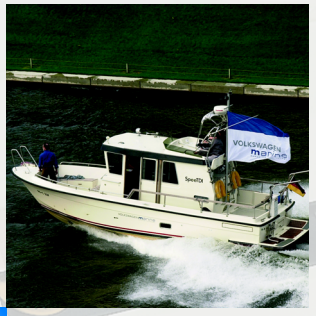
Installation description EB05

Design and function

Boat engines from Volkswagen Marine

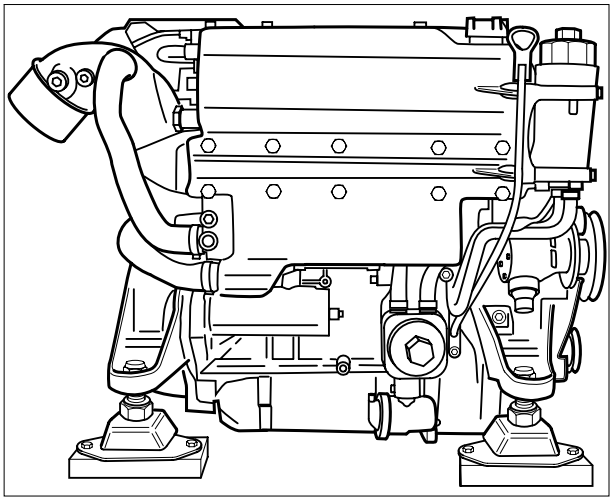


TDI 100-5
TDI 120-5
TDI 150-5 **SDI 55-5**
TDI 150-5D **SDI 75-5**
TDI 165-5

VOLKSWAGEN marine
SUPERIOR TECHNOLOGY

Forward

This installation description explains the procedure for installing all 5 cylinder Volkswagen Marine boat engines.



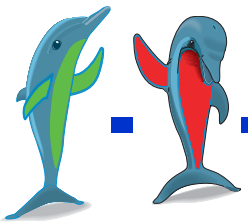
EB5-0001

Example: 5 cylinder SDI 55-5

General

- Products, that are lot listed in this installation description but which are nevertheless required, should only be sourced from specialist suppliers.
- The professional installation of this engine and its component parts is very important to make sure all components function correctly together in a fault-free manner.
  Therefore all work must be carried out with the utmost care.

NEW



Important Note

This installation manual includes the design and functioning of new developments!
The contents will not be updated.

Please see the relevant KD literature for the latest testing, adjustment and repair instructions!

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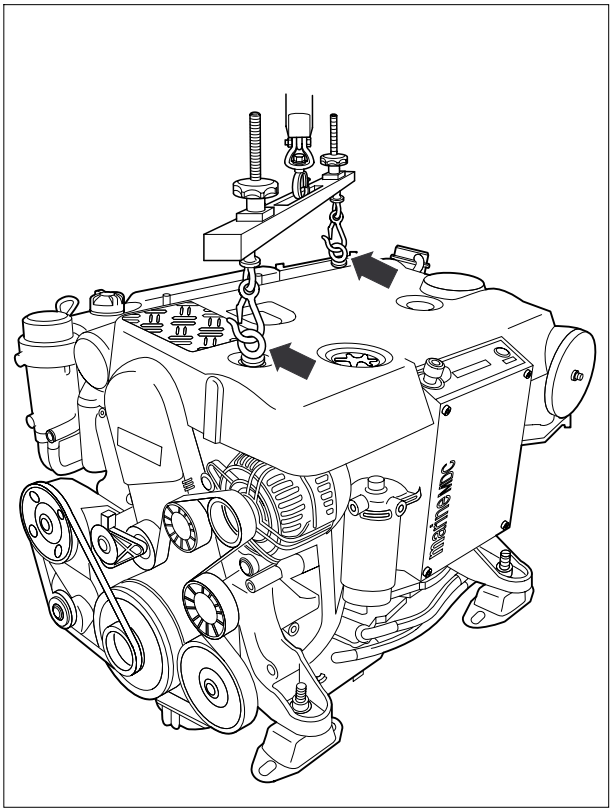
Installation instructions

- To lift the Volkswagen Marine boat engine out of its transport container, the transport eyes, provided in the tool kit, must be screwed into the threaded holes provided (see arrows in the figure). An engine hoist and suitable suspension device should be used.
- When installing or removing the Volkswagen Marine boat engine, the two suspension eyes provided on the engine (see figure) are to be used.
- Choose the engine installation location and compartment so that engine maintenance work may be easily carried out.
- Make sure that when installing or removing the engine, there is sufficient free space.

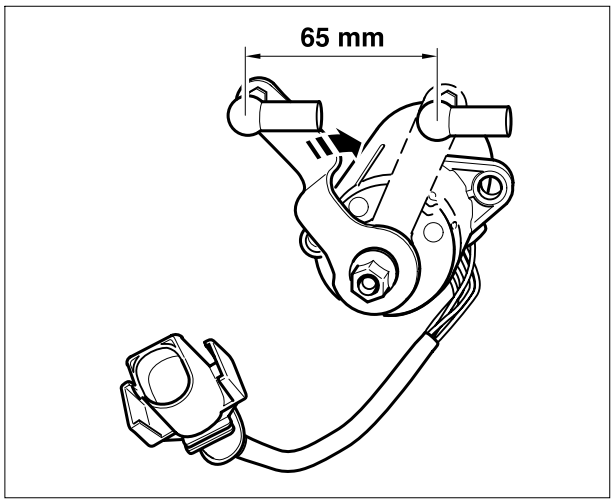


EB5-0096

Qualified specialists of the Volkswagen Marine team are at your disposal if you have specific questions or require technical information relating to the installation of the Volkswagen Marine boat engine.

Adjustment of the throttle bowden cable on the sender for throttle lever position

Adjust the throttle bowden cable so that there is a difference of 65 mm between idling and full throttle positions (see figure).



EB5-0097

Note

To achieve full engine output, the sender dimension must be correctly set.

Installation instructions

Retrofitting of a reverse gear unit to the Volkswagen Marine boat engine

- When retrofitting a reverse gear unit, various technical details must be observed and components exchanged. Please contact your Volkswagen Marine dealer for advice.

Operating an engine with a reverse gear unit

- Observe the instructions in your instruction manual!

Propeller model drive

- When selecting a propeller, ensure that the engine can attain the nominal rotation speed in all operating modes.

Operation with battery isolating diodes

- Operation with battery isolating diodes is **not** permitted.

- Always use battery relays. If in doubt, please contact your nearest Volkswagen Marine dealer.

Customized instrumentation (optional)

- If you require customized instrumentation, please contact your nearest Volkswagen Marine dealer.

Connection of a hot water boiler

- If you wish to install a hot water boiler, please contact your nearest Volkswagen Marine dealer.

If you do not observe the installation guidelines, your Volkswagen Marine boat engine may be damaged.

Introduction

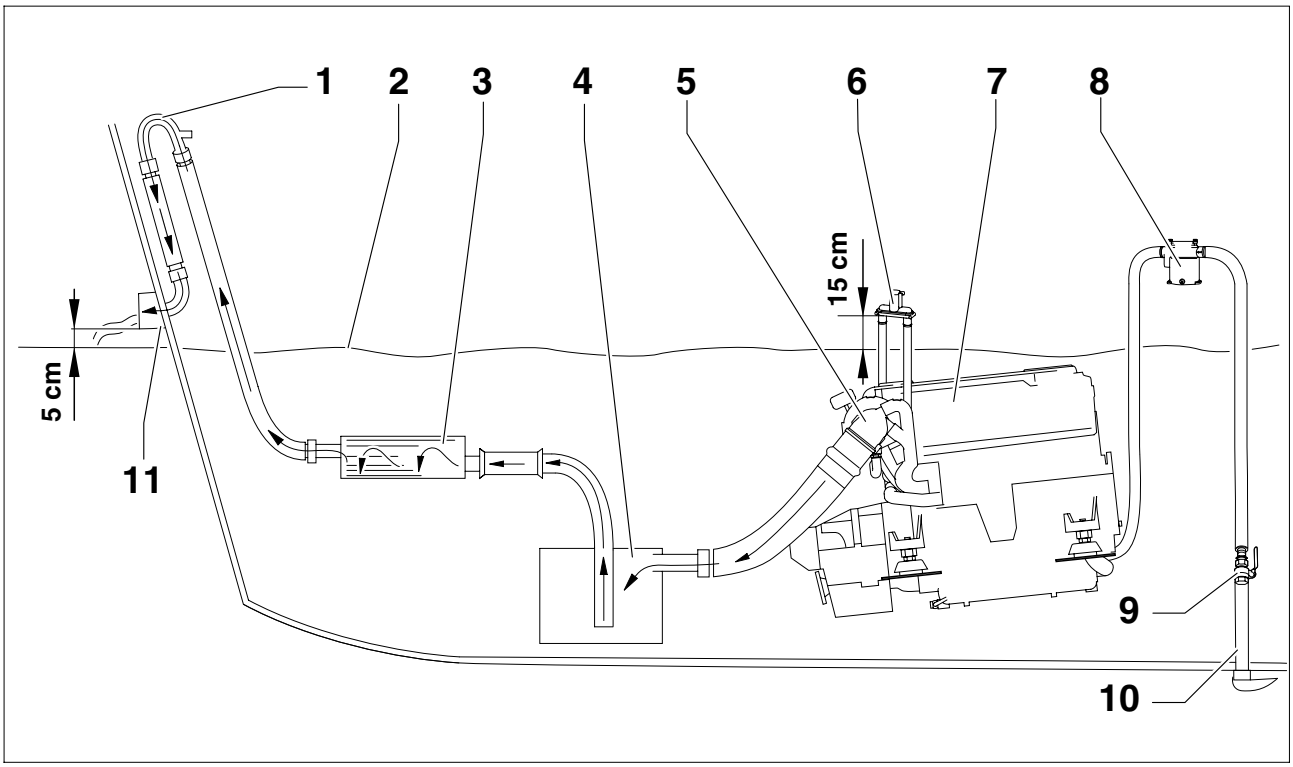
Volkswagen Marine boat engines are operated using wet exhaust systems.

Note

The water collector (item 4. in the figure) should be dimensioned so that it can accept the total amount of seawater / freshwater that can flow back.

The seawater / freshwater mixes with the exhaust gases, cooling them considerably so that in the remainder of the exhaust system, connection hoses made from rubber and PVC parts, capable of withstanding temperatures up to at least 200 °C, can be used.

Overview of the exhaust system installation: the example shown is a TDI engine with a reverse gear unit



EB5-0116

Legend

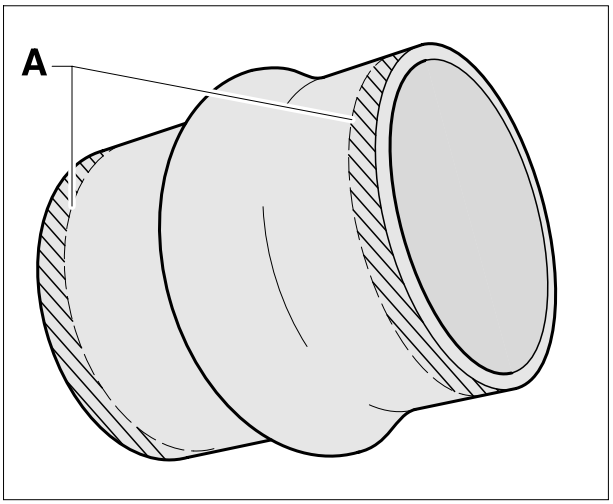
1. Swan-neck throat (the lower edge of the exhaust gas pipe at the transom outlet must be at least 5 cm above the water line)
2. Water line
3. Silencer
4. Water collector
5. Exhaust pipe
6. Ventilation unit (fit at least 15 cm above the water line)
7. Engine
8. Sea water / fresh water filter
9. Sea water / fresh water valve
10. Intake cap
11. Transom outlet

Exhaust system

Notes

- The complete exhaust system should be installed with as few pipe bends as possible. A minimum pipe cross section* of 100 mm must be maintained.
- Hose connections **-A-** should always be secured with double hose clips.
- Hose connections and rubber sleeves must be temperature-resistant.

** Note:*
The pipe cross-section for the SDI-Motor may be after consulting VW Marine!



EB5-0005

Exhaust gas pressures

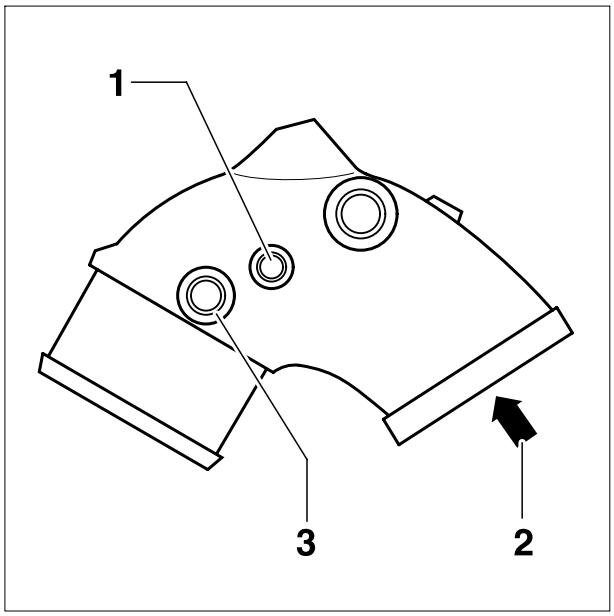
The exhaust system should not be made too long, to ensure that the correct maximum value for the exhaust gas counter pressure is not exceeded.

Exhaust gas pressures for particular motor units operating at rated power output:

- SDI 55-5 at 40 kW = 60 mbar
- SDI 75-5 at 55 kW = 150 mbar
- TDI 100-5 at 74 kW = 120 mbar
- TDI 120-5 at 88 kW = 200mbar
- TDI 150-5D at 108 kW = 250mbar
- TDI 150-5 at 111 kW = 250mbar
- TDI 165-5 at 121 kW = 250mbar

These values should not be exceeded.

SDI exhaust pipe connection



EB5-0086

Legend

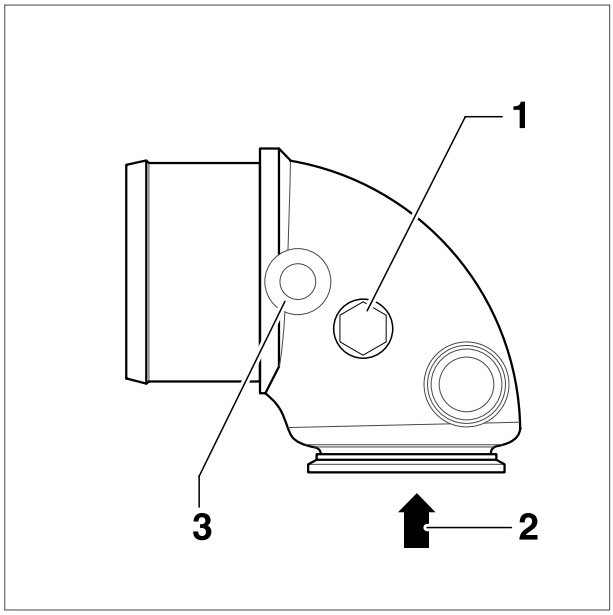
1. Screw plug for exhaust gas withdrawal
2. Exhaust gas inlet
3. Connection for freshwater temperature sensor (optional)

The measurement is made in the exhaust pipe connection. To do this, the measurement screw (see figure, item 1) must be unscrewed from the exhaust pipe connection and the exhaust gas withdrawal probe inserted.

Note

Instead of the screw plug, an exhaust gas temperature sensor may be fitted.

TDI exhaust pipe connection



EB5-0087

Legend

1. Screw plug for exhaust gas sampling
2. Exhaust gas inlet
3. Connection for freshwater temperature sensor (optional)

Unit mounting / engine mounting

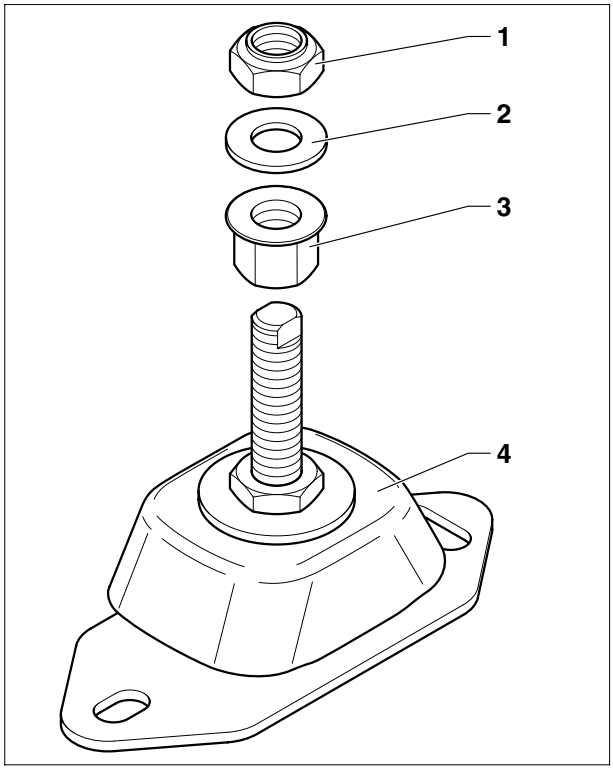
Instructions for installation of the unit mounting

- Do not tension the unit mounting when fitting it. To do so may result in severe vibration and damage.
- After installation and alignment of the engine, ensure that no residual tensions exist in the drive train and the unit mountings.
- Only use original Volkswagen Marine unit mountings.
- The securing screws for the unit mounting on the hull of the boat must be provided with washers (see upper figure on page 11).

Procedure

Centre and incline the engine to the appropriate height using the height adjuster (see item 3.in the figure) on the unit mounting. Ideally, centring will be in the middle of the height adjustment range.

After aligning the engine, uniformly tighten the securing nuts (see figure, item 1) on the unit mountings to a torque of **105 ± 5** Nm.



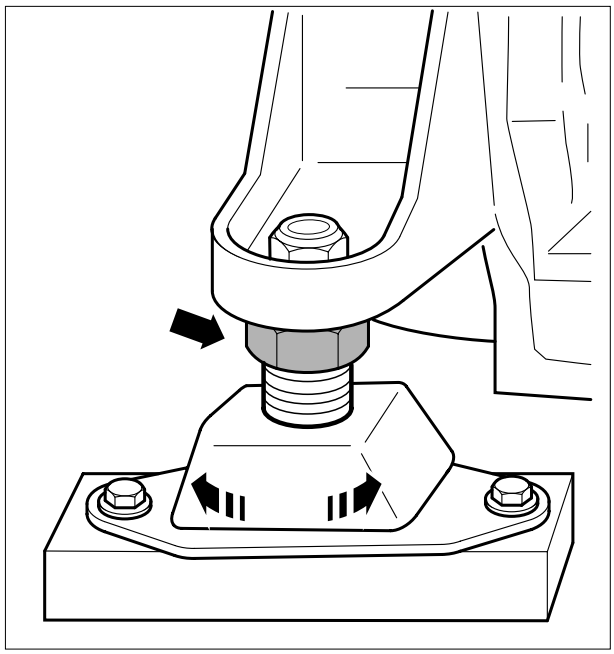
EB6-0015

Legend

1. Securing nut: 105 ± 5 Nm
2. Washer
3. Collar nut for height adjustment
4. Unit mounting with base plate

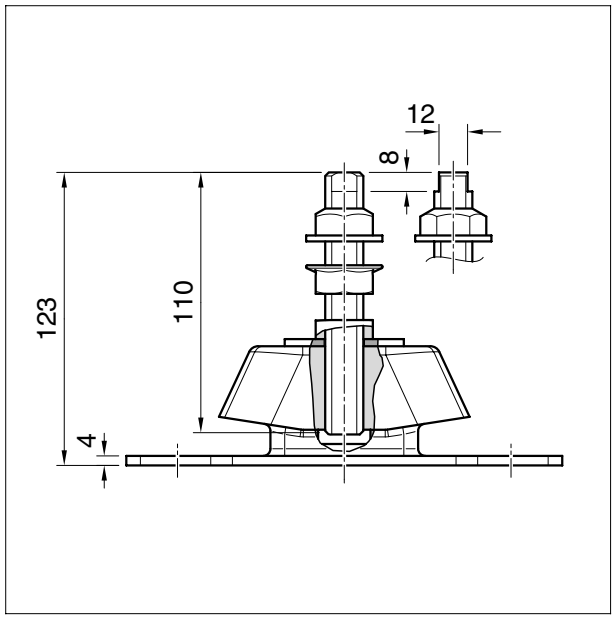
To prevent sideways turning (twisting) during tightening, the height adjuster -arrow- of the unit mounting / engine mounting must be held (turned in the opposite direction) with a suitable tool (e.g. an open-ended spanner).

To secure the base plate to the boat's hull, use securing screws with suitable washers.



EB5-0077

Unit mounting dimensions



EB6-0016

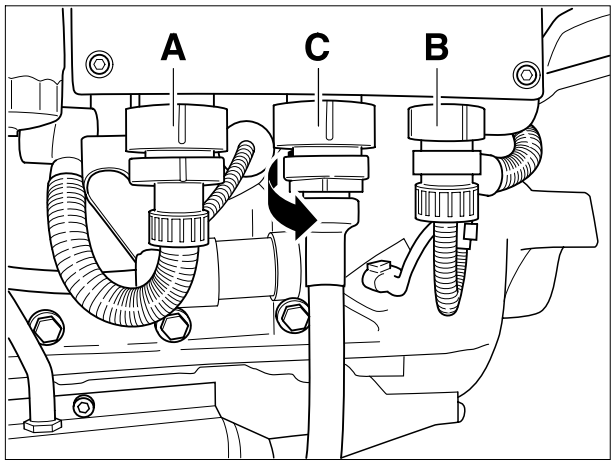
Electrical system

Connections to the engine

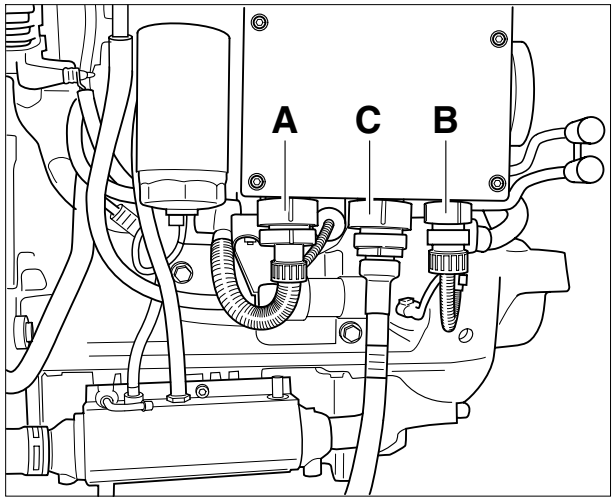
- Screw in the multiway connectors **-A-**, **-B-** and **-C-** of the engine central electrical system and the starter unit / relay box in the direction indicated by the arrow until the end ratchet connection is felt and the plugs are securely connected.

Note

Use the wiring harness tools, T 01905 and T 01906, to loosen and tighten the multiway connectors.



EB5-0010

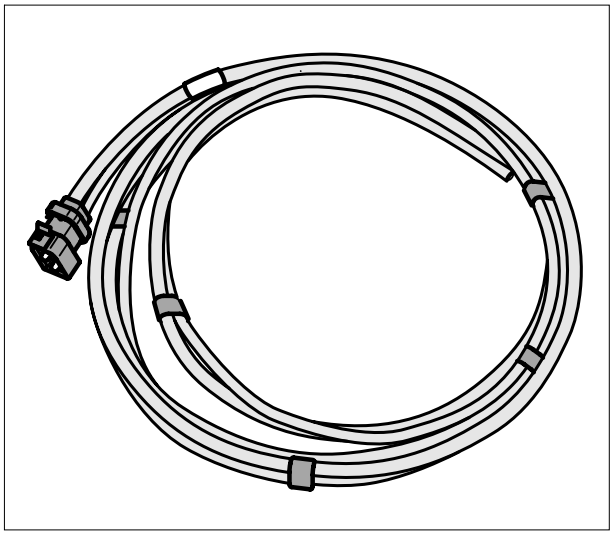


EB5-0009

The multiway connectors -A- and -B- are factory fitted. Connector -C- is fitted after engine installation.

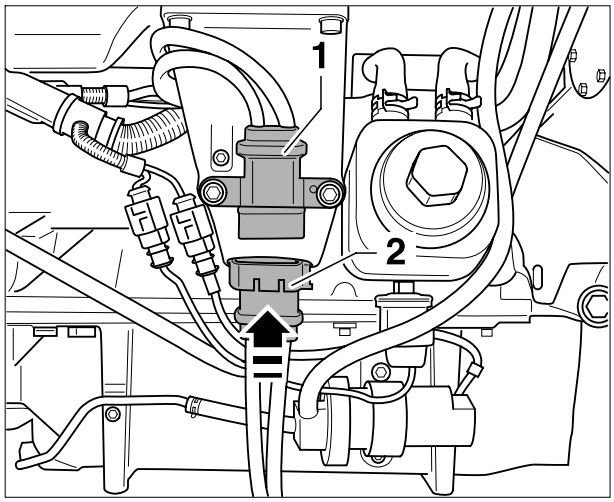
Battery connection

The battery connection cable supplied with the engine accessories kit has a special high-current connector at the engine end. Shorten the other end of the cable to the required length, and use suitable crimp connectors.



EB5-0041

Connect the high current connector **-2-** of the battery connection cable to the engine connector **-1-** in the direction shown by the arrow.



EB5-0089

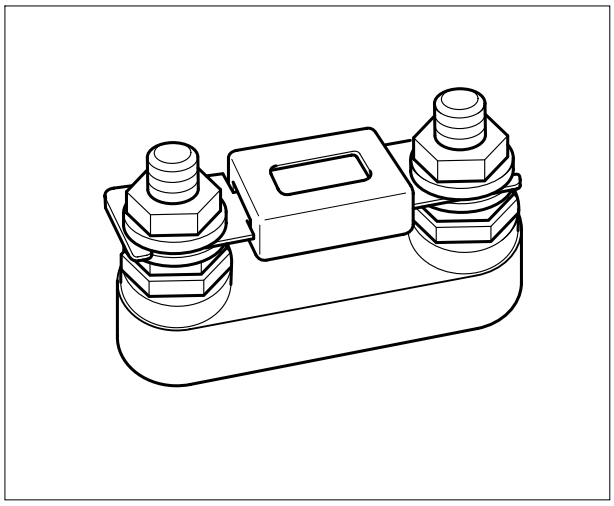
Only use high-quality battery terminals for the battery connections.

- Connect the black cable (earth) to the negative pole of the battery.
- Connect the red cable (positive) to the positive pole of the battery.

Safety precautions

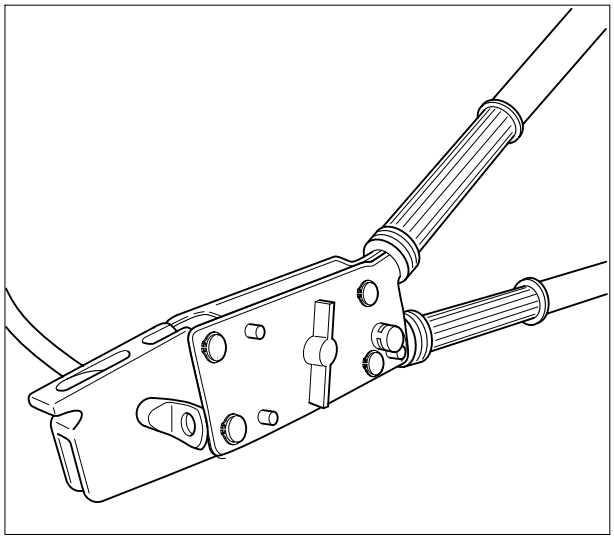
Volkswagen Marine recommends the installation of a flat fuse (400 A), immediately prior to the battery connection -see figure-, in the positive cable.

Additionally a battery master switch should be installed in the supply line to enable breaking of the main circuit in cases of danger and when working on the engine.



EB5-0012

When fitting the ring terminals to the cable ends (35 mm^2) of the battery connection cables, ensure these are correctly fitted with a crimp connection.



EB5-0013

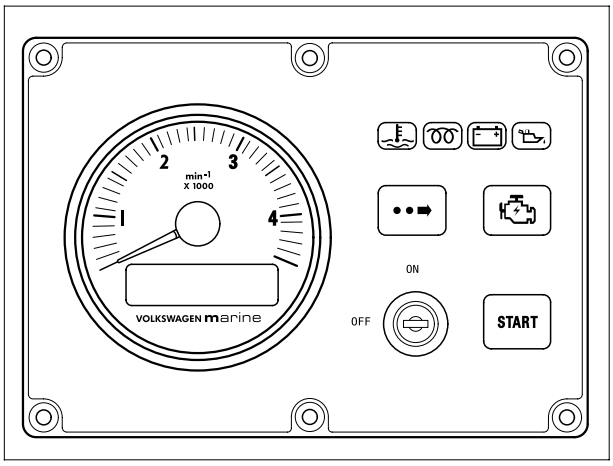
Electrical system

Instrumentation

Volkswagen Marine offers two instrumentation options for your boat.

1. A modern complete instrumentation set (see fig.) is supplied by Volkswagen Marine as standard instrumentation.
2. You can also assemble a customized instrumentation set (optional) from Volkswagen Marine yourself.
   Volkswagen Marine boat engines are designed for use with VDO Ocean Line™ White instruments.

The advanced functions of the multifunction display are only available when using the original Volkswagen Marine rev. counter. This rev. counter is supplied with all Volkswagen Marine instrumentation.



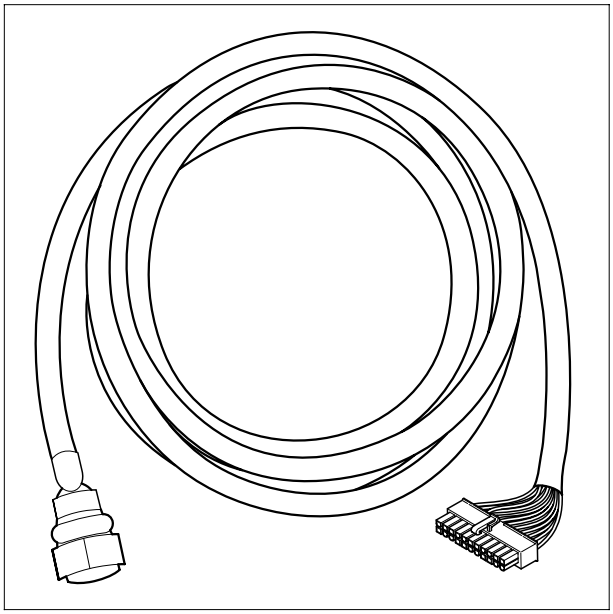
EB5-0112

Note

If you require customized instrumentation, please contact your nearest Volkswagen Marine dealer.

Main wiring harness for the standard instrumentation set

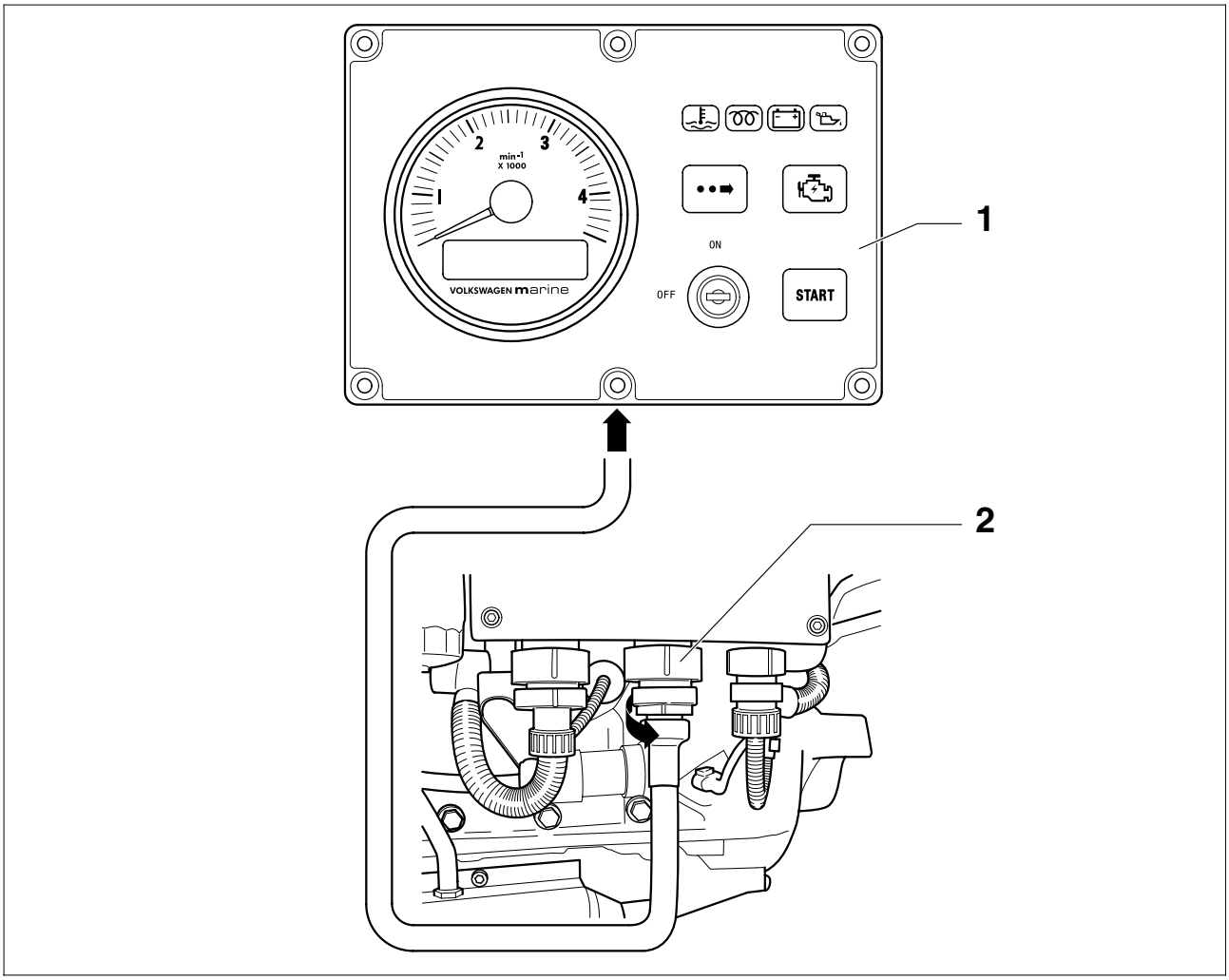
Connection cables are available from Volkswagen Marine in different lengths (see figure) and should be connected to the middle multiway connector of the engine electrical system (see figure on page 16; engine connector). The other end of the connection cable is connected to the instrument panel.



EB5-0107

Overview of standard instrumentation installation

An installation template to be used as a cut-out for fitting the instrumentation, can be found on page 38.



EB5-0108

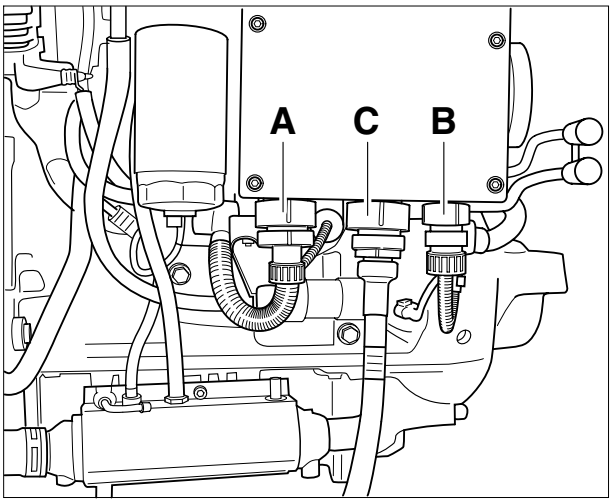
Legend

1. Instrument panel
2. Connector to the central electrical system

Electrical system

Engine connector

Connect the multiway connector of the main wiring harness to the central electrical system (connection **-C-**).



EB5-0009

Note

Use the wiring harness tools, T 01905 and T 01906, to loosen and tighten the multiway connectors.

Navigation instruments

To be able to use the advanced functions of the multifunction display in their entirety, the Volkswagen Marine instrumentation must be connected to a navigation instrument with a NMEA interface (e. g. GPS-receiver, LOG or similar).

* *see also protocol NMEA 0183*

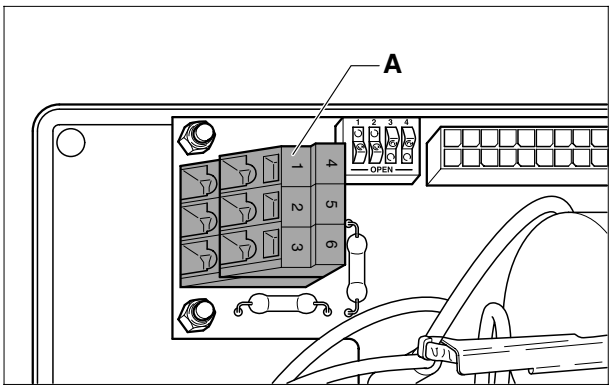
Note

To configure the multifunction display please read the additional instruction manual for the multifunction display in the main instruction manual.

Connection of the standard instrumentation

Terminal strip -A- for the navigation instrument on the rear side of the instrument panel:

1. Neutral
2. Neutral Out
3. Neutral with flybridge
4. D+ cut-off relay
5. NMEA-B
6. NMEA-A



EB5-0109

Connection variants

Reverse gear unit with simple instrumentation:

Place a bridge between terminals 1 + 2 of the terminal strip.

Reverse gear unit with flybridge:

Place a bridge between terminals 2 +3 of the terminal strip.

Z-drive with simple instrumentation:

Connect the throttle between terminals 1 + 2 of the terminal strip.

Z-drive with flybridgelybridge:

Connect the throttle between terminals 2 +3 of the terminal strip for the flybridge instrumentation.

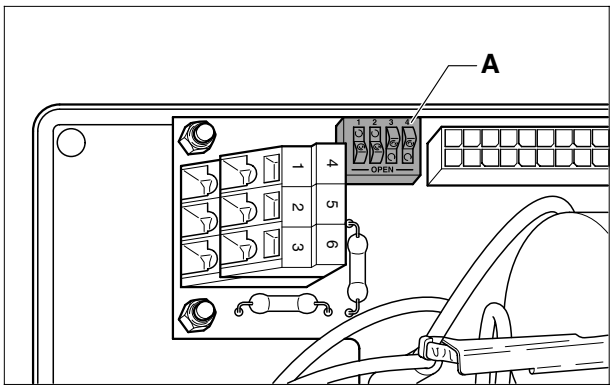
Electrical system

DIP switch on the rear side of the standard instrumentation

Change the DIP switches **-A-** between "On" and "Off" positions to make the following settings:

1.	Lighting	bright/dark
2.	Lighting	on/off
3.	Switch*	off position
4.	not used	off position

**Note:*
Switch in "Off" position for 4 + 5 cylinder engines / in "On" position for 6 cylinder engines.



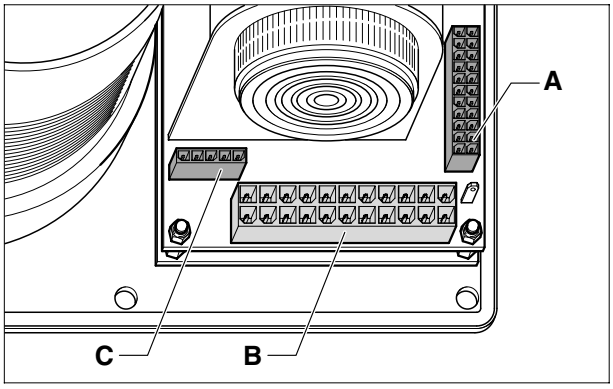
EB5-0110

Further connections on the rear side of the switch on the rear side of the standard instrumentation:

-A- 22 pole terminal strip for the flybridge

-B- 22 pole terminal strip for the central electrical system

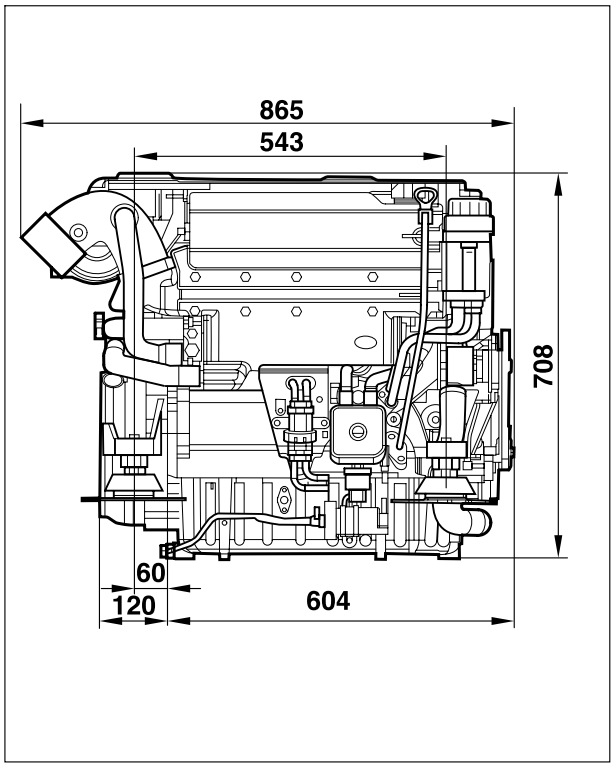
-C- 5 pole diagnosis terminal strip



EB5-0111

Installation dimensions for the SDI Volkswagen Marine boat engine

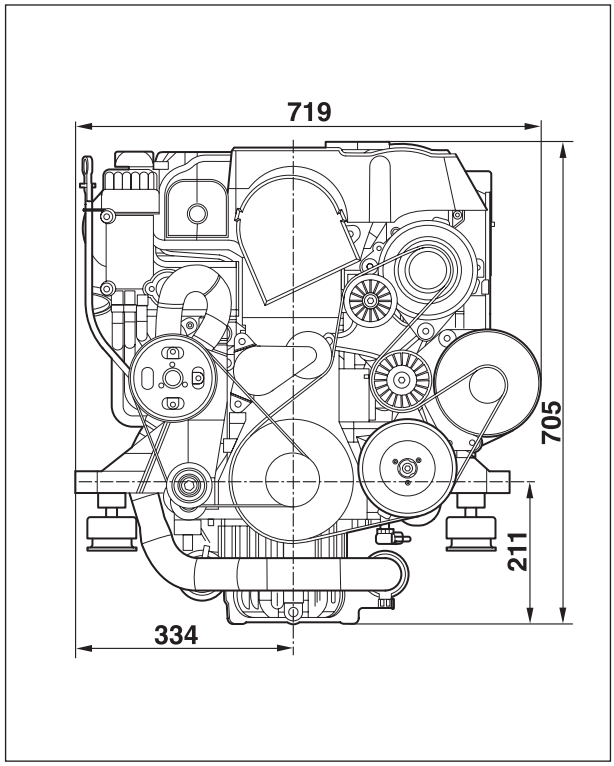
Side view



EB5-0028

SDI engine

Front view



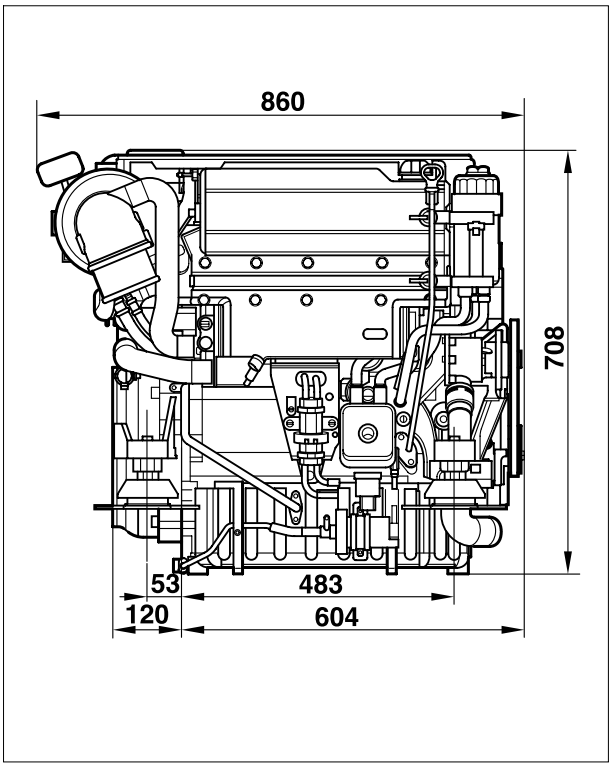
EB5-0029

SDI engine with auxiliary generator

Engine installation dimensions

Installation dimensions for the TDI Volkswagen Marine boat engine

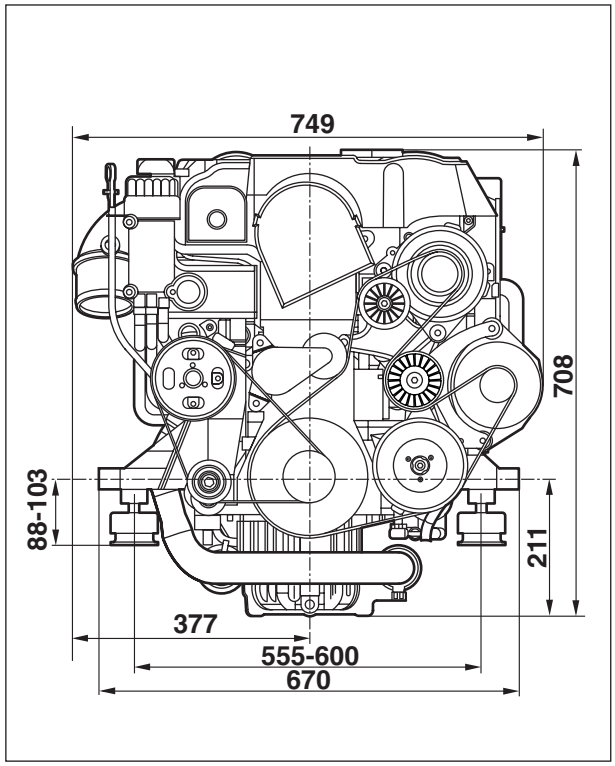
Side view



EB5-0030

TDI engine

Front view



EB5-0031

TDI engine with auxiliary generator

Transmission bell housing for engines with Z-drive

The following transmission bell housings can be used with Volkswagen Marine boat engines with Z-drive:

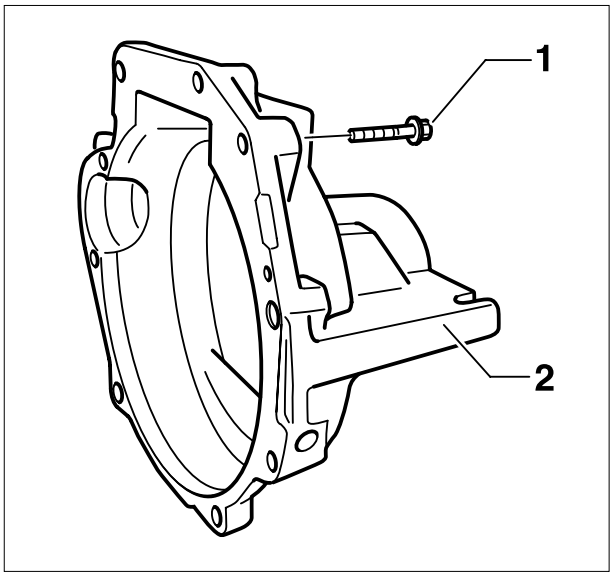
1. Transmission bell housing for VOLVO SX/DP-S
2. Transmission bell housing for VOLVO SP-E/DP-E
3. Transmission bell housing for Mercruiser Alpha/Bravo

Transmission bell housing for VOLVO SX/DP-S

Legend

1 - Securing screw 60 Nm

2 - Transmission bell housing



EB5-0053

Transmission bell housing for VOLVO SP-E/DP-E

Legend

1 - Securing screw 60 Nm

2 - Transmission bell housing

3 - Bearing

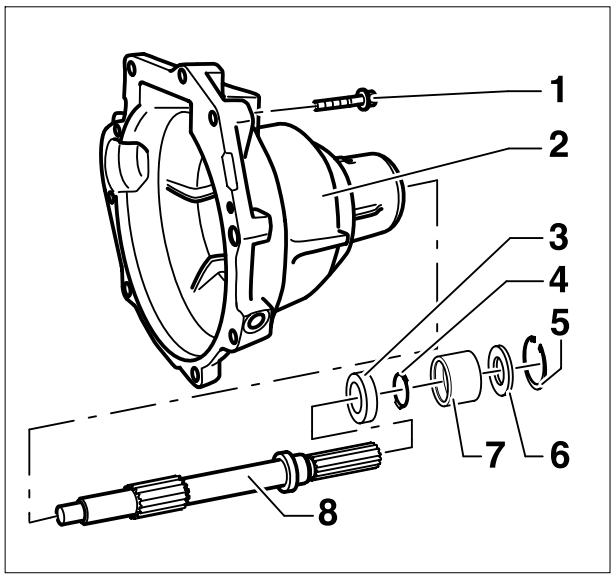
4 - Circlip

5 - Circlip

6 - Seal

7 - Sleeve

8 - Drive shaft



EB5-0054

Transmission bell housing for engines with Z-drive

Transmission bell housing for Mercruiser Alpha/Bravo

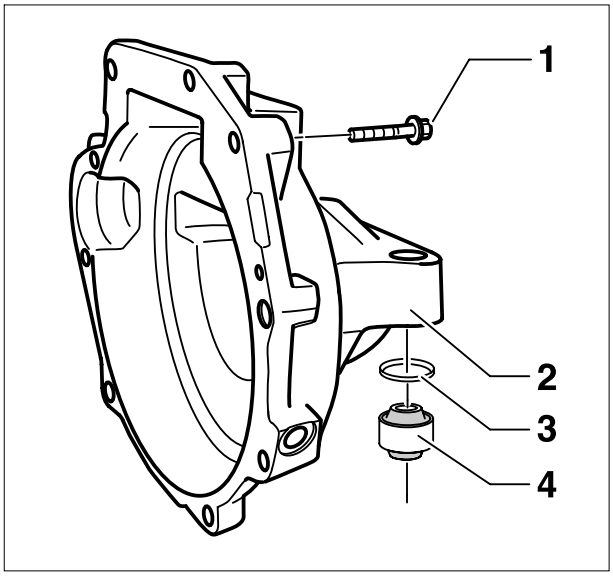
Legend

1 - Securing screw 60 Nm

2 - Transmission bell housing

3 - Cup washer

4 - Bearing



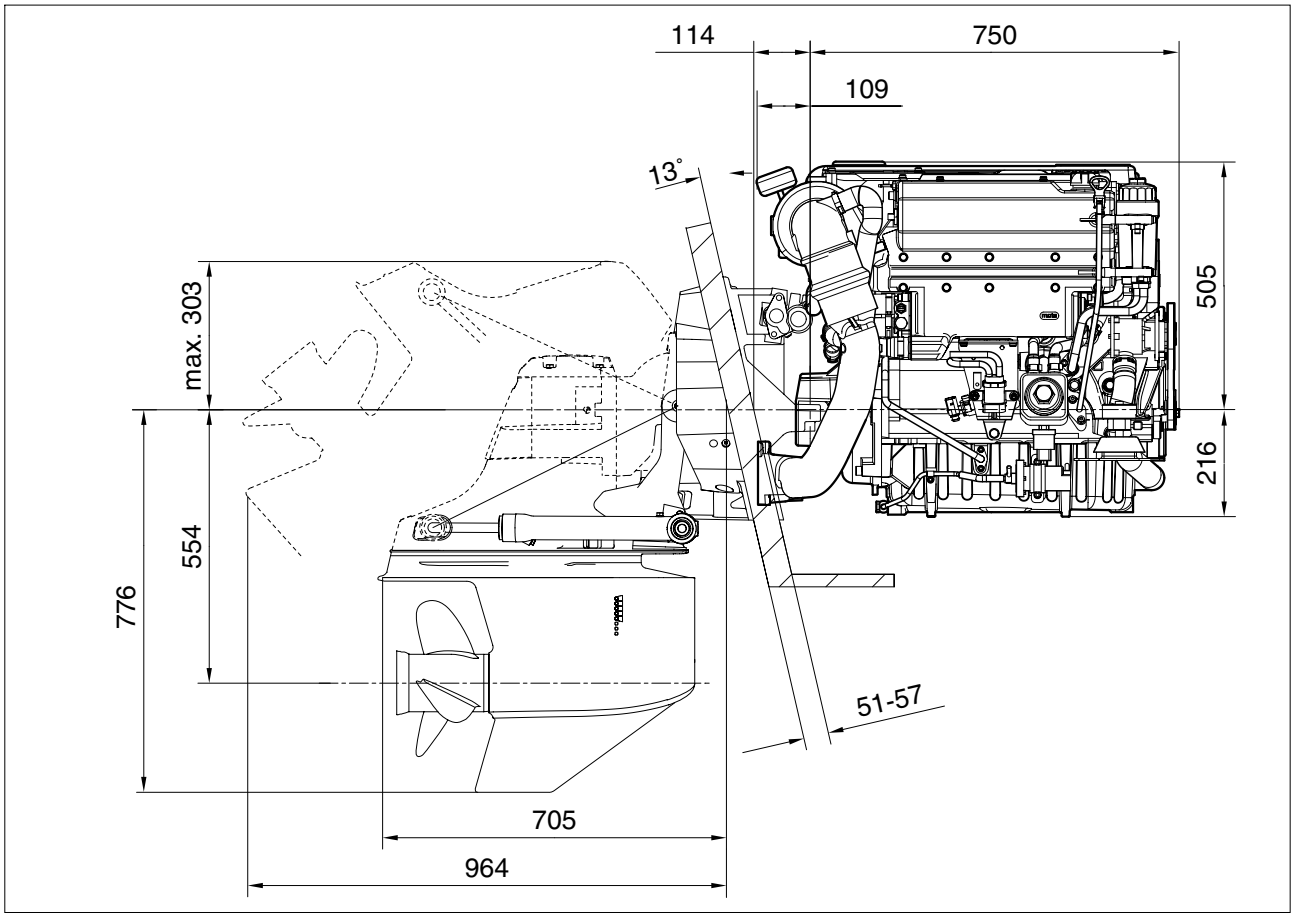
EB5-0052

Note

TDI engines, 150-5, 150-5D and 165-5 can be ordered from the factory with Mercruiser Bravo I and III drives.

Installation dimensions for engine with Mercruiser Bravo One

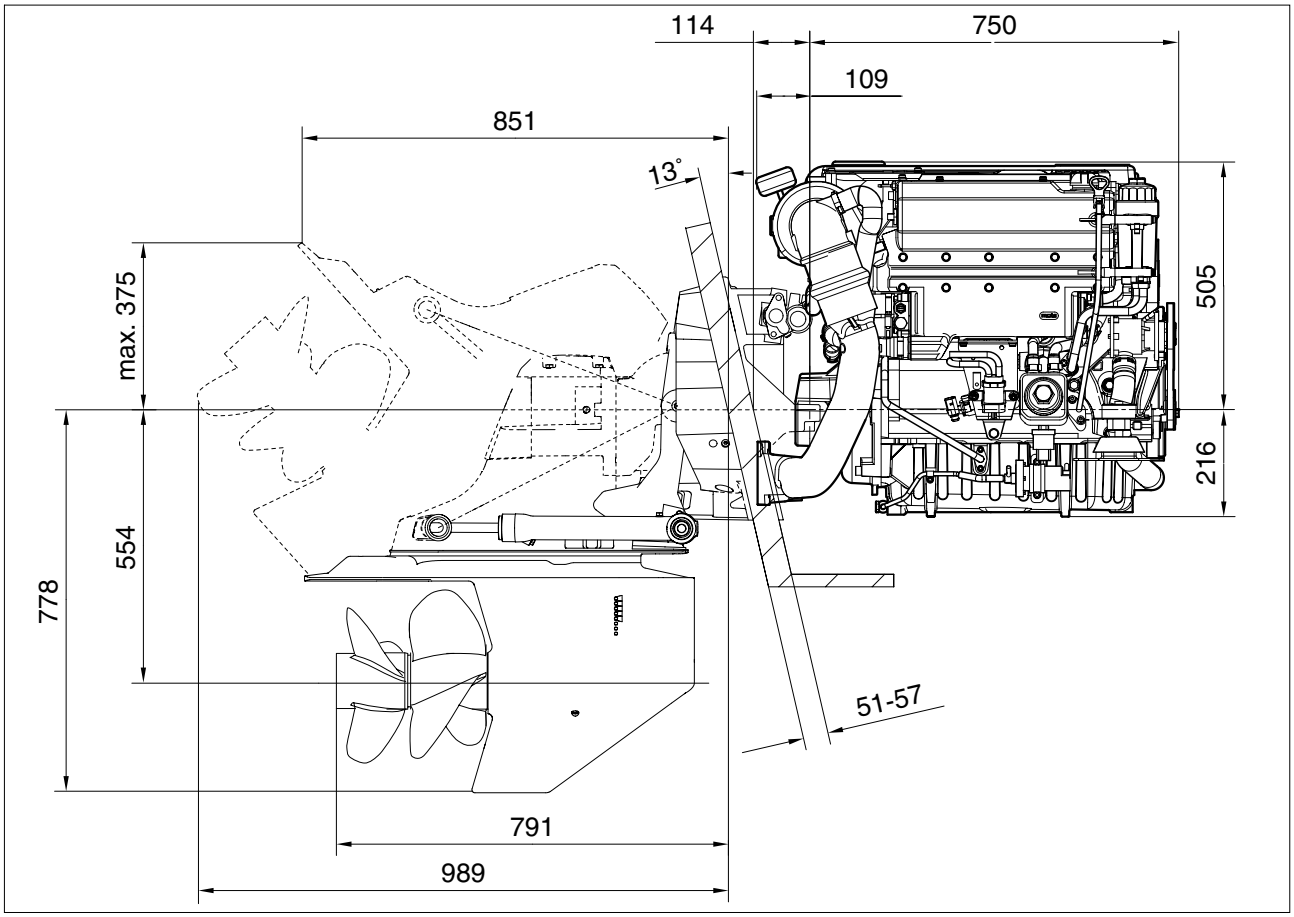
TDI 150-5 and TDI 165-5



EB5-0115

Installation dimensions for engine with Mercruiser Bravo Three

TDI 150-5 and TDI 165-5



EB5-0114

Transmission bell housing and installation dimensions for engine

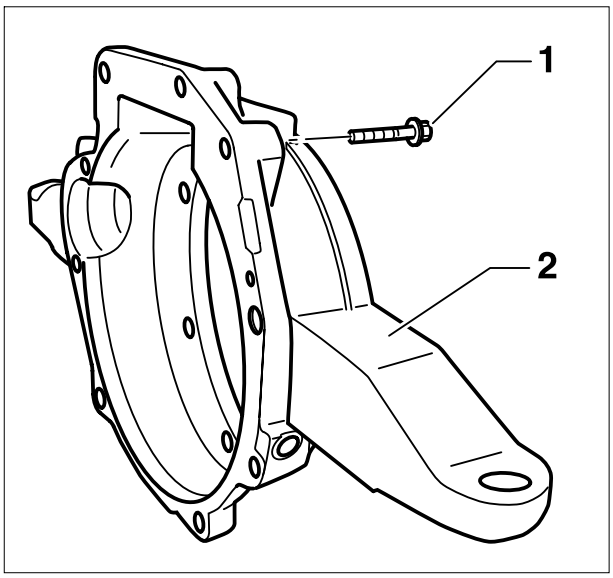
Transmission bell housing and installation dimensions for engine with reverse gear unit

The following transmission bell housings -2- (SAE-7) can be used with Volkswagen Marine boat engines with reverse gear units:

The transmission bell housing shown is suitable for the following reverse gear models:

- ZF 25A hydraulic 8°
- ZF 25A hydraulic straight
- ZF 45A hydraulic 8°

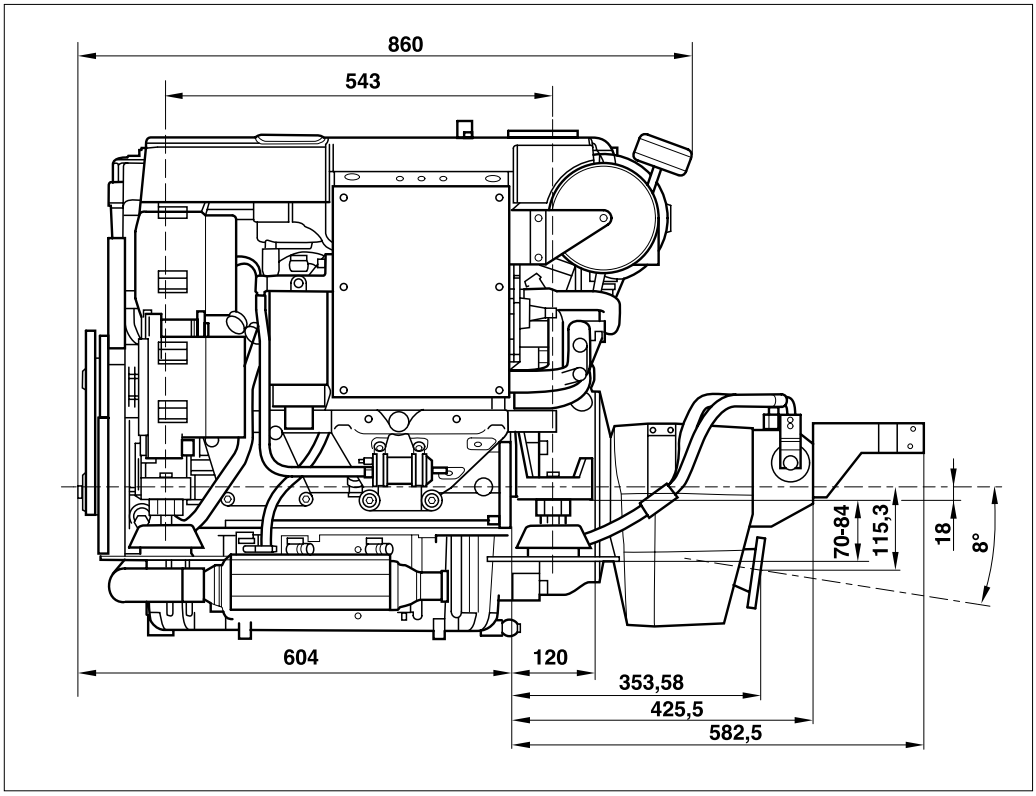
Tighten securing screw **-1-** to 60 Nm.



EB5-0051

The following Volkswagen Marine boat motors can use thefollowing reverse gear units:

SDI 55-5/SDI 75-5/TDI 100-5: <u>ZF 25A hydraulic 8°</u>



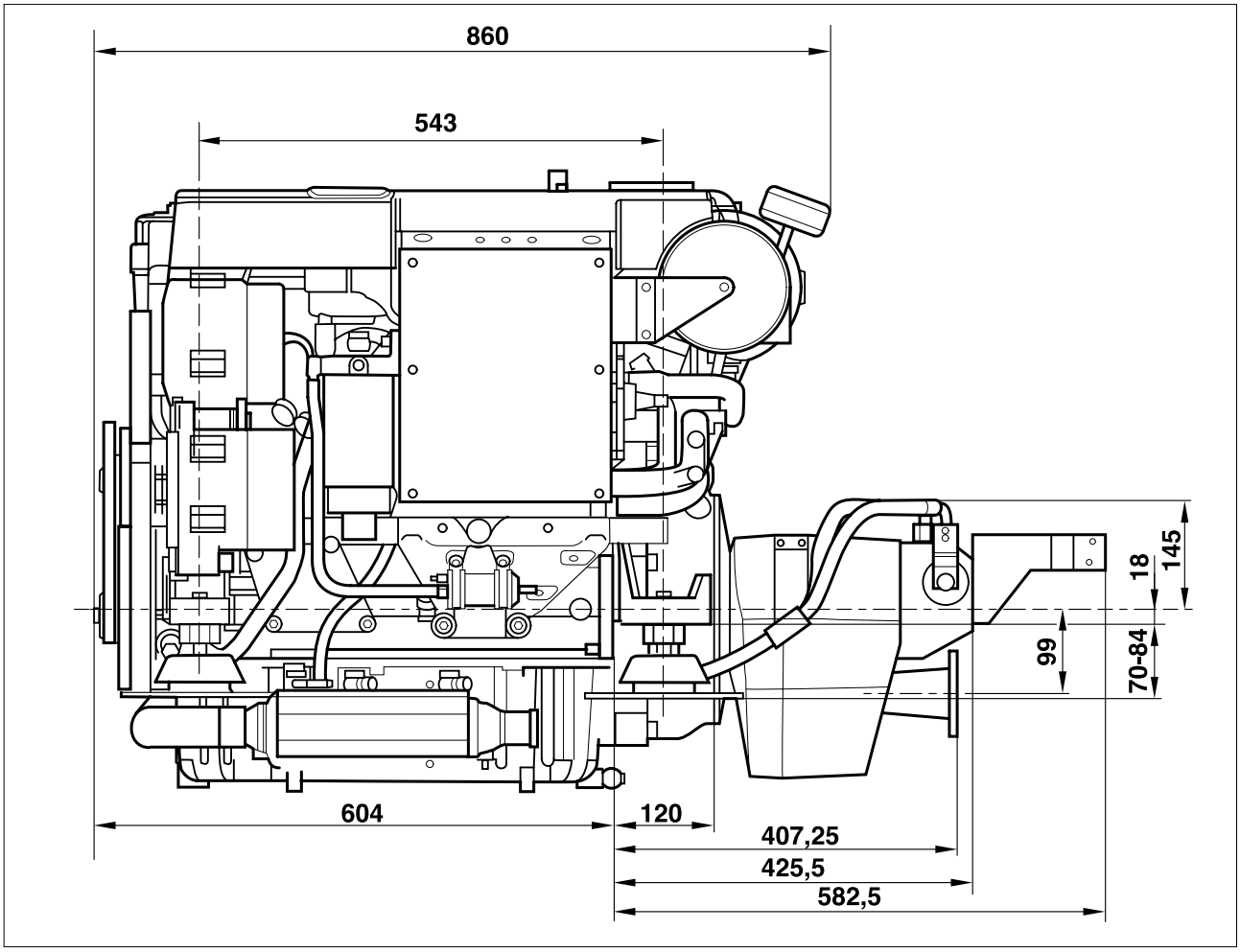
EB5-0078

Transmission bell housing and installation dimensions for engine

Transmission bell housing and installation dimensions for engine with reverse gear unit

SDI 55-5/SDI 75-5/TDI 100-5:

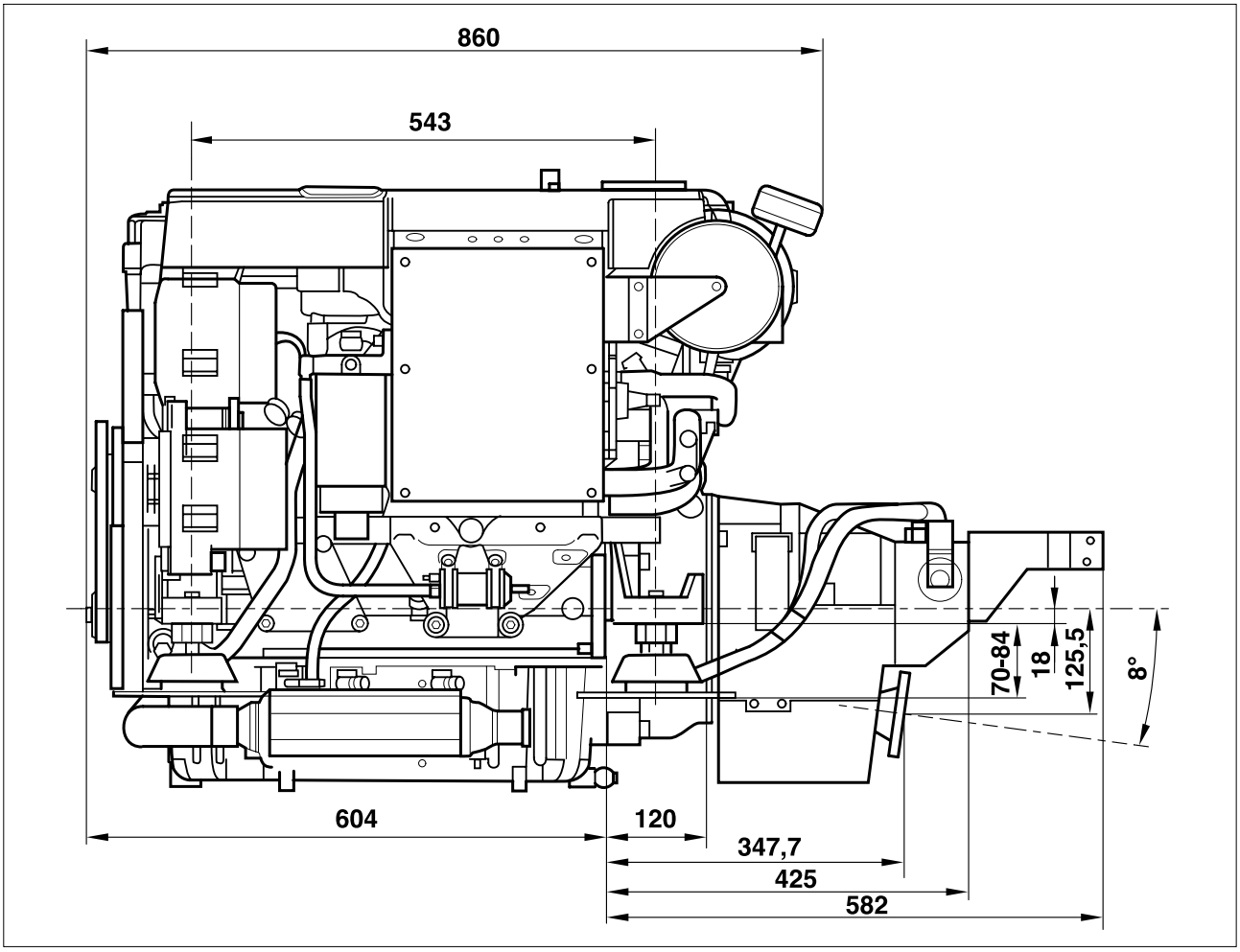
ZF 25 hydraulic straight



EB5-0079

TDI 120-5/TDI 150-5/TDI 150-5D/TDI 165-5:

ZF 45A hydraulic 8°



EB5-0080

Cooling system

Introduction

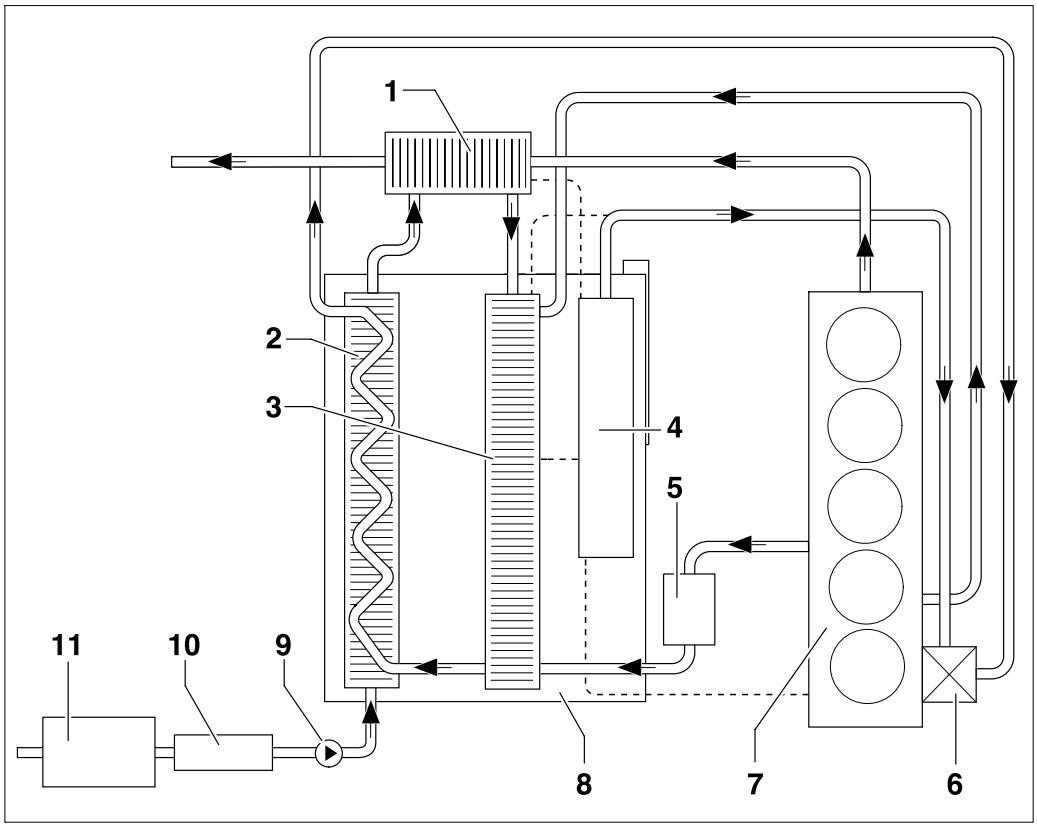
To maintain the engine free from aggressive media such as salt water, Volkswagen Marine boat engines have a twin-circuit cooling system.

The internal engine coolant circuit is a closed system and is mixed with antifreeze (G12).

The seawater /freshwater circuit, also called the secondary circuit, is an open circuit in which the seawater / freshwater is sucked in and, after flowing through the heat exchanger, fed back to the outside again via the exhaust system.

Coolant circuit

Example: SDI engine



EB5-0093

Legend

1. Exhaust manifold
2. Main heat exchanger
3. Exhaust collector
4. Coolant expansion tank
5. Oil cooler
6. Thermostat 70 °C
7. Engine
8. Radiator element housing
9. Sea water / fresh water pump
10. Combined cooler
11. Sea water / fresh water filter

Sea water / fresh water circuit

Seawater / freshwater is sucked in through a intake cap in the boat's hull, downstream of which there is a seawater / freshwater valve.

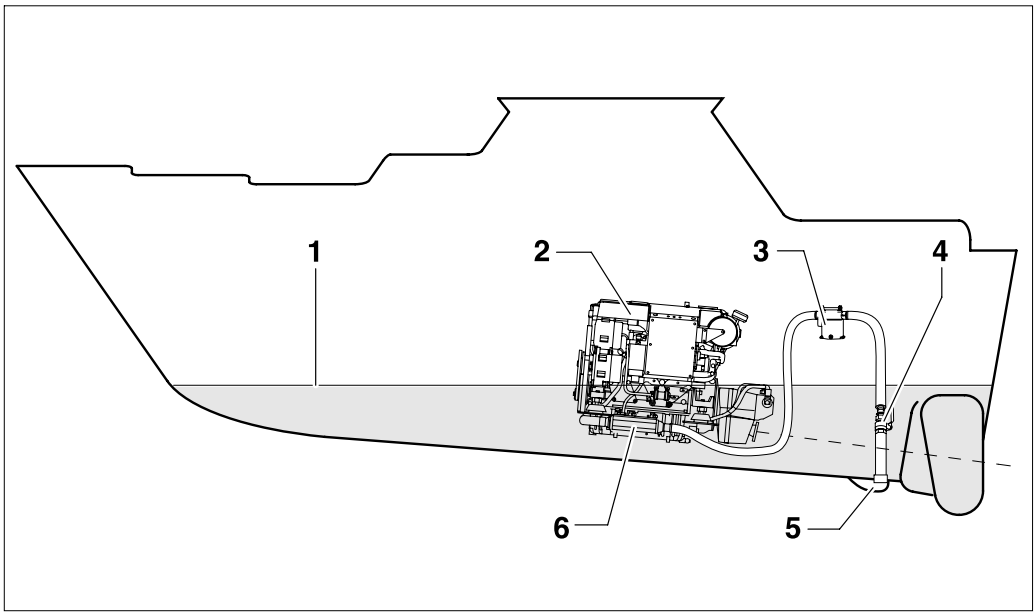
Aeration of the seawater / freshwater circuit using a ventilation unit

To prevent entry of seawater / freshwater into the exhaust system via the intake side of the seawater / freshwater circuit, a ventilation unit only has to be fitted if the engine is installed beneath the water line; (see figure on page 7, item number 6.; Overview of the exhaust system installation).

Explanation:

If the cooling system is beneath the water line, then filling of the exhaust system with water may occur, if the boat remains stationary for some time. This is because the seawater / freshwater pump is not 100 % watertight and causes a siphon / suction effect in the coolant circuit. If this occurs, the valve should be shut immediately.

Overview of seawater / freshwater cooling installation



EB5-0094

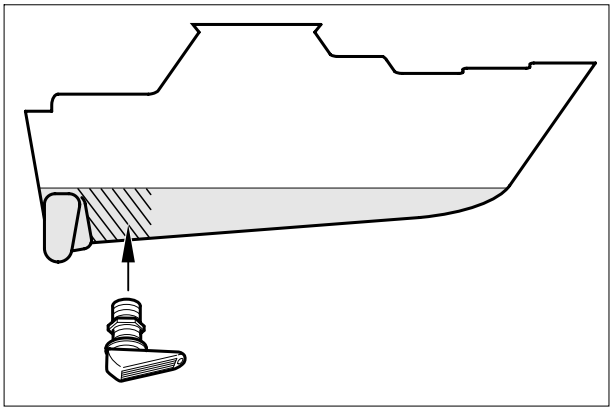
Legend

1. Water line
2. Engine
3. Sea water / fresh water filter
4. Sea water / fresh water valve
5. Intake cap
6. Combined cooler

Cooling system

Intake cap advice

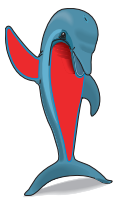
For motor boats, the sloping side of the intake mesh must point forwards. The fitting location of the intake cap should be as far to the rear of the boat as possible (see the hatched area in the figure).
In this case, the speed of the boat pushes the water inwards.



EB5-0017

General

- The seawater / freshwater flows through the filter of the combined cooler. This combined cooler (for fuel and hydraulic oil) is divided into two sections. The first half serves to cool the transmission oil (reverse gear unit) or the hydraulic oil of the power steering with the Z-drive.
  The second half cools the fuel flowing back to the fuel tank.
- The intake hose from the seawater / freshwater filter to the combined cooler must have a diameter of **at least 38 mm**. The hose should be as short as possible. Use of two hose clips per connection is recommended.
- For the TDI 150-5 and TDI 165-5 engines, the seawater / freshwater also flows through the intercooler.
- Before over-wintering of the boat, all seawater / freshwater must be drained away.



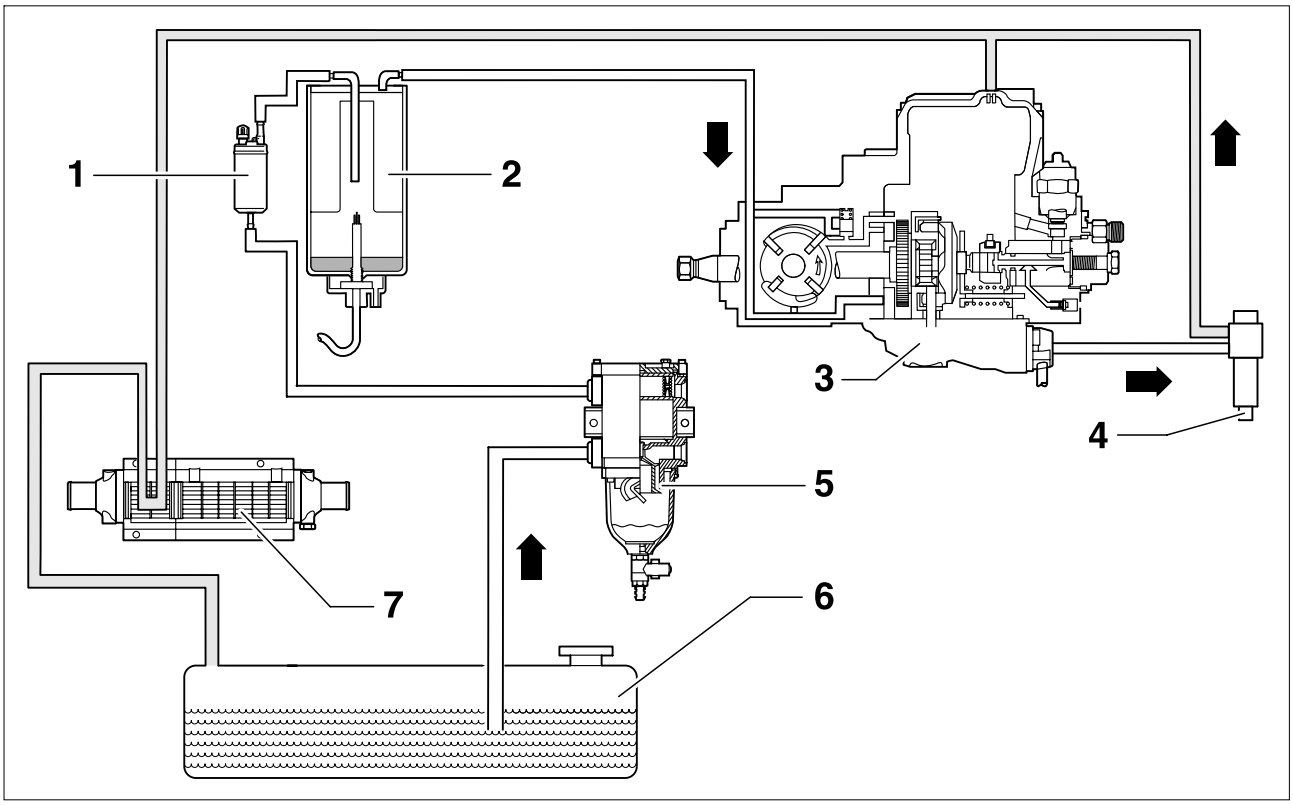
The measures required for over-wintering the Volkswagen Marine boat engine are described in the Volkswagen Marine boat engine instruction manual.

Introduction

The fuel system comprises a number of components. These components (fuel tank, circulation-prefilter with water separator etc.) must be impeccably clean and should be fitted with extreme care.

Dirt and impurities could cause incorrect engine operation. After installing the fuel system, check for leaks, to ensure optimum protection against the risk of fire.

Functional description of the fuel system



EB5-0095

Legend

1. Fuel circulation pump
2. Fine fuel filter with water monitor
3. Injection pump
4. Injector
5. Circulation prefilter with water separator
6. Fuel tank
7. Combined cooler with drainage screw for seawater / freshwater

Please observe the instructions on the following page!

Fuel system

- The compartment containing the fuel system must be sufficiently ventilated. Fuel tank and filler cap must have an earth connection to the battery (for steel boats to the hull).
- When arranging the components, ensure that there is sufficient clearance for any future maintenance and repair work.
- The fuel supply line is to be routed from the fuel tank via the circulation prefilter and water separator. The line cross section must be **at least 8 mm**.
- A fuel return line is to be routed from the combined cooler to the fuel tank. The line cross section must be **at least 8 mm**.
- The return line from the fuel injection pump to the combined cooler is fitted in the factory.
- Your Volkswagen Marine boat motor is approved for use with RME fuel (rapeseed oilmethyl ester / biodiesel).

Note

If you intend using RME fuel (rapeseed oil methyl ester / biodiesel), then all auxiliary fuel lines, seals and other connections to the engine must be suitable for use with RME fuel (see technical data on page 36).

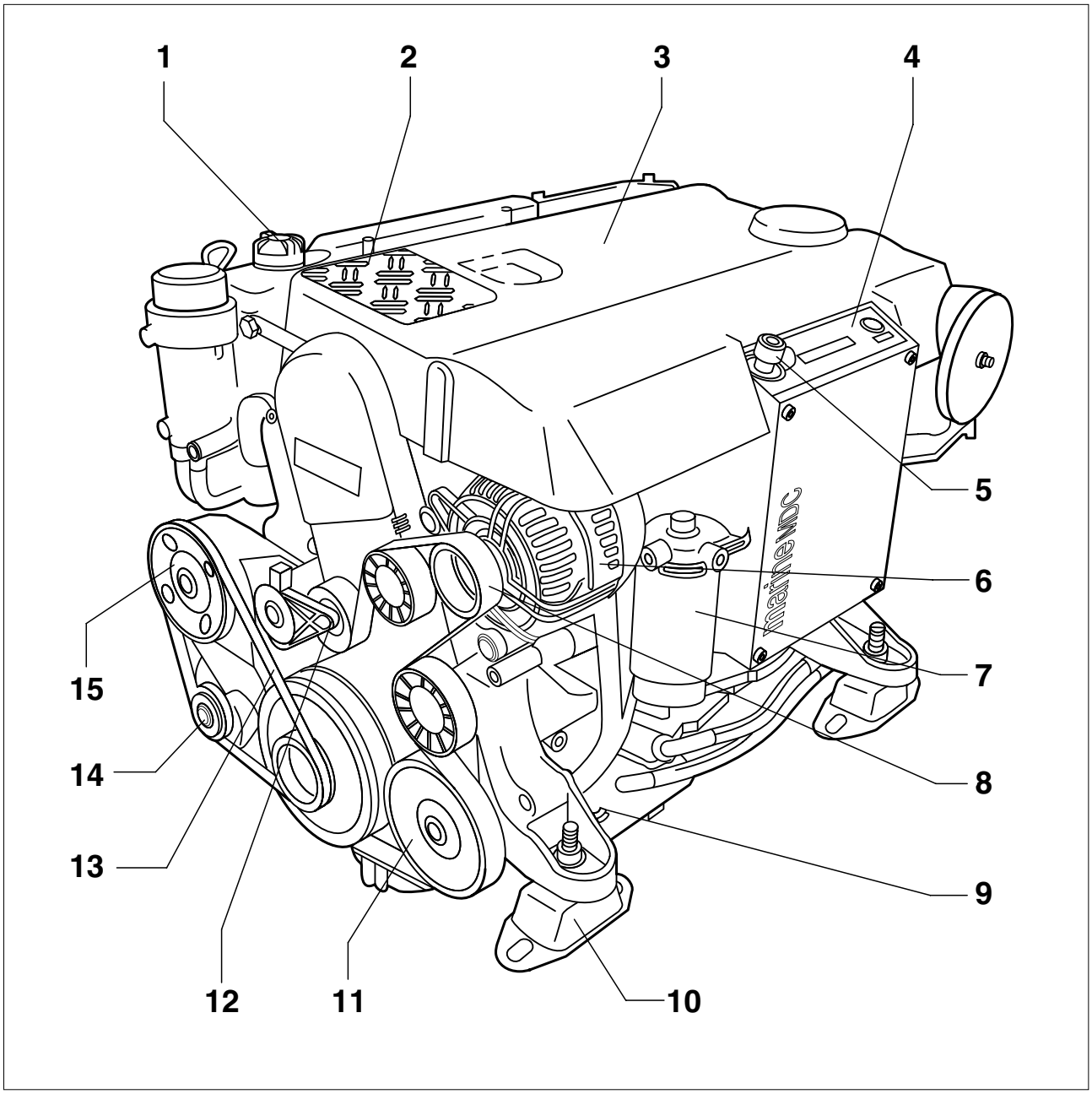
Engine compartment ventilation

Introduction

- The engine must be sufficiently ventilated to ensure that the temperature can be maintained at an optimum value, that is as low as possible.
($\Delta T_{max.}$ above ambient temperature: 10 °C to 15 °C).

- To ensure optimum engine compartment ventilation, the air inlet should be placed where the sucked-in air is as clean as possible and where the engine's own exhaust gases cannot be sucked in.
- Water must not be able to enter either the air inlet or the air outlet.
- The hydraulic cross section for the air inlet must equal **80 cm**^{2}.
- If other equipment that requires oxygen for its operation (e.g. an auxiliary heater) is located in the engine compartment, then this must also be considered when dimensioning the air inlet.

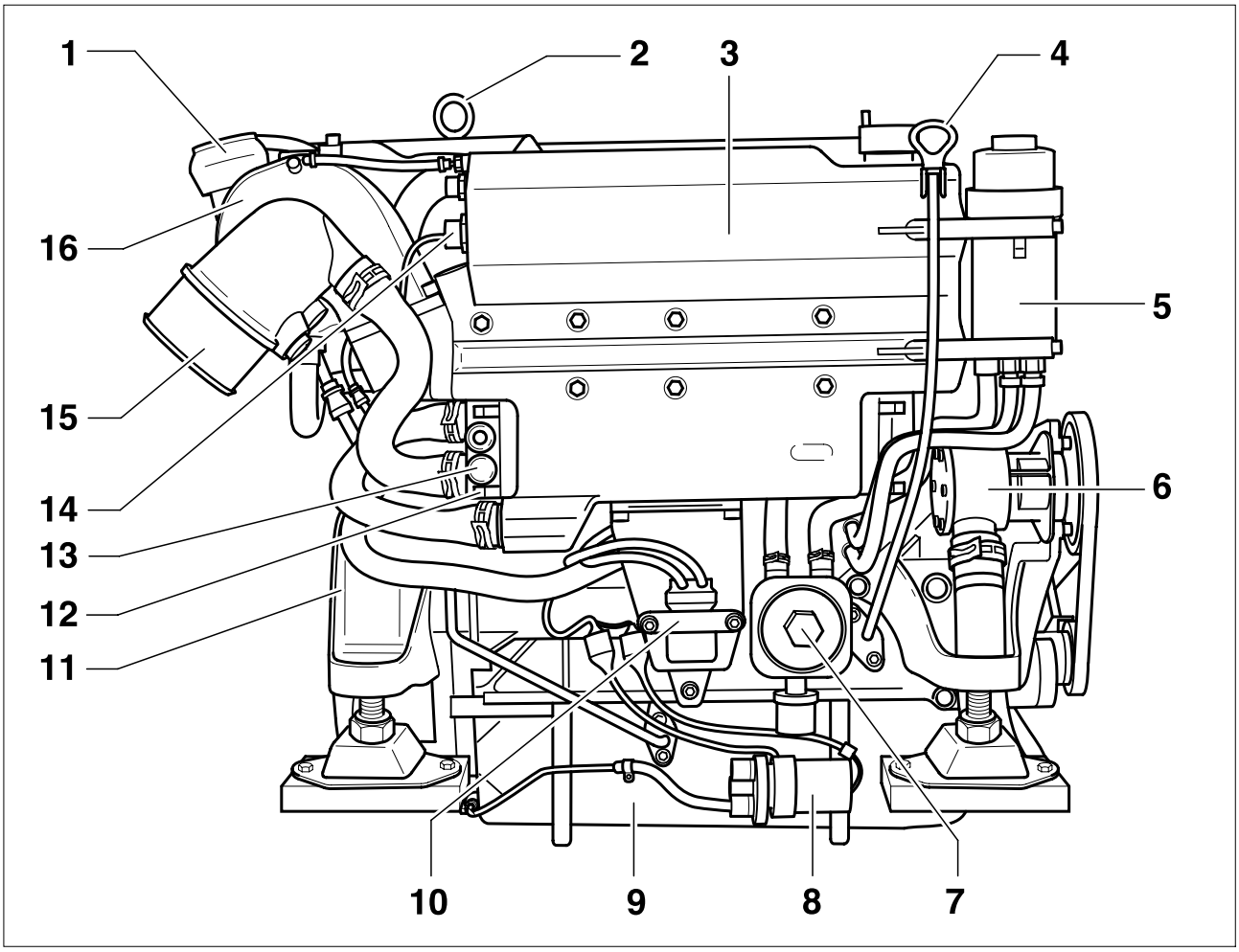
Engine components list



EB5-0082

Legend

1. Coolant sealing cap (use coolant G12, colour red)
2. Step plate
3. Cover (tighten securing screw to 4.5 Nm)
4. Central electrical system
5. Stop switch
6. Alternator
7. Fine fuel filter (see instruction manual for replacement intervals)
8. Ribbed V-belt
9. Combined cooling unit
10. Unit mounting
11. Power steering pump
12. Tensioner
13. Ribbed V-belt
14. Tensioner
15. Belt pulley for sea water / fresh water pump



EB5-0085

Legend

1. Turbocharger pressure unit
2. Suspension eye
3. Radiator element housing
4. Dipstick
5. Oil filter
6. Sea water / fresh water pump
7. Oil cooler
8. Oil extraction pump
9. Oil sump
10. Engine connector
11. Transmission bell housing
12. Coolant drain screw
13. Sacrificial anode
14. Water level sender
15. Exhaust pipe connection
16. Turbocharger

Technical Data

Engine description

Cubic capacity	cm^3	2461
Bore/stroke	mm	81/95.5
Compression ratio		19:1
Ignition sequence		1-2-4-5-3

Power output
(as per ISO 3046 with marine control unit)

SDI 55-5	at 2250 rpm	kW	40
SDI 55-5	at 3600 rpm	kW	55
TDI 100-5	at 2600 rpm	kW	74
TDI 100-5SE	at 3400 rpm	kW	74
TDI 120-5	at 3250 rpm	kW	88
TDI 150-5D	at 4000 rpm	kW	108
TDI 150-5	at 4000 rpm	kW	111
TDI 165-5	at 4000 rpm	kW	121

Charge air pressure
(at rated power output and under standardized operating conditions)

TDI 100-5	at 2600 rpm	bar	1.15
TDI 100-5SE	at 3400 rpm	bar	1.15
TDI 120-5	at 3250 rpm	bar	1.15
TDI 150-5	at 4000 rpm	bar	1.15
TDI 165-5	at 4000 rpm	bar	1.15

Weight

SDI 55-5	kg	approx. 245
SDI 75-5	kg	approx. 245
TDI 100-5	kg	approx. 255
TDI 120-5	kg	approx. 255
TDI 150-5	kg	approx. 265
TDI 165-5	kg	approx. 265

Maximum inclination during operation

15° in all directions

30° for short periods

Permissible engine operating data

Permissible engine temperature

Maximum permissible temperature in the oil sump	°C (°F)	130 (266)

Permissible coolant temperature

Maximum permissible temperature at the outlet from the engine during continuous operation	°C (°F)	105 (221)

Engine electrical equipment

12 V alternator	A	120
Starter 12 V	kW	2.0
Battery 12 V	A (Ah)	380 (63) minimum capacity
Glow plugs	V	12

Engine code letters

BCT	SDI	55-5
ANF	SDI	75-5
BCU	TDI	100-5
BCU	TDI	100-5SE
ANG	TDI	120-5
BCV	TDI	150-5D
ANH	TDI	150-5
BTW	TDI	165-5

Cooling system

Twin circuit cooling system (overpressure system with separate expansion tank and overpressure valve) and seawater / freshwater circuit with impeller pump.

Overpressure valve

Opens at	bar (overpressure)	1.3 – 1.5

Thermostat

Starts opening at	°C (°F)	70 (158)

Coolant

Use a mixture of 60% water and 40% G12 antifreeze as per TL VW 774D.

Fuel

Fuel	**diesel**	**as per DIN EN 590**
Required minimum cetane number		**CN > 51**
	Biodiesel	**as per EN 51 606**

Diameters / Line cross sections

Exhaust system	Ø	100 mm
Intake hose for sea water / freshwater	Ø	38 mm
Fuel lines	Ø	8 mm
Battery connection cable		35 mm^2

Oil supply

Engine oil quality

Oil type VW Marine Longlife, oil specification VW 505 00 (see also instruction manual information)

Oil pressure

At 2000 rpm and 80 °C (176 °F) engine oil temperature (overpressure) at least 2.0

Oil consumption

(maximum permitted)	l/10 h	0.05 - 0.1

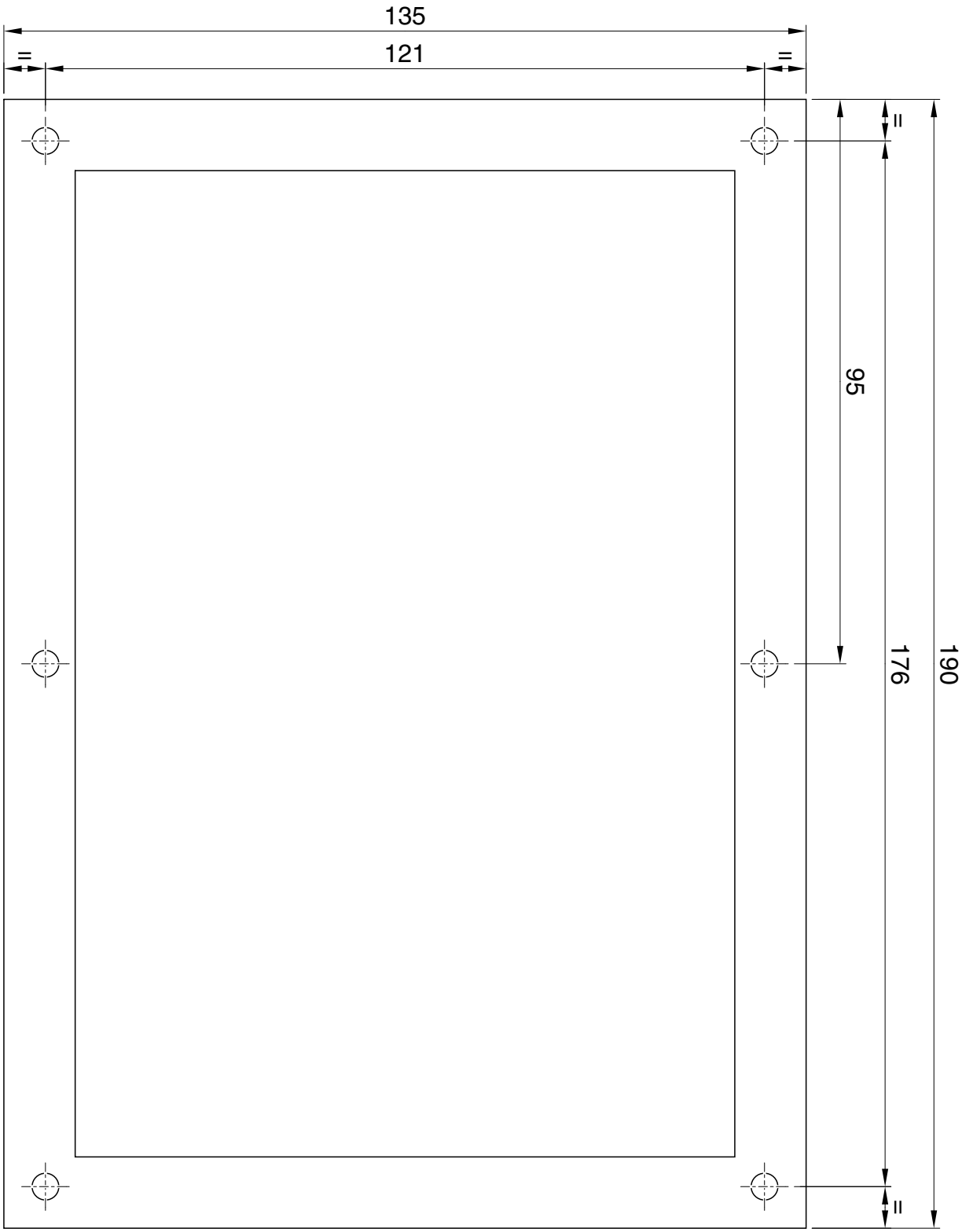
Filling quantities

Coolant circuit	ltr.	approx. 12

Oil circuit

Including filter change	ltr.	6.0
Volume difference between min. and max. markings on the dipstick	ltr.	approx. 1.0

Installation template for standard instrumentation



Installation description EB05

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