Thielert Aircraft Engines GmbH
Platanenstraße 14
D - 09350 Lichtenstein

Tel. +49 37204 696-0
Fax +49 37204 696-2912
www.centurion-engines.com
support@centurion-engines.com

Supplement Airplane Maintenance Manual

Apex Aircraft
ROBIN DR400/135CDI
CENTURION 2.0

Doc. No.: AMM-60-02
Issue 1 - Revision 5

■ CAUTION:
This Supplement to the Airplane Maintenance Manual must be read completely before maintenance action, as it contains important safety information.

■ CAUTION:
The organizations and staff who carry out these maintenance actions must be approved by the authority, with the exception of the "Pre-flight check"

◆ Note:
The supplement to the airplane maintenance manual is to be included at every DR400/135CDI / CENTURION 2.0 installation

◆ Note:
Please report any service difficulties to the Technical Support Centre at Thielert AircraftEngines GmbH.
See above for contact information.

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0.1 List of revisions

Document No.	Issue/Revision	Date	Approved by
AMM-60-00	1/0	November 16, 2007	R. van den Bosch
AMM-60-01	1/0	November 16, 2007	R. van den Bosch
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AMM-60-21	1/2	May 27, 2008	R. van den Bosch
AMM-60-71	1/2	May 27, 2008	R. van den Bosch
AMM-60-75	1/2	May 27, 2008	R. van den Bosch
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AMM-60-05	1/3	July 10, 2008	R. van den Bosch
AMM-60-71	1/3	July 10, 2008	R. van den Bosch
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AMM-60-21	1/4	October 18, 2010	R. van den Bosch
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AMM-60-79	1/4	October 18, 2010	R. van den Bosch
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AMM-60-01	1/5	May, 2011	R. van den Bosch
AMM-60-05	1/5	May, 2011	R. van den Bosch
AMM-60-06	1/5	May, 2011	R. van den Bosch
AMM-60-71	1/5	May, 2011	R. van den Bosch
AMM-60-75	1/5	May, 2011	R. van den Bosch

0.2 List of applicable chapters

Document No.	Issue/Revision	Date
AMM-60-00	1/5	May, 2011
AMM-60-01	1/5	May, 2011
AMM-60-04	1/0	November 16, 2007
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AMM-60-06	1/5	May, 2011
AMM-60-12	1/2	May 27, 2008
AMM-60-21	1/4	October 18, 2010
AMM-60-24	1/0	November 16, 2007
AMM-60-28	1/0	November 16, 2007
AMM-60-31	1/0	November 16, 2007
AMM-60-37	1/0	November 16, 2007
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AMM-60-73	1/0	November 16, 2007
AMM-60-74	1/0	November 16, 2007
AMM-60-75	1/5	May, 2011
AMM-60-77	1/0	November 16, 2007
AMM-60-78	1/0	November 16, 2007
AMM-60-79	1/4	October 18, 2010
AMM-60-80	1/0	November 16, 2007
AMM-60-91	1/0	November 16, 2007

Prepared by:	Checked by:	Released by:
D. Triques, CEAPR	M. Steinberg, MPI	R. van den Bosch, MPL

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1 Introduction

This operating and maintenance manual contains basic information related to the proper operation of the engine in various situations and under different conditions. It also contains instructions for maintenance.

The information and descriptions of components and systems in this manual were correct at the time of publication. Any amendments released through the update information service must also be taken into account.

Please contact Thielert Aircraft Engines GmbH if you have any questions. We would be glad to assist you further.

1.1 Accompanying applicable documents

- Apex Aircraft, DR400 Maintenance Manual (Doc no.1001606GB)
- Installation Manual IM 02-02 for CENTURION 2.0
- Installation Manual IM 02-02 for CENTURION 2.0 in DR400/140B
- Repair Manual RM-02-02 for CENTURION 2.0
- Operation and Maintenance Manual OM 02-02 for CENTURION 2.0
- Operation and Installation Manual E-124 for Propeller MTV-6-A/187-129
- Installation Manual IM-TAE-CED-125 and Operation Manual OM-TAE-CED-125
- Constant Speed Unit Manual CSU CENTURION 2.0
- Component Repair Manual CRM-02-02

1.2 Identification of parts of TAE 125 installation

Engine identification

Refer to OM-02-02.

Engine Mount identification

The Engine Mount of the CENTURION 2.0 is indicated by a part number and a serial number as shown in the following picture.

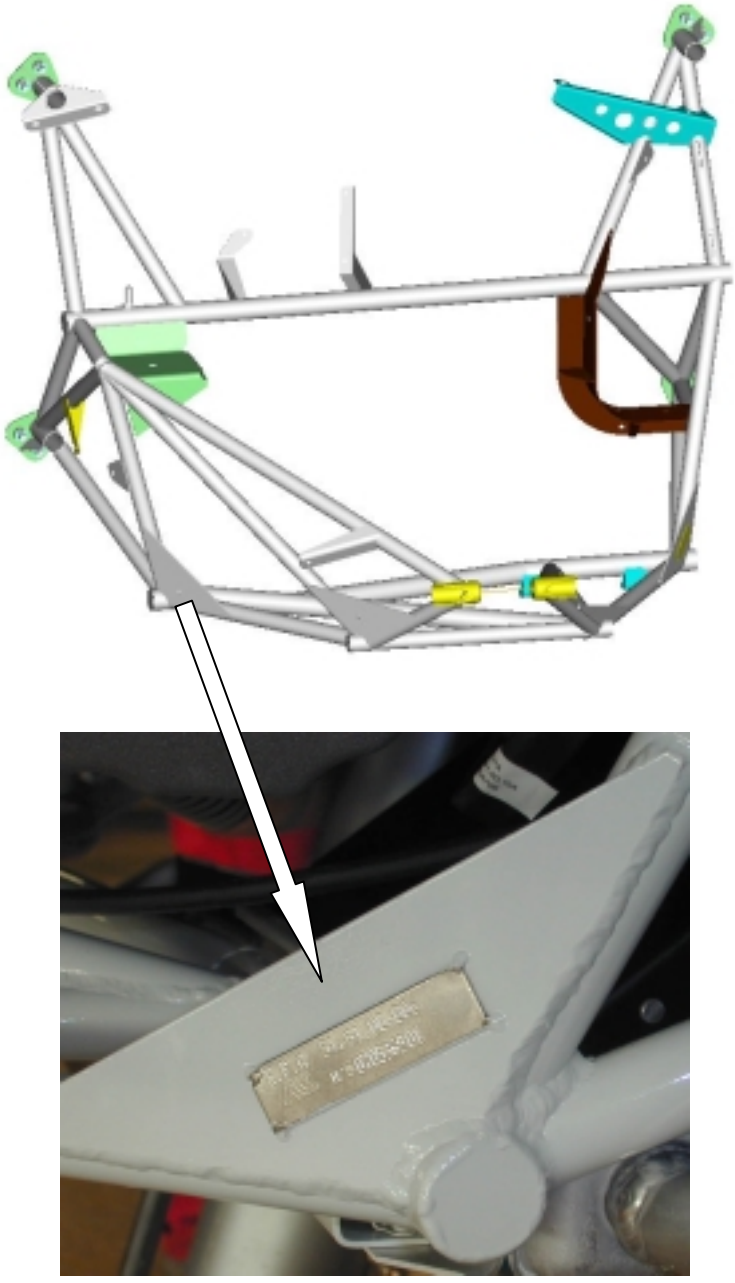

Figure 01-1b Identification of Engine Mount

CED identification

The CED is identified by a label.

An example of the identification label of a CED is shown below.

Figure 01-1c Identification Label CED-125

Propeller identification

The serial number of the propeller MTV-6-A/187-129 consists of five digits and is provided at the back side of the propeller flange and on a label at the front side of one propeller blade.

1.3 Copyright ©

1.4 Conventions in this manual

The following symbols and warning signs are used in the manual. They must be heeded strictly to prevent injury and material damage, to avoid impairment of the operating safety of the aircraft and to rule out any damage to the aircraft as a consequence of improper handling.

▲ **WARNING**: Disregarding these safety rules can lead to injury or even death.

■ CAUTION: Disregarding these special instructions and safety measures can cause damage to the engine or to the other components.

◆ Note: Additional note or instructions for better understanding of an instruction.

The indications "right", "left", "front" and "rear" are always relative to the flight direction. The following symbol is used:

Example of flight direction right: ▶

1.5 Validity of this manual

This manual applies only to the engine having the following

serial number:_____

installed in: DR400/135CDI

serial number:_____

Updates and modifications must be taken into account.

1.6 Abbreviations

The following abbreviations are used in this manual:

- FADEC Full Authority Digital Engine Control
- CED Compact Engine Display
- CSU Constant Speed Unit

1.7 Packing and transport

According to the Operation and Maintenance Manual OM-02-02

1.8 Storage

According to the Operation and Maintenance Manual OM-02-02

1.9 Qualifications of the operating and maintenance personnel

Tasks described in this manual may be performed only by trained personnel having necessary certificates and licenses.

All locally applicable national and international regulations must be observed.

1.10 Update information service

This manual is updated regularly. The engine/ aircraft operator is responsible for keeping up-to-date with all amendment bulletins issued by TAE GmbH and integrating them into this manual.

Please inform TAE GmbH if the owner of the engine / aircraft changes. Only is this way can we pass on information about any necessary / recommended changes. A form for this purpose is included in this manual.

1.11 Service life of the engine

For Service Life of the engine refer to chapter 4.

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4 Airworthiness Limitations

AIRWORTHINESS LIMITATIONS APPROVAL SHEET
For airworthiness limitations concerning CENTURION 2.0 engine, refer to OM-02-02 Operation & maintenance manual, chapter 5.

AIRWORTHINESS LIMITATIONS APPROVAL SHEET
The airworthiness limitation section is AESA approved and mandatory.
It specifies required maintenance unless an alternative program has been EASA approved.

04-1 ENGINE LIFE LIMIT

The entire engine CENTURION 2.0 as defined by the Type Design Definition ref. TDD-02-02, issue 1 or later approved revisions has a specific life limit of 1200 hours or 12 years whichever occurs first. This limit calls for replacement of the entire engine after these 1200 hours of operation or after 12 years whichever occurs first. No overhauls are allowed to the core engine. No repairs outside the published ICA's allowed to the engine.

04-2 MANDATORY MAINTENANCE ACTIONS

Mandatory maintenance actions of the engine are listed in chapter 02-OM-05-02 of the current operation and Maintenance manual OM-02-02.

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5 TIME LIMITS / MAINTENANCE CHECKS

The maintenance work on TAE aircraft engines must be carried out after specific time intervals or on reaching a specific operating hours interval. The pre-flight check must be conducted before each start. Refer to OM-02-02 “Operation & maintenance manual”.

Parts that are not included within the scope of supply of the engine must be maintained and checked according to the airplane manufacturer’s specifications (refer to airplane manual).

▲ **WARNING**: The entire engine has a service life (“time between replacement”); refer to chapter 04 of this manual.

▲ **WARNING**: It is strongly recommended that the maintenance intervals specified by the manufacturer should be adhered to. Non-compliance with the maintenance schedule can amongst other things lead to lapse of any claims to warranty.

◆ Note: For this engine, an extension program for the service life (time between replacement) is in progress. The up-to-date information is published in service bulletins.

◆ Note: Further information concerning service partners and servicing or parts to be replaced can be obtained from Thielert Aircraft Engines GmbH.

◆ Note: Thielert Aircraft Engines GmbH must be informed immediately in case of engine malfunction.

5.10 TIME LIMITS

INSPECTION REQUIREMENTS

The required periodic inspection procedures are listed in § 5.20 Scheduled Maintenance.

PREFLIGHT CHECKS

Perform a thorough pre-flight and walk-around check in addition to inspection intervals in periodic inspections.

Pilot or mechanic must include pre-flight check as normal procedure necessary for safe aircraft operation.

Refer to TAE 125 - Supplement of the Pilot's Operating Handbook for items that must be checked.

5.20 SCHEDULED MAINTENANCE CHECKS

A. PROPELLER GROUP

Refer to Operation and Installation Manual of MT-Propeller E124 (ATA 61-01-24) for Inspections and Maintenance of the propeller MTV-6-A/187-129.

For Time Between Overhaul (TBO), refer to MT-Propeller Service Bulletin no. 1(latest edition).

B. ENGINE GROUP

Refer to OM-02-02 "Operation & maintenance manual", chapter 6.

The engine related maintenance tasks according to the OM-02-02 must be accomplished together (simultaneously) with the aircraft maintenance inspections described in § C.

◆ Note: Due to the Diesel principle of the engine CENTURION 2.0, all information of the Airplane Maintenance Manual relating to
- Carburator and carburator pre-heating
- Ignition magnetos and spark plugs and
- Mixture control and priming system

are no longer valid.

▲ **WARNING**: Under extreme conditions such as low usage combined with operation in a salt water environment or in an environment laden with sand and dust, shorter maintenance and inspection intervals are recommended for your own safety.

C. EASA STC 10014219 INSTALLATION SPECIFIC PARTS

Reminder: The engine related maintenance tasks according to the OM-02-02 must be accomplished together (simultaneously) with the aircraft maintenance inspections.

5.20.01 Inspection dependent on engine operating time

After initial 3rd - 6th operating hour

- Further maintenance action according to Operation and Maintenance Manual OM-02-02.

Every 100 operating hours

- Check engine mount for signs of corrosion. Visually inspect the engine mount for chafe marks, deformation and any kind of damage. (Refer to Chapter 71).
- Check engine shock mounts (cuts, damage...).
- Check “coolant low level” warning (Refer to chapter 31).
- Check the mixture ratio of the coolant.
- Visual inspection, check for coolant leakage.
- Visually inspect the joints (e.g. hose connections)
- Inspect hoses from turbocharger to engine thru the intercooler radiator, and the intercooler.
- Visual inspection of the Wiggins clamp on the turbocharger and the outlet elbow of turbocharger. (Refer to chapter 71)
- If Liqui Moly “Diesel Fliess-Fit” is added to Diesel, check all fuel components from fuel cap to engine fuel inlet as well as the return fuel line for leaks.
- Replace fuel filter (Refer to chapter 28).
- Check airplane fuel electric pump (refer to apex aircraft DR400 maintenance manual Doc. 1001606GB).
- Inspect electric pump support.
- Check fuel circuit tightness.
- Check optional tank, valve, hoses and fittings for leaks.
- Check optional tank valve and flexible control for good functioning.
- Check optional tank fuel indications for good functioning.

- Battery: detailed inspection of the battery in order to detect possible leaks. Particularly check around terminals. (Refer to chapter 24)
- Check oil lubricating circuit tightness.
- Visual inspection of oil radiator. Look for cracks.
- Check and clean air filter. (Refer to chapter 71)
- Inspect hoses, fittings, turbocharger ducts, for chafing or damage.
- Visual inspection of FADEC various sensors
- Visual inspection of belt.
- Visual inspection of exhaust pipe. (Refer to chapter 78).
- Check tightness of the ball joints and of the extension tube assy on the exhaust system. (Refer to chapter 78).
- Check the fixing points of the exhaust system on the firewall and on the engine mount. (Refer to chapter 78).
- Detailed inspection of the silencer clamp. (Refer to chapter 78).
- Replace the 3 loop ceramic cords of the extension tube on the exhaust system. (Refer to chapter 78).

Every 200 operating hours

- Operations as described for every 100 operating hours.
- Check the battery support frame (seek for cracks...). (Refer to chapter 24).
- Check and cleaning of reducing union on vacuum circuit.
- Close examination of the electric fuel pump: fittings, tightening, electrical connectors, fixing parts, drain.
- Replace air filter. Check air conduct leading to turbocharger. (Refer to chapter 71).

Every 500 operating hours

- Operations as described for every 100 operating hours.
- Close examination of the complete fuel line from the tank to the firewall (tubing, hoses, selector, fittings, pump, filter...) and fuel return line. If Liqui Moly “Diesel Fliess-Fit” is added to Diesel, check all fuel components from fuel cap to firewall fitting as well as the return fuel line for material alteration (particles in the sumps...).
- Replace the silent blocks (dampers) of the exhaust silencer support. (Refer to chapter 78).

Every 2000 operating hours

- Replace o-rings of the optional tank valve and fittings.
- Check optional valve shuttle sliding pads.
- Check optional valve shuttle opening travel.
- Check optional tank flexible control shaft and housing. Grease as necessary.
- Check optional tank fixing elements and adjacent structures.

5.20.02 Inspection dependent on calendar time

Every 12 months

- Heating: Check tightness of air and water heating installation
- Battery: detailed inspection of the battery in order to detect possible leaks. Particularly check around terminals. (Refer to chapter 24).
- Remove the battery and check the support frame, the fixing area (seek for defective fixing, glue cracks...). (Refer to chapter 24).
- Replace the power supply back-up battery for the FADEC (Refer to chapter 24). (Reminder: alternator excitation battery inspection program is part of OM-02-02).
- Detailed examination of the firewall bulkhead.
- Replace air filter. Check air conduct leading to turbocharger. (Refer to chapter 71).
- Check thightness of the ball joints and of the extension tube assy on the exhaust system. (Refer to chapter 78).
- Check the fixing points of the exhaust system on the firewall and on the engine mount. (Refer to chapter 78).
- Detailed inspection of the silencer clamp (Refer to chapter 78).
- Replace the 3 loop ceramic cords of the extension tube on the exhaust system. (Refer to chapter 78).
- Check optional tank, valve, hoses and fittings for leaks.
- Check optional tank valve and flexible control for good functioning.
- Check optional tank fuel indications for good functioning.

Every 36 months

- Operations as described for every 12 months.
- Check and cleaning of reducing union on vacuum circuit.
- Close examination of the electric fuel pump: fittings, tightening, electrical connectors, fixing parts, drain.
- Replace the silent blocks (dampers) of the exhaust silencer support. (Refer to chapter 78).

Every 60 months

- Operations as described for every 12 months.
- Replace all fuel, oil, coolant lines and turbocharger ducts.

Every 6 years

- Replace o-rings of the optional tank valve and fittings.
- Check optional valve shuttle sliding pads.
- Check optional valve shuttle opening travel.
- Check optional tank flexible control shaft and housing. Grease as necessary.
- Check optional tank fixing elements and adjacent structures.

Every 10 years

- Operations as described for every 12 & 60 months.
- Inspection of engine electrical circuit. search for corrosion and rubbing wear; replacement of all corroded, worn elements.
- Cooling circuit. Replacement of rubber bleeder hoses (P/N 54.81.42.670) from sleeve with permanent bleeder to tee, (P/N 54.81.42.075) from coolant radiator to tee, (P/N 54.81.42.140) from tee to coolant reservoir (expansion tank).

Every 25 years

- Operations as described for every 12 & 60 months.
- Replacement of main battery. (Refer to chapter 24).
- Replacement: battery relay; ALT/Battery circuit-breaker; alternator relay; 50A ECU fuse; main bus10A fuse; FADEC ING breaker.

5.50 UNSCHEDULED MAINTENANCE

Engine Events: Over speed, sudden stoppage, loss of oil, over temperature, lightning strike, propeller strike.

Refer to

- Operation and Maintenance Manual OM 02-02 of the CENTURION 2.0
- Repair Manual RM 02-02 of the CENTURION 2.0
- Thielert Aircraft Engines GmbH for necessary corrective actions and Repair.
- Apex Aircraft DR400 Maintenance schedule (Doc no. 1001586).

5.60 TORQUE VALUES

For Torque values which are not specific to CENTURION 2.0 installation (not indicated in the following table), refer to DR400 Maintenance manual (Doc. 1001606GB) section 3, §3.3 "Torquing".

CENTURION 2.0 installation - specific torque values

Description	Torque values	Remarks
Engine mount fixation on bulkhead nr1	0.7 to 0.9 daN.m (62 to 80 lbf.in)	8 bolts. Only for non lubricated nuts 8 PH 135 M
Line connectors on electric pump lines	1 to 1.5 daN.m (88.5 to 133 lbf.in)	Drawing 52-81-16
Engine vibration damper Front attachment	1 to 1.2 daN.m (88.5 to 106 lbf.in)	Drawing 51-81-05
Engine vibration damper Right Hand attachment	1.5 to 2 daN.m (88.5 to 177 lbf.in)	Drawing 51-81-05
Engine vibration damper Upper Left Hand attachment	1.5 to 2 daN.m (88.5 to 177 lbf.in)	Drawing 51-81-05
Engine vibration damper Lower Left Hand attachment	1 to 1.2 daN.m (88.5 to 106 lbf.in)	Drawing 51-81-05
Fuel shut-off attachment to fuselage bottom	0.3 daN.m (27 lbf.in)	Drawing 52-81-11
Oil radiator attachment to support	0.3 daN.m (27 lbf.in)	Drawing 53-81-25
Heat box plate axle attachement to plate lever	0.15 daN.m (13.3 lbf.in)	Drawing 54-81-00
Intercooler to engine mount attaching lug bolt	0.3 daN.m (27 lbf.in)	Drawing 56-81-36
Turbo to intercooler to engine hose clamps	Torque value 0,5 daN.m with clamp mfg specs tolerances	Refer to section 71-60

Torque values for tightening flared tube fittings.

Extract from: "Standard Aircraft Handbook for Mechanics and Technicians" [1]

TUBING O.D.	FITTING BOLT OR NUT SIZE	ALUMINUM ALLOY TUBING, BOLT, FITTING OR NUT TORQUE INCH-LBS.	STEEL TUBING, BOLT FITTING OR NUT TORQUE INCH-LBS.	HOSE END FITTINGS AND HOSE ASSEMBLIES MS28740 OR EQUIVALENT END FITTING MINIMUM	MAXIMUM
1/8	-2	20 – 30			
3/16	-3	30 – 40	90 – 100	70	120
1/4	-4	40 – 65	135 – 150	100	250
5/16	-5	60 – 85	180 – 200	210	420
3/8	-6	75 – 125	270 – 300	300	480
1/2	-8	150 – 250	450 – 500	500	850
5/8	-10	200 – 350	650 – 700	700	1150
3/4	-12	300 – 500	900 – 1000		
7/8	-14	500 – 600	1000 – 1100		
1	-16	500 – 700	1200 – 1400		
1 1/4	-20	600 – 900	1200 – 1400		
1 1/2	-24	600 – 900	1500 – 1800		
1 3/4	-28	850 – 1050			
2	-32	950 – 1150			

Torque values for tightening flared tube fittings.

[1] "Standard Aircraft Handbook for Mechanics and Technicians" 6th Edition, Edited by Larry Reithmaier. ISBN 0-07-134836-0

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6 DIMENSIONS AND AREAS

6.1 MODEL

DR400/135CDI with CENTURION 2.0 installation.

6.2 ENGINE

Manufacturer	Thielert Aircraft Engines GmbH
Model	TAE 125-02-99 (CENTURION 2.0)
TCDSD	E.055
Takeoff power	135 HP / 99 kW
Rated Speed	2300 RPM
Gearbox Oil	Shell EP 75W-90 API GL-4 Shell Spirax GSX 75W-80 SPIRAX S6 GXME75W-80 SPIRAX S4 G 75W-90
Engine Oil	Shell Helix Ultra 5W-30 Shell Helix Ultra 5W-40 AeroShell Oil Diesel 10W-40 AeroShell Oil Diesel Ultra
Engine Oil Sump Capacity	4.5 to 6.0 liters (1.19 to 1.59 US Gallons)
Oil Capacity Gearbox	1 liter (0.26 US Gallons)
Coolant	Water/Radiator Protection at a ratio of 50:50
Radiator Protection	BASF Glysantin Protect Plus/G48 Valvoline/Zerex Glysantin G48
Gear Reduction	1.69:1

6.3 PROPELLER

Manufacturer ..... MT Propeller Entwicklung GmbH
Flugplatzstrasse 1
D-94348 Atting

Model..... MTV-6-A187/129

Number of blades 3

Diameter..... 1.87 m

Type ..... Constant Speed

6.4 FUEL SYSTEM

DR400/135CDI

Main tank:

total capacity:.....	110 litres (29 US gal)
total usable fuel:.....	109 litres (28.7 US gal)
total unusable fuel:.....	1 litre (0.26 US gal)

Optional tank:

The total fuel capacity can be increased to 160 litres (42.24 US gal) by installing an optional fuel tank of 50 litres (13.2 US gal) which flows into the main tank on command.
The total usable fuel is then: 159 litres (42 US gal).

12 SERVICING

12-00 GENERAL

The following figures show the service points of the CENTURION 2.0 installation.

1 coolant filler

2 engine oil filler with dip stick

3 engine oil filter

4 gearbox oil filler

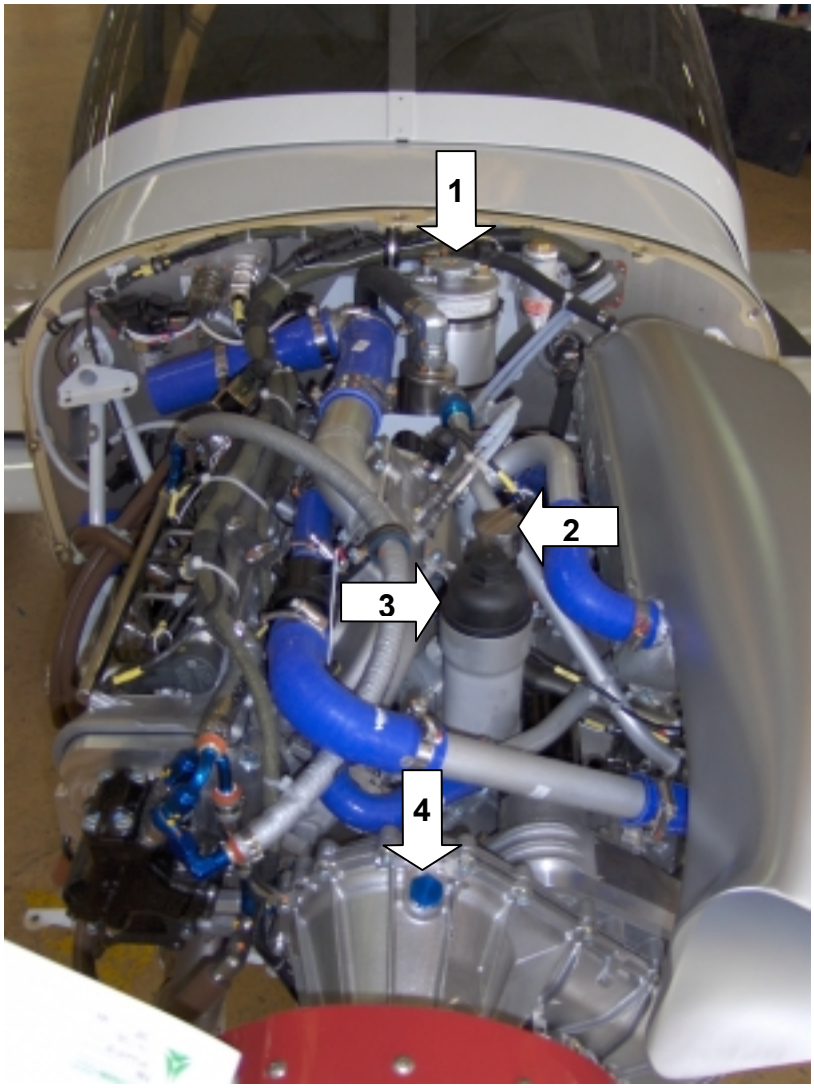

Figure 12-1a Service Points CENTURION 2.0

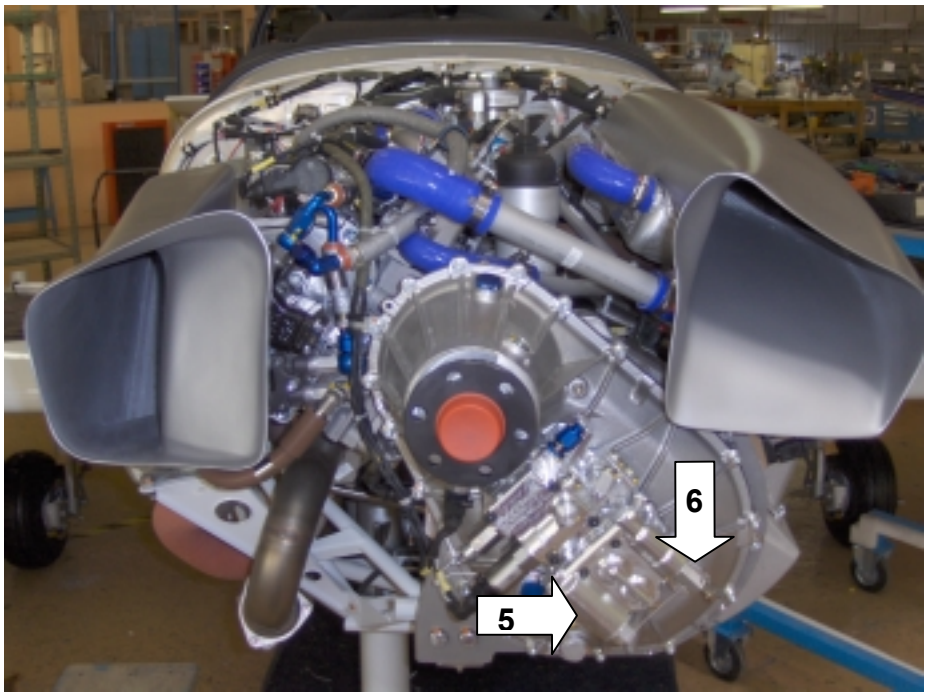

Figure 12-1b Service Points CENTURION 2.0

5 gearbox oil microfilter

6 gearbox oil viewer

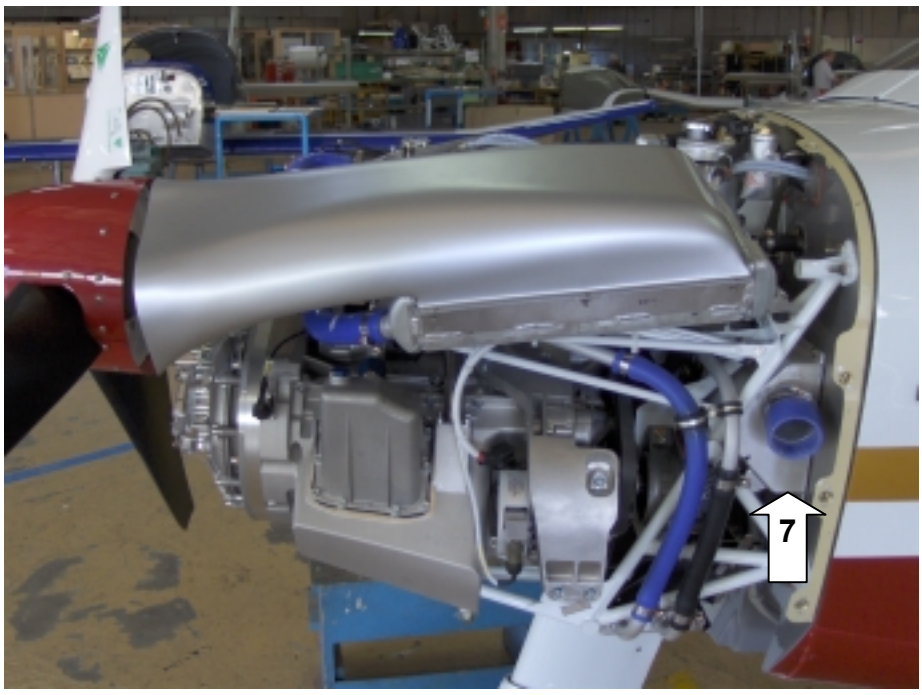

Figure 12-1c Service Points CENTURION 2.0

7 induction air filter

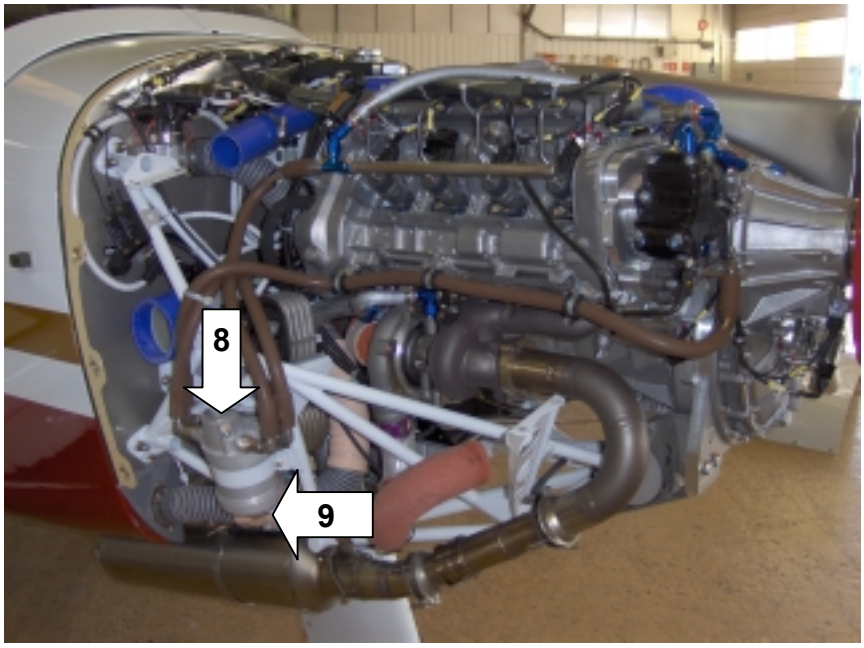

Figure 12-1d Service Points CENTURION 2.0

8 fuel filter

9 fuel filter drain

Cleaning of the engine compartment

Care must be taken when cleaning the engine compartment. If leaks are noticed, determine their location before cleaning.

The engine has to be cold before cleaning. The use of cold cleansers is recommended. (for instance Berner Kaltreiniger, Art.no.: 13618.0)

■ CAUTION: The use of flammable and acidic cleansers is not allowed.

Do not clean the engine electrical system, since it could be damaged.

Do not use high pressure cleaning equipment.

Dry the engine after cleaning with pressurized air (pressure less than 8 bar).

12-10 REPLENISHING

Fuel System

Filling Fuel Tanks

▲ **WARNING**: Observe all required safety precautions for handling kerosene.

■ CAUTION: Fill tanks with JET-A (ASTM 1655) or Diesel (DIN EN590) fuel only !

For capacity of the tank refer to chapter 6 of this supplement to airplane maintenance manual.

Draining Fuel Filter Bowl

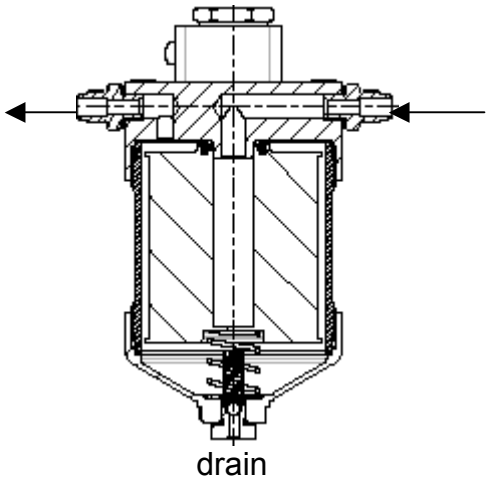

Figure 12.2a Fuel Filter Bowl and Screen

Drain at least a cupful of fuel (using sampler cup) from valve to check for water, sediment and proper fuel grade before each flight and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all fuel drain points until all contamination has been removed. If contaminants are still present, refer to following WARNING and do not fly the airplane.

▲ **WARNING**: If, after repeated sampling, evidence of contamination still exists, the airplane should not be flown. Tanks should be drained and system purged by qualified maintenance personnel. All evidence of contamination must be removed before further flight.

Engine Oil System

Check engine oil level before each flight according to appropriate POH supplement for CENTURION 2.0 installation.

Change engine oil and engine oil filter according to Operation and Maintenance Manual OM 02-02 of the CENTURION 2.0.

Gearbox Oil System

Check gearbox oil level before each flight according to appropriate POH supplement for CENTURION 2.0 installation.

Change gearbox oil and gearbox oil filter according to Operation and Maintenance Manual OM 02-02 of the CENTURION 2.0.

Liquid Cooling System

■ CAUTION: Do not drain the coolant if its temperature is above 40°C.

▲ **WARNING**: Risk of scalding! The cooling system may be pressurized. Carefully release the pressure before opening the drain plug.

1. Draining the coolant:

- Open the clamp on the lower hose of the water radiator, disconnect the hose and allow the coolant to drain into a prepared collecting container.
- Open the clamp on the lower hose of the heat exchanger, disconnect the hose and allow the coolant to drain into a prepared collecting container.
- Loosen the drain plug of the engine, but do not open it yet.
- Attach a suitable length of hose with a diameter of 14-15 mm onto the collar of the plug, and insert the other end of the hose into a collecting container.
- Open the drain plug. The coolant can drain off through the plug.
- Open the cover of the coolant filler (this allows the coolant to drain faster).
- After draining install a new seal and tighten the drain plug - tightening torque: 10 Nm.
- Reconnect the lower hoses of the water radiator and the heat exchanger and tighten the clamps.

2. Filling up new coolant:

- Fill up the cooling system by opening the coolant filler (use coolant according to Chapter 4 of Installation Manual IM 02-02).
- Close the cover of the coolant filler.
- Perform a test run according to Operation and Maintenance Manual OM 02-02.
- Check the cooling system for leaks according to Annex 3 of Operation and Maintenance Manual OM-02-02.
- Allow the engine to cool down.
- Check coolant level.

3. Bleeding of coolant circuit:

After every filling of new coolant, bleed the air off the coolant system by means of the maintenance bleeder screw on the thermostat.

The bleeder screw must be safetied by means of lockwire.

The gasket under bleeder screw must be replaced as necessary (depending on condition).

12-20 SCHEDULED SERVICING

◆ Note: See also Scheduled Maintenance Checks in Chapter AMM-60-05 (Section 5-20).

Electrical System

Refer to Chapter 5 of this supplement for checks of the electrical system.

Fuel System

Refer to Chapter 5 of this supplement for checks of the fuel system.

Propeller

Refer to Operation and Installation Manual of MT-Propeller E124 (ATA 61-01-24) for Inspections and Maintenance of the propeller MTV-6-A/187-129.

Power Plant

Regularly check the engine compartment for oil and fuel leaks, chafing of lines, loose wires and tightness of all parts. Be careful when cleaning the engine compartment.

Induction Air Filter

Regularly check and change the Induction Air Filter (refer to Chapter 5).

Coolant System

Refer to Chapter 5 Section 5-20 of this supplement for checks of the coolant system.

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21 ENVIRONMENTAL SYSTEMS

Cabin Heat and Defroster System

The CENTURION 2.0 installation includes a heat exchanger, which is part of the liquid coolant system and is located at the lower left aft section of the engine compartment.

Figure 21-1 Location of heat exchanger

Hose connections when gearbox without oil cooler

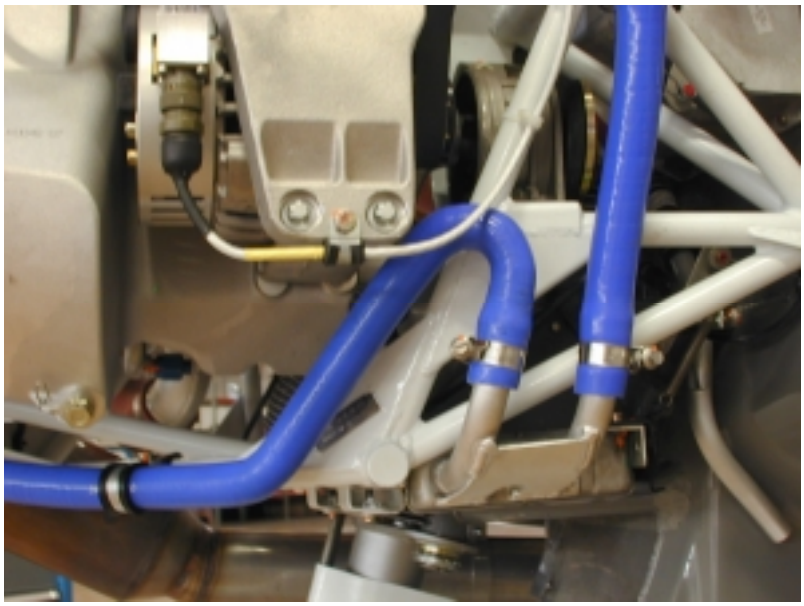


Figure 21-2 Location of heat exchanger

Hose connections when gearbox with oil cooler

The heat exchanger for cabin heat is installed inline with the unregulated exit of the cooling system thermostat. According to demand and outside air temperature, warm air is provided to the cabin.

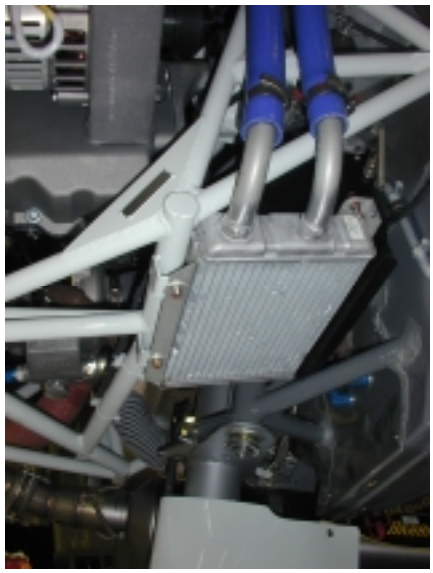
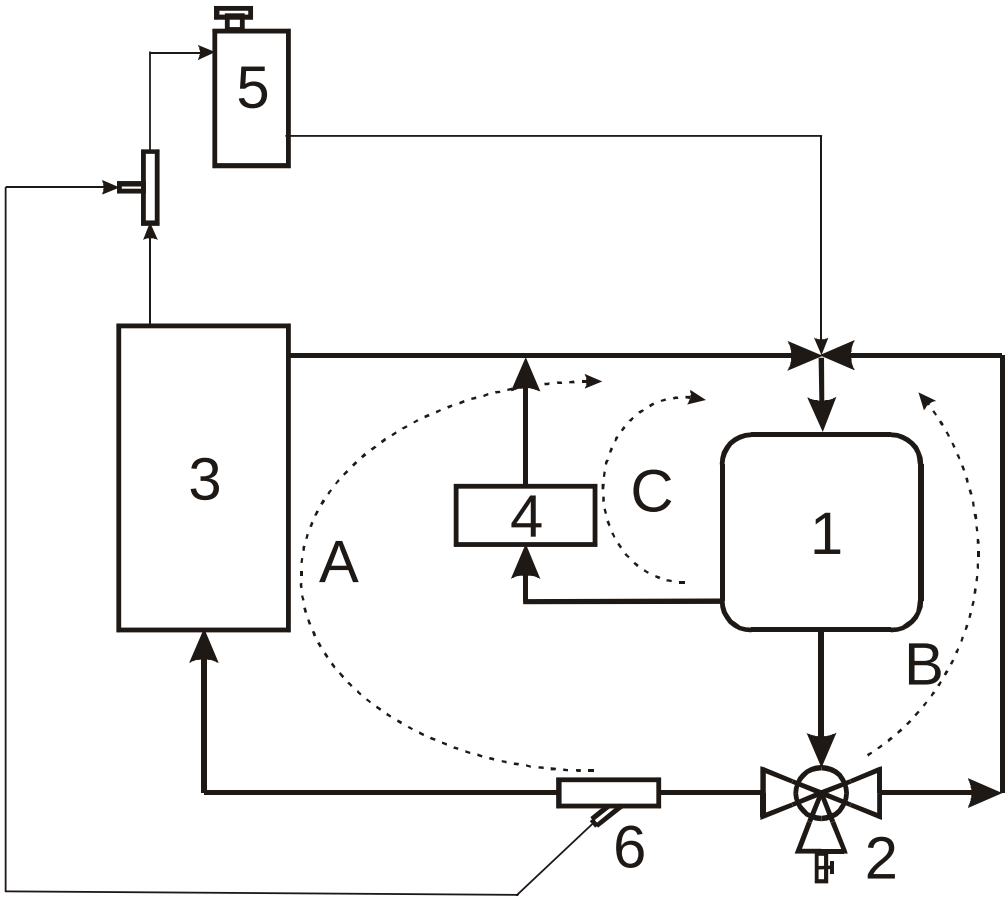


Figure 21-2 Heat exchanger

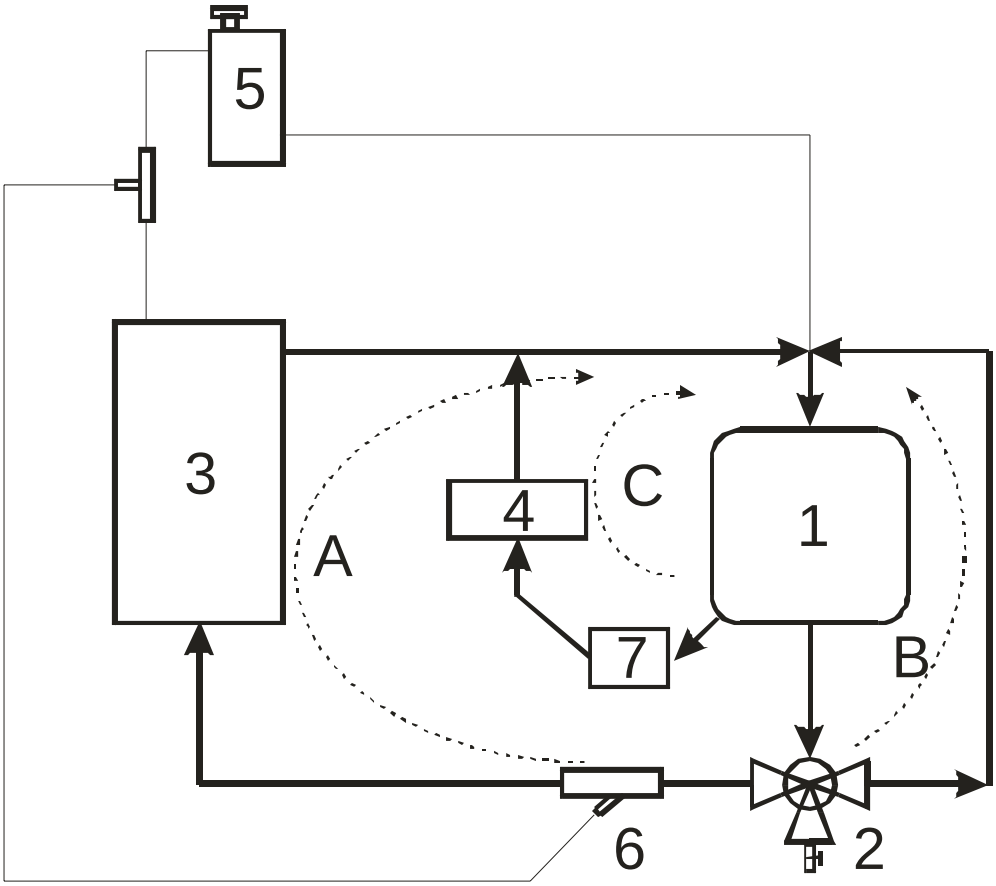
Engine coolant passes through the heater core and heats incoming air.
The coolant flow through the heater core is always open. The warm air supply is regulated by the pilot over the heating valve.
In normal operation the control knob “Shut-off Cabin Heat“ must be pulled.
With the control knob “Cabin Heat“, the supply of warm air into the cabin can be controlled.
In case of certain emergencies (refer to the appropriate Pilot´s Operating Handbook), the control knob “Shut-off Cabin Heat“ has to be closed according to the appropriate procedures.



1. Engine
2. Thermostat
3. Radiator
4. Cabin heat exchanger
5. Coolant reservoir
6. Sleeve with permanent bleeder

A flow: Engine cooling circuit
B flow: Small circuit
C flow: Cabin heating circuit

Figure 75-1
Coolant System of CENTURION 2.0
without gearbox oil cooler
(Schematic diagram)



1. Engine
2. Thermostat
3. Radiator
4. Cabin heat exchanger
5. Coolant reservoir
6. Sleeve with permanent bleeder
7. Gearbox oil/coolant heat exchanger

A flow: Engine cooling circuit

B flow: Small circuit

C flow: Cabin heating circuit

Figure 75-2

Coolant System of CENTURION 2.0

with gearbox oil cooler

(Schematic diagram)

24 ELECTRICAL POWER

24.00 GENERAL

Description and Operation

The DR400/135CDI with CENTURION 2.0 installation is fitted with a 14 volts electrical system.

The 14 Volts system is equipped with a 90 amp alternator, a 14 V starter, a 12 volts battery, an excitation battery for the alternator and a voltage regulator.

The battery is operated by a rocker switch (BAT) located on the lower instrument panel.

The alternator is disabled by a circuit breaker mounted below the battery switch on the lower instrument panel.

The excitation battery of the alternator is operated with the Engine Master simultaneously.

The back-up battery is supplying the FADEC in case of voltage drop.

A warning light (ALT) on the annunciator panel will illuminate if the alternator fails to produce current or overproduces.

The battery switch (BAT) must be ON before any electrical equipment will operate.

For wiring diagrams of the electrical systems of CENTURION 2.0 installations refer to chapter 91, Section 91.10 of this supplement.

24.30 DC GENERATION

Precautions

The following precautions must be observed when testing the electrical system.

▲ **WARNING**: Failure to observe these precautions will result in serious damage to the electrical equipment.

■ CAUTION Refer to wiring diagram in chapter AMM-60-91 (section 91.10) when installing or testing alternator.

■ CAUTION Disconnect battery and excitation battery before connecting or disconnecting test instruments (except voltmeter), or before removing or replacing any unit or wiring. Accidental grounding or shorting at alternator with internal regulator (14V version only), excitation battery, ammeter or accessories, will cause severe damage to units and/or wiring.

■ CAUTION Disconnect main battery before connecting or disconnecting the excitation battery. The excitation battery wire from the alternator (14V version) may carry electrical power even without connected excitation battery in case the main battery is still connected to the system.

■ CAUTION Grounding the alternator output terminal will damage alternator and/or circuit and components.

■ CAUTION Reversed battery connections will damage rectifiers, wiring, regulator and other charging system components. Battery polarity must be checked with a voltmeter before connecting battery. The aircraft is negative ground.

■ CAUTION If booster battery or fast charger is used, its polarity must be connected correctly to prevent damage to electrical system components.

Trouble	Check	Corrective Action
Lack of alternator current	Check alternator wiring	Repair alternator wiring
	Check alternator fuse	Replace alternator fuse
	Check alternator relay	Replace alternator relay
	Check alternator switch	Replace alternator switch
	Check alternator function	Replace alternator
Alternator does not work correctly without main battery connected and switched on	Check excitation battery	Replace excitation battery
	Check excitation battery wiring	Repair wiring

MAINTENANCE PRACTICES

1. General

These maintenance practices provide instructions to

- inspect the main battery
- replace the main battery
- replace the excitation battery

2. Inspecting the Main Battery

Refer to the battery manufacturer´s specifications.

3. Disconnecting/Connecting the Main Battery for Maintenance

A. Disconnect the Main Battery for Maintenance

(1) Remove the access panel (Fig. 24-2a). Refer to the airplane manufacturer´s specifications.

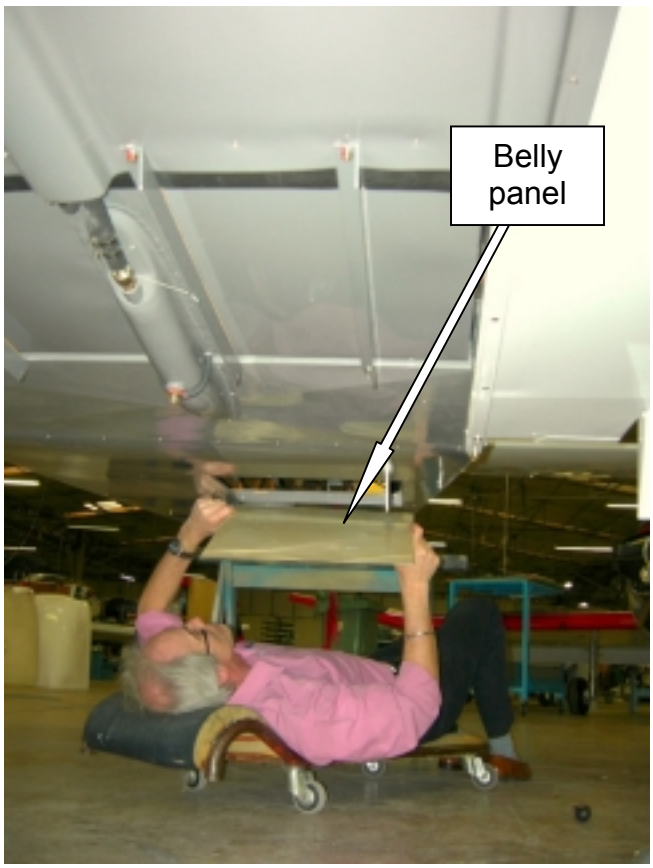


Fig. 24-2a.

(2) Disconnect the negative cable from the main battery.
(3) Disconnect the positive cable from the main battery.

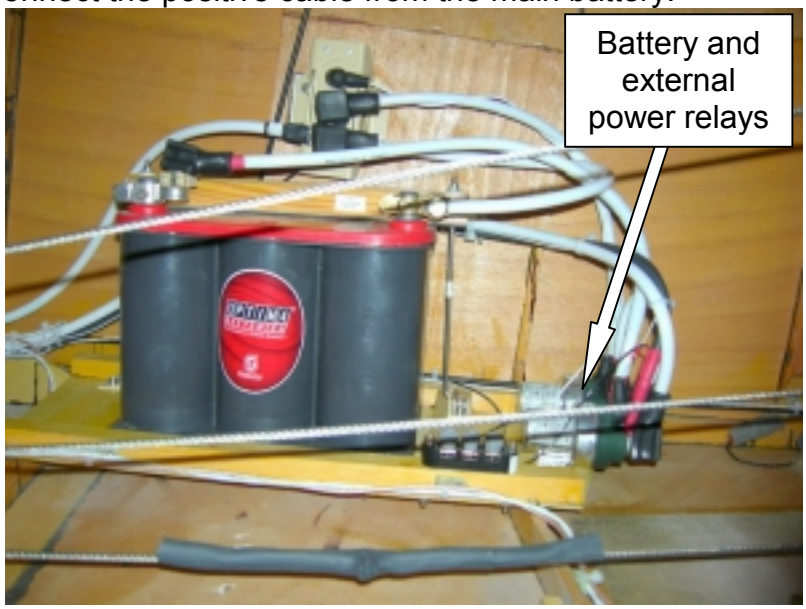


Fig. 24-2b.

B. Connect the Main Battery after Maintenance

(1) Connect the positive cable to the main battery
(2) Connect the negative cable to the main battery.
(3) Install the access belly panel. Refer to the airplane manufacturer´s specifications.

4. Replacing the Main Battery

A. Remove the Main Battery

(1) Remove the access belly panel. Refer to the airplane manufacturer´s specifications.
(2) Disconnect the negative cable from the main battery. See Fig. 24-2b.
(3) Disconnect the positive cable from the main battery.
(4) Remove the main battery from the airplane.

B. Install the new Main Battery in the Airplane

(1) Make sure that the main battery is dry and clean
(2) Place the main battery into position on the battery support
(3) Connect the positive cable to the main battery
(4) Connect the negative cable to the main battery.
(5) Install the access belly panel. Refer to the airplane manufacturer´s specifications.

■ CAUTION Make sure that you connect the cables to the correct terminals !Incorrect connection can damage the electrical and avionic systems.

5. Replacing the alternator excitation battery

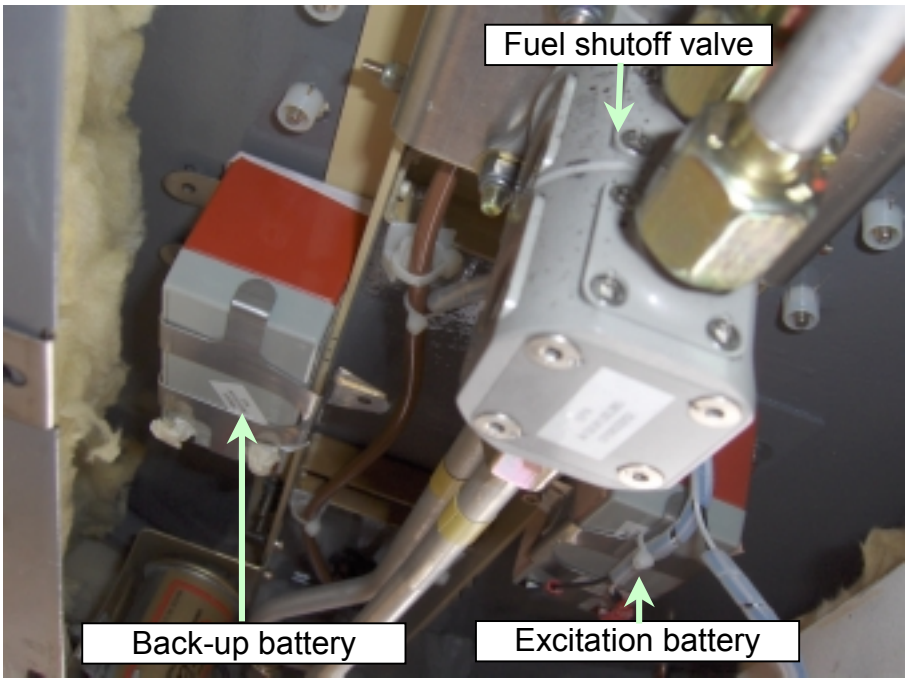


Fig. 24-2c. Location of alternator excitation battery an FADEC back-up battery

A. Remove the Excitation Battery

(1) Disconnect the main battery. Refer to 3, Disconnect/Connect the Main Battery for Maintenance.
(2) Locate the excitation battery (Fig. 24-2c).
(3) Disconnect the negative cable from the excitation battery.
(4) Disconnect the positive cable from the excitation battery.
(5) Remove the battery support.
(6) Remove the excitation battery from the airplane.

B. Install the new Excitation Battery

(1) Place the excitation battery into position.
(2) Install the battery support.
(3) Connect the positive cable to the excitation battery.
(4) Connect the negative cable to the excitation battery.
(5) Connect the main battery. Refer to 3, Disconnect/Connect the Main Battery for Maintenance.
(6) Do an engine ground run. Refer to OM-02-02. The Alternator Warning Lamp (AWL) must go OFF.

■ CAUTION Make sure that you connect the cables to the correct terminals !

6. Replacing the FADEC back-up battery

A. Remove the back-up battery

(1) Disconnect the main battery. Refer to 3, Disconnect/Connect the Main Battery for Maintenance.
(2) Locate the back-up battery (Fig. 24-2c).
(3) Disconnect the negative cable from the back-up battery.
(4) Disconnect the positive cable from the back-up battery.
(5) Remove the battery support.
(6) Remove the back-up battery from the airplane.

B. Install the new back-up Battery

(1) Place the back-up battery into position.
(2) Install the battery support.
(3) Connect the positive cable to the back-up battery.
(4) Connect the negative cable to the back-up battery.
(5) Connect the main battery. Refer to 3, Disconnect/Connect the Main Battery for Maintenance.
(6) Do an engine ground run. Refer to OM-02-02.

■ CAUTION Make sure that you connect the cables to the correct terminals !

■ CAUTION The back-up battery circuit has a diode (see fig. 24-2d) located on a support behind the lower instrument panel. When the diode has to be replaced, make sure that you connect the cables to the correct terminals (refer to the indications on the diode housing).

Fig. 24-2d. Diode

7. Replacing the regulator

The voltage regulator is located inside the cockpit, under the center console (see Fig. 24-2e).

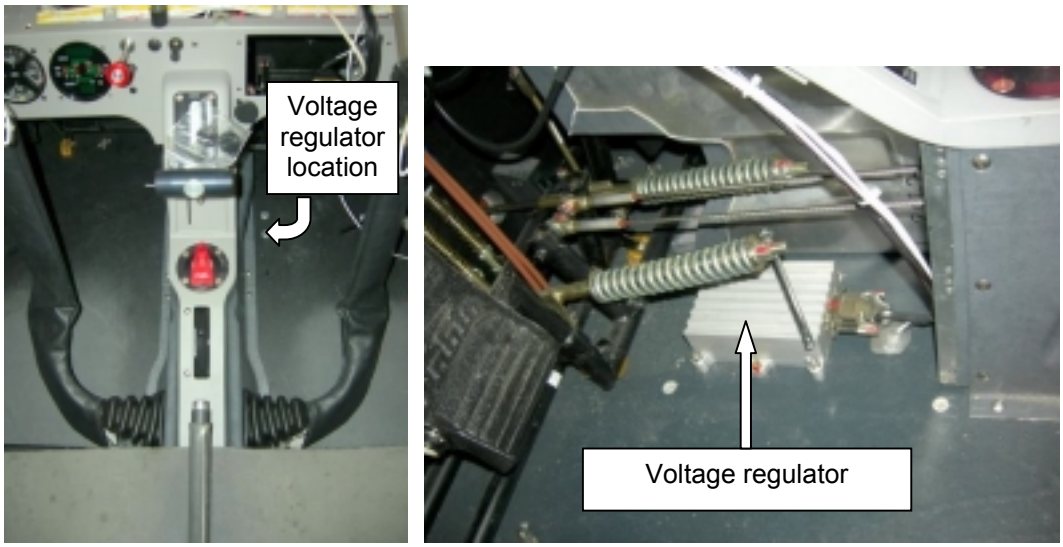


Fig. 24-2e.

(1) Remove the left-hand fairing of the center console (see fig. 24-2e).
(2) Remove the access belly panel (see fig. 24-2f).

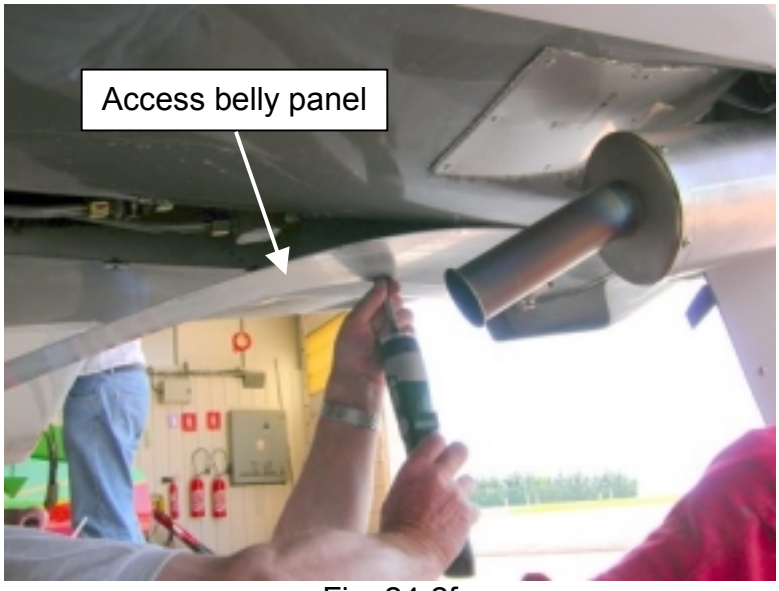


Fig. 24-2f

(3) Remove the two attaching screws of the regulator (see fig. 24-2g). Locate the position of the washers (large one on the wooden area).

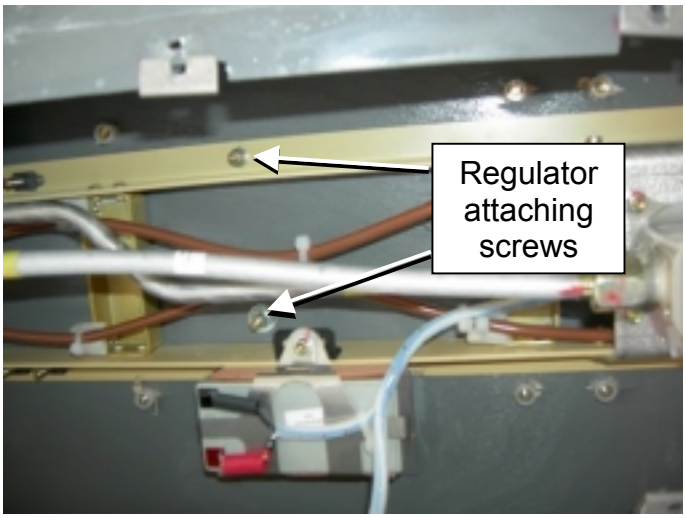


Fig. 24-2g

(4) Disconnect the regulator and remove it.
(5) Install the new regulator and connect it.
(6) Install the two attaching screws (Pay attention to put the washers at the proper place).
(7) Install the left-hand fairing of the center console.
(8) Install the access belly panel.

24.50 ELECTRICAL LOAD DISTRIBUTION

TROUBLESHOOTING

For Troubleshooting in case of malfunction refer to Chapter 71 “Trouble shooting”

MAINTENANCE PRACTICES

1. General

These maintenance practices provide instructions to inspect

- all relays

They also provide instructions to accomplish a function test of the following parts:

- all relays
- all switches
- all circuit breakers

2. Inspecting the relays

This is a visual inspection. Inspect whether the connections of the relays are firmly attached. In addition, the relays have to be checked for signs of corrosion.

The following relays have to be checked:

- Battery Relay (located next to the battery)
- External power relay (located next to the battery)
- Alternator Relay (located on the firewall)
- Glow Relay (located on the firewall)

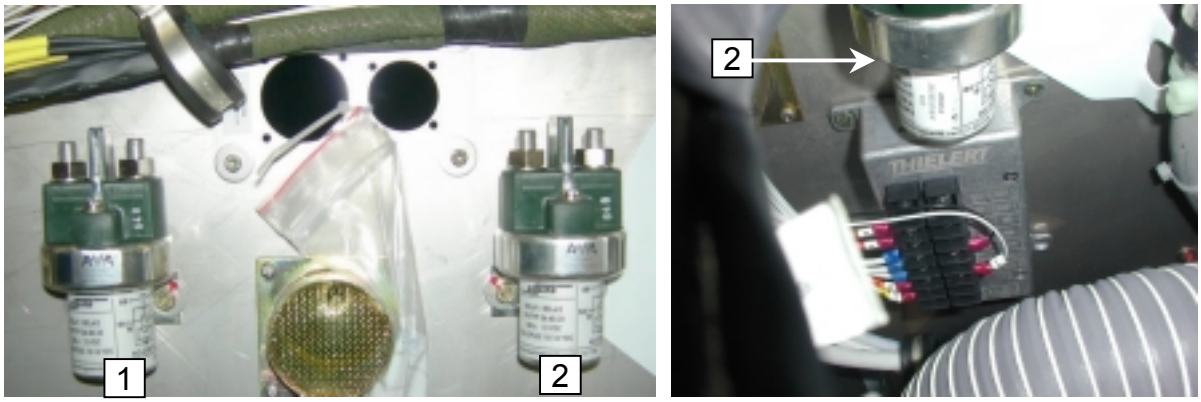


Fig. 24-2f.
1. Alternator relay 2. Glow relay

3. Accomplishing a function test of all relays.

The following relays must be tested:

- Battery Relay (located next to the battery) Fig. 24-2b
- Alternator Relay (located on the firewall) Fig. 24-2f, item 1.
- Glow Relay (located on the firewall) Fig. 24-2f, item 2.

A. Accomplish the function test of the Battery Relay
(1) Battery Switch “ON“
(2) CED illuminates (without data)
(3) Fuel Pump functional (switch Fuel Pump)
(4) => Battery Relay OK
(5) Battery Switch “OFF“

B. Accomplish the function test of the Alternator Relay
(1) Battery Switch “ON“
(2) Circuit Breaker Alternator “ON“
(3) A voltmeter must indicate the same voltage at the Alternator (Terminal Wire 3) as at the battery
(4) Circuit Breaker “OFF“: No voltage at the Alternator (Terminal Wire 3)
(5) => Alternator Relay OK
(6) Battery Switch “OFF“

C. Accomplish the function test of the Glow Relay
(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Voltage at the Glow Plugs, Glow Lamp “ON“ (approx. 5sec.)
(4) => Glow Relay OK
(5) Engine Master “OFF“
(6) Battery Switch “OFF“

D. Accomplish the function test of the Main Bus Relay
(1) Battery Switch “ON“
(2) Main Bus Switch “ON“
(3) Avionics, Lights etc. functional
(4) => Main Bus Relay OK
(5) Main Bus Switch “OFF“
(6) Battery Switch “OFF“

4. Accomplishing a function test of all switches/knobs
The following switches must be tested:

- Main Bus Switch
- Engine Master Switch
- Force B Switch
- FADEC Test Knob
- CED Test Knob

Fig. 24-2g.

A. Inspect all switches/knobs
(1) Visual inspect all switches/knobs on signs of corrosion
(2) Visual inspect whether all connections of the switches/ knobs are firmly attached

B. Accomplish the function test of the Main Bus Switch
(1) Battery Switch “ON“
(2) Main Bus Switch “ON“
(3) Main Bus Relay on, Avionics, Lights etc. functional
(4) => Main Bus Switch OK
(5) Main Bus Switch “OFF“
(6) Battery Switch “OFF“

▲ **WARNING**: Only run the engine on the ground with the propeller running, even for testing purposes, in a safe and clear area and ensure that prop area is clear !

C. Accomplish the function test of the Engine Master Switch
(1) Battery Switch “ON“
(2) Engine Master “ON“ => CED indicate data
(3) Start engine

▲ **WARNING**: Only run the engine on the ground with the propeller running, even for testing purposes, in a safe and clear area and ensure that prop area is clear !

(4) Load Selector “IDLE“
(5) Accomplish FADEC Test procedure => OK

(6) Battery Switch “OFF“ => Engine must run without Battery
(7) Switch FADEC A to FADEC B using the Force B switch => Engine running OK
(8) => Engine Master Switch OK
(9) Engine Master “OFF“
(10) Battery Switch “OFF“

D. Accomplish the function test of the Force B Switch

(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Start engine
(4) Load Selector “IDLE“
(5) FADEC toggles from FADEC A to FADEC B using the Force B switch
(6) => Force B switch OK
(7) Engine Master “OFF“
(8) Battery Switch “OFF“

▲ **WARNING**: Only run the engine on the ground with the propeller running, even for testing purposes, in a safe and clear area and ensure that prop area is clear !

E. Accomplish the function test of the FADEC Test Knob

(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Start engine
(4) Load Selector “IDLE“
(5) Push FADEC test knob => Test procedure OK
(6) => FADEC Test knob OK
(7) Engine Master “OFF“
(8) Battery Switch “OFF“

F. Accomplish the function test of the CED Test Knob

(1) Battery Switch “ON“
(2) Push CED test knob => Selftest CED OK
(3) => CED Test Knob OK
(4) Battery Switch “OFF“

5. Accomplishing a function test of all Circuit Breakers

The following circuit breakers must be tested:

- FADEC A/B
- CED
- Starter
- Alternator

▲ **WARNING**: Only run the engine on the ground with the propeller running, even for testing purposes, in a safe and clear area and ensure that prop area is clear !

A. Accomplish the function test of the Circuit Breaker FADEC A/B
(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Establish CAN communication by connecting the computer to the airplane
(4) Switch FADEC A/B via Circuit Breaker
(5) => Circuit Breaker FADEC A/B OK
(6) Remove CAN communication
(7) Engine Master “OFF“
(8) Battery Switch “OFF“

B. Accomplish the function test of the Circuit Breaker CED
(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Switch CED via Circuit Breaker CED
(4) => Circuit Beaker CED OK
(5) Engine Master “OFF“
(6) Battery Switch “OFF“

C. Accomplish the function test of the Circuit Breaker Starter
(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Switch Starter via Circuit Breaker Starter
(4) => Circuit Breaker Starter OK
(5) Engine Master “OFF“
(6) Battery Switch “OFF“

D. Accomplish the function test of the Circuit Breaker Alternator
(1) Battery Switch “ON“
(2) Engine Master “ON“
(3) Start engine
(4) Load Selector “IDLE“
(5) Circuit Breaker Alternator on: Alternator Warning Lamp (AWL) off
(6) Circuit Breaker Alternator off: No load current, voltage <14V, Alternator Warning Lamp on
(7) => Circuit Breaker Alternator OK
(8) Engine Master “OFF“
(9) Battery Switch “OFF“

▲ **WARNING**: Only run the engine on the ground with the propeller running, even for testing purposes, in a safe and clear area and ensure that prop area is clear !

28 FUEL

Table of contents

28.00 GENERAL

Description

The fuel system of the CENTURION 2.0 installation includes the original standard tank of the DR400. Additional sensors for Fuel Temperature and “Low Level” Warning are installed in the fuel tanks.

An optional supplemental tank may be fitted, which drains into the main tank.

The fuel flows out of the tank to the Fuel Selector Valve.

The electrically driven Fuel Pump supports the fuel flow to the Filter Module if required. Upstream to the Fuel Filter Module a thermostat-controlled Fuel Pre-heater is installed. Then, the engine-driven feed pump and the high-pressure pump supply the rail, from where the fuel is injected into the cylinders depending upon the position of the thrust lever and regulation by the FADEC.

Surplus fuel flows to the Filter Module and then through the Fuel Selector Valve back into the tank. A thermostat switch in the Filter Module controls the heat exchange between the fuel feed and return.

28.20 DISTRIBUTION

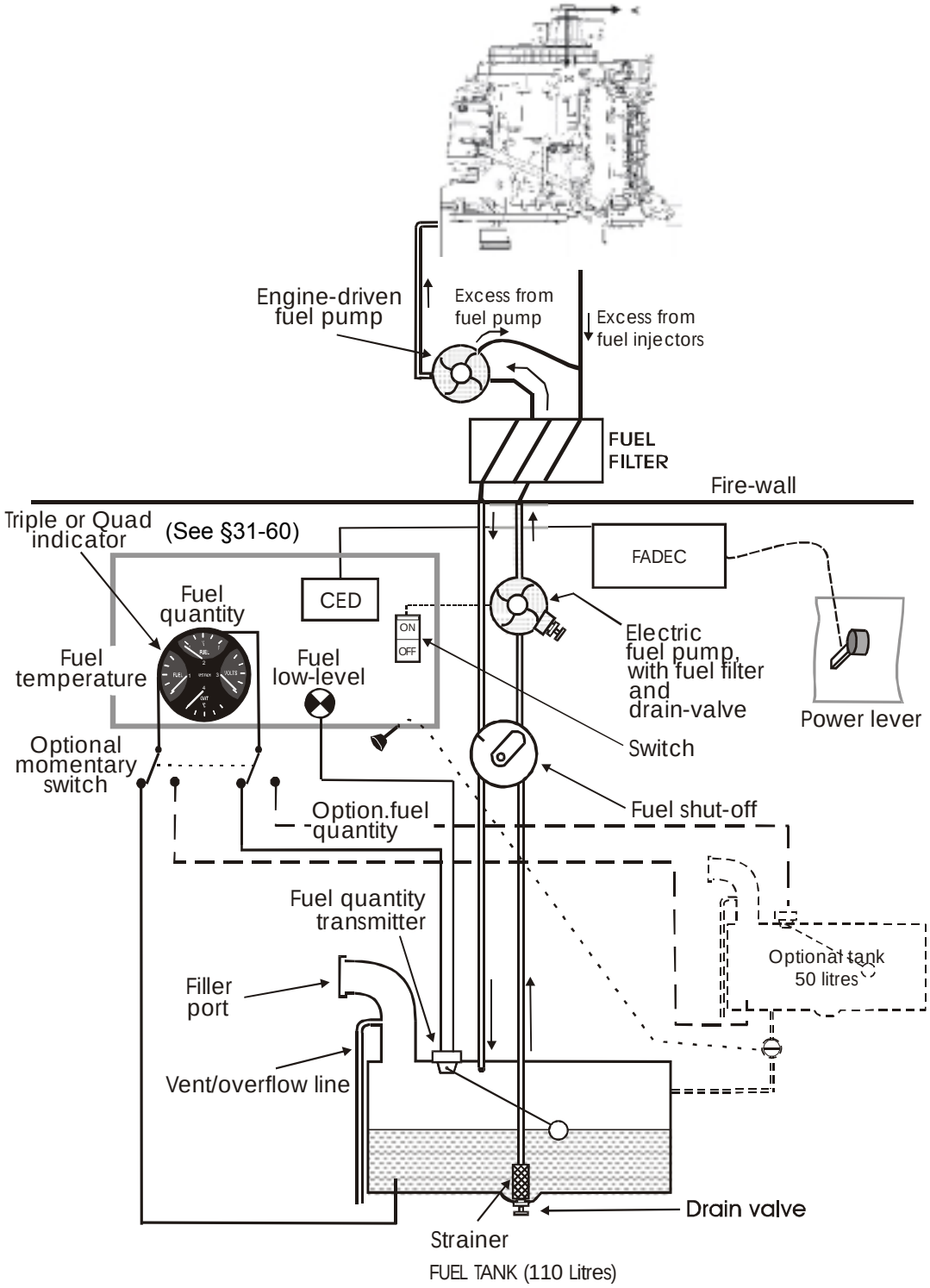
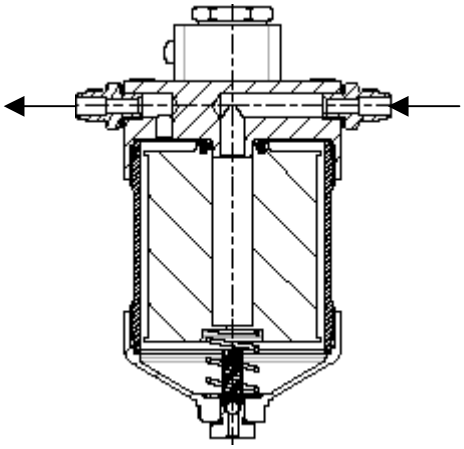


Figure 28-1 Fuel System Diagram with CENTURION 2.0 installation

Fuel Filter Bowl



drain

Figure 28-2a Fuel Filter Bowl of CENTURION 2.0 installation

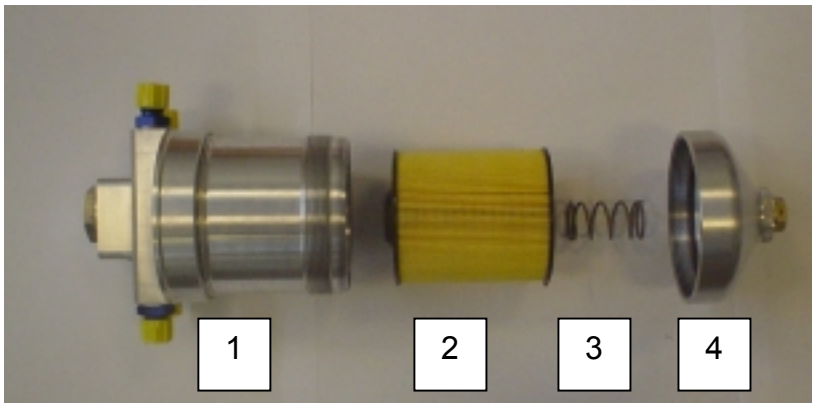


Figure 28-2b Fuel Filter Bowl Disassembled

1 Fuel Filter Housing
2 Fuel Filter Cartridge
3 Spring
4 Bottom Lid
5 O-Ring

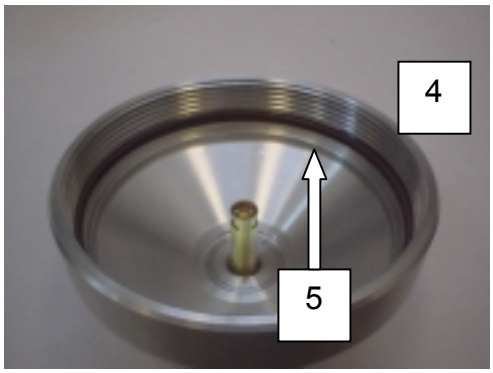


Figure 28-2c Bottom Lid with O-Ring

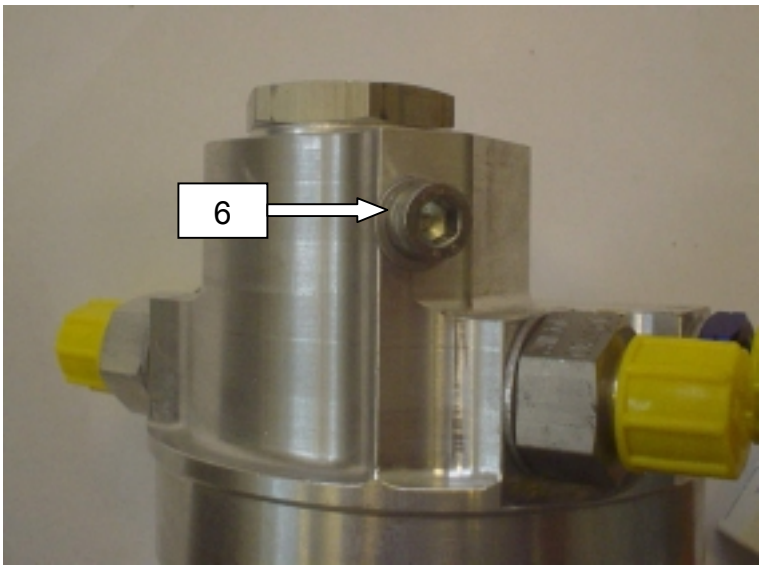


Figure 28-2d Bleed screw in top lid

FUEL FILTER MAINTENANCE PRACTICES

1. General

These maintenance practices provide instructions to remove/install the Fuel Filter and replace the Fuel Filter Cartridge.

2. Removing/Installing the Fuel Filter and replace the Fuel Filter Cartridge

A. Remove the Fuel Filter

(1) Remove the Fuel Filter from the aircraft by disconnecting all fuel lines and loosening the hose clamps that hold the filter in place. Use a wrench to hold the fittings in the fuel filter bowl while loosening the fuel lines to avoid inadvertently loosening the lines. Be careful to protect all lines and openings of the housing from contamination.

B. Replace the Fuel Filter Cartridge

(1) Unscrew the bottom lid (4) of the filter using a 27mm oil filter socket wrench (short socket). Remove the fuel filter cartridge (2) from the fuel filter housing. See Fig. 28-3a.

(2) Replace the O-Ring in the bottom lid (4), carefully seating it in the groove. Stretching the ring a little helps to retain it in the groove. See Fig. 28-4a.

(3) Insert the new fuel filter cartridge into the fuel filter. Ensure that the open end of the lid faces up into the housing.

(4) Carefully screw the bottom lid (4) onto the fuel filter housing (1), ensuring the spring seats correctly both in the lid and the fuel filter cartridge. Tighten the lid using a 27 mm oil filter socket wrench (short socket).

C. Install the Fuel Filter

(1) Install the fuel filter assembly in the aircraft. Tighten the hose clamps, and connect the fuel lines to the assembly.

Ensure correct connection of the lines to the filter housing, as the fittings are the same size. All connections are clearly labelled on the top lid of the fuel filter assembly.

(2) Bleed the fuel filter bowl by opening the allen head screw, opening the fuel selector valve and activating the auxiliary fuel feed pump until fuel drains from the opening. Replace and tighten the allen head screw, ensuring the crush washer is in place. See Fig. 28-5a.

(3) Conduct a ground run after completing any other maintenance on the aircraft.

28.40 INDICATING

Description

Low fuel Sensors

Electric cables connect the low fuel sensor to a low fuel warning lamp in the lightpanel. Refer to Chapter 31, Section 31.50 for more data on the light panel.

Fuel Temperature Sensor

Electric cables connect the fuel temperature sensor to the Triple or Quad indicator. Refer to Chapter 31, Section 31.60 for more data on the Triple or Quad indicator.

Troubleshooting

Table 28-4a Troubleshooting CENTURION 2.0 / Low Fuel Sensor

Trouble Cause	Corrective Action
Fuel low level warning lamp illuminate on the lightpanel when the tank has more than 2.6 US gal (10 l)	Low Fuel Sensor defective Replace Low Fuel Sensor

Low fuel sensor and fuel temperature sensor maintenance practices

1. General

These maintenance practices provide instructions to replace the low fuel sensor and the fuel temperature sensor.

2. Replacing the Low Fuel Sensor

A. Remove the Low Fuel Sensor

(1) Refer to the aircraft manufacturer´s specifications.
(2) Disconnect the electrical cables for the low fuel sensor.
(3) Remove the rivets of the fitting for the low fuel sensor.
(4) Remove the fitting of the low fuel sensor.
(5) Remove the low fuel sensor out of the fitting. See Fig. 28-6a.

▲ WARNING: Do not get fuel on you. Fuel can cause skin disease!

▲ **WARNING**: Do not allow fire near fuel. Fuel burns and causes injury to persons and damage to equipment!

▲ **WARNING**: Do not breath fuel vapor! Fuel vapor can make you ill!

(6) Clean the tank and the fitting.

B. Install the new Low Fuel Sensor

(1) Refer to IM-60-02, Chapter 5-020 and Chapter 5-060.

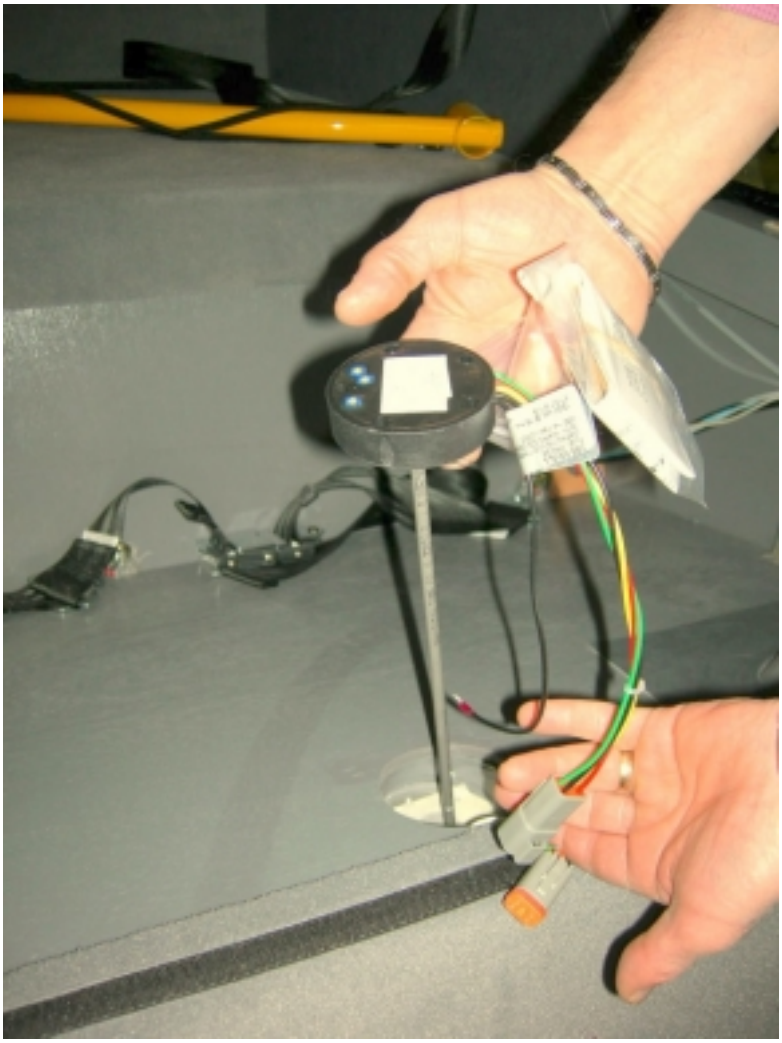


Fig. 28-4a Low fuel sensor

■ CAUTION: Make sure the fuel sensor is not in contact with the fuel tank.

C. Tuning the fuel sensor

(1) Level the aircraft (elbows spars must be horizontal)
(2) Check that sensor is not in contact with the tank
(3) Check the empty position: no fuel. Tune the potentiometer screw “empty” until indicator shows empty position

(4) Check low fuel level: 13 to 15 liters in the tank. Tune the “LO ADJ” potentiometer screw until indicator and alarm light show/ring low level position
(5) Check dipstick marking using this table
Table 28-4b

Marking	Fuel measurable quantity (liters)	Quantity margin (liters)
1/4	27.5	0, -3
1/2	55	0, -3
3/4	82.5	0, -3
1/1	110	0, -3

(6) Check full tank position: 100 liters (capacity: 110 liters). Tune the “Full” potentiometer screw until indicator shows “full” position

3. Replacing the Fuel Temperature Sensor

A. Remove the Fuel Temperature Sensor
(1) Refer to the aircraft manufacturer´s specifications.
(2) Disconnect the connector of the fuel temperature sensor.
(3) Remove the fuel temperature sensor. See Fig. 28-7a.
(4) Make sure that the tank and the adaptor of the fuel temperature sensor are clean.

B. Install the new Fuel Temperature Sensor
(1) Refer to IM-60-02, Chapter 5-060.

Fig. 28-4b Fuel temp. sensor

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31 INDICATING / RECORDING SYSTEMS

31.50 CENTRAL WARNING SYSTEMS

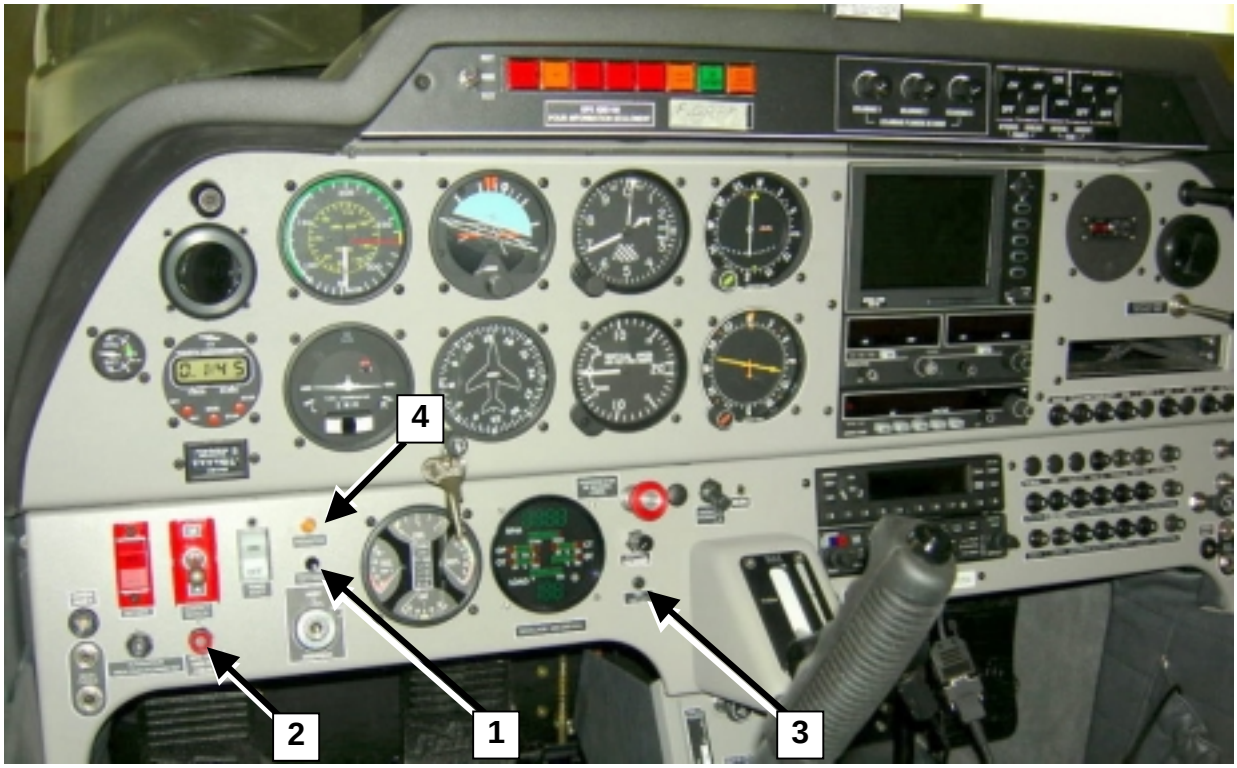
The CENTURION 2.0 warning system is integrated into the DR400 annunciator lights, plus features on the left lower panel.

Lightpanel

CED CAUTION	ALT	FUEL LOW LEVEL	FADEC A	FADEC B	FLAPS DOWN	PITOT HEATING	COOLANT LEVEL

Colour	Amber	Red	Red	Red	Red	Amber	Green	Red
English	CED CAUTION	ALT	FUEL LOW LEVEL	FADEC A	FADEC B	FLAPS DOWN	PITOT HEATING	COOLANT LEVEL
French	ALERTE CED	ALT	CARBURANT BAS NIVEAU	FADEC A	FADEC B	VOLETS SORTIS	CHAUFF. PITOT	NIVEAU LIQUIDE REFROID.
German	CED WARNUNG	ALT	KRAFT-STOFF RESERVE	FADEC A	FADEC B	KLAPPEN AUS	PITOT HEIZUNG	KÜHL MITTEL

Left lower panel warning items



Item nr	Nomenclature	Colour	Function
1	“FADEC” TEST	N/a	Test Button
2	“Force B”	N/a	Switch for manual switching to FADEC B
3	“CED” Test/confirm	N/a	Test/Confirm button for CED 125
4	“Glow”	amber	Glow Control Lamp

Tab. 31-1a Description of lower panel warnings functions

31.60 INDICATING INSTRUMENTS

QUAD INDICATOR

The fuel system of the CENTURION 2.0 installation includes a variant of the original standard tank of the DR400, plus a level sender and display, and an independent low-level warning light. An additionnal sensor for fuel temperature is installed and display is integrated in the combined indicator.

By means of a push-button, the fuel temperature and fuel level of the optional tank are displayed on the quad indicator.

Example of Quad indicator

CED 125

See TAE document listing for latest configuration.

Figure 31-2a CED 125

The engine data of the CENTURION 2.0 installation to be monitored are integrated in the combined engine instrument CED-125.
The ranges of the individual engine monitoring parameters are shown in the following table.

Instrument	Red Range	Amber Range	Green Range	Amber Range	Red Range
Tachometer [rpm]	-	-	0-2300	-	> 2300
Oil Pressure [mbar]	0-1200	1200-2300	2300-5200	5200-6000	> 6000
Oil Pressure [psi]	0-17.4	17.4-33.4	33.4-75.4	75.4-87	> 87
Coolant Temperature [°C]	< -32	-32...+60	60-101	101-105	> 105
Oil Temperature [°C]	< -32	-32...+50	50-125	125-140	> 140
Gearbox Temperature [°C]	-	-	< 115	115-120	> 120
Load [%]	-	-	0-100	-	-

Table 31-3a Markings of the CED 125

◆ Note: If an engine reading is in the amber or red range, the "Caution" lamp is activated. It only extinguishes when the "CED -Test/Confirm" button is pressed. If this test button is pressed longer than a second, a selftest of the instrument is initiated.

MAINTENANCE PRACTICES

1. General

This maintenance practice provides instructions to check the “WATER LEVEL“ signal.

2. Checking the “WATER LEVEL“ signal

A. Drain the Coolant from the Expansion Tank

(1) Remove the cap of the expansion tank.
(2) Disconnect the coolant hose connection and allow the coolant to drain in a suitable container. See Fig. 31-4a.

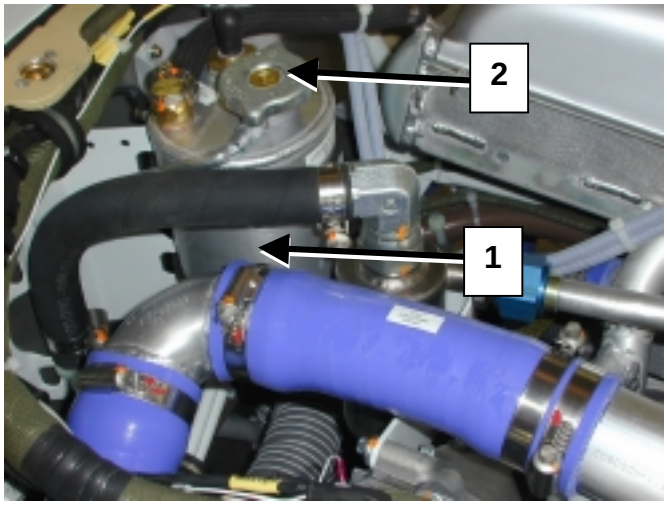


Fig. 31-4a Expansion Tank of CENTURION 2.0
1 Expansion Tank
2 Cap

(3) Seal the coolant connection of the expansion tank. See Fig. 31-4a.

▲ **WARNING**: Risk of scalding! The cooling system may be pressurized. Carefully release the pressure before opening the coolant system.

■ CAUTION: Do not drain the coolant if its temperature is above 40°C!

B. Check the “WATER LEVEL“ signal

(1) BATT and Main Bus Switch - “ON“
(2) The “WATER LEVEL“ - Signal must illuminate
(3) Fill the expansion tank half way with coolant
(4) The “WATER LEVEL“ - Signal must be extinguished, otherwise the “WATER LEVEL“ - Sensor must be replaced

C. Replenish the Coolant

(1) Connect the coolant hose to the expansion tank. See Fig.31-4a.
(2) Replenish the coolant (refer to Chapter 12, Section 12.10, Liquid Cooling System)

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37 VACUUM

37.00 GENERAL

DESCRIPTION

The CENTURION 2.0 engine includes a vacuum pump, which supplies the following flight instruments with suction air:

- the artificial horizon
- the directional gyro

The vacuum pump is mounted to the camshaft and works with oildust seal. An inline spring-loaded valve limits the suction pressure and the rate.

The original suction indicator of the aircraft is used to indicate the suction pressure.

For adjusting the vacuum system, refer to Apex Aircraft “DR400 maintenance manual” (Doc no.1001606GB) section 10.

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61 PROPELLER

61.10 CONSTANT SPEED PROPELLER

The CENTURION 2.0 installation is fitted with the propeller “MT Propeller” MTV-6-A/187-129.
For Inspections and Maintenance of the propeller refer to Operation and Installation Manual of MT-Propeller E124 (ATA 61-01-24).

The propeller control system uses gearbox oil to function. The oil pump delivers oil to the constant speed unit. Inside the constant speed unit the oil passes through a micro filter and a pressure relief valve where the pressure is reduced to a constant 20 bar before reaching the actual control valve. The propeller control valve regulates the oil pressure to the propeller to regulate pitch. Returned oil from the control valve is used to lubricate the gearbox. The propeller control valve is regulated by an electric signal from the FADEC while the pilot has no direct input to the propeller. The propeller itself is a conventional variable pitch propeller, pitch is increased by increasing oil pressure and is decreased by the blade pitching moment and a servo spring. Figure 61-1a shows a schematic of the propeller control system.

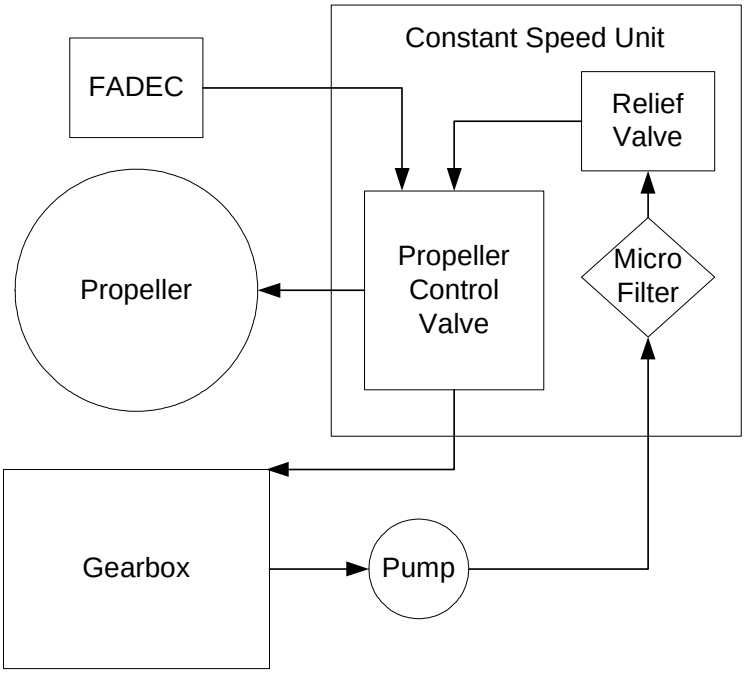

Figure 61-1a Propeller Control System of CENTURION 2.0

61.20 CONSTANT SPEED UNIT

The Constant Speed Unit (CSU) of the CENTURION 2.0 installation is a FADEC-controlled single-acting propeller governor produced by Thielert Aircraft Engines for hydraulically variable pitch propellers with and without feathering.

The CSU CENTURION 2.0 is installed on the front side of the gearbox.

No overhaul permitted.

The micro filter has to be exchanged according to chapter 5. No cleaning allowed.

Enter each filter exchange in CSU installation record.

The governor uses gear box oil with a pressure of 20 bar (290 psi).

Limitations

Maximum acceptable operation temperature: ..... +120°C

Range of altitude .....up to 18,000 ft

Refer to Thielert documentation (OM-02-02, RM-02-02,...).

Troubleshooting

Trouble	Cause	Remedy
Propeller Surging or “Wandering”	low level of gear box oil	-check oil level at oil viewer glass at front side of the gear box -fill up gear box oil (see OM-02-02)
	high contamination of micro filter	-check, when micro filter has been changed last time (every 50 operating hours) -authorised maintenance will change the micro filter -change gear box oil
	broken connection between FADEC and pressure control valve	-check electrical connection to pressure control valve
	incorrect function of the pid-regulator	-contact authorised maintenance or engine manufacturer
	dirty gear box oil	Contaminants in dirty gear box oil can cause blockage of close tolerance passages in the CSU, leading to erratic operation. Timely gear box oil changes should eliminate this problem.

Table 61-1a Troubleshooting CENTURION 2.0 / Propeller

Maintenance practices

General

These maintenance practices provide instructions to remove/install the micro filter. They also provide instructions to calibrate the CSU.

Exchanging the micro filter

A. Remove the micro filter

1) Open safety wire at bottom of the single stage pump.
2) Turn the cover of the filter with a wrench, remove the cover and the aluminium sealing ring.
3) Pull the filter downwards.

B. Install the new micro filter

1) Take a new filter (P/N 03-7212-K00400x). Lubricate the rubber o-ring with gear box oil.
2) Install the new filter.
3) Take the new aluminium o-ring (P/N NM-0000-012100x) and install it with the cover.
   Torque: 40 Nm (29.5 lbf.ft)
4) Attach safety wire so that filter cover cannot move.

Calibrating the CSU

◆ Note: The calibration of the CSU will be done by the engine manufacturer. If calibration is necessary by authorized maintenance, proceed at a gear box temperature of 50°C as follows:

A. Calibrate the CSU

1) Install a monometer between gear pump and micro filter
2) Loose the nut at pressure relief valve with a 25 mm wrench
3) Check the pressure which is indicated at the manometer
4) If the pressure is not 20 bar ± 2 bar (290 psi ± 29 psi), turn screw at pressure relief valve with a 10 mm wrench until this value is reached.
5) Tighten the nut with a 25 mm wrench.
   Torque : 25 Nm (18.4 lbf.ft)

◆ Note: The propeller pitch limits will be set by the propeller manufacturer.

71 POWER PLANT

Table of contents

71.00 GENERAL

DESCRIPTION (Refer to RM-02-02 chapter 00-00.05)

The CENTURION 2.0 is a liquid-cooled 4-cylinder in-line four-stroke diesel engine with DOHC (Double OverHead Camshaft). The valves are activated by cam follower. The direct Diesel injection engine operates based on the common-rail technique and turbocharging. The engine is controlled by a FADEC system. The propeller is driven through an integrated gearbox (i = 1.69) with a clutch. The engine is equipped with an electric starter and an alternator.

■ CAUTION: The engine requires an electrical power source for operation. If the battery and alternator break down simultaneously, this leads to engine stop. Therefore, it is important to pay attention to indications of alternator breakdown.

Due to the specific characteristic, all of the information from the airplane maintenance manual is no longer valid with reference to:

- carburetor and carburetor pre-heating
- ignition magnetos and spark plugs, and
- mixture control and priming system.

Whole assembly

The capacity is 1991 cm^3, each cylinder has a displacement of 498 cm^3. The engine produces 99 kW at 2300 rpm (Propeller rotational speed) with a static compression ratio of 18:1.

Crankcase

The aluminium crankcase is made using pressure die casting with ductile iron liners, bore is 80 mm (3.15 in). The gauge for boreholes is 90 mm. The crankcase main bearing caps are cross-bolted to provide maximum stiffness to weight. In normal running the cylinder pressure is always less than 165 bar (2393 psi).

Crankshaft
The stroke is 92 mm (3.62 in), main journal diameter is 55 mm (2.17 in), rod journal diameter is 46 mm (1.81 in). The flywheel is a single mass type.

Connecting rods
The connecting rods are made of forged steel. The big end diameter is 55 mm (2.17 in), the bushing in the small end has a diameter of 28 mm (1.1 in). In the case of overload the rod has the tendency to become shorter, it shows no bending tendency. The rods are forged in one piece, then the big end is cracked, so that the mating surfaces are perfectly aligned at assembly. They are equipped with M7 bolts and are axially guided at the piston. The rod length is 147.85 mm (5.82 in).

Pistons
The aluminum pistons have special steel inlays in the piston ring groove and are a cooling duct design. Special chrome ceramic rings guarantee good wear resistance.

Cylinder head
The 4 valve cast aluminium cylinder head has diametrically opposed valves. There are 2 water jackets which reduce the temperatures in the critical areas around the exhaust valve seats and the injector to less than 200 °C.
The hydraulically adjusted roller lifters acting on the nimonic valves guaranty low friction values benefiting the efficiency and reliability of the engine. An original three layer steel head gasket is used.
A glow plug is installed for the reason of starting in very cold conditions.

Camshafts
The forged steel camshafts are gun drilled. A simplex timing chain is fitted. The cam profiles provide an intake valve lift of 8.5 mm (0.33 in) and an exhaust valve lift of 8 mm (0.31 in).

Valve train
The intake valves have a shaft diameter of 6 mm (0.24 in) and a valve head diameter of 28.5 mm (1.12 in), the exhaust valves have a shaft diameter of 7 mm (0.28 in) and a valve head diameter of 25.4 mm (1 in). The valve springs have an inside diameter of 15.5 mm (0.61 in), an outside diameter of 21 mm (0.83 in) and 2.75 mm (0.108 in) wire diameter. The unstressed height of the spring is 45.5 mm (1.79 in), assembled height is 32.5 mm (1.28 in), it has 8 threads. The valve keys are of type MK6 to guarantee a good valve rotation.

Induction and fuel system
A common rail system with electrically actuated injectors is used. The high-pressure fuel pump is driven by the intake cam and is a three piston radial pump. The injection timing is advanced for a cooler exhaust temperature, to ensure exhaust temperature below 800 °C (during maximum continuous power), there is preinjection.
The gas exchange of the Centurion 2.0 is realized by the intake system, the exhaust system and the turbocharger. The system is controlled by the FADEC. No intake air restriction is necessary due to the qualitative mixture formation.

The fresh air passes the dry air filter to the turbocharger where it is compressed, and then passes through the intercooler into the intake manifold. Manifold air pressure and temperature are measured and forwarded to the FADEC, which is calculating a signal for the duty cycle valve.
The CENTURION 2.0 turbocharger consists of a radial compressor and a centripetal turbine which are connected with a common shaft. The turbine is driven by the exhaust gases of the engine. Due to the fixed connection this rotational energy is delivered to the compressor.

Oil system
The oil system of the CENTURION 2.0 is a wet oil sump system, consisting of the following components:

- the sump
- the oil pump driven by chain
- the thermostat
- the oil cooler
- the oil pressure sensor
- the oil filter
- the blow-by system
- the oil pump driven by the gearbox
- the oil temperature sensor

The oil system is used for lubrication, cooling and the micro sealing of the engine in the area of the piston and cylinder. The pressure cycle lubricates all heavily used bearings of the engine and supplies the turbocharger with oil. Cams, chain drive and valve guides are lubricated with pressure less leak oil. The oil is sucked by the chain driven pump from the sump and led to the filter, thereafter to the thermostat. At oil temperatures lower than 78°C oil is streaming directly to the main path through the short cycle. When the oil temperature rises above 78°C, the thermostat opens the path to the oil cooler. At temperatures above 94°C the oil is taking path through the oil cooler exclusively, which ensures a maximum oil temperature of 140°C under all operating conditions.
Then the engine parts are lubricated and cooled by the oil, the turbocharger is supplied by an extra hose. The oil within the engine is passing the bearings and then drops into the sump. The turbocharger oil is draining directly to the oil sump. The measured values of oil temperature and pressure are displayed at the CED 125 and led to the FADEC. The system contains 4.5 to 6 liters oil, the level can be checked with the dip stick.

Cooling system
The CENTURION 2.0 installation has got an independent liquid cooling system, consisting of the following parts:

- the radiator
- the water pump
- the thermostat
- the heat exchanger
- the expansion tank, including low level caution

- the power plant as heat source and
- lines and fittings

The CENTURION 2.0 installation is using a closed loop liquid cooling system with external expansion tank and overflow bottle for engine cooling. In normal operations, a closed loop cooling system does not have any loss of cooling fluid, the expansion tank ensures a proper fluid level in various temperatures and pressure situations up to the requested max. operation altitude of 18,000 ft.The three path dual plate thermostat regulates the coolant flow between the external and the short circuit. Below 84°C the short circuit is used and the water pump is pushing the coolant back to the engine to warm it up quickly. The heat exchanger for cabin heat is placed behind the unregulated exit of the thermostat. according to demand and outside air temperature the heat exchanger is providing warm air to the cabin. At 84°C the thermostat starts to open the path to the external circuit, the coolant is lead to the radiator. At 94°C the path to the external is fully opened, the short circuit is fully closed and the entire coolant is lead to the radiator, which ensures a maximum temperature of 105°C. The expansion tank is installed at the highest point of the cooling system, the connections are leading from the expansion tank to the water pipe, the coolant thermostat and the breather line to the outside. A sensor within the tank is sending a signal to a red “Coolant level” caution lamp at the instrument panel. The coolant temperature is measured in the intake manifold, giving the corresponding temperature value to the FADEC and CED 125. The maximum permitted pressure in the cooling system is limited to 1700 mBar by the cap of the expansion tank.

Propeller drive system

The drive for the propeller is via a gear set. The propeller shaft speed is 2300 rpm during start conditions. The gears are steel forged to reduce mass and to guaranty good reliability. The die cast housing is mounted directly to the crankcase and incorporates internal oil paths to lubricate the gears and constant speed propeller drive.

Governor system

The prop-pitch-control system is integrated in the FADEC. The gear oil is sucked off at the lower side of the gear and is brought to the pressure control and control unit with a gear pump. The system pressure regulator provides a constant system pressure of 20 bar (290 psi). The control unit controls the oil flow to the cylinder over a pulse valve, the cylinder controls the propeller pitch adjustment.

Auxiliary systems

The vacuum pump is direct driven by camshaft and provides the necessary vacuum for the navigation instruments.

Electronic and electrical system

The engine is controlled via a 32-bit Microprocessor Engine Management system (FADEC) incorporating redundancy. The FADEC consists of two complete and identical redundant halves and the most important sensors (Cam and Crank signals) are redundant as well. An intelligent control strategy manages switching between the two redundant FADEC channels in case of a failure. All sensor signals are continuously monitored, sensor failures are detected automatically and the control strategies account for sensor failures. The FADEC is equipped with two warning lights (one for each redundant half) that constitute the means to alert the crew of failures and when crew action is needed.

An event log store logging all failures and extreme sensor input values as well as an integral hours run meter ensure maximum safety against potentially damaging events.

An independent safety system monitors the stored events before every take off and independently makes a check of all functions including a switch to the other redundant half to make sure both FADEC channel are in working order.

The control system includes a data stream interface implemented as a CAN line that carries several sensor and FADEC internal values and can be used to drive an engine instrument like the CED-125.

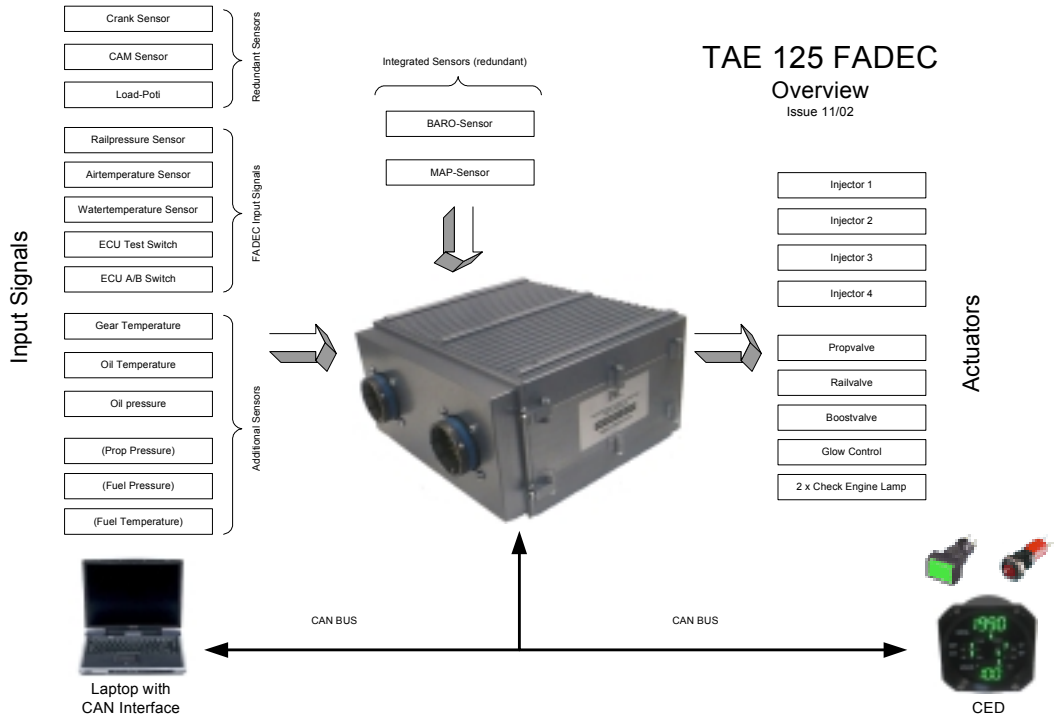

Figure 71-1a CENTURION 2.0 FADEC overview

Technical Data

Type of engine: ..... 4-cylinder inline, DOHC, 4 valves per cylinder
Engine code: ..... TAE 125-02-99 (CENTURION 2.0)
Displacement: ..... 1991 cm^3
Piston-swept volume: ..... 498 cm^3
Engine principle: ..... 4 cycle Diesel Direct Injection with turbocharger
Power: ..... 99 kW (132.8 HP) at 2300 rpm (Prop. rotational speed)
Torque: ..... 410 Nm (302.4 lbf.ft) at 2300 rpm (Prop. rotational speed)
Bore: ..... 83.0 mm (3.27 in)
Stroke: ..... 92.0 mm (3.62 in)
Gauge of boreholes: ..... 90.0 mm (3.54 in)
Compression ratio: 18:1
Main journal diameter: ..... 55.0 mm (2.17 in)
Rod journal diameter: ..... 50.0 mm (1.97 in)
Connecting rod length: ..... 147.85 mm (5.82 in)
Rod big end diameter: ..... 50.0 mm (1.97 in)
Rod small end diameter: ..... 28.0 mm (1.1 in)
Wrist pin diameter: ..... 28.0 mm (1.1 in)

Valves per cylinder: ..... 2 intakes, 2 exhausts
Valve lift intake: ..... 8.5 mm (0.33 in)
Valve lift exhaust: ..... 8.5 mm (0.33 in)
Intake valve head diameter: ..... 28.5 mm (1.12 in)
Exhaust valve head diameter: ..... 25.4 mm (1.0 in)
Intake valve shaft diameter: ..... 6.0 mm (0.24 in)
Exhaust valve shaft diameter: ..... 7.0 mm (0.28 in)
Valve spring outside diameter: ..... 21.0 mm (0.83 in)
Valve spring inside diameter: ..... 15.5 mm (0.61 in)
Valve spring wire diameter: ..... 2.75 mm (0.108 in)
Valve spring threads: 8
Valve spring height: ..... 45.5 mm (1.79 in)
Valve spring installed height: ..... 32.5 mm (1.28 in)
Valve key type: MK6

Max. fuel pressure: ..... 1350 bar (19580 psi)
Max. Exhaust temperature: ..... 820 °C
Oil system:
Oil pump: ..... 1 stage
Tappet clearance compensation: Hydraulic
Type of cam timing drive: ..... Chain

TROUBLE SHOOTING (Refer to RM02-02 chapter 00-00.04)

To isolate a fault, proceed as follows:

Step	*Action*
1	Select the "Fault Isolation" Tab
2	Find the heading appropriate to the fault
3	Find the symptom which best describes the fault
4	Follow the instructions in the following gap
5	If the Item passes the check, go to the next line
6	If an item fails a check, perform the following corrective action

◆ Note: Always proceed from top to bottom, and perform checks and corrective actions in the specified order.

"Sensor Properties" and "Actuator Control Signal" are separately provided files. They contain information relevant to tasks in the "corrective action" gap.

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Engine fails to start

Code	Indication	Code	Task/check	Check by	Corrective action
1	Engine does not turn	1.1	Check battery voltage	Measure battery voltage at battery terminals	Charge battery, check battery water level and acidity, replace battery
		1.2	Check Starter Supply Voltage	Measure voltage at starter power supply (with battery switch on) and starter control wire (while actuating starter)	Repair Starter Power Supply
		1.3	Check Starter Switch Operational	Check continuity of starter switch in both positions	Replace Switch
		1.4	Is starter operational?		Replace Starter
2	Engine turns but does not start	2.1	Verify Fuel Pressure (P-Rail) >280 bar	Connect FADEC service tool Energize FADEC, activate starter check “P-rail”	Proceed to Code 32-35 “ Low Fuel Pressure"
		2.2	Check crank signal using FADEC service tool	Connect FADEC service tool using CAN interface kit. Energize FADEC, activate starter. Both FADEC - halfs should show >140 RPM, and values should be identical	Check Crank Signal with Operator. Proceed to code 45, "Faulty Crank /CAM Signal"
		2.3	Check Glow Plug Operation		Proceed to Code 38 "Glow Plug Functionality"
3	Engine starts but dies	3.1	Check Fuel Type	Verify that the fuel is according to current operating / maintenance manual	Contact TAE if the wrong fuel type has been used

Code	Indication	Code	Task/check	Check by	Corrective action
		3.2	Check Crank signal using FADEC service tool	Connect FADEC service tool using CAN interface kit. Energize FADEC, activate starter. Both FADEC - halfs should deliver >140 RPM, and values should be identical	Check Crank Signal with Operator. Proceed to code 45, "Faulty Crank /CAMSignal"
		3.3	Verify Fuel Pressure (P-rail) >280 bar	Connect FADEC service tool. Energize FADEC, activate starter. Check “P-rail”	Proceed to Code 32-35 "Low Fuel Pressure"

FADEC Test

Code	Indication	Code	Task/check	Check by	Corrective action
4	Egine will not perform FADEC test	4.1	Ensure that the engine is in idle mode		Move power level to idle position
		4.2	Check whether engine has started on FADEC B	Connect FADEC service tool, check which “FADEC active” light is illuminated	Cycle FADEC power; restart engine. If engine does not start during initial cranking, cycle FADEC power before attempting to start again.
5	Engine dies during FADEC test	5.1	Ensure that FADEC backup battery is fully charged	Measure FADEC backup battery voltage	Charge or replace FADEC backup battery as appropriate

Engine runs roughly

Code	Indication	Code	Task/check	Check by	Corrective action
6	Engine vibrates, Runs on three Cylinders continuously	6.1	Check Injector Operation	Isolate faulty injector by running the engine with one injector connector removed at a time. Engine will run best with the faulty injector disconnected. **WARNING: Do not run the aircraft without an operator in the cockpit. Do not approach the engine bay while engine is running.**	Perform subsequent tests only on faulty injector.
				Check power supply to the injector by inspecting wiring harness for damage. Check condition of pins at the injector.	**Carefully** squeeze the pins on the harness side connector to improve contact. If possible, repair wiring harness. Refer to repair manual / contact TAE for allowable repairs.
			Replace injector		Refer to TAE Repair manual RM-02-02
		6.2	Check fuel type and quality		Contact TAE if wrong fuel type has been used
		6.3	Perform leak down test	Refer to repair manual for detailed instructions and limitations	Contact TAE
7	Engine vibrates, runs on three Cylinders intermittently	7.1	Check crank signal	Connect FADEC service tool using CAN interface kit. Both ECU's should deliver identical, stable RPM display.	Proceed to code 45, "Faulty crank signal"

Code	Indication	Code	Task/check	Check by	Corrective action
		7.2	Check injector operation	Isolate faulty injector by running the engine with one injector connector removed at a time. Engine will run best with the faulty injector disconnected. **WARNING: Do not run the aircraft without an operator in the cockpit. Do not approach the engine bay while engine is running.**	Perform subsequent tests only on faulty injector.
				Check power supply to the injector by inspecting wiring harness for damage. Check condition of pins at the injector.	**Carefully** squeeze the pins on the harness side connector to improve contact. If possible, repair wiring harness. Refer to repair manual / contact TAE for allowable repairs.
		7.3	Check P-rail sensor signal	Connect FADEC service tool while performing ground run and reproducing problem. Compare “P-rail” to “P-rail tar”. If capable, do so by generating graph. Intermittent P-rail sensor fault will result in erratic pressure indication and deviation from target value.	Proceed to code 41, “Erroneous indication”

Code	Indication	Code	Task/check	Check by	Corrective action
8	RPM surging (accompanied by rough running engine)	8.1	Check fuel quality / type	Ensure fuel type conforms to specification in current operating manual	Contact TAE
		8.2	Check Crank Signal	Connect FADEC service tool using CAN interface kit. both FADEC-halfs should deliver identical, stable RPM display.	Proceed to code 45, “Faulty Crank/Cam signal”
		8.3	Check P-rail sensor signal	Connect FADEC service tool while performing ground run and reproducing problem. Compare “P-rail” to “P-rail tar”. If capable, do so by generating graph. Intermittent P-rail sensor fault will result in erratic pressure indication and deviation	Proceed to code 41 “Erroneous indication”
		8.4	Check propeller operation	Refer to MT Propeller manual for inspection instruction of propeller	Repair / replace propeller according to MT instructions.

Power delivery

Code	Indication	Code	Task/check	Check by	Corrective action
9	Poor throttle response	9.1	Check fuel quality / Type	Ensure that the specifications ensure to TAE operation manual	Contact TAE

Code	Indication	Code	Task/check	Check by	Corrective action
10	Gradual power loss	10.1	Verify Fuel supply/Pressure	Connect FADEC service tool while performing ground run and reproducing problem. Compare “P-rail” to “P-rail tar”. If capable, do so by generating graph. Deviation must be within +50/-70 bar.	Proceed to Code 35 " Too low Fuel Pressure"
		10.2	Check manifold pressure	Connect FADEC service tool while performing ground run and reproducing the problem. Compare “MAP” to “LiMAPtar”. If capable, do so by generating graph. Deviation must be within +/- 50 mbar.	Proceed to code 30 “Lack of manifold pressure”
		10.3	Perform leak down test	Refer to repair manual for detailed instructions and limitations	contact TAE if not within specification
11	Unsatisfactory power at altitude	11.1	Check manifold pressure at altitude / check waste gate duty cycle on the ground	Connect FADEC service tool during test flight, reproducing the problem (at max. power). Compare “MAP” to “LiMAPtar”. If capable, do so by generating graph. Deviation must be within +/- 50 mbar. Waste gate duty cycle (WG_DC) must be 65-88% at max.power and sea level conditions.	Proceed to code 30 “Lack of manifold pressure”

Code	Indication	Code	Task/check	Check by	Corrective action
12	Temporary power loss	12.1	Verify steady fuel (Rail pressure)	Connect FADEC service tool while performing ground run and reproducing problem (at max. power). Compare “P-rail” to “P-rail Tar”. If capable, do so by generating graph. Deviation must be within +50/-70 bar. Have unapproved maneuvers been executed ?	Proceed to code 35, “Too low Pfuel in Flight”.
		12.2	Verify crank signal	Connect FADEC service tool using CAN interface kit. Both ECU’s should deliver identical stable RPM display.	Check crank signal with operator. Proceed to code 45, “Faulty crank/Cam signal”.
13	Sudden power loss	13.1	Verify steady fuel (Rail pressure)	Connect FADEC service tool while performing ground run and reproducing problem (at max. power). Compare “P-rail” to “P-rail Tar”. If capable, do so by generating graph. Deviation must be within +50/-70 bar.	Ensure steady fuel supply
		13.2	Check manifold pressure	Connect FADEC service tool during test flight, reproducing the problem (at max. power). Compare “MAP” to “LiMAPtar”. If capable, do so by generating graph. Deviation must be within +/- 50 mbar.	Proceed to code 30, “lack of manifold pressure”

Code	Indication	Code	Task/check	Check by	Corrective action
14	Complete power loss	14.1	Verify that FADEC is functional	Power up FADEC (FADEC master power). Engine instruments must display information (Coolant temp, Oil temp, etc., with CAN terminator connected)	Connect CAN terminator plug
		14.2	Check power supply to FADEC	Measure voltage to engine wiring harness power connection with FADEC power activated	Repair power supply as appropriate
				Verify that two main connectors are connected correctly	Connect connectors correctly
		14.3	Verify crank signal	Connect FADEC service tool using CAN interface kit. Both FADEC-halfs should deliver identical, stable RPM display.	Check crank signal with operator. Proceed to code 45, “Faulty Crank / CAM signal”
		14.4	Verify fuel supply	Connect FADEC service tool while performing ground run and reproducing the problem (at max. power). Compare “P-rail” to “P-rail Tar”. If capable, do so by generating graph. Deviation must be within +50/-70 bar.	Ensure fuel supply. Refer to code 32, “Lack of fuel pressure”
15	Engine does not reach target RPM or load during ground run	15.1	Verify gearbox oil temperature >50°C	Check engine instrumentation or connect FADEC Service Tool and check “Tgear”	Wait for gearbox oil to heat

Code	Indication	Code	Task/check	Check by	Corrective action
		15.2	Verify Manifold sufficient pressure	Connect FADEC Service Tool while performing ground run and reproducing the problem (at max. power). Compare “MAP” to “liMAP Tar”. If capable, do so by generating graph. Deviation must be within +/- 50 mbar.	Proceed to code 30, “Induction/exhaust system”.
		15.3	Verify propeller in low pitch	Remove connector from propeller control valve (gold valve on gearbox). Perform full power ground run. engine should reach RPM at or above specification of operating Manual	Adjust propeller low pitch stop if engine still does not reach target RPM. Refer to MT propeller manual for instruc-tions. If engine reaches target RPM without connector, proceed to next step.
		15.4	Verify CSU supply pressure = 20 bar	Install gauge in oil line between combi pump and CSU. Start engine, and verify that pressure is 20 bar +/- 1 at all power settings with warm gearbox.	Adjust CSU supply pressure at black bleed valve on CSU block. Close inner screw approximately quarter turn for an increase of 1 bar.
		15.5	Check prop control valve.		Replace prop control valve.

Engine speed Regulation

Code	Indication	Code	Task/check	Check by	Corrective action
16	Overspeed (for more than 5 seconds after application of power).	16.1	Check gearbox oil level		Replenish gearbox oil / contact TAE if gearbox has been operated with low oil level.
		16.2	Have aggressive / negative G maneuvers been executed		Wait for gearbox oil to settle
		16.3	Check CSU oil supply	Remove hose from gearbox oil pump to CSU. Oil should leak from hose.	Prime CSU by filling hose with oil. **Note**: if CSU supply pressure is 30 bar or more, contact TAE Support hotline.
		16.4	Verify CSU supply pressure = 20 bar	Install gauge in oil line between Dual Stage Pump and CSU. start engine, and verify that pressure is 20 bar +/- 1 at all power settings with warm gearbox.	Adjust CSU supply pressure at black bleed valve on CSU block. Close inner screw approximately quarter turn for an increase of 1 bar.
		16.5	Change gearbox oil filter		Replenish gearbox oil / Contact TAE if gearbox has been operated with low oil level.
		16.6	Check prop control signal		Refer to instructions to verify actuator / harness
		16.7	Replace prop control valve		

Code	Indication	Code	Task/check	Check by	Corrective action
17	Poor engine speed regulation	17.1	Check gearbox oil		Replenish gearbox oil / Contact TAE if gearbox has been operated with low oil level.
		17.2	Have aggressive / negative g maneuvers been executed ?		Wait for gearbox oil to settle
		17.3	Check CSU oil supply	Remove hose from gearbox oil pump to CSU. Oil should leak from hose.	Prime CSU by filling hose with oil.
		17.4	Verify CSU supply pressure = 20 bar	Install gauge in oil line between Dual Stage Pump and CSU. Start engine, and verify that pressure is 20 bar +/- at all power settings with warm gearbox.	Adjust CSU supply pressure at black bleed valve on CSU block. Close inner screw approximately quarter turn for an increase of 1 bar. **Note**: if CSU supply pressure is 30 bar or more, contact TAE Support hotline.
		17.5	Change gearbox oil filter		Change gearbox oil filter
		17.6	Check prop control signal		Refer to instructions to check actuator / harness
		17.7	Replace prop control valve		
		17.8	Check propeller		Refer to MT Propeller manual

Engine smokes

Code	Indication	Code	Task/check	Check by	Corrective action
18	White smoke	18.1	Check for coolant leak into exhaust chamber system / combustion chamber	Verify exhaust pipe is dry / Check coolant level, remove glow plugs, check combustion chamber for moisture	contact TAE if engine uses coolant or if moisture is found in combustion chamber
19	Blue smoke	19.1	Perform leak down test	Refer to repair Manual for detailed instructions and limitations	Contact TAE if not within specification
20	Black smoke	20.1	Check manifold pressure	Connect FADEC service tool while performing a ground run and reproducing the problem (at max. power). Compare “MAP” to “LiMAPTar”. If capable, do so by generating graph. Deviation must be within +/- 50 mbar.	Proceed to Code 30, “Induction System”
		20.2	Is engine running roughly ?		Proceed to code 6, “Engine runs roughly”

Cooling system

Code	Indication	Code	Task/check	Check by	Corrective action
21	Low coolant level / Coolant loss	21.1	Perform leak check on coolant system	Install cooling system leak tester in place of radiator cap. Pressurize cooling system to 2.8 bar for 5 minutes. Check for leaks.	Repair coolant leak.

Code	Indication	Code	Task/check	Check by	Corrective action
		21.2	Check for coolant system leak into exhaust pipe / conbustion chamber	Verify dry exhaust, remove glow plugs check combustion chamber for moisture.	Contact TAE. Replace engine if cooling jacket is damaged.
22	Low coolant temperature indication	22.1	Check coolant level	Check low coolant level annunciator. Open radiator cap, check level in expansion reservoir.	Replenish coolant / Isolate source of coolant loss.
		22.2	Extreme environmental conditions	Extremely cold OAT ?	Compare to normal environmental conditions; warm up engine.
		22.3	check coolant temp sensor function	Allow engine to adjust to environmental condition. Connect FADEC Service Tool, check “TH20”. Is displayed value closed to OAT ?	Proceed to code 41, “Erroneous indication”.
23	High coolant temperature indication	23.1	Check coolant level	Check low coolant level annunciator. Open radiator cap, check level in expansion reservoir.	Replenish coolant / Isolate source of coolant loss.
		23.2	Verify radiator / heater core unobstructed	Check cowl inlets for obstruction. Check radiator / heater core for contamination.	Remove obstruction / Clean radiator and heater core.
		23.3	Verify coolant temp sensor function	Allow engine to adjust to environmental condition. Connect FADEC Service Tool, check “TH203. Is displayed value closed to OAT ?	Proceed to Code 41, “Erroneous indication”

Lubrication system

Code	Indication	Code	Task/check	Check by	Corrective action
24	Low oil pressure indication	24.1	Check oil level		Replenish oil / Investigate for secondary damages
		24.2	Check oil pressure sensor connector and connector	Check P-oil pressure sensor connector	Proceed to Code 41, “Erroneous indication”
25	High oil pressure indication	25.1	Verify oil type		Replace oil
		25.2	Check oil pressure sensor wiring		Proceed to Code 41, “Erroneous indication”
		25.3	Verify correct connection of all oil lines to and from the appropriate location		Connect hoses correctly / Investigate for secondary damage. Contact TAE.
26	Erratic oil pressure indication	26.1	Check oil pressure sensor and connection	Check P-oil pressure sensor connector	Proceed to Code 41, “Erroneous indication”
27	High oil temperature indication	27.1	Check environmental conditions	Extremely high OAT ?	Compare to operation under normal conditions
		27.2	Check oil level		Replenish oil / Investigate for secondary damages
		27.3	Check oil cooler for obstructions	Check cowl inlets for obstruction. Check oil cooler core for contamination	Clean oil cooler / Remove obstruction

Code	Indication	Code	Task/check	Check by	Corrective action
		27.4	Check oil temperature sensor and connection		Proceed to code 41, “Erroneous indication”
28	Oil leak	28.1	Oil leak from wastegate control valve air filter. Oil present in induction manifold / exhaust pipe.		Examine turbocharger for leak / Replace turbocharger.
		28.2	Isolate oil leak source	Clean engine. Perform ground run. Locate oil leak. Determine whether engine oil (black) or gearbox oil (lighter color) leak.	Repair oil leak.
29	Excessive blow-by	29.1	Perform leak down test	Refer to Repair Manual for detailed instructions and limitations	Contact TAE if it’s not within specification

Induction / Exhaust system

Code	Indication	Code	Task/check	Check by	Corrective action
30	Lack of manifold pressure	30.1	Inspect induction system for leaks	Inspect MP lines to FADEC, inspect all hoses, connections. Pressurize induction system (<1 bar), while closing turbo intake and rotating engine so all valves are closed if necessary. Do not disassemble system if no leak has been found.	Repair hoses, connection as necessary.

Code	Indication	Code	Task/check	Check by	Corrective action
		30.2	Check waste gate adjustment	Connect FADEC Service Tool. Waste gate duty cycle must be 65-88 % at sea level conditions and max power.	Check and adjust waste gate according to Repair Manual.
		30.3	Inspect pneumatic waste gate control hoses	If hoses have been worked on, check for correct routing / connection	Install correctly, repair as necessary.
		30.4	Inspect wiring harness for damage or penetration		Replace damaged / penetrated harness
		30.5	Measure waste gate control signal		Refer to instructions for measuring actuator control signal
		30.6	Verify waste gate control valve function		Replace waste gate control valve
31	Smut build-up around exhaust manifold	31.1	Some smut build-up is normal	Check for cracked manifold. Check for distinct single cylinder combustion noise during cold engine start-up.	Replace exhaust manifold and gasket if necessary

Lack of fuel pressure

Code	Indication	Code	Task/check	Check by	Corrective action
32	Fuel pressure <30 bar during start-up	32.1	Ensure fuel supply		Refuel aircraft, check fuel filters, bleed system, ensure both fuel feed and return lines are clear of obstructions

Code	Indication	Code	Task/check	Check by	Corrective action
		32.2	Check fuel pumps. Measure fuel feed pressure between feed pump and high pressure pump. Ensure fuel delivery from high pressure pump.		Replace fuel pumps as necessary.
33	Fuel pressure =60 bar during start-up	33.1	Check crank signal using FADEC Service Tool	Connect FADEC Service Tool using CAN interface kit. Energize FADEC, activate starter. Both FADEC-halfs should deliver >140 RPM, and should be identical.	Proceed to code 45, “Faulty Crank Signal”.
		33.2	Verify rail control signal		Refer to instructions for checking harness / actuator control signal.
34	Fuel pressure >60 bar, but <280 bar	34.1	Check fuel supply		Refuel aircraft, check fuel filters, bleed system, ensure both fuel feed and return lines are clear of obstructions
		34.2	Check fuel pumps. Measure fuel feed pressure between feed pump and high pressure pump. Ensure fuel delivery from high pressure pump.		Replace fuel pump as necessary.

Code	Indication	Code	Task/check	Check by	Corrective action
35	Too low Pfuel in flight	35.1	Check fuel supply		Refuel aircraft, check fuel filters, bleed system, ensure both fuel feed and return lines are clear of obstructions
		35.2	Check fuel pumps. Measure fuel feed pressure between feed pump and high pressure pump. Ensure fuel delivery from high pressure pump.		Replace fuel pumps as necessary.

Electrical system / FADEC

Code	Indication	Code	Task/check	Check by	Corrective action
36	Flashing FADEC lights	36.1	Proceed according to indicated Code in event log		
37	Lack of FADEC power	37.1	Check FADEC power supply. Check power connections to wiring harness. Check battery power.		Re-establish FADEC power

Code	Indication	Code	Task/check	Check by	Corrective action
		37.2	Check FADEC power switch functional by checking continuity and connections of ECU power switch.		Repair FADEC power switch
38	Glow plug functionality	38.1	Check CAN termination plug is in place		Replace CAN terminator plug
		38.2	Check glow plug signal output	Measure voltage to glow plugs	Repair glow plug signal output. Check wiring / power connections of glow plugs.
		38.3	Check glow plug relay function		Replace glow plug relay
		38.4	Check glow plug function	Check resistance of two glow plugs in parallel by measuring resistance from connector to engine ground. Repeat for both pairs of glow plugs by checking both pins to ground. resistance for two plugs in parallel should be 1 ohm. If necessary, check resistance of individual glow plug. Resistance should be 2 ohm.	Replace glow plugs as necessary.
39	Lack of alternator charge	39.1	Check alternator connection		Repair alternator connection

Code	Indication	Code	Task/check	Check by	Corrective action
		39.2	Check alternator function		Replace alternator
40	Starter malfunction	40.1	Check battery voltage	Measure battery voltage at battery terminals	Repair starter power supply
		40.2	Check starter supply voltage	Measure voltage at starter power supply (with battery switch on) and starter control wire (while actuating starter). **Stay clear of propeller.**	Replace switch
		40.3	Check starter switch operational	Check continuity of starter switch in both positions.	Replace starter.
41	Erroneous indication	41.1	Check corresponding connector and wires / wiring harness	Refer to instructions for harness troubleshouting	
		41.2	Measure sensor	Refer to instructions for measuring sensor operation	

Code	Indication	Code	Task/check	Check by	Corrective action
42	Multiple sensor failure displayed by FADEC	42.1	Check 5V supply to FADEC	Connect FADEC Service Tool. Verify “Vref” is 5V	If 5V supply is less than 5V, check harness / connectors for short circuit (including unusedPFuel and Pgear connectors). Check supply voltage of each FADEC while each FADEC is active (use FADEC B). If supply voltage drops for both FADEC-halfs while active, check harness. If voltage for one FADEC is satisfactory **while it is active, while voltage from other FADEC is not satisfactory**, replace FADEC.
43	No display on instruments	43.1	Verify that CAN termination plug is installed		Install CAN termination plug
44	Engine will not perform FADEC test	44.1	Ensure engine is operating on FADEC A	Connect FADEC Service Tool, check which “FADEC active” lamp is illuminated.	Cycle FADEC power, reset warnings if necessary.
					Verifying crank signal on both FADEC-halfs using TAE service software tool. Proceed to Code 45, “Faulty Crank Signal”

Code	Indication	Code	Task/check	Check by	Corrective action
45	Faulty crank / cam signal	45.1	Check connector	Inspect connector for damage. Inspect connector pins for deformation. Inspect wires for damage.	Refer to instructions for damaged connector / harness
		45.2	Inspect crank / cam sensor. Check sensor for damage.	remove sensor from crankcase / cylinder head. Inspect sensor for damage or contamination.	Clean sensor. Replace if it's damaged.
		45.3	Check sensor clearance (crank sensor only)		Measure sensor clearance, verify within Repair Manual tolerances.

Table 71-1a Troubleshooting CENTURION 2.0

Troubleshooting the Wiring Harness

To troubleshoot the harness, unplug the connector in question, and perform the following measurements to verify functionality of the harness. If the harness fails the test, repair the connector as necessary**. If there is any damage to the harness other than directly at the connector, it must be replaced.** Move the end of the connector while performing the measurements to show any intermittent loss of continuity.

Input	From	To	Unit	Nominal Value
Temperatures (T Gear, T Oil, T Coolant, T Air);	Connector Gnd (Pin 2)	Gnd	Resistance (Ensure FADEC power is off)	0 Ω
	Connector Signal Pin (Pin 1)	5 V Supply (Pin xx of nearest Pressure connector)	Resistance (Ensure FADEC power is off)	3 k Ω
	Connector Signal Pin (Pin 1)	Connector GND (Pin 2)	Voltage (Ensure FADEC power is on)	5 V
Pressure (P Oil); Load	Connector Gnd (Pin 1)	Gnd	Resistance (Ensure FADEC power is off)	0 Ω
	Connector Signal (Pin 3)	Connector GND (Pin 1)	Resistance (Ensure FADEC power is off)	47 k Ω
	Connector Power Supply (Pin 2)	Connector GND (Pin 1)	Voltage (Ensure FADEC power is on)	5 V
Crank Sensor	Connector GND (Pin 2)	Gnd	Resistance (Ensure FADEC power is off)	0 Ω
	Connector Signal (Pin 1)	Connector Gnd (Pin 2)	Resistance (Ensure FADEC power is off)	10 k Ω
CAM Sensor	Connector GND (Pin 1)	Gnd	Resistance (Ensure FADEC power is off)	0 Ω
	Connector power Supply (Pin 3)	Connector Gnd (Pin 1)	Voltage (Ensure FADEC power is on9	5 V

Input	From	To	Unit	Nominal Value
	Connector Signal (Pin 2)	Connector 5 V Supply (Pin 3)	Resistance (Ensure FADEC power is off)	10 k Ω
Actor Supply (Waste Gate Control Valve, Rail Control Valve Prop Control Valve)	Connector Power (Pin 2)	Engine Gnd	Voltage (Ensure FADEC power is on)	12 V
	Connector power supply (Pin 2)	Connector Signal (Pin 1)	Resistance	0 Ω Note : The two pins are connected with a diode; Resistance will be infinite if the poles are reversed

Table 71-2a Troubleshooting Wiring Harness CENTURION 2.0

Sensor Properties

Sensor	***Location***	***Connect***	***Measure***	***Nominal Value*** at standard conditions
T-Oil	Oil Filter Housing	Pin 1	Resistance	6300 Ω at Room Temperature (Resistance decreases with increasing temperature)
P-Oil	Oil Thermostat housing	Pin 1: 5 V Pin 2: Gnd	Pin 3; Voltage	0.9 V
T-Air	Intake Manifold	n.A	Resistance across Sensor	2500 Ω at Room Temperature (Resistance decreases with increasing temperature)
T-Coolant	Coolant Thermostat Housing	n.A	Resistance across Sensor	3100 Ω at Room Temperature (Resistance decreases with increasing temperature)
T-Gear	Main Prop Bearing	n.A	Resistance across Sensor	6300 Ω at Room Temperature (Resistance decreases with increasing temperature)
MAP	Internal to FADEC	n.A	Cannot be measured	n/a
P-Baro	Internal to FADEC	n.A	Cannot be measured	n/a
P-Rail	Front end of Rail	Pin 1: Gnd Pin 3: 5 V	Pin 2; Voltage	0.5 V (without pressure)
Throttle (Load Sensor)	Throttle quadrant	Pin 1: 5V Pin 2; Gnd	Pin 3; Voltage	0.6 to 4.8 V, depending on throttle position

Table 71-3a Sensor Properties CENTURION 2.0

Connector Pin Locations

Figure 71-1a- Connector used for T-Gear, T-Oil, T-Air, Prop Control, Wastegate

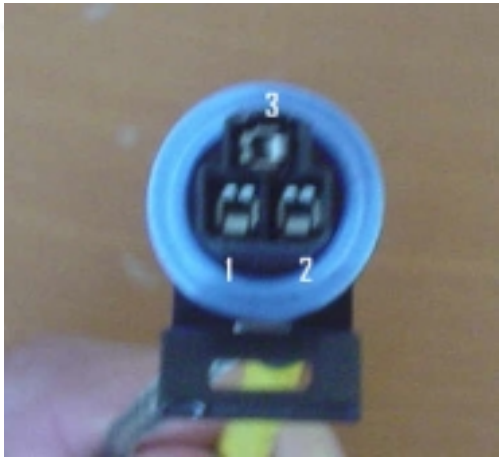


Figure 71-2a P-Oil Sensor Connector

Figure 71-3a Cam Sensor Connector

Figure 71-4a. Crank Sensor Connector Connector

Figure 71-5a P-Rail Sensor Connector

Figure 71-6a Rail Pressure Control

Figure 71-7a Load Sensor Connector

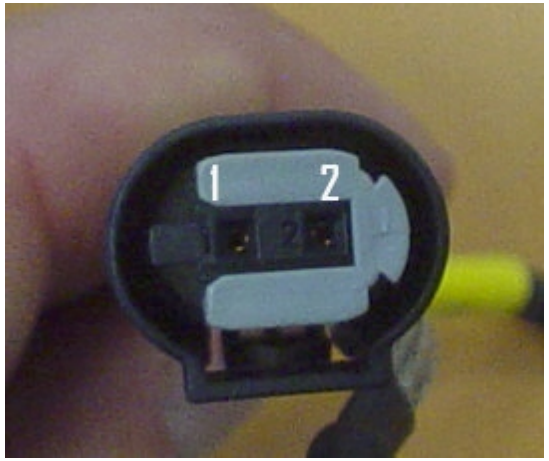


Figure 71-8a Coolant Temp Sensor Connector

Figure 71-9a Injector Connector

71.20 ENGINE MOUNT

DESCRIPTION

The engine mount is made of tubular steel. The engine mount has welded joints. Paint protects the engine mount from corrosion. Welded brackets hold components such as the coolant radiator mount. Rubber lined clamps and cable ties hold electrical cables and other items of equipment to the engine mount.
The engine mount has four small mounting pads at the rear of the mount.
Bolts through the pads attach the engine mount to the fuselage.
The engine is attached to the engine mount at three mounting pads.
Three shock-mounts isolate the airframe from engine vibrations.
See Fig. 71-20a.

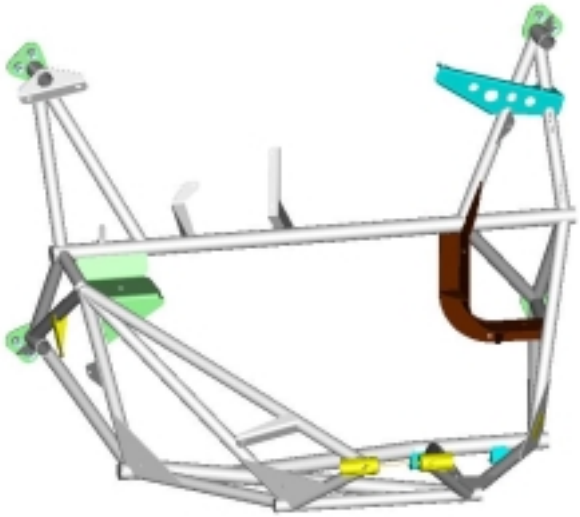


Fig. 71-20a Engine Mount of CENTURION 2.0

TROUBLESHOOTING

Trouble	Cause	Corrective action
Engine vibration	Cracked engine mount	Do a test for cracked tubes. look especially at the welded joints.
	Defective shock mounts	Refer to RM-02-02

Table 71-20a

MAINTENANCE PRACTICES

1. General

This maintenance practice provides instructions to check the engine mount.

2. Checking the engine mounts on signs of corrosion and for chafe marks

This is a visual inspection. Check the engine mount for signs of corrosion (e.g. nonexistent paint) and for chafe marks (e.g. chafing hoses) accurately.

3. Checking the engine mounts for signs of damage

This is a visual inspection. Check the engine mount for signs of deformation and any kind of mechanical damage. Paint crack may indicate deformation or cracks in the engine mount. Carefully check the welding seams.
If there are any damages, please contact C.E.A.P.R.

71.21 COOLANT RADIATOR MOUNT

DESCRIPTION

The radiator mount is made of tubular steel. The radiator mount has welded joints. Paint protects the radiator mount from corrosion. The radiator mount is attached to the engine mount at three positions.

See Fig. 71-21a. Coolant radiator mount

MAINTENANCE PRACTICES

1. General

This maintenance practice provides instructions to inspect the radiator mount.

2. Inspecting the Radiator Mount

This is a visual inspection. Check the radiator mount for signs of corrosion (e.g. inexistent paint) and for chafe marks (e.g. chafing hoses) accurately.

71.60 AIR INTAKES

The engine air intake system of the airplane consists of the air filter / alternate air door assembly and the turbo section.

71.61 AIR FILTER / ALTERNATE AIR DOOR ASSEMBLY

DESCRIPTION

The air intake filter / alternate air door assembly has three main parts (see Fig. 71-61a.):

- Air Filter Housing (Item 1)
- Air Filter (Item 2)
- Alternate Air Door (Item 3)

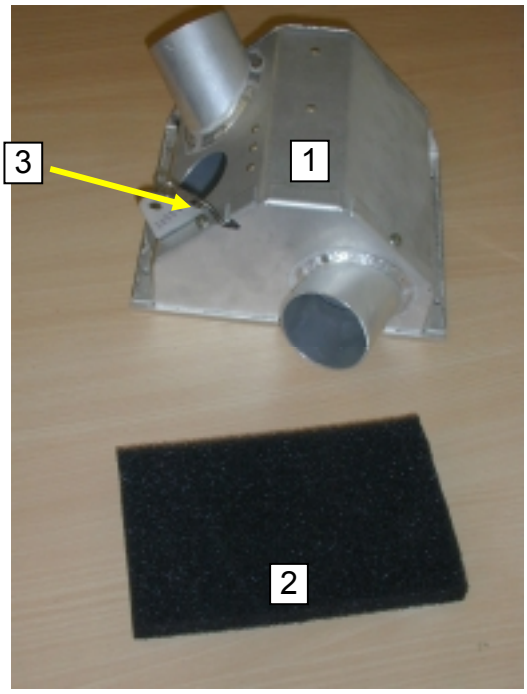


Fig. 71-61a.

Alternate Air Door
The alternate air door is part of the air filter housing. The alternate air door has an inlet direct from the engine compartment. A flap in the alternate air door can select either filtered or warm, unfiltered air.

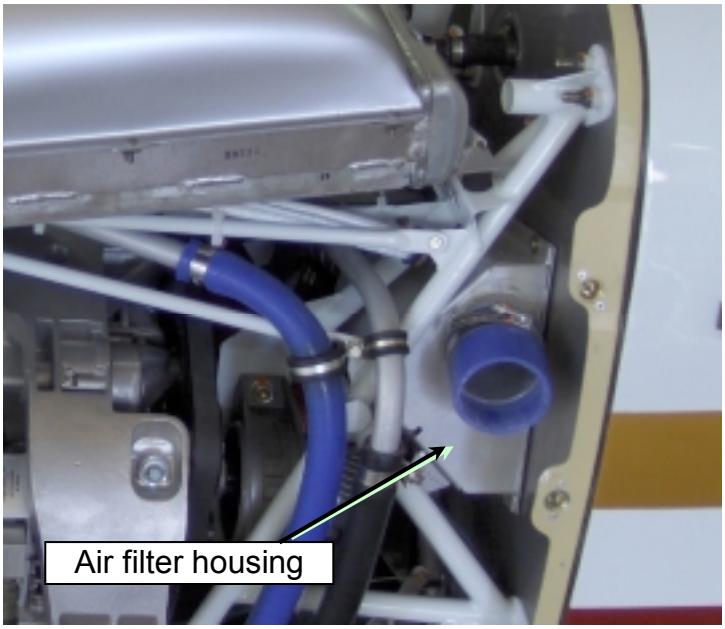


Fig. 71-61b. Location of air filter housing

Air Filter Housing
The air filter housing has a connection between the air intake assembly and the cowling. Four cylindrical bolts attach the air filter housing to the firewall. See Fig. 71-61c.

Air Filter
The air filter is located in the air filter housing. See Fig. 71-61a.

TROUBLE SHOOTING

Trouble	Cause	Corrective Action
Engine does not develop full power	Air Filter blocked/defective	Replace Air Filter

Table 71-60a Troubleshooting Air Filter CENTURION 2.0

MAINTENANCE PRACTICES

1. General

These maintenance practices provide instructions to inspect/replace the induction air filter and air hoses from turbo to engine thru intercooler.

2. Inspecting the induction air filter

This is a visual inspection. The air filter should not be blocked or defective.

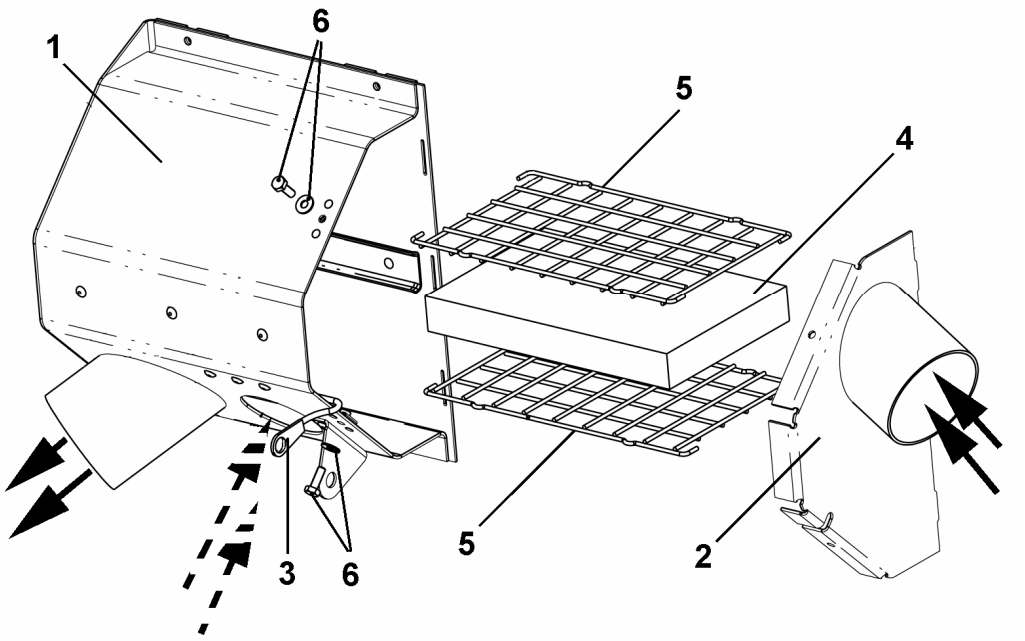


Fig. 71-61c. Air intake box

1. Air filter housing
2. Housing cover
3. Alternate air door control
4. Filter
5. Filter support grid
6. Housing cover fastening screws

Replace as necessary.

3. Replacing the Air Filter

◆ Note: When replacing the air filter check carefully that no foreign objects are in it.

A. Remove the Air Filter

(1) Remove the engine cowlings. Refer to the airplane manufacturer´s specifications.

(2) Disconnect the airplane main battery refer to Chapter 24, Section 24.30, Maintenance Practices.

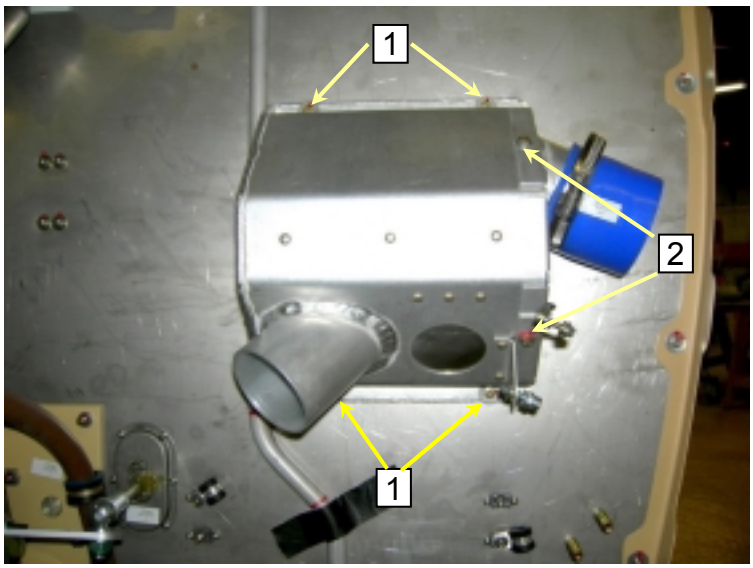


Fig. 71-61d. Air intake box
1. Air filter housing attaching bolts
2. Housing cover fastening screws

(3) Loosen the two housing cover fastening screws. See Fig. 71-61d.
(4) Pull the air filter out of the air filter housing.

B. Install the new air filter

(1) Make sure that the filter support grids are in position on the air filter.
(2) Put the air filter in position into the air filter housing.
(3) Tighten the two cover fastening screws. See Fig. 71-61d.
(4) Connect the airplane main battery refer to Chapter 24, Maintenance Practices.
(5) Install the engine cowlings. Refer to the airplane manufacturer´s specifications.

◆ Note: When replacing the air filter check carefully that no loosen parts are in it.

4. Inspecting Air Hoses from Turbo to Engine thru Intercooler

Check hose location for slippage with respect to the slip mark and check the torque value of the clamps on the intercooler air inlet, on the intercooler air outlet and on the turbocharger air outlet.

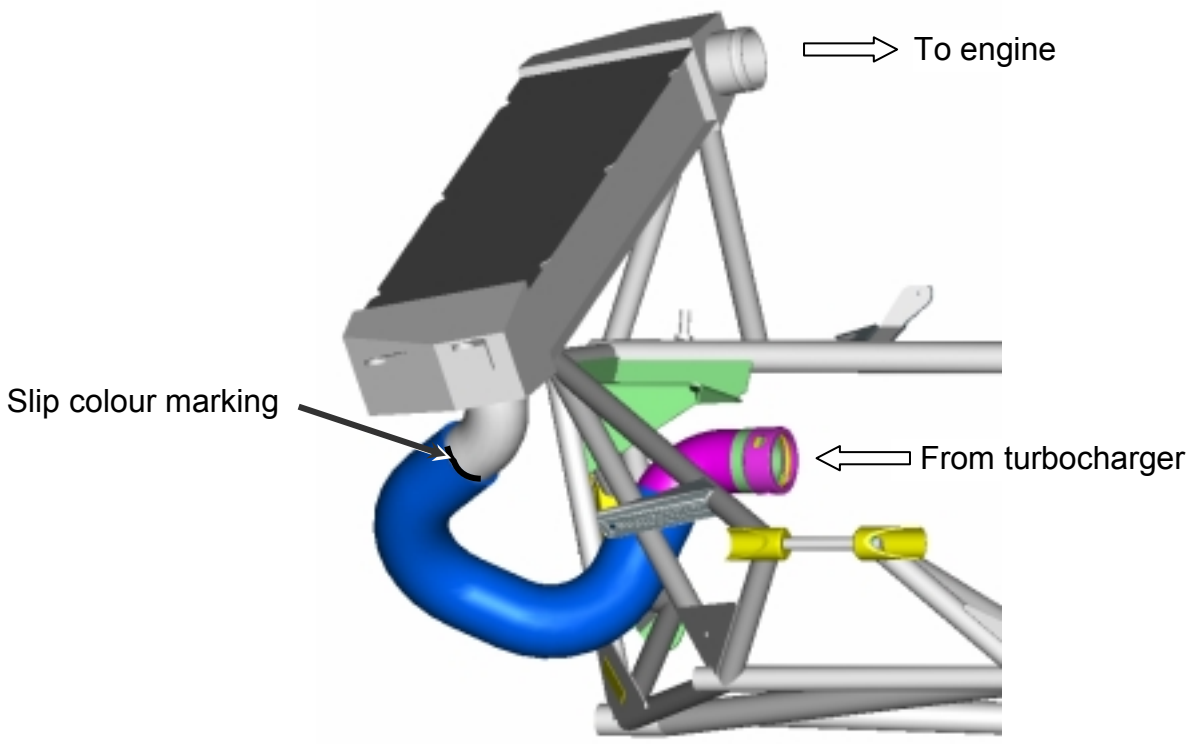


Fig. 71-61e

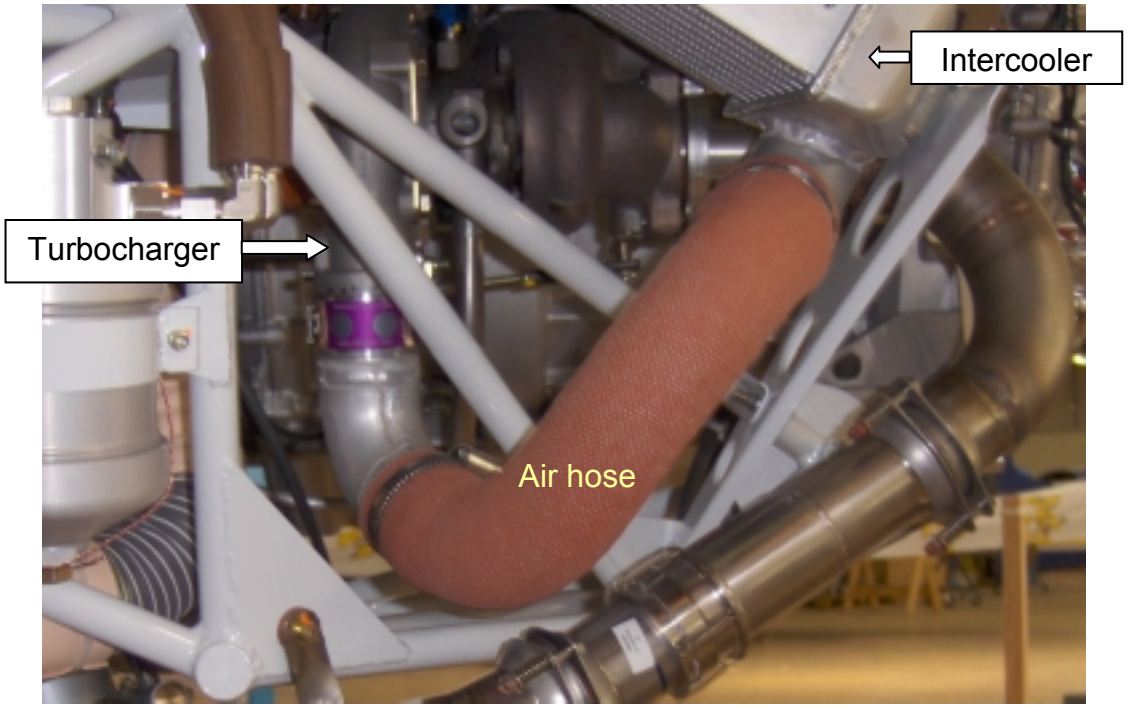


Fig. 71-61f Air hose from turbocharger to intercooler radiator

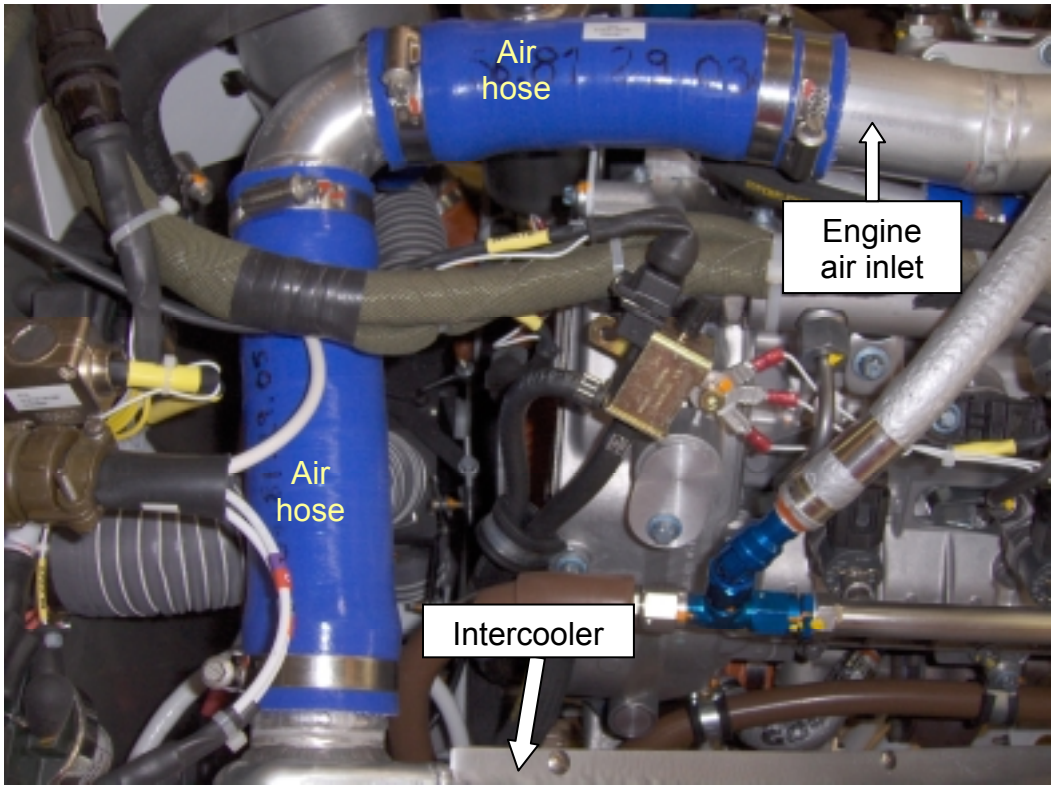


Fig. 71-61g Air hose from intercooler radiator to engine

71.62 TURBOCHARGER

MAINTENANCE PRACTICES

1. General

This maintenance practice provides instructions to inspect the outlet elbow of the turbocharger and the wiggins clamp, and to replace the intercooler as necessary (depending on inspection).

2. Inspecting the outlet elbow of turbocharger and the wiggins clamp

This is a visual inspection in order to verify that the outlet elbow of turbocharger and the wiggins clamp are not stressed by the air hose installation.

(1) Remove the wiggins clamp.
(2) Inspect the wiggins clamp for wear marks caused by friction and metal scoring.
(3) Inspect the outlet elbow for wear marks caused by friction and metal scoring.

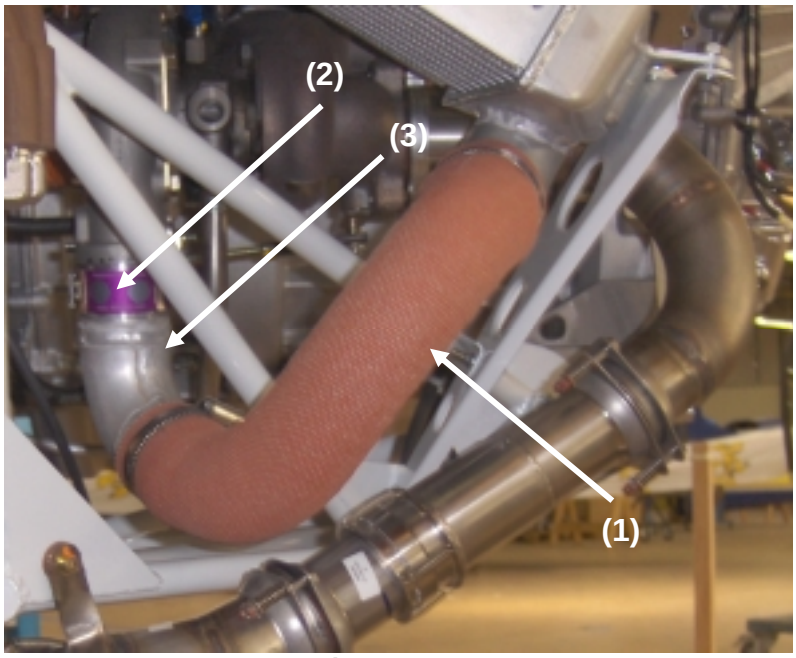


Figure 71-62a
(1) air hose from turbocharger to intercooler
(2) wiggins clamp
(3) outlet elbow of turbocharger

(4) In case of presence of wear marks, apply the replacement of the intercooler P/N 56.81.01.010 by the modified intercooler P/N 56.81.37.010 (refer to § 3).

If not, reinstall the wiggins clamp, and check that it is installed stress free by rotating the clamp. It must rotate free.

(5) Inspect the air hose from turbocharger to intercooler for damages caused by the exhaust gas.

3. Replacing the intercooler

(1) Remove the intercooler air intake, removing the six screws and save them for the reassembly.

(2) Detach the clamp of the air hose from intercooler to engine, at side of the intercooler. Save the clamp ∅40-60 for the reassembly.

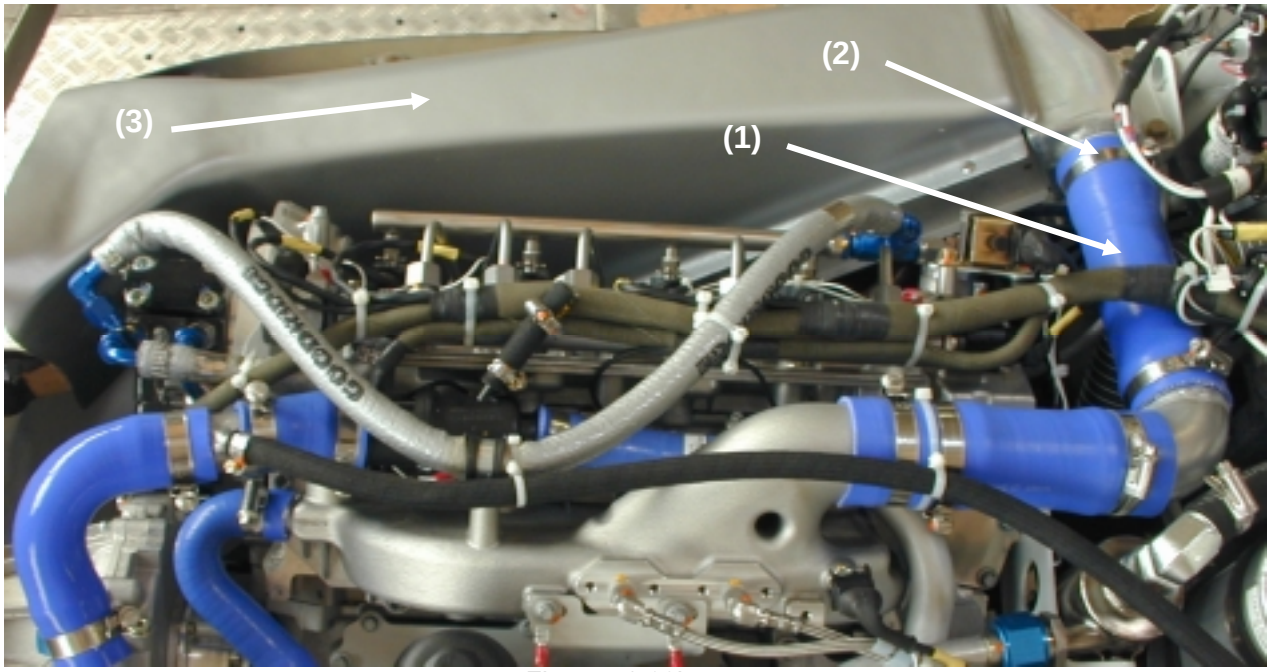


Figure 71-62b

(1) air hose from intercooler to engine
(2) clamp
(3) intercooler air intake

(3) Detach this air hose of the intercooler.

(4) Detach the two clamps ∅40-60 of the air hose from turbocharger to intercooler, one clamp at side of the turbocharger and one clamp at side of the intercooler. Save the two clamps ∅40-60 for the reassembly.

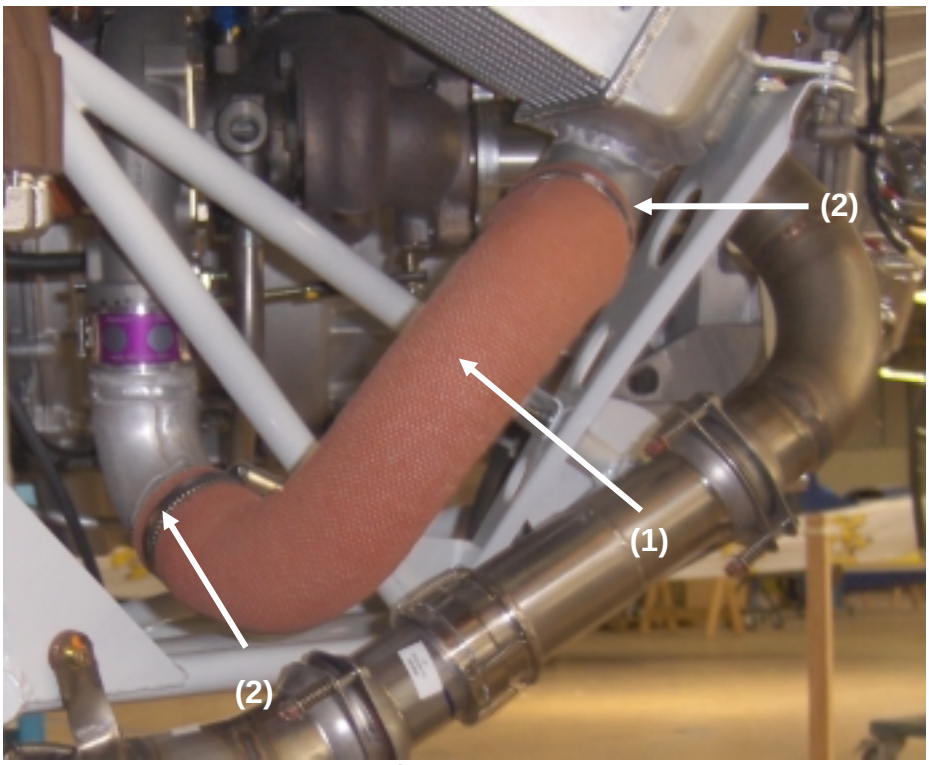


Figure 71-62c
(1) air hose from turbocharger to intercooler
(2) clamp

(5) Remove this air hose from turbocharger to intercooler
(6) Remove the intercooler (P/N 56.81.01.010), removing the attaching parts and save them for the reassembly.
(7) Replace the intercooler (P/N 56.81.01.010) by the modified intercooler (P/N 56.81.37.010). Attach it with the same attaching parts.
(8) Replace the wiggins clamp (P/N 57.81.00.056) as necessary (depending on the result of inspection)
(9) Replace the outlet elbow of turbocharger (P/N 56.81.08.010) as necessary (depending on result of inspection)
(10) Attach the air hose from intercooler to engine, using the same clamp ∅40-60 (see § (2)).

■ CAUTION: The air hose must be free of grease!

◆ Note: Do not tighten the clamp yet.

(11) Attach the air hose from turbocharger to intercooler, using the same clamps ∅40-60 (see § (4)).

This air hose must be positioned as indicated on figure 71-62d. The end of hose with a steep angle must be connected to the turbocharger outlet. The end of hose with a right angle must be connected to the intercooler inlet.

■ CAUTION: The air hose must be free of grease!

◆ Note: Do not tighten the clamp yet.

Check that the wiggins clamp is installed stress free by rotating the clamp. It must rotate free.

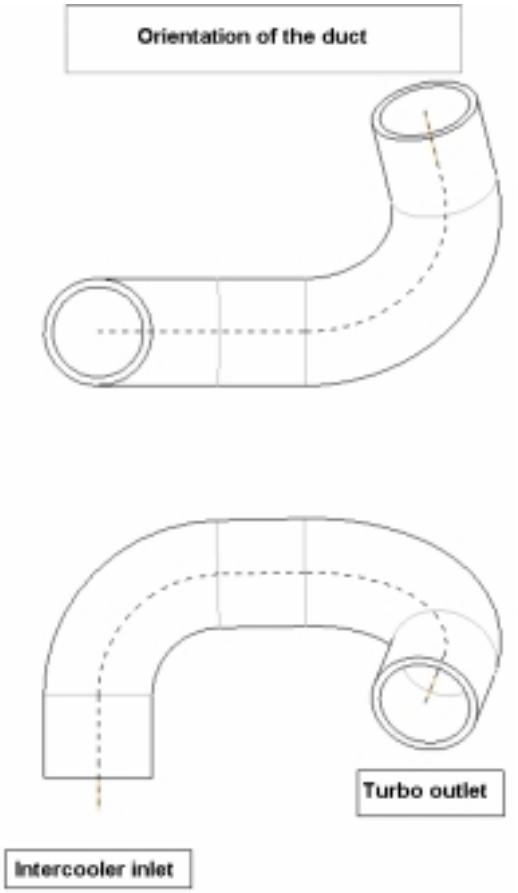


Figure 71-62d

(12)Position hoses and clamps per figure 71-62e.

- CAUTION: The clamps must be installed about 5 mm after the retaining shape, not over the retaining shape!
- CAUTION: The far end of the hose must be at least 5 mm aft of the clamp!
- CAUTION: Chafing of the clamps against other parts must be avoided!

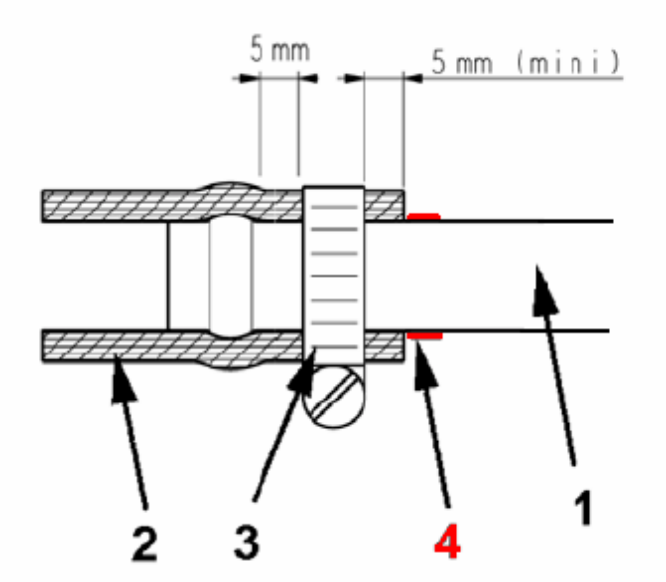


Figure 71-62e

(1) pipe
(2) silicone hose
(3) clamp ∅40-60
(4) slip mark

(13)Tighten the clamps.
Tightening torque:
5 Nm + 0.5 (3.69 lbf.ft +0.5)

■ CAUTION: Make sure, that the clamps were tightened correctly!

(14)Make slip marks at the end of the hose for a later check of slip.
(per figures 71-62e and 71-62f)

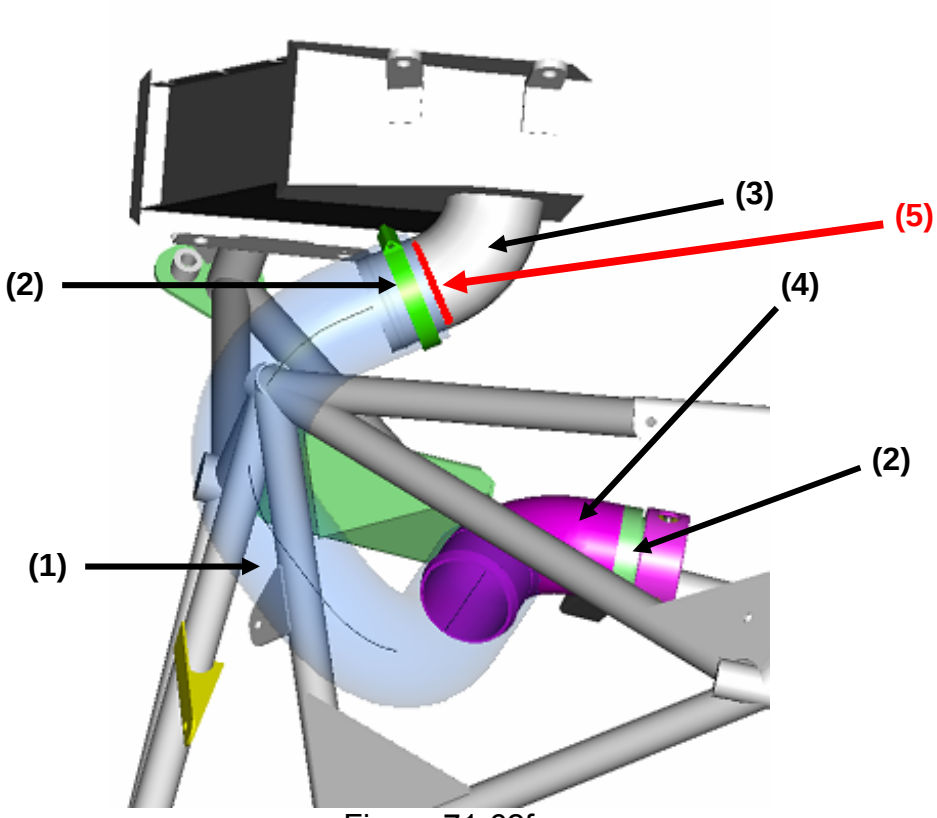


Figure 71-62f

(1) air hose from turbocharger to intercooler
(2) clamp
(3) intercooler
(4) outlet elbow of turbocharger
(5) slip mark

(15) Install the intercooler air intake with the six screws (saved for the reassembly).

73 ENGINE FUEL SYSTEM

Table of contents

73.00 GENERAL

DESCRIPTION

The CENTURION 2.0 is a direct Diesel injection engine with common-rail technology.
Fuel passes the Selector, the electrical gear pump (if installed) and reaches the filter module, where the cold fuel is warmed by returning fuel. (until the feeding fuel temperature of 60°C).
Thereafter it reaches the feed pump (building a pressure of 5 bar (72.5 psi)) and then the high pressure piston pump, producing a pressure up to 1500 bar (21755 psi), which is led to the rail. The pressure is measured and regulated between 500 bar (7252 psi) and 1350 bar (19580 psi) by a pulse width modulated control valve.
Since the main pump produces a high fuel flow and only a part of it is used for combustion, the rest is returned through the filter module and fuel selector to the tank in use, where it warms the remaining fuel.

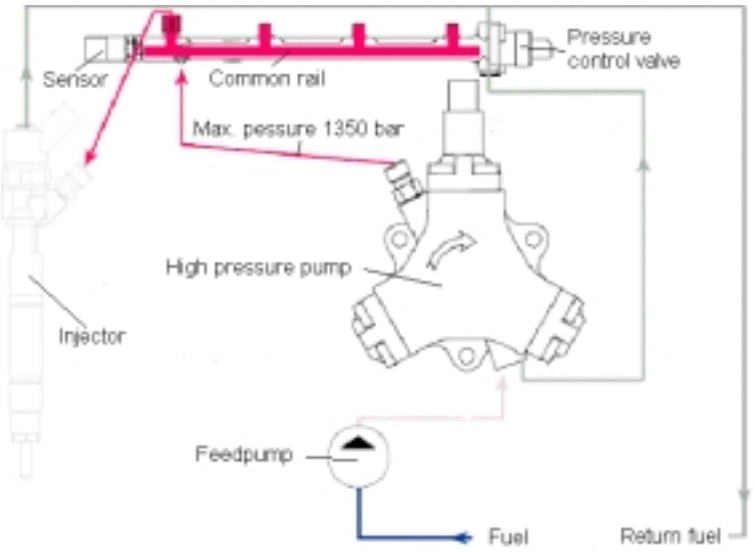
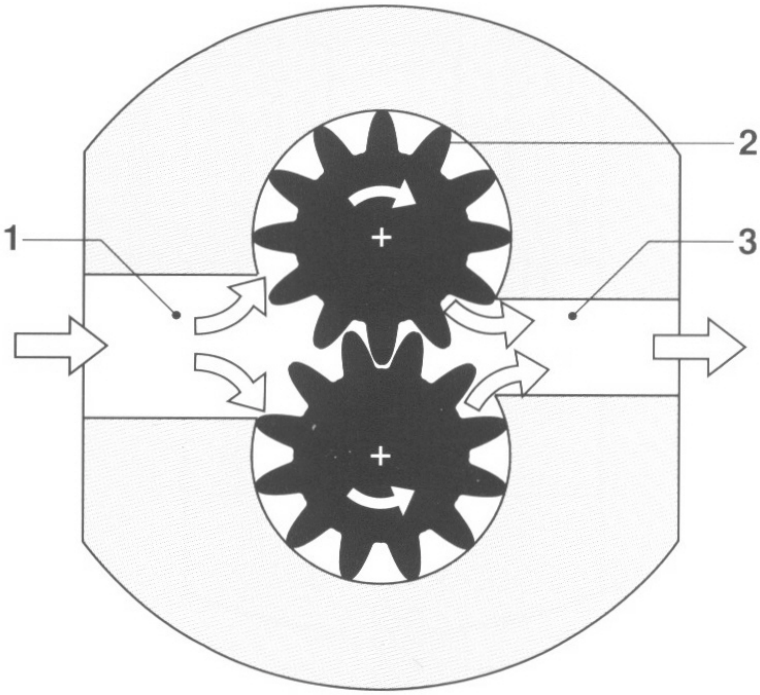


Figure 73-1a Engine Fuel System of CENTURION 2.0

◆ Note: Due to the Diesel injection principle there is no carburetor, primer or mixture necessary.

Feed pump

The feed pump is an intake-camshaft driven gearwheel pump which provides the HPP with diesel or jet-fuel with a pressure of 3-5 bar (43.5 psi to 72.5 psi).
The main components are two counter rotating gear wheels which mesh with each other when rotating, whereby fuel is trapped in the chambers formed between the gearwheels and is transported to the outlet. Due to the camshaft drive, the delivery quantity is proportional to the engine speed.

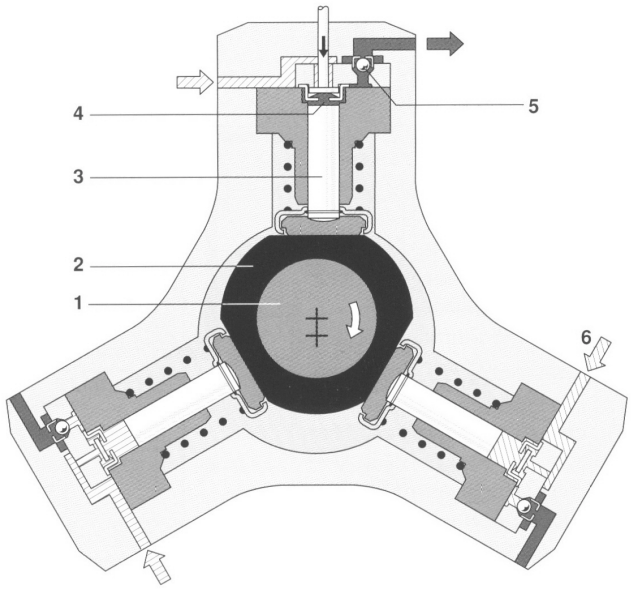


1 Suction end
2 Drive gear
3 Pressure end

Figure 73-2a Fuel Feed Pump of CENTURION 2.0

High pressure pump

The high pressure pump is an outlet-camshaft driven radial-piston-pump, which pressurizes the common rail with up to 1350 bar (19580 psi).
The HPP is the interface between the low pressure and the high pressure stages. In contrast to conventional systems, the HPP continually generates the rail pressure so the fuel does not have to be specially compressed for the injection process.
An eccentric drive shaft moves the 3 pistons of the pump up and down in accordance with the shape of the cam. The feed pump forces fuel through the inlet valve into the pumping element chamber and the down moving piston sucks the fuel into the cylinder. Passing the BDC the inlet valve closes and the fuel can now be compressed. As soon the pressure in the cylinder is higher than the rail pressure, the outlet valve opens and the fuel enters the high pressure circuit.
Several parts of the HPP have got a special coating to ensure the operation with diesel and jet fuel in any mix-ratio.

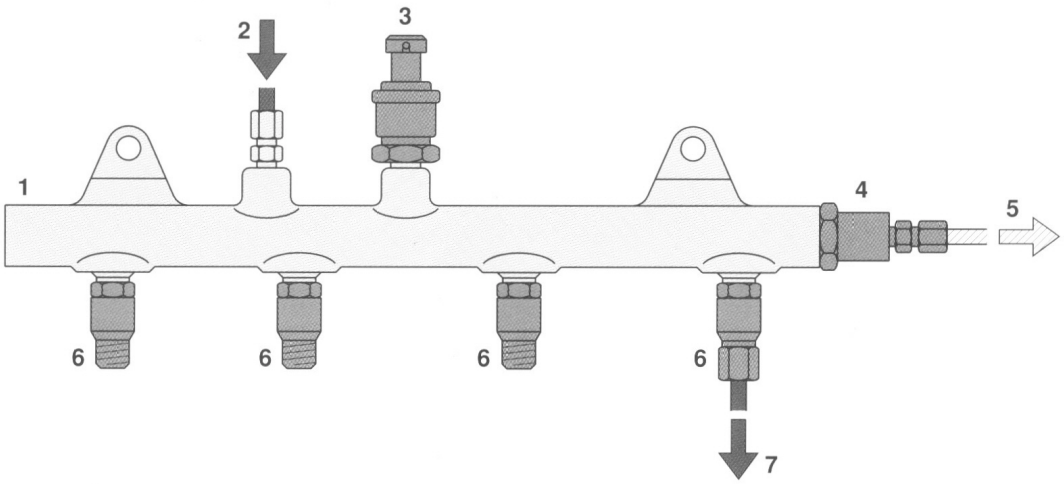


1 Driveshaft
2 Eccentric cam
3 Pumping element with pump piston
4 Inlet valve
5 Outlet valve
6 Inlet

Figure 73-3a High Pressure Pump of CENTURION 2.0

Common rail

The common rail stores the pressure of the HPP and supplies the injectors with fuel. The sensor and the pressure control valve are fit in the common rail.
The high pressure accumulator is common to all cylinders. Its available rail volume is permanently filled with pressurised fuel. The compressibility of the fuel resulting from the high pressure is utilised to achieve the accumulator effect. This causes a practically constant rail pressure even when fuel leaves the rail for injection.



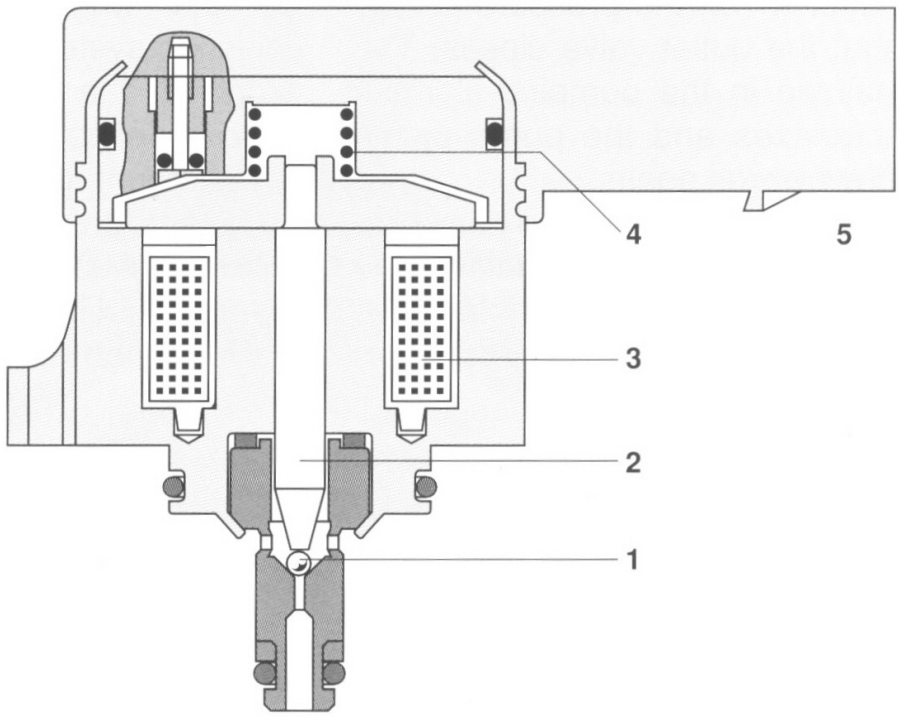
The rail shown is only a schematic figure

1 Rail
2 Inlet high pressure pump
3 Rail pressure sensor
4 Pressure control valve
5 Fuel return
6 Injector duct connection
7 High pressure supply

Figure 73-4a Common Rail of CENTURION 2.0

Pressure control valve

The pressure control valve sets the correct pressure in the rail. It is a solenoid operation valve actuated by FADEC.
The Pressure control valve is provided with a mounting flange for attachment to the rail and connection to the return fuel system. It incorporates two control loops:
-A fast-response mechanical control loop to compensate for the high-frequency pressure fluctuations. A spring closes the control valve up to maximum pressure of approximate 100 bar (1450 psi).
-A slow-response electrical control loop for setting a variable mean pressure in the rail. If the pressure in the high pressure circuit has to be increased, the force of the solenoid must be generated in addition to the spring force. The forces of the solenoid are proportional to its energizing current which is pulse width modulated with a frequency of 1 KHz.

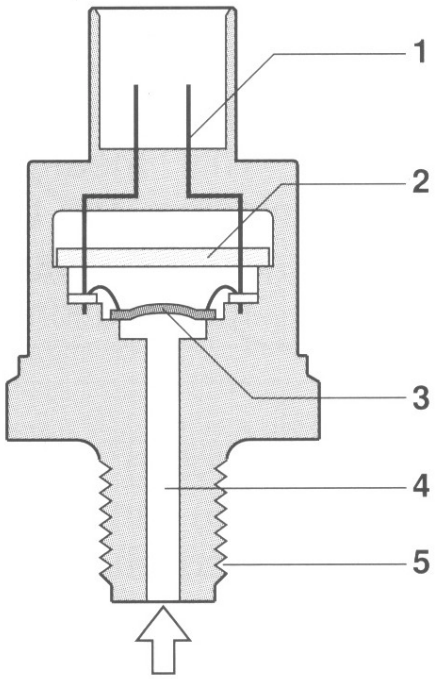


1 Valve ball
2 Armature
3 Electromagnet
4 Spring
5 Electrical Connection

Figure 73-5a Pressure Control Valve of CENTURION 2.0

Rail pressure sensor

The rail pressure sensor measures the instantaneous pressure in the rail and generates an output signal for the FADEC.
The fuel flows to the rail pressure sensor through in opening in the rail. Pressurized fuel reaches the sensor's diaphragm through a blind hole. The sensor element for converting the pressure to an electric signal is mounted on this diaphragm. The signal is needed as feedback signal for the FADEC to control the rail pressure.



1 electric connection
2 Evaluation circuit
3 Diaphragm with sensor element
4 High pressure connection
5 Threaded end

Figure 73-6a Rail Pressure Sensor of CENTURION 2.0

Injectors

The Injectors are solenoid operation injectors actuated by FADEC. They inject the fuel out of the common rail into the combustion chamber of each cylinder.
Fuel is fed from the high pressure connection, to the nozzle through the passage, and to the control chamber through the feed orifice which is opened by the solenoid valve.
With the orifice closed, the hydraulic force applied to the valve control plunger exceeds that at the nozzle needle pressure shoulder. As a result, the needle is forced into its seat and seals off the high pressure passage from the combustion chamber.
When the solenoid valve is triggered, the bleed orifice is opened. This leads to a drop in control chamber pressure and, as a result, the hydraulic pressure on the plunger drops, too. As soon as the hydraulic force drops below the force on the nozzle needle pressure shoulder, the nozzle-needle opens and fuel is injected through spray holes into the combustion chamber. This hydraulic force amplification is needed because the necessary forces cannot be directly generated by the solenoid valve. The control and leak-off fuel are returned to the fuel return.

1 Fuel return
2 Electrical connection
3 Triggering element
4 High pressure fuel inlet
5 Valve ball
6 Bleed orifice
7 Feed orifice
8 Valve control chamber
9 Valve control plunger
10 Feed passage to the nozzle
11 Nozzle needle

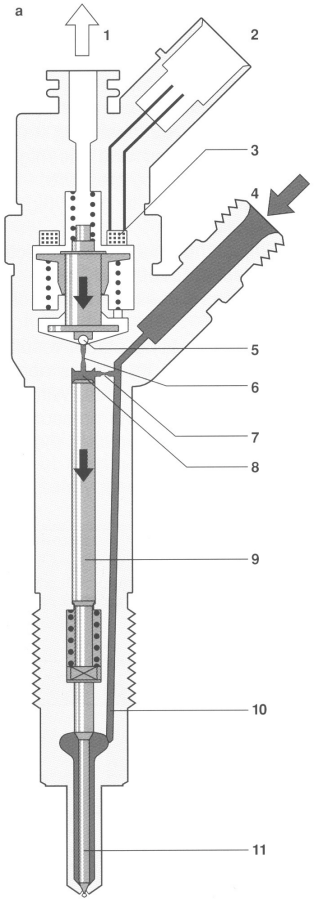


Figure 73-7a Injectors of CENTURION 2.0

CONTROLLING

With CENTURION 2.0 installations, the pilot selects the desired load with the single load lever which is connected to two redundant Load Potentiometers.

The FADEC regulates all engine parameters to achieve the desired condition. It consists of two redundant units which steer 5 main control loops through the use of 16 sensors and 9 actuators.

For more information refer to chapter 71 (Figure 71-1a) of this supplement.

INDICATING

Since all engine power parameters are controlled automatically by the FADEC, no indication of manifold air pressure, fuel pressure or exhaust gas temperature to the pilot is necessary.

73.10 MAINTENANCE PRACTICES

GENERAL

This maintenance practice provides instructions to inspect the fuel system.

INSPECTING THE FUEL SYSTEM

This is a visual inspection. Check all pipes, pipe joints, supply connections and engine housing separation points for leakage, seepage points and correct routing. Visually inspect fuel for water contamination.

▲ **WARNING**: No leakage or seepage points are permitted !

74 IGNITION

Table of contents

74.00 GENERAL

DESCRIPTION

Due to the Diesel principle of the CENTURION 2.0 engine, no ignition system is necessary.

The CENTURION 2.0 is equipped with 4 glow plugs – one for each cylinder – for better starting behaviour under cold weather conditions. The glow plugs are controlled by the FADEC.

74.10 TROUBLESHOOTING

For Troubleshooting in case of glow plug malfunction refer to chapter 71 of this supplement.

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75 LIQUID COOLING

Table of contents

75.00 GENERAL

DESCRIPTION

The CENTURION 2.0 is fitted with a fluid-cooling system whose three-way thermostat regulates the flow of coolant between the large and small cooling circuit.

The coolant exclusively flows through the small circuit up to a cooling fluid temperature of 84°C and then between 84°C and 94°C both through the small and the large circuit.

If the cooling temperature rises above 94°C, the complete volume of coolant flows through the large circuit and therefore through the radiator. This allows a maximum cooling fluid temperature of 105°C.

There is a sensor in the expansion reservoir which sends a signal to the warning lamp “Coolant level” on the instrument panel if the coolant level is low.

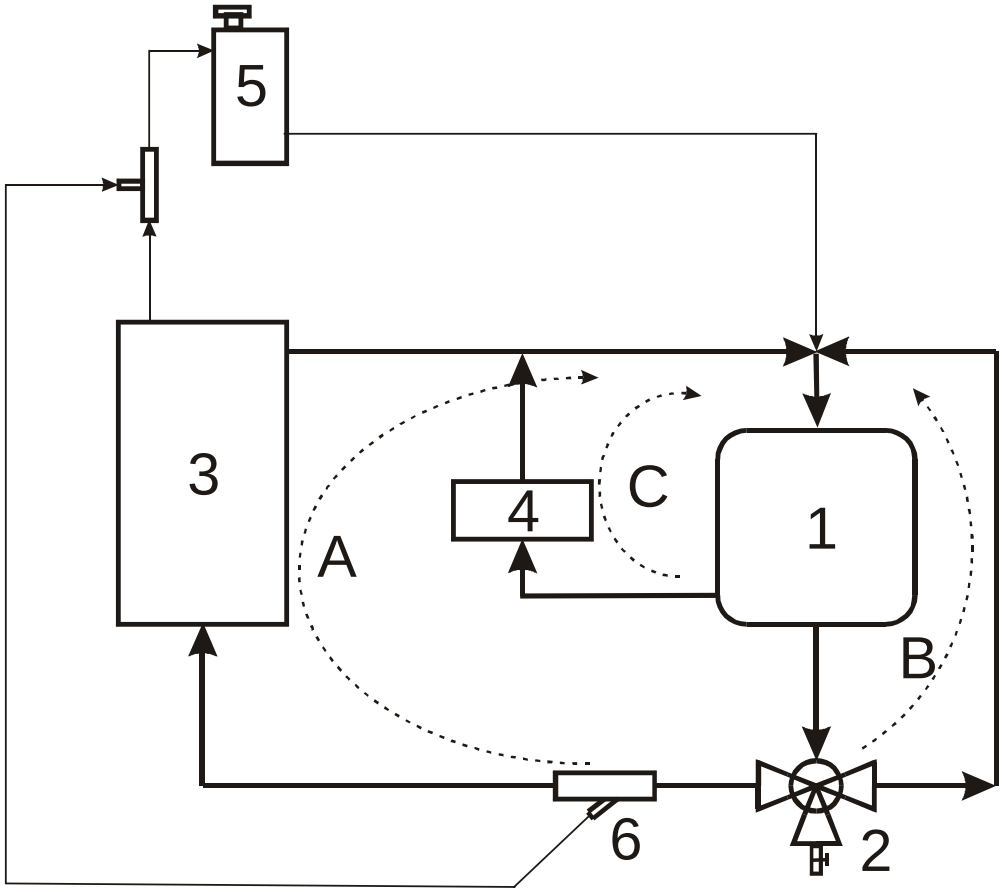
The cooling fluid temperature is measured in the housing of the thermostat and passed on to the FADEC and CED 125.

The connection to the heat exchanger for cabin heating is always open; the warm air supply is regulated by the pilot over the heating valve.

In normal operation the control knob “Shut-off Cabin heat” must be open, with the control knob “Cabin heat” the supply of warm air into the cabin can be controlled.

In case of certain emergencies, the control knob “Shut-off cabin heat” has to be closed according to the appropriate procedures.

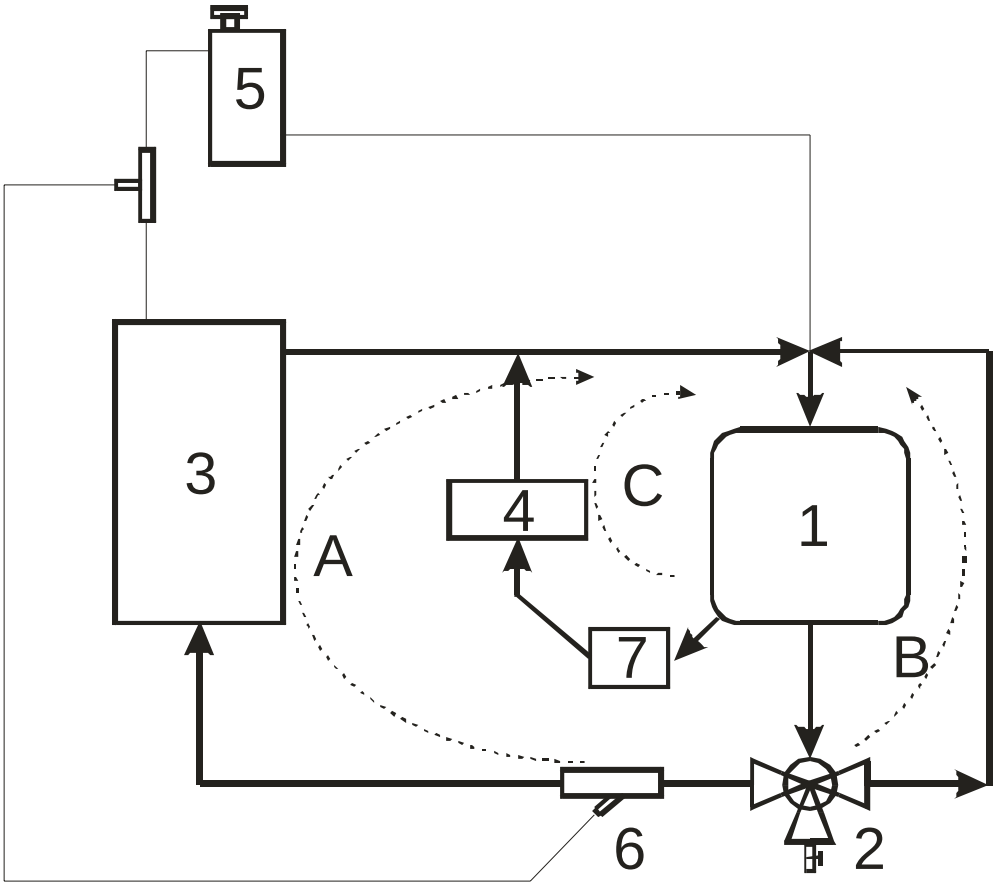
Coolant system of CENTURION 2.0



1. Engine
2. Thermostat
3. Radiator
4. Cabin heat exchanger
5. Coolant reservoir
6. Sleeve with permanent bleeder

A flow: Engine cooling circuit
B flow: Small circuit
C flow: Cabin heating circuit

Figure 75-1
Coolant System of CENTURION 2.0 without gearbox oil cooler
(Schematic diagram)



1. Engine
2. Thermostat
3. Radiator
4. Cabin heat exchanger
5. Coolant reservoir
6. Sleeve with permanent bleeder
7. Gearbox oil/coolant heat exchanger

A flow: Engine cooling circuit
B flow: Small circuit
C flow: Cabin heating circuit

Figure 75-2

Coolant System of CENTURION 2.0 with gearbox oil cooler

(Schematic diagram)

75.10 TROUBLE SHOOTING

For troubleshooting in case of malfunction refer to chapter AMM-60-71.

75.20 MAINTENANCE PRACTICES

1. Inspecting the liquid cooling system

Do a visual check of all coolant lines and connections. No leaks or chafe marks are permitted.

2. First installation of gearbox with oil cooler (oil/coolant heat exchanger)

2.1 Removal of the old gearbox

Drain the coolant circuit.
Remove all connections from the gearbox.
Remove the gearbox. Refer to RM-02-02 for details.

2.2 Installation of the new gearbox (P/N 05-7212-K033402)

Remove the old coolant line from the engine to the cabin heat exchanger. Refer to following table and figures 75.2a to 75.2c.

Item nr	P/N	Designation	qty	Remarks
1	54.81.00.073	Hose clamp	1	To be removed
2	54.81.27.010 (3 parts)	Hose	1	To be removed
3		Pipe	1	To be removed
4		Hose	1	To be removed
5	61.11.02.020	Clamp	1	To be removed
6	54.81.00.073	Hose clamp	1	To be removed
7	00.00.00.986	Screw	1	To be removed
8	95.61.03.000	Washer	1	To be removed
9	95.21.03.000	Nut	1	To be removed

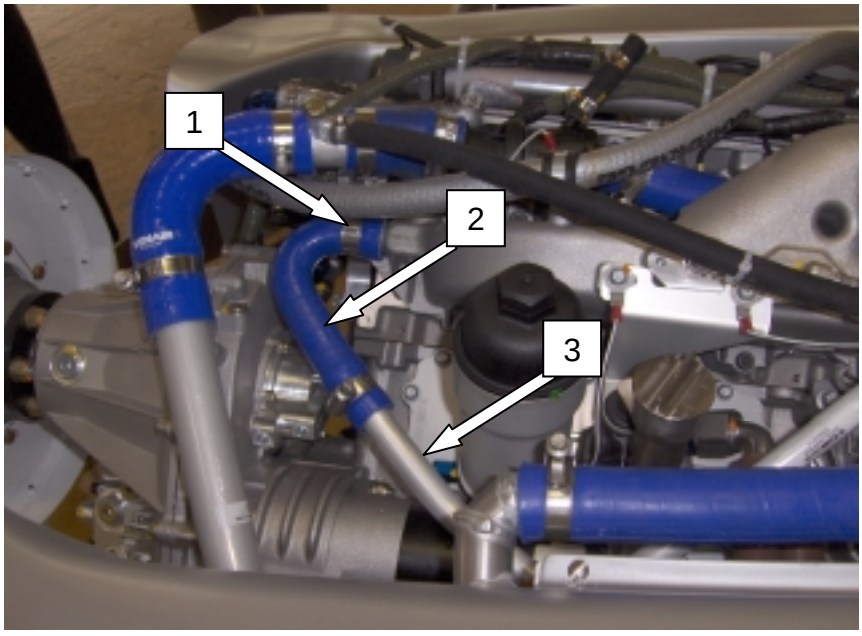


Fig. 75.2a

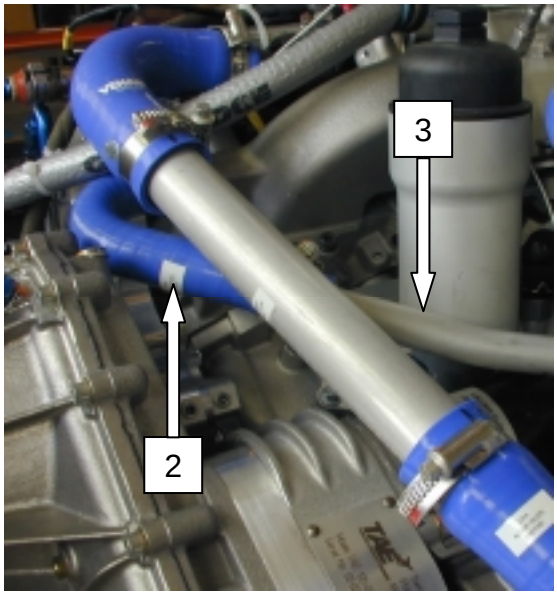


Fig. 75.2b

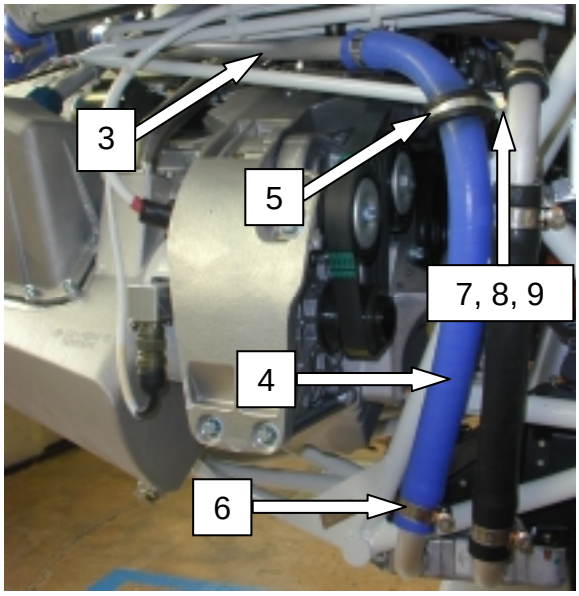


Fig. 75.2c

Attach the gearbox. Refer to RM-02-02.

The new cooling necessary parts (except the extension cable) are provided by CEAPR in the “Gearbox installation kit” (P/N 54.81.00.420), see following table and figures 75.2d to 75.2f.

Item nr	P/N	Designation	qty	Remarks
10	54.81.67.150	Hose	1	New part to be installed
11	54.81.00.073	Hose clamp	4	New part to be installed
12	67.81.00.126	Clamp	3	New part to be installed
13	95.12.06.000	Hexagon screw	1	New part to be installed
14	95.63.03.000	Star washer	1	New part to be installed
15	54.81.54.010	Hose	1	New part to be installed
16	67.81.00.119	Engine mount clamp	2	New part to be installed
17	95.13.16.000	Screws	2	New part to be installed
18	95.24.36.000	Nuts	2	New part to be installed
19	95.61.03.000	Washer	4	New part to be installed

The extension cable must be ordered from Thielert Aircraft Engines GmbH when installing the new gearbox (P/N 05-7212-K033402) for the first time.

20	//////	Extension cable (05-7150-E002501)	1	New part to be installed

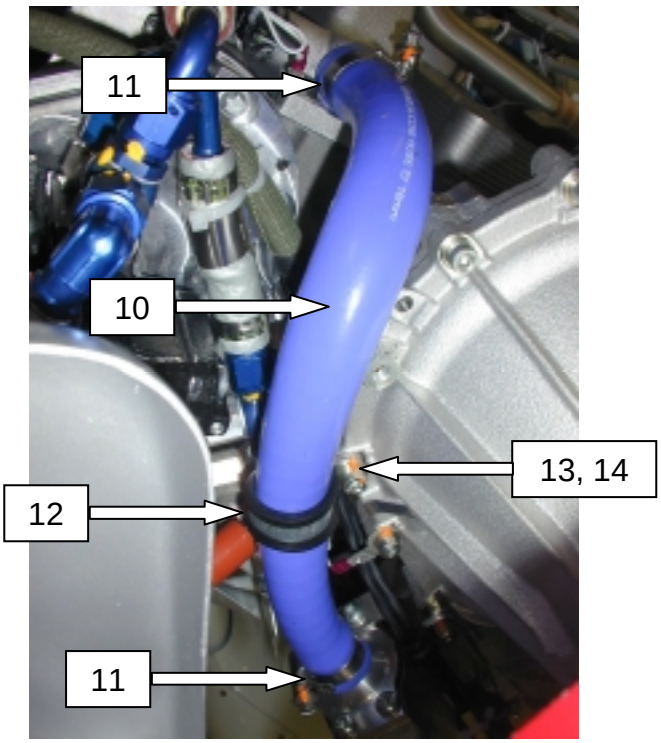


Fig. 75.2d Coolant hose to gearbox oil cooler

Mount the hose (item 10, P/N 54.81.67.150) between engine and oil/coolant heat exchanger using two hose clamps (item 11, P/N 54.81.00.073). See fig. 75.2d

Attach the hose to the gearbox using a clamp (item 12, P/N 67.81.00.126), a hexagon screw (item 13, P/N 95.12.06.000) and a star washer (item 14, P/N 95.63.03.000). See fig. 75.2d

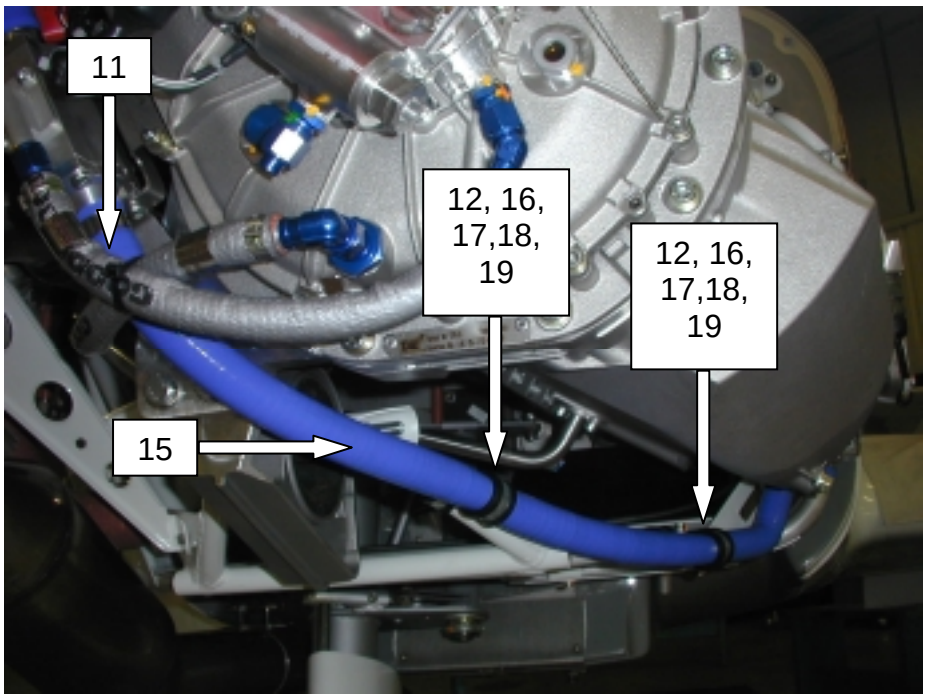


Fig. 75.2e
Coolant hose from oil/coolant heat exchanger to cabin heat exchanger

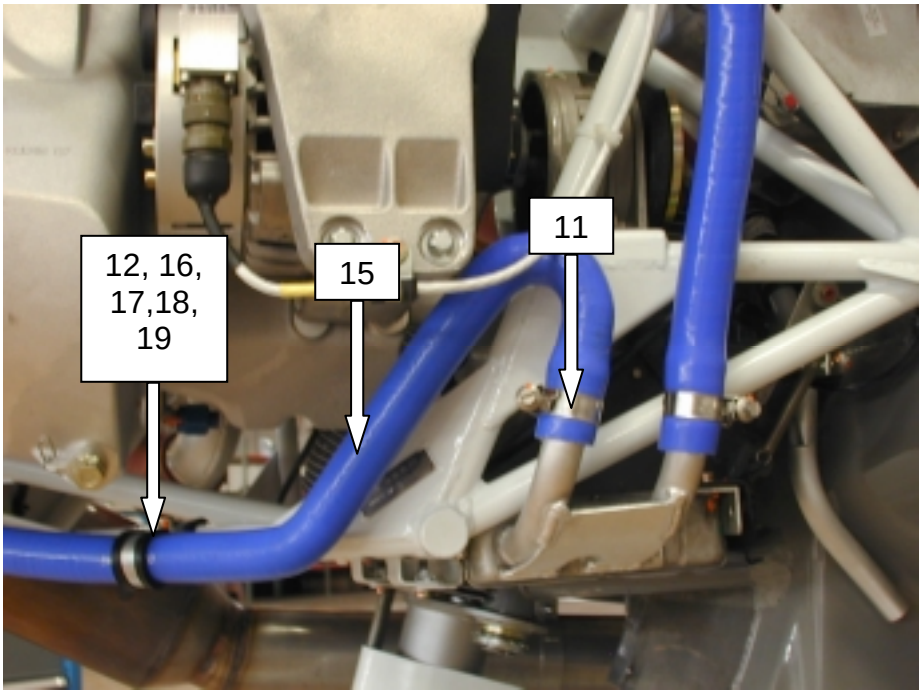


Fig. 75.2f
Coolant hose at cabin heat exchanger

Mount the hose (item 15, P/N 54.81.54.010) between oil/coolant heat exchanger and cabin heat exchanger using two hose clamps (item 11, P/N 54.81.00.073). See fig. 75.2e and 75.2f

Attach the hose to the engine mount using two clamps (item 12, P/N 67.81.00.126), two engine mount clamps (item 16, P/N 67.81.00.119), two screws (item 17, P/N 95.13.16.000), 2 nuts (item 18, P/N 95.24.36.000) and 4 washers (item 19, P/N 95.61.03.000). See fig. 75.2e and 75.2f.

Replenish the coolant (refer to Chapter 12, Section 12-10 Replenishing, liquid cooling system). Perform the seal test of the coolant circuit.

Reconnect all connections and plugs to the gearbox.

Note: being too short now, the oil temperature cable (TGear) has to be replaced with the extension cable (item 20, P/N 05-7150-E002501). See fig. 75.2g and 75.2h

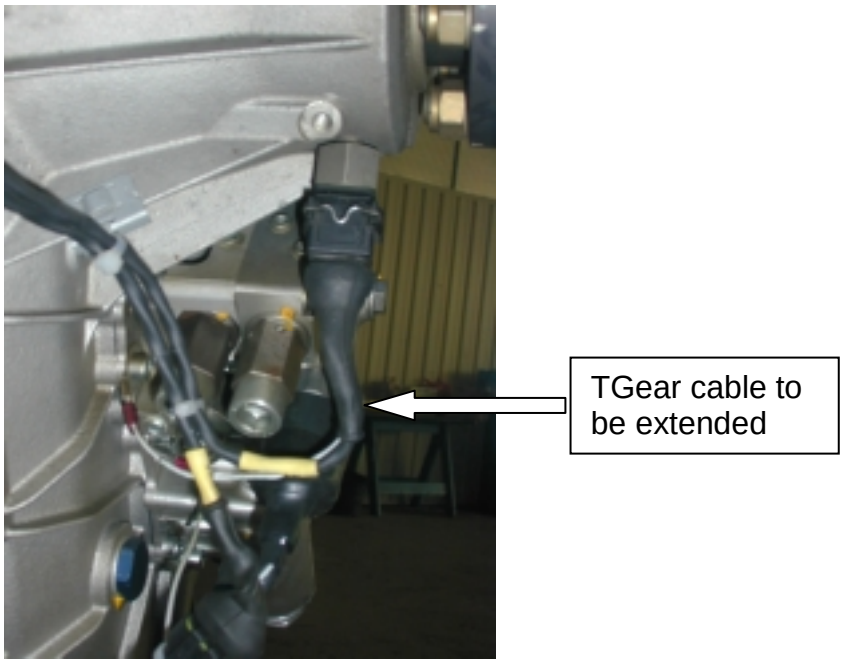


Fig. 75.2g
Gearbox without oil cooler

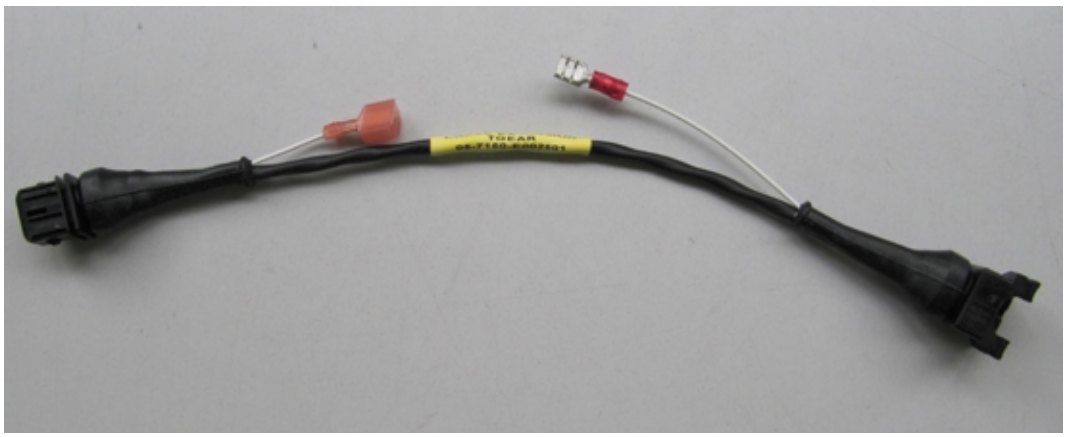


Fig. 75.2h
Extension cable

Connect the oil temperature cable (TGear) via the extension cable to the TGear socket. Connect ground terminals as appropriate.

3. Exchanging the gearbox with oil cooler (P/N 05-7212-K033402)

3.1 Removal of the gearbox

Loosen all ground connections and plugs from the gearbox
Disconnect the hose between the engine and the oil/coolant heat exchanger.
Remove the two hose clamps and the clamp at the gear box
Disconnect the cabin heat exchanger hose from the oil/coolant heat exchanger.

3.2 Installation of the gearbox

Attach the gear box per RM-02-02.

Mount the hose (P/N 54.81.67.150) between engine and oil/coolant heat exchanger using two hose clamps (P/N 54.81.00.073). See fig. 75.3a

Attach the hose to the gearbox using a clamp (P/N 67.81.00.126), a hexagon screw (P/N 95.12.06.000) and a star washer (P/N 95.63.03.000). See fig. 75.3a

Fig. 75.3a Coolant hose to gearbox oil cooler

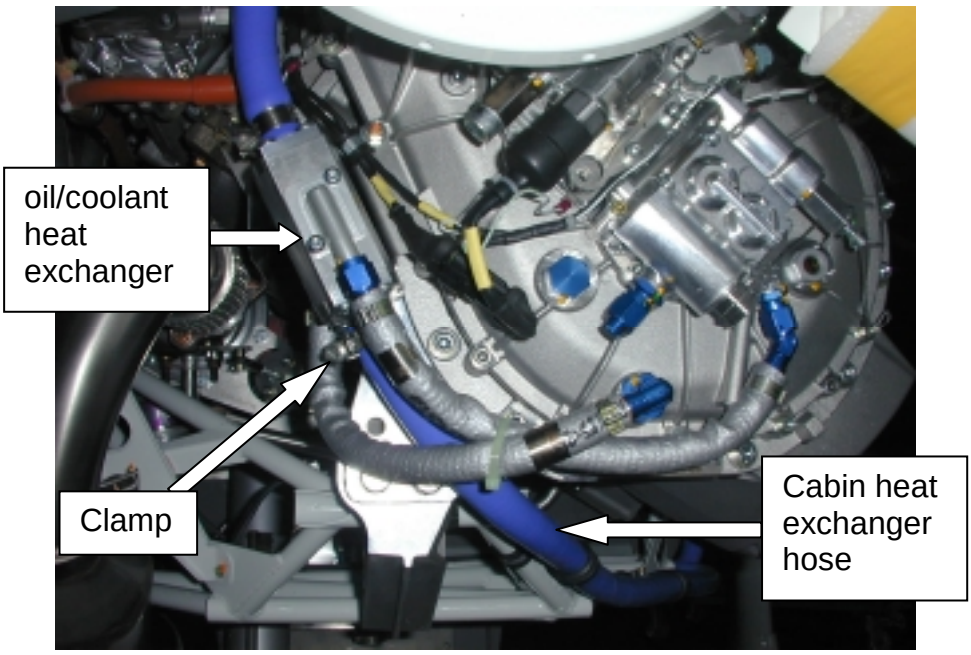


Fig. 75.3b
New gearbox

Attach the cabin heat exchanger hose to the oil/coolant heat exchanger using a hose clamp. See fig. 75.3b.

Reconnect all ground connections and plugs to the gearbox.
Use cable ties where appropriate.

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77 ENGINE INDICATION

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77.00 GENERAL

For indication instruments of the CENTURION 2.0 installation, refer to chapter 31 of this supplement.

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78 EXHAUST

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78.00 GENERAL

The exhaust system of the CENTURION 2.0 installation may include a muffler.

The turbocharger is driven by exhaust gases.

For inspection intervals of the exhaust system refer to chapter 5 of this supplement.

78.10 TROUBLESHOOTING

For Troubleshooting in case of exhaust malfunction refer to Chapter 71 of this supplement.

78.20 MAINTENANCE PRACTICES

GENERAL

This maintenance practice provides instructions to inspect the exhaust system.

INSPECTING THE EXHAUST SYSTEM

This is a visual inspection. Check the exhaust manifold and the exhaust muffler for cracks and leakage (e.g. exhaust manifold to the cylinder head). Check rubber mountings for damage, replace as necessary.

DESCRIPTION

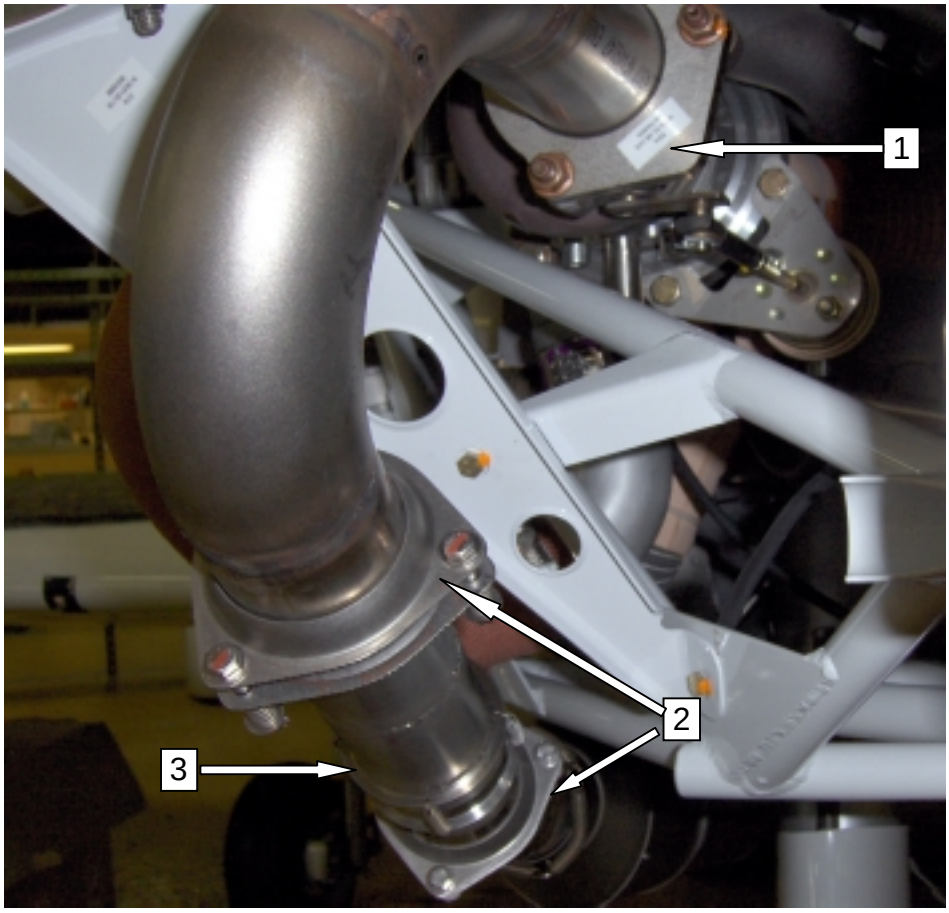

Fig. 78.2a Front view

1. Attachment to turbocharger
2. Ball joint
3. Extension tube assy

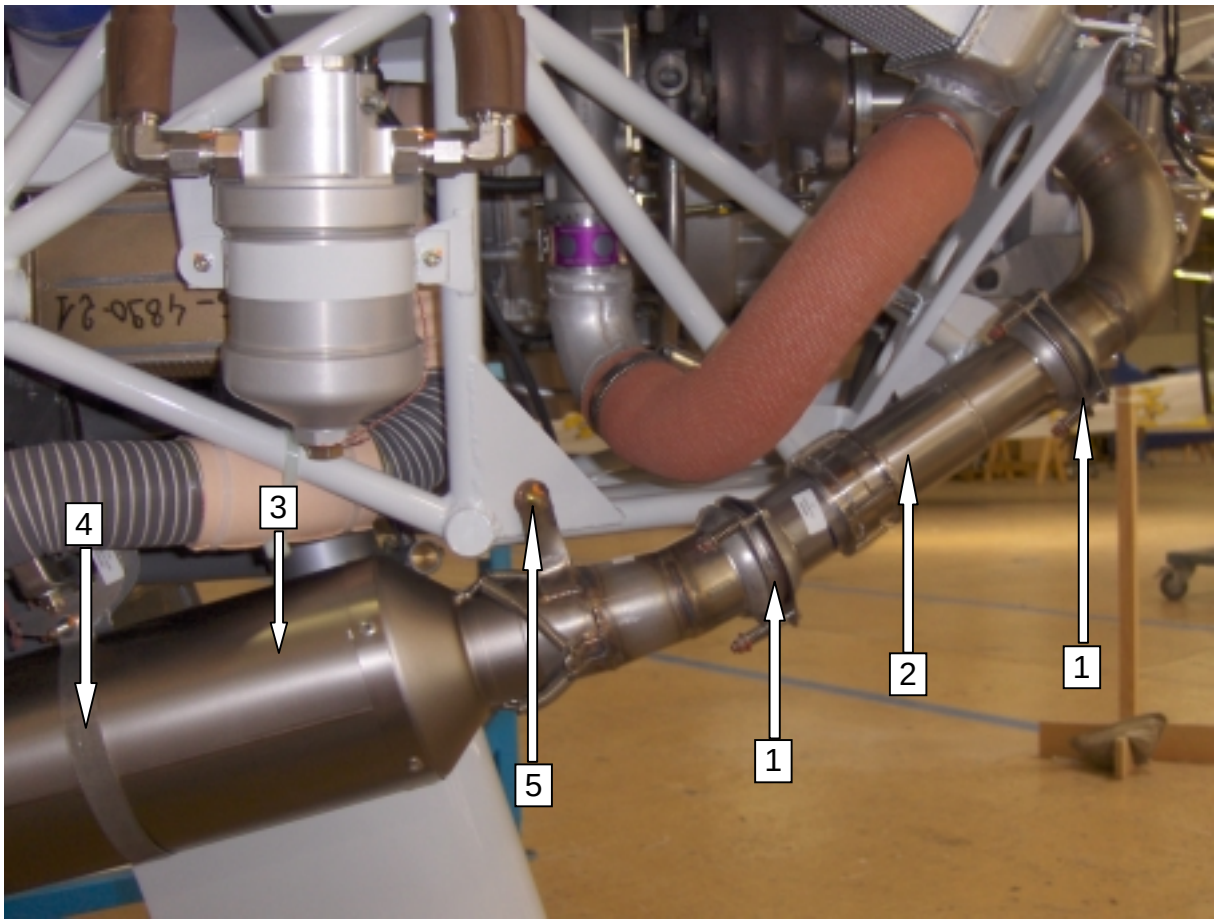

Fig. 78.2b Side view

1. Ball joint
2. Extension tube assy
3. Silencer
4. Silencer clamp
5. Fixing point on engine mount

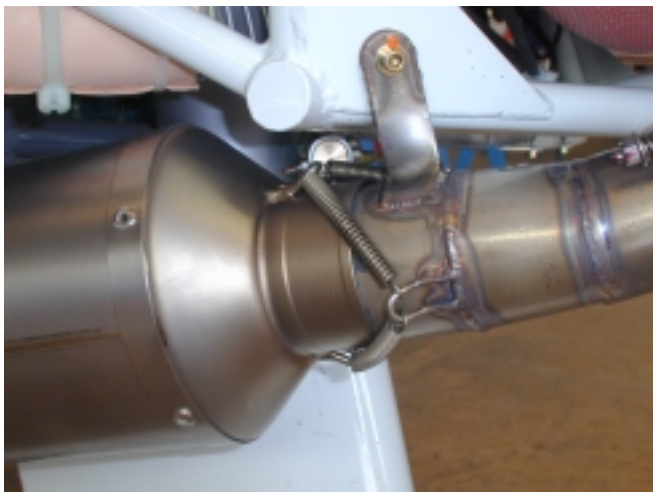

Fig. 78.2c Fixing point of exhaust system on engine mount

Fig. 78.2d Fixing point of exhaust system on firewall

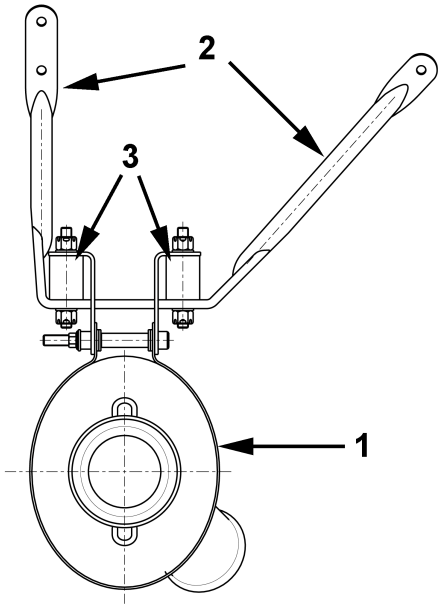

Fig. 78.2e Exhaust silencer support

1. Silencer
2. Support
3. Silent blocks (dampers)

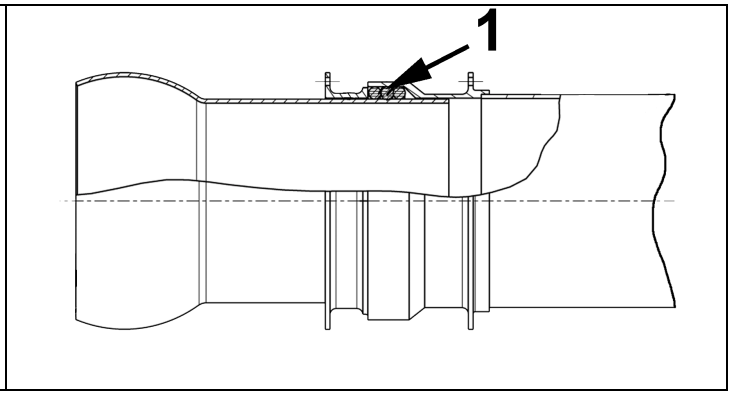

Fig. 78.2f Extension tube assy

1. Ceramic cord

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79 OIL

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79.00 GENERAL

DESCRIPTION (Refer to RM-02-02 chapter 05)

Engine oil system

The engine oil system of the CENTURION 2.0 is a wet oil sump system, consisting mainly of the following components:

- the sump
- the oil pump driven by chain
- the thermostat
- the oil cooler
- the oil pressure sensor
- the oil filter
- the blow-by system
- the oil pump driven by the gearbox
- the oil temperature sensor.

The oil system is used for lubrication, cooling and the micro sealing of the engine in the area of the piston and cylinder. The pressure cycle lubricates all heavily used bearings of the engine and supplies the turbocharger with oil. Cams, chain drive and valve guides are lubricated with pressure less leak oil.
The oil is sucked by the chain driven pump from the sump and led to the filter, thereafter to the thermostat. At oil temperatures lower than 78°C oil is streaming directly to the main path through the short cycle. When the oil temperature rises above 78°C, the thermostat opens the path to the oil cooler. At temperatures above 94°C the oil is taking the path through the oil cooler exclusively, which ensures a maximum oil temperature of 140°C under all operating conditions.
Then the engine parts are lubricated and cooled by the oil, the turbocharger is supplied by an extra hose.
The oil within the engine is passing the bearings and then drops back into the sump. The turbocharger oil is draining directly into the oil sump as well as the oil from the blow-by system.
This oil is supplied by the gear driven pump back to the sump.
The measured values of oil temperature and pressure are displayed at the CED 125 and led to the FADEC.
The system contains 4.5 to 6 liters (1.19 to 1.59 US gal) oil, the level can be checked with a dip stick.

For type of engine oil refer to Chapter 6 of this supplement.
Following limitations are established for the oil system of the CENTURION 2.0:
min. oil temperature for engine start: .....-32°C
min. oil temperature for operation:.....50°C
max. oil temperature:.....140°C
min. oil pressure: .....1.0 bar (14.5 psi)
min. oil pressure for take off power:.....2.3 bar (33.4 psi)
min. oil pressure for cruise power:.....2.3 bar (33.4 psi)
max. oil pressure: .....6.0 bar (87 psi)
max. oil pressure cold start < 20 sec: .....6.5 bar (94.2 psi)
max. oil consumption:.....0.1 l/h (0.026 US gal/hour)

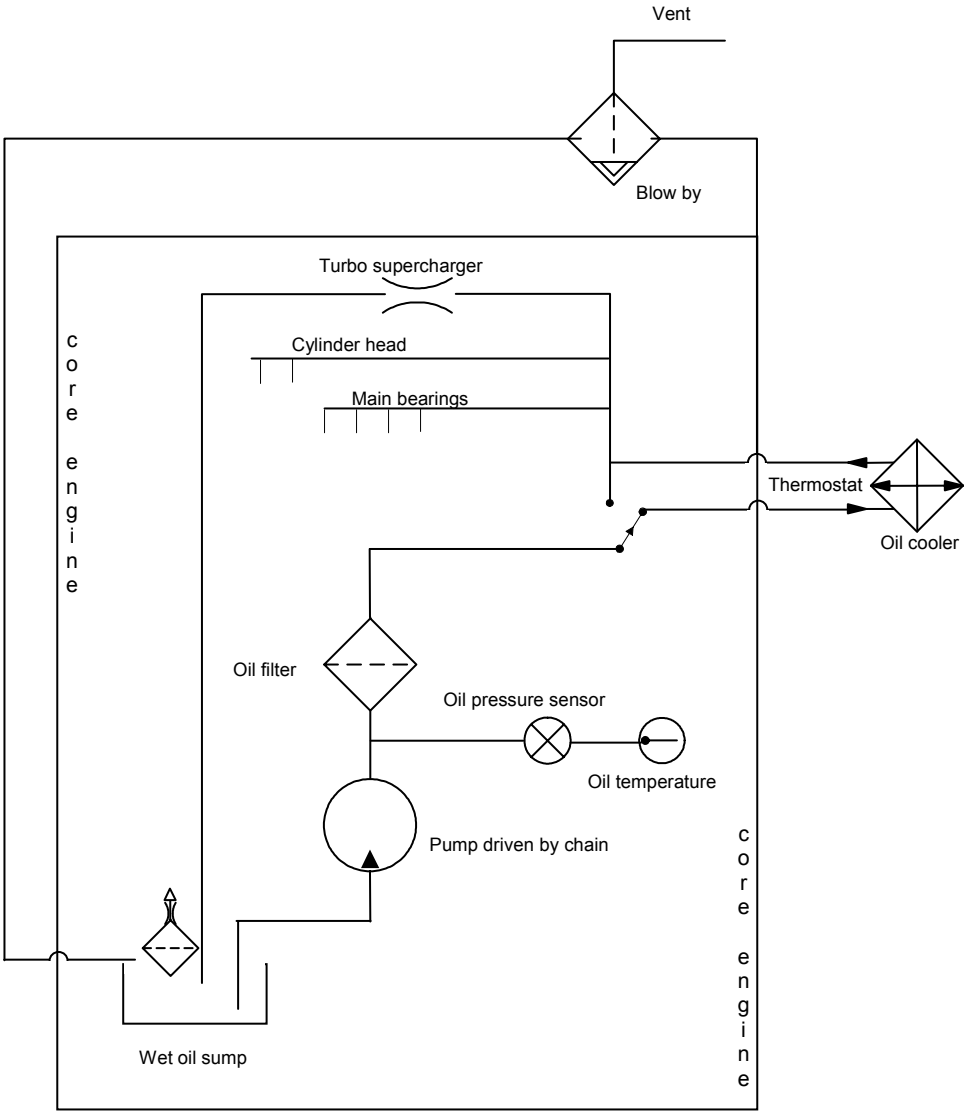

Figure 79-1a Engine Oil System of CENTURION 2.0

Gearbox oil system

The gearbox oil system of the CENTURION 2.0 is a wet oil sump system.
Gearbox oil is used for lubrication and cooling of the gearbox and for operation of the propeller regulation by the Constant Speed Unit. The bearings of the gearbox are lubricated without pressure, the gear wheels convey the oil and leak oil from the propeller regulation is used.
The oil pump sucks oil from the sump and leads it to the micro filter within the Constant Speed Unit, then to the pressure relief valve (mechanically adjusted to 20 +/- 2 bar (290 psi +/- 29 psi)) and thereafter to the regulation valve (electronically controlled by the FADEC with Pulse-Width-Modulation).
The new gearbox is fitted with an oil/coolant heat exchanger.
The oil is then reaching the piston of the propeller which is changing the blade pitch according to the value given by the FADEC. The oil temperature is measured at the propeller-shaft, leak oil of the propeller-regulation lubricates the bearings and returns to the sump.
The system contains 1 liter gearbox oil, the level can be checked at a viewer at the left lower front side of the gear accessible through a flap at the front side of the cowling.
A filler screw is installed on top, a screw for draining at the bottom of the gearbox housing.
For type of gearbox oil refer to Chapter 6 of this supplement.
Following limitations are established for the gearbox oil system:
min. oil temperature:..... -30°C
max. oil temperature: .....120°C

INDICATING

Relating to oil the Compact Engine Display CED 125 is indicating the following parameters:

- engine oil pressure “OP”
- engine oil temperature “OT” and
- gearbox temperature “GT”.

For further information refer to chapter 31 of this supplement.

79.10 MAINTENANCE PRACTICES

GENERAL

This maintenance practice provides instructions to inspect the oil system.

INSPECTING THE OIL SYSTEM

This is a visual inspection. Check all pipes, pipe joints, supply connections and engine housing separation points (e.g. cylinder head gasket, cylinder head cover gasket for leakage, seepage points and correct routing. Visually inspect oil for water contamination.

▲ **WARNING**: Do not get oil on you! Oil can cause skin disease!

▲ **WARNING**: No leaks or seepage points are permitted!

80 STARTER

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80.00 GENERAL

DESCRIPTION

The starter is free of maintenance, no overhaul permitted.

For troubleshooting refer to chapter 71 of this supplement.

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91 CHARTS AND WIRING DIAGRAMS

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91.00 WIRING DIAGRAMS

The wiring diagram for a 14 V system is applicable.

Figure 91-1a Wiring of the 14 V Electr. System with CENTURION 2.0 installation

Refer to appendix A.

91.10 SPECIAL TOOLS

To perform maintenance actions on CENTURION 2.0 engines the performing maintenance station must be trained and also be equipped with the specific tooling approved by TAE. This specific tooling is listed below.

Basic Tool Set (CENTURION 1.7) (TAE125) (P/N: ATA 00-0001-1000)

Section	***Action***	***Qty.***	***Tool description***
gearbox installation	gearbox inst./rem.	2x1	screwdriver bit 5+6mm allen key
glow plugs	contacts inst./rem.	1	flexible 6 point wrench 8 mm
	glow plug inst./rem.	1	swivel deep socket 10 mm with extension
engine oil exchange and fuel filter repl.		1	oil filter wrench 27 mm (short socket)
standard tools		1 1	flexible 6 point shaft wrench 6/7 mm
		1	12 point combination wrench 6-24 mm /17 tools
		1	wrench 17/19mm
		1	6 point ratchet set 3/8“ 6-22mm
		1	12 point deep socket 17 mm
		1	ratchet 3/8“

Table 91-1a Basic Tool Set (CENTURION 1.7)

Special Tool Set CENTURION 2.0 (P/N: ATA 00-0002-2000)

Section	***Action***	***Qty.***	***Tool description***
General		3x1	Torx sockets E 8/10/12
clutch	Fly wheel locking pin	1	special tool
	clutch shaft pull extraction	1	slide hammer puller 10 mm thread
	bearing extraction	1 1	internal extractor counter stay
cooling system	leak test	1	pressure tester incl.adapters
coolant fluid	check and replacement	1	anti-freeze tester
hose clamps	removal/ installation	1	hose clamp pliers
gear box	gear box removal	1	ratchets 3/8“ 0° follow-up angle
prop governor	pressure check	1	pressure gauge incl. connector
	governor valve repl.	1	special socket 27 mm
Clutch centering tool 2.0		1	V1-001-05-7211-K000302
Fly wheel locking tool 2.0		1	VR00173-01-0101

Table 91-2a Special Tool Set TAE 125-01

Special Tools for CENTURION 2.0 (per RM-02-02 chapter 95-00.01)

Part number	Description	Remarks	Qty
00-0002-09001R1	Retaining lock		1
00-0003-09003R1	Extractor		1
00-0003-09004R1	Special tool	Fitting valve steam seal	1
00-0002-09010R1	Socket wrench	proportional pres. reducing valve	1
00-0003-09009R1	Universal mount		1

Appendix A

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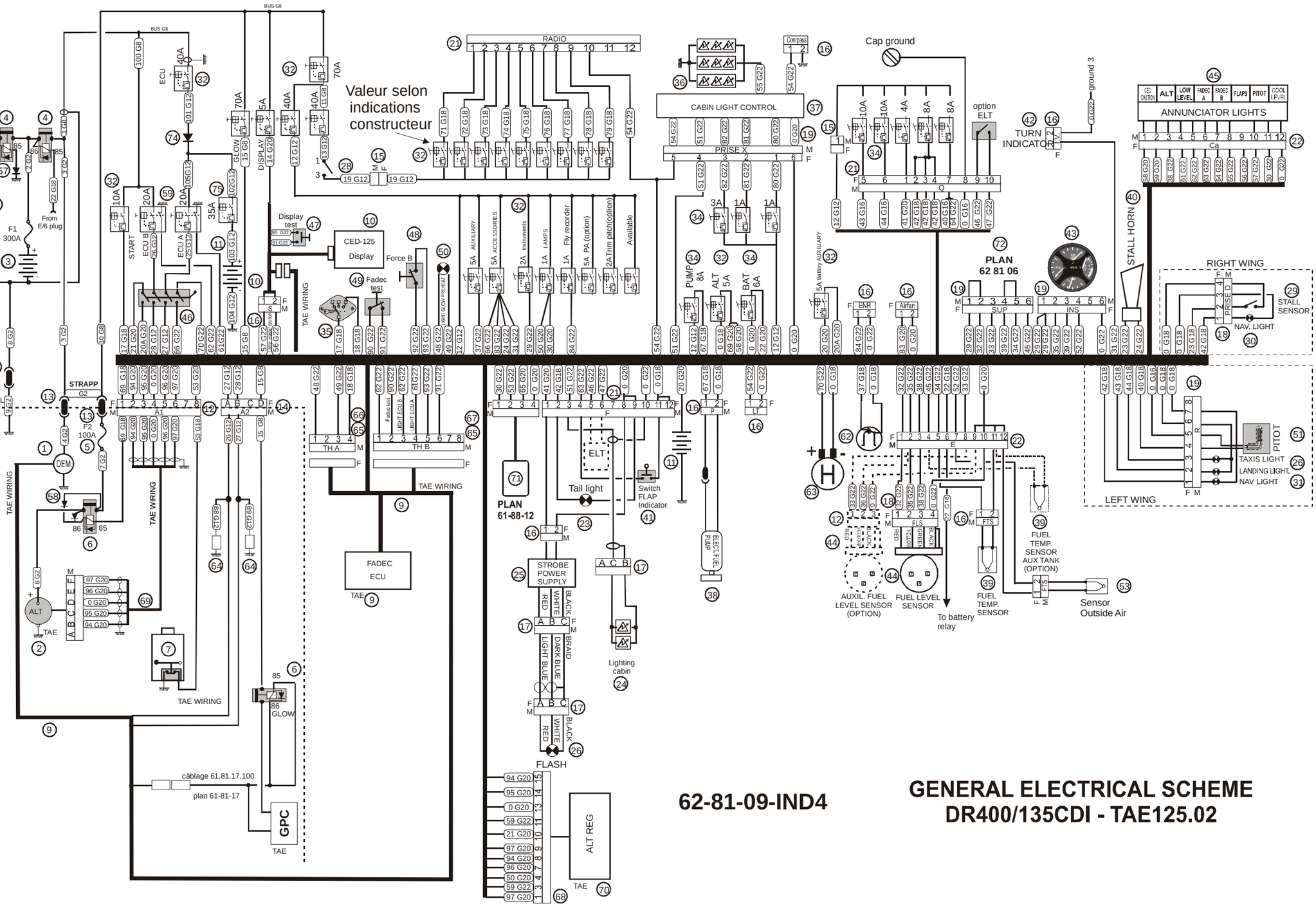
Appendix A (con't)

N°	DEFINITION	REFERENCE	DESIGNATION	Qty
1		61.81.00.250	STARTER	1
2	TAE 02-7150-55002R2	61.81.00.252	ALTERNATOR TO EXTERNAL REGULATOR	1
3	OPTIMA35 44Ah	61.81.00.042	MAIN BATTERY	1
4	Kissling 26.55.21 12V	61.81.00.033	RELAY BATTERY and PdP	2
5		61.81.00.252	FUSE ALTERNATOR	1
6	Kissling 26.60.25 12V	61.81.00.152	PRE-HEAT RELAY and ALTERNATOR	2
7	bache à eau avec contact	54.81.00.254	COOLANT LEVEL	1
8		61.81.00.255	FUSE BATTERY	1
9	FADEC PN 02-7610-5500-R1	61.81.00.015	FADEC ecu	1
9	FADEC ATA 022-7150-52-100-R7	61.81.00.013	CABLE ENGINE - FADEC	1
9		61.81.00.016	CABLE FADEC - CED	1
10	CED-125	76.81.00.054	CED	1
10		61.81.00.059	CED wiring	1
11	Batterie Cadmium nickel 1300mAH 12V TUDOR TD 1.3	61.81.00.020	BATTERY 12V 1,3AH	2
12	prise 8 br male jeager 5326 060 06	67.81.01.202	CONNECTOR MALE 8br	1
12	prise 8 br femelle chassis jeager 5366 060 06	67.81.01.201	CONNECTOR PANEL FEMALE 8br	1
13	traverse cloison plastique (prise de parc)	62.18.12.020	THROUGH.PANEL CONNECTOR EXTERNAL POWER	3
13	goujon diam 8 (prise de parc)	62.18.12.030	THROUGH.PANEL CONNECTOR EXTERNAL POWER	3
14	prise AMP 4br femelle MS 3102A 2222P	67.22.01.000	THROUGH-PANEL CONNECTOR 5366 0690 06MS 3102A 2222P	1
14	prise AMP 4br male embase MS 3106A 2222S	67.22.02.000	THROUGH-PANEL CONNECTOR MS 3106A 2222S	1
15	prolongateur femelle deutsch	67.21.47.000	CONNECTOR 1 PIN	1
15	contact 10A male deutsch	67.21.47.010	CONNECTOR 1 PIN	1
15	prolongateur male deutsch	67.21.47.020	CONNECTOR 1 PIN	1
15	contact 10A femelle deutsch	67.21.47.030	CONNECTOR 1 PIN	1
16	deustch 2 br femelle	67.21.40.000	CONNECTOR 2 PINS	7
16	deustch 2 br male	67.21.40.010	CONNECTOR 2 PINS	7
16	deustch 2 br cale male	67.21.40.020	CONNECTOR 2 PINS	7
16	deustch 2 br cale femelle	67.21.40.030	CONNECTOR 2 PINS	7
16	deustch contact male	67.21.45.000	CONNECTOR 2 PINS PIN CONTACT AGW16	84
16	deustch contact femelle	67.21.45.010	CONNECTOR 2 PINS SOCKET CONTACT AGW16	84
17	deustch 3 br femelle	67.21.41.000	CONNECTOR 3 PINS	3
17	deustch 3 br male	67.21.41.010	CONNECTOR 3 PINS	3
17	deustch 3 br cale male	67.21.41.020	CONNECTOR 3 PINS	3
17	deustch 3 br cale femelle	67.21.41.030	CONNECTOR 3 PINS	3
18	deustch 4 br femelle	67.21.42.000	CONNECTOR 4 PINS	5
18	deustch 4 br male	67.21.42.010	CONNECTOR 4 PINS	5
18	deustch 4 br cale male	67.21.42.020	CONNECTOR 4 PINS	5
18	deustch 4 br cale femelle	67.21.42.030	CONNECTOR 4 PINS	5
19	deustch 6 br femelle	67.21.43.000	CONNECTOR 6 PINS	2
19	deustch 6 br male	67.21.43.010	CONNECTOR 6 PINS	2
19	deustch 6 br cale male	67.21.43.020	CONNECTOR 6 PINS	2
19	deustch 6 br cale femelle	67.21.43.030	CONNECTOR 6 PINS	2
20	deustch 8 br femelle	67.21.44.000	CONNECTOR 8 PINS	4
20	deustch 8 br male	67.21.44.010	CONNECTOR 8 PINS	4
20	deustch 8 br cale male	67.21.44.020	CONNECTOR 8 PINS	4
20	deustch 8 br cale femelle	67.21.44.030	CONNECTOR 8 PINS	4
21	deustch 12 br femelle	67.21.46.000	CONNECTOR 12 PINS	2
21	deustch 12 br male	67.21.46.010	CONNECTOR 12 PINS	2
21	deustch 12 br cale male	67.21.46.020	CONNECTOR 12 PINS	2
21	deustch 12 br cale femelle	67.21.46.030	CONNECTOR 12 PINS	2
22	mini deutsch 12br femelle	67.21.48.010	CONNECTOR 12 PINS mini deutsch	1
22	mini deutsch 12br cale femelle	67.21.48.030	CONNECTOR 12 PINS mini deutsch	1
22	contact AGW20 femelle	67.21.50.020	CONNECTOR 12 PINS SOCKET CONTACT AGW20	12
23	complet	64.12.04.000	AFT NAVIGATION LIGHT	1
24	projecteur 12V	64.18.09.004	4 LED LIGHTING CABIN 12v	2
25	centrale 1 voie	64.34.50.005	STROBE POWER SUPPLY	1
26		64.34.50.010	LAMP ANTI-COLLISION	1
27		64.12.01.000	SPOTLIGHTS	2
28	KIPPSHALTER 08-1-1-13	69.80.00.140	INTER MASTER radio	1
29		79.88.00.000	DETECTOR STALL	1
30	complet	64.12.02.000	RIGHT GREEN NAV	1
31	complet	64.12.03.000	LEFT RED NAV	1
32	breaker ETA	69.22.03.010	BREAKER 60A	1
32	breaker ETA	69.22.03.020	BREAKER 70A	2
32	breaker ETA	69.22.15.000	BREAKER 40A	2
32	breaket crouzet	69.80.01.000	BREAKER 1A	2
32	breaket crouzet	69.80.01.010	BREAKER 2A	1
32	breaket crouzet	69.80.01.020	BREAKER 5A	5
32	breaket crouzet	69.80.01.030	BREAKER 10A	1
32	breaket crouzet	69.80.01.050	BREAKER 3A	3
32	breaket crouzet	69.80.01.022	BREAKER 6A	1
34		69.36.01.020	SWITCH CIRCUIT BREAKER 4A BLACK	1
34		69.36.01.030	SWITCH CIRCUIT BREAKER 6A RED	1
34		69.36.01.040	SWITCH CIRCUIT BREAKER 8A WHITE	1
34		69.36.01.050	SWITCH CIRCUIT BREAKER 8A BLACK	2
34		69.36.01.060	SWITCH CIRCUIT BREAKER 10A BLACK	2
35	BOSCH 0342 311 007	61.81.00.031	START SWITCH WITH KEY	1
36	support lampe navette	64.18.09.006	LAMPS LED LIGHTING	5
36	lampe navette 4W	64.18.10.005	LED STRIP TRACK	2
37		64.18.12.010	CABIN LIGHT POWER	2
38		52.88.03.100	FUEL PUMP	1
39	WESTACH 399W	52.81.00.289	FUEL TEMPERATURE SENSOR	1
40		79.80.00.000	DETECTOR STALL	1
41		16.11.16.000	FLAP POSITION INDICATOR SWITCH	1
42		67.11.11.000	TERMINAL STRIP	1
43	WESTACH 3AQ5-92V	76.81.00.170	QUADRUPLE INDICATOR (FUEL/TEMP FUEL/VOLTMETER/OAT)	1
44	WESTACH 395-S5-5LL coupé à 292 mm	52.81.00.257	LEVEL FUEL SENSOR	1
45	plan 62-81-10	64.81.00.359	ANNUNCIATOR LIGHT POWER	1
46	2P4T MS24660-220	61.81.00.260	DOUBLE SWITCH FOR ENGINE MASTER	1
47	APEM 9600 CND	64.81.06.070	PUSH BUTTON TEST CED	1
47	APEM U482 NOIR	64.81.06.090	CAP FOR PUSH BUTTON TEST CED	1
48	AN3021-3 ou MS35058-23	61.81.00.262	TOGGLE SWITCH	1
48	MS25224-1	61.81.00.261	SWITCHGARD	1
49	SECME 17 1785130	64.21.06.060	TEST FADEC PUSH BUTTON	1
49		64.21.06.080	CAP FOR PUSH BUTTON TEST FADEC	1
50		61.81.00.264	PRE-HEAT INDICATOR(ANNUNCIATOR LAMP)	1
51		17.12.04.020	HEATING PITOT	1
53	3990T (rem par 399W)	76.81.00.171	OAT PROBE (FOR QUAD INST.) 3990T	1
56		63.80.11.010	EXTERNAL POWER PLUG	1
57	SKR2682-20A400V	65.22.10.010	DIODE EXTERNAL POWER PLUG	1
58	1N4007	79.30.57.010	DIODE ANTI-RETURN	2
59	ETA 4120-G111-K1M1-A1S1ZN-20A	69.81.00.283	CIRCUIT BREAKER WITH WARNING CONTACT 20A	2
61	P9-1K-A	64.81.00.307	CED DIMMER POTENTIOMETER	1
61	201 37 03 + 301 30 13	76.18.00.050	CED DIMMER BUTTON	1
62	AC101E	61.81.00.019	AUXILIARY PLUG	1
63	TOLEC 321945-02	76.34.54.500	HOURMETER	1
64	Protek 704-15K36T	61.81.00.160	OVERVOLTAGE PROTECTOR - LIGHTNING	2
65	61316-1	61.81.00.277	AMP PIN MALE	12
66	180901-0	61.81.00.284	SOCKET FOR 4 PIN	1
67	163008-0	61.81.00.288	SOCKET FOR 8 PIN	1
68	type DB15 femelle capot metalique	67.21.04.040	REGULATOR MALE PLUG (see TAE 02-7150-55113)	1
68	capot metallique pour DB15	67.81.01.015	METAL COVER PLUG	1
69	Câblage fourni par TAE (02-7150-55113)	61-81-00-254	ALTERNATOR WIRING (see TAE 02-7150-55113)	1
70	02-7150-55812R1	61-81-00-253	EXTERNAL REGULATOR BY TAE 14V	1
71		61.81.00.294	COOLANT PROBE SIGNAL INVERTER	1
72	VOIR PLAN 62 81 06	52.81.00.368	AUX TANK INDICATOR KIT (OPTION)	1
73		05-7151-E00040	GPC	1
74	T70HF-40	62.81.09.075	DIODE 70A	1
75	483-G111-J2M1-K5S5ZG-35A	62.81.09.074	BREAKER 35A	ou 1
75	483-G411-J2M1-K5S0ZG-35A	62.81.09.076	BREAKER 35A	1

62-81-09-IND4

GENERAL ELECTRICAL SCHEME
DR400/135CDI - TAE125.02



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GENERAL ELECTRICAL SCHEME
DR400/135CDI - TAE125.02

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