the cart across the field or where the field is longer than one or two times the PE-pipe length. Moreover, the laying down method allows using smaller tractors because no pulling forces are applied on the pipe.

Drive into the field with the RAINSTAR allowing for the sprinkler's distance of throw.



*) W = distance of throw of the sprinkler



Lower the cart as described under Operating mode I, "Lowering the cart" and anchor it slightly.



Now move forward with the machine for about 2 to 3 metres, retract the machine supports and continue across the field.



Extending and retracting of the machine support is made much easier with the "control valve block - supports" option.

- If you are using a pipe guiding device, drive on about 10 to 20 metres after lowering the cart.
- Take the guide arms from the transport brackets and telescope the guide arm with the roller.
- Place the PE-pipe in the roller guide and close the side part of the pipe guide box.
- Take the supporting guide arm from the mounting and hook it up to the guide arm with the roller.
- Place the PE-pipe in the machine's wheel track or in the desired position between plant rows and secure the supporting guide arm with the lock pin in the appropriate hole.
- Hook up the chain to the "keyhole bracket".
- Withdraw the hydraulic support legs. The cart lift slightly hoists the pipe guiding device with the PE-pipe through the hooked up chain.
- Now the PE-pipe can be laid down in a perfectly straight line between plant rows, for instance in the machine's wheel track.
- Carry out all other steps according to the procedure described above.
-

Open the side part of
the pipe guide box
Place the PE pipe in the
roller guide
Close the side part of
the pipe guide box



Hook up the chain in the
desired position

5.6.1. FUNCTIONAL DESCRIPTION OF THE MAIN COMPONENTS

5.6.1.1. MACHINE DRIVE – FULL-FLOW TURBINE



The full-flow turbine TVR 60 is a specifically designed model with large cross sections and minimum pressure loss. Therefore they are also suited for high retraction speeds at very low flow rates. These turbines feature a very flow-promoting design and they are mounted directly on the reel shaft. They provide the energy needed for the PE-pipe retraction. The turbine speed is taken directly off the impeller shaft and transmitted over a V-belt drive to the BAUER change-speed gearbox.



BAUER change-speed gearbox reduces the turbine speed according to the set turbine revs. The gearbox incorporates four gears. Reel drive stop at the end of the irrigation strip is ensured by disengagement of the tooth clutch.

The four-speed gearbox adapts perfectly to existing operating conditions. As a result the following retraction speeds [m/h] can be reached:



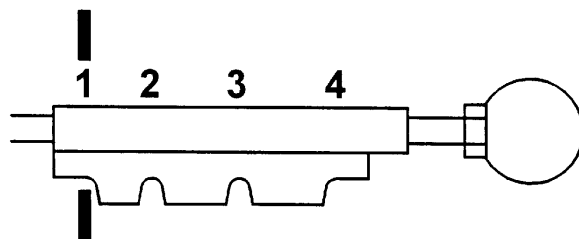
GEAR SPEED SELECTION

Shifting should be done at low turbine speed!!

DO NOT USE FORCE

TVR 60

1	8	--	20	m / h
2	16	--	32	m / h
3	28	--	50	m / h
4	> 45			m / h

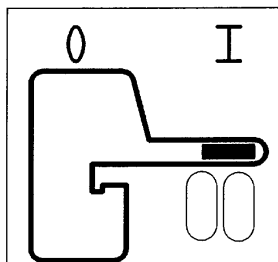


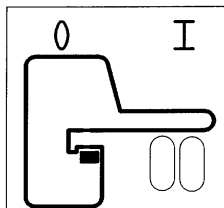
WARNING!

Removal of the drive cover for service is only permitted when the PE-pipe is completely slack and the water supply turned off !
The gear shift lever must be moved to the shut-off position ! This shut-off position must also be used for transporting the machine on the road !

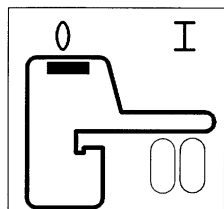
But note the following:

If the shut-off lever is in the „PE-pipe retraction“ position, the gear shift lever is locked and cannot be shifted.





If the shut-off lever is in the „PE-pipe pull off“ position.



or shut-off position

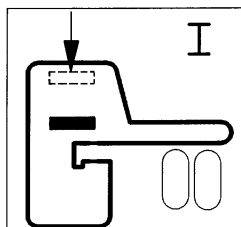
you can shift it to the required gears 1 to 4.

**WARNING!**

Before shifting gears – slacken the PE-pipe !
Always shift gears at low turbine speed!

**WARNING!**

If the shut-off lever is in the shut-off position, press the lever down slowly and carefully so that the band brake is released and the PE-pipe slackens (see also page 13).



5.6.2. PTO REWIND



If required, you can rewind the PE-pipe also with the tractor's PTO system

Rewind only under water pressure (oval PE-pipe)

PTO speed = max. **540** rpm



Shift the shut-off lever to the "PE-pipe pull-off" position.

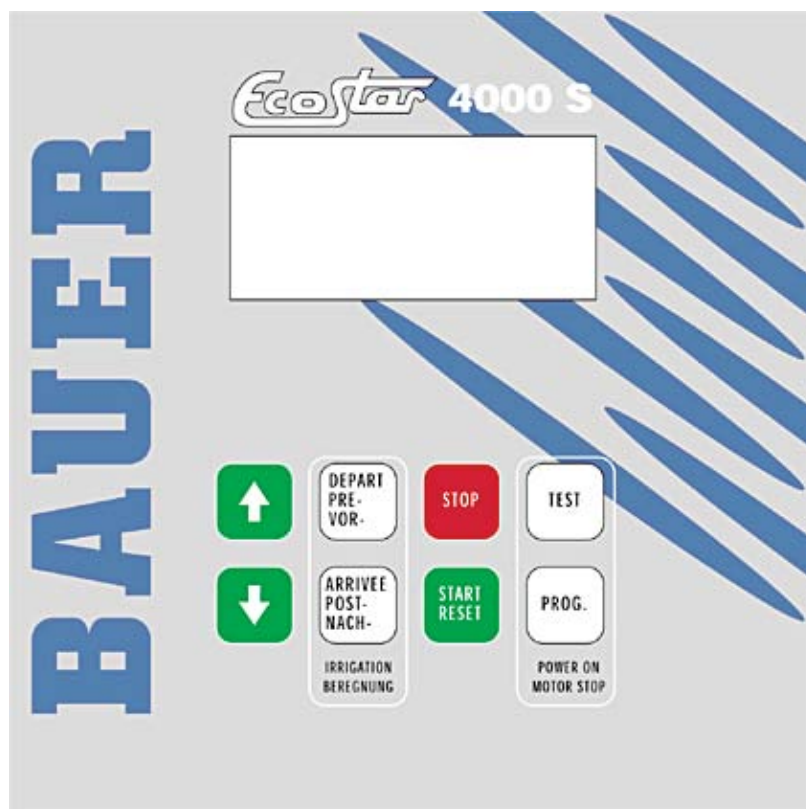
A spring presses the gear shift lever into a locking recess. In this position the band brake is slightly loosened and does not have any brake action during the wind-up.

Winding up the PE-pipe with the PTO will become necessary if there is no need to continue irrigating due to natural rainfall.

**WARNING!**

- Retract the pipe at the lowest possible PTO speed - start slowly and smoothly and avoid jerks.
 - Avoid strain by excessive articulation of the PTO shaft.
 - If the PE-pipe is covered with mud it should be loosened and lifted off the ground to reduce the tension load before rewinding it.
 - You can release the PE-pipe and lift it off the ground by tying around a hemp rope or a fabric belt and pulling it along the pipe.
 - If the soil is deep and heavy the PE-pipe must be wound up more slowly to make sure that the permissible loads on PE-pipe and RAINSTAR are not exceeded.
 - If you disengage the PTO shaft during PE-pipe retraction, make sure that the pipe reel stands still when you re-engage the PTO shaft.(Slacken the PE-pipe). Double motion may cause severe damage!
- When driving the reel with the PTO the automatic shut-off system is inactive.** Therefore you must stop the PTO shaft in time and wind up the end of the PE-pipe with the hand wheel. This will prevent damage to cart, shut-off system, gearbox, etc.

6 SPEED CONTROL WITH BAUER *Ecostar* 4000 S



6.1 GENERAL

BAUER ECOSTAR 4000 S allows you to operate your irrigation machine with ease at the touch of a button.

An illuminated four-line display provides comprehensive indication of the machine's operational status.

Through permanent comparison of set-point and actual value of the retraction speed you can administer your crops precisely the precipitation they need.

ECOSTAR 4000 S consists of the electronic box, a cable harness with the connected sensors for PE-pipe length, retraction speed and shut-off as well as connections for battery, solar panel, and turbine regulating motor.

Connections are also provided for installing both a shut-off valve and a pressure switch (both optional equipment).

The electronic system of ECOSTAR 4000 S is rigidly built and has been tested under different climatic conditions.

If problems still occur it is advisable to exchange the complete electronic box.

If a sensor is defective, you can replace the sensor only.


WARNING!

The front panel must be opened very carefully!
 To guarantee that the cover sealing provides proper protection against moisture the cover must be closed very carefully, too!


WARNING!

Always disconnect the battery before carrying out welding work and repairs on the RAINSTAR!

Because of the standard solar panel it is not necessary to charge the battery during the irrigation season. If you have to charge it nevertheless, the maximum charging current should not exceed 2 amperes. ECOSTAR 4000 S keeps the pre-selected retraction speed on a constant level throughout the pipe retraction. Due to simple key assignment, operator control requirements are very low. Normally, ECOSTAR 4000 S is in the energy-saving mode without displaying information. Simply press the "POWER ON" or "PE-pipe retraction" key to activate the electronic system and turn on the background illumination with the standard display.

6.2 DISPLAY WINDOWS

The *ECOSTAR 4000 S* has 3 different display windows:

Standard display (operational status)

Preset speed	30.0 m/h
Remaining irrigation time	00 : 00
Laid down PE-pipe length	000 m
Pre-irrigation 0 0 min	Post-irrigation 0 0 min

The first line indicates the desired retraction speed; it can be altered any time also while the system is irrigating (pre-setting 30 m/h).

The second line indicates the time (in hours and minutes) remaining until the irrigation run is finished, including pre and post irrigation. This time setting can be read off any time during the irrigation run.

The third line shows the length of PE-pipe laid down on the ground.

It is possible to enter this length by hand, for instance after a metering error (locate the cause and exchange the length sensor for instance) – for this purpose see Parameter Sheet no. 1, program constant no. 07.

The fourth line shows pre and post irrigation time in minutes. If the number is blinking, it means that the system is currently running on pre or post irrigation.

If the display shows LOW BAT instead of the speed the battery voltage is lower than 11.8 V. Charge the battery with a power supply unit or exchange the battery. (Check if solar panel charges properly, see 4th line of test menu).

Press the „TEST“ button once (1 x)



to get to the

1st Test menu (performance test)

Test 1	
Current speed	030 m/h
Battery voltage	12.3 V
Charging by solar panel	ON

The first line shows the menu status „Test 1“

The second line indicates the actual speed at which the machine is currently running.

This display information is needed to be able to check the maximum possible retraction speed of the machine in case the ECOSTAR 4000 S is set at a speed much higher than possible on account of the connected loads.

The actual speed may deviate from the pre-set speed, for instance after the start when the PE-pipe is not yet stretched.

The average running speed of ECOSTAR 4000S is precise within 10 m retraction and corresponds exactly with the desired pre-set speed (in the standard menu). The third line indicates the battery voltage.

The fourth line shows if the battery is being charged by the solar panel. The battery is charged when voltage drops below 14,0 volts.

Press the „TEST“ button twice (2 x)



to display the

2nd Test menu (performance test)

Test 2	Pressure switch ■
Stop - sensor	■
Speed – sensor	■ ■
MOTOR 1 ■	MOTOR 2 ■

If the symbol ■ appears on the display it means that this function is switched on.

The first line on the left indicates the menu status „Test 2“

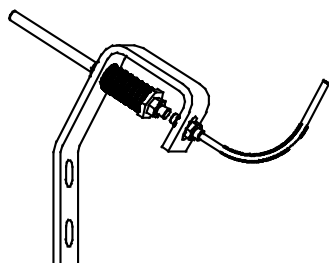
The first line on the right shows if - with a pressure sensor mounted - the pressure at the machine is sufficient.

The symbol ■ appears when pressure rises above the minimum pressure at which the pressure switch is set. The machine will operate only with sufficient pressure or stop in case the pressure is lower than the set minimum pressure.

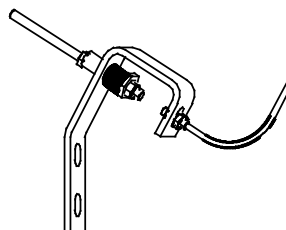
The second line shows if the stop sensor is activated, the symbol ■ is displayed if the stop sensor is activated (operating position, the magnet sits 2 – 5 mm close to the sensor)

The machine can only operate if the stop sensor is switched on and in the operating position.

Operating position



Shut-off position



The stop sensor has three functions:

- 1) Reset for the laid-down PE-pipe length:
When operated the laid-down pipe length is set to zero.
- 2) Post irrigation:
If the post-irrigation procedure is carried out at the end of the run (0 m laid-down PE-pipe length) the post-irrigation function is activated first and then the ECOSTAR shut-off.
In the standard program, post-irrigation is activated 8 m before the end of the run.
- 3) Prevents pulses to the regulating motor.
After the stop sensor is activated, no pulses are passed on to the regulating motor.

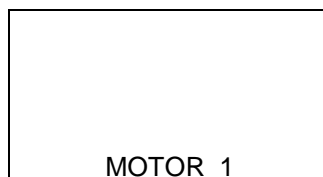
The third line shows if the speed sensors are in proper working order. The symbol ■■ appears when a magnet activates the two speed sensors at the turning of the magnet disk.

The fourth line shows if the motors 1 and 2 have been switched off after having reached their mechanical stop.

If the ■ symbol appears and one motor has not reached its end position there is a blockage inside the turbine (MOTOR 1) or the shut-off valve (MOTOR 2).

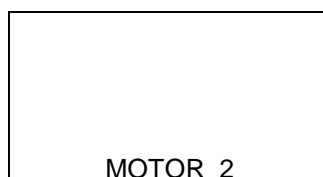
The motor is turned off when the current input rises above 4.7 amperes, the symbol ■ appears.

If the display shows MOTOR 1 blinking, it means that the regulating motor is currently running.



During this motor running time (max. 26 seconds), it is impossible to make entries on the keyboard.

If the display shows a blinking MOTOR 2, it means that the shut-off motor for the shut-off valve is currently running.

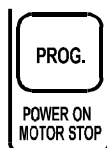


It is impossible to activate keys on the display while the motor is running. The motor runs for max. 26 seconds.

If the STOP button is pushed while the shut-off sensor is in the shut-off mode (end of irrigation, the magnet does not sit close on the shut-off sensor), the display shows POWER OFF for 2 seconds. Then the electronic system is in the stand-by mode.



The electronic system is activated



again when the PROG/POWER ON key is pressed or the PE-pipe pulled off.

The battery is only charged while the electronic system is active. No charging takes place in the stand-by mode.

6.3 HOW TO OPERATE THE BAUER ECOSTAR 4000 S

Summary:

- Pull off or lay down the PE pipe
- Couple the water supply
- Engage the gear box

ECOSTAR : Make entries only in the standard menu:

Take over the retraction speed from the previous run or make a new entry.

Push "START-RESET" button.



Activate pre-irrigation, if required.
Activate post-irrigation, if required.

Open the water supply.
The irrigation cycle runs automatically.

FURTHER INSTRUCTIONS

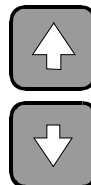
After a longer standstill the electronic system of ECOSTAR 4000 S is in the stand-by mode. Pulling off or laying down of the PE-pipe activates the electronic system and the length of the pulled off or laid down pipe is counted.

Example for standard display:

SPEED		30.0 m/h	
TIME		10 : 00	
LENGTH		300 m	
PRE	00 min	POST	00 min

6.3.1. SPEED ADJUSTMENTS

The pre-set speed of 30 m/h can be increased or reduced by means of the keys.



First the speed changes by 0.1 m/h step by step, then the speed changes by 1.0 m in steps of 10.

The speed can be changed at any time while the machine is running.

The time remaining until the end of the run is always adjusted automatically, too.

It is impossible to change the speed while a turbine regulating or shut-off valve motor is operating. The display shows MOTOR 1 or MOTOR 2.

Along with the speed change, the time pertaining to the speed setting it is also changed.

SPEED	20.0 m/h
TIME	15 : 00
LENGTH	300 m
PRE 00 min	POST 00 min

Caution!

When setting the speed you must check on the speed that can actually be reached according to the test window (push test key once).
In case of deviation you have to reduce the set speed to the speed actually possible.

6.3.2. PRE AND POST IRRIGATION

Use PRE and POST IRRIGATION keys to activate these functions.



Pre and post irrigation time are pre-programmed. ECOSTAR 4000 S calculates them as being 8 times the time required for covering 1 m at the actual speed.


Example: at $v_E = 20$ m/h the time for retracting 1 m is 3 minutes.
The resulting pre irrigation time amounts to 8×3 min = 24 min
The post irrigation time is also 8×3 min = 24 min

Example on standard display:

SPEED	20.0 m/h
TIME	15 : 48
LENGTH	300 m
PRE 24 min	POST 24 min

This value “8” can be changed in the program (program constants no. 1 and no. 2) - see Parameter Sheet 1: Constants

If the pre-irrigation mode is activated the machine runs for about half a meter after the start and then it stops for the pre-irrigation time.


If you press the “START-RESET”  key in the pr-irrigation mode, the pre-irrigation function is cancelled.

Before activating the pre or post irrigation mode the PE-pipe should be pulled off (the shut-off frame and thus the shut-off sensor should be in the operating mode) and the START-RESET button should have been pressed. If the post-irrigation mode is activated the machine stops 8 m before the end of the run for the post-irrigation time. This value is pre-adjusted and can be changed in the program constant no. 6 – see Parameter Sheet 1 : Constants.

If you push START – RESET in the post irrigation mode, the post irrigation function is cancelled.

6.3.3. START

When the PE-pipe is pulled off and the desired speed is set on the device, push the button to start irrigating.

If pre or post irrigation are required, push the  appropriate key.



The turbine can only start if the shut-off frame and thus also the shut-off sensor are in the operating state (PE-pipe pulled off).

If the START–RESET key is pressed the turbine flap closes, the toothed segment on the regulating motor turns away from the reel and the shut-off valve (if mounted - optional) opens.

6.3.4. MONITORING

The program has a built-in monitoring system.

This systems will work only in combination with a shut-off valve - overpressure.

In the factory setting, this monitoring is deactivated (Parameter sheet 2, machine data 17, value set to “0” – monitoring off).

If system is set according to parameter sheet 2, machine data 17 at value “1”, the monitoring function is activated.

In this mode the monitoring function starts to work when the RAINSTAR **fails** to reach the set speed within the programmed monitoring time (according to parameter sheet 1, program constant 03). In the factory setting the program constant 03 is set at 20 minutes. After this time the shut-off valve is closed and the machine stops.

Mostly the reason is that the retraction speed setting is too high, or the regulating flap is blocked etc.

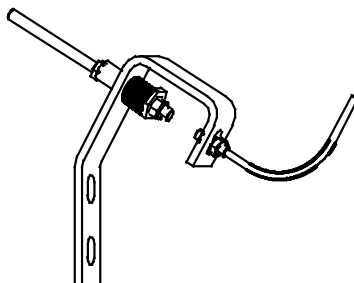
In order to ensure that the set retraction speed is really reached and the system is not shut off after the monitoring time, check up on the retraction speed that can actually be reached by pressing the TEST key once.

If a pressure switch is mounted; the machine will start operating when a certain pre-set minimum pressure is reached, or irrigation is interrupted at low pressure. Irrigation is resumed as soon as pressure returns to standard.

6.3.5. STOP

At the end of the run the shut-off sensor is activated through shut-off frame and shut-off rods.

Sensor in shut-off position



That way the turbine stops and the shut-off valve closes until the next run.

shut-off valve closes and remains in this position

If the RAINSTAR is connected to a hydrant the water pressure existing of the hydrant can be released by pressing the START-RESET key.

after closing



The shut-off valve opens and pressure is released through the PE-pipe. If a low-pressure shut-off valve is mounted it opens very quickly. It closes again after about 15 minutes.

The irrigation cycle can be stopped at any time by pressing the STOP key.



The turbine flap opens (the turbine stops), the overpressure shut-off valve closes or the low-pressure shut-off valve opens.

Thereby the laid-down PE-pipe length remains saved in the system. It is only reset to 000 if the shut-off sensor (shut-off position) is activated.



WARNING !

If the „STOP“ button is actuated during the retraction on a machine, that does not have a shut-off valve, the retraction stops, the gun, though, continues operating. To prevent a local over-irrigation around the gun, the machine should operate only for a short period of time without retraction, if required, and then put into operation again by pressing the START button.!!



WARNING !

When the machine data at pos. 12 is set „0000“, the retraction stops only for a short period of time when actuating the „STOP“ button. After a few seconds the retraction starts automatically again.

WARNING: When working on the machine always turn off the entire drive completely !!

STOPPING the REGULATING FUNCTION ,

By pressing the „STOP“ and „PROG.“ button at the same time, all ECOSTAR functions are halted, i.e. the regulating motors of turbine and shut-off valve remain in the position, where they are.

By pressing these buttons the turbine regulation at a low turbine speed, for instance, can be stopped in order to change the gears.

6.3.6. PRESSURE SWITCH (OPTIONAL EQUIPMENT)

If the RAINSTAR, after having been positioned for the run, is supposed to start-up only after the required pressure has built up in the supply line (pressure start), a pressure switch must be installed.

If such a switch is available, the monitoring system will also interrupt the irrigation cycle in case of low water pressure. As soon as the pressure returns to standard the run is continued.

CAUTION: The pressure switch always has to be used in connection with an overpressure shut-off valve. !!

6.4 FAULT DESCRIPTION – ECO STAR 4000 S

FAULT	CAUSE	REMEDY
The battery is not being charged.	Solar panel soiled.	Clean
	Solar panel defective.	Leave the machine in the sun. Exchange the solar panel.
	Battery defective.	Charge. Exchange.
Electronic system defective.	Electronic fault.	Cover solar panel, disconnect the battery and hook it up again (Reset).
		Call customer service.
		Exchange the electronic box
Premature machine shut-off	Overwinding fault.	Turn off water supply. Slacken PE-pipe. Readjust the machine.
	Shut-off frame has been activated unintentionally.	Put the shut-off frame into the operating position enter laid-down pipe length and press "START"
The retraction speed is not reached.	Low pressure in supply line or pump station	Increase pressure or enter retraction speed according to the performance chart

6.5 PROGRAMMING PROCEDURE

The electronic system is factory-programmed.

However, if site conditions require settings which deviate from these data it is possible to modify the program constants and machine data accordingly.

Proceed as follows:

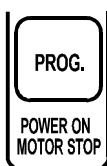
The speed must be set at 11,1 m/h or 11 f/h in order to reach the constants.



WARNING!

If the setting is in US units, you have to enter 11 [f/h] instead of 11,1 [m/h].

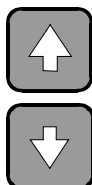
Immediately press the constant 01 (see Parameter



"PROGRAM" key 3 x (three times) in order to get access to program sheet no. 1).

Press the PROGRAM key for a short while again to select the program constants 01 to 09 – see parameter sheet no.1.

Use the cursor keys



to change the values of the constants as required.

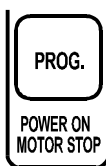
If you press the TEST key the program returns to the standard display and the changed constants are saved.

If the TEST key is not pressed the program will return to the standard display after 1 minute and the changes are not saved.

The constants remain saved even if the battery is disconnected for a longer period of time.

In the program constant 09 with the value 111 you have access to the machine data.

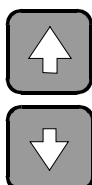
By pressing the PROGRAM key you enter
See Parameter Sheet No. 2.



the machine data mode.

Press the PROGRAM key for a short while again to select machine data numbers 00 – 18 .

Now you



can use the cursor keys to change values according to actual requirements.

If you press the TEST



key the program returns to the standard display and the changed machine data are saved.

PARAMETER SHEETS no. 1 and no. 2 Example

Constants: Parameter sheet no. 1

Program version : 4,1 ; 4,5

Prog. const.	Setting value	lowest value	highest value	Description
01	0008	0001	0015	Pre-irrigation [m]
02	0008	0001	0015	Post irrigation [m]
03	0000 or 0020	0000	0099	Monitoring time [min] 0 = without shut-off valve 20= with shut-off valve
04	0001 0002 0003 0004 0005 0006 0007	0001	0007	0001 = English 0002 = Danish 0003 = German 0004 = French 0005 = Dutch 0006 = Swedish 0007 = Spanish
05	0000 0001 0002	0000	0001	0000 = slow shut-off, for option overpressure shut-off valve 0001 = fast shut-off, for option low-pressure shut-off valve 0002 = without shut-off valve option
06	0008	0000	0015	Distance to post irrigation [m]
07	0000	0000	1000	Input of laid-down PE-pipe length [m] if shut-off sensor is defective or removed
08	0000	0000	1000	not used
09	0111	-	-	Code for access to machine data; 11 = with setted US units

**Machine data: Parameter sheet no.. 2****Program version : 4,1 ; 4,5**

Mach. data	Setting value	lowest value	highest value	Description
00	0480	0000	1000	Pipe length [m]
01	0090	0040	0200	Pipe diameter [mm]
02	1680	0500	3000	Reel diameter [mm]
03	13,64	05,00	30,00	Windings per layer
04	0256	0050	1000	Large chain wheel (reel sprocket) number of teeth x 2
05	0013	0005	0040	Small chain wheel (driving pinion) number of teeth
06	0004	0001	0020	Number of magnets
07	0089	0070	0100	Pipe ovality [%]
08	0003	0000	0045	first pulse to the shut-off motor [sec]
09	0160	0000	0300	pulse length to shut-off motor [msec]
10	0003	0001	0005	time between pulses [sec]
11	0100	0000	0250	number of short pulses
12	0003 0003 0004 0001 0001 0002	0000	0004	Shut-off system From version 4,5 0003= mechanical or no shut-off system 0003= shut-off systems closes when loosing pressure (overpressure shut-off) with 8 sec. delay 0004= shut-off system opens when loosing pressure (low pressure shut-off) with 8 sec. delay <u>till version 4,1 and for setting the shut-off from version 4,5:</u> 0001= mechanical or no shut-off system 0001= shut-off system closes when loosing pressure (overpressure shut-off without delay 0002= shut-off system opens when loosing pressure (low pressure shut-off without delay
13	008,2 004,1	000,9	026,1	time for closing of the regulating flap [sec] TX60, TX100 [sec] TX20,TVR20,TVR60 [sec]
14	0000 0001	0000	0002	0000 = pressure switch not in operation 0001 = pressure switch in operation
15	000,0	000,0	160,0	length sensor 000,0 = length sensor on gearbox (System BAUER) 062,5 = length sensor with roll, diam. 80, distances of the pulses at the PE-pipe [mm]
16	0000 1	0000	0001	0000 = shut-off valve opens with one pulse (12 sec.) 0001 = shut-off valve opens with the same pulses with which it closes
17	0000	0000	0001	Monitoring of the correct speed 0001 = monitoring ON 0000 = monitoring OFF
18	0000 0001	0000	0001	Change over from metric to US units 0000 = metric units [m] 0001 = US units [ft]

Note : If US units are set, you get access to the programming mode by entering 11 f/h
 Enter the program constants in US units, the machine data in metric units!



WARNING !

Shut-off system**

When „0 “ is set, the retraction only stops for a short period of time when pressing the STOP button. After a few seconds the retractions starts again automatically. **WARNING, when working on the machine, the entire drive has to be turned off completely !!**

6.5.1. BATTERY

The standard factory equipment includes a battery with 12 volts and 6,5 ampere-hours.

Due to the standard solar panel it is not necessary to charge the battery during the irrigation season. The battery should be newly charged every 6 months at a charging voltage of max. 2 amperes. (Please observe the enclosed service and maintenance instructions).

When you connect the battery the display shortly shows VERSION 4.1 and then the standard display comes up.

To reach a long life of the dry battery (LC-R 127R2PG 7,2 Ah/20 HR) used on the ECOSTAR, it is important to follow certain guidelines when storing it for a longer period of time and when charging it.

When using the battery on the ECOSTAR during the operation, there is no need for any special pre-cautions, because it get re-charged through the solar panel.

1. Every RAINSTAR irrigation machine delivered by BAUER, that is equipped with the electronic control ECOSTAR, comes with a fully charged battery, ready to be used.

The solar panel, though, is covered and not hooked up to the battery. If there is a longer period of time between delivery and first operation, follow the maintenance steps (as pointed out below)

This should also be observed, when a battery is stored for a longer period of time as a spare part.

2. If the RAINSTAR is not operating for a longer period of time, e.g. out of the irrigation season, disconnect and take off the battery.
3. Store the battery fully charged, separate from any conducting material and unexposed to sun. If the battery is stored uncharged for a longer period of time, it will not reach its full capacity again when re-charging it.
4. The optimum storage temperature is between 0° and +25°.

A stored battery discharges itself also. Therefore, re-charge at the following intervals:

<i>Storage temperature:</i>	<i>Interval to re-charge:</i>
less than +20°C	9 months
+20°C to +30°C	6 months
+30°C to +40°C	3 months

5. You will need a low humidity in the storage room (55%+/- 30%) to avoid a corrosion of the poles.
6. Avoid that the battery gets completely discharged. In that case, the battery can reach its full capacity again, but, if discharged completely repeatedly, its lifetime will be reduced.
7. Keep the batteries clean. To clean them, you can use a dry towel. If necessary, soak them in water or alcohol. Do not use oil, gas or dilutents.
8. In no case, you should take batteries apart, because they contain acid and can cause serious burns.
9. Do not short-circuit batteries, because this may damage them.
10. Charging the battery should be done with a charging current that does not exceed 2,0 A. If a battery is empty, it takes around 7 hours to re-charge it completely.
Devices to monitor the battery capacity and chargers with intelligent (self-regulating) charging function, enable a precise analysis and a controlled charging of the battery.



6.5.2. SOLAR PANEL

The standard factory equipment includes a 12 V/4 W solar panel.

The solar panel is maintenance-free.

1. In order to ensure optimum output the surface should be cleaned with a soft cloth and a household detergent (no abrasives), from time to time.
2. To fully expose the solar panel to the sun, turn it outward and lock it during the operation.
For transport turn it back again by lifting it a bit and pushing it towards the machine back to its original position, from where it is protected against damage.
3. In order to avoid over-charging of the battery or a faulty functioning of the ECOSTAR, the electronic system interrupts the charging, when the STOP key is pushed or the battery gets disconnected. (The machine is delivered with the terminals detached).
The charging procedure is resumed when the „START“ button is pressed or the PE pipe pulled off.

6.5.3. CABLE CONNECTIONS – WIRING DIAGRAM

Wiring diagram ECOSTAR 4000 S			
Terminal No.	Designation of the device	Core Color	
1	Battery + 12 V	brown	
2	Battery – 12 V Solar module –	blue	
3	Solar module +	brown	
4	Solar module –	blue	
5	Motor 1		Regulating motor
6	Motor 1		Regulating motor
7	Speed sensor 1	blue	
8	Speed sensor 1	black	
9	Speed sensor 2	yellow / green	
10	Speed sensor 2	brown	
11	Stop sensor	blue or brown	
12	Stop sensor	blue or brown	
13	Motor 2		Shut-off motor
14	Motor 2		Shut-off motor
15	Pressure sensor	blue or brown	
16	Pressure sensor	blue or brown	
17			free
18			free

6.5.4. CHECK-UP OF CONNECTIONS

Press „START“ key.



The regulating motor closes (the segment turns towards the limit bolt)
The overpressure shut-off valve is opened.
The low-pressure shut-off valve remains closed.

Press STOP key

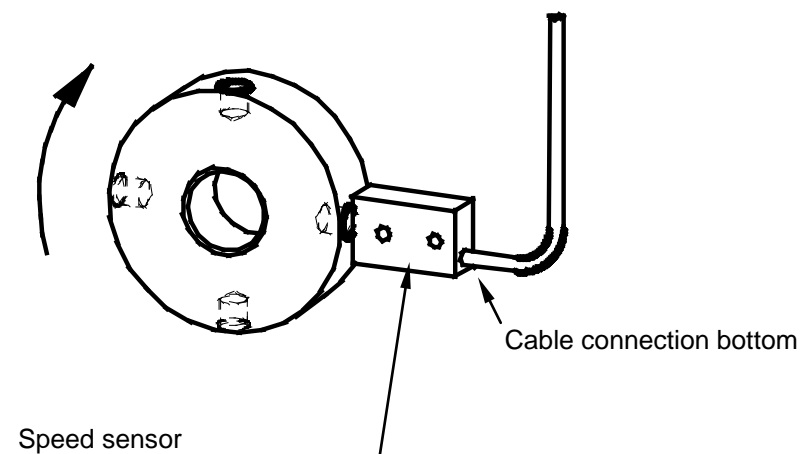


The regulating motor opens the turbine (the segment turns away from the limit bolt)
The overpressure shut-off valve closes.
The low-pressure shut-off valve is opened.

6.5.5. CHECK-UP OF LENGTH SENSOR

The magnet disk with 4 magnets is mounted on the input shaft of the gearbox and turns clockwise during pull-off.

Because of the clock-wise turn of the magnet disc, the display for the laid-down pipe must count from 0 m rising. If the distance meter counts into the opposite direction, the speed sensor must be turned around, so that the cable connection is pointing upward. Distance 2 – 5 mm between double sensor and magnet disc.





6.6 ECOSTAR

Adhering to the following points guarantees a problem-free functioning of the ECOSTAR. Further, you will find a detailed description to find the errors and how to remedy them.

6.6.1 LIMITER FOR TURBINE REGULATING FLAP WITH ECOSTAR 4000S AND 4200

See item 6.5. The regulating range of the turbine regulating flap has to be adjusted to the respective flow rate. If the limiter is not adjusted correctly, the regulation at the turbine might not function any more, i.e. that the PE pipe retraction is at a maximum speed.

If the flow rate is reduced considerably, the limiting bolt must be adjusted again because otherwise the retraction speeds according to the performance chart cannot be reached.

The flow rate can be drawn from the performance chart affixed on the machine right below the nozzle size used.

6.6.2 SHORT CHECKLIST FOR ECOSTAR 4000S / 4200

- 1. Checking the battery voltage (should be at least 12 V)**
 - a) Cover up the solar panel completely
 - b) Read battery voltage in Test Menu 1, (Press the TEST key once - ECOSTAR 4000 S, / MENU key once - ECOSTAR 4200)
 - c) If voltage is too low (lower than 12 V) or no charge available at all, check battery and cables as well as the fuses inside the electronic box.
- 2. Checking the sensor function**
 - a) Set test menu 2 (press the TEST key twice - ECOSTAR 4000 S, / MENU key twice - ECOSTAR 4200)
 - b) The installed sensors are displayed as the functional check-up.
- 3. Checking the length indication of the pulled-off PE-pipe**
 - a) Read the pulled-off PE-pipe length on standard display screen and compare it with the length marking printed on the PE-pipe.
 - b) If the display length is 000 m or much shorter than the pulled-off PE-pipe length, an adjustment must be made.
- 4. Checking the mechanical transmission to the stop sensor**
- 5. Checking the setting of the limiting bolt of the toothed segment of the regulating flap according to the values on the setting chart sticker.**

6.6.3 CHECKLIST FOR ECOSTAR 4000S / 4200

During the first start-up and at the start of the season, but also during operation, error messages or maloperation may occur in connection with the electronic system or the sensors connected as well as problems resulting from wrong operation.

In most cases, the error can be detected and eliminated very quickly by a systematic system check-up on the basis of the following checklist.

This checklist serves as a supplement to the detailed operating manual for ECOSTAR 4000 S and 4200

After checking up the device according to the separate SHORT CHECK-LIST the handling instructions can be taken from the table below.

Note: In some cases, operation differs due to different control keys of the models 4000 S and 4200. However, special reference is made at the respective points.

Pos.	Malfunction	Fault locating	Remedy
1.	Wrong or incomplete display read-out	Check battery voltage ! 1. Cover up the solar panel completely and read battery voltage indication in the first menu window after 2 to 3 minutes. (press once the TEST key – ECOSTAR 4000 S, once the MENU key - ECOSTAR 4200) Note ! <ul style="list-style-type: none"> If the solar panel is not covered up, the display may show a voltage read-out even if the battery is empty, or it may even pretend sufficient battery charge in sunshine. The electric charge, however, is not sufficient for system operation under these circumstances! 2. If the battery voltage (now uninfluenced by the covered-up solar panel) is lower than 12 V, power supply is not sufficient for system operation.	Charge or replace the battery
2.	No read-out on display	Check battery, cable connections, and fuse ! 1. Test battery voltage, battery is empty 2. The connecting cables between battery and ECOSTAR are not connected or do not make contact. 3. The fuse is defective. The fuse is located inside the electronic box where there is also a spare fuse. Notes ! <ul style="list-style-type: none"> When checking the contacts make sure that the cables are connected correctly: „+“ terminal = brown wire, „-“ terminal = blue wire. The solar panel should be covered up also while connecting and disconnecting the battery, and as long as the battery is disconnected because otherwise the system could display errors. The stored machine data are preserved when the battery is disconnected. When re-connecting the battery, never confuse the “Plus” and “Minus” terminals because this would short-circuit the system and trip the fuse, or possibly damage the electronic system. 	Charge or replace battery. Check connections and contacts. Replace fuse.



3.	Permanently low battery voltage	Check battery ! 1. If battery voltage remains too low in spite of continuous charging by solar panel, the battery must be examined and recharged, or replaced, if necessary.	Check / charge or replace battery
4.	Charging error due to solar panel	Check the solar panel ! Notes ! <ul style="list-style-type: none"> The normal charging function of the solar panel is designed to stop when the battery has reached a charge of 14.0 V or over. In the first menu window, "Charging by solar panel" is at "OFF". (1xTEST key - ECOSTAR 4000 S, 1x MENU key – ECOSTAR 4200) At 13.9 V or less battery voltage, the charging functions starts. "ON" appears in the same menu window. If at 13.9 V or less battery voltage the battery is not charged by the solar panel, display at "OFF", the following reasons are possible: <ol style="list-style-type: none"> Charging not possible due to insufficient light conditions. The „+ / -“ phases of the solar panel have been confused. Measure the polarity. The solar panel is defective. Determine this by measuring at panel output. 	Correct polarity. Replace panel.
5.	Confused display read-out	System voltage / starting error <ol style="list-style-type: none"> A confused display may indicate low voltage. It may also appear when the system is put into operation for the first time or after re-connection of the battery (even is voltage is sufficient) Note ! Disconnect battery and solar panel. Make contact between the „+/-„ poles of the ECOSTAR cable (neutralise). Connect battery and solar panel again after about 1 minute. Pay attention to the polarity of the cables!	Test battery voltage, charge battery. De-energise the electronic system for about 1 minute.
6.	No length indication on the display	Shut-off sensor / loose PE-pipe windings <ol style="list-style-type: none"> The PE-pipe is pulled off but the reading on the display shows only 000 m an. Notes ! <ol style="list-style-type: none"> In this case, the shut-off frame on the RAINSTAR and the shut-off sensor have been actuated, as a result the pipe length indication is reset to 000 m and the ECOSTAR stops the operation of the RAINSTAR. The shut-off frame may have been actuated manually or by a loose PE-pipe winding. The shut-off frame and the shut-off sensor may also have been actuated accidentally during pipe pull-off. In this case the system indicates a pulled-off pipe length but this value is lower than the length actually pulled off. This value must also be newly adjusted as described in the next column. If no length is counted during the PE-pipe pull-off, the value cannot be corrected and the RAINSTAR does not start. In this case, the shut-off sensor setting is wrong (spacing too small, see operating manual). Entry of PE-pipe length on the ECOSTAR Procedure (confer also to manual) <ol style="list-style-type: none"> Set retraction speed at 11.1 m/h Push the PROGRAM key 3 times, the parameter sheet no. 1 appears, push PROGRAMM key again to get to the constant 07. In this position the value of the constant can be set at the pulled-off PE-pipe length by means of the arrow keys. 	Enter the pulled-off PE-pipe length again on the ECOSTAR Set the shut-off sensor correctly

		<p>d) The pipe length actually pulled-off can be taken from the imprint on the PE-pipe directly at the RAINSTAR.</p> <p>e) Save the setting with the TEST key and the standard screen returns. You can start the RAINSTAR again.</p>	
7.	No length indicated on the display or length counting is the wrong way round	<p>Length sensor</p> <p>1. If the length is not counted during PE-pipe pull-off and runs the wrong way round during pipe retraction (indicated length increasing instead of decreasing), the length sensor is mounted the wrong way. (See instructions with drawing in the operating manual.</p>	Mount the length sensor correctly.
8.	Length on the display does not correspond with the pipe length actually pulled off.	<p>PE-pipe ovality</p> <p>1. The percentile difference between the laid-down PE-pipe length and the value indicated on the display is always the same. In this case the ovality of the pipe does not correspond with the programmed value and must be corrected.</p> <p>Correcting of the ovality constant</p> <p>a) To correct this constant, go to parameter sheet no. 1, as described under item 6 above and press the PROGRAMM key up to constant 09. In this constant enter the value 111 to open the parameter sheet 2, machine data. The ovality factor can be corrected under machine constant 07.</p> <p>b) If the displayed length is always longer than the pipe length actually pulled off, ovality is larger than programmed. The setting 0.89 must be corrected to 0.88 or 0.87.</p> <p>c) However, if the length on the display is always shorter than the PE-pipe actually pulled off, ovality is smaller than programmed. The factor must be corrected from 0.89 to 0.90 or 0.91.</p> <p>Length sensor / magnetic disk</p> <p>2. The pulled-off PE-pipe length and the value on the display always differ considerably.</p> <p>Note !</p> <p>a) One or several magnets are missing on the magnetic disk. Magnetic disks on all Ecostar models are equipped with 4 magnets.</p> <p>b) One or several magnets are no longer active. When the magnets move past the length sensor, one or several magnets produce no display (■) in the menu window (2 x TEST key 4000 S, 2 x MENU key 4200) .</p> <p>c) In the machine data the number of magnets programmed is different than 4. Correct the factor 06 to 4 in parameter sheet no. 2.</p> <p>No display at all on the screen (■). Length sensor defective.</p>	<p>Correct the ovality factor.</p> <p>Reduce the ovality factor. Increase the ovality factor.</p> <p>Complete the magnets. Replace inactive magnets. Correct the machine data.</p> <p>Replace the length sensor.</p>



9.	THE ELECTRIC SHUT-OFF VALVE DOES NOT CLOSE.	Shut-off sensor 1. If the electric shut-off valve (overpressure shut-off) does not close at the end of the irrigation strip (open with low-pressure shut-off), the shut-off sensor setting is wrong (sensor spacing too large) The sensor indication (■) does not disappear in the menu window.	Adjust shut-off sensor.
10.	The electric shut-off valve does not close or open.	Program constant 1. The ECOSTAR is not programmed for a shut-off valve. The parameter sheet no.1 - program constant 05 – shows the setting “0”. This constant must be corrected to “2” (with shut-off valve). In addition, make the following entry in parameter sheet no. 2 under machine data “12”: “1” for overpressure shut-off valve, or “2” for low-pressure shut-off valve Pressure switch 2. IF A PRESSURE SWITCH FOR LOW-PRESSURE SHUT-OFF IS MOUNTED, THE REASONS MAY BE AS FOLLOWS: a) Available pressure insufficient for RAINSTAR operation, the supply pressure is lower than the pressure setting of the pressure switch. b) The pressure switch is soiled or defective. To check the function of the pressure switch, the pressure switch can be deactivated in the program, parameter sheet no. 2, constant 12, by setting it at “0”. Dirt / foreign objects / connections 3. The shut-off flap is blocked by a foreign object. 4. The electrical connections of the shut-off valve are defective or not installed correctly. The motor of the valve (motor 2) is defective.	Correct the setting. Increase the supply pressure. Clean /replace the switch Clean the flap / inspect connections / check the motor / replace
11.	THE TURBINE REGULATION DOES NOT WORK, THE FLAP REMAINS OPEN OR CLOSED.	1. The limiting bolt that limits the setting of the regulating flap is not adjusted properly, the flap is closed too far and can no longer be opened by the motor (see enclosed setting chart for the turbines TVR 20 and TVR 60, the setting depends on the flow rate). 2. Electrical connections of the motor (Motor 1) are defective or not installed properly. 3. Motor of regulating flap (Motor 1) is defective. 4. Foreign objects impair the function of the regulating flap.	Adjust the bolt according to the chart. Check the connections Test / replace Remove foreign objects
12.	The machine stops during the run.	1. If the RAINSTAR is equipped with a pressure switch, the machine may be stopped due to low supply pressure. If you still want to continue operating, the pressure switch can be deactivated (see Item 10/2.b). 2. The machine also stops if the desired (setting) retraction speed is too high and the machine cannot reach this speed within 20 minutes time. However, this function can be deactivated as follows: Machine data, parameter sheet no. 2, constant 17 (monitoring of proper speed):) Setting „1“ Monitoring on Setting „2“ Monitoring off	Increase the supply pressure, turn off the pressure switch. Reduce the retraction speed. Deactivate the monitoring function.
13.	Further problems	If problems still occur with regard to display and accuracy as well as other functions, check the data entered in the ECOSTAR according to the constants in the parameter sheet no. and the machine data in the parameter sheet no. 2. Contact BAUER service department, if needed.	

6.6.4 PRE AND POST IRRIGATION CHART

ECOSTAR 4000S / 4200 feature a pre and post irrigation function in order to correct uneven precipitation at the beginning and at the end of the field . The rain height at both the beginning (pre-irrigation) and end (post irrigation) of the field is achieved by stopping the retraction of the sprinkler cart for a predetermined length of time The time of pre and post irrigation is set on the ECOSTAR by means of the program constants 01 and 02 in parameter sheet no. 1. The factory setting is program constant 08.

This factor establishes a relation between sprinkler retraction speed and pre as well as post irrigation. The set factor can be changed – as a result pre and post irrigation times change.

The table below shows pre and post irrigation time in minutes (rounded) at various setting factors. .

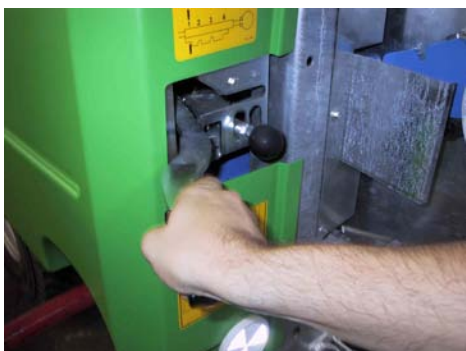
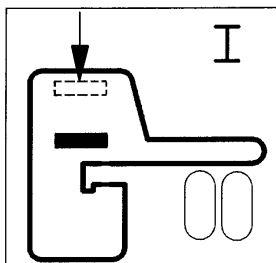
Con- stant -	Retraction speed in m/h Pre and post irrigation time in minutes -									
	10 m/h	20 m/h	30 m/h	40 m/h	50 m/h	60 m/h	70 m/h	80 m/h	90 m/h	100 m/h
1	6,0	3,0	2,0	1,5	1,2	1,0	0,9	0,8	0,7	0,6
2	12,0	6,0	4,0	3,0	2,4	2,0	1,7	1,5	1,3	1,2
3	18,0	9,0	6,0	4,5	3,6	3,0	2,6	2,3	2,0	1,8
4	24,0	12,0	8,0	6,0	4,8	4,0	3,4	3,0	2,7	2,4
5	30,0	15,0	10,0	7,5	6,0	5,0	4,3	3,8	3,3	3,0
6	36,0	18,0	12,0	9,0	7,2	6,0	5,1	4,5	4,0	3,6
7	42,0	21,0	14,0	10,5	8,4	7,0	6,0	5,3	4,7	4,2
8	48,0	24,0	16,0	12,0	9,6	8,0	6,9	6,0	5,3	4,8
9	54,0	27,0	18,0	13,5	10,8	9,0	7,7	6,8	6,0	5,4
10	60,0	30,0	20,0	15,0	12,0	10,0	8,6	7,5	6,7	6,0
11	66,0	33,0	22,0	16,5	13,2	11,0	9,4	8,3	7,3	6,6
12	72,0	36,0	24,0	18,0	14,4	12,0	10,3	9,0	8,0	7,2
13	78,0	39,0	26,0	19,5	15,6	13,0	11,1	9,8	8,7	7,8
14	84,0	42,0	28,0	21,0	16,8	14,0	12,0	10,5	9,3	8,4
15	90,0	45,0	30,0	22,5	18,0	15,0	12,9	11,3	10,0	9,0

7. EMERGENCY SHUT-OFF



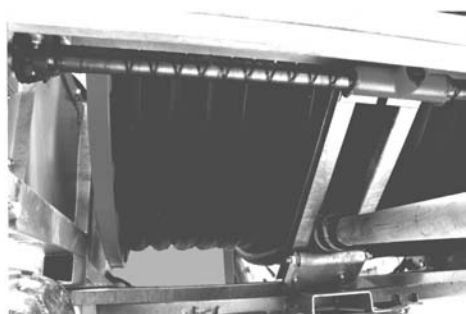
If something unforeseen happens, the pipe retraction can be interrupted with the emergency shut-off. Pull the gear shift lever with the open hand from the "PE-pipe retraction" position to the shut-off position (Do not operate the lever with the closed hand or release it immediately!). The gearbox is disengaged.

A spring snubs the lever up (shut-off position) and the band brake prevents fast reversing of the PE-pipe and the reel.



Slacken the PE-pipe by pushing down the gear shift lever carefully.

8. WINDING MECHANISM



The winding mechanism operates synchronously with the winding or unwinding of the PE-pipe. Starting from the reel it is operated through a chain and the helically grooved spindle transporting the winding carriage of the PE-pipe. The winding mechanism ensures that the PE-pipe is properly guided winding for winding. When you put the machine into operation for the first time, pull off the full length of the PE-pipe to let it take a circular shape under pressure and eliminate ovality. This step is essential for trouble-free operation of the winding mechanism.

9. SHUT-OFF AND SAFETY EQUIPMENT



Unattended operation of the RAINSTAR is made possible by a final and safety shut-off. The final shut-off is actuated when the sprinkler cart pushes against the shut-off frame, which in turn operates the shut-off lever through a system of rods. This way the drive is stopped.

To avoid troubles caused by faulty windings of the PE-pipe on the reel, the shut-off is also activated by the shut-off frame when faulty pipe windings build up on the reel.

10. CART



The high construction of both symmetric and asymmetric wheel carts provides maximum crop protection (Asymmetric wheel cart OPTIONAL). With infinitely variable track width the carts adapt to any crop row spacing. The width is symmetrically adjusted with the frame support member.



For easier PE-pipe pull-off the carts are equipped with a double draw-out hook. You pick up this hook with the tractor's toolbar and pull off the PE pipe.

To turn the pipe reel and re-position the RAINSTAR at its new set-up position, the cart must be pulled back into its end position at the RAINSTAR.

Depending on the type of sprinkler used, the nozzle height of the mounted sprinkler ranges between 1960 and 2120 mm.

At the end of the retraction, when the cart moves up to the machine it is slightly hoisted on the PE-pipe side. Owing to its pendulous mounting (self-balancing assembly) the sprinkler is not tilted and always remains in the optimum position regarding distance of throw and distribution uniformity. This pendulous mounting assembly compensates also slopes in the terrain in longitudinal direction.

11. SHUT-OFF VALVE – OVERPRESSURE (OPTION)



With an overpressure shut-off valve, the water supply to the machine is interrupted completely at the end of the irrigation run. When the valve closes, pressure rises in the supply line.

Therefore this valve can only be used in combination with an automatic pump shut-off device or in a line network supplying several machines. Before starting up again, the valve is opened again by the electronic system.

12. SHUT-OFF VALVE – LOW PRESSURE (OPTION)



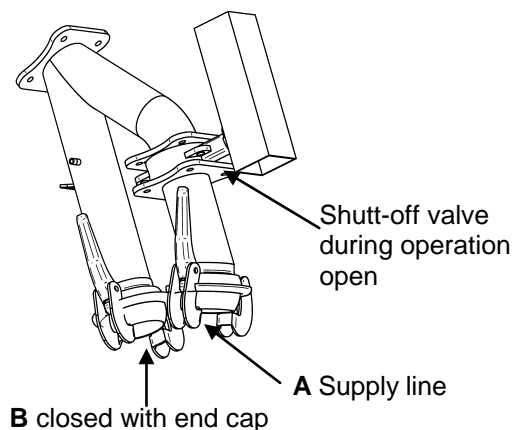
With the low pressure shut-off valve option, a shut-off valve is opened quickly at the end of the irrigation run, releasing quite a big water stream into the open. This causes a sudden pressure decrease in the supply line (to about half the original pressure). Through this drop in pressure a pressure switch shuts off the pumping unit and thus also the water supply. Therefore this valve can only be used in combination with an automatic pump shut-off device.

CAUTION!

The low pressure shut-off valve option can only be used if only one irrigation machine is fed by the pumping unit. If several machines are fed simultaneously by one pumping unit this low-pressure or underpressure shut-off valve cannot be used !

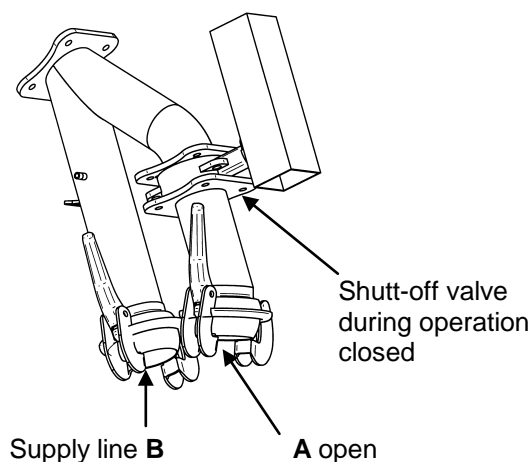
13. COMBINED SHUT-OFF SYSTEM

The combined shut-off combines the overpressure and low-pressure shut-off in one system. The double connection allows both overpressure and low-pressure shut-off at the end of the irrigation strip.



OVERPRESSURE SHUT-OFF

- a) Supply through connection „A“
- b) Connection „B“ is closed with an end cap.
- c) The ECOSTAR is programmed for overpressure shut-off.
Parameter sheet no.1, Progr. const. 05, setting value „0“
Parameter sheet no. 2, machine data 12, setting value „1“
- a) The shut-off valve is opened during the operation
- b) For the shut-off the shut-off valve closes slowly.
The pressure rises in the supply line. The pump must be shut down automatically by means of the pressure switch (or flow control).



Low pressure shut-off

- a) Supply through connection „B „
- b) Connection „A“ remains open.
- c) The ECOSTAR is programmed for low-pressure shut-off
Parameter sheet no.1, progr. const. 05, setting value „1“
Parameter sheet no.2, mashine data 12, setting value „2“
- d) The shut-off valve is closed during the operation.
- e) For the shut-off the shut-off valve opens quickly.
The pressure drops in the supply line. The pump must be shut down automatically by means of the pressure switch.



14. WINTERIZATION - DRAINING

In areas, where frost is likely in winter after the irrigation season, the machine must be drained in time. werden. A compressor with a minimum air capacity of 5000 l/min at 1,5 bar overpressure is best suited for this purpose. Connect the compressor to the inlet of the machine. For blowing out the water the PE-pipe should not be pulled off. It can stay on the reel.

In most cases, winding up the empty PE-pipe after the draining will cause extreme ovality and faulty winding. The small amount of water remaining in the PE-pipe after the draining (approx. 30 to 50 % of the volume) will not do any harm.

Turn out the drain plug on the bottom of the TVR 60 turbine. We recommend to turn it in again only when you start up the machine again at the beginning of the next season. Clean the RAINSTAR and regrease all appropriate points. The machine should preferably be stored in a roofed shelter where it is protected from direct exposure to the weather.



Open the drain valve on turbine



Drain screw for gear oil.



Oil or grease the jack.

14.1. DRAINING THE PE-PIPE

WITH THE BAUER BLOW-OUT AND COMPRESSOR UNIT

Note the following instructions to ensure proper function of the blow-out unit:

1. The blow-out must be performed before further transport of the machine to ensure that no water is drained from the PE pipe.

CAUTION!

If parts of the PE-pipe have run empty and air bubbles are enclosed in the pipe, the blow-out will not work !

2. If you use an electric shut-off valve, press the menu button „START“ so that the valve opens.
3. Connect a drain pipe at the inlet of the machine to avoid soaking the machine's standing position.

CAUTION!

If you use the supply hose (7) for draining, make sure that the hose is not kinked and the water can run off freely.

PROCEDURE:

The PE pipe is wound up on the reel, the cart is just before the shut-off position, take off the end cap (with bore and baffle plate) from the „garage“ (1).
Press the plastic ball in the “garage” down by hand or with a piece of wood until the ball gets to lie in the straight horizontal pipe (2) behind the outlet to the sprinkler.

Close the shut-off valve (3) to the sprinkler..

Connect the pipe bend 90° (4) to the coupling „garage“ (1) and the compressor hose (5) to the pipe bend (4) and the compressor (6).

The PE pipe can now be drained with the help of the compressor.
Technical specifications of the compressor:

- Operating pressure: 1,5 bar sufficient
- Air capacity: minimum 5000 litres at 1,5 bar

It does not take more than 5 to 8 minutes to drain the PE-pipe. If the blow-out takes longer, there are already air bubbles in the pipe that prevent further draining.

**BAUER**

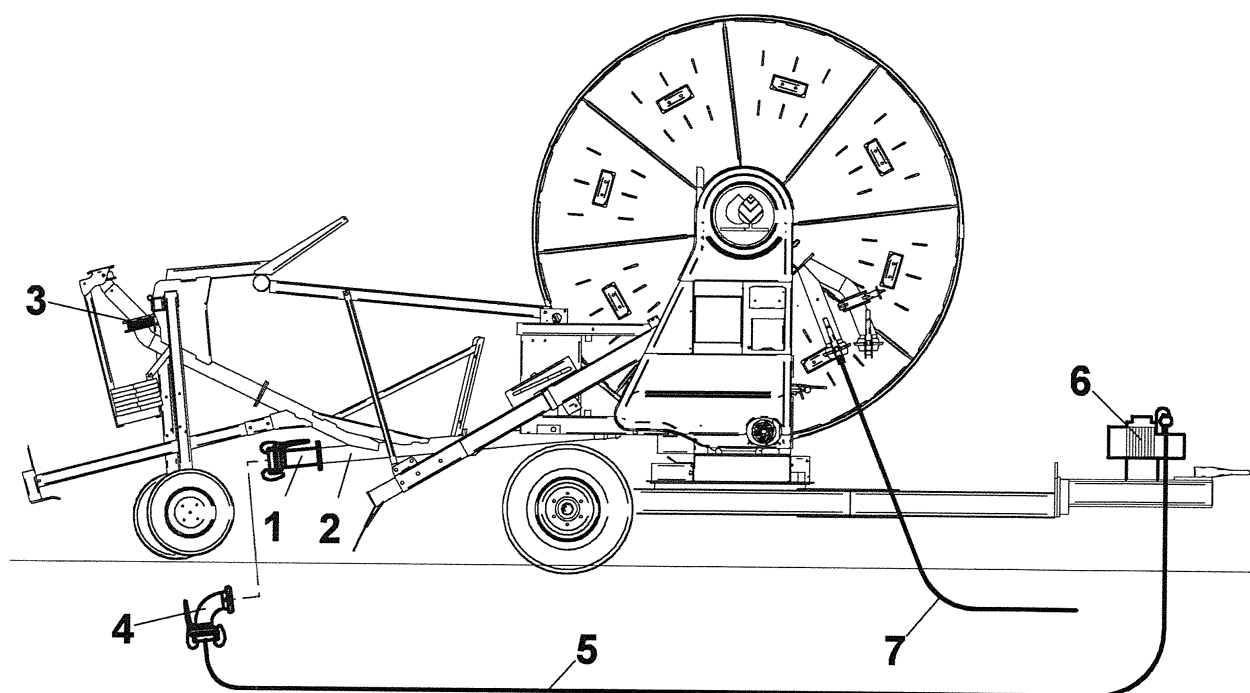
FOR A GREEN WORLD

**ATTENTION!**

After the blow-out and before opening the coupling, open the valve (3) so that the pressure in the PE pipe can escape !

Remove the fittings with the hose and couple the end cap with the baffle plate.

The blow-out ball is in the inlet bend to the reel and the water will carry it back to the „garage“ (at the end of the horizontal pipe), when you resume irrigation.



**14.1.1. POSSIBLE FAULTS DURING PE-PIPE BLOW-OUT WITH COMPRESSOR**

Fault	Remedy
PE-pipe has run empty.	Put the irrigation machine under pressure again until a full jet without air bubbles is discharged at the sprinkler.
Kink in the drain hose from the turbine.	Lay the hose straight without kinks or connect a rigid pipe.
Shut-off valves not opened.	Open shut-off valves.
Plastic ball not in the correct position.	Push down the plastic ball far enough to place it in the straight horizontal pipe
Incorrect plastic ball diameter.	Required ball diameter: PE-pipe dia. 100mm : Ball Ø : 100mm 110mm : : 100mm 120mm : : 110mm 125mm : : 125mm
Plastic ball damaged.	The ball must be round and faultless.
Insufficient compressor output.	Check compressor performance data and safety valve

CAUTION!

The end cap on the branch pipe of the horizontal pipe („Garage“ of the plastic ball) must have a vent bore through which the branch pipe is deaerated when the ball is pressed to the cap by the water pressure from the turbine side. Then the plastic ball will park properly in the „garage“ during irrigation. If this vent bore is missing, the plastic ball remains in the area of the horizontal pipe during irrigation and may cause considerable pressure loss on account of the reduced cross section..



14.1.2. SERVICE AND MAINTENANCE

We cannot emphasise often enough that proper service at the right time is essential for the operating reliability and service life of a machine. At the end of every irrigation season the RAINSTAR should be thoroughly checked and cleaned, and all parts greased carefully.

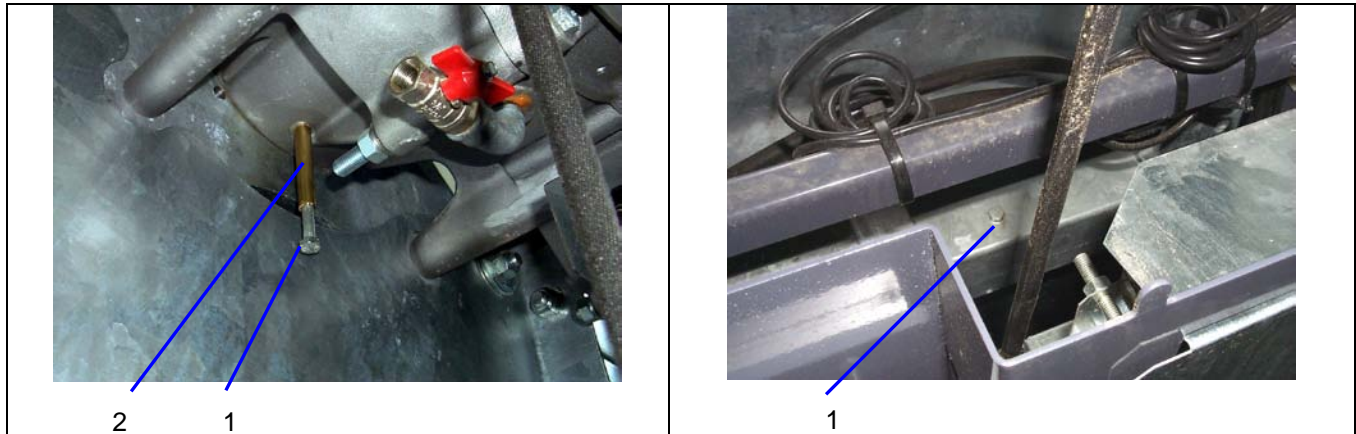
Machine part	Service interval	Lubricant, grease, oil
1. Helically grooved spindle of the winding mechanism	every 250 hours	multi-purpose grease (Alvania Grease)
2. Drive chain of winding mechanism	every 250 hours or as required	multi-purpose grease (Alvania Grease)
3. Driver (spindle nut) of winding mechanism	every 250 hours, replacement recommended after 2500 service hours	multi-purpose grease (Alvania Grease)
4. Driving chain	every 250 hours or as required	multi-purpose grease (Alvania Grease)
5. Turbine (see separate instruction)	every 250 hours	multi-purpose grease (Alvania Grease)
6. Change-speed gear	Change oil for first time after 500 service hours and then every 500 to 800 hours or at least once a year	Gear lubricant oil CLP – DIN 51517 – Teil 3, ISO VG 220 - 11,3 l
7. Ball race	every 500 hours	through grease nipple multi-purpose grease (Alvania Grease)
8. Jack	as required	multi-purpose grease (Alvania Grease) through grease nipple
9. Machine supports (sliding parts)	as required	multi-purpose grease (Alvania Grease)
10. Screwed joints	before putting into operation after 50 hours of operation	Tightening torques
Wheel nuts		300 Nm
Turntable side frame		210 Nm
Ball race on turntable and undercarriage		E11 - E41 = 85 Nm E 51 = 200 Nm
Drawbar on undercarriage		240 Nm
Hitch eye		200 Nm

Lubricating the reel sealing

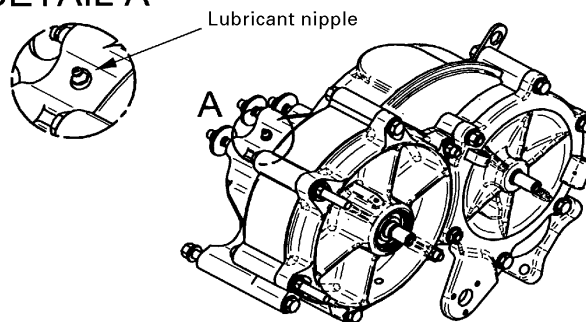
When lubricating, the screw (1) is mounted to the lubricating tube (2).
 When lubrication is completed, the screw (1) is in its place of deposit.

Screw in lubricating position

Screw in lubricating position



DETAIL A

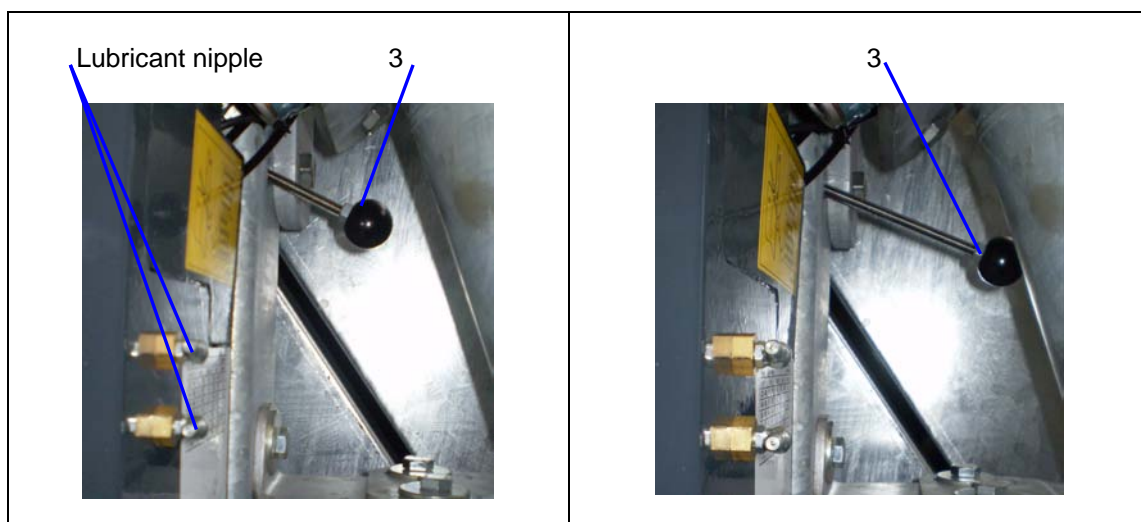


New design 2007

Push the lever (3) to the inside during lubricating. Then pull out the lever (3) for irrigating.

Position for lubricating

Position for irrigating

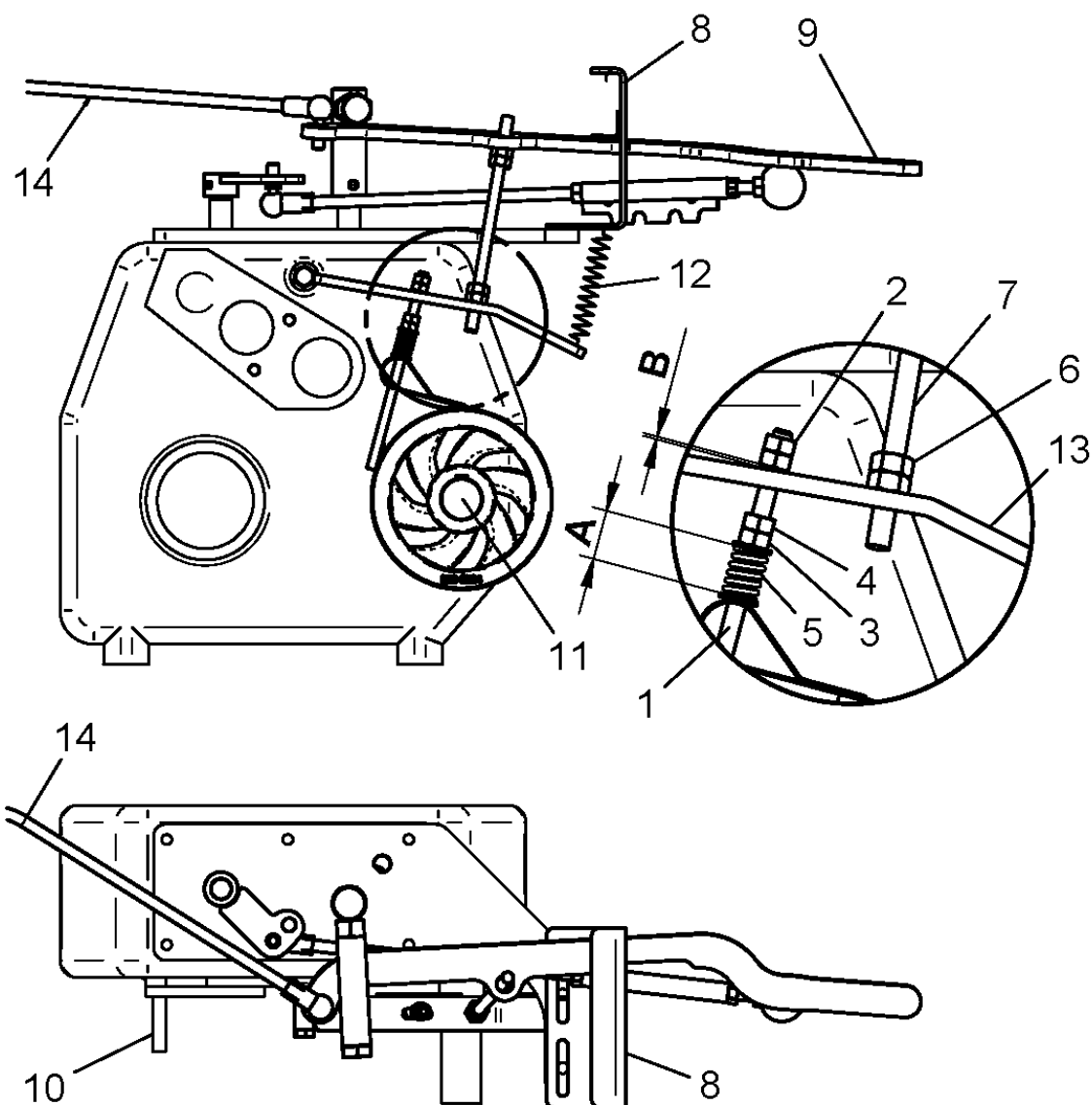




FAULT FINDING

FAULT	CAUSE	REMEDY
The PE-pipe cannot be pulled off.	Incorrect gear shift lever position.	Put it into the pull-off position.
	Brake band sticks to the brake drum.	Loosen the brake band.
PE-pipe retraction stops before the final shut-off is actuated	Turbine blocked by a foreign body.	Remove the foreign body.
	Pressure drop in supply line.	Check pumping station and hydrant connections.
	Overwinding of PE-pipe activates the safety shut-off.	Adjust the winding mechanism.
		Repair broken winding chain.
The final shut-off is activated but the shut-off valve does not close.	Values for shut-off valve activation are not set correctly.	Adjust the settings according to the manual.
The reel overwinds or the windings become loose when the PE-pipe is pulled off.	Tractor stopped abruptly.	Slow down gradually.
	No oil in the change-speed gear.	Refill oil.
The selected retraction speed is not reached	Incorrect drive transmission.	Select proper gear transmission
	Blocked sprinkler nozzle.	Remove blockage.
	General: Compare connecting pressure and water flow with performance chart values.	

15. SETTING INSTRUCTIONS FOR RAINSTAR E 11 – E 51

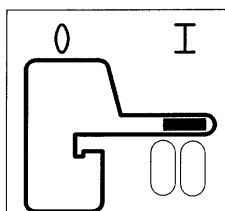


15.1. SETTING THE SHIFTING GATE

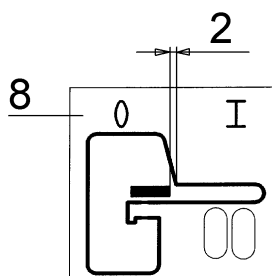
The shifting gate (8) must be adjusted to the shut-off point of the gearbox.

Procedure:

Move the shut-off lever (9) to the “PE-pipe retraction” position.



Turn the V-belt pulley (10) - the PTO shaft (11) rotates too!.
Shift the shut-off lever (9) slowly to the “0” position.



The shut-off point is reached when the PTO shaft no longer rotates.
Adjust the shifting gate (8) in this position according to the drawing (2 mm / 0,08 inch)!

The spring (12) presses the shut-off lever (9) upward along the incline of the shifting gate and thus into the recess in the gearbox.

15.2. SETTING THE BAND BRAKE on the gear box

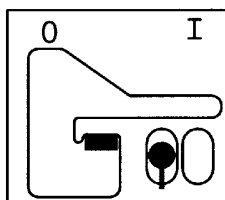
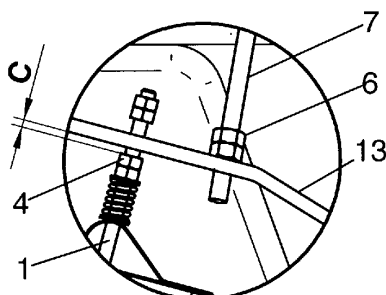
The hex. nuts (2) of the band brake (1) with engaged transmission to **B = 1 mm / 0,04 inch adjust.**

Lock the hex. nuts (2).

Hex. nut (3) is tightened until the spring (5) is pre-tensioned at **A = 22mm/0.86 inches** , lock with nut (4).

15.3. SETTING THE THREADED ROD

Shift the shut-off lever to the "PE -pipe pull-off" position.

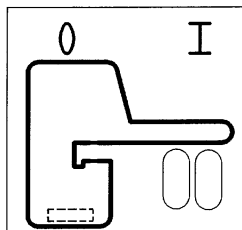


Turn the hex. nuts (6) on the threaded rod (7) apart until the spacing between the brake lever (13) and the nut (4) is at **C = 2 mm/0.08 inch**. Lock the hex. nut (6). shifting gate (8) and the shut-off lever (9) is about 4 to 5 mm. Secure the hex. nuts (6).

15.4. INSPECTING THE BAND BRAKE FOR RELEASE OF THE BRAKE BAND

Move shut-off lever (9) to the "Release" position.

In this position the brake band must be slightly lifted off the brake disk. This prevents the brake band from sticking to the brake disk.



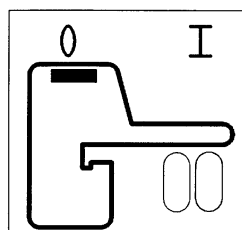
CAUTION!

The brake band may stick after a longer standstill or after the winter period. It must be loosened before putting the machine into operation again !!!
 Do this by shortly turning the PTO shaft right and left with the hand wheel.
 If you do not observe this, the gearbox may break !!!

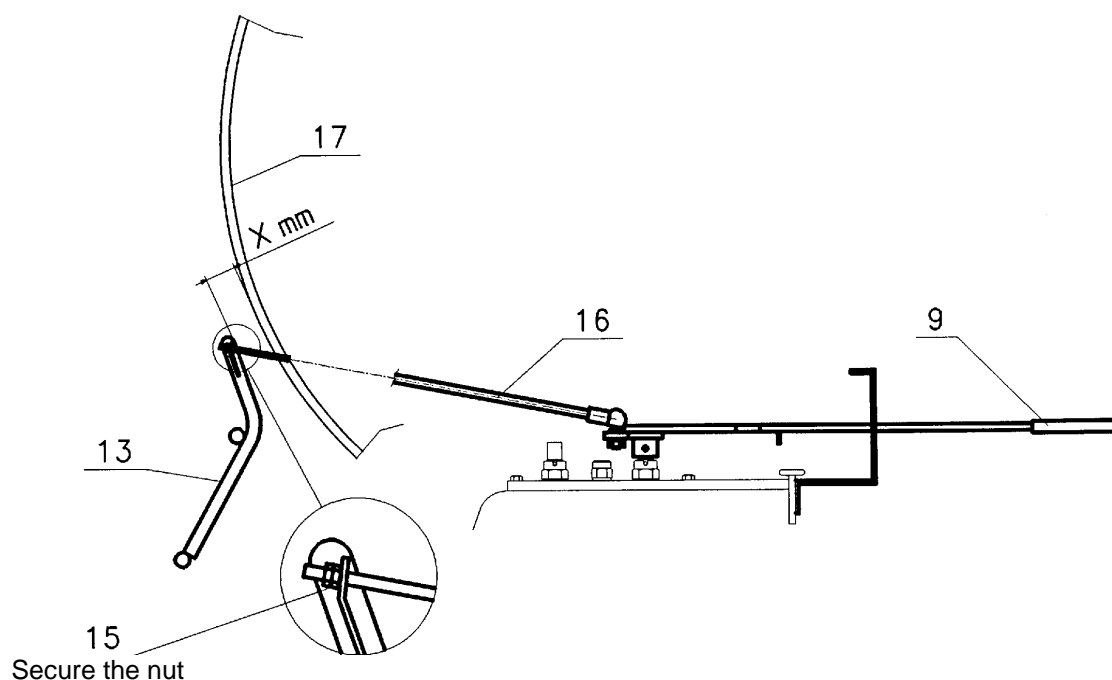
15.5. SETTING THE GEARBOX SHUT-OFF

In the **operating position** the spacing between the shut-off frame (13) and the reel (17) is $x = 25 \text{ mm}/1 \text{ inch}$

Set the shut-off frame (13) in the **shut-off position** at **X mm** from the reel (17) (see chart). Put the shut-off lever (9) into the shut-off position.



Adjust the hex. nut (15) on the control lever (16) to the bracket (14) of the shut-off frame.



Pipe Ø	X
90	70mm / 2,8 inch
100	70mm / 2,8 inch
110	70mm / 2,8 inch
120	70mm / 2,8 inch
125	70mm / 2,8 inch

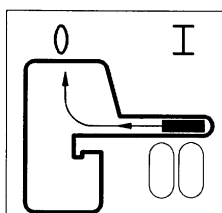
15.6. TESTING THE SHUT-OFF:

Put the shut-off frame into operating position ($X = 25 \text{ mm} / 1 \text{ inch}$)

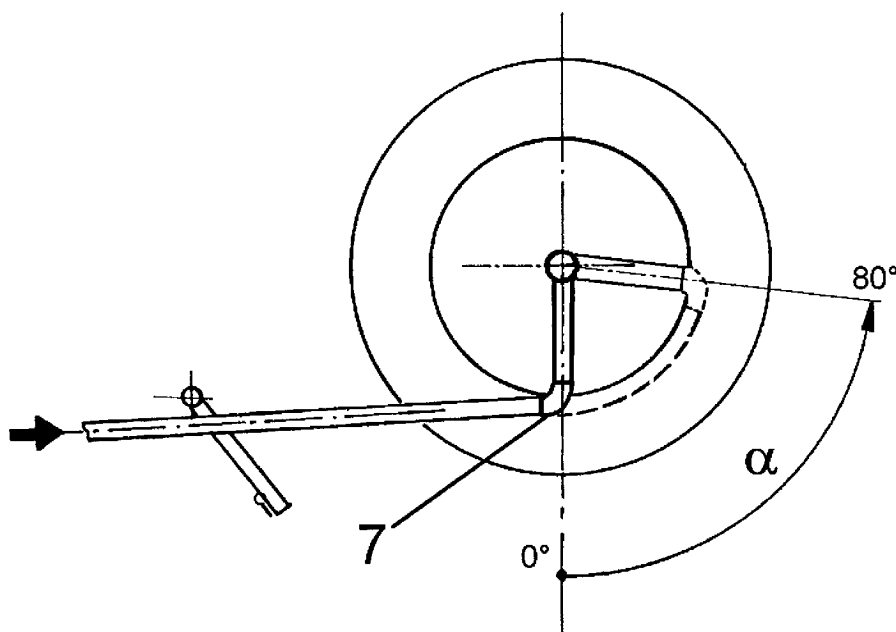
Move the shut-off lever (9) to the „PE pipe retraction“ position.

Pull the shut-off frame (13) to the shut-off position (= $X \text{ mm}$ from reel).

The shut-off lever must jump into the shut-off position!



15.7. ADJUSTING THE WINDING MECHANISM



Step 1:

Pull off the PE pipe and adjust the connecting bend (7) in a vertical position pointing down (except for E 51 PE-Pipe Ø 120, inner width of reel 1600 mm, $\alpha=80^\circ$).

Step 2:

Loosen the winding chain (1) between the reel and the helically grooved spindle (2).

Step 3:

Fasten the two guide bars (4 and 5) symmetrically at distance **X 2** on the guide part (3).

Mount the roller bracket (6) with the roller.

Step 4:

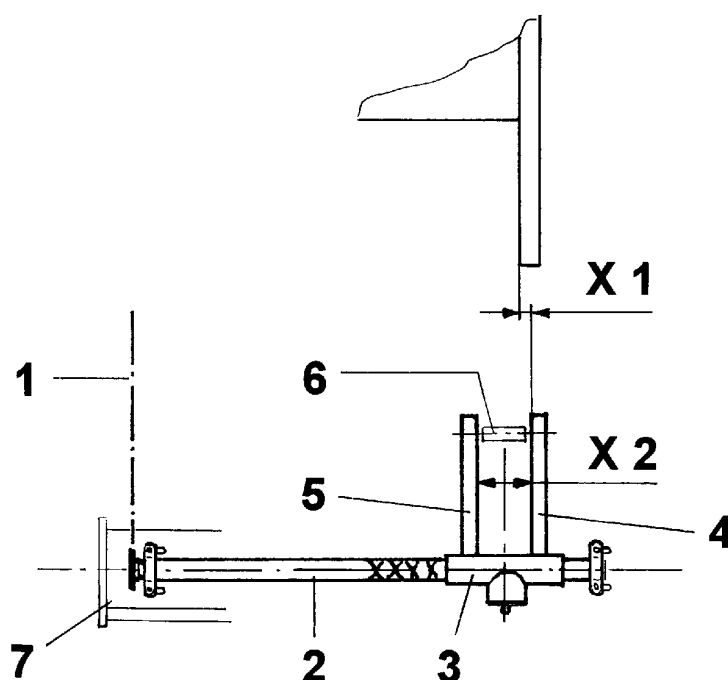
Move the guide part (3) of the winding carriage to the outermost reversing point of the groove on the right by turning the helically grooved spindle.

Loosen both pillow blocks. (Screws M12)

Check the connection of pillow block – helically grooved spindle, if safety screws (grub screw) are tightened.

The pillow block must rest on the shaft shoulder of the helically grooved spindle (2).

Shift the bearing and the helically grooved spindle (2) until value **X 1** is reached, fasten the right pillow block.



PE – pipe Ø		X 1	X 2
90	E11,E21	10 mm / 0,39 inch	110 mm / 4,33 inch
100	E11,E21,E31,E41	17 mm / 0,66 inch	126 mm / 4,96 inch
110	E11	14 mm / 0,55 inch	140 mm / 5,5 inch
110	E21,E31	20 mm / 0,78 inch	140 mm / 5,5 inch
110	E41	24 mm / 0,94 inch	146 mm / 5,74 inch
110	E51	28 mm / 1,1 inch	146 mm / 5,74 inch
120	E21	28 mm / 1,1 inch	150 mm / 5,9 inch
*120	E41	18 mm / 0,7 inch	150 mm / 5,9 inch
**120	E41	28 mm / 1,1 inch	150 mm / 5,9 inch
120	E51	28 mm / 1,1 inch	150 mm / 5,9 inch
125	E31,E41	24 mm / 0,94 inch	160 mm / 6,3 inch
125	E51	30 mm / 1,18 inch	160 mm / 6,3 inch
140	E41,E51	20 mm / 0,78 inch	170 mm / 6,7 inch



ATTENTION!

When using a PE-pipe repair coupling you must increase the spacing **X 2** symmetrically by 15 - 20 mm / 0,59 – 0,79 inch!

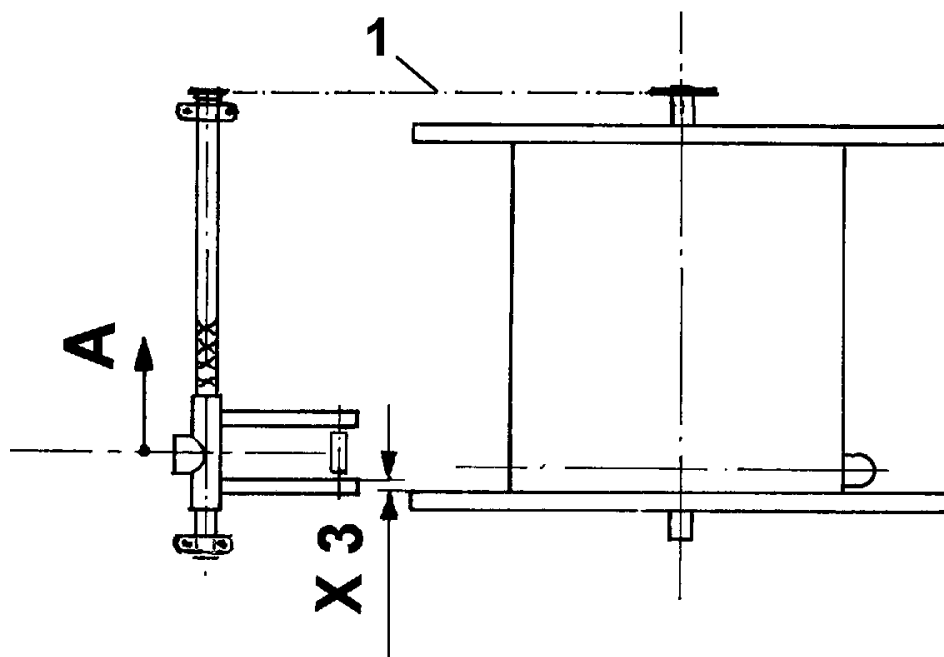
**Step 5:**

Align the right guide bar by turning the helically grooved spindle to the inner reel side wall at value **X 3**.
(see chart)

PE – pipe Ø		X 3	α
90	E11,E21	0	0°
100	E11,E21,E31,E41	0	0°
110	E11	0	0°
110	E21,E31	0	0°
110	E41	0	0°
110	E51	0	0°
120	E21	0	0°
120	E41	0	0°
*120	E51	0	80°
**120	E51	0	0°
125	E31,E41	0	0°
125	E51	0	0°
140	E41,E51	0	0°

*E 41, E 51 – Inner width of reel 1600 mm

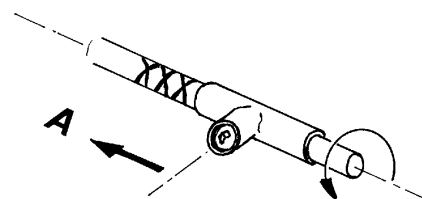
** E 41, E 51 – Inner width of reel 1570 mm

**ATTENTION**

In doing so, the spindle must be turned in wind-up direction (counter-clock-wise, see drawing).
At this point, the winding carriage moves from the reversing point to the left (direction A).

Step 6:

Mount the winding chain (1), reel unchanged with inlet bend pointing down
Fasten the left pillow block of the helically grooved spindle,
at the same time tighten the winding chain (1).

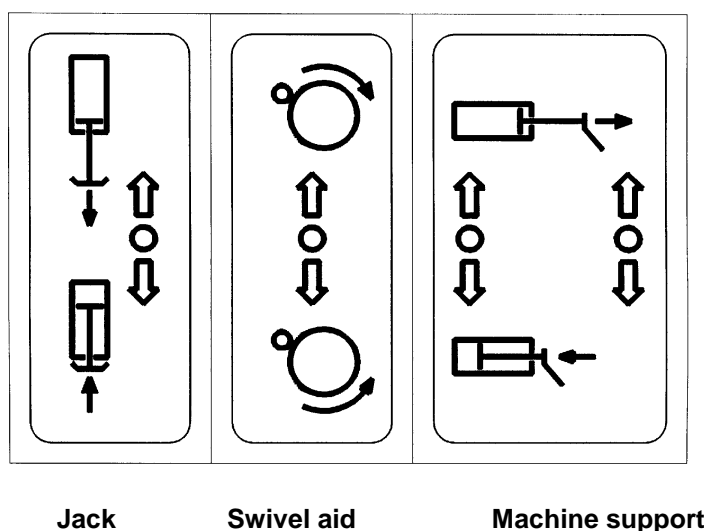


15.8. DESCRIPTION OF THE HYDRAULIC SYSTEM:

Now the hydraulic hoses are coupled with the non-return valve blocks (14).

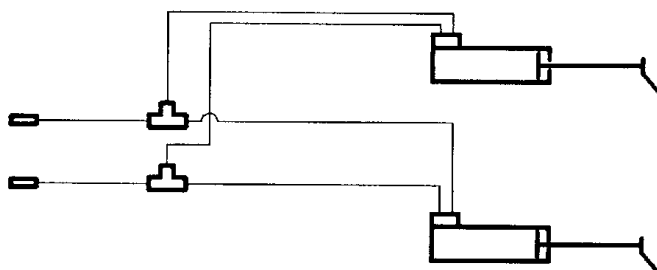
If the inspection of the hydraulic system shows that the cylinder movements are wrong you must exchange the hydraulic hoses !

This is also necessary when the moving directions with mounted control valve options do not correspond with the predefined switching diagrams.

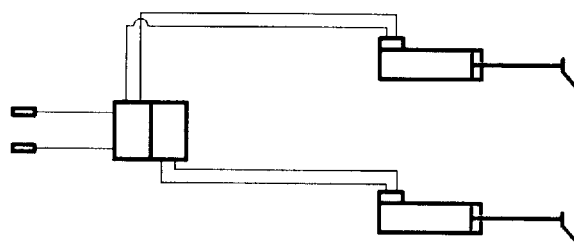


The standard RAINSTAR outfit includes hydraulic machine supports without a control valve block.

Standard“ hydraulic diagram:

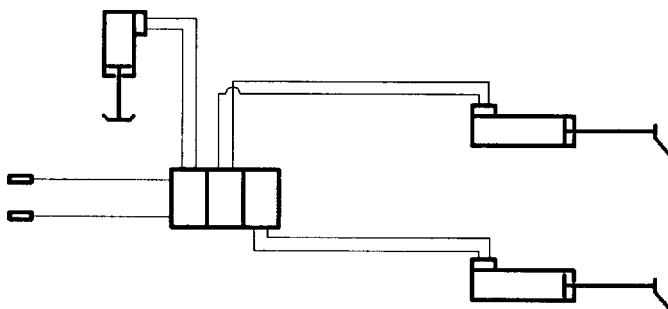


Hydraulic diagram “Control valve block - machine supports“ (OPTION)

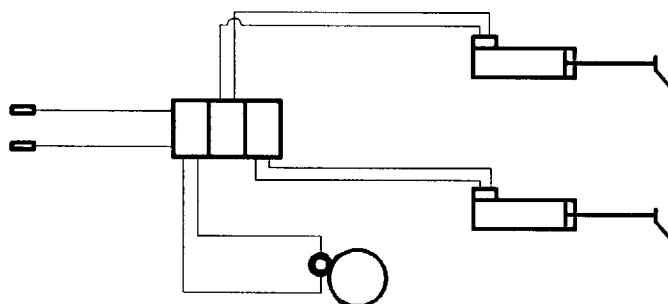




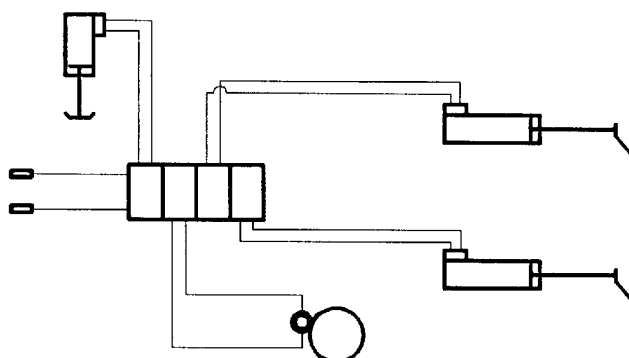
Hydraulic diagram "Control valve block - Machine supports + jack" (OPTION)



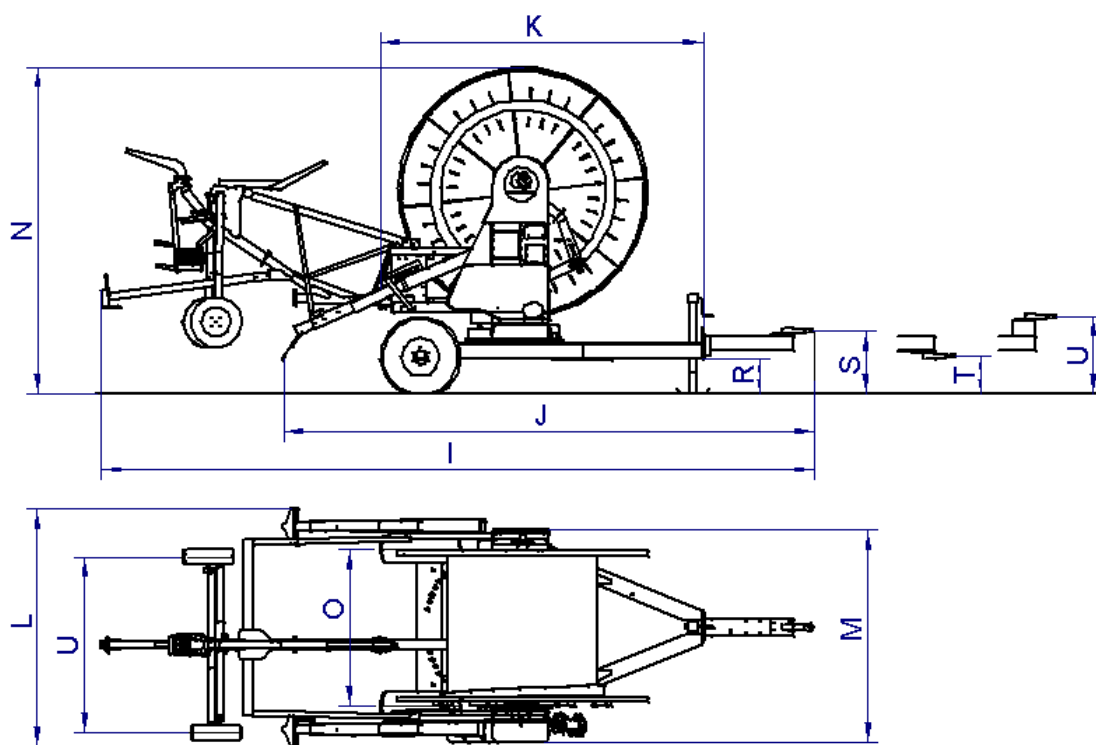
Hydraulic diagram "Control valve block - machine supports + swivel aid" (OPTION)



Hydraulic diagram "Control valve block – machine supports + jack + swivel aid" (OPTION)

**CAUTION!**

For safety reasons you must handle the hydraulic system with utmost care. The rear right support and the cart area are not directly visible from the operator's position. Therefore no other person is allowed in the immediate vicinity of the machine !



A	PE-pipe dia. x length	N	Overall height
B	Max. strip length	O	Track width of undercarriage
C	Turbine	P	Tires - undercarriage
E	Connecting pressure	Q	Tire pressure - undercarriage
G	Weight incl. PE-pipe with water *	R	Ground clearance
H	Weight incl. empty PE-pipe *	S	Hitch height - standard
I	Overall length incl. cart	T	Hitch height - below PTO
J	Overall length without cart	U	Hitch height - w. height increase
K	Shipping length	V	Cart track width
L	Max. width	W	Cart tires
M	Shipping width	X	Cart tire pressure

* Total weight including cart, sprinkler, and 4 sprinkler cart balancing weights.

Information:

Machine height with tandem axle: E11-E21/4W: N + 300mm, E31-E41/4W: N + 280mm, E51: N + 210mm
 Machine height with 4-wheel design 4WB: E31/4WB: N + 70mm, E41+E51/4WB: N + 90mm

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Typ		E 11										E 21									
		90-480	90-510	100-350	100-380	100-400	110-300	110-330	110-350	100-430	100-450	110-350	110-380	110-400	110-420	120-300					
A	mm x m	90x480	90x510	100x350	100x380	100x400	110x300	110x330	110x350	100x430	100x450	110x350	110x380	110x400	110x420	120x300					
B	m	530	560	400	430	450	350	380	400	480	500	400	430	450	470	350					
C		TVR 60										TVR 60									
E	bar	4,5 - 11										4,5 - 11									
G	kg	5595	5785	5290	5526	5683	5392	5677	5867	6156	6313	6105	6390	6580	6770	6115					
H	kg	3548	3654	3307	3391	3515	3350	3450	3506	3878	3940	3744	3855	3946	4027	3813					
I	mm	7600										7730									
J	mm	5450										5580									
K	mm	3160										3210									
L	mm	2530										2560									
M	mm	2170										2330									
N	mm	3480										3480									
O	mm	1800 - 2250										1800 - 2250									
P	mm	11,5 / 80 - 15,3 , 12 PLY										11,5 / 80 - 15,3 , 12 PLY									
Q	bar	5,5										5,5									
R	mm	340										340									
S	mm	660										660									
T	mm	380										380									
U	mm	830										830									
V	mm	1500 - 3000										1500 - 3000									
W	bar	165 / 70 R 13										165 / 70 R13									
X	bar	1,3										1,3									



Typ		E 31										E 41									
		100-480	100-500	100-520	110-450	110-470	110-490	125-310	125-350	100-550	100-590	110-500	110-520	110-550	120-420	120-450	125-370	125-400	140-340		
A	mm x m	100x480	100x500	100x520	110x450	110x470	110x490	125x310	125x350	100x550	100x590	110x500	110x520	110x550	120x420	120x450	125x370	125x400	114x340		
B	m	530	550	570	500	520	540	360	400	600	640	550	570	600	470	500	420	450	390		
C		TVR 60										TVR 60									
E	bar	4,5 - 11										4,5 - 11									
G	kg	6648	6805	6962	7154	7345	7535	6682	7173	7787	8101	8219	8409	8694	8217	8557	8008	8376	8855		
H	kg	4219	4275	4391	4334	4399	4486	4183	4351	5093	5248	5215	5284	5455	5045	5158	4888	5003	5302		
I	mm	7730										8120									
J	mm	5580										6160									
K	mm	3210										3670									
L	mm	2560										2670									
M	mm	2330										2410									
N	mm	3530										3730									
O	mm	1800 - 2250										1800 - 2250									
P	mm	12,5 / 80 - 15,3 , 12 PLY										12,5 / 80 - 15,3 , 12 PLY									
Q	bar	5,5										5,5									
R	mm	340										340									
S	mm	660										680									
T	mm	380										400									
U	mm	830										850									
V	mm	1500 - 3000										1500 - 3000									
W	bar	165 / 70 R13										165 / 70 R13									
X	bar	1,3										1,3									



Typ	E 51									
	110-590	110-620	110-650	120-530	120-550	120-570	125-450	125-500	140-400	
A	mm x m	110x590	110x620	110x650	120x530	120x550	120x570	125x450	125x500	140x400
B	m	640	670	700	580	600	620	500	550	450
C		TVR 60								
E	bar	4,5 - 11								
G	kg	8982	9267	9552	9369	9595	9822	8897	9511	9533
H	kg	5552	5698	5892	5532	5705	5837	5161	5480	5599
I	mm	8200								
J	mm	6230								
K	mm	3740								
L	mm	2670								
M	mm	2410								
N	mm	4070								
O	mm	1800 - 2250								
P	mm	12,5 / 80 - 15,3, 12 PLY								
Q	bar	5,5								
R	mm	360								
S	mm	710								
T	mm	430								
U	mm	880								
V	mm	1500 - 3000								
W	bar	165 / 70 R13								
X	bar	1,3								

15.9. TIRE PRESSURE

Always ensure that tire pressure is correct in order to guarantee maximum tire life and safe transport of the RAINSTAR!

Standard tires RAINSTAR E

Model	Tire dimension	Tire pressure required
E 11	11,5/80 – 15,3	5,5 bar
E 21	11,5/80 – 15,3	5,5 bar
E 31	12,5/80 – 15,3	5,5 bar
E 41	12,5/80 – 15,3	5,5 bar
E 51	12,5/80 – 15,3	5,5 bar

Standard tires RAINSTAR E / 4W

Model	Tire dimension	Tire pressure required
E 11 – E 51	10,0/75 – 15,3	6,0 bar

Special tires RAINSTAR E (Option)

Model	Tire dimension	Tire pressure required
E 11	15,0/55 – 17	3,5 bar
E 21	400/60 – 15,5	4,8 bar
E 31, E 41, E 51	400/60 – 15,5	4,8 bar
4W	15,0/55 – 17	3,5 bar
E11, E21, E31, E41, E51	400/60 – 15,5	4,8 bar

Note: Minimum track widths with wide tires on E 11 – E 51, E 11/4W - E 51/4W 1 900 mm

STANDARD TIRES ON RAINSTAR CART E 11 – E 51

Tire dimension	Tire pressure required
165 / 70 – R 13	1,3 bar

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16. CONFORMITY CERTIFICATE

EC Declaration of Conformity according to EC Directive 2006/42/EC

The manufacturer

Röhren- und Pumpenwerk BAUER Gesellschaft m.b.H.
Kowaldstraße 2, 8570 Voitsberg, Austria
phone +43 3142 200-0; fax: +43 3142 200-320/-340

herewith confirms that the machine mentioned below

Designation of machine	RAINSTAR
Machine type / basic units	E11, E21, E31, E41, E51
Consists of	Irrigation machine with cart

corresponds analogously to the requirements of the Machinery Directive 2006/42/EC.

In case of a modification of the machine not accorded with FAN GmbH, this declaration will cease to be valid.

The following standards as amended have been applied analogously:

DIN EN ISO 12100-1	Safety of machines – Basic concepts, general principles for design, Part 1: Basic terminology, methodology
DIN EN ISO 12100-2	Safety of machines – Basic concepts, general principles for design, Part 2: Technical principles and specifications
DIN EN 60204-1	Safety of machines - Electrical equipment of machines, Part 1: General requirements
EN ISO 14121-1	Safety of machines – Risk assessment

Norms related to products:

DIN EN 908	Irrigation machine with hard hose reel
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Person in charge of documentation: Thomas Theissl, Kowaldstraße 2, 8570 Voitsberg, Austria,

Technical Designer in Charge

Röhren- und Pumpenwerk
BAUER
Gesellschaft m.b.H.
A-8570 Voitsberg / Austria

Commercial Manager

Voitsberg, 12. 2. 2011