MTU_ValueService
Technical Documentation

Troubleshooting
Series 4000
Application: C & I (Mining)

Troubleshooting Guide
MS69000/00E

Printed in Germany

This handbook is provided for use by maintenance and operating personnel in order to avoid malfunctions or damage during operation.
Subject to alterations and amendments.

Wichtig – Important – Importante

Bitte die Karte „Inbetriebnahmemeldung“ abtrennen und ausgefüllt an MTU Friedrichshafen GmbH zurücksenden.

Die Informationen der Inbetriebnahmemeldung sind Grundlage für den vertraglich vereinbarten Logistik-Support (Gewährleistung, Ersatzteile etc.).

Please complete and return the “Commissioning Note” card below to MTU Friedrichshafen GmbH.

The Commissioning Note information serves as a basis for the contractually agreed logistic support (warranty, spare parts, etc.).

Veuillez séparer la carte “Signalisation de mise en service“ et la renvoyer à la MTU Friedrichshafen GmbH.

Les informations contenues dans la signalisation de mise en service constituent la base pour l'assistance en exploitation contractuelle (garantie, rechanges, etc.).

Rogamos separen la tarjeta “Aviso de puesta en servicio“ y la devuelvan rellenada a MTU Friedrichshafen GmbH.

Las informaciones respecto al aviso de puesta en servicio constituyen la base para el soporte logístico contractual (garantía, piezas de repuesto, etc.).

Ritagliare “Avviso di messa in servizio“ e rispedirlo debitamente compilato alla MTU Friedrichshafen GmbH.

Le informazioni ivi registrate sono la base per il supporto logistico contrattuale (garanzia, ricambi, ecc.).

É gentileza cortar o cartão "Participação da colocação em serviço", preenché-lo e devolvé-lo a MTU Friedrichshafen.

Os dados referentes à colocação em serviço representam a base para o suporte logístico (garantia, peças sobressalentes, etc.) estabelecido contratualmente.

Postcard

MTU Friedrichshafen GmbH
Technical Information Management
88040 Friedrichshafen
GERMANY

Bitte in Blockschrift ausfüllen!
Please use block capitals!
Prière de remplir en lettres capitales!
¡A rellenar en letras de imprenta!
Scrivere in stampatello!
Favor preencher com letras de forma!

Inbetriebnahme-meldung

Commissioning Note

Notice de mise en service

Aviso de puesta en servicio

Avviso di messa in servizio

Participação da colocação em serviço

Motornr.: Engine No.: N° du moteur: N° de motor: Motore N.: No. do motor:	Auftragsnr.: MTU works order No.: N° de commande: N° de pedido: N. commessa: No. do pedido:
Motortyp: Engine model: Type du moteur: Tipo de motor: Motore tipo: Tipo do motor:	Inbetriebnahmedatum: Date put into operation: Mise en service le: Fecha de puesta en servicio: Messa in servizio il: Data da colocação em serviço:
Eingebaut in: Installation site: Lieu de montage: Lugar de montaje: Installato: Incorporado em:	Schiffstyp / Schiffshersteller: Vessel/type/class / Shipyard: Type du bateau / Constructeur: Tipo de buque / Constructor: Tipo di barca / Costruttore Tipo de embarcação/estaleiro naval:

Endabnehmer/Anschrift:
End user`s address:
Adresse du client final:
Dirección del cliente final:
Indirizzo del cliente finale:
Usuário final/endereço:

Bemerkung:
Remarks:
Remarques:
Observaciones:
Commento:
Observações:

1 Fault list

1.1 Fault list, 4000 Series, Mining

016 – SS P-Lube Oil

PV-Number: 030 ZKP-Number: 2.0100.922

Shutdown by safety system: Lube oil pressure

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The Crash Recorder is started.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

058 – SS P-Coolant

PV-Number: 040 ZKP-Number: 2.0101.922

Shutdown by safety system: Coolant pressure

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Insufficient coolant in circuit.	1. Check coolant level. 2. Top up coolant if necessary. Observe permissible quality, additives and capacities (→ Page 242).
Coolant pump faulty	► MTU Service

064 – SS P-Crank Case

PV-Number: 035 ZKP-Number: 2.0106.932

Shutdown by safety system: Crankcase pressure

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The Crash Recorder is started.

Cause	Corrective action
Further troubleshooting (→ Page 127)	

416 – SS P-Coolant InterCooler

PV-Number: 045 ZKP-Number: 2.0107.922

Shutdown by safety system: Intercooler coolant pressure too low

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Filter clogged.	1. Check filter. 2. Clean filter and replace if necessary (→ Page 245).
Coolant pump defective or jamming.	1. Repair coolant pump. 2. Replace complete coolant pump as required.

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068 – SS T-Coolant

PV-Number: 130 ZKP-Number: 2.0120.932

Shutdown by safety system: Coolant temperature

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

004 – SS T-Fuel

PV-Number: 200 ZKP-Number: 2.0122.932

Shutdown by safety system: Fuel temperature

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 118)	

010 – AL L2 T-Coolant Intercooler

PV-Number: 398 ZKP-Number: 2.0124.932

Alarm: Intercooler coolant temperature (2nd limit value exceeded)

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 108)	

052 – SS T-Lube Oil

PV-Number: 144 ZKP-Number: 2.0125.932

Shutdown by safety system: Lube oil temperature

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 101)	

SS P-Differential Lube Oil

PV-Number: 009997 ZKP-Number: 2.0154.932

Shutdown by safety system: Lube oil differential pressure

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The Crash Recorder is started.

Cause	Corrective action
Further troubleshooting (→ Page 130)	

TIM ID: 0000029057 – 001

032 – SS ETC1 Overspeed

PV-Number: 070 ZKP-Number: 2.3012.932

Shutdown by safety system: Exhaust turbocharger 1 was overspeeding

OEM ADEC alarm: Red alarm that has to be reset manually. The alarm is stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

015 – LO P-Lube Oil

PV-Number: 029 ZKP-Number: 2.0100.921

Lube oil pressure too low (1st limit value not attained)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

057 – LO P-Coolant

PV-Number: 039 ZKP-Number: 2.0101.921

Coolant pressure too low (1st limit value not attained)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Insufficient coolant in circuit.	1. Check coolant level. 2. Top up coolant if necessary. Observe permissible quality, additives and capacities (→ Page 242).
Coolant pump faulty.	► MTU Service

065 – LO P-Fuel

PV-Number: 047 ZKP-Number: 2.0102.921

Fuel pressure too low (1st limit value not attained)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 123)	

TIM ID: 0000029057 – 001

063 – HI P-Crank Case

PV-Number: 034 ZKP-Number: 2.0106.931

Crankcase pressure too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 127)	

415 – LO P-Coolant InterCooler

PV-Number: 044 ZKP-Number: 2.0107.921

Intercooler coolant pressure too low (1st limit value not attained)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Filter clogged.	1. Check filter. 2. Clean filter and replace if necessary.
Coolant pump defective or jamming.	1. Repair coolant pump. 2. Replace complete coolant pump as required.

067 – HI T-Coolant

PV-Number: 129 ZKP-Number: 2.0120.931

Coolant temperature too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

005 – HI T-Charge Air

PV-Number: 133 ZKP-Number: 2.0121.931

Charge air temperature too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 111)	

TIM ID: 0000029057 – 001

003 – HI T-Fuel

PV-Number: 299 ZKP-Number: 2.0122.931

Fuel temperature too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 118)	

009 – AL L1 T-Coolant Intercooler

PV-Number: 139 ZKP-Number: 2.0124.931

Intercooler coolant temperature too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 108)	

051 – HI T-Lube Oil

PV-Number: 143 ZKP-Number: 2.0125.931

Lube oil temperature too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 101)	

122 – HI T-ECU

PV-Number: 170 ZKP-Number: 2.0132.921

ECU temperature too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Ambient temperature in engine room too high.	► Improve engine room ventilation.
Unfavorable arrangement of heat-radiating components (e.g. exhaust pipes).	1. Check arrangement of components in the engine room. 2. Change configuration as required. 3. Consultation with OEM and/or MTU Service required.

TIM ID: 0000029057 – 001

118 – LO ECU Power Supply Voltage

PV-Number: 122 ZKP-Number: 2.0140.921

ECU supply voltage too low (1st limit value not attained)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Battery voltage is too low.	1. Check battery voltage (measure directly at battery poles). 2. If this is within the tolerance range, the voltage must be measured as closely as possible to the engine governor (with governor connected). 3. If the voltage is below the tolerance level here, all electrical connections along the supply route between battery and engine governor must be checked for contact security.
Cross-section of cable used for supply is too small.	1. Consultation with OEM and/or MTU Service required. 2. Replace cable in accordance with specifications.

120 – HI ECU Power Supply Voltage

PV-Number: 123 ZKP-Number: 2.0140.931

ECU supply voltage too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Incorrect installation, supply voltage connected at wrong point.	► Check connection point and change installation as required (consult OEM).
Battery-charging generator defective.	1. Check battery-charging generator: (→ Page 134) 2. Replace battery-charging generator.
Drive belt too loose or defective.	1. Check drive belt (→ Page 246) 2. Replace defective parts (→ Page 247)

410 – LO U-PDU

PV-Number: - ZKP-Number: 2.0141.921

PDU voltage too low (1st limit value not attained)

Cause	Corrective action
Engine governor defective.	► Replace ECU.

412 – HI U-PDU

PV-Number: - ZKP-Number: 2.0141.931

PDU voltage too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus and the fault message “ECU Alarm ()” is tripped.

Cause	Corrective action
Engine governor defective.	► Replace ECU.

TIM ID: 0000029057 – 001

023 – LO Coolant Level

PV-Number: 055 ZKP-Number: 2.0152.921

Coolant level too low (1st limit value not attained)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Insufficient coolant in circuit.	► Top up coolant (→ Page 242).

025 – HI P-Diff-Lube Oil

PV-Number: 054 ZKP-Number: 2.0154.931

Lube oil differential pressure too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 130)	

414 – HI Level Water Fuel Prefilter

PV-Number: 225 ZKP-Number: 2.0156.931

Water level in fuel prefilter too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Water in fuel prefilter.	1. Open drain screw at fuel prefilter and drain water (collect in suitable vessel). 2. Clean fuel prefilter if necessary.
Water in fuel tank.	► Determine cause of water ingress and rectify
Poor diesel quality.	► Fill up fuel in accordance with MTU specifications.

555 – AL Call MTU Field Service

PV-Number: 009997 ZKP-Number: 2.0555.001

Alarm: Contact MTU Service

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault with complicated cause has occurred.	► Contact MTU Service.

031 – HI ETC1 Overspeed

PV-Number: 058 ZKP-Number: 2.3011.931

Overspeed, exhaust turbocharger 1; speed too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 106)	

454 – SS Power Reduction Active

PV-Number: 009 ZKP-Number: 2.7000.011

Safety system message: Power reduction is active

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further fault messages must be pending: At least one of them tripped the power reduction.	► Observe other fault messages.

AL Power Cut-Off detected

PV-Number: 009997 ZKP-Number: 2.7001.952

Alarm: Interruption in voltage supply detected

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Cabling faulty	► Check cabling in accordance with the cabling diagram.
Under certain load conditions (electrical load) in the electrical system, the battery voltage falls below a critical value.	1. Check batteries. 2. Check battery-charging generator: (→ Page 134)

478 – AL Comb. Alarm Yel (Plant)

PV-Number: - ZKP-Number: 2.8006.001

AL combined alarm yellow (plant)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
A yellow alarm from the plant (not the engine!) has been reported.	1. Determine individual plant faults. 2. Determine cause and rectify.

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- – AL ECU Error/Check Fail Codes

PV-Number: - ZKP-Number: -

Alarm: Fault in engine governor/see fault code

CAN message

Cause	Corrective action
There is a fault in the governor itself.	► Note further messages.

363 – AL Stop Power Stage

PV-Number: - ZKP-Number: 1.8004.560

Alarm: Engine stop due to fault in the power amplifier stage of the engine governor ECU

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Power amplifier stage of the engine governor faulty.	► Replace ECU.

365 – AL Stop MV-Wiring Ground

PV-Number: - ZKP-Number: 1.8004.561

Alarm: Engine stop due to short to ground of solenoid cabling

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
There is an electrical connection between the engine ground and an injector line.	1. Note further fault messages – possibly the indication of which injector is affected in another message. 2. Check cabling of injectors (injector wiring harness).
Injector defective	(→ Page 235)

229 – AL Stop Camshaft Sensor Defect

PV-Number: - ZKP-Number: 1.8004.562

Alarm: Engine stop due to defective speed sensor at camshaft

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Camshaft speed sensor is defective.	► Replace sensor.
Cabling between sensor and engine governor is interrupted or has a short circuit.	► Use a multimeter to check cabling in accordance with the cabling diagram for short circuits or interruptions.

066 – SS P-Fuel

PV-Number: 048 ZKP-Number: 2.0102.922

Shutdown by safety system: Fuel pressure too low

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Further troubleshooting (→ Page 123)	

083 – LO P-Fuel (Common Rail)

PV-Number: 064 ZKP-Number: 2.0104.921

Fuel pressure (at Common Rail) too low (1st limit value not attained)

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Further troubleshooting (→ Page 125)	

082 – HI P-Fuel (Common Rail)

PV-Number: 065 ZKP-Number: 2.0104.931

Fuel pressure (at Common Rail) too high (1st limit value exceeded)

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Further troubleshooting (→ Page 117)	

006 – SS T-Charge Air

PV-Number: 168 ZKP-Number: 2.0121.932

Shutdown by safety system: Charge air temperature too high

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Further troubleshooting (→ Page 111)	

TIM ID: 0000029057 – 001

119 – LOLO ECU Power Supply Voltage

PV-Number: 270 ZKP-Number: 2.0140.922

ECU supply voltage too low (2nd limit value not attained)

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Battery voltage is too low.	1. Check battery voltage (measure directly at battery poles). 2. If this is within the tolerance range, the voltage must be measured as closely as possible to the engine governor (with governor connected). 3. If the voltage is below the tolerance level here, all electrical connections along the supply route between battery and engine governor must be checked for contact security.
Cross-section of cable used for supply is too small.	1. Consultation with OEM and/or MTU Service required. 2. Replace cable in accordance with specifications.

121 – HH ECU Power Supply Voltage

PV-Number: 271 ZKP-Number: 2.0140.932

ECU supply voltage too high (2nd limit value exceeded)

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Incorrect installation, supply voltage connected at wrong point.	► Check connection point and change installation as required (consult OEM).
Battery-charging generator defective.	1. Check battery-charging generator: (→ Page 134) 2. Replace battery-charging generator.

411 – LOLO U-PDU

PV-Number: - ZKP-Number: 2.0141.922

PDU voltage too low (2nd limit value not attained)

Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus and the message “ECU fault” is issued. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Engine governor defective.	► Replace ECU.

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413 – HIHI U-PDU

PV-Number: - ZKP-Number: 2.0141.932

PDU voltage too high (1st limit value exceeded)

Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus and the message “ECU fault” is issued. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Engine governor defective.	► Replace ECU.

095 – AL Prelubrication Fault

PV-Number: 237 ZKP-Number: 2.1090.920

Alarm: Fault in prelubrication procedure

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Required lube oil pressure not reached within specified prelubrication time.	1. MTU dialog system “DiaSys” required: Check parameter for “Prelubrication time”. 2. Increase prelubrication time as required.
Oil priming pump defective.	1. Check oil priming pump. 2. Check oil priming pump contactor.
Oil priming pump cannot be activated.	1. Check control signal “Oil priming pump ON”. 2. If the signal is not pending, first: 3. check cabling in accordance with the cabling diagram; then 4. MTU dialog system “DiaSys” required: Check parameter for “Prelubrication”.

030 – SS Engine Overspeed

PV-Number: 003 ZKP-Number: 2.2510.932

Shutdown by safety system: Engine overspeed

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Further troubleshooting (→ Page 113)	

TIM ID: 0000029057 – 001

479 – AL Comb. Alarm Red (Plant)

PV-Number: - ZKP-Number: 2.8006.002

AL combined alarm red (plant)

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
A red alarm from the plant (not the engine!) has been reported.	1. Depending on the engine governor setting, this may result in an automatic engine stop. 2. Determine individual plant faults. 3. Determine cause and rectify.

266 – SD Speed Demand

PV-Number: - ZKP-Number: 2.8006.586

Speed specification missing

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Cabling faulty	1. Check cabling in accordance with the cabling diagram. 2. Determine short circuits or interruptions and eliminate them.
Setting of engine governor incorrect	1. MTU dialog system “DiaSys” required: Check “Speed specification” parameter for correct setting. 2. Correct the parameter as required.
Plant issues no signals.	► Check plant – determine whether a speed specification signal is issued.

270 – SD Frequency Input

PV-Number: - ZKP-Number: 2.8006.590

Frequency input sensor defective

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
There is no signal pending at the frequency input of the engine governor. Fault in the plant.	1. Check plant. 2. Consultation with OEM and/or MTU Service required.

TIM ID: 0000029057 – 001

450 – SD Idle/End-Torque Input [%]

PV-Number: - ZKP-Number: 2.8006.592

No idling speed/torque (%) signal at input

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
Torque cannot be determined due to a defective sensor.	► Contact MTU Service.

472 – Al Stop SD

PV-Number: - ZKP-Number: 2.8006.593

Engine stop due to defective sensor

ADEC single-point alarm: Red alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm is cleared automatically when the cause has been eliminated.

Cause	Corrective action
A sensor absolutely necessary for engine operation has failed.	► Note further fault messages. The corresponding sensor will be named in another message.

232 – SD Charger 1 Speed

PV-Number: - ZKP-Number: 1.3011.128

Engine speed sensor defective, turbocharger 1

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

TIM ID: 0000029057 – 001

500 – AL Wiring POM Starter 1

PV-Number: - ZKP-Number: 1.4500.900

Alarm: Cabling for Power Output Module, starter 1

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage or high contact resistance in supply line between POM (Power Output Module) and starter 1	► Check screw terminals at POM and starter – tighten loosened nuts (including nuts at the flat fuses of the POM and tighten as required).
Check crimp connections of cable rings – all strands of the supply cables must be seated firmly in the cable ring.	► Fit new cable ring if necessary (observe diameter).

501 – AL Wiring POM Starter 2

PV-Number: - ZKP-Number: 1.4500.901

Alarm: Cabling for Power Output Module, starter 2

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage or high contact resistance in supply line between POM (Power Output Module) and starter 1	► Check screw terminals at POM and starter – tighten loosened nuts (including nuts at the flat fuses of the POM and tighten as required).
Check crimp connections of cable rings – all strands of the supply cables must be seated firmly in the cable ring.	► Fit new cable ring if necessary (observe diameter).

502 – AL Open Load POM Alternator

PV-Number: - ZKP-Number: 1.4500.902

Alarm: Power Output Module: Battery-charging generator missing

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Battery-charging generator defective.	1. Check battery-charging generator: (→ Page 134) 2. Replace battery-charging generator.

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503 – AL Battery Not Charging

PV-Number: - ZKP-Number: 1.4500.903

Alarm: Battery not being charged

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Battery-charging generator defective.	1. Check battery-charging generator: (→ Page 134) 2. Replace battery-charging generator.
Drive belt too loose or defective.	1. Check drive belt (→ Page 246) 2. Replace defective parts (→ Page 247)

504 – AL CAN POM Node Lost

PV-Number: 373 ZKP-Number: 1.4500.904

Alarm: CAN node of Power Output Module missing

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
The device registered in the engine governor is missing (or is defective).	► Replace POM.
Setting in engine governor is wrong.	► MTU dialog system “DiaSys” required: Check “Node monitoring” parameter for correct setting. Only devices connected to the bus (e.g. SAM) with their node numbers must be entered.

506 – AL Low Starter Voltage

PV-Number: - ZKP-Number: 1.4500.906

Alarm: Voltage for starter(s) too low

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Battery too weak	► Replace battery.

507 – AL POM Error

PV-Number: - ZKP-Number: 1.4500.907

Alarm: Fault in Power Output Module

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Power Output Module defective	► Replace Power Output Module.

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508 – AL Wrong POM-ID

PV-Number: - ZKP-Number: 1.4500.908

Alarm: Power Output Module identification is wrong (incorrect resistance value)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
The resistance value in the POM connector does not match the actual configuration.	► Check configuration and measure resistance value in connector; establish correct assignment.
POM wiring harness defective.	► Replace POM wiring harness.

361 – AL Power Stage Low

PV-Number: - ZKP-Number: 1.8004.496

Alarm: Voltage in the power amplifier stage of the engine governor too low

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Power amplifier stage of the engine governor faulty.	► Replace ECU.

362 – AL Power Stage High

PV-Number: - ZKP-Number: 1.8004.497

Alarm: Voltage in the power amplifier stage of the engine governor too high

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Power amplifier stage of the engine governor faulty.	► Replace ECU.

230 – SD Crankshaft Speed

PV-Number: - ZKP-Number: 1.8004.498

Crankshaft speed sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

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231 – SD Camshaft Speed

PV-Number: - ZKP-Number: 1.8004.499

Camshaft speed sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

321 – AL Wiring Cylinder A1

PV-Number: - ZKP-Number: 1.8004.520

Cabling to injector of cylinder A1 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

322 – AL Wiring Cylinder A2

PV-Number: - ZKP-Number: 1.8004.521

Cabling to injector of cylinder A1 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

323 – AL Wiring Cylinder A3

PV-Number: - ZKP-Number: 1.8004.522

Cabling to injector of cylinder A3 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

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324 – AL Wiring Cylinder A4

PV-Number: - ZKP-Number: 1.8004.523

Cabling to injector of cylinder A4 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

325 – AL Wiring Cylinder A5

PV-Number: - ZKP-Number: 1.8004.524

Cabling to injector of cylinder A5 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.

326 – AL Wiring Cylinder A6

PV-Number: - ZKP-Number: 1.8004.525

Cabling to injector of cylinder A6 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

327 – AL Wiring Cylinder A7

PV-Number: - ZKP-Number: 1.8004.526

Cabling to injector of cylinder A7 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

328 – AL Wiring Cylinder A8

PV-Number: - ZKP-Number: 1.8004.527

Cabling to injector of cylinder A8 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

329 – AL Wiring Cylinder A9

PV-Number: - ZKP-Number: 1.8004.528

Cabling to injector of cylinder A9 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

330 – AL Wiring Cylinder A10

PV-Number: - ZKP-Number: 1.8004.529

Cabling to injector of cylinder A10 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

331 – AL Wiring Cylinder B1

PV-Number: - ZKP-Number: 1.8004.530

Cabling to injector of cylinder B1 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

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332 – AL Wiring Cylinder B2

PV-Number: - ZKP-Number: 1.8004.531

Cabling to injector of cylinder B2 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

333 – AL Wiring Cylinder B3

PV-Number: - ZKP-Number: 1.8004.532

Cabling to injector of cylinder B3 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

334 – AL Wiring Cylinder B4

PV-Number: - ZKP-Number: 1.8004.533

Cabling to injector of cylinder B4 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

335 – AL Wiring Cylinder B5

PV-Number: - ZKP-Number: 1.8004.534

Cabling to injector of cylinder B5 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

336 – AL Wiring Cylinder B6

PV-Number: - ZKP-Number: 1.8004.535

Cabling to injector of cylinder B6 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

337 – AL Wiring Cylinder B7

PV-Number: - ZKP-Number: 1.8004.536

Cabling to injector of cylinder B7 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

338 – AL Wiring Cylinder B8

PV-Number: - ZKP-Number: 1.8004.537

Cabling to injector of cylinder B8 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

339 – AL Wiring Cylinder B9

PV-Number: - ZKP-Number: 1.8004.538

Cabling to injector of cylinder B9 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

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340 – AL Wiring Cylinder B10

PV-Number: - ZKP-Number: 1.8004.539

Cabling to injector of cylinder B10 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Intermittent contact in cabling	1. Check connection points (injector on wiring harness) 2. Check connector at engine governor.

341 – AL Open Load Cylinder A1

PV-Number: - ZKP-Number: 1.8004.540

No load at output for injector of cylinder A1

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

342 – AL Open Load Cylinder A2

PV-Number: - ZKP-Number: 1.8004.541

No load at output for injector of cylinder A2

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

343 – AL Open Load Cylinder A3

PV-Number: - ZKP-Number: 1.8004.542

No load at output for injector of cylinder A3

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

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344 – AL Open Load Cylinder A4

PV-Number: - ZKP-Number: 1.8004.543

No load at output for injector of cylinder A4

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm "ECU fault alarm, see fault code" is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

345 – AL Open Load Cylinder A5

PV-Number: - ZKP-Number: 1.8004.544

No load at output for injector of cylinder A5

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm "ECU fault alarm, see fault code" is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

346 – AL Open Load Cylinder A6

PV-Number: - ZKP-Number: 1.8004.545

No load at output for injector of cylinder A6

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm "ECU fault alarm, see fault code" is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

347 – AL Open Load Cylinder A7

PV-Number: - ZKP-Number: 1.8004.546

No load at output for injector of cylinder A7

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm "ECU fault alarm, see fault code" is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

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348 – AL Open Load Cylinder A8

PV-Number: - ZKP-Number: 1.8004.547

No load at output for injector of cylinder A8

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

349 – AL Open Load Cylinder A9

PV-Number: - ZKP-Number: 1.8004.548

No load at output for injector of cylinder A9

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

350 – AL Open Load Cylinder A10

PV-Number: - ZKP-Number: 1.8004.549

No load at output for injector of cylinder A10

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

351 – AL Open Load Cylinder B1

PV-Number: - ZKP-Number: 1.8004.550

No load at output for injector of cylinder B1

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

352 – AL Open Load Cylinder B2

PV-Number: - ZKP-Number: 1.8004.551

No load at output for injector of cylinder B2

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

353 – AL Open Load Cylinder B3

PV-Number: - ZKP-Number: 1.8004.552

No load at output for injector of cylinder B3

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

354 – AL Open Load Cylinder B4

PV-Number: - ZKP-Number: 1.8004.553

No load at output for injector of cylinder B4

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

355 – AL Open Load Cylinder B5

PV-Number: - ZKP-Number: 1.8004.554

No load at output for injector of cylinder B5

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

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356 – AL Open Load Cylinder B6

PV-Number: - ZKP-Number: 1.8004.555

No load at output for injector of cylinder B6

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

357 – AL Open Load Cylinder B7

PV-Number: - ZKP-Number: 1.8004.556

No load at output for injector of cylinder B7

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

358 – AL Open Load Cylinder B8

PV-Number: - ZKP-Number: 1.8004.557

No load at output for injector of cylinder B8

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

359 – AL Open Load Cylinder B9

PV-Number: - ZKP-Number: 1.8004.558

No load at output for injector of cylinder B9

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

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360 – AL Open Load Cylinder B10

PV-Number: - ZKP-Number: 1.8004.559

No load at output for injector of cylinder B10

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage in cabling to injector	► Replace injector wiring harness.
Injector defective	(→ Page 235)

211 – SD P-Lube Oil

PV-Number: - ZKP-Number: 1.8004.563

Lube oil pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

212 – SD P-Coolant

PV-Number: - ZKP-Number: 1.8004.564

Coolant pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

240 – SD P-Fuel

PV-Number: - ZKP-Number: 1.8004.565

Fuel pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

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208 – SD P-Charge Air

PV-Number: - ZKP-Number: 1.8004.566

Charge air pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

215 – SD P-HD

PV-Number: - ZKP-Number: 1.8004.567

High-pressure sensor defective (Common Rail)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

214 – SD P-CrankCase

PV-Number: - ZKP-Number: 1.8004.568

Crankcase pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

213 – SD P-Coolant Intercooler

PV-Number: - ZKP-Number: 1.8004.569

Intercooler coolant pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

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201 – SD T-Coolant

PV-Number: - ZKP-Number: 1.8004.570

Coolant temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

203 – SD T-Charge Air

PV-Number: - ZKP-Number: 1.8004.571

Charge air temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

202 – SD T-Fuel

PV-Number: - ZKP-Number: 1.8004.572

Fuel temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

219 – SD T-Intake Air

PV-Number: - ZKP-Number: 1.8004.573

Intake air temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

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205 – SD T-Coolant Intercooler

PV-Number: - ZKP-Number: 1.8004.574

Intercooler coolant temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

216 – SD T-Lube Oil

PV-Number: - ZKP-Number: 1.8004.575

Lube oil temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

444 – SD U-PDU

PV-Number: - ZKP-Number: 1.8004.578

Voltage measurement PDU sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective.	► Replace ECU.

220 – SD Level Coolant Water

PV-Number: - ZKP-Number: 1.8004.584

Coolant level sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

TIM ID: 0000029057 – 001

221 – SD Dif Lube Oil

PV-Number: - ZKP-Number: 1.8004.585

Lube oil differential pressure sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

470 – SD T-ECU

PV-Number: - ZKP-Number: 1.8004.587

ECU temperature sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective.	► Replace ECU.

471 – SD Coil Current

PV-Number: - ZKP-Number: 1.8004.592

Coil current sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective.	► Replace ECU.

473 – AL Wiring PWM_CM2

PV-Number: - ZKP-Number: 1.8004.593

Alarm: Cabling at output PWM_CM2 of engine governor (pulse-width modulated signal)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Intermittent contact or detached cable at engine governor output	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

TIM ID: 0000029057 – 001

417 – SD Level Water Fuel Prefilter

PV-Number: - ZKP-Number: 1.8004.594

Water level sensor in fuel prefilter defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

SD P-Lube Oil before Filter

PV-Number: - ZKP-Number: 1.8004.620

Lube oil pressure sensor upstream of filter defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

104 – AL Eng Hours Counter Defect

PV-Number: - ZKP-Number: 1.8004.623

Alarm: Hour meter defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective.	► Replace engine governor.

102 – AL Fuel Cons. Counter Defect

PV-Number: - ZKP-Number: 1.8004.624

Alarm: Fuel consumption measurement faulty

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective.	► Replace engine governor.

TIM ID: 0000029057 – 001

373 – AL Wiring TO 3

PV-Number: - ZKP-Number: 1.8004.636

Alarm: Cabling at transistor output TO 3 defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at output of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

476 – AL Crash Rec. Init. Error

PV-Number: - ZKP-Number: 1.8010.007

Alarm: Initialization of Crash Recorder unsuccessful

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective.	► Switch engine governor off and then on again (reinitialization of the software)
Engine governor defective.	► Replace ECU.

475 – AL CR Trigger Engine Stop

PV-Number: - ZKP-Number: 1.8010.009

Alarm: Tripping of engine stop by Crash Recorder

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
A status recorded by the Crash Recorder resulted in an engine stop.	► Note further messages.

025 – HI P-Diff-Lube Oil / LSI 3-Switch

PV-Number: 054 ZKP-Number: 2.0151.931

Differential pressure sensor determines excessive pressure difference before and after the filter (applies to sensors connected to output LSI 3 of the engine governor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Further troubleshooting (→ Page 130)	

TIM ID: 0000029057 – 001

480 – Lim ext Plant Engine Prot Bin

PV-Number: - ZKP-Number: 2.0291.921

A signal is pending at the input “external power reduction request” – externally connected components trip a power reduction

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Fault in the plant – externally supplied fault message.	► See documentation for non-MTU system

180 – AL CAN1 Node Lost

PV-Number: - ZKP-Number: 2.0500.680

Alarm: at CAN1 (default), a device is missing (node is not detected)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
A device, the node number of which is registered in the engine governor, is not detected – device faulty	1. Determine device. 2. Replace device.
A node number is incorrectly registered in the engine governor for monitoring although the device is not present.	► MTU dialog system “DiaSys” required: Check “Node monitoring” parameter for correct setting. Only devices connected to the bus (e.g. SAM) with their node numbers must be entered.

181 – AL CAN2 Node Lost

PV-Number: - ZKP-Number: 2.0500.681

Alarm: at CAN2 (redundant), a device is missing (node is not detected)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
A device, the node number of which is registered in the engine governor, is not detected – device faulty	1. Determine device. 2. Replace device.
A node number is incorrectly registered in the engine governor for monitoring although the device is not present.	► MTU dialog system “DiaSys” required: Check “Node monitoring” parameter for correct setting. Only devices connected to the bus (e.g. SAM) with their node numbers must be entered.

182 – AL CAN Wrong Parameters

PV-Number: - ZKP-Number: 2.0500.682

Alarm: CAN parameters are incorrectly set

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
General error in programming.	► Contact MTU Service.

183 – AL CAN No PU-Data

PV-Number: - ZKP-Number: 2.0500.683

Alarm: CAN, no PU data available

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
General error in programming.	► Contact MTU Service.

184 – AL CAN PU-Data Flash Error

PV-Number: - ZKP-Number: 2.0500.684

Alarm: CAN, a fault occurred when saving PU data to the Flash memory

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
PU data cannot be saved.	► Contact MTU Service.

186 – AL CAN1 Bus Off

PV-Number: - ZKP-Number: 2.0500.686

Alarm: CAN1 (default) bus stationary

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Short circuit on bus.	1. Check cabling with a multimeter. 2. The resistance between CAN(H) and CAN(L) must be approx. 60 Ω. 3. The resistance between CAN(H) and ground and CAN(L) and ground must be above 1 MΩ.
Terminal resistor missing.	► At the end of the bus, install a resistor with 121 Ω via CAN(H) and CAN(L).

TIM ID: 0000029057 – 001

187 – AL CAN1 Error Passive

PV-Number: - ZKP-Number: 2.0500.687

Alarm: CAN1 (default) not transferring data

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Error in the software.	► Restart the system.

188 – AL CAN2 Bus Off

PV-Number: - ZKP-Number: 2.0500.688

Alarm: CAN2 (default) bus stationary

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Short circuit on bus.	1. Check cabling with a multimeter. 2. The resistance between CAN(H) and CAN(L) must be approx. 60 Ω. 3. The resistance between CAN(H) and ground and CAN(L) and ground must be above 1 MΩ.
Terminal resistor missing.	► At the end of the bus, install a resistor with 121 Ω via CAN(H) and CAN(L).

189 – AL CAN2 Error Passive

PV-Number: - ZKP-Number: 2.0500.689

Alarm: CAN2 (redundant) not transferring data

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Error in the software.	► Restart the system.

544 – AL Configuration Changed

PV-Number: 009997 ZKP-Number: 2.0555.003

Alarm: Configuration has been changed

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Checksum between engine governor and SAM does not match.	► Download the software.

TIM ID: 0000029057 – 001

543 – AL Multiple FDH Slaves

PV-Number: 347 ZKP-Number: 2.0555.005

Alarm: Multiple FDH slaves

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
	► MTU Service

094 – LO T-Preheat

PV-Number: 357 ZKP-Number: 2.1090.921

Preheating temperature too low (1st limit value not attained)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Preheater not working.	► Check preheater.
Preheating time too short.	1. Consultation with OEM and/or MTU Service required. 2. MTU dialog system “DiaSys” required: Change parameter for “Preheating time”.

093 – SS T-Preheat

PV-Number: 358 ZKP-Number: 2.1090.922

Shutdown by safety system: Preheating temperature too low

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Preheater not working.	► Check preheater.
Preheating time too short.	1. Consultation with OEM and/or MTU Service required. 2. MTU dialog system “DiaSys” required: Change parameter for “Preheating time”.

092 – SS Starter Speed Not Reached

PV-Number: 239 ZKP-Number: 2.1090.923

Shutdown by safety system: Starting speed not reached

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine not turning fast enough after required time.	► MTU Service

TIM ID: 0000029057 – 001

091 – SS Release Speed Not Reached

PV-Number: 240 ZKP-Number: 2.1090.924

Shutdown by safety system: Enable speed not reached

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine not turning fast enough to disengage the starter after required time.	► MTU Service

090 – SS Idle Speed Not Reached

PV-Number: 241 ZKP-Number: 2.1090.925

Shutdown by safety system: Idling speed not attained

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine does not reach idling speed after required time.	► MTU Service

515 – AI Starter Not Engaged

PV-Number: 433 ZKP-Number: 2.1090.926

Alarm: Starter does not engage.

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Starter defective.	► Replace starter.

089 – AL Engine Speed Low

PV-Number: 177 ZKP-Number: 2.2500.030

Alarm: Engine speed too low

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine load too high.	► Reduce load.

TIM ID: 0000029057 – 001

176 – AL LifeData not available

PV-Number: - ZKP-Number: 2.4000.004

Alarm: Engine operational data no longer available

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Fault in engine governor.	► Contact MTU Service.

177 – AL LifeData restore incomplete

PV-Number: - ZKP-Number: 2.4000.006

Alarm: Restoring of engine operational data was not successful

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Fault in engine governor.	► Contact MTU Service.

549 – AL Power Cut-Off detected

PV-Number: - ZKP-Number: 2.7001.952

Alarm: Interruption in supply voltage

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling faulty	► Check cabling in accordance with the cabling diagram.
Under certain load conditions (electrical load) in the electrical system, the battery voltage falls below a critical value.	1. Check batteries. 2. Check battery-charging generator: (→ Page 134)

510 – AL Override applied

PV-Number: - ZKP-Number: 2.7002.010

Alarm: Override is selected

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine continues running even if certain limit values have been violated.	► –

TIM ID: 0000029057 – 001

245 – SD ECU Power Supply Voltage

PV-Number: - ZKP-Number: 2.8006.589

ECU supply voltage sensor defective

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Engine governor defective	► Replace ECU.

400 – AL Open Load Digital Input 1

PV-Number: - ZKP-Number: 2.8006.625

Alarm: No load at digital input DI 1 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

401 – AL Open Load Digital Input 2

PV-Number: - ZKP-Number: 2.8006.626

Alarm: No load at digital input DI 2 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

TIM ID: 0000029057 – 001

402 – AL Open Load Digital Input 3

PV-Number: - ZKP-Number: 2.8006.627

Alarm: No load at digital input DI 3 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

403 – AL Open Load Digital Input 4

PV-Number: - ZKP-Number: 2.8006.628

Alarm: No load at digital input DI 4 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

404 – AL Open Load Digital Input 5

PV-Number: - ZKP-Number: 2.8006.629

Alarm: No load at digital input DI 5 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

TIM ID: 0000029057 – 001

405 – AL Open Load Digital Input 6

PV-Number: - ZKP-Number: 2.8006.630

Alarm: No load at digital input DI 6 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

406 – AL Open Load Digital Input 7

PV-Number: - ZKP-Number: 2.8006.631

Alarm: No load at digital input DI 7 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

407 – AL Open Load Digital Input 8

PV-Number: - ZKP-Number: 2.8006.632

Alarm: No load at digital input DI 8 of engine governor ECU (cabling damage monitor)

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

TIM ID: 0000029057 – 001

381 – AL Wiring TOP 1

PV-Number: - ZKP-Number: 2.8006.638

Alarm: Cabling at transistor output TOP 1 of the engine governor ECU faulty

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at output of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

382 – AL Wiring TOP 2

PV-Number: - ZKP-Number: 2.8006.639

Alarm: Cabling at transistor output TOP 2 of the engine governor ECU faulty

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at output of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

383 – AL Wiring TOP 3

PV-Number: - ZKP-Number: 2.8006.640

Alarm: Cabling at transistor output TOP 3 of the engine governor ECU faulty

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at output of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

384 – AL Wiring TOP 4

PV-Number: - ZKP-Number: 2.8006.641

Alarm: Cabling at transistor output TOP 4 of the engine governor ECU faulty

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at output of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

TIM ID: 0000029057 – 001

474 – AL Wiring FO

PV-Number: - ZKP-Number: 2.8006.655

Alarm: Cabling at frequency output FO of the engine governor ECU faulty

ADEC combined alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus. The alarm “ECU fault alarm, see fault code” is also issued.

Cause	Corrective action
Cabling damage at output of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

527 – TD EngineSpeed Sensor Deviation

PV-Number: 009997 ZKP-Number: 1.0480.093

Deviating measurement results from first and second sensor (Transmitter Deviation), engine speed sensors

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Position of sensors incorrect.	► Correct the sensor position.

397 – TD P-Oil Sensor Deviation

PV-Number: 476 ZKP-Number: 1.0480.293

Deviating measurement results from first and second sensor (Transmitter Deviation), lube oil pressure sensors

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
One of the sensors is defective.	1. Note further fault messages 2. Carry out appropriate remedial measures at sensor reported as defective.

576 – AL ESM Override

PV-Number: 322 ZKP-Number: 1.1075.083

Alarm: Corrected MCR (Maximum Continuous Rate) or speed-sensitive fuel limiter (DBR)/MCR curve is exceeded

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Engine overloaded during operation.	► Reduce engine load.

TIM ID: 0000029057 – 001

390 – AL MCR exceeded

PV-Number: 390 ZKP-Number: 1.1085.009

Alarm MCR (Maximum Continuous Rate) curve is exceeded

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Engine overloaded during operation.	► Reduce engine load.

142 – AL MCR exceeded 1 hour

PV-Number: 448 ZKP-Number: 1.1088.006

Alarm MCR (Maximum Continuous Rate) exceeded for more than one hour

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Engine overloaded during operation. This has occurred for longer than one hour.	► Reduce engine load.

141 – AL Power too high

PV-Number: 449 ZKP-Number: 1.1088.007

Alarm overload

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Engine overloaded during operation.	► Reduce engine load.

528 – SD Engine Speed 3rd Sensor

PV-Number: - ZKP-Number: 1.2500.102

Third engine speed sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

TIM ID: 0000029057 – 001

233 – SD Charger 2 Speed

PV-Number: - ZKP-Number: 1.3011.129

Exhaust turbocharger 2 speed sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

081 – AL Rail Leakage

PV-Number: 185 ZKP-Number: 1.8004.046

Alarm, leak in H.P. fuel line (Common Rail)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Rail damaged (gasket).	1. Determine leak (visual inspection). 2. Replace gasket.

AL ETC4 CutIn Failure

PV-Number: - ZKP-Number: 1.8004.202

Alarm, exhaust turbocharger 4 cannot be cut in

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Flap jamming.	1. Check why flap is jamming. 2. Assure ease of movement.
Actuator faulty.	1. Check actuator (coil for continuity). 2. Replace actuator as required.
Exhaust turbocharger damaged.	► Replace turbocharger.

AL ETC3 CutIn Failure

PV-Number: - ZKP-Number: 1.8004.203

Alarm, exhaust turbocharger 3 cannot be cut in

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Flap jamming.	1. Check why flap is jamming. 2. Assure ease of movement.
Actuator faulty.	1. Check actuator (coil for continuity). 2. Replace actuator as required.
Exhaust turbocharger damaged.	► Replace turbocharger.

39 – AL ETC2 Cut in Fail

PV-Number: - ZKP-Number: 1.8004.204

Alarm, exhaust turbocharger 2 cannot be cut in

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Flap jamming.	1. Check why flap is jamming. 2. Assure ease of movement.
Actuator faulty.	1. Check actuator (coil for continuity). 2. Replace actuator as required.
Exhaust turbocharger damaged.	► Replace turbocharger.

38 – AL ETC Speed Deviation

PV-Number: - ZKP-Number: 1.8004.205

Alarm, exhaust turbocharger speed deviation

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Exhaust turbocharger faulty.	► Replace turbocharger.

29 – HI ETC2 Idle Speed High

PV-Number: - ZKP-Number: 1.8004.206

Idling speed of exhaust turbocharger 2 too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Idling speed exhaust turbocharger too high.	1. Check turbocharger flap. 2. Assure ease of movement.

301 – AL Timing Cylinder A1

PV-Number: - ZKP-Number: 1.8004.500

Alarm: Flying time of injector A1 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A1

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

TIM ID: 0000029057 – 001

302 – AL Timing Cylinder A2

PV-Number: - ZKP-Number: 1.8004.501

Alarm: Flying time of injector A2 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A2

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

303 – AL Timing Cylinder A3

PV-Number: - ZKP-Number: 1.8004.502

Alarm: Flying time of injector A3 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A3

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

304 – AL Timing Cylinder A4

PV-Number: - ZKP-Number: 1.8004.503

Alarm: Flying time of injector A4 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A4

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

305 – AL Timing Cylinder A5

PV-Number: - ZKP-Number: 1.8004.504

Alarm: Flying time of injector A5 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A5

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

TIM ID: 0000029057 – 001

306 – AL Timing Cylinder A6

PV-Number: - ZKP-Number: 1.8004.505

Alarm: Flying time of injector A6 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A6

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

307 – AL Timing Cylinder A7

PV-Number: - ZKP-Number: 1.8004.506

Alarm: Flying time of injector A7 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A7

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

308 – AL Timing Cylinder A8

PV-Number: - ZKP-Number: 1.8004.507

Alarm: Flying time of injector A8 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A8

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

309 – AL Timing Cylinder A9

PV-Number: - ZKP-Number: 1.8004.508

Alarm: Flying time of injector A9 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A9

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

310 – AL Timing Cylinder A10

PV-Number: - ZKP-Number: 1.8004.509

Alarm: Flying time of injector A10 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) A10

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

311 – AL Timing Cylinder B1

PV-Number: - ZKP-Number: 1.8004.510

Alarm: Flying time of injector B1 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B1

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

312 – AL Timing Cylinder B2

PV-Number: - ZKP-Number: 1.8004.511

Alarm: Flying time of injector B2 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B2

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

313 – AL Timing Cylinder B3

PV-Number: - ZKP-Number: 1.8004.512

Alarm: Flying time of injector B3 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B3

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

TIM ID: 0000029057 – 001

314 – AL Timing Cylinder B4

PV-Number: - ZKP-Number: 1.8004.513

Alarm: Flying time of injector B4 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B4

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

315 – AL Timing Cylinder B5

PV-Number: - ZKP-Number: 1.8004.514

Alarm: Flying time of injector B5 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B5

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

316 – AL Timing Cylinder B6

PV-Number: - ZKP-Number: 1.8004.515

Alarm: Flying time of injector B6 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B6

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

317 – AL Timing Cylinder B7

PV-Number: - ZKP-Number: 1.8004.516

Alarm: Flying time of injector B7 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B7

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

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318 – AL Timing Cylinder B8

PV-Number: - ZKP-Number: 1.8004.517

Alarm: Flying time of injector B8 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B8

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

319 – AL Timing Cylinder B9

PV-Number: - ZKP-Number: 1.8004.518

Alarm: Flying time of injector B9 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B9

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

320 – AL Timing Cylinder B10

PV-Number: - ZKP-Number: 1.8004.519

Alarm: Flying time of injector B10 is incorrect (time during which the injector needle moves between “OPEN” and “CLOSED”) B10

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Injector defective.	1. Replace injector (→ Page 235). 2. MTU dialog system “DiaSys” required: Reset injector setting.

206 – SD T-Exhaust A

PV-Number: - ZKP-Number: 1.8004.576

Bulk exhaust gas temperature A sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

207 – SD T-Exhaust B

PV-Number: - ZKP-Number: 1.8004.577

Bulk exhaust gas temperature B sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

468 – SD T-AUX 1

PV-Number: - ZKP-Number: 1.8004.579

Input AUX 1 temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

445 – SD P-Ambient Air

PV-Number: - ZKP-Number: 1.8004.580

Ambient air pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

241 – SD T-Charge Air Seq Ctrl

PV-Number: - ZKP-Number: 1.8004.581

Charge air sequential control temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

TIM ID: 0000029057 – 001

222 – SD Level Leakage Fuel

PV-Number: - ZKP-Number: 1.8004.582

Leak-off fuel level sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

223 – SD Level Coolant Intercooler

PV-Number: - ZKP-Number: 1.8004.583

Intercooler coolant level sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

221 – SD Dif Lube Oil

PV-Number: - ZKP-Number: 1.8004.585

Lube oil differential pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

466 – SD T-AUX 2

PV-Number: - ZKP-Number: 1.8004.586

Input AUX 2 temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

465 – SD P-AUX 2

PV-Number: - ZKP-Number: 1.8004.588

Input AUX 2 pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

464 – SD P-AUX 1

PV-Number: - ZKP-Number: 1.8004.589

Input AUX 1 pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

469 – SD AUX 1

PV-Number: - ZKP-Number: 1.8004.590

Input AUX 1 signal sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

463 – SD AUX 2

PV-Number: - ZKP-Number: 1.8004.591

Input AUX 2 signal sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

TIM ID: 0000029057 – 001

228 – SD P-Fuel before Filter

PV-Number: - ZKP-Number: 1.8004.595

Fuel pressure upstream of filter, pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

SD T-Exhaust C

PV-Number: - ZKP-Number: 1.8004.596

Exhaust gas C temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

SD T-Exhaust D

PV-Number: - ZKP-Number: 1.8004.597

Exhaust gas D temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

239 – SD P-Diff Fuel

PV-Number: - ZKP-Number: 1.8004.598

Fuel differential pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

419 – SD T-Coolant before Engine

PV-Number: - ZKP-Number: 1.8004.604

Coolant before engine, temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

227 – SD P-Lube Oil before Filter

PV-Number: - ZKP-Number: 1.8004.620

Lube oil upstream of filter, pressure sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

244 – SD P-Lube Oil redund.

PV-Number: - ZKP-Number: 1.8004.621

Lube oil pressure sensor defective (redundant sensor)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

242 – SD T-Coolant redundant

PV-Number: - ZKP-Number: 1.8004.622

Coolant temperature sensor defective (redundant)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

TIM ID: 0000029057 – 001

371 – AL Wiring TO 1

PV-Number: - ZKP-Number: 1.8004.634

Alarm, cabling at transistor output TO 1 defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Cabling damage at output TO 1	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

372 – AL Wiring TO 2

PV-Number: - ZKP-Number: 1.8004.635

Alarm, cabling at transistor output TO 2 (SAM) defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Cabling damage at output TO 2	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

374 – AL Wiring TO 4

PV-Number: - ZKP-Number: 1.8004.637

Alarm, cabling at transistor output TO 4 defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Cabling damage at output TO 4 (SAM).	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.

525 – AL P-Lube Oil (R2)

PV-Number: - ZKP-Number: 1.8004.638

Alarm, lube oil pressure (R2)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

526 – SD T-Coolant (R2)

PV-Number: - ZKP-Number: 1.8004.639

Coolant (R2) temperature sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Sensor faulty.	► Replace sensor.
Cabling faulty.	► Check cabling in accordance with the cabling diagram for short circuits or interruptions.

448 – HI P-Charge Air

PV-Number: 050 ZKP-Number: 2.0103.931

Charge air pressure too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 111)	

449 – SS P-Charge Air

PV-Number: - ZKP-Number: 2.0103.932

Shutdown by safety system: Charge air pressure too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 111)	

440 – L1 P-Aux 1

PV-Number: - ZKP-Number: 2.0110.921

Pressure at input AUX 1 outside permissible range (1st limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

TIM ID: 0000029057 – 001

442 – L2 P-Aux 1

PV-Number: - ZKP-Number: 2.0110.931

Pressure at input AUX 1 outside permissible range (2nd limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

033 – Hi P-Diff-Fuel

PV-Number: - ZKP-Number: 2.0114.931

Fuel differential pressure too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 130)	

034 – SS P-Diff-Fuel

PV-Number: - ZKP-Number: 2.0114.932

Shutdown by safety system: Fuel differential pressure too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 130)	

059 – SS T-Coolant L3

PV-Number: ??? ZKP-Number: 2.0120.933

Shutdown by safety system: Coolant temperature too high (3rd limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

TIM ID: 0000029057 – 001

060 – SS T-Coolant L4

PV-Number: ??? ZKP-Number: 2.0120.934

Shutdown by safety system: Coolant temperature too high (4th limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

019 – HI T-Exhaust A

PV-Number: 147 ZKP-Number: 2.0126.931

Exhaust gas temperature on engine side A too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

020 – SS T-Exhaust A

PV-Number: 296 ZKP-Number: 2.0126.932

Shutdown by safety system: Exhaust gas temperature on engine side A too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

TIM ID: 0000029057 – 001

021 – HI T-Exhaust B

PV-Number: 150 ZKP-Number: 2.0127.931

Exhaust gas temperature on engine side B too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

022 – SS T-Exhaust B

PV-Number: 297 ZKP-Number: 2.0127.932

Shutdown by safety system: Exhaust gas temperature on engine side B too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

085 – HI T-Recirculation

PV-Number: - ZKP-Number: 2.0128.931

Recirculation temperature too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
	► MTU Service

TIM ID: 0000029057 – 001

086 – HIHI T Recirculation

PV-Number: - ZKP-Number: 2.0128.932

Recirculation temperature too high (2nd limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
	► MTU Service

428 – L1 T-Aux 1

PV-Number: - ZKP-Number: 2.0130.921

Temperature at input AUX 1 outside permissible range (1st limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

467 – L2 T-Aux 1

PV-Number: - ZKP-Number: 2.0130.922

Temperature at input AUX 1 outside permissible range (2nd limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

484 – HI T-Exhaust C

PV-Number: - ZKP-Number: 2.0133.931

Exhaust gas temperature too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

TIM ID: 0000029057 – 001

485 – SS T-Exhaust C

PV-Number: - ZKP-Number: 2.0133.932

Shutdown by safety system: Exhaust temperature C too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

486 – HI T-Exhaust C

PV-Number: - ZKP-Number: 2.0134.931

Exhaust gas temperature D too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

487 – SS T-Exhaust D

PV-Number: - ZKP-Number: 2.0134.932

Shutdown by safety system: Exhaust temperature D too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

027 – HI Level Leakage Fuel

PV-Number: 056 ZKP-Number: 2.0151.931

Leak-off fuel level too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fuel line porous or damaged.	► Replace fuel line.

044 – L1 Level Coolant Intercooler

PV-Number: 099 ZKP-Number: 2.0153.921

L1 Intercooler coolant level too low (1st limit value not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Insufficient coolant in circuit	► Top up coolant (→ Page 248).

026 – SS P-Diff-Lube Oil

PV-Number: - ZKP-Number: 2.0154.932

Shutdown by safety system: Lube-oil differential pressure too high – Fault isolation

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 130)	

420 – L1 Aux 1

PV-Number: - ZKP-Number: 2.0160.921

Value at input AUX 1 outside permissible range (1st limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

TIM ID: 0000029057 – 001

421 – L2 Aux 1

PV-Number: - ZKP-Number: 2.0160.922

Value at input AUX 1 outside permissible range (2nd limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

430 – Lo P-Coolant before Engine

PV-Number: 442 ZKP-Number: 2.0168.921

Coolant pressure upstream of engine too low (1st limit value not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Insufficient coolant in circuit (→ Page 242).	1. Check coolant level. 2. Top up coolant if necessary. Observe permissible quality, additives and capacities (→ Page 242).
Coolant pump faulty.	► MTU Service

431 – SS P-Coolant before Engine

PV-Number: 443 ZKP-Number: 2.0168.922

Shutdown by safety system: Coolant pressure upstream of engine too low

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Insufficient coolant in circuit.	1. Check coolant level. 2. Top up coolant if necessary. Observe permissible quality, additives and capacities (→ Page 242).
Coolant pump faulty.	► MTU Service

434 – Hi T-Coolant before Engine

PV-Number: 444 ZKP-Number: 2.0173.931

Coolant temperature upstream of engine too high (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

435 – SS T-Coolant before Engine

PV-Number: 445 ZKP-Number: 2.0173.932

Shutdown by safety system: Coolant temperature upstream of engine too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

524 – SS Engine Overspeed Mid Val

PV-Number: 478 ZKP-Number: 2.0480.089

Shutdown by safety system: Engine overspeed (middle value)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 113)	

550 – SS Engine Overspeed Red2

PV-Number: 446 ZKP-Number: 2.0480.095

Shutdown by safety system: Engine overspeed (redundant)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 113)	

529 – SS T-Coolant Red2

PV-Number: - ZKP-Number: 2.0480.195

Shutdown by safety system: Coolant temperature (redundant)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

392 – Hi T-Coolant Red

PV-Number: 331 ZKP-Number: 2.0480.197

Coolant temperature (redundant) too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

TIM ID: 0000029057 – 001

523 – SS T-Coolant Red Mid Val

PV-Number: 480 ZKP-Number: 2.0480.198

Shutdown by safety system: Coolant temperature (redundant) too high (averaging)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

393 – SS T-Coolant Red

PV-Number: 332 ZKP-Number: 2.0480.199

Shutdown by safety system: Coolant temperature (redundant) too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

530 – SS P-Lube Oil Red2

PV-Number: - ZKP-Number: 2.0480.295

Shutdown by safety system: Lube oil pressure too low (redundant 2)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

394 – Lo P-Lube Oil Red

PV-Number: 333 ZKP-Number: 2.0480.297

Lube oil pressure too low (redundant, 1st limit value not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

521 – SS P-Lube Oil Mid Val

PV-Number: 482 ZKP-Number: 2.0480.298

Shutdown by safety system: Lube oil pressure too low (averaging)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

395 – SS P-Lube Oil Red

PV-Number: 334 ZKP-Number: 2.0480.299

Shutdown by safety system: Lube oil pressure (redundant) too low

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 119)	

190 – AL EMU Parameter Not Supported

PV-Number: - ZKP-Number: 2.0500.690

Alarm, EMU parameter is not supported

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
The EMU is registered in the engine governor although it is not present.	► MTU dialog system “DiaSys” required: Change parameter for EMU.

551 – SS Engine Overspeed Camshaft

PV-Number: 009997 ZKP-Number: 2.2510.933

Shutdown by safety system: Engine overspeed (camshaft speed evaluated)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 113)	

037 – SS ETC2 Overspeed

PV-Number: 071 ZKP-Number: 2.3013.912

Shutdown by safety system: Exhaust turbocharger 2 overspeed

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

036 – HI ETC2 Overspeed

PV-Number: 060 ZKP-Number: 2.3013.931

Exhaust turbocharger 2 running at overspeed (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

TIM ID: 0000029057 – 001

488 – HI ETC3 Overspeed

PV-Number: 009997 ZKP-Number: 2.3014.931

Exhaust turbocharger 3 running at overspeed (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

489 – SS ETC3 Overspeed

PV-Number: 009997 ZKP-Number: 2.3014.932

Shutdown by safety system: Exhaust turbocharger 3 was overspeeding

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

490 – HI ETC4 Overspeed

PV-Number: 009997 ZKP-Number: 2.3015.931

Exhaust turbocharger 4 running at overspeed (1st limit value exceeded)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

491 – SS ETC4 Overspeed

PV-Number: 009997 ZKP-Number: 2.3015.932

Shutdown by safety system: Exhaust turbocharger 4 was overspeeding

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 106)	

269 – SD Loadp.Analog filt

PV-Number: - ZKP-Number: 2.8006.588

Loadp. analog filter sensor defective

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Engine governor defective.	► Replace engine governor

408 – AL Open Load Emerg. Stop Input ESI

PV-Number: - ZKP-Number: 2.8006.633

Alarm, no load at emergency-stop input ESI (cabling damage monitor)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Cabling damage at input of engine governor.	1. Use multimeter to check cable connections to non-MTU system. 2. Repair detached or interrupted connections.
A cabling damage monitoring system is set in the engine governor although the 33kΩ resistor is not connected.	1. Install resistor above connected relay contact. 2. MTU dialog system “DiaSys” required: Check “Cabling damage monitoring” parameter for correct setting. If a resistor is not connected, it must not be activated.

455 – AL Aux 1 Plant L1

PV-Number: - ZKP-Number: 2.8006.650

Alarm at input AUX 1 plant (1st limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

456 – AL Aux 1 Plant L2

PV-Number: - ZKP-Number: 2.8006.651

Alarm at input AUX 1 plant (2nd limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Fault in non-MTU system.	1. Determine assignment of input AUX 1. 2. Continue troubleshooting in accordance with assignment in non-MTU system.

TIM ID: 0000029057 – 001

460 – AL Exhaust EMU High

PV-Number: - ZKP-Number: 2.8006.652

Alarm, exhaust gas temperature (measurement by EMU) too high

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

461 – AL Exhaust EMU Low

PV-Number: - ZKP-Number: 2.8006.653

Alarm, exhaust gas temperature (measurement by EMU) too low

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
No injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)

462 – AL Coolant EMU L1

PV-Number: - ZKP-Number: 2.8006.654

Alarm, coolant (measurement by EMU, 1st limit value exceeded or not attained)

Internal, display only possible via DiaSys: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Cause	Corrective action
Further troubleshooting (→ Page 103)	

SS Overspeed

PV-Number: 001003

Shutdown by safety system: Overspeed (ECU) detected

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 113)	

Power Reduction Active

PV-Number: 001009

Message from safety system: Power reduction active

The engine governor has initiated a power reduction.

Cause	Corrective action
Further fault messages must be pending: At least one of them tripped the power reduction.	► Observe other fault messages.

LO P-Lube Oil

PV-Number: 001029

Lube oil pressure (ECU) too low (1st limit value not attained)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 119)	

LOLO P-Lube Oil

PV-Number: 001030

Shutdown by safety system: Lube oil pressure (ECU) too low

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 119)	

HI P-Crankcase

PV-Number: 001034

Crankcase pressure too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 127)	

HIHI P-Crankcase

PV-Number: 001035

Shutdown by safety system: Crankcase pressure too high

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 127)	

TIM ID: 0000029057 – 001

LO P-Coolant after Pump

PV-Number: 001039

Coolant pressure downstream of pump too low (1st limit value not attained)

Yellow alarm

Cause	Corrective action
Insufficient coolant in circuit.	1. Check coolant level. 2. Top up coolant if necessary. Observe permissible quality, additives and capacities (→ Page 242).
Coolant pump faulty.	► MTU Service

LOLO P-Coolant after Pump

PV-Number: 001040

Shutdown by safety system: Coolant pressure downstream of pump too low

Red alarm

Cause	Corrective action
Insufficient coolant in circuit.	1. Check coolant level. 2. Top up coolant if necessary. Observe permissible quality, additives and capacities (→ Page 242).
Coolant pump faulty.	► MTU Service

LO P-Coolant InterCooler

PV-Number: 001044

Charge air coolant pressure too low (1st limit value not attained)

Yellow alarm

Cause	Corrective action
Filter clogged.	1. Check filter. 2. Clean filter and replace if necessary.
Coolant pump defective or jamming.	1. Repair coolant pump. 2. Replace complete coolant pump as required.

LOLO P-Coolant Intercooler

PV-Number: 001045

Shutdown by safety system: Charge air coolant pressure too low

Red alarm

Cause	Corrective action
Filter clogged.	1. Check filter. 2. Clean filter and replace if necessary.
Coolant pump defective or jamming.	1. Repair coolant pump. 2. Replace complete coolant pump as required.

TIM ID: 0000029057 - 001

LO P-Fuel

PV-Number: 001047
Fuel pressure too low (1st limit value not attained)
Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 123)	

LOLO P-Fuel

PV-Number: 001048
Shutdown by safety system: Fuel pressure too low
Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 123)	

AL P-Charge Air

PV-Number: 001050
Charge air pressure too low (1st limit value not attained)
Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 111)	

HI P-Lube Oil Differential

PV-Number: 001054
Lube oil differential pressure too high (1st limit value exceeded)
Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 130)	

LO Coolant Level

PV-Number: 001055
Coolant level too low (1st limit value not attained)
Yellow alarm

Cause	Corrective action
Insufficient coolant in circuit.	► Top up coolant (→ Page 242).

TIM ID: 0000029057 – 001

HI Charger Speed ETC1

PV-Number: 000158

Overspeed, exhaust turbocharger 1; speed too high (1st limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 106)	

LO P-Fuel (Common Rail)

PV-Number: 001064

Fuel pressure (Common Rail) too low (1st limit value not attained)

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 125)	

HI P-Fuel (Common Rail)

PV-Number: 001065

Fuel pressure (Common Rail) too high (1st limit value exceeded)

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 118)	

HIHI Charger Speed ETC1

PV-Number: 001070

Shutdown due to overspeed, exhaust turbocharger 1; speed too high (2nd limit value exceeded)

ADEC single-point alarm: Yellow alarm stored in the fault memory and in the trip fault memory. At the same time, the fault message is transferred on the CAN bus.

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 106)	

Preheat Temp. Not Reached

PV-Number: 001089

Preheating temperature not attained

Yellow alarm

Cause	Corrective action
Preheater not working.	► Check preheater.
Preheating time too short.	1. Consultation with OEM and/or MTU Service required. 2. MTU dialog system “DiaSys” required: Change parameter for “Preheating time”.

LO Intercooler Coolant Level

PV-Number: 001099

Charge air coolant level too low (1st limit value not attained)

Yellow alarm

Cause	Corrective action
Insufficient coolant available.	► Top up coolant (→ Page 248)

AL ECU Defect

PV-Number: 001116

Alarm: ECU defective

Yellow alarm

Cause	Corrective action
ECU damaged	► Replace ECU.

AL Speed Demand Defect

PV-Number: 001118

Alarm: Failure of RCS speed setpoint

Red alarm

Cause	Corrective action
Cabling faulty	1. Check cabling in accordance with the cabling diagram. 2. Determine short circuits or interruptions and eliminate them.
Setting of engine governor incorrect	1. MTU dialog system “DiaSys” required: Check “Speed specification” parameter for correct setting. 2. Correct the parameter as required.
Plant issues no signals.	► Check plant – determine whether a speed specification signal is issued.

TIM ID: 0000029057 – 001

LO Power Supply

PV-Number: 001122

ECU voltage supply too low (1st limit value not attained)

Yellow alarm

Cause	Corrective action
Battery voltage is too low.	1. Check battery voltage (measure directly at battery poles). 2. If this is within the tolerance range, the voltage must be measured as closely as possible to the engine governor (with governor connected). 3. If the voltage is below the tolerance level here, all electrical connections along the supply route between battery and engine governor must be checked for contact security.
Cross-section of cable used for supply is too small.	1. Consultation with OEM and/or MTU Service required. 2. Replace cable in accordance with specifications.

HI Power Supply

PV-Number: 001123

ECU voltage supply too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Incorrect installation, supply voltage connected at wrong point.	► Check connection point and change installation as required (consult OEM).
Battery-charging generator defective.	1. Check battery-charging generator: (→ Page 134) 2. Replace battery-charging generator.

HI T-Coolant

PV-Number: 001129

Coolant temperature (ECU) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 103)	

HIHI T-Coolant

PV-Number: 001130

Shutdown by safety system: Coolant temperature (ECU) too high

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 103)	

HI T-Charge Air

PV-Number: 001133

Charge air temperature too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 111)	

HI T-Coolant Intercooler

PV-Number: 001139

Intercooler coolant temperature too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 108)	

HI Oil

PV-Number: 001143

Lube oil temperature too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 101)	

HIHI Oil

PV-Number: 001144

Shutdown by safety system: Lube oil temperature too high

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 101)	

HIHI T-Charge Air

PV-Number: 001168

Shutdown by safety system: Charge air temperature too high

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 111)	

TIM ID: 0000029057 – 001

HI T-ECU

PV-Number: 001170

ECU temperature too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Ambient temperature of engine governor too high – insufficient engine room ventilation	► Improve engine room ventilation.

SS Engine Speed Low

PV-Number: 001177

Shutdown by safety system: Engine speed too low

Yellow alarm

Cause	Corrective action
Engine load too high in lower speed range	► Reduce engine load.
During the starting procedure, the necessary speed was not reached within the specified time frame.	1. Make another start attempt. 2. If the engine can still not be started: MTU Service

AL Check ECU Error Code

PV-Number: 001178

Alarm: See ECU fault code

Yellow alarm

Cause	Corrective action
The engine governor has issued different fault messages.	► Query the fault messages individually and acknowledge/eliminate causes accordingly.

AL Common Rail Leakage

PV-Number: 001185

Alarm: Leak in H.P. fuel line

Yellow alarm

Cause	Corrective action
Leak on high-pressure side of Common Rail.	1. Determine discharge point. 2. Replace defective component.

TIM ID: 0000029057 – 001

HIHI T-Fuel

PV-Number: 001200

Fuel temperature too high (2nd limit value exceeded)

Red alarm:

Cause	Corrective action
Further troubleshooting (→ Page 118)	

HI Level Water Fuel Prefilter

PV-Number: 001225

Water in fuel prefilter

Yellow alarm: The level of separated water in the fuel prefilter is too high.

Cause	Corrective action
Water level too high.	1. Drain water. 2. Check fuel quality and improve if necessary.

AL Prelubrication Fault

PV-Number: 001237

Alarm, prelubrication unsuccessful.

Red alarm: The necessary prelubrication pressure was not reached within the specified time frame.

Cause	Corrective action
Oil priming pump defective.	► MTU Service
Oil filter clogged	► Replace oil filter.
Oil level too low.	1. Determine further fault messages. 2. Top up oil: (→ Page 194)

AL Start Speed Not Reached

PV-Number: 001239

Message: Starting speed, low.

Yellow alarm: The necessary starting speed was not reached within the specified time frame.

Cause	Corrective action
Starter defective	► MTU Service

AL Runup Speed Not Reached

PV-Number: 001240

Message: Runup speed, low

Yellow alarm: The necessary runup speed was not reached within the specified time frame.

Cause	Corrective action
Engine too cold	► Carry out preheating.

TIM ID: 0000029057 – 001

AL Idle Speed Not Reached

PV-Number: 001241

Message: Idling speed, low

Yellow alarm: The necessary idling speed was not reached within the specified time frame.

Cause	Corrective action
Engine too cold	► Carry out preheating.

LOLO ECU Power Supply Voltage

PV-Number: 001270

ECU supply voltage too low

Red alarm

Cause	Corrective action
Battery voltage is too low.	1. Check battery voltage (measure directly at battery poles). 2. If this is within the tolerance range, the voltage must be measured as closely as possible to the engine governor (with governor connected). 3. If the voltage is below the tolerance level here, all electrical connections along the supply route between battery and engine governor must be checked for contact security.
Cross-section of cable used for supply is too small.	1. Consultation with OEM and/or MTU Service required. 2. Replace cable in accordance with specifications.

HIHI ECU Power Supply Voltage

PV-Number: 001271

ECU supply voltage too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Incorrect installation, supply voltage connected at wrong point.	► Check connection point and change installation as required (consult OEM).
Battery-charging generator defective.	1. Check battery-charging generator: (→ Page 134) 2. Replace battery-charging generator.

HI T-Fuel

PV-Number: 001299

Fuel temperature too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Further troubleshooting (→ Page 118)	

TIM ID: 0000029057 – 001

LO T-Preheat

PV-Number: 001357

Preheating temperature (1st limit value not attained)

Yellow alarm

Cause	Corrective action
Preheater not working.	► Check preheater.
Preheating time too short.	1. Consultation with OEM and/or MTU Service required. 2. MTU dialog system “DiaSys” required: Change parameter for “Preheating time”.

LOLO T-Preheat

PV-Number: 001358

Preheating temperature (2nd limit value not attained)

Yellow alarm

Cause	Corrective action
Preheater not working.	► Check preheater.
Preheating time too short.	1. Consultation with OEM and/or MTU Service required. 2. MTU dialog system “DiaSys” required: Change parameter for “Preheating time”.

MCR Limit reached

PV-Number: 001390

“Maximum Continuous Rate” curve exceeded

Cause	Corrective action
Engine load too high.	► Reduce engine load

HIHI T-Coolant Intercooler

PV-Number: 001398

Intercooler coolant temperature too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Further troubleshooting (→ Page 108)	

TIM ID: 0000029057 – 001

Override

PV-Number: 001807

Override active

Yellow alarm: In “Override” operating mode, limit value violations NO LONGER LEAD TO AUTOMATIC SHUTDOWN of the engine.

Cause	Corrective action
Operator tripped this function manually due to an emergency situation.	► –

HI T-Exhaust A (MG)

PV-Number: 006011

Alarm: Temperature exhaust gas_A (MG)

Only message

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

HI T-Exhaust A (Y)

PV-Number: 006012

Temperature of exhaust gas A (yellow alarm) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

TIM ID: 0000029057 – 001

HIHI T-Exhaust A (R)

PV-Number: 006013

Alarm: Temperature of exhaust gas_A (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

HIHI T-Exhaust A (RS)

PV-Number: 006014

Temperature of exhaust gas_A (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

HI T-Exhaust B (MG)

PV-Number: 006021

Temperature of exhaust gas B (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

TIM ID: 0000029057 – 001

HI T-Exhaust B (Y)

PV-Number: 006022

Temperature of exhaust gas B (yellow alarm) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

HIHI T-Exhaust B (R)

PV-Number: 006023

Temperature of exhaust gas B (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

HIHI T-Exhaust B (RS)

PV-Number: 006024

Temperature of exhaust gas B (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Uncontrolled injection of fuel at one cylinder.	1. Determine the affected cylinder. 2. Possible causes: • Injector defective: (→ Page 235)
Oil ingress in cylinder chamber of a cylinder	1. Determine the affected cylinder. 2. Determine cause of oil ingress: • Check intake channel for oil ingress • Check turbocharger

HI Pressure 1 (MG)

PV-Number: 006031

Pressure at input 1 (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HI Pressure 1 (Y)

PV-Number: 006032

Pressure at input 1 (yellow alarm) too high (2nd limit value exceeded)

Yellow alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HIHI Pressure 1 (R)

PV-Number: 006033

Pressure at input 1 (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HIHI Pressure 1 (RS)

PV-Number: 006034

Pressure at input 1 (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HI Pressure 2 (MG)

PV-Number: 006051

Pressure measurement at input 2 (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

TIM ID: 0000029057 – 001

HI Pressure 2 (Y)

PV-Number: 006052

Pressure measurement at input 2 (yellow alarm) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HIHI Pressure 2 (R)

PV-Number: 006053

Pressure at input 2 (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HIHI Pressure 2 (RS)

PV-Number: 006054

Pressure at input 2 (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HI Air Filter Restr. (MG)

PV-Number: 006071

Air filter maintenance (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
Air filter clogged	► Replace air filter.

HI Air Filter Restr. (Y)

PV-Number: 006072

Air filter maintenance (yellow alarm) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Air filter clogged	► Replace air filter.

TIM ID: 0000029057 – 001

HIHI Air Filter Restr. (R)

PV-Number: 006073

Air filter maintenance (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Air filter clogged	► Replace air filter.

HIHI Air Filter Restr. (RS)

PV-Number: 006074

Air filter maintenance (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Air filter clogged	► Replace air filter.

HI Fuel Filter Restr. (MG)

PV-Number: 006081

Fuel filter maintenance (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
Fuel filter blocked.	1. Replace fuel filter (→ Page 234) 2. Vent system (→ Page 178)

HI Fuel Filter Restr. (Y)

PV-Number: 006082

Fuel filter maintenance (yellow alarm) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
Fuel filter blocked.	1. Replace fuel filter (→ Page 234) 2. Vent system (→ Page 178)

HIHI Fuel Filter Restr. (R)

PV-Number: 006083

Fuel filter maintenance (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Fuel filter blocked.	1. Replace fuel filter (→ Page 234) 2. Vent system (→ Page 178)

TIM ID: 0000029057 – 001

HIHI Fuel Filter Restr. (RS)

PV-Number: 006084

Fuel filter maintenance (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
Fuel filter blocked.	1. Replace fuel filter (→ Page 234) 2. Vent system (→ Page 178)

HI Aux Engine Protection (MG)

PV-Number: 006091

Auxiliary engine protection (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HI Aux Engine Protection (Y)

PV-Number: 006092

Auxiliary engine protection (yellow alarm) too high (1st limit value exceeded)

Yellow alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HIHI Aux Engine Protect. (R)

PV-Number: 006093

Auxiliary engine protection (red alarm) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

HIHI Aux Engine Protect. (RS)

PV-Number: 006094

Auxiliary engine protection (red alarm with automatic shutdown) too high (2nd limit value exceeded)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

TIM ID: 0000029057 – 001

AL Aux Protection Switch (MG)

PV-Number: 006101

Auxiliary protection switch (message) too high (1st limit value exceeded)

Only message

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

AL Aux Protection Switch (Y)

PV-Number: 006102

Alarm: Auxiliary protection switch (yellow alarm)

Yellow alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

AL Aux Protection Switch (R)

PV-Number: 006103

Alarm: Auxiliary protection switch (red alarm)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

AL Aux Protection Switch (RS)

PV-Number: 006104

Alarm: Auxiliary protection switch (red alarm with automatic shutdown)

Red alarm

Cause	Corrective action
External fault message.	► See non-MTU system documentation.

WB Fan Control Fan 1

PV-Number: 006531

WB control fan 1

Yellow alarm

Cause	Corrective action
Fan drive faulty.	1. Drive belt tension insufficient (→ Page 251). 2. Drive belt defective (→ Page 253).

TIM ID: 0000029057 – 001

WB Fan Control Fan 2

PV-Number: 006541

WB control fan 2

Yellow alarm

Cause	Corrective action
Fan drive faulty.	1. Drive belt tension insufficient (→ Page 251). 2. Drive belt defective (→ Page 253).

MD CAN Speed Demand

PV-Number: 009970

Missing data: CAN Speed Demand

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Torque Limit 1

PV-Number: 009971

Missing data: CAN Torque Limit 1

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Torque Limit 2

PV-Number: 009972

Missing data: CAN Torque Limit 2

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Override

PV-Number: 009973

Missing data: CAN Override

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Start interlock

PV-Number: 009974

Missing data: CAN Override

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Engine Start

PV-Number: 009975

Missing data: CAN Override

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Engine Stop

PV-Number: 009976

Missing data: CAN Engine Stop

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Alarm Reset

PV-Number: 009977

Missing data: CAN Alarm Reset

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Lamptest

PV-Number: 009978

Missing data: CAN Lamptest

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

TIM ID: 0000029057 – 001

MD CAN Speed Setting Limit act

PV-Number: 009979

Missing data: CAN speed setting limit actual

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Reset Trip Fuel counter

PV-Number: 009980

Missing data: CAN Reset trip fuel counter

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Ext Power curve limit

PV-Number: 009981

Missing data: CAN external power curve limit

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Park brake interlock

PV-Number: 009982

Missing data: CAN parking brake interlock

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Neutral

PV-Number: 009983

Missing data: CAN Neutral

Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

TIM ID: 0000029057 – 001

MD CAN Alternate Minimum

PV-Number: 009984
Missing data: CAN Neutral
Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

MD CAN Ext Preheating Enable

PV-Number: 009985
Missing data: CAN external preheating enable
Yellow alarm

Cause	Corrective action
Incorrect configuration or incorrect parameters entered via DiaSys.	► MTU Service

AL CCB J1939 Error

PV-Number: 009995
Alarm: CCB J1939 error
Yellow alarm

Cause	Corrective action
CCB board in SAM defective	► Replace CCB board in SAM (see)

AL CCB CANopen Error

PV-Number: 009996
Alarm: CAN open error
Yellow alarm, the CANOpen bus for external devices is faulty.

Cause	Corrective action
CCB board in SAM defective	► Replace CCB board in SAM (see)
Faults in devices connected to CANOpen bus.	1. See documentation of non-MTU devices. 2. Have configuration checked by MTU Service.

AL CCB Error

PV-Number: 009997
Alarm: CCB error
Yellow alarm, the CAN interface for board (inserted in SAM Slot 3) is not working.

Cause	Corrective action
CCB board in SAM defective	► Replace CCB board in SAM (see)

TIM ID: 0000029057 – 001

2 Troubleshooting

2.1 Troubleshooting – Lube oil temperature too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed).
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Is engine coolant temperature too high or oil pressure too low?

If engine coolant temperature is too high: → **08**

If oil pressure is too low: → **09**

If not: → **02**

02

► Check oil temperature sensor (→ Page 268).

Fault rectified?

Yes: → **11**

No: → **03**

03

► Check oil level (→ Page 194).

Oil level below MIN mark?

Check lube oil components for external leaks → **04**

04

1. Check lube oil components for external leaks (→ Page 191) .
2. Check turbocharger oil supply for external leaks (→ Page 284).
3. Check oil priming pump and oil ducts for external leaks (→ Page 285).
4. Check automatic filter for external leaks (→ Page 196).
5. Check centrifugal oil filter for external leaks (→ Page 203).
6. Check oil cooler for external leaks (→ Page 286).
7. Check remaining oil lines/oil ducts for external leaks.

Fault rectified?

Yes: → **11**

No: → **05**

05

1. Evaluate oil quality by visual inspection and carry out engine oil analysis using the MTU test kit (→ Page 195).
2. Change engine oil if required (→ Page 192).

Poor oil quality?

Yes: → **07**

No: → **06**

06

1. Check coolant level (→ Page 208).
2. Check coolant sample visually and using the MTU test kit (→ Page 209)

Is the coolant contaminated or has its condition changed?

If coolant quality is impaired, check lube oil heat exchanger and replace if necessary. → **07**

TIM ID: 0000029229 – 001

07

1. Remove oil heat exchanger (→ Page 205) .
2. Clean oil heat exchanger or replace if necessary (→ Page 304).

Fault rectified?

Yes: → **11**
No: → **10**

08

► Continue troubleshooting in HT coolant circuit (→ Page 103).

09

► Continue troubleshooting in “Troubleshooting – Lube oil pressure too low” (→ Page 119) .

10

1. Check whether repair work was performed on coolant distribution housing.
2. Check restrictors on coolant distribution housing. If necessary, refer to: (→ Page 213). Refer to engine coolant circuit diagram.

11

► Problem solved

TIM ID: 0000029229 – 001

2.2 Troubleshooting – Engine coolant temperature too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Further coolant fault messages displayed?

Yes: → **03**
No: → **02**

02

► Check coolant temperature sensor (→ Page 268)

Fault rectified?

Yes: → **17**
No: → **11**

03

► Check coolant level (→ Page 208)

Coolant irregular?

Visual inspection of vehicle/engine for external coolant leaks → **07**
Check end cover of expansion tank → **06**
Check coolant level monitor → **04**
Contaminated or altered coolant: → **05**

04

► Check coolant level monitor and replace if necessary.

05

► Check coolant sample visually and using the MTU test kit (→ Page 209)

Is the coolant contaminated or in improper condition?

After rectifying the fault, replace coolant → **18**
If necessary, check intercooler on cooler side for contamination/deposits and clean as required. → **16**

06

► Check end cover of expansion tank for correct opening pressure (see manufacturer's documentation)

Fault rectified?

Yes: → **17**
No: → **07**

07

► Check all coolant lines on vehicle/plant/engine for external coolant leaks and replace damaged part(s).

Fault rectified?

Yes: → **17**
No: → **08**

TIM ID: 0000029230 – 001

08

1. Check coolant expansion lines on the HT coolant circuit for external damage (→ Page 206)
2. Check vent lines from intercooler to expansion tank on vehicle for external damage.
3. Check coolant expansion lines of LT circuit for external damage.
4. Check coolant vent lines from turbochargers to expansion tank in vehicle for external damage.
5. Check coolant vent lines from engine block to expansion tank in vehicle for external damage.
6. Check coolant vent lines from oil cooler to expansion tank in vehicle for external damage.

Fault rectified?

Yes: → **17**
No: → **09**

09

► Check resilient elbows in vehicle for reduced flow.

Fault rectified?

Yes: → **17**
No: → **10**

10

1. Operate engine at partial load.
2. Check coolant pressure in HT circuit

Is the coolant pressure too low?

Check coolant pipework in HT coolant circuit for reduction in cross-sectional area → **15**
Check engine coolant pump and replace if necessary. → **14**

11

1. Check HT heat exchanger for external contamination, reduction of cooling area and damaged/fractured cooling plates.
2. Check air pipework between LT and HT heat exchanger for reduced air flow.

Fault rectified?

Yes: → **17**
No: → **12**

12

1. Check fan function for correct activation/fan speed as a function of engine operating load
2. Check fan for mechanical damage.

Fault rectified?

Yes: → **17**
No: → **13**

13

► Check thermostat insert (→ Page 214)

Fault rectified?

Yes: → **17**
No: → **14**

14

1. Inspect engine coolant pump visually, check for running noise and coolant discharge from relief bore, replace engine coolant pump if necessary (→ Page 279).
2. Engine coolant pump renewed before? Check part No. of engine coolant pump!

Fault rectified?

Yes: → **17**
No: → **15**

TIM ID: 0000028230 – 001

15

1. Remove all coolant pipework in the HT coolant circuit (see also the chapter “Coolant circuit” in the job description) and check for flow reduction (→ Page 212)
2. Remove coolant expansion lines in the HT coolant circuit and check for flow reduction.
3. Remove expansion lines of LT coolant circuit and check for reduced flow.
4. Remove vent lines from turbochargers to expansion tank in vehicle and check for reduced flow. (→ Page 210).
5. Remove vent lines from crankcase to expansion tank in vehicle and check for reduced flow.
6. Remove coolant vent lines from intercooler to expansion tank in vehicle and check for reduced flow.
7. Remove coolant vent lines from oil cooler to expansion tank in vehicle and check for reduced flow.

Fault rectified?

Yes: → **17**

No: → **13**

16

► Check intercooler on coolant side for contamination/deposits and remove and (→ Page 184) clean if necessary (→ Page 182)

17

► Problem solved

18

► Change coolant.

TIM ID: 0000029230 – 001

2.3 Troubleshooting – Exhaust turbocharger speed too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed).
3. If required, study and analyze the Crash Record with all associated operating data.
4. Pay special attention to alarms and fault messages related to suction restrictor and injectors. Check injection quantities and compare with Acceptance Test Protocol.

Is the turbocharger speed far above the normal range?

Yes: → 08
No: → 02

02

► Site altitude is higher than 2700 m above sea level.At altitudes above 2700 m above sea level, turbocharger speed may exceed nominal speed due to the lower air mass.

Is the site altitude higher than 2700 m above sea level and turbocharger speed only slightly above the normal range?

Yes: → 09
No: → 03

03

► Check air pipework from turbocharger to air pipework before cylinder for external damage, secure seating of connections, damaged gaskets or other leaks (→ Page 186) (→ Page 299) and repair if necessary.

Fault rectified?

Yes: → 09
No: → 04

04

► Take reading on vacuum pressure gauge after air filter.

Reading > 30 mbar?

Check resistance sensor → 10
Remove air filter, check it and replace air filter insert if necessary. → 05

05

1. Check air filter for damage.
2. Clean or replace air filter.

Fault rectified?

Yes: → 09
No: → 06

06

1. Check air intake from air filter to exhaust turbocharger for external damage, secure seating of connections or other damage.
2. Remove air intake pipework from filter to turbocharger and check for reduction of cross-sectional area in intake pipework (→ Page 320)

Fault rectified?

Yes: → 09
No: → 07

07

1. Inspect compressor wheel or turbine wheel shaft (→ Page 180).
2. If compressor wheel or turbine shaft wheel is damaged, repair exhaust turbocharger (→ Page 142).

Fault rectified?

Yes: → 09
No: → 08

TIM ID: 0000029231 – 001

08	► Check turbocharger speed sensor (→ Page 144).
09	► Problem solved
10	► Check sensor.

TIM ID: 0000029231 – 001

2.4 Troubleshooting – Charge air coolant temperature too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Charge air temperature high? (If not, the charge air coolant temperature sensor is most probably defective.)

Yes: → 03
No: → 02

02

► Check coolant temperature sensor (→ Page 268)

Fault rectified?

Yes: → 18
No: → 03

03

► Check coolant level (→ Page 208)

Has the coolant changed?

Visual inspection of vehicle/engine for external coolant leakages → 07
Check end cover of expansion tank → 06
Check coolant level monitor → 04
Contaminated or altered coolant: → 05
Check intercooler drain for obstructions and emerging coolant → 16

04

► Check coolant level monitor and replace if necessary.

Fault rectified?

Yes: → 18
No: → 05

05

► Check coolant sample visually using the MTU test kit (→ Page 209)

Has the coolant changed?

After rectifying the fault, replace coolant → 19
Check intercooler on cooler side for contamination/deposits and clean if necessary. → 16

06

► Check end cover of expansion tank for correct opening pressure (see manufacturer's documentation)

Fault rectified?

Yes: → 18
No: → 07

07

► Check all coolant lines on vehicle/plant/engine for external coolant leaks and replace damaged part(s).

Fault rectified?

Yes: → 18
No: → 08

TIM ID: 0000029232 – 001

08

1. Check coolant expansion lines of the LT circuit for external damage (see also the “Coolant Circuit” chapter in the Functional Description).
2. Check coolant vent lines from intercooler to expansion tank in vehicle for external damage.
3. Check coolant expansion lines of HT circuit for external damage.
4. Check coolant vent lines from turbochargers to expansion tank in vehicle for external damage.
5. Check coolant vent lines from engine block to expansion tank in vehicle for external damage.
6. Check coolant vent lines from oil cooler to expansion tank in vehicle for external damage.

Fault rectified?

Yes: → **18**
No: → **09**

09

► Check resilient elbows in vehicle for reduced flow.

Fault rectified?

Yes: → **18**
No: → **11**

10

1. Operate engine at partial load.
2. Check coolant pressure in LT circuit

Is the coolant pressure too low?

Check coolant pipework in charge air coolant circuit for reduction in cross-sectional area → **15**
Check charge air coolant pump and replace if necessary. → **14**

11

1. Check LT heat exchanger for external contamination, reduction of cooling area and damaged/fractured cooling plates.
2. Check coolant lining between LT heat exchanger and HT heat exchanger for damage (bypass function for intake air to heat exchanger).

Fault rectified?

Yes: → **18**
No: → **12**

12

1. Check fan function for correct activation/fan speed as a function of engine operating load
2. Check fan for mechanical damage.

Fault rectified?

Yes: → **18**
No: → **14**

13

► Check thermostat insert (→ Page 214)

Fault rectified?

Yes: → **18**
No: → **14**

14

1. Inspect charge air coolant pump visually, check for running noises and coolant discharge from relief bore, replace charge air coolant pump if necessary (→ Page 279).
2. Charge air coolant pump renewed before? Check part No. of charge air coolant pump!

Fault rectified?

Yes: → **18**
No: → **15**

TIM ID: 0000029232 – 001

15

1. Remove all coolant pipework on the LT coolant circuit (→ Page 206) and check for flow reduction (→ Page 212)
2. Remove coolant expansion lines of the LT coolant circuit and check for flow reduction.
3. Remove coolant vent lines from intercooler to expansion tank in vehicle and check for reduced flow.
4. Remove expansion lines of HT coolant circuit and check for reduced flow.
5. Remove vent lines from turbochargers to expansion tank in vehicle and check for reduced flow. (→ Page 210).
6. Remove vent lines from crankcase to expansion tank in vehicle and check for reduced flow.
7. Remove vent lines from oil cooler to expansion tank in vehicle and check for reduced flow.

Fault rectified?

Yes: → **18**
No: → **13**

16

1. Check intercooler drain for obstructions and coolant discharge (→ Page 143); remove intercooler if necessary (→ Page 184) and check for leaks (→ Page 183)
2. Check intercooler on coolant side for contamination/deposits and, if necessary, remove (→ Page 184) and clean (→ Page 182)
3. Check intercooler for leaks (→ Page 183)
4. Check intercooler on air side for contamination. Clean intercooler if air side is contaminated (→ Page 182). Check air intake pipework for leaks to determine the cause of the contamination.

Fault rectified?

Yes: → **17**
No: → **18**

17

► Replace charge air coolant pump (→ Page 279)

18

► Problem solved

19

► Change coolant.

2.5 Troubleshooting – Charge air temperature too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Charge air pressure too low and exhaust temperature too high?

Check intake air pipework from filter to exhaust turbocharger → **04**

No irregularities or further fault messages → **02**

02

► Check charge air temperature sensor (→ Page 268)

Fault rectified?

Yes: → **14**

No: → **03**

03

1. Start engine and operate at partial load to check air intake pipework from filter to turbocharger for possible reduction of cross-sectional area.
2. Also take reading on contamination indicator after air filter.

Irregularities in the intake air pipework, e.g. contamination indicator > 30 mbar

Check air filter or contamination indicator → **05**

No significant fault found: → **08**

04

► Remove air intake pipework from filter to turbocharger and check for reduction of cross-sectional area (→ Page 320)

Fault rectified?

Yes: → **14**

No: → **07**

05

► Take reading on contamination indicator after air filter.

Reading > 30 mbar?

Check resistance sensor → **15**

Replace contaminated air filter → **06**

06

1. Check air filter
2. Clean air filter or replace.

Fault rectified?

Yes: → **14**

No: → **04**

07

1. Visually inspect turbochargers for damage, e.g. of the compressor wheel (→ Page 180) .
2. Check radial and axial bearing play of turbochargers manually.
3. If there is increased radial or axial bearing clearance, repair the exhaust turbocharger (→ Page 142)

Fault rectified?

Yes: → **14**

No: → **08**

TIM ID: 0000029233 – 001

08

1. Operate engine at partial load.
2. Check intercooler drain for coolant discharge (→ Page 143) .

Fluid visible in drain bore?

If coolant emerges from the drain bore, the intercooler might be leaky and heat transfer might be limited. → **13**

If no coolant emerges from the drain bore: → **09**

09

1. Operate engine at partial load.
2. Check coolant pressure in LT circuit

Is the coolant pressure too low?

Check coolant pipework in charge air coolant circuit for reduction in cross-sectional area → **10**

Check charge air coolant pump and replace if necessary. → **11**

10

► Remove all coolant pipework of the LT coolant circuit (refer also to the functional description of the coolant circuit) and check for flow reduction (→ Page 212)

Fault rectified?

Yes: → **14**

No: → **11**

11

► Replace charge air coolant pump (→ Page 279)

Fault rectified?

Yes: → **14**

No: → **12**

12

1. Start engine and operate at partial load.
2. Check coolant temperature.

Coolant temperature too high?

If coolant temperature is too high, continue troubleshooting in the LT circuit. → **13**

13

► Continue troubleshooting in LT circuit. (→ Page 111)

14

► Problem solved

15

► Check sensor.

TIM ID: 0000028233 – 001

2.6 Troubleshooting – Engine was shut down due to overspeed

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed).
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Further fault messages or irregularities?

Yes: → **03**
No: → **02**

02

► Check engine speed sensor (→ Page 144).

Fault rectified?

Yes: → **08**
No: → **03**

03

► Check if engine load was disconnected.

Fault rectified?

Yes: → **08**
No: → **04**

04

► Check injector and replace if required (→ Page 235).

Fault rectified?

Yes: → **08**
No: → **05**

05

1. Run engine at partial load (if possible).
2. Check intercooler drain for coolant discharge (→ Page 143).

Oil residues visible at drain bore?

Yes: → **06**
No: → **07**

06

1. Check turbocharger radial and axial bearings for wear (→ Page 137).
2. Repair turbocharger if required (→ Page 142).

Fault rectified?

Yes: → **08**
No: → **07**

07

► Contact Service.

08

► No further action required.

TIM ID: 0000029619 – 001

2.7 Troubleshooting – Engine speed too low

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed), e.g.: Charge air temperature and/or charge air pressure sufficient, sufficient injection quantities, exhaust turbocharger speeds sufficiently high, fuel LP and HP sufficient?
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further fault messages are active, consider possible causal relationship

Further fault messages or irregularities?

Yes: → **03**
No: → **02**

02

► Check engine speed sensor (→ Page 144)

Fault rectified?

Yes: → **14**
No: → **03**

03

► Check for increased load acceptance.

Is there an increased load acceptance?

Yes: → **14**
No: → **04**

04

► Check fuel quality and change fuel if necessary.

Fault rectified?

Yes: → **14**
No: → **05**

05

1. Check fuel inlet from fuel tank to prefilter for leakages or reduced flow.
2. Vent fuel system if necessary (→ Page 178)
3. Check fuel inlet pressure and, if too low, continue troubleshooting with “Troubleshooting – Fuel inlet pressure too low” (→ Page 117)

Fault rectified?

Yes: → **14**
No: → **06**

06

1. Fuel filter cut-out?
2. Check fuel filter for contamination and replace if necessary (→ Page 234)

Fault rectified?

Yes: → **14**
No: → **07**

07

► Check fuel pressure in Common Rail and, if too low, continue troubleshooting with “Troubleshooting – Fuel in Common Rail too low”. (→ Page 125)

Fault rectified?

Yes: → **14**
No: → **08**

TIM ID: 0000029618 – 001

08

► Check injector and replace if necessary (→ Page 235)

Fault rectified?

Yes: → **14**
No: → **09**

09

1. Check entire exhaust pipework for reduced exhaust flow.
2. Remove exhaust pipework downstream of turbocharger and check for reduced flow or limitation of cross-sectional area (→ Page 188)

Fault rectified?

Yes: → **14**
No: → **10**

10

► Check exhaust pipework downstream of cylinder head to turbocharger for leaks or reduced flow

Fault rectified?

Yes: → **14**
No: → **11**

11

1. Check air filter for sufficient air flow rate (read off contamination indicator downstream of air filter). Clean or replace air filter as necessary.
2. Check air intake from air filter to exhaust turbocharger for external damage, secure seating of connections or other damage.
3. Remove air intake pipework from filter to turbocharger and check for reduction of cross-sectional area (→ Page 320)

Fault rectified?

Yes: → **14**
No: → **12**

12

► Check air pipework from turbocharger to air pipework before cylinder for external damage, secure seating of connections, damaged gaskets or other leaks or flow reductions (→ Page 186) (→ Page 299) and repair if necessary.

Fault rectified?

Yes: → **14**
No: → **13**

13

► Contact Service.

14

► No further action required.

TIM ID: 0000029618 – 001

2.8 Troubleshooting – Engine did not reach idle speed during starting sequence – starting sequence was terminated

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further fault messages are active, consider possible causal relationship.

Further fault messages or irregularities?

Yes: → **02**
No: → **02**

02

► Continue troubleshooting in “Troubleshooting – Engine speed too low” (→ Page 114)

Fault/malfunction found?

Yes: → **04**
No: → **03**

03

► Contact Service.

04

► No further action required.

TIM ID: 0000029617 – 001

2.9 Troubleshooting – Fuel pressure in Common Rail too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further fault messages are active, consider possible causal relationship

Further fault messages or irregularities?

Yes: → **03**
No: → **02**

02

► Check sensor for recording fuel pressure in the Common Rail (→ Page 254) and replace if necessary.

Fault rectified?

Yes: → **05**
No: → **03**

03

► Check suction restrictor of HP fuel pump and replace if necessary (→ Page 171).

Fault rectified?

Yes: → **05**
No: → **04**

04

► Contact Service.

05

► No further action required.

TIM ID: 0000029615 – 001

2.10 Troubleshooting – Fuel temperature too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further fault messages are active, consider possible causal relationship (e.g. fuel pressure).

Further fault messages or irregularities?

Yes: → **02**
No: → **05**

02

► Check fuel level in tank; possibly no fuel in tank.

Fault rectified?

Yes: → **08**
No: → **03**

03

► Check fuel inlet from fuel tank to prefilter

Fault rectified?

Yes: → **08**
No: → **04**

04

► Check fuel filter for contamination and replace if necessary (→ Page 234)

Fault rectified?

Yes: → **08**
No: → **05**

05

► Check fuel temperature sensor (→ Page 268)

Fault rectified?

Yes: → **08**
No: → **06**

06

1. Check suction restrictor on HP fuel pump.
2. Check operation of HP fuel pump
3. Driver between H.P. and L.P. pump broken?

Fault rectified?

Yes: → **08**
No: → **07**

07

► Contact Service.

08

► No further action required.

TIM ID: 0000029616 – 001

2.11 Lube oil pressure too low

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed).
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Lube oil temperature too high?

Yes: → 27

No: → 02

02

► Check oil pressure sensor (→ Page 254) and replace if necessary.

Fault rectified?

Yes: → 28

No: → 03

03

► Check oil level (→ Page 194).

Oil level below MIN mark?

Yes: → 04

No: → 10

04

1. Check oil lines/oil ducts for external leaks (→ Page 189).
2. Check lube-oil carrying components for external leaks (→ Page 191).
3. Check turbocharger oil supply for external leaks (→ Page 284).
4. Check oil priming pump and oil ducts for external leaks (→ Page 285).
5. Check automatic filter for external leaks (→ Page 196).
6. Check centrifugal oil filter for external leaks (→ Page 203).
7. Check oil cooler for external leaks (→ Page 286).

No significant fault found?

Check oil quality → 05

Check operation of oil priming pump → 11

05

1. Visually assess oil quality and examine engine oil with MTU test kit (→ Page 195).
2. Change engine oil if required (→ Page 192).

Was fuel or water detected in the engine oil?

If there is evidence of fuel in engine oil, check oil lubrication of the HP fuel pump for leaks → 07

If fuel is found in the engine oil, check injectors → 06

If water is found in the engine oil, check gaskets and O-rings on the internal pipework → 26

Oil quality OK → 08

06

► Replace injector (→ Page 235)

Is there still fuel in the engine oil?

Yes: → 07

No: → 28

07

► Remove HP fuel pump (→ Page 171) and replace it.

TIM ID: 0000029234 – 001

08

► Check engine for abnormal running noises in several operating conditions.

Abnormal running noise audible?

Yes: → **10**
No: → **09**

09

► Check engine coolant visually and with MTU test kit for oil residue (→ Page 209).

Is there still residual oil in the engine coolant?

Yes: → **26**
No: → **10**

10

1. Check oil indicator filter (→ Page 201) Remove oil filter candles and replace if necessary (→ Page 197) .
2. Unfold filter element of oil filter candles and check for metallic residue.

Metallic residue found in filter elements?

If no metallic residue was found: → **20**
If there is evidence of iron residue, examine cylinder liner endoscopically → **12**
If copper-based alloys are found, check bearing of rotor unit at the centrifugal oil filter. → **13**
If iron residue is found, check valve drive for wear/abrasion → **16**
If copper-based alloys are found, check conrod bearing → **17**
If copper-based alloys are found, check crankshaft bearing. → **18**

11

1. Check valve in the hose line for start prelubrication correctly installed or defective? (→ Page 285)
2. Check suction pressure and operation of oil priming pump.

12

1. Carry out endoscopic examination of cylinder liner (→ Page 148).
2. Replace cylinder liner if necessary (→ Page 149).

Origin of metallic residue identified?

Yes: → **28**
No: → **13**

13

1. Check bearings of rotor unit on centrifugal oil filter (→ Page 204).
2. Check hood of centrifugal oil filter (→ Page 204).

Origin of metallic residue identified?

Yes: → **28**
No: → **16**

14

► Check if seal plug at the rocker shaft support is mounted (→ Page 164).

Fault rectified?

Yes: → **28**
No: → **15**

15

► Check if crankshaft covers are mounted.

Fault rectified?

Yes: → **28**
No: → **22**

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16

► Remove valve drive (→ Page 170) and check for wear/abrasion (→ Page 167).

Origin of metallic residue identified?

Yes: → **28**
No: → **17**

17

► Remove conrod (→ Page 160) and check for wear (→ Page 162) .

Origin of metallic residue identified?

Yes: → **28**
No: → **18**

18

► Carry out partial engine disassembly and check crankshaft bearing points.

Origin of metallic residue identified?

Yes: → **28**
No: → **19**

19

► Proceed with engine disassembly and check wear parts.

20

► Check pressure relief valve.

Fault rectified?

Yes: → **28**
No: → **14**

21

► Take oil sample when engine is running (→ Page 195).

Are air bubbles visible when taking the oil sample?

Check intake air pipework up to oil pump → **22**

22

1. Remove inspection port cover (→ Page 147).
2. Check intake elbow and suction pipe for secure seating (visual inspection) (→ Page 151).
3. Check piston cooling oil spray nozzles for secure seating (visual inspection) (→ Page 318).
4. Remove oil pan (→ Page 153) .
5. Disassemble intake elbow and suction pipe up to oil pump and inspect all parts.

Fault rectified?

Yes: → **28**
No: → **23**

23

1. Check pressure relief valve of oil pump (→ Page 240).
2. Check oil pump flow rate and replace lube-oil pump if necessary (→ Page 288).
3. Check lube oil pump drive (gears). (→ Page 240)
4. Check bearing shell of lube oil pump.
5. Check rotor shaft position of lube oil pump.

Fault rectified?

Yes: → **28**
No: → **24**

24

► Check flow through oil heat exchanger and replace heat exchanger if necessary (→ Page 310).

Fault rectified?

Yes: → **25**
No: → **28**

25 ► Check gaskets on oil pipework housing

26 ► Partially disassemble engine and check gaskets on coolant distribution housing and all internal sealing faces/transitions on the oil pipework for leaks (→ Page 213).

27 ► Proceed with “Troubleshooting – Lube oil temperature too high” (→ Page 119).

28 ► No further action required.

TIM ID: 0000029234 – 001

2.12 Fuel inlet pressure too low

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further fault messages are active, consider possible causal relationship (e.g. fuel temperature).

Further fault messages or irregularities?

Yes: → **02**
No: → **03**

02

► Check fuel level in tank; possibly no fuel in tank.

Fault rectified?

Yes: → **09**
No: → **03**

03

► Check fuel pressure sensor (→ Page 254)

Fault rectified?

Yes: → **09**
No: → **04**

04

1. Check fuel filter for contamination and replace if necessary (→ Page 234)
2. Check fuel filter system for correct installation (→ Page 179)

Fault rectified?

Yes: → **09**
No: → **05**

05

1. Check fuel inlet from fuel tank to prefilter during operation for leakages.
2. Disassemble fuel inlet from fuel tank to prefilter and check for reduced flow
3. Check all external and internal fuel lines and straight unions for correct seating or leaks (→ Page 175)
4. Check bore in line downstream of filter to HP pump (fuel filter permanent ventilation) for correct specified size.

Fault rectified?

Yes: → **09**
No: → **06**

06

► Disassemble check valve between fuel delivery pump and fuel filter, check it (visual inspection) and replace if necessary.

Fault rectified?

Yes: → **09**
No: → **07**

07

1. Check fuel delivery pump (visual inspection).
2. Check driver between H.P. and L.P. for damage/breakage.

Fault rectified?

Yes: → **09**
No: → **08**

08

► Contact Service.

09 ► No further action required.

TIM ID: 0000029614 – 001

2.13 Fuel pressure in Common Rail too low – Fault isolation

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further fault messages are active (e.g. fuel inlet pressure too low), consider possible causal relationship

Further fault messages or irregularities?

Yes: → **02**
No: → **03**

02

► Check fuel level in tank; possibly insufficient fuel in tank.

Fault rectified?

Yes: → **09**
No: → **03**

03

► Check sensor for recording fuel pressure in the Common Rail (→ Page 254)

Fault rectified?

Yes: → **09**
No: → **04**

04

1. Check fuel filter for contamination and replace if necessary (→ Page 234)
2. Check fuel filter system for correct installation (→ Page 179)

Fault rectified?

Yes: → **09**
No: → **05**

05

1. Check all external and internal fuel lines and straight unions for correct seating, leaks or flow reduction. (→ Page 175)
2. Check fuel lines and straight unions in the HP circuit for leaks or flow reduction (visual inspection) (→ Page 312)
3. Check bore in line downstream of filter to HP pump (fuel filter permanent ventilation) for correct specified size.

Fault rectified?

Yes: → **09**
No: → **06**

06

► Replace breather valve in fuel distributor (→ Page 312)

Fault rectified?

Yes: → **09**
No: → **07**

07

1. Check fuel lines and straight unions at fuel delivery pump for leaks.
2. Check fuel delivery pump (visual inspection).
3. Check whether sufficient fuel delivery pressure is available.

Fault rectified?

Yes: → **09**
No: → **08**

08

► Contact Service.

TIM ID: 0000029059 – 001

09 ► No further action required.

TIM ID: 0000029059 – 001

2.14 Crankcase pressure too high – Fault isolation

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Further fault messages or irregularities?

Yes: → **02**
No: → **05**

02

1. Check engine in operating status for irregularities (visual inspection).
2. Check crankcase breather in operating status for faults (visual inspection).

Fault rectified?

Yes: → **08**
No: → **03**

03

1. Check oil separator insert (→ Page 158)
2. Check oil separator diaphragm (→ Page 158)

Fault rectified?

Yes: → **08**
No: → **04**

04

► Remove crankcase vent lines and check for flow reduction and correct seating (→ Page 155)

Fault rectified?

Yes: → **08**
No: → **05**

05

► Check crankcase pressure sensor (→ Page 254)

Fault rectified?

Yes: → **08**
No: → **06**

06

► Check oil return line of compressor (→ Page 218)

Fault rectified?

Yes: → **08**
No: → **07**

07

► Contact Service.

08

► No further action required.

TIM ID: 0000029060 – 001

2.15 Charge air pressure too low

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Crash Record with irregularities?

Check charge air coolant temperature → **02**

If the turbocharger speed is too high, check air filter → **08**

Check intake air pipework from air filter to turbocharger → **09**

No irregularities or no further fault messages → **03**

02

► Check coolant charge air temperature. If the coolant charge air temperature is too high, continue troubleshooting in “Troubleshooting – Charge air temperature too high” (→ Page 111)

03

► Check charge air pressure sensor (→ Page 254)

Fault rectified?

Yes: → **14**

No: → **04**

04

1. Check entire exhaust pipework for reduced exhaust flow.
2. Remove exhaust pipework downstream of turbocharger and check for reduced flow or limitation of cross-sectional area (→ Page 188)

Fault rectified?

Yes: → **14**

No: → **05**

05

► Check exhaust pipework downstream of cylinder head to turbocharger for leaks.

Fault rectified?

Yes: → **14**

No: → **06**

06

1. Start engine and operate at partial load to check for possible air leaks between turbocharger and air inlet to cylinders.
2. Take reading on contamination indicator after air filter.
3. Operate engine in various load ranges, record and analyze operating parameters. Check if specified power is reached. Check injection quantities and turbocharger speeds and compare with Acceptance Test Protocol.
4. Check intercooler drain for discharge of oily fluid (→ Page 143).

Reading on contamination indicator > 30 mbar or oily fluid discharged from drain bore?

Check air filter or contamination indicator → **07**

If oil emerges from the drain bore, the turbocharger bearings must be checked. → **10**

No serious fault detected: → **09**

07

► Take reading on contamination indicator after air filter.

Reading > 30 mbar?

Check resistance sensor → **13**

Replace contaminated air filter → **08**

TIM ID: 0000029061 – 001

08

1. Check air filter
2. Clean air filter or replace.

Fault rectified?

Yes: → **14**
No: → **09**

09

► Remove air intake pipework from filter to turbocharger and check for reduction of cross-sectional area (→ Page 320)

Fault rectified?

Yes: → **14**
No: → **10**

10

1. Inspect compressor wheel or turbine wheel shaft (→ Page 180).
2. Check radial and axial bearing play of turbochargers manually.
3. If there is increased radial or axial bearing clearance in the compressor wheel, repair the exhaust turbocharger (→ Page 142)

Fault rectified?

Yes: → **14**
No: → **06**

11

1. Check air pipework from turbocharger to intercooler (→ Page 187) for leaks.
2. Remove air elbow downstream of intercooler (→ Page 185) and check for leaks.
3. Check inlet and outlet openings of intercooler for air-side contamination and damage (visual inspection).

Fault rectified?

Yes: → **14**
No: → **12**

12

► If the intercooler is contaminated (→ Page 111)

13

► carry out a sensor check.

14

► Problem solved

TIM ID: 0000029061 – 001

2.16 Lube-oil differential pressure too high

01

1. Read out fault memory and analyze alarm file.
2. Analyze records of relevant engine parameters (e.g. temperature, pressure, speed)
3. If required, study and analyze the Crash Record with all associated operating data.
4. If further alarms are active, consider possible causal relationship.

Any irregularities found?

Yes: → **03**
No: → **02**

02

1. Check oil pressure sensor downstream of lube-oil filter (→ Page 254)
2. Check oil pressure sensor upstream of lube-oil filter (→ Page 254)

Fault rectified?

Yes: → **08**
No: → **03**

03

► Check oil level. (→ Page 194)

Oil level below MIN mark?

Check lube oil components for external leaks → **04**

04

1. Check lube oil components for external leaks (→ Page 191)
2. Check oil supply for exhaust turbocharger for external leaks (→ Page 284)
3. Check oil priming pump and oil pipework for external leaks (→ Page 285)
4. Check automatic filter for external leaks (→ Page 196)
5. Check centrifugal oil filter for external leaks (→ Page 203)
6. Check oil cooler for external leaks (→ Page 286).
7. Check remaining oil lines/oil ducts for external leaks.

Fault rectified?

Yes: → **08**
No: → **05**

05

1. Evaluate oil quality by visual inspection and carry out engine oil analysis using the MTU test kit (→ Page 195).
2. Change engine oil if required (→ Page 192).

Fault rectified?

Yes: → **08**
No: → **06**

06

1. Check and clean oil indicator filter (→ Page 201).
2. Remove oil filter candles and replace if necessary (→ Page 197)

Fault rectified?

Yes: → **08**
No: → **07**

07

► Contact Service

08

► No further action required.

TIM ID: 0000029062 – 001

2.17 AL ECU Defect – Fault isolation

Preconditions

- Operating voltage is available.
- Diagnostic LED of ECU 7 visible.

01

► Continue analyzing fault indications.

Are detailed messages displayed?

Yes: → 12

No: → 02

02

1. Release lock the four connectors on the ECU 7 and pull out connectors.
2. Check contact pins in each connector: they must not be oxidized or bent.

Contact oxidized?

Yes: → 03

No: → 05

03

1. Clean contacts with isopropyl alcohol. Ensure that pins are not bent
2. Insert connector and engage interlock.
3. Switch on operating voltage.

Did the fault message “AL ECU Defect” disappear?

Yes: → 11

No: → 04

04

► Check resistance between the cable connectors, referring to the wiring diagram or wiring harness running-out list.

Does one of the resistance values go to infinity?

Yes: → 05

No: → 06

05

1. The wiring harness with the relevant connector, i.e. the harness with excessive resistance, must be replaced.
2. Injector wiring harness: (→ Page 220)
3. Sensor wiring harness: (→ Page 220)
4. Wiring harnesses to plant: Observe information from OEM.
5. After wiring harness replacement, switch on operating voltage.

Did the fault message “AL ECU Defect” disappear?

Yes: → 11

No: → 10

06

► Check operating voltage:

Voltage out of tolerance?

Voltage (measured in the connector) below 18 VDC. → 07

Voltage (measured in connector) above 36 VDC. → 08

TIM ID: 0000029063 – 001

07

1. Check batteries.
2. Check wiring harness.

Which fault is present?

Battery voltage (measured at battery poles) too low. → **09**

Resistance in the cables for operating voltage (measure positive and negative lead!) too high. → **04**

08

► Repeat measurement.

Is the voltage really too high?

Yes: → **10**

No: → **02**

09

► Have batteries replaced by the vehicle manufacturer.

10

► Contact Service.

11

1. The problem is resolved.
2. Resume normal operation.

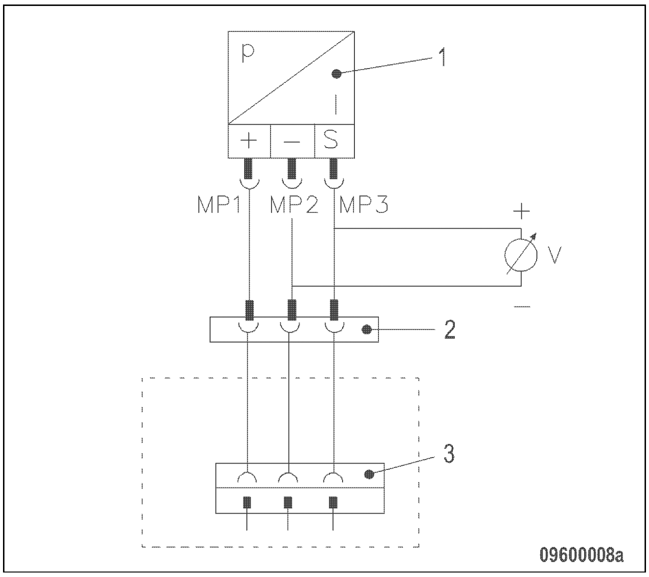
12

► Analyze further messaged displayed.

TIM ID: 0000029063 – 001

2.18 Level sensor check – Simulation

01



1 Sensor, pin assignment (→ Page 220)
2 Sensor cable connector
3 Engine governor connector, pin assignment (→ Page 223)

1. Make test configuration in accordance with illustration
2. Measure voltage between MP1 and MP2

Is voltage of 5V applied?

Yes: → **03**
No: → **02**

02

1. Disconnect sensor
2. Measure voltage at engine wiring harness again.

Is the voltage (5V) now present?

Yes: → **06**
No: → **05**

03

1. Remove cable from measurement output of sensor.
2. Measure current in the lead to connection “S” on sensor.

Is the value between 4 ... 20 mA ?

Yes: → **04**
No: → **06**

04

► Contact Service

05

1. Repeat measurement with unconnected sensor
2. Replace engine governor ECU (→ Page 219)

06

► Replace pressure sensor (→ Page 295)

07

► No further action required.

TIM ID: 0000029066 – 001

2.19 Battery-charging generator – Check

DANGER	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

01

► Check connecting cable on battery-charging generator.

Are all crimp connections properly secured, all screws tightened, is there no limitation of cross-sectional area due to partly torn-off cables?

Yes: → **04**
No: → **02**

02

1. Make terminals of battery-charging generator accessible.
2. Start engine.
3. Measure voltage at the terminals of the battery-charging generator.

Is the voltage too high or too low?

Yes: → **03**
No: → **05**

03

► Replace battery-charging generator (→ Page 216)

Has the fault message disappeared?

Yes: → **06**
No: → **05**

04

1. Renew crimp connections (use new cable rings!).
2. Renew damaged cables.
3. Tighten screws.

05

► Contact MTU Service.

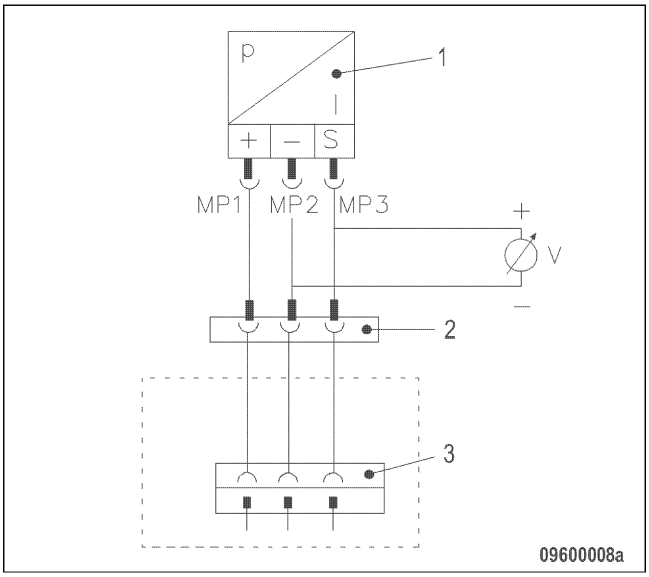
06

► No further action required.

TIM ID: 0000029064 – 001

2.20 Pressure sensor check – Simulation

01



1 Sensor, pin assignment (→ Page 220)
2 Sensor cable connector
3 Engine governor connector, pin assignment, see (→ Page 223)

1. Make test configuration in accordance with illustration
2. Measure voltage between MP1 and MP2

Is voltage of 5V applied?

Yes: → **03**
No: → **02**

02

1. Disconnect sensor
2. Measure voltage at engine wiring harness again.

Is the voltage (5V) now present?

Yes: → **06**
No: → **05**

03

1. Remove cable from measurement output of sensor.
2. Measure current in the lead to connection “S” on sensor.

Is the value between 4 ... 20 mA ?

Yes: → **04**
No: → **06**

04

► Contact Service

05

1. Repeat measurement with unconnected sensor
2. Replace engine governor ECU (→ Page 219)

06

► Replace pressure sensor (→ Page 295)

07

► No further action required.

TIM ID: 0000029065 – 001

TIM ID: 0000029065 – 001

3 Fault elimination

3.1 Exhaust turbocharger – Check

Material

Designation / Use	Part No.	Qty.
Crack test oil (No. 63)	→ FLS	1
Crack test compound (UV-Apelux 1031)	→ FLS	1

Spare parts

Designation / Use	Part No.	Qty.
Exhaust turbocharger	→ SPC	
Nut	→ SPC	
Retaining ring	→ SPC	
Heat shield	→ SPC	
Turbine housing	→ SPC	
Turbine wheel	→ SPC	
Housing cover	→ SPC	
Bearing housing	→ SPC	
Thrust bearing	→ SPC	
Ring carrier	→ SPC	
Compressor wheel	→ SPC	
Clamping element	→ SPC	
Compressor housing	→ SPC	
Studs	→ SPC	

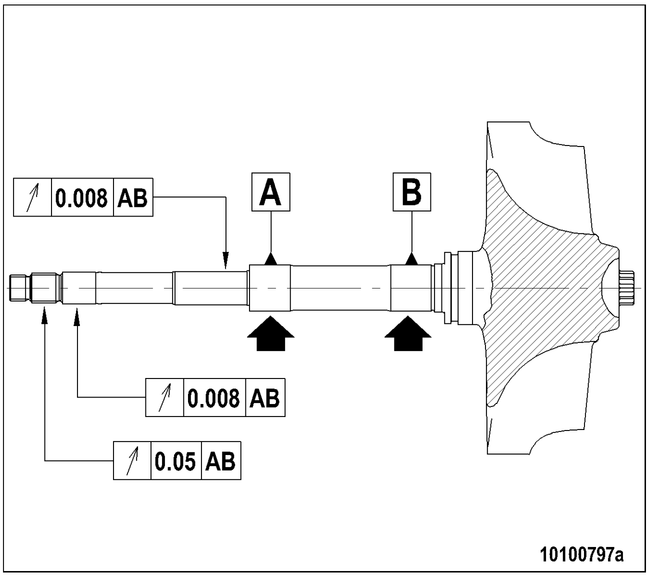
TIM ID: 0000033870 – 001

Checking exhaust turbocharger

Item	Findings	Action
Check shaft of turbine wheel, housing and compressor wheel for cracks using magnetic crack testing procedure.	Crack indication	Replace
Check turbine housing, heat shield, housing cover, bearing housing, compressor housing, turbine and compressor wheel shaft for scores and grinding marks.	• Grinding marks • Scores visible	• Rework: smoothen with oilstone. • Replace
Measure housing cover bore, bearing housing bore, bearing bushing bore, retaining ring bore, compressor wheel bore, bearing bushing bore outer Ø, turbine shaft outer Ø. Values (→ Page 275)	Values exceeded or not reached.	Replace
Studs on turbine housing	Damaged	Replace
Check clamp element, retaining ring, nut, ring carrier, thrust bearing and washers for wear.	Wear visible	Replace
Check securing screw threads.	Damaged	Replace

Checking true running of turbine wheel

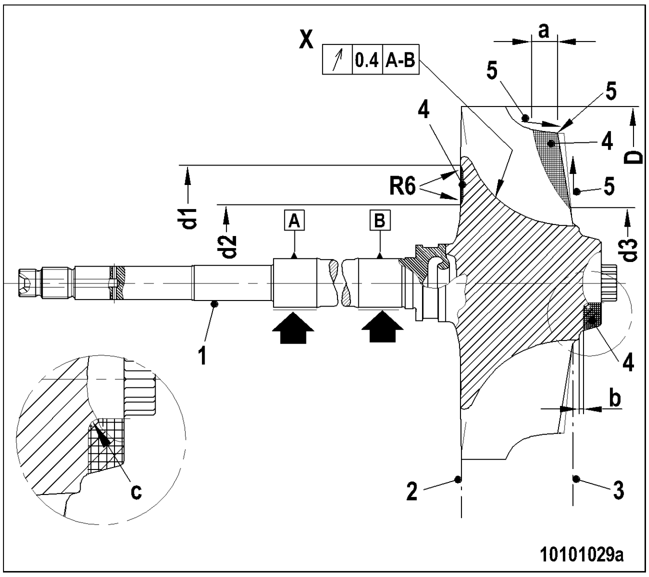
1. Support the turbine wheel shaft at the bearings (arrowed) in a roll prism.
2. Shaft runout > 0.05 / 0.008 mm: replace turbine wheel.



TIM-ID: 0000033870 – 001

Turbine wheel test balancing

1. Support turbine wheel (1) at bearings (arrowed).
2. Permitted residual imbalance per balancing plane, see table below



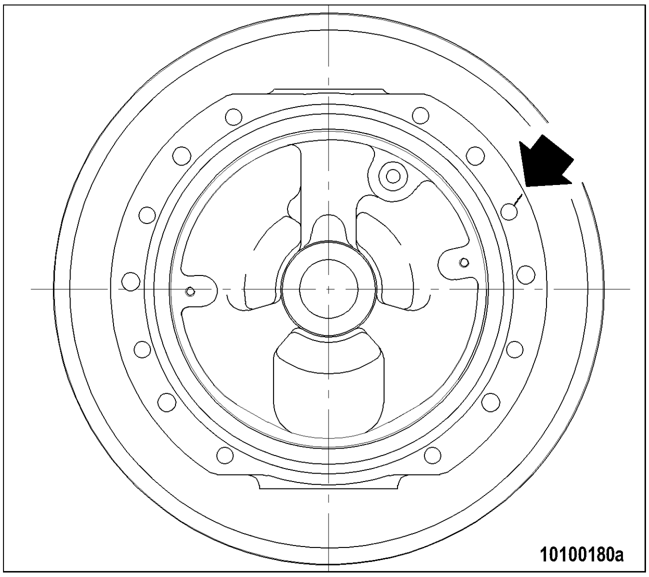
1 Turbine wheel
2 Balancing plane I
3 Balancing plane II
4 Material removal for balancing in larger areas on rear of wheel, max. 1.3 mm depth with $\sqrt{\text{Rz 6,3}}$ and on cone with $\sqrt{\text{Rz 25}}$. Additional material removal distributed over max. 4 blades permissible in shaded area. Check radial runout of hub in the event of major material removal. Max. permissible radial runout see pos. (X).
5 Conical material removal up to minimum blade thickness of 1.2 mm. Radial machining scores $\sqrt{\text{Rz 10}}$.

ETC type	D Ø (mm)	d1 Ø (mm)	d2 Ø (mm)	d3 Ø (mm)	a (mm)	b (mm)	c (mm)	Permissible residual imbalance per balancing plane (gmm)
ZR 175	158	100	70	70	10	2.0	min. R3	3.5
ZR 195	180	120	80	76	12	2.0	min. R3	3.5

Checking bearing housing

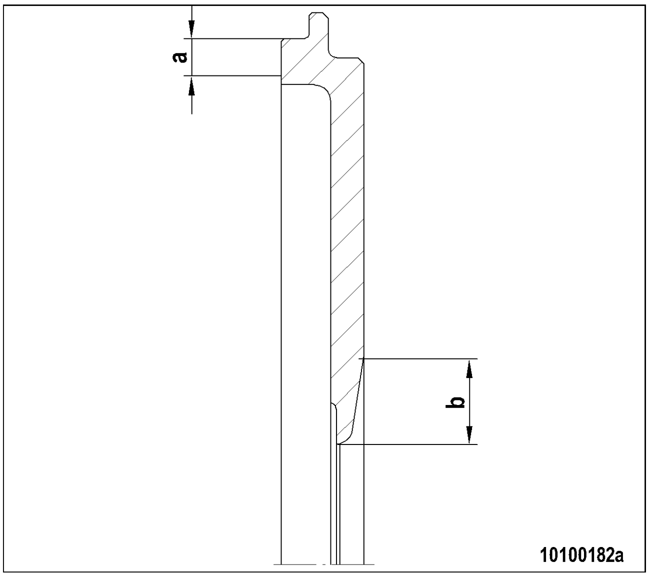
Note: Surface cracks from outer Ø to bore Ø permissible (arrowed).

1. Check bearing housing for surface cracks.
2. Number of cracks = number of bores



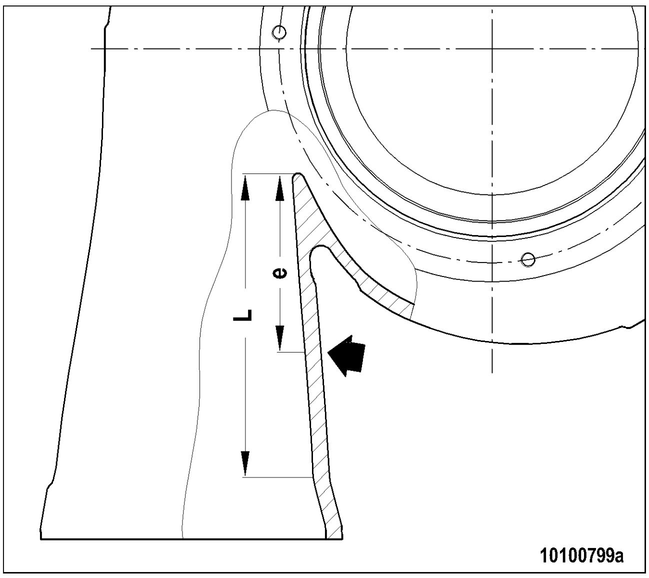
Checking heat shield

1. Check heat shield for surface cracks.
2. Crack length greater than max. crack length: (a = 10 mm) or (b = 15 mm): Replace heat shield.



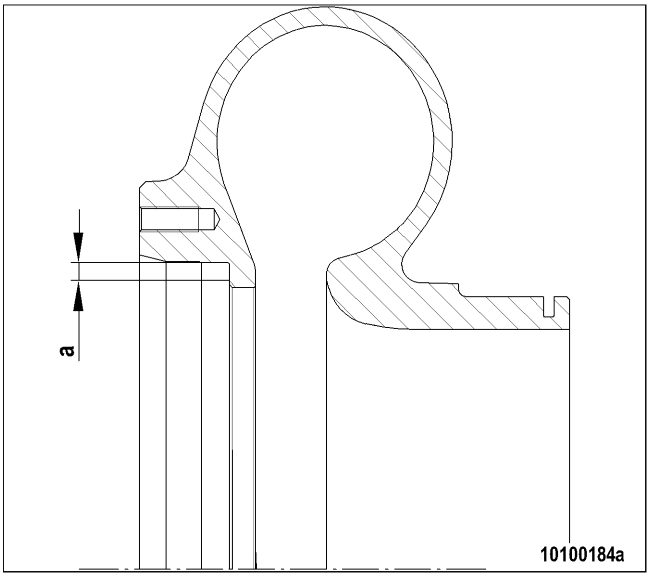
Checking turbine housing

1. Check turbine housing for cracks.
2. Crack length greater than max. crack length: (e = 2/3 L) stop-drilled with 3 mm permitted (arrowed): replace turbine housing.

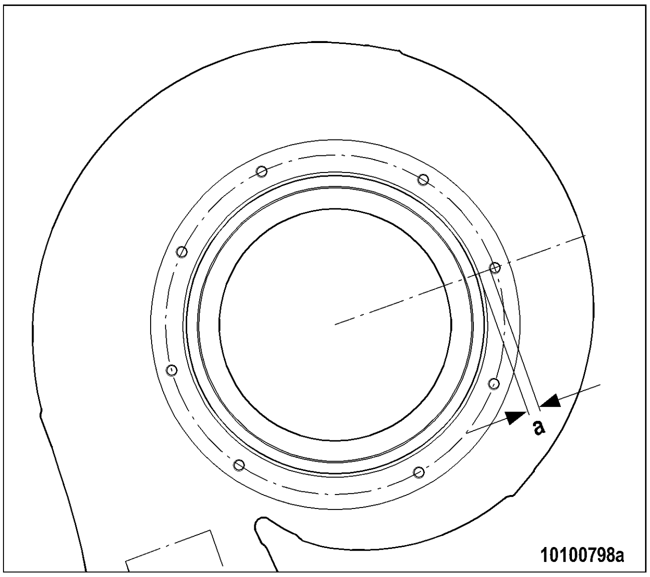


TIM ID: 0000033870 – 001

3. Crack length greater than max. crack length: (a = 6 mm): Replace turbine housing.

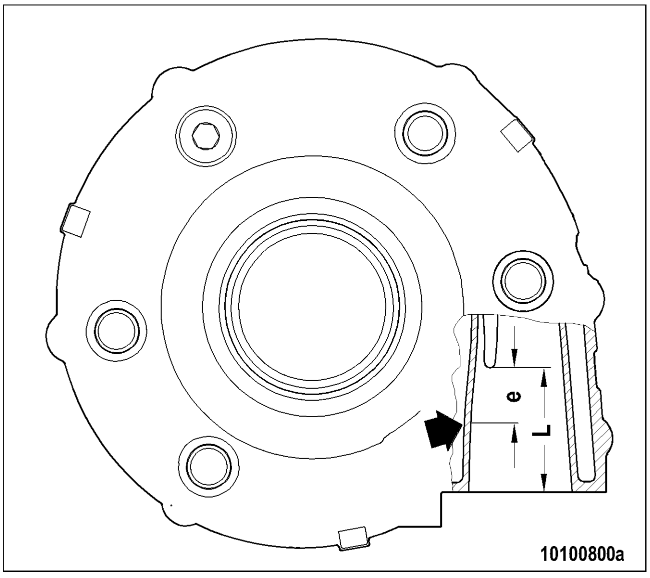


4. a = Surface cracks from inner Ø to bore Ø permissible; number of surface cracks = number of bores



Checking compressor housing

1. Check compressor housing for cracks.
2. Crack length greater than max. crack length: (e = 2/3 L) stop-drilled with 3 mm permitted (arrowed): Replace compressor housing.



TIM ID: 0000033870 – 001

3.2 Exhaust turbocharger – Removal

Preconditions

- Preparatory steps have been completed.

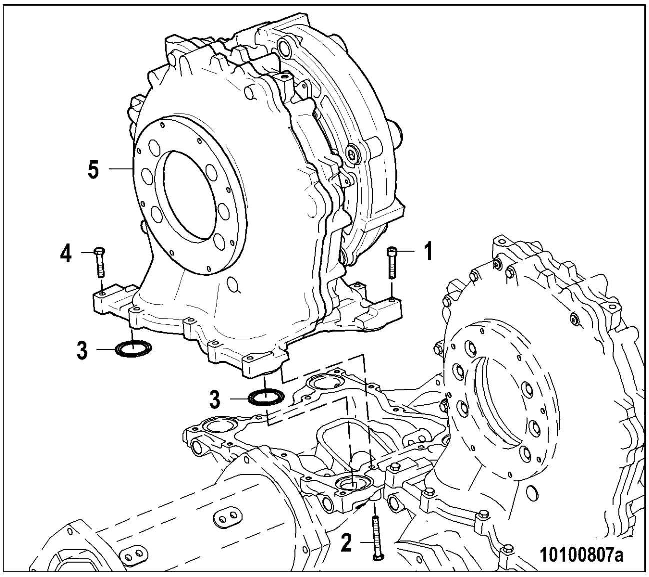
Special tools

Designation / Use	Part No.	Qty.
Lifting equipment	→ TC	1

WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Removing exhaust turbocharger

1. Remove screws (1, 2, 4).
2. Using lifting device, remove turbocharger with carrier housing (5) from exhaust housing.
3. Remove gaskets (3) from grooves.
4. Seal openings with suitable covers.



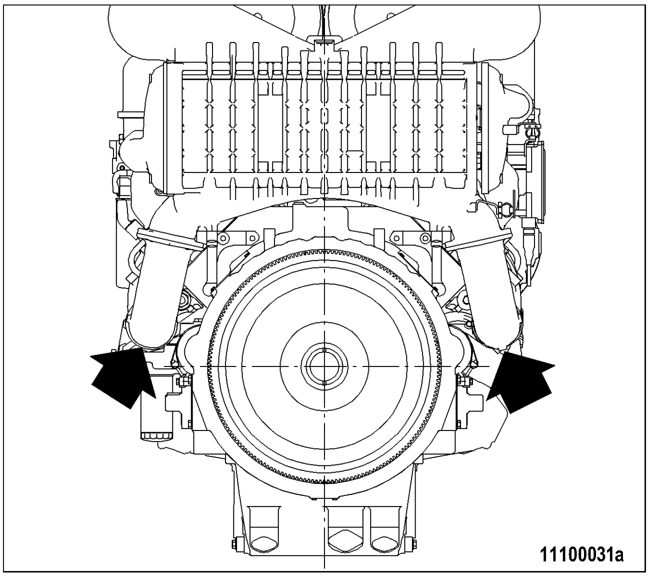
TIM ID: 0000033871 – 001

3.3 Intercooler – Checking condensate drains for coolant discharge and obstructions

DANGER	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.
WARNING	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.
WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.

Intercooler – Checking condensate drains for coolant discharge and obstructions

1. With the engine running, verify that air emerges from the condensate drain(s) at driving end, left and right engine side. If no air emerges:
2. Clean drain bore(s) and blow out with compressed air.
3. If a large amount of coolant is continuously discharged, the intercooler is leaking. Contact Service.



Emergency measures prior to engine start with a leaking intercooler

1. Remove injectors (→ Page 235).
2. Bar engine manually (→ Page 274).
3. Bar engine with starting system to blow out combustion chambers (→ Page 280).
4. Install injectors (→ Page 235).

TIM ID: 0000033872 – 001

3.4 Speed sensors – Check

Preconditions

- Operating voltage switched off

Special tools

Designation / Use	Part No.	Qty.
Digital multimeter with measuring cable, measuring clips and probes	→ TC	1
Pliers for bayonet couplings	→ TC	1

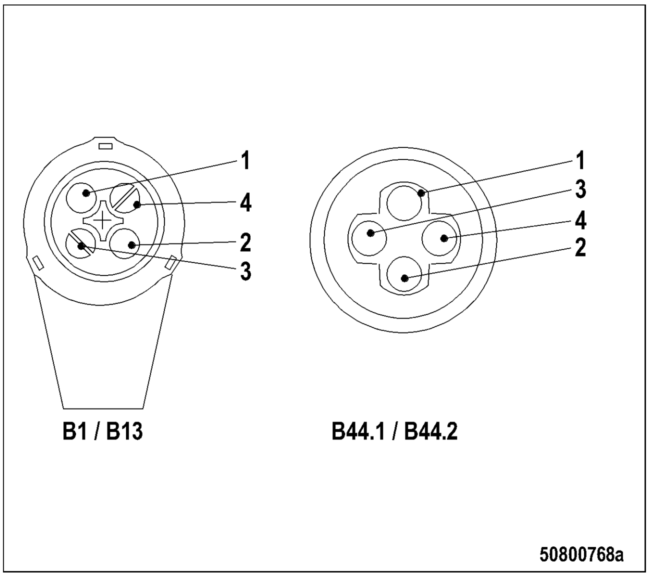
DANGER

Unguarded rotating and moving engine components.
Risk of serious injury — danger to life!
- Before working on the engine, disable engine start.

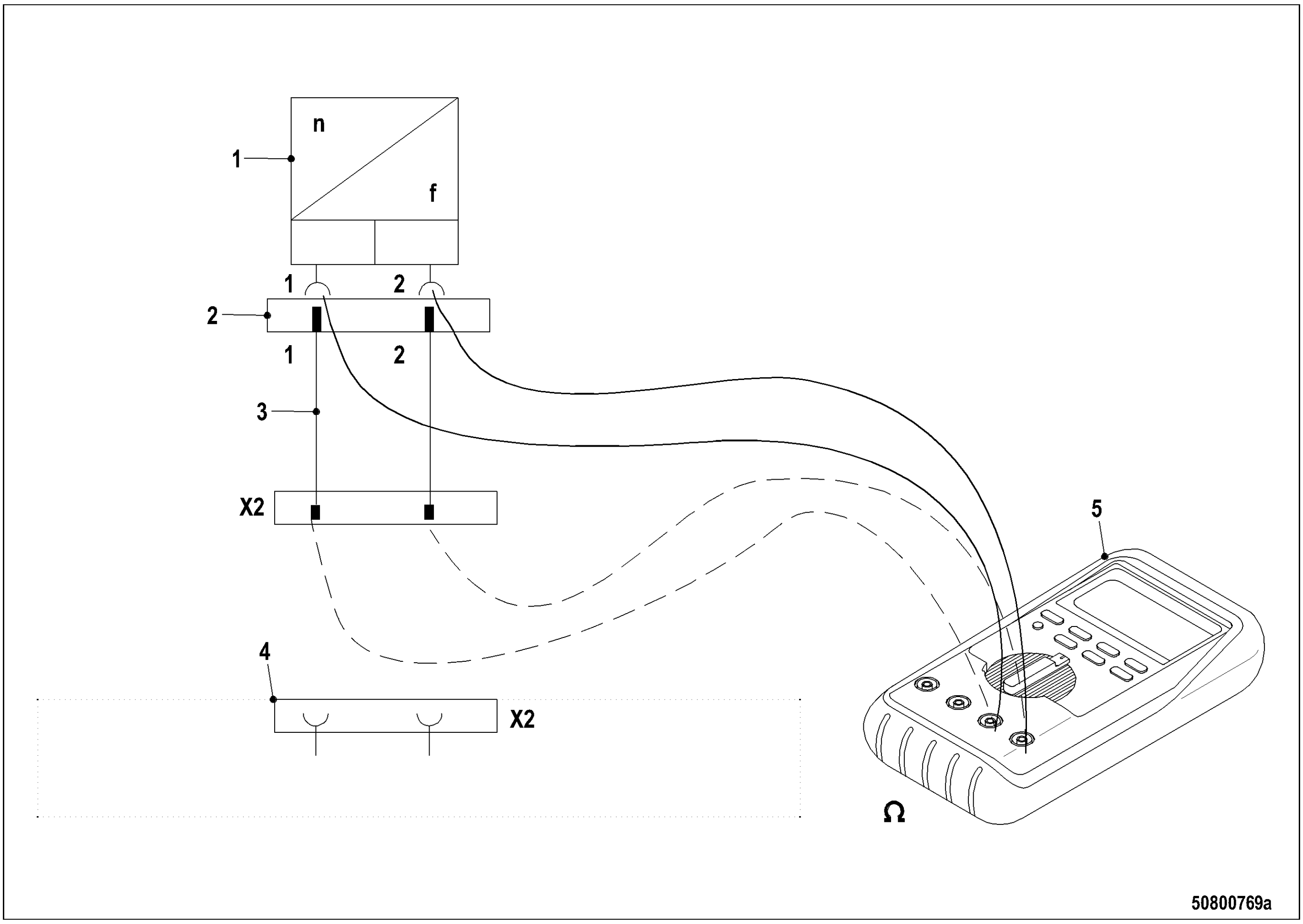
Checking a speed sensor

1. Switch off engine and engine governor.
2. Localize the corresponding sensor connector on the engine and disconnect connector on sensor.
3. Measure the resistance between pins 1 and 2.

   Result: With the engine cold (room temperature 20°C) it must be:
   - B1, B13: approx. 135 Ω
   - B44.1, B44.2: approx. 1000 Ω to 1385 Ω
     In addition the resistance between each pin and ground (metal housing) must be measured. It must exceed 1 MΩ. If the resistances deviated significantly, the sensor must be replaced.
   - If the resistances are within tolerance, the wiring (in corrugated pipe) between the engine governor and the sensor must be checked. To do this, the connector on the sensor must be connected. Subsequently the connector on the engine governor must be disconnected. The following table indicates the connection of the sensors on the connectors of the engine governor (assignment of sensor connector to pins). The three resistance measurements must be repeated as per step 3 (pins against each other and against ground). If the measurement results gained on the engine governor connector deviate significantly from those gained directly on the sensor, the wiring harness must be replaced.
   - If the measured values are within tolerance (deviation approx. 40%), the relevant input on the engine governor is defective and it must be replaced.



TIM ID: 0000033873 – 001



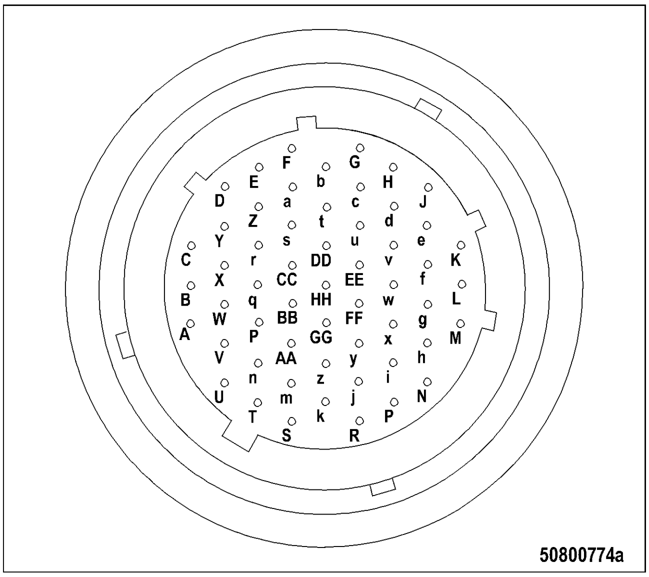
1 Speed sensor
2 Connector on sensor
3 Engine wiring harness
4 Engine governor, connector X2
5 Multimeter in Ω range

4. Connect connector to sensor.

TIM ID: 0000033873 - 001

Pin assignment: Engine governor, connector X2 – Speed sensors

1. Connect all sensors to wiring harness.
2. Disconnect connector X2 on the engine governor.
3. Carry out measurements between the pins on the wiring harness connector. Ensure that no short circuit to other pins is caused.
4. Ensure that the probes used in connector sockets are not too thick (they would widen the sockets, thereby causing future slack joints).



Sensor	Measured value	Pin	Signal	Measuring range	Channel
B1	Camshaft speed	t	IN +	0 rpm ... 5000 rpm	NW
		N	IN –		
B13	Crankshaft speed	M	IN +	0 rpm ... 5000 rpm	KW
		s	IN –		
B44.1	Primary turbocharger speed (ETC A)	P	IN +	0 rpm ... 50000 rpm	DME1
		AA	IN –		
B44.2	Secondary turbocharger speed (ETC B)	a	IN +	0 rpm ... 50000 rpm	DME2
		U	IN –		

5. Following testing and simulation the original system status must be restored:
   - All connectors on devices connected, bayonet union nuts secured using connector pliers, safety catches secured
   - All sensor connectors connected
   - All cables correctly connected to terminals
   - All devices closed
6. Recheck all connectors for correct connection.

TIM ID: 0000033873 – 001

3.5 Inspection port cover – Removal

Preconditions

- Preparatory steps have been completed.

⚠ **WARNING**	Components have sharp edges. **Risk of injury!** • Wear protective gloves.

Inspection port cover – Removal

1. Unscrew screws on inspection port cover / safety valve.
2. Remove inspection port cover or safety valve as shown in overview drawing (→ Page 258).

TIM ID: 0000033874 – 001

3.6 Cylinder liner – Endoscopic examination

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Rigid endoscope	→ TC	1

Preparatory steps

1. Remove cylinder-head cover (→ Page 260).
2. Remove injector (→ Page 235).

Positioning crankshaft at BDC

1. Using barring device, turn crankshaft until crankpin of the cylinder to be tested has reached BDC.
2. Insert endoscope into cylinder liner through injector seat.

Cylinder liner - Endoscopic examination

Findings	Task
• Thin carbon coating on carbon scraper ring • Slight localized additive deposits at top edge • Localized smooth areas at lower edge • Carbon deposits on entire circumference between top piston ring and lower edge of carbon scraper ring • First signs of marks left by top piston ring • Bright mark on entire circumference • Faultless, even honing pattern • First signs of marks left by lower cooling bores • Running pattern seems darker	No actions required
• Darker areas of even or varying color intensity • Beginning and end of the discoloration are not sharply defined and do not cover the entire stroke area • Dark areas in the upper section of the cooling bore, remaining circumference cannot be faulted • Piston rings cannot be faulted	Further endoscopic examination required as part of maintenance work
• On the entire circumference not only bright discoloration (not critical for operation) clearly visible darker stripes that begin at the top piston ring • Heat discoloration in the direction of stroke and honing pattern damage • Heat discoloration of piston rings	Cylinder liner must be replaced; Service must be contacted

1. Compile endoscopy report using the table.
2. Use technical terms for description of the liner surface (→ Page 261).
3. Depending on findings:
   - Do not take any action or
   - carry out further endoscopic examination as part of maintenance work or
   - contact Service: cylinder liner must be replaced.

Final steps

1. Install injector (→ Page 235).
2. Install cylinder-head cover (→ Page 260).

TIM ID: 0000033875 – 001

3.7 Cylinder liner – Removal

Special tools

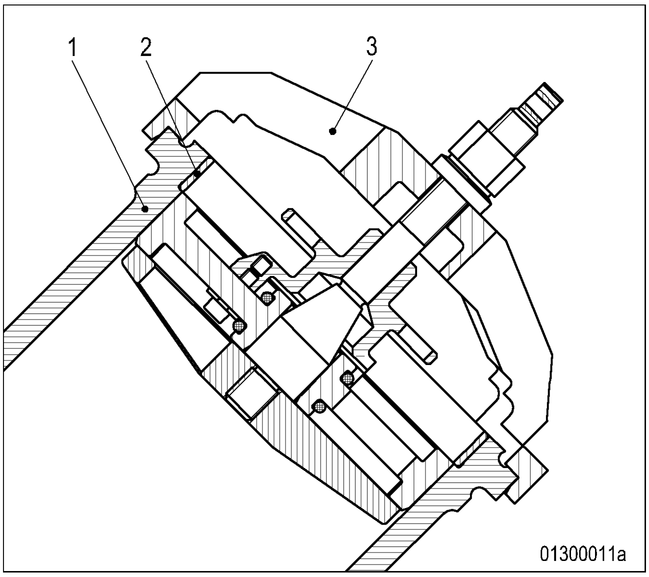
Designation / Use	Part No.	Qty.
Removal tool for carbon scraper ring	→ TC	1
Removal tool for cylinder liner	→ TC	1

WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

WARNING	Components have sharp edges. **Risk of injury!** • Wear protective gloves.

Removing carbon scraper ring

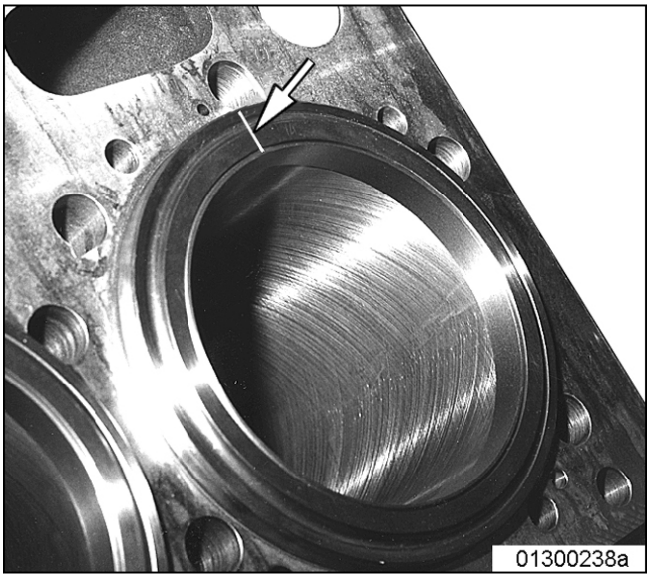
1. Mount removal tool (3) on cylinder liner (1).
2. Remove carbon scraper ring (2) with removal tool (3) from cylinder liner fit (1).
3. Remove removal tool (3).
4. Remove piston and conrod (→ Page 160).



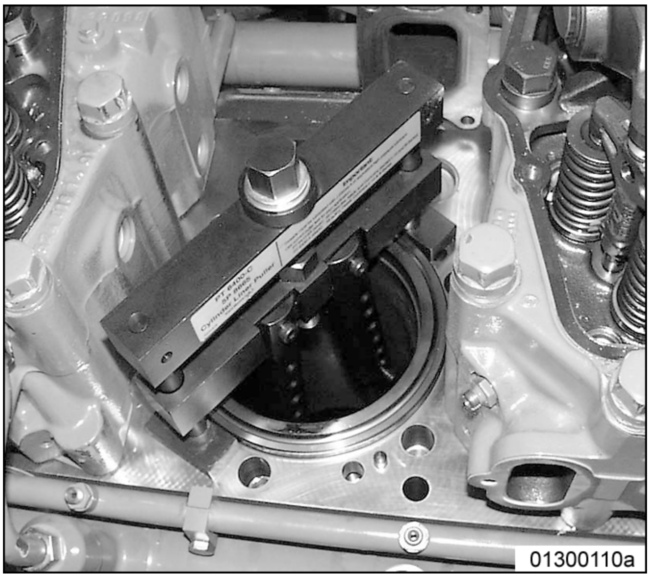
TIM ID: 0000033876 – 001

Cylinder liner – Removal

1. Mark installation position of cylinder liner to crankcase with a marker pen (arrowed).



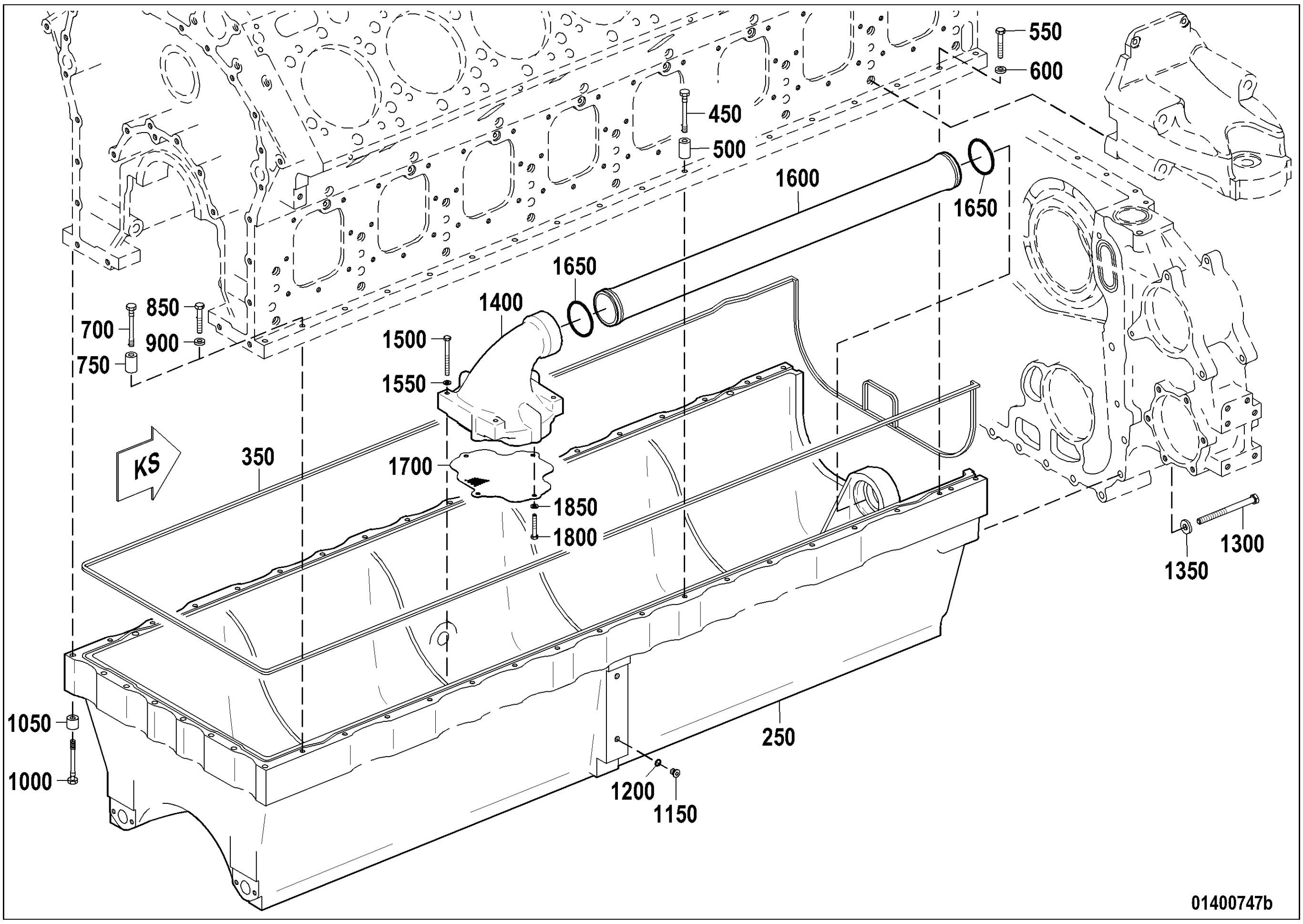
2. Insert removal tool into cylinder liner.
3. Position removal tool at lower collar of cylinder liner. Take care not to damage the oil spray nozzle.
4. To avoid tensioning the liner, only place fork in position lightly.
5. Rotate the removal tool spindle until the cylinder liner is released from the crankcase bore.
6. Remove removal tool.
7. Remove cylinder liner from crankcase.
8. Remove sealing rings from cylinder liner.



TIM ID: 0000033876 – 001

3.8 Oil pan – Overview

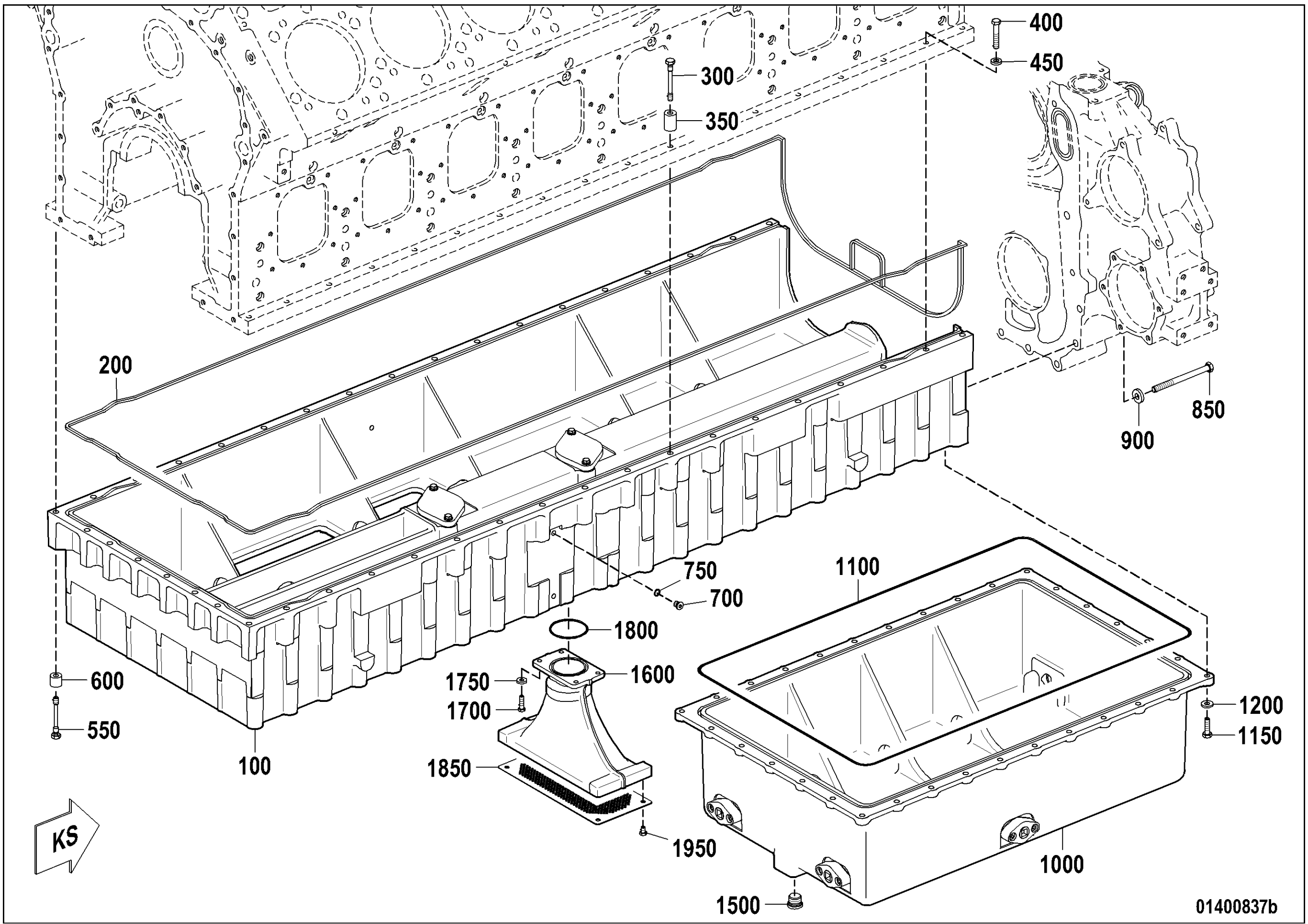
Oil pan (flat version)



250	Oil pan	850	Screw	1400	Intake elbow
350	Rubber profile	900	Washer	1500	Screw
450	Screw	1000	Screw	1550	Washer
500	Spacer sleeve	1050	Spacer sleeve	1600	Plug-in pipe
550	Screw	1150	Plug screw	1650	O-ring
600	Washer	1200	Sealing ring	1700	Screen
700	Screw	1300	Screw	1800	Screw
750	Spacer sleeve	1350	Washer	1850	Washer

TIM ID: 0000033877 – 001

Oil pan (deep version)



100 Oil pan
200 Rubber profile
300 Screw
350 Spacer sleeve
400 Screw
450 Washer
550 Screw
600 Washer
700 Screw
750 Sealing ring
850 Screw
900 Washer
1000 Lower oil pan section
1100 Rubber profile
1150 Screw
1200 Washer
1500 Plug screw
1600 Intake elbow
1700 Screw
1750 Washer
1800 O-ring
1850 Screen
1950 Screw

TIM ID: 0000033877 – 001

3.9 Oil pan – Removal

Preconditions

- Preparatory steps have been completed.

Special tools

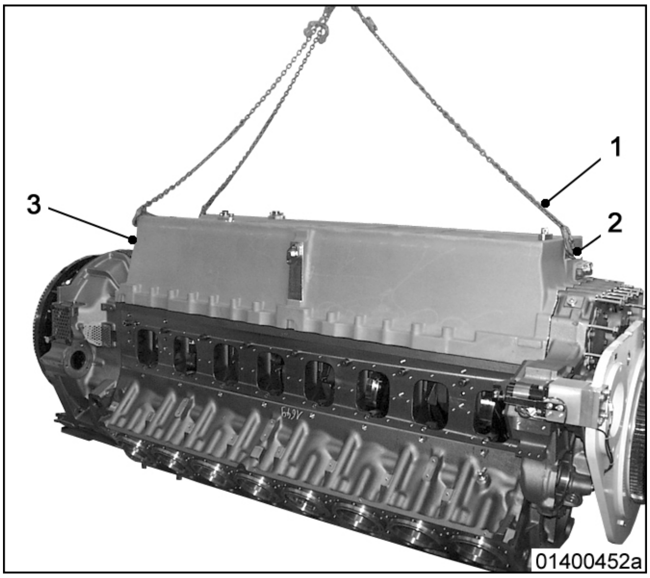
Designation / Use	Part No.	Qty.
Eyebolts	→ TC	
4-strand hook-ended chain sling	→ TC	

DANGER	Suspended load. **Danger to life!** • Use appropriate lifting devices and appliances. • Never stand beneath a suspended load.

WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Oil pan – Removal

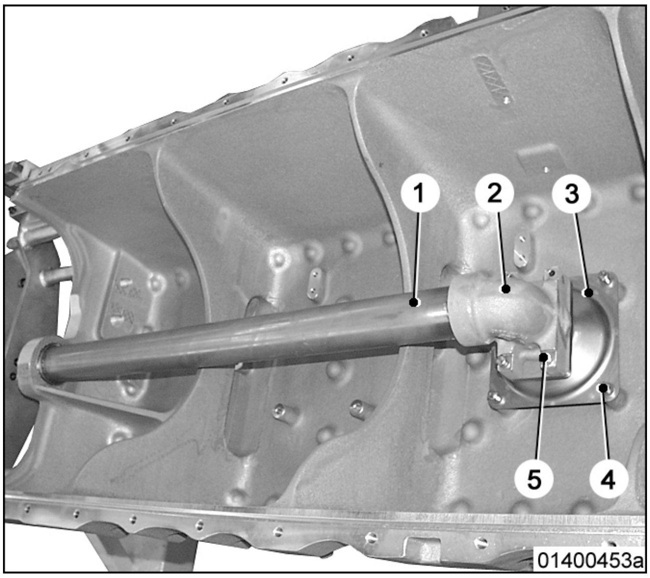
1. Install engine in rotation device and turn by 180°.
2. Remove hex bolts from oil pan (3).
3. Remove plug screws at end faces and insert eyebolts (2).
4. Lift oil pan (3) with hook-ended chain sling (1) and crane and place on suitable surface.
5. Remove flanges at end faces.
6. Remove rubber profile.



TIM ID: 0000033878 – 001

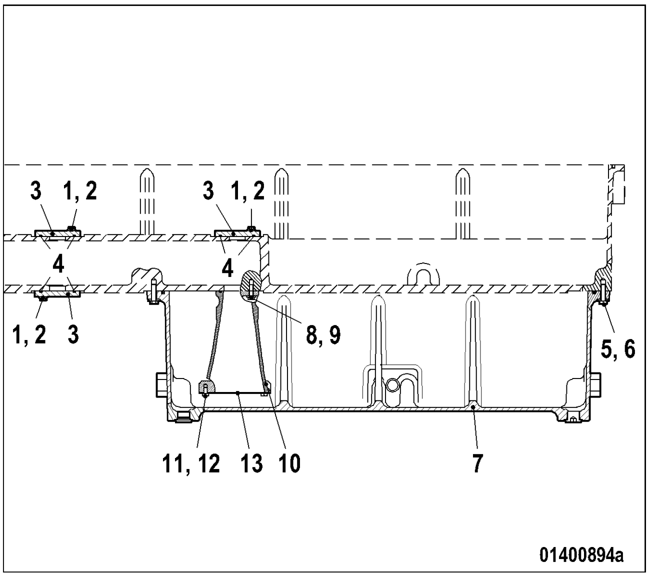
Removing suction basket (flat oil pan)

1. Remove hex bolts (5) from connecting piece (2).
2. Remove connecting piece (2) with plug-in pipe (1).
3. Extract plug-in pipe (1) from connecting piece (2).
4. Remove O-rings.
5. Remove hex bolts (4) from suction basket (3).
6. Remove suction basket (3).



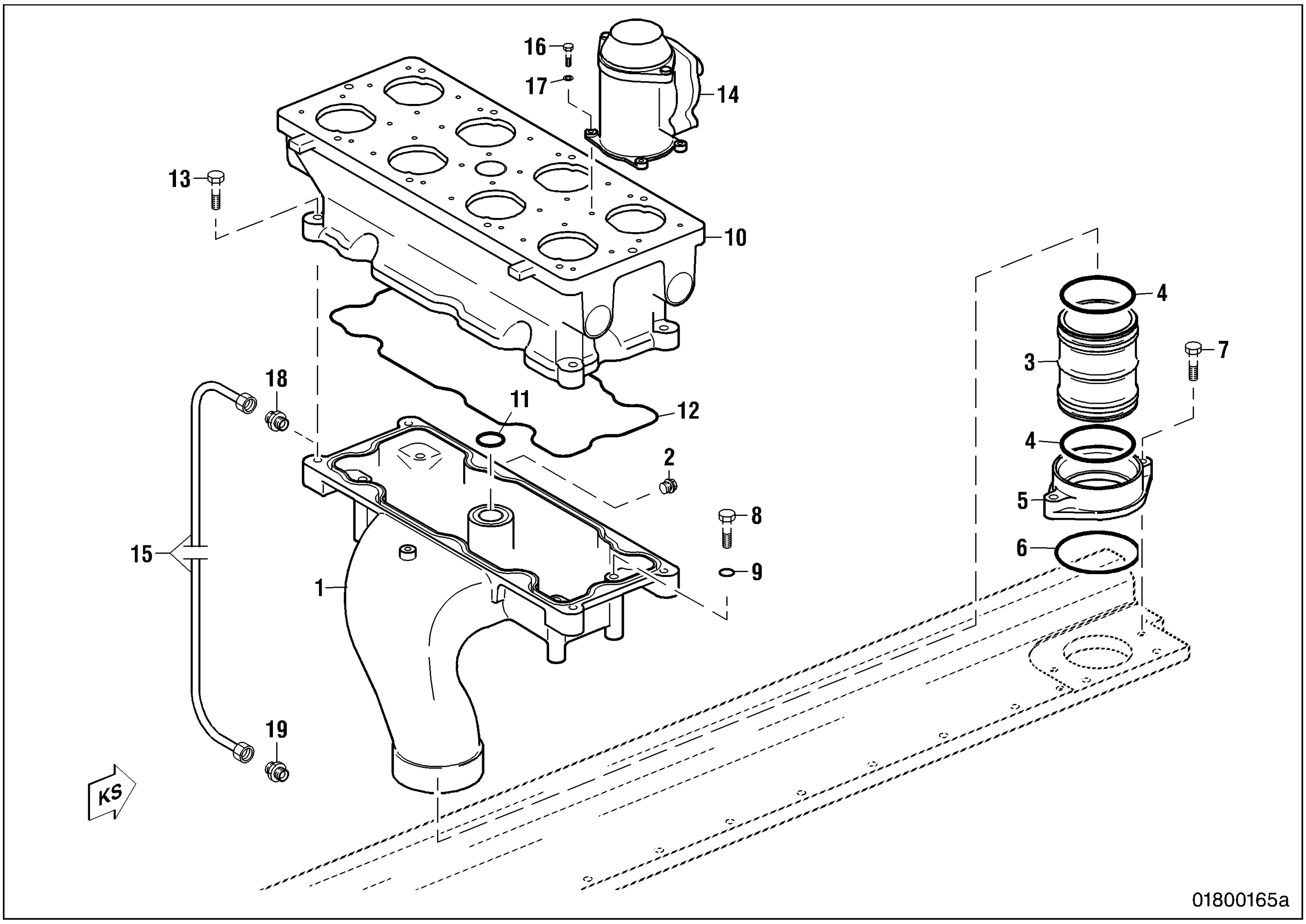
Removing suction basket (deep oil pan)

1. Remove screws (1) with washers (2).
2. Remove cover (3).
3. Remove O-ring (4) from covers (3).
4. Remove all screws (5) with washers (6) for lower oil pan section (7).
5. Lower bottom oil pan section (7).
6. Remove screws (12) with washers (11).
7. Remove screen (13) from intake elbow (10).
8. Remove screws (8) with washers (9).
9. Remove intake elbow (10).



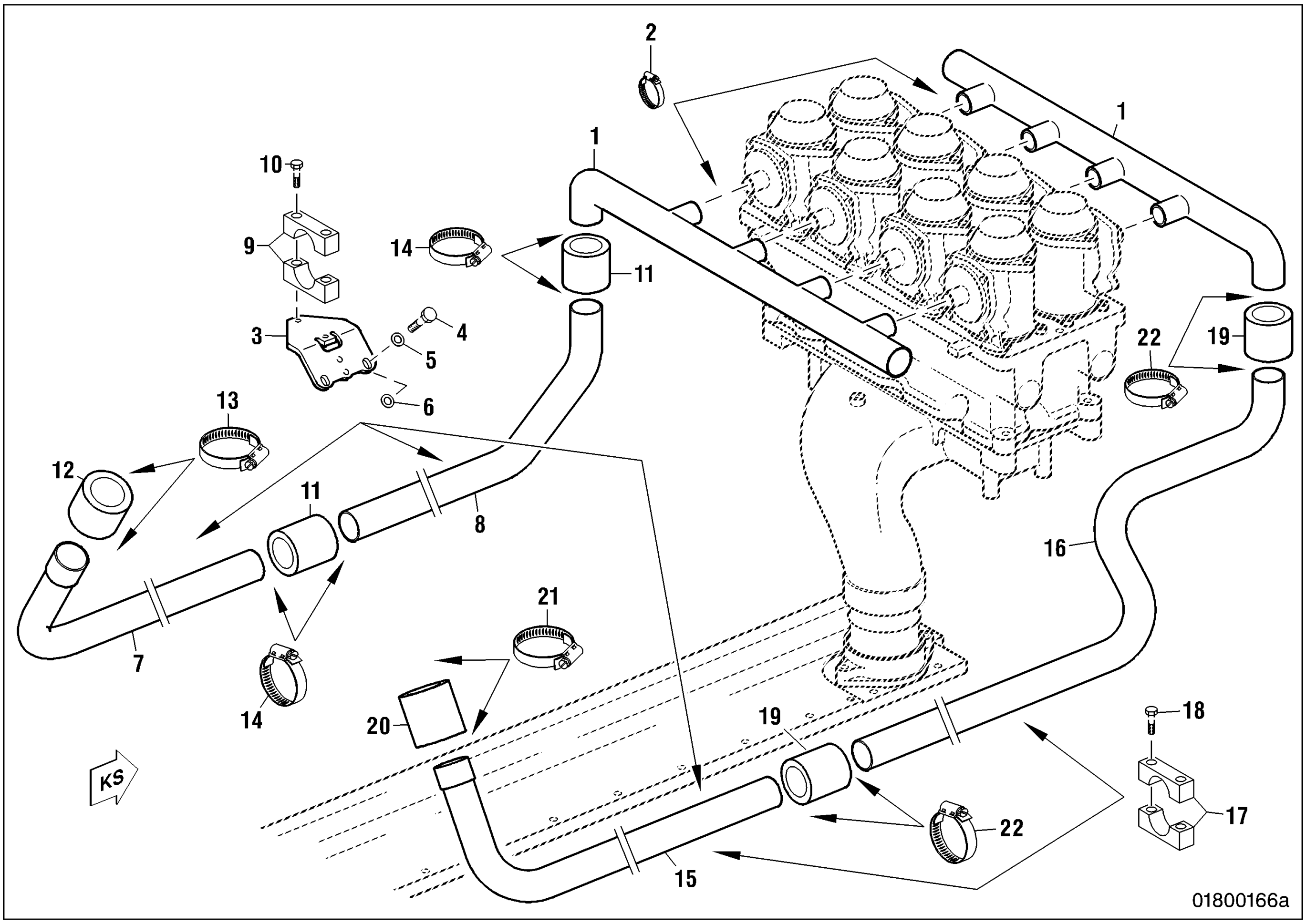
TIM ID: 0000033878 – 001

3.10 Crankcase ventilation – Overview



1	Vent housing	8	Screw	15	Oil pipe
2	Plug screw	9	O-ring	16	Screw
3	Plug-in pipe	10	Vent housing	17	Washer
4	O-ring	11	O-ring	18	Threaded union
5	Flange	12	O-ring	19	Threaded union
6	O-ring	13	Screw		
7	Screw	14	Oil separator		

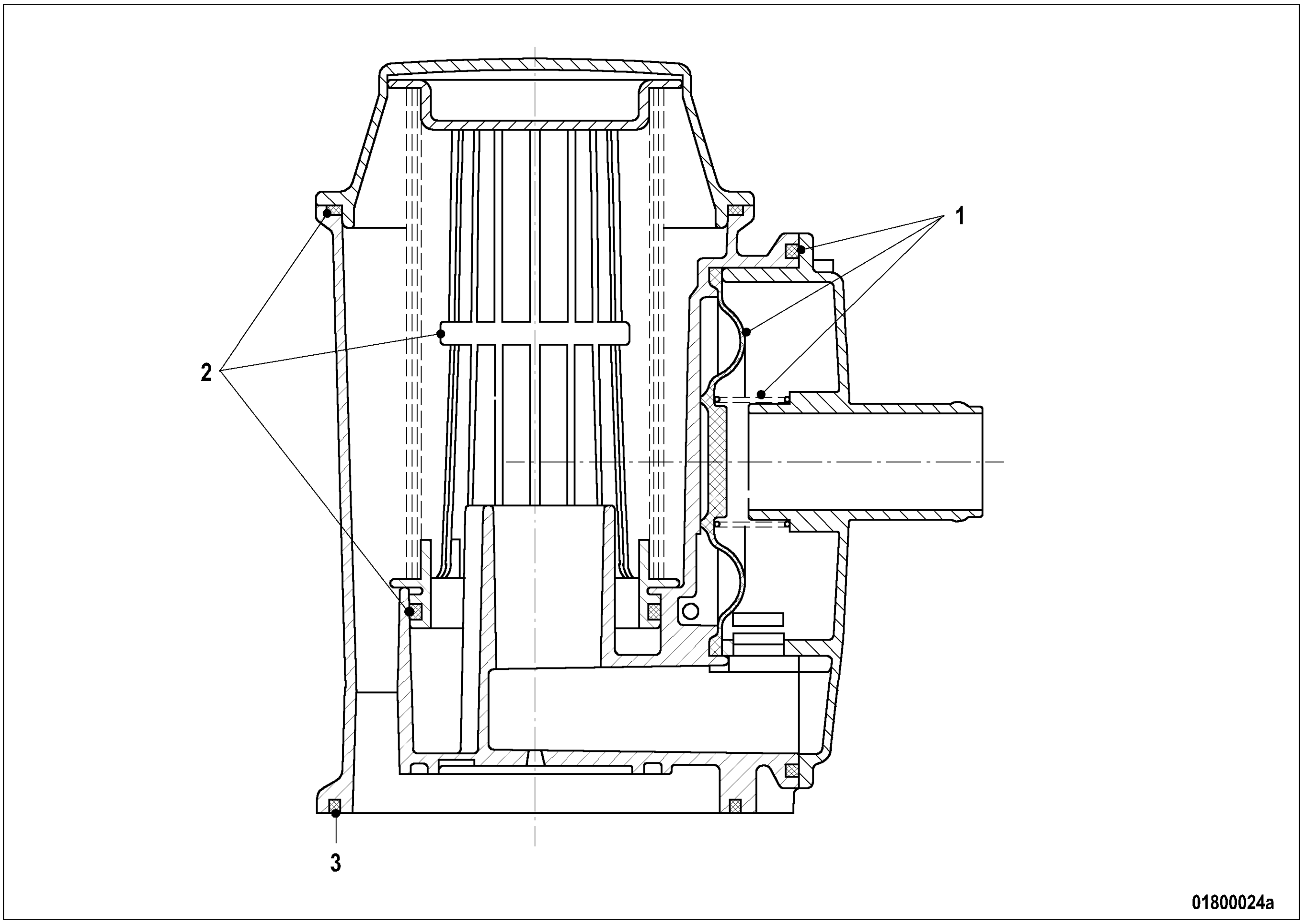
TIM ID: 0000033879 – 001



1	Manifold	9	Pipe half-clamp	17	Pipe half-clamp
2	Clamp	10	Screw	18	Screw
3	Support	11	Rubber sleeve	19	Rubber sleeve
4	Screw	12	Rubber sleeve	20	Rubber sleeve
5	Washer	13	Clamp	21	Clamp
6	Washer	14	Clamp	22	Clamp
7	Vent line	15	Vent line		
8	Vent pipe	16	Vent pipe		

TIM ID: 0000033879 – 001

Oil separator



1 Diaphragm 2 Insert 3 Gasket

TIM ID: 0000033879 - 001

3.11 Crankcase breather – Oil separator replacement, diaphragm check and replacement

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Torque wrench 6-50 Nm	→ TC	1

Spare parts

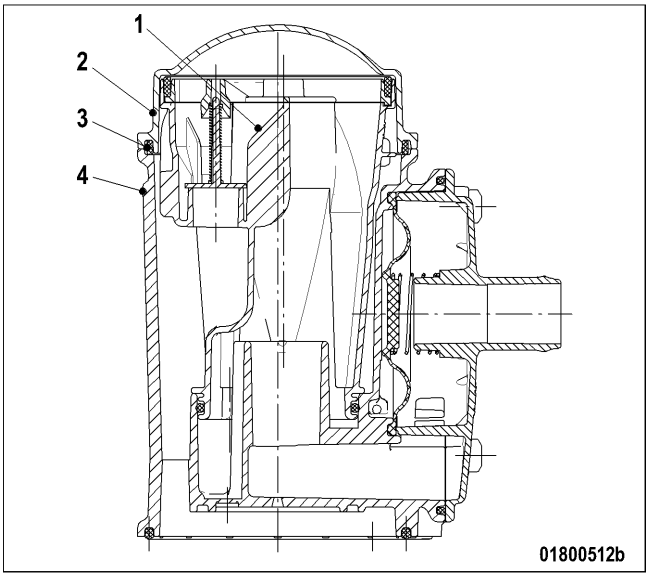
Designation / Use	Part No.	Qty.
Filter element	→ SPC	
Diaphragm	→ SPC	
Seal	→ SPC	

WARNING

Hot oil.
Oil can contain combustion residues which are harmful to health.
Risk of injury and poisoning!
- Wear protective clothing, gloves, and goggles / safety mask.
- Avoid contact with skin.
- Do not inhale oil vapor.

Replacing oil separator

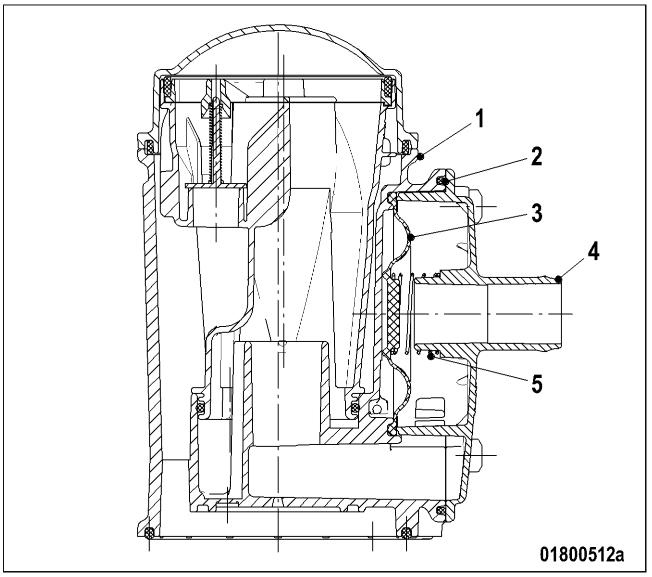
1. Remove cover (2) with O-ring (3).
2. Remove filter element (1) from housing (4).
3. Insert new filter element in housing (4).
4. Fit cover (2) with new O-ring.
5. Use torque wrench to tighten the screws of cover (2) to specified torque 10 Nm -2 Nm.
6. Replace further oil separator elements in the same way.



TIM ID: 0000033880 – 001

Checking diaphragm

1. Remove cover (4).
2. Take off spring (5), seal (2) and diaphragm (3).
3. Check diaphragm (3) for damage, fit new diaphragm if used one is damaged.
4. Mount diaphragm (3) on housing (1).
5. Install new seal (2) and spring (5) together with cover (4).
6. Use torque wrench to tighten the screws of cover (4) to specified torque 10 Nm -2 Nm.
7. Check diaphragms in further oil separators in the same way.



3.12 Piston and conrod – Removal

Preconditions

- Preparatory steps have been carried out.

Special tools

Designation / Use	Part No.	Qty.
Lifting gear with M6 thread	→ TC	1
Lifting gear with M8 thread	→ TC	1
Lifting device with 2x M6 thread	→ TC	1
Barring tool	→ TC	1
Pointer for barring tool	→ TC	1
Graduation plate, free end	→ TC	1
Socket insert, 22 A/F, conrod screws	→ TC	1
Assembly dolly	→ TC	1

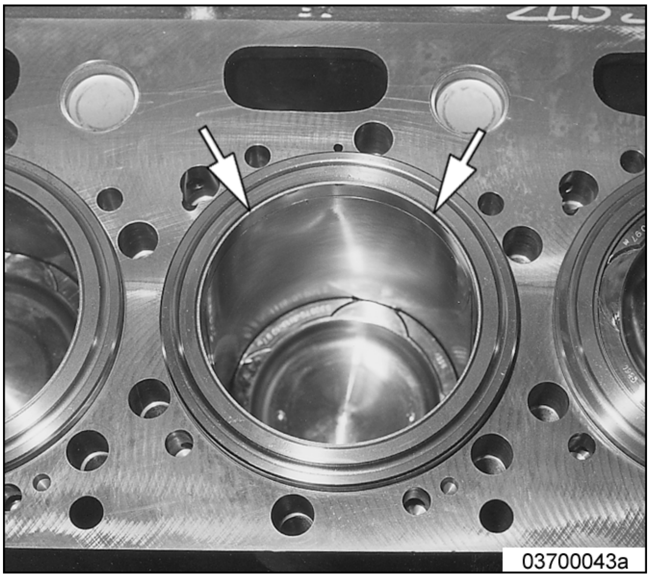
DANGER	Suspended load. **Danger to life!** • Use appropriate lifting devices and appliances. • Never stand beneath a suspended load.

DANGER	Suspended load. **Danger to life!** • Use appropriate lifting devices and appliances. • Never stand beneath a suspended load.

WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Remove piston and conrod in assembly dolly

1. Remove combustion residues from cylinder liner.
2. Remove carbon scraper ring (arrows) (→ Page 149).
3. Install barring tool.



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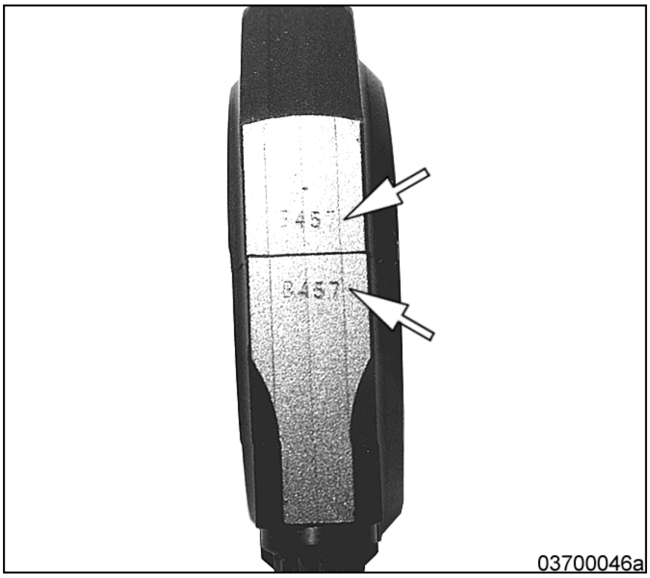
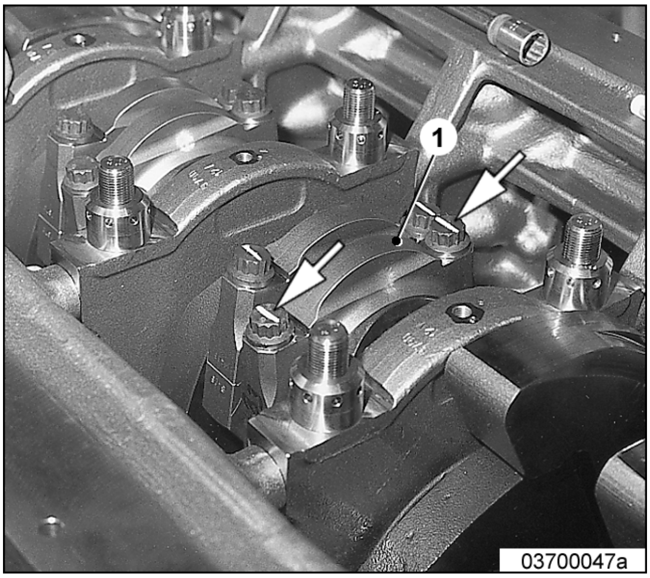
Note: Bearing cap and piston rod are a single unit and must not be interchanged.

4. Check marking (arrows) of conrod cap to piston rod. If necessary, mark components.



Note: Bar crankshaft only with flywheel or axial locating device mounted.

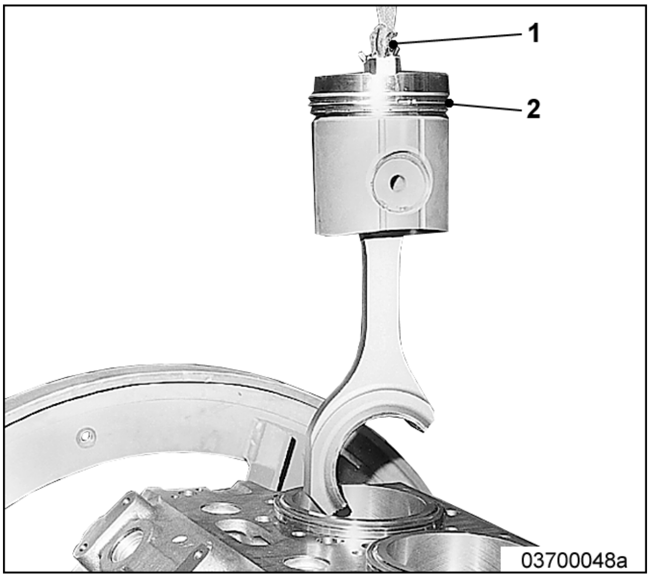
5. Pivot crankcase into assembly dolly.
6. Put conrod cap (1) on piston to be removed into horizontal position.
7. Remove conrod screws and remove conrod cap (1).
8. Remove bearing shell from conrod cap taking care not to damage the meshing on the parting surface of the conrod cap.
9. Protect conrod cap (1) against damage.



10. Turn crankcase in assembly dolly until the piston to be removed with conrod is vertical.
11. Install lifting gear (1) on piston crown.

    Note: Do not assert pressure to lifting gear.

12. Pull piston and conrod with crane from the cylinder liner fit taking care not to damage the oil spray nozzle.
13. Carefully place the piston and conrod onto a soft surface and remove from the crane.
14. Remove lifting gear (1) from piston crown.
15. Seal openings with suitable plugs.



3.13 Conrod – Check

Special tools

Designation / Use	Part No.	Qty.
Bore gauge, 18-100 mm	→ TC	1
Bore gauge, 100-160 mm	→ TC	1

Spare parts

Designation / Use	Part No.	Qty.
Conrod	→ SPC	
Conrod screw	→ SPC	
Bearing shells	→ SPC	

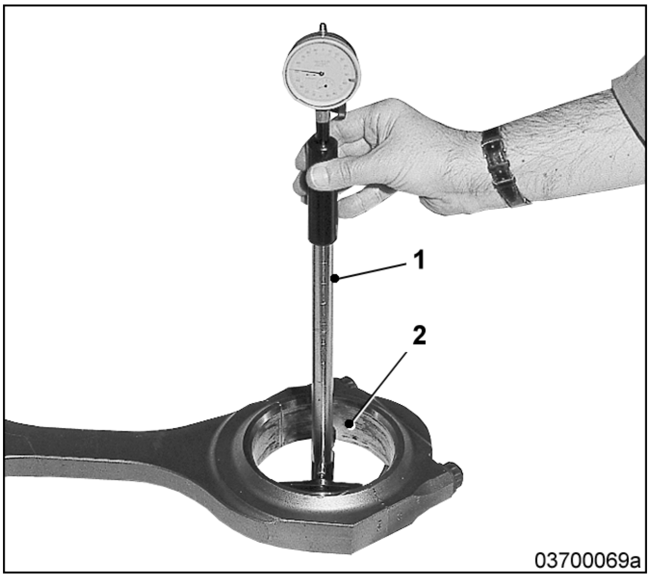
Checking conrod

Item	Findings	Task
Check conrod main bore for blue discoloration.	Blue discoloration	Replace conrod.
Check conrod bushing for scores, contamination, stress marks and heat discoloration marks.	Damaged	• Recondition • Replace conrod bushing.
Check threads of conrod and conrod screw for damage.	Damaged	• Replace conrod. • Replace conrod screw.
Check conrod screw length. Values (→ Page 300)	Value exceeded	Replace
Check conrod bearing cap mating face for conrod screws for traces of wear and scoring.	• Wear • Scores visible	Replace
Check basic bore for wear and scores.	• Wear • Scores visible	• Recondition • Replace
Inspect toothing for damage and check wear pattern with engineer's blue.	Damaged	Replace

TIM ID: 0000033882 – 001

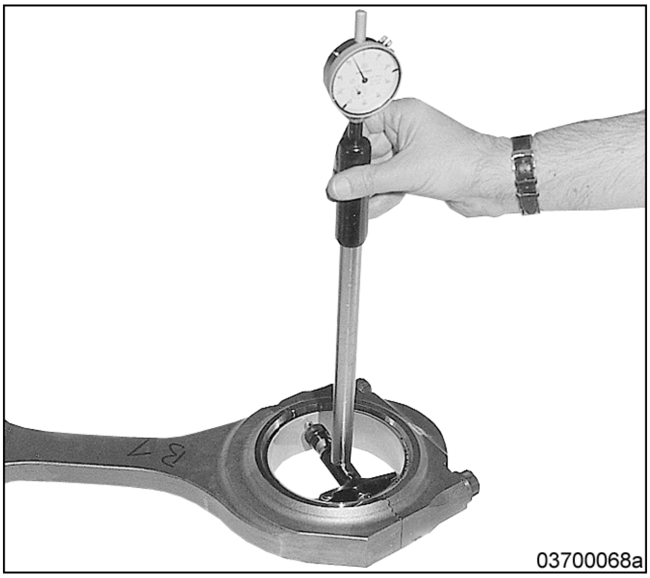
Measuring conrod main bore without bearing shells

1. Assemble conrod (→ Page 263).
2. Adjust bore gauge (1) and measure conrod main bore (→ Page 300).
3. If values are exceeded, replace conrod.



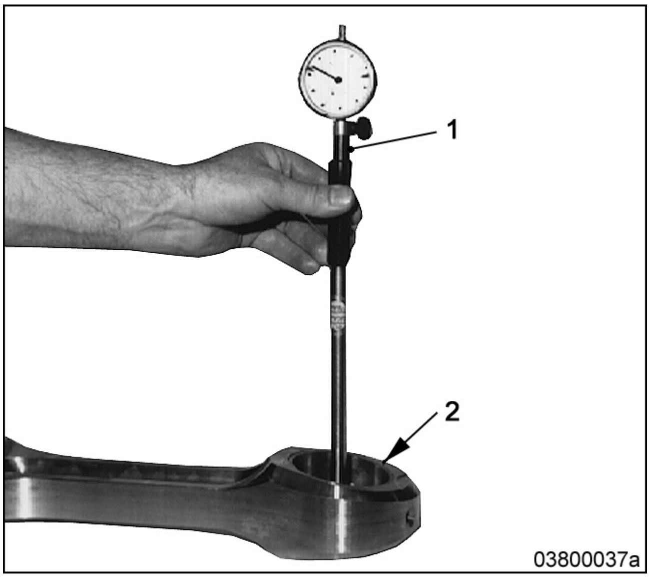
Measuring conrod main bore with bearing shells

1. Assemble conrod (→ Page 263)
2. Coat sliding surfaces of bearing shells with engine oil.
3. Measure conrod bearing bore. Values (→ Page 300).
4. Record measured values in data sheet.
5. Replace bearing shells if limit values are not attained or exceeded.
6. Remove conrod screws, conrod cap and bearing shells.
7. Protect bearing shells from damage.



Measuring conrod bushing of small conrod eye

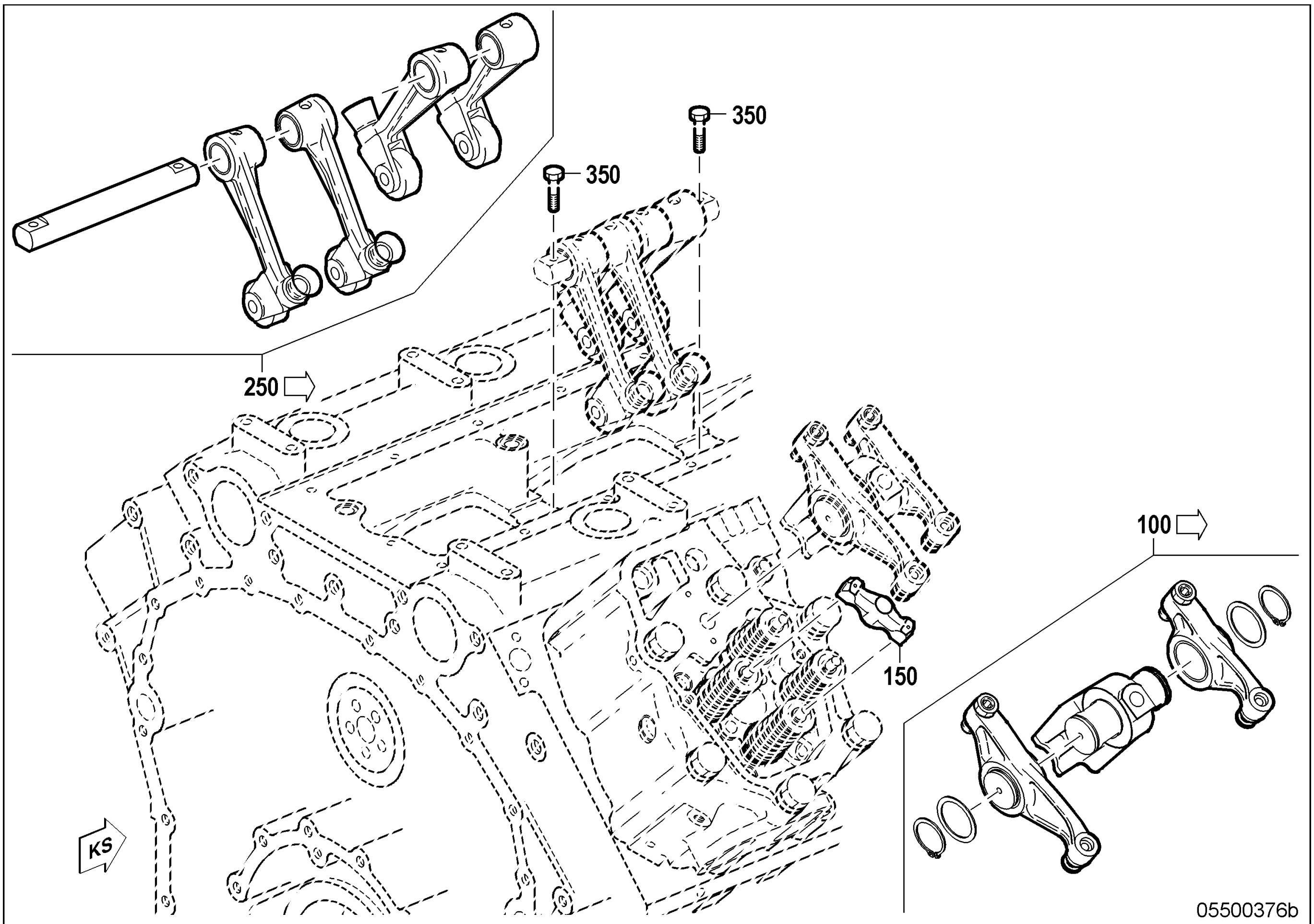
1. Adjust bore gauge (1) to zero dimension of conrod bushing bore and measure conrod bushing bore (2). Values (→ Page 300).
2. If values are exceeded: Replace conrod.



TIM ID: 0000033882 – 001

3.14 Valve drive – Overview

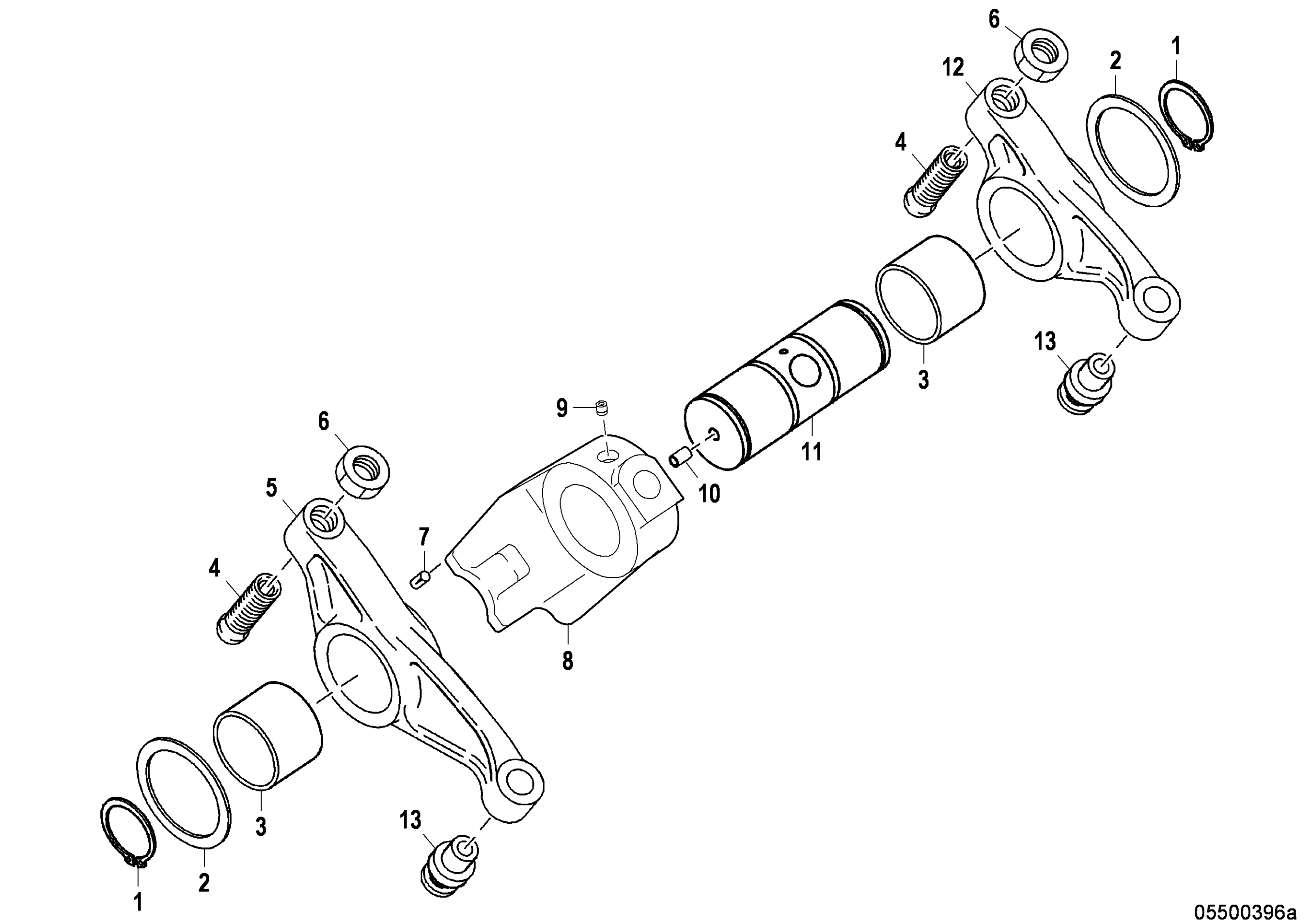
Rocker arms, swing followers



100	Rocker arm	250	Swing follower
150	Valve bridge	350	Hex screw

TIM ID: 0000033883 – 001

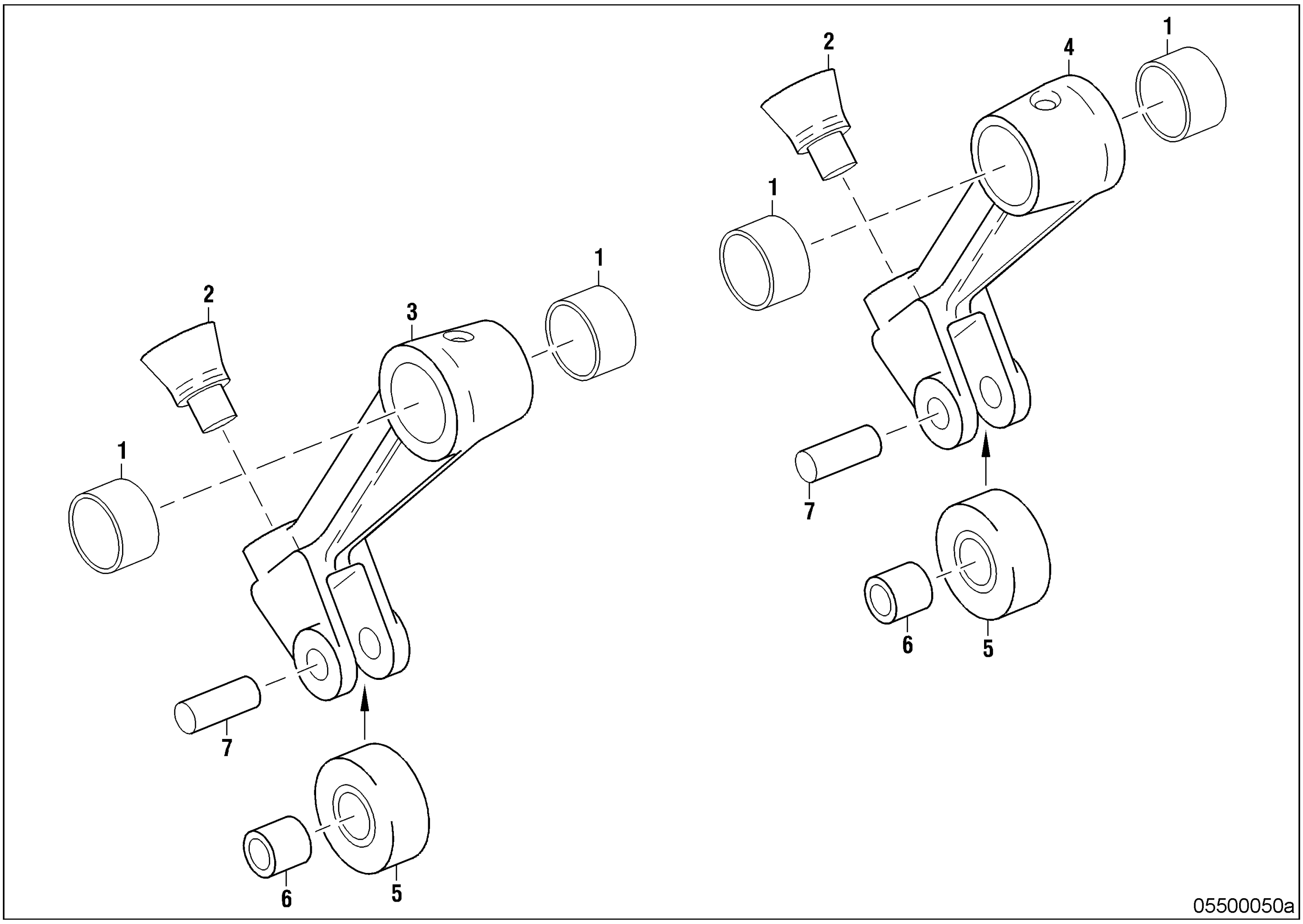
Rocker shaft support



1 Snap ring
2 Shim
3 Bushing
4 Adjusting screw
5 Rocker arm, inlet valve
6 Nut
7 Grooved pin
8 Shaft support
9 Oil spray nozzle
10 Sealing plug
11 Shaft
12 Rocker arm, exhaust valve
13 Thrust pad

TIM ID: 0000033883 – 001

Swing followers



1 Bushing
2 Ball seat
3 Swing follower, exhaust valve
4 Swing follower, inlet valve
5 Roller
6 Bushing
7 Stud

TIM ID: 0000033883 – 001

3.15 Valve drive – Check

Special tools

Designation / Use	Part No.	Qty.
Bore gauge, 18-100 mm	→ TC	1
C-frame micrometer, 25-50 mm	→ TC	1
Dial gauge	→ TC	1
Holder	→ TC	1

Material

Designation / Use	Part No.	Qty.
Crack testing oil (Nr. 63)	→ FLS	1
Crack testing paste (UV-Apelux Paste 1031)	→ FLS	1

Spare parts

Designation / Use	Part No.	Qty.
Snap ring	→ SPC	
Lockwasher	→ SPC	
Rocker shaft support	→ SPC	
Bearing bushing	→ SPC	
Swing follower	→ SPC	
Swing follower shaft	→ SPC	
Valve bridge	→ SPC	
Roller	→ SPC	
Pushrod	→ SPC	
Hex screw	→ SPC	
Adjusting screw	→ SPC	

CAUTION	Contamination of components. **Damage to component!** • Observe manufacturer's instructions. • Check components for special cleanness.

TIM ID: 0000033884 – 001

Checking valve drive

Item	Findings	Task
Using the magnetic crack-testing method, check the following components for cracks. • Rocker shaft support and axles • Rocker arms • Valve bridges • Swing followers • Roller • Pin • Swing follower shaft • Pushrods • Hex screws • Adjusting screws	Cracks visible	Replace
Check running surfaces of axles, rollers, valve bridges and rocker arms for wear, indentations and scoring.	• Wear • Indentations • Scores visible	• Recondition • Replace
Check mating faces on rocker shaft support.	Damaged	• Recondition • Replace
Check snap ring grooves of axles for condition.	Damaged	• Recondition • Replace
Check ball element. The ball element must not jam within the swivel angle, on all sides at least 10°, and must move freely.	Sluggish	Replace
Check screws, nuts and adjusting screws for damage.	Damaged	Replace
Check pushrod concentricity.	Out-of-round	Replace

Measuring diameter of bushing bore in rocker arm

1. Adjust bore gauge to basic size of bushing bore and measure diameter of bore. Values (→ Page 266).
2. If limits are exceeded, replace bearing bushing.

05500052a

Measuring diameter of rocker shaft support axles

1. Using outside micrometer, measure outside diameters of bearings. Values (→ Page 266).
2. If values are not attained, replace rocker shaft support.

Measuring swing follower bushing bore

1. Adjust bore gauge to basic size of bushing bore and measure diameter of bore.
2. If limits are exceeded, replace bearing bushing. Values (→ Page 266).
3. Replace gaskets and sealing washers.
4. Make sure that oil bores are perfectly clean and free of obstruction.

3.16 Valve drive – Removal

Preconditions

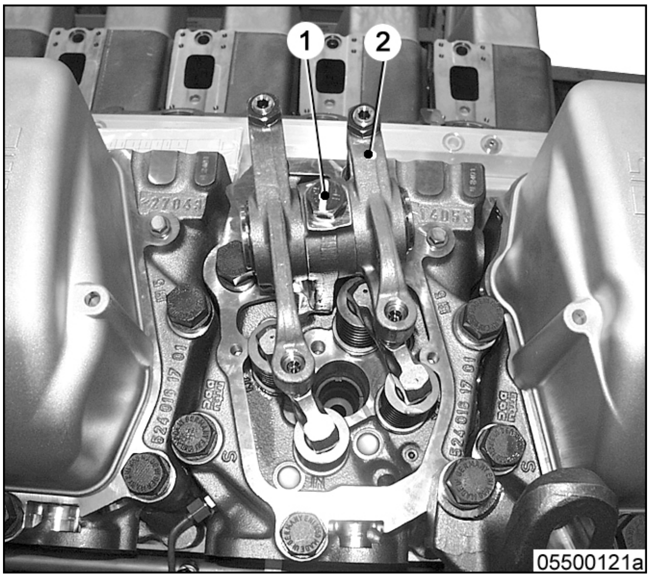
- Preparatory steps have been completed.

Rocker arm – Removal

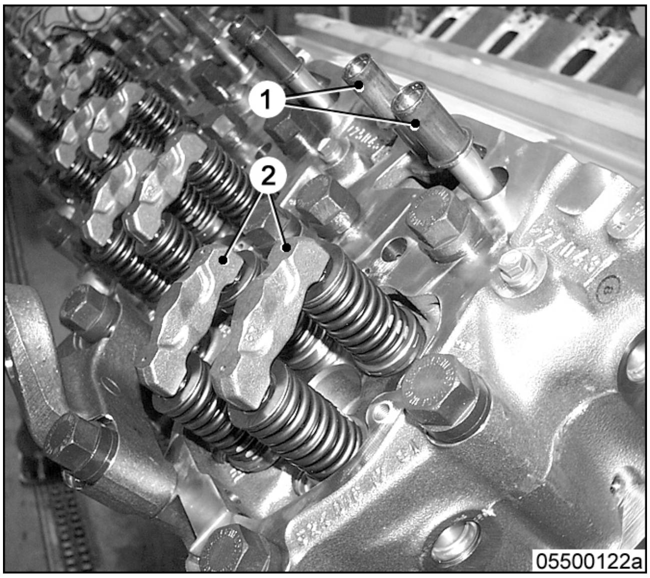
1. Set the piston of the appropriate cylinder to firing TDC. The piston is at firing TDC when both rocker arms are unloaded.

   Note: Ensure that no pushrod is removed by the suction effect at the ball socket.

2. Remove screw (1) and remove rocker shaft support (2) from cylinder head.



3. Remove valve bridges (2).
4. Remove pushrods (1).
5. Seal openings with suitable plugs.



TIM ID: 0000033885 – 001

3.17 High-pressure pump – Removal

Special tools

Designation / Use	Part No.	Qty.
Lifting device	→ TC	1

WARNING	Fuels are combustible. **Risk of fire and explosion!** • Avoid open flames, electrical sparks and ignition sources. • Do not smoke.
WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.
WARNING	Component is hot. **Risk of burning!** • Wear protective gloves.

High-pressure pump – Removal

1. Hook high-pressure pump on to lifting device.
2. Remove securing screws as shown in overview drawing (→ Page 272).
3. Remove high-pressure pump.
4. Seal openings with suitable covers.

TIM ID: 0000033888 – 001

3.18 Injection pump – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Torque wrench, 20-100 Nm	→ TC	1
Ratchet adapter	→ TC	1
Adapter	→ TC	1
Crowfoot wrench, 19 mm	→ TC	1
Crowfoot wrench, 22 mm	→ TC	1
Torque wrench, 0.5-5 Nm	→ TC	1

Material

Designation / Use	Part No.	Qty.
Grease (Kluthe Hakuform 30-10/Emulgier)	→ FLS	1
Engine oil	→ FLS	
Adhesive (Terokal 2444)	→ FLS	1

Spare parts

Designation / Use	Part No.	Qty.
Sealing ring	→ SPC	
Sealing ring	→ SPC	
Seal	→ SPC	

⚠ DANGER	Unguarded rotating and moving engine components. **Risk of serious injury — danger to life!** • Before barring the engine, ensure that nobody is in the danger zone.

⚠ WARNING	Fuels are combustible. **Risk of fire and explosion!** • Avoid open flames, electrical sparks and ignition sources. • Do not smoke.

Preparatory steps

1. Shut off fuel supply line.
2. Remove engine governor (→ Page 219).
3. Remove charge-air pipes and all seals.
4. Drain fuel (→ Page 273).

TIM ID: 0000033889 – 001

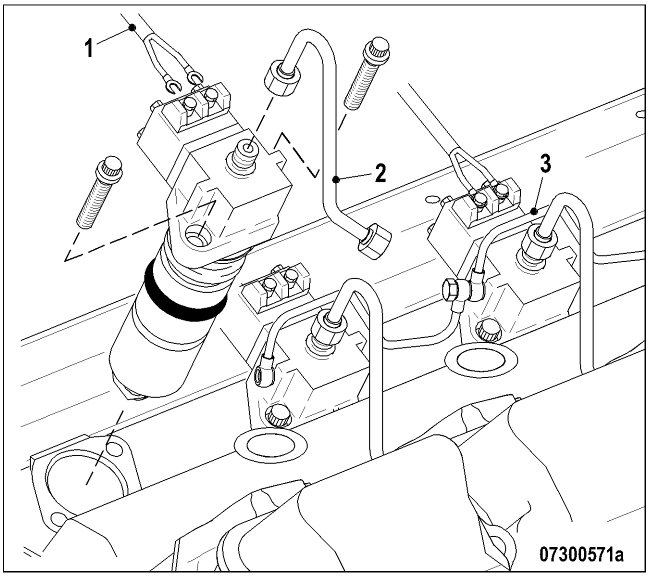
Removing injection pump

1. Mark installation position of injection pump.
2. Remove leak-off fuel line (3).
3. Disconnect wiring (1) from injection pump.
4. Remove fuel line (2).
5. Unscrew securing screws of injection pump by approx. 6 mm.
   - The pretensioned compression spring presses the injection pump out of the crankcase, if not:

   5.1. Turn crankshaft using barring device (→ Page 274)
   - The pump cam on the camshaft presses the injection pump out of the crankcase, if not:

   .

   5.2. Carefully press out injection pump at the recess in the injection pump head.
6. Remove injection pump securing screws.
7. Remove injection pump.
8. Remove sealing rigs from injection pump.
9. Seal all openings with appropriate covers after removal.



Installing injection pump

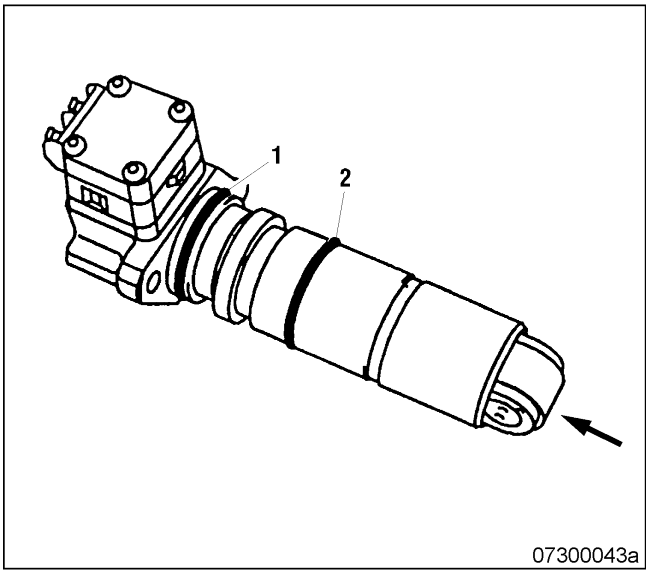
1. Remove all blanking plugs and covers.
2. Clean mating face of injection pump and roller.

Note: Sealing ring (1) Ø47 mm

3. Coat sealing ring (1) with grease and fit onto injection pump.

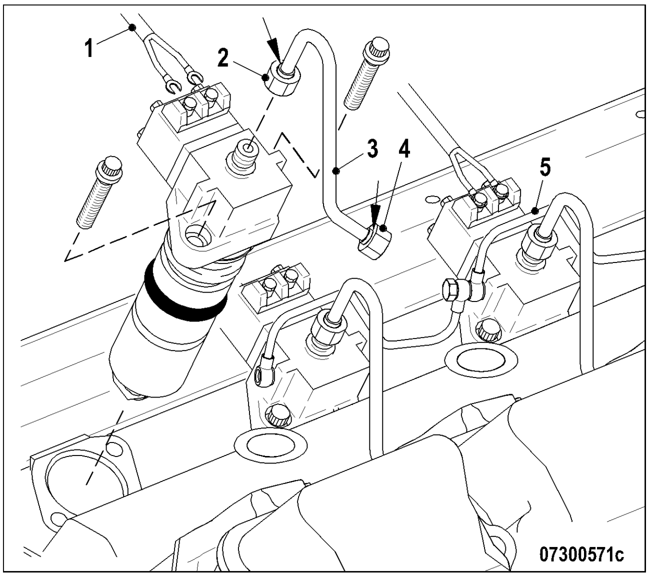
Note: Sealing ring (2) Ø45 mm

4. Coat sealing ring (2) with grease and fit onto injection pump.
5. Coat roller (arrowed) with engine oil.
6. Clean sealing face and fuel bores in crankcase.
7. Using barring device (→ Page 274) set pump cam on camshaft to base circle.



TIM ID: 0000033889 - 001

8. Install injection pump, observing marked installation position.
9. Install securing screws of injection pump and tighten with torque wrench to specified torque 60 Nm +12 Nm.
10. Coat mating face between union nut and fuel line, ball seal and thread on both ends of the fuel line (3) with engine oil.
11. Install fuel line (3).
12. Observe marking on union nut (2).
    - Use torque wrench to tighten union nut (2), with marking “35+3 Nm” to specified tightening torque 35 Nm +3 Nm.
    - Tighten union nut (2) without marking to specified torque 30 Nm +5 Nm.
13. Observe marking on union nut (4).
    - Use torque wrench to tighten union nut (4) with marking “35+3 Nm” to specified tightening torque 35 Nm +3 Nm.
    - Tighten union nut (4) without marking to specified torque 25 Nm +3 Nm.
14. Install injection pump wiring (1).
15. Tighten screws to specified torque 1.5 Nm ±0.2 Nm using torque wrench.
16. Install leak-off fuel line (5).



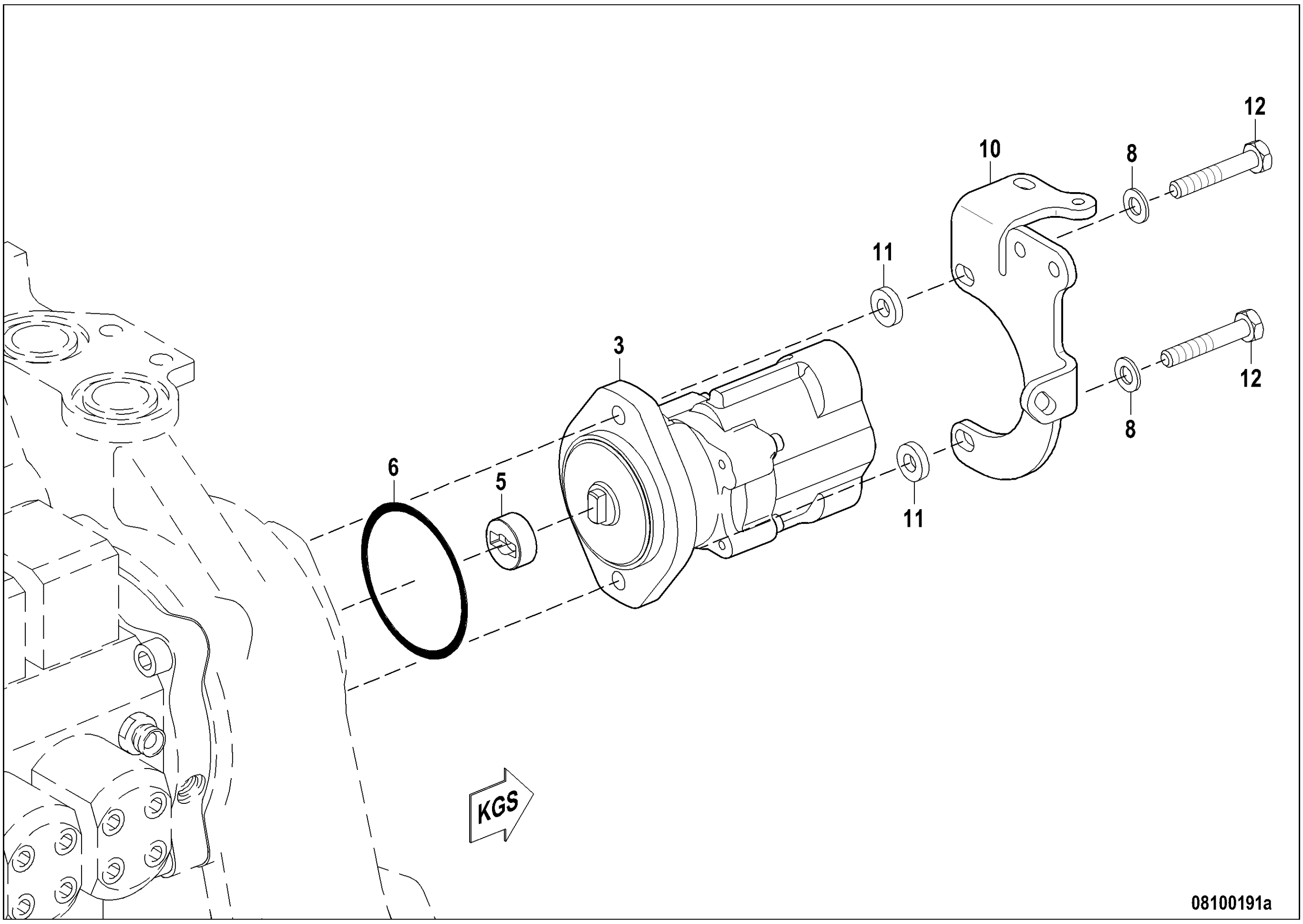
Final steps

1. Remove barring device (→ Page 274).
2. Clean mating faces on cylinder head and charge-air pipe.
3. Coat new gaskets with adhesive and fit onto cylinder head.
4. Install charge-air pipes.
5. Install engine governor (→ Page 219).
6. Open fuel supply.
7. Vent fuel system (→ Page 178).

TIM ID: 0000033889 – 001

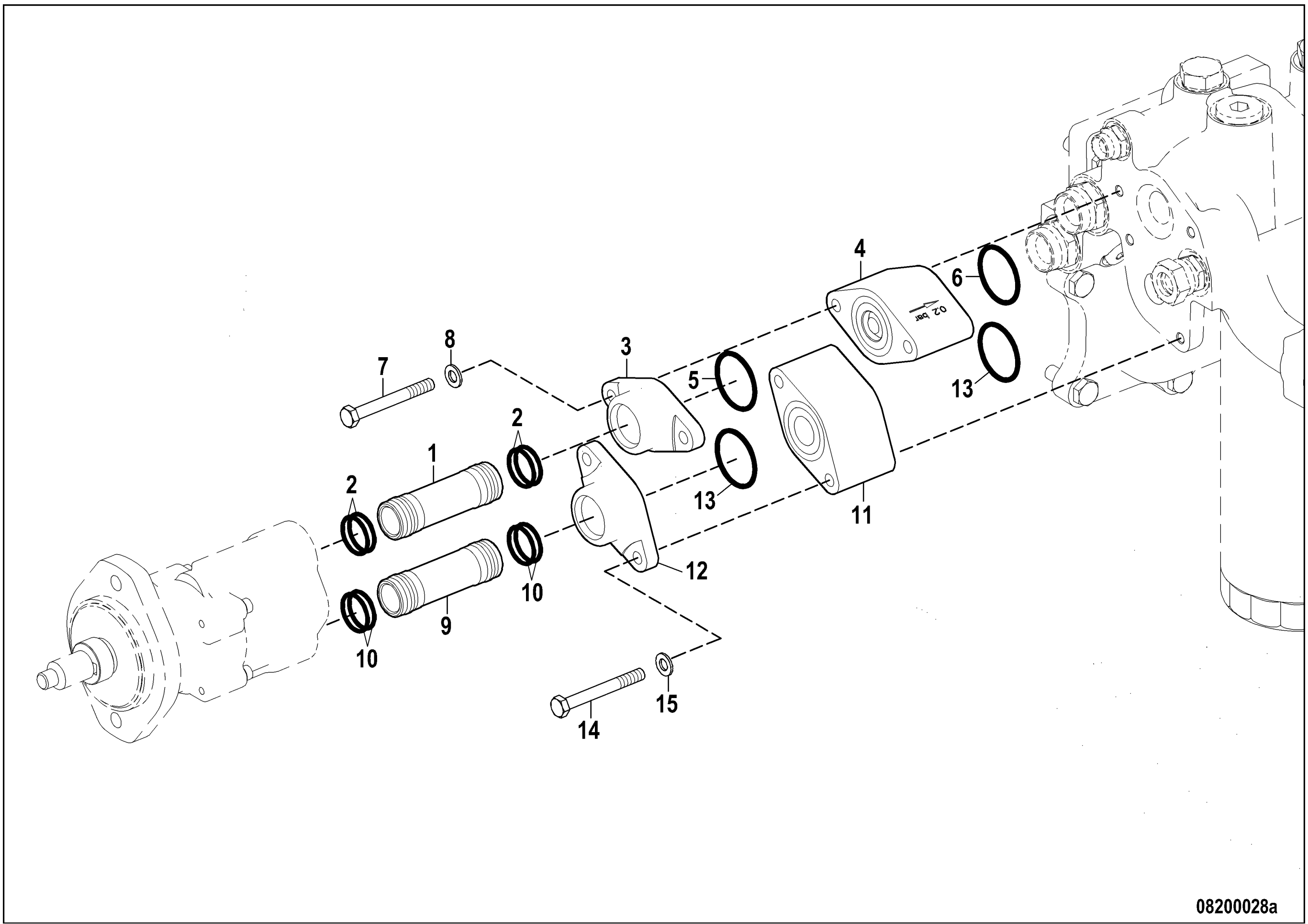
3.19 Low-pressure fuel system – Overview

Fuel delivery pump



3	Fuel delivery pump	8	Washer	12	Screw
5	Coupling	10	Retainer		
6	O-ring	11	Washer		

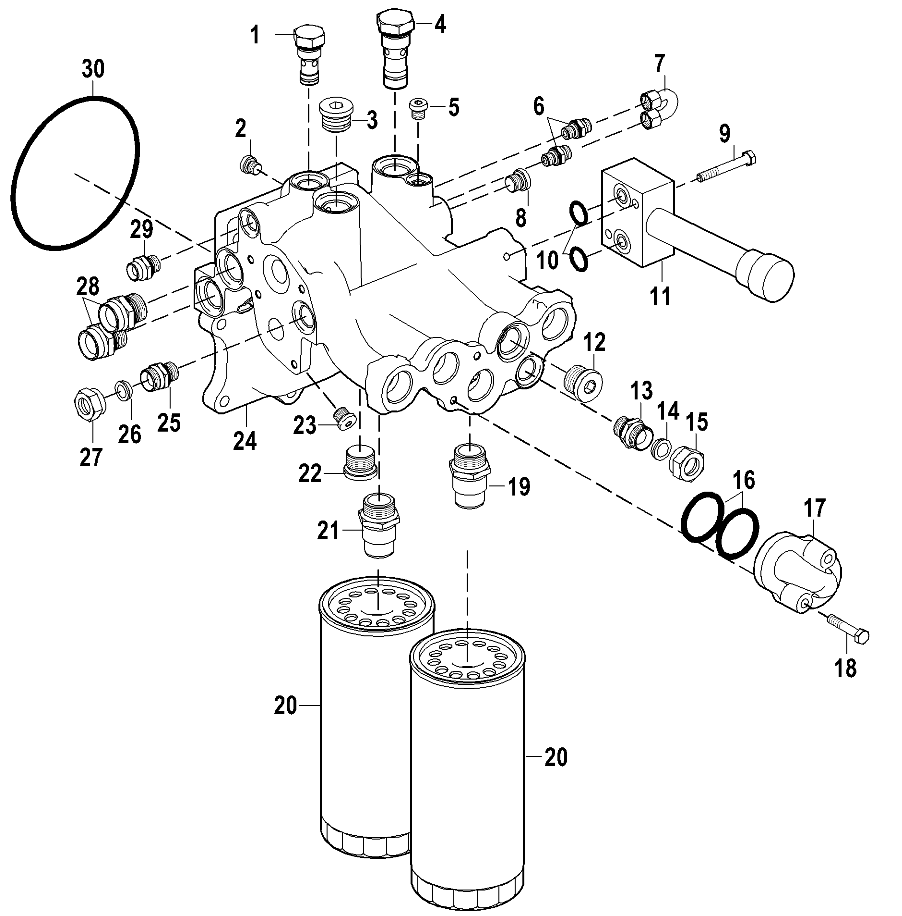
Fuel pipework between fuel delivery pump and fuel filter



1 Plug-in pipe
2 O-ring
3 Flange
4 Non-return valve
5 O-ring
6 O-ring
7 Hex bolt
8 Washer
9 Plug-in pipe
10 O-ring
11 Flange
12 Flange
13 O-ring
14 Hex bolt
15 Washer

TIM ID: 0000033890 – 001

Fuel duplex filter



1 Valve (0.5 bar)
2 Plug screw
3 Plug screw
4 Valve (2 bar)
5 Plug screw
6 Threaded union
7 Fuel line
8 Plug screw
9 Screw
10 O-ring
11 Fuel priming pump
12 Plug screw
13 Threaded union
14 Blanking cone
15 Nut
16 O-ring
17 Elbow
18 Screw
19 Threaded nipple
20 Easy-change fuel filter
21 Threaded nipple
22 Plug screw
23 Plug screw
24 Filter head
25 Threaded union
26 Blanking cone
27 Nut
28 Threaded union
29 Threaded union
30 O-ring

3.20 Fuel system – Venting

Preconditions

- Engine is stopped and starting disabled.

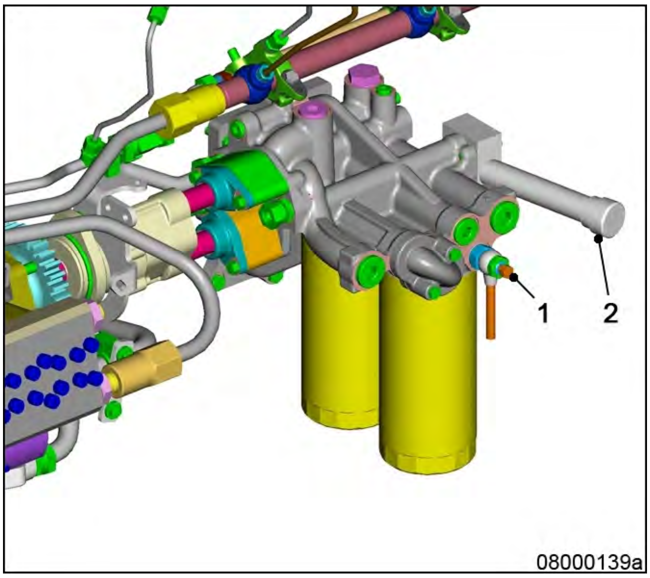
Material

Designation / Use	Part No.	Qty.
Diesel fuel	→ FLS	

WARNING	Fuels are combustible. **Risk of fire and explosion!** • Avoid open flames, electrical sparks and ignition sources. • Do not smoke.

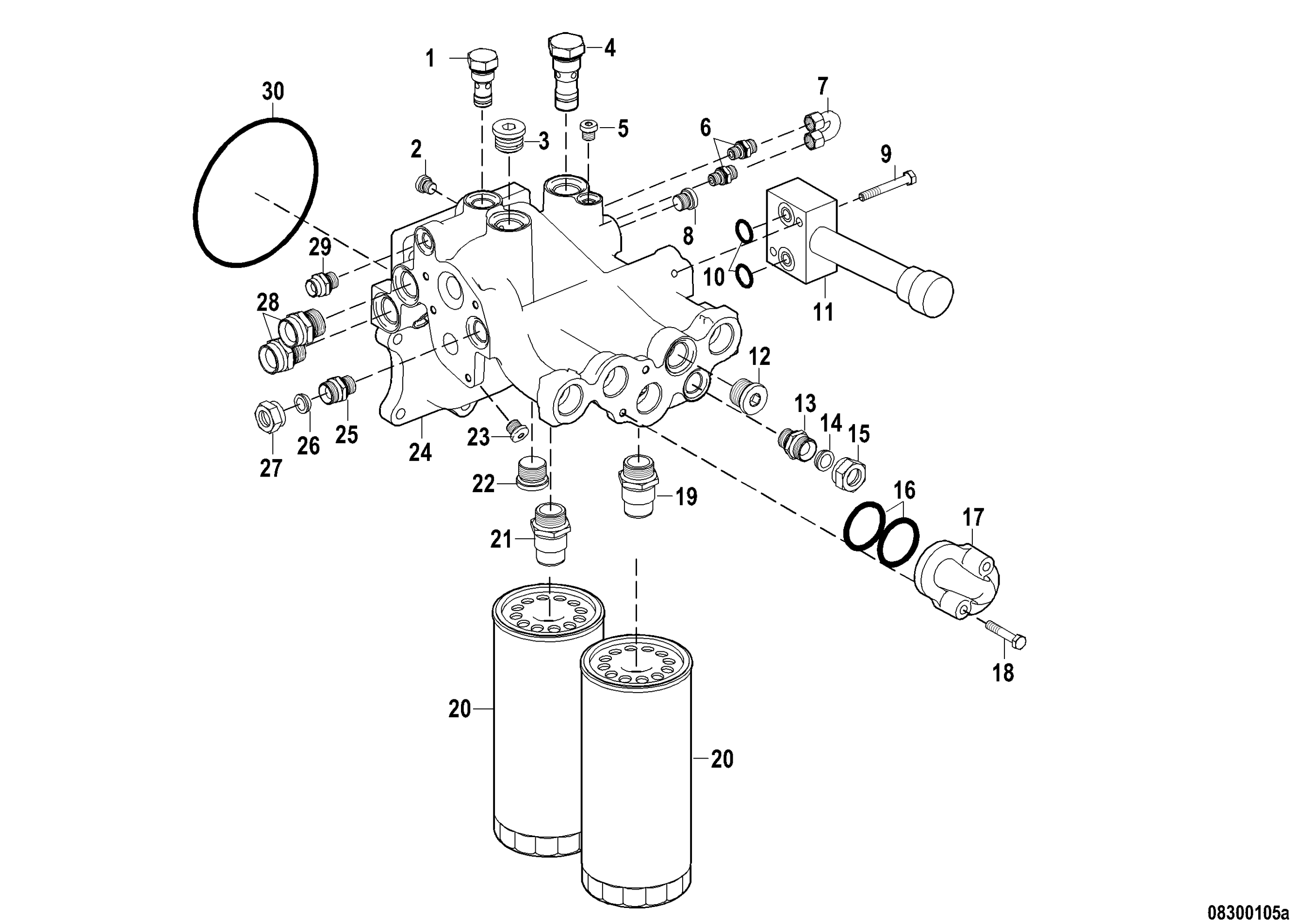
Venting LP fuel system

1. Open vent plug (1).
2. Unlock fuel priming pump (2), screw out handle by turning it counterclockwise.
3. Operate the pump with the handle (2) until bubble-free fuel emerges from the vent plug (1).
4. Close vent plug (1).
5. Screw in handle, turning it clockwise.
6. Verify that fuel priming pump (2) is locked: Handle must be tightened.



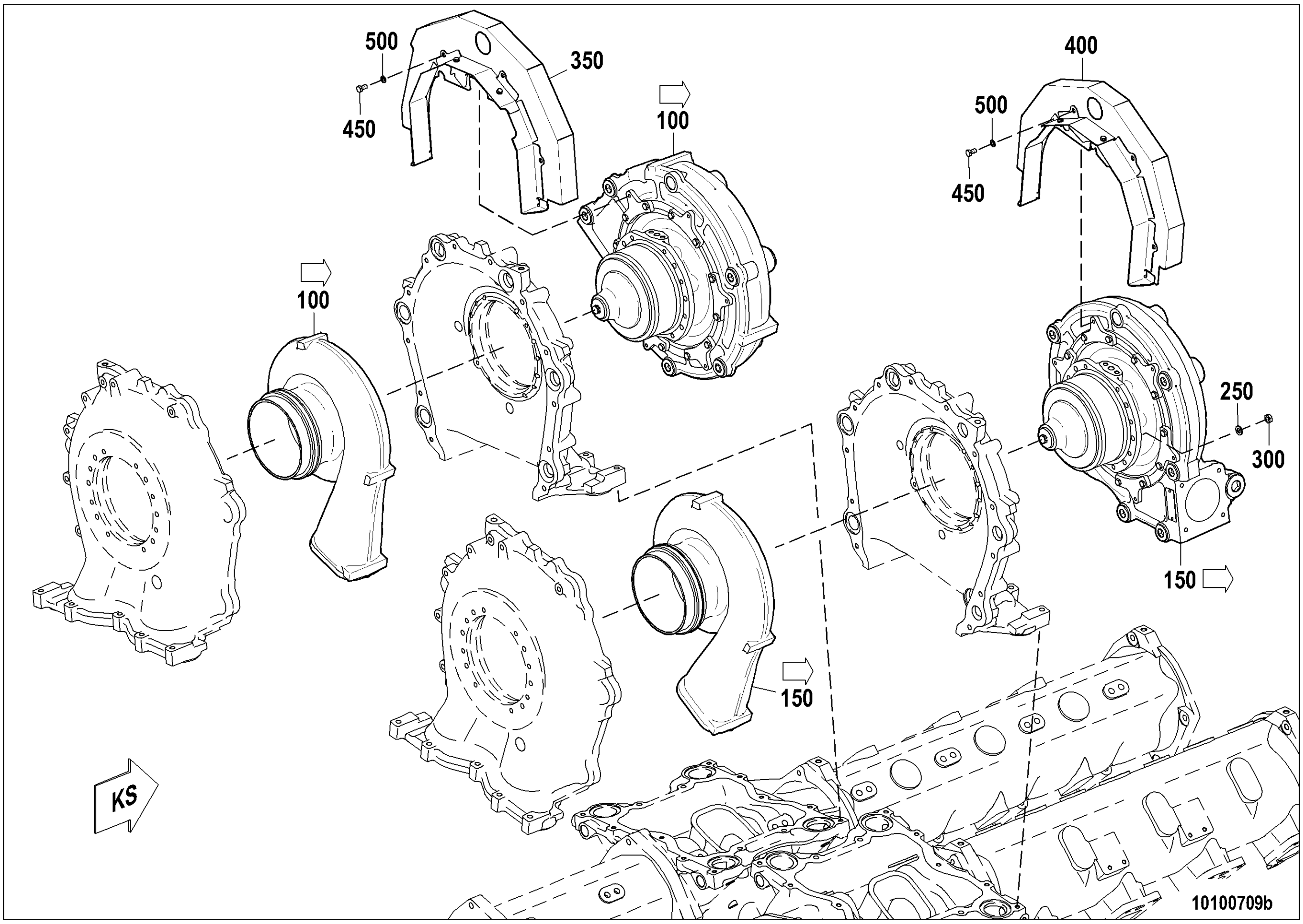
TIM ID: 0000033891 – 001

3.21 Fuel duplex filter – Overview



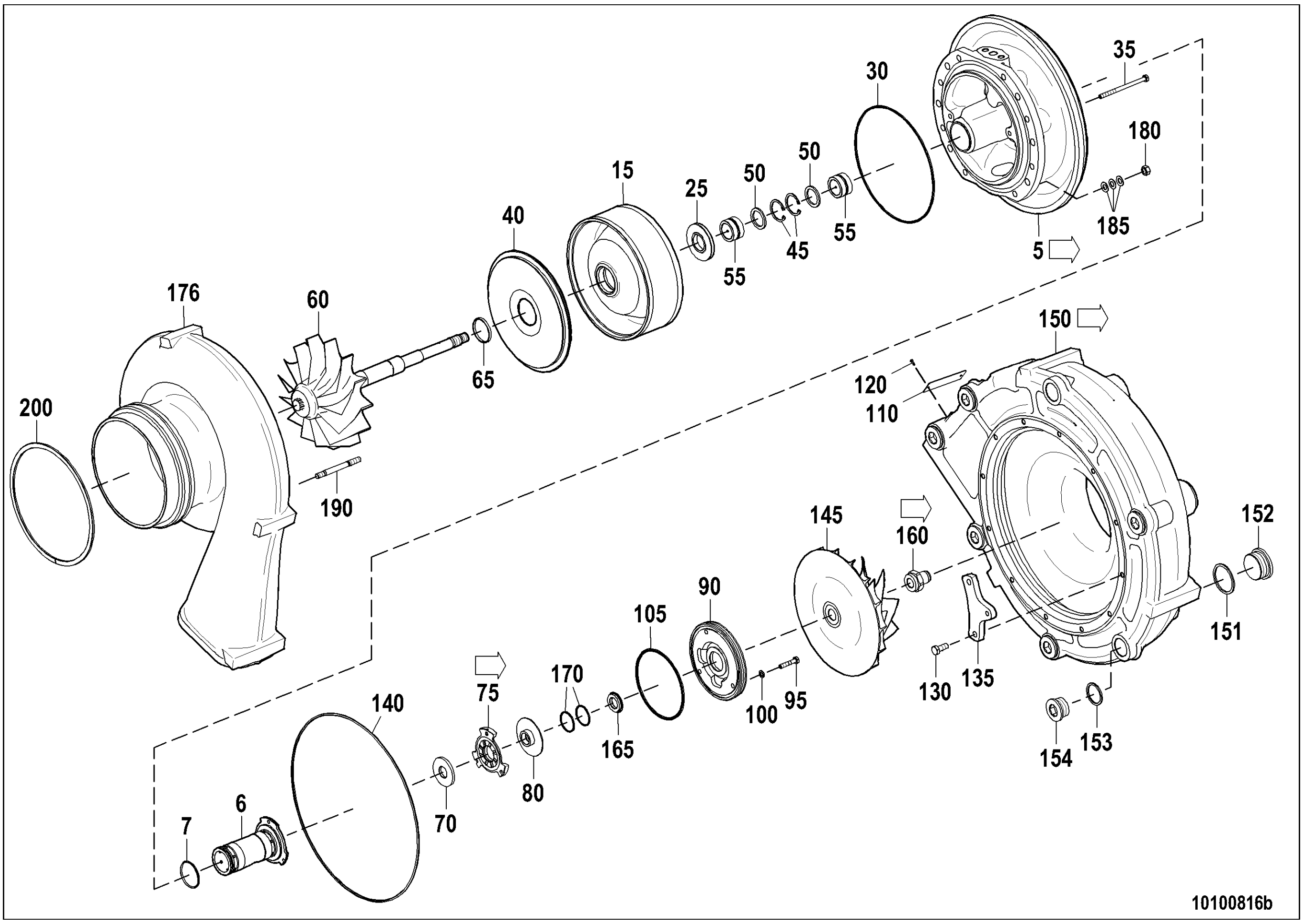
1	Valve (0.5 bar)	11	Fuel hand pump	21	Threaded nipple
2	Plug screw	12	Plug screw	22	Plug screw
3	Plug screw	13	Threaded union	23	Plug screw
4	Valve (1 bar)	14	Blanking cone	24	Filter head
5	Plug screw	15	Nut	25	Threaded union
6	Threaded union	16	O-ring	26	Blanking cone
7	Fuel line	17	Elbow	27	Nut
8	Plug screw	18	Screw	28	Threaded union
9	Screw	19	Threaded nipple	29	Threaded union
10	O-ring	20	Easy-change fuel filter	30	O-ring

3.22 Exhaust turbocharger – Overview



100 Exhaust turbocharger, left-hand side	250 Washer	500 Washer
150 Exhaust turbocharger, right-hand side	350 Heat shield	
	400 Heat shield	
	450 Screw	

TIM-ID: 0000033893 – 001



5	Bearing housing	70	Washer	150	Compressor housing
6	Bearing body	75	Thrust bearing	151	Sealing ring
7	O-ring	80	Washer	152	Plug screw
15	Housing cover	90	Retaining ring	153	Sealing ring
25	Washer	95	Screw	154	Plug screw
30	O-ring	100	Washer	160	Magnetic nut
35	Screw	105	O-ring	165	Ring carrier
40	Heat shield	110	Nameplate	170	Piston ring
45	Snap ring	120	Grooved pin	176	Turbine housing
50	Washer	130	Screw	180	Nut
55	Bearing bushing	135	Clamping element	185	Dish washer
60	Turbine wheel	140	O-ring	190	Stud
65	Piston ring	145	Compressor wheel	200	R-ring

TIM ID: 0000033893 – 001

3.23 Intercooler – Cleaning

Material

Designation / Use	Part No.	Qty.
Cleaning agent (Hakupur 312)	→ FLS	1

⚠ WARNING	Chemical substances in cleaners. **Risk of irritation and chemical burns!** • Always obey manufacturer's instructions for use!

⚠ CAUTION	Excessive reaction time of cleaning agents on components. **Damage to component!** • Observe manufacturer's instructions. • Wear protective clothing, gloves, and goggles / safety mask.

⚠ CAUTION	Contamination of components. **Damage to component!** • Observe manufacturer's instructions. • Check components for special cleanness.

Cleaning the intercooler

1. Remove all deposits on function and sealing surfaces.
2. Clean all function and sealing surfaces using cleaning agent.
3. Dry all function and sealing surfaces using a clean, lint-free cloth.
4. Remove anticorrosive from new component using cleaning agent.

TIM ID: 0000033894 – 001

3.24 Intercooler – Check

Spare parts

Designation / Use	Part No.	Qty.
Intercooler	→ SPC	

⚠ WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.
⚠ WARNING	Component is hot. **Risk of burning!** • Wear protective gloves.
⚠ WARNING	Compressed air is pressurized. Hot testing liquid. **Risk of injury and scalding!** • Pressure must not exceed 0.5 bar. • Wear protective clothing, gloves, and goggles / safety mask.

Intercooler – Check

Item	Findings	Task
Check all components for damage (visual inspection).	Damaged	• Recondition • Replace
Check all sealing, mating and support surfaces for damage and unevenness.	• Damaged • Uneven	• Recondition: Smooth with oilstone or crocus cloth. • Replace

TIM ID: 0000033895 – 001

3.25 Intercooler – Removal

Preconditions

- Preparatory steps have been completed.

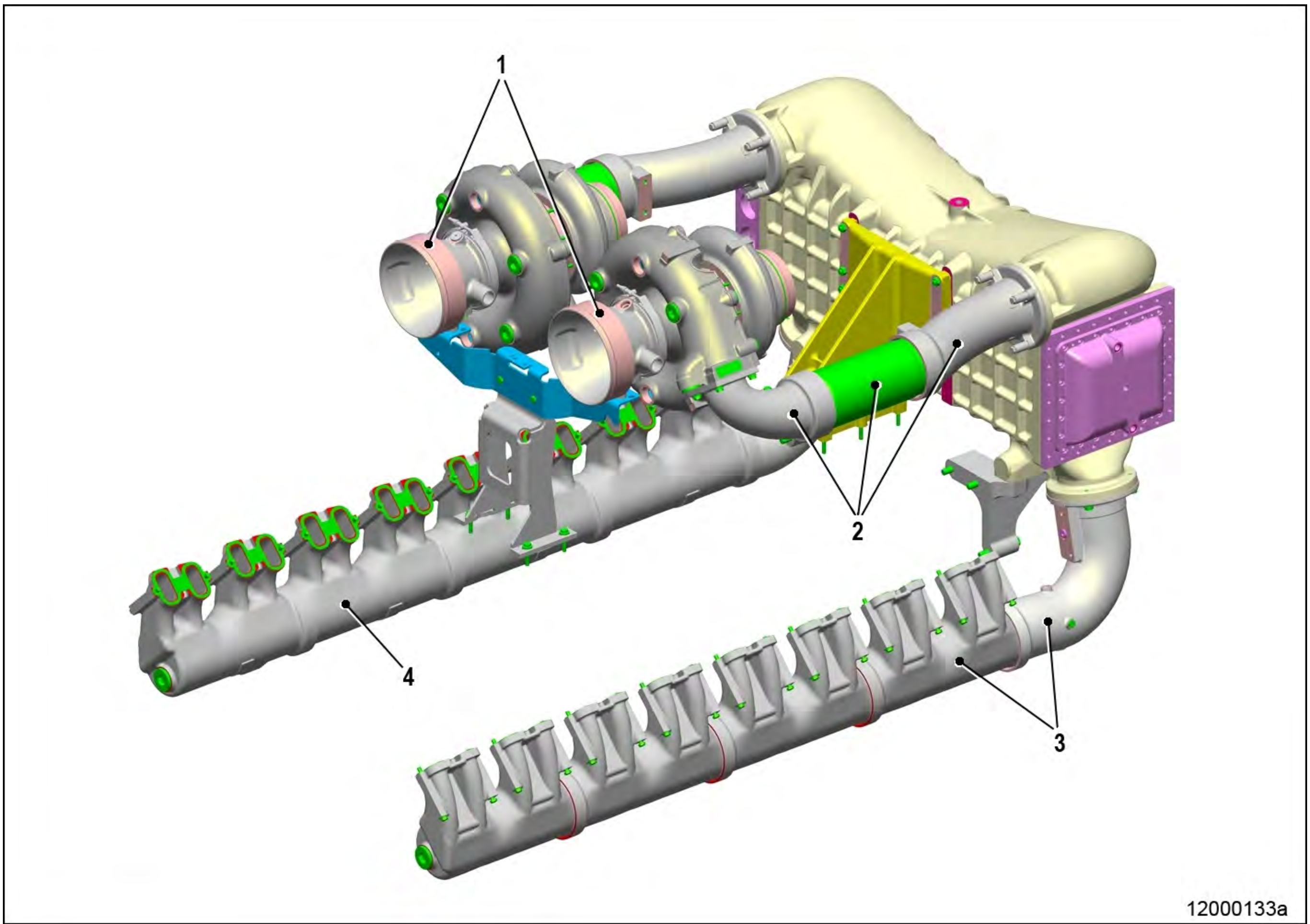
⚠ WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Intercooler – Removal

1. Remove intercooler and elbow as per overview drawing (→ Page 281).
2. Attach intercooler to crane with rope and carefully raise from engine.
3. After removing the intercooler, seal all openings with suitable covers.
4. Protect intercooler from damage.

TIM ID: 0000033896 – 001

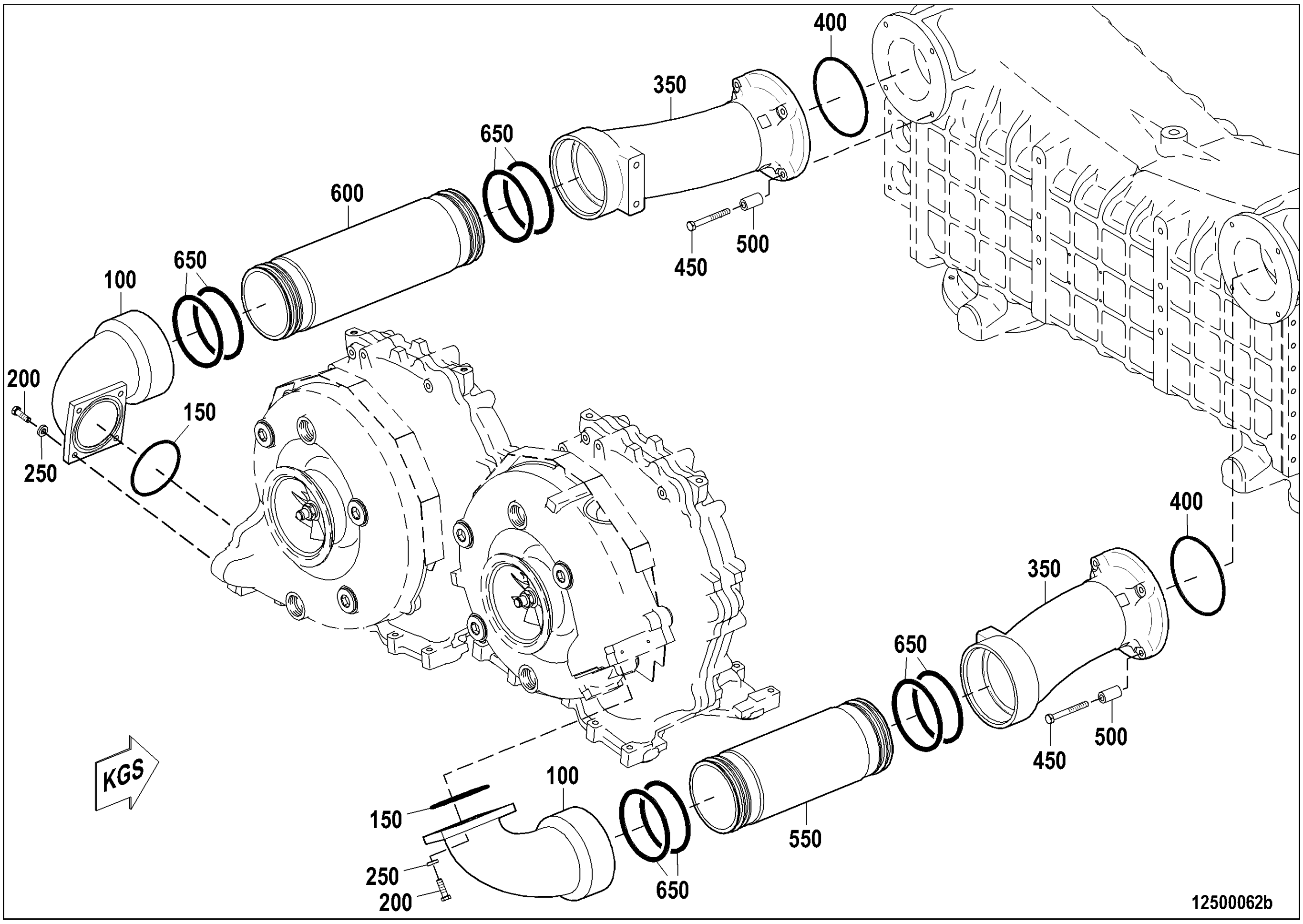
3.26 Air intake / air supply – Overview



1 Air intake housing
2 Air supply from ETC to intercooler
3 Air supply to left-hand side cylinders
4 Air supply to right-hand side cylinders

TIM ID: 0000033897 – 001

3.27 Air pipework from ETC to intercooler – Overview



100 Elbow	350 Elbow	550 Connecting pipe
150 O-ring	400 O-ring	600 Connecting pipe
200 Screw	450 Screw	650 O-ring
250 Washer	500 Spacer tube	

TIM ID: 0000033888 – 001

3.28 Air supply from turbocharger to intercooler – Removal

Preconditions

- Preparatory steps have been completed.

Air supply from turbocharger to intercooler – Removal

1. Before removing the air pipework, take photos or mark pipework accordingly.
2. Remove air supply pipework as per overview drawing (→ Page 186).
3. Seal openings with suitable covers.

TIM ID: 0000033899 – 001

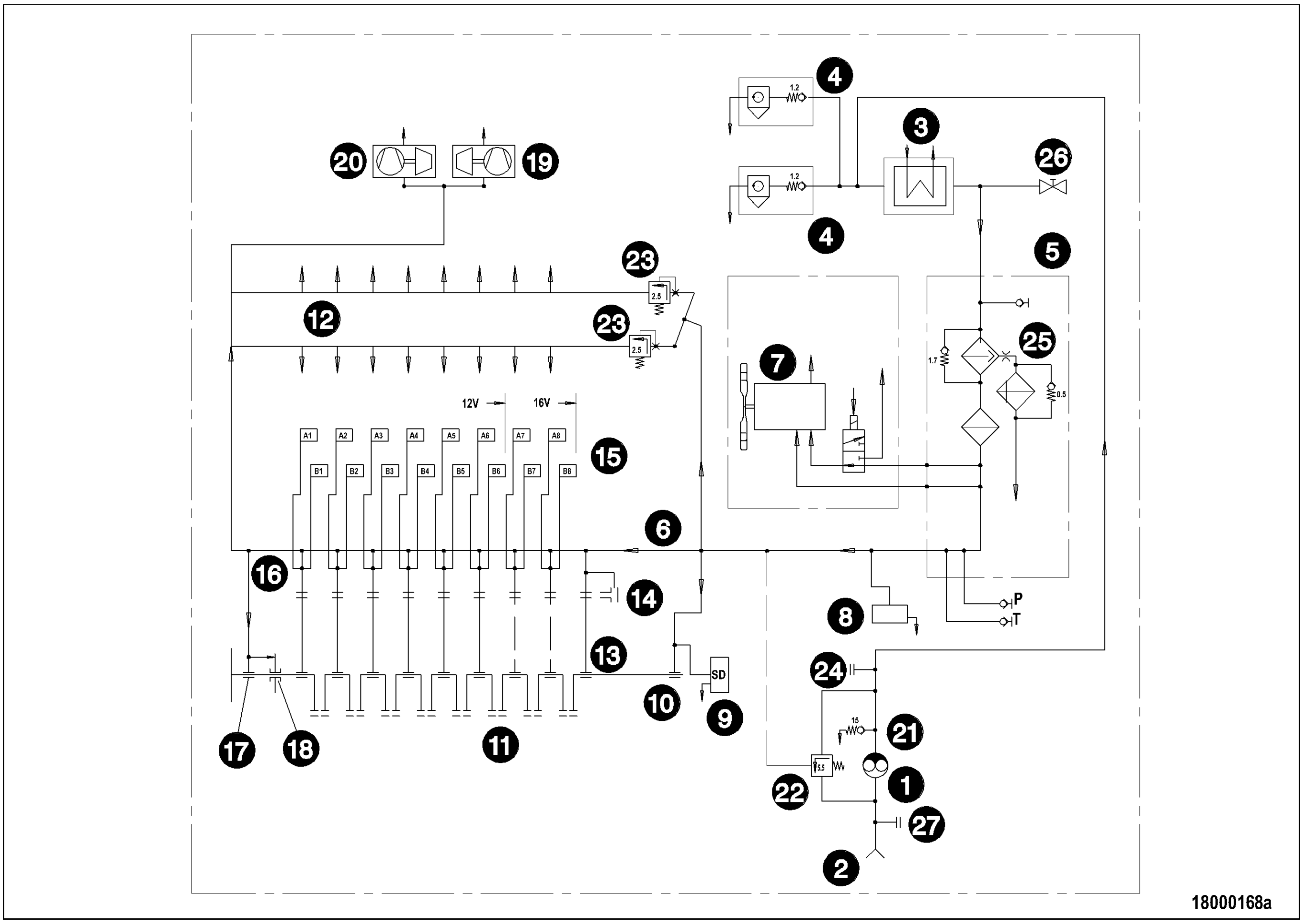
3.29 Exhaust pipework after turbocharger – Removal

Exhaust pipework after turbocharger – Removal

1. Remove exhaust elbow and bellows as per overview drawing (→ Page 283).
2. Loosen and remove sealing ring from exhaust pipe bellows.
3. Seal openings with suitable covers.

TIM ID: 0000033900 – 001

3.30 Lube oil system



1 Engine-oil pump
2 Suction basket
3 Engine oil heat exchanger
4 Centrifugal oil filters
5 Automatic oil filter
6 Main oil gallery
7 Fan
8 HP fuel pump
9 Vibration damper
10 Crankshaft support bearing, free end
11 Conrod bearings
12 Piston cooling nozzle
13 Crankshaft main bearing
14 Camshaft thrust bearing
15 Cylinder head
16 Camshaft bearing
17 Crankshaft support bearing, driving end
18 Crankshaft thrust bearing
19 Exhaust turbocharger bearing, left side
20 Exhaust turbocharger bearing, right side
21 Pressure relief valve
22 Pressure limiting valve before engine
23 Pressure maintaining valve
24 Lube-oil priming pump inlet connection
25 Indicator filter
26 Oil sampling connection
27 Lube-oil priming pump outlet connection

Technical data

- Wet sump forced-feed lubrication system
- High engine-oil filtering efficiency provided by centrifugal oil filters
- Automatic oil filter

Benefits

- Long oil-change intervals

Operation

The engine oil pump (1) draws oil from the oil pan through a suction basket (2) and delivers it to the engine oil heat exchanger (3) and to the centrifugal oil filters (4) via a connecting line.

These clean (centrifuge) the oil. The cleaned oil returns to the oil pan by gravity.

The oil mainly flows through the automatic oil filter (5) directly to the lubrication points in the engine and to the main oil gallery (6).

The following components / assemblies are supplied directly:

- Fan (7)
- HP fuel pump (8)
- Vibration damper (9)
- Crankshaft support bearing, free end (10)
- Conrod bearing (11)
- Piston-cooling-oil spray nozzles (12)

The following components / assemblies are supplied from the main oil gallery (6):

- Crankshaft main bearing (13)
- Camshaft thrust bearing (14)
- Cylinder head (15)
- Camshaft bearings (16)
- Crankshaft support bearing, driving end (17)
- Crankshaft thrust bearing (18)
- Exhaust turbocharger bearings (19, 20)

The engine oil pump (1) is a gear pump. It is driven by the crankshaft via an idler gear. A pressure relief valve (21) protects the pump against excessive oil pressure.

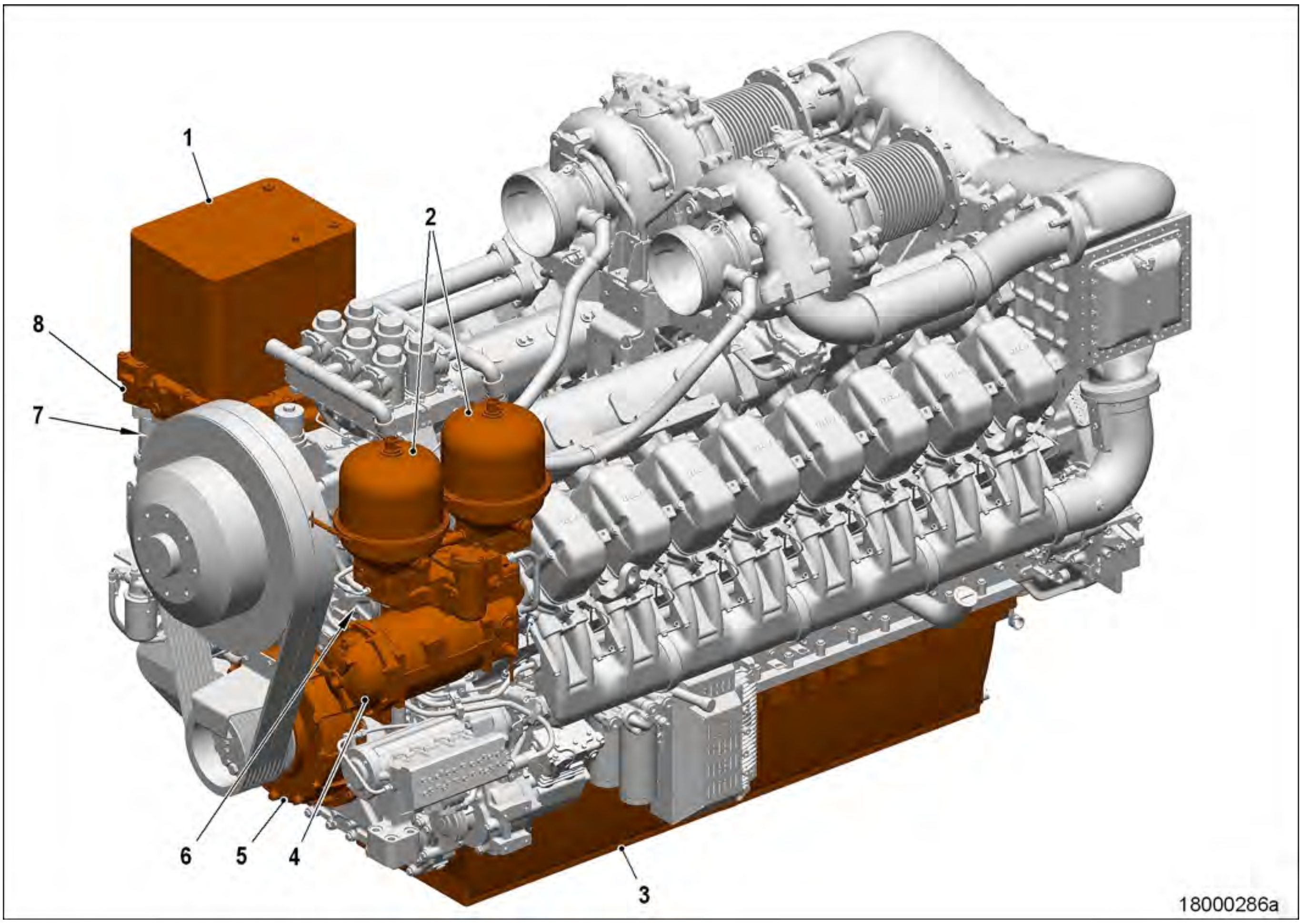
The pressure limiting valve (22) provides oil-pressure control independent of engine speed.

Pressure maintaining valves (23) supply the spray nozzles for piston cooling when a minimum oil pressure has been reached. They thus ensure lubrication of the engine at lower speeds.

TIM ID: 0000033901 – 001

3.31 Lube-oil system – Overview

Illustration applies in the same way to 12/20 V 4000 Cx3



1 Oil cooler
2 Centrifugal oil filter
3 Oil pan
4 Oil filter
5 Vibration damper
6 Equipment carrier with lube-oil pump and pressure reduction valve
7 Coolant distribution housing with oil pipework
8 Oil cooler housing

TIM ID: 0000033942 – 001

3.32 Engine oil – Change

Preconditions

- Engine is stopped and starting disabled.
- Engine is at operating temperature.
- MTU Fluids and Lubricants Specifications (A001061/..) are available.

Special tools

Designation / Use	Part No.	Qty.
Torque wrench 40-200 Nm	→ TC	1
Ratchet adapter	→ TC	1

Material

Designation / Use	Part No.	Qty.
Engine oil	→ FLS	

Spare parts

Designation / Use	Part No.	Qty.
Sealing ring	→ SPC	

WARNING

Hot oil.
Oil can contain combustion residues which are harmful to health.
Risk of injury and poisoning!
- Wear protective clothing, gloves, and goggles / safety mask.
- Avoid contact with skin.
- Do not inhale oil vapor.

Procedure without pump: Draining oil at drain plug(s) on oil pan

1. Provide a suitable container in which to collect the oil.
2. Remove drain plug(s) and drain oil.
3. Install drain plug(s) with new sealing ring.

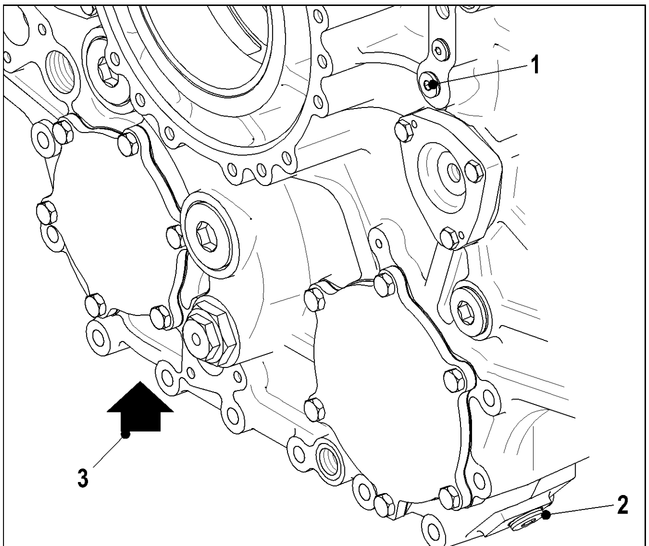
Procedure with pump: Oil extraction

1. Provide a suitable container in which to collect the oil.
2. Extract all oil from oil pan using the pump.

TIM ID: 0000033683 – 001

Draining residual oil at the equipment carrier

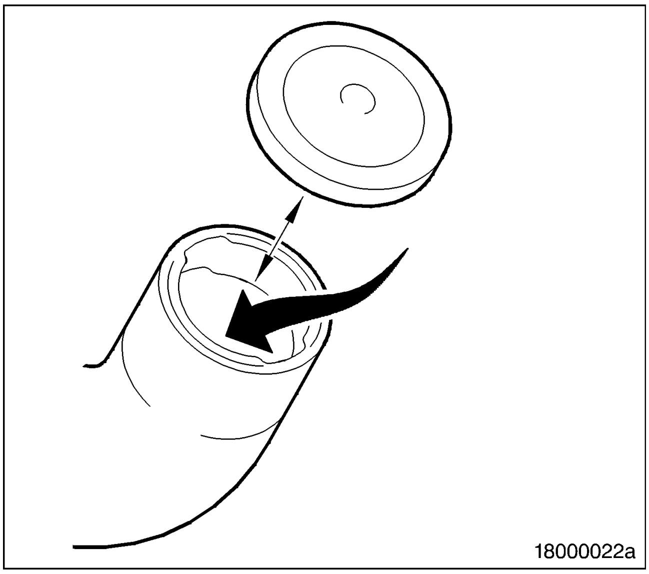
1. Provide a suitable container in which to collect the oil.
2. Remove drain plug (1) and drain oil (approx. 7 liters) from oil heat exchanger and oil filter.
3. Remove drain plug (2) and (3) and drain oil:
   - approx. 12 liters at (2)
   - approx. 5 liters at (3)
4. Install drain plug(s) with new sealing ring.
5. Tighten drain plugs (2) and (3) to specified torque 100 Nm +10 Nm using torque wrench.



18000170a

Filling with new oil

1. Open cover of filler neck.
2. Pour oil in at filler neck up to "max." mark at oil dipstick.
3. Close cover of filler neck.
4. Check engine oil level (→ Page 194).
5. After oil change, bar engine with starting system (→ Page 280).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TIM ID: 0000033683 – 001

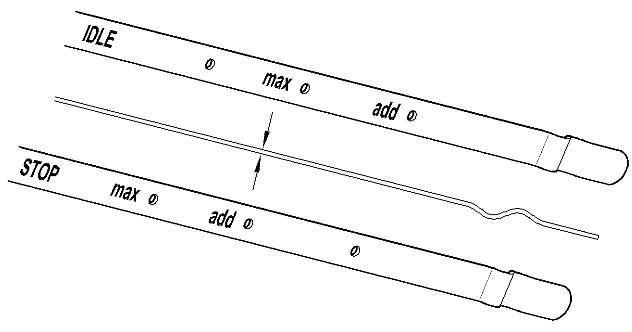
3.33 Engine oil – Level check

Oil level check prior to engine start

1. Withdraw dipstick from guide tube and wipe it.
2. Insert dipstick into guide tube up to the stop, withdraw after approx. 10 seconds. Check oil level on oil dipstick side marked "5 Min. after Stop".

   Note: After extended standstill, the oil level may exceed the "max." mark by up to 2 cm. This can be caused by oil flowing from e.g. oil filter or heat exchanger back to the oil pan.

3. The oil level must reach the "max." mark or exceed it by up to 2 cm.
4. If necessary, top up to "max." mark (→ Page 192).
5. Insert dipstick into guide tube to stop.



18000109a

Checking engine oil level with the engine running

1. After the engine has run for approx. 10 minutes at a constant speed of 900 rpm, withdraw oil dipstick from guide tube and wipe it.
2. Insert dipstick into guide tube up to the stop, withdraw after approx. 10 seconds. Check oil level on the dipstick side marked "IDLE".
3. Oil level must not be lower than the "add" mark.
4. If necessary, top up to "max." mark (→ Page 192).

Oil level check after the engine is stopped

1. 5 minutes after stopping the engine, remove oil dipstick from the guide tube and wipe it.
2. Insert dipstick into guide tube up to the stop, withdraw after approx. 10 seconds. Check oil level on oil dipstick side marked "5 Min. after Stop".
3. Oil level must be between "add." and "max." marks.
4. If necessary, top up to "max." mark (→ Page 192).
5. Insert dipstick into guide tube to stop.

TIM ID: 0000033684 – 001

3.34 Engine oil – Sample extraction and analysis

Preconditions

- MTU Fluids and Lubricants Specifications (A001061/..) are available.

Special tools

Designation / Use	Part No.	Qty.
MTU test kit	→ TC	1

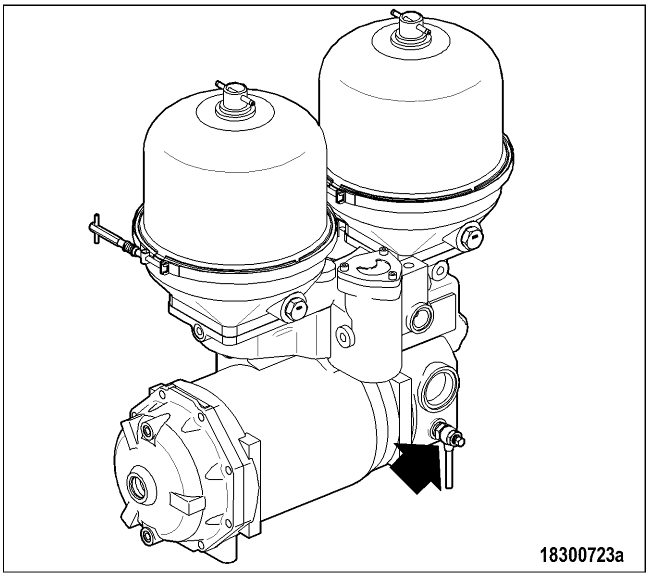
DANGER	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

WARNING	Hot oil. Oil can contain combustion residues which are harmful to health. **Risk of injury and poisoning!** • Wear protective clothing, gloves, and goggles / safety mask. • Avoid contact with skin. • Do not inhale oil vapor.

WARNING	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.

Engine oil – Sample extraction and analysis

1. With the engine running at operating temperature, open screw on oil filter by 1 to 2 turns.
2. Drain approx. 2 liters engine oil to flush out the oil sludge.
3. Drain approx. 1 liter engine oil into a clean container.
4. Close screw.
5. Using the equipment and chemicals of the MTU test kit, examine oil for:
   - Dispersion capability (spot test);
   - Water content;
   - Dilution by fuel.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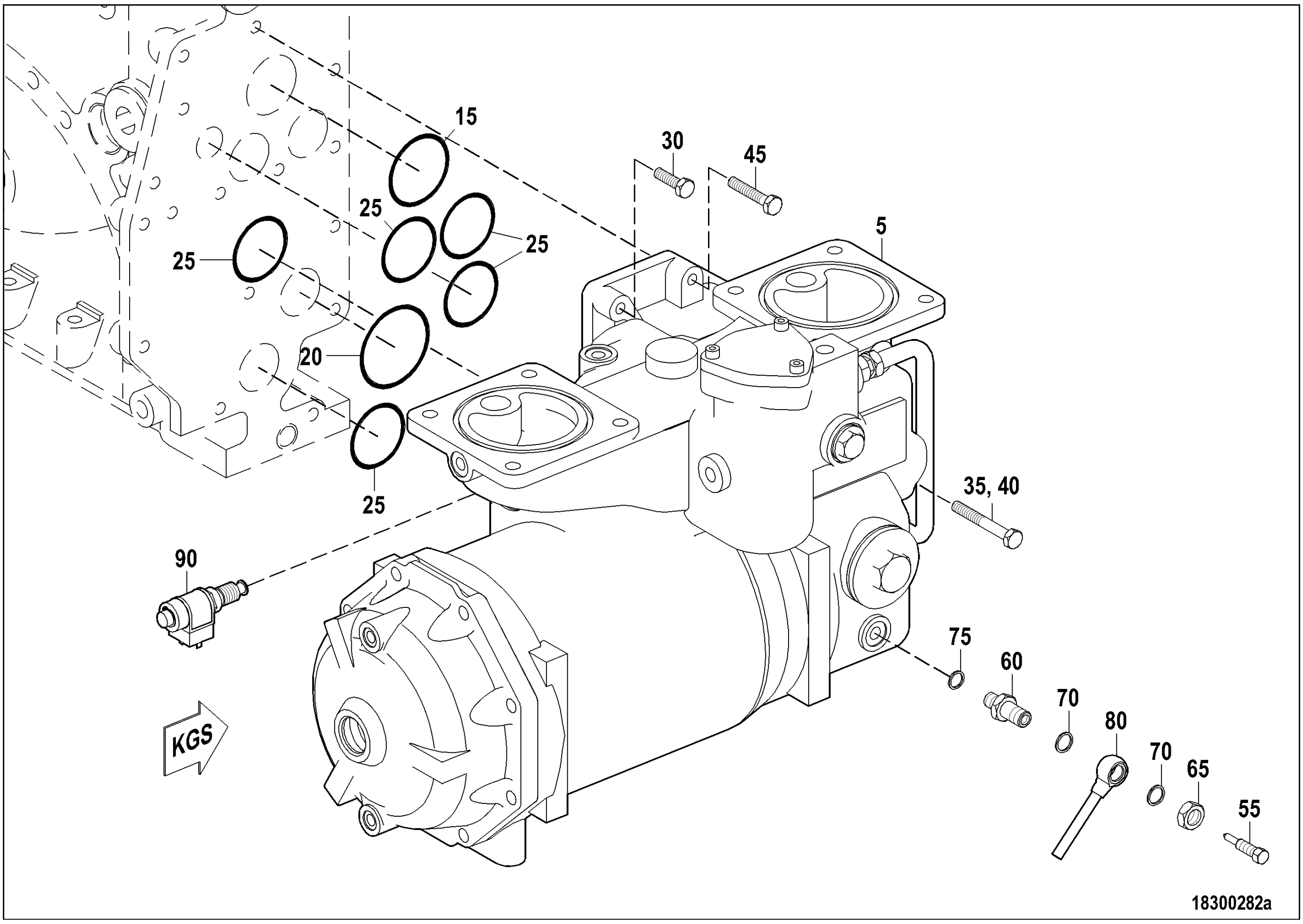
TIM ID: 0000033944 – 001

3.35 Automatic oil filter – Overview

Automatic oil filter



5	Oil filter	35	Screw	65	Nut
15	O-ring	40	Screw	70	Sealing ring
20	O-ring	45	Screw	75	Sealing ring
25	O-ring	55	Screw	80	Vent line
30	Screw	60	Unions	90	Pressure monitor

TIM ID: 0000033954 – 001

3.36 Oil filter candles – Replacement

Preconditions

- Engine is stopped and starting disabled.

Material

Designation / Use	Part No.	Qty.
Engine oil	→ FLS	
Petroleum jelly, white	→ FLS	

Spare parts

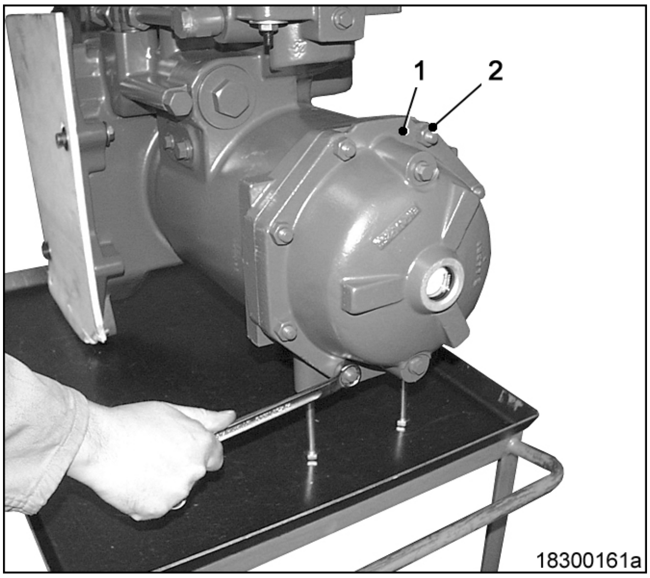
Designation / Use	Part No.	Qty.
O-ring	→ SPC	
Oil filter candles	→ SPC	

⚠ WARNING	Hot oil. Oil can contain combustion residues which are harmful to health. **Risk of injury and poisoning!** • Wear protective clothing, gloves, and goggles / safety mask. • Avoid contact with skin. • Do not inhale oil vapor.

⚠ CAUTION	Contamination of components. **Damage to component!** • Observe manufacturer's instructions. • Check components for special cleanness.

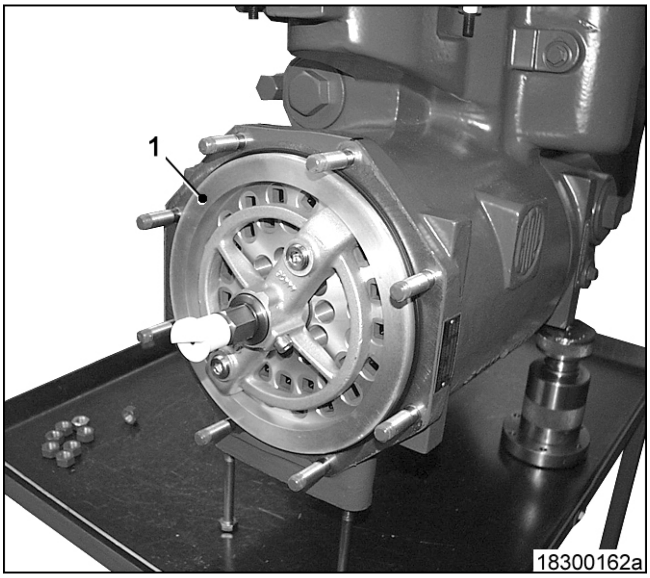
Removing oil filter candles

1. Unscrew hex nuts (2) from oil filter cover (1).
2. Remove oil filter cover.

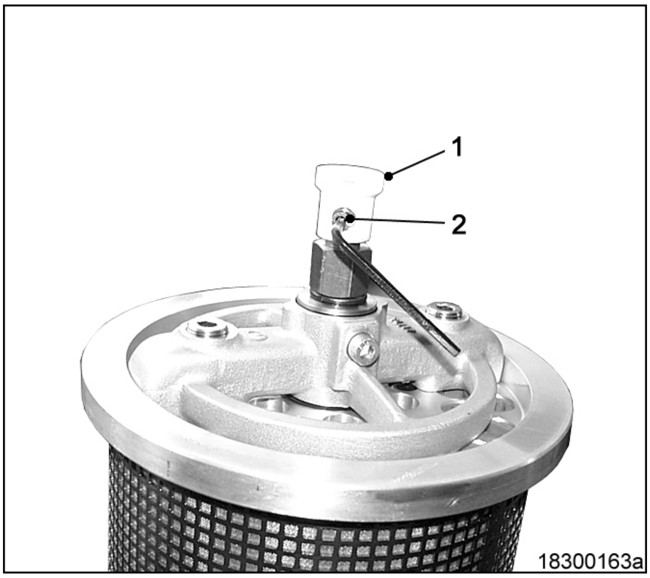


TIM ID: 0000033964 – 001

3. Extract automatic oil filter insert (1).
4. Remove O-ring.



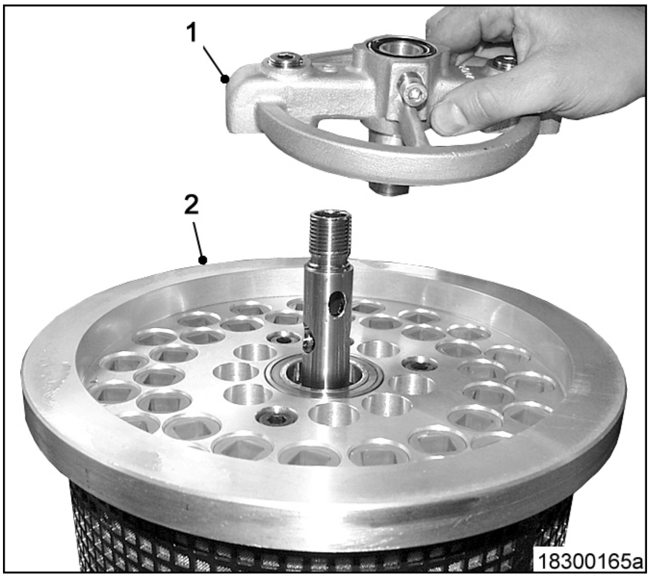
5. Remove cylinder screws (2).
6. Take off synthetic control rotor (1) with spring.



7. Unscrew lock nut (1).
8. Remove spring washer (4) and washer (3).
9. Remove cylinder screws (2).

TIM ID: 0000033964 - 001

10. Remove flushing arm (1) from screen plate (2).



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11. Rotate filter insert by 180° and use suitable tool to push out filter candles.

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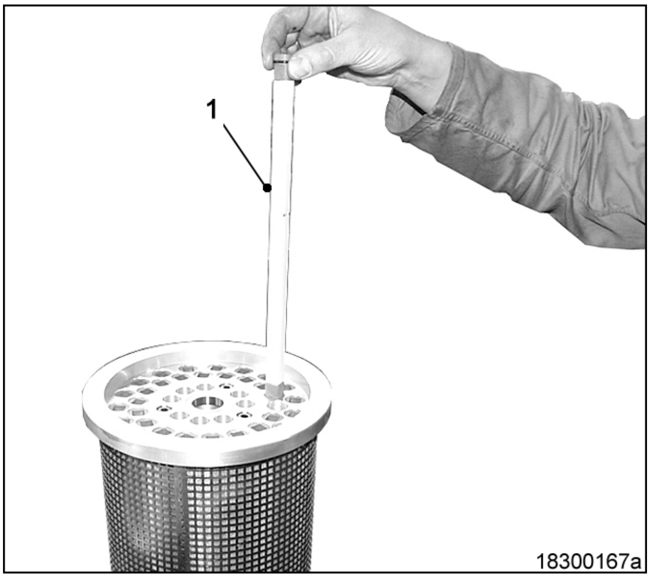
12. Rotate filter insert by 180° and insert new filter candles (1) with chamfer facing downwards.



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TIM ID: 0000033964 – 001

Installing oil filter candles

1. The procedure is the same as described for removal, only in reverse sequence.
2. Additionally, the following instructions should be complied with:
   2.1. Renew all sealing elements.
   2.2. Coat O-rings with petroleum jelly.
   2.3. Insert O-rings in grooves.
   2.4. Observe position of cylinder screw to elongated hole on shaft.

TIM ID: 0000033964 – 001

3.37 Oil indicator filter – Check

Preconditions

- Engine is stopped and starting disabled.

Spare parts

Designation / Use	Part No.	Qty.
Strainer	→ SPC	
Square-section ring	→ SPC	
O-ring	→ SPC	

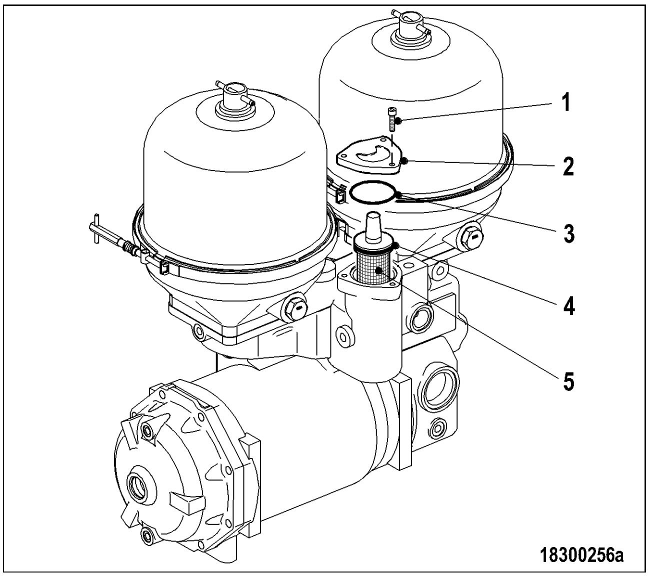
WARNING	Hot oil. Oil can contain combustion residues which are harmful to health. **Risk of injury and poisoning!** • Wear protective clothing, gloves, and goggles / safety mask. • Avoid contact with skin. • Do not inhale oil vapor.

WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.

CAUTION	Unsuitable cleaning tools. **Damage to component!** • Observe manufacturer's instructions. • Use appropriate cleaning tool.

Removing strainer

1. Clean oil indicator filter before disassembling it.
2. Remove screws (1).
3. Take off cover (2) with O–ring (3).
4. Take strainer (5) from filter housing.



TIM ID: 0000033981 – 001

Checking strainer

Item	Findings	Task
Strainer	Metallic residues	• Clean • Monitor engine operation • Check strainer daily • Contact Service.
Strainer	Damaged	Replace
Square-section ring	Damaged	Replace
O-ring	Damaged	Replace

Cleaning strainer

1. Wash strainer (5) with cleaner.
2. Remove stubborn deposits with soft brush.
3. Blow out strainer (5) with compressed air from inside.

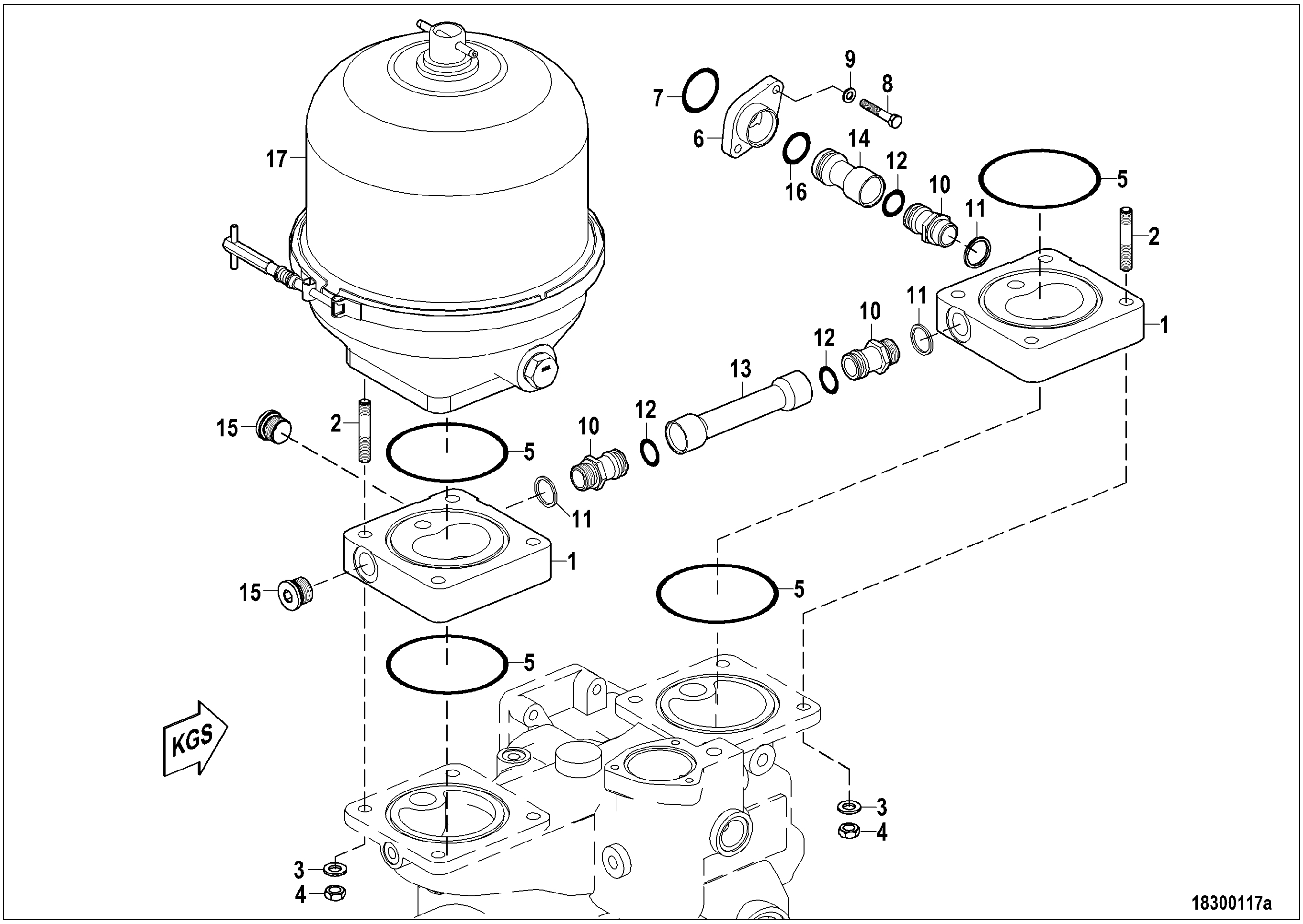
Installing strainer

1. Coat square-section ring (4) on strainer (5) with engine oil and install strainer (5).
2. Coat O–ring (3) with engine oil and fit in filter housing.
3. Fit cover (2) and secure with screws (1) and washers.

TIM ID: 0000033981 – 001

3.38 Centrifugal oil filter – Overview

Centrifugal oil filter



1 Flange
2 Stud
3 Washer
4 Hex nut
5 O-ring
6 Flange
7 O-ring
8 Hex screw
9 Washer
10 Threaded adapter
11 Sealing ring
12 O-ring
13 Plug-in pipe with bell
14 Plug-in pipe with bell
15 Plug screw
16 O-ring
17 Centrifugal oil filter

3.39 Centrifugal oil filter – Check

Material

Designation / Use	Part No.	Qty.
Aqueous developer (standard check)	→ FLS	1
Dye penetrant, red	→ FLS	1
Penetrant remover (standard check)	→ FLS	1

Spare parts

Designation / Use	Part No.	Qty.
Housing	→ SPC	
Rotor	→ SPC	
Nozzle	→ SPC	
Pipe	→ SPC	
Screw	→ SPC	
Compression spring	→ SPC	
Valve piston	→ SPC	
Plug	→ SPC	

Centrifugal oil filter – Check

Item	Findings	Task
Check all sealing, mating and sliding surfaces for stress marks, scoring and indentations.	• Stress marks • Scores • Indentations visible.	• Corrective work: Smooth with oilstone or emery cloth. • Replace
Check housing and substructure with dye penetrant for cracks.	Signs of cracks	Replace rotor unit.
Check all threads and threaded holes.	Damaged	• Corrective work: Recut threads • Replace
Check journals on rotor and bearing running surfaces on shaft for stress marks.	Stress marks visible	• Corrective work: Smooth with oilstone or emery cloth. • Replace
Check piston and spring of valve (→ Page 203) for stress marks.	Stress marks visible	• Corrective work • Replace
Check bearing clearance at rotor unit.	Bearing clearance more than 0.25 mm	Rotor unit, replace lower section

TIM ID: 0000033983 – 001

3.40 Oil cooler and oil distribution housing – Removal

Special tools

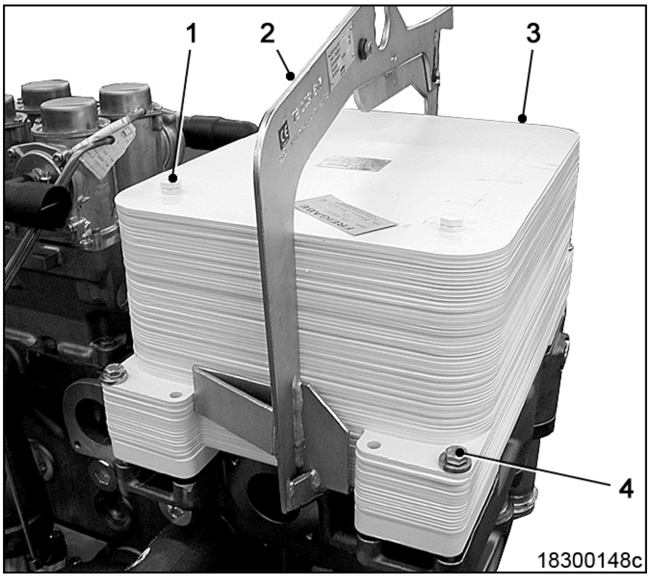
Designation / Use	Part No.	Qty.
Carrying bracket	→ TC	1

⚠ **WARNING**	Hot oil. Oil can contain combustion residues which are harmful to health. **Risk of injury and poisoning!** • Wear protective clothing, gloves, and goggles / safety mask. • Avoid contact with skin. • Do not inhale oil vapor.

⚠ **WARNING**	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Oil cooler – Removal

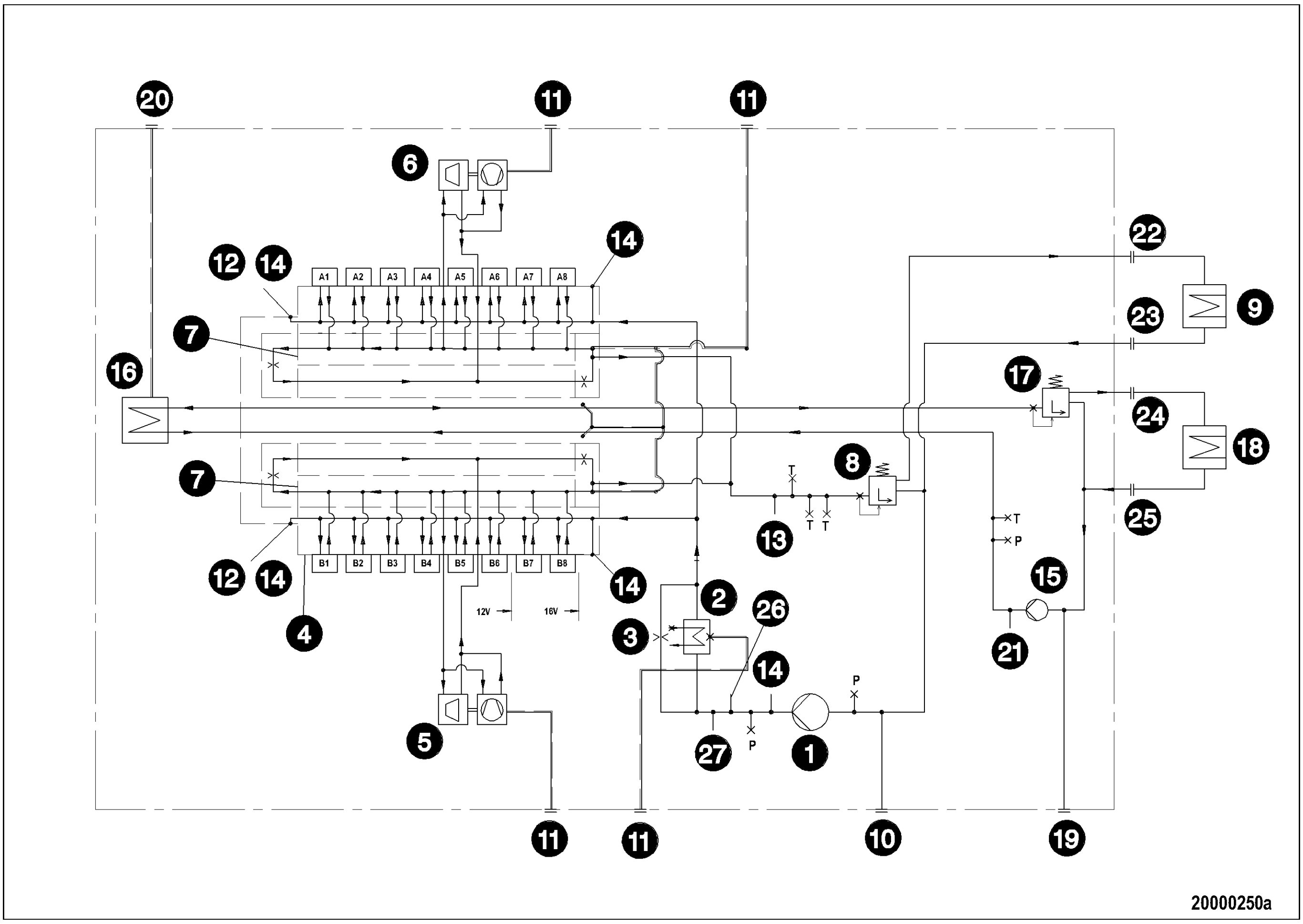
1. Secure oil cooler (3) with lifting equipment (2) and crane.
2. Remove screws (4).
3. Remove oil cooler with lifting equipment (2).
4. Catch any oil remains that emerge.
5. Remove oil distribution housing as per overview drawing (→ Page 286).



TIM ID: 0000033984 – 001

3.41 Cooling system

Engine coolant circuit



1 Engine coolant pump
2 Engine oil heat exchanger
3 Flow control flap
4 Crankcase
5 Exhaust turbocharger, right side
6 Exhaust turbocharger, left side
7 Exhaust line, water-cooled
8 Thermostat
9 Engine coolant cooler
10 Engine coolant expansion tank HT
11 Expansion and vent line HT
12 Engine coolant preheater inlet (option)
13 Engine coolant preheater outlet (option)
14 Engine coolant drain plug
15 Charge-air coolant pump
16 Intercooler
17 Thermostat, LT
18 Charge-air coolant cooler
19 Charge-air coolant expansion tank LT
20 Expansion and vent line LT
21 Charge-air coolant drain plug
22 Engine coolant outlet to engine coolant cooler
23 Engine coolant inlet from engine coolant cooler
24 Charge-air coolant outlet to charge-air coolant cooler
25 Charge-air coolant inlet from charge-air coolant cooler
26 Compartment heater inlet connection
27 Compartment heater return connection

P = Pressure measuring point
T = Temperature measuring point

Technical data

- Two separate cooling circuits:
  - Engine coolant HT (high-temperature)
  - Charge-air coolant LT (low-temperature)
- Coolant cooling by:
  - Electrically-driven fan
  - Mechanically-driven fan
  - Water/water heat exchanger (e.g. plate-core heat exchanger)
- Thermostat-controlled coolant circuit
- Coolant-cooled / preheated charge-air

Benefits

- Engine, oil and charge-air reach optimum operating temperature very quickly
- White smoke prevented by heating the charge air in idling and low-load operation
- Charge-air cooling during load-operation

Operation

Engine coolant circuit (high-temperature HT)

After starting the engine, the engine coolant pump (1) pumps part of the coolant through the lube-oil heat exchanger (2) into the cooling compartments in the crankcase (3). The other part of the coolant passes there directly via a flow control flap (4). The coolant flows around the cylinder liners and passes to the cylinder heads.

Here, the coolant flows through the coolant compartments and bores in the cylinder heads and exhaust turbochargers (5, 6). The coolant then flows to the thermostat (8) via the exhaust manifolds (7) on the left and right.

The thermostat (8) diverts the engine coolant to the engine coolant cooler (9) when the engine is under load (warm engine). Cooled charge-air coolant coming from the engine coolant cooler (9) then flows back to the engine coolant pump (1).

The thermostat (8) diverts engine coolant directly to the engine coolant pump (1) when the engine is cold.

Bypassing the engine coolant cooler (9) allows the engine, lube oil and engine coolant to reach operating temperature quickly.

The engine coolant expansion tank (10) is installed at the highest point of the cooling system. It compensates engine coolant quantity and pressure and is connected to the circuit by an expansion and vent line (11).

The engine is generally equipped with a preheating device (26, 27).

Drain plugs (14) are provided at the lowest points of the engine coolant circuit.

Charge-air coolant circuit (low-temperature LT)

The charge-air coolant pump (15) installed on the engine pumps the charge-air coolant to the intercooler (16).

The charge-air coolant passes to the thermostat (17) via the intercooler (16). The charge-air coolant passes to the charge-air coolant cooler (18) via the thermostat (17) when the engine is at operating temperature. Cooled charge-air coolant coming from the charge-air coolant cooler (18) flows to the charge-air coolant pump (15).

The thermostat (17) diverts charge-air coolant directly to the charge-air coolant pump (15) when the engine is cold.

The charge-air coolant expansion tank (19) is installed at the highest point of the cooling system. It compensates charge-air coolant quantity and pressure and is connected to the circuit by an expansion and vent line (20).

Drain plugs (21) are provided at the lowest points of the charge-air coolant circuit.

3.42 Engine coolant – Level check

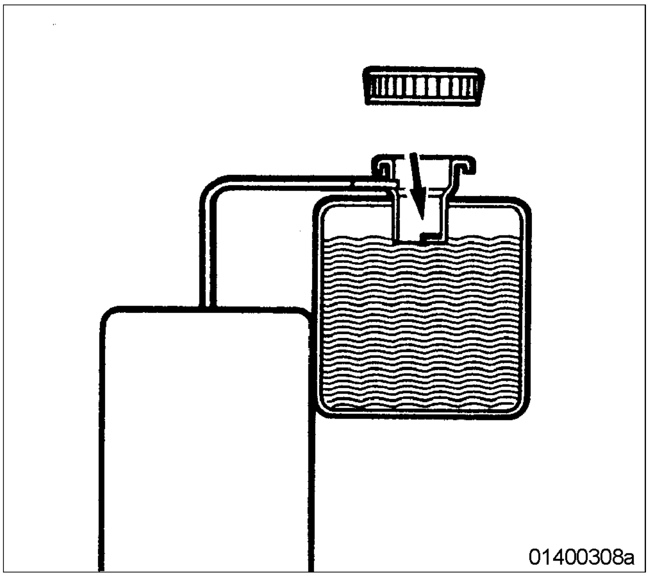
Preconditions

- Engine is stopped and starting disabled.
- MTU Fluids and Lubricants Specifications (A001061/..) are available.

WARNING	Coolant is hot and under pressure. **Risk of injury and scalding!** • Let the engine cool down. • Wear protective clothing, gloves, and goggles / safety mask.

Engine coolant level check at external cooler:

1. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.
3. Check coolant level (coolant level must be between "min." and "max." mark).
4. If required, top up with treated coolant (→ Page 242).
5. Check and clean breather valve.
6. Set breather valve onto filler neck and close it.



TIM ID: 0000033986 – 001

3.43 Engine coolant – Sample extraction and analysis

Preconditions

- MTU Fluids and Lubricants Specifications (A001061/..) are available.

Special tools

Designation / Use	Part No.	Qty.
MTU test kit	→ TC	1

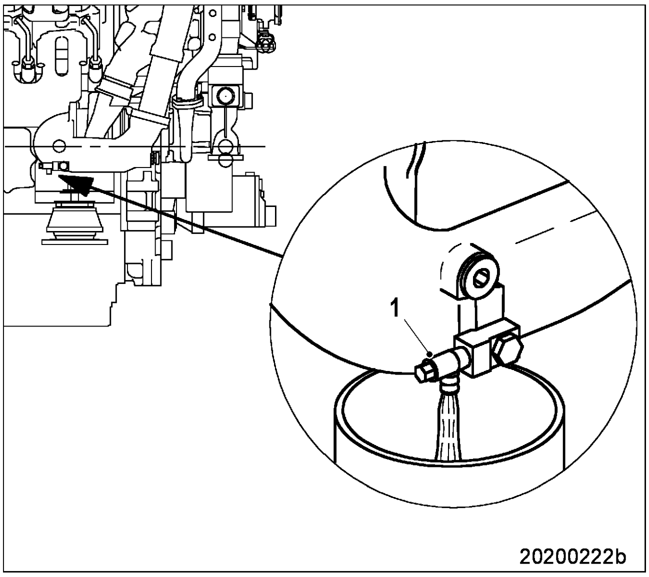
⚠ DANGER	Unguarded rotating and moving engine components. **Risk of serious injury – danger to life!** • Take special care when working on a running engine.

⚠ WARNING	Coolant is hot and under pressure. **Risk of injury and scalding!** • Let the engine cool down. • Wear protective clothing, gloves, and goggles / safety mask.

⚠ WARNING	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.

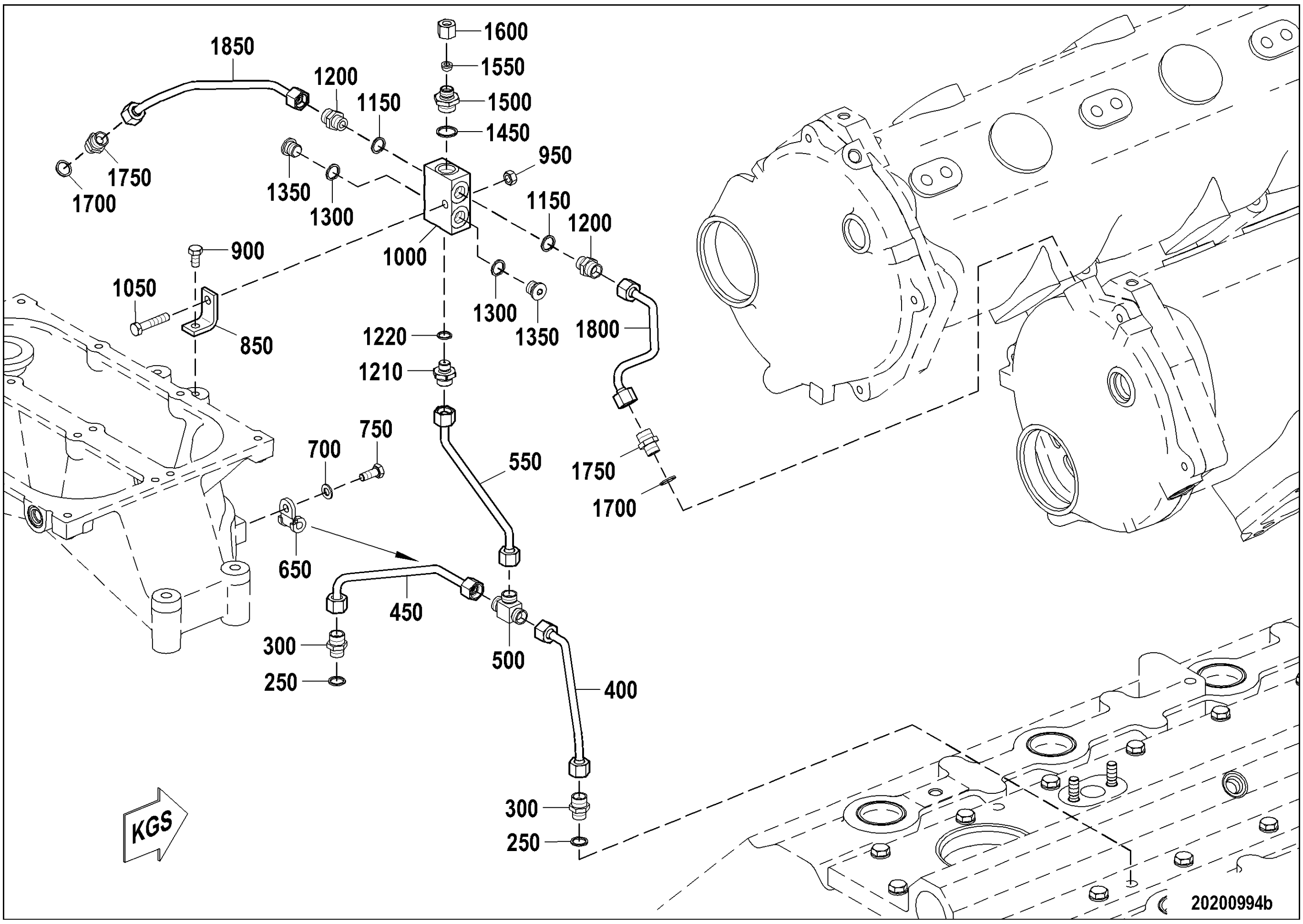
Engine coolant – Sample extraction and analysis

1. With the engine running, open drain valve (1).
2. Flush sample-extraction point by draining approx. 1 liter coolant.
3. Drain approx. 1 liter coolant into a clean container.
4. Close drain valve (1).
5. Using the equipment and chemicals of the MTU test kit, examine coolant for:
   - antifreeze concentration;
   - corrosion inhibitor concentration;
   - pH value.
6. For engine coolant change intervals (→MTU Fluids and Lubricants Specifications).



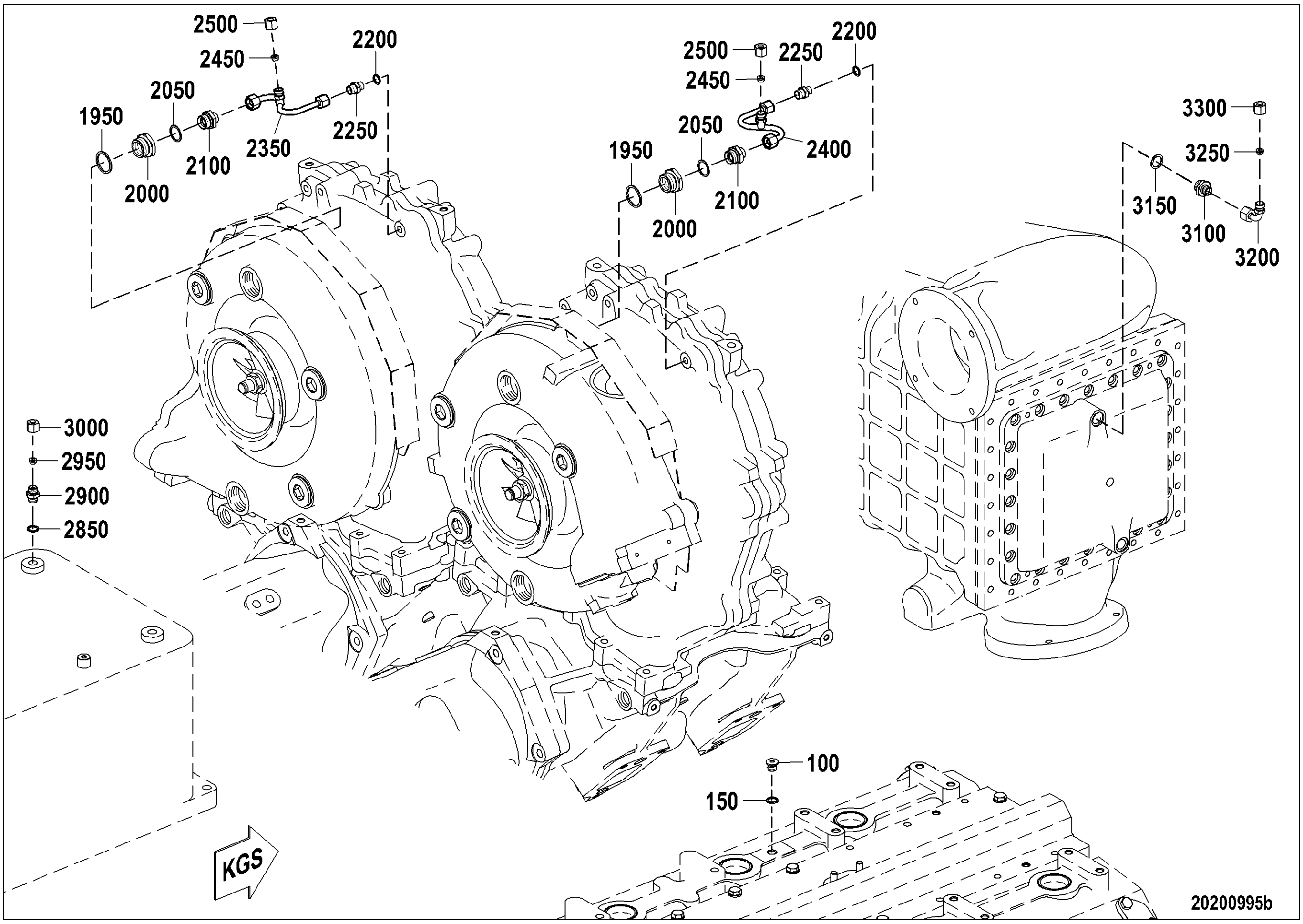
3.44 Coolant ventilation – Overview

Coolant vent lines



300	Neck	900	Screw	1350	Plug screw
400	Vent line	950	Nut	1450	Sealing ring
450	Vent line	1000	Distributor	1500	Neck
500	T-piece	1050	Screw	1550	Blanking cone
550	Vent line	1150	Sealing ring	1600	Nut
650	Clamp	1200	Neck	1700	Sealing ring
700	Washer	1210	Neck	1750	Neck
750	Screw	1220	Sealing ring	1800	Vent line
850	Bracket	1300	Sealing ring	1850	Vent line

TIM ID: 0000033988 – 001



100	Plug screw	2250	Neck	2950	Blanking cone
150	Sealing ring	2350	Vent line	3000	Nut
1950	Sealing ring	2400	Vent line	3100	Neck
2000	Threaded bush	2450	Blanking cone	3150	Sealing ring
2050	Sealing ring	2500	Nut	3200	Elbow
2100	Neck	2850	Sealing ring	3250	Blanking cone
2200	Sealing ring	2900	Neck	3300	Nut

3.45 Coolant pipework from/to intercooler – Removal

Preconditions

- Preparatory steps have been completed.

Removing coolant pipework

1. Before removing the lines, it is advisable to take photographs of the fitted lines or to mark lines and attachments.
2. Remove lines as per overview drawing (→ Page 289).
3. Remove sealant.
4. After removal, seal all connections with plugs.

TIM ID: 0000033989 – 001

3.46 Coolant distribution housing – Check

Material

Designation / Use	Part No.	Qty.
Aqueous developer (standard check)	→ FLS	1
Dye penetrant, red	→ FLS	1
Penetrant remover (standard check)	→ FLS	1

Spare parts

Designation / Use	Part No.	Qty.
Coolant distribution housing	→ SPC	

⚠ **WARNING**	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.

⚠ **WARNING**	Component is hot. **Risk of burning!** • Wear protective gloves.

Coolant distribution housing – Check

Item	Findings	Task
Check all parts for damage and wear.	Damaged	Replace
Check coolant distribution housing with dye penetrant for cracks.	Signs of cracks	Replace
Check all contact and sealing surfaces for damage and stress marks.	• Stress marks • Damage visible	• Corrective work: Smooth with oilstone or emery cloth. • Replace
Check locating bores of thermostat elements for damage.	Damaged	• Corrective work: Smooth with emery cloth. • Replace
Check threads in coolant distribution housing for ease of movement.	Sluggish	Replace thread inserts.
Sealing rings and O-rings	–	Replace
Check coolant and oil chambers of coolant distribution housing for leaks with air and corrosion inhibitor in water bath. Maintain a coolant temperature of min. = 30 °C or max. = 40 °C and a test pressure of 0.5 bar.	Leaking	Replace

TIM ID: 0000033990 – 001

3.47 Thermostat – Check

Spare parts

Designation / Use	Part No.	Qty.
Thermostat housing	→ SPC	
Thermostat elements	→ SPC	
Flange	→ SPC	

⚠ **WARNING**	Component is hot. **Risk of burning!** • Wear protective gloves.

Coolant pipework with thermostat – Check

Item	Findings	Task
Check all parts for damage and condition.	Damaged	Replace
Check all contact and sealing faces for stress marks and damage.	• Stress marks • Damage visible	• Recondition: Smooth with oilstone or emery cloth. • Replace
Check locating bores of thermostat elements for damage.	Damaged	• Recondition: Smooth with oilstone. • Replace
Gaskets, sealing rings and O-rings	–	Replace

Checking thermostat element

1. Remove thermostat element (→ Page 290).

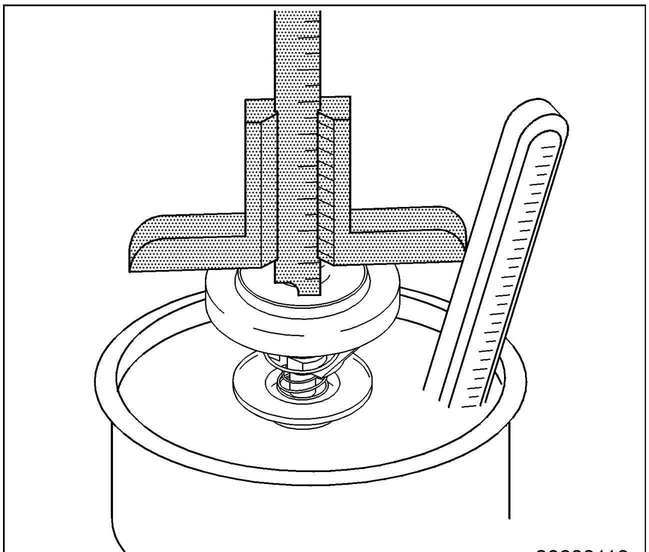
   Note: Thermostat element must not touch the container.

2. Hang thermostat element with a wire in a glass full of water.
3. Heat water with suitable heat source.

   Note: Start-of-opening temperature is stamped on thermostat element.

4. Check thermostat element for start of opening with constant heat supply and water in constant circulation. From approx. 10 °C below the start-of-opening temperature on, the heating-up rate should not be more than 1 °C per minute.
5. Replace thermostat element if results of check are negative.
6. Continue heating water to complete-opening temperature.

   Result: Thermostat element must be completely open after 6 to 8 minutes.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7. Measure stroke travel of thermostat element.
8. If stroke travel is below 9.5 mm, replace thermostat element (→ Page 290).

TIM ID: 0000033991 - 001

3.48 Battery-charging generator – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Special tools

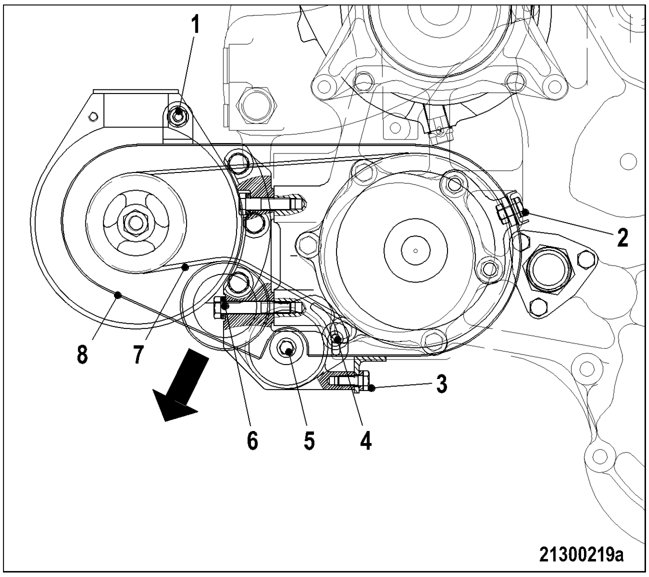
Designation / Use	Part No.	Qty.
Torque wrench 20-100 Nm	→ TC	1
Ratchet adapter	→ TC	1

WARNING

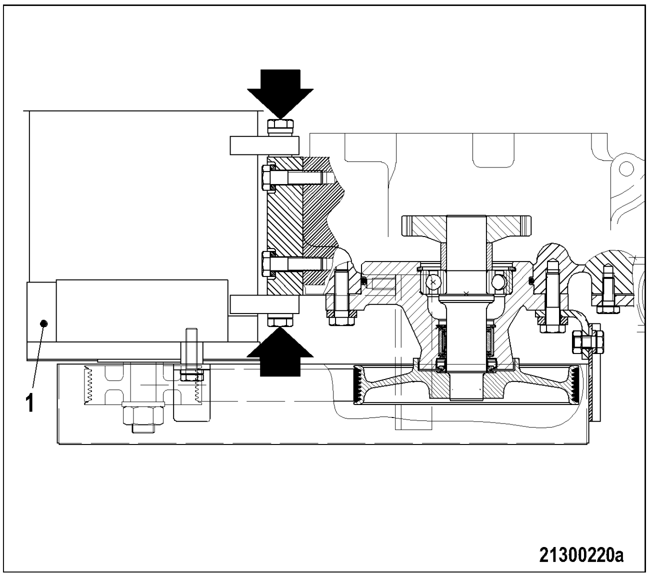
Heavy object.
Risk of crushing!
- Use appropriate lifting devices and appliances.

Removing battery-charging generator

1. Undo screws (1), (2) and (3).
2. Remove protective cover (8).
3. Mark electric cables on battery-charging generator and remove.
4. Protect all cables from damage.
5. Slacken screws (4) and (5) by half a turn.
6. Place socket adapter or box wrench on screw (6) and press belt tensioner in the direction indicated by the arrow as far as it will go.
7. Tighten screw (4).
8. Remove drive belt (7).



9. Undo screws (arrow).
10. Remove battery-charging generator (1).
11. Clean battery-charging generator (1) thoroughly (→ Page 293).
12. Install battery-charging generator (1) following reverse sequence of working steps.



TIM ID: 0000033992 – 001

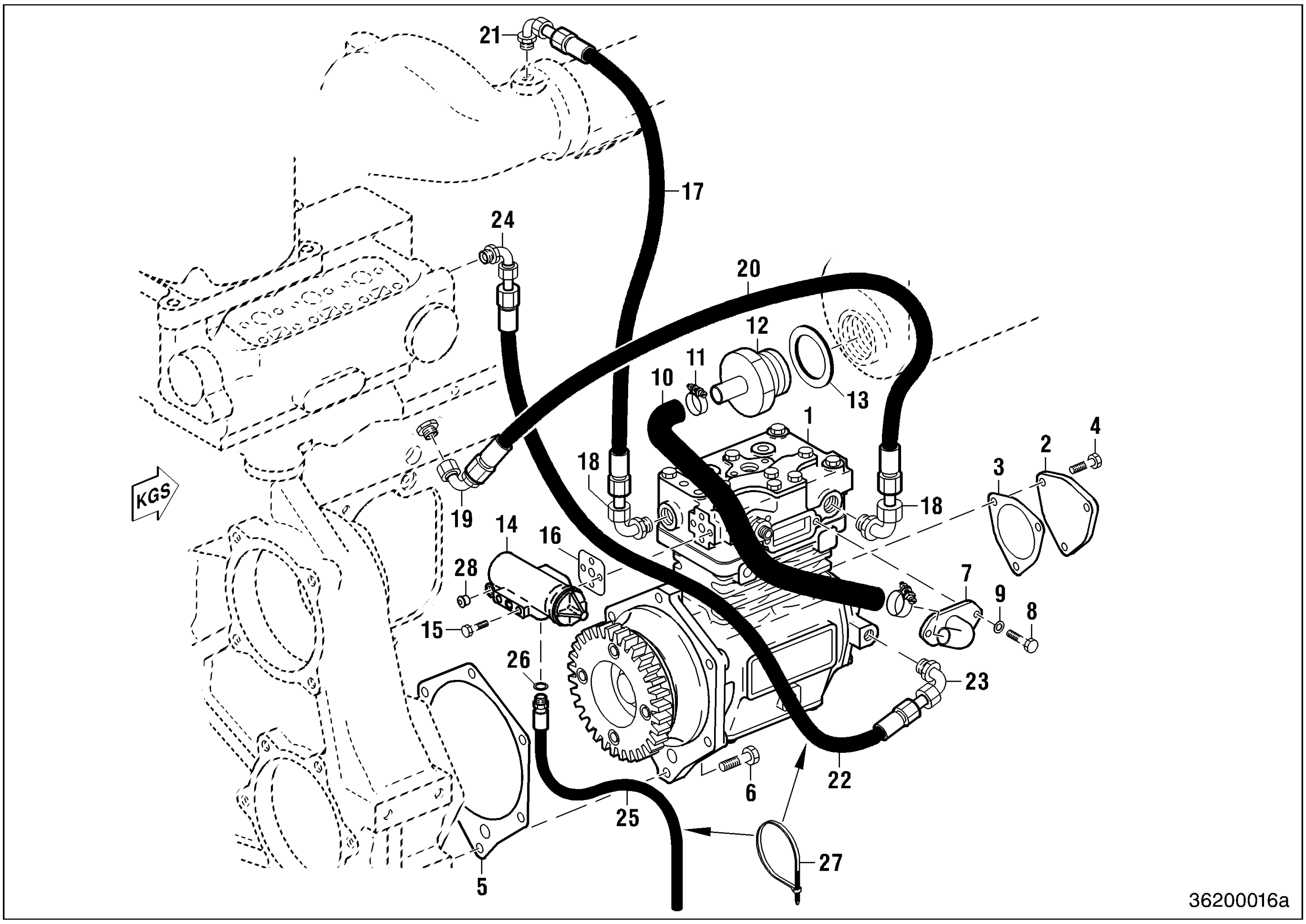
Tensioning drive belt

1. Fit drive belt (7).
2. Slacken screw (4) by half a turn.
   Result: Belt tensioner moves against the drive belt and tensions it.
3. Use torque wrench to tighten screw (5) to the specified torque 42 Nm and screw (4) to 60 Nm up to 65 Nm.
4. Install protective cover (8).
5. Readjust belt tension after 30 minutes and again after 8 hours engine runtime (→ Page 294).

TIM ID: 0000033992 – 001

3.49 Air compressor – Overview

Air compressor – Overview



1 Air compressor
2 Cover
3 Gasket
4 Screw
5 Gasket
6 Screw
7 Pipe
8 Screw
9 Washer
10 Rubber sleeve
11 Clamp
12 Connector
13 Sealing ring
14 Pressure relief valve
15 Screw
16 Gasket
17 Hose line
18 Union
19 Union
20 Hose line
21 Union
22 Hose line
23 Union
24 Union
25 Hose line
26 Sealing ring
27 Cable clamps
28 Plug

TIM ID: 0000033993 – 001

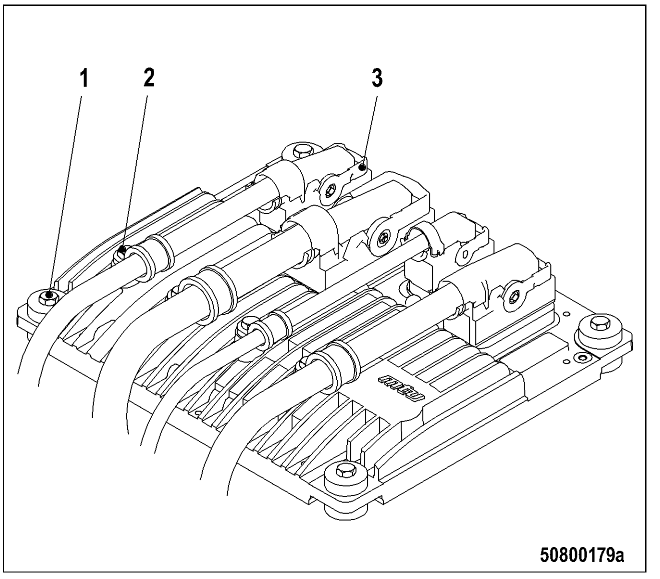
3.50 Engine governor – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Removing engine governor from engine

1. Note or mark assignment of cables and connectors.
2. Remove all screws (2).
3. Release lock (3) of connectors.
4. Withdraw all connectors.
5. Remove screws (1).
6. Take off engine governor.



Installing engine governor on engine

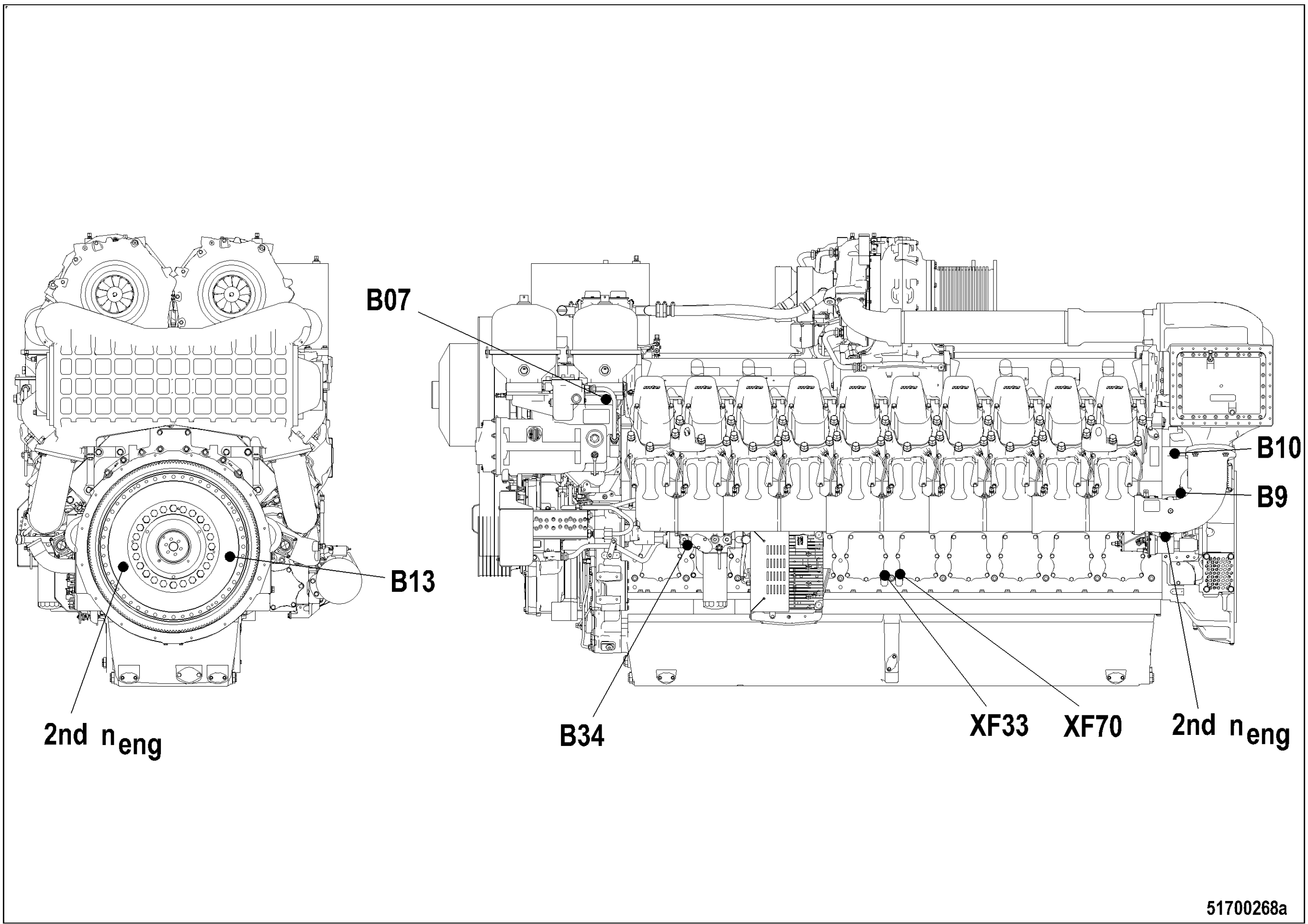
1. For installation follow reverse sequence of working steps. Ensure that connectors are plugged in the correct socket.
2. Check rubber bearing before installation.

   Result: If the rubber bearing is porous or defective, fit a new one.

TIM ID: 0000033994 – 001

3.51 Sensors at 20V 4000 C03 engines

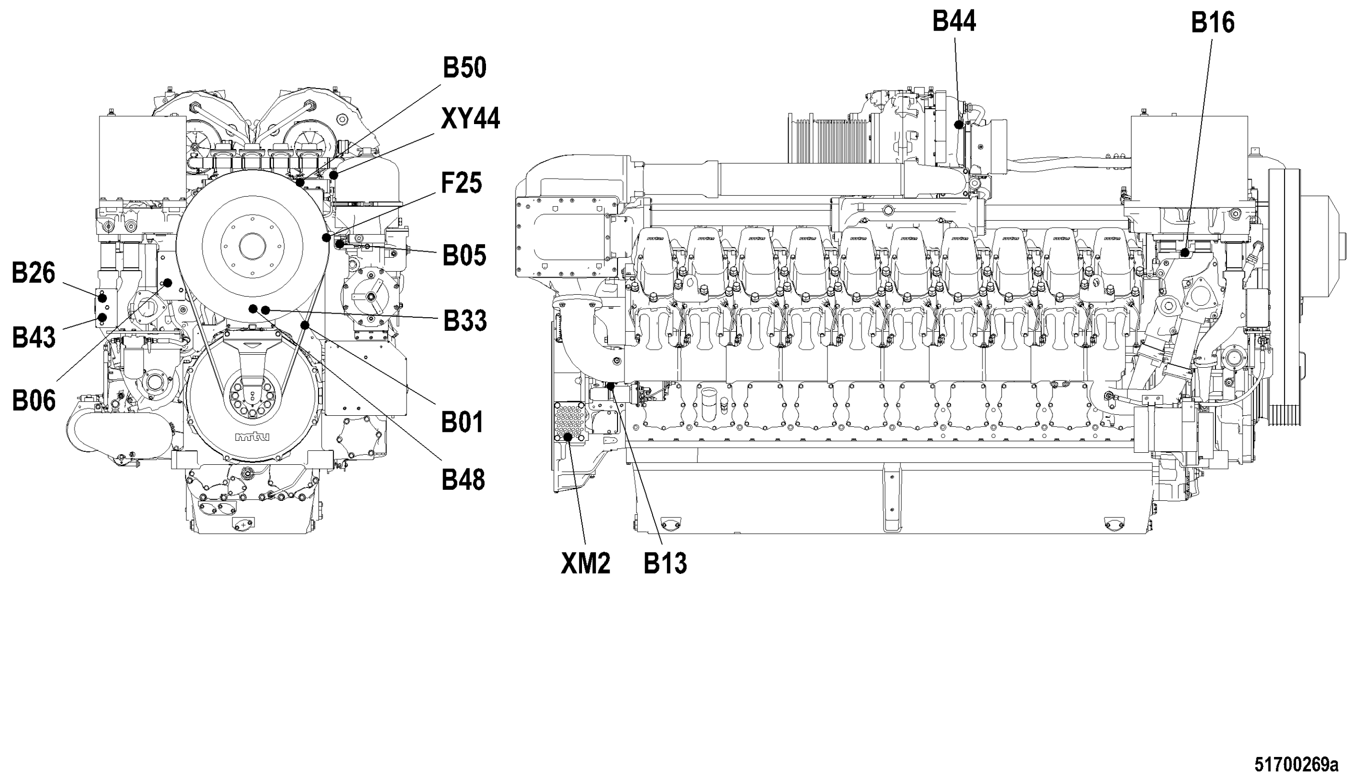
At driving end (driving end and left side)



B07	Lube oil temperature	B13	Crankshaft speed	XF70	Fuel prefilter water level connector
B09	Charge-air temperature	B34	Fuel pressure after filter	2nd n_{eng}	Optional: second crankshaft speed sensor, for systems at the vehicle
B10	Charge-air pressure	XF33	Coolant level connector		

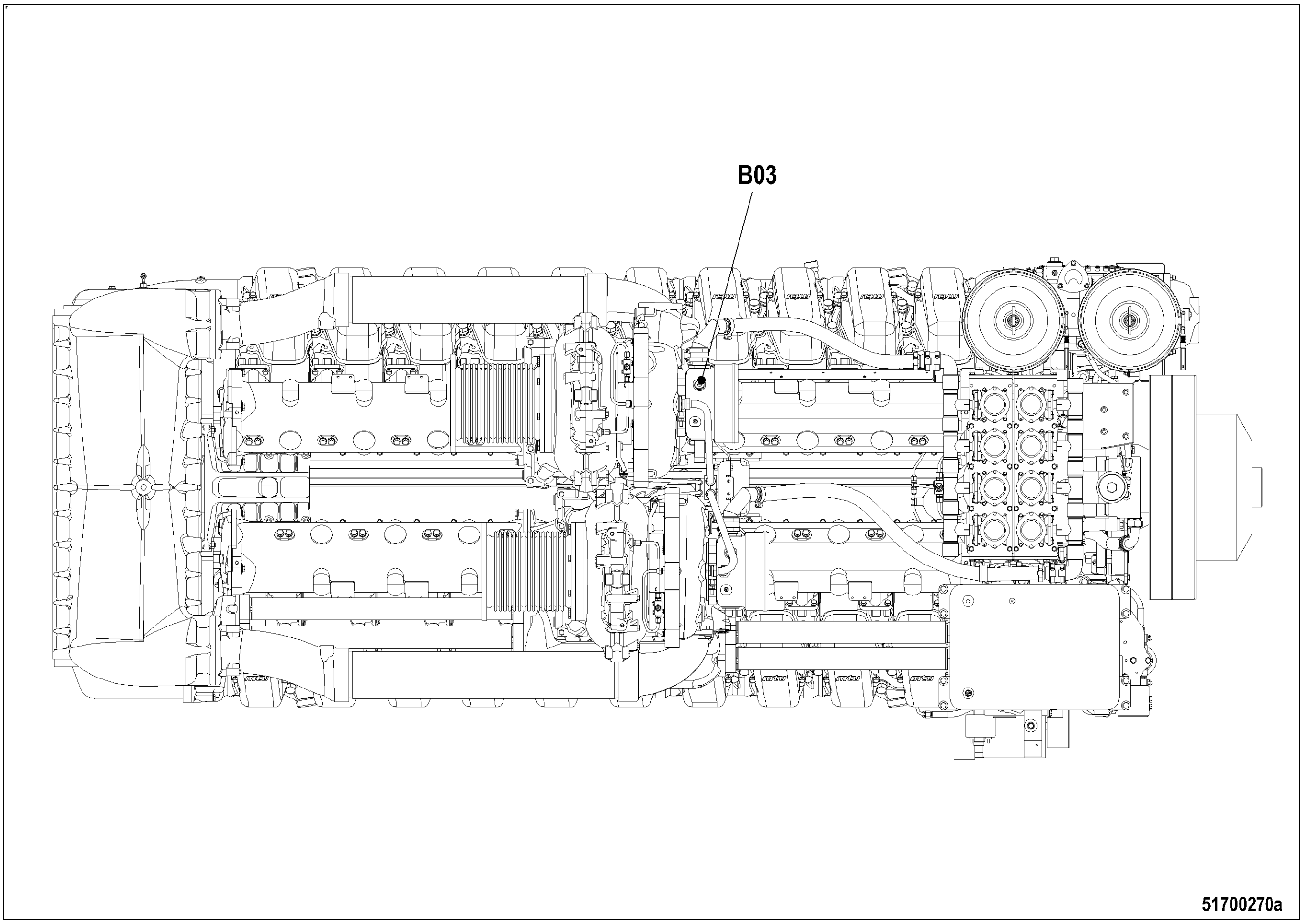
TIM ID: 0000033995 – 001

Free end (free end and right side)



B01	Camshaft speed	B06	Coolant temperature	B44	Exhaust turbocharger speed
B05	Lube-oil pressure (as of 01/2008: B05 lube-oil pressure before filter)	B13	Crankshaft speed	B50	Crankcase pressure
F25	Lube oil differential pressure after filter (as of 01/2008: B05.03 lube-oil pressure after filter)	B16	Coolant pressure	XM2	Oil priming pump
		B26	Intercooler coolant temperature	XY44	Engine wiring harness (XY44 for ventilation control)
		B33	Fuel temperature		
		B43	Intercooler coolant pressure		

Top side



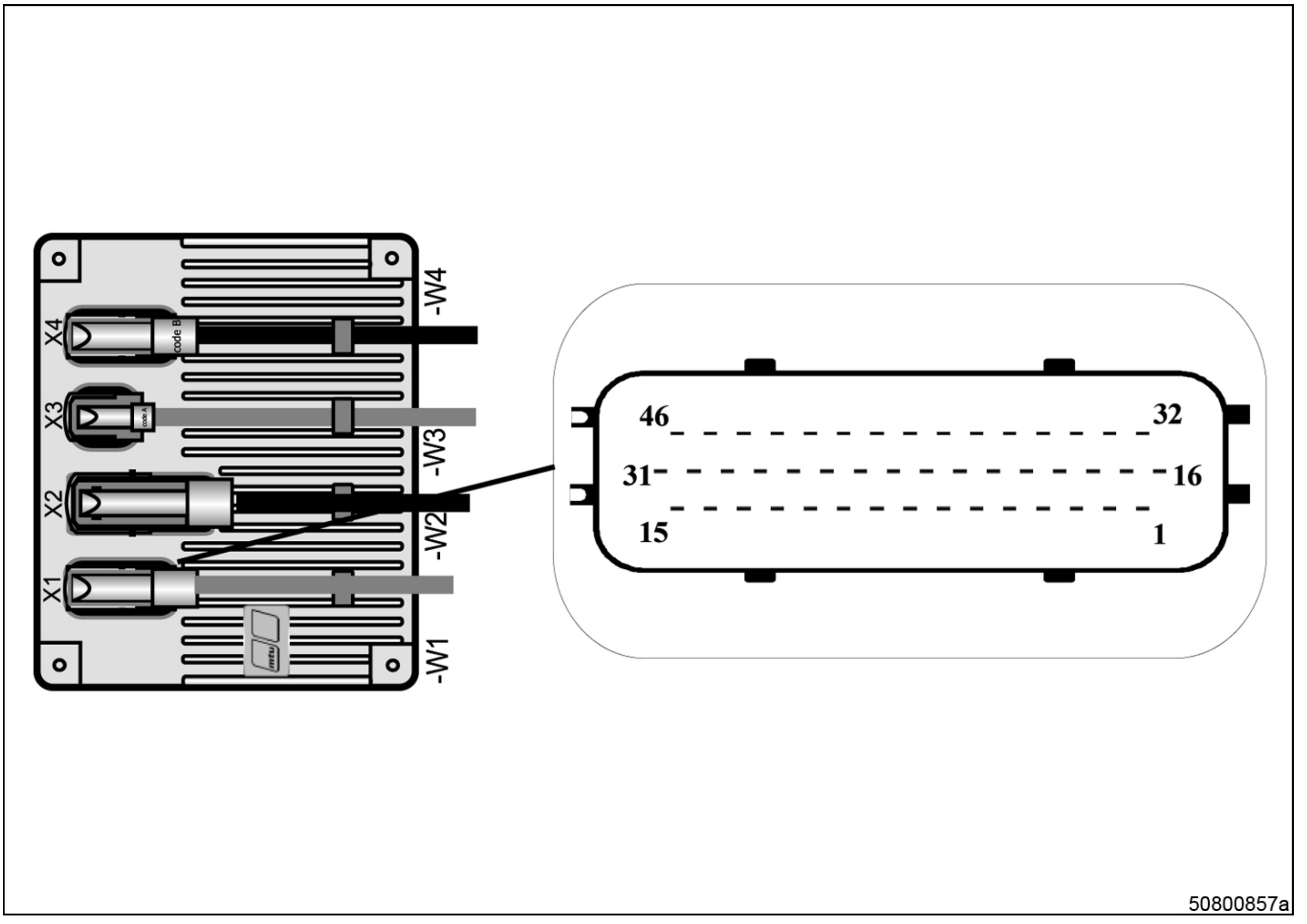
B03 Intake air temperature

TIM ID: 0000033995 – 001

3.52 Connectors of the engine governor ECU 7 (ADEC)

Connector Assignment

Pin assignment X1



This connector forms the interface to the plant:

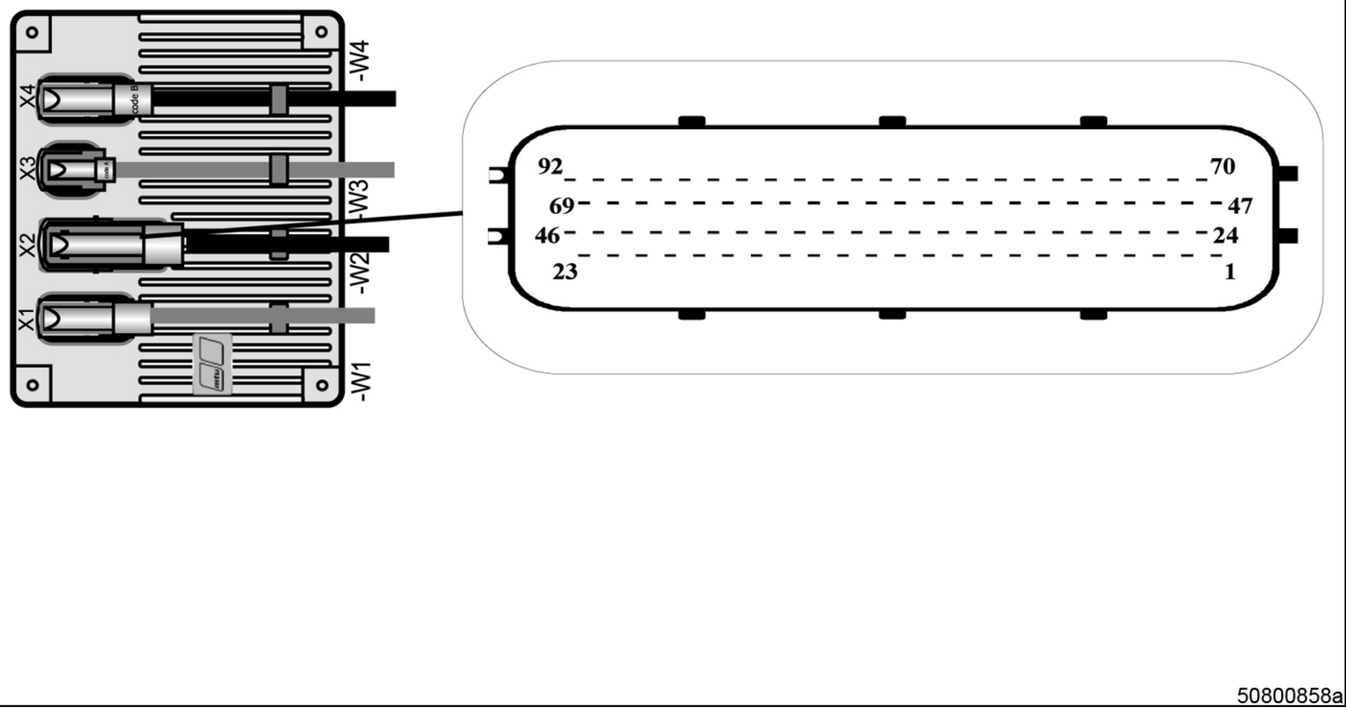
The following table gives the connector assignment of the connector X1. The short specification gives the most important properties of a channel.

Designation	Pin X1	Signal type	Short specification
CAN1_P	19	CAN1_P_H	50 V isolated
CAN1_P	35	CAN1_P_L	
CAN1_P	20	CAN1_P_GND	
CAN2_P	33	CAN2_P_H	50 V isolated
CAN2_P	8	CAN2_P_L	
CAN2_P	34	CAN2_P_GND	
DI1	43	DI1_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high

Designation	Pin X1	Signal type	Short specification
DI1	28	DI1_L	50 V isolated
DI2	42	DI2_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI2	27	DI2_L	50 V isolated
DI3	41	DI3_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI3	26	DI3_L	50 V isolated
DI4	40	DI4_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI4	25	DI4_L	50 V isolated
DI5	39	DI5_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI5	24	DI5_L	50 V isolated
DI6	38	DI6_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI6	23	DI6_L	50 V isolated
DI7	37	DI7_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI7	22	DI7_L	50 V isolated
DI8	36	DI8_H	< 4 V (< 1.1 mA) = low > 8 V (> 1.5 mA) = high
DI8	21	DI8_L	50 V isolated
ESI	4	ESI_IN	<4 V (2mA) = low/>8V (4mA) = high
AI1_2	44	AI1_2_5V	5 V/25 mA ±50 V isolated to other potential
AI1	31	AI1_U	0...10 V (not isolated to AI2)
AI1	46	AI1_I	0...23.7 mA (not isolated to AI2)
AI2	30	AI2_U	0...10 V (not isolated to AI1)
AI2	45	AI2_I	0...23.7 mA (not isolated to AI1)
AI1_2	29	AI1_2_GND	AI_GND ±50 V isolated to other potential
AO1	7	AO1_OUT	0..10 V/8 mA
AO2	6	AO2_OUT	0..10 V/8 mA
AO1_2_FIP	5	AO1_2_FIP_GND	GND
FIP	8	FIP_IN	0..5 V or frequency input
TOP1	14	TOP1_OUT	24 V/TOP1+..+TOP4 = 3 A; max. 1.5 A source/sink
TOP2	13	TOP2_OUT	24 V/TOP1+..+TOP4 = 3 A; max. 1.5 A source/sink

Designation	Pin X1	Signal type	Short specification
TOP1_2	12	TOP1_2_GND	LGND (3 A)
TOP3	11	TOP3_OUT	24 V/TOP1+..+TOP4 = 3 A; max. 1.5 A source/sink
TOP4	10	TOP4_OUT	24 V/TOP1+..+TOP4 = 3 A; max. 1.5 A source/sink
TOP3_4	9	TOP3_4_GND	LGND (3 A) 17
FO	15	FO_OUT	24 V/1.5 A sink to LGND/<500 Hz
ITS_O	3	TxD_1	ITS OFF -> ITS_O (3) Jumper to ITS_I (2)
ITS_I	2	RxD_1	ITS OFF -> ITS_O (3) Jumper to ITS_I (2)
FGND	1		NC
	32		NC
	16		NC
	17		NC

Pin assignment X2



The engine sensor system is connected to this connector.

The following table gives the connector assignment of the connector X2. The short specification gives the most important properties of a channel.

Designation	Pin X1	Signal type	Short specification
TI1	1	TI1_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI1	2	TI1_GND	GND
TI2	3	TI2_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI2	4	TI2_GND	GND
TI3	5	TI3_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI3	6	TI3_GND	GND
TI4	7	TI4_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI4	8	TI4_GND	GND
TI5	9	TI5_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI5	10	TI5_GND	GND
TI6	11	TI6_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI6	12	TI6_GND	GND
TI7	13	TI7_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI7	14	TI7_GND	GND
TI8	15	TI8_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI8	16	TI8_GND	GND
TI9	17	TI9_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI9	18	TI9_GND	GND
TI10	19	TI10_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI10	20	TI10_GND	GND
TI11	21	TI11_IN	0...5 V/internal 1k91 pull-up to TI_BUF
TI12	22	TI12_IN	0...5 V/internal 1k91 pull-up to TI_BUF
PI1	23	PI1_5V_T1	5 V/12 mA/tracker T1
PI1	24	PI1_IN	0...5 V/internal 47k5 pull-down
PI1	25	PI1_GND	GND
PI2	26	PI2_5V_T2	5 V/12 mA/tracker T2
PI2	27	PI2_IN	0...5 V/internal 47k5 pull-down
PI2	28	PI2_GND	GND
PI3	29	PI3_5V_T3	5 V/12 mA/tracker T3
PI3	30	PI3_IN	0...5 V/internal 47k5 pull-down
PI3	31	PI3_GND	GND

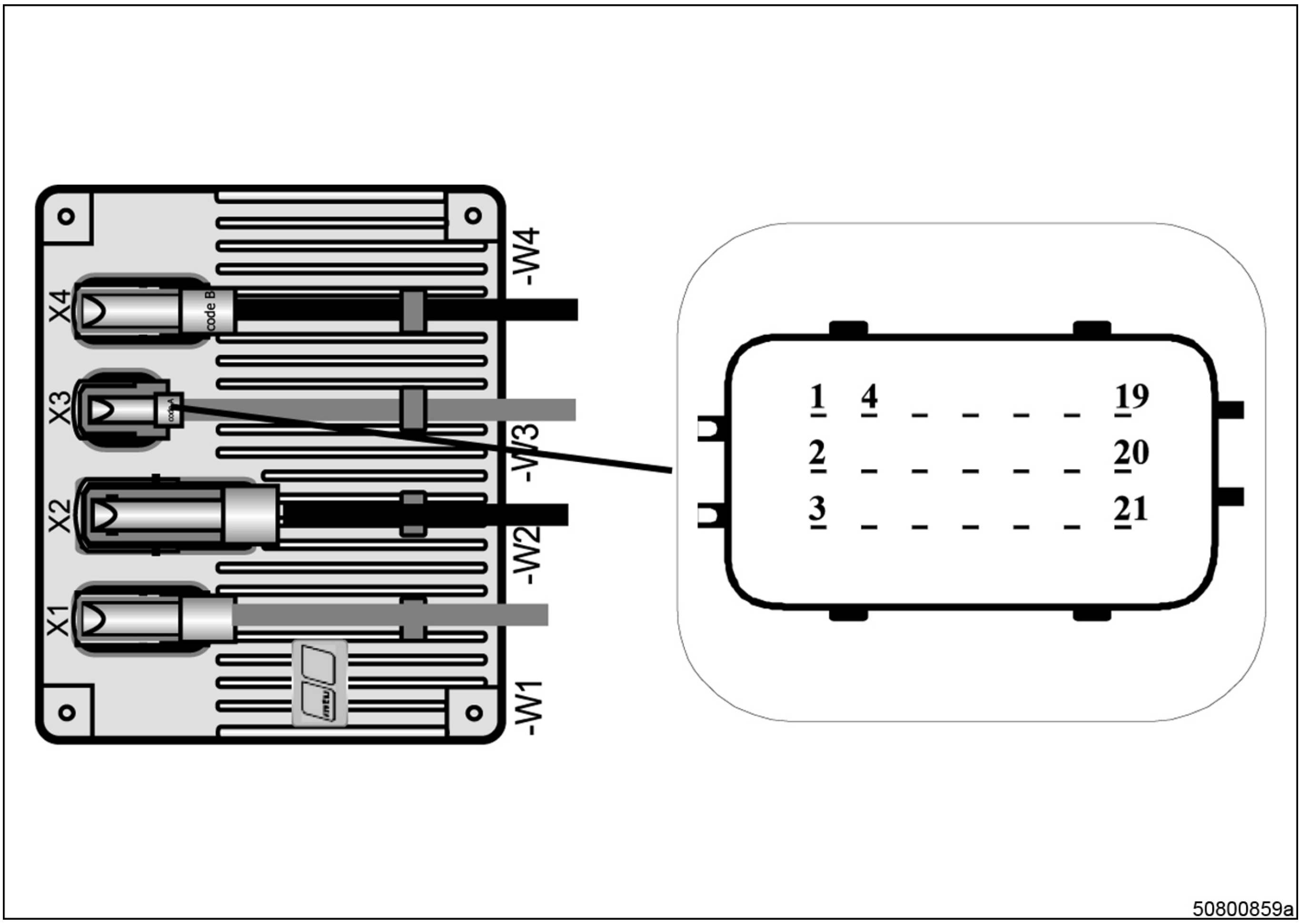
TIM ID: 0000033996 – 001

Designation	Pin X1	Signal type	Short specification
PI4	32	PI4_5V_T4	5 V/12 mA/tracker T4
PI4	33	PI4_IN	0...5 V/internal 47k5 pull-down
PI4	34	PI4_GND	GND
PI5	35	PI5_5V_T5	5 V/12 mA/tracker T5
PI5	36	PI5_IN	0...5 V/internal 47k5 pull-down
PI5	37	PI5_GND	GND
PI6	38	PI6_5V_T6	5 V/12 mA/tracker T6
PI6	39	PI6_IN	0...5 V/internal 47k5 pull-down
PI6	40	PI6_GND	GND
PI7	41	PI7_5V_T7	Supply 5 V/tracker T7 for PI7.. 48 mA
PI7	42	PI7_IN	0...5 V/internal 47k5 pull-down
PI7	43	PI7_GND	GND
PI8	44	PI8_5V_T8	Supply 5 V/tracker T8 for PI8.. 48 mA
PI8	45	PI8_IN	0...5 V/internal 47k5 pull-down
PI8	46	PI8_GND	GND
PI9	47	PI9_5V_T9	Supply 5 V/tracker T9 for PI9.. 48 mA
PI9	48	PI9_IN	0...5 V/internal 47k5 pull-down
PI9	49	PI9_GND	GND
PI10	50	PI10_IN	0...5 V/internal 47k5 pull-down (supply 5 V: T7 or T8 or T9)
PI11	51	PI11_IN	0...5 V/internal 47k5 pull-down (supply 5 V: T7 or T8 or T9)
PI12	52	PI12_IN	0...5 V/internal 47k5 pull-down (supply 5 V: T7 or T8 or T9)
PI13	53	PI13_IN	0...5 V/internal 47k5 pull-down (supply 5 V: T7 or T8 or T9)
PI14	54	PI14_IN	0...5 V/internal 47k5 pull-down (supply 5 V: T7 or T8 or T9)
PTI	55	PTI_IN	0...5 V/internal 47k5 pull-down (supply 5 V: T7 or T8 or T9)
PFI1	56	PFI1_IN	PxI 0...5 V/internal 47k5 pull-down/xFI CMOS 3k32 pull-up
PFI2	57	PFI2_IN	PxI 0...5 V/internal 47k5 pull-down/xFI CMOS 3k32 pull-up
PFI3	58	PFI3_IN	PxI 0...5 V/internal 47k5 pull-down/xFI CMOS 3k32 pull-up
LSI1	59	LSI1_13V_5V_T10	Supply 13 V/5 V for LSI1 max. 12 mA/channel tracker 10
LSI1	60	LSI1_IN	0...5 V/internal 47k5 pull-down PI/pull-up LSI
LSI1	61	LSI1_GND	GND
LSI2	62	LSI2_13V_5V_T11	Supply 13 V/5 V for LSI2 max. 12 mA/channel tracker 11
LSI2	63	LSI2_IN	0...5 V/internal 47k5 pull-down PI/pull-up LSI
LSI2	64	LSI2_GND	GND

Designation	Pin X1	Signal type	Short specification
LSI3	65	LSI3_13V_5V_T12	Supply 13 V/5 V for LSI3 max. 12 mA/channel tracker 12
LSI3	66	LSI3_IN	0...5V/internal 47k5 pull-down PI/ pull-up LSI
LSI3	67	LSI3_GND	GND
ASI1	68	ASI1_L	<-130 mV = low <0 mV = high
ASI1	69	ASI1_H	
ASI2	70	ASI2_L	<-130 mV = low <0 mV = high
ASI2	71	ASI2_H	
FI1	72	FI1_H	<-630 mV = low >540 mV = high
FI1	73	FI1_L	
FI2	74	FI2_H	<-630 mV = low >540 mV = high
FI2	75	FI2_L	
FI3	76	FI3_H	<-630 mV = low >540 mV = high
FI3	77	FI3_L	
FI4	78	FI4_H	<-630 mV = low >540 mV = high
FI4	79	FI4_L	
TO1	80	TO1_OUT	24 V/1.5 A
TO1	81	TO1_GND	LGND
TO2	82	TO2_OUT	24 V/1.5 A
TO2	83	TO2_GND	LGND
TO3	84	TO3_OUT	24 V/1.5 A
TO3	85	TO3_GND	LGND
TO4	86	TO4_OUT	24 V/1.5 A
TO4	87	TO4_GND	LGND
PWM_CM1	88	PWM_CM1_OUT	24 V/3 A with current measurement (CM)
PWM_CM1	89	PWM_CM1_GND	LGND
CAN3_E	90	CAN3_E_H	50 V isolated
CAN3_E	91	CAN3_E_L	
CAN3_E	92	CAN3_E_GND	

TIM ID: 0000033996 – 001

Pin assignment X3



The supply voltage as well as the “ignition” signal is fed through this connector.

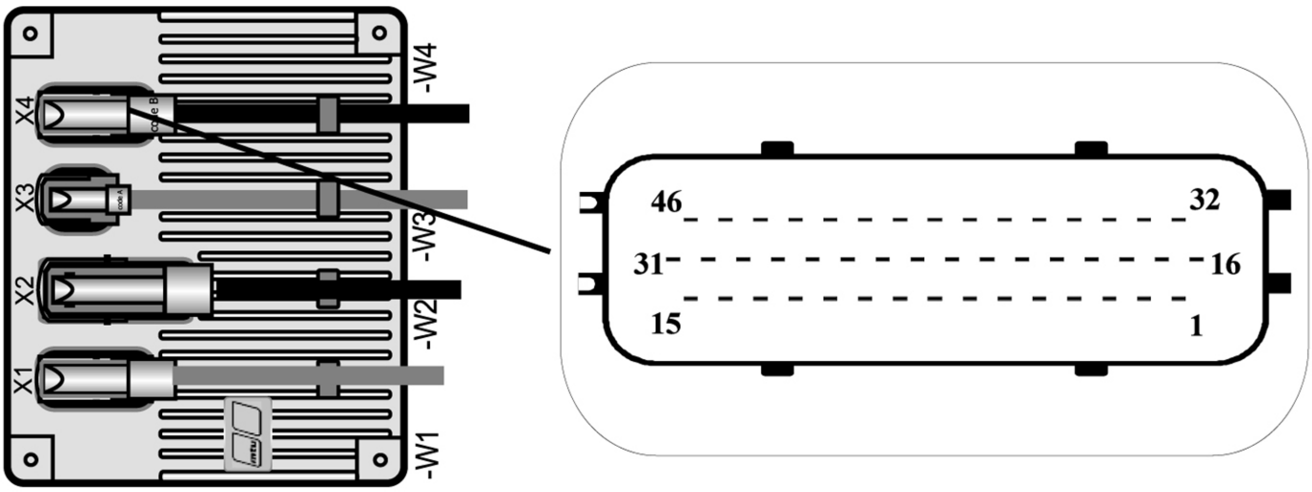
TIM ID: 0000033996 – 001

The following table gives the connector assignment of the connector X3. The short specification gives the most important properties of a channel.

Designation	Pin X1	Signal type	Short specification
POWER	3	+24V	24 V/30 A
POWER	6	+24V	
POWER	9	+24V	
POWER	12	+24V	
POWER	1	GND	GND/30 A
POWER	4	GND	
POWER	7	GND	
POWER	10	GND	
IGI	16	IGI_24V	24 V/10 mA (bridge to IGI_IN to disable IGI function)
IGI	13	IGI_IN	<4 V (2 mA) = low >8 V (4 mA) = high
	2	NC	
	5	NC	
	8	NC	
	11	NC	
	14	NC	
	15	NC	
	17	NC	
	18	NC	
	19	NC	
	20	NC	
	21	NC	

TIM ID: 0000033996 – 001

Pin assignment X4



All injectors of the engine are connected to this connector.

The following table gives the connector assignment of the connector X4. The short specification gives the most important properties of a channel.

Designation	Pin X1	Signal type	Short specification
IO11	39	IO11_H	24 V/17 A; 42 V/10 A
IO11	23	IO11_L	Bank 1
IO12	38	IO12_H	24 V/17 A; 42 V/10 A
IO12	22	IO12_L	Bank 1
IO13	37	IO13_H	24 V/17 A; 42 V/10 A
IO13	21	IO13_L	Bank 1
IO14	36	IO14_H	24 V/17 A; 42 V/10 A
IO14	20	IO14_L	Bank 1
IO15	35	IO15_H	24 V/17 A; 42 V/10 A
IO15	19	IO15_L	Bank 1
IO21	46	IO21_H	24 V/17 A; 42 V/10 A

Designation	Pin X1	Signal type	Short specification
IO21	45	IO21_L	Bank 2
IO22	44	IO22_H	24 V/17 A; 42 V/10 A
IO22	43	IO22_L	Bank 2
IO23	42	IO23_H	24 V/17 A; 42 V/10 A
IO23	26	IO23_L	Bank 2
IO24	41	IO24_H	24 V/17 A; 42 V/10 A
IO24	25	IO24_L	Bank 2
IO25	40	IO25_H	24 V/17 A; 42 V/10 A
IO25	24	IO25_L	Bank 2
IO31	11	IO31_H	24 V/17 A; 42 V/10 A
IO31	27	IO31_L	Bank 3
IO32	12	IO32_H	24 V/17 A; 42 V/10 A
IO32	28	IO32_L	Bank 3
IO33	14	IO33_H	24 V/17 A; 42 V/10 A
IO33	30	IO33_L	Bank 3
IO34	13	IO34_H	24 V/17 A; 42 V/10 A
IO34	29	IO34_L	Bank 3
IO35	15	IO35_H	24 V/17 A; 42 V/10 A
IO35	31	IO35_L	Bank 3
IO41	2	IO41_H	24 V/17 A; 42 V/10 A
IO41	1	IO41_L	Bank 4
IO42	4	IO42_H	24 V/17 A; 42 V/10 A
IO42	3	IO42_L	Bank 4
IO43	8	IO43_H	24 V/17 A; 42 V/10 A
IO43	7	IO43_L	Bank 4
IO44	6	IO44_H	24 V/17 A; 42 V/10 A
IO44	5	IO44_L	Bank 4
IO45	10	IO45_H	24 V/17 A; 42 V/10 A
IO45	9	IO45_L	Bank 4
PWM1	33	PWM1_OUT	24V/3A/< 500Hz
PWM1	17	PWM1_GND	LGND
PWM2	32	PWM2_OUT	24V/3A/< 500Hz
PWM2	16	PWM2_GND	LGND

TIM ID: 0000033996 – 001

Designation	Pin X1	Signal type	Short specification
PWM_CM2	34	PWM_CM2_OUT	24V/3A/< 500Hz
PWM_CM2	18	PWM_CM2_GND	LGND (10 mΩ)

3.53 Fuel filter – Replacement

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Filter wrench	→ TC	1

Material

Designation / Use	Part No.	Qty.
Engine oil	→ FLS	

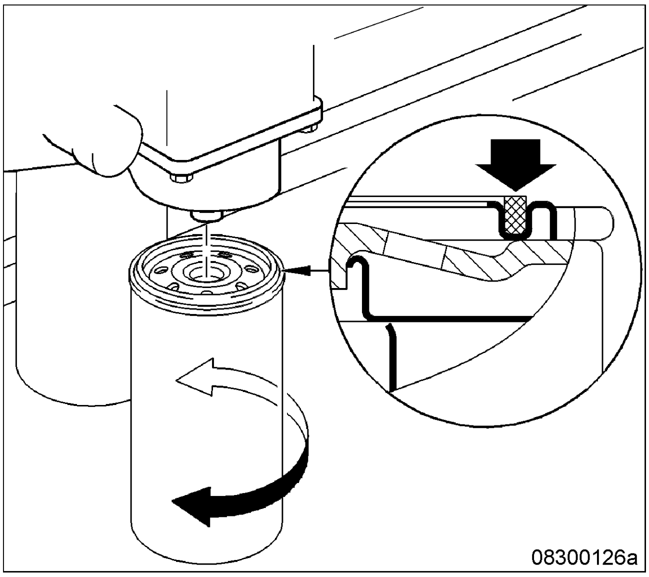
Spare parts

Designation / Use	Part No.	Qty.
Easy-change filter	→ SPC	

⚠ WARNING	Fuels are combustible. **Risk of fire and explosion!** • Avoid open flames, electrical sparks and ignition sources. • Do not smoke.

Fuel filter – Replacement

1. Remove easy-change filter using filter wrench.
2. Clean the sealing surface of the filter head.
3. Slightly lubricate seal on the easy-change filter.
4. Screw on easy-change filter by hand until the seal connects and tighten manually.
5. Replace further easy-change filters in the same way.
6. Vent fuel system (→ Page 178)



TIM ID: 0000033682 – 001

3.54 Injector – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Injector removal/installation tool	→ TC	1
Milling cutter	→ TC	1
Slotted screwdriver	→ TC	1
Torque wrench 0.5-5 Nm	→ TC	1
Torque wrench 10-60 Nm	→ TC	1
Torque wrench 60-320 Nm	→ TC	1

Material

Designation / Use	Part No.	Qty.
Assembly paste (Optimoly Paste White T)	→ FLS	1
Grease (Kluthe Hakuform 30-10/Emulgier)	→ FLS	1
Engine oil	→ FLS	

WARNING

Fuels are combustible.
Risk of fire and explosion!
- Avoid open flames, electrical sparks and ignition sources.
- Do not smoke.

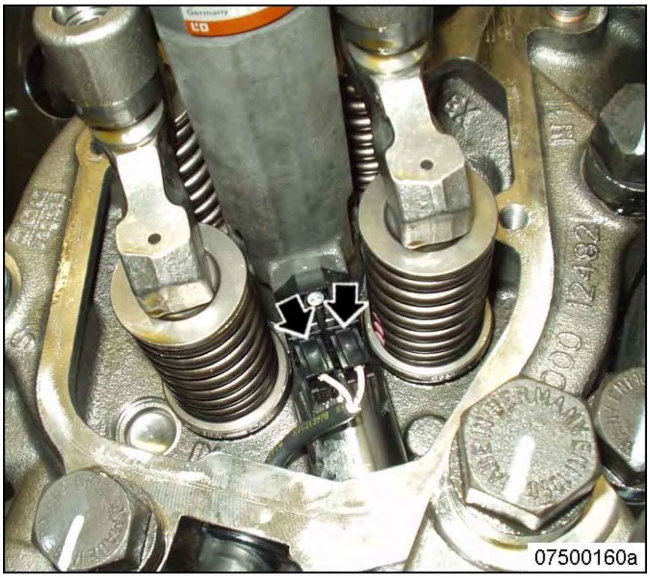
Preparatory steps

1. Shut off fuel supply to engine.
2. Remove cylinder head cover (→ Page 260).

TIM ID: 0000033680 – 005

Removing injector

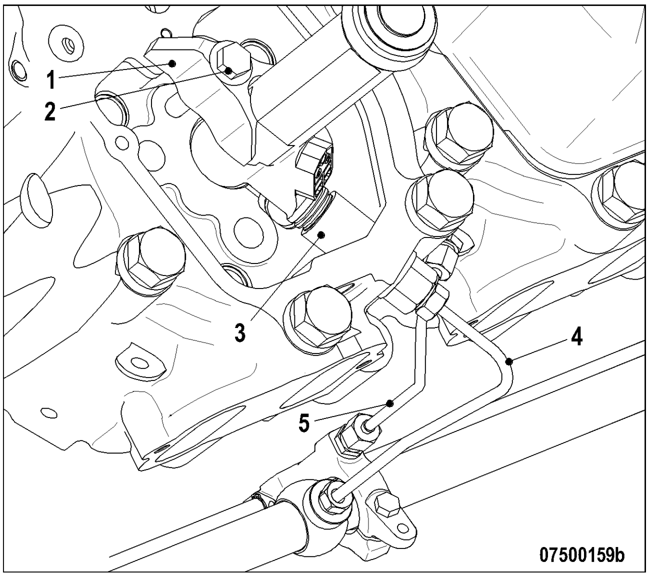
1. Disconnect cable connector on injector.



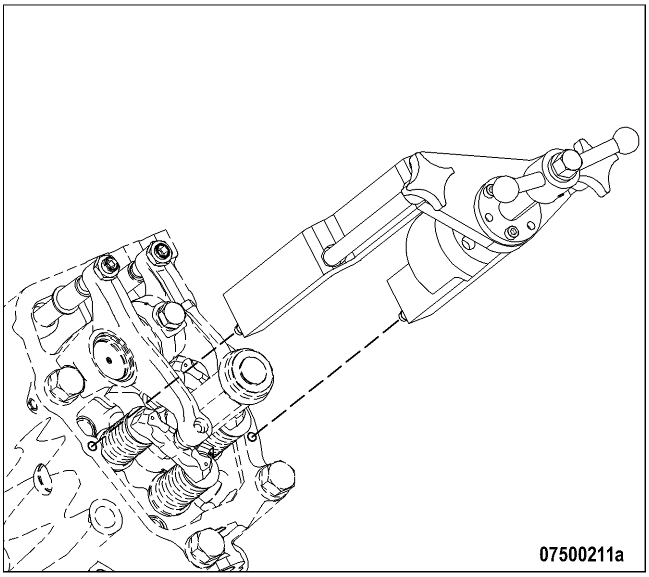
2. Remove HP fuel line (4).
3. Remove return line (5).

   Note: The injector accumulator will be emptied when removing the adapter.

4. Remove adapter (3).
5. Remove bolt (2) and take off hold-down clamp (1).

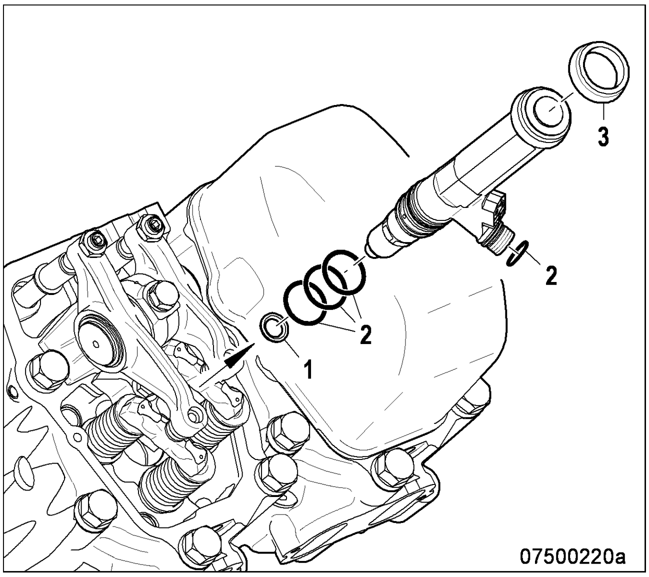


6. Install installation/removal tool on cylinder head.
7. Remove injector with installation/removal tool.
8. Remove installation/removal tool.



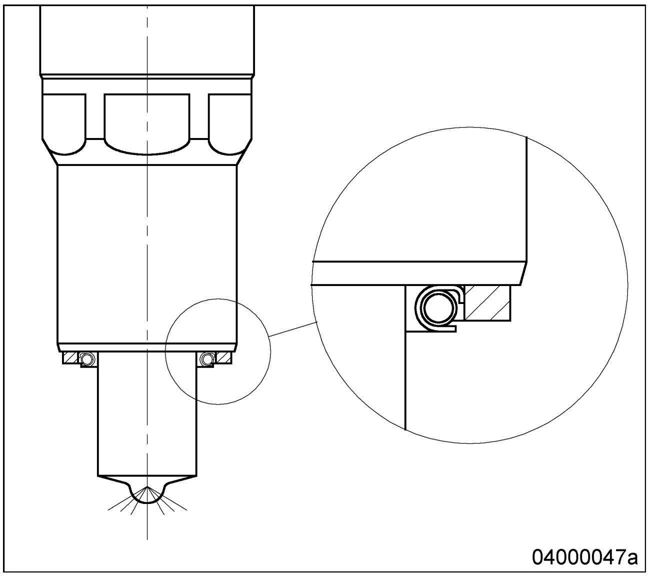
TIM ID: 0000033680 – 005

9. Remove sealing ring (1) from injector or use a self-made hook to take it out of the cylinder head.
10. Remove O-rings (2) and damper ring (3) from injector.
11. Cover all connections and bores, or seal with suitable plugs.

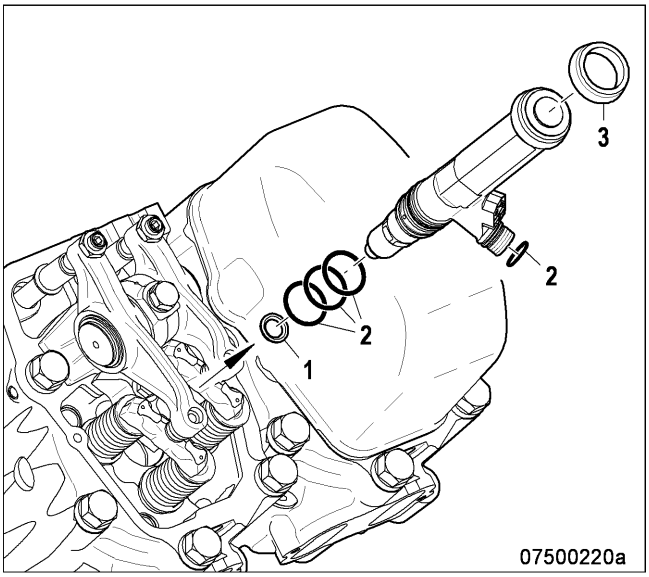


Installing injector

1. Remove plugs prior to installation. (HP line plugs must only be removed directly before adapter installation).
2. Coat injector with assembly paste in the area of the nozzle retaining nut.
3. Fit new sealing ring with grease on injector, observe installation position of sealing ring.

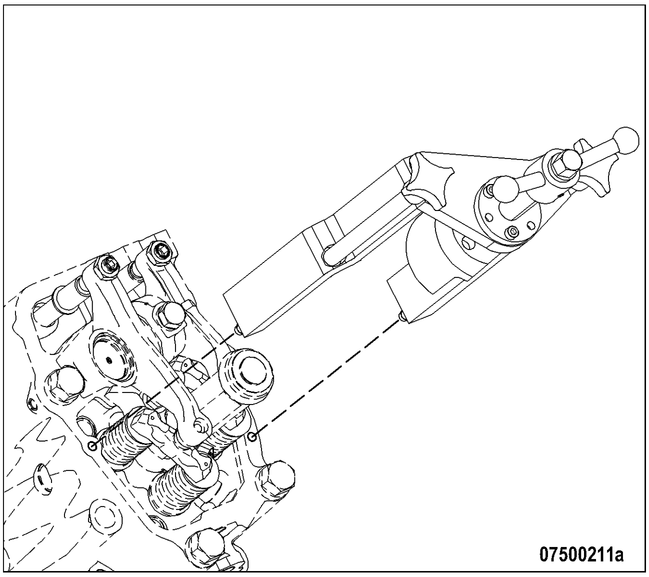


4. Install new O-rings (2) and new damper ring (3) on injector and coat with grease.

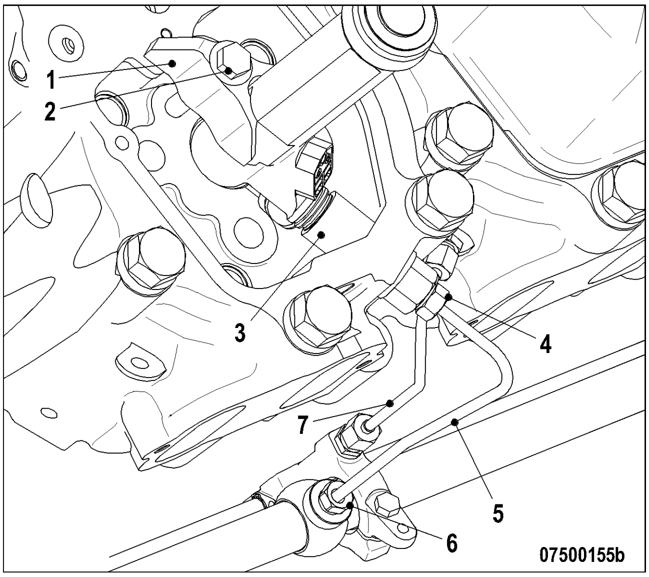


TIM ID: 0000033680 – 005

5. Clean sealing surfaces on cylinder head and protective sleeve with milling cutter.
6. Insert injector into cylinder head, ensuring that the HP line connection is aligned correctly.
7. Use installation/removal tool to press in injector.
8. Remove installation/removal tool.



9. Coat bolt mating face (2) and thread with engine oil.
10. Fit hold-down clamp (1) in the correct position and use torque wrench to tighten bolt (2) to the specified initial tightening torque.



Name	Size	Type	Lubricant	Value/Standard
Bolt	M12	Preload torque	Engine oil	**5 Nm to 10 Nm**

Note: Ensure particular cleanliness.

11. Coat thread and sealing cone of adapter (3) with engine oil.
12. Install adapter (3) and use torque wrench to tighten to the specified initial tightening torque.

Name	Size	Type	Lubricant	Value/Standard
Adapter		Preload torque	Engine oil	**5 Nm to 10 Nm**

13. Tighten bolt (2) with correct tightening torque using a torque wrench.

Name	Size	Type	Lubricant	Value/Standard
Bolt	M12	Tightening torque		**100 Nm + 10 Nm**

TIM ID: 0000033680 – 005

14. Tighten adapter (3) with correct tightening torque using a torque wrench.

Name	Size	Type	Lubricant	Value/Standard
Adapter		Tightening torque		**100 Nm + 10 Nm**

15. Install return line (7).

    Note: Ensure particular cleanliness.

16. Coat thread and sealing cone of HP line (5) with engine oil.

    Note: Two HP line versions (single- and double-walled) with different torques as described below.

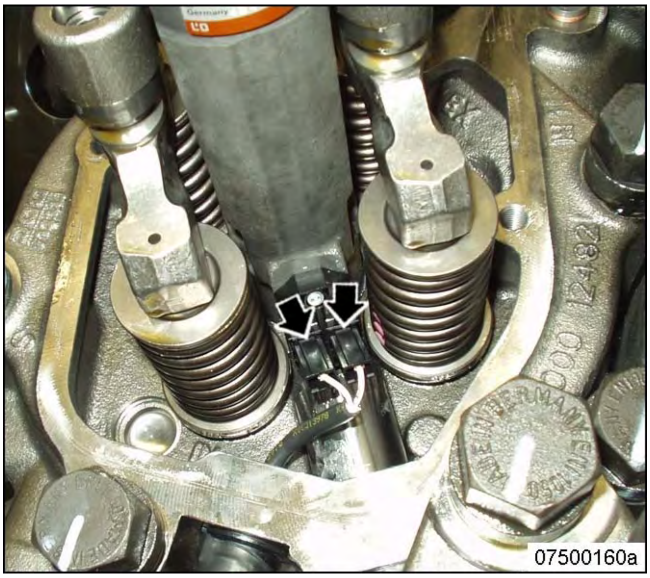
17. Tighten single-walled HP line (5) to specified tightening torque using a torque wrench.
    Tightening sequence:
    1 Rail (6)
    2 Adapter (4)

Name	Size	Type	Lubricant	Value/Standard
Union nut/ thrust screw		Tightening torque		**30 Nm + 5 Nm**

18. Tighten double-walled HP line (5) to specified tightening torque using a torque wrench.
    Tightening sequence:
    1 Adapter (4)
    2 Rail (6)

Name	Size	Type	Lubricant	Value/Standard
Union nut/ thrust screw		Tightening torque		**40 Nm + 5 Nm**

19. Install cable connector on injector.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Final steps

1. Install cylinder head cover (→ Page 260).
2. Open fuel supply to engine.

3.55 Lube-oil pump with drive – Check

Material

Designation / Use	Part No.	Qty.
Aqueous developer (standard check)	→ FLS	1
Dye penetrant, red	→ FLS	1
Penetrant remover (standard check)	→ FLS	1

Spare parts

Designation / Use	Part No.	Qty.
Oil pump	→ SPC	
Pressure reduction valve	→ SPC	
Oil line	→ SPC	
Banjo screw	→ SPC	
Screw	→ SPC	
Pipe half-clamp	→ SPC	

WARNING

Test liquid is hot and pressurized.
Risk of injury and scalding!
- Wear protective clothing, gloves, and goggles / safety mask.

TIM ID: 0000033952 – 001

Lube-oil pump with drive – Check

Item	Findings	Task
Visually inspect outside of lube-oil pump for damage and defects.	Damaged	Have lube-oil pump operation checked and repaired at manufacturer.
Visually inspect oil line for damage.	Damaged	• Corrective work • Replace
Check sealing faces for irregularities.	Uneven	• Corrective work and check for evenness with ink-check plate. • Replace
Check banjo screws for damage and threads for ease of movement.	• Damaged • Sluggish	Replace
Check drive gear with dye penetrant for cracks.	Signs of cracks	Replace
Check tooth flanks of drive gear for stress marks, indentations and chipping.	• Stress marks • Indentations • Chipping visible	• Corrective work • Replace lube-oil pump
Check screws for damage.	Damaged	Replace
Check breather valve for opening pressure of 15 bar. Test medium: Engine oil SAE 30 medium temperature: from 90 °C to 100 °C.	Opening pressure not reached or exceeded.	Replace
Disassembly of the pressure reduction valve is not planned; check for damage by visual inspection only.	Damaged	Replace
Check pressure reduction valve opening pressure. Operation: The valve limits the oil flow so that a constant pressure of 5.5 +1 bar is maintained at the last crankshaft bearing. Medium temperature: from 90 °C to 100 °C, design pressure at n/min 1.5 bar at n/max 7 bar of oil pump.	Opening pressure not reached, or exceeded.	Replace

TIM ID: 0000033952 – 001

3.56 Engine coolant – Filling

Preconditions

- Engine is stopped and starting disabled.
- MTU Fluids and Lubricants Specifications (A001061/..) are available.

Material

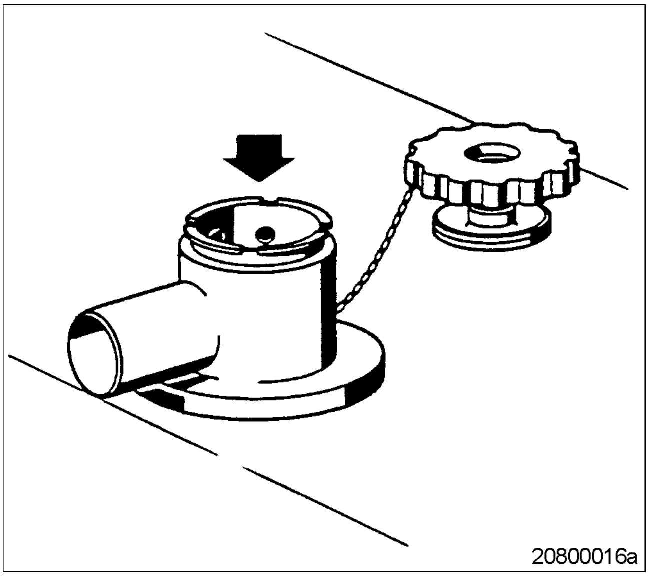
Designation / Use	Part No.	Qty.
Engine coolant	→ FLS	

⚠ **WARNING**	Coolant is hot and under pressure. **Risk of injury and scalding!** • Let the engine cool down. • Wear protective clothing, gloves, and goggles / safety mask.

⚠ **CAUTION**	Cold coolant in hot engine can cause thermal stress. **Formation of cracks in components!** • Fill / top up coolant only into cold engine.

Preparatory steps

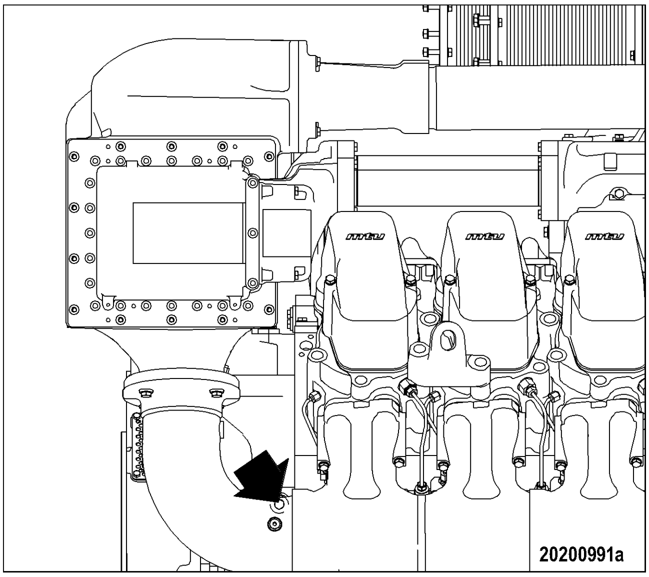
1. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.



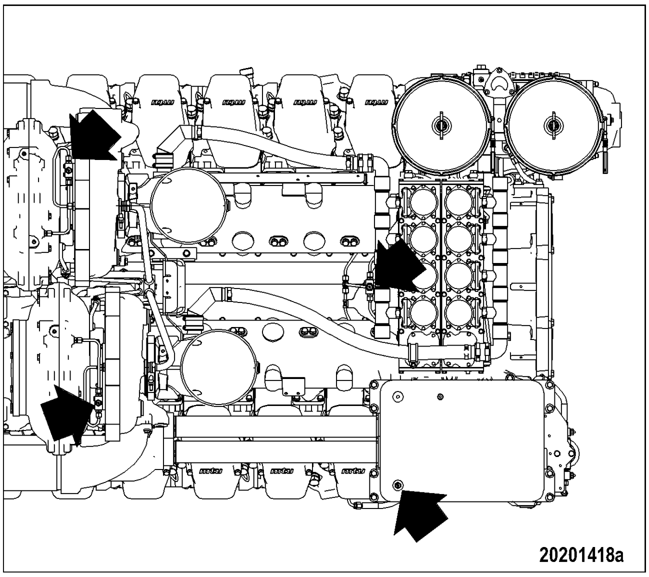
TIM ID: 0000033685 – 001

Filling with coolant using pump

1. Connect a suitable pump with a hose to drain valve (arrow).

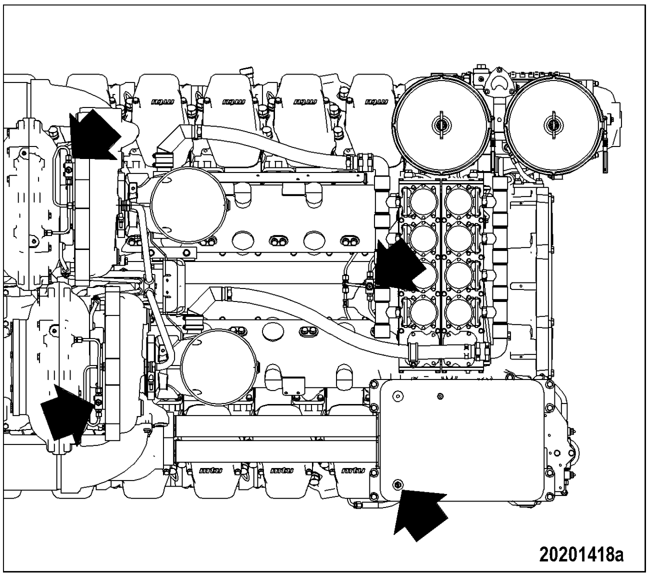


2. Open vent points at distributor, oil heat exchanger and exhaust turbochargers (arrowed).
3. Open drain valve and pump coolant into engine at 0.5 bar minimum.
4. When coolant emerges from the vents, close vents successively from bottom to top.
5. Fill expansion tank until overflow edge is reached.
6. Close drain valve.
7. Check proper condition of breather valve and clean sealing faces if required.
8. Set breather valve onto filler neck and close.
9. Start engine (→ Page 307).
10. After the engine has run without load for 10 seconds, stop engine (→ Page 308).
11. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
12. Continue to turn breather valve counterclockwise and remove.
13. Check coolant level (→ Page 208) and top up as required:
    13.1. Fill in coolant in expansion tank until the coolant level at top edge of filler neck remains constant.
    13.2. Set breather valve onto filler neck and close.
    13.3. Repeat steps from Start engine → 9. until no more coolant has to be added.
    13.4. Disconnect pump and hose.



TIM ID: 0000033685 – 001

Alternatively: Filling coolant through filler neck



1. Open vent points at distributor, oil heat exchanger and exhaust turbochargers (arrowed).
2. Fill in coolant through filler neck on expansion tank until the coolant level at top edge of filler neck remains constant.
3. When coolant emerges from the vents, close vents successively from bottom to top.
4. Check proper condition of breather valve and clean sealing faces if required.
5. Set breather valve onto filler neck and close until first stop is reached.
6. Start engine (→ Page 307).
7. After the engine has run without load for 10 seconds, stop engine (→ Page 308).
8. Turn breather valve counterclockwise and remove.
9. Check coolant level (→ Page 208) and top up as required:
   - 9.1. Repeat the steps from Start engine→ 6. until no more coolant has to be added.
   - 9.2. Check proper condition of breather valve and clean sealing faces if required.
   - 9.3. Set breather valve onto filler neck and close.

Final steps

1. Start engine and operate it without load for a few minutes.
2. Check coolant level (→ Page 208) and top up as required.

TIM ID: 0000033685 – 001

3.57 Coolant filter – Replacement

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Filter wrench	→ TC	1

Material

Designation / Use	Part No.	Qty.
Engine oil	→ FLS	

Spare parts

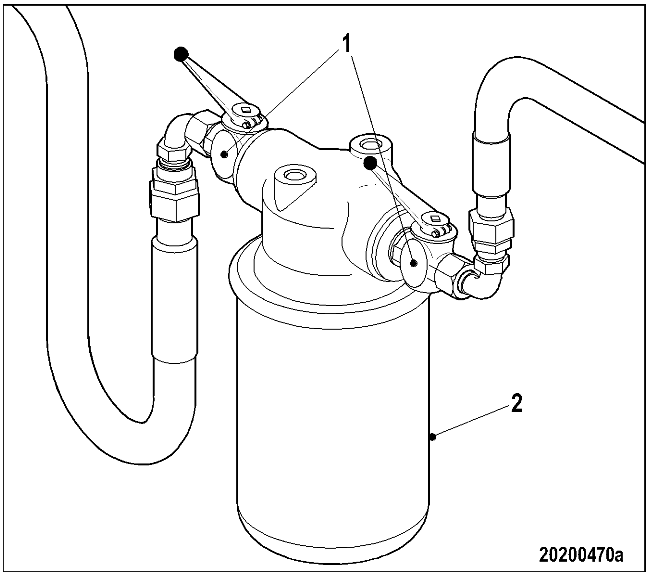
Designation / Use	Part No.	Qty.
Coolant filter	→ SPC	

WARNING

Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

Coolant filter – Replacement

1. Close shut-off cocks (1).
2. Remove coolant filter (2) with filter wrench.
3. Clean the sealing surface of the filter head.
4. Coat seal on new coolant filter with engine oil.
5. Screw on coolant filter and tighten hand-tight.
6. Open shut-off cocks (1).

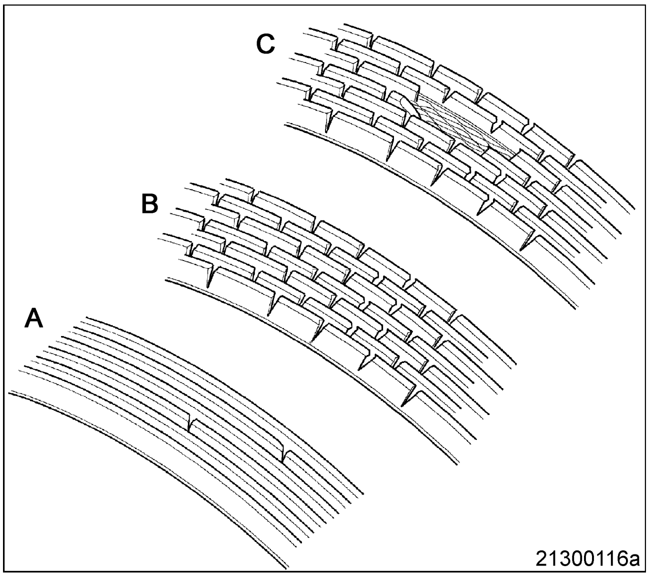


TIM ID: 0000033740 – 001

3.58 Drive belt – Condition check

Preconditions

- Engine is stopped and starting disabled.
- Guard is removed.



Item	Findings	Task
Drive belt A	Breaks in a few individual places	None
Drive belt	Belt is oily, shows signs of overheating	Replace (→ Page 247)
Drive belt B	Breaks around the entire circumference	
Drive belt C	Areas of belt material missing	

3.59 Battery-charging generator drive – Drive belt and belt tensioner replacement

Preconditions

- Engine is stopped and starting disabled.

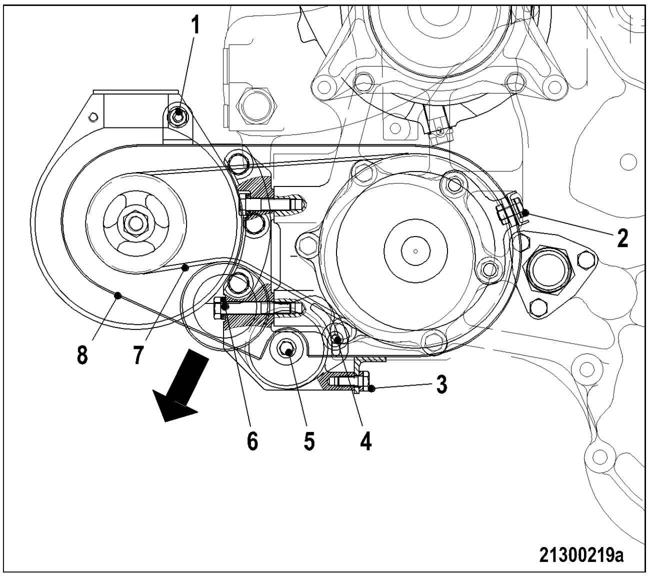
Special tools

Designation / Use	Part No.	Qty.
Torque wrench 20-100 Nm	→ TC	1
Ratchet adapter	→ TC	1

WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Replacing drive belt and belt tensioner

1. Undo screws (1), (2) and (3).
2. Remove protective cover (8).
3. Slacken screws (4) and (5) by half a turn.
4. Place socket adapter or box wrench on screw (6) and press belt tensioner in the direction indicated by the arrow as far as it will go.
5. Tighten screw (4).
6. Remove drive belt (7).
7. Screw on screw (5) and replace belt tensioner.
8. Fit new drive belt (7).



Tensioning drive belt

1. Slacken screw (4) by half a turn.
   Result: Belt tensioner moves against the drive belt and tensions it.
2. Use torque wrench to tighten screw (5) to the specified torque 42 Nm and screw (4) to 60 Nm up to 65 Nm.
3. Install protective cover (8).
4. Readjust belt tension after 30 minutes and again after 8 hours engine runtime (→ Page 294).

TIM ID: 0000033678 – 001

3.60 Charge-air coolant – Filling

Preconditions

- Engine is stopped and starting disabled.
- MTU Fluids and Lubricants Specifications (A001061/..) are available.

Material

Designation / Use	Part No.	Qty.
Charge-air coolant	→ FLS	

WARNING

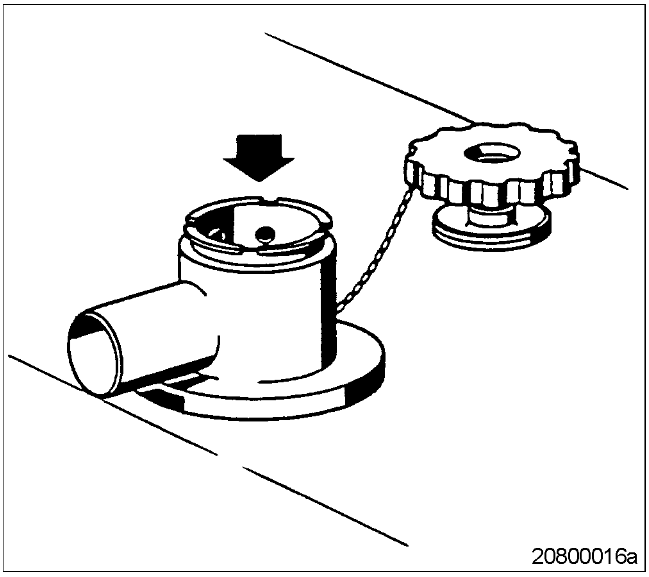
Coolant is hot and under pressure.
Risk of injury and scalding!
- Let the engine cool down.
- Wear protective clothing, gloves, and goggles / safety mask.

CAUTION

Cold coolant in hot engine can cause thermal stress.
Formation of cracks in components!
- Fill / top up coolant only into cold engine.

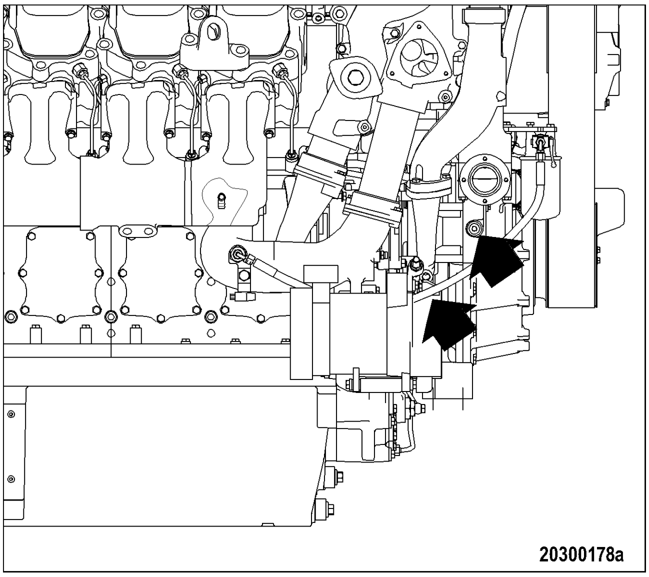
Preparatory steps

1. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.

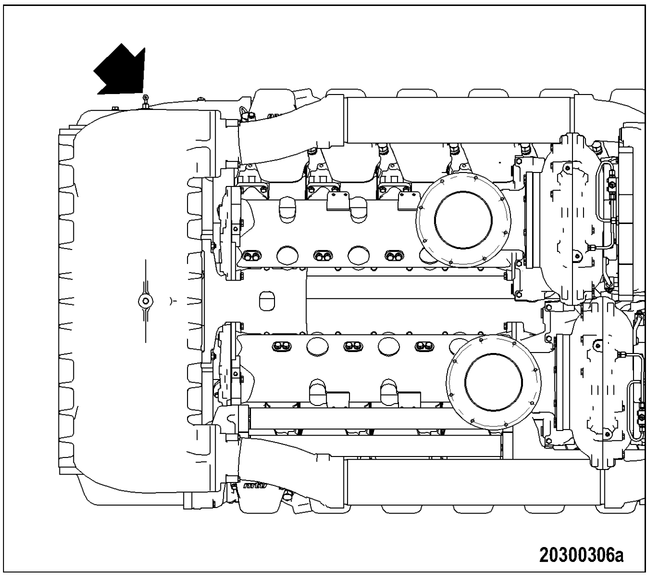


Filling with charge-air coolant using pump

1. Connect a suitable pump with a hose to one of the drain valves (arrow).



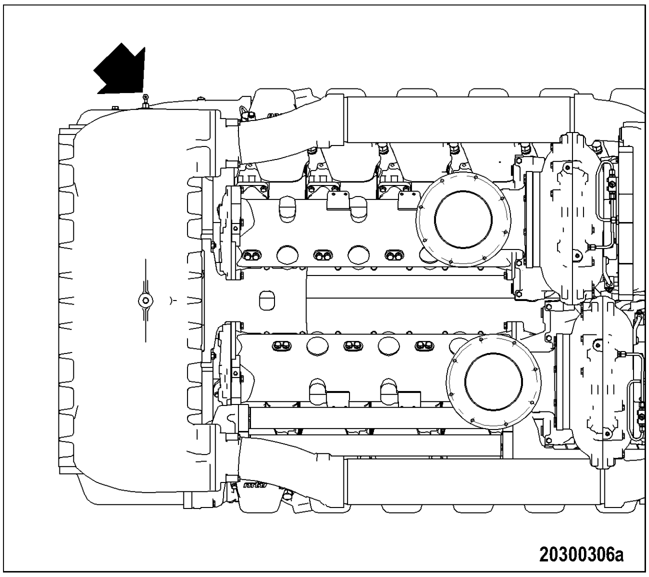
2. Open vent on intercooler (arrow).
3. Open drain valve and pump coolant into engine at 0.5 bar minimum.
4. When coolant emerges from the vent, close vent.
5. Fill expansion tank until overflow edge is reached.
6. Close drain valve.
7. Check proper condition of breather valve and clean sealing faces if required.
8. Set breather valve onto filler neck and close.
9. Start engine (→ Page 307).
10. After the engine has run without load for 10 seconds, stop engine (→ Page 308).
11. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
12. Continue to turn breather valve counterclockwise and remove.
13. Check coolant level (→ Page 298) and top up if required:
    - 13.1. Add coolant to expansion tank until the coolant level at top edge of filler neck remains constant.
    - 13.2. Set breather valve onto filler neck and close.
    - 13.3. Repeat steps from Start engine → 9. until no more coolant has to be added.
    - 13.4. Disconnect pump and hose.



TIM ID: 0000033688 – 001

Alternatively: Filling coolant through filler neck

1. Open vent on intercooler (arrow).
2. Fill in coolant through filler neck on expansion tank until the coolant level at top edge of filler neck remains constant.
3. When coolant emerges from the vent, close vent.
4. Check proper condition of breather valve and clean sealing faces if required.
5. Set breather valve onto filler neck and close until first stop is reached.
6. Start engine (→ Page 307).
7. After the engine has run without load for 10 seconds, stop engine (→ Page 308).
8. Turn breather valve counterclockwise and remove.
9. Check coolant level (→ Page 298) and top up if required:
   9.1. Repeat the steps from Start engine → 6. until no more coolant has to be added.
   9.2. Check proper condition of breather valve and clean sealing faces if required.
   9.3. Set breather valve onto filler neck and close.



Final steps

1. Start engine and operate it without load for a few minutes.
2. Check coolant level (→ Page 298) and top up if required.

TIM ID: 0000033688 – 001

3.61 Fan drive belt– Tension check / adjustment

Preconditions

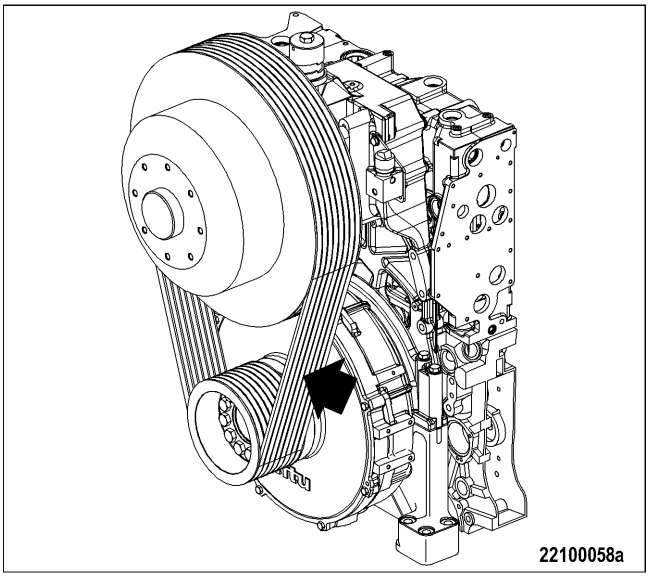
- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Optibell 2 belt tension tester	→ TC	1

Preparatory steps

1. Remove guard cover.
2. Check belt condition visually (→ Page 246).
   Result: If required, replace drive belt (→ Page 253).



Checking Vee belt tension

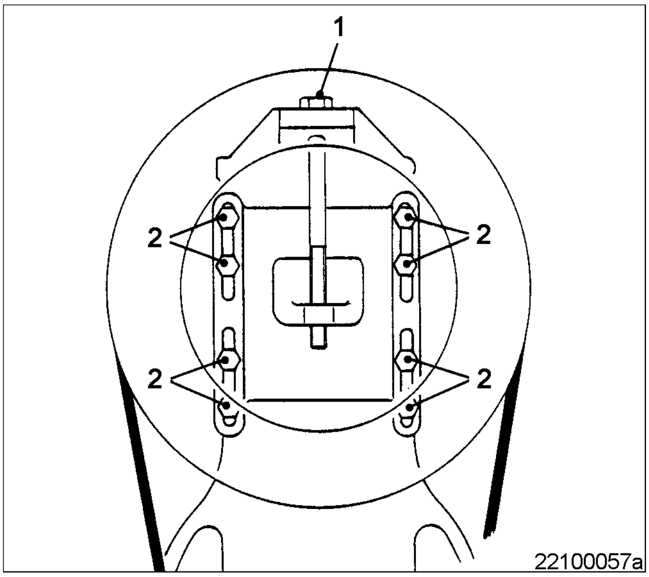
1. Switch on belt tension tester.
2. Hold measuring tip of belt tension tester over belt drive. Tap drive belt (arrowed) with a suitable tool.
3. Hold belt tension tester over belt drive until the measured value is indicated.

Initial assembly at MTU	Initial operation with fan	Belt tension adjustment
36 Hz ± 5 Hz	49 Hz ± 5 Hz	44 Hz ± 5 Hz

TIM ID: 0000033691 – 001

Adjusting drive belt tension

1. Release screws (2) until fan coupling can be moved.
2. Tighten stud (1) until the required frequency is achieved.
3. Tighten screws (2) to 250 Nm ± 25 Nm.



TIM ID: 0000033691 – 001

3.62 Fan drive belt – Replacement

Preconditions

- Engine is stopped and starting disabled.

Spare parts

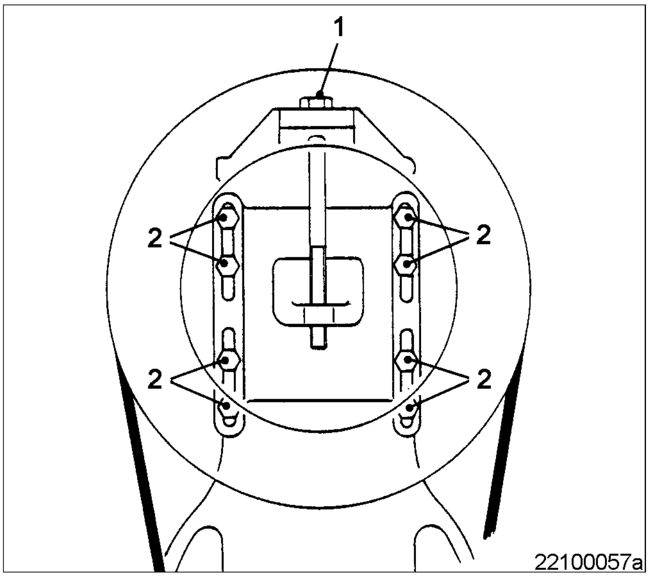
Designation / Use	Part No.	Qty.
Drive belt	→ SPC	

Preparatory steps

1. Remove guard cover.
2. Remove fan.

Replacing drive belt

1. Release screws (2).
2. Slacken off stud (1) until drive belt can be removed.
3. Clean belt pulleys.
4. Fit new drive belt on belt pulleys, ensuring that it is not under tension.
5. Adjust belt tension (→ Page 251)



TIM ID: 0000033692 – 001

3.63 Pressure sensors – Check

Preconditions

- Operating voltage switched off

Special tools

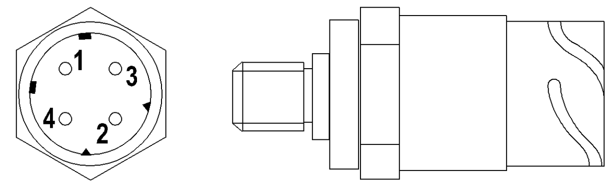
Designation / Use	Part No.	Qty.
Digital multimeter with measuring cable, measuring clips and probes	→ TC	1
Pliers for bayonet couplings	→ TC	1

DANGER

Unguarded rotating and moving engine components.
Risk of serious injury — danger to life!
- Before working on the engine, disable engine start.

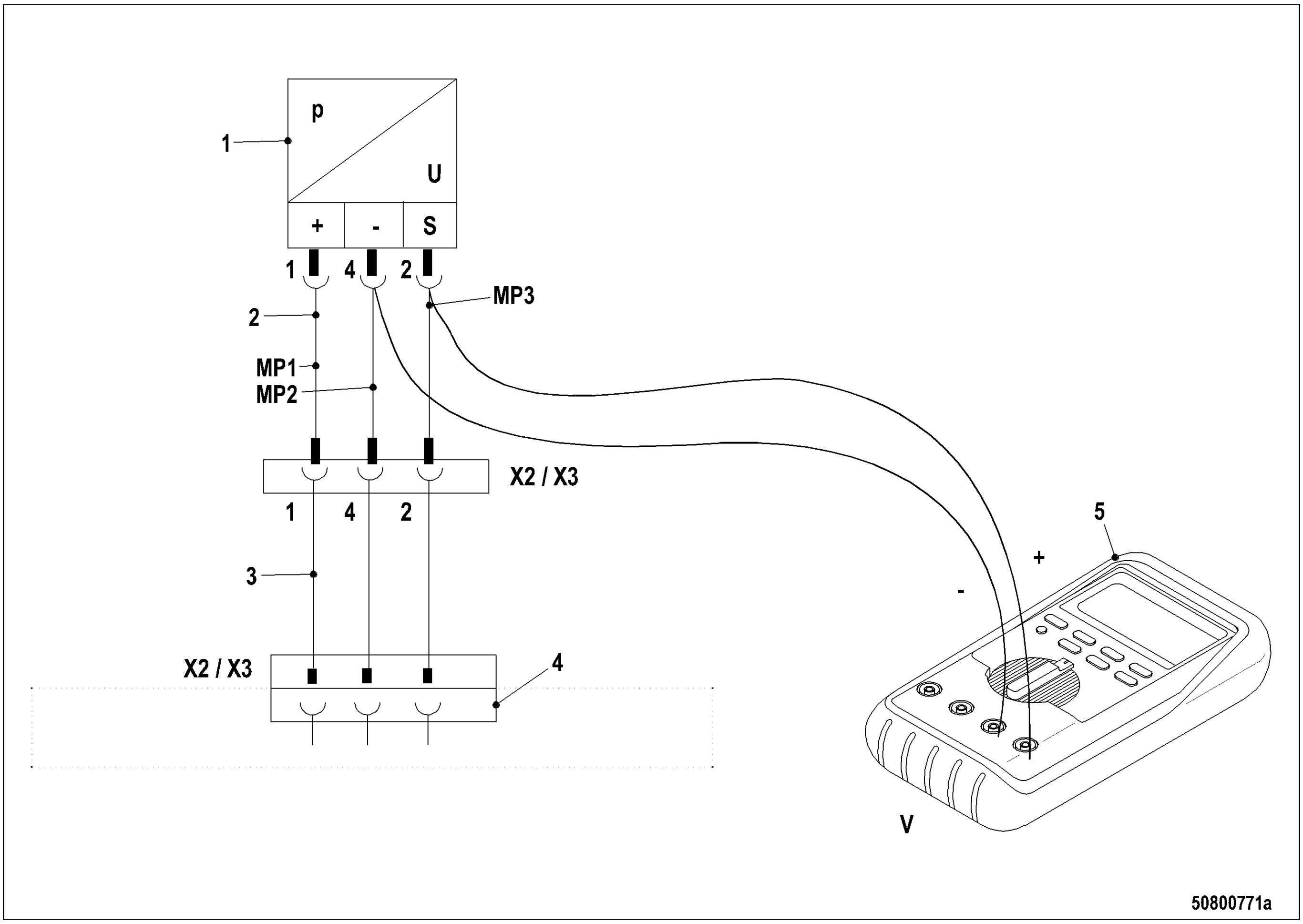
Checking a pressure sensor

1. Switch off engine and engine governor.
2. Localize the corresponding sensor connector on the engine and disconnect connector on sensor.
3. Make the three connections between pressure sensor and connector using measuring cables. Ensure that all connections are made correctly.



1 Supply voltage + 5 V DC
2 Measuring signal 0.5 V ... 4.5 V
3 Pressure balance (pin not assigned)
4 Ground

TIM ID: 0000034677 – 001



1 Pressure sensor
2 Temporary connection using measuring cables
3 Engine wiring harness
4 Engine governor, connector X2
5 Multimeter in Ω range

4. Switch on system but do not start the engine.
5. Measure point MP1 against point MP2.

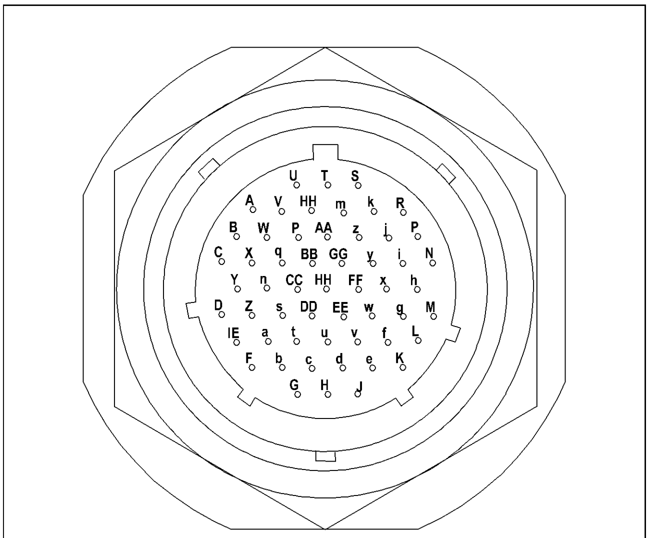
   Result: The voltage must be 5 V.
   - If this is not the case disconnect the sensor and measure the voltage on the connector of the engine wiring harness. If the voltage can be measured now, the sensor must be replaced.
   - If there is still no voltage, the wiring between the sensor and the engine governor must be checked without voltage being applied. If this connection is defective, the engine wiring harness must be replaced.
   - If the wiring is OK, the voltage must be measured directly on the engine governor connector. If there is no voltage on the relevant pin of the engine governor, the engine governor must be replaced.
6. Measure point MP2 against point MP3.

   Result: The voltage measured must be 0.5 V at a relative pressure of 0 bar. For the charge-air pressure sensor the output voltage is approx. 1 V at an ambient air pressure of 1000 mbar.
7. If the measured value deviates upwards or downwards, the sensor must be replaced.

TIM ID: 0000034677 – 001

Pin assignment: Engine governor, connector X2 – Pressure sensors

1. Connect all sensors to wiring harness.
2. Disconnect connector X2 on the engine governor.
3. Carry out measurements between the pins on the wiring harness connector. Ensure that no short circuit to other pins is caused.
4. Ensure that the probes used in connector sockets are not too thick (they would widen the sockets, thereby causing future slack joints).



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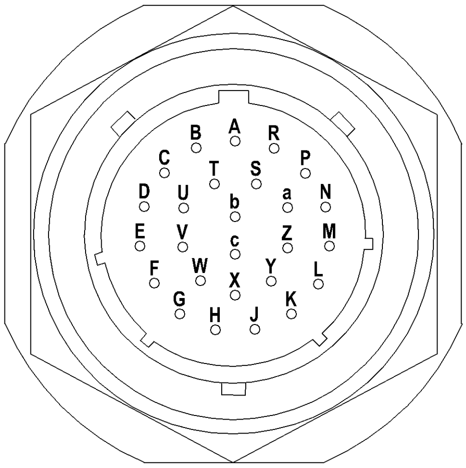
Sensor	Measured value	Pin	Signal	Measuring range	Channel
B50	Crankcase pressure	R	5 V_BUF1	+/- 70 mbar, relative pressure	DE2
		s	IN		
		CC	GND		
B34	Fuel pressure downstream of filter	BB	5 V_BUF1	0 ... 15 bar, relative pressure	DE3
		GG	IN		
		HH	GND		
B24	Oil level	D	5 V_BUF1	0 ... 150 mm	DE4
		h	IN		
		j	GND		
B5	Lube oil pressure	F	5 V_BUF1	0 ... 10 bar, relative pressure	DE5
		v	IN		
		E	GND		
B10	Charge-air pressure	c	5 V_BUF1	0.5 ... 4.5 bar, relative pressure	DE7
		g	IN		
		b	GND		

TIM ID: 0000034677 – 001

5. Carry out measurements on connector X3 as on connector X2:

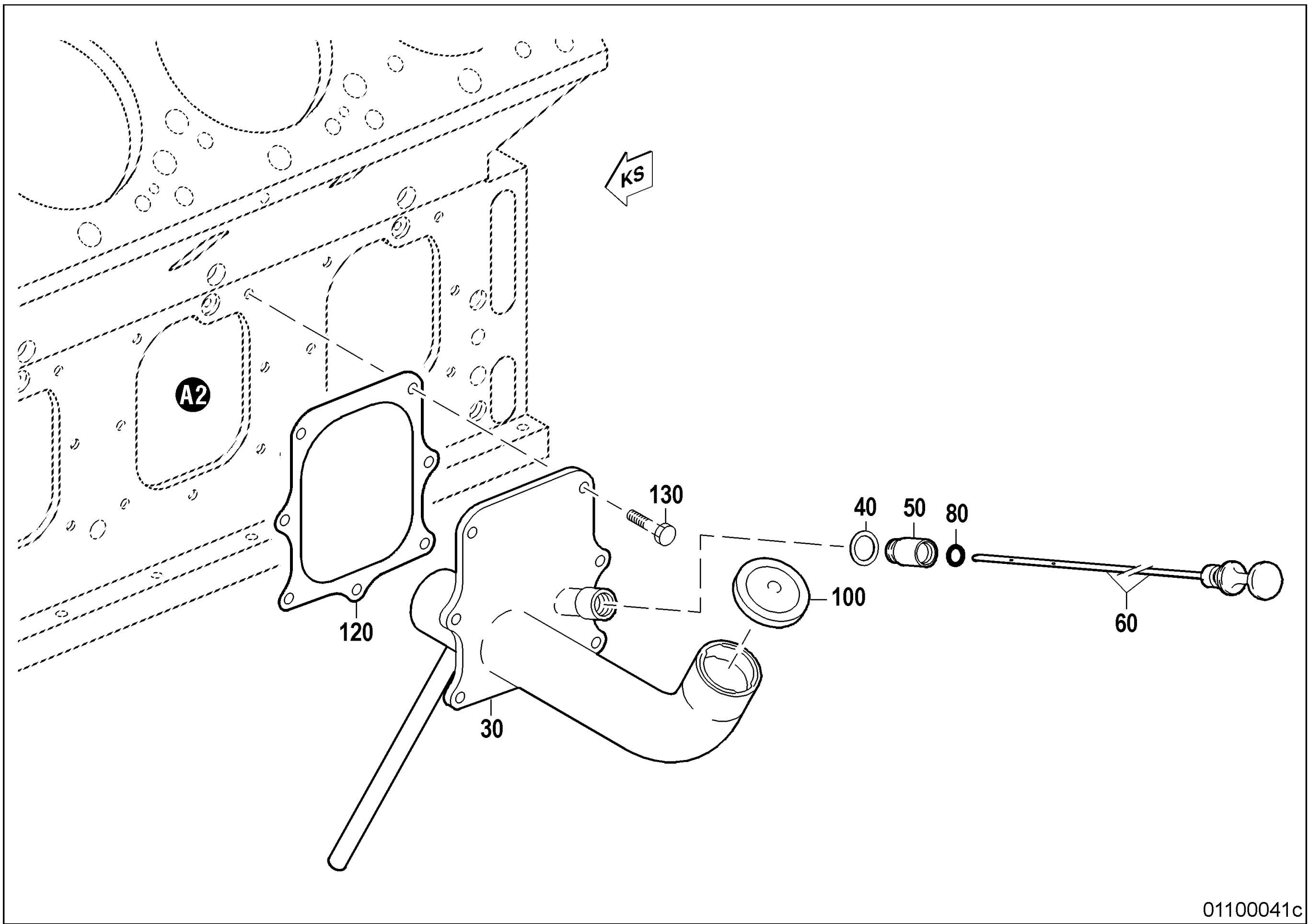


Sensor	Measured value	Pin	Signal	Measuring range	Channel
B48	Fuel pressure (HP)	b	5 V_BUF1	0 ... 1600 bar	DEH
		t	IN		
		c	GND		

6. Following testing and simulation the original system status must be restored:
   - All connectors on devices connected, bayonet union nuts secured using connector pliers, safety catches secured
   - All sensor connectors connected
   - All cables correctly connected to terminals
   - All devices closed
7. Recheck all connectors for correct connection.

TIM ID: 0000034677 – 001

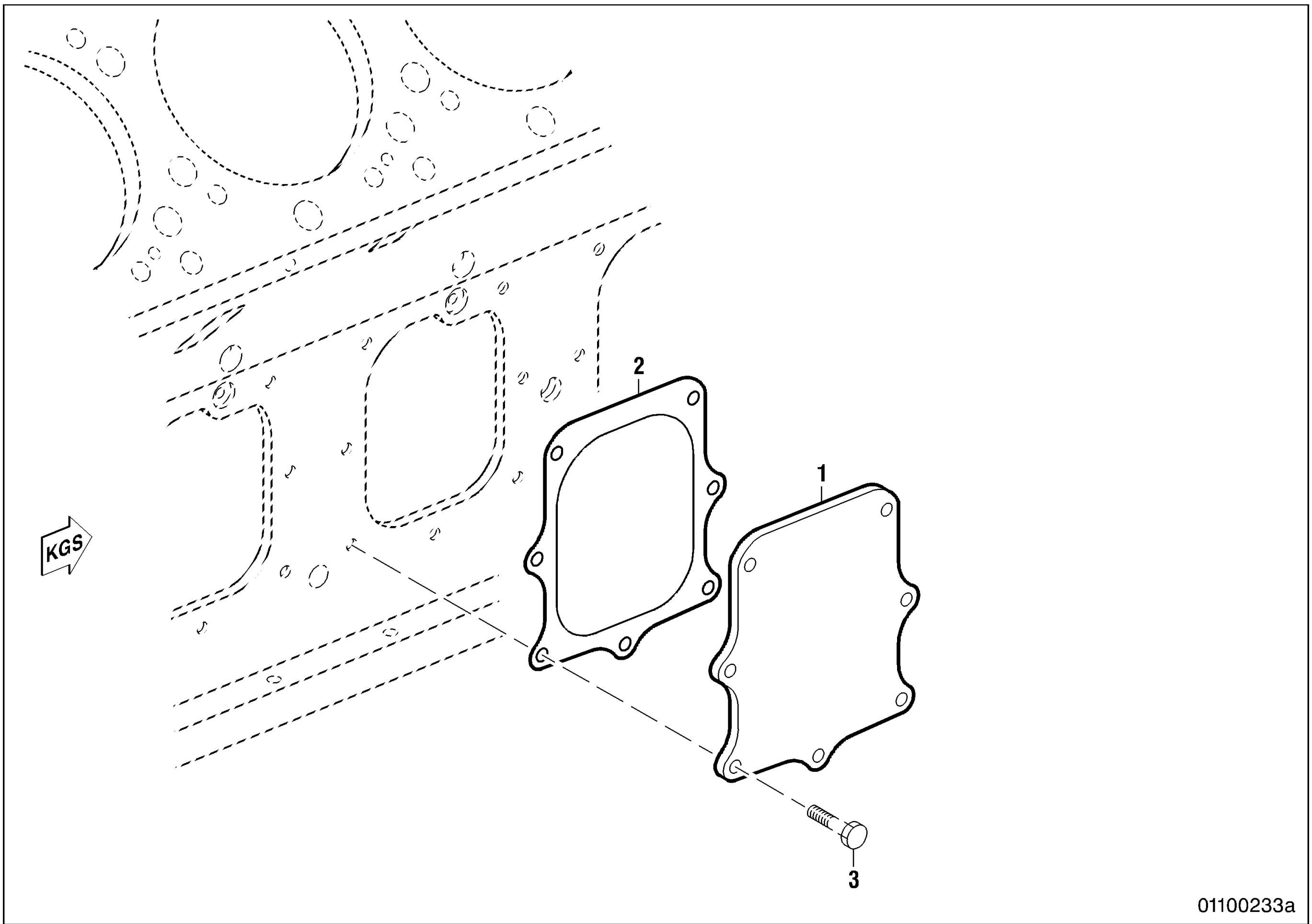
3.64 Inspection port cover – Overview



30	Inspection port cover	80	O-ring
40	Sealing ring	100	Cover
50	Union	120	Gasket
60	Oil dipstick	130	Screw

TIM ID: 0000034678 – 001

Inspection port cover – Overview



1 Inspection port cover 2 Gasket 3 Screw

3.65 Cylinder head cover – Removal and installation

Preconditions

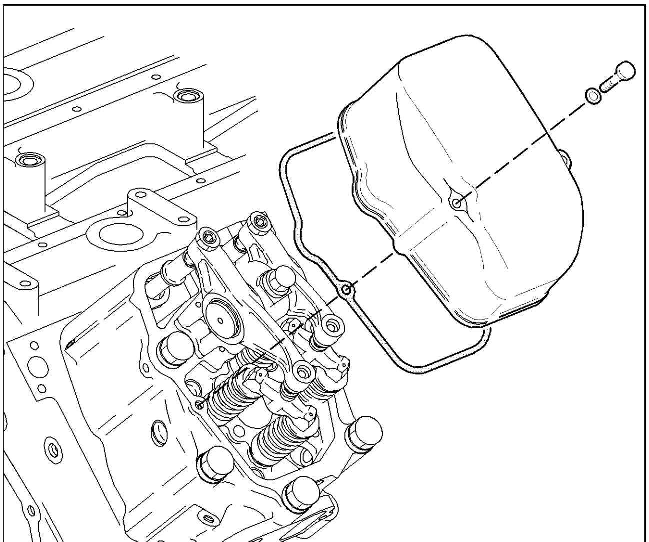
- Engine is stopped and starting disabled.

Spare parts

Designation / Use	Part No.	Qty.
Gasket	→ SPC	

Cylinder head cover removal

1. Clean very dirty cylinder head covers prior to removal.
2. Remove screws.
3. Remove cylinder head cover with gasket from cylinder head.



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Cylinder head cover installation

1. Clean mating faces.
2. Check condition of gasket, replace if necessary.
3. Place gasket and cylinder head cover on cylinder head.
4. Install cylinder head cover.

TIM ID: 0000034679 – 001

3.66 Instructions and comments on endoscopic and visual examination of cylinder liners

Terms used for endoscopic examination

Use the terms listed below to describe the condition of the cylinder-liner surface in the endoscopic examination report.

Light scoring	Minor dirt scores can occur during the assembly of a new engine (honing products, particles, broken-off burrs). Removed cylinders clearly exhibit such scoring on the running surface under endoscope magnification. Cannot be felt with the fingernail. Findings not critical.
Single scores	Clearly visible scores caused by hard particles. They usually start in the TDC area and cross through the honing pattern in the direction of stroke. Findings not critical.
Scored area	These areas consist of scores of different lengths and depths next to one another. In most cases, they are found at the 6-o'clock and 12-o'clock positions (inlet/exhaust) along the transverse engine axis. Findings not critical.
Smoothened area	Smoothened areas are changes to the running surface but almost the whole honing pattern is still visible. Smoothened areas appear brighter and more brilliant than the surrounding running surface. Findings not critical.
Polished area	Polished areas are on the running surface and show local removal of the honing pattern. Grooves from the honing process are not visible any more. New cylinder liners must be fitted in the following cases Polished area: covers more than 20% of the entire piston running surface, covers more than 30° of the circumference and extends over more than 50% of piston stroke, is wider than 15 mm over the entire piston stroke.
Discoloration	This is caused by oxidation (surface discoloration through oil or fuel) and temperature differences around the liner. It appears rather darker within the honed structure in contrast to the bright metallic running surface. The honing pattern is undisturbed. Discolorations extend in stroke direction and may be interrupted. Findings not critical.
Corrosion fields / spots	Corrosion fields / spots result from water (condensed water) with the valves in the overlap (open) position. They are clearly visible due to the dark color of the honing groove bottom. This corrosion is not critical unless there are corrosion pittings.
Black lines	Black lines are a step towards heat discoloration. They are visible as a clear discoloration from TDC to BDC in the running surface and the start of localized damage to the honing pattern. Cylinders with a number of black lines around the running surface have limited service life and should be replaced.

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Discolorations (Heat)	These are caused by a disturbance in the liner / ring tribosystem. Usually they run over the whole ring-travel area (TDC/BDC), starting at the first TDC-ring and becoming more visible from the second TDC-ring onwards and less pronounced from TDC-ring 1. The honing pattern is usually no longer visible and displays a clearly defined (straight) edge to the undisturbed surface. The damaged surface is usually discolored. The circumferential length varies. Liners with heat discoloration starting in the TDC-ring 1 have to be replaced.
Seizures, Seizure marks	Seizure marks are of irregular circumferential length and depth. Can be caused by either the piston skirt or the piston crown. Material deposits on the liner (smears) show heavy discoloration and scoring. Replace liner.

Evaluation of findings and further measures

The findings in the start phase of oxidation discoloration and heat discoloration are similar. Thorough investigation and compliance with the above evaluation criteria allows a definite evaluation. To avoid unnecessary disassembly work, it is recommended that another inspection be carried out after further operation of the engine.

3.67 Conrod - Assembly

Special tools

Designation / Use	Part No.	Qty.
Torque wrench, 60-320 Nm	→ TC	1
Torque wrench, 300-800 Nm	→ TC	1
Socket, SW 22	→ TC	1
Ratchet adapter	→ TC	1

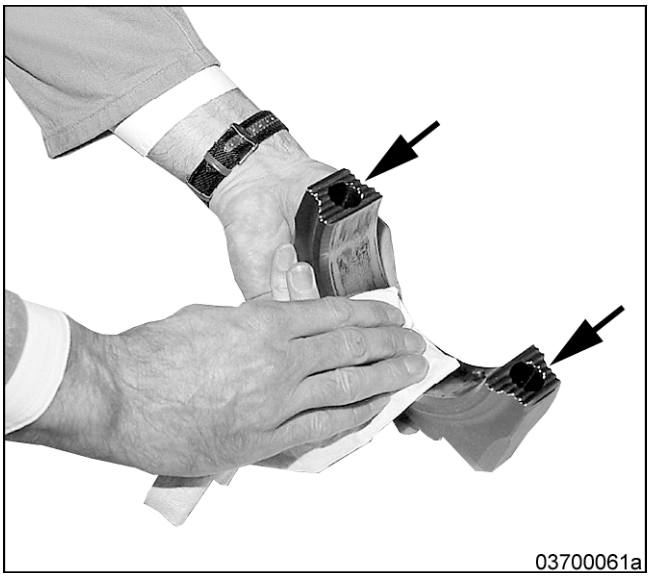
Material

Designation / Use	Part No.	Qty.
Engine oil	→ FLS	

WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.
CAUTION	Contamination of components. **Damage to component!** • Observe manufacturer's instructions. • Check components for special cleanness.
CAUTION	Incorrect installation of components and lines. **Damage to component!** • Ensure that components/lines are installed so that they are never under tension or strain. • Ensure correct installation position of components.

Preparing conrod

1. Blow out mating faces (arrows) on conrod and conrod bearing cap with compressed air and clean.
2. Wipe bearing shell mating faces on conrod and conrod bearing cap.
3. Before installing bearing shells, compare repair stage data on conrod and on crankshaft data sheet.
4. Mark bearing shells according to cylinder number on end face.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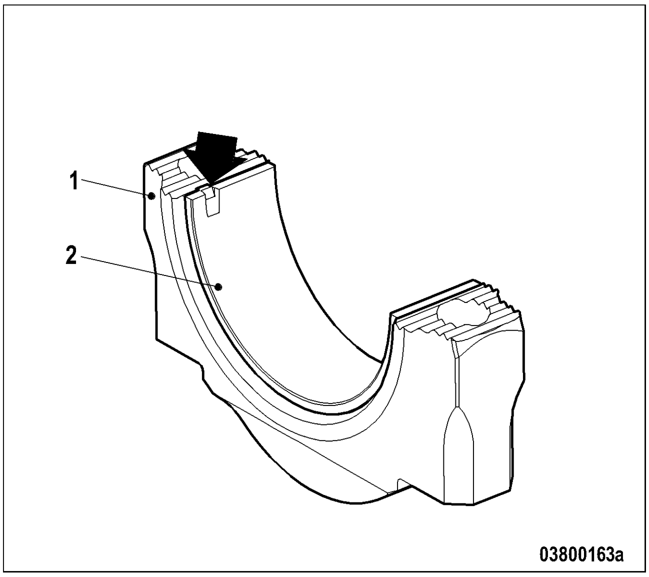
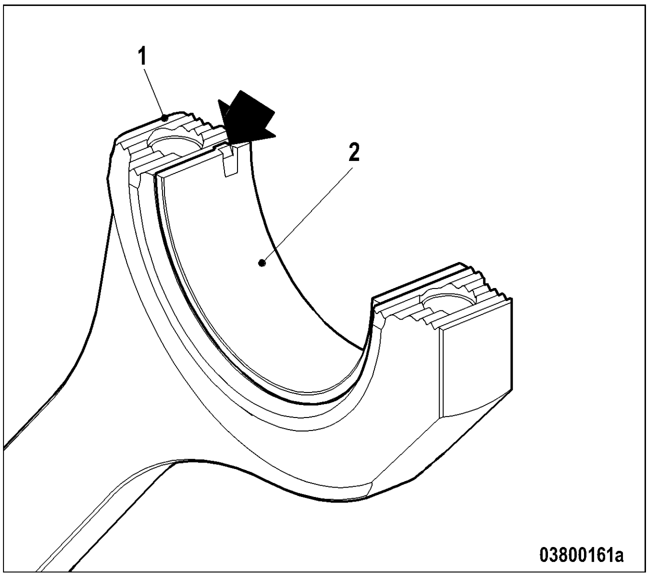
5. Insert lower conrod bearing shell (2) with securing lug (arrow) in groove of conrod bearing cap (1).



6. Clamp conrod in assembly trolley or in bench vise with aluminum jaws with mating face in horizontal position.
7. Insert upper conrod bearing shell (2) with securing lug (arrow) in groove of conrod (1).
8. Carefully press conrod bearing cap by hand onto conrod.
9. Coat threads of conrod bearing screws and screw head seating surfaces with engine oil.



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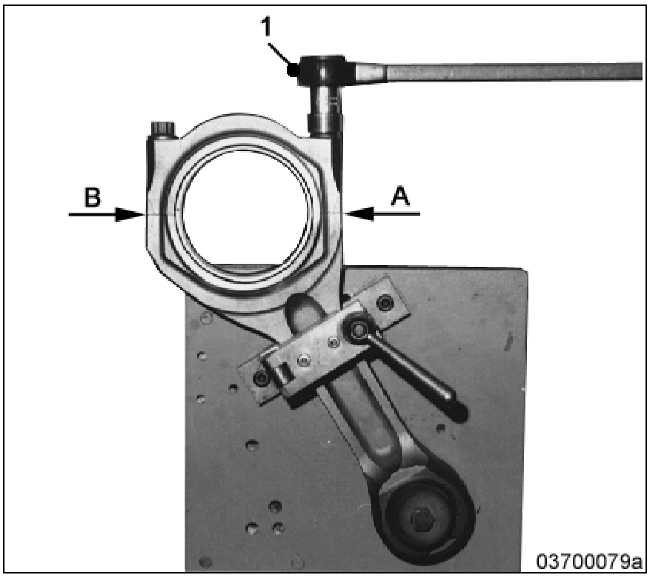
Note: Thread must not be recut.

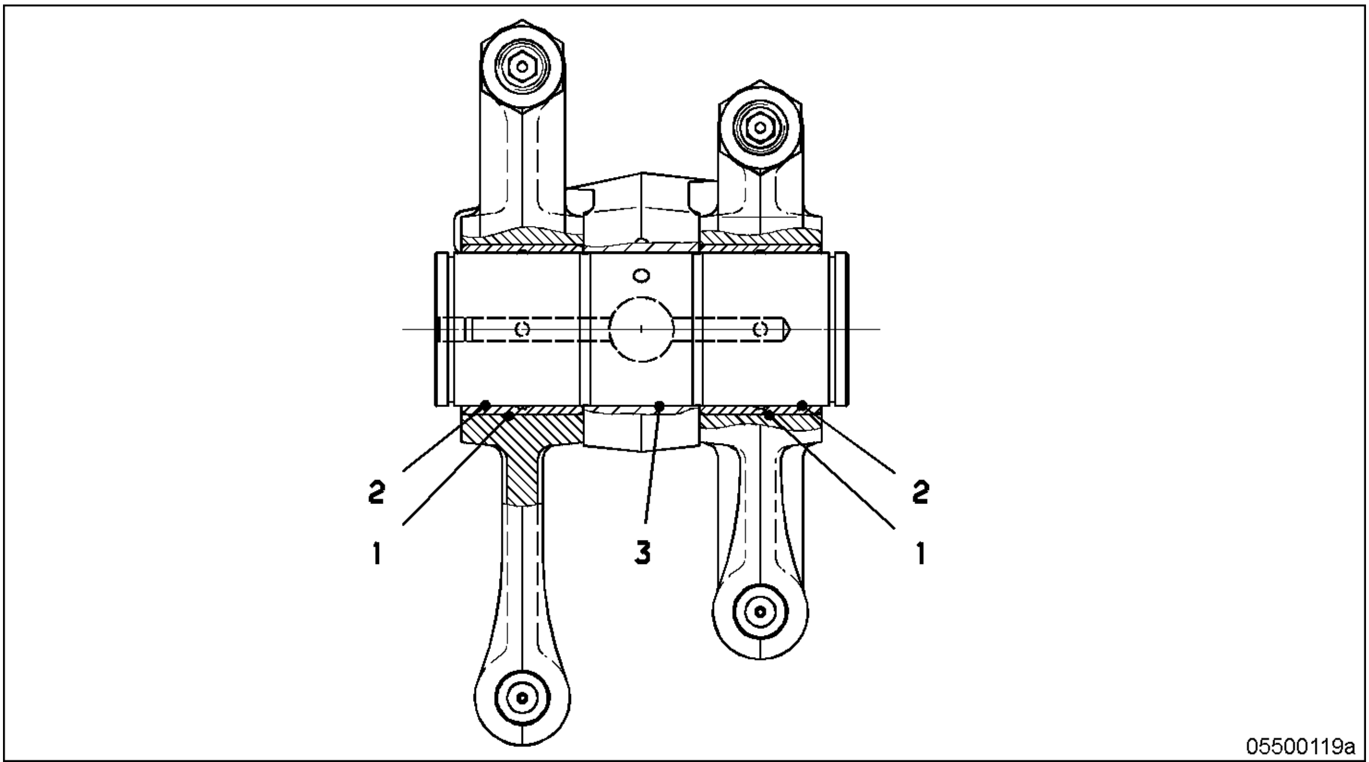


10. Carefully insert conrod bearing screw into bore in conrod bearing cap by hand until initial contact with thread flanks is established, then turn first three turns without a tool.
11. Install conrod bearing screws until screw heads make contact and use socket wrench to tighten firmly by hand. Ensure that conrod and conrod cap serrations is closed at short and long conrod arms.
12. Use torque wrench (1) to tighten conrod bearing screws to specified tightening torque . Tightening sequence:
12.1.Short arm
12.2.Long arm

Name	Size	Type	Lubricant	Value/Standard
Conrod screw	M20 x 1.5	Preload torque	Engine oil	**240 Nm +20 Nm**
Conrod screw	M20 x 1.5	Residual angle of rotation		**90° +10°**
Conrod screw	M20 x 1.5	Control torque		**450 Nm +20 Nm**

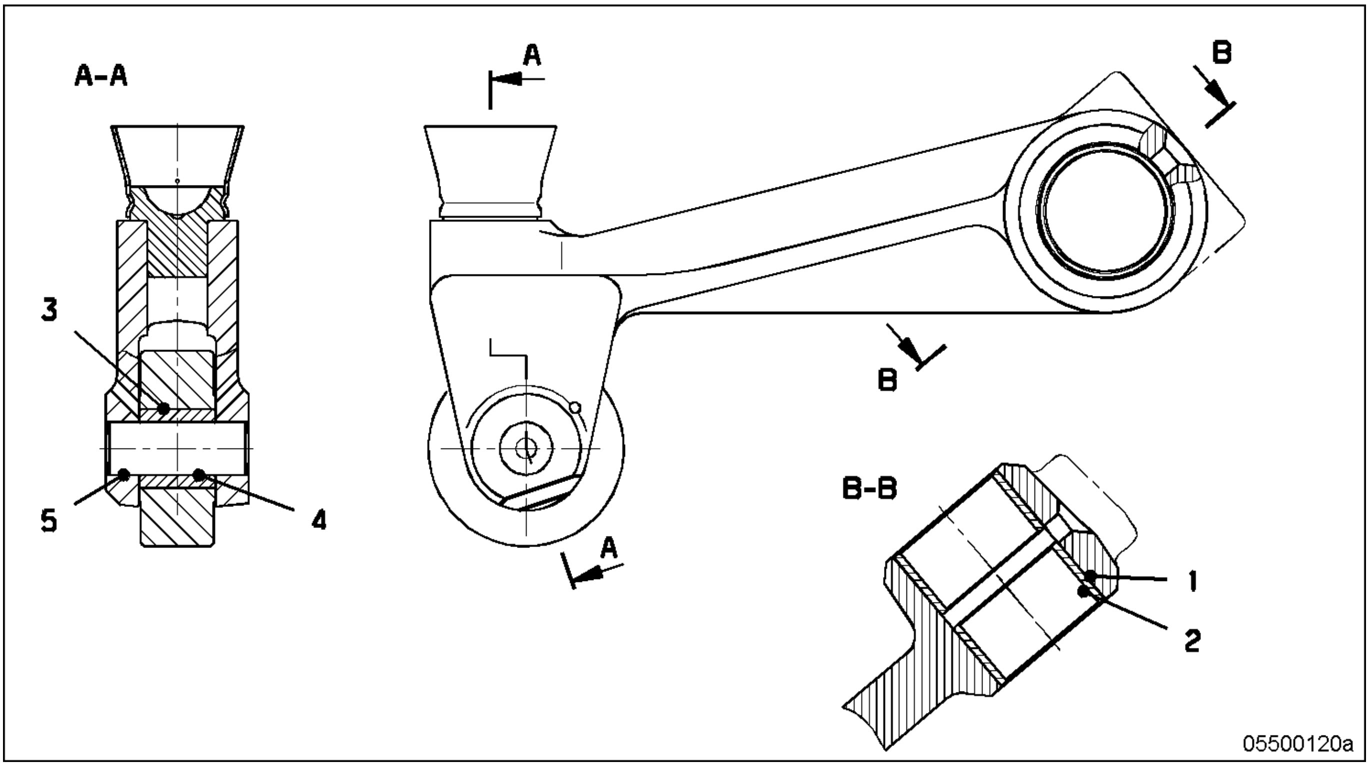
3.68 Valve drive – Tolerances

Rocker shaft support, inlet and exhaust



No.	Designation	Repair size	Tol. size Basic size	Deviation		Clearance		Interference		Wear limit
				lower	upper	min.	max.	min.	max.	
1	Rocker arm bore		50.000 ^{H7}	0	+0.025			0.018	0.059	
	Bush OD		50.000 $_{s6}$	+0.043	+0.059					
2	Bush bore									
	installed		45.000	0	+0.050	0.025	0.091			Clearance max. 0.100
	removed		45.000 ^{E6}	+0.050	+0.066					
	Rocker shaft OD		45.000 $_{f6}$	–0.041	–0.025					
3	Rocker shaft support bore		45.000 ^{U7}	–0.086	–0.061			0.020	0.061	
	Rocker shaft OD		45.000 $_{f6}$	–0.041	–0.025					

Swing follower support, inlet and exhaust



No.	Designation	Repair size	Tol. size Basic size	Deviation lower	Deviation upper	Clearance min.	Clearance max.	Interference min.	Interference max.	Wear limit
1	Swing follower bore		36.000^{H7}	0	+0.025			0.018	0.059	
	Bush OD		36.000_{s6}	+0.043	+0.059					
2	Bush bore									
	installed		32.000	0	+0.050	0.025	0.091			Clearance max. 0.100
	removed		32.000^{E6}	+0.050	+0.066					
	Shaft OD		32.000_{f6}	–0.041	–0.025					
3	Roller bore		21.000^{E7}	+0.040	+0.061	0.040	0.082			Clearance max. 0.090
	Bush OD		21.000^{H7}	–0.021	0					
4	Bush bore		14.000^{E7}	+0.032	+0.050	0.032	0.058			Clearance max. 0.065
	Pin OD		14.000_{h5}	–0.008	0					
5	Swing follower bore		14.000^{P6}	–0.026	–0.015			0.007	0.026	
	Bush OD		14.000_{h5}	–0.008	0					

3.69 Temperature sensors – Check

Preconditions

- Operating voltage switched off

Special tools

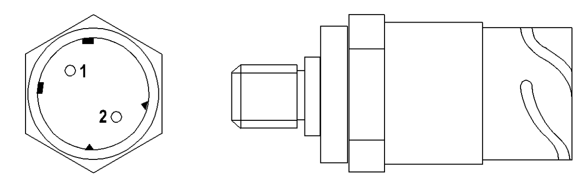
Designation / Use	Part No.	Qty.
Digital multimeter with measuring cable, measuring clips and probes	→ TC	1
Pliers for bayonet couplings	→ TC	1

⚠ **DANGER**	Unguarded rotating and moving engine components. **Risk of serious injury — danger to life!** • Before working on the engine, disable engine start.

Checking a temperature sensor (Pt100 and Pt1000)

1. Switch off engine and engine governor.
2. Localize the corresponding sensor connector on the engine and disconnect connector on sensor.
3. Measure the resistance between pins 1 and 2.

   Result: With the engine cold (room temperature 20°C) it must be:
   - Pt100 approx. 100 Ω (see table)
   - Pt1000 approx. 1000 Ω (see table)
     In addition the resistance between each pin and ground (metal housing) must be measured. It must exceed 1 MΩ. If the resistances deviated significantly, the sensor must be replaced.
   - If the resistances are within tolerance, the wiring (in corrugated pipe) between the engine governor and the sensor must be checked. To do this, the connector on the sensor must be connected. Subsequently the connector on the engine governor must be disconnected. The following table indicates the connection of the sensors on the connectors of the engine governor (assignment of sensor connector to pins). The three resistance measurements must be repeated as per step 3 (pins against each other and against ground). If the measurement results gained on the engine governor connector deviate significantly from those gained directly on the sensor, the wiring harness must be replaced.
   - If the measured values are within tolerance (deviation approx. 40%), the relevant input on the engine governor is defective and it must be replaced.



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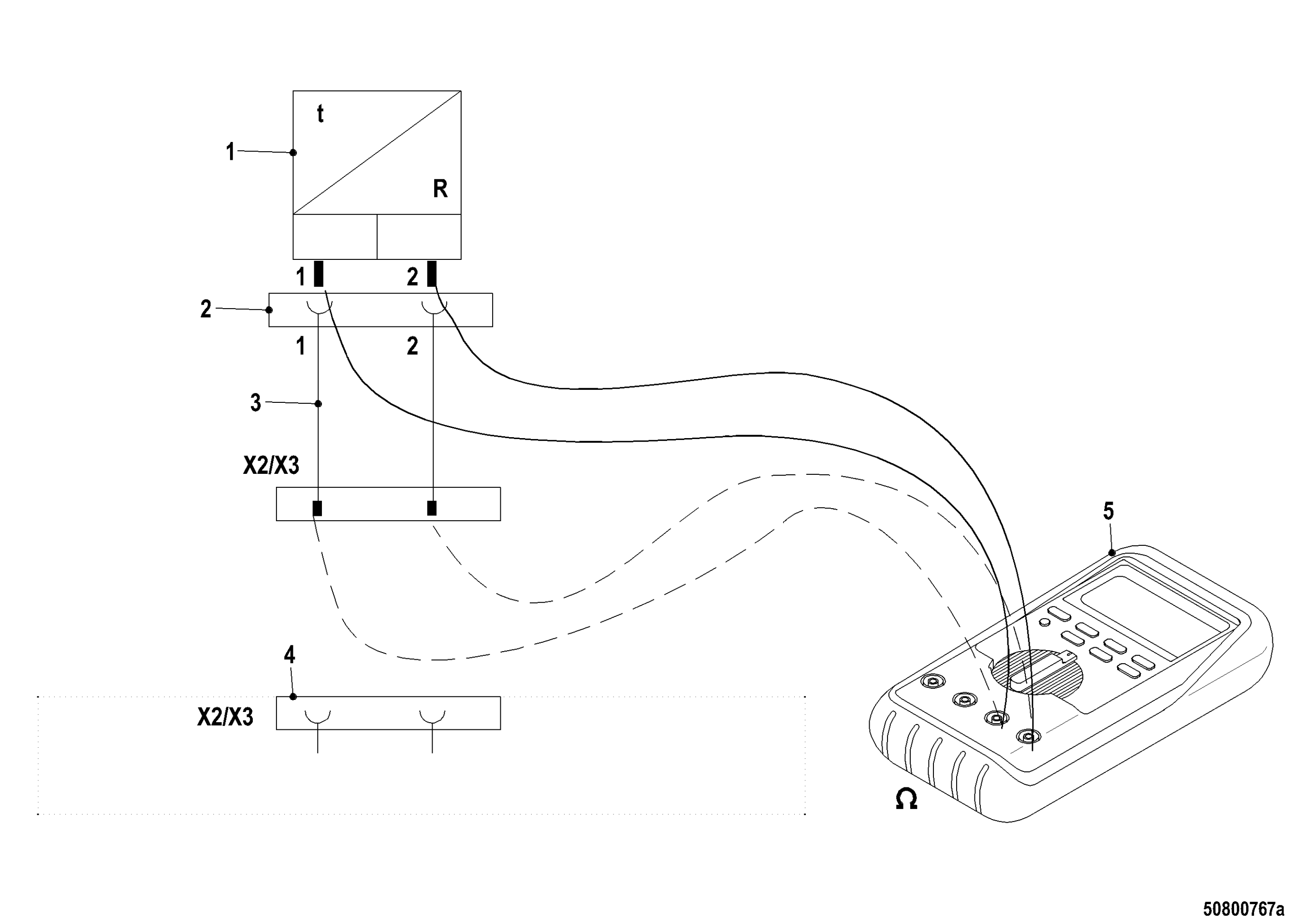
TIM ID: 0000034683 – 001



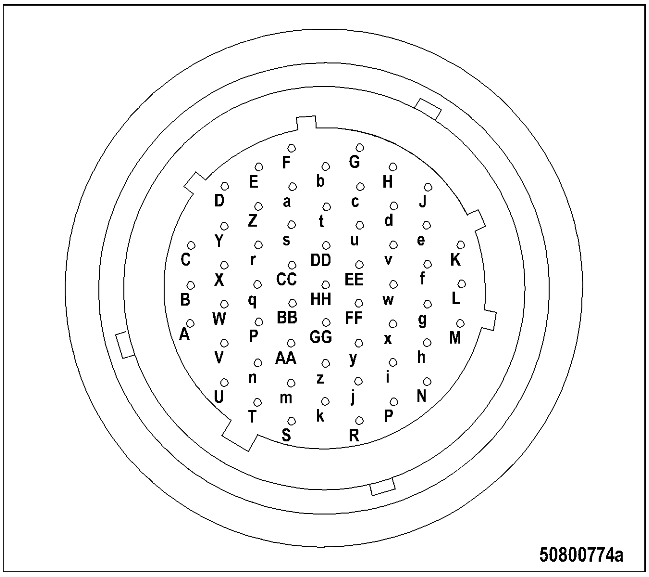
1 Temperature sensor
2 Connector on sensor
3 Engine wiring harness
4 Connectors X2, X3 on engine governor
5 Multimeter in Ω range

4. Connect connector to sensor.

TIM ID: 0000034683 – 001

Pin assignment: Engine governor, connector X2 – Temperature sensors

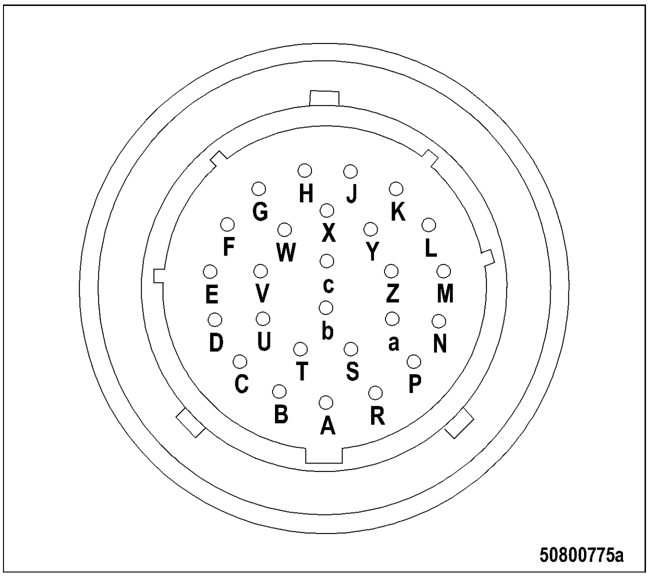
1. Connect all sensors to wiring harness.
2. Disconnect connector X2 on the engine governor.
3. Carry out measurements between the pins on the wiring harness connector. Ensure that no short circuit to other pins is caused.
4. Ensure that the probes used in connector sockets are not too thick (they would widen the sockets, thereby causing future slack joints).



Sensor	Measured value	Pin	Signal	Remarks	Measuring range	Channel
Engine governor, connector X2						
B6	Coolant temperature	k	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE1
		z	GND			
B9	Charge-air temperature	N	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE2
		P	GND			
B3	Intake-air temperature	M	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE5
		g	GND			
B26	Coolant temperature, intercooler	y	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE6
		FF	GND			
B7.1	Lube oil temperature	W	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE7
		x	GND			
B4.21	Combined exhaust temperature, A-bank	t	IN	Pt100, resistance between 100 Ω and 360 kΩ	0 °C... 1000 °C	TE8
		a	GND			
B4.22	Combined exhaust temperature, B-bank	E	IN	Pt100, resistance between 100 Ω and 360 kΩ	0 °C... 1000 °C	TE9
		F	GND			

Pin assignment: Engine governor, connector X3 – Temperature sensors

1. Connect all sensors to wiring harness.
2. Disconnect connector X3 on the engine governor.
3. Carry out measurements between the pins on the wiring harness connector. Ensure that no short circuit to other pins is caused.
4. Ensure that the probes used in connector sockets are not too thick (they would widen the sockets, thereby causing future slack joints).

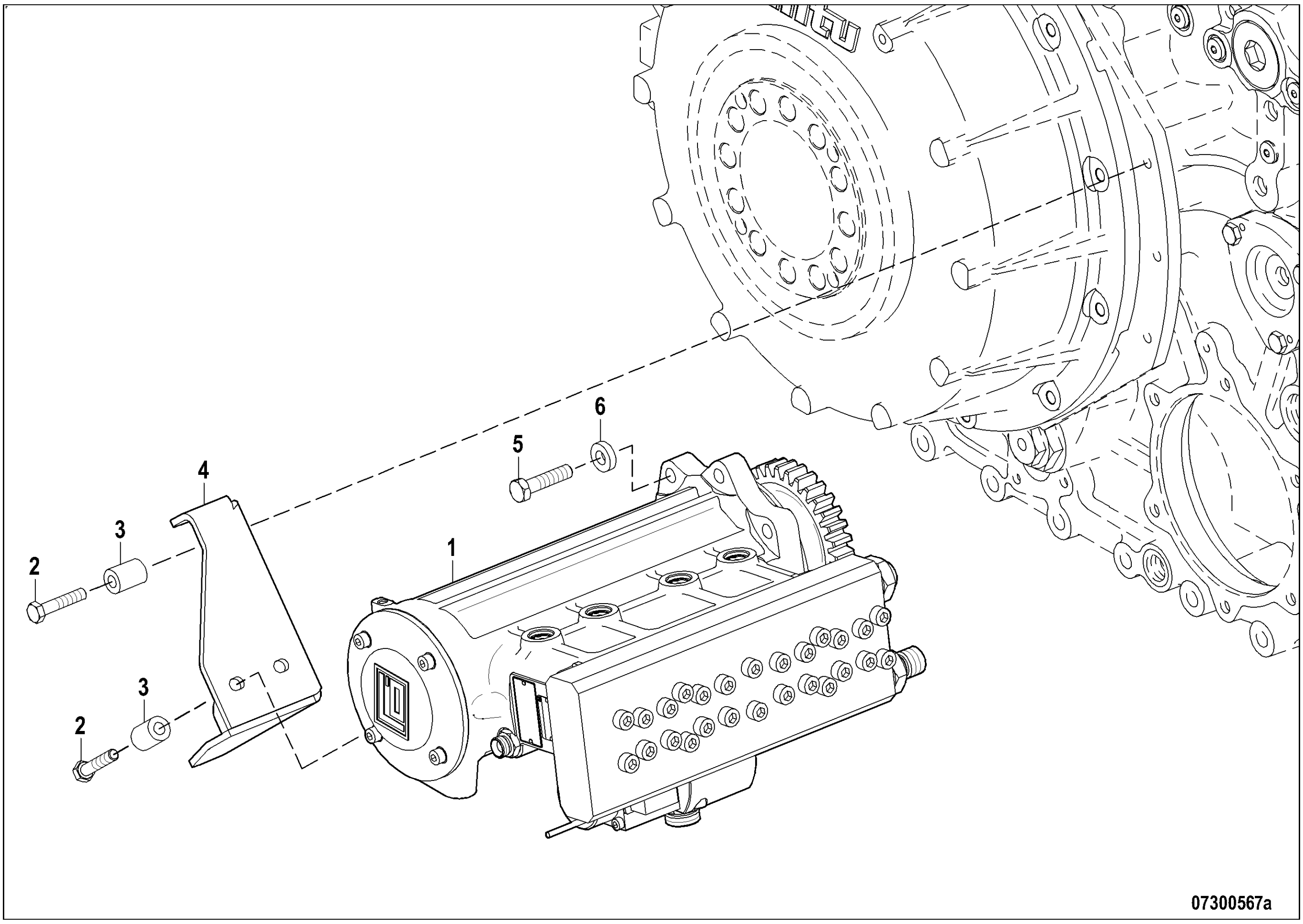


Sensor	Measured value	Pin	Signal	Remarks	Measuring range	Channel
Engine governor, connector X3						
B33	Fuel temperature, common rail	b	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE3
		c	GND			
B7.2	Oil temperature in oil pan	E	IN	Pt1000, resistance between 1 kΩ and 1.5 kΩ	-40 °C... 150 °C	TE10
		D	GND			

5. Following testing and simulation the original system status must be restored:
   - All connectors on devices connected, bayonet union nuts secured using connector pliers, safety catches secured
   - All sensor connectors connected
   - All cables correctly connected to terminals
   - All devices closed
6. Recheck all connectors for correct connection.

TIM ID: 0000034683 – 001

3.70 High-pressure pump – Overview



1 High-pressure fuel pump	3 Spacer bushing	5 Screw
2 Screw	4 Retainer	6 Washer

TIM ID: 0000034684 – 001

3.71 Fuel – Draining

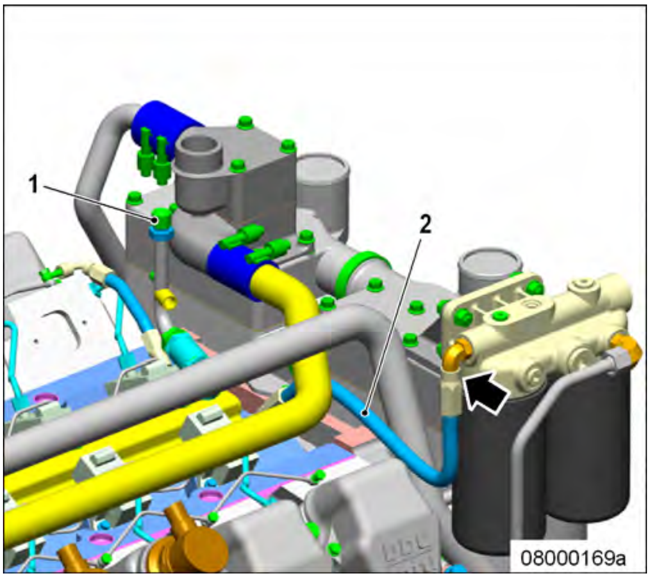
Preconditions

- Engine is stopped and starting disabled.

WARNING	Fuels are combustible. **Risk of fire and explosion!** • Avoid open flames, electrical sparks and ignition sources. • Do not smoke.

Fuel – Draining

1. Release union (1) on fuel return line to tank.
2. Remove hose line (2) on filter head (see arrow).
3. Hold hose line (2) end down and collect emerging fuel in a suitable container.
4. When fuel no longer emerges, install hose line (2).
5. Tighten union (1).



TIM ID: 0000034685 – 001

3.72 Engine – Barring manually

Preconditions

- Engine is stopped and starting disabled.

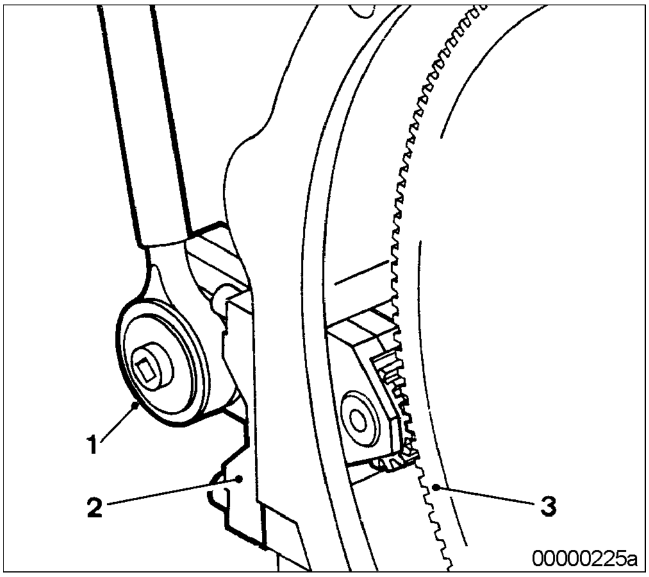
Special tools

Designation / Use	Part No.	Qty.
Barring tool	→ TC	1
Adapter	→ TC	1
Ratchet	→ TC	1

DANGER	Unguarded rotating and moving engine components. **Risk of serious injury — danger to life!** • Before barring the engine, ensure that nobody is in the danger zone.

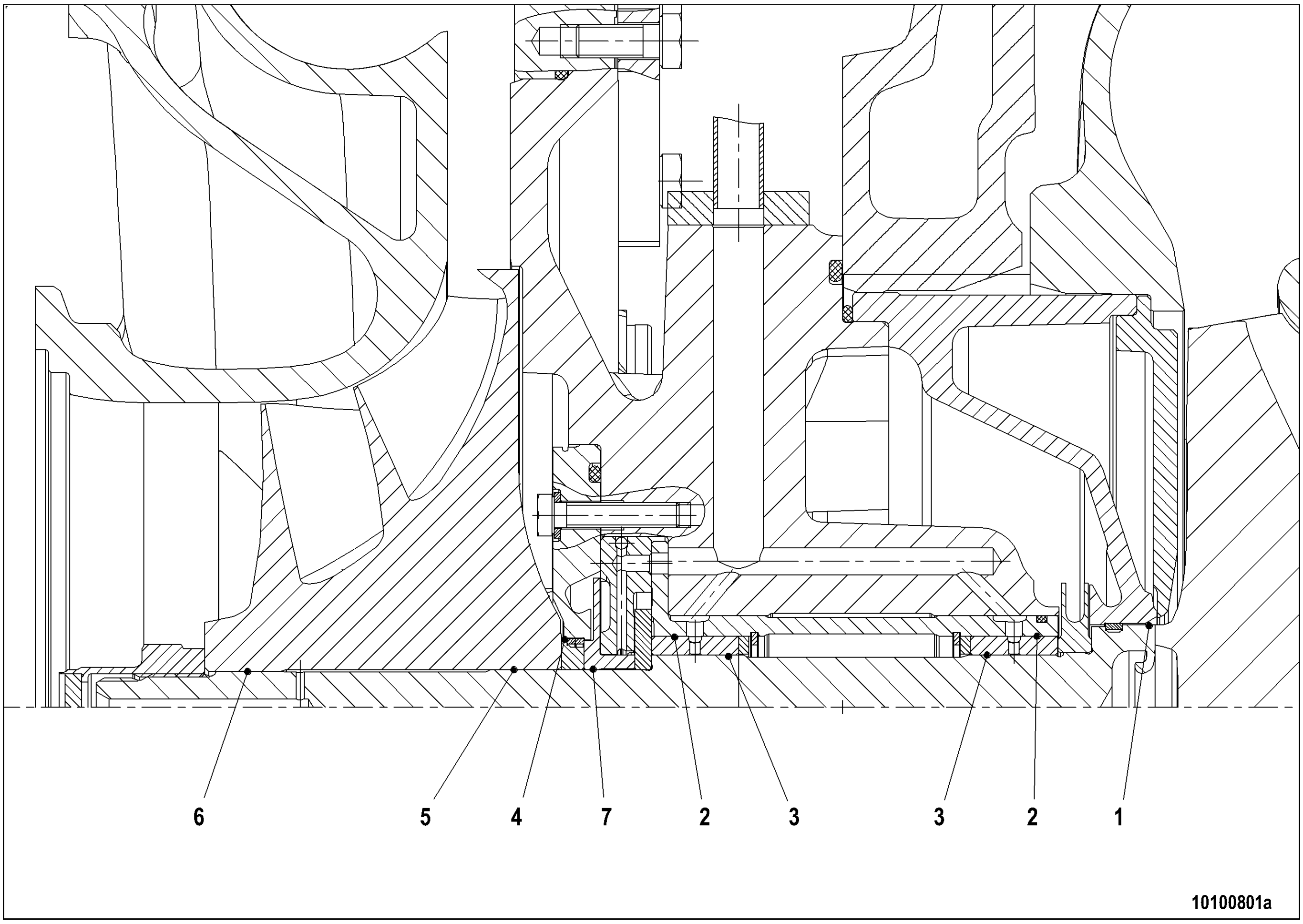
Engine – Barring manually

1. Remove protective plate.
2. Install barring tool (2) with adapter on the flywheel housing in the 6 o'clock position.
3. Set ratchet (1) onto barring tool (2).
4. Rotate crankshaft in engine direction of rotation. Apart from the normal compression resistance, there should be no abnormal resistance.
5. For barring-tool removal follow reverse sequence of working steps.



TIM ID: 0000034686 – 001

3.73 Exhaust turbocharger – Tolerances



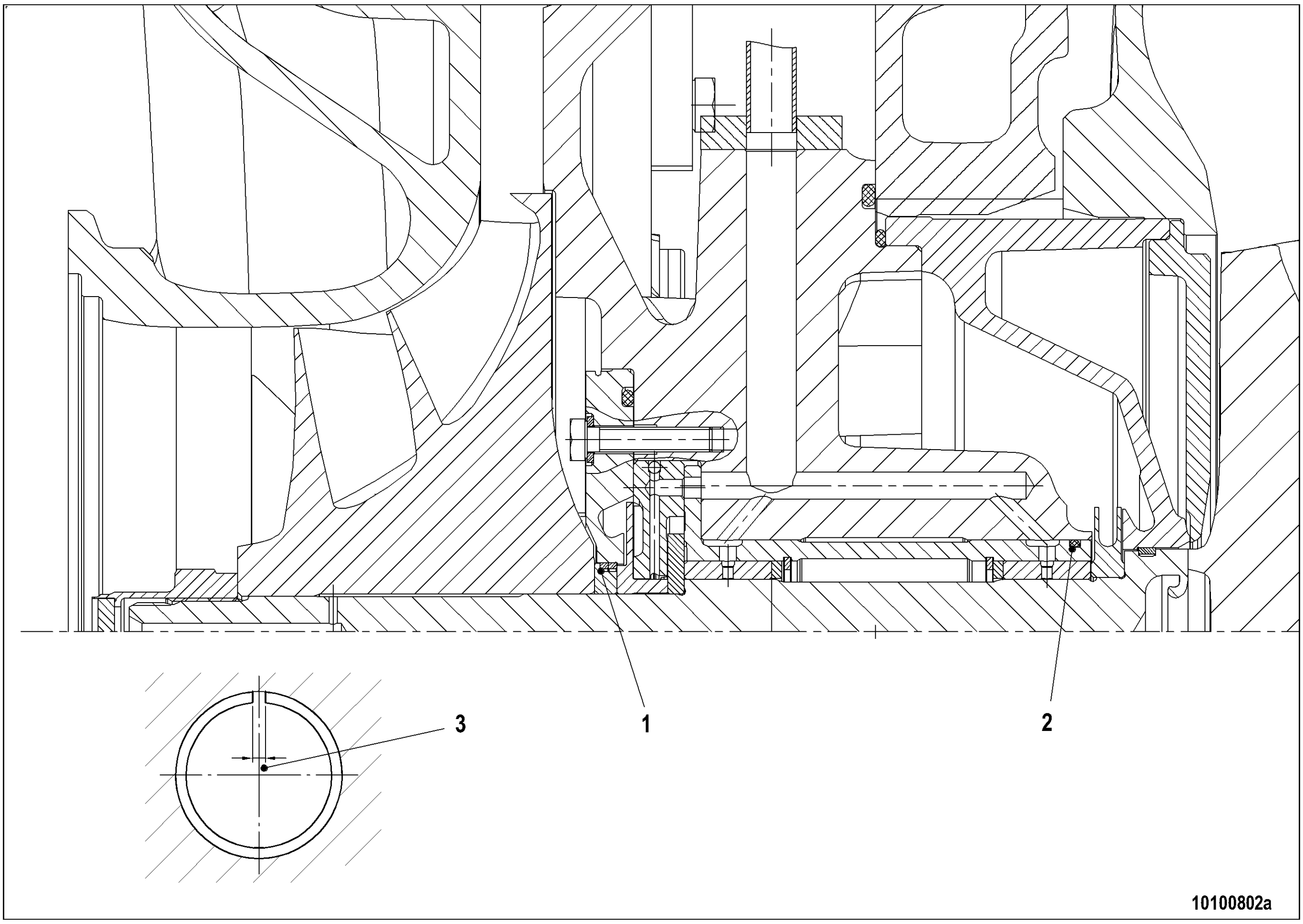
No.	Designation	Stage	Toler-anced size Basic size	Deviation Lower	Deviation Upper	Clearance Min.	Clearance Max.	Interference Min.	Interference Max.	Wear limit
1	Housing cover bore		40.200 H7	0	+0.025					
2	Bearing body bore		34.000 H6	0	+0.016	0.095	0.126			
	Bearing bushing outer Ø		34.000	−0.110	−0.095					
3	Bearing bushing bore		25.000 H6	0	+0.013	0.050	0.073			
	Turbine shaft outer Ø		25.000	−0.060	−0.050					
4	Retaining ring bore		33.000 F7	+0.025	+0.050					

No.	Designation	Stage	Toler-anced size Basic size	Deviation		Clearance		Interference		Wear limit
				Lower	Upper	Min.	Max.	Min.	Max.	
5	Compressor wheel bore		18.000^{H7}	0	+0.018		0.011		0.018	
	Turbine shaft outer Ø		18.000_{m6}	+0.007	+0.018					
6	Compressor wheel bore		17.000^{H6}	0	+0.011		0.004		0.018	
	Turbine shaft outer Ø		17.000_{m6}	+0.007	+0.018					
7	Washer bore		18.000^{F7}	+0.016	+0.034					

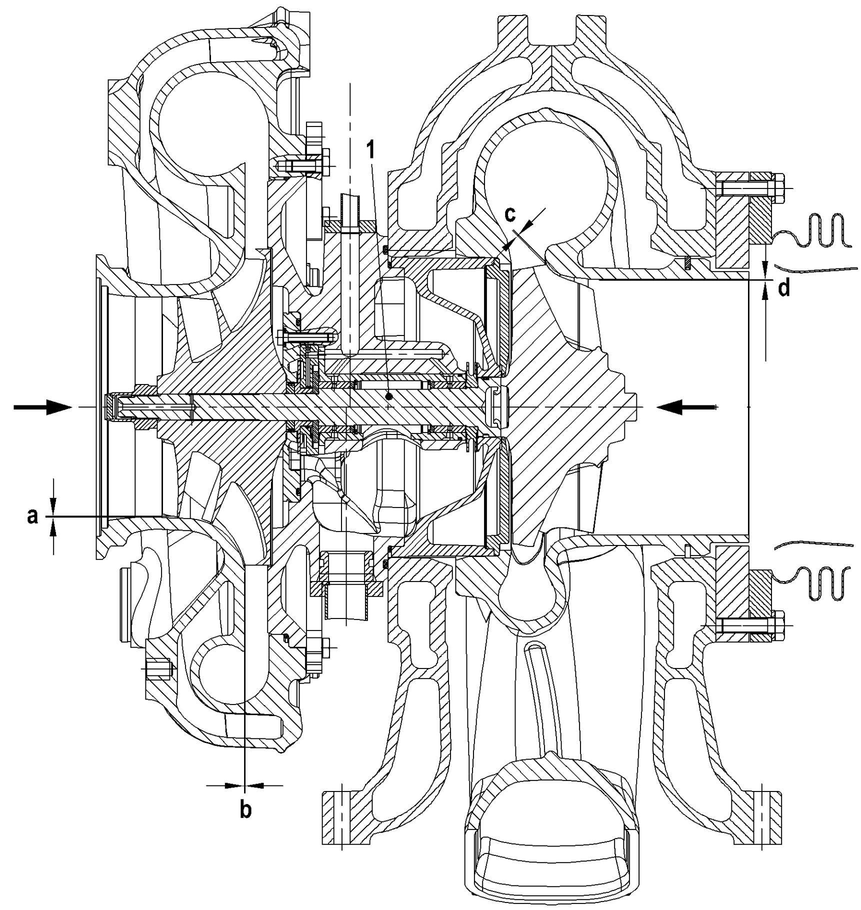
Note

Re 5: Fit length 18.0 H7 : 14 mm ±1 mm

TIM ID: 0000034687 – 001



No.	Designation	Stage	Toleranced size Basic size	Deviation		Clearance		Interference		Wear limit
				Lower	Upper	Min.	Max.	Min.	Max.	
1	Ring carrier groove width		4.000 ^{D9}	+0.030	+0.060	0.030	0.110			
	Piston ring V-side		2.000 $_{h9}$	−0.025	0					
2	Turbine wheel groove width		4.000 ^{C9}	+0.070	+0.100		0.121			
	Piston ring T-side		4.000 $_{h9}$	−0.030	0					
3	Ring end clearance measured in corresponding housing									
	Piston ring V-side					0.020	0.230			
	Piston ring T-side					0.630	0.850			



Clearance between		Specified value (mm)
Check gap clearances with wire feeler gauges		
a	Compressor wheel and compressor housing	0.50 to 0.60
b	Compressor wheel and compressor housing	0.5 to 0.845
	min. dimension for stop on turbine shaft (1) in the direction of the compressor side max. dimension for stop on turbine shaft (1) in the direction of the turbine side	
c	Turbine wheel and turbine housing	0.63 to 1.172
	min. dimension for stop on turbine shaft (1) in the direction of the turbine side max. dimension for stop on turbine shaft (1) in the direction of the compressor side	
d	Turbine wheel and turbine housing	0.50 to 0.70
Axial clearance		0.11 to 0.15

TIM ID: 0000034687 – 001

3.74 Charge-air coolant pump – Removal

Preconditions

- Preparatory steps have been completed.

⚠ **WARNING**	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

⚠ **WARNING**	Components have sharp edges. **Risk of injury!** • Wear protective gloves.

Charge-air coolant pump – Removal

1. Remove securing screws for charge-air coolant pump as shown in overview drawing (→ Page 309).
2. Use crowbar to release charge-air coolant pump from equipment carrier and remove.
3. Mask installation hole for charge-air coolant pump.
4. Remove O-ring from charge-air coolant pump.

TIM ID: 0000034688 – 001

3.75 Engine – Barring with starting system

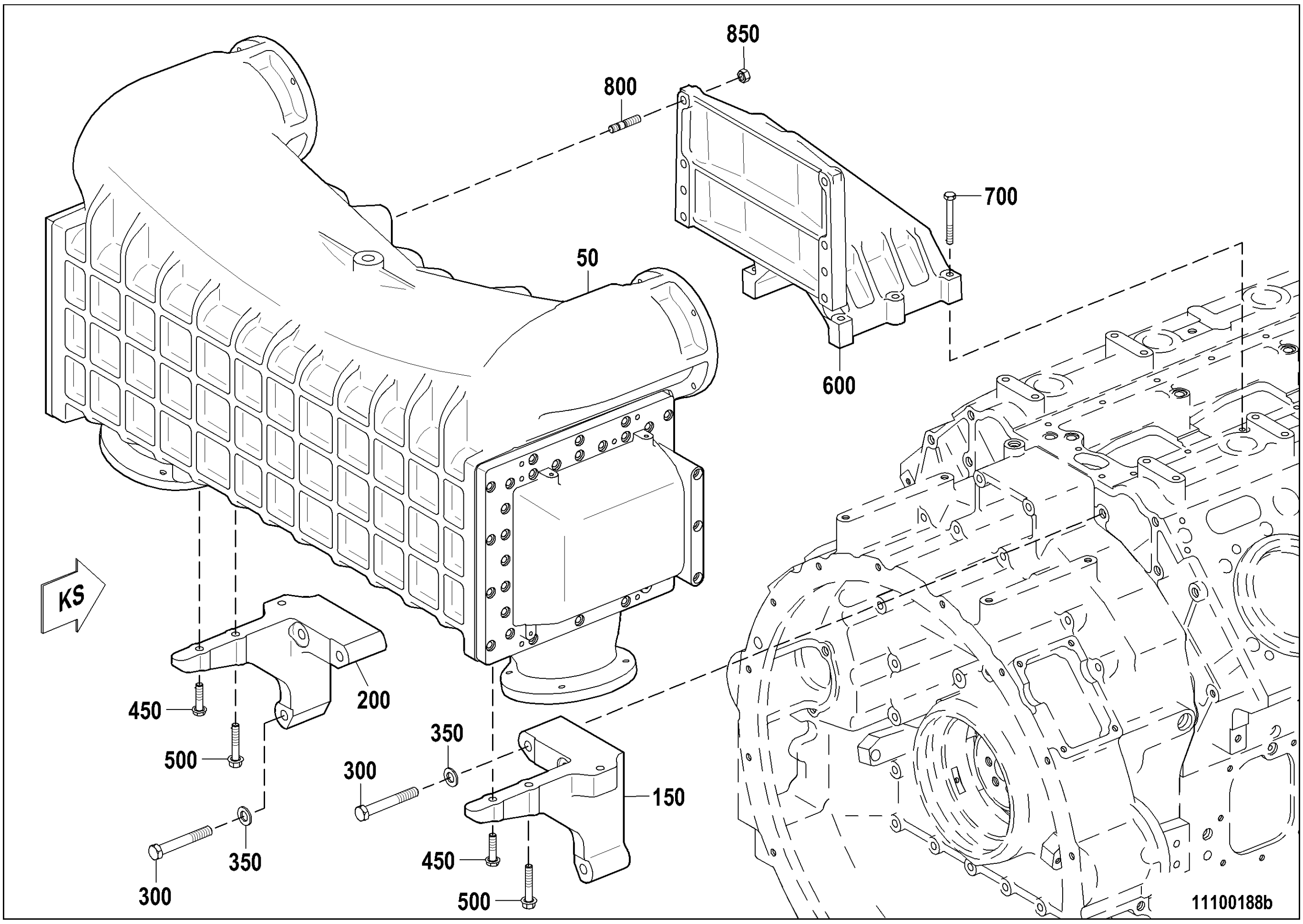
DANGER	Unguarded rotating and moving engine components. **Risk of serious injury - danger to life!** • Before barring or starting the engine, ensure that nobody is in the danger zone. • After working on the engine, check that all protective devices have been reinstalled and all tools removed from the engine.

Engine – Barring with starting system

1. Release latch of connector X4.
2. Disconnect connector from engine governor.
3. Bar engine in unloaded condition: Press START button.
4. Let the crankshaft rotate until oil pressure is indicated.
5. Engine start is automatically interrupted when specified starting period is expired. If necessary, re-start the engine after approx. 20 seconds.
6. Connect connector X4 to engine governor and latch in position.

TIM ID: 0000034689 – 001

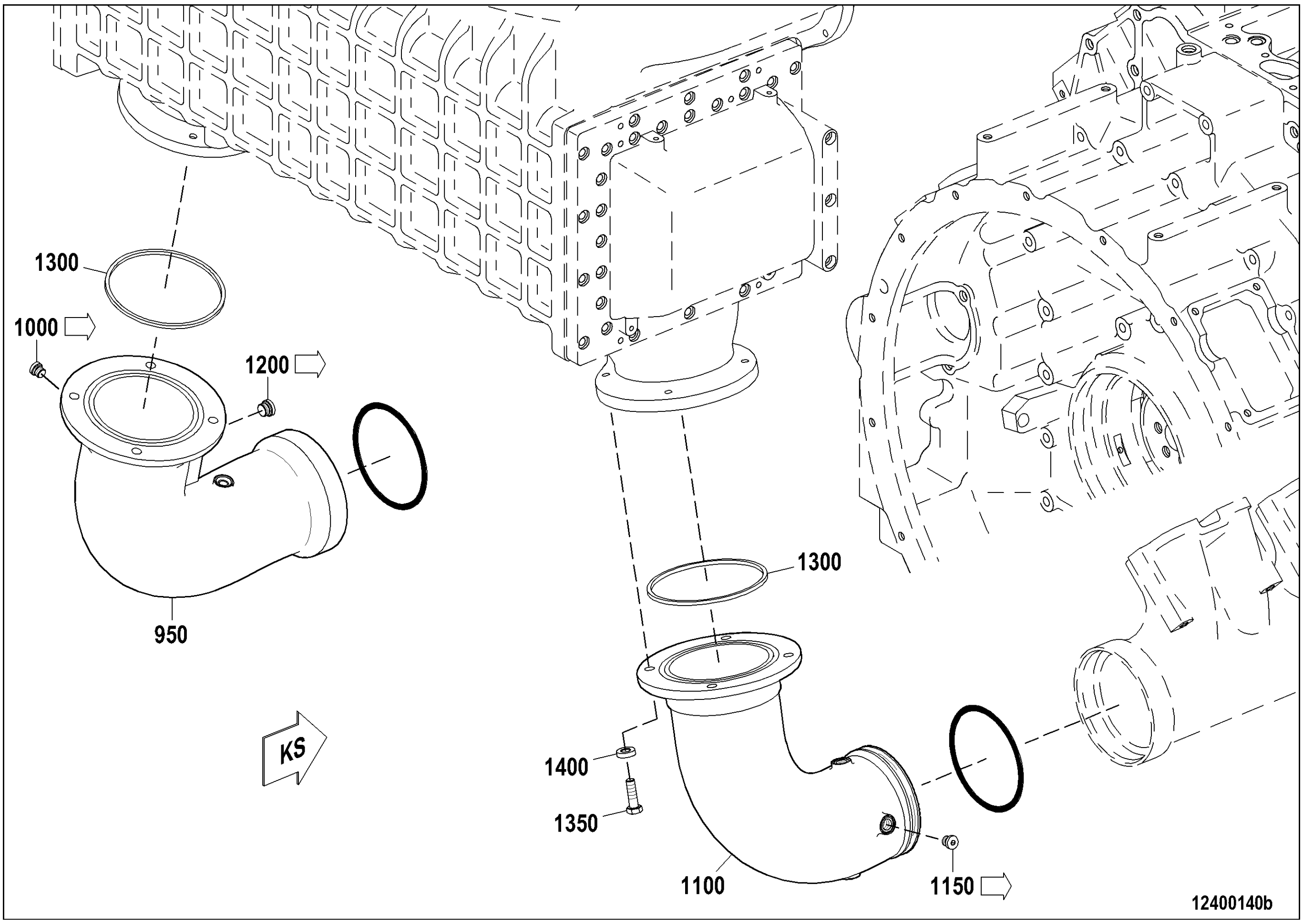
3.76 Intercooler – Overview



50	Intercooler	350	Washer	700	Screw
150	Mounting bracket	450	Screw	800	Stud
200	Mounting bracket	500	Screw	850	Nut
300	Screw	600	Carrier		

TIM ID: 0000034690 – 001

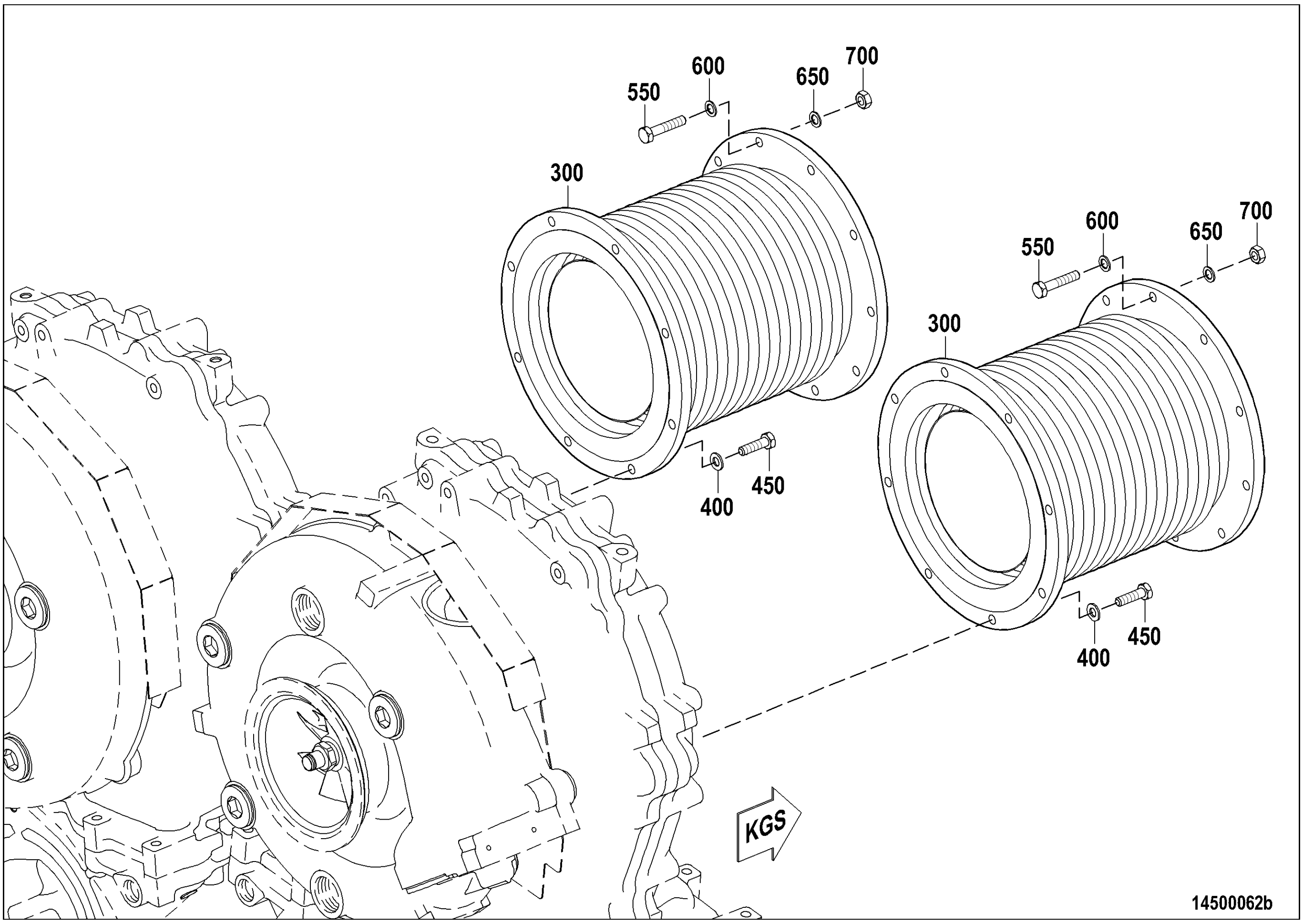
Charge-air cooling



950	Elbow	1200	Plug screw
1000	Plug screw	1300	O-ring
1100	Elbow	1350	Screw
1150	Plug screw	1400	Washer

3.77 Exhaust pipework after exhaust turbocharger – Overview

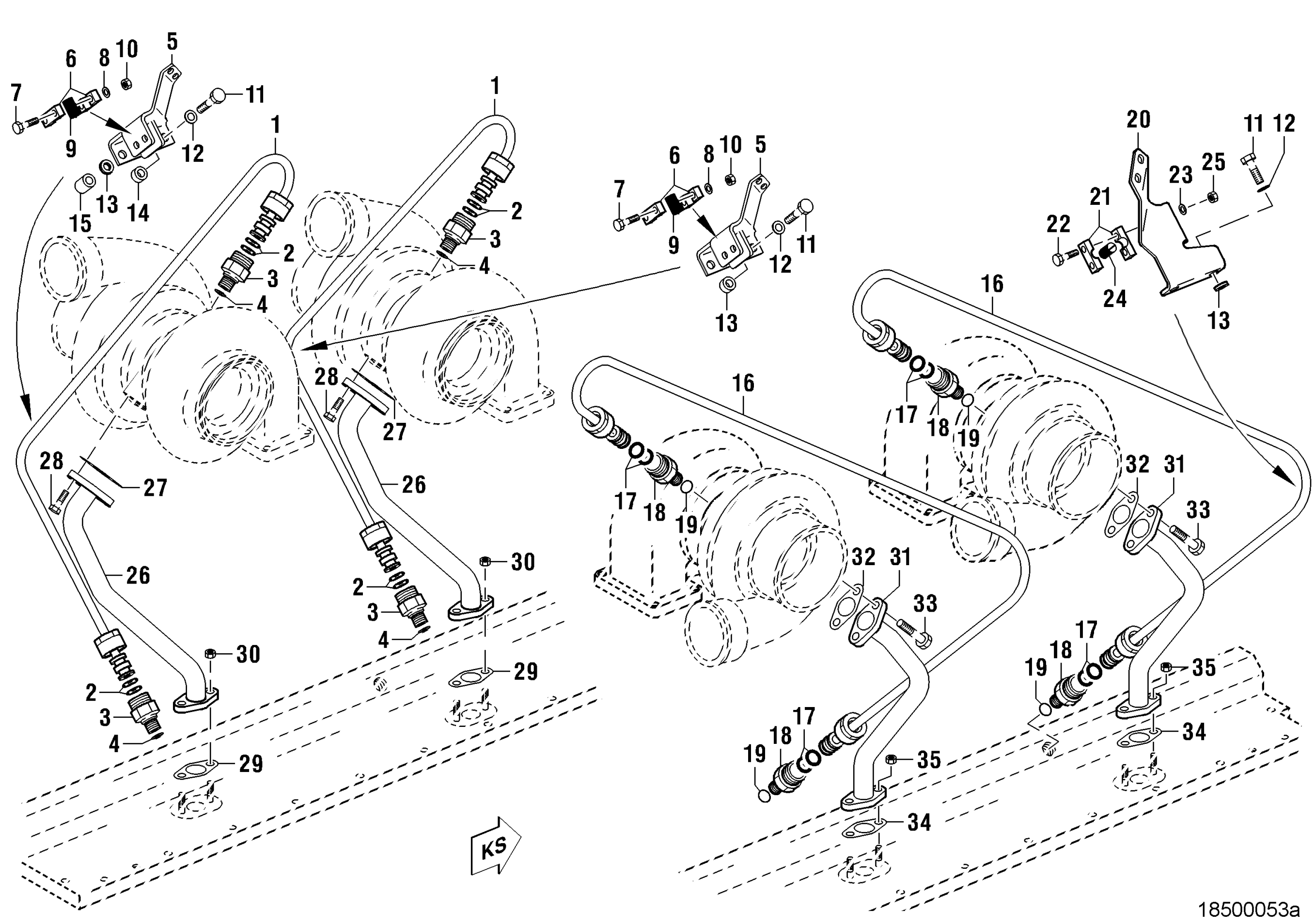
Exhaust system



300 Exhaust pipe bellows
400 Washer
450 Screw
550 Screw
600 Washer
650 Nut
700 Washer

3.78 Turbocharger oil supply – Overview

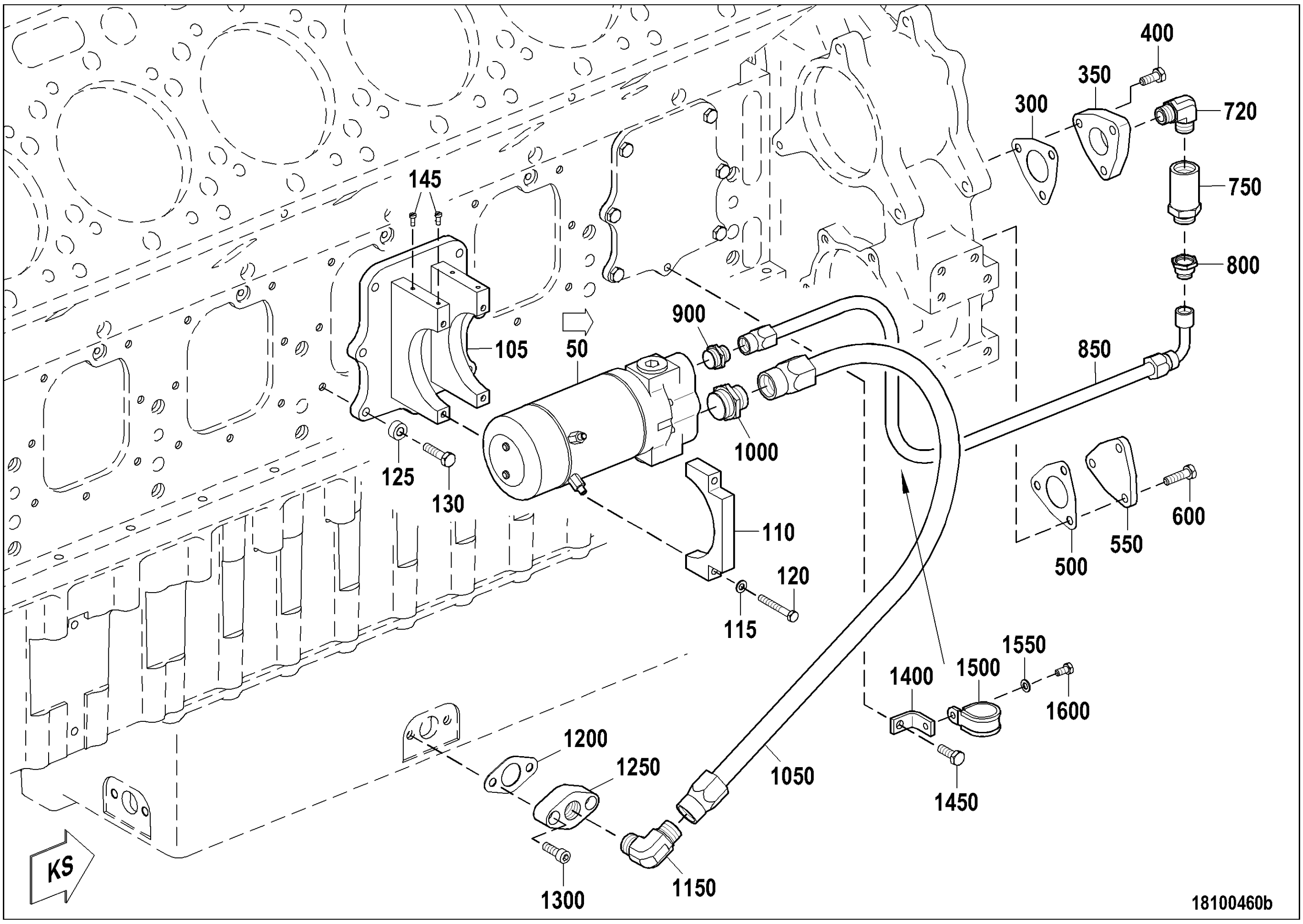
Exhaust turbocharger oil supply



1	Oil line	13	Washer	25	Nut
2	O-ring	14	Spacer sleeve	26	Pipe, left side of engine
3	Threaded adapter	15	Spacer bush	27	Gasket
4	O-ring	16	Oil line	28	Screw
5	Retainer	17	O-ring	29	Gasket
6	Pipe half-clamp	18	Threaded adapter	30	Nut
7	Screw	19	O-ring	31	Pipe, right side of engine
8	Washer	20	Retainer	32	Gasket
9	Grommet	21	Pipe half-clamp	33	Screw
10	Nut	22	Screw	34	Gasket
11	Screw	23	Washer	35	Nut
12	Washer	24	Grommet		

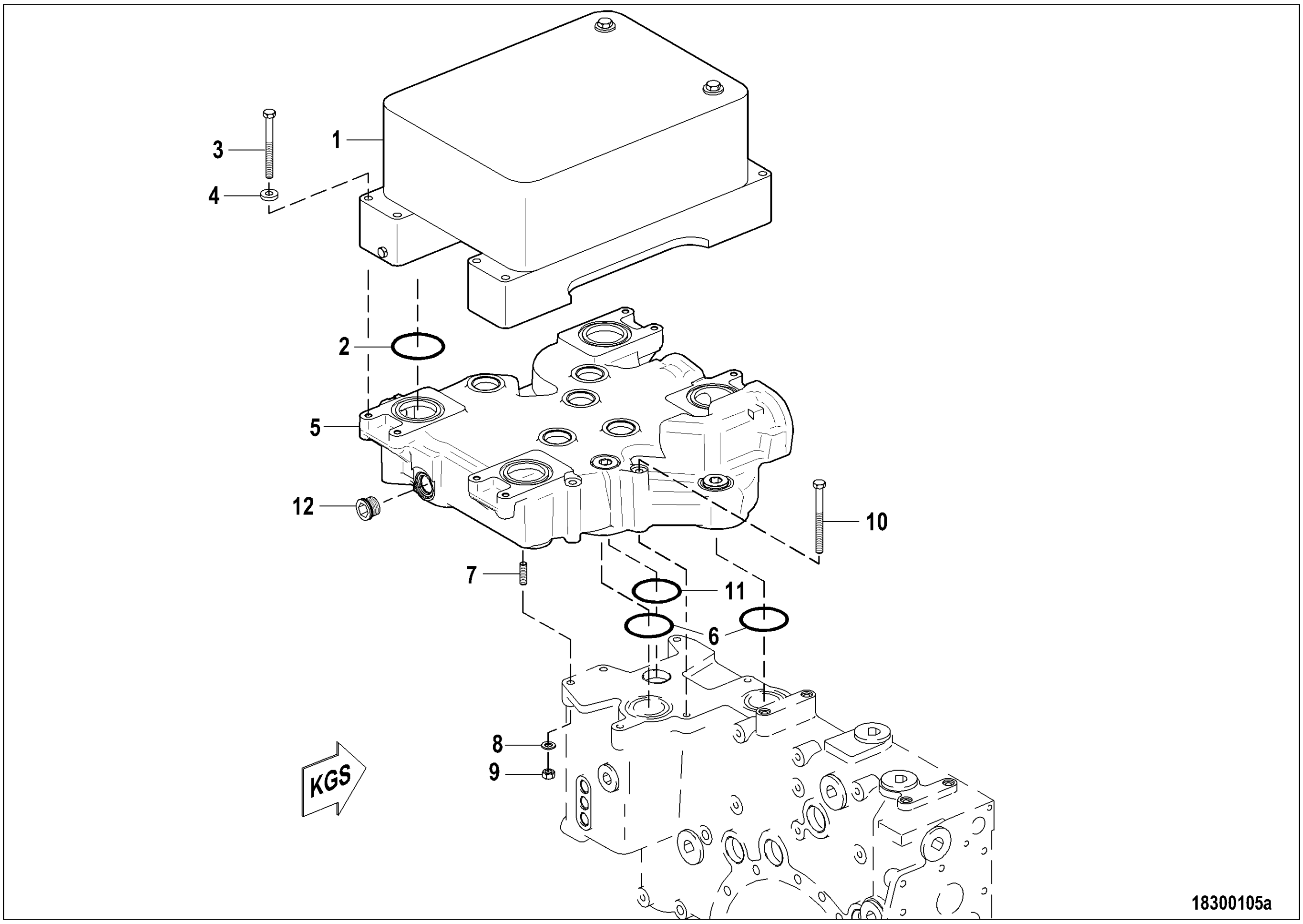
TIM ID: 0000034692 – 001

3.79 Oil priming pump – Overview



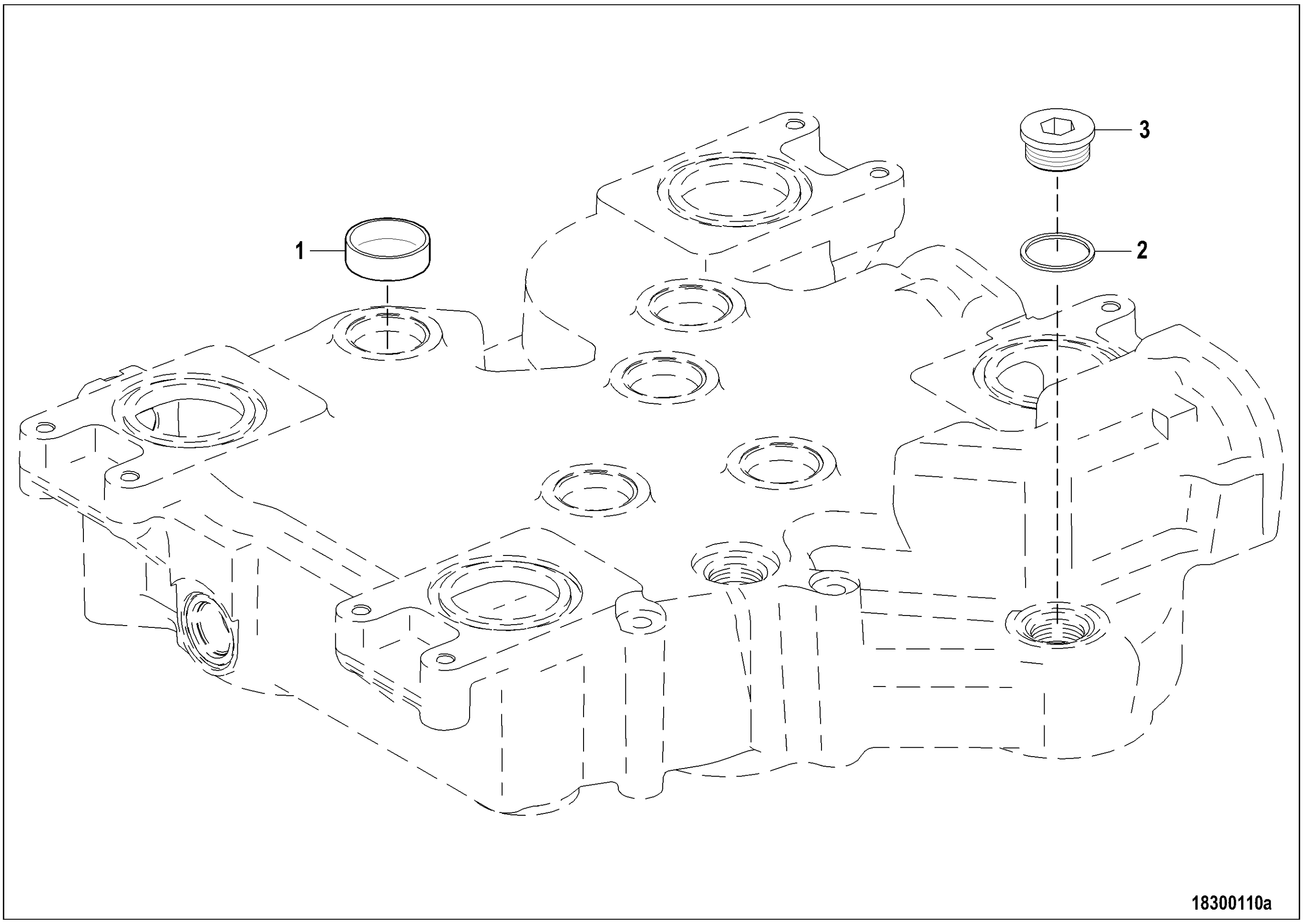
50	Oil priming pump (oil pump)	400	Screw	1050	Hose
105	Inspection port cover	500	Gasket	1150	Adapter
110	Pipe clamp half	550	Cover	1200	Gasket
115	Washer	600	Screw	1250	Flange
120	Screw	720	Elbow	1300	Screw
125	Washer	750	Non-return valve	1400	Retainer
130	Screw	800	Adapter	1450	Screw
145	Fillister-head screw	850	Hose	1500	Clamp
300	Gasket	900	Adapter	1550	Washer
350	Cover	1000	Adapter	1600	Screw

3.80 Oil cooler and oil distribution housing – Overview



1 Oil cooler
2 O-ring
3 Screw
4 Washer
5 Oil distribution housing
6 O-ring
7 Stud
8 Washer
9 Nut
10 Screw
11 O-ring
12 Plug screw

TIM ID: 0000034694 – 001



1 Plug 2 Sealing ring 3 Plug screw

TIM ID: 0000034694 – 001

3.81 Lube-oil pump with drive – Removal

Special tools

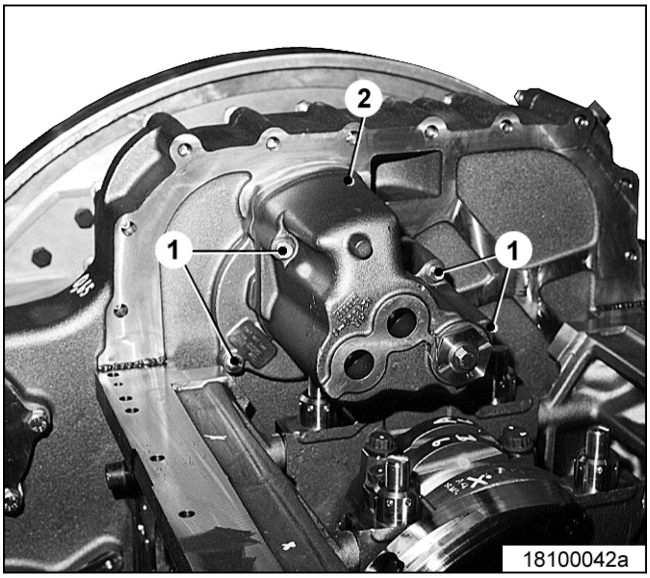
Designation / Use	Part No.	Qty.
Support bracket	→ TC	1

WARNING	Heavy object. **Risk of crushing!** • Use appropriate lifting devices and appliances.

Removing oil pump with safety valve

Note: The illustration does not show engine in installation position.

1. Unscrew all screws (1) on the oil pump (2).
2. Attach support bracket to oil pump and with rope, slightly tensioned, to crane.
3. Remove oil pump from equipment carrier and place aside.



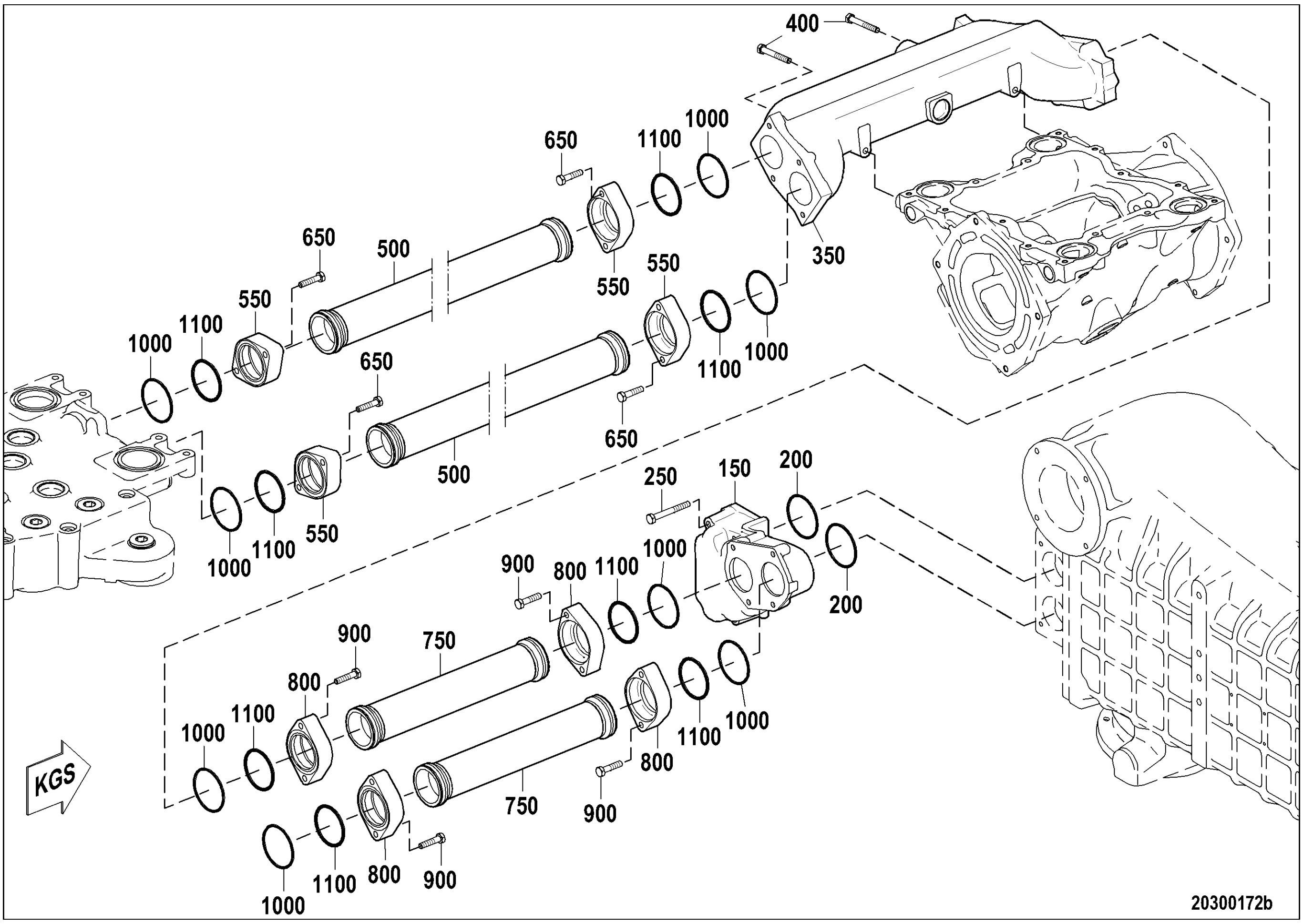
Removing oil line and pressure reducing valve

1. Remove oil line from equipment carrier as per overview drawing (→ Page 306).
2. Remove pressure reducing valve from equipment carrier.
3. Remove sealing rings.
4. Seal connections with suitable plug.
5. Protect oil line from damage.

TIM ID: 0000034695 – 001

3.82 Coolant pipework from/to intercooler – Overview

Coolant pipework



150	Twin elbow	500	Line	800	Flange
200	O-ring	550	Flange	900	Screw
250	Screw	650	Screw	1000	O-ring
400	Screw	750	Line	1100	O-ring

TIM ID: 0000034697 – 001

3.83 Thermostat insert – Replacement

Special tools

Designation / Use	Part No.	Qty.
Impact mandrel	→ TC	
Puller	→ TC	

Material

Designation / Use	Part No.	Qty.
Grease (Kluthe Hakuform 30-10/Emulgier)	→ FLS	1

Spare parts

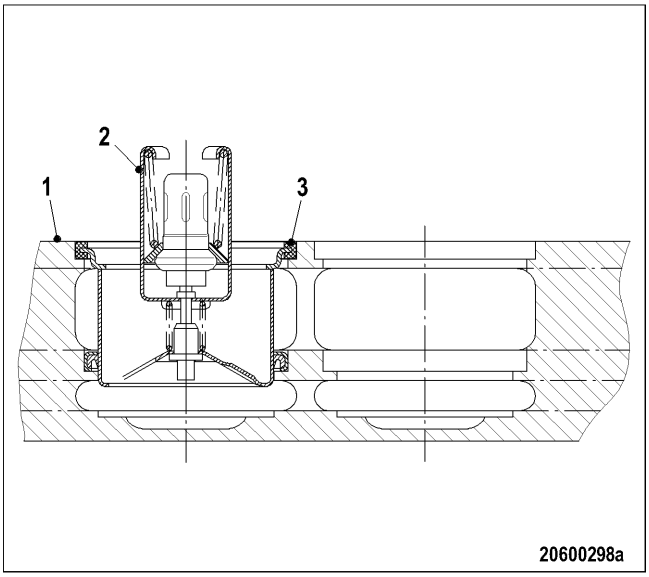
Designation / Use	Part No.	Qty.
Thermostat insert	→ SPC	
Thermostat insert	→ SPC	
Sealing ring	→ SPC	

CAUTION	Contamination of components. **Damage to component!** • Observe manufacturer’s instructions. • Check components for special cleanness.

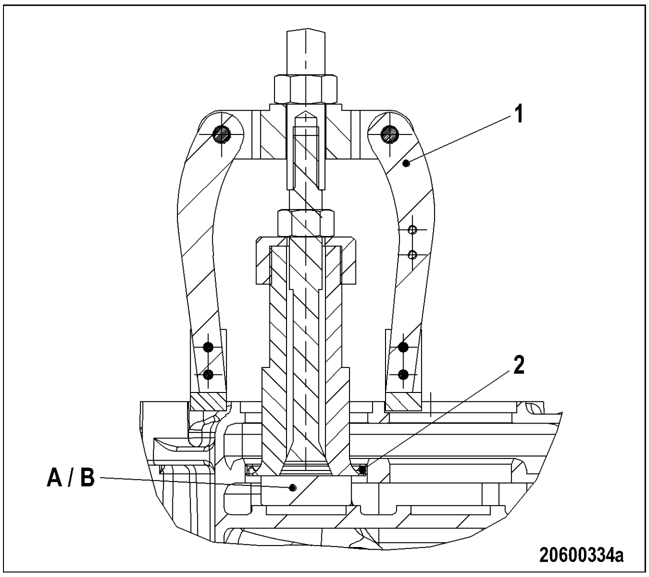
TIM ID: 0000034698 – 001

Removing thermostat insert

1. Remove thermostat insert (2) with sealing ring (3) from thermostat housing (1).



2. Use puller (1) to pull sealing ring (Teflon) (2) out of cover.



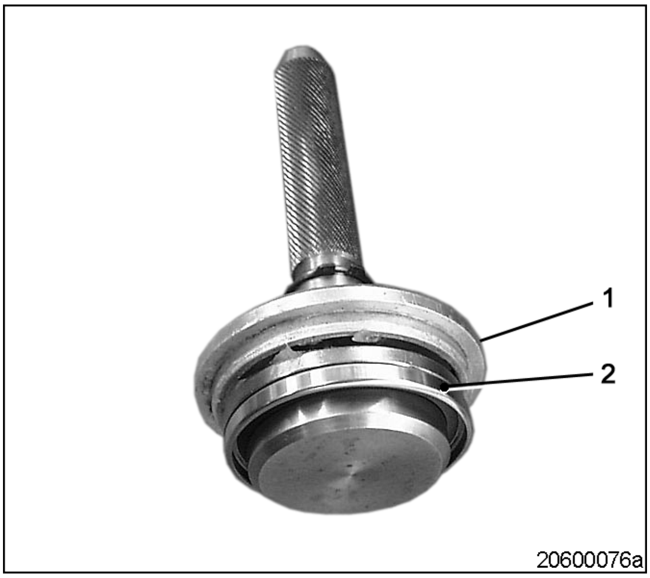
A Round Ø 50 x 25 (Series 2000)
B Round Ø 50 x 20 (Series 4000)

Installing sealing ring in thermostat housing

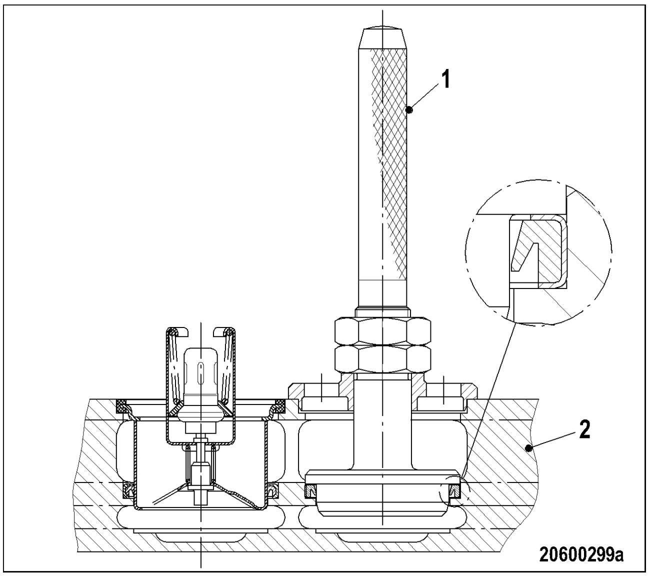
1. Push sealing ring (2) onto impact mandrel (1).

   Note: Observe installation position, refer to illustration below.

2. Clean seating surface on sealing ring (2).

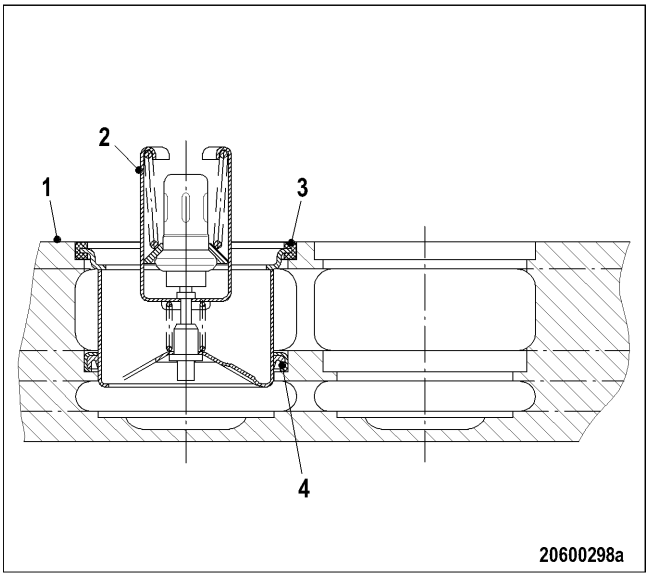


3. Use impact mandrel (1) to fit sealing ring in thermostat housing (2).



Fitting thermostat insert

1. Coat sealing ring (3) on thermostat insert (2) with grease.
2. Coat sealing ring (4) on thermostat housing (1) with grease.
3. Position thermostat insert (2) in thermostat housing (1).



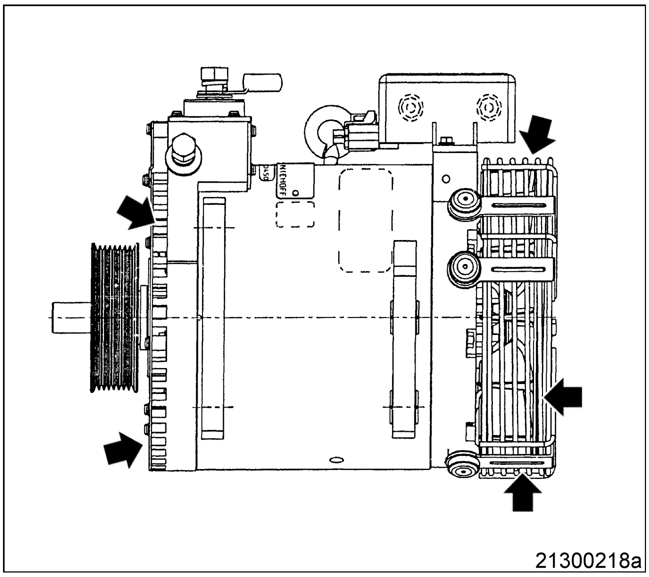
TIM ID: 0000034698 - 001

3.84 Battery-charging generator – Check

Preconditions

- Engine is stopped and starting disabled.

WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.



Battery-charging generator – Check

Item	Diagnosis	Task
Ventilation area (arrow)	Clean	None
Ventilation area (arrow)	Dirty	Clean

Cleaning battery-charging generator

Note: Dry-clean battery-charging generator only.

1. Remove coarse dirt from battery-charging generator.
2. Blow out ventilation area (arrow) with compressed air until all dust is cleared.

3.85 Battery-charging generator drive – Drive belt tension adjustment

Preconditions

- Engine is stopped and starting disabled.

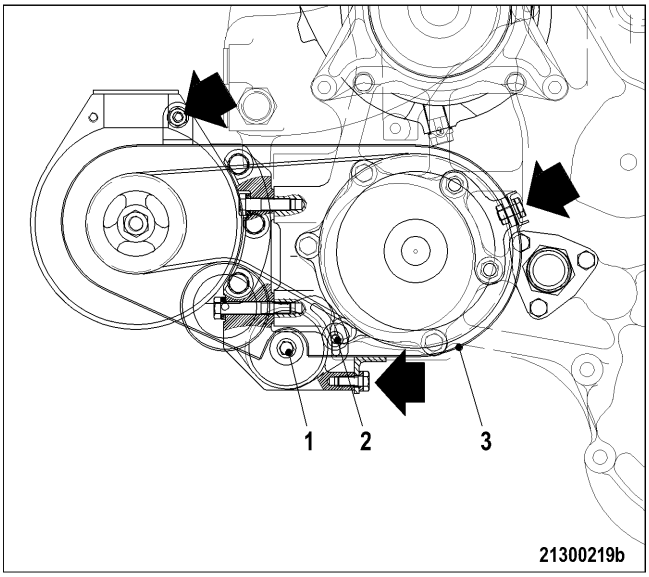
Special tools

Designation / Use	Part No.	Qty.
Torque wrench 20-100 Nm	→ TC	1
Ratchet adapter	→ TC	1

WARNING	Spring/circlip/tensioning roller preload. **Risk of injury!** • Only use specified tool and equipment.

Adjusting belt tension

1. Undo screw (arrow) and remove protective cover (3).
2. Slacken screws (1) and (2) by half a turn.
   Result: Belt tensioner moves against the drive belt and tensions it.
3. Use torque wrench to tighten screw (1) to the specified torque 42 Nm and screw (2) to 60 Nm up to 65 Nm.
4. Install protective cover (3).



TIM ID: 0000034700 – 001

3.86 Sensors, actuators and injectors – Removal

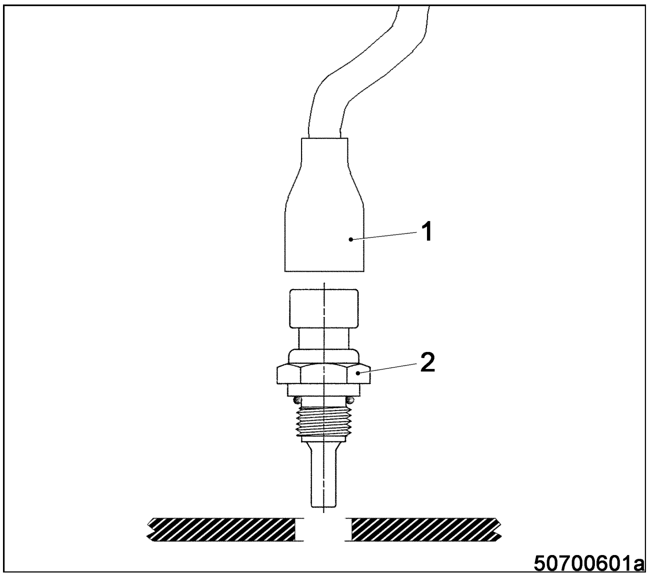
WARNING	Fuels are combustible. **Risk of fire and explosion!** • Avoid open flames, electrical sparks and ignition sources. • Do not smoke.

WARNING	Hot oil. Oil can contain combustion residues which are harmful to health. **Risk of injury and poisoning!** • Wear protective clothing, gloves, and goggles / safety mask. • Avoid contact with skin. • Do not inhale oil vapor.

WARNING	Coolant is hot and under pressure. **Risk of injury and scalding!** • Let the engine cool down. • Wear protective clothing, gloves, and goggles / safety mask.

Removing temperature sensors

1. Always note:
   - The sensors are identical with regard to design and electrical function. Removal is also identical.
   - Arrangement and position of sensors (→ Page 322).
2. Observe the following prior to removal:



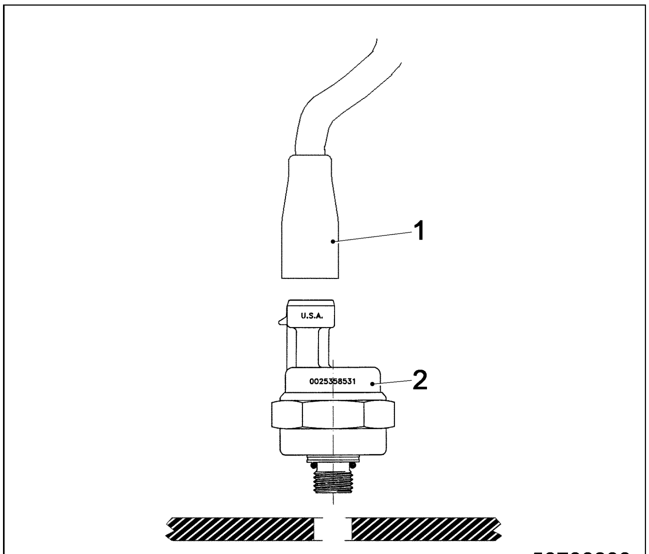
Coolant temperature	For tasks and safety instructions (→ Page 326)
Oil temperature	During removal, small amounts of engine oil may emerge. Catch engine oil in a suitable container.
Fuel temperature	During removal, small amounts of fuel may emerge. Catch fuel in a suitable container.

3. Remove connector (1).
4. Remove sensor via nut (2).

TIM ID: 0000034701 – 001

Removing pressure sensor (crankcase pressure)

1. Always note:
   - The sensors are identical with regard to design and electrical function. Removal is also identical.
   - Arrangement and position of sensors (→ Page 322).
2. Remove connector (1).
3. Remove sensor via nut (2).



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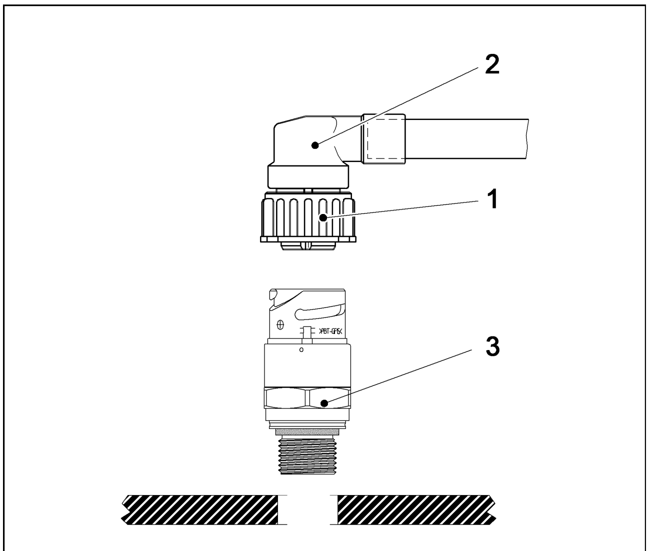
Remove pressure sensor (charge air pressure)

1. Always note:
   - The sensors are identical with regard to design and electrical function. Removal is also identical.
   - Arrangement and position of sensors (→ Page 322).
2. Release bayonet lock(1) and remove connector (2).
3. Remove sensor via nut (3).



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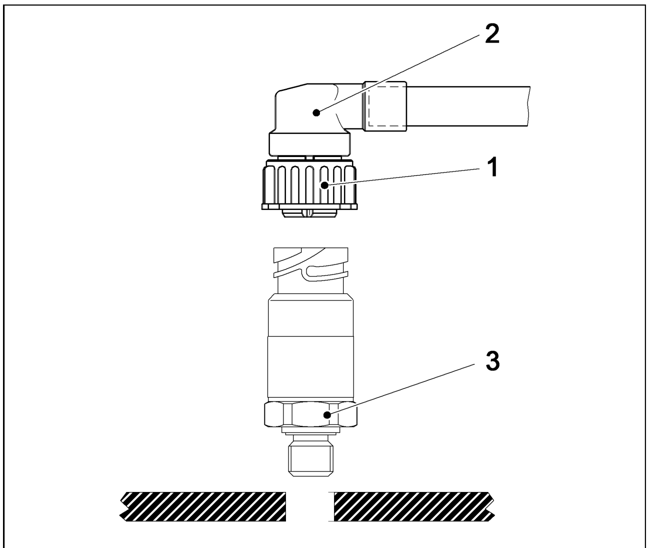
Removing pressure sensor (coolant pressure, L.P. fuel pressure)

1. Always note:
   - Arrangement and position of sensor (→ Page 322).
   - During removal of the fuel pressure sensor, small amounts of fuel may emerge. Catch fuel in a suitable container.
2. Release bayonet lock(1) and remove connector (2).
3. Remove sensor via nut (3).

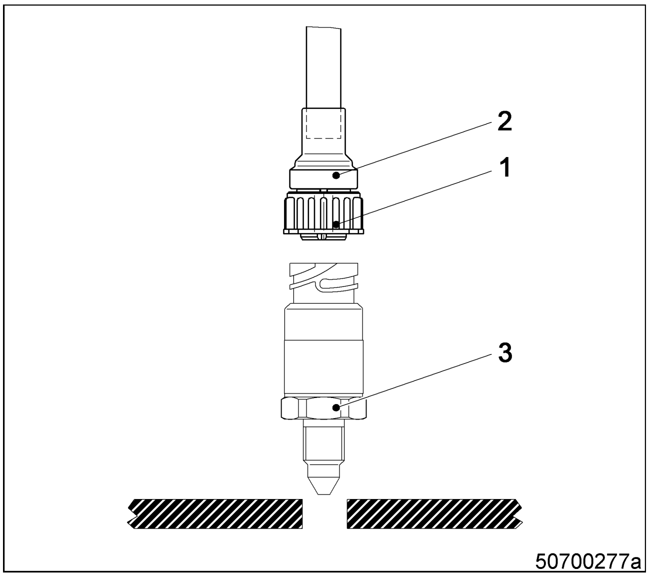


50700276a

TIM ID: 0000034701 – 001

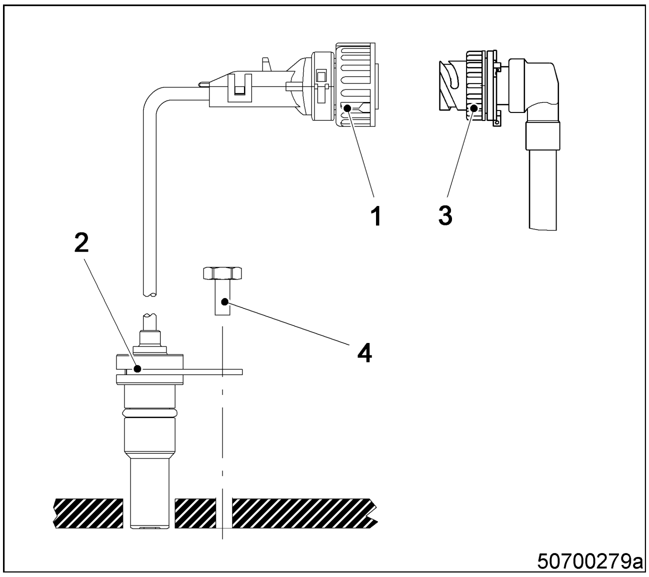
Removing pressure sensor (crankcase pressure)

1. Always note:
   - Arrangement and position of sensor (→ Page 322).
   - During removal of H.P. fuel pressure sensor, small amounts of fuel may emerge. Catch fuel in a suitable container.
2. Release bayonet lock(1) and remove connector (2).
3. Remove sensor via nut (3).



Removing speed sensor (crankshaft, camshaft)

1. Always note:
   - The sensors are identical with regard to design and electrical function. Removal is also identical.
   - Arrangement and position of sensors (→ Page 322).
2. Release bayonet lock(1) of speed sensor (2) and remove connector (3) from engine wiring system.
3. Remove screw (4).
4. Remove speed sensor (2).



TIM ID: 0000034701 – 001

3.87 Charge-air coolant level check

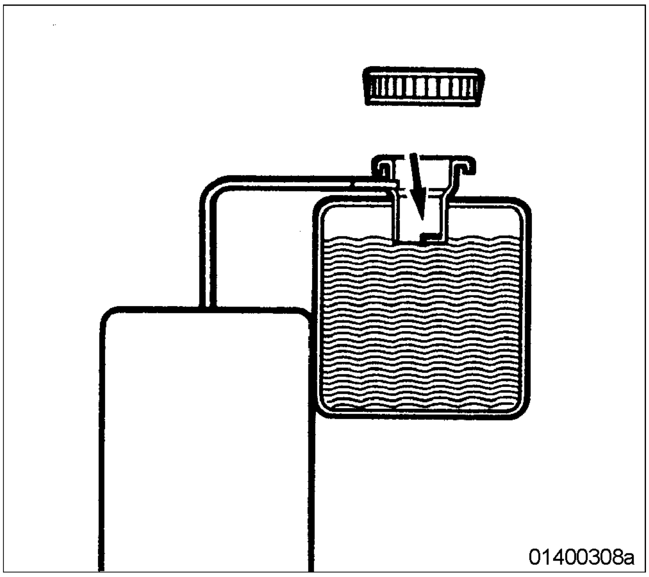
Preconditions

- Engine is stopped and starting disabled.
- MTU Fluids and Lubricants Specification (A001061/..) is available.

WARNING	Coolant is hot and under pressure. **Risk of injury and scalding!** • Let the engine cool down. • Wear protective clothing, gloves, and goggles / safety mask.

Charge-air coolant level check at filler neck:

1. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.
3. Check coolant level (coolant must be visible at marking plate).
4. If required, top up with treated coolant (→ Page 248).
5. Check proper condition of breather valve, clean sealing faces if required.
6. Fit breather valve onto filler neck and close it.

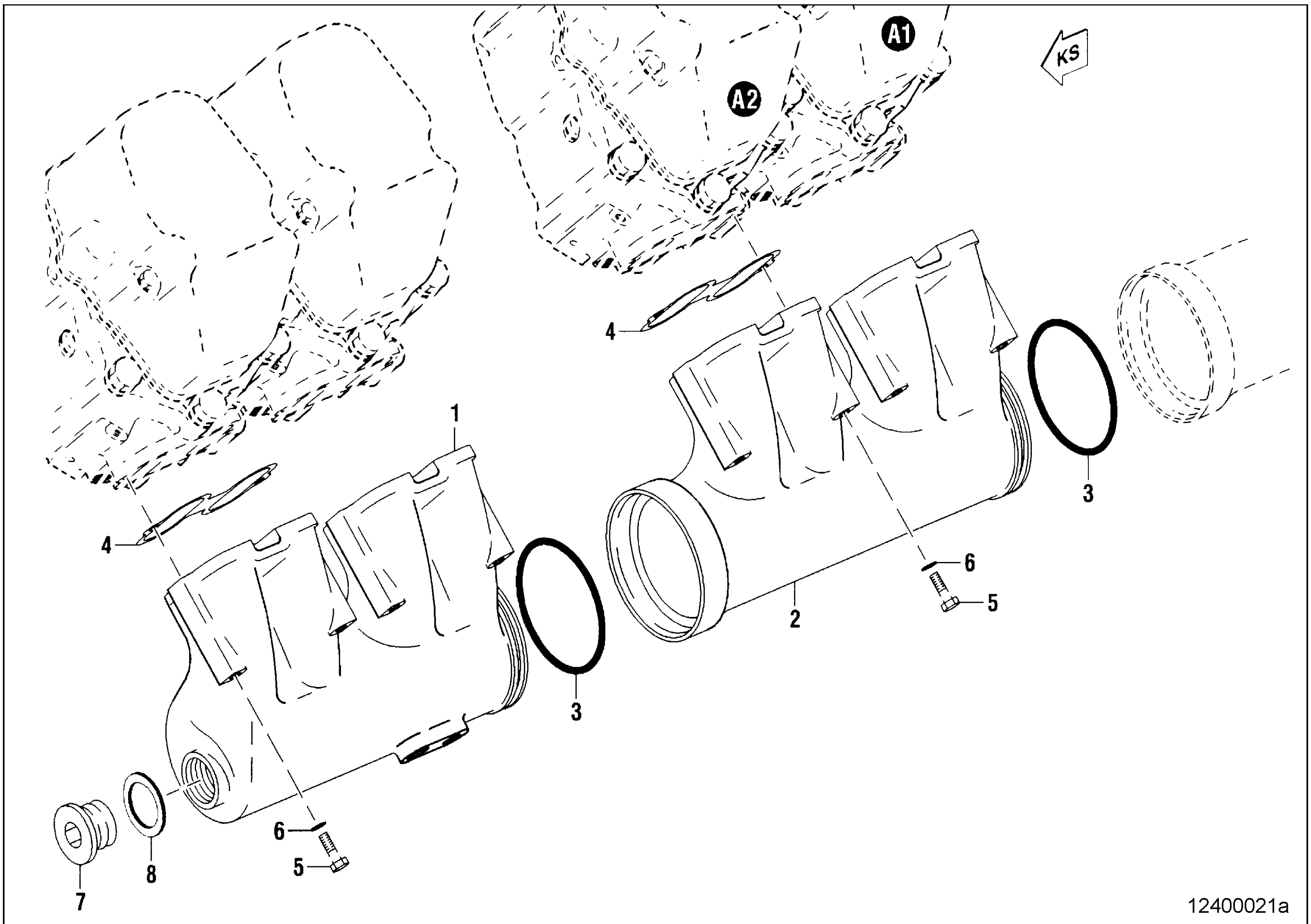


Charge-air coolant level check by means of level sensor:

1. Switch engine control system ON and check display (coolant level is automatically monitored by the engine control system).
2. If required, top up with treated coolant (→ Page 248).

TIM ID: 0000033690 – 001

3.88 Intake air system to cylinders, left – Overview

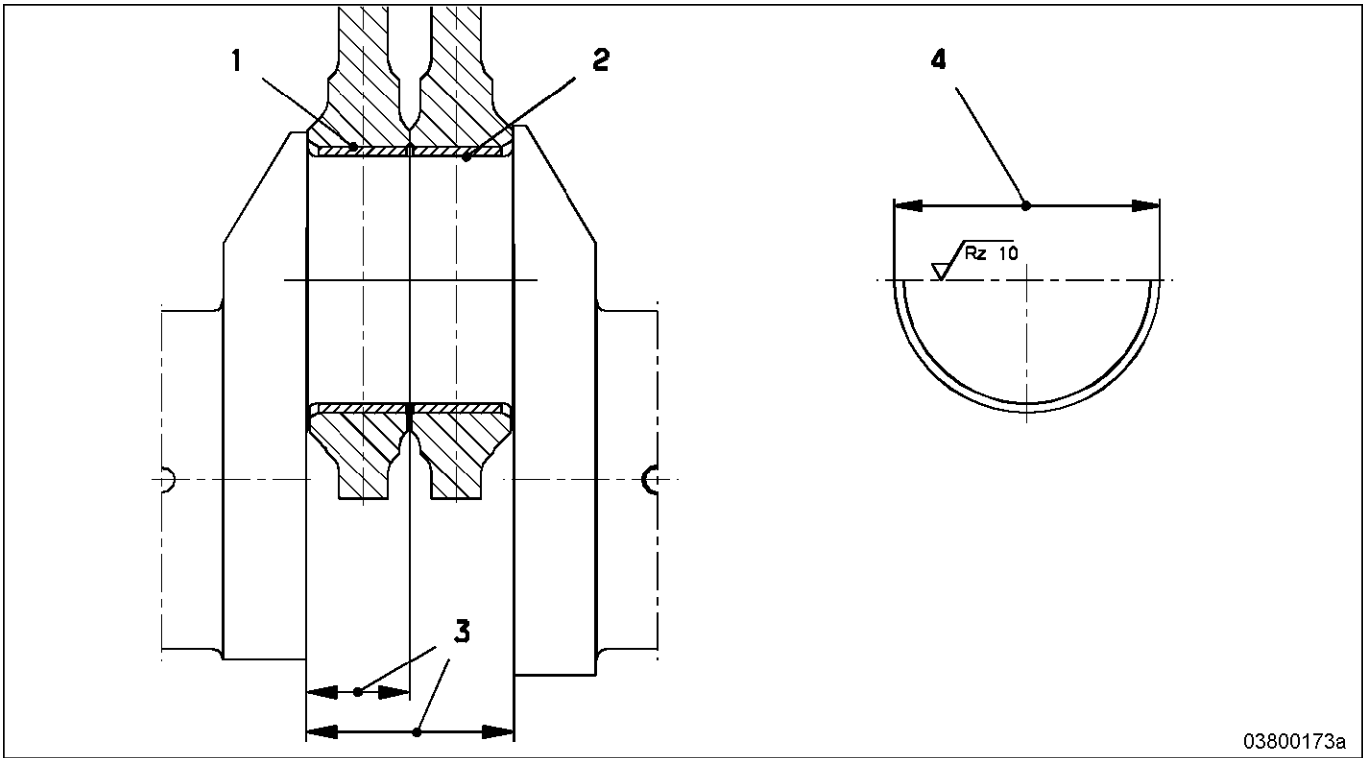


1 Charge air manifold
2 Charge air manifold
3 O-ring
4 Gasket
5 Hex screw
6 Washer
7 Plug
8 Sealing ring

TIM ID: 0000034729 - 001

3.89 Conrod – Tolerances

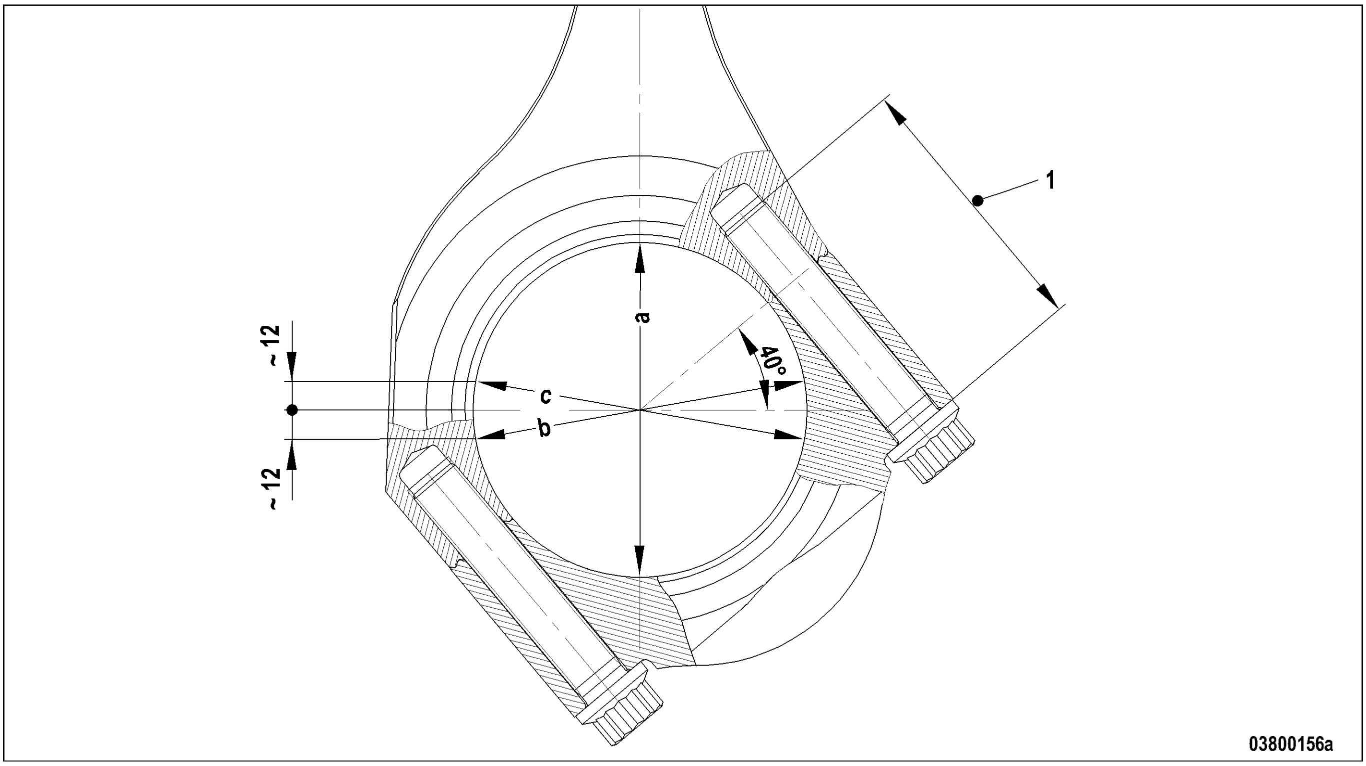
Conrod bearings



No.	Designation	Stage	Toler-anced size Basic size	Deviation		Clearance		Interference		Limit value
				Lower	Upper	Min.	Max.	Min.	Max.	
1	Conrod bore		126.000 H6	0	+0.025					
2	Conrod bearing bore Conrod bearing installed	0 - 0	117.082	0	+0.048	0.082	0.152			
		0 - 1	116.882							
		0 - 2	116.682							
		0 - 3	116.482							
	Conrod journal dia.	0 - 0	117.000 h6	–0.022	0					
		0 - 1	116.800 h6							
		0 - 2	116.600 h6							
		0 - 3	116.400 h6							
3	Crankpin length		97.500	−0.100	+0.100	0.200	0.600			
	Conrod width		48.600	−0.100	0					

No.	Designation	Stage	Toler-anced size Basic size	Deviation		Clearance		Interference		Limit value
				Lower	Upper	Min.	Max.	Min.	Max.	
4	Expansion dimension Conrod bearing shell. upper and lower halves	0 - 0	126.400	0	+1.000					
		0 - 1	126.400							
		0 - 2	126.400							
		0 - 3	126.400							

Conrod screw length



No.	Designation	Stage	Toler-anced size Basic size	Deviation		Clearance		Interference		Limit value
				Lower	Upper	Min.	Max.	Min.	Max.	
1	Screw length removed		103.000	−0.400	+0.200					104.500

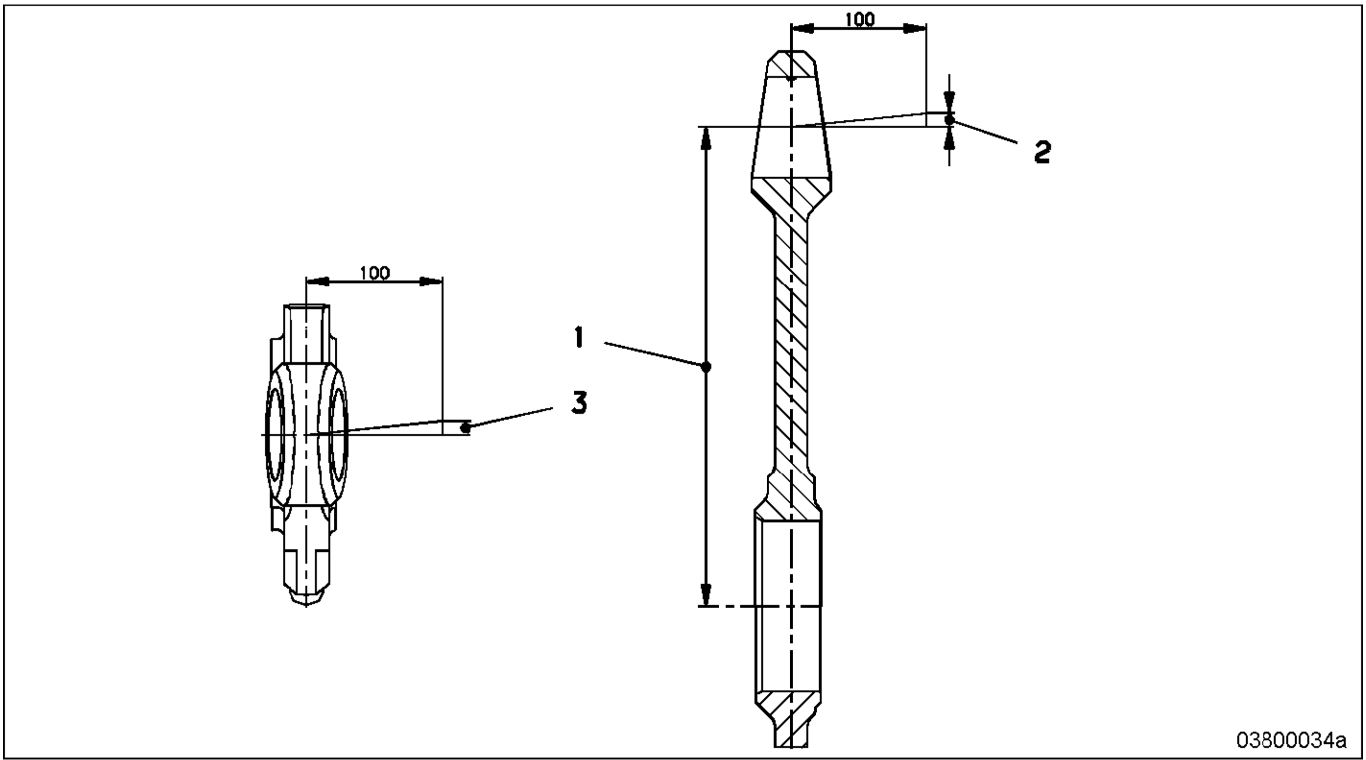
Notes:

Tighten conrod bearing - conrod - conrod cap according to torque specification.

Measure conrod bearing bore in a, b and c. Smallest dimension must be near a.

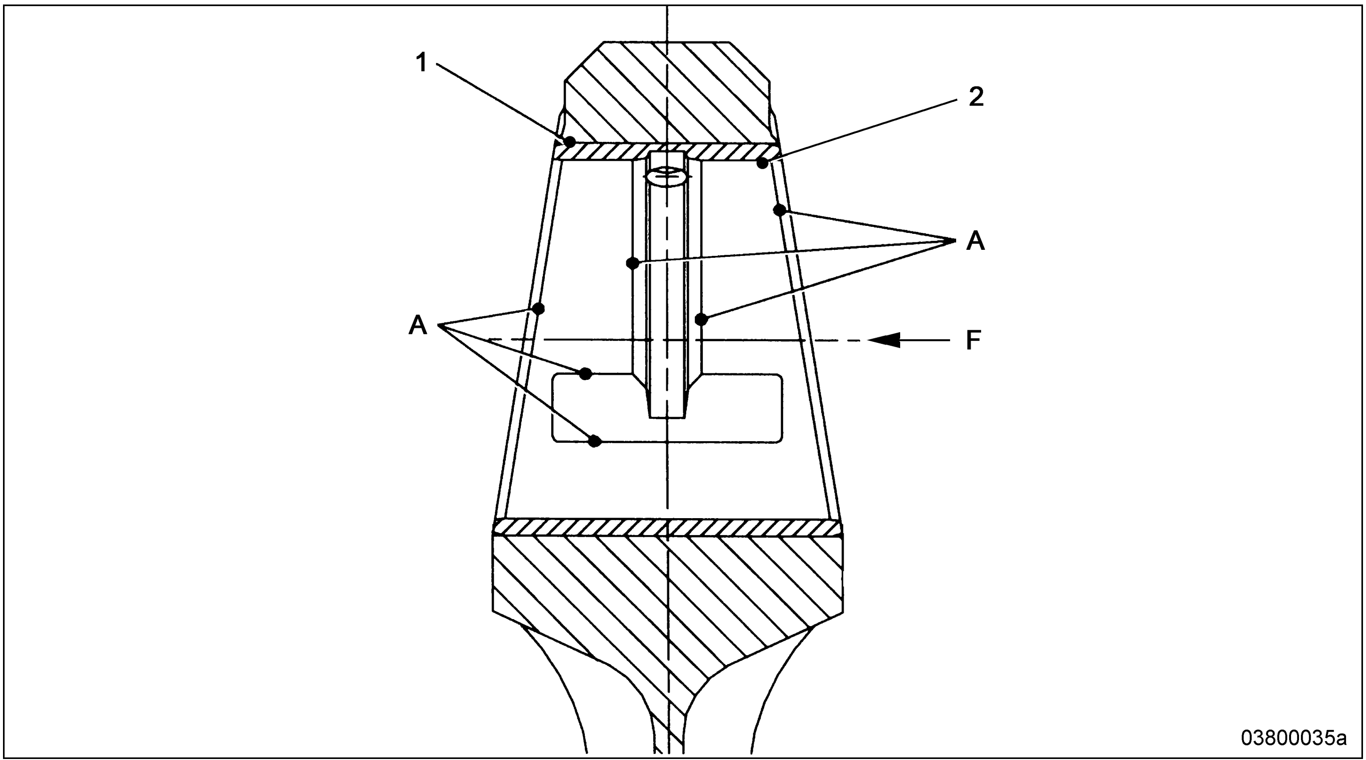
Re 1: Limit value exceeded: Replace screw.

Conrod bore parallelism



No.	Designation	Stage	Tol. size Basic size	Deviation		Clearance		Interference		Limit value
				Lower	Upper	Min.	Max.	Min.	Max.	
1	Conrod length		364.000	−0.100	+0.100					
2	Axial parallelism Inclination	0.070 over a distance of 100 mm								Inclination max. 0.100
3	Axial parallelism Offset	0.250 over a distance of 100 mm								Offset max. 0.350
Conrod weight		9.580 kg		-0.060 kg	+0.060 kg					

Small conrod bore



No.	Designation	Stage	Tol. size Basic size	Deviation Lower	Deviation Upper	Clearance Min.	Clearance Max.	Interference Min.	Interference Max.	Limit value
1	Conrod bore	0	75.000 H6	0	+0.019			0.101	+0.139	
		1	75.200 H6							
		2	75.400 H6							
	Conrod bushing outer dia.	0	75.000 v6	+0.120	+0.139					
		1	75.200 v6							
		2	75.400 v6							
2	Conrod bushing ID		68.000	+0.070	+0.080					
F	Axial test force for conrod: 30000 N (tested conrod bushings are marked with an "X")									
A	Edges rounded									

3.90 Oil heat exchanger and oil control housing – Cleaning

Material

Designation / Use	Part No.	Qty.
Porozink from Parobe-Chemie	→ FLS	
Porodox from Henkel	→ FLS	
Branorol 32/10 made by Brangs u. Heinrich	→ FLS	
3 to 5% P3 FD solution made by Henkel.	→ FLS	
Cleaning agent (Snow-White)	→ FLS	1
Cleaning agent (Hakupur 312)	→ FLS	1

WARNING	High-pressure water jet. **Risk of injury!** • Do not direct water jet at persons, electric or electronic equipment. • Wear protective clothing, gloves, and goggles / safety mask.

WARNING	High-pressure water jet. **Risk of injury!** • Do not direct water jet at persons, electric or electronic equipment. • Wear protective clothing, gloves, and goggles / safety mask.

WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.

WARNING	Cleaner is extremely caustic. **Risk of injury and suffocation!** • Avoid contact with eyes and skin. • Do not inhale vapors and smoke. • Do not eat, drink, smoke when working with cleaner. • Wear protective clothing, gloves, and goggles / safety mask. • Take measures against electrostatic charging.

CAUTION	Excessive reaction time of cleaning agents on components. **Damage to component!** • Observe manufacturer's instructions. • Wear protective clothing, gloves, and goggles / safety mask.

Oil heat exchanger – Cleaning the water side

1. Inspect oil heat exchanger for contamination before cleaning water side.
2. Clean with a suitable cleaning agent, e.g. Porodox or Porozink if encrustations of hardness minerals, dirt and oil deposits are visible on the water side (inlet area).

   Note: Soaking time depends on the condition and temperature of the solution and the nature and stubbornness of the deposits.

3. Fill cleaning agent into the oil heat exchanger.
4. Flush the oil heat exchanger with water after cleaning. pH value difference between fresh water and flushing water max. 1 pH

TIM ID: 0000034731 – 001

5. Dry and preserve the oil heat exchanger if it is not put back into operation immediately.
    5.1. Dry in a drying furnace.
        - Temperature: 110 °C to 120 °C
        - Drying time: 3 hours
    5.2. Preserving oil heat exchanger
        - Preservative: Branorol 32/10
        - Dosage: 2 ml Branorol 32/10 per liter of cooling volume
6. Seal openings with suitable covers after preserving.

Oil heat exchanger – Cleaning the oil side

1. Replace oil heat exchanger in case of swarf ingress in engine oil system, e.g. due to piston seizure or bearing damage.
2. Connect oil side to a closed-circuit flushing facility.
    - Filter system mesh size: 0.05 mm

    Note: Flush with cleaning agent in opposite direction of oil flow in normal operation.

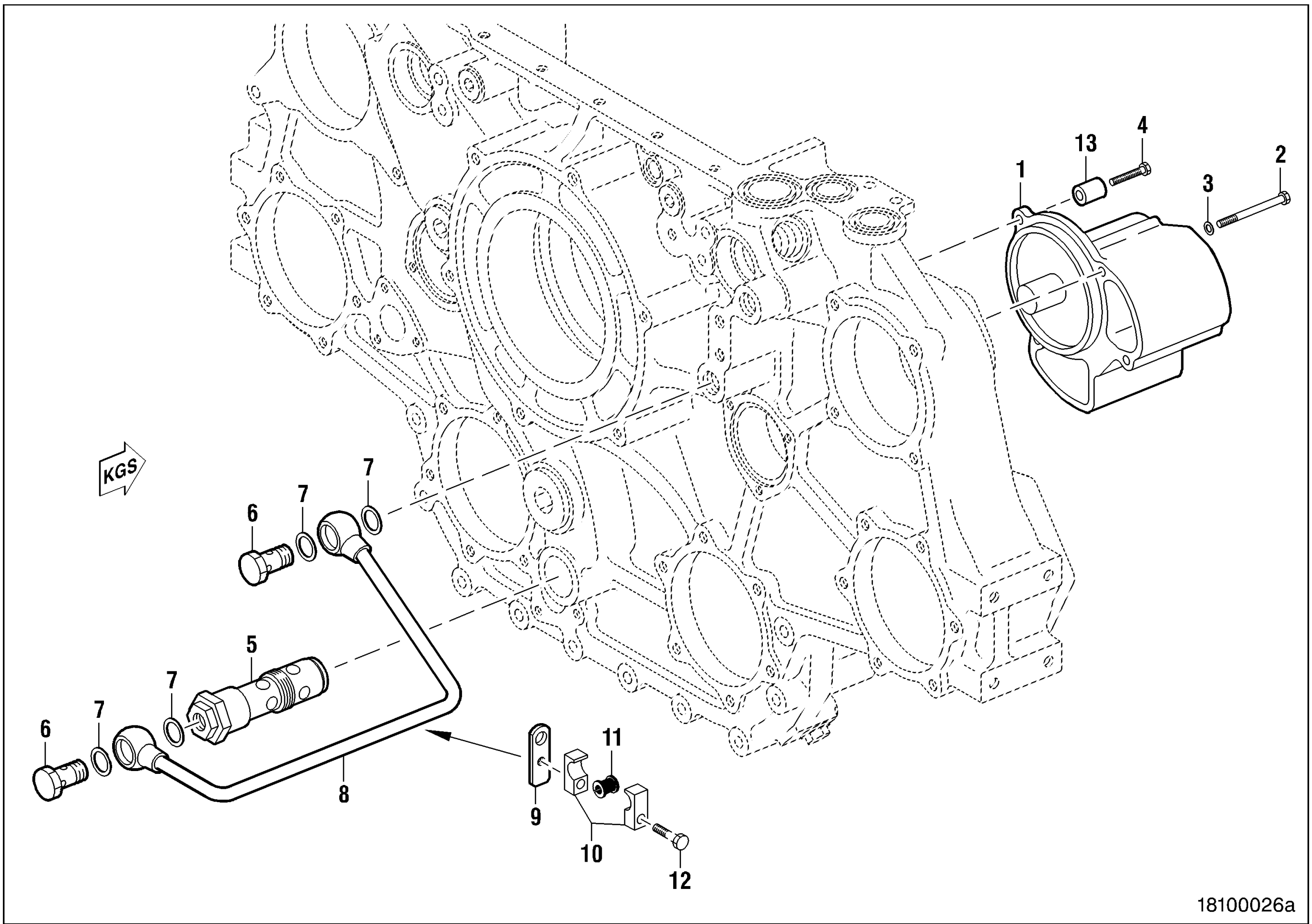
3. Prepare cleaning agent in accordance with manufacturer’s instructions. Cleaning agent: 3 to 5% P3 FD solution
    - Flushing pressure: 3 bar to 4 bar at 150 liters/minute to 300 liters/minute
    - Cleaning results may be additionally improved by use of ultrasound.
4. Flush the oil heat exchanger with water after cleaning. pH value difference between fresh water and flushing water max. 1 pH
5. If the oil heat exchanger is not put into operation immediately afterwards, after this cleaning it must be dried and then preserved (see cleaning the water side).

Oil control housing – Cleaning

1. Clean all metallic parts with cleaning agent (Snow-White 11-0) then flush with cleaning agent (Hakupur 312).
2. Blow out all components with compressed air.

TIM ID: 0000034731 – 001

3.91 Lube-oil pump with drive – Overview



1 Oil pump	6 Banjo screw	11 Grommet
2 Screw	7 Sealing ring	12 Screw
3 Washer	8 Oil line	13 Spacer sleeve
4 Screw	9 Retainer	
5 Pressure reducing valve	10 Pipe half-clamp	

TIM ID: 0000034732 – 001

3.92 Starting the engine in manual mode

Preconditions

- Engine is unloaded.
- External start interlock is not activated.

DANGER	Unguarded rotating and moving engine components. **Risk of serious injury — danger to life!** • Before barring or starting the engine, ensure that nobody is in the danger zone.

WARNING	Engine noise above 85 dB (A). **Risk of damage to hearing!** • Wear ear protectors.

Preparation

Item	Task
Operating mode selector switch (if provided)	Change to manual mode.
Coolant preheating unit (if provided)	Switch ON.

Starting the engine

Item	Task
Switching cabinet, control panel etc. (depending on manufacturer)	If coolant temperature is • > 40 °C (with coolant preheating unit, if provided) press start button. • Automatic starting procedure is performed; • Tachometer indicates increasing crankshaft speed; • After the starting procedure is completed, engine is running at idle speed.

TIM ID: 0000034733 – 001

3.93 Stopping the engine in manual mode

Preconditions

- Engine is not under load.
- Engine is running in manual mode.

CAUTION	Stopping the engine when it is running at full load causes extreme stress to the engine. **Risk of overheating, damage to components!** • Before stopping the engine, operate it at idle speed until operating temperatures decrease and stable values are indicated.

Preparation

Item	Task
Engine	Allow engine to cool down by operating it idle for approx. 5 minutes.

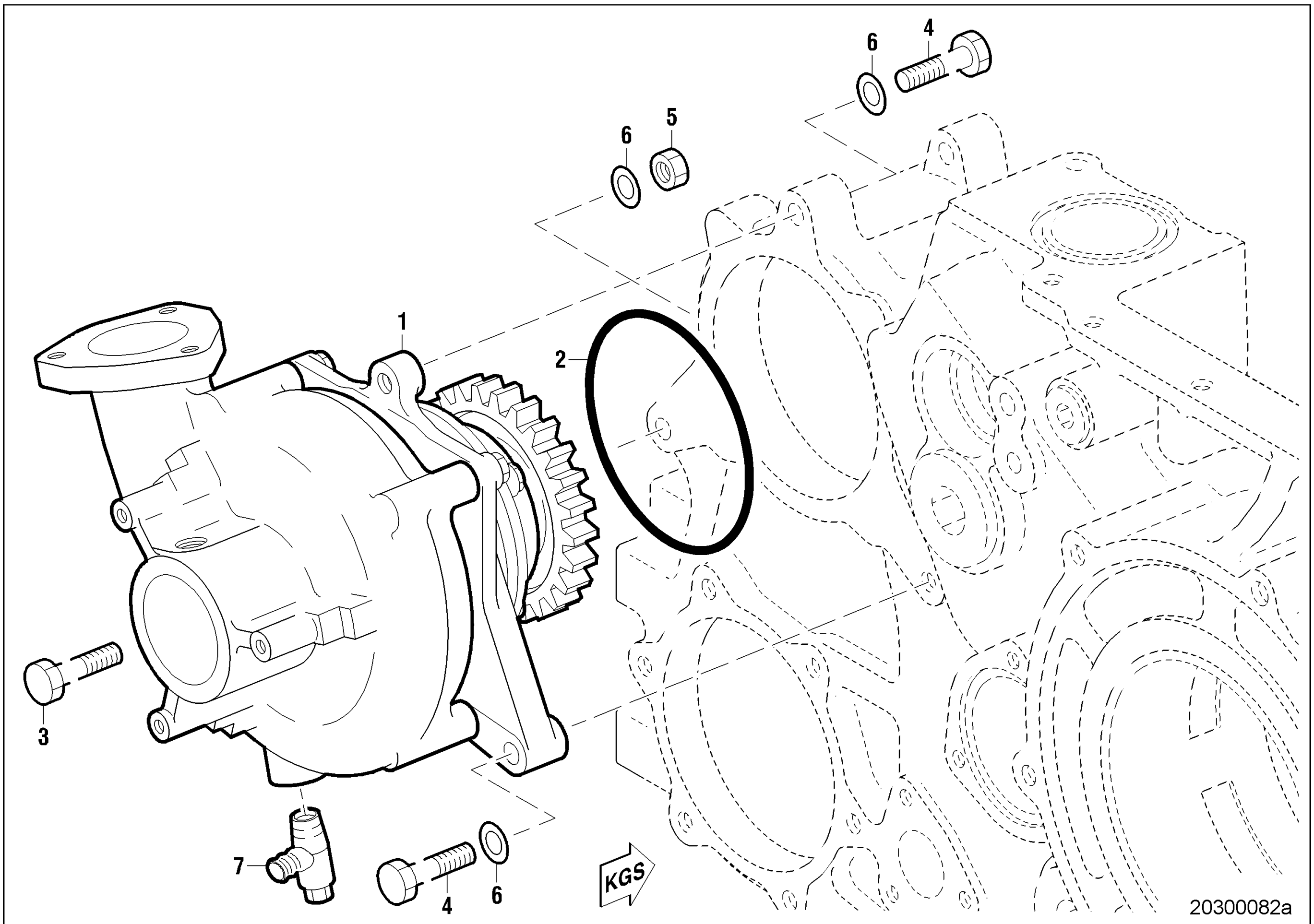
Stopping the engine

Item	Task
Switching cabinet, control panel etc. (depending on manufacturer)	Press stop button. • Automatic stopping procedure is performed; • Engine is stopped.

TIM ID: 0000034734 – 001

3.94 Charge-air coolant pump – Overview

Charge-air coolant pump – Overview



1 Charge-air coolant pump
2 O-ring
3 Screw
4 Screw
5 Nut
6 Washer
7 Drain valve

TIM ID: 0000034735 – 001

3.95 Oil heat exchanger – Check

Material

Designation / Use	Part No.	Qty.
Red dye penetrant for surface crack-testing procedure	→ FLS	

Spare parts

Designation / Use	Part No.	Qty.
Oil heat exchanger housing	→ SPC	
Heat exchanger core	→ SPC	
Retainer	→ SPC	
Plug-in pipe	→ SPC	

⚠ WARNING	Compressed air. **Risk of injury!** • Do not direct compressed-air jet at persons. • Wear protective goggles / safety mask and ear protectors.
⚠ WARNING	Compressed air is pressurized. Hot testing liquid. **Risk of injury and scalding!** • Pressure must not exceed 0.5 bar. • Wear protective clothing, gloves, and goggles / safety mask.
⚠ WARNING	Component is hot. **Risk of burning!** • Wear protective gloves.
⚠ CAUTION	Contamination of components. **Damage to component!** • Observe manufacturer's instructions. • Check components for special cleanness.

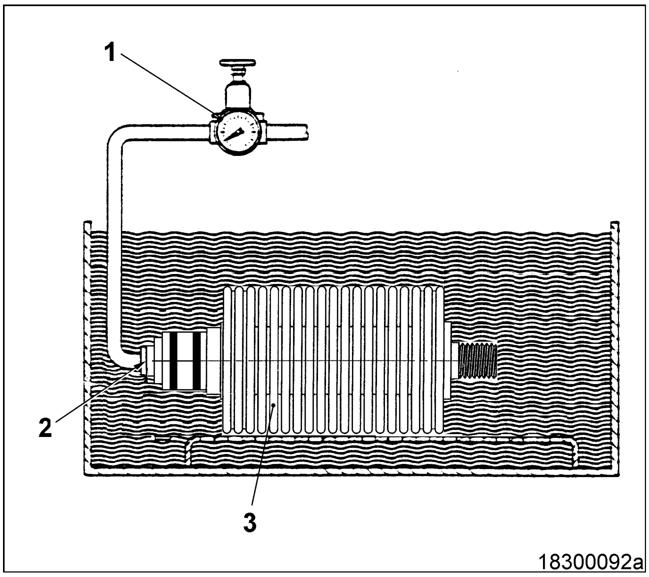
Oil heat exchanger check

Item	Findings	Action
Visually inspect all components for damage.	Damaged	• Corrective work • Replace
Check all sealing, mating and contact faces for damage and unevenness.	• Damaged • Uneven	• Corrective work: Smooth with oilstone or crocus cloth. • Replace
Check thread for easy movement.	Sluggish	• Recut • Replace
Check oil heat exchanger housing for cracks with red dye penetrant.	Cracks indicated	Replace

TIM ID: 0000034696 – 001

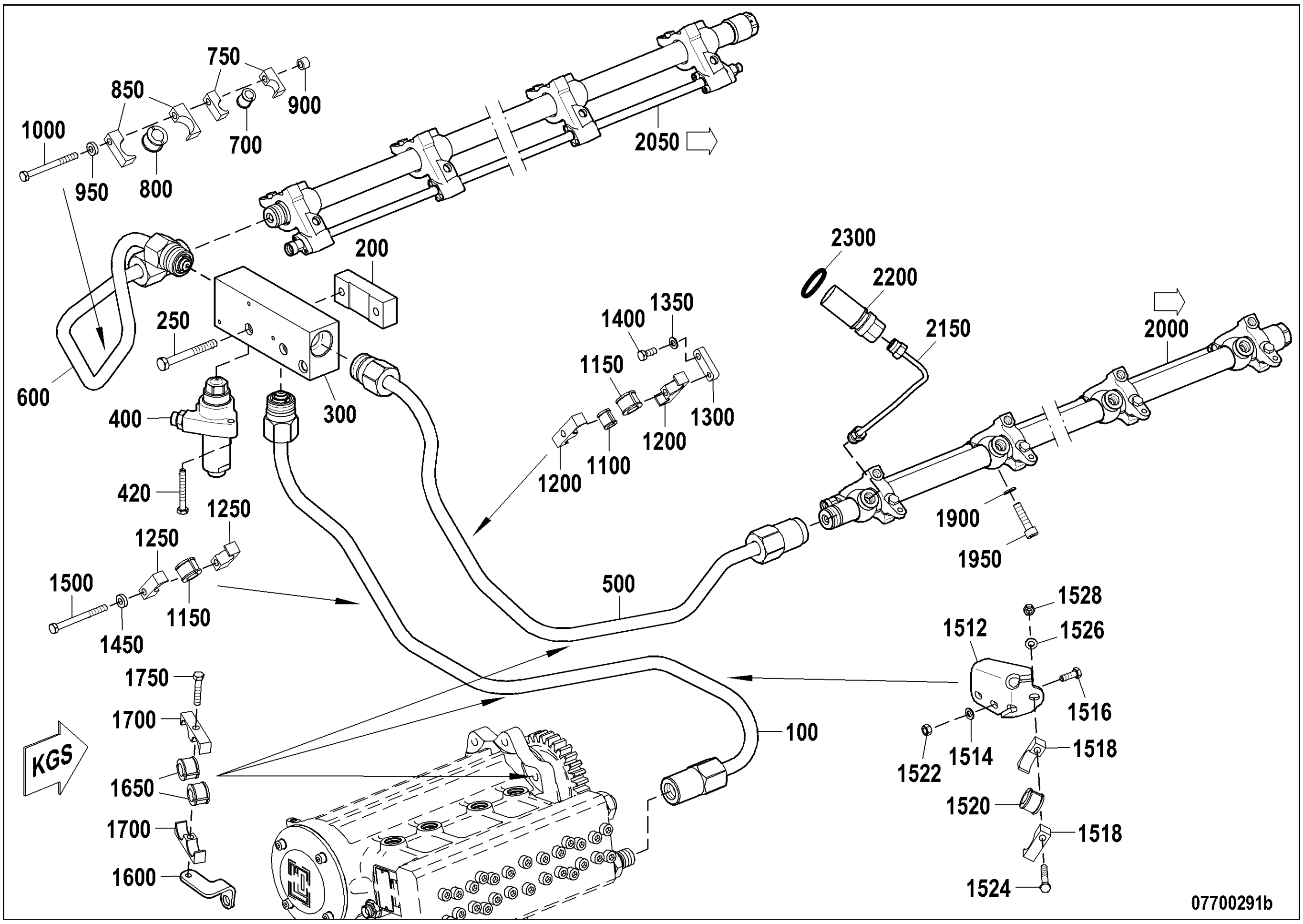
Heat exchanger core leak check

1. Seal oil chamber connections of heat exchanger core (3) with suitable sleeves, blanking plugs, plugs (2) and clamps.
2. Connect pressure line (1) at plug (2).
3. Preheat test bath to 80 °C.
4. Immerse heat exchanger core (3) in test bath.
5. Open compressed air supply and set pressure reducer (1) to 0.5 bar.
6. Pressuretest heat exchanger core (3) for leaks with air in water bath; no bubbles should emerge.
7. Replace heat exchanger core (3) if leaky.
8. Remove compressed-air line (1), sleeves and plug (2).
9. Blow out cooling fins of heat exchanger core (3) with compressed air in vertical direction.



3.96 High-pressure fuel line – Overview

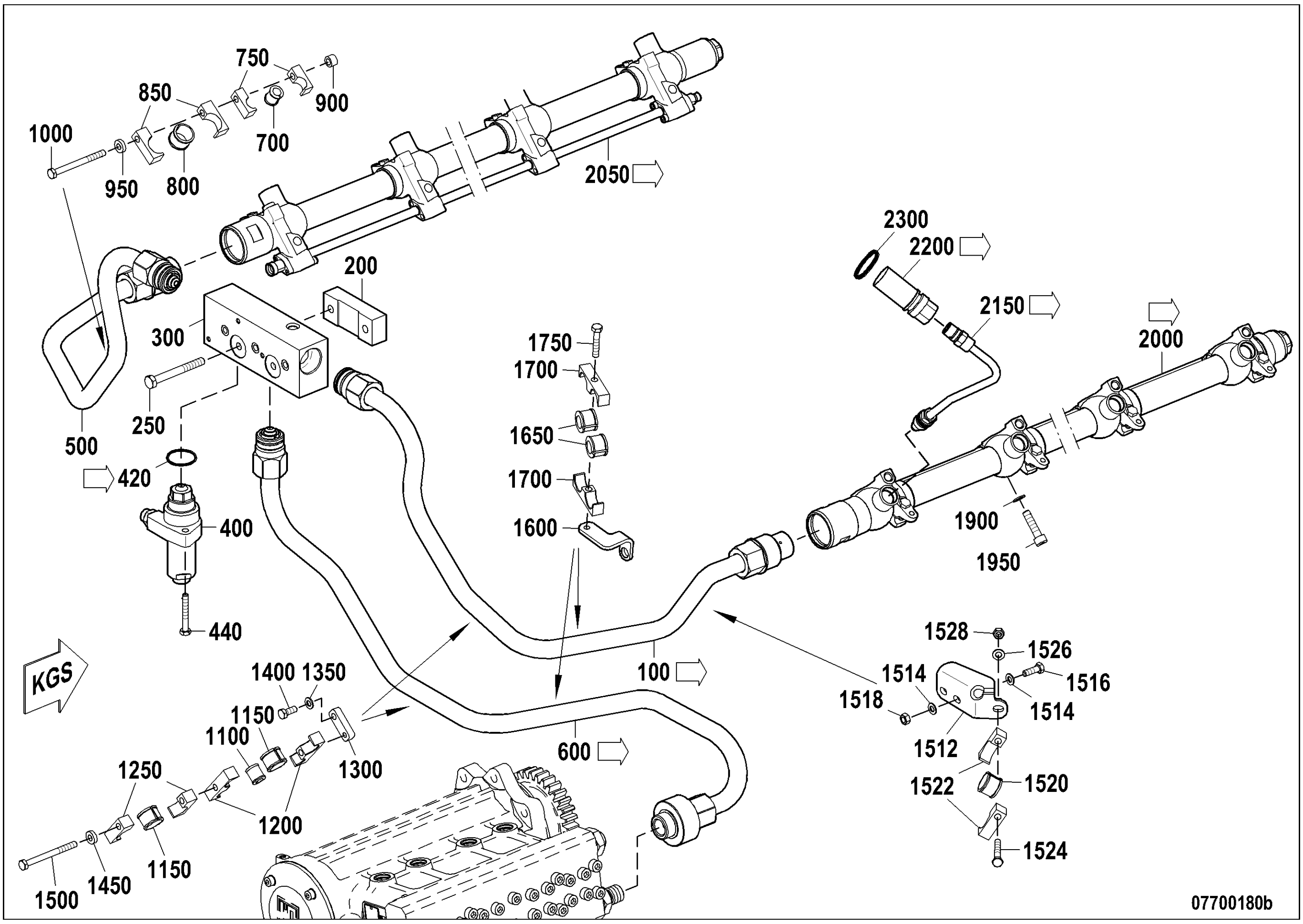
High-pressure line, single-walled, from high-pressure fuel pump to injector with attachments



100 High-pressure fuel line, single-walled
200 Intermediate plate
250 Screw
300 Fuel distributor, single-walled
400 Pressure relief valve for 16 V/20 V
420 Screw
500 High-pressure fuel line, single-walled
600 High-pressure fuel line, single-walled
700 Grommet
750 Pipe half-clamp
800 Grommet
850 Pipe half-clamp
900 Spacer
950 Washer
1000 Screw
1100 Grommet
1150 Grommet
1200 Pipe half-clamp
1250 Pipe half-clamp
1300 Retainer
1350 Washer
1400 Screw
1450 Washer
1500 Screw
1512 Retainer
1514 Washer
1516 Screw
1518 Screw
1520 Grommet
1522 Nut
1524 Screw
1526 Washer
1528 Nut
1600 Retainer on injection pump
1650 Grommet
1700 Pipe half-clamp
1750 Screw
1900 Washer
2000 High-pressure accumulator, single-walled, left
2050 High-pressure accumulator, single-walled, right
2200 Adapter
2300 O-ring

TIM ID: 0000023109 – 001

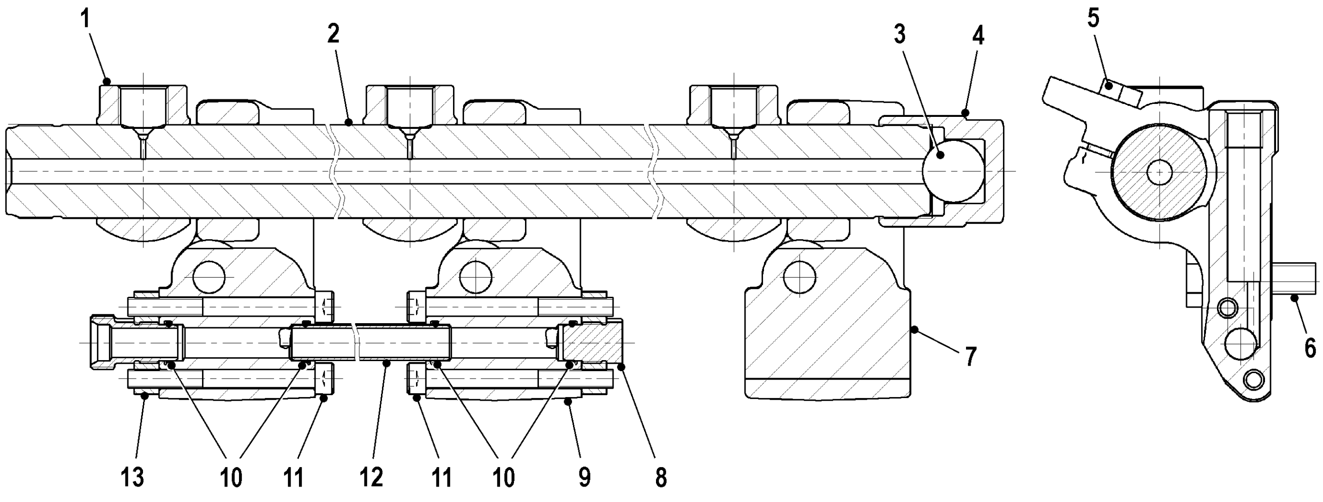
High-pressure line, double-walled, from high-pressure fuel pump to injector with attachments



100	Fuel line, double-walled
200	Intermediate plate
250	Screw
300	Distributor piece, double-walled
400	Breather valve for 16 V/20 V
420	O-ring
440	Screw
500	High-pressure fuel line
600	High-pressure fuel line, double-walled
700	Grommet
750	Pipe half-clamp
800	Grommet
850	Pipe half-clamp
900	Spacer
950	Washer
1000	Screw
1100	Grommet
1150	Grommet
1200	Pipe half-clamp
1250	Pipe half-clamp
1300	Retainer
1350	Washer
1400	Screw
1450	Washer
1500	Screw
1512	Retainer
1514	Washer
1516	Screw
1518	Nut
1520	Grommet
1522	Pipe half-clamp
1524	Screw
1526	Washer
1528	Nut
1600	Retainer on injection pump
1650	Grommet
1700	Pipe half-clamp
1750	Screw
1900	Washer
1950	Screw
2000	High-pressure accumulator, double-walled, left
2050	High-pressure accumulator, double-walled, right
2150	High-pressure fuel line to injector
2200	Adapter, jacketed
2300	O-ring

TIM ID: 0000023109 - 001

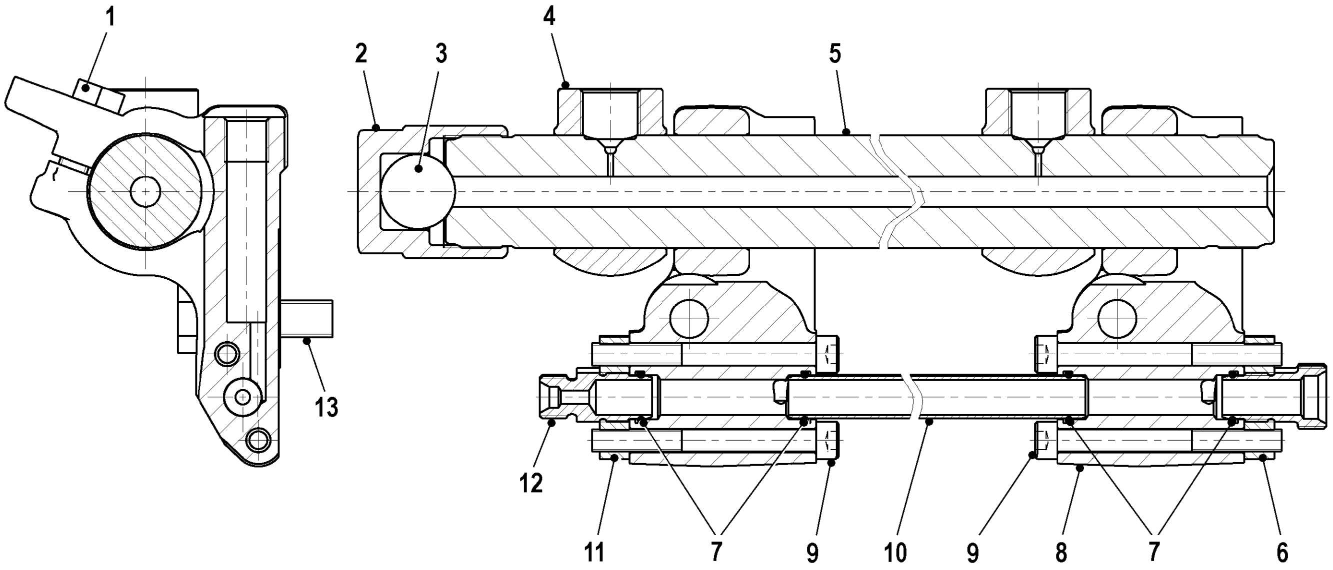
High-pressure accumulator, left engine side



1 Banjo union	6 Screw	11 Socket-head screw
2 High-pressure accumulator	7 Hold-down clamp	12 Plug-in pipe
3 Ball	8 Plug	13 Flange
4 Union nut	9 Hold-down clamp	
5 Screw	10 O-ring	

TIM ID: 0000023109 – 001

High-pressure accumulator, right engine side



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1 Screw
2 Union nut
3 Ball
4 Banjo union
5 High-pressure accumulator
6 Flange
7 O-ring
8 Hold-down clamp
9 Socket-head screw
10 Plug-in pipe
11 Flange
12 Flange

3.97 Engine coolant – Draining

Preconditions

- Engine is stopped and starting disabled.

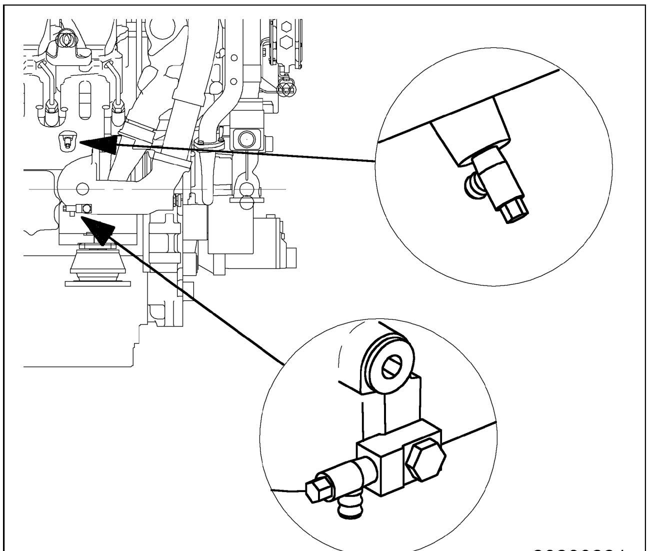
⚠ **WARNING**	Coolant is hot and under pressure. **Risk of injury and scalding!** • Let the engine cool down. • Wear protective clothing, gloves, and goggles / safety mask.

Preparatory steps

1. Provide an appropriate container to drain the coolant into.
2. Switch off preheating unit.

Engine coolant – Draining

1. Turn breather valve of filler neck on coolant expansion tank counterclockwise to first stop and allow pressure to escape.
2. Continue to turn breather valve counterclockwise and remove.
3. Draw off precipitated corrosion inhibitor oil from the expansion tank through filler neck.
4. Open drain valves and drain plugs and drain coolant at the following points:
   - Preheating unit;
   - HT coolant pump elbow;
   - Crankcase, left and right side.



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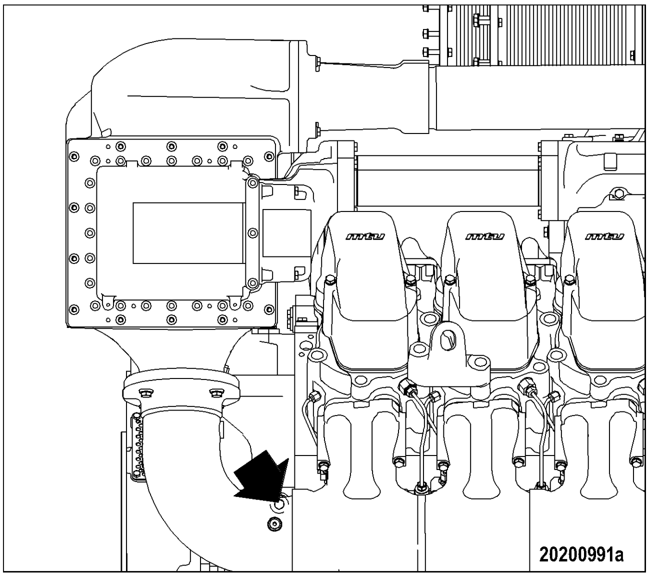
5. Drain points at driving end, left and right side.



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TIM ID: 0000034775 – 001

Final steps

1. Close all open drain points.
2. Set breather valve onto filler neck and close it.

3.98 Expansion tank – sight glass cleaning

Preconditions

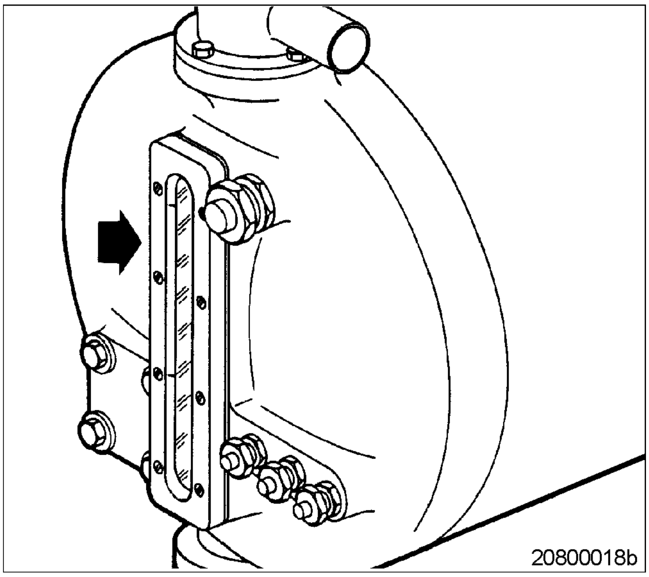
- Engine is stopped and starting disabled.

Spare parts

Designation / Use	Part No.	Qty.
Rubber seal	→ SPC	

Expansion tank – sight glass cleaning

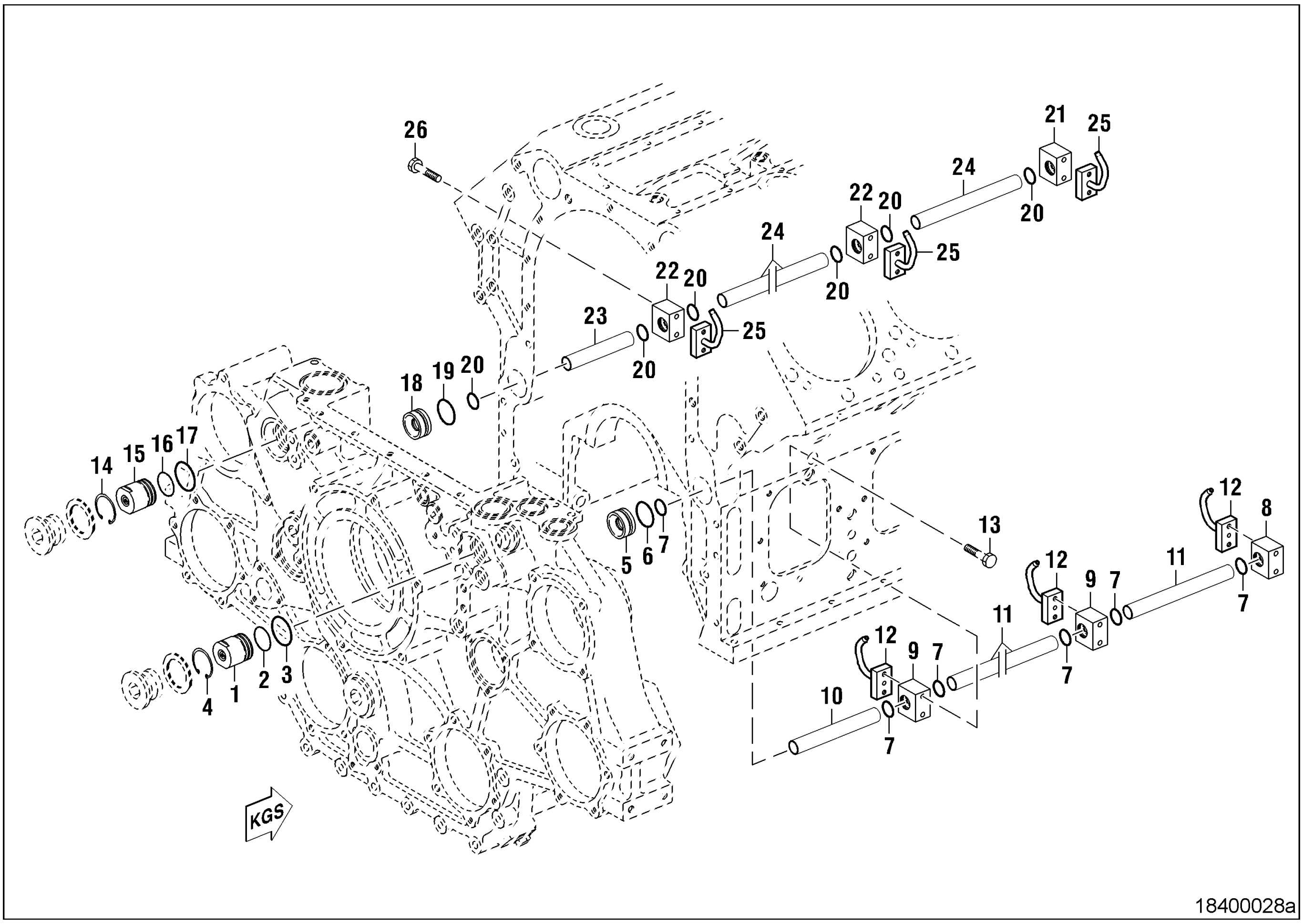
1. Remove screws from coolant level display crosswise.
2. Take off coolant level display and sight glass, be aware of the seals.
3. Clean sight glass and coolant transition ducts in the expansion tank.
4. Check seals for damage, replace damaged seals.
5. Fit seals, sight glass and coolant level display.
6. Install screws and tighten evenly and crosswise.
7. Check for leaks.



TIM ID: 0000034776 – 001

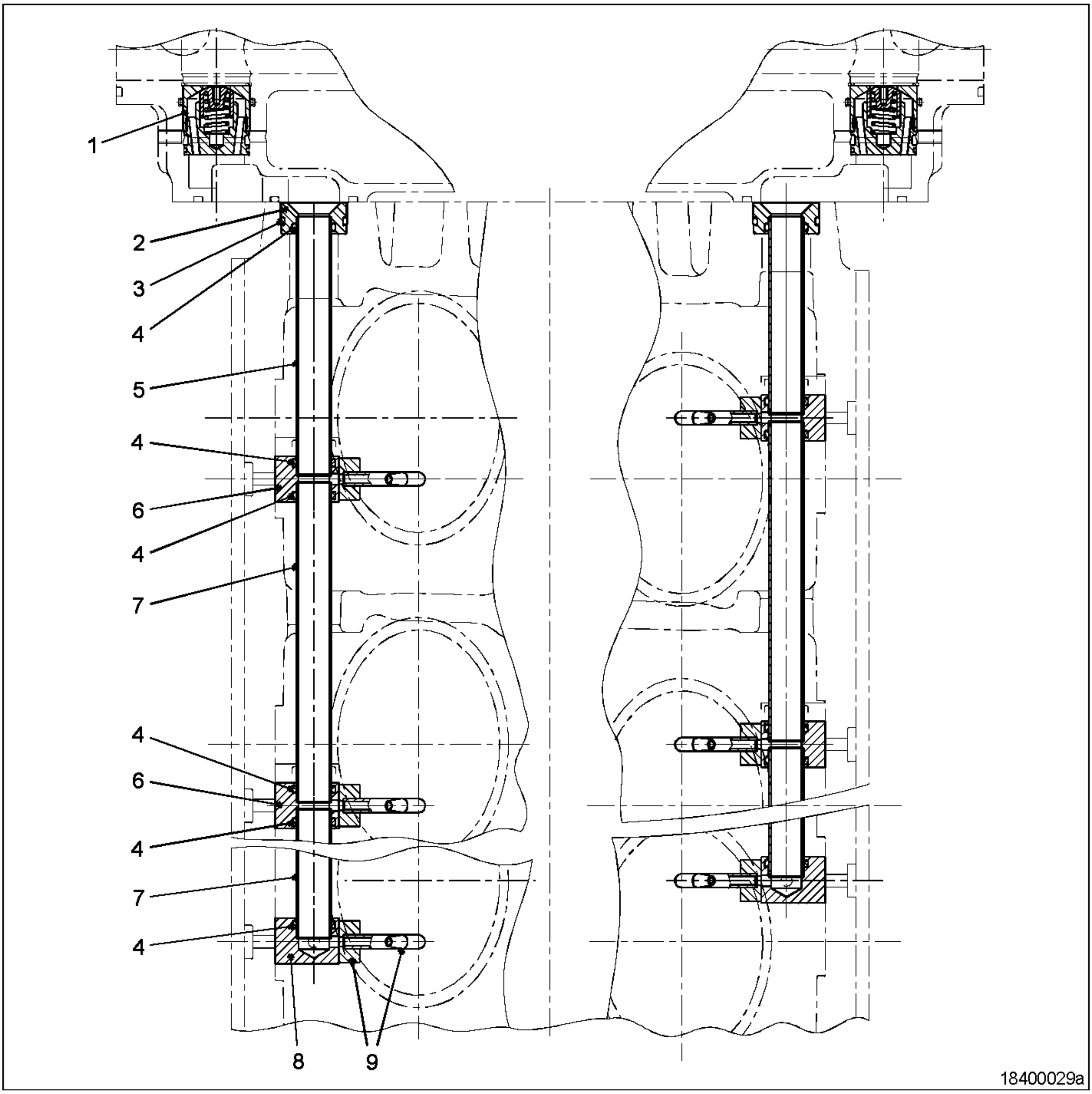
3.99 Oil system in crankcase – Overview

Oil system



1 Delivery valve
2 O-ring
3 O-ring
4 Snap ring
5 Washer
6 O-ring
7 O-ring
8 Holder
9 Holder
10 Pipe
11 Pipe
12 Oil spray nozzle
13 Hex screw
14 Snap ring
15 Delivery valve
16 O-ring
17 O-ring
18 Washer
19 O-ring
20 O-ring
21 Holder
22 Holder
23 Pipe
24 Pipe
25 Oil spray nozzle
26 Hex screw

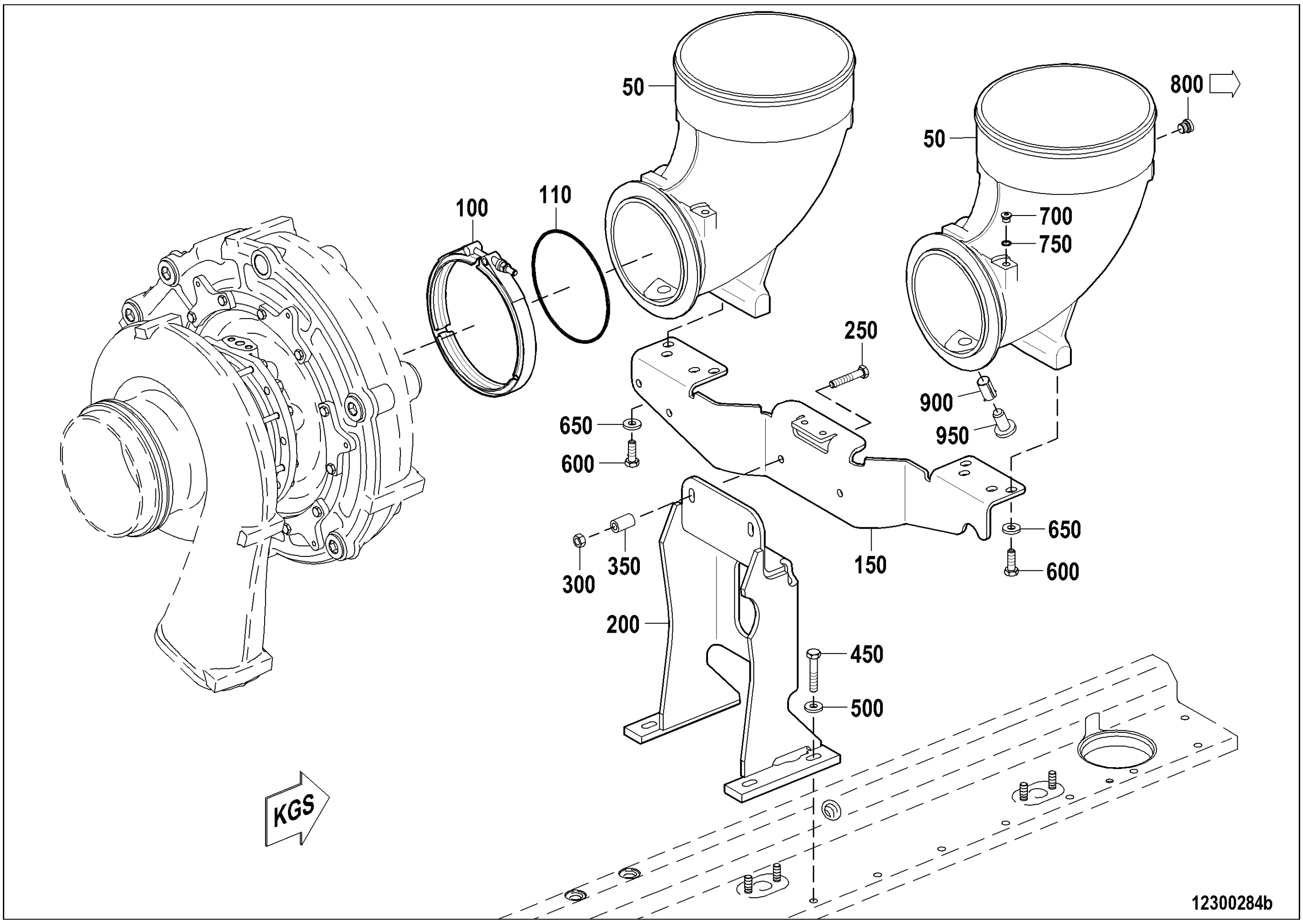
TIM ID: 0000002875 – 001



1 Delivery valve	4 O-ring	7 Holder
2 O-ring	5 Pipe	8 Holder
3 Washer	6 Holder	9 Oil spray nozzle

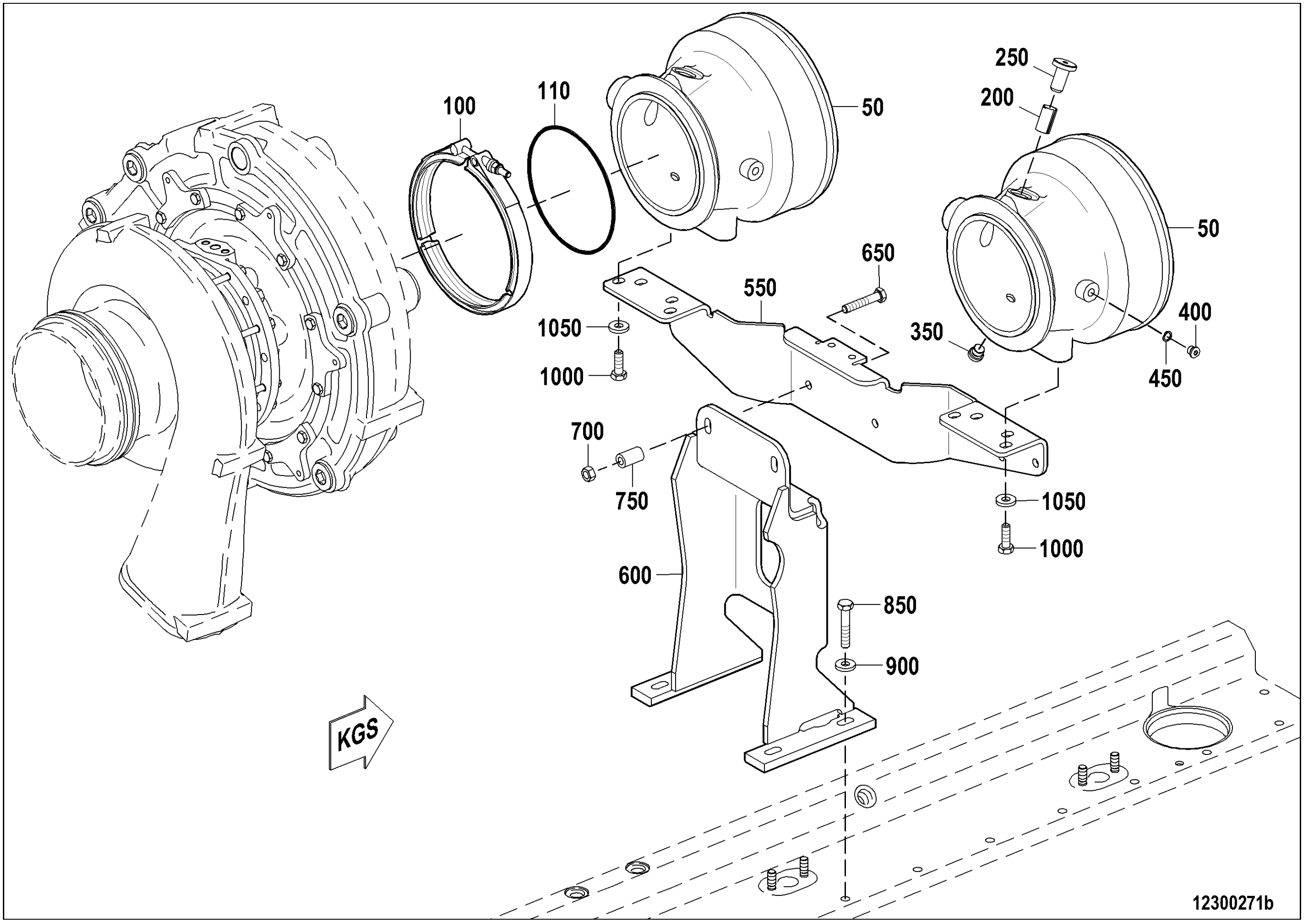
TIM ID: 0000002875 – 001

3.100 Air intake housing – Overview



50	Air intake housing	300	Nut	700	Plug screw
100	Clamp	350	Spacer bushing	750	Sealing ring
110	O-ring	450	Screw	800	Plug screw
150	Bracket	500	Washer	900	Bushing for speed sensor
200	Carrier	600	Screw	950	Plug
250	Screw	650	Washer		

TIM ID: 0000019456 – 002

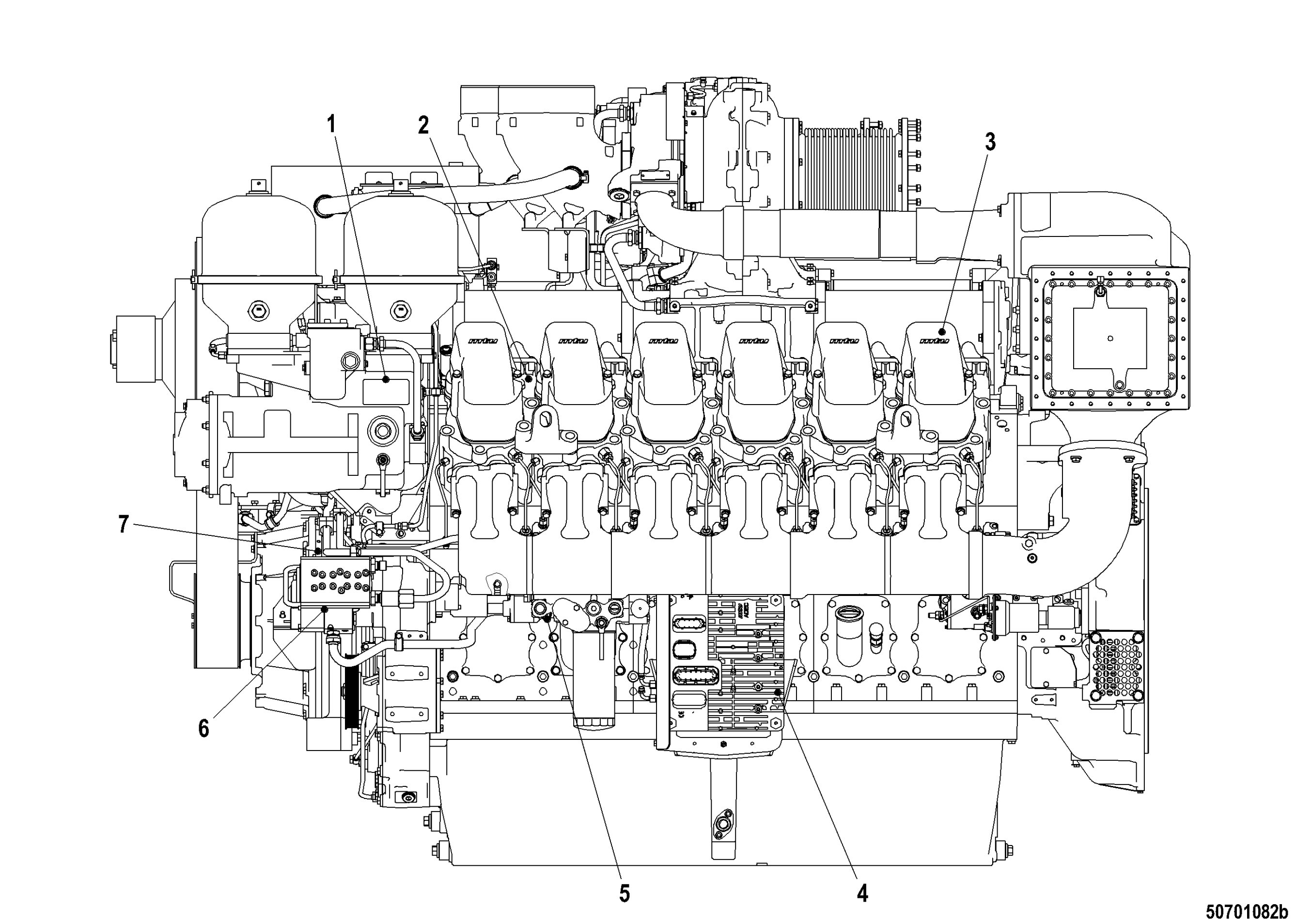


50	Air intake housing	400	Plug screw	750	Spacer bushing
100	Clamp	450	Sealing ring	850	Screw
110	O-ring	550	Bracket	900	Washer
200	Bushing for speed sensor	600	Carrier	1000	Screw
250	Plug	650	Screw	1050	Washer
350	Plug screw	700	Nut		

TIM ID: 0000019456 – 002

3.101 Sensors, actuators and injectors – Overview

Illustration is valid for 16V 4000 Cx3 engines



1 B07 (lube oil temperature)
2 Exhaust temperature sensors for individual cylinders B4.1 to B4.8 (A bank) (optional for 16V only)
3 Injectors Y39.1 to Y39.6 (A-bank)
4 ADEC (ECU 7)
5 B34 (fuel pressure after filter)
6 B48 (fuel pressure in common rail)
7 M8 (HP fuel pump actuator)

The injectors are located under the cylinder-head covers. For replacement of injectors and necessary operations (→ Page 327).

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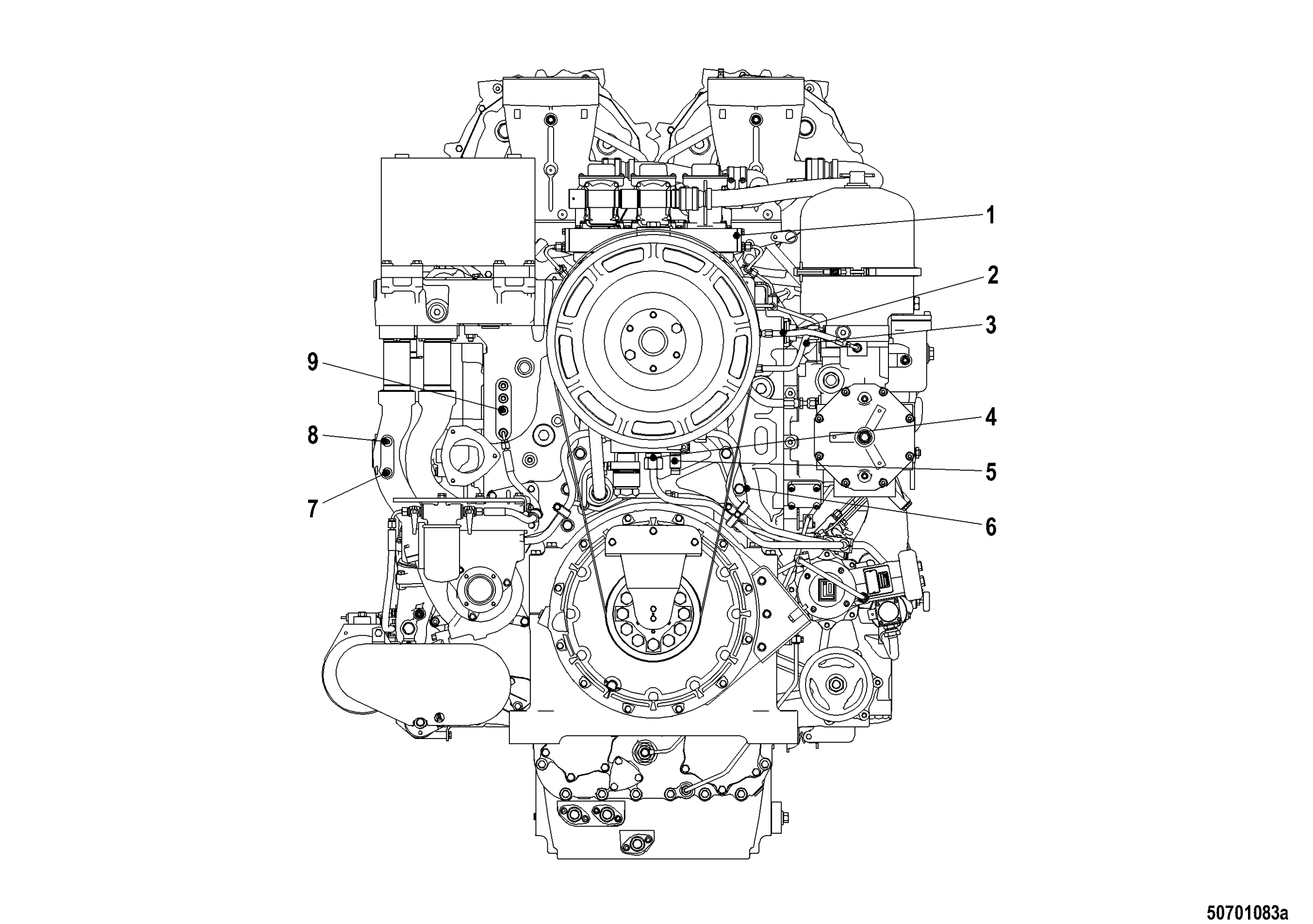

1 B50 (crankcase pressure)
2 B05.3 (lube oil pressure before filter)
3 B05 (lube oil pressure after filter)
4 B33 (fuel temperature in common rail)
5 B01 (camshaft speed)
6 B48 (fuel pressure in common rail)
7 B43 (charge-air coolant pressure)
8 B26 (charge-air coolant temperature)
9 B06 (coolant temperature)

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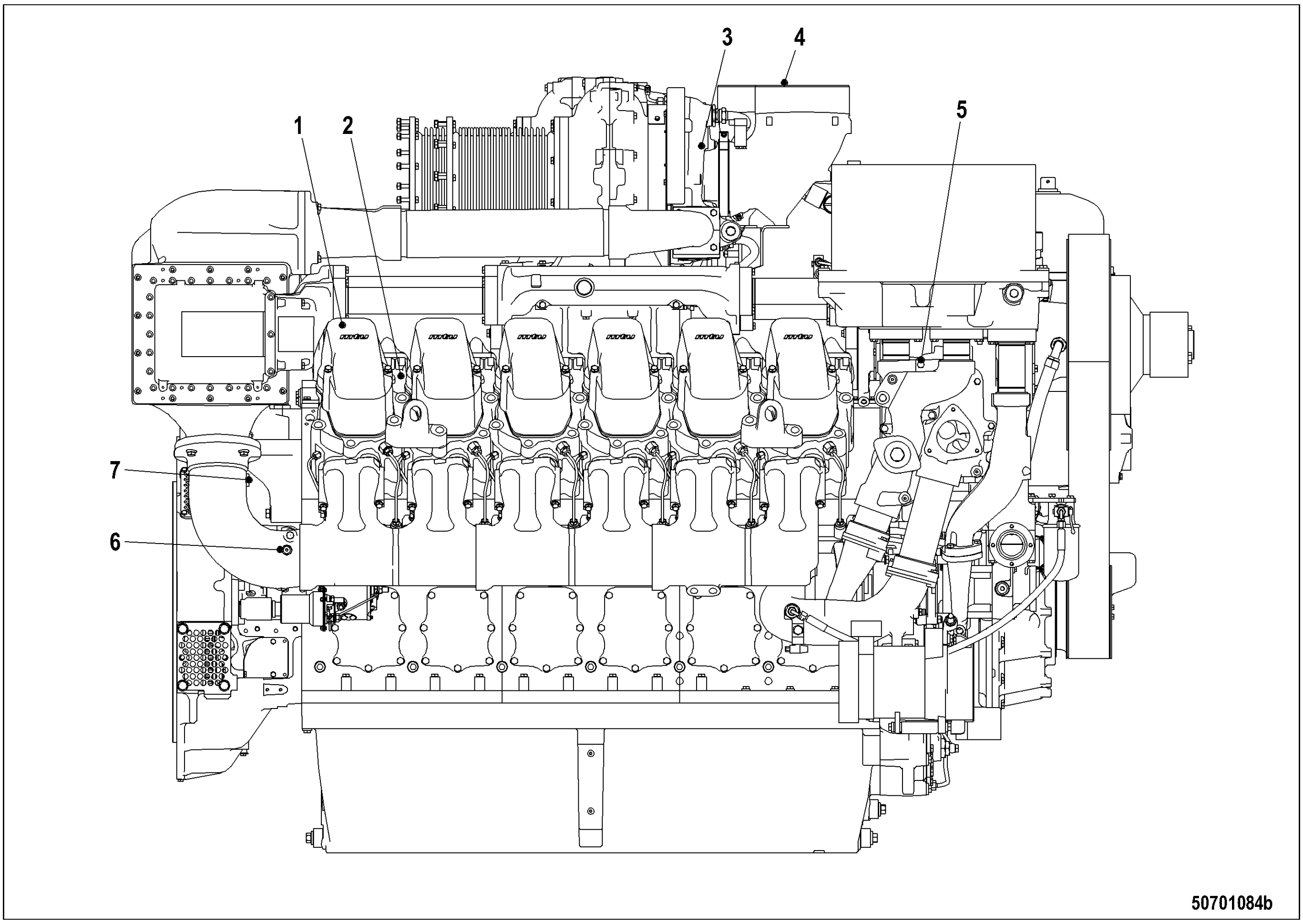

1 Injectors Y39.11 to Y39.16 (B-bank)
2 Exhaust temperature sensors for individual cylinders B4.11 to B4.18 (B bank) (optional for 16V only)
3 B44 (turbocharger speed)
4 B03 (intake air temperature)
5 B16 (coolant pressure)
6 B10 (charge-air pressure)
7 B09 (charge-air temperature)

The injectors are located under the cylinder-head covers. For replacement of injectors and necessary operations (→ Page 327).

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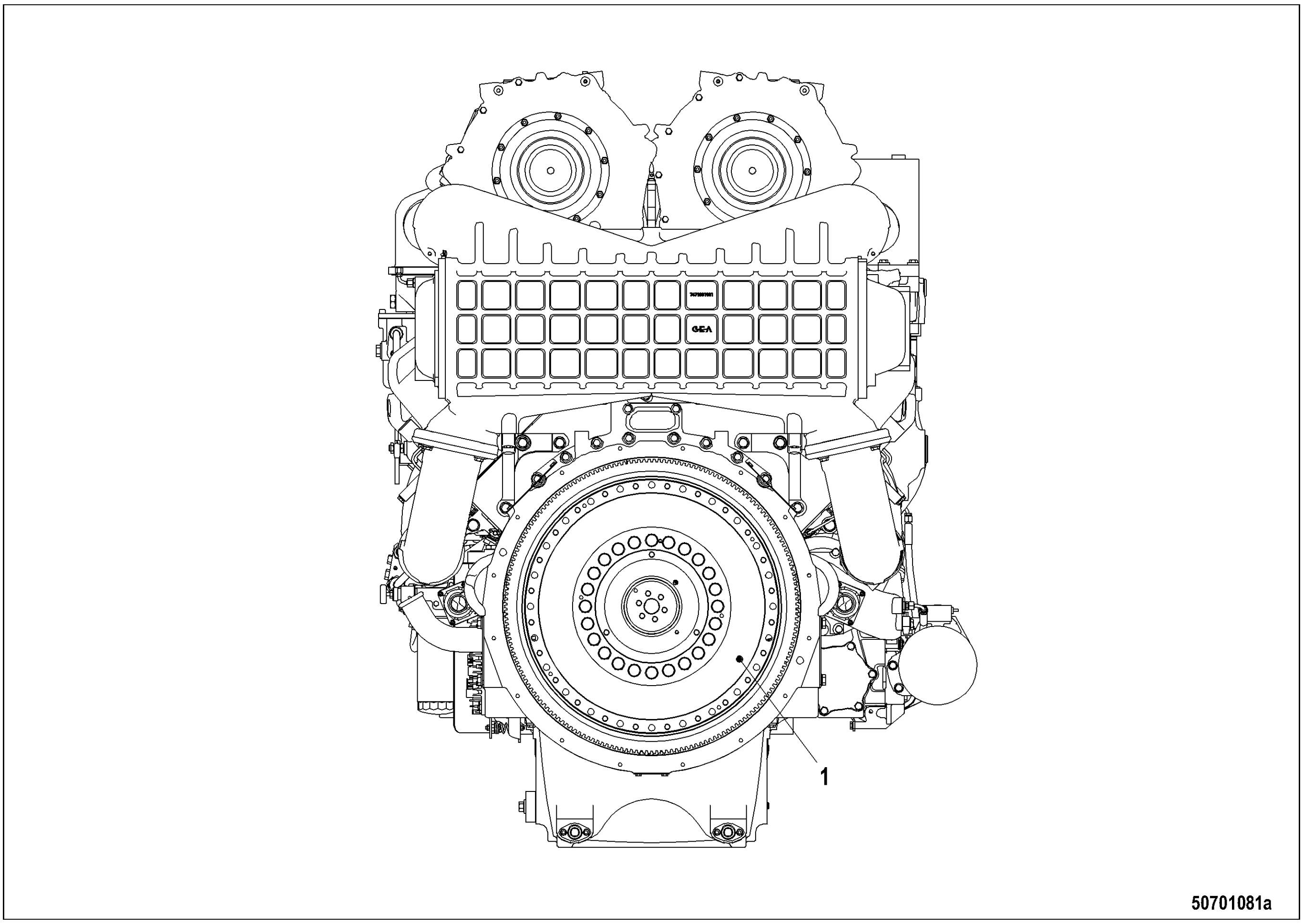

1 B13 (crankshaft speed)

3.102 Engine coolant change

Material

Designation / Use	Part No.	Qty.
Coolant	→ FLS	

Drain engine coolant (→ Page 316)**.**

Clean sight glass of expansion tank (→ Page 317)**.**

Fill engine coolant circuit (→ Page 242)**.**

TIM ID: 0000002009 – 001

3.103 Injector – Replacement

Spare parts

Designation / Use	Part No.	Qty.
Injector	→ SPC	

Remove injector and install new one (→ Page 235)**.**

TIM ID: 0000001178 – 003

3.104 Index

TIM ID: 0000001178 – 003

