



Automatic Greasing System  
**TRIPLUS**  
Trailer version  
EG1603P01

## ***General information***

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# PREFACE



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## Automatic Greasing System **TRIPLUS**

This general manual gives a description of the TRIPLUS automatic greasing system. It aims at giving insight in the system's operation and possibilities. Furthermore, in this manual you will find the technical data on several components of the TRIPLUS automatic greasing system.

In this manual the following icons are used to inform or warn the user:



### **ATTENTION**

Draws the user's attention to important information meant to avoid problems.



### **WARNING**

Warns the user for physical injuries or serious damage to the equipment caused by improper actions.

# 1.

# INTRODUCTION



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## 1.1 Introduction

This chapter offers a short presentation of Groeneveld Transport Efficiency and the products supplied by us. Furthermore, a description of the TRIPLUS automatic greasing system is provided.

## 1.2 GROENEVELD Transport Efficiency B.V.

Investing in operational safety. Based on this idea *Groeneveld* was founded in 1971. The already international network is managed from the head office in Gorinchem, The Netherlands. *Groeneveld* aims at further expansion of this leading position, which was realized thanks to the solid image and a customer oriented working method.

*Groeneveld* employees form a dedicated team that works with daily enthusiasm to satisfy the customer's needs. Far-reaching automation enables a high working rate. The ISO 9001 standard forms the basis for guaranteed quality of *Groeneveld* products. Frequent contact with the relations and an extensive dealer network guarantee *Groeneveld's* good reputation. We know what today's entrepreneur needs: not a ready-made product, but a custom-built solution for automating daily maintenance.

New techniques offer new applications. Therefore, *Groeneveld* has a large budget for developing new cost-reducing products. Our own Research and Development department cooperates with prominent external organizations, but also with leading manufacturers of vehicles and machines.

Besides the TRIPLUS automatic greasing system, *Groeneveld* also supplies products like:

- temperature registration systems
- board computer systems
- speed limiters
- automatic oil level regulator
- reversing security-systems

*Groeneveld* supplies a complete program of cost-reducing and comfort-enhancing products.



Figure 1.1 Head office Groeneveld



### **1.3 TRIPLUS automatic greasing system**

*Groeneveld's* automatic greasing systems take care of the daily maintenance of anything that has moving parts. These systems prevent unnecessary wear and down-time and thus reduce exploitation costs and guard against annoying, costly, unexpected problems.

*Groeneveld's* automatic greasing systems are applied in, among other fields, manufacturing, off-the-road vehicles, agriculture and the off-shore and transport industries.

The most important advantages:

- longer maintenance intervals; less unnecessary down-time.
- reduced wear of the greased components due to accurate and constant greasing.
- less repair and replacement costs.
- less unnecessary down-time; less loss of production.

## Notes

[illegible]

## 2.

# GENERAL INFORMATION



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## 2.1 Introduction

With an automatic greasing system of *Groeneveld* all grease points of a vehicle or machine are lubricated automatically at the correct moment and with the correct amount of grease. Because greasing takes place while the vehicle or machine is in operation, the applied grease is spread optimally over the whole surface to be greased. The greasing system requires no user intervention to operate, apart from periodically replacing the grease in its reservoir.

*Groeneveld's* automatic greasing systems are designed with the utmost care and tested rigorously. This guarantees an extended operational life and error-free operation, even under the most extreme operating conditions.

Proper installation, using the correct type of grease, and periodic checks are prerequisites for the continual hassle-free operation of the system. The periodic checks, which take little time and effort, can be performed during the normal maintenance of the vehicle or machine (during oil-replacement, for instance). Careful selection of construction materials, makes the greasing system itself virtually maintenance-free.



### ATTENTION

The automatic greasing system reduces the time and effort spent on manual greasing significantly. However, do not forget that there may be grease points that are *not* served by the greasing system and must still be greased by hand.

## 2.2 The TRIPLUS automatic greasing system

A *Groeneveld* TRIPLUS automatic greasing system serves each grease point of the vehicle, machine or installation in sequence, i.e. grease is supplied to the connected grease points one at a time and one after the other (it is a progressive greasing system).

TRIPLUS systems are mainly applied on machines with a fixed number of grease points that require fixed amounts of grease at fixed intervals. This, because the amount of grease that will be supplied to the individual grease points is governed by the distribution ratios that results from the choice of doser segment types and the manner in which those segments are combined in distribution blocks.

A *Groeneveld* TRIPLUS automatic greasing system comprises the following parts (see Figure 2.1):

1. An electric grease pump (plunger pump) with integrated grease reservoir and a digital control unit with data storage facility.
2. One or more distribution blocks (assembled from multiple doser segments).
3. Primary grease lines between the pump unit and the distribution blocks and interconnecting the distribution blocks themselves.
4. Secondary grease lines between the distribution blocks (doser segments) and the individual grease points.

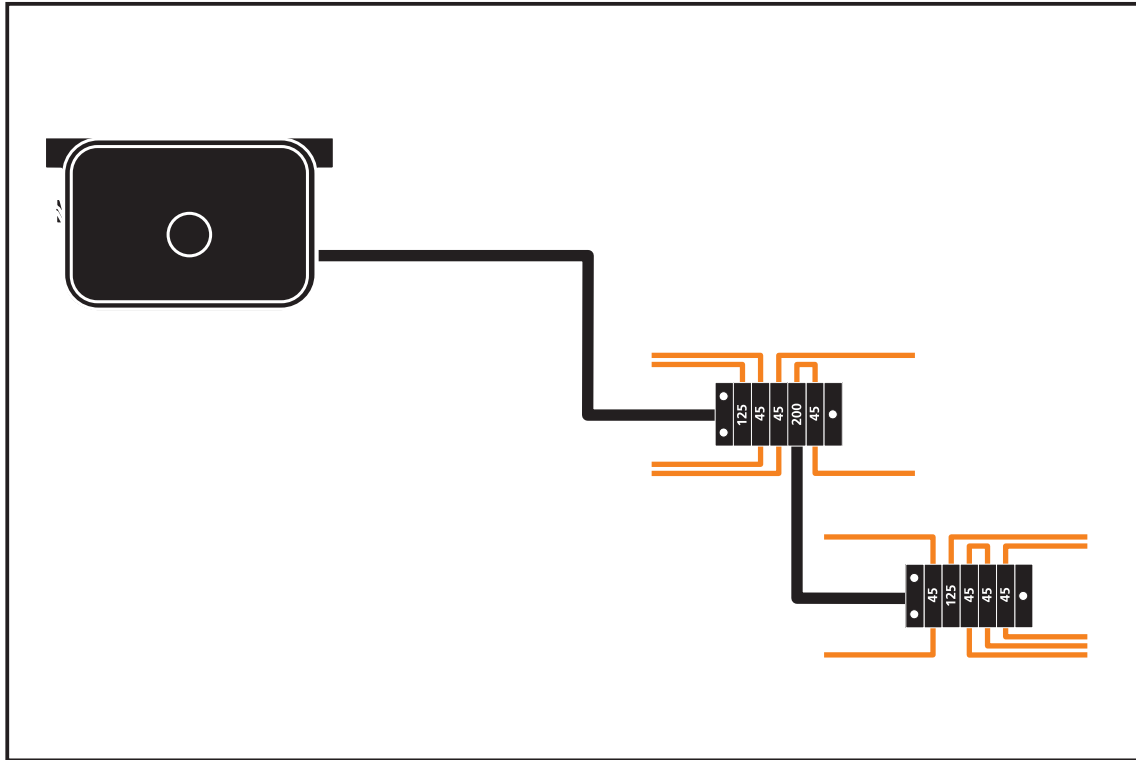


Figure 2.1 System overview

Two types of pump units are available:

- The TRIPLUS pump
- The TRIPLUS trailer pump

The TRIPLUS pump is applied when the supply voltage needed to power the greasing system is always available (while the vehicle or machine is in operation). The TRIPLUS trailer pump is used on pulled vehicles, where the supply voltage will not (always) be available.

## Notes

[illegible]

# 3.

## DESCRIPTION COMPONENTS



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### 3.1 Properties

The *Groeneveld*/TRIPLUS **trailer** pump is designed specifically for use on machines and pulled vehicles on which a supply voltage for the greasing system is not (always) available while the vehicle (trailers) or machine is in operation. The trailer pump unit features an integrated control unit.

The most significant properties of the TRIPLUS **trailer** pump unit are:

- The grease interval is determined by the number of brake commands received by the braking system;
- The grease output of the pump is monitored;
- The maximum acceptable grease pressure is monitored;
- The grease level in the reservoir is monitored;
- The electrical wiring and components are monitored.



### 3.2 Composition of the TRIPLUS trailer pump

The TRIPLUS **trailer** pump comprised the following components:

1. Grease reservoir with follower piston.
2. Stirring gear.
3. Plunger pump.
4. Electronic control and monitoring unit with permanent memory.
5. Relief valve with return line to the grease reservoir and electric contact for monitoring purposes by the control unit.
6. Grease output port 1.
7. Impulse sender used to count the number of revolutions of the drive shaft of the pump.
8. Electric motor with reduction gear.
9. Test pushbutton.
10. Filler grease nipple with filter.
11. De-aerating and grease-overflow opening.
12. Electrical connector.
13. Minimum grease-level switch.

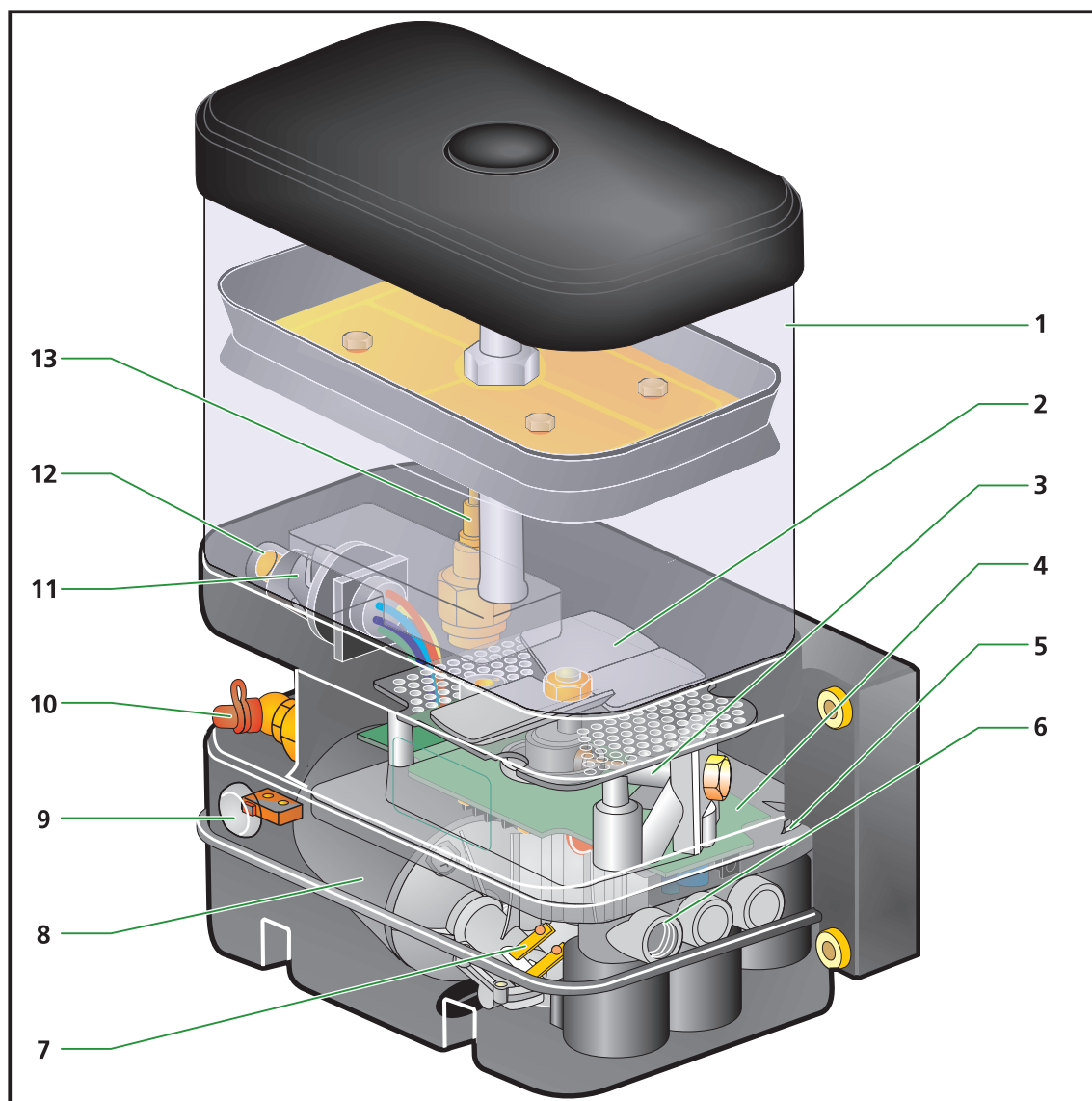


Figure 3.1 TRIPLUS trailer pump

### 3.3 The integrated control and monitoring unit

The control and monitoring unit initiates and controls the greasing cycles of the greasing system. All required system and program parameters, such as at which intervals (number of brake commands or pulses) grease should be applied and with what quantities, are laid down in the control unit. The control unit monitors the performance of various components of the greasing system, and stores and reports the malfunction it detects.

The control unit can be programmed or read-out with a GINA (Groeneveld tester for **I**nstallation and **A**nalysis) (see Figure 3.2).



Figure 3.2 Connecting the GINA to the trailer pump.

### 3.4 The plunger pump

The electric motor drives the plunger pump through a reduction gear. The plunger pump comprises a drive shaft with eccentric, a cylinder with piston, and a non-return valve. The eccentric moves the piston back and forth, once every revolution of the drive shaft. During the return stroke of the piston, grease is sucked from the reservoir into the cylinder (through an opening in the cylinder wall). During the forward stroke of the piston, the grease is pressed, via the non-return valve, towards the output port(s) of the pump unit. The amount of grease supplied during each stroke (revolutions of the drive shaft) depends on the (fixed) diameter of the cylinder and the stroke length of the piston.

### 3.5 Safety and control features

#### 3.5.1 Maximum grease pressure

A relief valve (fitted with an electrical contact) is installed in the grease channel between the plunger pump and the output port. This relief valve will start to lead the grease back to the reservoir if the maximum grease pressure is exceeded during the pump phase of a greasing cycle. The grease pressure may become too high, for example, when one of the grease lines to the grease points has become blocked, or when the viscosity of the grease has become too high (at low temperature).

#### 3.5.2 Minimum grease-level in the reservoir

A minimum-level switch is installed in the grease reservoir. If the grease reaches its minimum level, the control unit will process, store and report the occurrence of that condition.

#### 3.5.3 Defective wiring and short-circuits

Open-loads (interruptions) in the wiring to the sensors, minimum-level switch, relief valve, electric motor and external signalling devices (e.g. buzzer or signal light) will be detected and processed by the control unit. Short-circuits in the wiring or components will also be noticed by the control unit.

### 3.6 The test pushbutton

The test pushbutton on the pump unit has two functions:

- Performing a test cycle via the grease output port of the pump unit.
- Retrieving error messages stored in the memory of the control unit.

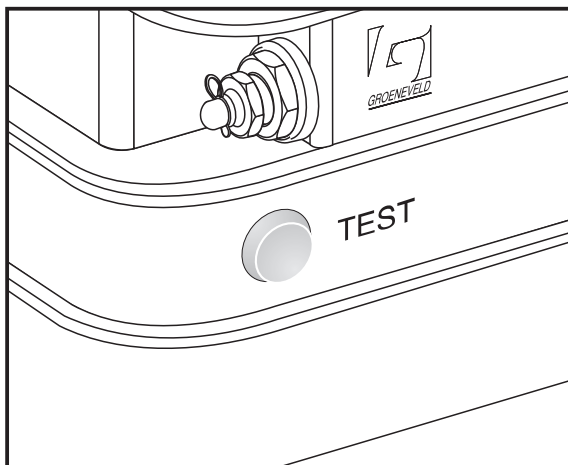


Figure 3.3 The test pushbutton

### 3.6.1 Performing a test cycle

A test cycle can be performed using the test pushbutton, as follow:

1. The supply voltage for the pump unit must be available (brakes on).
2. Press the test pushbutton momentarily (not longer than 1 second), one time.
3. The test cycle starts two seconds after you pressed the test pushbutton.

During the test cycle the signal light will blink at a particular frequency.  
Any errors that occur during the test cycle will not be indicated by the signal light and will not be stored in the memory of the control unit.

### 3.6.2 Retrieving fault messages

In the memory of the control unit information is stored about the operation of the greasing system. Two categories of fault messages can be distinguished:

1. **Pending errors:** errors that were detected since the control unit was switched on last (from the moment the supply voltage became available).
2. **Stored errors:** all errors that were detected by the control unit in the past.

All new errors that occur will be stored as pending errors. If the control unit is switched off all pending errors will be added to list of stored errors, and the list with the pending errors will be erased.

#### Retrieving fault messages:

The fault messages stored in the control unit's memory can be retrieved by keeping the test pushbutton on the pump unit depressed for at least five seconds. Seven seconds after you released the test pushbutton the signal light will start producing the blink codes to indicate the stored errors.

### 3.7 The signal light

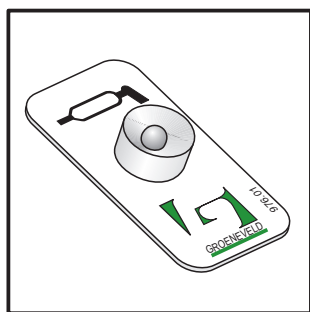


Figure 3.4 The signal light

The driver or operator will be informed about the operation of the greasing system through a signal light which is installed on the dashboard in the cabin. The physical form of the signal light may vary, but it is always installed so that is easily visible.

**The signal light produces the following signals:**

<i>Signal</i>	<i>Moment</i>	<i>Significance</i>
1 x 3 seconds on.	5 seconds after switching on contact.	The supply voltage for the control unit is available and the signal light is OK.
1 x 2 minutes on.	After completion of a pump phase.	An error occurred during the pump phase. Precisely which error occurred can be determined by using the test pushbutton.
Repeatedly: 1 x 0,3 seconds on, followed by a pause of 2 seconds.	After momentarily pressing the test pushbutton once.	A test cycle is being performed via grease output port 1.

The signal light indicates the fault codes by blinking:

The decades of the fault code: long pulses (0,5 seconds)

The units of the fault code: short pulses (0,15 seconds)

There is a two second pause between successive fault codes. For example, if the fault codes 13 and 22 are displayed, you will see the blink codes:

*long, short, short, short*                      fault code 13  
two second pause

*long, long, short, short*                      fault code 22  
two second pause

Each fault message has been assigned a two-digit fault code:

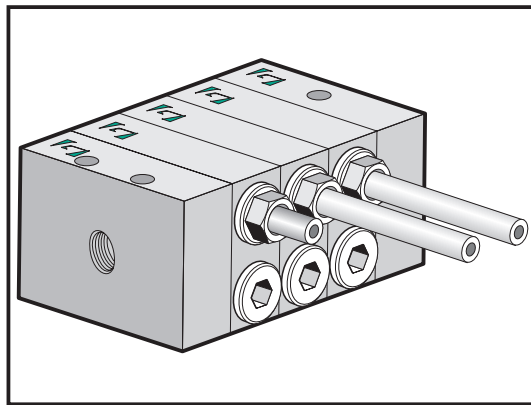
<i>Fault code</i>	<i>Meaning</i>
10	No error on this moment.
11	Distribution block monitoring switch has not switched.
12	Relief valve activated during a pump phase in output port 1 (maximum grease pressure exceeded).
15	Grease reservoir is empty.
21	The pump did not complete the programmed number of revolutions within the set time.
22	Pump motor: open load.
23	Pump motor eliminated during pump phase concerning a too high flow usage.
33	Signal light: open load.
34	Signal light: short circuit in wiring (or lampfitting).
35	Short circuit components or wiring called in of above.

### 3.8 The distribution blocks

#### 3.8.1 Properties

TRIPLUS distribution blocks distribute the grease to the various grease points and meter-out the amount of grease that goes to each individual grease point. They do so in a progressive, sequential way. The progressive distribution blocks in the greasing system distribute the grease to the grease points, one grease point at a time, and one grease point after another. Progressive distribution blocks can be placed in series, in which case an output of a block is used to feed the next block in line (through a primary grease line).

#### 3.8.2 Composition



A progressive distribution block comprises the following components:

1. a start-segment
2. an end-segment
3. at least three doser segments

The doser segments to be deliverable in several versions with several amounts (quantity of grease which by cycle it is supplied). By several doser segments in a distribution block combine can a certain partitioning of the grease be obtained.

Figure 3.5 Distribution block.

Each doser segment always has two grease output ports, with identical grease outputs per cycle. The grease channels between the segments are sealed by O-rings and the segments are pressed together with two compression bolts.

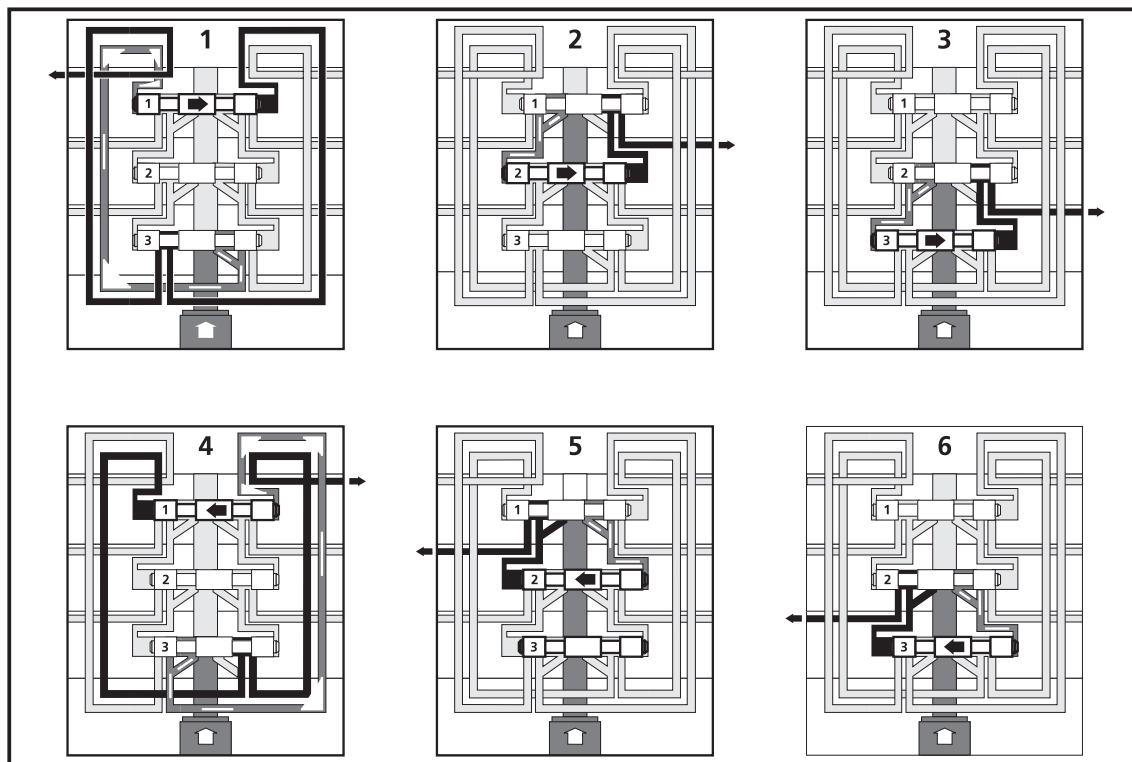
**3.8.3 Principle of operation**

Figure 3.6 Principle of operation.

To operate, progressive distribution blocks need no other energy source than the grease pressure supplied by the pump of the greasing system:

1. The lubricant flows from the input port, via piston 3, through all segments to the left-hand side of piston 1.
2. Piston 1 is pushed to the right by the grease pressure. The grease at the right-hand side of piston 1 is pressed to output port 1. Because piston 1 has now been pushed to the right, the lubricant now flows, via piston 1, from the central input channel to the left-hand side of piston 2.
3. Piston 2 is then moves and supplies grease to output 2. Because piston 2 has been pushed to the right, the lubricant now flows, via piston 2, to the left-hand side of piston 3. Piston 3 is pushed to the right and supplies lubricant to output port 3.
4. After piston 3 has been pushed to the right, the lubricant is pressed to the right-hand side of piston 1. Piston 1 will move to the left and supply lubricant to output port 4.
5. Afterwards piston 2 will also be pressed to the right and will supply lubricant to output port 5.
6. Afterwards piston 3 will also be pressed to the right and will supply lubricant to output port 6.
1. The distribution block then arrives back at its starting-off point, and the cycle will repeat as long as there is pressure in the primary grease line.

### Remark:

The description and illustration above assume there is a fixed starting-off point for the doser segments in the distribution block. This is not so. The distribution block always continues from where it left-off during the previous pump phase of the grease cycle.



### WARNING:

To be able to operate at all, a distribution block needs to have at least three doser segments.

#### 3.8.4 Non-return valves

Non-return valves are installed in the outputs of the distribution block to prevent lubricant from flowing back into the distribution block. All output ports to which primary lines are connected or which are used to interconnect distribution blocks **must** be fitted with non-return valves. Output ports which secondary grease lines are connected, must be fitted with non-return valves if significantly different return pressures are expected at different output ports.

#### 3.8.5 Failure of one of the doser segments

If one of the doser segments fails to operate properly (due to internal or external damage), the whole greasing system will fail to operate.

#### 3.8.6 Closing outputs

An output may only be closed-off after removal of the little plug that separates the two outputs of a doser segment. Removing the plug allows the grease meant for the close-off to exit through the output that remains open (it doubles the output of the one that remains open). The distribution block will become inoperable if the little plug is not removed.



### 3.8.7 Combining outputs

The outputs of a distribution block can be combined by installing an external interconnection line. The total grease output in that case is the sum of all outputs thus interconnected.

The two outputs of a doser segment can be combined by removing the little internal plug that separates the two outputs and closing-off one of the ports. This doubles the output of the port that remains open.

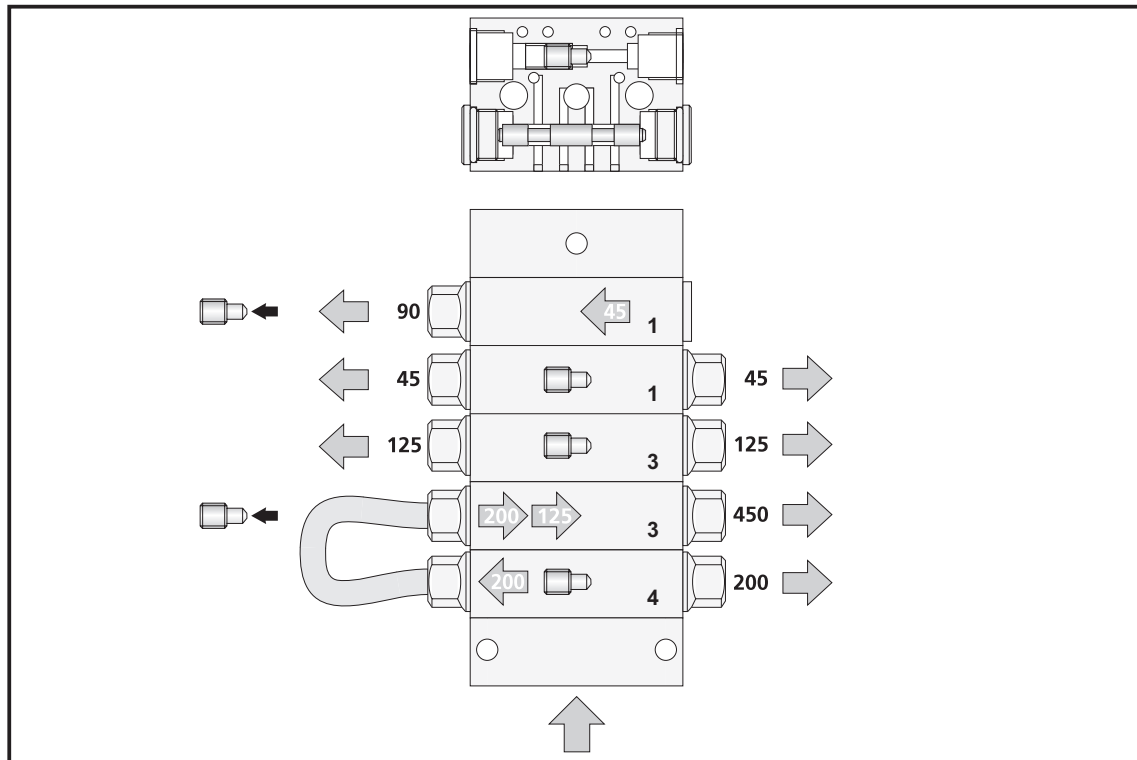


Figure 3.7 Combining outputs.

The values in the illustration represent the outputs of the ports in  $\text{mm}^3$  (0,001 cc) per complete cycle of the distribution block. The amount supplied is determined by the diameter of the piston.

## Notes

[illegible]

4.

# THE GINA



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### 4.1 Introduction

The GINA (**G**roeneveld tester for **I**nstallation and **A**nalysis) is a programming and read-out device for the digital control unit of the TRIPLUS automatic greasing system.



Figure 4.1 The GINA.

In the description that follows all screens of the GINA are dealt with in the order in which they have been placed in its menu system. To get acquainted with the menu system and the features the GINA offers, we advise you to follow the sequence as presented, if only once. In practise there is, of course, no reason whatsoever for such a rigid and time consuming approach.

The read-outs and setting have been grouped in three menus: main menu, parameters timer and diagnosis menu. You can access each of these menus by pressing <MAIN>, <PARAMETERS> or <DIAGNOSIS> on the keypad of the GINA.

You can do so at any time, regardless of the screen currently shown on the display.

Some screens just show information. You cannot change anything in those screens. Other screens allow you to change parameters or the status of a particular input or output. You can recognise those screens by the blinking cursor that appears on them (with the exception of the system configuration and error-logging-reset screens).

A number of screens show the current time in their top-right corner. In the screens, as reproduced in this manual, this is indicated by **hh:mm:ss**.

Values are usually denoted to by a number of **x**-signs, with one '**x**' for every possible digit in the number.

## 4.2 Connecting the GINA

The supply voltage of the control unit to be read or programmed must be available (from the vehicle or an external power supply, if need be).

Connect the GINA with the control unit, using the supplied interconnection cable.

## 4.3 Control pad

<i>Key</i>	<i>Function</i>
<POWER ON/OFF>	to turn the GINA on or off (toggle)
<F1> .. <F4>	('soft keys') to make a particular choice in a menu
<0> .. <9>	to enter numerical data
<MAIN>	to call the main menu to view miscellaneous information
<PARAMETERS>	to call the parameter menu to view and enter parameter data
<DIAGNOSIS>	to call the diagnosis menu to view various system data
<NEXT>	to go to the next screen in the menu system
<ENTER>	to confirm a setting you have changed or entered

## 4.4 Switching on the GINA

The GINA can be switched-on after:

- the GINA has been connected with the control unit, and
- the power supply has been available to the control unit for at least 8 seconds.

Press <POWER ON/OFF>.

You can access the main menu, parameters timer and diagnosis menu by pressing, respectively <MAIN>, <PARAMETERS> or <DIAGNOSIS>.

This message appears when the GINA is unable to communicate with the control unit:

**Communication error**

This can be caused by:

- bad connection (wire in cable broken or bad connector).
- GINA switched-on too quickly.

Always try to alleviate the problem first by turning the GINA off and then on again, or by pressing one of the softkeys (<F1>, <F2>, <F3> or <F4>).

## Automatic Greasing System **TRIPLUS**

This message appears if the control unit is not supported by this GINA:

**DEVICE NOT SUPPORTED**

You need another GINA to access this control unit.

## 4.5 The Main menu

Press <main>

```
MAIN MENU

info  time  contr
```

The main menu contains various data about the GINA and the control unit that is connected. You can change only some of the data.

Press <F1> (**info**).

```
INFO
User ID
last access: xxxxxx
u-ac  d-ac  u-ch  d-ch
```

The screen shows the identification number of the person who most recently connected a GINA to this control unit.

**ATTENTION:** This number is overwritten when the GINA is switched off, with your own identification number.

Press <F2> (**d-ac**).

```
INFO
Time&date , last access
xx-xx-xx  xx:xx
u-ac  d-ac  u-ch  d-ch
```

The screen shows the date and time at which a GINA has, most recently, been connected with this control unit.

**ATTENTION:** This date and time will be updated when you switched-off the GINA.

Press <F3> (**u-ch**).

```
INFO
User ID
last change: xxxxxx
u-ac  d-ac  u-ch  d-ch
```

The screen shows the identification number of the person who, most recently, changed any settings of this control unit.

**ATTENTION:** This number will be overwritten with your own identification number when you switch-off the GINA, provided you have changed at least one setting.

Press <F4> (**d-ch**).

```
INFO
Time&date , last change
xx-xx-xx  xx:xx
u-ac  d-ac  u-ch  d-ch
```

The screen shows the date and time at which the settings of this control unit were most recently changed.

**ATTENTION:** This time and date will be updated when you switch-off the GINA, provided you have changed at least one setting.

Press <NEXT>.

```
INFO
Software-version
Prog unit:  xxxx
p-s      p-ui  acces
```

The screen shows the version number of the software in this GINA.

Press <F2> (**p-ui**).

```
INFO
User ID
Prog unit:  xxxx
p-s      p-ui  acces
```

The screen shows the identification number of the registered user of this GINA.

Press <F3> (**acces**).

```
INFO
Authorisation level
xxx [Device 7]
ald7  ald8
```

The screen shows the access level of the control unit (GINA) in the TRIPLUS program (truck version / device 7). You cannot change this setting.

Press <F2> (**ald8**).

```
INFO
Authorisation level
xxx [Device 8]
ald7  ald8
```

The screen shows the access level of the control unit (GINA) in the TRIPLUS program (trailer version / device 8). You cannot change this setting.

Press <NEXT>.

```
INFO
Software-version
Prog unit:  xxxx
p-s      p-ui  acces
```

The screen shows the version number of the software in this GINA.

Press <NEXT>.

```
text vers. xxxx78002
September 1997
```

The screen shows the version number of the display texts in the software of the GINA.



Press <MAIN>.

### **MAIN MENU**

**info   time   contr**

The main menu contains various data about the GINA and the control unit that is connected. You can change only some of the data.

Press <F2> (**time**).

### **TIME**

**Enter hours**

**xx**

**hrs   min**

The screen shows the hours of the current date and time. You can change this setting with the numeric keys. Confirm the new setting with <ENTER>.

Press <F2> (**min**).

### **TIME**

**Enter minutes**

**xx**

**hrs   min**

The screen shows the minutes of the current date and time. You can change this setting with the numeric keys. Confirm the new setting with <ENTER>. As soon as you press <ENTER>, the seconds will start running at zero.

Press <NEXT>.

### **DATE**

**Enter day**

**xx**

**day   mnth   year**

The screen shows the day of the month of the current date and time. You cannot change this setting.

Press <F2> (**mnth**).

### **DATE**

**Enter month**

**xx**

**day   mnth   year**

The screen shows the month of the current date and time. You cannot change this setting.

Press <F3> (**year**).

**DATE**  
Enter year  
xx  
day mnth year

The screen shows the year of the current date and time. You cannot change this setting.

Press <MAIN>.

**MAIN MENU**  
  
info time contr

The main menu contains various data about the GINA and the control unit that is connected. You can change only some of the data.

Press <F3> (**contr**).

**MAIN MENU**  
**Adjust contrast**

-

+

The contrast of the display may be increased or decreased in this screen.  
Press <F1> (-) to lower the contrast or <F4> (+) to raise it.

## 4.6 Parameters timer

The parameters timer menu contains the parameter settings for the grease cycle. You can view and/or change these parameters, provided you have the correct 'access level'.

Press **<parameters>**

```
PARAMETERS TIMER
Delivery
xxx.x [cc]
del  rdlv  cbp  psdt
```

The screen shows the grease output (in cc) of output port 1. The grease output set must match the grease demand per greasing cycle of the branch of the greasing system connected to this output port.

Range: 0,0 ... 999,9 cc

The location of the cursor (the flashing square) indicates the digit will be changed; after you entered a digit, the cursor will automatically move forward to the next digit. Press **<ENTER>** when you are satisfied with the setting. The cursor will then disappear from the screen.

Press **<F2>** (**rdlv**).

```
PARAMETERS TIMER
Rotation delivery
x.xx [cc/r]
del  rdlv  cbp  psdt
```

The screen shows the output (in cc) of the plunger pump per revolution of its drive shaft (determined by the stroke length and diameter of the plunger). With this parameter the program will be able to calculate the number of revolutions needed to achieve a certain grease output during each greasing cycle.

The default value is 0,10 (cc/r) and may not be changed.

Press **<F3>** (**cbp**).

```
PARAMETERS TIMER
Cycle brake pulses
xxxxx
del  rdlv  cbp  psdt
```

The screen shows the duration of the greasing interval, expressed in brake commands.

Range: 0 ... 65535 brake commands.

If necessary, change this value and confirm with **<ENTER>**.

Press **<F4>** (**psdt**).

```
PARAMETERS TIMER
Pump startup delay
xxxxx [msec]
del  rdlv  cbp  psdt
```

The screen shows the delay (in milliseconds) between the activation of the brake lights of the vehicle and the start of the pump of the greasing system. This delay prevents the fuse from blowing, which would be likely to happen if both were switched on simultaneously.

The default is 300 ms and this should not be changed.

Press <NEXT>.

**PARAMETERS TIMER**  
**Max release errors**  
 xxx [%]  
 mre poct loct end1

The screen shows a filter period, in % of the total pumping phase, in which a possible opening of the over-pressure relieve valve will be ignored by the program. The maximum setting is 50% calculated from the end of the pumping phase, which means that during the second half of the pumping phase valve openings will be ignored. The standard setting is 25%, ignoring possible valve openings during the last 1/4 of the pumping phase. Openings during the first 3/4 will cause a "release during grease" (rdg) error and trigger the lamp for the rest of the pumping phase.

If necessary, change this setting and confirm with <ENTER>.

Press <F2> (**poct**).

**PARAMETERS TIMER**  
**Pump oc time**  
 xxx [msec]  
 mre poct loct end1

The screen shows the amount of time (in milliseconds) the control unit tolerates an overcurrent or short-circuit in the electric motor of the pump, before it disconnect the electric motor.

The default is 50 ms and value should not be changed.

Press <F3> (**loct**).

**PARAMETERS TIMER**  
**Lamp oc time**  
 xxx [msec]  
 mre poct loct end1

The screen shows the amount of time (in milliseconds) the control unit tolerates an overcurrent or short-circuit in the signal light circuit, before it disconnect the signal light.

The default is 10 ms and value should not be changed.

Press <F4> (**end1**).

**PARAMETERS TIMER**  
**End line switch**  
 xxx [cycles]  
 mre poct loct end1

The screen shows the number of grease cycles within at least 1 pulse of the end-(block) switch (optional) must be received, to prevent an error. The setting should be 0 when no end-switch is installed. If necessary, change this setting and confirm with <ENTER>.

## 4.7 Diagnosis menu

Press <diagnosis>

```
DIAGNOSIS MENU

err  I/O  var  tinfo
```

The diagnosis menu shows various pieces of information concerning the current status of the greasing system, such as error messages and the status of its input and output signals.

Press <F1> (**err**).

```
ERRORS
Pump over current
xxxxx
poc  rdgr  lowl  rto
```

The screen shows the total number of times an overcurrent or short-circuit has been detected in the circuit of the electric motor of the pump unit.

Press <F2> (**rdgr**).

```
ERRORS
Release during grease
xxxxx
poc  rdgr  lowl  rto
```

The screen shows the total number of time the relief valve in the pump unit activated itself because the maximum grease pressure was exceeded during a pump phase.

Press <F3> (**lowl**).

```
ERRORS
Low level
xxxxx
poc  rdgr  lowl  rto
```

The screen shows the number of greasing cycles in which the grease level switch in the reservoir reported a low grease level.

Press <F4> (**rto**).

```
ERRORS
Revolution time out
xxxxx
poc  rdgr  lowl  rto
```

The screen shows the number of greasing cycles during which the pump was disconnected by the control unit because its drive shaft rotated too slowly or not at all.

Press <NEXT>.

```
ERRORS
End line switch
xxxxx
end1  eres  pol  lol
```

The screen shows the end switch in the greasing system, connected to the output port, did not send any or not enough pulses to the control unit.

Press <F2> (**eres**).

```
ERRORS
Empty reservoir
xxxxx
end1  eres  pol  lol
```

The screen shows the number of cycles which are not progressed because of the empty reservoir. After the first empty reservoir warning the control unit calculates how many cycles can be progressed with the available grease in the reservoir. After those number of cycles, without filling the reservoir, the pump stops with greasing, only the errors are counted.

Press <F3> (**pol**).

```
ERRORS
Pump open load
xxxxx
end1  eres  pol  lol
```

The screen shows how many times the short-circuit in circuit of the electric pump motor has been occurred. The pump phase has been cut short.

Press <F4> (**lol**).

```
ERRORS
Lamp open load
xxxxx
end1  eres  pol  lol
```

The screen shows how many times open load in the signal light circuit has been occurred.

Press <NEXT>.

```
ERRORS
Lamp over current
xxxxx
loc
```

The screen shows how many times over current in the signal light circuit has been occurred.

Press <NEXT>.

DIAGNOSIS			
Pending errors (1)			
0	0	0	0
poc	loc	pol	lol

The screen shows four "pending errors".  
(0= did not occur / 1= occurred):

- poc** short-circuit in circuit of the electric pump motor during the last pump phase. The pump phase has been cut short.
- loc** short-circuit in the signal light circuit during the last pump phase.
- pol** open load in circuit of electric pump motor during the last pump phase.
- lol** open load in the signal light circuit during the last pump phase.

Press <NEXT>.

DIAGNOSIS			
Pending errors (2)			
0	0	0	0
rdgr	rto	end1	eres

The screen shows four "pending errors".  
(0= did not occur / 1= occurred):

- rdgr** relief valve activated during the last pump phase.
- rto** the drive shaft of pump turns too slowly or not at all during the last pump phase. The pump phase has been cut short.
- end1** the end switch in the greasing system did not send any or not enough pulses to the control unit during the last pump phase.
- eres** reservoir is empty, the reserve of grease 400cc (4000 revolutions after the first low level warning is expired). The pump is disconnected and the signal lamp lits.

Press <NEXT>.

DIAGNOSIS MENU			
err	I/O	var	tinfo

Press <F2> (I/O).

INP/OUTP			
Mode: 0=auto 1=man			
X 2=test			
Mode			

The screen shows the current operating mode of the greasing system:

- 0 auto** the system operates on automatic and is executing the program stored in the control unit.
- 1 man** the functions of the greasing system are operated by hand (by means of the GINA).
- 2 test** the system is performing a test cycle (amount dependent on parameter setting)

You can change the current operating mode by pressing one of the numeric keys <0> to <2> and confirm that with <ENTER>.

If the current greasing cycle (in "auto" mode) is interrupted, that greasing cycle will not be completed when the system is put back on "auto". The "auto" mode will automatically be restored when the contact is switched on.

Press <NEXT>.

INP/OUTP				hh:mm:ss	
I/O (1)					
0	0	0	0		
pump	spr	lamp	spr		

This is the first I/O-screen. It shows the status of various output signals:

- pump** electric pump motor is running.
- lamp** signal light lits.
- spr** spare.

To test the system, these outputs may toggled manually by pressing function key <F1> and <F3> to (de)activate the signal light or the pump motor. You can only do this after the system's operating mode has been set to "1" (**manual**).

Press <NEXT>.

INP/OUTP				hh:mm:ss	
I/O (2)					
0	0	0	0		
pol	lowl	test	rvlv		

This is the second I/O-screen. It shows the status of various output signals:

- pol** open load in circuit of electric pump motor.
- lowl** minimum grease level reached in the reservoir.
- test** test pushbutton actuated.
- rvlv** relief valve activated (maximum grease pressure exceeded).

Press <NEXT>.



INP/OUTP		hh:mm:ss	
I/O (3)			
0	0	0	0
end1	lol	spr	revol

Dit is het derde I/O-schermb. Getoond wordt de status van diverse ingangssignalen:

**end1** sensor signal at each distribution block cycle in output port 1.  
**lol** open load in signal light circuit.  
**spr** spare.  
**revol** sensor impulse sent at every revolution of the drive shaft of the pump.

Press <DIAGNOSIS>.

DIAGNOSIS MENU			
err	I/O	var	tinfo

Press <F3> (**var**).

VARIABLES		hh:mm:ss	
Remainder brakes			
xxxxx			
rbrk	rrev	rerr	rcem

The screen shows the remaining part (expressed in brake commands) of the current greasing interval.

Press <F2> (**rrev**).

VARIABLES		hh:mm:ss	
Remainder revolution			
xxxxx			
rbrk	rrev	rerr	rcem

The screen shows the remaining part of the number of revolutions of the drive shaft of the pump that constitute the pump phase that is currently being executed.

Press <F3> (**rerr**).

VARIABLES		hh:mm:ss	
Release errors			
xxx			
rbrk	rrev	rerr	rcem

The screen shows the moment the "mre" filter gets active. From start of the pumping phase this counter counts down till 0, which is the moment the filter gets active and possible over-pressure relieve valve openings will be ignored by the program.

Press <F4> (**rcem**).

**VARIABLES**      **hh:mm:ss**  
**Remainder cycles empty**  
 xxx  
 rbrk    rrev    rerr    rcem

The screen shows the remaining revolutions of the drive shaft, after the first empty reservoir warning, until the reserve of grease 400cc (4000 revolutions) is been used.

Press <NEXT>.

**VARIABLES**      **hh:mm:ss**  
**Remainder cycles end line**  
 xxx  
 rcel

The screen shows the remaining number of pulses of the end-switch during a pump phase, to avoid an error.

Press <NEXT>.

## DIAGNOSIS MENU

err    I/O    var    tinfo

Press <F4> (**tinfo**).

## DIAGNOSIS MENU

pdif    hist

Press <F1> (**pdif**).

**PRODUCTION INFO**  
**Part number**  
 xxxxx  
 prno   srno   tive

The screen shows the part number of the control unit PCB

Press <F2> (**srno**).

**PRODUCTION INFO**  
**Serial number**  
 xxxxxxxxxxxx  
 prno   srno   tive

The screen shows the serial number of the control unit PCB.

## Automatic Greasing System **TRIPLUS**

Press <F3> (**tive**).

```
PRODUCTION INFO
Timer version
xxx
prno  srno  tive
```

The screen shows a version number which denotes both the software version and the type of hardware present.

Press <NEXT>.

```
DIAGNOSIS MENU

pdif  hist
```

Press <F2> (**hist**).

```
HISTORY
Total cycles
xxxxxxxx
tcy   tbrk  tpt   skrv
```

The screen shows the total number of correct executed greasing cycles. The number of in-correct cycles can be found in the error menu.

Press <F2> (**tbrk**).

```
HISTORY
Total brake pulses
xxxxxxxx
tcy   tbrk  tpt   skrv
```

The screen shows the total number of brake commands received. (That number coincides with the number of times that the EEPROM has been overwritten).

Note:

When the interval between two stoplight pulses is shorter than 5 seconds, the second pulse will be ignored by the program.

Press <F3> (**tpt**).

```
HISTORY
Total pumping time
xxxxx
tcy   tbrk  tpt   skrv
```

The screen shows the total pumping time of the pump unit.

Press <F4> (**skrv**).

HISTORY			
Skipped revolutions			
xxxxxx			
tcy	tbrk	tpt	skrv

The screen shows the total number of revolutions of the drive shaft of the pump that were skipped during all pump phases. All (programmed) revolutions that were not completed during the previous pump phase are added to this counter when the next pump phase begins.

If the counter reaches a value higher than about 20% of the total programmed revolutions (number of greasing cycles multiplied by the programmed number of revolutions per cycle), the greasing interval has been set too short or the number of revolutions per cycle (output of the pump in cc) has been set too high.

All screens have now been visited. If you have completed reading or programming the control unit, you can switch-off the GINA.

Press <POWER ON/OFF> and disconnect the interconnection cable and remove the GINA.

## 4.8 Layout of the menu system

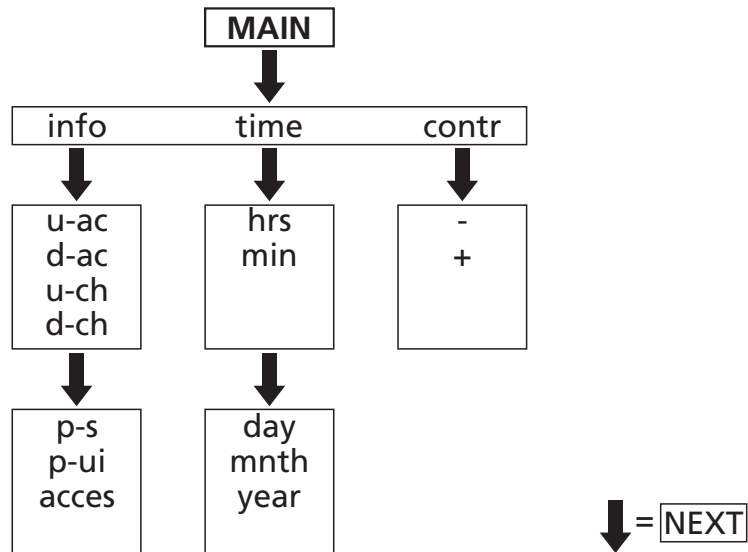
### 4.8.1 Used abbreviations

<i><b>Abbrevia- tion</b></i>	<i><b>Meaning</b></i>
-	minus (decreasing contrast)
+	plus (increasing contrast)
access	authorisation level
ald (8)	authorisation level device (8) (Triplus trailer-version)
auto	automatic
cbp	greasing interval expressed in brake commands
contr	screen contrast
d-ac	time & date, last access
d-ch	time & date, last change
day	day
del	delivery output (1)
end1	end-switch in the system, connected to output port (1)
err	errors
hist	history
hrs	hours
I/O	inputs/outputs
info	information GINA
lol	lamp open load
lwl	low level switch
man	manual
min	minutes
mode	mode
month	month
mre	filter period in which a possible opening of the over-pressure relieve valve will be ignored by the program
p-s	software-version GINA
p-ui	user id GINA
pdif	production info
poc	pump over-current
poct	pump over-current time
pol	pump open load

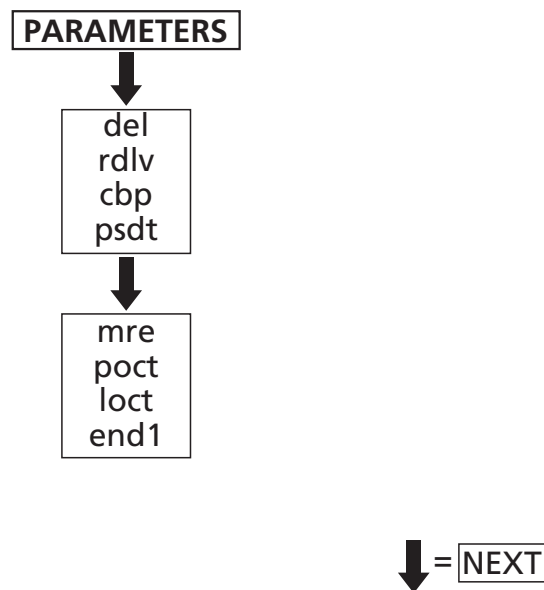
## Automatic Greasing System **TRIPLUS**

<b>Abbrevia- tion</b>	<b>Meaning</b>
prno	part number
psdt	pump startup delay time
pump	pump
rbrk	relief valve activated before start of pump phase
rcel	remaining end-switch pulses, to prevent "end-line" errors
rcem	remaining number of revolutions until the reserve of grease is been used.
rdgr	relief valve activated during pump phase
rdlv	grease output per revolution of the pump drive shaft
rerr	relief valve errors
rrev	remaining number of revolutions for the current pump phase
rto	revolution time out
skrv	total number of revolutions of the drive shaft that were skipped
spr	spare
srno	serial number
tbrk	total number of brake commands (total numbers EEPROM writes)
tcy	total cycles
test	test pushbutton
text vers.	text version, software GINA
time	time
tinfo	timer information
tive	timer version
tpt	total pumping time
u-ac	user id, last access
u-ch	user id, last change
var	variables
year	year

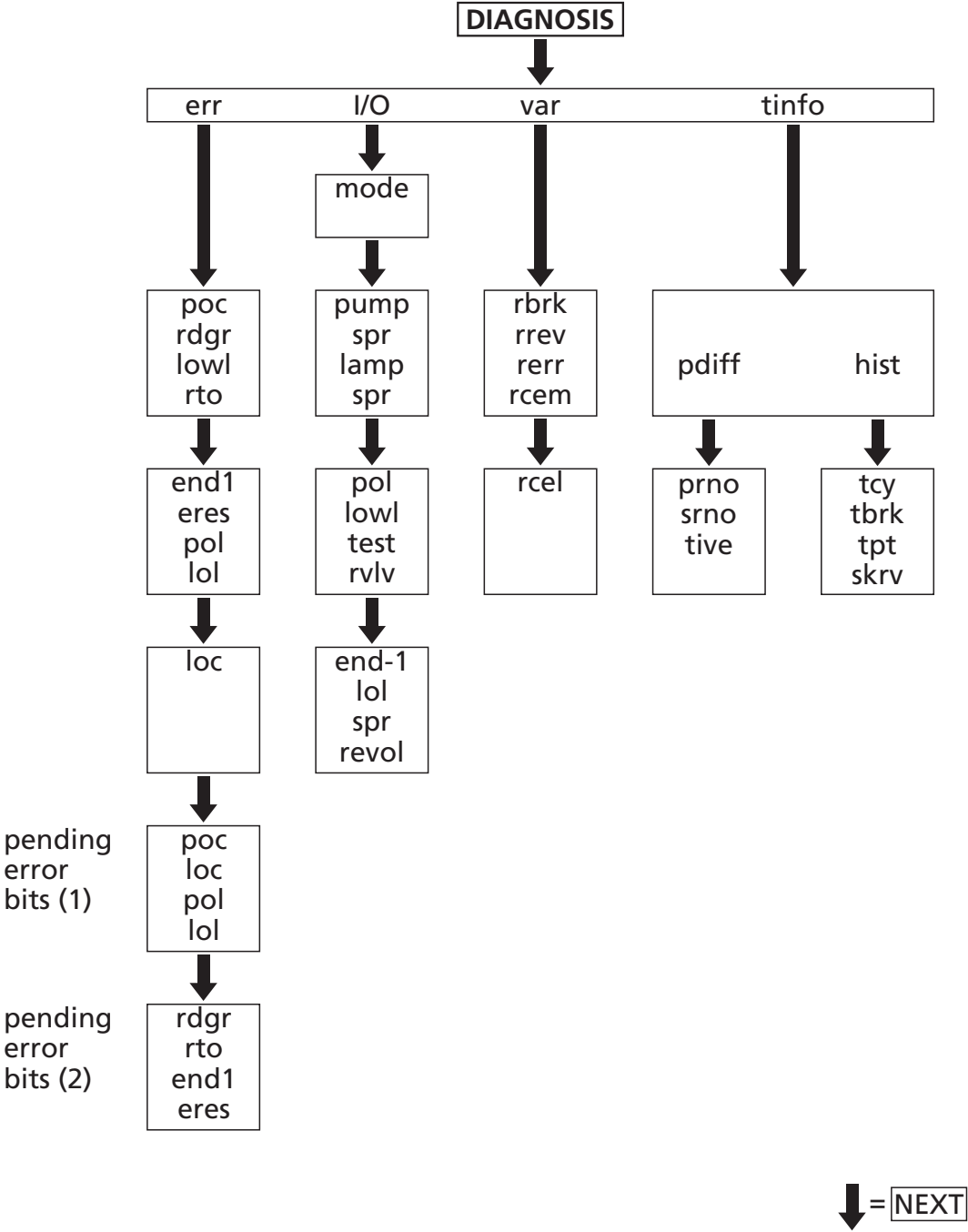
#### 4.8.2 Main menu



#### 4.8.3 Parameters menu



4.8.4 Diagnosis menu





# 5.

## DESIGNING A SYSTEM



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## 5.1 Introduction

The following aspects influence the design of a TRIPLUS greasing system:

1. The number of grease points to be connected and:
  - The position of the grease points on the vehicle or machine.
  - The grease demand of the grease points.
  - The greasing interval required by the grease points.
2. The space available on the vehicle or machine for the pump unit and the distribution blocks.
3. The NLGI class of the grease to be used and the lowest ambient temperature under which the greasing system is expected to function.

## 5.2 Points of departure

<b>Pump</b>	
Maximum working pressure	275 bar
Number of grease output ports	1
<b>Distribution blocks</b>	
Maximum number of distribution blocks in series	2
Available segment types	table 1
Minimum number of doser segments in a distribution block	3
Maximum number of doser segments in a distribution block	12
Pressure drops in a distribution block, related to:	table 2
• The number of segments in the distribution block	
• The NLGI class of the grease used	
• The ambient operating temperatures	
<b>Primary and secondary grease lines</b>	
Pressure drops in the grease lines, connected with:	table 3
• The diameter of the lines	
• The length of the lines	
• The NLGI class of the grease used	
• The ambient operating temperatures	
<b>Resistance at the grease point</b>	
Ball or roller bearing	5 bar
Slide bearing	15 bar

Table 1: Outputs of doser segments

<i>Segment type</i>	<i>Output per segment (2 outputs) [cc]</i>	<i>Output with combined outputs [cc]</i>
45	2 x 0,045cc	0,090cc
125	2 x 0,125cc	0,250cc
200	2 x 0,200cc	0,400cc

Table 2: Internal resistance in a distribution block (bar)

<i>Grease class</i>	<i>T [°C]</i>	<i>3 doser segments</i>	<i>8 doser segments</i>	<i>12 doser segments</i>
NLGI 2	+20	14 bar	16 bar	22 bar
	+10	28 bar	24 bar	26 bar
	0	34 bar	44 bar	55 bar
	-10	52 bar	58 bar	72 bar
	-15	73 bar	77 bar	100 bar
	-20	80 bar	85 bar	170 bar

Table 3: Grease line resistance (bar per metre)

<i>Grease class</i>	<i>T [°C]</i>	<i>PA ø3/16 ø2,4 mm i.d.</i>	<i>PA ø6 ø3 mm i.d.</i>	<i>High-pres- sure hose DN4 ø4mm i.d.</i>	<i>High-pres- sure hose DN6 ø6mm i.d.</i>
NLGI 2	+20	6 bar	6 bar	6 bar	3 bar
	+10	14 bar	8 bar	6 bar	4 bar
	0	17 bar	12 bar	10 bar	6 bar
	-10	25 bar	18 bar	16 bar	9 bar
	-15	34 bar	25 bar	20 bar	14 bar
	-20	55 bar	36 bar	30 bar	22 bar

**Remark:**

The values in these tables were collected during laboratory and field tests and will be supplemented as new data becomes available.

## 5.3 Method

1. Determine the conditions under which the system must be able to operate.
2. Make a so-called greasing plan.
3. Indicate, in the greasing plan, the grease demand and greasing interval required by each grease point.
4. Compile the greasing points in groups.
5. Determine the required layout of the greasing system.
6. Check, by calculation, whether the system will be able to operate under the conditions determined during step 1.

### 5.3.1 Determine the operating conditions

Determine with which type and NLGI class of grease the system must be able to operate at the lowest ambient temperature expected.

### 5.3.2 Produce a greasing plan

Make a simplified layout drawing of the vehicle and/or the machine. Indicate the positions of the grease points on that drawing and number them.

### 5.3.3 Determine the grease demand of the grease points

Note the grease demand (per particular period) of each grease point in a particular period on the greasing plan. The grease demand can be determined by combining the recommended amount and the recommended greasing frequency. This information can be extracted from:

- The maintenance instructions concerning the vehicle or machine.
- Existing greasing plans for class 0 or 2 grease systems.
- Information provided by the manufacturer, importer, dealer, owner or maintenance personnel.
- The information in the table below.

<i>Description</i>	<i>Segment type</i>	<i>Description</i>	<i>Segment type</i>
Upper stub axle	3	Stub axle, single grease point	2 x 3
Lower stub axle	3	Automatic brake adjuster	1
Suspension bearing, brake axle (drum side)	1	Suspension bearing (brake adjuster side)	1
Upper stabiliser	1	Lower stabiliser	1
Spring shackle	3	Rotation point of spring	3
Cabin bearing	1	Coupling disc pin	1
Coupling disc	2 x 4	Tail board hinge	1
Coupling disc, rotation point	1	Suspension bearing drive shaft	1
Tail board cylinder	1		

### 5.3.4 Group the grease points

Compile groups of grease points, taking account of the following:

- A main distribution block or multiple grease output ports on the TRIPLUS pump may be utilised.
- The maximum and minimum number of doser segments that can be combined in a single distribution block.
- The lengths of the primary and secondary lines in relation with the NLGI class of grease that must be used and the projected operating temperatures.
- Any special demands that might be placed on the grease output and the greasing interval.

### 5.3.5 Determine the layout of the system

Note the positions of the pump unit and the distribution blocks on the greasing plan. Determine the required composition of the distribution blocks, based on the group of grease points to be connected with that block. Indicate the routing of the grease lines on the greasing plan. Take account of:

- The routing of the lines and the type of secondary grease lines that will be used (single or composite lines with 2 to 3 separate lines).
- The possibility to combine outputs of doser segments.
- The minimum (3) and maximum (12) number of doser segments that can be combined in a single distribution block.

Calculate the grease demand of the whole distribution block per whole cycle of the distribution block (the sum of all rated grease outputs of all doser segments in the block).

#### System featuring a main distribution block

Determine the composition of the main distribution block by:

- Determining the ratios of the grease demands of the distribution blocks to be connected to the main distribution block.
- Selecting segment types for the main distribution block with which those ratios are most precisely matched.
- Determining the required grease output of the pump unit. This is the sum of the grease demands of all distribution blocks connected with that output port (**excluding the main distribution block!**).

This value can be used in a later stage to determine the grease output of that output port of the pump unit.

#### System without a main distribution block

- The determined values may be used to calculate the required grease output port of the pump unit.

Determine the lengths of the primary grease lines between the pump unit and the distribution blocks (between the distribution blocks) and the lengths of the secondary grease lines between the distribution blocks and the grease points. Note those lengths on the greasing plan. Determine the number of non-return valves that must be incorporated into the greasing system.

### 5.3.6 Check the design

Before the components of the system are assembled and installed, the projected system should be checked, by calculation, against the operating conditions it was designed for. Will it work under the giving operating conditions?

The loss of pressure in the system may not exceed  $P_p$  ( $P_p$  equals 90% of the maximum operating pressure supplied by the pump unit).

1. Calculate the pressure loss  $P_v$  over the distribution blocks, under the set operating conditions, using table 2.
2. Determine, using the greasing plan, which grease point is furthest from the pump unit. Calculate, using table 3, the total pressure loss " $P_l$ " over that grease line.
3. Determine which type of grease point is connected to this grease line. Determine the resistance " $P_s$ " induced by that type of grease point (see 5.2 Points of departure).
4. Calculate the largest, total loss of pressure " $P_t$ " for each output port of the pump unit by adding together the values of the pressure losses in the grease lines, distribution blocks and at the grease point ( $P_t = P_v + P_l + P_s$ ).
5. Check: that  $P_t \leq P_p$ .

If the loss of pressure in the system exceeds  $P_p$  investigate the following:

1. Is it possible to use a grease of a lower NLGI class?
2. Is it possible to raise the minimum operating temperature requirement?
3. It might be necessary to redesign the system and reconsider whether:
  - Its not better to omit the main distribution block.
  - The layout of the system can be modified to shorten the grease lines or to reconfigure the distribution blocks.
  - Using a grease line of larger diameter to reduce pressure loss will solve the problem.

After you have redesigned the system you should always recalculate its suitability.

# 6.

# INSTALLATION



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## 6.1 Overview

To install a *Groeneveld* TRIPLUS greasing system the following tasks must be performed:

1. Mounting the pump (including the control unit).
2. Mounting the progressive distribution blocks.
3. Mounting the primary grease lines (between the pump and the distribution blocks and between the distribution blocks themselves).
4. Mounting the secondary grease lines and couplings.
5. Mounting the electrical wiring.
6. Testing the system.

There are a few different types of pump unit available (all with integrated control unit). The type of pump unit most suitable for a particular greasing system can be determined on the basis of:

- The type and model of the vehicle or machine on which the TRIPLUS system is to be installed. An important discriminator is, for instance, whether the vehicle or machine is capable of supplying the greasing system with an uninterrupted power supply voltage (+15 or +30).
- The number of greasing points to be served and the layout of the greasing system.
- The specific wishes the user may have concerning the greasing system.

## 6.2 Safety precautions

1. Take the necessary precautions to prevent potentially dangerous situations from occurring during installation, checking and maintenance.
2. Always apply or use adequate safety measures to prevent bodily harm and damage, before you start working on the vehicle.
3. Ensure the vehicle is immobilised before you start work. Remove the ignition key and store it in a safe place. Block parts that may move on their own accord. Engage the parking brake.
4. Pay special attention to tailbords, loading flaps, drop flaps, etc. Take care that you can work safely under these parts, without these parts can drop down.
5. Never work underneath a vehicle which is raised by a jack only. Always use a trestle and check that the ground is firm and flat enough.
6. Keep in mind that a vehicle with air-suspension may drop of its own accord.
7. Only work underneath the cabin if it is fully tilted (and latched). Otherwise a support must be placed underneath the cabin to ensure the cabin cannot drop back.
8. Disconnect the earth-clamp from the vehicle's battery. This prevents electrical equipment from being inadvertently activated.
9. Avoid working on the cooling system without allowing it to cool down first. The system is pressurised and may cause burns. Direct contact with the (poisonous) cooling fluid must be avoided.
10. Adhere to all regulations, specifications and limitations as specified by the manufacturer of the machine, vehicle or engine.
11. Only use tools that fit and are designed for the specific task you want to perform with them.
12. A vehicle or machine may only be operated by those who are competent to do so and aware of all possible dangers. If necessary, an expert should be consulted.
13. Keep the environment in which you work clean and tidy. This enhances safety.



### 6.3 General installation directives

1. Check the contents of the parts kit (using the parts list including in the kit).
2. Before you start installing the greasing system: Check that all grease points are open and furnished with a sufficient amount of grease. If that is not the case, grease the grease points by hand. This prevents insufficient greasing of the grease points during the period following the first few greasing cycles of the greasing system.
3. Apply Teflon tape, or another type of sealant (e.g. Loctite), to the couplings and plugs on the distribution blocks and pump unit, if not already fitted with O-rings, gaskets or sealing rings. While mounting the couplings and plugs, make sure that the tape does not cause internal contamination of the system.
4. Prevent contamination of the system during the installation. Work with clean tools and clean the areas on the vehicle or machine where the distribution blocks and pump unit are to be mounted, before you start installing them.

#### **Even small contaminations can cause the greasing system to malfunction!**

Flush the primary grease lines after installation or maintenance, if contaminations or moisture could not be prevented from entering the system. The de-aerating procedure may be used to flush the system.

5. During installation of the grease lines and electrical wiring, ensure that:
  - the lines are not mounted onto parts that may become hot, such as the exhaust, retarder, compressor, turbo charger and air conditioning;
  - the lines are routed straight and neatly, and are properly fixed in place with small or large tie-wraps or clamps;
  - the lines that are mounted along moving parts have enough slack and are mounted in such a manner that , even in the long run, they will not be damaged, through abrasion or otherwise;
  - the lines to moving parts are sufficiently long to follow the movements. Check this by moving the parts to all positions possible;
  - feed-through rubbers are applied at all locations where the lines may otherwise get damaged.

### 6.4 TRIPLUS pump unit

#### 6.4.1 Pump types

There are a few different types of pump unit available (all with integrated control unit).

The type of pump unit most suitable for a particular greasing system is determined by:

- The type and model of the vehicle or machine on which the TRIPLUS system is to be installed. An important discriminator is, for instance, whether the vehicle or machine is capable of supplying the greasing system with an uninterrupted power supply voltage (+15 or +30).
- The number of greasing points to be served and the layout of the greasing system.
- The specific wishes the user may have concerning the greasing system.

The following pump unit types are available:

- The TRIPLUS pump units with 1, 2 or 3 independent grease output ports.
- The TRIPLUS trailer pump unit with 1 grease output port.

The TRIPLUS pump units are usually applied on pulling vehicles (trucks). The TRIPLUS trailer pump units are primarily meant for use on pulled vehicles (trailers).

#### 6.4.2 Mounting the pump

1. If the projected location for the pump unit is not indicated on a vehicle-specific greasing plan, determine, in consultation with the client, the most suitable location of the pump unit on the vehicle. Take account of:
  - The pump unit must be easily accessible (for filling its grease reservoir).
  - The grease level in the reservoir must be easy to inspect visually.
  - The pump unit must be protected against possible damage.
2. First investigate whether existing mounting holes in the chassis of the vehicle can be used to mount the mounting plate of the pump unit. Always follow the directions of the vehicle's manufacturer when you need to drill new holes. Do not let the mounting plate rest on the profile flange of the chassis and do not drill additional mounting holes in the flange in an effort to fix the mounting plate even more securely. Be sure not to damage anything (e.g. lines or air-tanks) that may be present behind the part in which you drill a hole. After drilling a hole, always remove the chips (with compressed air or brush).
3. If the mounting plate is to be welded onto the vehicle, the directions of the vehicle's manufacturer should be strictly adhered to.
4. Mount the mounting plate with the pump unit onto the chassis.
5. Remove the yellow/red transport plugs from the grease output port and the de-aerating opening of the pump unit.
6. Mount the couplings for the primary grease line onto the output port of the pump unit.

### **6.5 TRIPLUS distribution blocks**

#### **6.5.1 General**

The composition of a progressive distribution block is always vehicle/machine-specific.

If the distribution blocks are part of an installation kit, the secondary grease lines and the couplings for the primary grease lines (to the pump unit or main distribution block) will, usually, have already been mounted onto the distribution blocks. If the blocks are not part of an installation kit and have not been pre-assembled, you should mount the grease lines and couplings before you mount the distribution block onto the vehicle or machine.

#### **6.5.2 Assembling distribution blocks**

The distribution block must be assembled before it can be installed on the vehicle. To ensure the reliability of the greasing system, the distribution blocks should be assembled in a clean, dust-free environment.

The criteria that govern the composition (number and type of doser segments) of a distribution block are discussed in the Designing a system section of this manual.

1. First study the drawing of the distribution block to be assembled.
2. Check whether all required components are at hand and whether the right couplings for the right kinds of secondary grease line are available.
3. Begin by placing the start-segment (to which the primary grease line will be connected) onto the work bench with the port for the primary grease line facing downward.
4. Place, in the order as indicated on the drawing, the various doser segments on top of the start-segment. Place the end-segment on top of the stack. Ensure that all the openings in the segments are line-up and check that the required O-rings have been correctly placed between all the segments.
5. Place, using two toothed spring washers, the compression bolts through their respective holes. Tighten the two bolts alternately and in phases (allen key: 5mm). Tightening moment: 12 Nm.
6. If two output ports of a doser segment need to be combined, remove (allen key: 2,5mm) the little internal plug that separates the two output ports. The grease output of the port that remains open will then be double its normal output.
7. Mount the couplings, non-return valves and plugs into the output ports of the distribution blocks, as indicated on the drawing.
8. Mount the secondary grease lines.
9. Connect a grease pump or manual grease gun to the port of the primary grease line to test the operation of the distribution block and to check for leakage.

### 6.5.3 Mounting the distribution blocks

Determine the location of the distribution block on the vehicle or machine. Consult the specific installation instruction card and/or take account of:

- No stresses may be present in the mounted distribution block. It is best to use mounting brackets to install the distribution blocks!
- The distribution blocks should not be installed too near moving parts.
- The distribution blocks should not be installed near parts that become hot (e.g. turbo charger, exhaust).
- Existing mounting holes in the chassis should be utilised, whenever possible.

The distribution blocks can be mounted with the mounting brackets in two ways:

1. First mount the brackets. Then mount the distribution block onto the brackets (this method is compulsory if the brackets are welded onto the vehicle or machine).
2. First mount the distribution block onto the bracket. Then mount this assembly on the vehicle.

Which method is to be preferred depends on the manoeuvring space you have available.



#### ATTENTION:

Always apply toothed spring washers to the M5 mounting nuts and bolts of the distribution blocks. Tighten the bolts alternately and evenly. Maximum tightening moment: 5 Nm.

## 6.6 Primary grease lines and couplings

### 6.6.1 Grease line types

The primary grease lines are those between the pump unit and the distribution blocks, and between the distribution blocks themselves. The primary grease lines are available in a number of different sizes and materials.

- Flexible high-pressure line DN4 (inside diameter 4,0 mm - outside diameter 9,7 mm).
- Flexible high-pressure line DN6 with steel-wire armour (inside diameter 6,0 mm - outside diameter 12,0 mm).
- Metal lines with sizes  $\varnothing 6 \times 1$  mm or  $\varnothing 8 \times 1$  mm.

The type of primary grease line most commonly used in the transport industry is the flexible high-pressure line DN4. This high-quality line combines compactness with high strength and flexibility.

### 6.6.2 Mounting the primary grease lines

To limit the loss of pressure in the system, particularly at low temperatures, the length of the system of grease lines should be as short as possible. Please take account of this, especially when you decide to re-route a grease line.

1. Determine the required length of the grease line to be installed, and cut it to that length.
2. Mount the couplings onto the line (with high-pressure lines).

#### Removable couplings:

- a. Clamp the sleeve in a bench vice.
- b. Turn the line into the sleeve, to end of the sleeve (counter-clockwise!).
- c. Turn the line backward 1/4 to 1/2 turn.
- d. Apply oil or grease to the pillar, the sleeve and the inside of the line.
- e. Turn (clockwise) the grease line pillar in the sleeve, until it is in position without tension.
- f. Mount the coupling at the other end of the grease line in a similar way.

#### Press couplings (applied with a simple hand-operated press) for high-pressure line DN4 (05716):

- a. Slide the press sleeve completely over the end of the grease line, so that the line fills the sleeve completely.
- b. Slide, use some oil if necessary, the pillar or the required coupling pin into the end of the grease line until the pillar is completely in the grease line.
- c. Place the assembly in the press in such a manner that a little piece of the sleeve remains visible at both sides. Apply pressure until the lever of the hand-operated press reaches its end-stop.
- d. Mount the coupling at the other end of the grease line in a similar way.

#### ATTENTION:

A simple hand-operated press that can be placed in a bench vice is used with DN4 high-pressure lines. The thin-walled sleeve of the couplings for this type of grease line must be pressed exactly in the middle, so that small pieces of unpressed sleeve remain on both sides. This note of attention does not apply to sleeves meant for use with a hydraulic press. Those types of sleeves must be pressed over their whole length.



### **Press couplings (applied with a hydraulic press) for high-pressure grease line DN6 (00817):**

- a. Check that the press is fitted with the correct type of press blocks, and the set press diameter. The correct press diameter for this type of grease line is 14,6 mm.
  - b. Slide the sleeve over the end of the grease line, until it covers the line completely.
  - c. Slide, use some oil if necessary, the pillar or the required coupling pin into the end of the grease line until the pillar is completely in the grease line.
  - d. Pull the sleeve back slightly until it touches the outside edge of the coupling pin. While doing this, ensure that the pillar remains in place and is not pressed out of the grease line.
  - e. Place the assembly into the press and press the sleeve to the required diameter (14,6 mm).
  - f. Check the resulting diameter by measuring it (between ridges that may have formed).
  - g. Mount the coupling at the other end of the grease line in a similar way.
3. Remove any burrs and other remnants produced by cutting the line, and clean the grease line by blowing it through. Check that the line is free of obstructions and check it for internal damage behind the couplings (the inner lining may have been upset).
  4. Fill the line with grease. Either use a pneumatic or hand-operated grease gun.
  5. Install the grease line and fix it in place with tie-wraps or clamps. Do not yet connect the primary grease line(s) to the output port(s) of the pump unit, if you want to use the pneumatic or hand-operated grease gun to de-aerate the system.



### **ATTENTION:**

**Always use steel cutting rings when using metal grease lines and couplings.**

### **6.7 Secondary grease lines and couplings**

#### **6.7.1 Grease line types**

The secondary grease lines are the ones between the distribution blocks and the grease points. These grease lines are connected to the grease points with the aid of special couplings. A wide variety of couplings is available.

Which types of couplings should be applied depends, among more things, on:

- The screw thread at the greasing point.
- The position of the greasing point.
- The direction from which the grease line approaches the grease point.
- The type of grease line employed (polyamide lines with brass or steel couplings; metal lines or high-pressure lines with steel couplings).
- The operation conditions.

The secondary grease lines can be supplied in a number of different sizes and materials:

- Polyamide lines with outside diameters of 3/16" or 6 mm (standard).
- Stainless steel lines with the outside diameters of 3/16" or 6 mm (standard).
- Kunifer (copper/nickel) lines with outside diameters of 3/16" or 6 mm (standard).
- Flexible high-pressure lines with inside diameters of 4 mm or 6 mm (1/4").

The type of secondary grease line most commonly used in the transport industry is the polyamide line with an outside diameter of 3/16" or 6 mm. These grease lines are supplied as composite lines. In a composite line 2 or 3 polyamide lines are held together by a single plastic jacket. Each grease line in such a composite line has its own colour (red, blue or black), so that they can be easily distinguished at the ends of the composite line (necessary for easy installation and maintenance).

If a composite line is connected to doser segments with different grease outputs, the individual grease lines should be connected as follows:

- |  |            |
|--|------------|
| • Doser segment with the lowest output   | Red line   |
| • Doser segment with the highest output  | Black line |
| • Doser segment with intermediate output | Blue line  |

### 6.7.2 Mounting the secondary lines

Take attention at the following points during mounting the secondary grease lines and couplings:

- Always make sure the screw threads of the coupling(s) and the grease point are identical.
- To identify them, elbow couplings with metric screw thread are marked with a "M". Straight couplings with metric screw thread have a groove on their hexagons.
- Always apply brake booster rubbers when routing grease lines along the vehicle's booster lines (this to prevent the booster lines from becoming pinched-off (over time) by the tie-wraps that are usually used to fix grease lines).
- Never add extra grease points on your own accord. The integrity of certain structures may be adversely affected by drilling holes. Always adhere to the relevant directives issued by the vehicle's manufacturer.

If a vehicle-specific greasing plan is available, the types (or combination) of couplings to be used at grease point will have been noted on that plan.

First remove the existing grease nipple at the grease point, and replace it by the required coupling(s).

If the grease point to be connected is a so-called "added" grease point, a hole must be drilled and the right thread tapped. Do not forget to clean the new hole of any debris. Mount the required coupling(s) onto the grease point (see the greasing plan). Make sure that elbow couplings point in the direction of the grease line (avoid unnecessary (sharp) corners in the grease line).



#### ATTENTION:

Always check that the newly drilled grease point is open by applying a hand-operated grease gun to it.

1. Determine the most suitable route for the (composite) grease line to the grease line(s).
2. Cut the grease line at roughly the required length.
3. Determine approximately, the required length of the individual grease lines in a composite (polyamide) line. Make absolutely sure that you do not damage the individual grease lines!
4. Strip and remove the outer jacket.
5. Fix the line in place with tie-wraps or clamps up to the coupling at the grease point.
6. Cut the (individual) grease line to its required length and connect it with the coupling to the grease point.



## 6.8 Electrical wiring

### 6.8.1 General

Detailed wiring diagrams are available as aids to install the electrical wiring. Where possible, pre-assembled wire harnesses are employed.

#### ATTENTION:



To prevent damage to the electrical system of the vehicle or machine, the correct fuses must be installed in power supply circuit (+15 and +30). This does not apply to systems with a TRIPLUS trailer-pump, because those systems make use of the already adequately fused brake-light circuit of the vehicle. Consult the wiring diagrams or the tables below for the correct fuse values

On VLG vehicles special demands are placed on:

- the components (e.g. pump, wiring and switches).
- the location of the components on the vehicle.
- the manner in which the greasing system is to be connected to the vehicle's electrical system.

Always verify whether the system you are installing and the methods you plan to use meet those demands.

- Install the wiring only after the main components of the greasing system have been mounted (e.g. pump unit, signal light, monitoring switches on the distribution blocks).
- Try, as far as possible, to route the electrical wiring along the grease lines, and fix the wiring in place together with the grease lines.
- Connect the trailer-pump to the braking-lights supply wire and ground potential (do not exchange these connections). Make the connection in a waterproof junction box on the trailer, and ensure the cable is fed into the junction box properly (watertight). If required, mount an extra swivel onto the junction box.

### 6.8.2 Fuse ratings

<b>Voltage</b>	<b>Supply circuit fuse</b>	<b>Control circuit fuse</b>
12 Vdc	15 A	5 A
24 Vdc	7,5 A	5 A

### 6.8.3 Pin-layout of the connector on the pump unit

<i>Pin number connector</i>	<i>Description connection</i>
1	Stoplight (+)
2	Ground (-31)
3	n.a.
4	Signal light (-)
5	n.a.
6	K-line (communication with the GINA)
7	n.a.
8	End-switch for output port 1



### 6.9 De-aerating of the greasing system

The greasing system can be de-aerated in three different ways:

#### Method 1

This method can be used when a pneumatic greasing system is available in the workshop. With such a system the greasing system can be de-aerated quickly by connecting the primary grease line of the TRIPLUS system (at the pump unit) with that system. After the system has been de-aerated, the primary line must be reconnected to the output port of the pump unit.

#### Method 2

This method may be used when only a hand-operated grease gun is available. The procedure is the same as described for method 1.

#### Method 3

This method will have to be used when neither a pneumatic system or a hand-operated grease gun is available. The pump unit must then be started and be allowed to run until the branch of the system connected to the selected output port is properly de-aerated.

The system has been de-aerated properly when a closed collar of fresh grease is present at all grease points.

### 6.10 Commissioning of the greasing system

During commissioning, the system parameters (greasing interval, grease supply per phase, etc.) must be set or checked using the GINA. Detailed information about the system parameters and the operation of the GINA can be found in the chapter "GINA" of this manual.

After you have set or checked the system parameters with the GINA, you should initiate a test cycle with the GINA or the test pushbutton on the pump unit. A test cycle should be performed for every grease output port of the pump unit. After conclusion of the test cycle you can check with the GINA whether the system functioned properly.

Check, again with the GINA, whether the various input signals of the control system (e.g. the extra control voltages S1 and S2, sensors and switches) are received properly. To do this, check the read-outs in the DIAGNOSIS/IO screens 4 and 5, while switching the relevant input signals.



#### ATTENTION:

If the system has a TRIPLUS trailer-pump it is required that the brake lights of the vehicle are lit during the test cycle(s), otherwise the pump unit would be without a power supply.

# 7.

## MAINTENANCE



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### 7.1 General

The maintenance of *Groeneveld's* TRIPLUS systems can be combined with the normal maintenance of the vehicle or machine.



#### WARNING:

If a high-pressure steam/water jet is used to clean the vehicle or machine, the pump unit of the greasing system should not be directly exposed to the jet. This to prevent water from entering the pump unit through its de-aerating opening. During normal operation, however, water will never be able to enter the pump unit.



#### ATTENTION:

The automatic greasing system reduces the time and effort spent on manual greasing significantly. However, do not forget that there may be grease points that are not served by the greasing system and must still be greased by hand.

### 7.2 Regularly checks of the greasing system

Check the following points of the TRIPLUS greasing system:

1. The grease level in the reservoir of the pump unit (refill on time).
2. The pump unit for damage and leakage.
3. The operation of the whole greasing system. Perform a test cycle for every grease output port of the pump unit. Retrieve the fault codes stored in the control unit, either by using the test pushbutton on the pump unit or by connecting a GINA to the control unit.
4. The primary and secondary grease lines for damage and leakage.
5. The grease points, collar of fresh grease should be present at all grease points.

### 7.3 Filling the grease reservoir

When the grease in the reservoir reaches its minimum level, the reservoir needs to be refilled. To facilitate this, the pump unit is fitted with a grease nipple onto which a garage grease pump can be placed.

To be able to fill the reservoir using a special filling pump, a special filler coupling can be installed. *Groeneveld* can supply you with both mobile or stationary, hand-operated or pneumatic filling pumps.

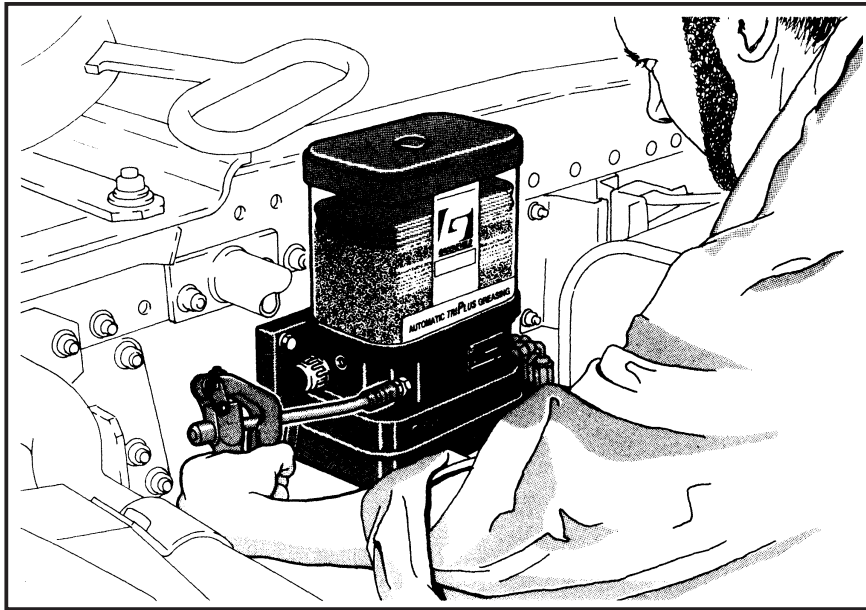


Figure 7.1 Filling the reservoir with a garage grease pump.

#### Filling procedure

The grease pump must be suitable for class 2 grease.

First fill the filling hose with grease (if the filling pump or grease barrel is new). This prevents air being introduced in the grease reservoir.

1. Remove the dust cap of the filler coupling.
2. Clean the filler coupling and the coupling on the hose thoroughly.
3. Lock the hose onto the filler coupling or position the grease gun onto the filler coupling.
4. Fill the reservoir up to its maximum level, as indicated on the reservoir. Never fill the reservoir any higher than the maximum level indicated, otherwise the follower piston may become damaged.
5. Remove the filling hose or grease gun.
6. Clean the dust cap and the grease nipple or filling coupling with a clean rag. Place the dust cap back onto the filler coupling.

#### Notes:

If the pumping action seems to go heavy, check the filter behind the grease nipple or filling coupling on the pump unit. Clean the filter and the grease nipple or filler coupling. Also check the filling hose for obstructions and clean it.

Any air that may be introduced beneath the follower piston will escape through an opening at the top of the guide rod of the follower piston. These air inclusions, together with any excess grease, will exit via the de-aerating opening at the side on the pump unit.

**7.4 Fault finding**

<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Signal light does not light-up after contact was switched on.	1. No supply voltage (+15) on pin 1 or at signal light.  2. No ground potential on pin 2.  3. Signal light defective.  4. Wiring to pump unit or to signal light defective.	Check the fuse and, if required, replace the fuse.  Check the ground connection and, if required repair it.  Replace the bulb.  Check the wiring and, if required, repair it.
Signal light lights during 2 minutes after a pump phase has been concluded.	1. Minimum level in grease reservoir reached.  2. System is malfunctioning.	Fill the reservoir.  Retrieve the fault codes with the test pushbutton or the GINA and repair the system.
All grease points connected to one of the grease output ports of the pump unit are too dry, but no malfunction is indicated.	The interval (pause phase) or pump phase for this grease output port is not set correctly for the current application.	Set a shorter interval or lengthen the pump phase for this output port of the pump unit.
Too much grease has been applied to all grease points	The interval (pause phase) or pump phase for this grease output port is not set correctly for the current application.	Lengthen the interval or set a shorter pump phase for this output port of the pump unit.
One or more grease points are too dry while others received the correct amount of grease.	Improper composition of the distribution blocks.	Change the composition of the distribution blocks.



<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
All grease points are too dry, and a malfunction is indicated.	Defective pump unit or blockage in the system.	<p>Retrieve the fault code. If "Maximum pressure exceeded" (relief valve opened during a pump phase):</p> <ol style="list-style-type: none"> <li>1. System contains grease that is not suitable for the current operating conditions. Solution: Replace the grease in the pump and flush the system.</li> <li>2. Distribution block, grease line or grease point blocked. Solution: Remove the grease lines behind the main block one by one, and each time perform a test cycle. If the "maximum pressure" error does not occur during a test, the problem is located in the branch you disconnected. If the line with the problem leads to a block, you should repeat this procedure for the lines connected to that block, until you find the blockage. Removing the blockage: If the "maximum pressure" error persists, even after disconnecting every grease line in turn, the blockage resides in the block itself. Disassemble the block and clean it internally.</li> </ol> <p>Other fault codes: Remedy the indicated malfunction.</p>

**Remark:**

A programming and read-out unit (GINA) is used to program and read-out the control unit. The GINA can also be used to consult a list of faults that have occurred and were stored in the memory of the control unit. If the system features a signal light in the cabin the stored fault codes can also be viewed with the aid of this signal light and the test pushbutton on the pump unit.

[illegible]

# 8.

## TECHNICAL DATA



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## 8.1 TRIPLUS trailer pump unit

Maximum operating pressure	: 250bar
Operating temperature	: -20 ... +85 °C
Supply voltage	: either 12 or 24 Vdc
Rating pump motor (nominal at 20 °C)	: 36 W
Rest current	: 10 mA
Capacity grease reservoir (standard)	: 3 litres *
Minimum-level switch	: standard
Pump material	: hard anodised aluminium - nylon reinforced
Delivery pump output	: 0,1 cc per stroke
Protection class	: IP67 (for lower part of pump unit)
Grease types	: NLGI 2 **

\* Other grease reservoirs are available on request.

\*\* Depending on the ambient temperature (consult your grease supplier).

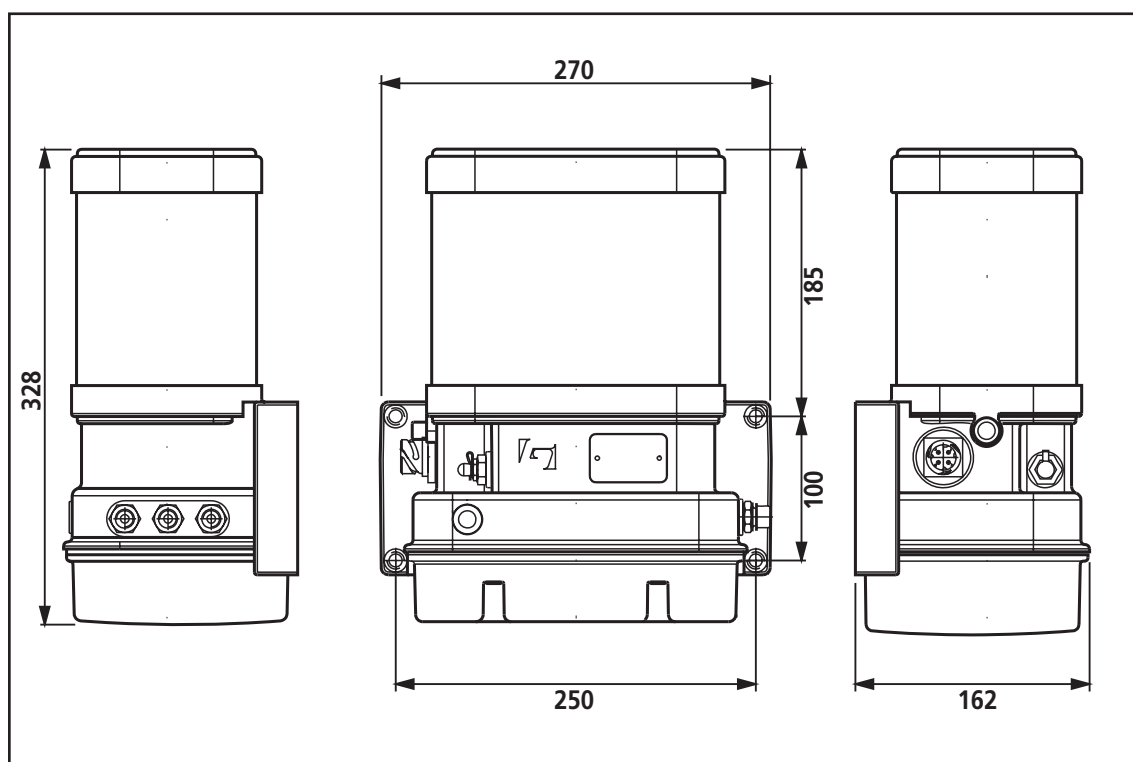


Figure 8.1 Dimensions of the TRIPLUS trailer pump with 3 litre reservoir.

## 8.2 Distribution blocks

Maximum operating pressure	: 250bar
Operating temperature	: -20 ... +85 °C
Minimum number of doser segments	: 3 (excluding start- and end segments)
Maximum number of doser segments	: 12 (excl. start- and end segments)
Material	: galvanised steel
Material O-rings	: NBR
Grease inlet port thread	: M10 x 1 mm
Delivery per output type 45 (two per segment)	: 0,045 cc
Delivery per output type 125 (two per segment)	: 0,125 cc
Delivery per output type 200 (two per segment)	: 0,200 cc

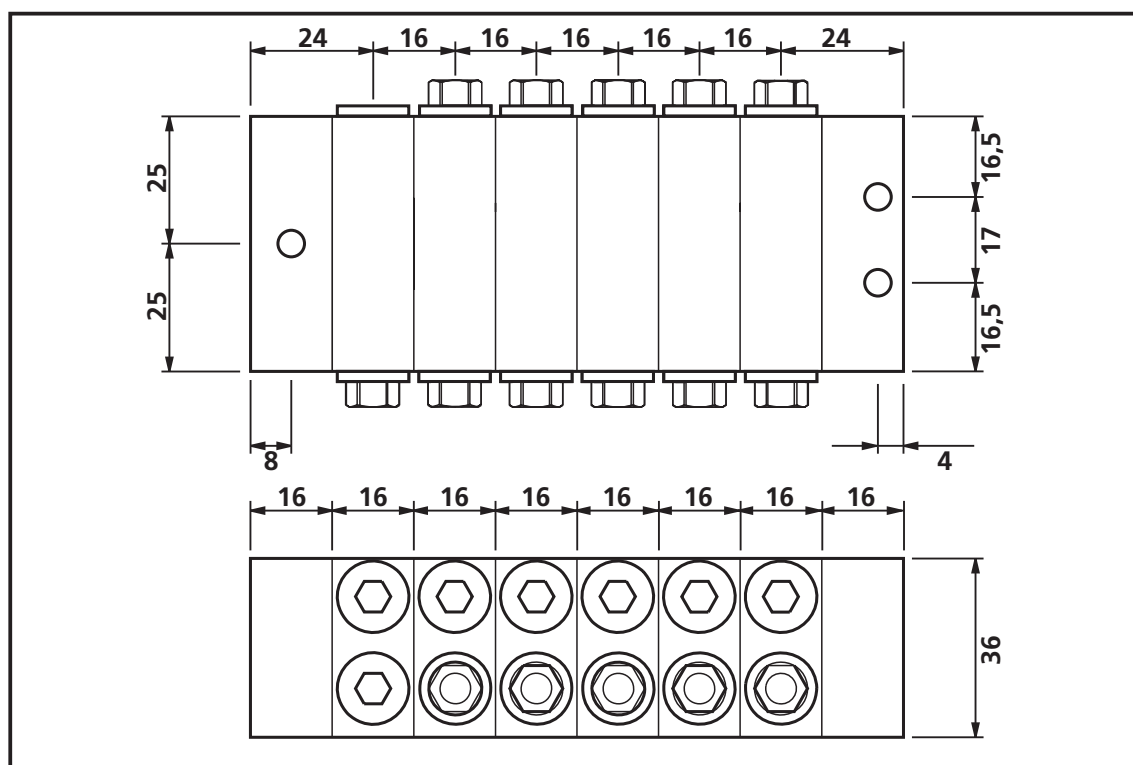


Figure 8.2 Dimensions of the distribution block.

## Notes

[illegible]

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