



EPS 610



BOSCH

en Original instructions
Injection pump test bench

Contents English

1. Symbols used	4		
1.1 In the documentation	4		
1.1.1 Warning notices - Structure and meaning	4		
1.1.2 Symbols in this documentation	4		
1.2 On the product	4		
2. User information	5		
2.1 Important notes	5		
2.2 Safety instructions	5		
3. Product description	6		
3.1 Application	6		
3.2 Requirements	6		
3.3 Delivery specification	6		
3.4 Special accessories	6		
3.5 Description of unit	7		
3.5.1 EPS 610	7		
3.5.2 Drive	8		
3.5.3 Front panel	8		
3.5.4 Frame	8		
3.5.5 Measuring glass carrier	8		
3.5.6 Control cabinet	10		
3.5.7 Human Machine Interface (HMI)	10		
3.5.8 Test oil supply unit	11		
3.5.9 Pressure control valve for high and low pressure	11		
3.6 Test oil tank	11		
3.6.1 Cooling the test oil	11		
3.6.2 Heating the test oil	12		
3.7 Temperature measurement and control	12		
3.8 Temperature control for VE pumps	12		
3.9 Power supply for start / stop valve (12/24 V for distributor pumps)	12		
4. Initial start-up	13		
4.1 Transportation	13		
4.2 Unpacking the EPS 610	13		
4.3 Moving the EPS 610 to the installation location	13		
4.4 Before turning on for the first time	14		
4.4.1 Installation	14		
4.4.2 Mains connections	15		
4.4.3 HMI connection	15		
4.4.4 Test oil connections	16		
4.4.5 Connection for cooling water	17		
4.4.6 Checking pressure gauges	17		
5. Program description	17		
5.1 Description of keys on the HMI	17		
5.2 Operation of the HMI	18		
5.3 Changing the set values	18		
5.3.1 Setting the motor speed	18		
5.3.2 Change direction of rotation	19		
5.3.3 Set number of strokes	19		
5.3.4 Oil temperature control	19		
5.4 Automatic selection of stroke count and motor speed	19		
5.4.1 Selecting a preset stroke count	19		
5.4.2 Selecting a preset motor speed	19		
5.5 Saving customer-specific speed rates	20		
5.6 Activate stroke counting	20		
6. Operation	20		
6.1 Switch-on	20		
6.2 Switch-off	21		
6.3 Emergency stop	21		
6.3.1 Activating emergency stop	21		
6.3.2 Deactivating emergency stop	21		
6.4 Preparing to carry out tests	21		
6.5 Checking pre-stroke, start of delivery and cam offset for in-line pumps	22		
6.6 Checking start of delivery for distributor pumps with pre-stroke specifications	23		
7. Troubleshooting	23		
7.1 System error messages	24		
7.2 Drive error messages	25		
8. Maintenance	26		
8.1 Cleaning	26		
8.2 Spare and wearing parts	26		
8.3 Servicing	26		
8.3.1 Maintenance intervals	26		
8.3.2 Removing contaminated test oil	27		
8.3.3 Cleaning the MGT strainer	27		
8.3.4 Replacing the filter insert	27		
8.3.5 Draining the test oil from the test oil tank	28		
8.3.6 Cleaning the suction strainer	28		
8.3.7 Flexible coupling	29		
8.3.8 Adjusting the MGT tray	29		
9. Decommissioning	30		
9.1 Temporary shutdown	30		
9.2 Change of location	30		
9.3 Disposal and scrapping	30		
9.3.1 Substances hazardous to water	30		
9.3.2 EPS 610 and accessories	30		
10. Technical data	31		
10.1 EPS 610	31		
10.2 Bench layout	32		
10.3 Tightening torques	33		
10.3.1 Fastening parts	33		
10.3.2 Coupling halves	33		
10.4 Machinery noise information pursuant to the bench safety code	33		

1. Symbols used

1.1 In the documentation

1.1.1 Warning notices -

Structure and meaning

Warning notices warn of dangers to the user or people in the vicinity. Warning notices also indicate the consequences of the hazard as well as preventive action. Warning notices have the following structure:

Warning symbol

KEY WORD – Nature and source of hazard!

Consequences of hazard in the event of failure to observe action and information given.

➤ Hazard prevention action and information.

The key word indicates the likelihood of occurrence and the severity of the hazard in the event of non-observance:

Key word	Probability of occurrence	Severity of danger if instructions not observed
DANGER	Immediate impending danger	Death or severe injury
WARNING	Possible impending danger	Death or severe injury
CAUTION	Possible dangerous situation	Minor injury

1.1.2 Symbols in this documentation

Symbol	Designation	Explanation
!	Attention	Warns about possible property damage.
i	Information	Practical hints and other useful information.
1. 2.	Multi-step operation	Instruction consisting of several steps.
➤	One-step operation	Instruction consisting of one step.
⇒	Intermediate result	An instruction produces a visible intermediate result.
→	Final result	There is a visible final result on completion of the instruction.

1.2 On the product

! Observe all warning notices on products and ensure they remain legible.



WARNING - Danger of hands getting trapped between rotating parts

- Never hold your hand anywhere near the flywheel when the EPS 610 is in operation!
- Cover rotating parts.



WARNING - Risk of burning!

The test oil might be hot and can cause burning.

- Allow the test oil to cool before proceeding with maintenance tasks.
- Wear safety gloves



WARNING!

The tommy bar used to rotate the flywheel by hand must not be left inserted in the locating holes of the flywheel!

- Always remove the tommy bar before starting the EPS 610!

Symbol	Description
	Operate the machine only after connecting the fuel injection pump.
	Do not operate the machine without connecting the fuel injection pump.
	Ensure that the glass tubes do not hit the fixtures for the fuel injection pump while rotating the swivel plate.
	Wear safety goggles
	Wear ear mufflers

	Wear safety shoes
	Wear safety gloves
	Wear a safety mask
	Comply with these original instructions and all other technical documentation relating to the EPS 610.
	Do not use diesel. Use only ISO 4113 test oil.
	Dispose of used electrical and electronic devices, including cables, accessories and batteries, separately from household waste.
	

2. User information

2.1 Important notes

Important information on copyright, liability and warranty provisions, as well as on equipment users and company obligations, can be found in the separate manual "Important notes on and safety instructions for Bosch Diesel Test Equipment". These instructions must be carefully studied prior to start-up, connection and operation of the EPS 610 and must always be heeded.

2.2 Safety instructions

All the pertinent safety instructions can be found in the separate manual "Important notes on and safety instructions for Bosch Diesel Test Equipment". These instructions must be carefully studied prior to start-up, connection and operation of the EPS 610 and must always be heeded.

3. Product description

3.1 Application

The original instructions describes the EPS 610 - a heavy-duty fuel injection pump calibration test bench. The EPS 610 can be used for checking Bosch distributor/in-line injection pumps PE(S) A, M, MW, P 3000 to 8100 series, VP 36/37, VE and other comparable makes of injection pump.

-  The EPS 610 cannot be used with:
- Electronically controlled distributor pumps like VP 29, 30, 44 and UI/VP
 - Common rail fuel injection pumps

3.2 Requirements

 See chapter 10.2 for the dimensions of the bench.

- The EPS 610 must be operated in closed, sheltered and dust-free room. Do not operate EPS 610 outdoors.
- Operating temperature should be between 5 °C to 40 °C
- Flat surface with rigid (concrete) flooring
- Adequate ventilation and lighting

 Use only ISO 4113 test oil. Do not use inflammatory liquids such as petrol, diesel, naphtha or thinner.

- 50 lts of ISO 4113 test oil
- The customer must provide a pressure reducer (set to 200 kPa), a safety valve and a shut-off valve in the cooling water inlet. A coolant flow rate of min. 15 l/min. must be ensured, in order to provide sufficient cooling.
- The cooling water temperature must not exceed 17 °C. If the coolant feed temperature exceeds 17 degrees Celsius, a cooling device must be fitted by the customer.
- Provision of a grounded, symmetrical 3-phase AC network with 50 Hz mains frequency.
- Back-up fuse protection required:
 - 400 V – 500 V = 35 amps
- Safety equipment, such as safety goggles, ear protection, safety shoes and face shields must be provided and worn.
- Basic workshop tools like spanners, screw-drivers, torque wrenches etc.
- The operator must provide noise protection facilities.

3.3 Delivery specification

Description
Basic test bench (415 V)
Flexible coupling (mounted on bench)
Coupling guard (mounted on bench)
Measuring glass - 30 cc (8 nos.)
Measuring glass - 180 cc (8 nos.)
Hose for test oil supply
Hose for test oil return
Tommy bar
Taper punch
Electric cable for VE pump solenoid connection
Rubber damper
EPS 610 original instructions
Hose between flushing valve and pressure gauge
Hollow bolt with PMSC connector
Long pipe connector
Copper washer
Hose nipple - 1/2 inch
Stainless steel hose clamp (dia. 18-25)
Hydraulic circuit diagram
Electrical circuit diagram

Tab. 1: Delivery specification

3.4 Special accessories

Designation	Part number
Distance piece	F 002 DG1 9B5

Tab. 2: Special accessories

 To order special accessories contact customer service.

3.5 Description of unit

3.5.1 EPS 610

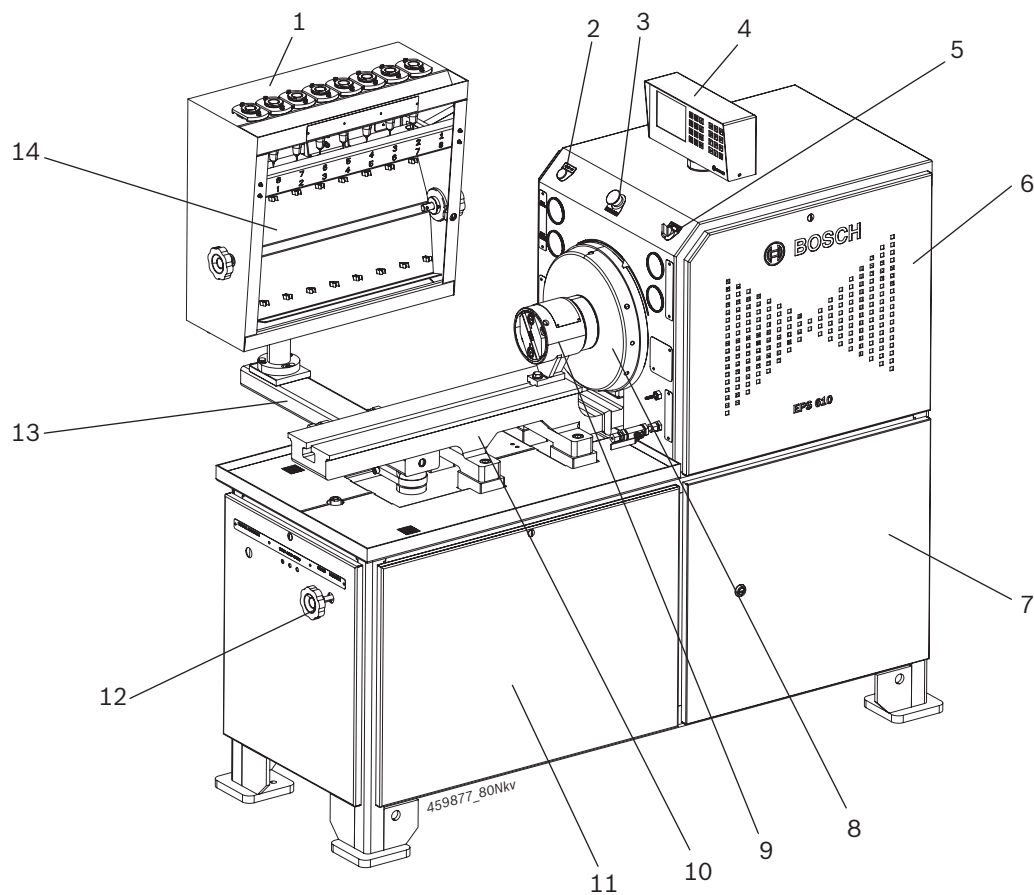


Fig. 1: EPS 610

- 1 Measuring glass carrier (MGT) assembly
- 2 "Mains on" indicator
- 3 Emergency stop
- 4 Human Machine Interface (HMI)
- 5 MGT illumination switch
- 6 Motor Right Hand (RH) side panel
- 7 Control cabinet door
- 8 Graduated flywheel
- 9 Coupling guard
- 10 Fuel injection pump mounting bed
- 11 Bottom right panel
- 12 Pressure control valve regulator
- 13 Swivel arm
- 14 Swivel plate

3.5.2 Drive

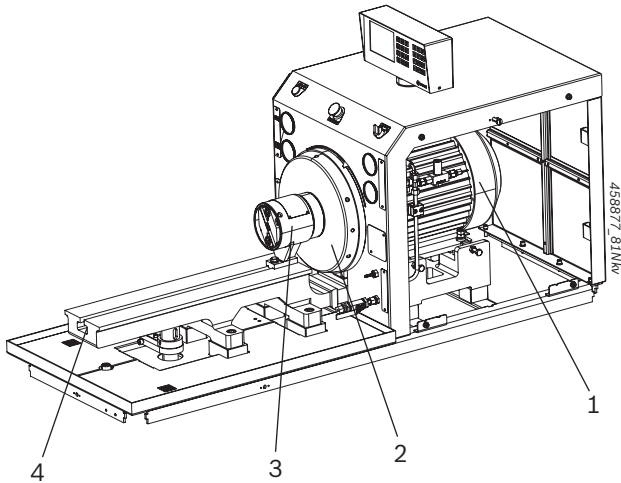


Fig. 2: Drive

- 1 11 kW motor
- 2 Flywheel
- 3 Coupling guard
- 4 T-slot



Ensure that the coupling guard is in place before starting the drive.



The ISO drive coupling is a safety component of the EPS 610. The ISO drive coupling may only be repaired only by Bosch service technicians.

The drive system consists of a motor (Fig. 2, Pos. 1), flywheel (Fig. 2, Pos. 2) and coupling. The clamping position for small injection pumps can be altered with the additional intermediate flange (special accessory).

-  The flywheel is directly mounted on the motor shaft. The scale on the flywheel is used to set the "start of delivery" position of the cylinders in a multi-cylinder fuel injection pump.
-  The cam on the fuel injection pump camshaft moves the piston of the barrel and valve assembly upwards via the roller tappet. The "start of delivery" position is attained when the piston closes the inlet bore.
-  The axis of the flywheel is set at 125 ± 0.1 mm from the top of the pump mounting bed.

The drive motor is mounted on the test pump mounting bed. The complete test pump mounting bed assembly is mounted on the frame. During calibration, the drive coupling is connected to the coupling of the fuel injection pump. The drive coupling is covered with a coupling guard (Fig. 2, Pos. 3).

3.5.3 Front panel

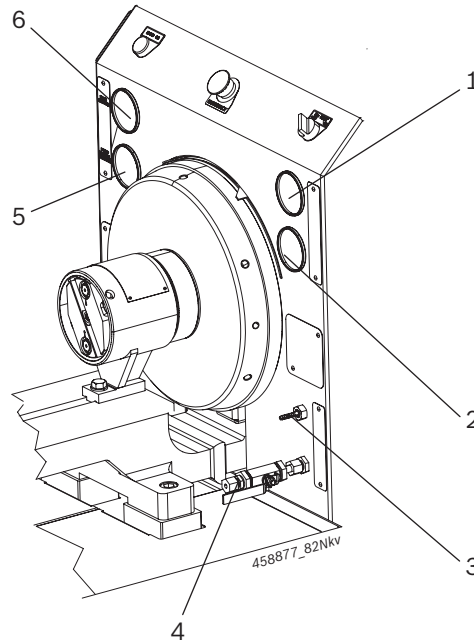


Fig. 3: Front panel\

- 1 Inlet pressure gauge, 0 – 600 kPa
- 2 Internal pressure gauge, 0 – 1600 kPa
- 3 Gauge connection for 1600 kPa
- 4 Test oil supply connection
- 5 Low inlet pressure gauge, -100 – 300 kPa
- 6 High pressure gauge, 0 – 6 MPa

3.5.4 Frame

The frame supports the drive system, MGT assembly (Fig. 1, Pos. 1), test oil tank (Fig. 8, Pos. 3) and tandem pump (Fig. 8, Pos. 1). The frame has adequate reinforcements to withstand the dynamic loads on the bench. The frame has panels on all sides which can be easily removed to enable maintenance.

3.5.5 Measuring glass carrier

The measuring glass carrier (Fig 1, Pos 1) comprises of the measuring glasses installed in a steel housing. The MGT assembly is mounted on a swivel arm (Fig. 1, Pos. 13). The measuring glasses are reinforced to the swivel plates by the holding clamps. Using the knob, (Fig 4, Pos 1), the swivel plate can be rotated to empty the measuring glasses and also to change over from 30 cc measuring glasses to 180 cc measuring glasses. A cam plate (Fig 4, Pos 2) limits the movement of the swivel plate.

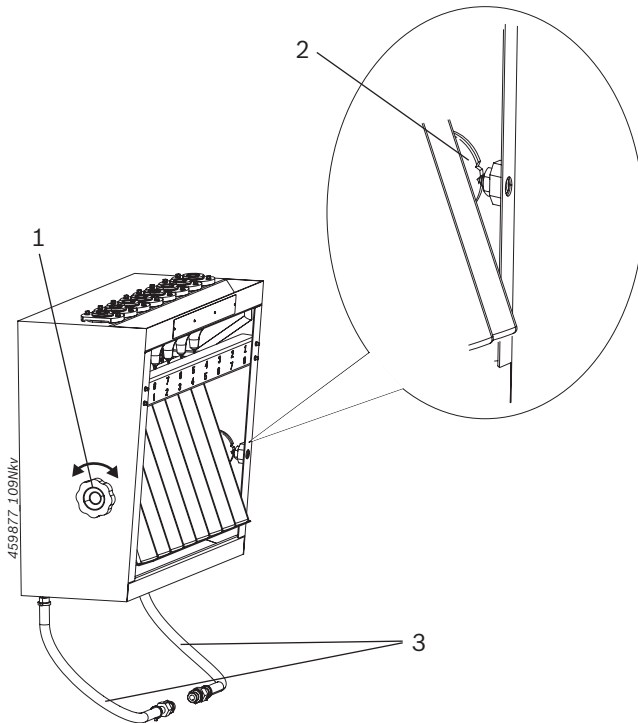


Fig. 4: Movement of the swivel plate

- 1 Knob
- 2 Cam plate
- 3 Hose



Warning - Breakage of measuring glass tubes

The measuring glass tubes will break if they hit against hard objects (for eg., fixtures for the fuel injection pump).

- Ensure that the measuring glass tubes do not hit against any hard objects.
- Wear protective gloves.
- Replace broken measuring glass tubes immediately.

During calibration of the fuel injection pump, the test oil can be collected by orienting the measuring glasses in a tilted position. The delivery quantity can be measured by orienting the measuring glass tubes in a vertical position.

 Ensure that the correct slot on the cam plate is engaged to avoid free rotation of the swivel plate (Fig. 1, Pos. 14).

The quantity of test oil fed into the measuring glasses is controlled by the movement of a stroke valve. The direction and movement of the stroke is governed by the electronic control unit of the bench.

The test oil is routed back from the MGT to the tank via the hose (Fig. 4, Pos. 3).

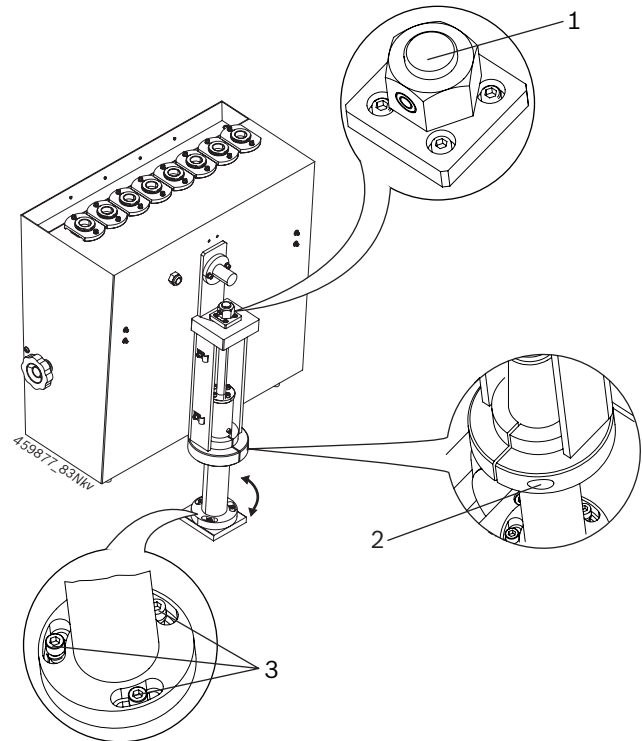


Fig. 5: MGT height adjustment mechanism

- 1 Bush
- 2 Locking screw for MGT vertical movement
- 3 Screws for fixing the vertical guide

The MGT is pivoted on a swing arm and can be swivelled 15° on either side by loosening the locking screw (Fig. 5, Pos. 2).

 The swing arm is located under the pump mounting bed. It can be rotated 180° so that the EPS 610 can be operated from either side (left hand side or right hand side).

Vertical MGT adjustment

To move the MGT vertically, loosen the screw (Fig. 5, Pos. 2). Then, rotate the hexagon bush (Fig. 5, Pos. 1). The MGT can traverse 150 mm vertically to adjust the height for different lengths of high pressure pipes. The swing arm can be fixed in the required position by tightening the allen bolt on the clamping piece

3.5.6 Control cabinet



DANGER: Risk of electric shock from live parts

Touching live parts in the control cabinet might result in shock and fatal injury or death.

- Work in the control cabinet is only to be performed by qualified electricians or authorized personnel under the supervision of a qualified electrician.
- Cover or cordon off live parts.

All the electrical components and control elements required for operation are located in the control cabinet (Fig. 6). The control cabinet is fixed to the base of the test bench.

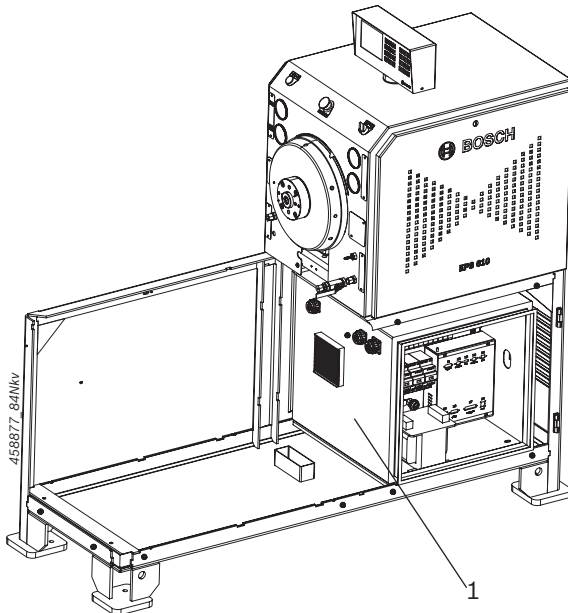


Fig. 6: Control cabinet



DANGER: Risk of electric shock from live parts

Touching the frequency drive or the braking resistor terminals may result in electric shock even after the mains supply is switched off.

- Disconnect the mains supply.
- Do not touch the frequency drive or the braking resistor for 10 minutes after switching off the mains supply.

The master switch is located at the rear of the test bench and the MGT illumination switch (Fig 1, Pos 5) is located on the front panel.

3.5.7 Human Machine Interface (HMI)

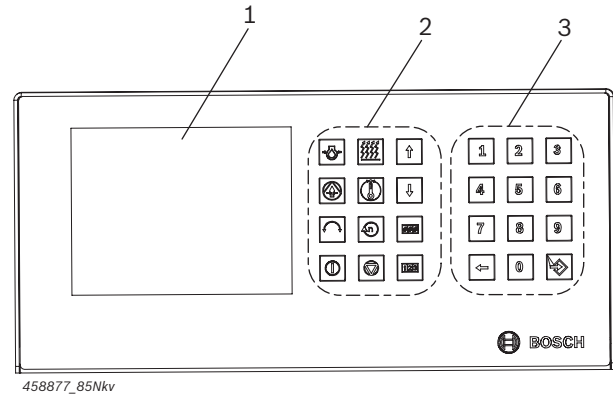


Fig. 7: Human Machine Interface (HMI)

- 1 HMI display
- 2 Control keys
- 3 Input keys

The Human Machine Interface (HMI) is the main interface for controlling the EPS 610. The following functions can be performed via the HMI:

- RPM setting and display
- Stroke setting and countdown
- Oil temperature setting and display
- Error diagnostics

 Refer to chapter 5.1 for the description of the control keys on the HMI.

The HMI can be connected to a PC via the USB port for updating the software.

 Contact Bosch customer service for enquiries about software updates.

 Do not press the keypad buttons with sharp objects or with greased hands.

The following data is displayed on the HMI screen:

- RPM
- Number of strokes
- Oil temperature
- Direction of rotation of flywheel
- Error code (if any)

The HMI can be turned and positioned conveniently for viewing the display from either side of the EPS 610 (refer Fig. 21).

3.5.8 Test oil supply unit

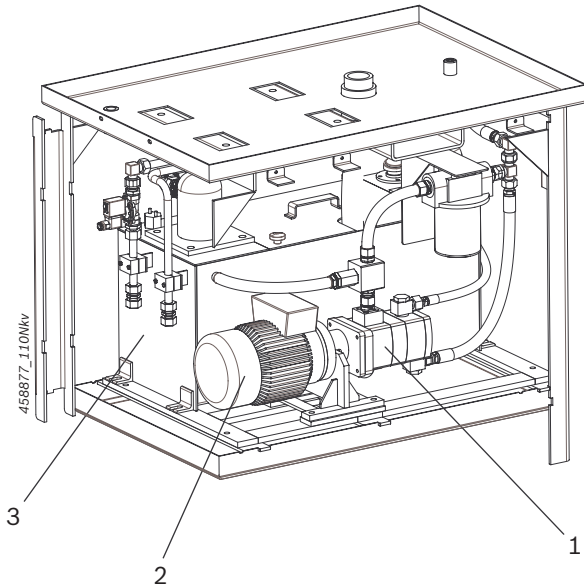


Fig. 8: Test oil supply unit

- 1 Test oil pump
- 2 Motor
- 3 Oil tank

The test oil supply unit consists of a test oil pump (Fig. 8, Pos. 1) driven by an electric motor (Fig. 8, Pos. 2). This unit supplies test oil to the fuel injection pump under test.

A flexible coupling connects the test oil pump and the motor. The frame supports the test oil supply unit.

⚠ Ensure that the motor is powered on only in the specified direction. The direction is indicated on the motor.

3.5.9 Pressure control valve for high and low pressure

The pressure control valve is used for controlling the pressure of the test oil fed into the fuel injection pump under test. When the hand knob (Fig. 1, Pos. 12) is turned counterclockwise to the extreme position, the high pressure test oil (upto 4 Mpa) can be tapped from the pressure line connection. When the threaded spindle is turned clockwise, the high pressure oil bleeds off. Low pressure oil can be tapped at the pressure line connection.

The pressure can be adjusted between rotating the hand knob. The pressure ranges are as follows:

- For phasing - 0 - 4 Mpa
- For calibration - 0 - 400 Kpa

3.6 Test oil tank

The test oil tank, mounted on the frame of the EPS 610, has a capacity of 50 lts. To access the test oil tank, open the rear bottom panel.

ⓘ Ensure that the test oil tank is always filled to its capacity.

A test oil heater is provided for heating the test oil. To measure the test oil temperature, a temperature probe is provided. An oil level sensor is provided to prevent dry running of the tandem pump. During calibration, the test oil is routed back from the fuel injection pump to the test oil tank.

3.6.1 Cooling the test oil

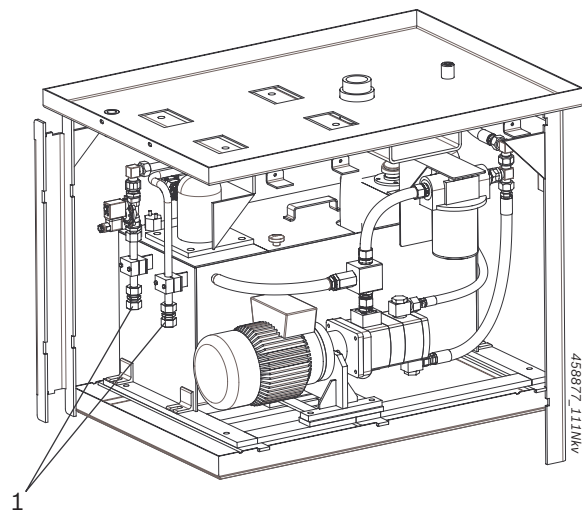


Fig. 9: Connections for cooling water

- 1 Inlet and outlet for cooling water

The test oil is cooled by a heat exchanger. The test oil flows through the cooling pipes and dissipates heat to the cooling water.

The test oil temperature is measured by the temperature sensors and is controlled by the cooling water supplied to the heat exchanger. The supply of cooling water is controlled by the logic board through solenoid valves.

ⓘ See chapter 10 for details on requirements for cooling water.

3.6.2 Heating the test oil

The test oil is heated by an electrical resistance heater installed in the test oil tank.

 To prevent the risk of fire due to overheating of test oil, adequate safety measures have been provided.

The time required for heating the test oil from room temperature to 40 °C depends on the amount of test oil in the tank.

When the <Test oil pump on / off> key is switched on, the heater and water inlet valve are used for maintaining the oil temperature at the inlet / outlet (depending on the user selection). The temperature sensors continuously monitor the temperature. The temperature values are also displayed on the HMI display.

3.7 Temperature measurement and control

As soon as the drive motor is switched on, the test oil temperature is regulated by way of the heating and the water control valve.

 For fuel injection pumps of a certain size, the test oil warms up while testing the fuel injection pumps and hence, no additional heating is required. In case of larger fuel injection pumps, heating the test oil causes the temperature to exceed beyond the prescribed limit. It is then necessary to cool the test oil. Fuel injection pumps should be calibrated only when the test oil is heated within the specified temperature limits.

The heat exchanger supplies enough cooling water so that the preset test oil temperature is maintained. If test oil heating is on and the temperature in the test oil tank exceeds 70°C, the EPS 610 initiates emergency automatically.

The EPS 610 can be restarted and the test oil heating can be switched on again after the temperature of the test oil reduces below 70°C.

 If the temperature sensor is not connected or is damaged, an error message is displayed. Refer to chapter 7 for the list of error messages.

3.8 Temperature control for VE pumps

Because of the overflow throttle, there is significant heat generation when a VE pump is in operation. When larger VE pumps are operated at high speeds, the overflow temperature rises quickly. There is some delay in reducing the temperature within limits. To facilitate quicker cooling, the flushing valve is used. Pressing the flushing valve causes the overflow oil to flow to the tank. This reduces the heat generation in the pump enabling a quicker reduction in overflow temperature.

 Do not press the flushing valve during measurement of injected and overflow quantity. This will lead to wrong results.

3.9 Power supply for start / stop valve (12/24 V for distributor pumps)

 Never connect two or more items of electrical equipment (e.g. solenoid valve) to the 12/24 V supply terminals of the EPS 610, as this could damage the electrical equipment!

 Never disconnect or connect electrical equipment with the EPS 610 switched on.

 The operating current should not exceed 5 A.

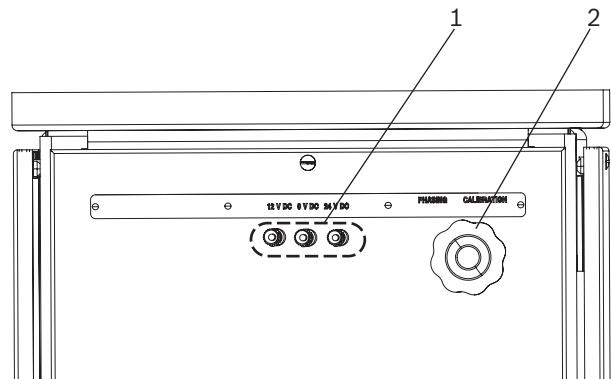


Fig. 10: Front panel

- 1 Power supply sockets
- 2 Test oil pressure regulator

For operation of the pump solenoid, a set of cables (red and black) and crocodile clips are provided. These can be used for connection to any one of the sockets based on the pump type to be tested.

 Ensure that the crocodile clips do not short. Else, the Miniature Circuit Breaker (MCB) in the electrical cabinet (F5 for 12 V and F6 for 24 V) will trip. Switch on the MCB (F5 for 12 V and F6 for 24 V) in case it trips.

4. Initial start-up

! The EPS 610 is to be assembled, connected and commissioned only by a trained technician.

4.1 Transportation

! After unpacking the EPS 610, it should not be left in an unsheltered and dusty location.

i The base of the EPS 610 is mounted and bolted to a wooden pallet. It is also covered with polythene and aluminium sheets for protection from rain and dirt. For ease of unpacking, the top is bolted to the sides.

The following table describes the symbols on the wooden pallet.

Symbol	Description
	Lashing points
	Centre of gravity
	Lift only from this side using long forklift.
	Do not lift the crate from this side.



Risk of injury from improper handling
Improper handling of the EPS 610 during unpacking could lead to injuries and damage the EPS 610.

- Wear safety shoes.
- Always use suitable transport and lifting equipment with an adequate load-bearing capacity.
- Observe the CG (refer to CG symbol on the packaging).
- Always secure the packaging case at the specified lashing points when moving with a crane or other lifting equipment.
- Never stand beneath suspended loads.

! Ensure that all parts are clamped before slinging.

! The EPS 610 must be hoisted such that it does not sway uncontrollably. Lift the bench slightly above the ground to check if it tilts in one direction. If the bench tilts, lower the bench and adjust the hoisting cables.

4.2 Unpacking the EPS 610

! Do not use excessive force to open the packing.

1. Visually, check if there is any damage to the packing case.

i In case of damage, do not dispose of the damaged items. They have to be preserved for inspection by Bosch and the insurance company.

i Observe the method of packaging on one side.

2. Dismantle the packaging case on any of the sides.

4.3 Moving the EPS 610 to the installation location

! Avoid hard shocks and jolts.

i In the case of a crane, the crane hook is positioned directly above the Centre of Gravity (CG) symbol.

1. Lift the bench slightly to check the center of gravity. If the bench tilts, lower the bench and adjust the hoisting cables.
2. Hoist the bench.

i If you are using a forklift, approach only from the front or from rear side of the EPS 610. Use wooden boards on the blades of the forklift to avoid damage to the EPS 610. Ensure that the forks are equidistant from the CG symbol. Place the forklift beneath the EPS 610. Slightly lift to check if the bench is lifted about its center of gravity.

i The recommended diameter of the steel bars is 20 mm - 24 mm.

i The following items should be removed only after the bench is transported and positioned at the actual location.

- Wrapping used for protection from rain and dirt
- Straps used for clamping, pipes, cables etc

3. Place the EPS 610 on a flat surface with the rubber dampers as cushioning.
4. Remove all packaging material inside the machine and the control cabinet.

i When the EPS 610 is unpacked, ensure that you retain the small boxes or packages containing parts.

4.4 Before turning on for the first time

4.4.1 Installation

 The bench does not need anchoring/grouting. The bench must be installed on a firm and level floor.

 Although the design and construction of the EPS 610 are rugged enough, sudden shocks and jerks may disturb the accuracy of the bench. If the EPS 610 has to be levered into position with a crowbar, ensure that it is done with short, smooth strokes with wooden skids placed underneath. Thereby, the bench always comes to rest on the skid.

1. Carefully, peel off the CG symbol on the right and left hand side panels.
2. Place a spirit level on the test pump mounting bed (Fig. 1, Pos. 10).
3. Check if the EPS 610 is placed on a flat surface. Else, lift the bench and place shims beneath the dampers till the flatness is OK.

 Ensure that the air grids on the rear panel are not blocked. The air grids are provided to circulate air for cooling the components inside the control cabinet.

 Do not operate the EPS 610, unless the grease coating has been thoroughly cleaned and wiped out. Do not use steel brushes or scrapers for cleaning. Avoid blowing air.

4. Using a soft, clean cloth, wipe off the grease coating thoroughly on the items only when they are taken up for use. Use cleaning oil or petroleum-based solvents.
5. Apply a layer of rust-preventive oil on all the bright machined parts immediately after wiping off the corrosion-preventive coating.

 The MGT is locked by tightening the clamp (Fig. 11, Pos. 1) to avoid any damage during transit. Every time the EPS 610 is transported, ensure that the MGT is locked.

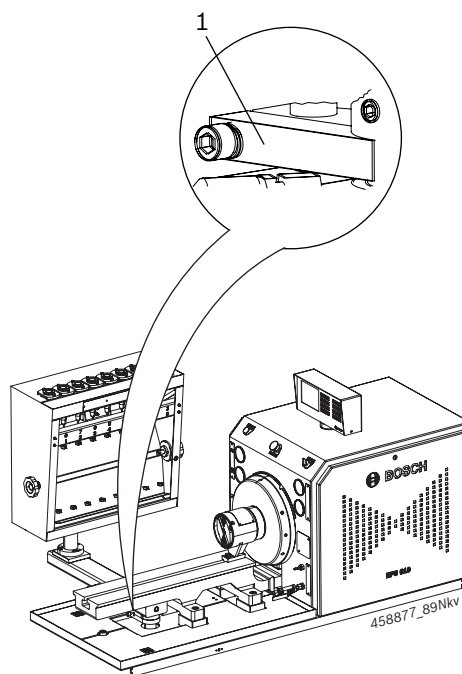


Fig. 11: Clamp for fixing the MGT during transit

1 Clamp

6. Loosen the clamp (Fig. 11, Pos. 1)
7. Lift the measuring glass assembly off the clamping rail (refer to Fig. 5).
8. Position the MGT to a convenient position.
9. Adjust the MGT assembly to a comfortable operating height. Refer to chapter 3.5.5.



Risk - Breakage of measuring glass tubes

The measuring glass tubes will break if they hit against hard objects (for eg., fixtures for the fuel injection pump).

- Ensure that the measuring glass tubes do not hit against any hard objects.
- Replace broken measuring glass tubes immediately.
- Wear safety gloves.

10. Mount the glass tubes (30 cc and 180 cc) carefully to the holding clamps on the swivel plate.
11. Reposition the MGT to the normal position.
12. Lock the clamp (Fig. 11, Pos. 1) of the swing arm.
13. Adjust the height of the MGT.

4.4.2 Mains connections



DANGER: Risk of electric shock from live parts

Even when the master switch is off, the input terminals of the master switch L1, L2 and L3 and are live. Contact with the input terminals of the master switch L1, L2 and L3 will lead to electric shocks, heart failure and fatal injury.

- Work in the control cabinet is only to be performed by qualified electricians or authorized personnel under the supervision of a qualified electrician.
- Cover or cordon off live parts.

❗ The EPS 610 must be connected to the mains (400 V - 440 V). It is recommended to use a current-limiting circuit-breaker with a rating of 300 mA.

❗ The minimum cross-section of the incoming mains cable is 6 mm².

1. Connect a three-phase mains cable of capacity 40 A from a three-phase mains isolator of 40 A with fuse / MCB as a protective device.
2. Route the mains cable through the protective gland located at the bottom of the control cabinet to the main switch.
3. Connect the mains supply to the main switch terminals as follows:
 - L1 to terminal 1 on main switch.
 - L2 to terminal 3 on main switch.
 - L3 to terminal 5 on main switch.
 - Neutral to terminal 7
 - Power earth to system power earth (earthing link) at the bottom of the control cabinet.

ⓘ Ensure that the system ground is connected to the power earth terminal of the incoming 3-phase supply via a 10 mm² green / yellow earth cable.

❗ Ensure that the conduit, which connects to the main supply bus bars is properly grounded.

4. Conduct a Megger test to check if the earthing is OK.
5. Check the primary voltage of the control transformer. The primary terminal connections should be modified as per the measured primary voltage.

ⓘ Observe the label pasted on the test oil motor to find the correct direction of rotation. If the direction of rotation is incorrect, switch off the master switch and the mains supply. Interchange any two phases at the mains and ensure that the motor runs in correct direction.

4.4.3 HMI connection

1. Open either the motor RH panel or motor LH panel.

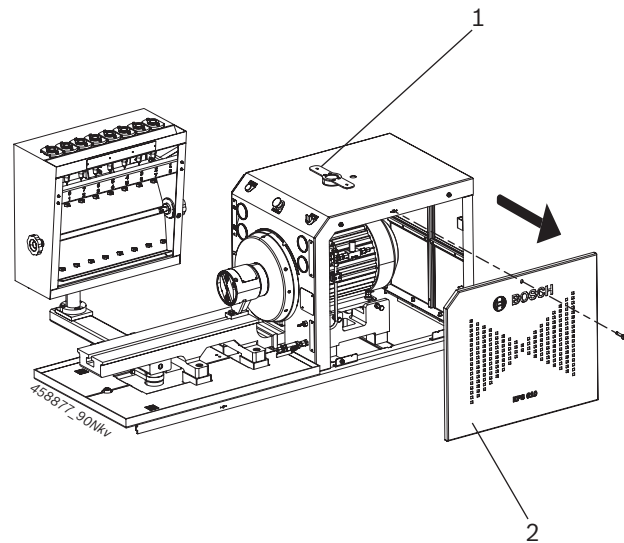


Fig. 12: Opening the motor RH panel

- 1 HMI mounting tray
- 2 Motor RH panel
2. Detach the HMI cable from the cable holder.
3. Fix the HMI cable to the connector of the HMI unit and tighten.
4. Place the HMI on the HMI mounting tray (Fig. 12, Pos. 1).
5. Open the plug (Fig. 14, Pos. 1).
6. Unfasten the HMI locking screw (Fig. 13, Pos. 4) and remove the HMI locking mechanism.

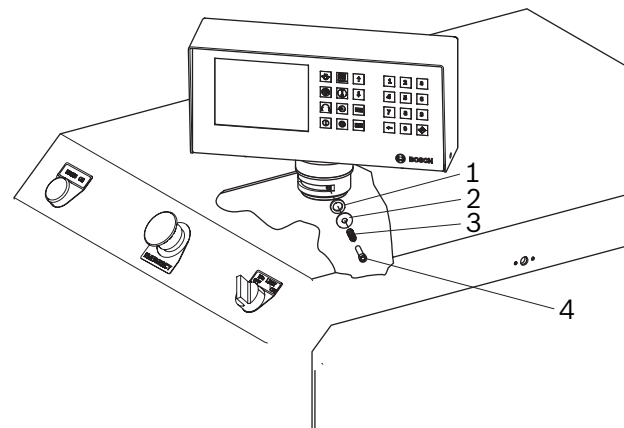


Fig. 13: HMI unit

- 1 Nylon washer
- 2 Plain washer
- 3 Spring
- 4 Locking screw
7. Rotate the HMI such that the HMI stud (Fig. 14, Pos. 2) is directly above the slot on the front panel (Fig. 14, Pos. 5).
8. Insert the spring washer (Fig. 14, Pos. 3) and the dome nut (Fig. 14, Pos. 4) into the lever.
9. Insert the lever through the slot in the front panel (Fig. 14, Pos. 5) and tighten the dome nut.

10. Rotate the HMI tray such that the second dome nut is directly above the slot in the front panel.
11. Tighten the other dome nut.

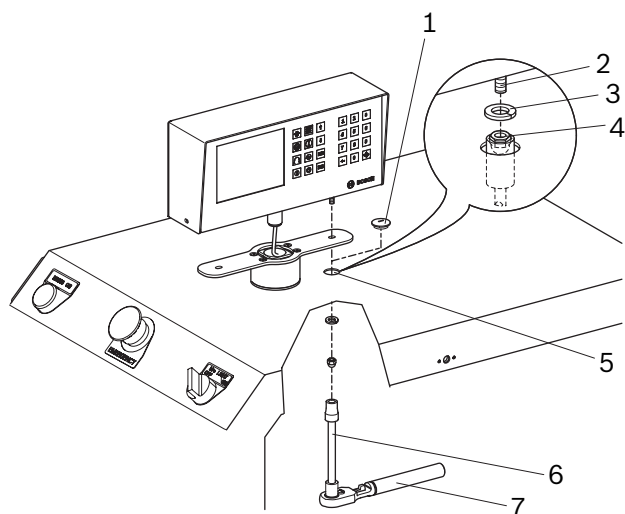


Fig. 14: Tightening the dome nut

- 1 Plug
- 2 Stud
- 3 Spring washer
- 4 Dome nut
- 5 Slot for tightening the dome nuts
- 6 Lever
- 7 Ratchet

12. Rotate the HMI to a convenient position.

! Overtightening the screw might damage the spring.

13. Insert the locking screw (Fig. 13, Pos. 4) into the spring (Fig. 13, Pos. 3). Insert a plain washer (Fig. 13, Pos. 2) and nylon washer (Fig. 13, Pos. 1) at the other end of the screw. Insert the whole assembly into the screw hole of the HMI locking mechanism. Tighten the screw only till a short length of the screw shank is engaged inside the screw hole of the HMI stand.
14. Press one of the keys gently on the HMI to check if there is no rotation. If there is rotation, tighten the locking screw till the displacement is arrested.
15. Switch on the mains supply.
16. Switch on the master switch on the EPS 610.
⇒ The HMI boots after a few seconds and the display starts.
17. Press the <Test oil pump on / off> key and check the direction of rotation of the test oil motor on the HMI display. Refer to chapter 5.1.

! Observe the label pasted on the test oil motor to find the correct direction of rotation. If the direction of rotation is incorrect, switch off the master switch and the mains supply. Interchange any two phases at the mains and ensure that the motor runs in correct direction.

18. Switch off the master switch.
19. Switch off the mains supply.
20. Close the motor RH or LH panel.
21. Close the control cabinet.
→ The HMI connection is complete.

4.4.4 Test oil connections

! All the test oil connections of the EPS 610 are connected at the factory and are ready to use.

1. Open the bottom right panel (Fig. 1, Pos. 11).
2. Check if any hydraulic connections are disconnected.

! If there are any connections that have come loose, restore the connections.

3. Loosen the fasteners on the tank cover.
4. Open the cover.

! Use only test oil ISO 4113. Do not use inflammatory liquids such as petrol, naphtha or thinner.

5. Clean the test oil tank thoroughly with a clean soft cloth.
6. Fill about 50 lts of ISO 4113 fresh test oil to the test oil tank.

! To order ISO 4113 test oil, use the part number F 002 S3E 001.

! During the test run, it is necessary to bleed air pockets in the pipeline and top up the oil level in the test oil tank.

4.4.5 Connection for cooling water

 The following components must be installed in the inlet line:

- Pressure reducing valve with pressure gauge set to 200 Kpa
- Protective filter
- Shut-off valve

1. Connect the cooling water connection to the water supply.
2. Route the flexible water lines (inlet and return) to the heat exchanger using suitable clamps.
3. Ensure that the connections are leak-proof.

 The cooling water supply valve to the bench must be closed when EPS 610 is not in use.

4.4.6 Checking pressure gauges

- Observe the pointer of the pressure gauge.
 - ⇒ The pointer should indicate "0".

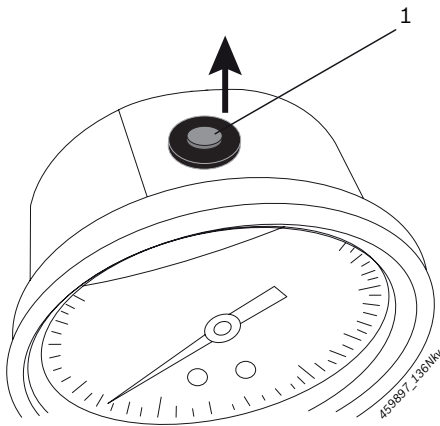


Fig. 15: Equalizing pressure inside the gauge

1 Rubber cap

 If the pointer does not indicate zero, lift the rubber cap (Fig. 15, Pos. 1) to equalize the pressure inside the gauge to the atmospheric pressure. Once the pressure is equalized, close the cap.

5. Program description

5.1 Description of keys on the HMI

Control key symbol	Designation	Explanation
	Test oil pump on / off	Switch on/ off the test oil pump
	Fixed RPM setting	Set constant setting of 200 RPM
	Direction of motor rotation ²⁾	Change the direction of the motor rotation
	Drive motor on ²⁾	Start drive motor.
	Heater on / off ²⁾	Switch on/ off the heater
	Temperature selection	Change the set temperature of the test oil tank and the inlet/ outlet of the fuel injection pump
	RPM selection ³⁾	Change the set RPM
	Drive motor off	Stop drive motor.
	Increase ⁴⁾	Navigation within control panel and change of speed, stroke rate and temperature values
	Decrease ⁴⁾	Navigation within control panel and change of speed, stroke rate and temperature values
	Stroke counter selection ³⁾	Change the set stroke counter
	Stroke counter on / off	Switch on/ off the stroke counter to calculate the injection amount
	Backspace	Exit a menu and go back up one level
	Enter	Confirm selection or accept displayed value

Tab. 3: Description of control keys on the HMI#

¹⁾ In view to the shaft of the injection pump

²⁾ Only possible when test oil pump is turned off

³⁾ No change possible during stroke counting

⁴⁾ When holding down the button, the value first changes in increments of 1, then ten times in increments of 10, and then in increments of 100.

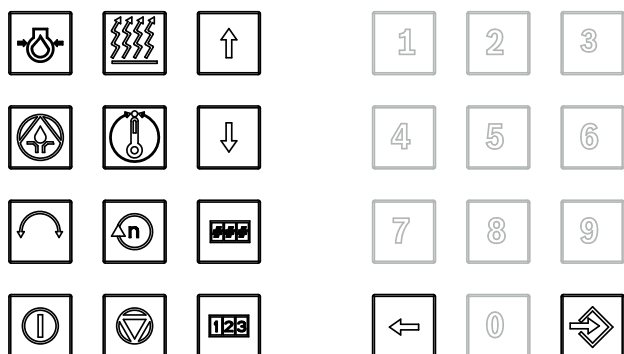


Fig. 16: Control buttons

5.2 Operation of the HMI

As a good practice, it is recommended to switch on and switch off the EPS 610 twice before first operation.

➤ Switch on the EPS 610.

- ⇒ The HMI is powered on. Wait until the default screen is displayed.
- ⇒ A typical view of the default screen is depicted below.

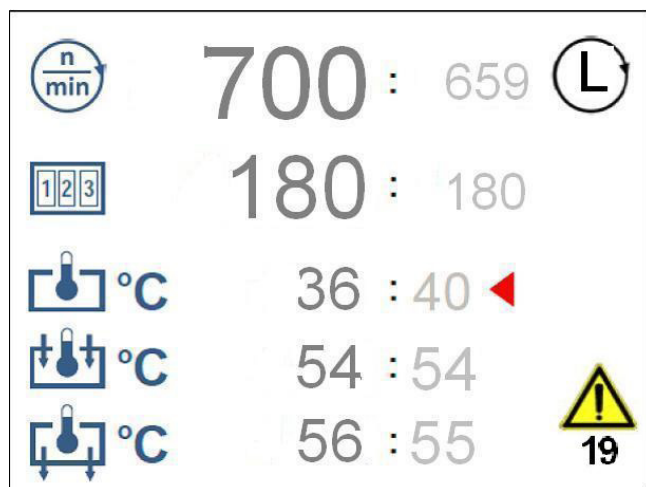


Fig. 17: Example default screen

The symbols on the HMI display are described in the following table.

Display symbol	Description
	Indicator of RPM left: actual RPM right: target RPM
	Direction of rotation of the drive motor L = counter clockwise R = clockwise
	Stroke count left: Remaining strokes, right: Stroke count to be measured
	Cursor
	Tank temperature left: actual temperature right: target temperature
	Inlet temperature left: actual temperature right: target temperature
	Outlet temperature left: actual temperature right: target temperature
	In the lower right area of the display, error messages are displayed or the status is shown briefly

Tab. 4: Description of the default screen symbols

1) In view to the shaft of the injection pump

Refer to the test specification of the pump and change the parameters accordingly.

5.3 Changing the set values

The changes are saved and are available after switching the EPS 610 off and back on again.

Changes to the set value are only possible with a switched on test oil pump.

5.3.1 Setting the motor speed

4. Press <RPM selection>.

⇒ The cursor appears on the display.

5. Set desired rotational speed with <↑> or <↓> or with the numerical keys.

6. Press <Enter>.

➔ The motor speed value is stored and displayed.

5.3.2 Change direction of rotation

! Do not attempt to change the direction of rotation when the motor is in operation.

- Press **<Direction change>**.
- ➔ The change of direction is indicated on the HMI display. The direction of rotation of the motor is changed.

i To change back to preset direction, press **<Direction change>** again.

5.3.3 Set number of strokes

1. Press **<Stroke counter selection>**.
⇒ The cursor blinks on the display.
2. Using the numerical keys, enter any value between 1 to 9999. Else, press **<↑>** or **<↓>** to adjust the stroke.

i If the stroke value is out of this range, an error message is displayed. Refer to chapter 7 for more information on error messages.

3. Press **<Enter>**.
➔ The stroke value is stored until it is explicitly changed.

5.3.4 Oil temperature control

i The oil temperature that can be set in the range of 30 °C to 60 °C.

1. Press **<Temperature selection>**.
⇒ The cursor blinks on the display.
2. Set desired temperature value with **<↑>** or **<↓>** or with the numerical keys.

! The drive motor can not be turned off during entry or adjustment of the temperature value.

3. Press **<Enter>**.
4. Enter temperature value using the numerical keys. Else, press **<↑>** or **<↓>** to adjust the temperature.
5. Press **<Enter>**.
➔ The temperature is set and displayed.

i In case an additional temperature is required set value with **<↑>** or **<↓>** and repeat the procedure.

i The temperature for supply or return can be changed while the drive motor is running.

5.4 Automatic selection of stroke count and motor speed

The automode feature provides easy selection of preset speeds and stroke counts. This feature is useful when different pumps are repeatedly calibrated at the same speed and stroke count.

i Changes to the set value are only possible with a switched on test oil pump.

5.4.1 Selecting a preset stroke count

1. Press **<Stroke counter selection>** for three seconds.
 2. Press **<↑>** or **<↓>** to select a preset stroke count.
- The preset stroke values are listed in the following table:

Program number	Stroke count
Program 01	100
Program 02	200
Program 03	500
Program 04	1000
Program 05	Stroke actuation for 3.6 seconds

i If program 5 is selected, the test oil is collected only for 3.6 seconds. The volume of oil collected, expressed in cm³, is equivalent to the delivery expressed in l/h (litre per hour). For example, if 1 cm³ is collected during this program, then the delivery is 1 l/h.

3. Press **<Enter>**.
➔ Stroke count is stored and listed.

5.4.2 Selecting a preset motor speed

1. Press **<RPM selection>** for three seconds
⇒ The program number and the corresponding RPM value are displayed.
2. Press **<↑>** or **<↓>** to select a program.

Programme	RPM
00	20
01	100
02	200
03	300
....	
40	4000

3. Press **<Enter>**.
➔ The RPM of the drive motor is stored and listed.

5.5 Saving customer-specific speed rates

 The RPM can be programmed from 100 to 4000 with resolution of 1 RPM.

1. Press **<RPM selection>** for three seconds till the cursor blinks on the HMI display.
 - ⇒ The program number and the corresponding RPM value are displayed.
2. Press **<↑>** or **<↓>** to select any program number from 41 to 99.

 Any program from 41 to 99 can be used for defining "custom" preset speeds.

3. Press **<Enter>**.
4. Using the numerical keys, enter an RPM value
5. Press **<Enter>**.

→ The required RPM value is stored.

5.6 Activate stroke counting

 Do not actuate **<Stroke counter On/Off>** on the display and control unit at standstill of motor.

 Stroke actuation can be done only if the actual RPM does not vary by more than ± 5 RPM with respect to set RPM.

➤ Press **<Stroke Counter On/Off>**.

→ The stroke counter starts the measurement and counts the strokes down. The test oil starts accumulating in the measuring glass tubes. Once the number of strokes reaches 0, the measurement stops.

 To stop the stroke counter before completion of preset strokes, press **<Stroke Counter On/Off>**. The value at which the stroke counter is stopped is displayed

6. Operation



➤ Wear safety goggles.



➤ Wear safety gloves.



➤ Wear slip resistant safety shoes.



➤ Wear ear muffs.



➤ Wear a safety mask.



Warning - Risk of injury due to spillage of test oil or due to parts being thrown around!

If the high pressure lines are not connected to the fuel injection pump correctly, test oil can spurt out at high pressure, or parts of the fuel injection pump under test can fly apart during the test.

- Do not operate the EPS 610 without mounting the fuel injection pump.
- Before switching on, check if all the high pressure lines are connected properly.
- Do not open the coupling guard, until the EPS 610 drive has stopped.
- Replace any leaking and defective hose lines.
- Wear safety goggles.
- Wear slip-resistant safety shoes.



Warning: Noise can impair hearing

When performing tests with the EPS 610, the noise level is in excess of 80 dB(A). Such noise levels can permanently impair hearing.

- Wear ear muffs.

6.1 Switch-on

1. Close the shut-off cock for the test oil supply.
2. Switch on the EPS 610 at the master switch.
 - ⇒ The EPS 610 is ready for operation.
3. Press the **<Heater on /off>** key to start heating the test oil.
4. From the HMI, switch on the test oil pump

6.2 Switch-off

1. From the HMI, switch off the drive motor
2. Press **<Test oil pump on / off>**.
3. Switch off the EPS 610 at the master switch.
→ The EPS 610 is switched off.

 There is a delay of 15 seconds for the EPS 610 to start when it is switched off successively.

6.3 Emergency stop

6.3.1 Activating emergency stop

Actuate the emergency stop switch in the event of faults like:

- Coupling failure
- Burnt smell
- Fire
- Abnormal speed
- Wrong direction of rotation of motor
- Water or oil leakage
- Bursting of pipes
- Measuring glass tube breakage
- Machine-generated emergency

 Refer to chapter 7 for the list of error messages and the troubleshooting actions.

 Even if the emergency stop switch is pressed, the test oil supply runs for some time so that the fuel injection pump under test is not damaged.

- In the event of a fault, press the emergency stop (Fig. 1, Pos. 3) switch.
- The main actuators (motor etc.) of the EPS 610 are switched off. The error code 02 is displayed on the screen.

6.3.2 Deactivating emergency stop

1. Rectify the fault.
 2. Press the emergency stop switch gently and rotate clockwise.
- The EPS 610 is ready for operation.

 Check the emergency stop switch (Fig. 1, Pos. 3) before starting the EPS 610. If the emergency stop switch is pressed, rotate and release it.

6.4 Preparing to carry out tests

 Always switch off the master switch of the EPS 610 before mounting or dismounting the fuel injection pump.

1. Using the required mounting accessories, mount the injection pump to be tested on the pump mounting bed.

 Contact your Bosch dealer for ordering mounting accessories.

 Tighten the tensioning bolts with a torque wrench. Refer to chapter 10.3 for the torque values. Tensioning bolts which are not properly fastened could work loose during operation of the bench. Over-tightening the bolts might lead to damage and could break. In either case, the coupling could get damaged and parts of the coupling might fly apart.



Ensure that the coupling guard is in place before starting the drive.



The ISO drive coupling is a safety component of the EPS 610. The ISO drive coupling may be repaired only by Bosch service technicians.

2. Using a tommy bar, clamp the coupling half of the injection pump to the clamping jaws of the flexible drive coupling. Ensure that there is a gap of 1 mm to 2 mm between the coupling of the pump and the drive coupling.



The tommy bar used to rotate the flywheel by hand must not be left inserted in the locating holes of the flywheel!

3. Tighten the tension bolts for the drive coupling with a defined tightening torque.
4. Connect the high pressure test lines from the fuel injection pump to the test injectors.

 With an additional distance piece (special accessory) the fixture position can be changed for small injection pumps.

5. Connect the inlet and outlet test oil points.

 For distributor-type fuel injection pumps, the pressure gauges for internal pressure measurement and measurement of the supply pump pressure must also be connected.

-  The temperature sensor on the flushing valve must always be fitted in such a way that the connecting cable is in a vertical position.



Warning: Risk of trapping in rotating parts!

Clothing, jewelry or hair can get caught in rotating parts and result in serious injury.

- Keep well away from rotating and moving parts.
- Cover rotating parts.
- Keep hands away from rotating parts.

6. Refer to the data sheet of the pump under test and set the following parameters:
 - RPM
 - Direction of rotation of pump
 - Stroke value
 - Tank temperature
 - Inlet and outlet temperature
7. Operate the pressure control valve regulator (Fig. 1, Pos. 12) to adjust the test oil pressure as per the data sheet of the fuel injection pump under test.
8. Observe the HMI and check if the tank temperature has already attained the set value. Else, wait till the tank temperature reaches the set value.

➔ The pump is ready for testing.

6.5 Checking pre-stroke, start of delivery and cam offset for in-line pumps

1. Seal the outlet for the test oil return line on the fuel injection pump.
2. Switch on the calibration-fluid supply.
3. Set the specified high pressure by rotating the control valve for the test oil supply pressure.
4. Open the screw plug of the 'start-of-delivery' elbow on the test nozzle holder of the first cylinder. For specific injection pump types, another cylinder can also be specified.

-  Loosen the screw plug with a box wrench and screw it open by about half a turn.

5. Using the tommy bar, rotate the flywheel in the direction of rotation of the fuel injection pump until the cam of the first cylinder is at bottom dead center. In this position, oil drains out of the start-of-delivery elbow.
6. Attach the 'start-of-delivery' measuring device to the injection pump.
7. Place the position sensor of the measuring device on the roller tappet. At the lowest position, set the dial gauge to **0**.

8. Continue rotating the flywheel in the direction of the injection pump.

➔ The cam on the fuel injection pump camshaft moves the piston of the barrel and valve assembly upwards via the roller tappet. The "start of delivery" position is attained when the piston closes the inlet bore. At the same time, the oil flow at the elbow reduces to a drip. In this position the pre-stroke dimension is indicated on the dial gauge

-  The specified pre-stroke dimension or the specified start-of-delivery value can be adjusted, depending on the fuel injection pump model by any of the following methods:

- adjusting screw
- spacer plates of varying thicknesses
- exchanging the rollers or rotating the barrel and valve assembly.

9. Once the specified start-of-delivery has been reached, set the pointer of the pointer plate to the zero position of the flywheel.
10. Close the screw plug for the start-of-delivery elbow.
11. Repeat the process for the next cylinder in the injection sequence.

-  The start of delivery for the corresponding cylinders must occur at the following angles.

Type of pump	Start of delivery
3-cylinder pumps	every 120 degrees
4-cylinder pumps	every 90 degrees
5-cylinder pumps	every 72 degrees
6-cylinder pumps	every 60 degrees
8-cylinder pumps	every 45 degrees

-  Deviation from the angles listed in the previous table corresponds to the cam offset of the particular cylinder.

-  For certain fuel injection pump types (for e.g. ZWM Stage II) the pre-stroke must be set on each cylinder.

12. After the fuel injection pump has been set, disconnect the test oil high pressure line and connect the test oil return line.

6.6 Checking start of delivery for distributor pumps with pre-stroke specifications

 Voltage is supplied to the solenoid valve of the injection pump via the connection cables.

1. Fix the pre-stroke measuring device with the appropriate extension and dial gauge to the central screw plug.
2. Insert the tommy bar into the flywheel. Manually, crank the distributor injection pump until the distributor piston is at bottom dead center.
3. Pressurize the dial gauge to 4 mm.



The tommy bar used to rotate the flywheel by hand must not be left inserted in the locating holes of the flywheel!

4. Crank the distributor pump by hand until the distributor piston is at bottom dead center again.
5. Set the dial gauge to zero.
6. Set the oil supply to the appropriate low pressure by rotating the hand wheel on the control valve in a clockwise direction.
 - ⇒ The pressure in the supply line can be read on the low pressure gauge. Test oil flows out of the overflow pipe on the measuring device.
7. Slowly rotate the drive shaft in the direction of rotation until start of delivery.

 Start of delivery is confirmed when one drop per second of test oil flows out of the overflow pipe.

8. Read the dial gauge and compare the reading with the set point value indicated on the test sheet.
9. Correct any deviations below the piston flow using the appropriate shims.

7. Troubleshooting

 If some of the actions recommended in this chapter cannot be performed, contact customer service. The error messages listed in this chapter are displayed on the HMI.

 Refer to the electrical and hydraulic circuit diagrams to perform some of the actions listed in this chapter.

7.1 System error messages

Error code	Causes	Remedy
01	HMI Communication Failure	<ul style="list-style-type: none"> Visually, check if the HMI communication cable is damaged. Check the status of HMI power. Contact customer service.
02	<ul style="list-style-type: none"> The <Emergency> key is pressed. Emergency cable damaged. 	<ul style="list-style-type: none"> Unlock both Emergency stop buttons. <p>Error code 02 is displayed continuously for 30 seconds till the EPS 610 can be started again.</p>
03	<ul style="list-style-type: none"> The test oil level is less than the predefined value. Oil level sensor cable damaged. 	<ul style="list-style-type: none"> Check the quantity of oil available in the tank. At least 30 lts of test oil should be available in the tank. Contact customer service.
04	Tank temperature exceeds 65 °C.	<ul style="list-style-type: none"> Check if the tank temperature sensor connection is loose. Check the water temperature. It should be in the range of 17° C to 20° C. Contact customer service.
05	Drive Communication Failure	Contact customer service.
06	There is no feedback on the drive health status.	Contact customer service.
07	Tank temperature sensor is disconnected.	<ul style="list-style-type: none"> Check if the tank temperature sensor is disconnected. Visually, check if the tank temperature sensor cable is damaged. Contact customer service.
08	Tank temperature sensor S5 is shorted	Contact customer service.
09	<ul style="list-style-type: none"> Test oil motor thermal overload relay tripped. Test oil motor is jammed. 	Contact customer service.
10	Inlet temperature sensor S6 is shorted.	Contact customer service.
11	Inlet temperature sensor S6 is disconnected	Contact customer service.
12	Test Oil Motor Contactor Faulty	Contact customer service.
13	Outlet temperature sensor S7 is disconnected.	Contact customer service.
14	The input values for speed/stroke/temperature are beyond the defined minimum and maximum values	Check the manual for getting the information regarding allowed data setting range for all the parameters such as RPM, stroke and temperature.
15	<ul style="list-style-type: none"> Power supply to heater has failed MCB F2 has tripped Heater has failed Heater cable damaged 	<ul style="list-style-type: none"> Check power supply to heater. Switch on the MCB F2. Switch off and switch on EPS 610. Contact customer service.
16	Outlet temperature sensor S7 is short circuited.	Contact customer service.
17	If inlet temperature output exceeds 65 °C.	<ul style="list-style-type: none"> Check if the water temperature is as specified in chapter 10. Contact customer service.
18	If outlet temperature output exceeds 65°C	<ul style="list-style-type: none"> If a VE pump is being calibrated, check if the flushing valve is actuated. Contact customer service.
19	<ul style="list-style-type: none"> Speed of motor greater than 50 RPM. Also, stability is not within +/-5 RPM of set value for stroke actuation. 	<ul style="list-style-type: none"> Wait till the speed reaches the defined limit. Then, further testing can be started. Contact customer service.

7.2 Drive error messages

Error code	Causes	Remedy
1000	A phase is missing on the supply side, or the mains voltage imbalance is too high.	<ul style="list-style-type: none"> • Check the incoming power supply at the frequency drive. • Contact customer service.
1001	There is no communication to the frequency converter.	<ul style="list-style-type: none"> • Check if the frequency drive settings are as per the electrical wiring diagram. • Contact customer service.
1002	There is a short circuit in the motor or on the motor terminals.	<ul style="list-style-type: none"> • Check if the connections from the motor to the drive are as per the electrical wiring diagram. • Contact customer service.
1003	Motor has not been connected to the output of the frequency converter.	<ul style="list-style-type: none"> • Check if the connections from the motor to the drive are as per the electrical wiring diagram. • Contact customer service.
1004	DC overvoltage	<ul style="list-style-type: none"> • Check the parameter setting, it should be as per the electrical circuit diagram. • Switch off the EPS 610 and switch on. • If the error persists, contact customer service to replace the frequency drive.
1005	The frequency converter is overloaded by more than 100%.	<ul style="list-style-type: none"> • Check the condition of the fuel injection pump under test. • Contact customer service.
1006	The inverter peak current (approximately 200% of the rated current) is exceeded.	<ul style="list-style-type: none"> • Contact customer service. <p>The warning will last approximately 8-12 seconds. Then, the frequency converter trips and issues an alarm.</p>
1007	The intermediate circuit voltage is higher than the overvoltage limit of the control system. The frequency converter is still live.	<ul style="list-style-type: none"> • Check the incoming connection, braking resistor and the fuel injection pump under test. • Contact customer service.
1008	Torque Limit	<ul style="list-style-type: none"> • Check the condition of the fuel injection pump under test.
1009	Brake Resistor Short circuited	Contact customer service.
1010	Motor is too hot since it is loaded more than 100%.	<ul style="list-style-type: none"> • Check the condition of the fuel injection pump under test. • Check if the coupling can freely transfer the torque.
1011	Braking power is higher than 100%.	Contact customer service.
1012	Short circuit or brake resistor overheat.	Contact customer service.
1013	There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.	Contact customer service.
1014	Internal Fan Fault	Contact customer service.
1015	The intermediate circuit voltage is below the under voltage limit of the control system.	Contact customer service.
1016	The intermediate circuit voltage is below the under voltage limit of the control system.	Contact customer service.
1020	A fitted option is not handled by the present control board	Contact customer service.
1021	Signal on terminal 53 or 54 is less than 50%	Contact customer service.
1022	Brake Resistor open circuit	Contact customer service.
1023	Motor phase U is missing.	Contact customer service.
1024	Motor phase V is missing.	Contact customer service.
1025	Motor phase W is missing.	Contact customer service.

8. Maintenance

! Work on electrical and hydraulic equipment is only to be performed by persons with sufficient knowledge and experience of electrical and hydraulic systems.

8.1 Cleaning

! Do not use any abrasive cleaning agents or rough cleaning cloths.

➤ Only use soft cleaning cloths and neutral cleaning agents to clean the EPS 610.

8.2 Spare and wearing parts

Designation	Order no.
Hose for calibrating oil supply	F 002 81N F07
Suction strainer	F 002 81N F75
Filter insert	F 002 DG1 9F2
Flexible coupling	1 686 401 026

8.3 Servicing

The EPS 610 requires proper maintenance at regular intervals. The maintenance intervals are recommended under the assumption that the EPS 610 is operated for 8 hours at a vehicle service center. The intervals have to be reduced if the operating time is extended.



➤ Wear safety goggles.



➤ Wear safety gloves.



➤ Wear slip resistant safety shoes.



➤ Wear ear muffs.

i Do not perform any other maintenance tasks other than those described in this chapter.

! Quit the voltage supply during the maintenance if possible.

8.3.1 Maintenance intervals

Sl. no.	Maintenance task	Daily	Weekly	After testing 200 pumps	During inspection	Yearly
8.1	Cleaning of EPS 610	x			x	
-	Check the measuring glasses visually for any defects. In case of defects, contact customer service to order spare measuring glasses.	x			x	
8.3.2	Drain the used test oil from the top tray	x			x	
8.3.3	Cleaning of strainer in MGT	x			x	
-	Check the nozzle opening pressure pursuant to the regulations. If required, adjust the pressure.		x		x	
-	Interchange the nozzle holders and pressure lines and compare the flow rates. The flow rates must be equal.		x		x	
-	Check if the sealing cones and bores of the pressure lines are perfectly functional. Else, replace with new pressure lines.			x	x	
-	Contact customer service to check pressure gauges.			x	x	
-	Contact customer service to check accuracy of the temperature unit, measuring and control devices.			x	x	
8.3.4	Change the test oil in test oil tank. Check for water leakage from the heat exchanger into the tank before refilling oil.			x	x	
8.3.5	Clean and rinse the test oil tank and suction filter. If the suction strainer is contaminated even after rinsing, contact customer service.			x	x	
8.3.6	Check the drive coupling.			x	x	
8.3.7	Clean the suction strainer in test oil tank			x	x	
-	Tightening torque for fixtures and pumps: Check and tighten if required. Refer chapter 10.3 for information on torque values.				x	x

Tab. 5: Maintenance intervals

8.3.2 Removing contaminated test oil

 The contaminated oil must be drained weekly, or as required.

1. Switch off the mains supply.
2. Open the bottom right panel (Fig. 1, Pos. 11).
3. Place a container with a funnel below the ball valve.
4. Open the ball valve (Fig. 18, Pos. 1) to drain the contaminated oil.

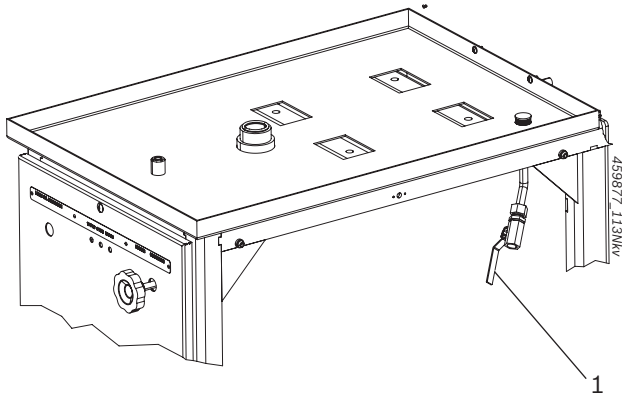


Fig. 18: Opening the ball valve

1 Ball valve

 Do not reuse the contaminated test oil.

 Refer to chapter 9 for more information on disposal of contaminated oil.

5. After the contaminated oil is drained, close the ball valve.
6. Close the bottom right panel.

8.3.3 Cleaning the MGT strainer

The strainer is located beneath the perforated base plate. The test oil from the MGT is routed back to the test oil tank through the MGT strainer.

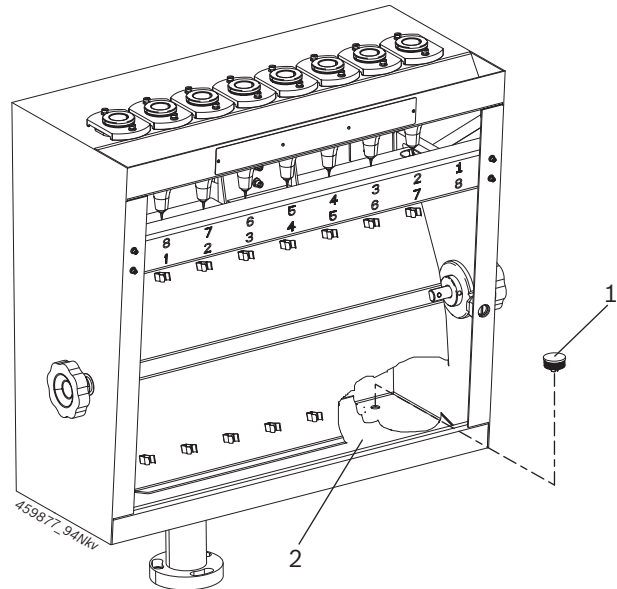


Fig. 19: MGT assembly

1 MGT strainer

2 Perforated base plate

Cleaning the MGT strainer:

1. Use the rotary knob to turn the swivel plate until the perforated base plate is readily accessible.
2. Remove the perforated base plate from the measuring glass assembly.
3. Pull out the MGT strainer (Fig. 19, Pos. 1).
4. Using a blower, clean the strainer.
5. Place the strainer back.
6. Insert the perforated base plate in the measuring glass assembly.

8.3.4 Replacing the filter insert



Risk of burning

The test oil might be hot and can cause burning.

- Allow the test oil to cool before proceeding with the maintenance task.
- Wear safety gloves.



Warning: Risk of slipping!

Stepping on test oil might lead to slippage and injury.

- Ensure that test oil does not spill on the floor.
- Wear slip-resistant safety shoes.

1. Switch off the mains supply.
 2. Open the bottom right panel.
 3. Using a belt wrench, rotate the filter casing anti-clockwise and loosen.
 4. Pull out the filter insert.
 5. Fit the new filter insert.
 6. Fit back the filter casing.
 7. Switch on the EPS 610.
 8. Switch on the test oil pump.
 9. Check if there is any leakage.
 - ⇒ If there is any leakage, check if the filter is connected properly. If the leakage persists, contact Bosch customer service.
- The filter insert is replaced.

8.3.5 Draining the test oil from the test oil tank



Risk of burning

The test oil might be hot and can cause burning.

- Allow the test oil to cool before proceeding with the maintenance task.
- Wear safety gloves.



Using contaminated test oil could damage the injection pumps.



If the test oil is clear but has a strong yellow tinge, the indication is that it has been mixed with the lubricating oil. If the test oil has a cloudy grey tinge, the indication is that it is contaminated.

As part of routine maintenance, clean the test oil tank. The test oil can be drained via the delivery pump and the pump supply line.

Execute the following procedure to drain the test oil from the test oil tank.

1. Open the bottom right panel.
2. Open the test oil tank cover.
3. Route the test oil supply hose to a vessel capable of collecting up to 40 lts of test oil.
4. Switch on the EPS 610.
5. Press the **<Test oil pump on / off>** key.
6. Using the pressure control valve regulator (Fig. 1, Pos 12), ensure that the pressure is set to ≤ 0.2 Mpa.
 - ⇒ The test oil motor starts. The test oil from the tank starts collecting in the vessel. When the oil level dips below the minimum quantity, the test oil motor stops.
7. Switch off the EPS 610.
8. Disconnect the mains supply.
9. Place a tray capable of collecting about 16 lts of test oil on the floor, just below the test oil tank.

10. Reach beneath the base of the EPS 610 and open the drain.
 - ⇒ The remaining test oil starts collecting in the vessel beneath the test tank.
11. When the tank is completely drained, dispose the oil. Refer to chapter 9.
12. Close the drain.
13. Wipe the tank thoroughly with a soft clean cloth.
14. Check if there is any leakage of water from the heat exchanger into the tank. If there is leakage in the heat exchanger, contact customer service.
15. Fill about 50 lts of fresh test oil.



Check if there is any leakage from the drain. If there is leakage, close the drain properly.



Use only test oil ISO 4113. Do not use inflammatory liquids such as petrol, naphtha or thinner.

16. Close the test oil tank cover.
17. Close the side panel.

→ The tank is drained and filled with fresh test oil.

8.3.6 Cleaning the suction strainer



DANGER: Risk of electric shock from live parts

Contact with live parts may result in electric shocks, heart failure and fatal injury.

- Do not touch any live parts.



Risk of burning

The test oil might be hot and can cause burning.

- Allow the test oil to cool before proceeding with the maintenance task.
- Wear safety gloves.

The suction strainer in the test oil tank has to be cleaned:

- every time the test oil is replaced
- during routine inspection

1. Switch off the master switch.
2. Switch off the mains supply.
3. Disconnect the power cable from the mains supply.
4. Open the rear bottom panel (Fig. 1, Pos. 11).
5. Remove the hose connection to the test oil supply unit.

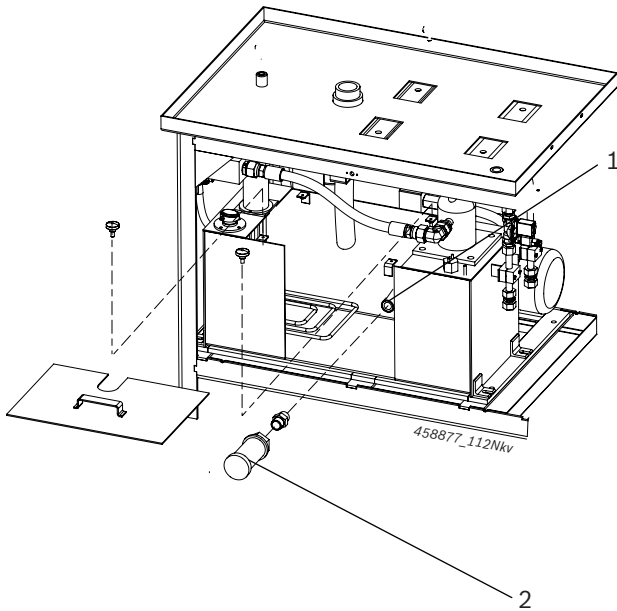


Fig. 20: Test oil tank

- 1 Adapter
- 2 Suction strainer

6. Open the test oil tank cover.
7. Loosen the fasteners for the hose clamps and remove the hose clamps.
8. Pull out the tube from the test oil tank and drain the oil in the tube to a container.
9. Loosen the adapter (Fig. 20, Pos. 1) and pull out the suction strainer (Fig. 20, Pos. 2).
10. Wipe the suction strainer with a soft clean cloth.
11. Clean the suction strainer using a blower.

⚠ Ensure that the blower pressure is in the range of 3 bar to 4 bar.

12. Connect the tube back to the suction strainer.
13. Fix the suction strainer back to the adapter.
14. Insert the tube back into the tank and fix the hose clamps.
15. Connect the other end of the tube back to the test oil supply unit.

⚠ Ensure that the hoses are connected properly to avoid any leakage.

16. Fill test oil into the test oil tank.
17. Close the test oil tank cover.
18. Connect the power cable to the mains supply.
19. Switch on the mains supply.
20. Switch on the master switch of the EPS 610.
21. Press the **<Control on>** key and start the test oil motor. Check for any leakage.

ⓘ If there is no leakage, the hose connection is OK. If there is any leakage, switch off and check the hose connections again.

22. Switch off the EPS 610.
 23. Close the rear bottom panel.
- ➔ The suction strainer is cleaned.

8.3.7 Flexible coupling

It is recommended to remove the flexible coupling for inspection and reconditioning. However, this has to be done only by technicians from Bosch. Contact customer service to replace the flexible coupling.

⚠ Do not attempt to service the flexible coupling. Non-compliance invalidate the warranty.

⚠ Improper servicing of the flexible coupling by untrained technicians could result in damage to the fuel-injection pumps.

8.3.8 Adjusting the MGT tray

1. Dismount the fuel injection pump mounted on the pump mounting bed.
2. Empty the test oil from the measuring glass tubes.
3. Remove the screws of the solenoid cover at the rear of the MGT and pull out the cover.
4. Check if the drip pointers in the funnels are correctly aligned to the cutouts in the tray. Else, oil collection and measurement in the measuring glass tubes will not be accurate.
5. If the alignment is not OK, press the actuator and adjust the position of the solenoid.
6. Tighten the nut of the solenoid at the rear of the MGT cabinet.
7. Loosen the screws at the rear of the MGT and adjust the position of the solenoid horizontally till the drip pointers are adjusted in the correct positions.
8. Tighten the MGT screws.

9. Decommissioning

9.1 Temporary shutdown

In the event of lengthy periods of non-use:

- Disconnect the EPS 610 from the mains.
- Drain the test oil from the test oil tank.
- Shut off and disconnect the water supply.
- Plug all the hoses.
- Apply anti-corrosive material to machined surfaces.
- Cover the EPS 610.

9.2 Change of location

- If the EPS 610 is passed on, all the documentation included in the scope of delivery must be handed over together with the unit.
- The EPS 610 is only ever to be transported in the original or equivalent packaging.
- Unplug the electrical connection.
- Heed the notes on initial commissioning.
- Contact customer service to shift the EPS 610 from one place to another.
- During transportation, fit transportation safeguards.
- Drain the test oil from the test oil tank.
- Ensure that there are no loose parts.
- Apply anti-corrosive to the machined surfaces of the EPS 610 before transportation.
- Secure the MGT.

9.3 Disposal and scrapping

9.3.1 Substances hazardous to water



Oils and greases as well as refuse containing oil and grease (e.g. filters) represent a hazard to water.

1. Substances hazardous to water must not be allowed to enter the sewage system.
2. Substances hazardous to water must be disposed of in accordance with the applicable regulations.



Test oil as per ISO 4113 is classified under used oil collection category 1. In category 1, the used oil must not contain any foreign substances such as used oils of a different category, gasoline or diesel. The corresponding refuse code number can be taken from the safety data sheet of the test oil.

9.3.2 EPS 610 and accessories

1. Disconnect the EPS 610 from the mains and detach the power cord.
2. Dismantle the EPS 610 and sort out and dispose of the different materials in accordance with the applicable regulations.

Dispose of used electrical and electronic devices, including cables, accessories and batteries, separately from household waste.

- Make use of the local return and collection systems for disposal.
- Proper disposal of the EPS 610 prevents environmental pollution and possible health hazards.

10. Technical data

10.1 EPS 610

Property	Unit	Value
Overall dimensions		
Length	mm	1770
Height	mm	1720
Width	mm	973
Weight	kg	850
Drive motor		
Voltage	V	400 - 415
Frequency	Hz	50
Ingress protection		IP32 (Overall bench including HMI)
		IP43 (Electrical cabinet)
Power	KW	11
Current (at maximum power)	A	28
Speed range (adjustable)	RPM	50-4000
Efficiency	%	89
Accuracy	RPM	± 2 - (For speed above 50 RPM)
Torque - Drive		
Speed - 0 – 1500 RPM	Nm	72
Speed - 1500 – 4000 RPM	Nm	72-26
MGT assembly		
Size of measuring glass	ml	30 and 180 (calibrated at 27 °C to achieve accuracy)
Quantity of measuring glasses		8 each
Bench		
Moment of inertia of graduated flywheel	Kgm ²	0.75
Shaft height (mounting rail height to axis of drive coupling)	mm	125 ± 0.1
Logic board		
Stroke counting	Stroke	1 - 9999
Delivery pump capacity		
Test-oil – low pressure	l/min	16.5
Test-oil – high pressure	l/min	1.8
Test-oil heater rating	KW	2.5
Test-oil cooling: Connection		½" BSP
Cooling water consumption at 17°C	l/min	15
Range of temperature (adjustable)	°C	30 - 60
Pressure gauges		
Internal pressure	kPa	0 to 1600
High pressure	MPa	0 to 6
Inlet pressure	kPa	0 to 600
Low inlet pressure	kPa	-100 to 300
Filling quantities		
Test oil tank	l	50
Top tray capacity for contaminated oil	l	10
HMI		
Color LCD display size	inches	5.7

Property	Unit	Value
Angular rotation of the display unit	degrees	45 (on each side)
Noise		
Workplace emission sound pressure level L_{PA} with drive motor running at a speed of 4000 min ⁻¹ and without injection pump	dB-A	83.18
Auxiliary power supply		
Adjustable DC power supply for start / stop magnet	V	12 / 24
	A	7
Permissible ambient temperature ranges		
Maximum ambient temperature	°C	40
Operating range	°C	5 to 40
Storage temperature	°C	-25 to 60
Miscellaneous		
Average time taken to heat test oil from 25 °C to 45 °C	minutes	approximately 20 minutes

10.2 Bench layout

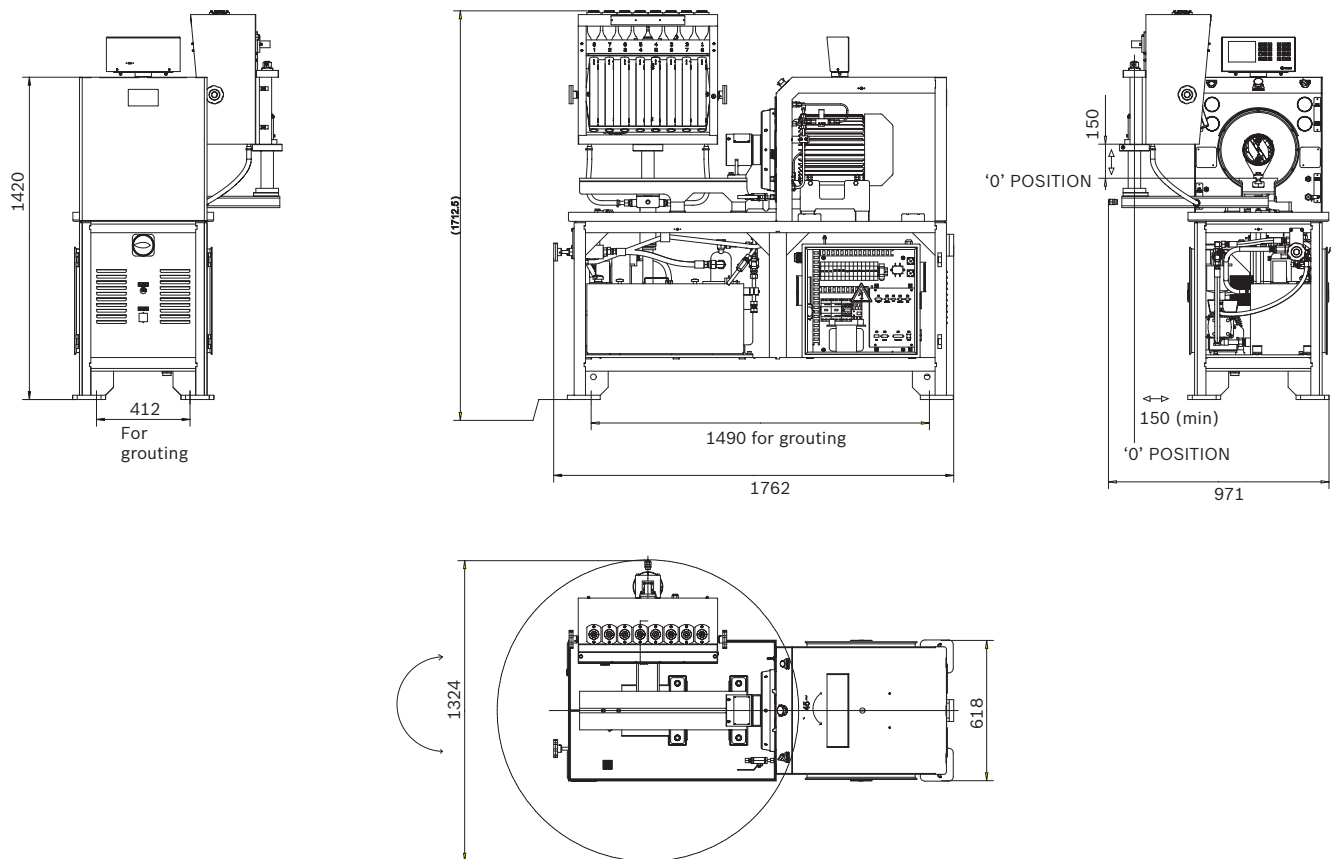


Fig. 21: Bench layout
(All dimensions in mm)

10.3 Tightening torques

For the purpose of safety, the tightening torques listed in the following sections must be used during routine maintenance or during repair.

10.3.1 Fastening parts

Tightening torques of the fastening parts:

Size	5.6	6.8	8.8	10.9
M 5			5 +2	
M 8	14 +3		23 +3	32 +5
M 10			45 +8	65 +8
M 12			80 +8	125 +10
M 14		90 +10	135 +10	
M 16		135 +10	210 +10	

10.3.2 Coupling halves

On the injection-pump camshaft

Size	Bevel gear diameter [mm]	Tightening torque [Nm]
M 12	17	60 +10
M 14 x 1,5	20	80 +10
M 18 x 1,5	25	130 +10
M 20 x 1,5	30	200 +20
M 24 x 1,5	35	250 +50
M 30 x 1,5	40	300 +50

10.4 Machinery noise information pursuant to the bench safety code

- Noise measurement performed in accordance with DIN EN ISO 3744 and DIN EN ISO 11201 standards.
- Sound power measurement performed in accordance with DIN ISO 3744 standard.

Measurement conditions	Test bench without injection pump		Test bench with injection pump (6 cylinder)
	0	4000	1050
Speed min-1			
Acoustic power level L_{WA} , db	67	86.43	83.48
Workplace related sound pressure level L_{pA} , db	57.2	83.18	78.4

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