

VARIFUEL2 200-120

MAINTENANCE AND REPAIR INSTRUCTIONS



VariFuel2 
MOTORTECH AIR/FUEL RATIO MIXER

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1 GENERAL INFORMATION

1.1 What Is the Purpose of this Installation Instruction?

The purpose of this maintenance and repair instruction is to assist installation of the product and support the technical staff in all maintenance and repair work to be carried out on the VariFuel2 200-120. Furthermore, this manual is aimed at preventing dangers to life and health of the user and third parties.

1.2 Who Is this Installation Instruction Targeted to?

The maintenance and repair instruction provides a code of conduct for personnel trained by MOTORTECH tasked with set-up, maintenance and repair of stationary gas engines. A certain level of technical knowledge with respect to the operation of stationary engines and basic knowledge of the components used are necessary.

1.3 What Symbols Are Used in the Installation Instruction?

The following symbols are used in this manual and must be observed:



Example

This symbol indicates examples, which point out necessary handling steps and techniques. In addition, you receive additional information from the examples, which will increase your knowledge.



Notice

This symbol indicates important notices for the user. Follow these. In addition, this symbol is used for overviews that give you a summary of the necessary work steps.



Warning

This symbol indicates warnings for possible risks of property damage or risks to health. Read these warning notices carefully and take the mentioned precautionary measures.



Danger

This symbol indicates warnings for danger to life, especially due to high voltage. Read these warning notices carefully and take the mentioned precautionary measures.

2 SAFETY INSTRUCTIONS

2.1 General Safety Instructions

MOTORTECH equipment is manufactured as state of the art and therefore safe and reliable to operate. Nevertheless the equipment can cause risks or damages can occur, if the following instructions are not complied with:

- The gas engine must only be operated by trained and authorized personnel.
- Operate the equipment only within the parameters specified in the technical data.
- Use the equipment correctly and for its intended use only.
- Never apply force.
- For all work, such as installation, conversion, adaptation, maintenance, and repair, all equipment must be disconnected from the power supply and secured against unintentional restarting.
- Perform only such maintenance and repair work as is described in this instruction, and follow the instructions given while working. For maintenance of the equipment, only use spare parts supplied by MOTORTECH. Further work must only be performed by personnel authorized by MOTORTECH. Non-compliance with the instructions will void any warranties for the proper function of the equipment as well as the responsibility for the validity of the certifications.
- Safety devices must not be dismantled or disabled.
- Avoid all activities that can impair the function of the equipment.
- Operate the equipment only while it is in proper condition.
- Investigate all changes detected while operating the gas engine or ignition system.
- Ensure compliance with all laws, directives and regulations applicable to the operation of your system, including such not expressly stated herein.
- If the system is not entirely tight and sealed, gas may escape and lead to an explosion hazard. Upon completion of all assembly works, always check the system's tightness.
- Always ensure adequate ventilation of the engine compartment.
- Ensure a safe position at the gas engine.

2.2 Special Safety Instructions for the Device

The following safety instructions must be observed during work on the VariFuel2:



Explosion hazard!

When the system is powered up, do not remove any connectors unless the system is not located in a potentially explosive atmosphere.



Explosion hazard!

If the system is not entirely tight and sealed, gas may escape and lead to an explosion hazard. Upon completion of all assembly works, always check the system's tightness. Make sure too that the gauge ports on the VariFuel2 are closed.

All works involving gas-carrying parts must be executed by trained personnel only.



Operational safety!

All screws of the connectors must be adequately tightened.



Risk of damage!

The stepper motor of the VariFuel2 is not suitable for carrying or lifting a gas mixer. There is a danger that the stepper motor could break, and if the gas mixer were to fall, it could result in injury or property damage.

Always carry or lift the gas mixer by its exterior housing.

2.3 Proper Disposal

After the expiration of its service life, MOTORTECH equipment can be disposed of with other commercial waste, or it may be returned to MOTORTECH. We will ensure its environmentally friendly disposal.

3 EQUIPMENT

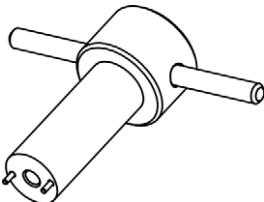
Depending on the work you carry out on your gas mixer, you need the following equipment:

Special MOTORTECH Tools

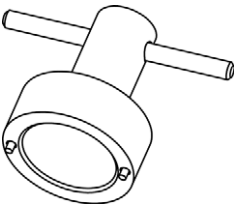
- VariFuel2 adjustment tool for belt tension for VariFuel2 200-120



- VariFuel2 locking tool for toothed pulley



- VariFuel2 tool for inspection window (only for VariFuel2 models with inspection window in upper section)



Stepper Motor Card

Some operations on the VariFuel2 require a subsequent adjustment of the fuel ring. In this case you need a suitable stepper motor card.

Pressure Test Bench

After the conclusion of all maintenance and repair work on the VariFuel2, you have to carry out a tightness test. In this case you need a suitable pressure test bench.

Additional Equipment

- Soft cloth
- Standard commercial solvent
- Wire brush
- Silicone spray
- Thread lock fluid (medium tight)
- Torque wrench
- Safety goggles
- Leak detection spray

4 REPAIR KITS

The maintenance and repair kits contain spare parts and wearing parts. With this manual staff trained by MOTORTECH can carry out maintenance and repair work on the VariFuel2 200-120.

There are four maintenance and repair kits for the VariFuel2 200-120:

- Basic kit
- Inlet nozzle kit
- Stepper motor kit
- Gauge port kit



Repair and maintenance only possible with basic kit

Components from the basic kit are needed to use the inlet nozzle kit and stepper motor kit. By contrast, the basic kit and gauge port kit can be used without components from other maintenance and repair sets.

The following tables provide information on the content of each individual maintenance and repair kit:

4.1 Basic Kit

The basic kit for the VariFuel2 200-120 includes the following components:

Components	Number
Shaft seal ring	1
O-ring small for inlet nozzle	1
Gasket for air-fuel mix	1
Gas connection seal	2
Washer for toothed pulley	1
Hexagon socket head cap screw M6x16 for motor adapter plate	4
Hexagon socket head cap screw M4x16 for toothed pulley	1
Copper gasket A10x13	1
Hexagon socket head cap screw M5x12 for stepper motor	4
Hexagon socket head cap screw M6x20 for inlet nozzle	4
O-ring 34.5x2.65 for cover of toothed pulley	1
O-ring 37.5x2.65 for stepper motor	1
O-ring for inlet and outlet nozzle	2
Locking screw A2 G1/8	1
Hexagon socket head cap screw M5x10 for maintenance cover	1
Locking screw A4 G1/4 A	1
Hexagon socket head cap screw M6x35 for outlet nozzle	4
Hexagon socket head cap screw M8x25 for closing plate	4
Hexagon socket head cap screw M8x35 for mounting flange	4
Copper gasket 13x18	1
Toothed pulley	1
Drive belt	1
Fuel ring	1
Self-locking nut M5 V2A	1

4 REPAIR KITS

4.2 Inlet Nozzle Kit

The inlet nozzle kit for the VariFuel2 200-120 includes the following component:

Components	Number
Inlet nozzle	1

4.3 Stepper Motor Kit

The stepper motor kit for the VariFuel2 200-120 includes the following components:

Components	Number
Stepper Motor	1
Shaft	1
Setscrew for shaft	1

4.4 Gauge Port Kit

The gauge port kit for the VariFuel2 200-120 includes the following components:

Components	Number
Instrument nozzle	1
Paper seal	1
Screw joint	1
Die ring	1
Union nut M16x1.5	1
Locking plug	1
Copper gasket 13x18	1

5 MAINTENANCE AND REPAIR

5.1 General Information



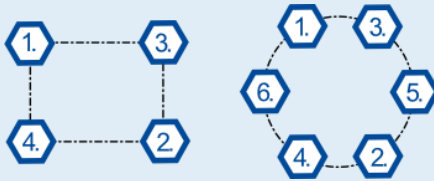
Explosion hazard!

Check the tightness of the system after conclusion of all maintenance and repair work. The VariFuelz may not be used under any circumstances without having passed the tightness test.



Tighten screws properly

Tighten the screws that are arranged in a rectangle or in a circle initially *always crosswise hand-tight*.



Then tighten the screws in the *same order* with the respective torque.



Tolerances for torques

All the torques stated in this instruction have a tolerance of $\pm 10\%$.

Maintenance and repair of the VariFuelz 200-120 are divided into five sections.

- *Outlet Nozzle* on page 15
- *Inlet Nozzle, Fuel Ring, Drive Belt* on page 16
- *Stepper Motor* on page 24
- *Gauge Ports* on page 32
- *Gas Inlets* on page 30

The components included in the basic kit should at all events be replaced during any maintenance of the fuel mixer. The components included in the other maintenance and repair kits must be replaced as necessary.

5 MAINTENANCE AND REPAIR

5.2 Information on Cleaning

Customized assembly and smooth functioning of the VariFuelz are only guaranteed with clean components. You may have to clean components of the VariFuelz before reinstallation which you do not replace, but would instead like to reuse.

Stepper Motor

Wipe off the stepper motor with a soft cloth.

Mechanical Components

Clean the surfaces with standard commercial solvents and a wire brush.

Wearing Parts

Wearing parts like seals and O-rings may not be reused.

5.3 Outlet Nozzle

5.3.1 Material Needed

Parts from the Basic Kit

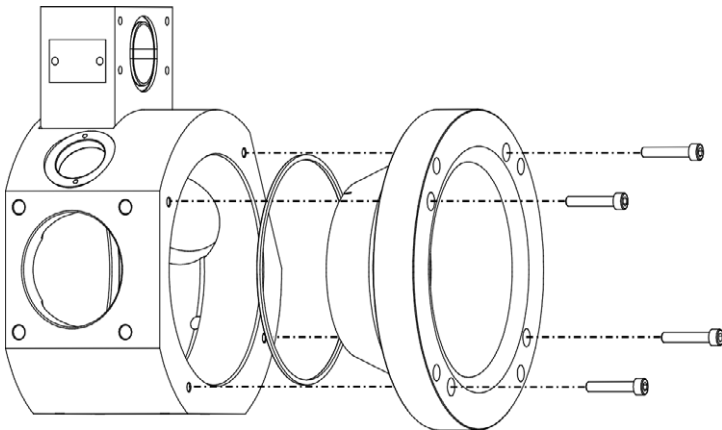
Large O-ring **1**, hexagon socket head cap screw M6x35 (4x) **2**

Additional Material

Thread lock fluid (medium tight), silicone spray

5.3.2 Preparation

The explosion view provides information on how the outlet nozzle has been installed.

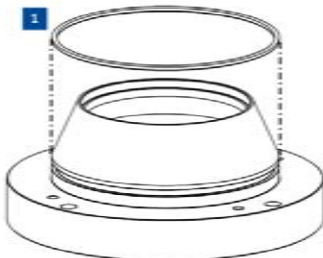


Remove the outlet nozzle and the large O-ring.

5.3.3 Installation

The following steps show the installation of the outlet nozzle.

1. Place the large O-ring **1** on the outlet nozzle.



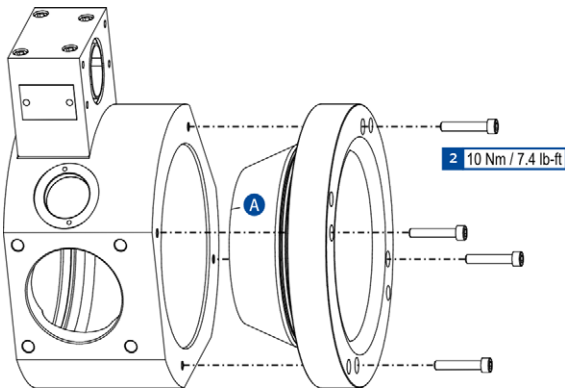
5 MAINTENANCE AND REPAIR

2. Moisten the large O-ring with silicone spray.
3. Moisten the hexagon socket head cap screws M6x35 **2** with thread lock fluid.
4. Screw the outlet nozzle into the housing.



Align marking

The reference marking **A** must be visible in the inspection window of the gas mixer after installation. It is the reference point for the scale on the fuel ring.



- The outlet nozzle has been installed.

5.4 Inlet Nozzle, Fuel Ring, Drive Belt

5.4.1 Material needed

Parts from the Basic Kit

Drive belt **1**, fuel ring **2**, small O-ring **3**, large O-ring **4**, hexagon socket head cap screw M6x20 (4x) **6**, self-locking nut M5 V2A **7**

Parts from the Inlet Nozzle Kit

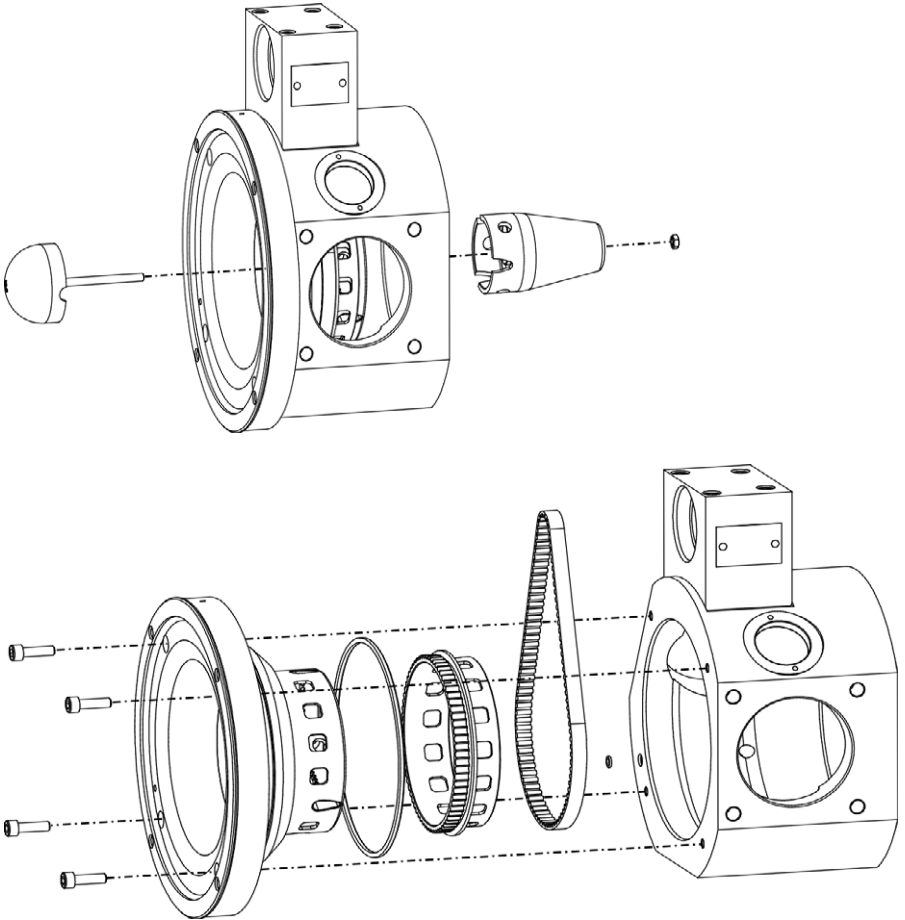
Inlet nozzle **5**

Additional Material

Thread lock fluid (medium tight), silicone spray

5.4.2 Preparation

The explosion views provide information on how the flow body, inlet nozzle, fuel ring and drive belt are installed.



Replace drive belt

In order to replace the drive belt the stepper motor together with the toothed pulley must first be de-installed (see section *Stepper Motor* on page 24).

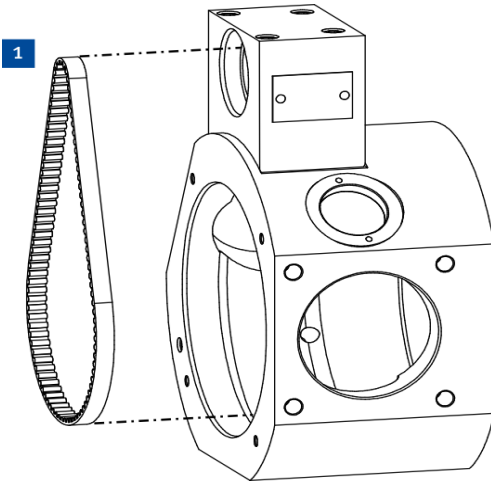
5 MAINTENANCE AND REPAIR

Remove the flow body, inlet nozzle, the large O-ring, small O-ring, fuel ring and if necessary the drive belt.

5.4.3 Installation

The following steps show the installation of the inlet nozzle, the fuel ring and drive belt.

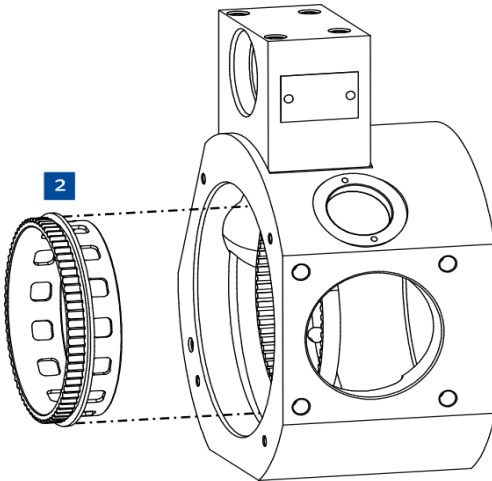
1. If applicable, insert the drive belt **1** through the inlet opening into the gas mixer.



2. Insert the fuel ring **2** through the inlet opening into the drive belt.

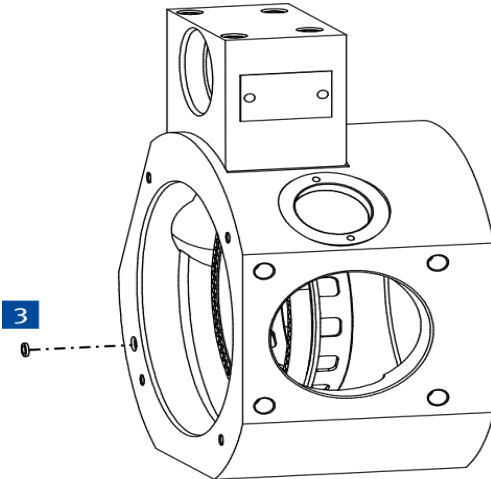
**Cogs must interlock**

The cogs of the fuel ring and drive belt must interlock with each other throughout.

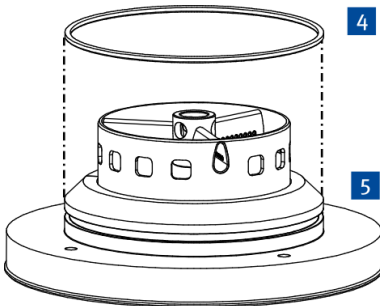


5 MAINTENANCE AND REPAIR

3. Insert the small O-ring **3** into the gas mixer. (New housing designs have no sink. The small O-ring may not be inserted in these.)



4. Place the large O-ring **4** on the inlet nozzle **5**.



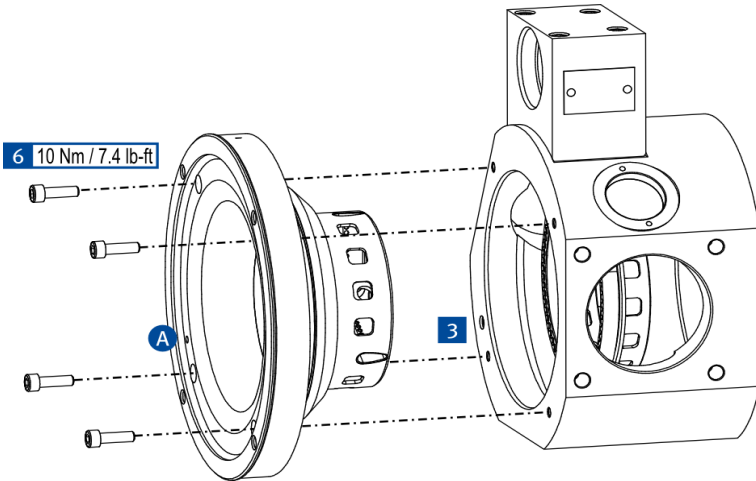
5. Moisten the large O-ring with silicone spray.
6. Moisten the hexagon socket head cap screws M6x20 **6** with thread lock fluid.

7. Screw the inlet nozzle into the housing.



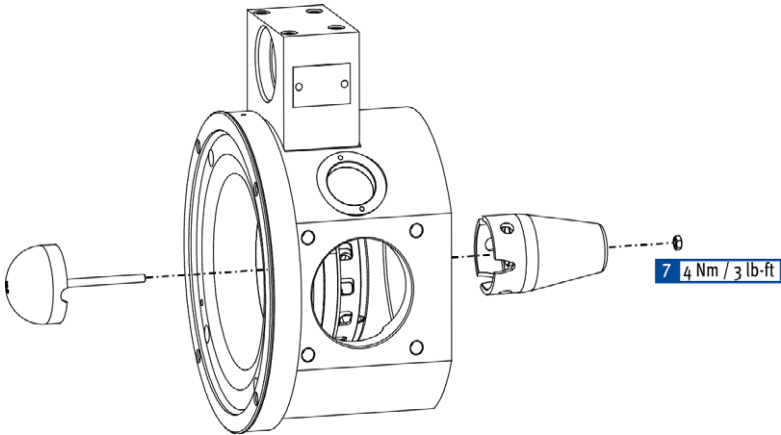
Alignment of the inlet nozzle

The drill hole **A** in the inlet nozzle must align with the corresponding drill hole (in several housing versions with small O-ring **3**) in the housing.



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8. Screw the flow body with the self-locking nut M5 V2A **7** into the VariFuel2. The torque depends on the material of the flow body.
- Aluminum flow body: 5 Nm (3.7 lb-ft)
 - Plastic flow body 3 Nm (2.2 lb-ft)



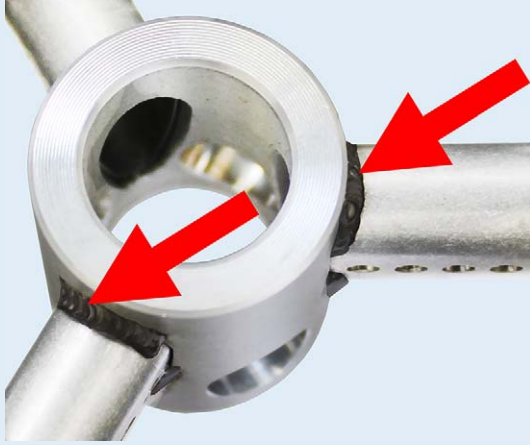
Risk of damage!

An improperly installed flow body can damage gas mixer and engine. Therefore observe the following points.

- The flow body must be installed to fit properly and may not wobble.
- The self-locking nut may not be reused under any circumstances. It is only suitable for tightening once.

**Welded central nozzle ring**

If your new inlet nozzle has a welded central nozzle ring (see illustration), several older flow bodies cannot be installed to fit exactly.



In this case contact MOTORTECH.

- ▶ The inlet nozzle, fuel ring and if applicable the drive belt have been installed.

**Adjust the fuel ring if necessary**

If you have demounted the drive belt or the fuel ring, the fuel ring must then be adjusted (see section *Stepper Motor* on page 24).

5 MAINTENANCE AND REPAIR

5.5 Stepper Motor

5.5.1 Material Needed

Parts from the Basic Kit

Shaft seal ring **4**, hexagon socket head cap screw M5x12 (4x) **5**, toothed pulley **6**, washer **7**, hexagon socket head cap screw M4x16 **8**, O-ring 37.5x2.65 **9**, hexagon socket head cap screw M6x16 (4x) **10**, O-ring 34.5x2.65 **11**, hexagon socket head cap screw M5x10 **12**

Parts from the Stepper Motor kit

Setscrew **1**, shaft **2**, stepper motor **3**

Stepper Motor Card

To adjust the fuel ring you need an operational stepper motor card.

Special Tools from MOTORTECH

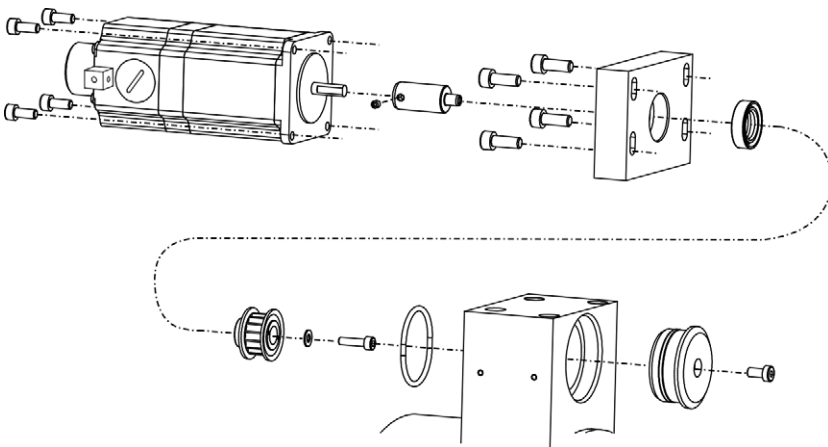
- VariFuelz adjustment tool for belt tensioning
- VariFuelz locking tool for toothed pulley
- VariFuelz tool for inspection window (only in VariFuelz models with inspection window in upper section)

Additional Material

Thread lock fluid (medium tight), silicone spray

5.5.2 Preparation

The explosion view provides information on how the stepper motor has been installed.



The following steps describe how the stepper motor is disconnected from the VariFuel2.

1. Remove the maintenance cover.
New VariFuel2 models have an inspection window instead of the maintenance cover. Remove it with the VariFuel2 tool for inspection windows. For this purpose read the instruction for the VariFuel2 tool for inspection windows.
2. Remove the adapter plate with the stepper motor and O-ring from the housing of the VariFuel2.
3. Disconnect the toothed pulley from the shaft of the stepper motor.
4. Disconnect the adapter plate, the stepper motor, the shaft and shaft seal ring from each other.

5.5.3 Installation and Calibration

Stepper Motor Installation



Conditions for the installation of the stepper motor

In order to install the stepper motor on the VariFuel2 the inlet nozzle, fuel ring, drive belt and outlet nozzle have to be installed (see section *Inlet Nozzle, Fuel Ring, Drive Belt* on page 16).

The following steps show the installation of the stepper motor.

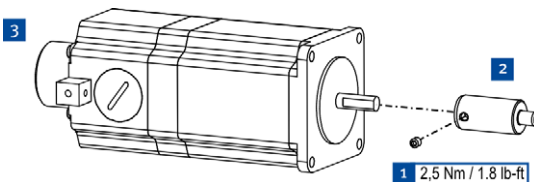
1. Moisten the setscrew **1** with thread lock fluid.
2. Place the shaft **2** on the axis of the stepper motor **3**.



Alignment and positioning of the shaft

Observe the following while positioning the shaft.

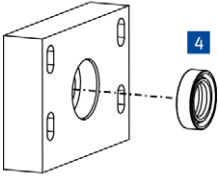
- The drill hole in the shaft must be aligned with the flattening of the axle.
- The shaft must be 1 mm from the stepper motor.



3. Moisten the shaft seal ring **4** with silicone spray.

5 MAINTENANCE AND REPAIR

- Press the shaft seal ring **4** into the adapter plate.

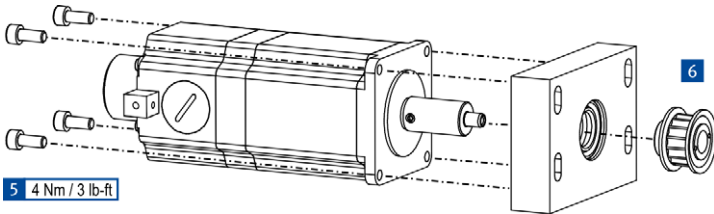


- Moisten the hexagon socket head cap screws M5x12 **5** with thread lock fluid.
- Screw the adapter plate to the stepper motor and place the toothed pulley **6** on the shaft.



Observe alignment of stepper motor

Align the stepper motor and adapter plate as shown in the illustrations. The ground block and the elongated holes on the adapter plate serve as orientation.



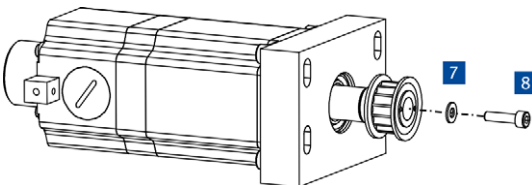
5 4 Nm / 3 lb-ft

- Attach the toothed pulley with the washer **7** and the hexagon socket head cap screw M4x16 **8** to the shaft of the stepper motor.

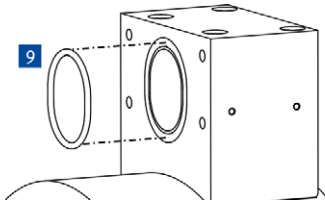


Do not tighten the bolts

Do not tighten the hexagon socket head cap screw M4x16 **8**. The toothed pulley must be rotatably mounted on the shaft to allow the fuel ring to be adjusted.



8. Insert the O-ring 37.5x2.65 **9** into the housing of the VariFuel2.

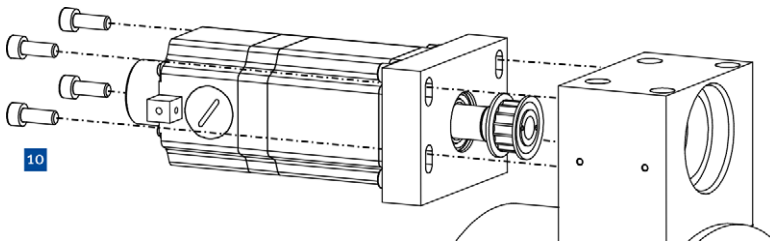


9. Attach the stepper motor with the hexagon socket head cap screws **10** M6x16 of the adapter plate to the VariFuel2.



Do not tighten the screws

Do not tighten the hexagon socket head cap screws M6x16 **10**. The stepper motor has to remain movable to enable the correct belt tension to be set.



10. Tighten the drive belt with the VariFuel2 adjusting tool for belt tension. For this purpose read the instruction for the VariFuel2-adjusting tool for belt tension.
- ▶ The stepper motor has been installed. You can continue with the adjustment of the fuel ring.

5 MAINTENANCE AND REPAIR

Adjusting the Fuel Ring



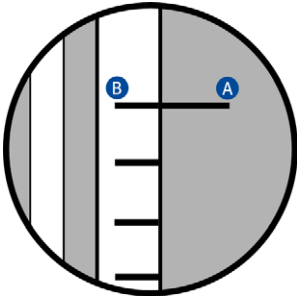
Conditions for the adjustment of the fuel ring

In order to be able to adjust the fuel ring, the following conditions must be met.

- The outlet nozzle must be installed (see section *Outlet Nozzle* on page 15).
- Inlet nozzle and fuel ring have to be installed (see sections *Inlet Nozzle*, *Fuel Ring*, *Drive Belt* on page 16)
- The toothed pulley may not be tightened. It must be mounted rotatably on the shaft.

Adjust the fuel ring as follows.

1. Connect the stepper motor to the stepper motor card. For this purpose read the operating manual of the stepper motor card.
2. Run the stepper motor to the closed position.
3. Turn the reference scale of the fuel ring in the inspection window on the side of the VariFuel2 by moving the drive belt by hand. Then set the closed position of the fuel ring so that the reference marking **A** points to the last line **B** of the reference scale.



4. Hold the toothed pulley with the VariFuel2 locking tool for the toothed pulley. For this step read the instruction for the VariFuel2 locking tool for the toothed pulley. Tighten the toothed pulley with the hexagon socket head cap screw M4x16 **8** on the shaft (torque 2.5 Nm / 1.9 lb-ft).



Conduct in the event of an error message

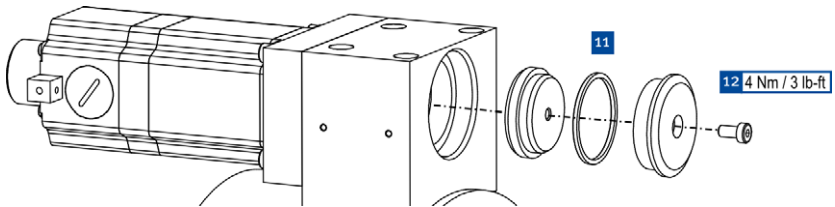
If you move the stepper motor while tightening the screw, you will get an error message from the stepper motor card. Confirm this via the MICT.

5. Trigger a reference run via the stepper motor card.
 - ▶ The fuel ring has been adjusted and the stepper motor approaches all positions correctly again.

Installing the Maintenance Cover

Install the maintenance cover as follows.

1. Place the O-ring 34.5x2.65 **11** between the two halves of the maintenance cover.
2. Insert the maintenance cover into the maintenance opening.
3. Fasten the maintenance cover with the hexagon socket head cap screw M5x10 **12**.



Inspection windows in new VariFuel2 models

Newer models of the VariFuel2 do not have a maintenance cover, but instead an inspection window. Install this with the VariFuel2 tool for inspection windows. For this purpose read the instruction for the VariFuel2 tool for inspection windows.

- ▶ The maintenance cover has been installed.

5 MAINTENANCE AND REPAIR

5.6 Gas Inlets

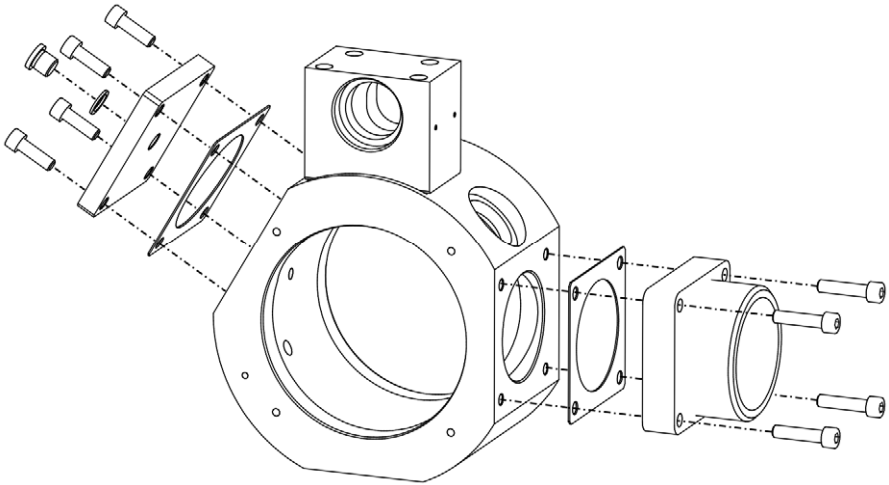
5.6.1 Material Needed

Parts from the Basic Kit

Gas connection seal (2x) **1**, hexagon socket head cap screw M8x25 (4x) **2**, locking screw A4 G1/4 **3**, copper gasket 13x18 **4**, hexagon socket head cap screw M8x35 (4x) **5**.

5.6.2 Preparation

The explosion view provides information on how the closing plate and mounting flange are attached. The position of the closing plate and mounting flange can be exchanged depending on the application. It is also possible to install a mounting flange on both gas inlets.



Remove the mounting flange(s) and if necessary the closing plate.

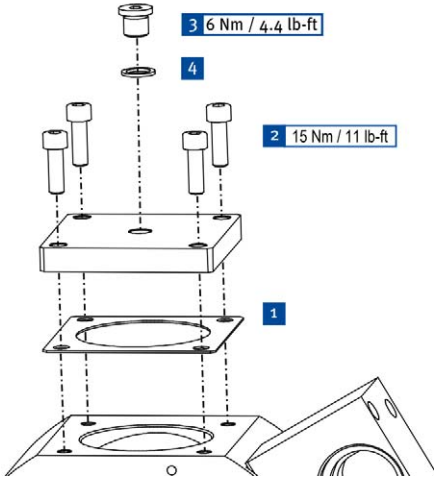
5.6.3 Installation

Close Gas Inlet

The following steps describe the closing of the gas inlet:

1. Place the gas connection seal **1** on the gas mixer.
2. Fasten the closing plate with the hexagon socket head cap screws M8x25 **2**.

3. Close the measurement port with the locking screw A4 G1/4 A **3** and the copper gasket 13x18 **4** (not present in several models).



- ▶ The closing plate has been installed.

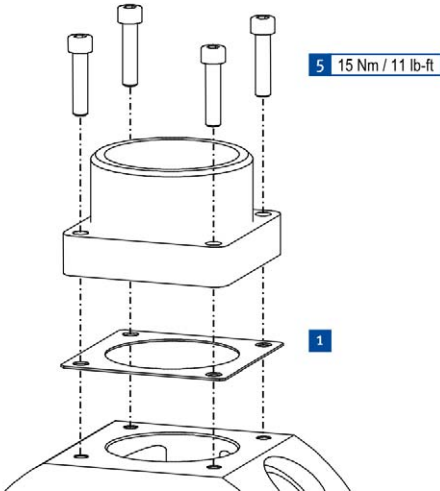
Install Mounting Flange

The following steps describe the installation of a mounting flange.

1. Place the gas connection seal **1** on the gas mixer.

5 MAINTENANCE AND REPAIR

2. Screw the mounting flange with the hexagon socket head cap screws M8x35 **5** to the gas mixer.



- The mounting flange has been installed.

5.7 Gauge Ports

5.7.1 Material Needed

Parts from the Basic Kit

Locking screw **3**, A2 G1/8, copper gasket 10x13 **4**

Parts from the Gauge Port Kit

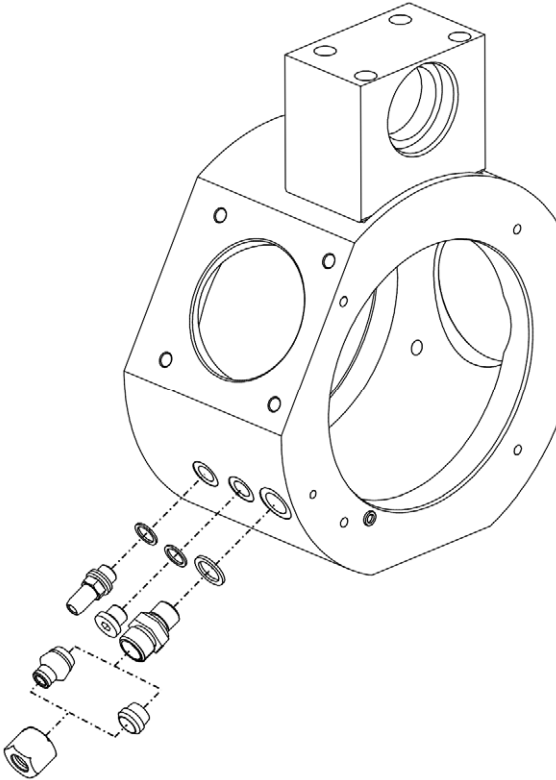
Instrument nozzle **1**, paper seal **2**, screw joint **5**, copper gasket 13x18 **6**, locking plug **7a**, die ring **7b**, union nut M16x1.5 **8**

Additional Material

Thread lock fluid (medium tight)

5.7.2 Preparation

The explosion view provides information on how the gauge ports have been installed.



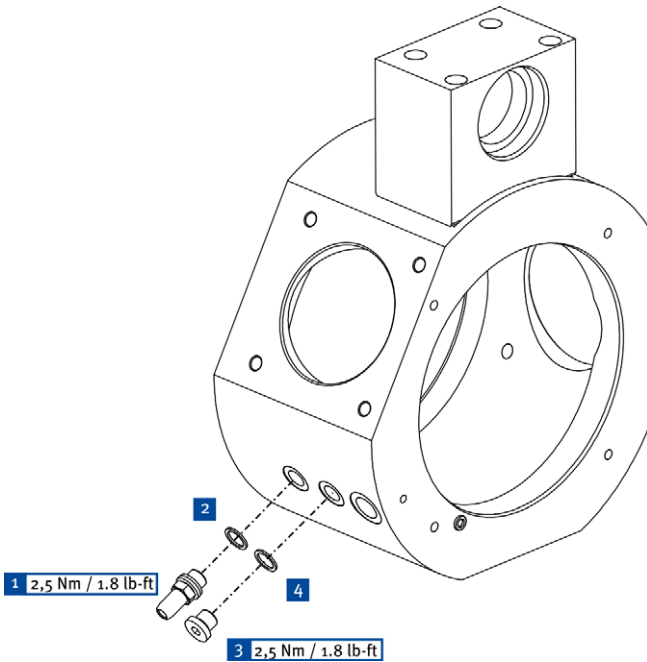
Remove the gauge ports.

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5.7.3 Installation

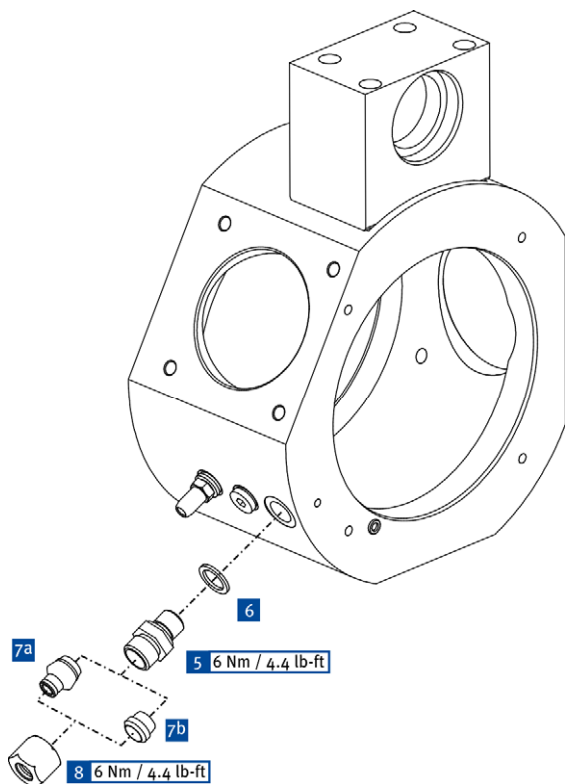
The following steps show the installation of the gauge ports.

1. Screw in the instrument nozzle **1** together with the paper seal **2**.
2. Screw in the locking screw **3** together with the copper gasket 10x13 **4**.



3. Moisten the smaller thread of the screw joint A2 G1/8 **5** with the thread lock fluid.
4. Screw in the screw joint A2 G1/8 together with the copper gasket 13x18 **6**.
5. Insert the locking plug **7a** (when mounting a control cable, insert the die ring **7b**).

6. Attach the locking plug or die ring with the union nut M16x1.5 **8**.



- ▶ The gauge ports have been installed.

5.8 Tightness Test

After the conclusion of all maintenance and repair work on the VariFuel2, you have to carry out a tightness test. This ensures that no gas can escape during operation.

If your VariFuel2 does not pass the tightness test, it may not be used under any circumstances.

5.8.1 Equipment Needed

You need the following equipment for the tightness test.

- Suitable pressure test bench
- Leak detection spray
- Safety goggles

5 MAINTENANCE AND REPAIR

5.8.2 Carry Out Test



Risk of injury!

Overpressure can detach components from the VariFuelz. Wear protective goggles and protect yourself and other people from flying parts.



Risk of damage

Excessive pressure can destroy the VariFuelz. Consequently, the pressure applied may not exceed 1 bar.

Conduct the tightness test as follows:

1. Insert your VariFuelz in the pressure test bench. For this purpose read the operating manual for the pressure test bench.
2. Make sure that all gauge ports are sealed.
3. Put on safety goggles.
4. Set a pressure of 0.5 bar to 1 bar.
5. Spray the VariFuelz with leak detection spray.
 - ▶ Leaks will become visible.

If the VariFuelz has no leaks, you can use it.

Leaks

If leaks emerge during the tightness test, proceed as follows:

1. Make sure that all screws are tightened with the appropriate torque.
2. Make sure that all seal rings have been inserted properly.
3. Conduct the tightness test again.

If the VariFuelz still does not pass the tightness test, you must not use it. In this case, contact MOTORTECH (see section *Customer Service Information* on page 38).

6 INSTALLATION AND START UP

If your VariFuel2 passed the tightness test required after conclusion of all maintenance and repair works, you can install the gas mixer and put it into operation.

Follow the instructions of the VariFuel2 operating manual during the installation and start up.

7 SERVICE AND CUSTOMER SERVICE

For more information read also the VariFuelz operating manual.

7.1 Customer Service Information

You can reach our customer service during business hours at the following phone and fax number, or by e-mail:

Phone: +49 5141 93 99 0

Fax: +49 5141 93 99 99

Email: service@motortech.de

7.2 Returning Equipment for Repair / Inspection

Get a return form and return number from MOTORTECH to return the device for repair and inspection.

Fill out the return form completely. The completely filled out return form guarantees fast, smooth processing of the repair order.

Send the device and the return form to one of the two addresses below or to the nearest MOTORTECH representative:

MOTORTECH GmbH

Hogrevestr. 21-23
29223 Celle

Germany

Phone: +49 5141 93 99 0

Fax: +49 5141 93 99 98

www.motortech.de

motortech@motortech.de

MOTORTECH Americas, LLC

1400 Dealers Avenue, Suite A
New Orleans, LA 70123

USA

Phone: +1 504 355 4212

Fax: +1 504 355 4217

www.motortechamericas.com

info@motortechamericas.com

7.3 Instructions for Packaging the Equipment

For return shipment, equipment should be packaged as follows:

- Use packaging material that does not damage the equipment surfaces.
- Wrap the equipment with sturdy materials and stabilize it inside the packaging.
- Use sturdy adhesive film to seal the packaging.

Original MOTORTECH Accessories for Stationary Gas Engines

As a supplier, MOTORTECH develops, produces and distributes accessories as well as spare and wearing parts for nearly all kinds of stationary gas engines worldwide: ignition control and monitoring, industrial spark plugs and high tension leads, wiring systems and gas regulation – from detonation to speed control and complete gas engine management. On-site support and special training courses complete our service.



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