Chapter 4

Lubrication System

Chapter 4 Lubrication System
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Lubrication system parts

External and internal parts

A Groeneveld Twin automatic greasing sytems comprises the following parts:

External components

1. An electric grease pump (plunger pump working with CANBus) with integrated grease reservoir and a digital control unit with data storage facility;
2. Primary grease lines A;
3. Primary grease lines B;
4. Distribution blocks;
5. Metering units;
6. Pressure switch;
7. Secondary grease lines
8. Electrical harness

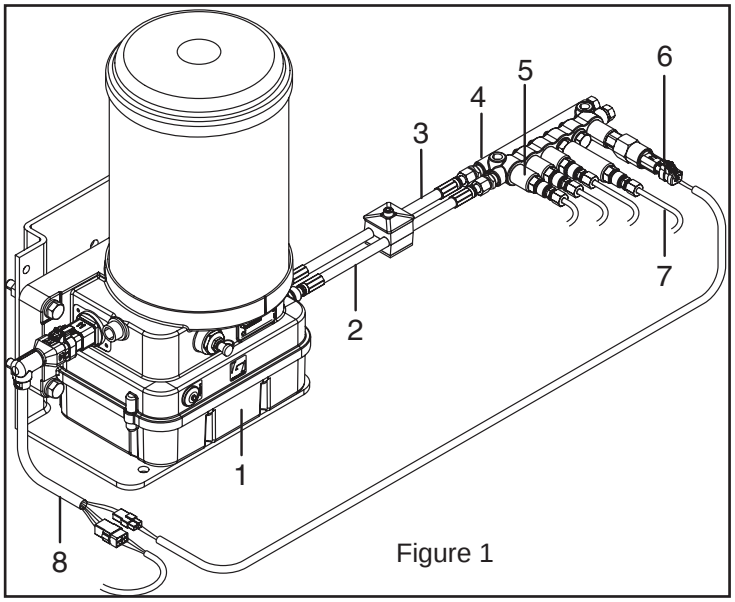


Figure 1

Internal components

1. Shaft kit reservoir
2. Cover + O-ring
3. Reservoir kit
4. O-ring
5. Follower plate
6. Cable harness kit
7. Reservoir Y-support kit
8. Pump body
9. Outlet M16x1.5
10. Grease filter kit
11. Test switch kit
12. Low level switch
13. Timer clip
14. Timer 12 - 24 Vdc
15. Gasket cover
16. Pump unit 24 Vdc
17. Bottom cover kit
18. Sealing kit

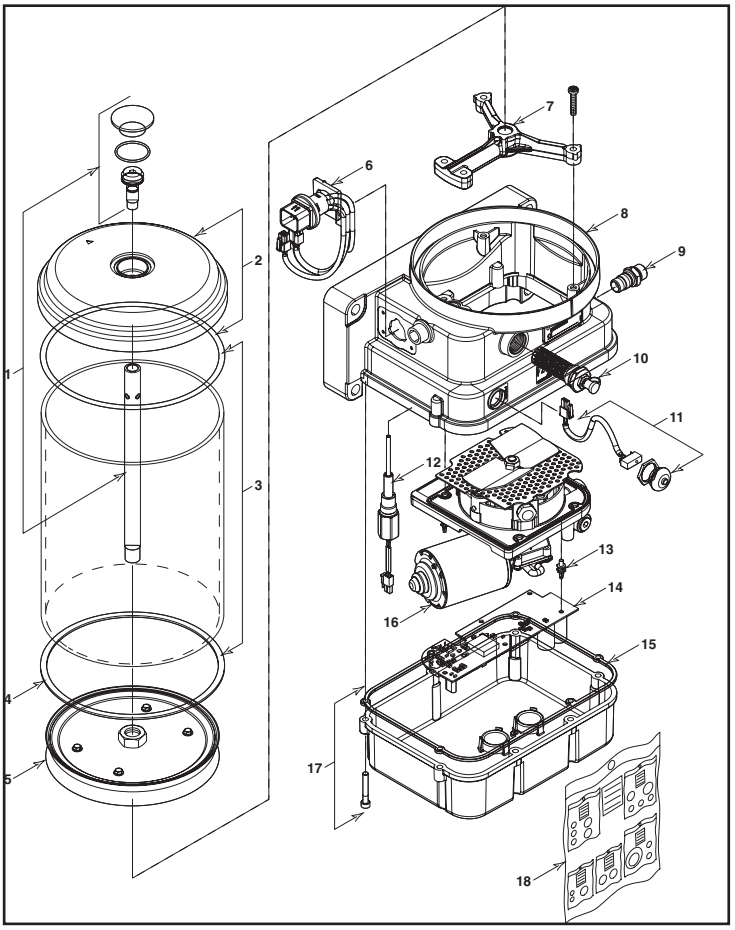


Figure 2

Groeneveld Twin internal wiring

The electronic control unit steers and controls the course of the greasing cycles. All system and program parameters are stored in it.
The control unit processes mal-function reports, gives possible alarms reports and automatically records a log. All relevant incidents will be stored in the log.
All data in the control unit always be retained, even when the power is shut off or when the system is turned off.
To view the log an Uni or PC-GINA is needed.

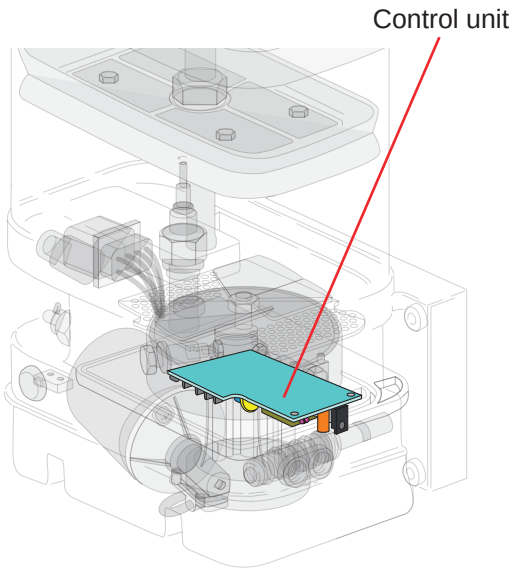


Figure 3

Metering Units

Various types of metering units with the twin greasing system are available, each with a different grease output. Each greasing point can receive the correct dose of grease per greasing cycle by a careful choice of the type of metering unit. The metering units are mounted on a brass or stainless steel distribution block per group.
The metering units and distribution blocks are made of brass or stainless steel. The various metering units are distinguished from each other using numbers.
Because of their closed construction the metering units are exceptionally well suitable for use in dirty and dusty environment.
The table below is an overview of the various metering unit numbers and their grease capacity (see the overview Lubrication Points on DA series on the next page).

Metering unit number	*Grease capacity (cm³) per cycle*
0	0,025
1	0,050
2	0,100
3	0,150
4	0,200
5	0,250
6	0,300
7	0,350
8	0,400
8,5	0,700
9	1,000
10	2,000
11	4,000

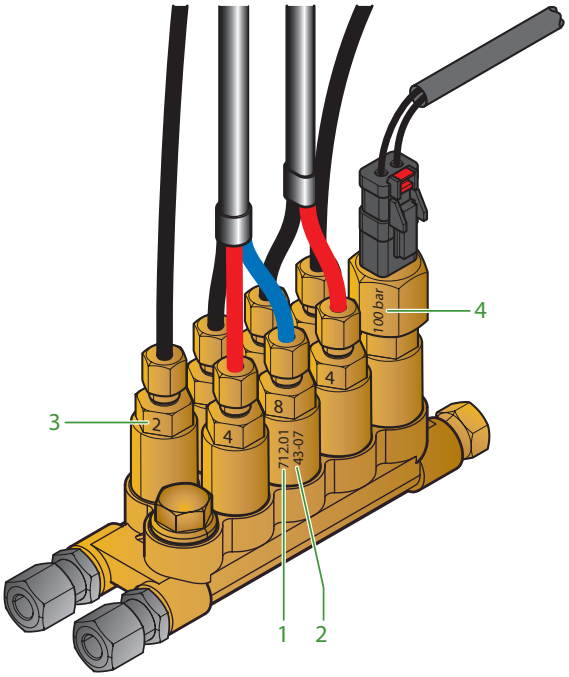


Figure 4

Greasing cycles

Every greasing cycle consists of four phases.
The greasing cycles as carried out alternately by the grease lines A and B. The 5/2 way valve, which is integrated in the pump housing, determines which primary grease line is connected to the pump and which is connected to the grease reservoir.

Greasing cycle A

Pumping phase: in this phase the grease is pumped from the reservoir, through primary grease line A, to the distribution blocks. The pumping phase ends when the pressure switch reaches a predetermined level. During the pumping phase, the metering units press a certain amount of grease (the dosage) through the secondary grease lines to the grease points.

Pressure retaining phase: a period in which the pressure primary grease lines is maintained at a certain pressure. During the pressure retaining phase, the metering units can deliver the grease dosage, which was not yet delivered during the pumping phase.

Pressure decrease phase: in this phase, the pressure in the primary grease line is decreased through the 5/2 way valve. To accomplish this, the control unit energizes the 5/2 way valve, so the grease pressure in the primary grease line A is decreased and the grease flows back to the reservoir. When the greasing system needs more time to build up the required grease pressure (because of low temperature or grease with a high viscosity), the system will also need more time to decrease that same pressure.

Pause phase: the length of the pause phase is equal to the predetermined cycle-time minus the lenght of the other phases. When the cycle-time is adjusted too short to carry out a complete greasing cycle, the program will ignore the cycle-time. However the pause phase will be omitted, because the predetermined cycle-time is exceeded. The greasing system begins directly with the first phase of the next greasing cycle.

Greasing cycle B

Greasing cycle B begins when the control unit restarts the pump. During pumping phase B and pressure retaining phase B, the control unit still has the 5/2 way valve energized, causing the pump to be connected to primary grease line B. Primary grease line A is shut off from the pump during these phases and connected to the reservoir. During phase B pressure decrease, the control unit de-energizes the 5/2 way valve, so the grease pressure in the grease line B decreases and the grease flows back to the reservoir.

Principle of operation of metering unit

Two grease chambers are located in a metering unit (on for each primary grease line, A and B). These chambers are filled with an exact amount of grease. When the actual greasing takes places through one of both chambers, the grease is pressed from the chambers to the relevant greasing point.

Internal greasing metering unit overview

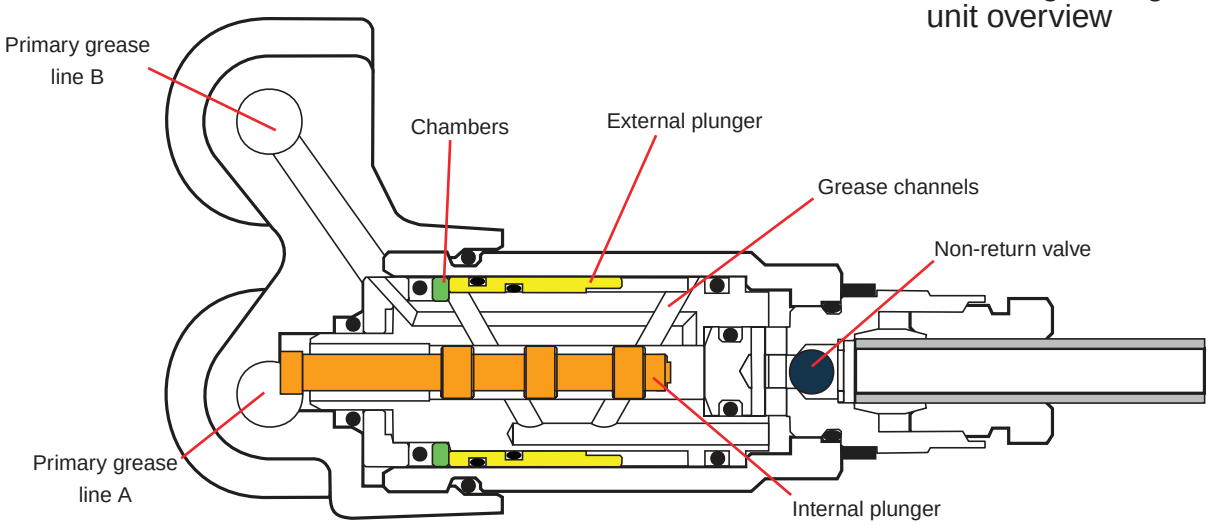


Figure 5

Grease is pumped into the metering unit (pumping phase A) through primary grease line A. Because of the grease pressure, internal plunger (3) is pushed to right, passed channel (1). The grease fills chambers (2) through the channels and press the external plunger (4) to the right.

After a while, the pressure drops in the primary grease line A (during the pressure decrease phase of the greasing cycle). This has no influence on the metering unit.

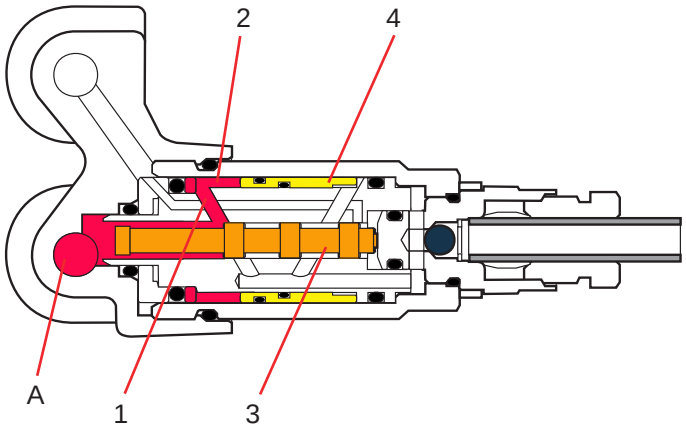


Figure 6

Grease is pumped into channel (6) of the metering unit (pumping phase B) through primary grease line B. Because of the grease pressure, internal plunger (3) is pushed back leftward, passed channel (8). The grease fills chamber (7) and pushes external plunger (4) back to the left. The complete grease volume of chamber (2), to the left of external plunger (4), is pressed through channel (1), internal plunger (3) and channel (9) and the secondary grease line (5) to the greasing point. Sphere in non-return valve is pushed back to clear the path to the secondary grease line.

After a while, the pressure drops in the primary grease line B (during the pressure decrease phase of the greasing cycle). This has no influence on the metering unit.

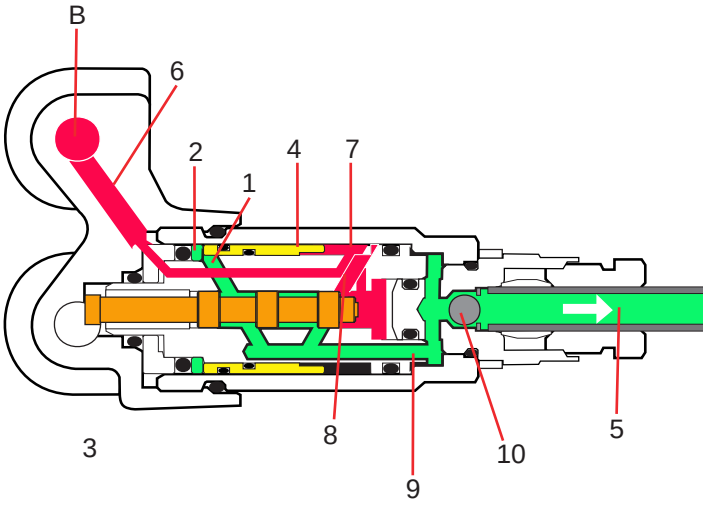


Figure 7

In this phase the same happens as in the first phase described early. However chamber (7) is now filled with grease. External plunger (4) is pushed to the right while chamber (2) is filled. The complete grease volume of chamber (7) is pressed through channel (8), internal plunger (3) and channel (9) and the secondary grease line (5) to the greasing points. Sphere (10) in the non-return valve is pushed back to clear the path to the secondary grease line.

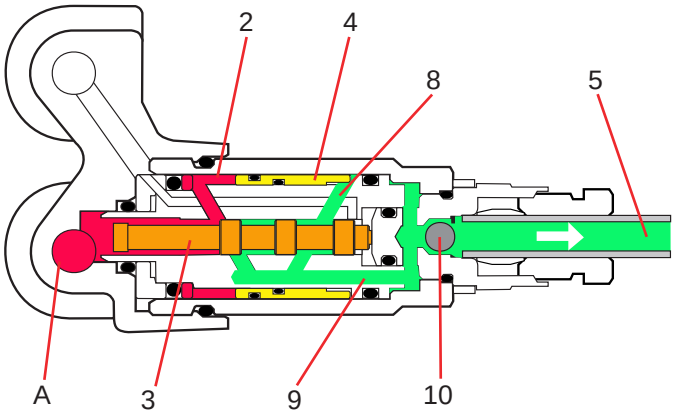


Figure 8

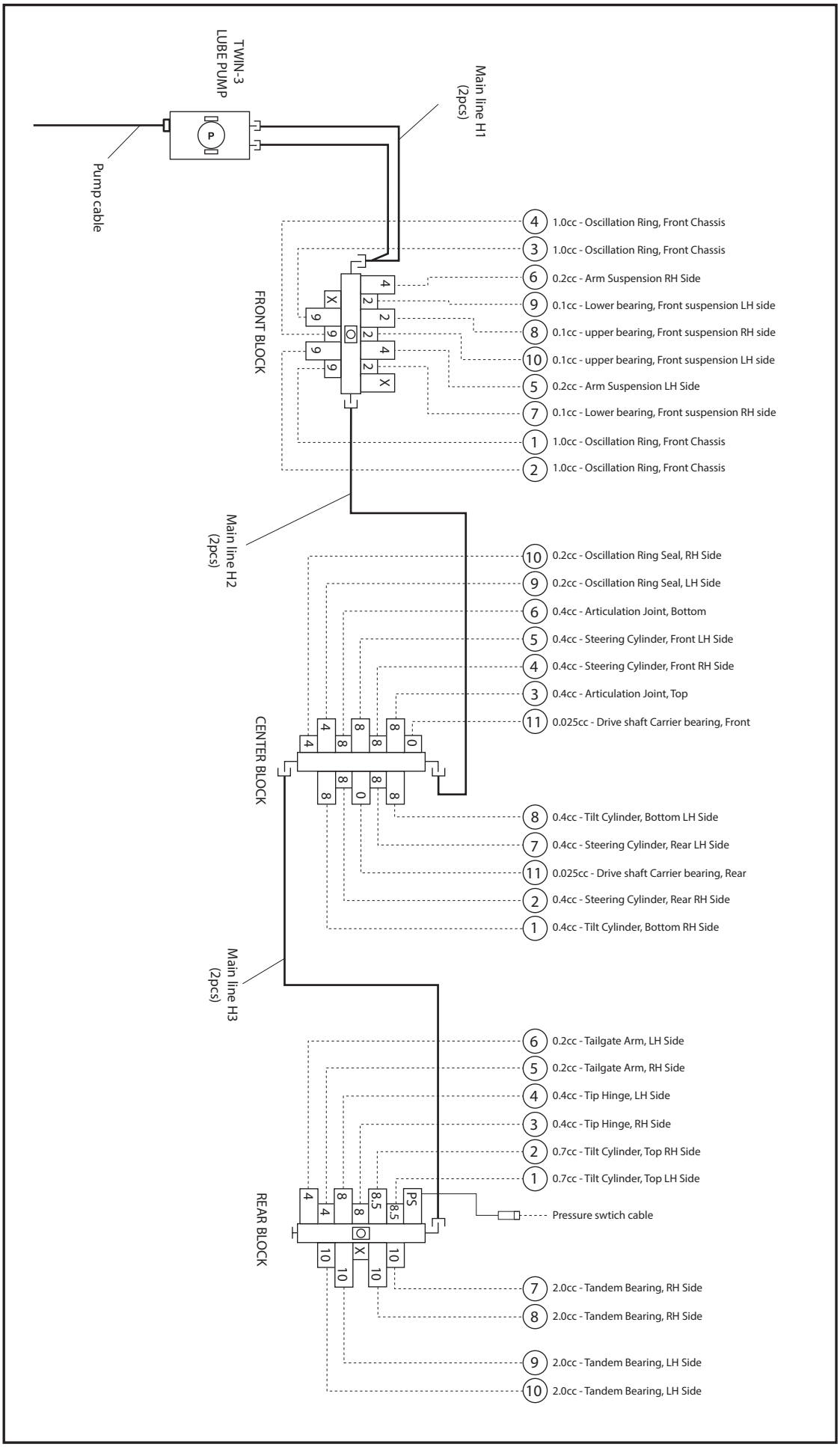

TWIN-3
LUBE PUMP
P
Pump cable
Main line H1
(2pcs)
FRONT BLOCK
4 1.0cc - Oscillation Ring, Front Chassis
3 1.0cc - Oscillation Ring, Front Chassis
6 0.2cc - Arm Suspension RH Side
9 0.1cc - Lower bearing, Front suspension LH side
8 0.1cc - upper bearing, Front suspension RH side
10 0.1cc - upper bearing, Front suspension LH side
5 0.2cc - Arm Suspension LH Side
7 0.1cc - Lower bearing, Front suspension RH side
1 1.0cc - Oscillation Ring, Front Chassis
2 1.0cc - Oscillation Ring, Front Chassis
Main line H2
(2pcs)
CENTER BLOCK
10 0.2cc - Oscillation Ring Seal, RH Side
9 0.2cc - Oscillation Ring Seal, LH Side
6 0.4cc - Articulation Joint, Bottom
5 0.4cc - Steering Cylinder, Front LH Side
4 0.4cc - Steering Cylinder, Front RH Side
3 0.4cc - Articulation Joint, Top
11 0.025cc - Drive shaft Carrier bearing, Front
8 0.4cc - Tilt Cylinder, Bottom LH Side
7 0.4cc - Steering Cylinder, Rear LH Side
11 0.025cc - Drive shaft Carrier bearing, Rear
2 0.4cc - Steering Cylinder, Rear RH Side
1 0.4cc - Tilt Cylinder, Bottom RH Side
Main line H3
(2pcs)
REAR BLOCK
6 0.2cc - Tailgate Arm, LH Side
5 0.2cc - Tailgate Arm, RH Side
4 0.4cc - Tip Hinge, LH Side
3 0.4cc - Tip Hinge, RH Side
2 0.7cc - Tilt Cylinder, Top RH Side
1 0.7cc - Tilt Cylinder, Top LH Side
PS
Pressure swtich cable
7 2.0cc - Tandem Bearing, RH Side
8 2.0cc - Tandem Bearing, RH Side
9 2.0cc - Tandem Bearing, LH Side
10 2.0cc - Tandem Bearing, LH Side

Figure 9

Grease pressure switch

The grease pressure switch notifies the control unit that sufficient pressure has been built up during the pumping phase stops the pump. When the required pressure is not reached, the pumping phase is only ended after reaching the set maximum pumping time and an alarm will follow.

Preferably the grease pressure switch is mounted on the distribution block, located the farthest from the pump (on DA series is mounted on the last distribution block, on the rear part of the rear frame). This is done to be sure that the required grease pressure of 100 bar also reached the last distribution block.
The switch pressure on the DA series is 100 bar standard.

Principle of operation of pressure switch

Phase 1 - during this phase, both channels A and B are not under pressure. There is no pressure in chamber (1). Spring (10) pushes switch plunger (2) to the left. The electrical contact (3 and 4) is open.

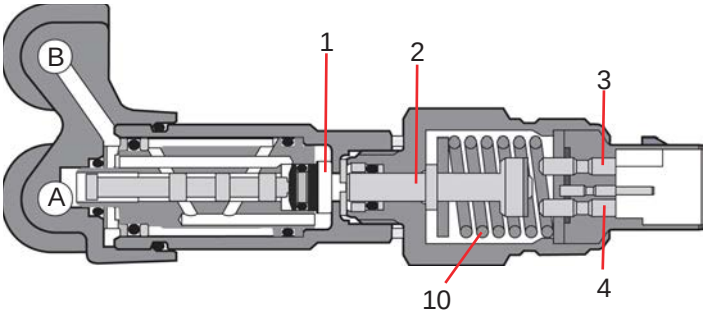


Figure 10

Phase 2 - during pumping phase A grease is pressed into channel A. While the grease pressure built up, piston (6) is pushed to the right. Chamber (1) is connected to channel A (through the channels 7, 8 and 9).
As soon as the pressure in chamber (1) is more than the pressure force of the spring (10), plunger (2) goes to the right. The electrical contact (3 and 4) is closed by the contact plate (5).
During the pressure decrease phase, as soon as the grease pressure in channel A is lower than the pressure force of the spring, the connection of the electrical contact is broken.

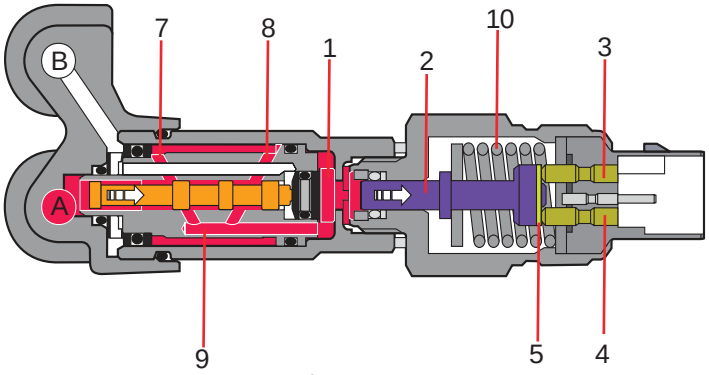


Figure 11

Phase 3 - during pumping phase B grease is pressed into channel B. While the grease pressure built up, chamber (11) fills with grease (through channel 12). The grease pressure pushes piston (6) is pushed to the left. Because of that the channel (8) is opened, causing the grease to flow to chamber (1) through channel (7) and channel (9).
As soon as the pressure in chamber (1) is greater than the pressure force of the spring (10), plunger (2) goes to the right. The electrical contact (3 and 4) is closed by the contact plate (5).
During the pressure decrease phase, as soon as the grease pressure in channel B is lower than the pressure force of the spring, spring (10), the connection of the electrical contact is broken.

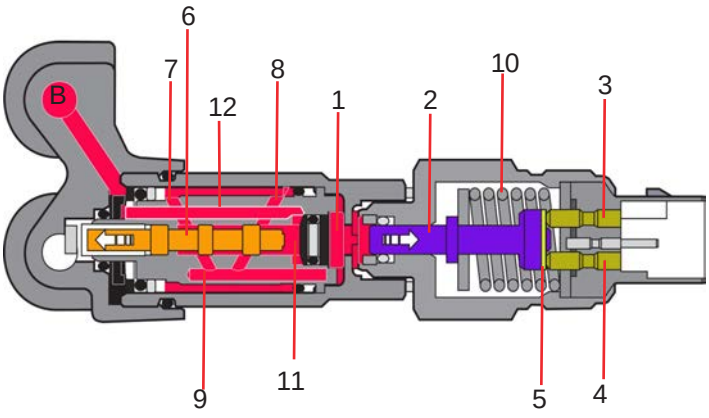


Figure 12

The 5/2 way valve

When the 5/2 way valve is at stationary (not energized), greasing will take place through primary grease line A and the pressure in primary grease line B will decrease and the grease will be lead back to the reservoir through return line R_B.

When the 5/2 way valve is energized by the control unit, the grease supply channel P will be connected to primary grease line B and primary grease line A will be connected to return line R_A in the pump. Greasing takes place through primary grease line B, the pressure in primary grease line A will decrease and the grease will be lead back to the reservoir through line R_A.

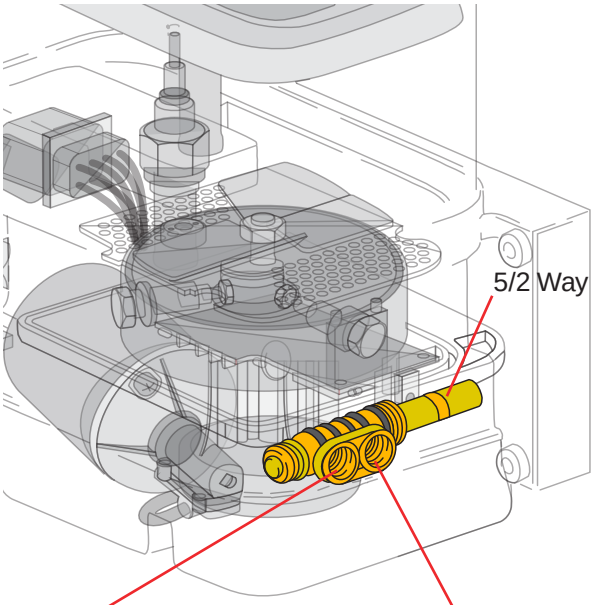
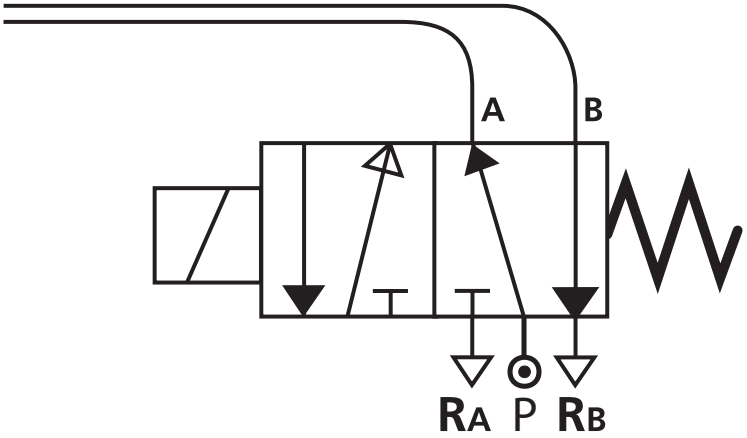


Figure 13



A - Primary grease line A (port A)
B - Primary grease line B (port B)
P - From Pump
R_A - Return line A to grease reservoir
R_B - Return line B to grease reservoir

Figure 14

The relief valve

A relief valve is mounted in the grease line between the plunger-pump and the 5/2 way valve . When the grease pressure exceeds 250 bar during the pumping phase, the relief valve will redirect the grease to reservoir.
The maximum grease pressure will exceeded when:

- a malfunction of the grease pressure switch, which is mounted in the system occurs;
- a malfunction in the cable of the grease pressure switch occurs.

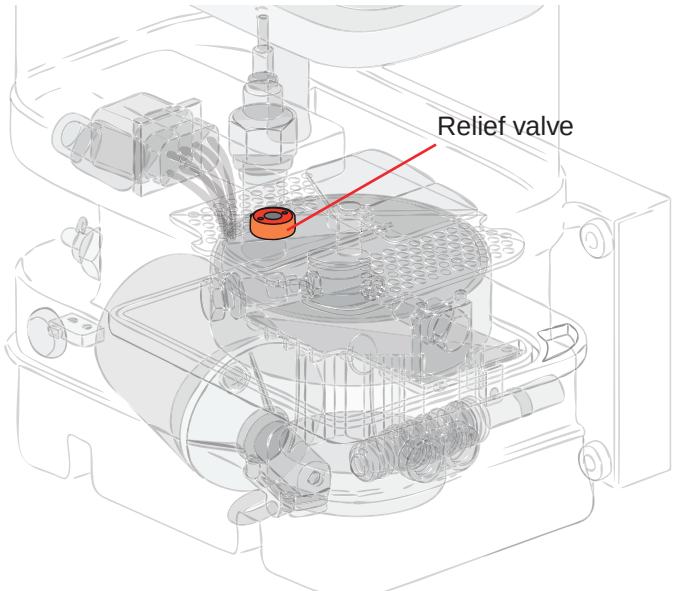


Figure 15

The minimum level switch

A minimum level switch monitors the grease level in the reservoir. When the grease reaches the minimum level, the minimum level switch will notify the control unit.
After “X” cycles, the pump stops to avoid it to work empty.

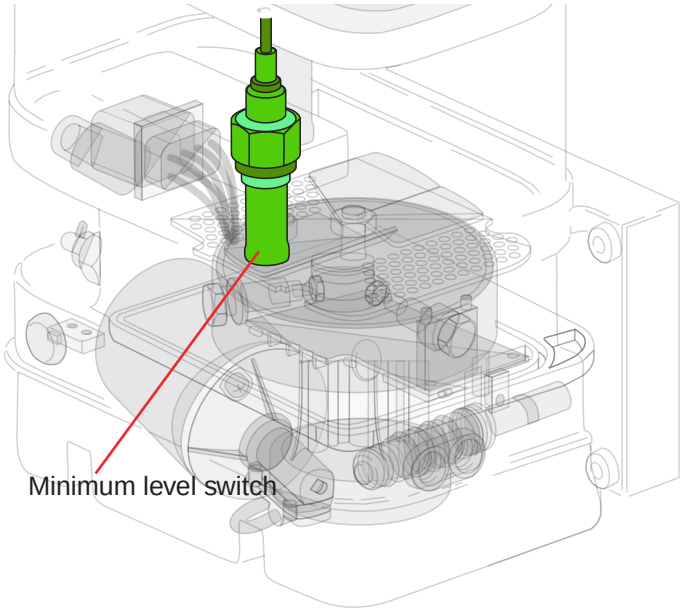


Figure 16

System test

Introduction

To test the greasing system two different test cycles can be carried out with the test push-button on the grease pump unit:

1. The single test cycle /through the A or B grease line).
2. The continuous test cycle (successive greasing cycles through the A and B grease lines).

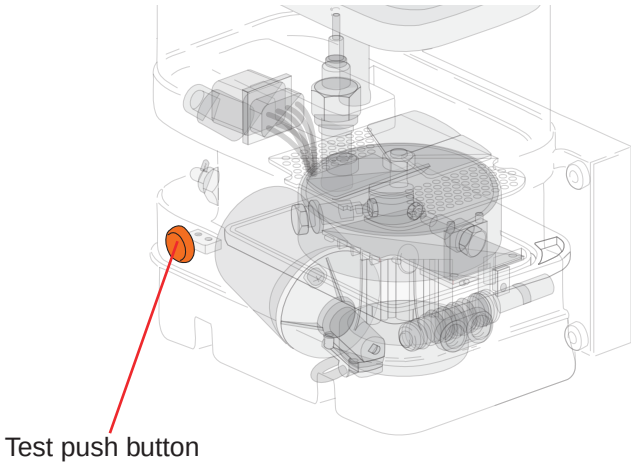


Figure 17

The single-test cycle

Proceed as follows to carry out a single-test cycle:

1. Turn on the contact switch.
2. Push the test push-button on the pump for at least 2 seconds, but no longer than 6 seconds.

NOTE

The codes and errors can be check through CanBus PC.

The single-test cycle ends after the pressure decrease phase or when the contact is turned off. When the contact switch is turned on again the program will always begin with the pause phase of the cycle that just been interrupted.

ATTENTION:
Remember that a single-test cycle only tests one of the primary grease lines.
To test the other primary grease line, a second single-test cycle has to be carried out.

Lubrication system diagnostic

Access “MENU” by pressing the MENU button:

Figure 18

Select by pressing: UP or DOWN arrows

Access by pressing: OK

From the MENU, choose “Machine status”.

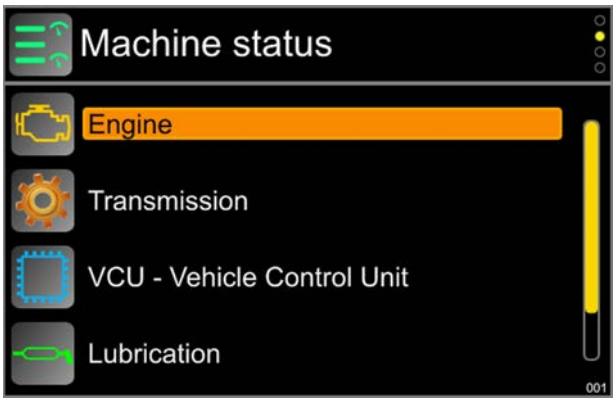


Figure 19

From Machine status, choose “Lubrication”

By pressing the OK key it is possible to make an extra lubrication cycle.

1. Current mode of the pump
2. When disabled all lubrication has stopped !
3. Grease reservoir status. Needs a refill when empty.
4. Lubrication only takes places when the truck is moving.

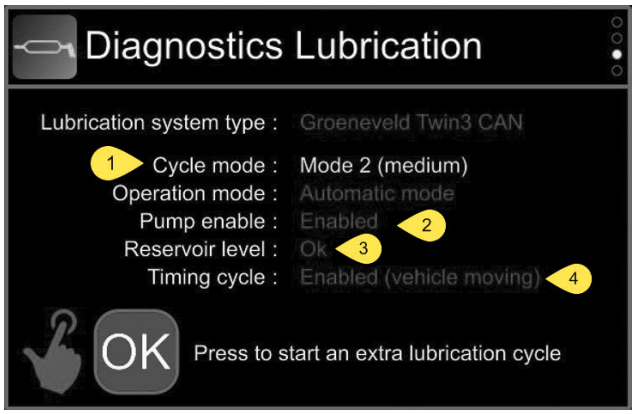


Figure 20

The continuous-test cycle

With a continuous-test cycle extra grease can quickly be added to the greasing points or the grease system can be bled.

Proceed as follows to carry out a continuous-test cycle:

1. Turn on the contact switch.
2. Push the test push-button on the pump for at least 6 seconds.

The system will start a pumping phase. After pumping phase A, pressure retaining phase A and pressure decrease phase A are ended, pumping phase B is started immediately, then again A, then B, etc. The pause phases are skipped entirely every time.

ATTENTION:
It is also possible to skip the pressure retaining phase and pressure decrease phase during the continuous-test cycles, by activating the “enable fast multiple test” option with a diagnosis unit. Please be aware that when activated at low temperatures, the output of the metering units in the end of the system might get reduced to 0, due to these missing phases.

3. Turn off the ignition switch to end the continuous-test cycle.

When the ignition switch is turned on again the program will always begin with the pause phase of the pumping phase that has just been interrupted.

Warning signal

The warning light is mounted on the Display screen (Ref O&M Manual).
This warning light shows the status of the greasing system and the malfunction reports by means error codes (Ref . Chapter 10 Error code list)

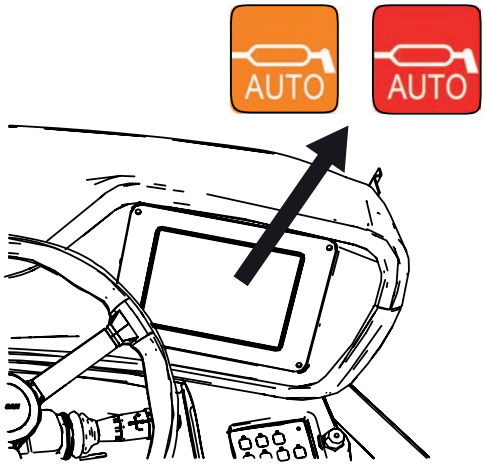


Figure 21

It is the utmost importance that the correct grease is used in the Twin greasing system (Ref O&M Manual). Please consult your grease supplier or Groenneveld when a different grease is to be used.

The Twin grease system is developed for use with grease up to NLGI-class 2.
Which NLGI-class has to be used, mainly depends on the temperature in which the greasing system has to operate:

Lowest operating temperature	Highest operating temperature	Use NLGI class
-20°C (-4°F)	+70°C (+158°F)	2
< -20°C (-4°F)	+70°C (+158°F)	Synthetic 2
< -20°C (-4°F)	0°C (+32°F)	0 / 1

Solid additives in the grease (e.g. Teflon (PFTE) and graphite) can cause blockages in the greasing system in the long run. Therefore Groeneveld advises against the use of these kinds of grease in the greasing system. Grease with molybdenum disulphide (MoS_2) may only be used when the grease is of top quality and contains no more than 5% MoS_2.

Description	ASTM test Method	Min/Max	Specification	Remarks
NLGI Grade		Std	2	-10 to +40 Degree Celsius
Thickener type		Min	Lithium Complex	
Solid Additives, Moly		Max	3 %	No Graphite
Oxidation Stability @ 100hrs	D942	Max	0,3 bar	
Water washout @ 79°C		Max	4 %	
Dropping point	D1264	Min	230°C	
Rust protection	D1743		Pass	
Copper corrosion	D4048	Max	1b	
Base oil viscosity	D445	Min	600 cSt	@ 40°C
Four ball (EP) weld point	D2596	Min	400 kg	
Four ball wear	D2266	Max	0,6mm	1hr @ 75°C/1200rpm/40kg

Maintenance

Regularly checks of the greasing system

Check the following points of the Twin 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 both primary grease lines;
4. The primary and secondary grease lines for damage and leakage;
5. The greasing points, collar of fresh grease should be present at all greasing points;
6. The stored data in the controller-unit of the pump by connecting a diagnosis-unit (PC-GINA).

Bleeding the pump

When the system malfunctions repeatedly after the grease reservoir has been emptied, it is possible that the pump or the ain-lines have to be bled.

Proceed as follows:

1. Make sure that the grease reservoir is filled to the max;

WARNING

Check that the system is pressureless, before the system is opened.

2. Remove both lines from the pump;
3. Turn on the ignition;
4. Press the test button on the pump unit for at least 6 seconds (continuous-test cycle);
5. Turn off the ignition as soon as pure grease (without air-pockets) leaves on of the outlets.

NOTE

When after a few minutes still no grease exits the pump outlet we advise to pump some oil into the reservoir along the filler-coupling (500cc or 1/8 gallon will be sufficient). This will help to push aside the air-pockets around the pump piston. The oil can be pumped into the reservoir along grease outlet B, but than first the pump need to be stopped by turning off ignition.

6. Re-mount the lines to the pump as soon as grease without air-pockets come from one of the pump outlets;
7. Carry out a single-test cycle twice to check that the greasing system functions correctly;
8. When pressure build up in the system is still not sufficient it is possible that also the grease lines need to be bled;
9. To make sure that the pump is still in good condition also the grease pressure could be measured with a pressure gauge, direct at one of the pump outlets. During the pumping phase the pressure should reach 230 to 250 bar and is not allowed to fall below 200 bar during succussion “pressure retaining phase”.

NOTE

Please install a 1 meter hose in between the pump outlet and the pressure gauge to give the test circuit some extra contents in away that small pressure fluctuations can be faded and make sure that this pressure gauge assembly it can handle minimal 250 bar.

Bleeding the system

When the system malfunctions repeatedly after the grease reservoir has been emptied, it is possible that one or both grease lines have to be bled.

Proceed as follows:

1. Make sure that there is enough grease in the reservoir

WARNING

Check that the system is pressureless, before the system is opened.

2. Remove the end plugs from the distribution blocks that are at end of every branch of the greasing system;
3. Turn on the ignition;
4. Press the test push-button of the pump unit for at least 6 seconds (continuous-test cycle). Because the end plugs are removed, no grease pressure is build up. When the maximum pumping time has past, the system switches automatically to the other primary grease line. This is repeated until the contact switch is turned off;
5. Turn off the ignition as soon as only grease and no air bubbles come from the relevant channels;
6. Re-mount the end plugs into the distribution blocks;
7. Repeat steps 4, 5 and 6 until all branches of the greasing system are bled;
8. Carry out a single-test twice to check that the greasing system functions correctly.

Technical data

Maximum operating pressure:	250 bar
Operating temperature:	-20°C...+70°C
Supply voltage:	either 12 or 24 Vdc
Rating pump motor with valve (nominal at 20°C):	72W
Controller absorption:	40mA (12 / 24Vdc)
Advised fusing:	10A (24Vdc) - 20A (12 Vdc)
Capacity reservoir:	6 liters
Nominal grease output:	12 cm^3 / min.
Grease follower piston:	Standard
Minimum level switch:	Standard
Pump material:	Hard anodised aluminium / Nylon reinforced
The Twin automatic greasing system complies to the electromagnetic compatibility requirements of:	Automotive directive 72/245/EC, as last amended by directive 2006/28/EC. Earth Moving Machinery standard; ISO 13766 (1999).

Dimensions of the Twin Pump

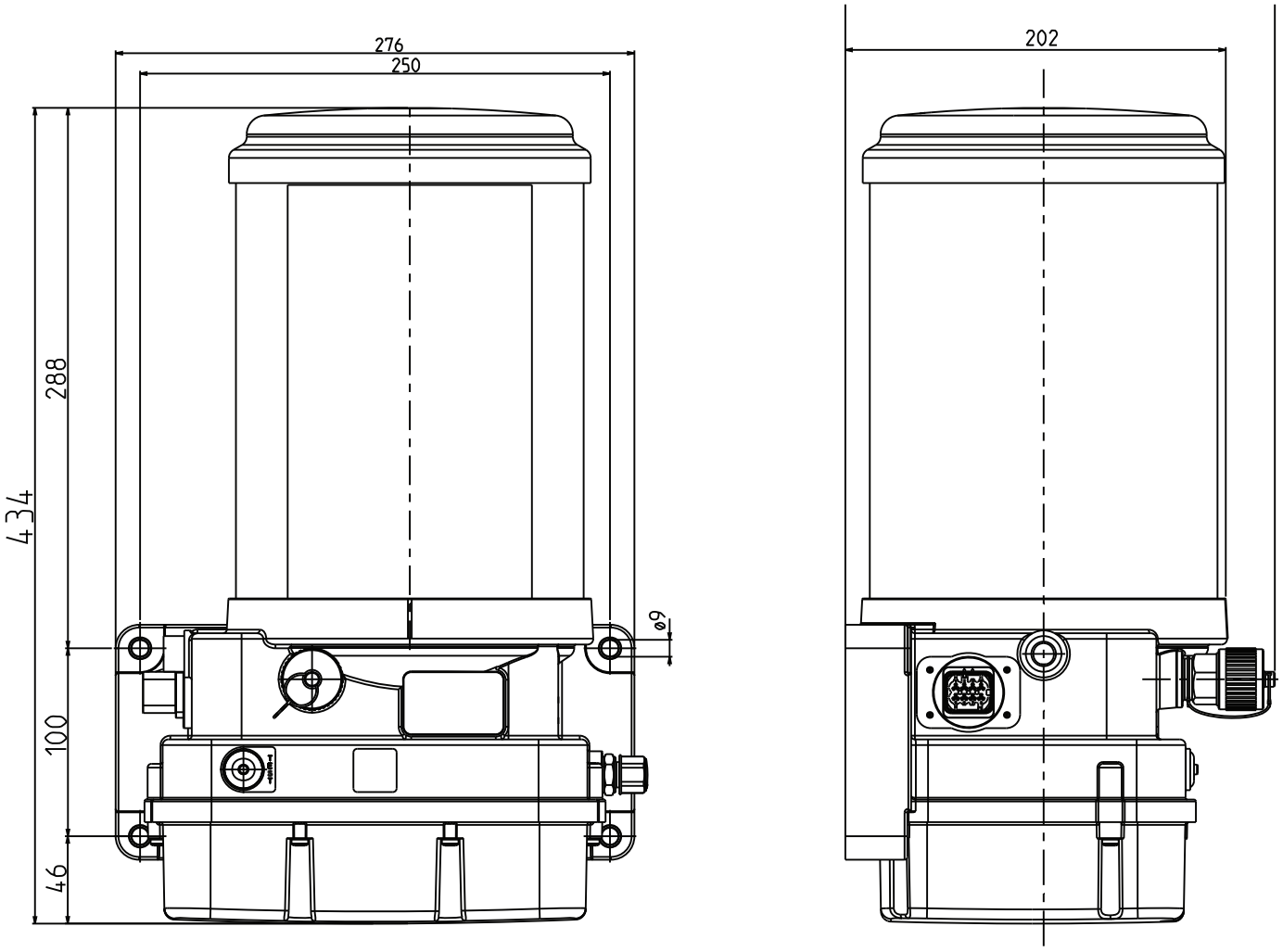


Figure 22