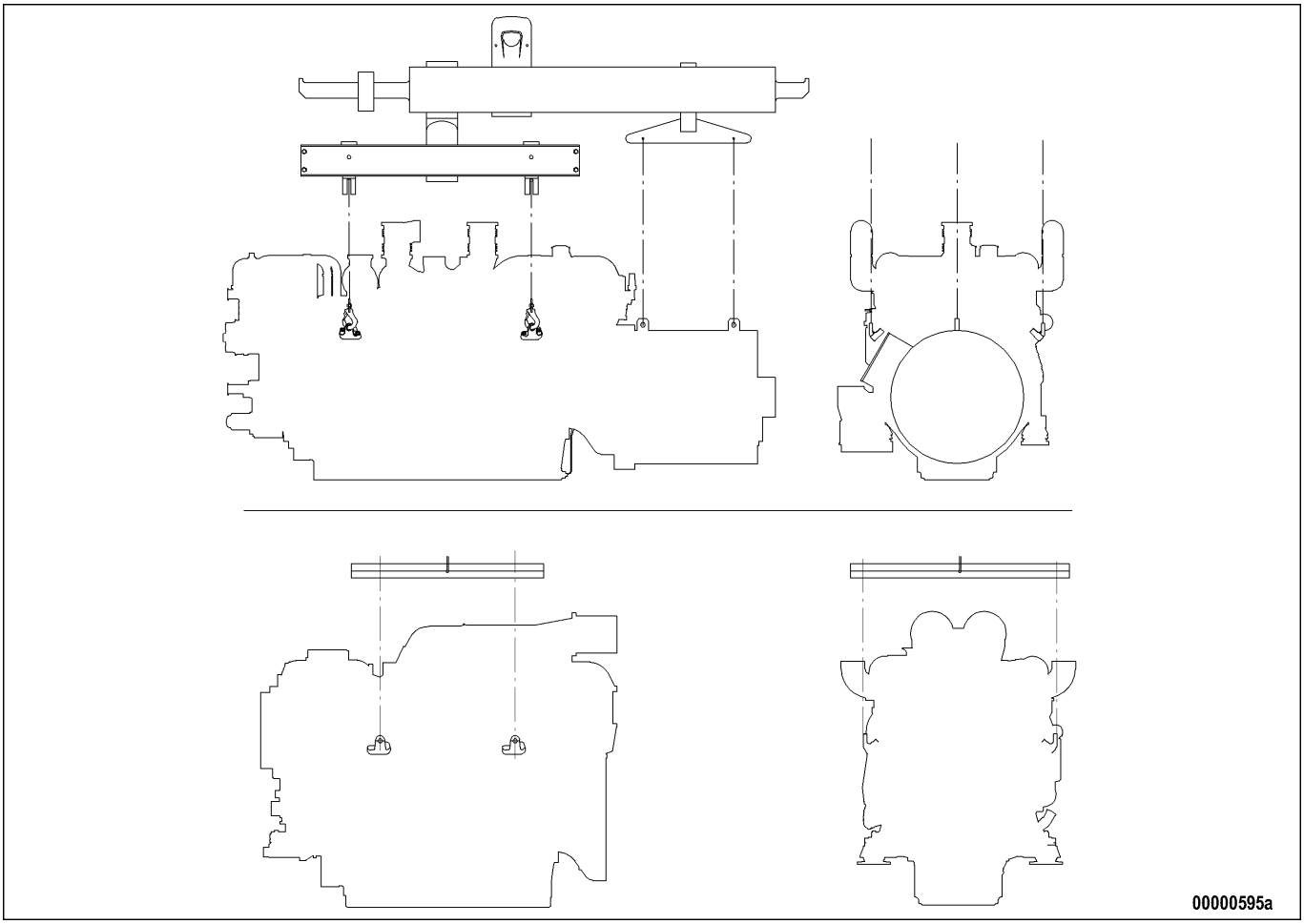
Technical Documentation

Diesel Engine
8 V 4000 R41, R41L, R41R
12 V 4000 R41, R41L, R41R
16 V 4000 R41, R41L, R41R

Operating Instructions
M015575/06E

1.3 Transport

Transport



Always use the lifting eyes on the engine and generator/gearbox when transporting gensets.

Always use the lifting eyes on the engine when transporting an engine separately.

Use only the transport and lifting equipment approved by MTU.

Transport the engine/genset in the installation position only, maximum admissible inclination is 10°.

Remove any loose parts on the genset.

Hoist the engine/genset slowly ensuring that lifting cables/chains do not touch the engine or any of its component parts. Readjust lifting tackle as necessary.

Pay attention to the center of gravity of the engine/genset.

When specially wrapped in aluminum foil, suspend the engine/genset by the lifting eyes on the bearing pedestal or transport by means of handling equipment (forklift truck) capable of bearing the load.

Fit the crankshaft shipping lock on the engine and fit the engine mount locking devices prior to transport.

Secure the engine/genset such as to preclude tipping during transport. Secure such as to preclude slipping and tipping when driving up or down inclines and ramps.

Placement after transport

Place the engine/genset on a firm, flat surface only.

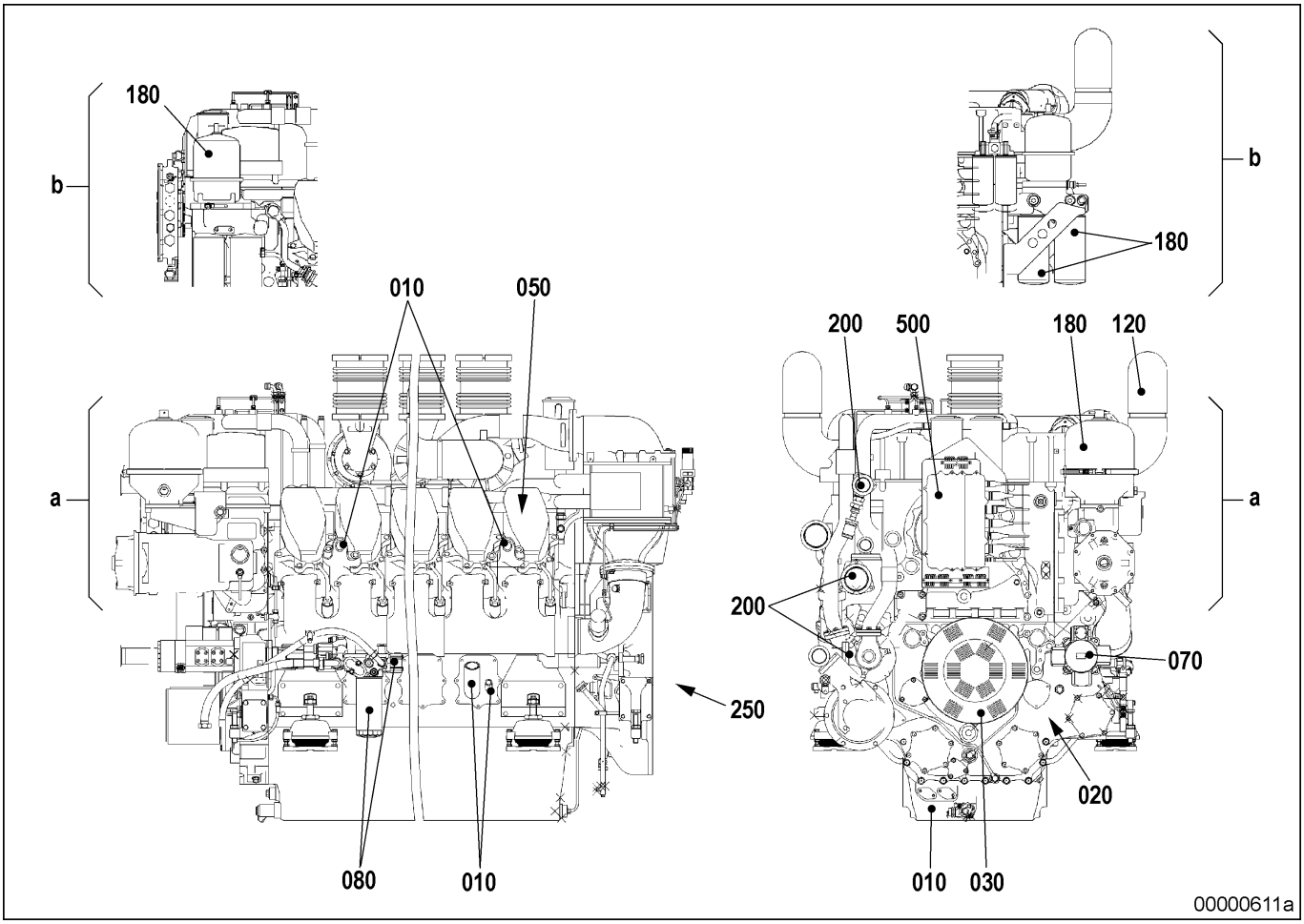
Ensure appropriate consistency and load-bearing capacity of the ground or support surface.

Never place an engine on the oil pan, unless expressively authorized by MTU on a case-to-case basis to do so.

2 Product Overview

2.1 Engine Overview

2.1.1 Engine layout



a Version with automatic filter
b Version with easy-change filter
010 Engine crankcase and add-on components
020 Gear train
030 Running gear
050 Valve gear
070 Fuel system (high-pressure)
080 Fuel system (low-pressure)
120 Air intake/air supply
180 Lube oil system/lube oil circuit
200 Coolant system
250 Drive system, driving end and free end (clutch)
500 Monitoring, control and regulation system, general electrical systems

COOLING SYSTEM (LT circuit)

Number of cylinders			8V 4000	12V 4000	16V 4000
Coolant temperature (at engine outlet to cooling equipment)	R	°C	55	56	57
Coolant temperature before intercooler (with up to 40% antifreeze)	A	°C	45	45	45
Coolant temperature differential after/before intercooler, min.	L	°C	10	10	10
Coolant temperature differential after/before intercooler, max.	L	°C	15	15	16
Coolant antifreeze content, max.	L	%	50	50	50
Charge air temperature after intercooler, max.	L	°C	67	67	67
Thermostat: starts to open	R	°C	38	38	38
Thermostat: fully open	R	°C	51	51	51

LUBE OIL SYSTEM

Number of cylinders			8V 4000	12V 4000	16V 4000
Lube oil operating temperature before engine, from	R	°C	88	88	88
Lube oil operating temperature before engine, to	R	°C	93	93	93
Lube oil operating pressure before engine (measuring block)	R	bar	5.0	5.0	5.0
Lube oil pressure before engine, alarm	R	bar	4.2	4.2	4.2
Lube oil pressure before engine, shutdown	L	bar	3.9	3.9	3.9
Lube oil operating pressure, low idle (meas. point: before engine)	R	bar	2.0	2.0	2.0

FUEL SYSTEM

Number of cylinders			8V 4000	12V 4000	16V 4000
Fuel pressure at supply connection on engine, min. (when engine is starting)	L	bar	-0.1	-0.1	-0.1
Fuel pressure at supply connection on engine, min. (when engine is running)	L	bar	-0.3	-0.3	-0.3
Fuel pressure at supply connection on engine, max. (when engine is starting)	L	bar	1.5	1.5	1.5

3 Operation

3.1 Putting the engine into operation after extended out-of-service periods (>3 months)

Preconditions

- Engine is stopped and starting disabled.
- MTU Fluids and Lubricants Specification (A001061/..) is available.

Putting the engine into operation after extended out-of-service-periods (>3 months)

Item	Task
Engine	Depreserve (→MTU Fluids and Lubricants Specification A001061/..).
Valve Gear	Lubricate valve gear (→ Page 80).
Lube oil system	Check engine oil level (→ Page 101).
Fuel system	Vent (→ Page 93).
Engine coolant circuit	If engine is out of service for more than one year, change engine coolant (→ Page 109); Change charge-air coolant (→ Page 118).
Engine coolant circuit	Check engine coolant level (→ Page 108); Check charge-air coolant level (→ Page 117).
Engine coolant circuit	Preheat engine coolant with preheating unit.
ECU	Check plug connections (→ Page 128).
ECS	Switch ON.

4.2 Maintenance schedule matrix

Maintenance schedule matrix V 4000 R41/R41 R, 0-21,000 operating hours

Item	Limit years	Operating hours [h]																					
		Daily	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000	18,000	19,000	20,000	21,000
Engine oil filter	2																						
Engine operation	-	X																					
Air filter	-		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Centrifugal oil filter	-		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Valve drive	-		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fuel filter	2		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Crankcase breather	-				X			X			X			X			X			X			X
Fuel injectors	-							X						X						X			
Combustion chambers	-							X						X						X			
Air filter	3							X						X						X			
Exhaust turbocharger	-											X										X	
Component maintenance	-											X										X	
Rubber sleeves	6											X										X	
Cylinder head	-																X						
Hose lines	6																						
Extended component maintenance	18																						

Coolant leaks on intercooler

Component	Probable Cause	Task
Intercooler	Leaking, major coolant discharge	Contact Service.

Exhaust gas black

Component	Probable Cause	Task
Air supply	Air filter clogged	Check position of contamination indicator signal ring (if fitted) (→ Page 99).
Fuel injection equipment	Injector defective	Replace (→ Page 86).
Engine	Overloaded	Contact Service.

Exhaust gas blue

Component	Probable Cause	Task
Engine oil	Too much oil in engine	Drain engine oil (→ Page 102).
	Oil separator of crankcase breather contaminated	Replace (→ Page 79).
Exhaust turbocharger, cylinder head, piston rings, cylinder liner	Defective	Contact Service.

Exhaust gas white

Component	Probable Cause	Task
Engine	Not at operating temperature	Run engine to reach operating temperature.
Fuel system	Water in fuel	Check fuel system on fuel prefilter. Drain fuel prefilter.
Intercooler	Leaking	Contact Service.

Fault code	Alarm text	Meaning	Action
324	WIRING CYLINDER A4	Faulty cabling to solenoid valve cylinder A4; Misfiring	1. Check cabling. 2. Contact Service.
325	WIRING CYLINDER A5	Faulty cabling to solenoid valve cylinder A5; Misfiring	1. Check cabling. 2. Contact Service.
326	WIRING CYLINDER A6	Faulty cabling to solenoid valve cylinder A6; Misfiring	1. Check cabling. 2. Contact Service.
327	WIRING CYLINDER A7	Faulty cabling to solenoid valve cylinder A7; Misfiring	1. Check cabling. 2. Contact Service.
328	WIRING CYLINDER A8	Faulty cabling to solenoid valve cylinder A8; Misfiring	1. Check cabling. 2. Contact Service.
329	WIRING CYLINDER A9	Faulty cabling to solenoid valve cylinder A9; Misfiring	1. Check cabling. 2. Contact Service.
330	WIRING CYLINDER A10	Faulty cabling to solenoid valve cylinder A10; Misfiring	1. Check cabling. 2. Contact Service.
331	WIRING CYLINDER B1	Faulty cabling to solenoid valve cylinder B1; Misfiring	1. Check cabling. 2. Contact Service.
332	WIRING CYLINDER B2	Faulty cabling to solenoid valve cylinder B2; Misfiring	1. Check cabling. 2. Contact Service.
333	WIRING CYLINDER B3	Faulty cabling to solenoid valve cylinder B3; Misfiring	1. Check cabling. 2. Contact Service.
334	WIRING CYLINDER B4	Faulty cabling to solenoid valve cylinder B4; Misfiring	1. Check cabling. 2. Contact Service.
335	WIRING CYLINDER B5	Faulty cabling to solenoid valve cylinder B5; Misfiring	1. Check cabling. 2. Contact Service.
336	WIRING CYLINDER B6	Faulty cabling to solenoid valve cylinder B6; Misfiring	1. Check cabling. 2. Contact Service.
337	WIRING CYLINDER B7	Faulty cabling to solenoid valve cylinder B7; Misfiring	1. Check cabling. 2. Contact Service.

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.

6.6.2 Injector – Removal and installation

Preconditions

- Engine is stopped and starting disabled.

Special tools

Designation / Use	Part No.	Qty.
Puller for injector	F30377769	1
Puller bracket for injector	F6557991	1
Force-in lever for injector	F6557952	1
Lever for force-in lever	F6555197	1
Injector installation jig	F30378403	1
Slotted screwdriver	F30379005	1
Torque wrench 0.5-5 Nm	0015384230	1
Torque wrench 10-60 Nm	F30510423	1
Torque wrench 60-320 Nm	F30047446	1

Material

Designation / Use	Part No.	Qty.
Assembly paste (Optimoly Paste White T)	40477	1
Grease (Kluthe Hakuform 30-10/Emulgier)	X00029933	1

WARNING

Fuels are combustible.
Risk of fire and explosion!
- Avoid naked flames, electrical sparks and ignition sources.
- Do not smoke.

Preparatory steps

1. Shut off fuel supply to engine.
2. Remove cylinder head cover (→ Page 84).

6.10.2 Air filter replacement

Spare parts

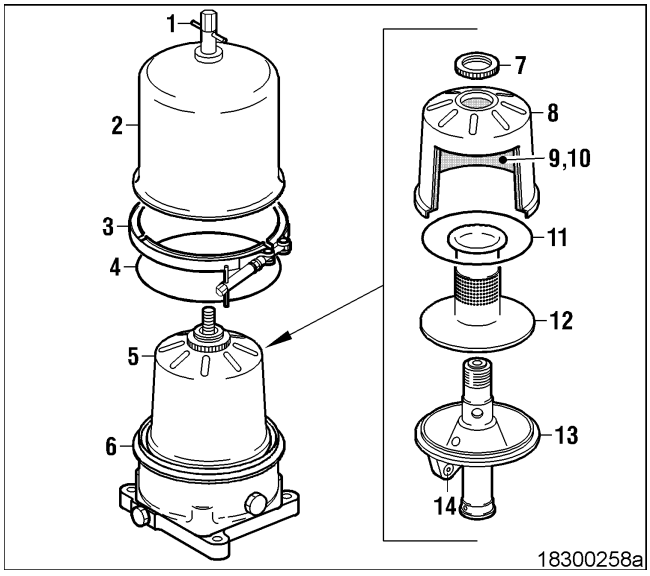
Designation / Use	Part No.	Qty.
Air filter		

Remove air filter and install new one (→ Page 98)**.**

Reset signal ring of service indicator (→ Page 99)**.**

Centrifugal oil filter – Cleaning and filter-sleeve replacement

1. Loosen screw (1) and remove.
2. Remove clamp (3) and take off cover (2).
3. Carefully remove rotor (5) from housing.
4. Hold rotor assembly (5) firmly in position with filter wrench and release knurled nut (7).
5. Take off rotor cap (8).
6. Remove filter sleeve (9), stiffener plate (10) and sealing ring (11).
7. Measure thickness of oil residues on filter sleeve.
8. If maximum layer thickness of oil residues exceeds 30 mm, shorten maintenance interval.
9. Remove tube (12) from rotor lower section (13).
10. Wash cover (2), rotor cap (8), stiffener plate, (10) tube (12), rotor lower section (13) and nozzles (14) with cleaner and blow out with compressed air. Do not use sharp-edged objects for cleaning.
11. Check nozzles (14) for obstructions.
12. Push tube (12) onto rotor lower section (13).
13. Insert new filter sleeve (9) with stiffener plate (10) into rotor cap (8), ensuring that the smooth surface of the filter sleeve (9) faces the rotor cap (8).
14. Check sealing ring (11), replace if necessary. Coat sealing ring with petroleum jelly and insert in groove of rotor cap (8).
15. Place rotor cap (8) over tube (12).
16. Hold rotor assembly (5) firmly in position with filter wrench and tighten curled nut (7).
17. Lubricate bearings of rotor (5), insert into housing (6) and check for ease of movement.
18. Check sealing ring (4), replace if necessary. Fit sealing ring on housing (6).
19. Fit cover (2).
20. Hand-tighten screw (1).
21. Fit clamp (3) and tighten with torque wrench to 6 Nm.
22. Tighten screw (1) with torque wrench to 6 Nm.



6.16 Low-temperature Circuit

6.16.1 Charge-air coolant level check

Preconditions

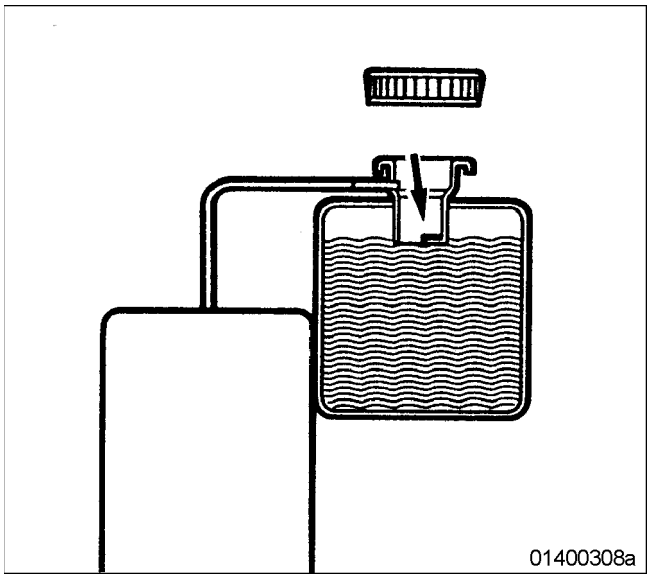
- Engine is stopped and starting disabled.
- MTU Fluids and Lubricants Specification (A001061/..) is available.

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 120).
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 120).

6.19 Accessories for (electronic) Engine Governor / Control System

6.19.1 Engine governor and connectors – Cleaning

Preconditions

- Engine is stopped and starting disabled.

Material

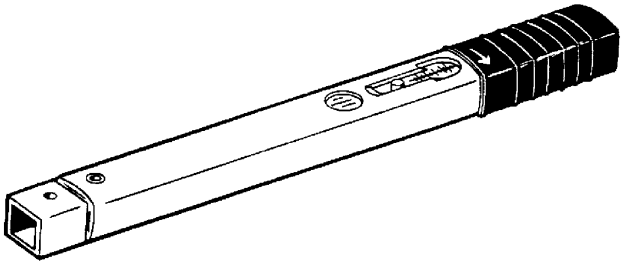
Designation / Use	Part No.	Qty.
Isopropyl alcohol		

Engine governor and connectors – Cleaning

1. Remove coarse dirt from housing surface using a cloth moistened with isopropyl alcohol.
2. Remove dirt from connector and cable surfaces with isopropyl alcohol.
3. Check legibility of cable labels. Clean or replace illegible labels.

Cleaning heavily contaminated connectors on engine governor

1. Release latches of connectors and withdraw connectors.
2. Clean connector housings, connector socket housings and all contacts with isopropyl alcohol.
3. When connectors, sockets and all contacts are dry: Fit connectors and secure latches.

Part No.	Designation / Use	Qty.	
F30027337	Torque wrench	1	
F30027341	Ratchet adapter	1