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Supplement
Pilot´s Operating Handbook

for the

Piper PA-28-140 - Cherokee Cruiser
Piper PA-28-150/160/180 - Cherokee
Piper PA-28-151 - Cherokee Warrior
Piper PA-28-161 - Cadet, Warrior II & III

Equipped with TAE 125 Installation

Issue 4

MODEL No. PA28-161
SERIAL No. 28-41050
REGISTRATION No. SE-LXR

This supplement must be attached to the EASA approved Pilot´s Operating Handbook when the TAE 125 installation has been installed in accordance with STC EASA A.S.01632 or EASA STC 10014364.

The information contained in this supplement supersede or add to the EASA approved Pilot´s Operating Handbook only as set forth herein. For limitations, procedures, performance and loading information not contained in this supplement, consult the EASA approved Pilot´s Operating Handbook.

This supplement Pilot's Operating Handbook is approved with EASA STC 10014364.

TAE-Nr.: 40-0310-40024

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LOG OF REVISIONS

<table>
<tr><th rowspan="2">Issue / Revision</th><th rowspan="2">Section</th><th rowspan="2">Description</th><th colspan="2">Approved</th></tr>
<tr><th>Date</th><th>Endorsed</th></tr>
<tr><td>4/0</td><td>All</td><td>New issue</td><td>06.08.2010</td><td>EASA STC 10014364</td></tr>
<tr><td rowspan="3">4/1</td><td>0</td><td>Updated</td><td>Aug. 2010</td><td rowspan="3">Revision No. 1 to AFM supplement ref. 40-0310-40024 is approved under the authority of DOA ref. EASA.21J.010. Date: 09.08.2010
Office of Airworthiness</td></tr>
<tr><td>3</td><td>Procedures updated</td><td>Aug. 2010</td></tr>
<tr><td>7</td><td>Gearbox oil cooler added
Editorial changes</td><td>Aug. 2010</td></tr>
<tr><td rowspan="6">4/2</td><td>0</td><td>Updated</td><td>April 2011</td><td rowspan="6">Revision No. 2 to AFM supplement ref. 40-0310-40024 is approved under the authority of DOA ref. EASA.21J.010. Date: 14.04.2011
Office of Airworthiness</td></tr>
<tr><td>1</td><td>New oil</td><td>April 2011</td></tr>
<tr><td>2</td><td>New oil</td><td>April 2011</td></tr>
<tr><td>3</td><td>Procedures updated</td><td>April 2011</td></tr>
<tr><td>4</td><td>Procedures updated</td><td>April 2011</td></tr>
<tr><td>5</td><td>Editorial changes</td><td>April 2011</td></tr>
</table>

4/3	0	Updated	June 2011	Revision No. 3 to AFM supplement ref. 40-0310-40024 is approved under the authority of DOA ref. EASA.21J.010. Date: 30.06.2011 Office of Airworthiness
	1	New gearbox oil	June 2011	
	2	New gearbox oil	June 2011	
	3	Procedures updated	June 2011	
	7	Electrical system scheme updated	June 2011	
	8	Information added	June 2011	

4/4	0	Updated	March 16, 2012	Revision No. 4 to AFM supplement ref. 40-0310-40024 is approved under the authority of DOA ref. EASA.21J.010. Date: 16.03.2012 Office of Airworthiness
	1	New fuel, new gearbox oil		
	2	New fuel, new gearbox oil		
	4	Procedures updated		

Remark: The parts of the text which changed are marked with a vertical line on the margin of the page.

LIST OF EFFECTIVE SECTIONS

Sections	Issue/ Revision	Date
0	4/4	March 2012
1	4/3	March 2012
2	4/3	March 2012
3	4/3	June 2011
4	4/2	March 2012
5	4/1	April 2011
6	4/0	Feb. 2010
7	4/2	June 2011
8	4/1	June 2011

Approval

The content of approved chapters is approved by EASA. All other content is approved by TAE under the authority of EASA DOA No. EASA.21J.010 in accordance with Part 21.

General remark

The content of this POH supplement is developed on basis of the EASA approved POH.

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TABLE OF CONTENTS

CONVERSION TABLES

VOLUME		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Liter [l]	[l] / 3.7854 = [US gal] [l] / 0.9464 = [US qt] [l] / 4.5459 = [[Imp gal] [l] x 61.024 = [in³]	
US gallon [US gal] US quart [US qt] Imperial gallon [Imp gal] Cubic inch [in³]		[US gal] x 3.7854 = [l] [[US qt] x 0.9464 = [l] [[Imp gal] x 4.5459 = [l] [in³] / 61.024 = [l]

TORQUE		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Kilopondmeter [kpm]	[kpm] x 7.2331 = [ft.lb] [kpm] x 86.7962 = [in.lb]	
Foot pound [ft.lb] Inch pound [in.lb]		[ft.lb] / 7.2331 = [kpm] [in.lb] / 86.7962 = [kpm]

TEMPERATURE		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Degree Celsius [ºC]	[ºC] x 1.8 + 32 = [ºF]	
Degree Fahrenheit [ºF]		([ºF] - 32) / 1.8 = [ºC]

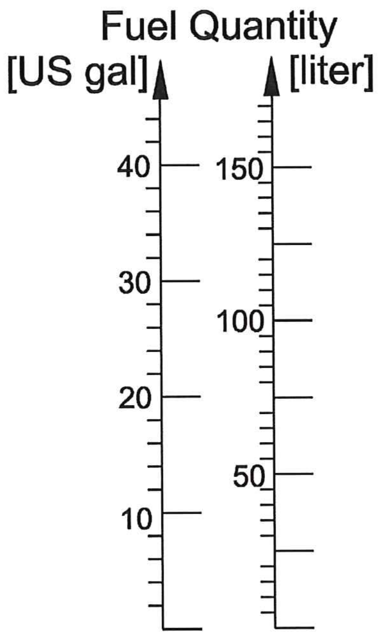
SPEED		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Kilometers per hour [km/h] Meters per second [m/s]	[km/h] / 1.852 = [kts] [km/h] / 1.609 = [mph] [m/s] / 196.85 = [fpm]	
Miles per hour [mph] Knots [kts] Feet per minute [fpm]		[mph] x 1.609 = [km/h] [kts] x 1.852 = [km/h] [fpm] / 196.85 = [m/s]

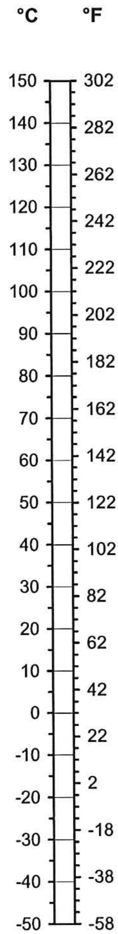
PRESSURE		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Bar [bar] Hectopascal [hpa] =Millibar [mbar] Pounds per square inch [psi] inches of mercury column [inHg]	[bar] x 14.5038 = [psi] [hpa] / 33.864= [inHg] [mbar] / 33.864 = [inHg]	psi] / 14.5038 = [bar] [inHg] x 33.864 = [hPa] [inHg] x 33.864 = [mbar]

MASS		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Kilogramm [kg] Pound [lb]	[kg] / 0.45359 = [lb]	[lb] x 0.45359 = [kg]

LENGTH		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Meter [m] Millimeter [mm] Kilometer [km] Inch [in] Foot [ft] Nautical mile [nm] Statute mile [sm]	[m] / = 0.3048 [ft] [mm] / = 25.4 [in] [km] / = 1.852 [nm] [km] / = 1.609 [sm]	[in] x 25.4 = [mm] [ft] x 0.3048 = [m] [nm] x 1.852 = [km] [sm] x 1.609 = [km]

FORCE		
Unit [Abbr.]	Conversion factor SI to US / Imperial	Conversion factor US / Imperial to Si
Newton [N] Decanewton [daN] Pound [lb]	[N] / 4.448 = [lb] [daN] / 0.4448 = [lb]	[lb] x 4.448 = [N] [lb] x 0.4448 = [daN]


Fuel Quantity
[US gal]
[liter]
40
30
20
10
150
100
50


°C
°F
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
302
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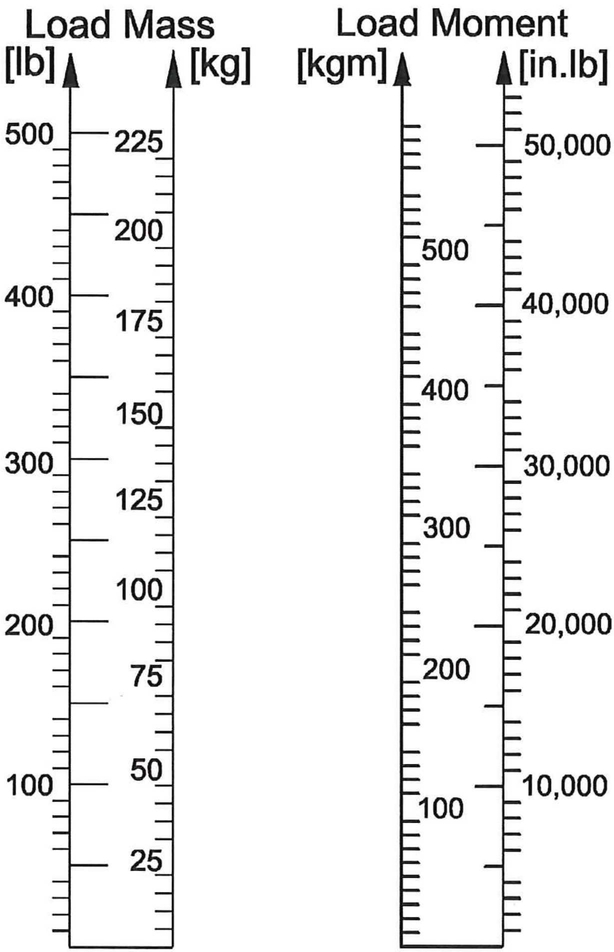
262
242
222
202
182
162
142
122
102
82
62
42
22
2
-18
-38
-58


Load Mass
[lb]
[kg]
Load Moment
[kgm]
[in.lb]
500
400
300
200
100
225
200
175
150
125
100
75
50
25
500
400
300
200
100
50,000
40,000
30,000
20,000
10,000

ABBREVIATIONS

TAE	Thielert Aircraft Engines GmbH, developing and manufacturing company of TAE 125
FADEC	Full Authority Digital Engine Control
CED 125	Compact Engine Display Multifunctional instrument for indication of engine data of TAE 125
AED 125	Auxiliary Engine Display Multifunctional instrument for indication of engine and airplane data

SECTION 1
GENERAL

CONVENTIONS IN THIS HANDBOOK

This manual contains following conventions and warnings. They should be strictly followed to rule out personal injury, property damage, impairment to the aircraft's operating safety or damage to it as a result of improper functioning.

▲ **WARNING:**	Non-compliance with these safety rules could lead to injury or even death.
■ CAUTION:	Non-compliance with these special notes and safety measures could cause damage to the engine or to the other components.
◆ Note:	Information added for a better understanding of an instruction.

UPDATE AND REVISION OF THE MANUAL

▲ **WARNING:**	A safe operation is only assured with an up to date POH supplement. Information about actual POH supplement issues and revisions are published in the TAE Service Bulletin TM TAE 000-0004.
◆ Note:	The TAE-No. of this POH supplement is published on the cover sheet of this supplement.

ENGINE

Engine manufacturer:............... Thielert Aircraft Engines GmbH
Engine model:........................... TAE 125-01 or TAE 125-02-99

The TAE 125-02-99 is the successor of the 125-01. Both engine variants have the same power output and the same propeller speeds but different displacement. While the TAE 125-01 has 1689 ccm, the TAE 125-02 has 1991 ccm. Both TAE 125 engine variants are liquid cooled in-line four-stroke 4-cylinder motor with DOHC (double overhead camshaft) and are direct Diesel injection engines with common-rail technology and turbocharging. Both engine variants are controlled by a FADEC system. The propeller is driven by a built-in gearbox with mechanical vibration damping and overload release. Both engines have an electrical self starter and an alternator.
Due to this specific characteristic, all of the information from the flight manual recognized by EASA are no longer valid with reference to:

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

▲ **WARNING** The engine requires an electrical power source for operation. If the main battery and alternator fail simultaneously, the engine will only operate on A-FADEC for maximum 30 minutes on FADEC backup battery power (if installed). Therefore, it is important to pay attention to indications of alternator failure.

PROPELLER

Manufacturer:........................MT Propeller Entwicklung GmbH
Model: MTV-6-A/187-129
Number of blades:...3
Diameter: ....1.87 m (73.6 in)
Type:........................ Variable-pitch propeller (constant speed)

LIQUIDS

■ CAUTION: Use of unapproved fuels may result in damage to the engine and fuel system components, resulting in possible engine failure.

Fuel:..JET A-1 (ASTM 1655)
Alternatives: .... JET A (ASTM D 1655)
....Fuel No.3 (GB 6537-2006)
.... JP-8, JP-8+100 (MIL-DTL-83133E)
.... Diesel (**DIN** EN 590)
Only TAE 125-02-99 (C2.0):
.... TS-1 (GOST 10227-86)
..........................TS-1 (GSTU 320.00149943.011-99)

Engine oil: .... AeroShell Oil Diesel Ultra
.... AeroShell Oil Diesel 10W-40
....Shell Helix Ultra 5W-40
....Shell Helix Ultra 5W-30

Gearbox oil:............................ Shell Spirax S6 GXME 75W-80
....Shell Spirax S4 G 75W-90
.... Shell Getriebeöl EP 75W-90 API GL-4
.... Shell Spirax EP 75W-90
.................................Shell Spirax GSX 75W-80 GL-4

■ CAUTION: Use the approved oil with exact designation only.

Coolant:................Water/Radiator Protection at a ratio of 50:50

Radiator Protection: .... BASF Glysantin Protect Plus/G48
.... Mobil Antifreeze Extra/G48
....ESSO Antifreeze Extra/G48
.... Comma Xstream Green - Concentrate/G48
.... Zerex Glysantin G48

▲ **WARNING:** The engine must not be started under any circumstances if any fluid level is too low.

■ CAUTION: Normally it is not necessary to fill the cooling liquid or gearbox oil between maintenance intervals. If the level is too low, please notify the TAE service department immediately.

◆ Note: The freezing point of the coolant is -36°C (-32.8°F).

SECTION 2
LIMITATIONS

AIRSPEED LIMITATIONS

No change

AIRSPEED INDICATIOR MARKINGS

No change

ENGINE OPERATING LIMITS

Engine manufacturer:............... Thielert Aircraft Engines GmbH
Engine model:......................... TAE 125-01 or TAE 125-02-99
Take-off and Max. continuous power:.............. 99 kW (135 HP)
Take-off and Max. continuous RPM:...........................2300 rpm

Propeller Manufacturer: ....MT Propeller Entwicklung GmbH
Propeller Model:.. MTV-6-A/187-129
Number of blades:..3
Propeller Diameter:...1.87 m (73.6 in)

▲ **WARNING** The engine requires an electrical power source for operation. If the main battery and alternator fail simultaneously, the engine will only operate on A-FADEC for maximum 30 minutes on FADEC backup battery power (if installed). Therefore, it is important to pay attention to indications of alternator failure.

▲ **WARNING** It is not allowed to start up the engine using external power. If starting the engine is not possible using battery power, the condition of the battery must be verified before flight.

◆ Note: This change of the original aircraft is certified up to an altitude of 14,000 ft.

◆ Note: In the absence of any other explicit statements, all of the information on RPM in this supplement to the Pilot's Operating Handbook are propeller RPM.

Engine operating limits for take-off and continuous operation:

▲ **WARNING:** It is not allowed to start the engine outside of these temperature limits.

◆ Note: The operating limit temperature is a temperature limit below which the engine may be started, but not operated at the Take-off RPM. The warm-up RPM to be selected can be found in Section 4 of this supplement.

Oil temperature

Minimum engine starting temperature: .... -32 °C (-25.6 °F)
Minimum operating limit temperature: .... 50 °C (122 °F)
Maximum operating limit temperature: .... 140 °C (284 °F)

Coolant temperature

Minimum engine starting temperature: .... -32 °C (-25.6 °F)
Minimum operating limit temperature: .... 60 °C (140 °F)
Maximum operating limit temperature: .... 105 °C (221 °F)

Gearbox temperature

Minimum operating limit temperature: .... -30 °C (-22 °F)
Maximum operating limittemperature: .... 120 °C (248 °F)

Fuel temperature

Min. fuel temperature limits in the fuel tank:

Fuel	Minimum permissible fuel temperature in the fuel tank before take-off	Minimum permissible fuel temperature in the fuel tank during the flight
JET A-1, JET A, Fuel No.3, JP-8, JP-8+100, TS-1 (only C2.0)	-30°C (-22°F)	-35°C (-31°F)
Diesel	greater than 0° (32°F)	-5° (23°F)

Table 2-1 Minimum fuel temperature limits in the fuel tank

▲ **WARNING:** The fuel temperature of the fuel tank not used should be monitored if its later use is intended.

▲ **WARNING:** The following applies to Diesel and JET fuel mixtures in the tank:
As soon as the proportion of Diesel in the tank is more than 10% Diesel, the fuel temperature limits for Diesel operation must be observed. If there is uncertainty about which fuel is in the tank, the assumption should be made that it is Diesel.

Oil pressure

Minimum oil pressure:..1.2 bar (14.5psi)
Minimum oil pressure (at Take-off power): .....2.3 bar (33.4 psi)
Minimum oil pressure (in flight):.......................2.3 bar (33.4 psi)
Maximum oil pressure:.......................................6.0 bar (87 psi)
Maximum oil pressure (cold start < 20 sec.):....6.5 bar (94.3 psi)
Maximum oil consumption: ....0.1 l/h (0.1 quart/h)

ENGINE INSTRUMENT MARKINGS

The engine data of the TAE 125 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	[bar]	0-1.2	1.2-2.3	2.3-5.2	5.2-6.0	> 6.0
	[psi]	0-17.4	17.4-33.4	33.4-75.4	75.4-87.0	> 87.0
Coolant temperatur	[°C]	< -32	-32...+60	60-101	101-105	> 105
	[°F]	< -25.6	-25.6+140	140-214	214-221	> 221
Oil temperatur	[°C]	< -32	-32...+50	50-125	125-140	> 140
	[°F]	< -25.6	-25.6+122	122+257	257-284	> 284
Gearbox temperatur	[°C]	--------	--------	< 115	115-120	> 120
	[°F]	--------	--------	< 239	239-248	> 248
Load	[%]	--------	--------	0-100	--------	--------

Table 2-2 Markings of the engine instruments

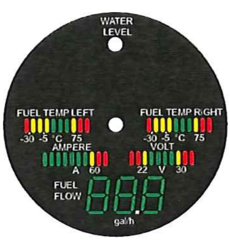


Figure 2-1a AED 125

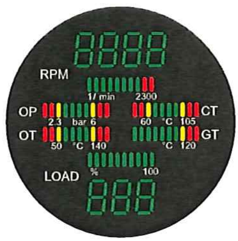


Figure 2-1b CED 125

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

WEIGHT LIMITS

PA 28-140 (Normal category):

Serial no. 28-20001 to 28-20939:

Maximum Ramp Weight: .... 886 kg (1952 lbs)
Maximum Takeoff Weight: .... 885 kg (1950 lbs)
Maximum Landing Weight .... 885 kg (1950 lbs)

Serial no. 28-20001 to 28-20939, with Piper Kit 756962 installed and, Serial no. 28-20940 and up:

Maximum Ramp Weight: .... 977 kg (2152 lbs)
Maximum Takeoff Weight: .... 976 kg (2150 lbs)
Maximum Landing Weight .... 976 kg (2150 lbs)

PA 28-140 (utility category):

Maximum Ramp Weight: .... 886 kg (1953 lbs)
Maximum Takeoff Weight: .... 885 kg (1950 lbs)
Maximum Landing Weight .... 885 kg (1950 lbs)

PA 28-150 (normal category):

Maximum Ramp Weight: .... 977 kg (2152 lbs)
Maximum Takeoff Weight: .... 976 kg (2150 lbs)
Maximum Landing Weight .... 976 kg (2150 lbs)

PA 28-151 (normal category):

Maximum Ramp Weight: .... 1,056 kg (2327 lbs)
Maximum Takeoff Weight: .... 1,055 kg (2325 lbs)
Maximum Landing Weight .... 1,055 kg (2325 lbs)

PA 28-151 (utility category):

Maximum Ramp Weight: .... 886 kg (1953 lbs)
Maximum Takeoff Weight: .... 885 kg (1950 lbs)
Maximum Landing Weight .... 885 kg (1950 lbs)

PA 28-160 (normal category, reduced weight):

Maximum Ramp Weight: .... 977 kg (2152 lbs)
Maximum Takeoff Weight: .... 976 kg (2150 lbs)
Maximum Landing Weight .... 976 kg (2150 lbs)

PA 28-161 (normal category, Warrior III reduced weight):

Maximum Ramp Weight: .... 1,056 kg (2327 lbs)
Maximum Takeoff Weight: .... 1,055 kg (2325 lbs)
Maximum Landing Weight .... 1,055 kg (2325 lbs)

PA 28-161 (utility category):

Maximum Ramp Weight: .... 917 kg (2022 lbs)
Maximum Takeoff Weight: .... 916 kg (2020 lbs)
Maximum Landing Weight .... 916 kg (2020 lbs)

PA 28-180 (normal category, reduced weight):

Maximum Ramp Weight: .... 977 kg (2152 lbs)
Maximum Takeoff Weight: .... 976 kg (2150 lbs)
Maximum Landing Weight .... 976 kg (2150 lbs)

PA 28-180 (utility category):

Maximum Ramp Weight: .... 886 kg (1953 lbs)
Maximum Takeoff Weight: .... 885 kg (1950 lbs)
Maximum Landing Weight .... 885 kg (1950 lbs)

CENTER OF GRAVITY LIMITS

No change, note the maximum weight

MANEUVER LIMITS

■ CAUTION: Intentionally initiating negative G maneuvers is prohibited!

Normal Category: No change

Utility Category: Intentionally initiating spins is prohibited

FLIGHT LOAD FACTORS

No change

◆ Note: The load factor limits for the engine must also be observed. Refer to the Operation & Maintenance Manual for the engine.

■ CAUTION: Avoid extended negative g-loads duration. Extended negative g-loads can cause propeller control and engine problems.

KINDS OF OPERATION EQUIPMENT LIST

No change

PERMISSIBLE FUEL GRADES

■ CAUTION: Using non-approved fuels and additives can lead to dangerous engine malfunctions.

Fuel: ....JET A-1(ASTM 1655)
Alternative: .... JET A (ASTM D 1655)
....Fuel No.3 (GB 6537-2006)
....JP-8 (MIL-DTL-83133E)
.....................................JP-8+100 (MIL-DTL-83133E)
.... Diesel (**DIN** EN 590)
<u>Only TAE 125-02-99 (C2.0):</u>
.... TS-1 (GOST 10227-86)
..........................TS-1 (GSTU 320.00149943.011-99)

MAXIMUM FUEL QUANTITIES

Due to the higher specific density of Kerosene and Diesel in comparison to Aviation Gasoline (AVGAS) with the TAE 125 installation the permissible tank capacity has been reduced

2 standard tanks: ....each 85.2 l (22.5 US gal)
Total capacity: ....170.4 l (45 US gal)
Total usable fuel: ....162.8 l (43 US gal)
Total unusable fuel: ....7.6 l (2 US gal)

■ CAUTION: To prevent air from penetrating into the fuel system avoid flying the tanks dry. As soon as the "Low Level" Warning Light illuminates, switch to a tank with sufficient fuel or land.

◆ Note The tanks are equipped with a Low Fuel Warning. If the fuel level is below 10 l (2.6 US gal), the "Fuel L" or "Fuel R" Warning Light illuminates respectively.

PERMISSIBLE OIL TYPES

Engine oil: .... AeroShell Oil Diesel Ultra
.... AeroShell Oil Diesel 10W-40
.... Shell Helix Ultra 5W-40
.... Shell Helix Ultra 5W-30

Gearbox oil:............................. Shell Spirax S6 GXME 75W-80
.... Shell Spirax S4 G 75W-90
.... Shell Getriebeöl EP 75W-90 API GL-4
.... Shell Spirax EP 75W-90
.................................Shell Spirax GSX 75W-80 GL-4

■ CAUTION: Use the approved oil with exact designation only.

PERMISSIBLE COOLING LIQUID

Coolant:................Water/Radiator Protection at a ratio of 50:50
Radiator Protection: .... BASF Glysantin Protect Plus/G48
.... Mobil Antifreeze Extra/G48
....ESSO Antifreeze Extra/G48
.... Comma Xstream Green - Concentrate/G48
.... Zerex Glysantin G48

▲ **WARNING** The engine must not be started under any circumstances if any fluid level is too low.

PLACARDS

Near the fuel tank caps:

JET A-1 / Diesel Fuel
CAP. 81.0 LITER (21.5 U.S. GAL.) USABLE
TO BOTTOM OF FILLER INDICATOR TAB

On the oil funnel or at the flap of the engine cowling:

"Oil, see POH supplement"

If installed, at the flap of the engine cowling to the External Power Receptacle**:**

„ATTENTION 12 V DC OBSERVE CORRECT POLARITY"

OR

„ATTENTION 24 V DC OBSERVE CORRECT POLARITY"

SECTION 3
EMERGENCY PROCEDURES

INDEX OF CHECKLISTS

GENERAL

In addition to the original AFM/POH, the following applies:

▲ **WARNING:** Due to an engine shut-off or a FADEC diagnosed failure there might be a loss propeller valve currency which leads in a low pitch setting of the propeller. This might result in propeller overspeed.
Airspeeds below 100 KIAS/ 115 mph are suitable to avoid propeller overspeed in failure case. If the propeller speed control fails, climb flights can be performed at 65 KIAS/ 75 mph and a powersetting of 100%.

EMERGENCY PROCEDURES CHECK LIST

ENGINE FIRE WHEN STARTING ENGINE ON GROUND

(1) Engine Master - OFF
(2) Fuel Selector - CLOSED
(3) Electrical Fuel Pump - OFF
(4) Switch “Battery“ - OFF
(5) Extinguish the flames with a fire extinguisher, wool blankets or sand.
(6) Examine the fire damages throughly and repair or replace the damaged parts before the next flight.

ENGINE MALFUNCTION DURING TAKE-OFF (ON GROUND)

(1) Thrust Lever - IDLE
(2) Brakes - APPLY
(3) Wing flaps (if extended) - RETRACT to increase the braking effect on the runway.
(4) Engine Master - OFF
(5) Circuit Breaker or Switch “Alternator“, Switches “Main Bus“ and “Battery“ - OFF

ENGINE MALFUNCTION IMMEDIATELY AFTER TAKE-OFF

- Take-off abort -

If there is an engine malfunction after take-off, at first lower the nose to keep the airspeed and attain gliding attitude. In most cases, landing should be executed straight ahead with only small corrections in direction to avoid obstacles.

▲ **WARNING:** Altitude and airspeed are seldom sufficient for a return to the airfield with a 180° turn while gliding.

(1) Airspeed............................ 73 KIAS (wing flaps retracted)
.... 65 KIAS (wing flaps extended)
(2) Fuel Selector - CLOSED
(3) Engine Master - OFF
(4) Wing flaps - as required (40° is recommended)
(5) Circuit Breaker or Switch "Alternator", Switches "Main Bus" and "Battery" - OFF

LOSS OF ENGINE POWER DURING FLIGHT

(1) Push Thrust Lever full forward (Take-off position).
(2) Fuel Selector to tank with sufficient fuel quantity and temperature
(3) Electrical Fuel Pump - ON
(4) Establish Best Glide Speed
(5) Check engine parameters (FADEC lights, oil pressure and temperature, fuel quantity)

If normal engine performance is not achieved, the pilot should:

i) Land as soon as possible.
ii) Be prepared for an emergency landing
iii) Expect an engine failure.

▲ **WARNING:** The high-pressure pump must be checked before the next flight.

EMERGENCY LANDING WITH ENGINE OUT

If all attempts to restart the engine fail and an emergency landing is imminent, select suitable site and proceed as follows:

(1) When field can easily be reached slow down to 63 KIAS for shortest landing.

(2) Fuel Selector - CLOSED

(3) Engine Master - OFF

(4) Flaps - as required (40° is recommended)

(5) Circuit Breaker or Switch "Alternator", Switches "Main Bus" and Battery" - OFF

(6) Seat belts and harnesses - TIGHT

(7) Touch-down-slightly nose up attitude

(8) Brake firmly

◆ Note: Gliding Distance. Refer to Figure "Glide range" in Section 5 of this Supplement to the Pilot's Operating Handbook.

ENGINE FIRE IN FLIGHT

(1) Engine Master - OFF

(2) Fuel Selector - CLOSED

(3) Selector an appropriate airspeed to avoid engine overspeed

(4) Electrical Fuel Pump - OFF (if in use)

(5) Switch "Main Bus" - OFF

(6) Cabin heat and defroster - OFF

(7) Perform emergency landing (as described in the procedure "Emergency Landing With Engine Out")

ELECTRICAL FIRE IN FLIGHT

The first signs of an electrical fire is usually the odour of burning or smouldering insulation. Proceed as follows:

(1) Switch "Main Bus" - OFF
(2) Switch "Avionics" - OFF
(3) Vents - OPEN
(4) Cabin Heat - OFF
(5) Fire Extinguisher – Activate (if available)

▲ **WARNING:** After the fire extinguisher has been used, make sure that the fire is extinguished before exterior air is used to remove smoke from the cabin.

If there is evidence of continued electrical fire, consider turning off battery and alternator.

▲ **WARNING:** If the FADEC Backup battery is not installed this will shut down the engine and require an emergency landing. The engine has been demonstrated to continue operating for a maximum of 30 minutes when powered by the FADEC Backup battery only.

(6) Check Circuit Breaker, do not reset if open
(7) Switch "Main Bus" - ON
(8) Switch "Avionics" - ON

▲ **WARNING:** Turn on only electrical equipment required to continue flight depending on the situation and land as soon as practical.
Do only switch ON one at a time, with delay after each.

LOSS OF OIL PRESSURE (<2.3 bar IN CRUISE (amber range) OR <1.2 bar AT IDLE (red range))

(1) Reduce power as quickly as possible

(2) Check oil temperature: If the oil temperature is high or near operating limits,

i) Land as soon as possible.

ii) Be prepared for an emergency landing.

iii) Expect an engine failure.

◆ Note: During warm-weather operation or longer climbouts at low airspeed engine temperatures could rise into the amber range and trigger the caution light. This warning allows the pilot to avoid overheating of the engine as follows:

(1) Increase airspeed by decreasing the pitch angle

(2) Reduce power, if the engine temperatures approach the red area

LOSS OF FUEL PRESSURE

Not applicable for TAE 125 installation

HIGH OIL TEMPERATURE ("OT" in red range)

(1) Increase airspeed and reduce power as quickly as possible
(2) Check the oil pressure: if the oil pressure is lower than normal (<2.3 bar at cruise or <1.2 bar at idle),
    i) Land as soon as possible.
    ii) Be prepared for an emergency landing.
    iii) Expect an engine failure.
(3) If the oil pressure is in normal range:
    i) Land as soon as practical.

HIGH COOLANT TEMPERATURE ("CT" in red range)

(1) Increase airspeed and reduce power as quickly as possible
(2) Cabin Heat and Shut Off Cabin Heat - COLD, resp. CLOSED
(3) If this reduces the coolant temperature to within the normal operating range quickly, continue to fly normally and observe coolant temperature, Cabin Heat as required
(4) As far as this does not cause the coolant temperature to drop
    i) Land as soon as practical.
    ii) Be prepared for an emergency landing.
    iii) Expect an engine failure.

"Water Level" LIGHT ILLUMINATES

(1) Increase airspeed and reduce power as quickly as possible
(2) Coolant temperature "CT" - CHECK and OBSERVE
(3) Oil temperature "OT" - CHECK and OBSERVE
(4) As far as coolant temperature and/or oil temperature are rising into amber or red range,
    i) Land as soon as practical.
    ii) Be prepared for an emergency landing.
    iii) Expect an engine failure.

HIGH GEARBOX TEMPERATURE ("GT" in red range)

(1) Reduce power to 55% - 75% as quickly as possible
(2) Land as soon as practical

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

■ CAUTION: The TAE 125 requires an electrical power source for its operation. If the alternator fails, continued engine operation time is dependant upon the remaining capacity of the main batter, the FADEC backup battery (if installed) and equipment powered. The engine has been demonstrated to continue operating for approximately 120 minutes based upon the following assumptions:

Equipment		Time switched on	
		in [min]	in [%]
NAV/COM 1 receiving	ON	120	100
NAV/COM 1 transmitting	ON	12	10
NAV/COM 2 receiving	OFF	0	0
NAV/COM 2 transmitting	OFF	0	0
GPS	ON	60	50
Transponder	ON	120	100
Fuel Pump	OFF	0	0
AED-125	ON	120	100
Battery Ignition Relay	ON	120	100
CED-125	ON	120	100
Landing Light	ON	12	10
Flood Light	ON	1.2	1.0
Pilot Heat	ON	24	20
Wing Flaps	ON	1.2	1.0
Interior Lightning	OFF	0	0
Navigation Lights	OFF	0	0
Beacon Lights	OFF	0	0
Strobe Lights	OFF	0	0
ADF	OFF	0	0
Intercom	OFF	0	0
Turn Indicator	OFF	0	0
Engine control system	ON	120	100

(continued next page)

■ CAUTION: This table only gives a reference point. The pilot should turn off all nonessential items and supply power only to equipment which is absolutely necessary for continued flight depending upon the situation.
If deviated from this recommendation, the remaining engine operating time may change.

▲ **WARNING:** If the power supply from both alternator and main battery is interrupted, continued engine operation is dependant on the remaining capacity of the FADEC backup battery (if installed). The engine has been demonstrated to continue operating for 30 minutes when powered by the FADEC backup battery only. In this case, all electrical equipment will not operate:
- land immidiately
- do not switch the „FORCE-B“ switch, this will shut down the engine

ALTERNATOR WARNING LIGHT ILLUMINATES DURING NORMAL ENGINE OPERATION

(1) Ammeter - CHECK

(2) Circuit Breaker or Switch "Alternator" CHECK - ON

■ CAUTION: If the FADEC was supplied by battery only until this point, the RPM can momentarily drop, when the alternator will be switched on. In any case: leave the alternator switched ON!

(3) Battery Switch CHECK - ON

(4) Electrical load - REDUCE IMMEDIATELY depending upon operation as follows:

- i) NAV/ COM 2 – OFF
- ii) Fuel Pump – OFF
- iii) Landing Light – OFF (use as required for landing)
- iv) Taxi Light – OFF
- v) Strobe Light – OFF
- vi) Nav Lights – OFF
- vii) Beacon – OFF
- viii) Interior Lights – OFF
- ix) Intercom – OFF
- x) Pitot Heat – OFF (use as required)
- xi) Autopilot – OFF
- xii) Non-essential equipment – OFF

(5) The pilot should

- i) Land as soon as practical.
- ii) Be prepared for an emergency landing.
- iii) Expect an engine failure.

AMMETER SHOWS BATTERY DISCHARGE DURING NORMAL ENGINE OPERATION FOR MORE THAN 5 MINUTES

◆ Note: When the AED Ammeter indication is illuminated at the outer left side and the voltage indication is decreasing simultaneously, the battery is being discharged.

(1) Circuit Breaker or Switch "Alternator" CHECK - ON

■ CAUTION: If the FADEC was supplied by battery only until this point, the RPM can momentarily drop, when the alternator will be switched on. In any case: leave the alternator switched ON!

(2) Battery Switch CHECK - ON

(3) Electrical load - REDUCE IMMEDIATELYdepending upon operation as follows:

i) NAV/ COM 2 – OFF
ii) Fuel Pump – OFF
iii) Landing Light – OFF (use as required for landing)
iv) Taxi Light – OFF
v) Strobe Light – OFF
vi) Nav Lights – OFF
vii) Beacon – OFF
viii) Interior Lights – OFF
ix) Intercom – OFF
x) Pitot Heat – OFF (use as required)
xi) Autopilot – OFF
xii) Non-essential equipment – OFF

(4) The pilot should,

i) Land as soon as practical.
ii) Be prepared for an emergency landing.
iii) Expect an engine failure.

TOTAL ELECTRICAL FAILURE

(all equipment inoperative, except engine)

▲ **WARNING:** If the power supply from both alternator and main battery is interrupted simultaneously, continued engine operation is dependant on the remaining capacity of the FADEC backup battery. The engine has been demonstrated to continue operating for 30 minutes when powered by the FADEC backup battery only. In this case, all other electrical equipment will not operate.

▲ **WARNING:** If the aircraft was operated on battery power only until this point (alternator warning light illuminated), the remaining engine operating time may be less than 30 minutes.

(1) Circuit Breaker or Switch "Alternator" CHECK – ON
(2) Battery Switch CHECK – ON
(3) Land as soon as possible
    i) Be prepared for an emergency landing
    ii) Expect an engine failure

▲ **WARNING:** Do not active the FORCE-B switch, this will shut down the engine.

FADEC WARNING LIGHTS ILLUMINATE

◆ Note: The FADEC consists of two components that are independent of each other: FADEC A and FADEC B. In case of malfunctions in the active FADEC, it automatically switches to the other.

One FADEC Light is flashing

(1) Press FADEC-Testknob at least 2 seconds
(2) FADEC Light extinguished (LOW category warning):
    a) Continue flight normally
    b) Inform service center after landing
(3) FADEC Light steady illuminated (HIGH category warning):
    a) Observe the other FADEC light
    b) Land as soon as practical
    c) Select an airspeed to avoid engine overspeed
    d) Inform service center after landing

(continued next page)

Both FADEC Lights are flashing

◆ Note: The load display may not correspond to the actual value.

(1) Press FADEC-Testknob at least 2 seconds
(2) FADEC Light extinguished (LOW category warning):
  a) Continue flight normally
  b) Inform service center after landing
(3) FADEC Light steady illuminated (HIGH category warning):
  a) Check the available engine power
  b) Expect engine failure
  c) Flight can be continued, however the pilot should:
    i) Select an appropriate airspeed to avoid engine overspeed.
    ii) Land as soon as possible.
    iii) Be prepared for an emergency landing.
  d) Inform service center after landing.
(4) In case a tank was flown dry, proceed at the first signs of insufficient fuel feed as follows:
  a) Immediately switch the Fuel Selector to tank with sufficient fuel quantity.
  b) Electrical Fuel Pump - ON
  c) Select an appropriate airspeed to avoid engine overspeed.
  d) Check the engine (engine parameters, airspeed / altitude change, whether the engine responds to changes in the Thrust Lever position).
  e) If the engine acts normally, continue the flight and land as soon as practical.

▲ **WARNING:** The high-pressure pump must be checked before the next flight

ABNORMAL ENGINE BEHAVIOR

If the engine acts abnormally during flight and the system does not automatically switch to the B-FADEC, it is possible to switch to the B-FADEC manually.

▲ **WARNING:** It is only possible to switch from the automatic position to B-FADEC (A-FADEC is active in normal operation, B-FADEC is active in case of malfunction). This only becomes necessary when no automatic switching occurred in case of abnormal engine behavior.

(1) Select an appropriate airspeed to avoid engine overspeed

▲ **WARNING:** When opearting on FADEC backup battery only, the "Force B" switch must not be activated. This will shutdown the engine.

(2) "Force B" switch - SELECT manually to B-FADEC
(3) Flight may be continued, but the pilot should:
    i) Select an appropriate airspeed to avoid engine overspeed.
    ii) Land as soon as practical
    iii) Be prepared for an emergency landing

SPIN RECOVERY

No change for the TAE 125 installation

OPEN DOOR

No change for the TAE 125 installation

ROUGH ENGINE OPERATION

ENGINE MALFUNCTION DURING FLIGHT

◆ Note: Flying a tank dry activates both FADEC lights flashing.

In case that one tank was flown dry, at the first signs of insufficient fuel feed proceed as follows:

(1) Immediately switch the Fuel Selector to tank with sufficient fuel quantity
(2) Electrical Fuel Pump - ON
(3) Check the engine (engine parameters, airspeed/altitude change, whether the engine responds to changes in the Thrust Lever position)
(4) If the engine acts normally, continue the flight and land as soon as practical.

▲ **WARNING:** The high-pressure pump must be checked before the next flight.

PROPELLER RPM TOO HIGH

with propeller RPM between 2,300 and 2,400 for more than 20 seconds or over 2,400:

(1) Reduce power
(2) Reduce airspeed below 100 KIAS or as appropriate to prevent propeller overspeed
(3) Set power as required to maintain altitude and land as soon as practical.

◆ Note: If the propeller speed control fails, climb flights can be performed at 65 KIAS/ 75 mph and a power setting of 100%. In case of overspeed the FADEC will reduce the engine power at higher airspeeds to avoid propeller speeds above 2500 rpm

FLUCTUATIONS IN PROPELLER RPM

If the propeller RPM fluctuates by more than +/- 100 RPM with a constant Thrust Lever position:

(1) Change the power setting and attempt to find a setting where the propeller RPM no longer fluctuates
(2) If this does not work, set the maximum power at an airspeed <100 KIAS until the propeller speed stabilizes
(3) If the problem is resolved, continue the flight
(4) If the problem continues, reduce power to 55% - 75& or select a power level where the propeller RPM fluctuations are minimum. Fly at an airspeed below 110 KIAS and land as soon as practical

ENGINE SHUT DOWN IN FLIGHT

If it is necessary to shut down the engine in flight (for instance, abnormal engine behavior does not allow continued flight or there is a fuel leak, etc.), proceed as follows:

(1) Select an appropriate airspeed to avoid engine overspeed
(2) Engine Master - OFF
(3) Fuel Selector - CLOSED
(4) Electrical Fuel Pump - OFF (if in use).
(5) If the propeller also has to be stopped (for instance, due to excessive vibrations)
    i) Reduce airspeed to below 55 KIAS.
    ii) when the propeller is stopped, continue to glide at 73 KIAS.

RESTART AFTER ENGINE FAILURE

Whilst gliding to a suitable landing strip, try to determine the reason for the engine malfunction. If time permits and a restart of the engine is possible, proceed as follows:

(1) Airspeed between 65 and 85 KIAS (maximal 100 KIAS)

(2) Glide below 13000 ft

(3) Fuel Selector to tank with sufficient fuel quantity and temperature

(4) Electrical Fuel Pump - ON

(5) Thrust Lever - IDLE

(6) Engine Master OFF, than ON (if the propeller does not turn, then additionally “Starter“ ON)

(7) Check the engine power: Thrust Lever 100%, engine parameters, check altitude and airspeed

◆ Note: The propeller will normally continue to turn as long as the airspeed is above 65 KIAS. Should the propeller stop at an airspeed of 65 KIAS or more, the reason for this should be found out before attempting a restart. If it is obvious that the engine or propeller is jammed, do not use the starter

◆ Note: If the Engine Master is in position OFF, the load display shows 0% even if the propeller is turning.

CARBURETOR ICING

Not applicable for the TAE installation.

FLIGHT IN ICING CONDITIONS

▲ **WARNING:** Flight into known icing conditions is prohibited.

In case of inadvertent icing encounter proceed as follows:

(1) Pitot Heat switch - ON (if installed)

(2) Turn back or change the altitude to obtain an outside air temperature that is less conducive to icing.

(3) Cabin heat control full and open defroster outlets to obtain maximum windshield defroster airflow. Adjust cabin air control to get maximum defroster heat and airflow.

(4) Advance the Thrust Lever to increase the propeller speed and keep ice accumulation on the propeller blades as low as possible.

(5) Watch for signs of air filter icing and pull the "Alternate Air Door" control if necessary. An unexplained loss in engine power could be caused by ice blocking the air intake filter. Opening the "Alternate Air Door" allows preheated air from the engine compartment to be aspirated.

(6) Plan a landing at the nearest airfield. With an extremely rapid ice build up, select a suitable "off airfield" landing side.

(7) With an ice accumulation of 0.5 cm or more on the wing leading edges, a significantly higher stall speed should be expected.

(8) Leave wing flaps retracted. With a severe ice build up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.

(9) Open left window, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.

(10) Perform a landing approach using a forward slip, if necessary, for improved visibility.

(11) Approach at increased airspeed depending upon the amount of the accumulation.

(12) Perform a landing in level attitude.

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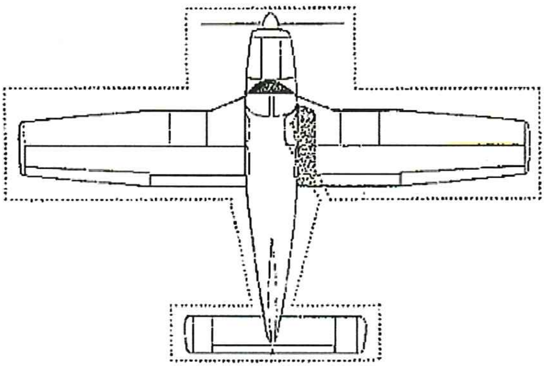
SECTION 4
NORMAL PROCEDURES

PREFLIGHT INSPECTION



PREPARATION

Airplane status .... airworthy, papers on board
Logbook ....CHECK refuelling with allowed fuel (see section 2)
Weather ....suitable
Baggage .... weighed, stowed, tied
Weight and CG ....within limits
Navigation .... planned
Charts and navigation equipment ....on board
Performance and range .... computed and safe

COCKPIT

Control wheel .... release belts
Avionics .... OFF
Parking brake .... SET
Electric switches .... OFF
Engine Master switch .... OFF
Shut-off Cabin Heat .... OPEN

▲ **WARNING:** When turning on the battery switch, using an external power source, or pulling the propeller through by hand, treat the propeller as if the Engine Master was ON.

Switches "Battery" and "Main Bus“ .... ON
Fuel quantity gauges .... CHECK
Fuel Temperature .... CHECK
"Water level" Light on AED .... CHECK, that OFF
Annunciator panel .... CHECK
Switches "Battery" and "Main Bus“ .... OFF
Flight Controls .... CHECK
Flaps .... CHECK
Trim .... CHECK, set NEUTRAL
Pitot drain .... DRAIN, CLOSE
Static drain .... DRAIN, CLOSE
Windows .... CHECK, CLEAN
Tow bar .... STOW
Baggage .... SECURE
Baggage door .... CLOSE, SECURE

RIGHT WING

Wing .... free of ice, snow, frost
Control surfaces .... CHECK for interference
.... free of ice, snow, frost
Hinges .... CHECK for interference
Static wicks .... CHECK
Wing tip and lights .... CHECK
Fuel tank .... CHECK supply visually,
.... fuel level not above bottom of filler indicator tab
.... secure caps
Fuel tank sump .... DRAIN, CHECK for water
.... sediment and proper fuel (see section 2)
Fuel vent .... CLEAR
Tie down and chock .... REMOVE
Main gear strut .... Proper Inflation (114 ± 6 mm / 4.50 in.)
Tire .... CHECK
Brake block and discs .... CHECK
Fresh air inlet .... CLEAR

NOSE

Oil .... CHECK level
Oil dipstick .... SECURE
Fuel and oil .... CHECK for leaks
Cowling .... SECURE
Windshield .... CHECK
Propeller and spinner .... CHECK
Air inlets .... UNDAMAGED and CLEAR
Landing light .... CHECK
Gearbox oil .... CHECK level
Nose chock .... REMOVE
Nose gear strut .... Proper Inflation (83 ± 6 mm / 3.25 in.)
Nose wheel tire .... CHECK
Fuel strainer .... DRAIN
.... CHECK for watersediment and proper fuel (see section 2)

LEFT WING

Wing .... free of ice, snow, frost
Fresh air inlet .... CLEAR
Main gear strut .... Proper Inflation (114 ± 6 mm / 4.50 in.)
Tire .... CHECK
Brake block and discs .... CHECK
Fuel tank .... CHECK supply visually,
.... fuel level not above bottom of filler indicator tab
.... secure caps
Fuel tank sump .... DRAIN, CHECK for water,
.... sediment and proper fuel (see section 2)
Fuel vent .... CLEAR
Tie down and chock .... REMOVE
Pitot heat .... REMOVE cover - holes CLEAR
Wing tip and lights .... CHECK
Control surfaces .... CHECK for interference-
.... free of ice, snow, frost
Hinges .... CHECK for interference
Static wicks .... CHECK

FUSELAGE

Antennas .... CHECK
Empennage .... free of ice, snow, frost
Fresh air inlet .... CLEAR
Stabilator and trim tab .... CHECK for interference
Tie down .... REMOVE
Battery switch .... ON
Check lighting .... CHECK
Nav and strobe lights .... CHECK
Stall warning .... CHECK
Pitot heat .... CHECK
All switches .... OFF
Passengers .... board

Cabin door .... CLOSE and SECURE
Seat belts and harnesses .... FASTEN - CHECK inertia reel

BEFORE STARTING ENGINE

Brakes .... SET
Fuel Selector .... desired tank
Radios .... OFF
Alternate Air Door .... CLOSED

STARTING ENGINE

▲ **WARNING:** It is not allowed to start up the engine using external power. If starting the engine is not possible using battery power, the condition of the battery must be verified before flight.

Thrust Lever .... IDLE
Circuit Breaker "Alternator" .... CHECK IN
or
Switch "Alternator" .... ON
Switches "Battery" and "Main Bus" .... ON
.... CHECK fuel quantity and temperature

■ CAUTION: The electronic engine control needs an electrical power source for its operation. For normal operation battery, alternator and main bus have to be switched on. Separate switching is only allowed for tests and in the event of emergencies.

Strobe lights .... ON
Electrical fuel pump .... ON
Engine Master .... ON
Glow Control Light .... CHECK ON, then OFF

(continued next page)

Starter .... ENGAGE until engine starts
Oil pressure.. CHECK

■ CAUTION: Shut down the engine immediately if the minimum oil pressure of 1 bar is not indicated after 3 seconds!

CED/AED Test Button............ PRESS (to delete Caution Light)
Ammeter .... CHECK for positive charging current
Voltmeter.. CHECK for GREEN range
FADEC Backup Battery Test (if installed)

a) Alternator .... OFF, engine must operate normally
b) Battery .... OFF, for min. 10 seconds; engine must operate normally, the red FADEC lamps must not be illuminated
c) Battery ....ON
d) Alternator ....ON

▲ **WARNING** It must be ensured that both battery and alternator are ON!
If the guarded alternator switch is installed, the switch guard must be closed.

Avionics..ON
Ammeter .... Check for positive charging current
Voltmeter... Check for green range

STARTING ENGINE WHEN COLD....................................N/A
STARTING ENGINE WHEN HOT......................................N/A
STARTING ENGINE WHEN FLOODED.............................N/A
GROUND CHECK...N/A

WARM UP

Let the engine warm up for about 2 minutes at 890 RPM.

Increase RPM to 1400 until Oil temperature 50 °C, Coolant temperature 60 °C.

FADEC AND PROPELLER ADJUSTMENT FUNCTION CHECK

a) Thrust Lever - IDLE, both FADEC lights should be OFF
b) FADEC Test Button - PRESS and HOLD for entire test
c) Both FADEC lights - ON, RPM increases

▲ **WARNING:** If the FADEC lights do not come on at this point, it means that the test procedure has failed and take-off should **not** be attempted.

d) The FADEC automatically switches to B-component (only FADEC B light is ON)
e) The propeller control is excited; RPM decreases
f) The FADEC automatically switches to A-component (only FADEC A light is ON), RPM increases
g) The propeller control is excited; RPM decreases
h) FADEC A light goes OFF, idle RPM is reached, the test is completed
i) FADEC Test Button - RELEASE

▲ **WARNING:** If there are prolonged engine misfires or the engine shuts down during the test, take off may not be attempted.

▲ **WARNING:** The whole test procedure has to be performed without any failure. In case the engine shuts down or the FADEC lights are flashing, take-off is prohibited. This applies even if the engine seems to run without failure after the test.

◆ Note: If the Test Button is released before the self-test is over, the FADEC immediately switches over to normal operation.

◆ Note: While switching from one FADEC to another, it is normal to hear and feel a momentary surge in the engine.

Thrust Lever .... FULL FORWARD,
.... load display min. 94%, RPM 2240 - 2300
Thrust Lever .... IDLE

BEFORE TAKE-OFF

Circuit Breaker or Switch "Alternator", Switches "Battery" and "Main Bus“.. CHECK ON
Flight instruments.. CHECK
Alternator Warning Light .... OFF
Fuel Selector... proper tank
Fuel Temperature .... CHECK
Electrical Fuel Pump .... ON
Engine Instruments... CHECK
Alternate Air Door .... CLOSED
Seat backs .... ERECT
Belts / harness .... FASTENED / CHECK
Empty seats. .... seat belts snugly FASTENED
Flaps .... SET
Trim tab .... SET
Controls.. FREE
Door .... LATCH

TAKE-OFF

Normal take-off - PA 28-140/-150/-160/-180

Flaps .... 10° (first notch)
Trim .... SET
Accelerate to 57 KIAS
Control wheel .... back pressure to rotate to climb attitude

Accelerate to and maintain 65 KIAS until obstacle clearance is achieved.

Best rate climb speed (flaps 10°) .... 70 KIAS

◆ Note: For better engine cooling a climb speed of 79 KIAS is recommended.

Flaps .... RETRACT slowly

Normal take-off - PA 28-151/161

Flaps .... 10° (first notch)
Trim .... SET
Accelerate to 50 KIAS
Control wheel .... back pressure to rotate to climb attitude

Accelerate to and maintain 55 KIAS until obstacle clearance is achieved.

Best rate climb speed (flaps 10°) .... 65 KIAS

◆ Note: For better engine cooling a climb speed of 79 KIAS is recommended.

Flaps .... RETRACT slowly

CLIMB

Best rate climb speed (flaps up)
PA 28-140/150/160/180 .... 75 KIAS
PA 28-151/161 .... 70 KIAS

◆ Note: For better engine cooling a climb speed of 79 KIAS is recommended.

En route .... 87 KIAS
Electrical Fuel Pump .... OFF at desired altitude

CRUISING

Cruise Power .... SET
.... (max. 100%, 75% or less is recommended)
CED 125, AED 125 and Caution Light .... MONITOR
.... (oil pressure, water level as well as temperature of oil,
.... water, gearbox and fuel within operating limits)
Fuel quantity .... MONITOR
(Gauges and LOW LEVEL caution lights)

Select the other fuel tank approximately every 30 minutes to empty and heat both tanks equally (observe Section 2 "Operating Limits" Chapter "Engine Operating Limits").

■ CAUTION: Do not use any fuel tank below the minimum permissible fuel temperature!

FADEC Warning Lights .... MONITOR

DESCENT

Normal

Thrust Lever .... AS REQUIRED
Airspeed .... NOT EXCEED V_{NO}

Power off

Thrust Lever .... IDLE
Airspeed .... AS REQUIRED
Power ....verify with Thrust Lever every 30 seconds

APPROACH AND LANDING

Fuel Selector .... proper tank
Seat backs .... ERECT
Belts / harness .... FASTEN / CHECK
Electrical Fuel Pump .... ON
Flaps .... SET - NOT EXCEED V_{FE}
Trim .... to 70 KIAS
Final approach speed (flaps 40°) .... 63 KIAS

STOPPING ENGINE

Flaps .... RETRACT
Electrical Fuel Pump .... OFF
Radios .... OFF
Thrust Lever .... IDLE
Engine Master .... OFF
Switches "Battery" and "Main Bus" .... OFF

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SECTION 5
PERFORMANCE

FLIGHT PLANNING EXAMPLE

◆ Note: The information contained in this Section is to be used for example purposes only. The maximum weights according to section 2 are to be observed for flight planning.
This example is based on a PA 28-161 - Normal category;
Max. Ramp Weight 1056 kg (2327 lbs),
Max. Take-Off Weight 1055 kg (2325 lbs)

a) Airplane Loading

The first step in planning a flight is to calculate the airplane weight and center of gravity by utilizing the information provided by Section 6 (Weight and Balance) of this supplement to the Pilot's Operating Handbook.

The Basic Empty Weight of the airplane, determined by the company who made the modification, has been entered in Figure 6-5a of this supplement. If any alterations to airplane have been made affecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current Basic Empty Weight of the airplane.

Make use of the Weight and Balance Loading Form (Figure 6-11a) of this supplement and the C.G. Range and Weight graph of the EASA approved Pilot's Operating Handbook approved to determine the total weight of the airplane and the center of gravity position.

After proper utilization of the information provided, the following weights apply to the flight planning example:

The landing weight cannot be determined until the weight of fuel to be used has been established (refer to item (g)(1)).

(1) Basic Empty Weight .... 730 kg (1609 lbs)

(2) Occupants (2 x 77 kg/ 170 lbs)................ 154 kg (340 lbs)

(3) Baggage and cargo .... 24 kg (51 lbs)

(4) Fuel (0.84 kg/l x 170 l, 7 lb/gal x 45 US gal, JET A-1) .... 142 kg (315 lbs)

(5) Take-off Weight .... 1,050 kg (2315 lbs)

(6) Landing Weight

(a) (5) minus (g) (1)
(1050 kg minus 51.6 kg).............................. 998.4 kg
(2317 lbs minus 113.4 lbs) ....2201.6 lbs

The take-off weight is below the maximum of 1055 kg (2325 lbs), and the weight and balance calculations have determined that the C.G. position is within the approved limits.

(b) Take-off and landing

Now that the aircraft loading has been determined, all aspects of the take-off and landing must be considered.

All of the existing conditions at the departure and destination airport must be acquired, evaluated and maintained throughout the flight.

Apply the departure airport conditions and take-off weight to the appropriate take-off performance figures (Figure 5-1) to determine the length of runway necessary for the take-off and/ or the barrier distance.

The landing distance calculations are performed in the same manner using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The take-off and landing distances required for the example flight have fallen well below the available runway lengths.

		Departure Airport	Destination Airport
(1)	Pressure Altitude	1,500ft	2,500 ft
(2)	Temperature	27°C (ISA + 15°C) 81°F (ISA + 27°F)	24°C (ISA + 14°C) 75°F (ISA + 25°F)
(3)	Wind Component	0 knots	0 knots
(4)	Runway Length Available	1,463 m	2,316 m

The takeoff distance chart, Figure 5-1 (Takeoff Distance), should be consulted, keeping in mind that distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, temperature and altitude. For example, in this particular sample problem, the takeoff distance information presented for a weight of 1,055 kg, pressure altitude of 2000 ft and a temperature of ISA+20°C/ +36°F should be used and results in the following:

Ground Roll	424 m (1391ft)
Total Distance to clear a 15 m obstacle	714 m (2343ft)

For calculation of landing distance refer to original POH

◆ Note: The remainder or the performance charts used in this flight planning example assume no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

(c) Climb

The next step in the flight plan is to determine the necessary climb segment components.
The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the table "Time, Fuel and Distance to Climb" (Tab. 5-3). After time, distance and quantity of fuel for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to Tab. 5-3. Now, subtract the values obtained from the table for the field of departure conditions from those for the cruise pressure altitude.The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example:

(1) Cruise Pressure Altitude................................ 5,000 ft
(2) Cruise OAT...... 16°C (ISA + 11°C)/ 61°F (ISA + 20°F)

Due to the difference in temperature to the standard atmosphere, the following correction applies:

$$\frac{11\,°C(20\,°F)}{10\,°C(18\,°F)} x10\% \;=\; 11\% \text{ Increase}$$

(3) Time to Climb
(8.4 min minus 1.6 min = 6.8) + 11%) .... 7.5 min
(4) Distance to Climb
((10.4 NM minus 1.9 NM = 8.5) + 11%)...........9.4 NM
(5) Fuel to Climb
((4.3 l minus 0.8 l Jet A-1 = 3.5 l) + 11%)............ 3.9 l
((1.1 minus 0.2 US gal = 0.9 US gal) + 11%) 1 US gal
(6) Fuel to start-up, taxi and take-off............1l/ 0.3 US gal
(7) Fuel for start-up, taxi and take-off and climb
(1 l plus 3.9 l).. 4.9 l
(0.3 US gal plus 1 US gal)......................... 1.3 US gal

(d) Descent

To determine the descent data for fuel, time and distance Table 5-4 "Cruise performance, range and endurance" can be used with sufficient accuracy.

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb to establish the total cruise distance.

Calculate the cruise fuel consumption for the cruise power setting with Table 5-4.

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel consumption by the cruise time.

The cruise calculations established for the cruise segment of the flight planning example are as follows:

(1) Total Distance .... 300 NM

(2) Cruise Distance
(e)(1) minus (c)(4)
(300 NM - 9.4 NM) .... 290.6 NM

(3) Cruise Power 70%

(4) Cruise Speed (98 KTAS + 2%) .... 100 KTAS

(5) Cruise Fuel Consumption .... 19.4 l/h (5.1 US gal/h)

(6) Cruise Time
(e)(2) divided by (e)(4)
(290.6 NM divided by 100 KTAS) .... =2.91 h

(7) Cruise Fuel
(e)(5) multiplied by (e)(6)
(19.4 l/h x 2.91 h) .... =56.5 l
(5.1 US gal/h x 2.91 h) .... =14.9 US gal

(f) Total Flight Time

The total flight time is determined by adding the time to climb and the cruise time.

◆ Note: The time values taken from the climb table are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example:

Total Flight Time
(c)(3) plus (e)(6)
(0.1 h + 2.91 h) .... =3.01 h

(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb and the cruise fuel. When the total fuel (in US gal or liters) is determined, multiply this value by 0.84 kg/l (7 lb/US gal) for JET A-1 or for Diesel to determine the total fuel weight used for flight.

The total fuel calculations for the example flight plan are shown below:

(1) Total Fuel Required
(c)(7) plus (e)(7)
(4.9 l plus 56.5 l of Jet A-1)................................ 61.4 l
(1.3 US gal plus 14.9 US gal) .... 16.2 US gal
(61.4 l x 0.84 kg/l) .... 51.6 kg
(16.2 US gal x 7 lb/ US gal) ....113.4 lbs

TAKE-OFF DISTANCE for PA-28-151/-161

Conditions:
Flaps 10°
Full Power Prior to Brake Release
Paved, level, dry runway
Zero Wind
Lift-off speed: 50 KIAS
Speed at 15 m (50 ft): 55 KIAS

Notes:

(1) Decrease distances 10% for each 9 Knots headwind; Increase distances 10% for each 2 knots of tailwind up to 10 Knots.

(2) For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.

(3) Consider additionals for wet grass runway, softened ground or snow.

Takeoff Distance at 1,055 kg (2325 lbs) PA 28-151/-161

PRESS ALT	DISTANCE	TEMPERATURE - °C			
[ft]	[m]	ISA	ISA+10°C	ISA+20°C	ISA+30°C
0	Gnd Roll	309	337	366	397
	50 ft	512	560	611	665
1000	Gnd Roll	333	362	394	427
	50 ft	553	605	661	719
2000	Gnd Roll	358	390	424	460
	50 ft	598	654	714	777
3000	Gnd Roll	386	421	458	496
	50 ft	647	708	773	841
4000	Gnd Roll	417	454	493	535
	50 ft	701	766	837	910
5000	Gnd Roll	450	490	532	577
	50 ft	759	830	906	986
6000	Gnd Roll	485	529	575	623
	50 ft	822	900	982	1068

PRESS ALT	DISTANCE	TEMPERATURE - °F			
[ft]	[m]	ISA	ISA+18°F	ISA+36°F	ISA+54°F
0	Gnd Roll	1014	1106	1201	1302
	50 ft	1680	1837	2005	2182
1000	Gnd Roll	1093	1188	1293	1401
	50 ft	1814	1985	2169	2359
2000	Gnd Roll	1175	1280	1391	1509
	50 ft	1962	2146	2343	2549
3000	Gnd Roll	1266	1381	1503	1627
	50 ft	2123	2323	2536	2759
4000	Gnd Roll	1368	1490	1617	1755
	50 ft	2300	2513	2746	2986
5000	Gnd Roll	1476	1608	1745	1893
	50 ft	2490	2723	2972	3235
6000	Gnd Roll	1591	1736	1886	2044
	50 ft	2697	2953	3222	3504

Figure 5-1a Takeoff Distance at take-off weight 1055 kg (2325 lbs)

Takeoff Distance at 885 kg (1950 lbs) PA 28-151/-161

PRESS ALT	DISTANCE	TEMPERATURE - °C			
[ft]	[m]	ISA	ISA+10°C	ISA+20°C	ISA+30°C
0	Gnd Roll	196	213	232	251
	50 ft	324	355	387	421
1000	Gnd Roll	211	229	249	270
	50 ft	350	383	418	454
2000	Gnd Roll	227	247	269	291
	50 ft	379	414	452	492
3000	Gnd Roll	245	267	290	314
	50 ft	410	448	489	533
4000	Gnd Roll	264	287	312	339
	50 ft	444	485	530	576
5000	Gnd Roll	285	310	337	365
	50 ft	481	526	574	624
6000	Gnd Roll	307	335	364	395
	50 ft	521	570	622	677

PRESS ALT	DISTANCE	TEMPERATURE - °F			
[ft]	[m]	ISA	ISA+18°F	ISA+36°F	ISA+54°F
0	Gnd Roll	643	699	761	823
	50 ft	1063	1165	1270	1381
1000	Gnd Roll	692	751	817	886
	50 ft	1148	1257	1371	1490
2000	Gnd Roll	745	810	883	955
	50 ft	1243	1358	1483	1614
3000	Gnd Roll	804	876	951	1030
	50 ft	1345	1470	1604	1749
4000	Gnd Roll	866	942	1024	1112
	50 ft	1457	1591	1739	1890
5000	Gnd Roll	935	1017	1106	1198
	50 ft	1578	1726	1883	2047
6000	Gnd Roll	1007	1099	1194	1296
	50 ft	1709	1870	2041	2221

Figure 5-1b Takeoff Distance at take-off weight 885 kg (1950 lbs)

TAKE-OFF DISTANCE for PA-28-140/-150/-160/-180

Conditions:
Flaps 10°
Full Power Prior to Brake Release
Paved, level, dry runway
Zero Wind
Lift-off speed: 57 KIAS
Speed at 15 m (50 ft): 65 KIAS

Notes:

(1) Decrease distances 10% for each 9 Knots headwind; Increase distances 10% for each 2 Knots of tailwind up to 10 Knots.

(2) For operation on dry, grass runway, increase distances by 15% of the "ground roll" figure.

(3) Consider additionals for wet grass runway, softened ground or snow.

Takeoff Distance at 976 kg (2150 lbs) PA 28-140/-150/-160/-180

PRESS ALT	DISTANCE	TEMPERATURE - °C			
[ft]	[m]	ISA	ISA+10°C	ISA+20°C	ISA+30°C
0	Gnd Roll	297	323	352	381
	50 ft	543	594	648	705
1000	Gnd Roll	320	348	379	410
	50 ft	587	642	701	760
2000	Gnd Roll	345	345	408	442
	50 ft	635	694	758	824
3000	Gnd Roll	371	405	440	477
	50 ft	686	751	820	892
4000	Gnd Roll	401	436	474	514
	50 ft	743	813	887	965
5000	Gnd Roll	432	471	512	555
	50 ft	805	880	961	1046
6000	Gnd Roll	467	508	553	599
	50 ft	872	954	1041	1133

PRESS ALT	DISTANCE	TEMPERATURE - °F			
[ft]	[m]	ISA	ISA+18°F	ISA+36°F	ISA+54°F
0	Gnd Roll	974	1060	1155	1250
	50 ft	1781	1949	2126	2313
1000	Gnd Roll	1050	1142	1243	1345
	50 ft	1926	2106	2300	2493
2000	Gnd Roll	1132	1132	1339	1450
	50 ft	2083	2277	2487	2703
3000	Gnd Roll	1217	1329	1444	1565
	50 ft	2251	2464	2690	2927
4000	Gnd Roll	1316	1430	1555	1686
	50 ft	2438	2667	2910	3166
5000	Gnd Roll	1417	1545	1680	1821
	50 ft	2641	2887	3153	3432
6000	Gnd Roll	1532	1667	1814	1965
	50 ft	2861	3130	3415	3717

Figure 5-1c Takeoff Distance at take-off weight 976 kg (2150 lbs)

Takeoff Distance at 885 kg (1950 lbs) PA 28-140/-150/-160/-180

PRESS ALT	DISTANCE	TEMPERATURE - °C			
[ft]	[m]	ISA	ISA+10°C	ISA+20°C	ISA+30°C
0	Gnd Roll	231	251	273	296
	50 ft	422	462	504	548
1000	Gnd Roll	249	271	294	319
	50 ft	456	499	545	594
2000	Gnd Roll	268	292	317	344
	50 ft	493	540	589	641
3000	Gnd Roll	289	314	342	370
	50 ft	534	584	637	693
4000	Gnd Roll	311	339	396	400
	50 ft	578	632	690	750
5000	Gnd Roll	336	366	398	431
	50 ft	626	684	747	813
6000	Gnd Roll	363	395	430	465
	50 ft	678	742	810	881

PRESS ALT	DISTANCE	TEMPERATURE - °F			
[ft]	[m]	ISA	ISA+18°F	ISA+36°F	ISA+54°F
0	Gnd Roll	758	823	896	971
	50 ft	1385	1516	1654	1798
1000	Gnd Roll	817	889	965	1047
	50 ft	1496	1637	1788	1949
2000	Gnd Roll	879	958	1040	1129
	50 ft	1617	1772	1932	2103
3000	Gnd Roll	948	1030	1122	1214
	50 ft	1752	1916	2090	2274
4000	Gnd Roll	1020	1112	1299	1312
	50 ft	1896	2073	2264	2461
5000	Gnd Roll	1102	1201	1306	1414
	50 ft	2054	2244	2451	2667
6000	Gnd Roll	1191	1296	1411	1526
	50 ft	2224	2434	2657	2890

Figure 5-1d Takeoff Distance at take-off weight 885 kg (1950 lbs)

MAXIMUM CLIMBSPEED for PA-28-151/-161

Conditions:

Take-off weight 1055 kg (2325 lbs)
Climb speed V_y = 70 KIAS
Flaps Up
Full Power

Pressure altitude [FT]	Climbspeed (ft/min)			
	ISA	ISA + 10°C (ISA + 18°F)	ISA + 20°C (ISA + 36°F)	ISA + 30°C (ISA + 54°F)
0	606	606	602	595
1000	606	602	595	584
2000	603	596	585	569
3000	597	586	571	549
4000	588	572	552	523
5000	574	554	528	495
6000	556	531	500	461
7000	533	503	468	422
8000	506	470	431	380
9000	474	433	390	335
10000	437	392	346	287
11000	396	348	299	237
12000	351	301	251	

Figure 5-2a Climbspeed, PA-28-151/-161, 1055 kg (2325 lbs)

MAXIMUM CLIMBSPEED for PA-28-151/-161

Conditions:

Take-off weight 885 kg (1950 lbs)
Climb speed V_y = 70 KIAS
Flaps Up
Full Power

Pressure altitude [FT]	Climbspeed (ft/min)			
	ISA	ISA + 10°C (ISA + 18°F)	ISA + 20°C (ISA + 36°F)	ISA + 30°C (ISA + 54°F)
0	**759**	759	757	752
1000	**759**	757	753	744
2000	**758**	753	745	730
3000	**754**	746	732	711
4000	**747**	734	714	685
5000	**736**	716	689	650
6000	**719**	692	656	606
7000	**695**	659	615	551
8000	**663**	618	563	485
9000	**623**	567	500	406
10000	**572**	504	425	313
11000	**510**	430	337	204
12000	**436**	341	235	

Figure 5-2b Climbspeed, PA-28-151/-161, 855 kg (1950 lbs)

MAXIMUM CLIMBSPEED for PA-28-140/-150/-160/-180

Conditions:

Take-off weight 976 kg (2150 lbs)
Climb speed V_y = 75 KIAS
Flaps Up
Full Power

Pressure altitude [FT]	Climbspeed (ft/min)			
	ISA	ISA + 10°C (ISA + 18°F)	ISA + 20°C (ISA + 36°F)	ISA + 30°C (ISA + 54°F)
0	548	547	541	530
1000	547	542	531	513
2000	543	532	515	490
3000	534	517	493	460
4000	520	496	465	424
5000	499	468	430	381
6000	472	433	389	334
7000	437	393	343	281
8000	397	346	292	226
9000	351	296	239	171
10000	300	242	184	118
11000	246	187	131	70
12000	191	133	82	

Figure 5-2c Climbspeed, PA-28-140/-150/-160/-180, 976 kg (2150 lbs)

MAXIMUM CLIMBSPEED for PA-28-140/-150/-160/-180

Conditions:
Take-off weight 885 kg (1950 lbs)
Climb speed V_y = 75 KIAS
Flaps Up
Full Power

Pressure altitude [FT]	Climbspeed (ft/min)			
	ISA	ISA + 10°C (ISA + 18°F)	ISA + 20°C (ISA + 36°F)	ISA + 30°C (ISA + 54°F)
0	657	653	643	627
1000	654	644	629	607
2000	646	631	610	583
3000	633	612	586	552
4000	615	589	557	517
5000	592	560	523	477
6000	564	526	484	431
7000	531	487	440	381
8000	492	444	391	325
9000	449	395	337	264
10000	400	431	279	198
11000	346	282	215	126
12000	287	218	146	

Figure 5-2d Climbspeed, PA-28-140/-150/-160/-180, 855 kg (1950 lbs)

TIME, FUEL AND DISTANCE TO CLIMB for PA-28-151/-161

Notes :

(1) Add 1 l (0.3 US gal) of fuel for engine start, taxi and takeoff allowance.

(2) Increase time and distance by 10% for 10°C/ 18°F above standard temperature.

(3) Distances shown are based on zero wind.

(4) Time, distance and fuel required are only valid from the point where the airplane climbs at v_y = 70 KIAS.

Conditions:

Takeoff weight 1055 kg (2325 lbs); Climb speed v_y = 70 KIAS
Flaps Up; Full Power; Zero wind, Standard Temperature

				From Sea Level			
Press. Alt.	Temp. (ISA)		Rate of Climb	Time	Distance to climb	Fuel used	
[ft]	[°C]	[°F]	[ft/min]	[MIN]	[NM]	[US gal]	[l]
0	15	59	606	0.0	0.0	0.0	0.0
1000	13	55	606	1.6	1.9	0.2	0.8
2000	11	52	603	3.3	3.9	0.4	1.6
3000	9	48	597	5.0	6.0	0.7	2.5
4000	7	45	588	6.7	8.1	0.9	3.4
5000	5	41	574	8.4	10.4	1.1	4.3
6000	3	38	556	10.1	12.8	1.4	5.3
7000	1	34	533	12.0	15.3	1.7	6.3
8000	-1	30	506	13.9	18.0	2.0	7.4
9000	-3	27	474	15.9	21.0	2.2	8.5
10000	-5	23	437	18.1	24.3	2.6	9.7
11000	-7	20	396	20.5	27.9	2.9	11.0
12000	-9	16	351	23.2	32.1	3.2	12.3

Figure 5-3a Time, Fuel and Distance to Climb at 1055 kg (2325 lbs)
PA-28-151/-161

Conditions:

Takeoff weight 885 kg (1950 lbs); Climb speed v_y = 70 KIAS
Flaps Up; Full Power; Zero wind, Standard Temperature

				From Sea Level			
Press. Alt.	Temp. (ISA)		Rate of Climb	Time	Distance to climb	Fuel used	
[ft]	[°C]	[°F]	[ft/min]	[MIN]	[NM]	[US gal]	[l]
0	15	59	759	0.0	0.0	0.0	0.0
1000	13	55	759	1.3	1.5	0.2	0.6
2000	11	52	758	2.6	3.1	0.3	1.3
3000	9	48	754	4.0	4.8	0.5	2.0
4000	7	45	747	5.3	6.5	0.7	2.7
5000	5	41	736	6.6	8.2	0.9	3.5
6000	3	38	719	8.0	10.1	1.1	4.3
7000	1	34	695	9.4	12.0	1.4	5.2
8000	-1	30	663	10.9	14.1	1.6	6.0
9000	-3	27	623	12.5	16.4	1.8	7.0
10000	-5	23	572	14.1	18.9	2.1	7.9
11000	-7	20	510	16.0	21.7	2.4	9.0
12000	-9	16	436	18.1	25.0	2.7	10.1

Figure 5-3b Time, Fuel and Distance to Climb at 885 kg (1950 lbs)
PA-28-151/-161

TIME, FUEL AND DISTANCE TO CLIMB
for PA-28-140/-150/-160/-180

Notes :

(1) Add 1 l (0.3 US gal) of fuel for engine start, taxi and takeoff .
(2) Increase time and distance by 10% for 10°C/ 18°F above standard temperature.
(3) Distances shown are based on zero wind.
(4) Time, distance and fuel required are only valid from the point where the airplane climbs at v_y = 75 KIAS.

Conditions:

Takeoff weight 976 kg (2150 lbs); Climb speed v_y = 75 KIAS
Flaps Up; Full Power; Zero wind, Standard Temperature

				From Sea Level			
Press. Alt.	Temp. (ISA)		Rate of Climb	Time	Distance to climb	Fuel used	
[ft]	[°C]	[°F]	[ft/min]	[MIN]	[NM]	[US gal]	[l]
0	15	59	548	0.0	0.0	0.0	0.0
1000	13	55	547	1.8	2.2	0.2	0.9
2000	11	52	543	3.7	4.4	0.5	1.8
3000	9	48	534	5.5	6.8	0.7	2.7
4000	7	45	520	7.4	9.2	1.0	3.7
5000	5	41	499	9.4	11.9	1.2	4.7
6000	3	38	472	11.4	14.7	1.6	5.9
7000	1	34	437	13.6	17.8	1.9	7.1
8000	-1	30	397	16.0	21.3	2.2	8.4
9000	-3	27	351	18.7	25.2	2.6	9.8
10000	-5	23	300	21.8	29.8	3.0	11.3
11000	-7	20	246	25.4	35.3	3.4	13.0
12000	-9	16	191	30.0	42.4	4.0	15.1

Figure 5-3c Time, Fuel and Distance to Climb at 976 kg (2150 lbs)
PA-28-140/-150/-160/-180

Conditions:

Takeoff weight 885 kg (1950 lbs); Climb speed v_y = 75 KIAS
Flaps Up; Full Power; Zero wind, Standard Temperature

				From Sea Level			
Press. Alt.	Temp. (ISA)		Rate of Climb	Time	Distance to climb	Fuel used	
[ft]	[°C]	[°F]	[ft/min]	[MIN]	[NM]	[US gal]	[l]
0	15	59	657	0.0	0.0	0.0	0.0
1000	13	55	654	1.5	1.8	0.2	0.7
2000	11	52	646	3.1	3.7	0.4	1.5
3000	9	48	633	4.6	5.7	0.6	2.3
4000	7	45	615	6.2	7.8	0.8	3.2
5000	5	41	592	7.9	10.0	1.1	4.1
6000	3	38	564	9.6	12.4	1.3	5.0
7000	1	34	531	11.4	14.9	1.6	6.1
8000	-1	30	492	13.4	17.8	1.9	7.2
9000	-3	27	449	15.5	20.9	2.2	8.3
10000	-5	23	400	17.9	24.4	2.5	9.6
11000	-7	20	346	20.6	28.6	2.9	10.9
12000	-9	16	287	23.7	33.5	3.3	12.5

Figure 5-3d Time, Fuel and Distance to Climb at 885 kg (1950 lbs)
PA-28-140/-150/-160/-180

CRUISE PERFORMANCE, RANGE AND ENDURANCE for PA-28-151/-161

Conditions:
Flaps Up
Zero wind

Notes:

(1) Endurance information are based on fuel tanks with a capacity of 162.8 l (43 US gal) usable fuel and include a reserve of 45 min at 55% power (11.1 l / 2.9 US gal).

(2) Increase true airspeed and range by 2% per 10°C (18°F) above ISA temperature. Decrease true airspeed and range by 2% per 10°C (18°F) below ISA temperature.

Cruise Performance, Range and Endurance for PA-28-151/-161 at 1055 kg (2325 lbs)

Press.Alt. [ft]	Load [%]	KTAS	FF[l/h]	FF [US gal/h]	NM	Hrs
2000	60	88	17.4	4.6	819	9.3
2000	70	95	19.4	5.1	793	8.4
2000	80	101	22.1	5.8	740	7.3
2000	90	106	25.6	6.8	671	6.3
4000	60	90	17.4	4.6	838	9.3
4000	70	97	19.4	5.1	810	8.4
4000	80	102	22.1	5.8	748	7.3
4000	90	107	25.6	6.8	677	6.3
6000	60	91	17.4	4.6	847	9.3
6000	70	98	19.4	5.1	818	8.4
6000	80	104	22.1	5.8	762	7.3
6000	90	109	25.6	6.8	690	6.3
8000	60	93	17.4	4.6	866	9.3
8000	70	100	19.4	5.1	835	8.4
8000	80	106	22.1	5.8	777	7.3
8000	90	111	25.6	6.8	702	6.3
10000	60	94	17.4	4.6	875	9.3
10000	70	101	19.4	5.1	843	8.4
10000	80	108	22.1	5.8	792	7.3
12000	60	96	17.4	4.6	894	9.3
12000	70	103	19.4	5.1	860	8.4
12000	80	110	22.1	5.8	806	7.3

Figure 5-4a Cruise Performance, Range and Endurance at 1055 kg (2325 lbs)

Cruise Performance, Range and Endurance for PA-28-151/-161 at 885 kg (1950 lbs)

Press.Alt. [ft]	Load [%]	KTAS	FF[l/h]	FF [US gal/h]	NM	Hrs
2000	60	100	17.4	4.6	931	9.3
2000	70	106	19.4	5.1	885	8.4
2000	80	112	22.1	5.8	821	7.3
2000	90	117	25.6	6.8	740	6.3
4000	60	101	17.4	4.6	940	9.3
4000	70	108	19.4	5.1	902	8.4
4000	80	114	22.1	5.8	836	7.3
4000	90	119	25.6	6.8	753	6.3
6000	60	103	17.4	4.6	959	9.3
6000	70	110	19.4	5.1	919	8.4
6000	80	116	22.1	5.8	850	7.3
6000	90	121	25.6	6.8	766	6.3
8000	60	105	17.4	4.6	978	9.3
8000	70	112	19.4	5.1	935	8.4
8000	80	118	22.1	5.8	865	7.3
8000	90	123	25.6	6.8	778	6.3
10000	60	107	17.4	4.6	996	9.3
10000	70	114	19.4	5.1	952	8.4
10000	80	120	22.1	5.8	880	7.3
12000	60	109	17.4	4.6	1015	9.3
12000	70	116	19.4	5.1	969	8.4
12000	80	123	22.1	5.8	902	7.3

Figure 5-4b Cruise Performance, Range and Endurance
at 885 kg (1950 lbs)

CRUISE PERFORMANCE, RANGE AND ENDURANCE for PA-28-140/-150/-160/-180

Conditions:
Flaps Up
Zero wind

Notes:

(1) Endurance information are based on fuel tanks with a capacity of 162.8 l (43 US gal) usable fuel and include a reserve of 45 min at 55% power (11.1 l / 2.9 US gal).

(2) Increase true airspeed and range by 2% per 10 °C (18 °F) above ISA temperature. Decrease true airspeed and range by 2% per 10 °C/ (18 °F) below ISA temperature.

Cruise Performance, Range and Endurance for PA-28-140/-150/-160/-180 at 976 kg (2150 lbs)

Press.Alt. [ft]	Load [%]	KTAS	FF[l/h]	FF [US gal/h]	NM	Hrs
2000	60	85	17.4	4.6	791	9.3
2000	70	94	19.4	5.1	785	8.4
2000	80	102	22.1	5.8	748	7.3
2000	90	109	25.6	6.8	690	6.3
4000	60	85	17.4	4.6	791	9.3
4000	70	95	19.4	5.1	793	8.4
4000	80	103	22.1	5.8	755	7.3
4000	90	110	25.6	6.8	696	6.3
6000	60	86	17.4	4.6	801	9.3
6000	70	96	19.4	5.1	802	8.4
6000	80	104	22.1	5.8	762	7.3
6000	90	112	25.6	6.8	709	6.3
8000	60	87	17.4	4.6	810	9.3
8000	70	97	19.4	5.1	810	8.4
8000	80	105	22.1	5.8	770	7.3
8000	90	113	25.6	6.8	715	6.3
10000	60	87	17.4	4.6	810	9.3
10000	70	98	19.4	5.1	818	8.4
10000	80	107	22.1	5.8	784	7.3
12000	60	88	17.4	4.6	819	9.3
12000	70	99	19.4	5.1	827	8.4
12000	80	108	22.1	5.8	792	7.3

Figure 5-4c Cruise Performance, Range and Endurance at 976 kg (2150 lbs)

Cruise Performance, Range and Endurance for PA-28-151/-161 at 885 kg (1950 lbs)

Press.Alt. [ft]	Load [%]	KTAS	FF[l/h]	FF [US gal/h]	NM	Hrs
2000	60	93	17.4	4.6	866	9.3
2000	70	102	19.4	5.1	852	8.4
2000	80	110	22.1	5.8	806	7.3
2000	90	118	25.6	6.8	747	6.3
4000	60	94	17.4	4.6	875	9.3
4000	70	104	19.4	5.1	868	8.4
4000	80	112	22.1	5.8	821	7.3
4000	90	119	25.6	6.8	753	6.3
6000	60	95	17.4	4.6	884	9.3
6000	70	105	19.4	5.1	877	8.4
6000	80	113	22.1	5.8	828	7.3
6000	90	121	25.6	6.8	766	6.3
8000	60	96	17.4	4.6	894	9.3
8000	70	106	19.4	5.1	885	8.4
8000	80	115	22.1	5.8	843	7.3
8000	90	123	25.6	6.8	778	6.3
10000	60	97	17.4	4.6	903	9.3
10000	70	108	19.4	5.1	902	8.4
10000	80	117	22.1	5.8	858	7.3
12000	60	98	17.4	4.6	912	9.3
12000	70	109	19.4	5.1	910	8.4
12000	80	118	22.1	5.8	865	7.3

Figure 5-4d Cruise Performance, Range and Endurance at 885 kg (1950 lbs)

GLIDE RANGE
PA 28-151/-161

Conditions:
Take-off weight 1055 kg (2325 lbs)
Propeller windmilling
Flaps 0°, Zero wind, 73 KIAS

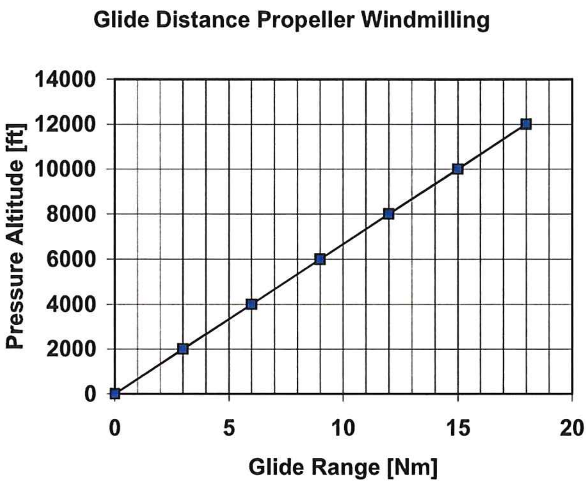

Figure 5-5a Glide Range PA 28-151/-161

GLIDE RANGE
PA 28-140/-150/-160/-180

Conditions:
Take-off weight 976 kg (2150 lbs)
Propeller windmilling
Flaps 0 °, Zero wind, 78 KIAS

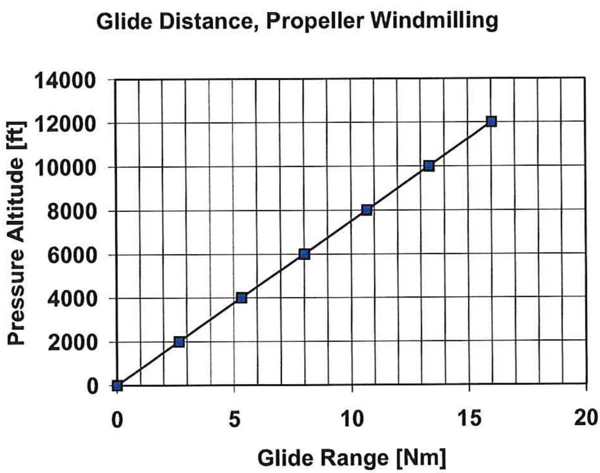

Figure 5-5b Glide Range PA 28-140/-150/-160/-180

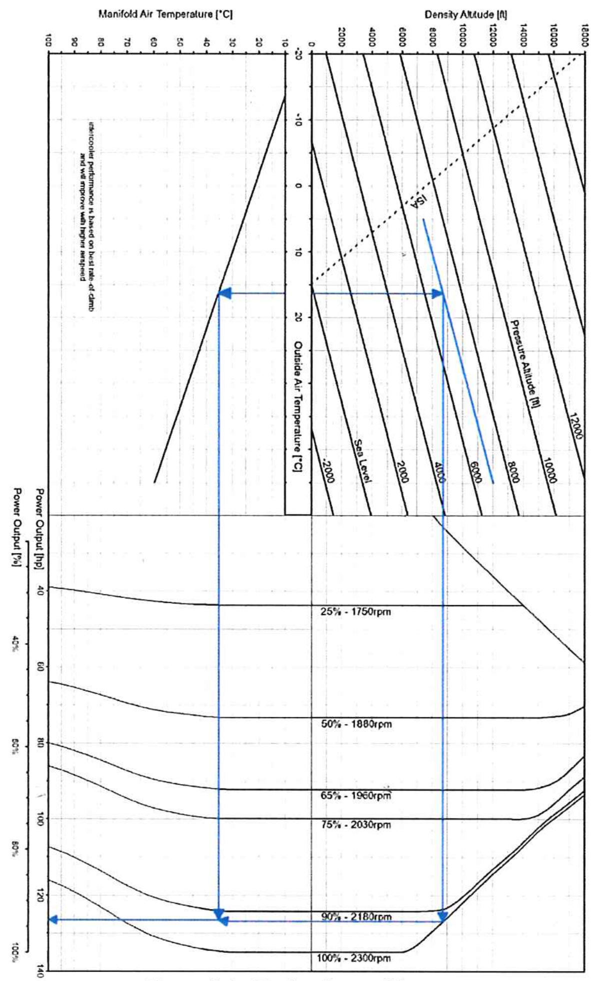

Figure 5-6a Engine Power Diagram

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SECTION 6
WEIGHT & BALANCE

MODEL PA-28-151/-161 with TAE-125

Airplane Serial Number: ____________
Registration Number: ____________
Date: ____________

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (kg/ lb) x	C.G. Arm = (m/ in Aft of Datum)	Moment (kgm/ lbs in)
Standard Empty Weight	Actual: Computed:		
Optional Equipment			
Basic Empty Weight			

* The standard empty weight includes full engine oil capacity, full gearbox oil capacity, full coolant capacity and 8 l (2 US gal) unusable fuel.

AIRPLANE USEFUL LOAD

(Ramp Weight) -	(Basic Empty Weight) =	Useful Load
(Normal category:	1056 kg) - (............kg) =	kg
	(2327 lb) - (.............lb) =	lb
(PA 28-161 Utility cat.:	917 kg) - (............kg) =	kg
	(2022 lb) - (.............lb) =	lb
(PA 28-151 Utility cat.:	886 kg) - (............kg) =	kg
	(1952 lb) - (.............lb) =	lb

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS INSPECTED AFTER MODIFICATION. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT & BALANCE DATA FORM

Figure 6-5a

MODEL PA-28-140 with TAE-125

Airplane Serial Number: ____________
Registration Number: ____________
Date: ____________

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight x (kg/ lb)	C.G. Arm = (m/ in Aft of Datum)	Moment (kgm/ lbs in)
Standard Empty Weight	Actual: Computed:		
Optional Equipment			
Basic Empty Weight			

* The standard empty weight includes full engine oil capacity, full gearbox oil capacity, full coolant capacity and 8 l (2 US gal) unusable fuel.

AIRPLANE USEFUL LOAD

(Ramp Weight) -	(Basic Empty Weight) =	Useful Load
(Normal category:	977 kg*) - (............kg) =	kg
	(2152 lb*) - (.............lb) =	lb
(Normal category:	886 kg*) - (............kg) =	kg
	(1952 lb*) - (.............lb) =	lb
(Utility category:	886 kg) - (............kg) =	kg
	(1952 lb) - (.............lb) =	lb

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS INSPECTED AFTER MODIFICATION. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT & BALANCE DATA FORM

Figure 6-5b

*Serial no. 28-20001 to 28-20939: 886 kg, if Piper Kit 756962 installed 997 kg, Serial no. 28-20940 and up: 977 kg. <u>Refer to original POH.</u>

MODEL PA-28-150/-160/-180 with TAE-125

Airplane Serial Number: ____________
Registration Number: ____________
Date: ____________

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (kg/ lb) x	C.G. Arm = (m/ in Aft of Datum)	Moment (kgm/ lbs in)
Standard Empty Weight	Actual: Computed:		
Optional Equipment			
Basic Empty Weight			

* The standard empty weight includes full engine oil capacity, full gearbox oil capacity, full coolant capacity and 8 l (2 US gal) unusable fuel.

AIRPLANE USEFUL LOAD

(Ramp Weight) -		(Basic Empty Weight) =	Useful Load
(Normal category:	977 kg)	- (.............kg) =	kg
	(2152 lb)	- (.............lb) =	lb
(PA 28-180 Utility cat.:	886 kg)	- (.............kg) =	kg
	(1952 lb)	- (.............lb) =	lb

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS INSPECTED AFTER MODIFICATION. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT & BALANCE DATA FORM
Figure 6-5b

WEIGHT & BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.

(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.

(c) Add the moment of all items to be loaded to the basic empty weight moment.

(d) Divide the total moment by the total weight to determine the C.G. location.

(e) By using the figures of item (a) and (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

WEIGHT & BALANCE LOADING FORM PA 28-151/-161

	Weight (kg)	Arm Aft Datum (m)	Moment (kgm)
- Basic Empty Weight - Pilot and Front Passenger - Passengers (Rear Seats)* - Fuel (max. 162.8 l usable) - Baggage* (max. 90 kg, PA 28-161 Cadet max. 23 kg)		 2.04 3.00 2.41 3.63	
- Ramp Weight PA 28-151 (1056 kg Normal aircraft, 886 kg Utility, Maximum) PA 28-161 (1056 kg Normal aircraft, 917 kg Utility Maximum)			
- Fuel Allowance for Engine Start, Taxi and Run up	-1	2.41	-2.41
- Take-off Weight PA 28-151 (1055 kg Normal aircraft, 885 kg Utility, Maximum) PA 28-161 (1055 kg Normal, 916 kg Utility, Maximum)			

* Utility Category Operation - No baggage or aft passengers allowed. Maximum baggage as per original POH

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight & Balance Data Form (Figure 6-5a). If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-11a

WEIGHT & BALANCE LOADING FORM PA 28-151/-161

	Weight (lb)	Arm Aft Datum (in)	Moment (lbs in)
- Basic Empty Weight - Pilot and Front Passenger - Passengers (Rear Seats)* - Fuel (max. 43 gal usable) - Baggage* (max. 200 lbs) PA 28-161 Cardet max. 50 lbs)		 80.5 118.1 95 142.8	
- Ramp Weight PA 28-151 (2327 lbs Normal aircraft, 1952 lbs Utility, Maximum) PA 28-161 (2327 lbs Normal aircraft, 2022 lbs Utility Maximum) - Fuel Allowance for Engine Start, Taxi and Run up	 -2	 95	 -190
- Take-off Weight PA 28-151 (2325 lbs Normal aircraft, 1950 lbs Utility, Maximum) PA 28-161 (2325 lbs Normal, 2020 lbs Utility Maximum)			

* Utility Category Operation - No baggage or aft passengers allowed. Maximum baggage as per original POH

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight & Balance Data Form (Figure 6-5a). If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-11a

WEIGHT & BALANCE LOADING FORM

PA 28-140

	Weight (kg)	Arm Aft Datum (m)	Moment (kgm)
- Basic Empty Weight			
- Pilot and Front Passenger		2.17	
- Passengers (Rear Seats)*		2.97	
- Fuel (max. 162 l usable)		2.41	
- Baggage* , Area 1**		2.97	
- Baggage* , Area 2**		3.39	
- Ramp Weight (977 kg Normal aircraft, 886 kg Utility Maximum)			
- Fuel Allowance for Engine Start, Taxi and Run up	-1	2.41	-2.41
- Take-off Weight (976 kg Normal, 885 kg Utility Maximum)			

* Utility Category Operation - No baggage or aft passengers allowed. Maximum baggage as per original POH

**See next page

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight & Balance Data Form (Figure 6-5b). If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-11b

WEIGHT & BALANCE LOADING FORM

PA 28-140

	Weight (lb)	Arm Aft Datum (in)	Moment (lbs in)
- Basic Empty Weight			
- Pilot and Front Passenger		85.5	
- Passengers (Rear Seats)*		117	
- Fuel (max. 43 gal usable)		95	
- Baggage*, Area 1**		117	
- Baggage*, Area 2**		133	
- Ramp Weight (2152 lbs Normal aircraft,1952 lbs Utility Maximum)			
- Fuel Allowance for Engine Start, Taxi and Run up	-2	95	-190
- Take-off Weight (2150 lbs Normal, 1950 lbs Utility Maximum)			

* Utility Category Operation - No baggage or aft passengers allowed. Maximum baggage as per original POH

**For normal category see next page.

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight & Balance Data Form (Figure 6-5b). If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-11b

**** <u>Refer to original POH for limitations:</u>**
Maximum allowable baggage for the PA 28-140 as normal category aircraft:

<u>Serial no. 28-20001 through 28-20939:</u>

Baggage area 1:	45 kg (100 lbs) 90 kg (200 lbs), if Piper Kit 756962 is being installed
Baggage area 2:	45 kg (100 lbs), if Piper Kit 756962 is being installed and when modified in accordance with Piper Drawing 66671

<u>Serial no. 28-20940 and up:</u>

Baggage area 1:	90 kg (200 lbs)
Baggage area 2:	45 kg (100 lbs), when modified in accordance with Piper Drawing 66671

WEIGHT & BALANCE LOADING FORM

PA 28-150/-160/-180

	Weight (kg)	Arm Aft Datum (m)	Moment (kgm)
- Basic Empty Weight			
- Pilot and Front Passenger		2.17	
- Passengers (Rear Seats)*		3.00	
- Fuel (max. 162 l usable)		2.41	
- Baggage* (max. 90 kg)		3.63	
- Ramp Weight (977 kg Normal aircraft, 886 kg Utility Maximum)			
- Fuel Allowance for Engine Start, Taxi and Run up	-1	2.41	-2.41
- Take-off Weight (976 kg Normal, 885 kg Utility Maximum)			

* Utility Category Operation - No baggage or aft passengers allowed. Maximum baggage as per original POH

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight & Balance Data Form (Figure 6-5c). If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-11c

WEIGHT & BALANCE LOADING FORM
PA 28-150/-160/-180

	Weight (lb)	Arm Aft Datum (in)	Moment (lbs in)
- Basic Empty Weight			
- Pilot and Front Passenger		85.5	
- Passengers (Rear Seats)*		118.1	
- Fuel (max. 43 gal usable)		95	
- Baggage* (max. 200 lbs)		142.8	
- Ramp Weight (2152 lbs Normal aircraft,1952 lbs Utility Maximum)			
- Fuel Allowance for Engine Start, Taxi and Run up	-2	95	-190
- Take-off Weight (2150 lbs Normal, 1950 lbs Utility Maximum)			

* Utility Category Operation - No baggage or aft passengers allowed. Maximum baggage as per original POH

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight & Balance Data Form (Figure 6-5c). If the airplane has been altered, refer to the Weight and Balance Record for this information.

Figure 6-11c

LOADING GRAPH PA-28-140

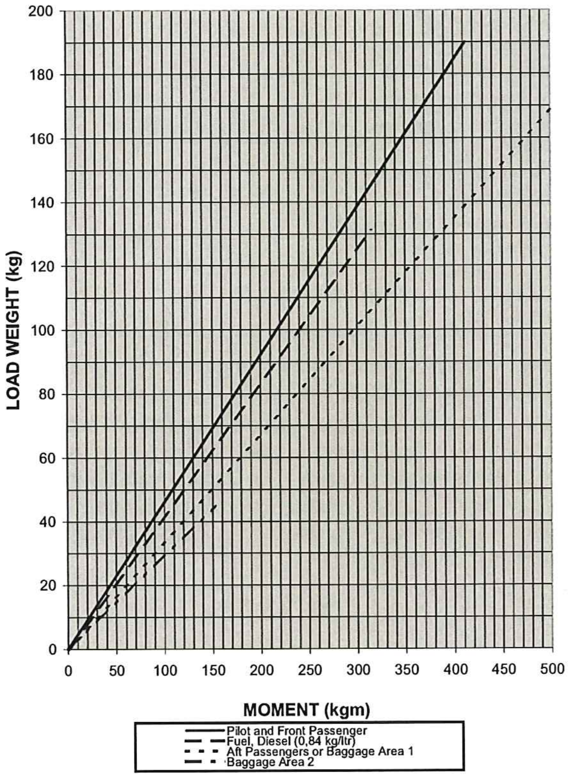

Figure 6-13a Loading Graph PA28-140

LOADING GRAPH PA-28-140

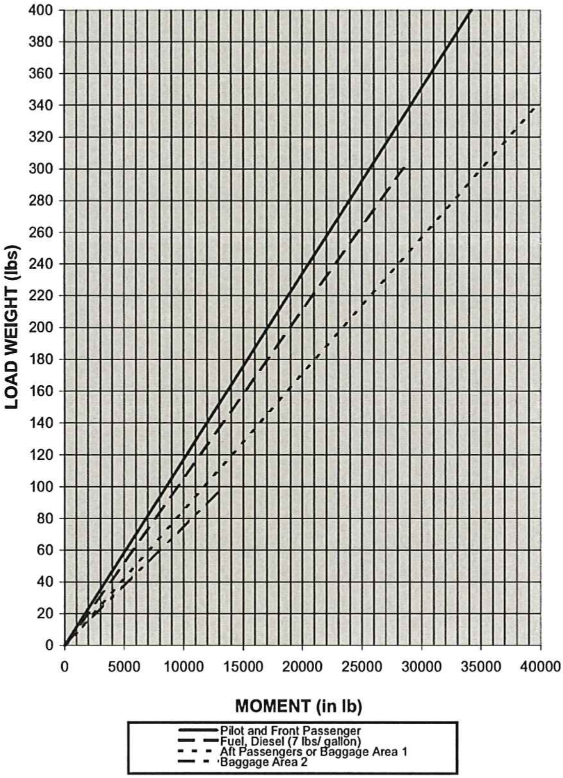

Figure 6-13a Loading Graph PA28-140

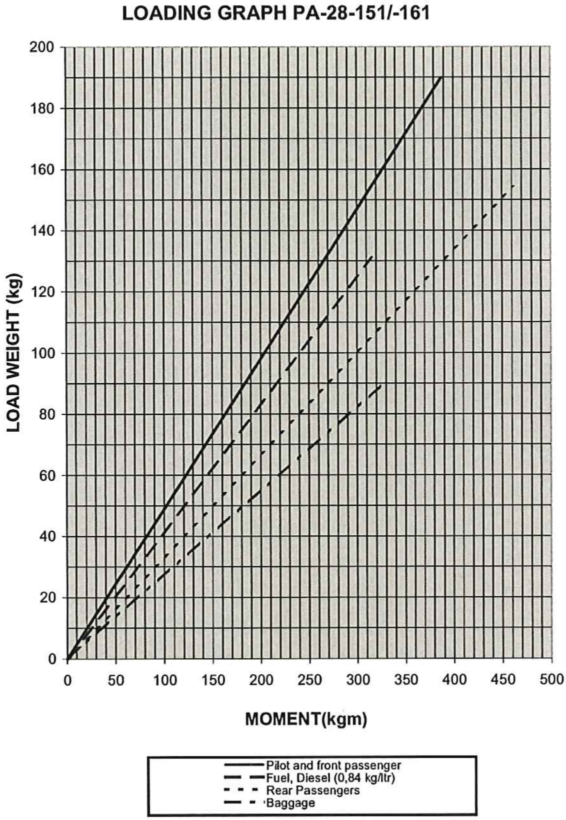

Figure 6-13b Loading Graph PA28-151/-161

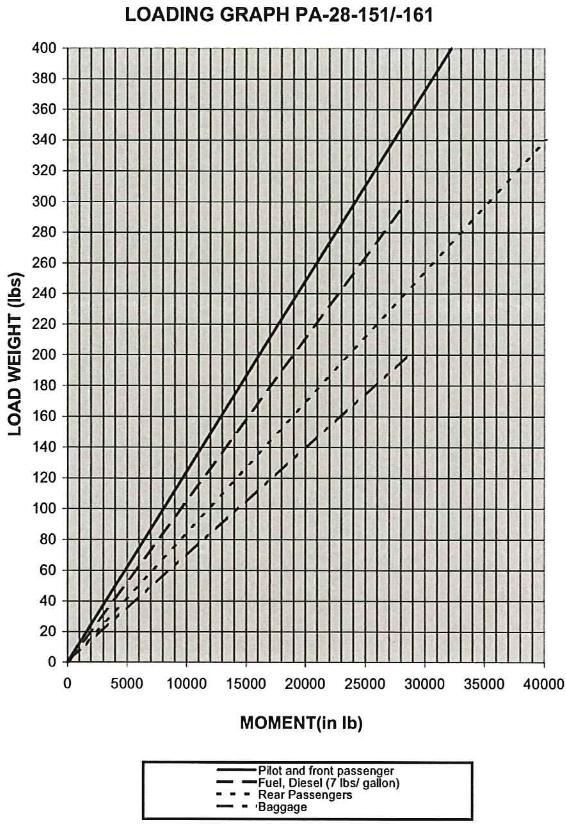

Figure 6-13b Loading Graph PA28-151/-161

LOADING GRAPH PA 28-150/-160/-180

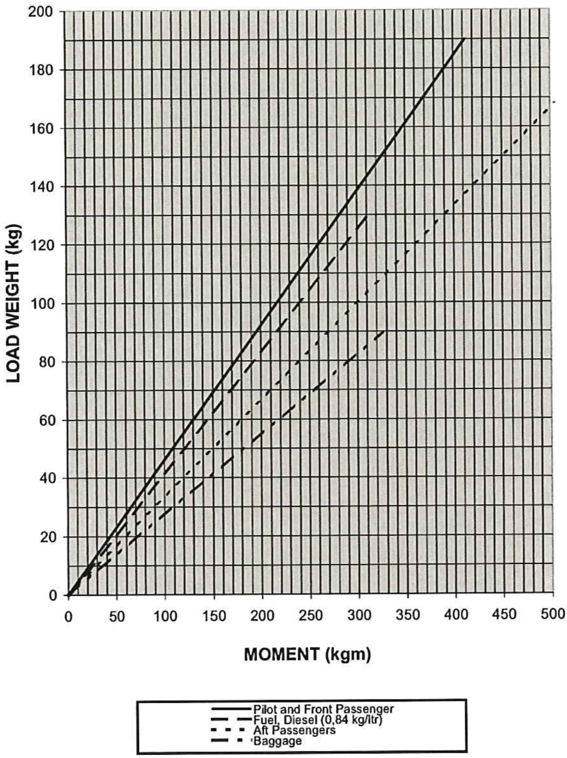

Figure 6-13c Loading Graph PA28-150/-160/-180

LOADING GRAPH PA 28-150/-160/-180

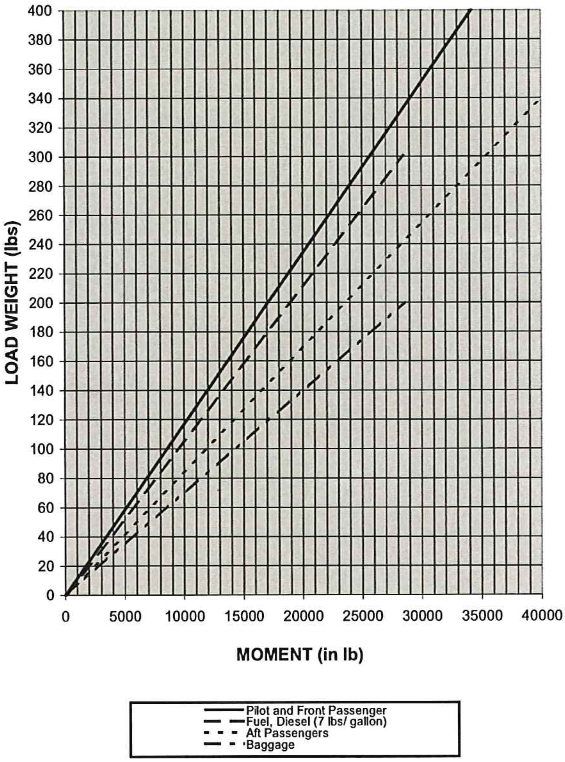

Figure 6-13c Loading Graph PA28-150/-160/-180

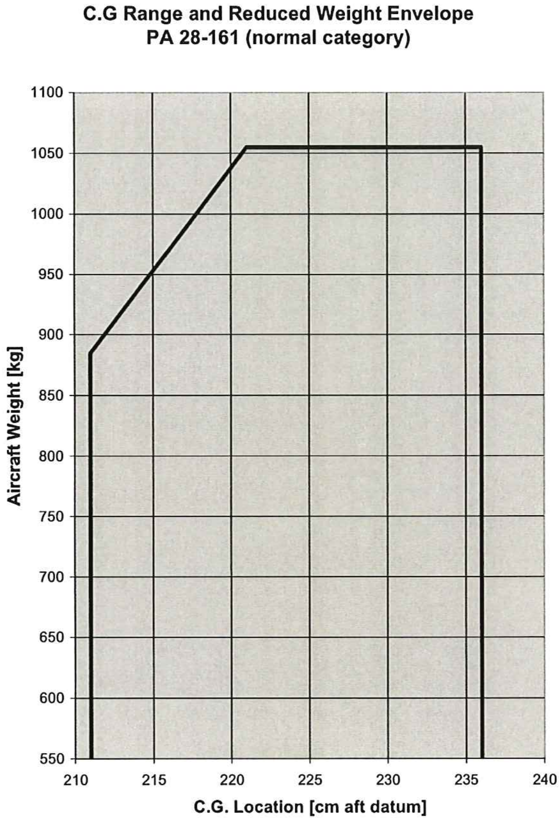
C.G Range and Reduced Weight Envelope
PA 28-161 (normal category)
Aircraft Weight [kg]
1100
1050
1000
950
900
850
800
750
700
650
600
550
210
215
220
225
230
235
240
C.G. Location [cm aft datum]

Figure 6-14a

C.G Range and Reduced Weight Envelope
PA 28-161 (normal category)

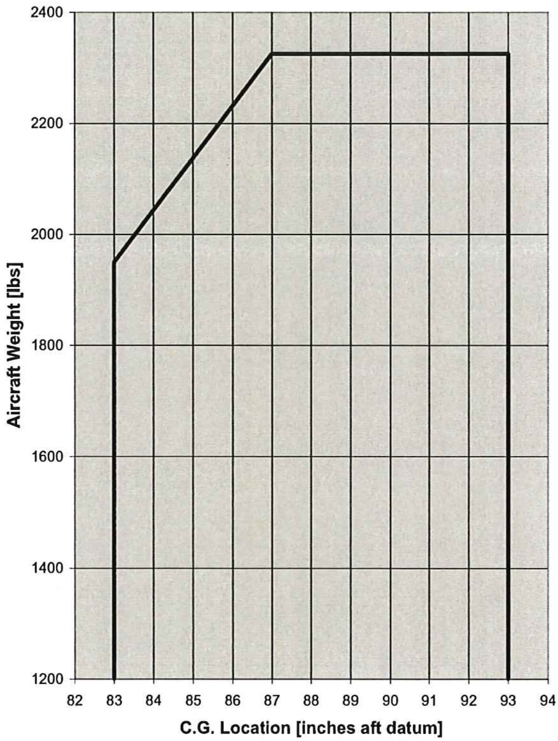

Figure 6-14b

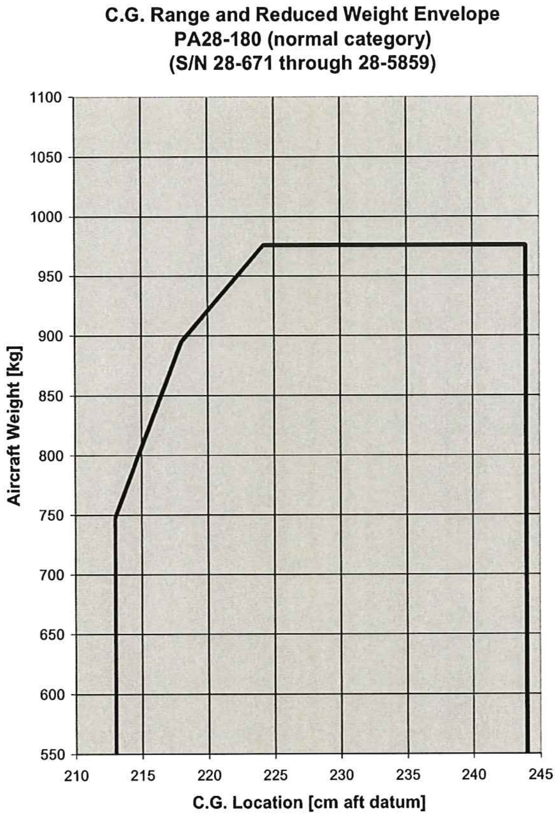
C.G. Range and Reduced Weight Envelope
PA28-180 (normal category)
(S/N 28-671 through 28-5859)
Aircraft Weight [kg]
1100
1050
1000
950
900
850
800
750
700
650
600
550
210
215
220
225
230
235
240
245
C.G. Location [cm aft datum]

Figure 6-14c

C.G. Range and Reduced Weight Envelope
PA28-180 (normal category)
(S/N 28-671 through 28-5859)

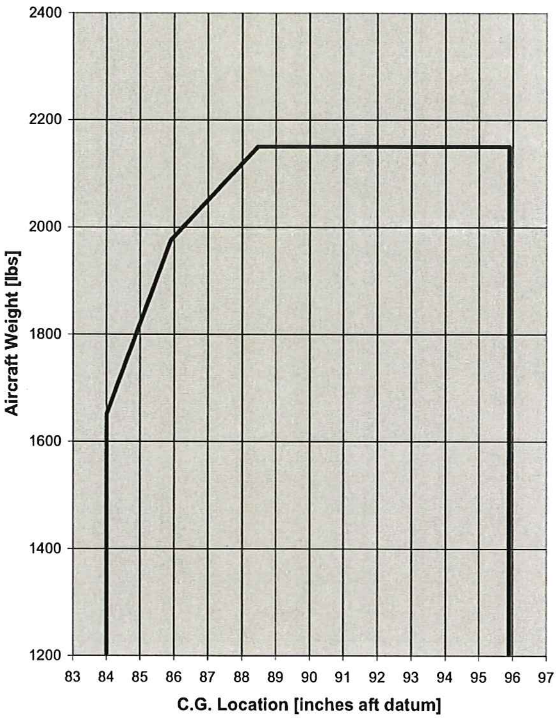

Figure 6-14d

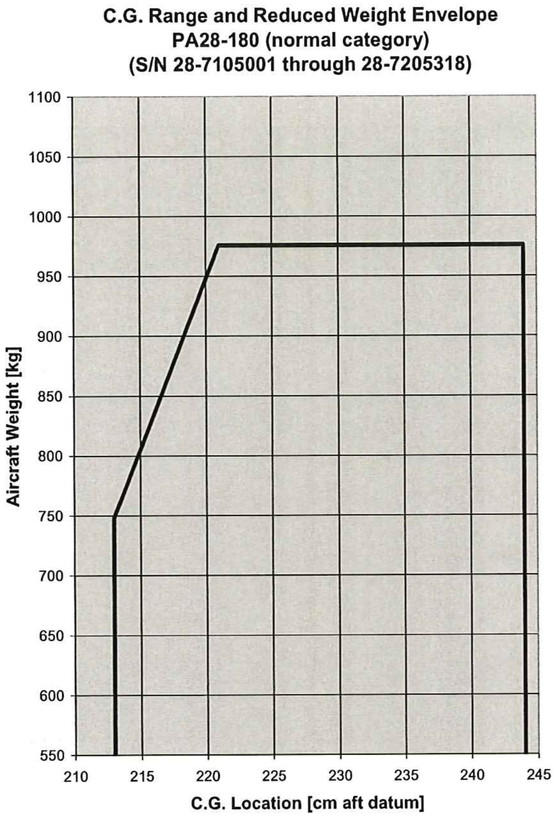
C.G. Range and Reduced Weight Envelope
PA28-180 (normal category)
(S/N 28-7105001 through 28-7205318)
1100
1050
1000
950
900
850
800
750
700
650
600
550
Aircraft Weight [kg]
210
215
220
225
230
235
240
245
C.G. Location [cm aft datum]

Figure 6-14e

C.G. Range and Reduced Weight Envelope
PA28-180 (normal category)
(S/N 28-7105001 through 28-7205318)

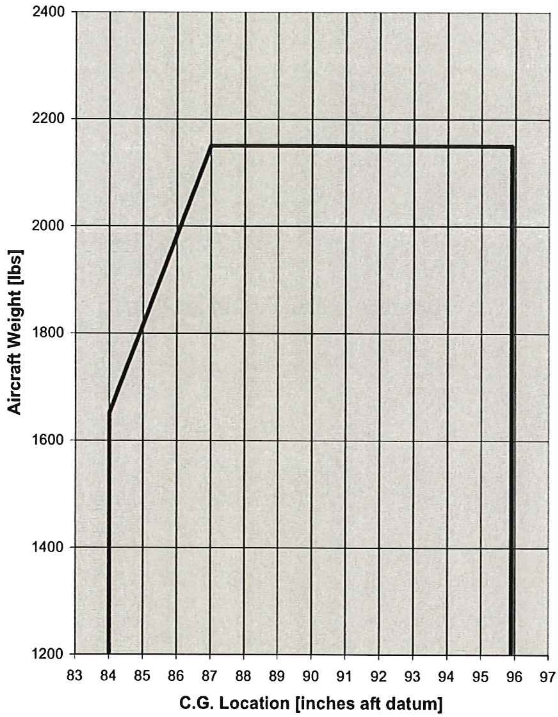

Figure 6-14f

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SECTION 7
DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

ENGINE AND PROPELLER

The TAE 125-02-99 is the successor of the 125-01. Both engine variants have the same power output and the same propeller speeds but different displacement. While the TAE 125-01 has 1689 ccm, the TAE 125-02-99 has 1991 ccm. Both TAE 125 engine variants are liquid cooled in-line four-stroke 4-cylinder motor with DOHC (double overhead camshaft) and are direct Diesel injection engines with common-rail technology and turbocharging. Both engine variants are controlled by a FADEC system. The propeller is driven by a built-in gearbox (i = 1.69) with mechanical vibration damping and overload release. Both engines have an electrical self starter and an alternator.
The constant speed propeller MTV-6-A-187/129 has three propeller blades and is electronically controlled by the FADEC.

ENGINE CONTROLS

The engine is operated by the pilot exclusively by means of the Thrust Lever (see Figure 7-5a). The friction lock as the lower knob on the Thrust Lever can easily be operated with the forefinger and middle finger.
Due to the Diesel principle mixture control, carburetor pre-heating, ignition magnetos and spark-plugs as well as priming system are omitted.
An alternate air door has been added and can be opened by the pilot in case of a blocked air filter. The control is located right of the Thrust Lever.

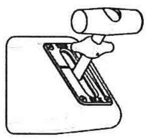

Figure 7-5a Thrust Lever

FUEL SYSTEM

The fuel system for the TAE 125 installation includes the original fuel tank of the Piper PA-28. Additional sensors for Fuel Temperature and "Low Level" Warning are installed.
The fuel flows out of the tank to the Fuel Selector Valve (located on the left side panel forward of the pilot´s seat) with the positions LEFT, RIGHT and OFF. The safety knob must be lifted if the Fuel Selector should be moved from or into position OFF.
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 back through the Fuel Selector Valve into the pre-selected tank.
A temperature sensor in the Filter Module controls the heat exchange between the fuel feed and return.
Since Diesel and Kerosene fuel tends to form paraffin at low temperatures, the information in Section 2 "Limitations" pertaining to fuel temperature have to be observed. The return fuel ensures a quicker rapid warm up of the fuel in the tank in use.
Diesel according DIN EN 590 has to be used exclusively.

◆ Note: There are differences in the national supplements to EN 590. Approved are Diesel fuels with the addition DIN.

Fuel Capacity			
Tanks	Total Usable Fuel	Total Unusable Fuel	Total Capacity
2 Standard Tanks: each 22.5 US gal = 85 l	43 US gal = 162.8 l	2 US gal = 7.6 l	45 US gal = 170.4 l

■ CAUTION: In flight conditions with one wing pointing downward continuously (e.g. slipping), switch the fuel selector to the upward pointing fuel tank.

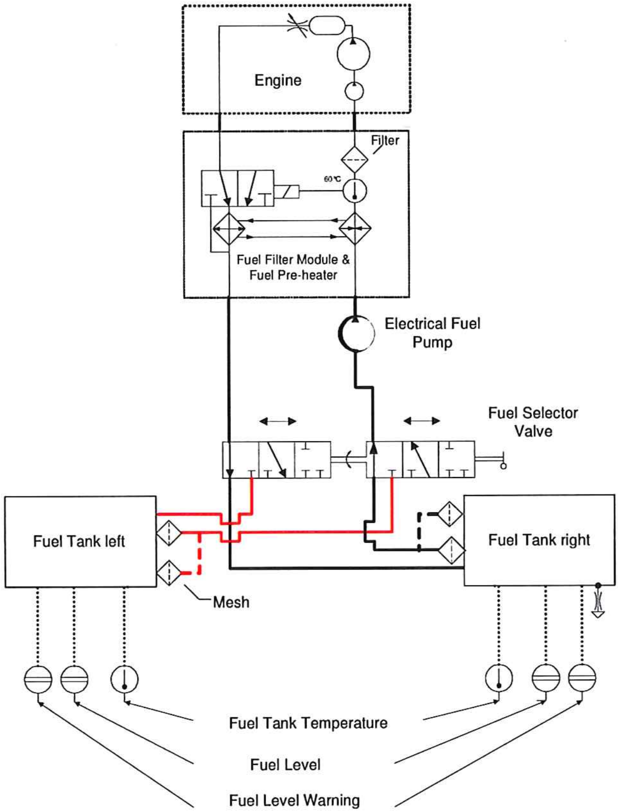

Figure 7-9a Scheme of the Fuel System

ELECTRICAL SYSTEM

The electrical system of the TAE 125 installations differs from the previous installation and is equipped with the following operating and display elements:

1. Switch "Main Bus"
   This switch controls the Main Bus. The Main Bus is necessary to be able to run FADEC and engine with Battery/ Alternator without disturbance in the event of onboard electrical system malfunctions. In normal operation Alternator, Main Bus and Battery must be ON.
2. Circuit Breaker or Switch "Alternator"
   Controls the alternator. The circuit breaker must be in during normal operation, the guarded switch must be closed during normal operation.
3. Switch "Battery"
   Controls the Main Battery.
4. Push Button "Starter"
   Controls the magneto switch of the starter.
5. Ammeter
   The Ammeter shows the charging or discharging current to/ from the battery.
6. Warning Light "Alternator"
   Illuminates when the power output of the alternator is too low or the Circuit Breaker or Switch "Alternator" is switched off. Normally, this warning light always illuminates when the "Engine Master" is switched on without revolution and extinguishes immediately after starting the engine.
7. Switch "Fuel Pump" (if installed)
   This switch controls the electrical fuel pump.

8. Switch "Engine Master"
   The switch "Engine Master"Controls the two redundant FADEC components and the Alternator Excitation Battery with two independent contacts. The Alternator Excitation Battery is used to ensure that the Alternator continues to function properly even if the main battery fails.

▲ **WARNING:** If the "Engine Master" is switched off, the power supply to the FADEC is interrupted and the engine will shut down.

9. Backup Battery (if installed)
   The electrical system includes a backup battery to ensure power supply to A-FADEC in case that supply from both battery and alternator is interrupted. The engine has been demonstrated to continue operating for 30 minutes when powered by the FADEC backup battery only. Only A-FADEC is connected to the backup battery.
10. Switch FADEC Force B
   If the FADEC does not automatically switch from A-FADEC to the B-FADEC in case of an emergency despite of obvious necessity, this switch allows to switch manually to the B-FADEC.

▲ **WARNING:** When operating on FADEC backup battery only, the "Force B" switch must not be activated. This will shut down the engine.

The basic wiring of the TAE 125 installation is available in 14V as well as 28V versions.

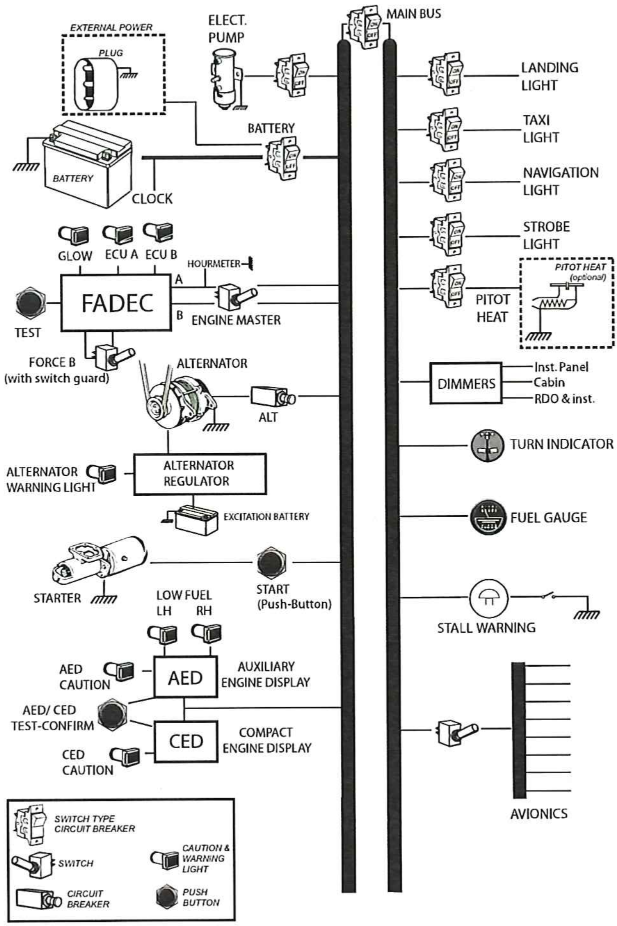

Figure 7-11a Basic Wiring of the Electrical System with alternator c/b and without FADEC backup battery

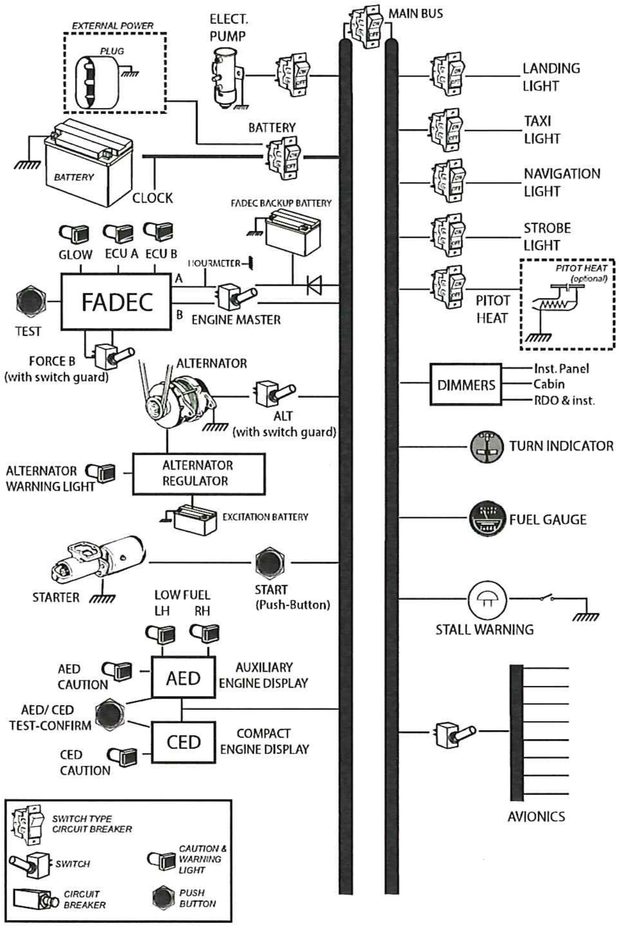

Figure 7-11b Basic Wiring of the Electrical System with alternator switch and FADEC Backup Battery

INSTRUMENT PANEL

The following information relate to Figure 7-15 "The instrument panel" of the EASA approved Pilot´s Operating Handbook. Components of the new installation can be seen as an example in the following Figures.

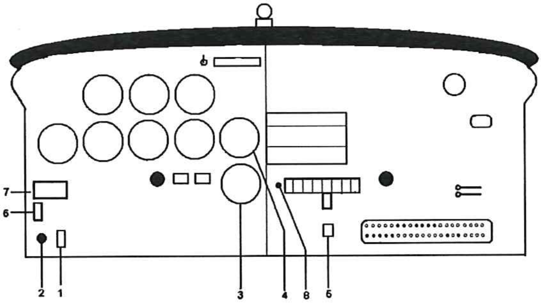

Figure 7-15a Example Cadet with TAE-125 installation

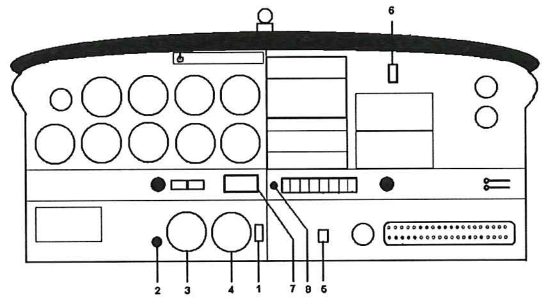

Figure 7-15b Example Cherokee, Warrior & Warrior II with TAE 125 installation

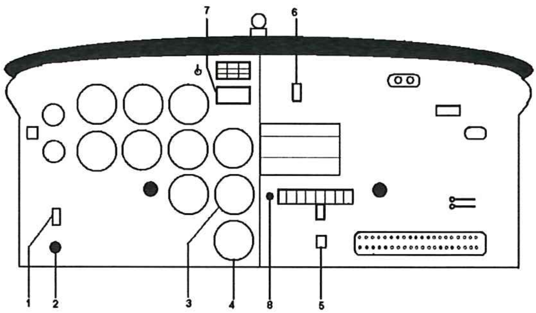

Figure 7-15c Example Warrior III with TAE-125 installation

(1) "Engine Master" - Master Switch for Engine
(2) "Starter" Push Button for Starter
(3) AED 125 SR with indication of Fuel Temperature, Voltage, Fuel Flow and a caution light "Water Level" (amber) for low coolant level
(4) CED 125, combined engine monitoring instrument for Propeller Rotary Speed, Oil Pressure, Oil Temperature, Coolant Temperature, Gearbox Temperature and Load. (Engine instrument for Oil Temperature, Oil Pressure and Fuel Pressure N/A)
(5) "Alt. Air Door" Alternate Air Door (Carburetor Heat Button N/A)
(6) "Force B" Switch for manually switching the FADEC

(continued next page)

(7) Lightpanel with:
"FADEC" test knob
"A FADEC B" warning lights for FADEC A and B
"Alt" Alternator warning light (red)
"AED" caution light (amber) for AED 125
"CED" caution light (amber) for CED 125
"CED/AED" Test/Confirm Knob for CED 125, AED 125 and caution lights
"Fuel L"; "Fuel R"- caution lights for low fuel level (amber)
"Glow" Glow Control Light (amber)

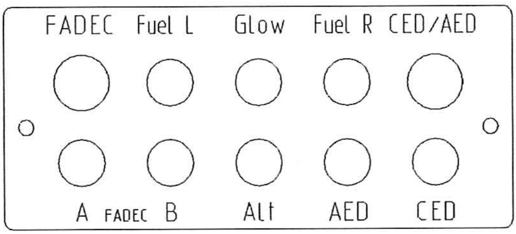

Figure 7-15f Lightpanel

(8) "ALT" Circuit Breaker or guarded switch for Alternator

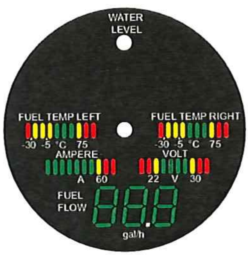

Figure 7-15g AED 125 SR

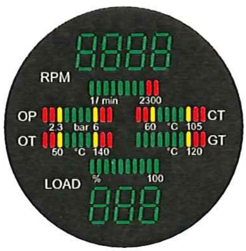

Figure 7-15h CED 125

FADEC-RESET

In case of a FADEC-warning, one or both FADEC warning lights are flashing. If then the "FADEC" Test Knob is pressed for at least 2 seconds,

a) the active warning lights will extinguish if it was a LOW category warning.

b) the active warning lights will be illuminated steady if it was a HIGH category warning.

■ CAUTION: If a FADEC-warning occurred, contact your service center.

COOLING

The TAE 125 is equipped with a fluid-cooling system. A three-way thermostat regulates the flow of coolant between the large and small cooling circuit.
Up to a coolant temperature of 84°C (183°F) the coolant flows exclusively through the small circuit, between 84 and 94°C (183 and 201°F) through the small and the large circuit simultaneously.
If the coolant temperature rises above 94°C (201°F), the complete volume of coolant flows through the large circuit and therefore through the radiator. This ensures a maximum coolant temperature of 105°C (221°F). A sensor in the expansion reservoir sends a signal to the caution Light "Water Level" on the instrument panel, if the coolant level is low.
The coolant 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. See Figure 7-16.
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 (refer to section 3), the control knob "Shut-off Cabin Heat" has to be closed according to the appropriate procedures.

Aircraft having a TAE 125-02-99 engine installation, can be equipped with a gearbox oil cooler that is connected to the coolant circuit. See Figure 7-16b.

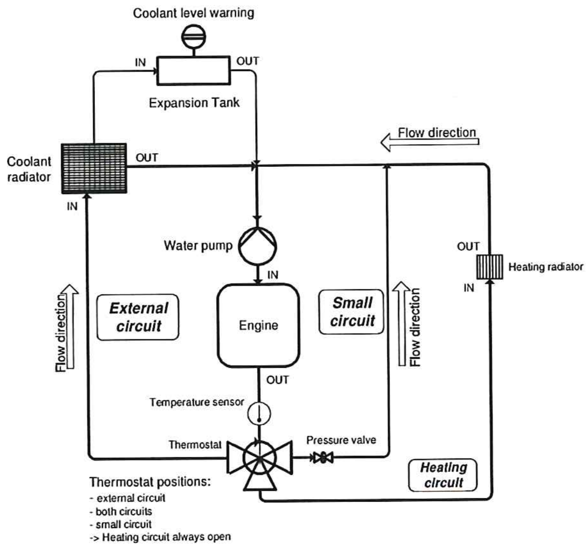

Figure 7-16a Cooling System

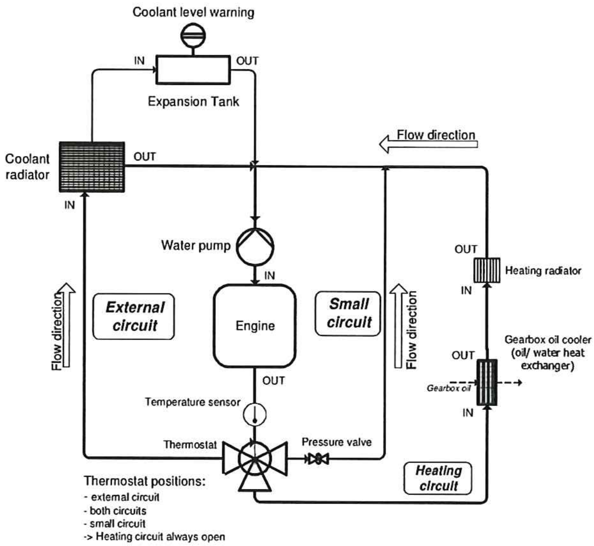

Figure 7-16b Cooling System with gearbox oil cooler
(TAE 125-02-99 only)

CABIN HEATING AND VENTILATION SYSTEM

Warm air for cabin heating and windscreen defrosting system is delivered from the heat exchanger of the TAE 125 installation cooling system. See article "Cooling" above.

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SECTION 8
AIRPLANE HANDLING, SERVICING AND MAINTENANCE

■ CAUTION: Normally, a refill of coolant or gearbox oil between service intervals is not necessary. In case of low coolant or gearbox oil levels, inform the maintenance company immediately.

▲ **WARNING:** Do not start the engine in any case when filling levels are below the corresponding minimum marking.

ENGINE AIR FILTER

Checks and exchanges of the engine air filter have to be performed regularly according to the Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.

PROPELLER SERVICE

Avoid high propeller rotary speeds on stationary ground runs to avoid nicks in the propeller blades due to stones.
Clean the propeller regularly from dirt and oil. A small amount of oil is acceptable since assembly oil can leak out during the first operating hours. Do not push or pull the aircraft on the propeller spinner!

ENGINE OIL

The TAE 125 is filled with 4.5 - 6 l (1.2 - 1.6 gallon) engine oil. A dip stick is used to check the oil level. It is accessible by a flap on the upper right-hand side of the engine cowling.
The drain screw is located on the lower left-hand outside of the oil pan, the oil filter is on the upper left-hand side of the housing.

Checks and exchanges of oil and oil filter have to be performed regularly according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.

GEARBOX OIL

To ensure the necessary propeller speed, the TAE 125 is equipped with a reduction gearbox filled with gearbox oil according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation. The level can be checked through a viewing glass on the lower leading edge of the gearbox. To do so, open the flap on the left front side of the engine cowling.
The drain screw is located at the lowest point of the gearbox. A filter is installed upstream of the pump, as well as a microfilter in the Constant Speed Unit.
Regular checks as well as oil and filter exchanges have to be performed according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.

FUEL SYSTEM

Regular checks as well as fuel filter exchanges have to be performed according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.
The TAE 125 can be operated with JET A-1 kerosene or Diesel. Due to the higher specific density of JET A-1 or Diesel in comparison to aviation gasoline (AVGAS) the permissible capacity for fuel tanks is reduced to a total of 170 l (45 US gal). Appropriate placards are attached near the fuel filler connections.

For temperature limitations refer to Section 2 "Limitations" and Section 4 "Normal Procedures".
It is recommended to refuel before each flight and to enter the type of fuel into the log-book.

BATTERY SERVICE

Regular checks and exchanges of the battery, FADEC backup battery and the alternator excitation battery have to be performed according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.

EXTERNAL POWER

External power may be used to charge the battery or for maintenance purposes. To charge the battery with external power the battery switch must be ON.
It is not allowed to start up the engine using external power. If starting the engine is not possible using battery power, the condition of the battery must be verified before flight.

ENGINE CLEANING

Cleaning the engine has to be performed according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.

COOLANT

Regular checks and exchanges of coolant and hoses have to be performed according to Operation and Maintenance Manual OM-02-01 for the TAE 125-01 and OM-02-02 for the TAE 125-02-99 installation, see also Supplement AMM-40-01 for the TAE 125-01 and AMM-40-02 for the TAE 125-02-99 installation.

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