

# Diamond DA 40-TDI G1000

DA40-TDI-G1000 Version 1.1

Diamond DA40-TDI G1000



## Dimensions



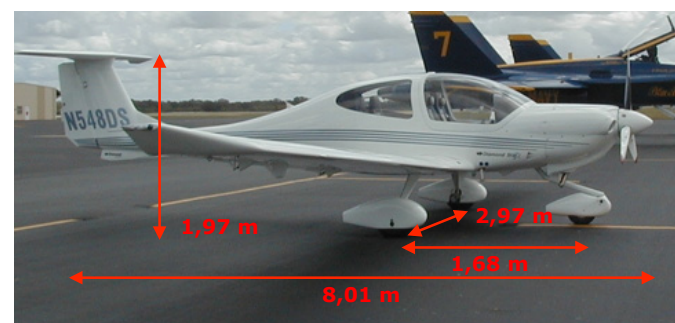
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## Dimensions



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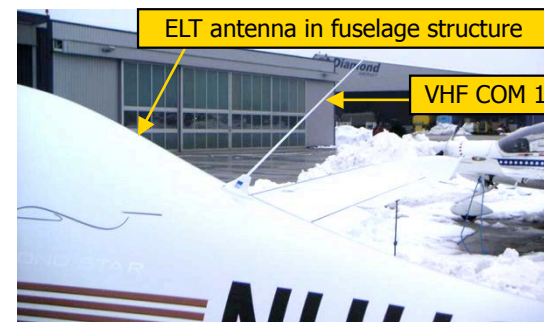
## Diamond DA40-TDI G1000



Exterior

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## ELT and VHF COM 1 Antenna



ELT antenna in fuselage structure

VHF COM 1

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## VHF COM 2 antenna



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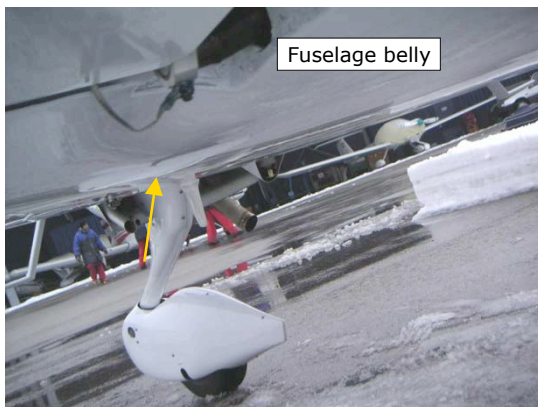
## VHF NAV + GP Antennas



in the horizontal stabilizer

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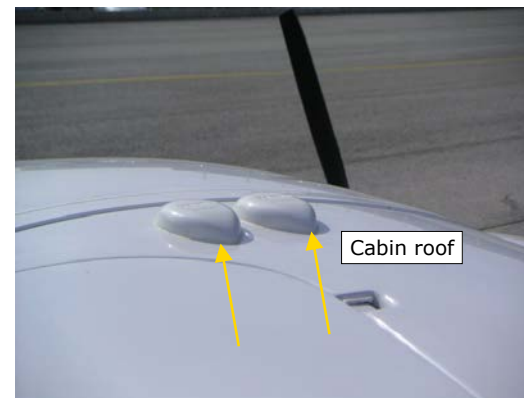
## Marker Antenna



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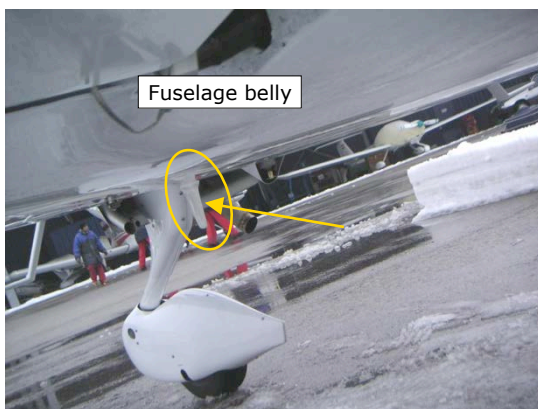
## GPS Antennas



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## DME, TXPDR Antenna



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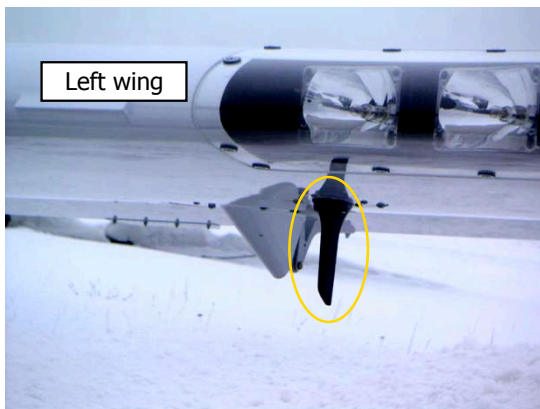
## ADF antenna



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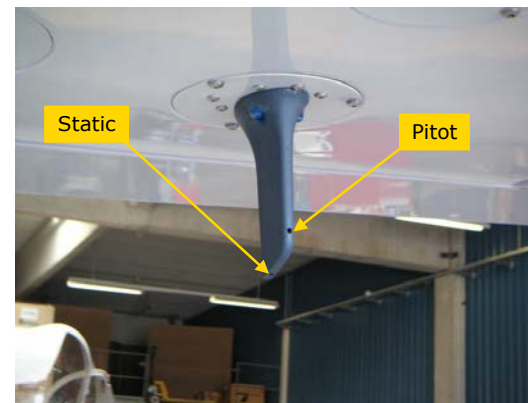
## Pitot/Static Probe



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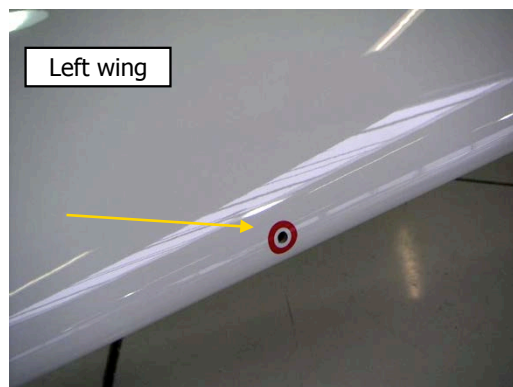
## Pitot/Static Probe



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## Lift Detector (Stall Warning)



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## Engine Oil



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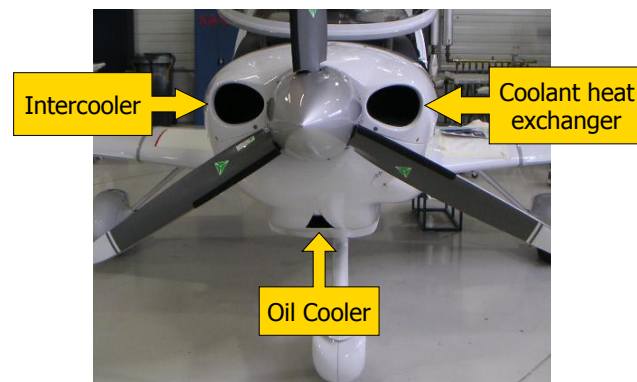
## Engine Oil



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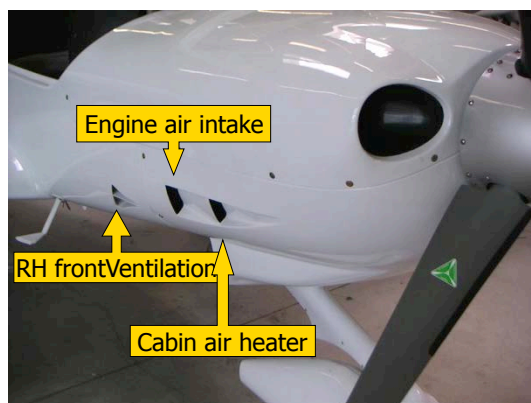
## Air Inlets



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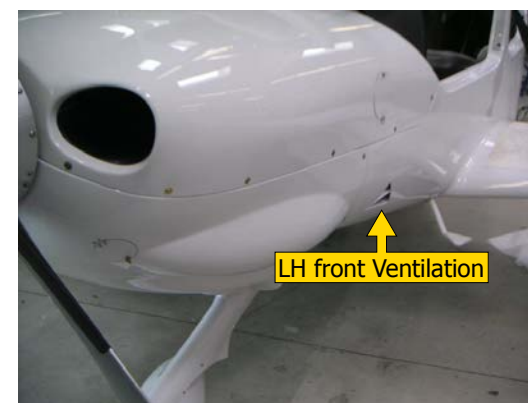
## Air Inlets



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## Air Inlets



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## Diamond DA40-TDI G1000



## Operating Limitation



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## Temperature Limitation



- The airplane may only be operated when its temperature prior to operation is not less than  $-20^{\circ}\text{C}$  and not higher than  $54^{\circ}\text{C}$ .
- With the airplane cold soaked and its temperature below  $-20^{\circ}\text{C}$  the use of an external pre-heater for the engine and pilot compartment prior to operation is mandatory.

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## Diamond DA40-TDI G1000



## Mass



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## Mass (Weight)



Empty (typical)	830 kg
Max TKOF	1150 kg
Max LDG	1150 kg
Max Baggage	30 kg
Max Baggage with „Baggage Extension“	45 kg (max 18 kg in aft compartment)

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## Mass (Weight)



### Attention!

JET fuel and Diesel are heavier than  
AVGAS!

Typical fuel weight:

JET A1:	Diesel:
0,8 kg/ltr	0,84 kg/ltr
3,03 kg/USG	3,2 kg/USG

## Diamond DA40-TDI G1000



### Speeds



## Characteristic Speeds



V <sub>NO</sub>	129 KIAS
V <sub>NE</sub>	178 KIAS
V <sub>A</sub> 780-980 kg	94 KIAS
V <sub>A</sub> 980-1150 kg	108 KIAS

## Characteristic Speeds



V <sub>SO</sub>	49 KIAS
V <sub>S1</sub>	52 KIAS
V <sub>FE</sub> (Flaps T/O)	108 KIAS
V <sub>FE</sub> (Flaps LDG)	91 KIAS

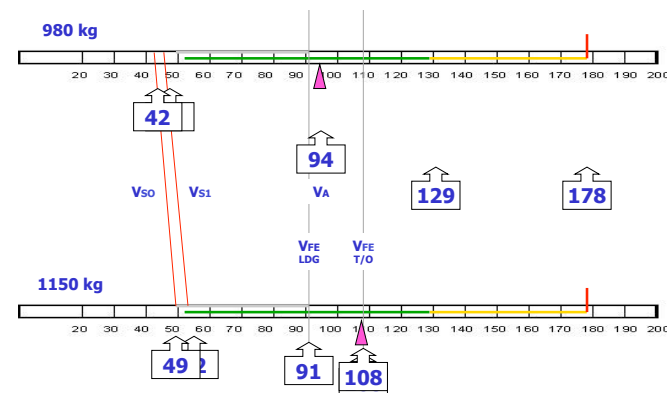
## Characteristic Speeds



	850 kg	1000 kg	1150 kg
$V_X = V_Y$	54 KIAS	60 KIAS	66 KIAS
$V_{climb}$	60 KIAS	68 KIAS	73 KIAS
$V_{LDG Flaps UP}$	60 KIAS	68 KIAS	73 KIAS
$V_{LDG Flaps LDG}$	58 KIAS	63 KIAS	71 KIAS

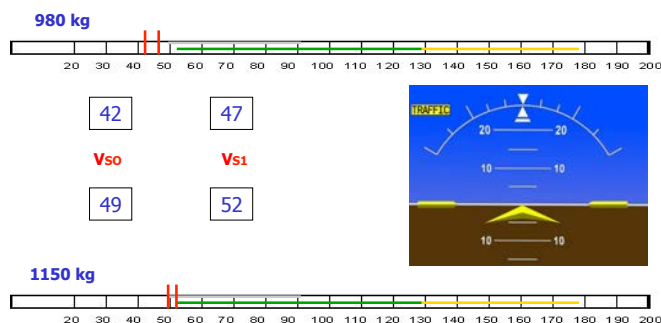
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## Characteristic Speeds



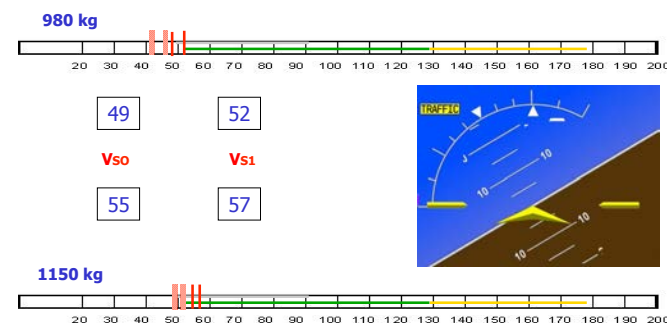
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## Stalling Speeds



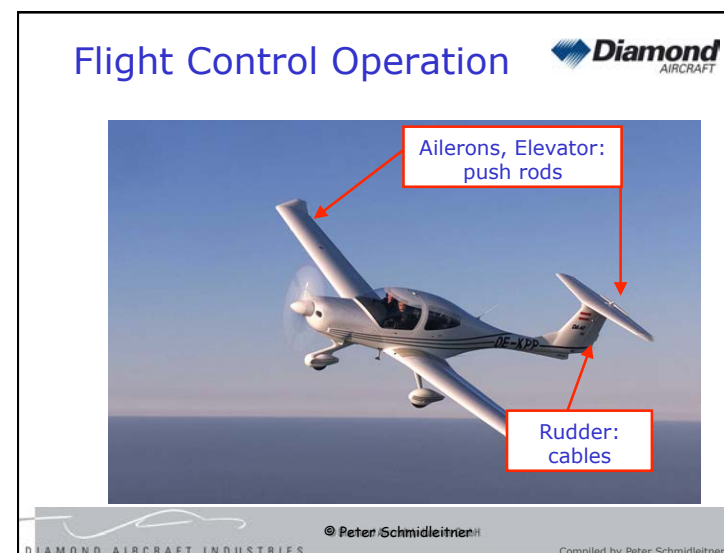
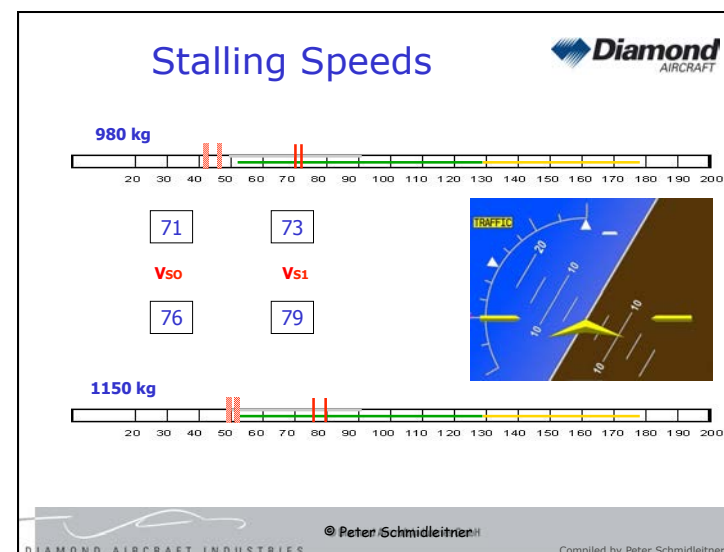
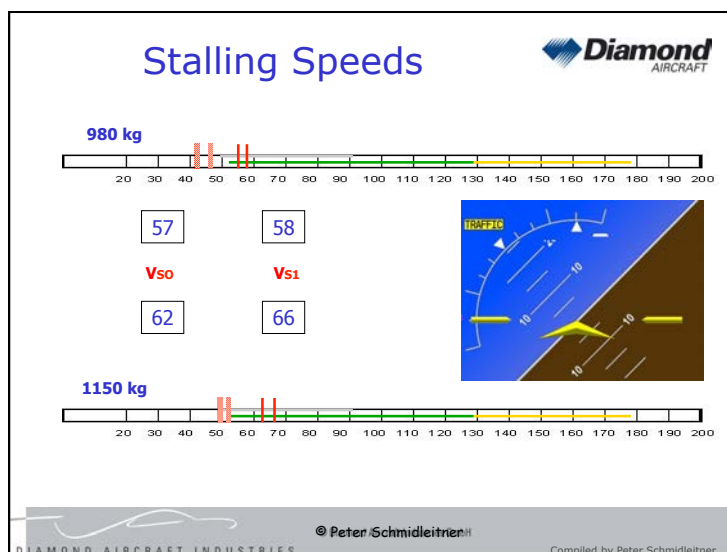
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## Stalling Speeds

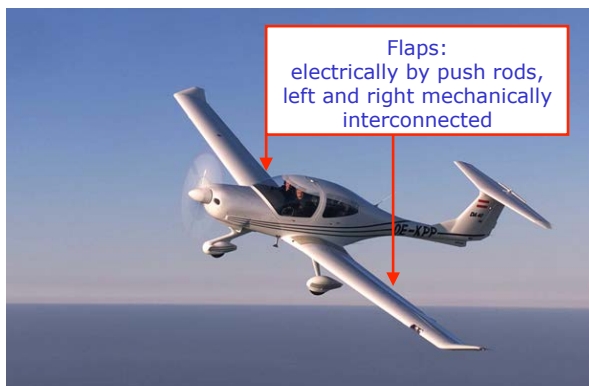


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## Flight Control Operation



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## Diamond DA40-TDI G1000



### Instrument Panel



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## Instrument Panel



Garmin 1000

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## Instrument Panel

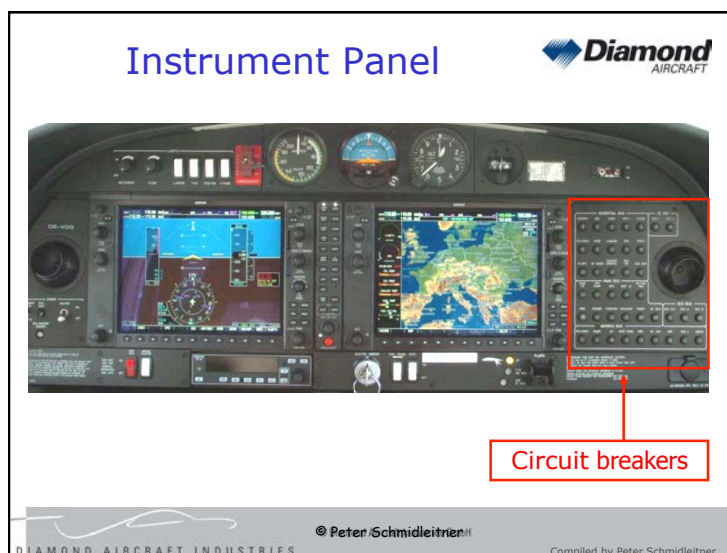
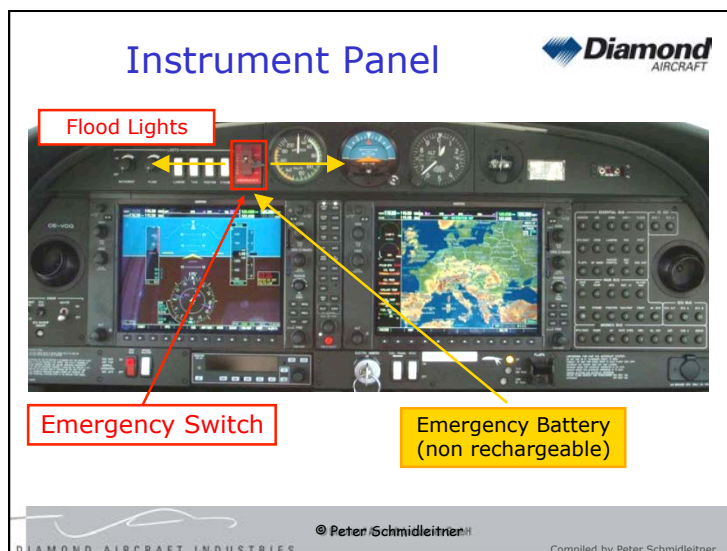


Backup Instruments

Compass

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## Instrument Panel



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## Instrument Panel



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## Instrument Panel



Autopilot

Flaps

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## Alternate Static Valve



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## Alternate Static Valve



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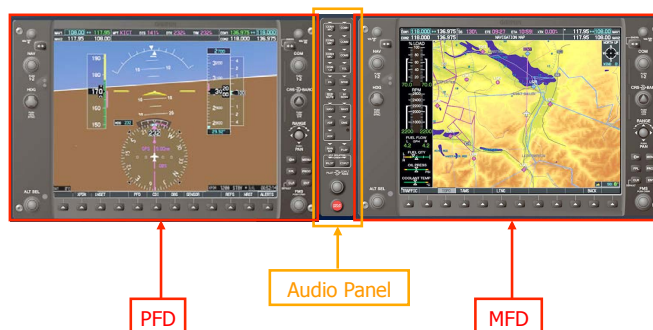
## Diamond DA40-TDI G1000



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## DA 42 Garmin 1000



PFD

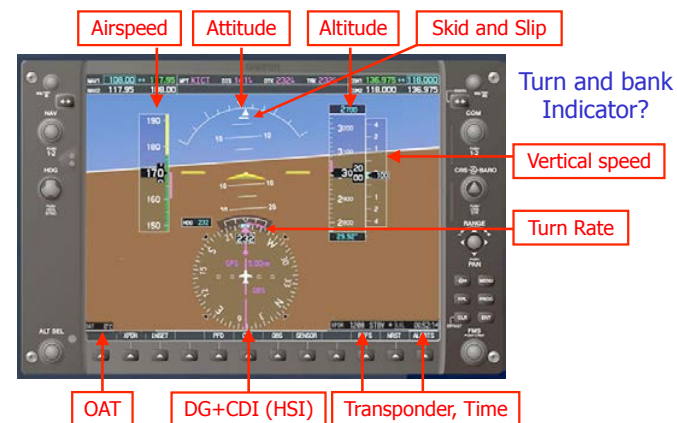
Audio Panel

MFD

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## PFD



OAT

DG+CDI (HSI)

Transponder, Time

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## Garmin 1000 MFD



EIS / Engine Indication System

Multi Function Display



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## Engine Indication System



Default page

Display when  
pushing the  
SYSTEM buttonDisplay when  
pushing the  
FUEL button

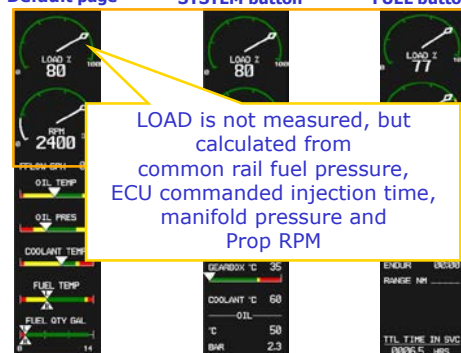
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## Engine Indication System



Default page

Display when  
pushing the  
SYSTEM buttonDisplay when  
pushing the  
FUEL button

LOAD is not measured, but calculated from common rail fuel pressure, ECU commanded injection time, manifold pressure and Prop RPM

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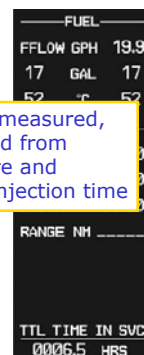
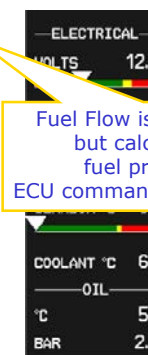
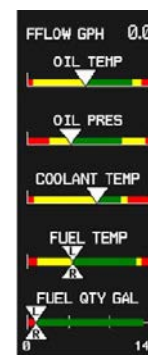
## Engine Indication System



Default

SYSTEM

FUEL

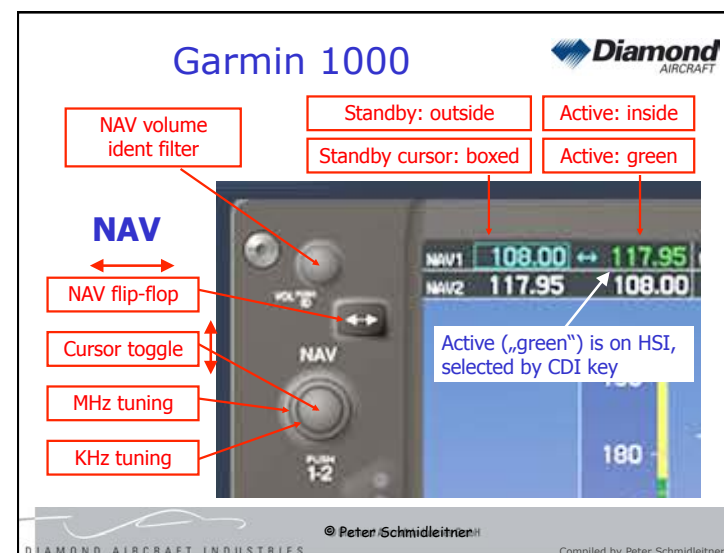
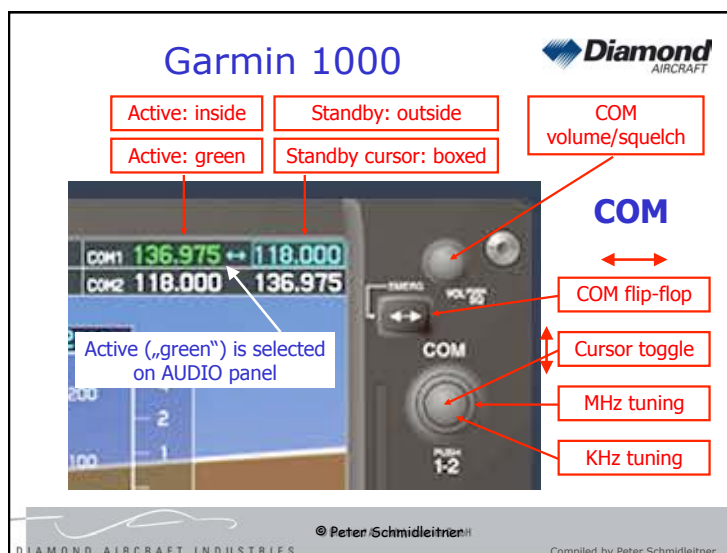
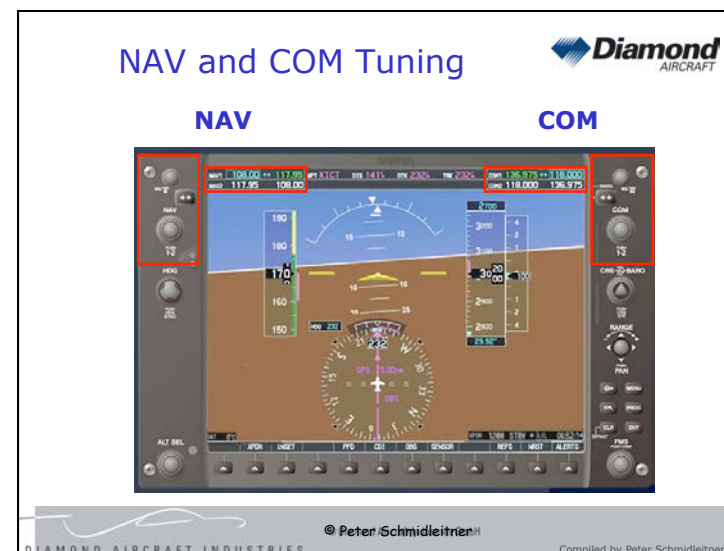
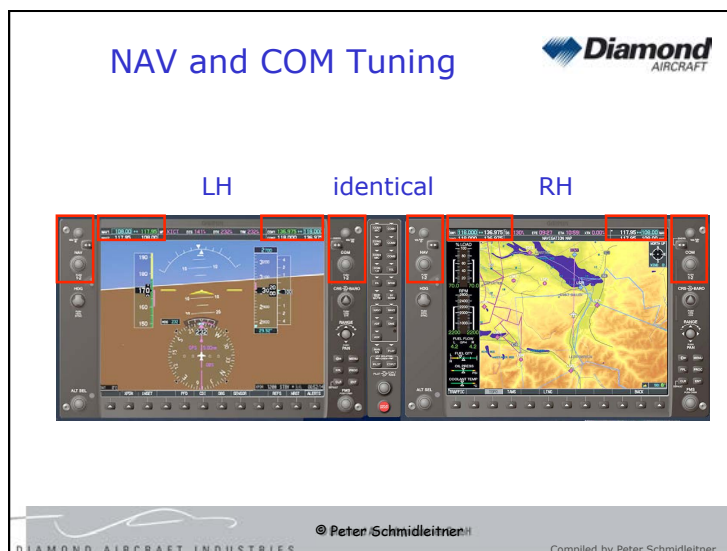


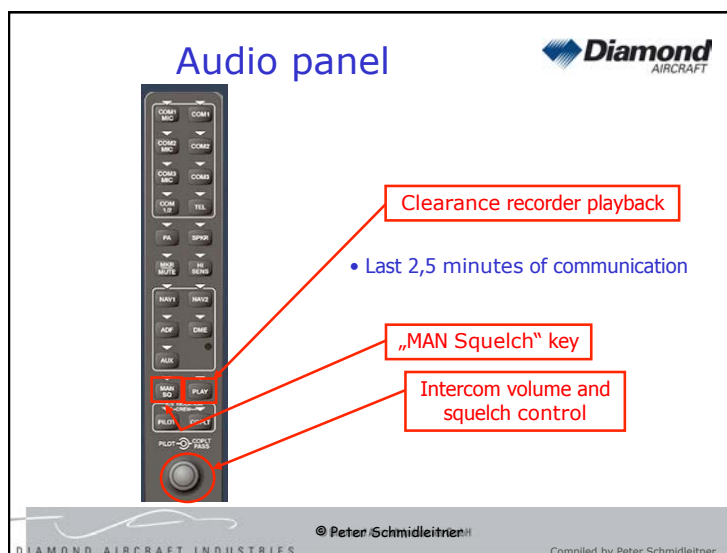
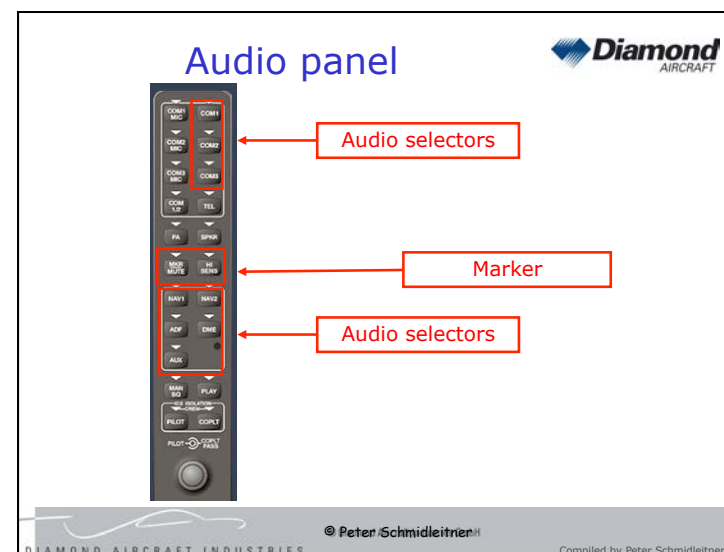
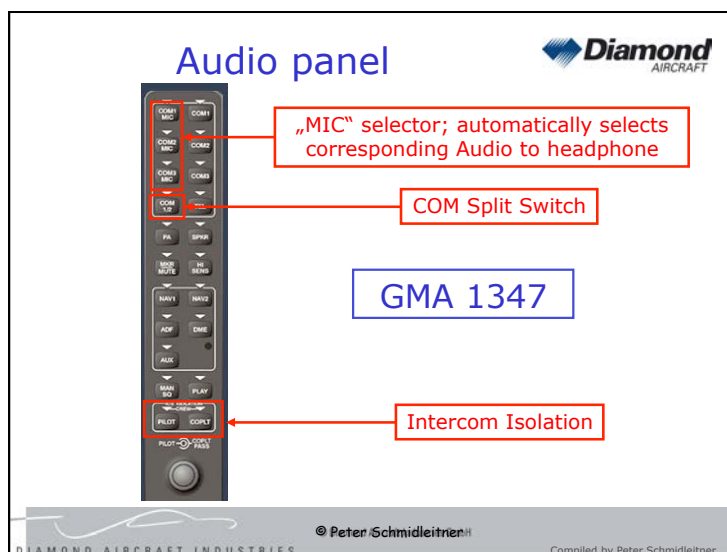
Fuel Flow is not measured, but calculated from fuel pressure and ECU commanded injection time

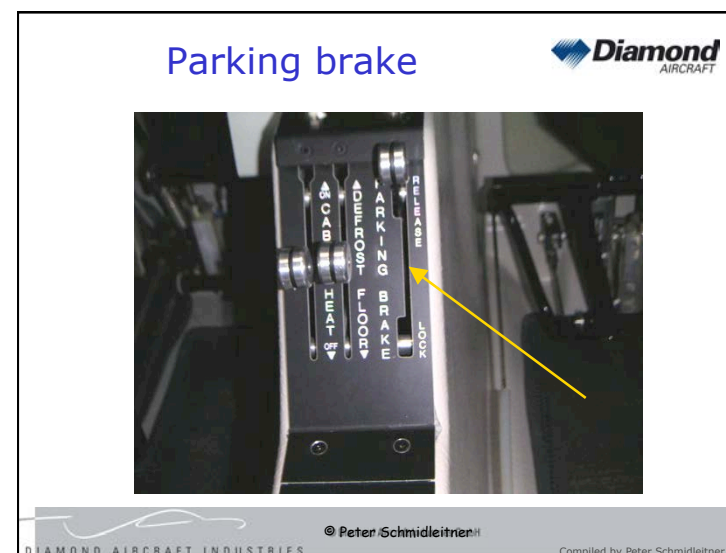
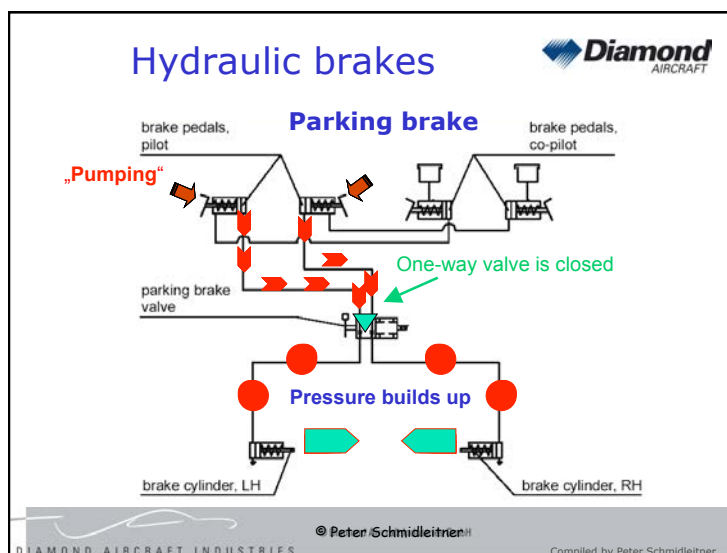
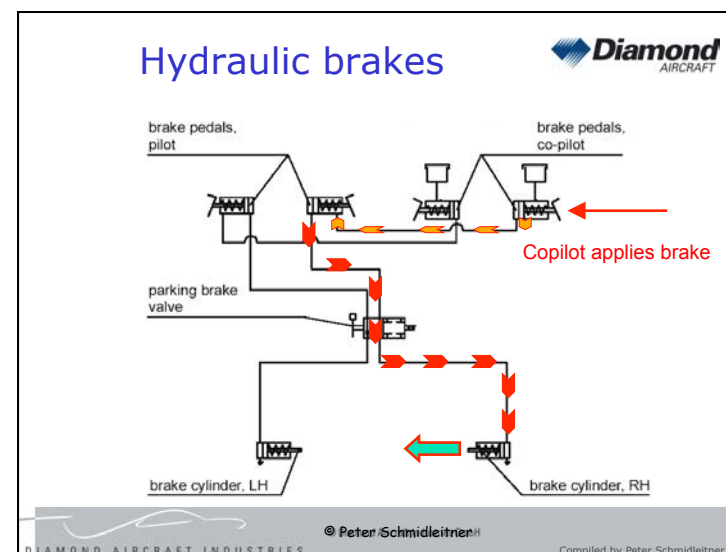
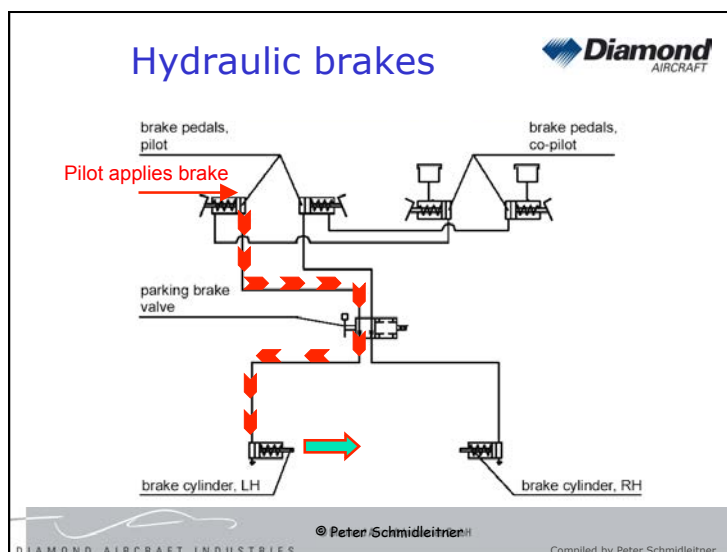
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## Diamond DA40-TDI G1000



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## Diamond DA40 TDI Engine



- Thielert Aircraft Engine TAE125-02-99
  - Previously: TAE125-01
- Four cylinders, liquid-cooled
  - 1991 ccm (TAE125-01: 1689 ccm)
- Common-rail direct injection
- Reduction gear 1:1,69
- Dual digital engine control
- Turbocharger
- Max. power: 99kW (135 HP) at 2300 RPM
- Max cont. power: 99kW (135 hp) at 2300 RPM

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## Digital Engine Control

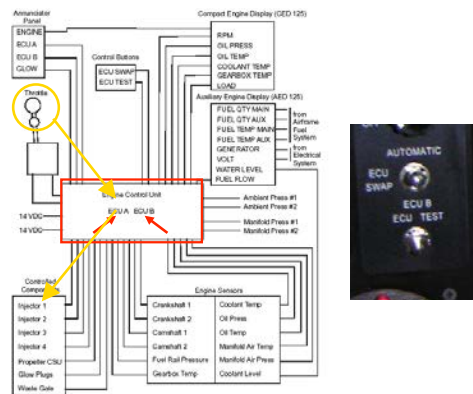


- **ECU**
  - Engine Control Unit
- this is a
- **FADEC**
  - Full Authority Digital Engine Control

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## ECU – Engine Control Unit



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## E.O.T. – Engine Order Telgraph („Chadburn“)



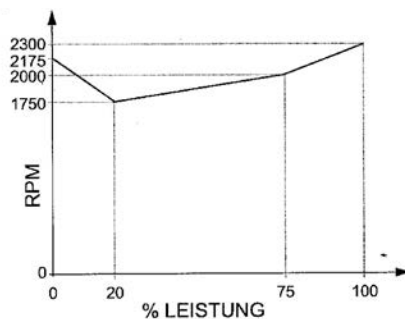
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## Diamond DA40 TDI Engine



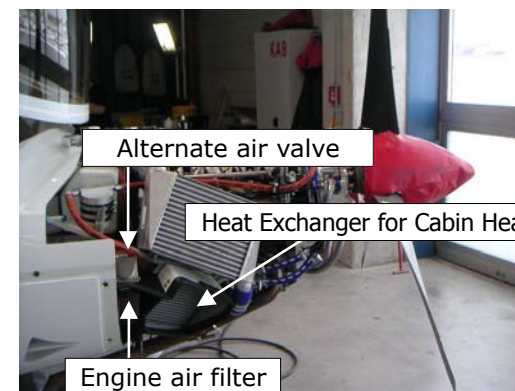
- Power lever selects power (LOAD in %)
- RPM automatically determined by selected power



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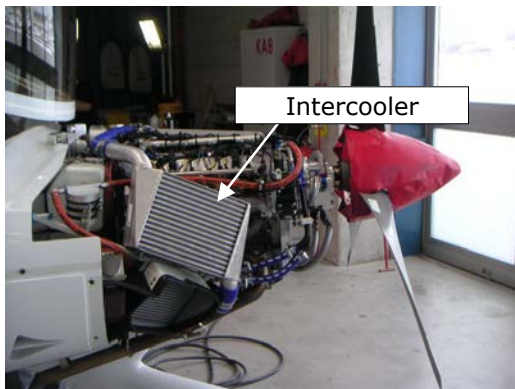
## Diamond DA40 TDI Engine



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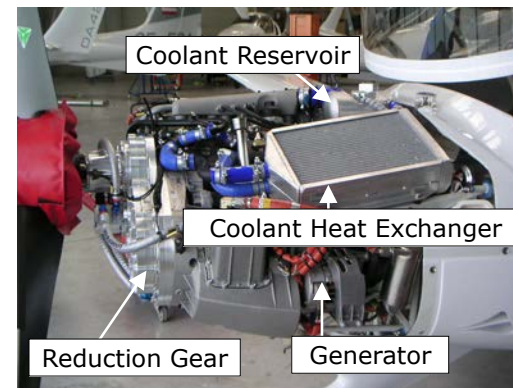
## Diamond DA40 TDI Engine



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## Diamond DA40 TDI Engine



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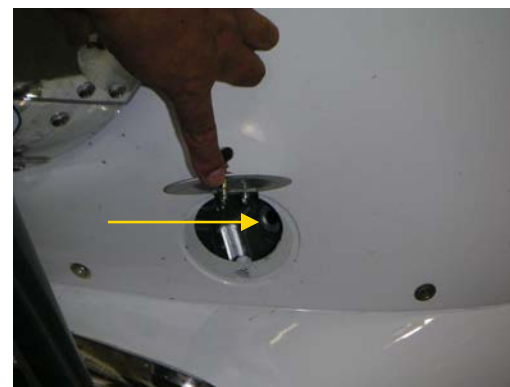
## Power plant – Gear oil



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## Power plant – Gear oil



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## Power plant – Gear oil



Is this the little bubble ?

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## Power plant limitations



■ *Italic figures are for the „old“ 125-01 engine*

- Max RPM: 2300
- Oil pressure: 1.0 – 6.5 bar
- Oil quantity (per engine): 4.5 – 6.0 liters
- Max. oil consumption: 0.1 liters/hr
- Oil temperature: -30 *(-32)* °C – 140 °C
- Gearbox temperature: max. 120 °C
- Coolant temperature: -30 *(-32)* °C – 105 °C
- Max. restart altitude: 8000 ft *(6500 ft)*, 73–120 KIAS

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## Power plant fluid specifications



- Fuel: JET A-1 or JET A (ASTM D 1655)  
JET No. 3 (GB6537-94)  
**Diesel (EN 590)** !
- Oil: SHELL Helix Ultra 5W30 synth. API SL/CF  
SHELL Helix Ultra 5W40 synth. API SL/CF  
AERO SHELL Diesel 10W-40
- Gearbox oil: SHELL EP 75W90 API GL-4
- Coolant: DAI-G30-MIX  
special water (TAE-125-OM-02-01)  
+ cooler protection 1:1  
(BASF Glysantin Alu Protect Plus/G30)  
(freezing point -36 °C)

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## „Diesel“ limitations



- Temperature limits
  - Below -5° C no engine start
  - Below +5° C no take-off
- Be sure that no diesel fuel is in the tanks – otherwise temp limitations for diesel ops must be observed

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## „Diesel“ limitations

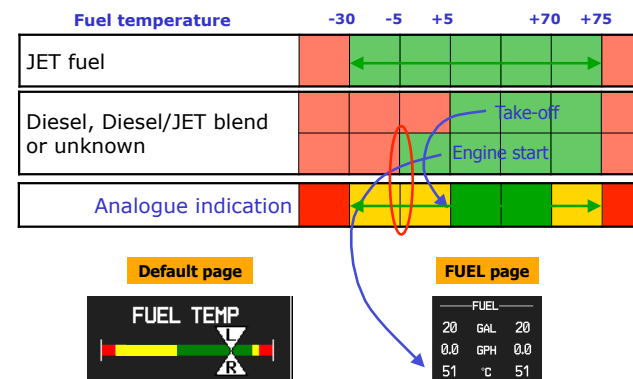


- When is no more diesel in the tanks?
  - each tank to be refilled at least twice with more than
    - 10,6 USG (40 ltrs) (normal tanks)
    - 17,2 USG (65 ltrs) (long range tanks)
 of Jet fuel
  - otherwise
  - tank must be drained

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## „Diesel“ limitations



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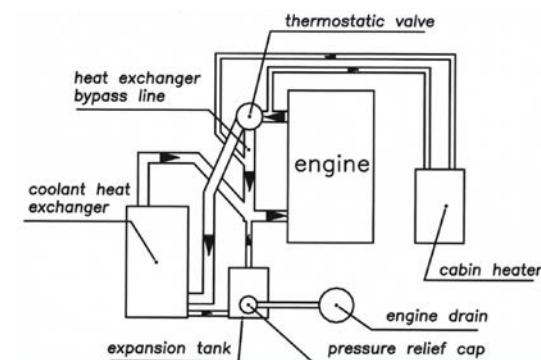


### Cooling System

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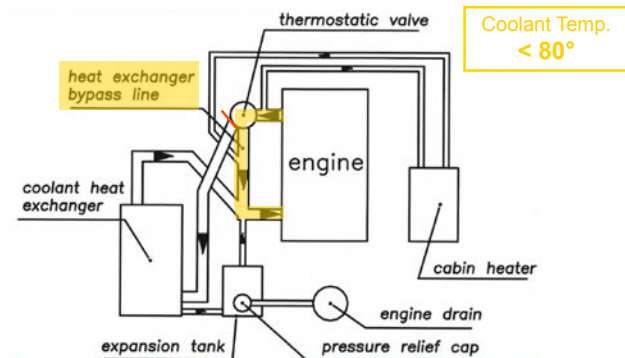
## DA 40 TDI Cooling System



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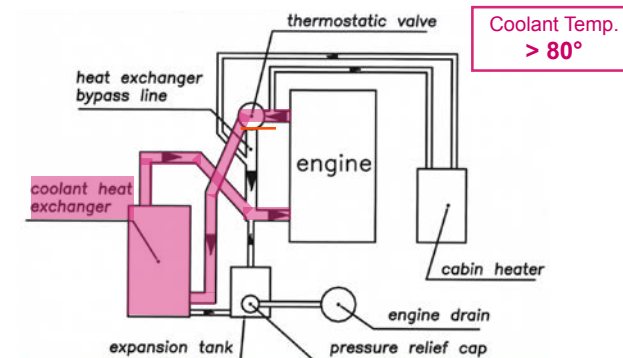
## DA 40 TDI Cooling System



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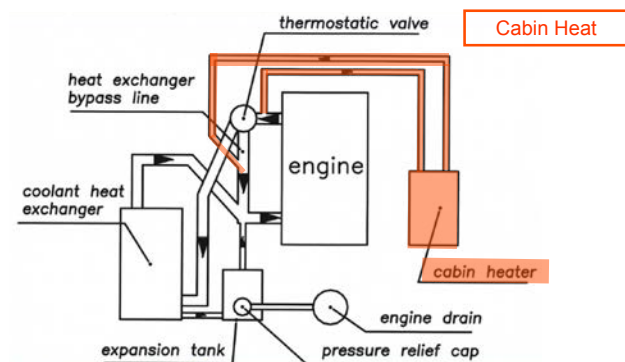
## DA 40 TDI Cooling System



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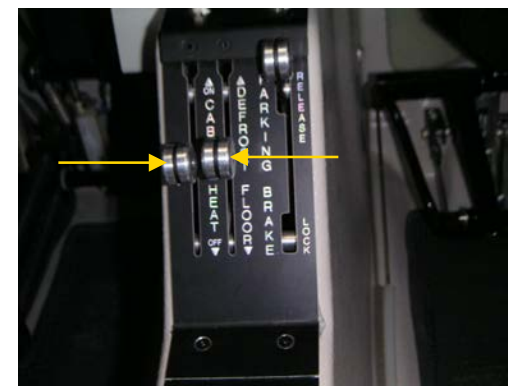
## DA 40 TDI Cooling System



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## DA 40 TDI Cabin Heat



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## DA 40 TDI Ventilation

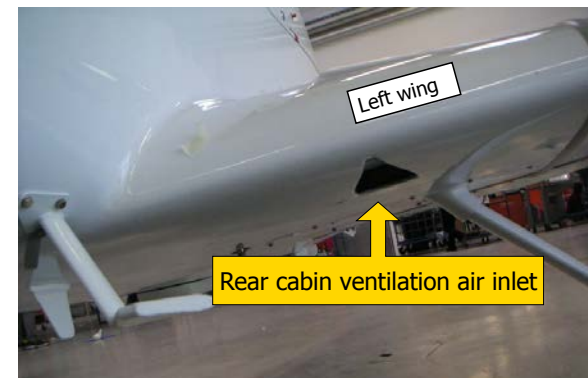


Cabin

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## DA 40 TDI Ventilation



Rear cabin ventilation air inlet

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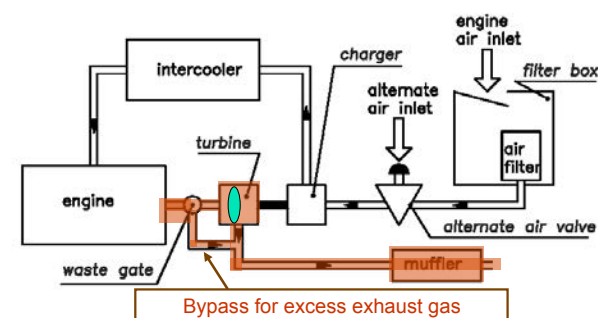
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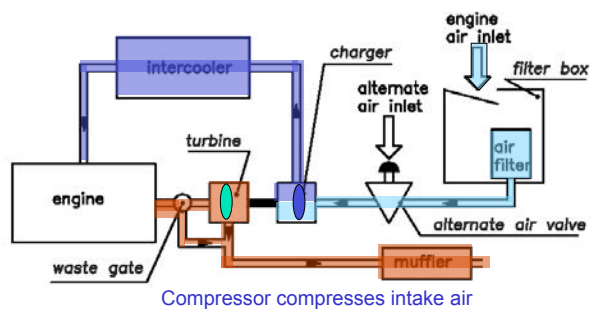
## DA 40 TDI Turbo Charger



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## DA 40 TDI Turbo Charger



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## DA 40 TDI Fuel System



- 2 x 14 USG usable
- = 28 USG
- = 85 kg
- At 70% power: ~ 5 USG/hr

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## DA 40 TDI Fuel System



- Long Range Tanks:  
2 x 19,5 USG usable
- = 39 USG
- = 120 kg
- Max indicated fuel per tank: 15 USG
- Max. unbalance: 9 USG

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## DA 40 TDI Fuel System



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## DA 40 TDI Fuel System

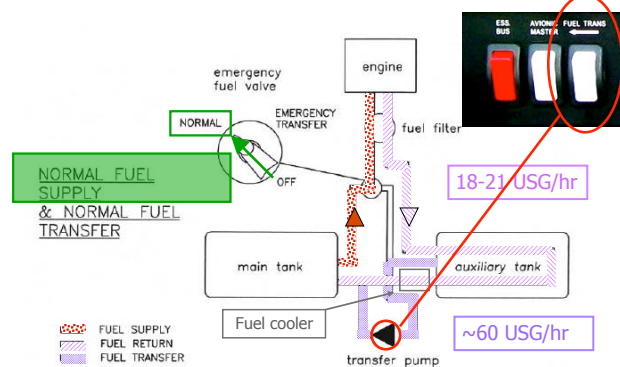


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## DA 40 TDI Fuel System

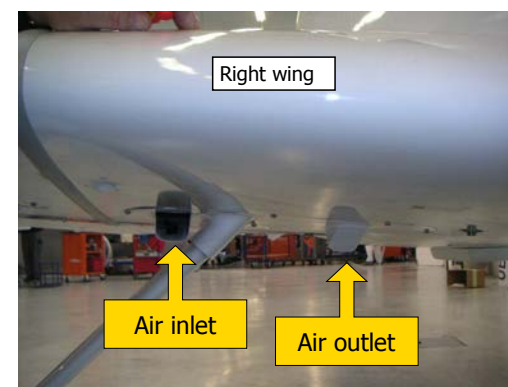


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## Fuel cooler



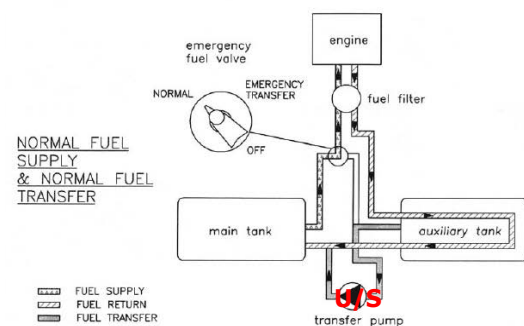
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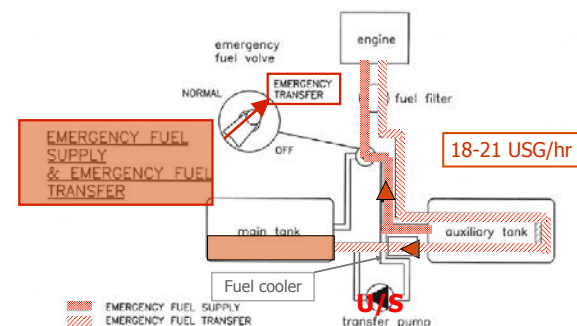
## DA 40 TDI Fuel System



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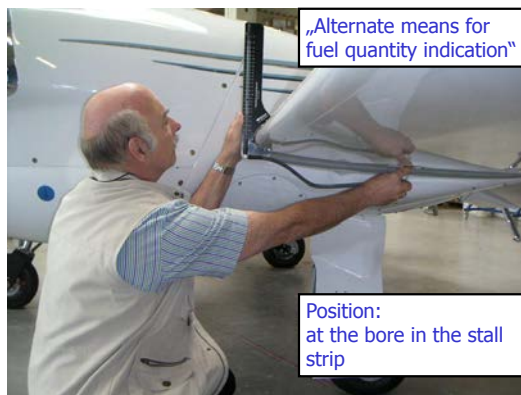
## DA 40 TDI Fuel System



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## DA 40 Fuel system



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## Fuel vents



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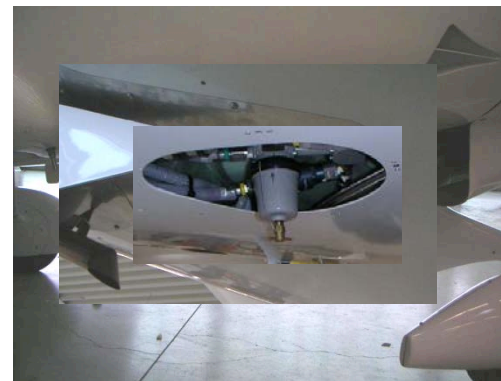
## Fuel tank drain



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## Fuel gascolator drain



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## Diamond DA40-TDI G1000

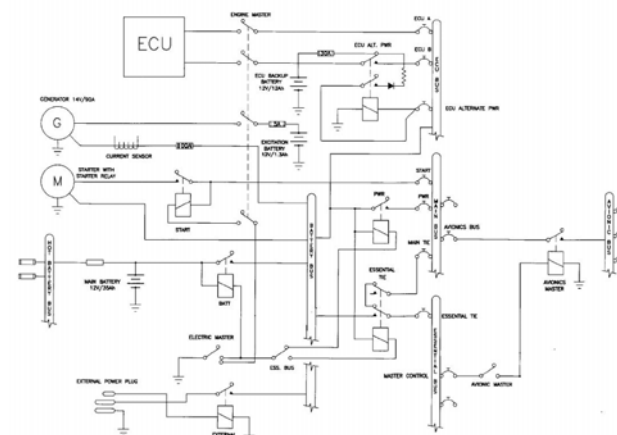


## Electrical System

© Diamond Aircraft Industries GmbH

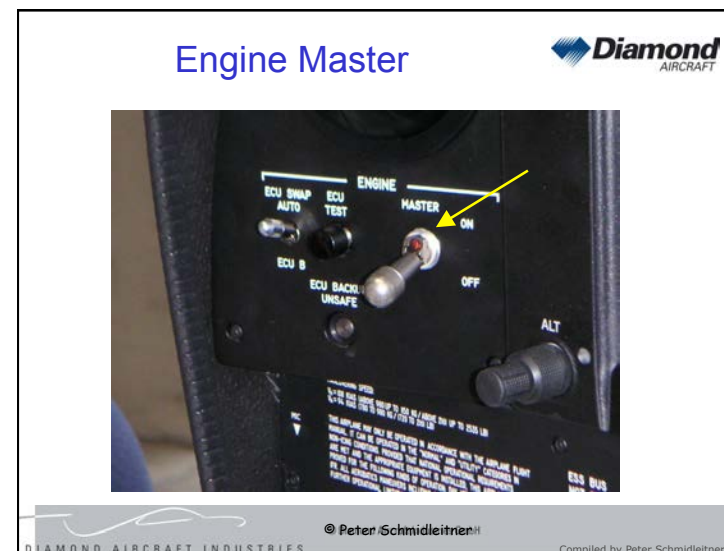
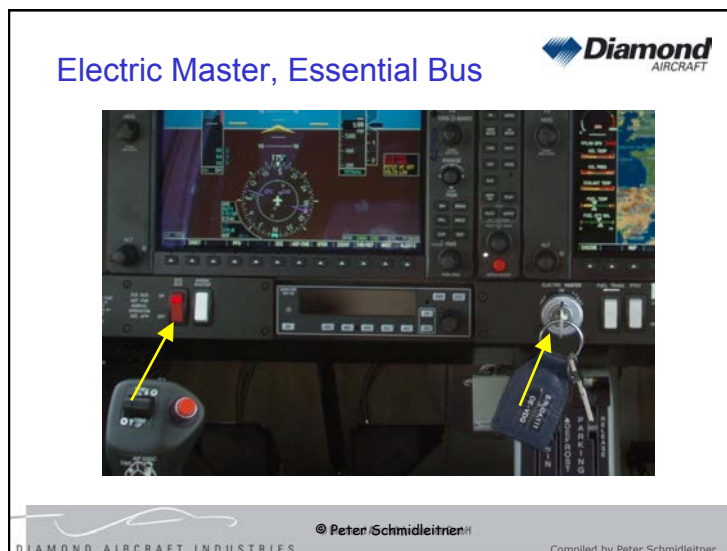
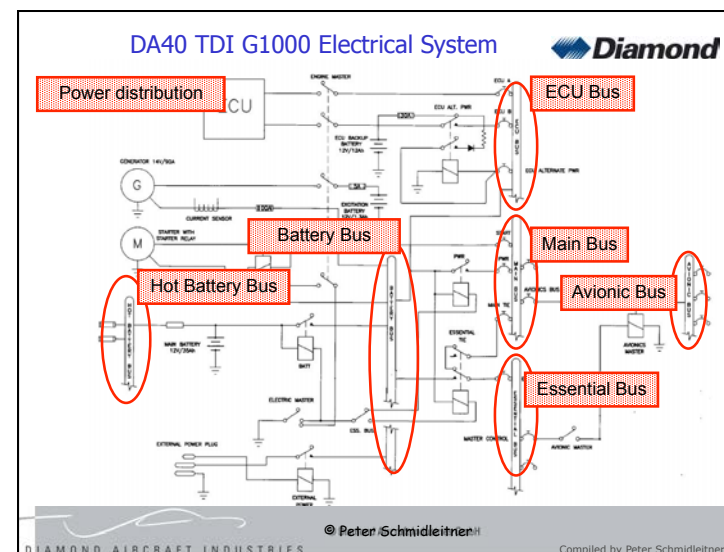
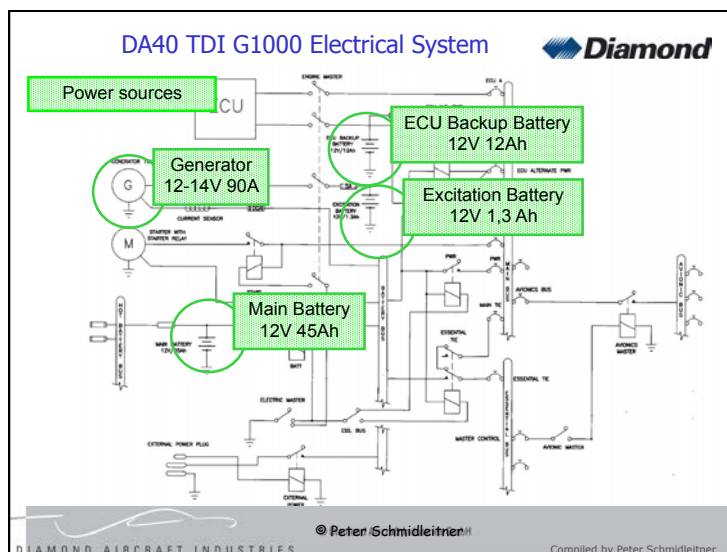
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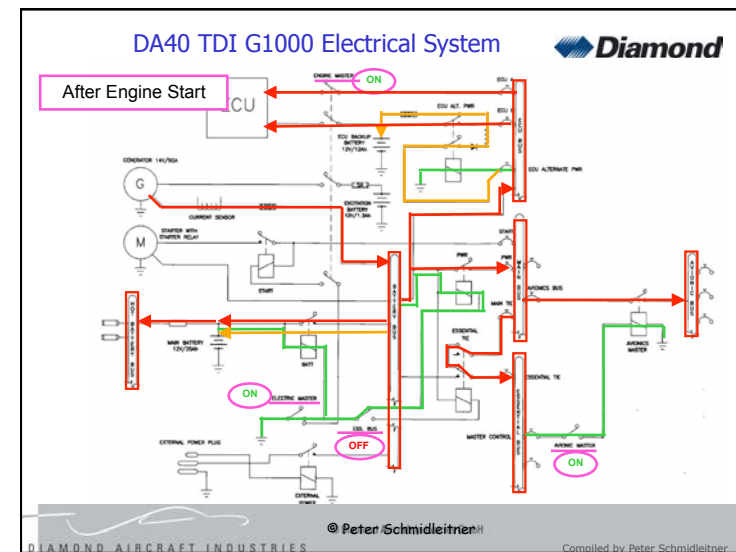
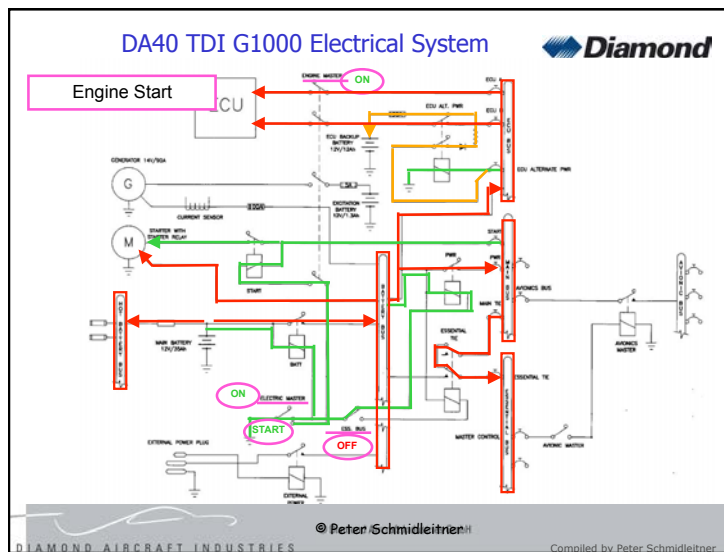
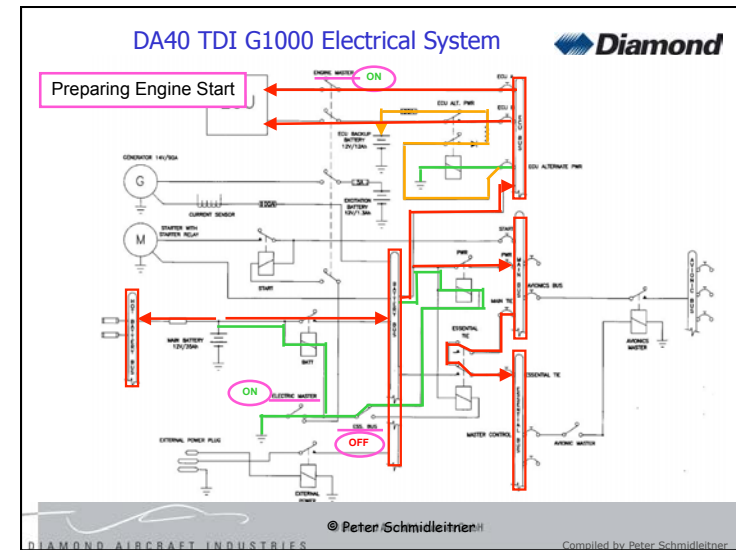
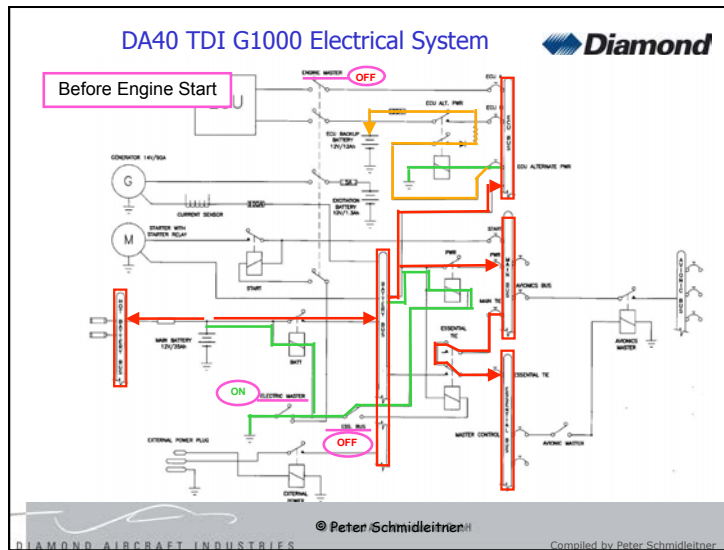
## DA40 TDI G1000 Electrical System



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## External Power Receptable



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## External Power Receptable



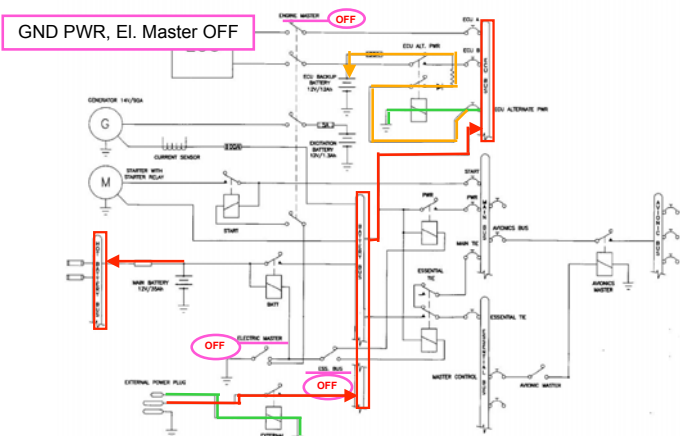
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## DA40 TDI G1000 Electrical System



GND PWR, El. Master OFF



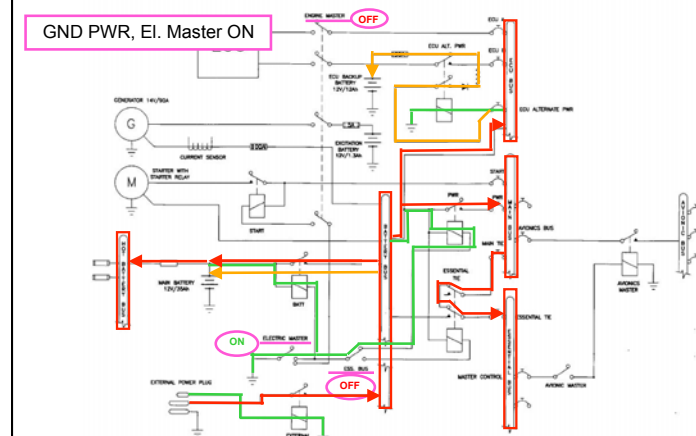
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## DA40 TDI G1000 Electrical System



GND PWR, El. Master ON



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## Emergency Switch



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## DA40-TDI G1000



# The mysterious Essential Bus Switch



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## Switch location



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## When is it used ?



- When the generator fails
- to disconnect unnecessary electrical consumers
- to supply battery power to essential electrical consumers

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Compiled by Peter Schmidleitner



## Essential Electrical Power



### ■ Essential Bus

- PFD
- Horizon \*)
- AHRS
- ADC
- Flaps
- Landing light
- Pitot Heating
- Landing Light
- Flood Light \*)
- COM 1
- GPS / NAV Receiver 1
- Transponder
- Engine instruments

### ■ Hot Battery Bus

- (Essential Bus)
- Pilot's map/reading light
- Auxiliary jack

\*) Emergency Battery

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## Essential Electrical Power



### ■ Main unserviceable systems

- Fuel x-fer pump
- MFD
- Acionic / CDU fan
- Position light, Strobe lights, Taxi light
- Instrument lights, Map light
- Starter
- (Avionics Bus)
  - COM2, NAV/GPS2, ADF, DME, WX500, Audio, Autopilot

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## What happens ...

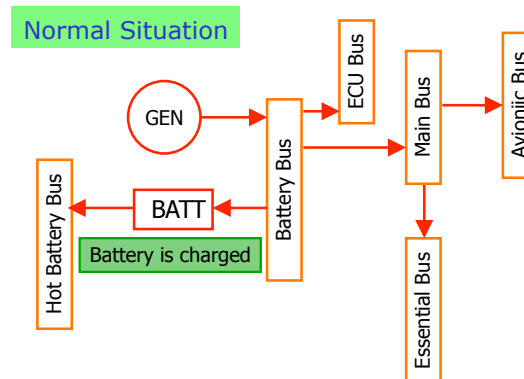


- ... if it is switched ON during normal operation?
- Will the battery be discharged?
  - **NO !**

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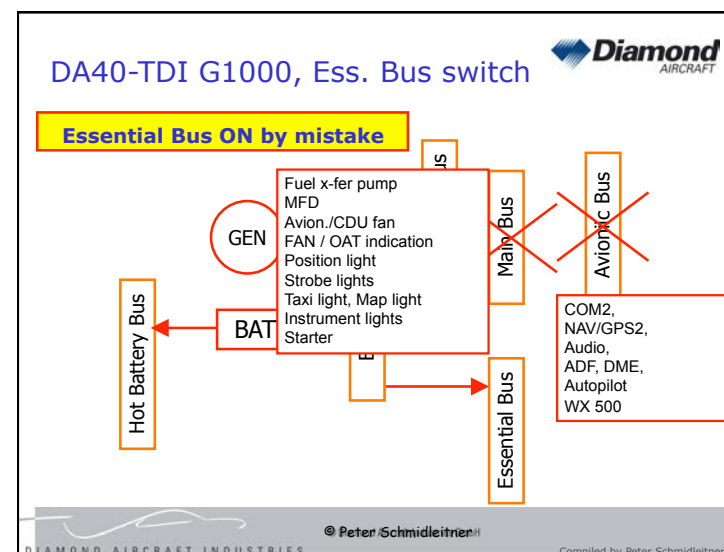
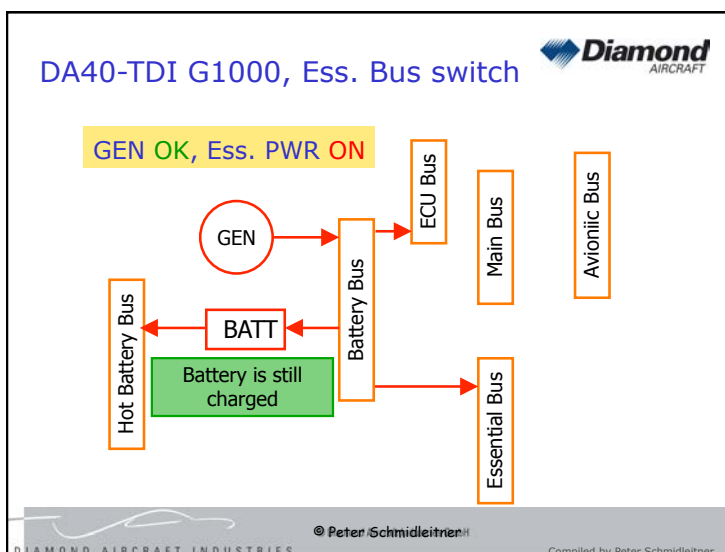
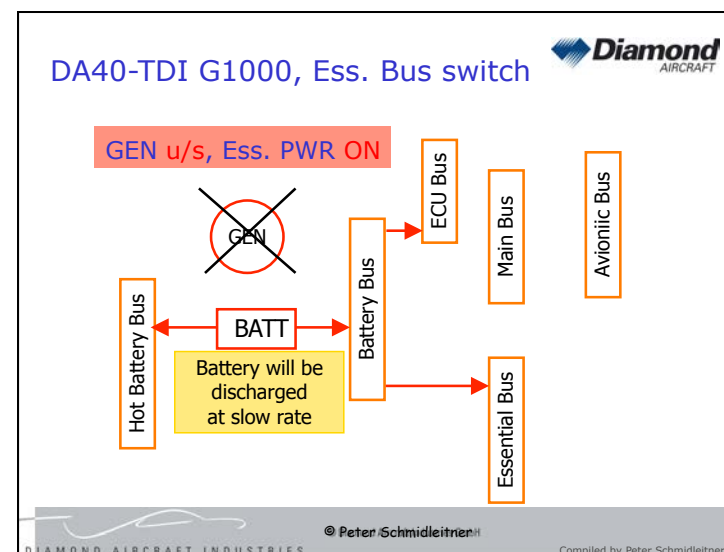
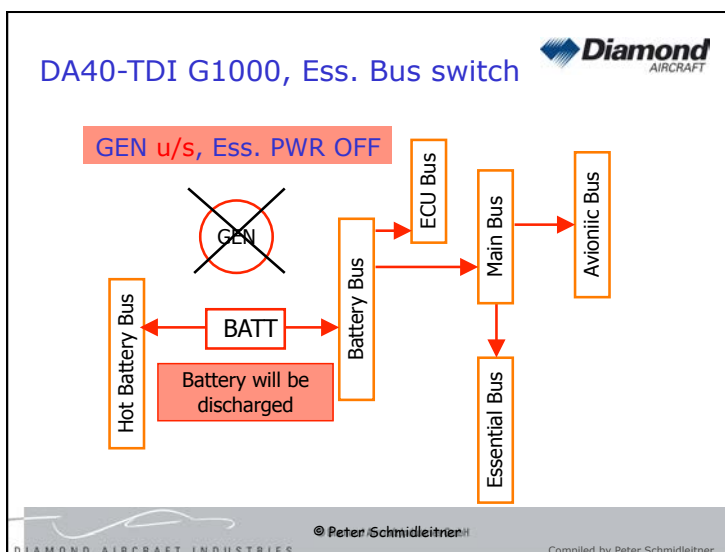
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## DA40-TDI G1000, Ess. Bus switch



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## DA40-TDI G1000, Ess. Bus switch



- A very special engine start problem:
  - Start witch ON
  - Nothing happens!
- Why?
  - Essential Bus switch ON by mistake!

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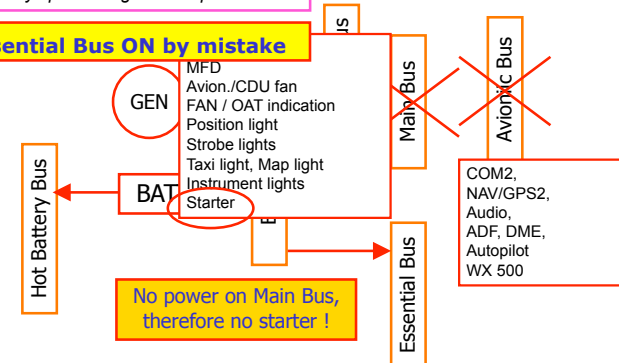
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## DA40-TDI G1000, Ess. Bus switch



A very special engine start problem

## Essential Bus ON by mistake



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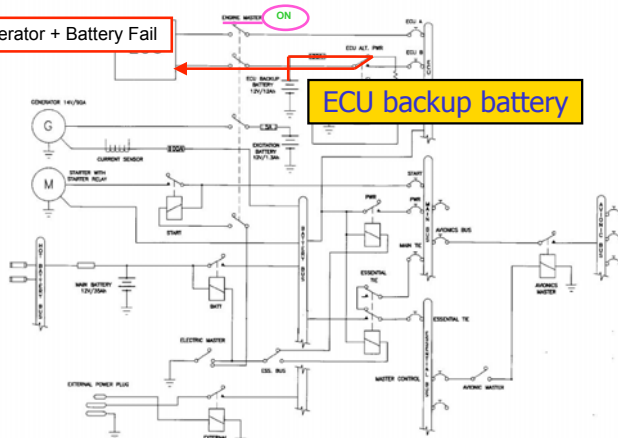
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## DA40 TDI G1000 Electrical System



Generator + Battery Fail

ECU backup battery



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## Diamond DA40-TDI G1000



Autopilot

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## Autopilot limitations



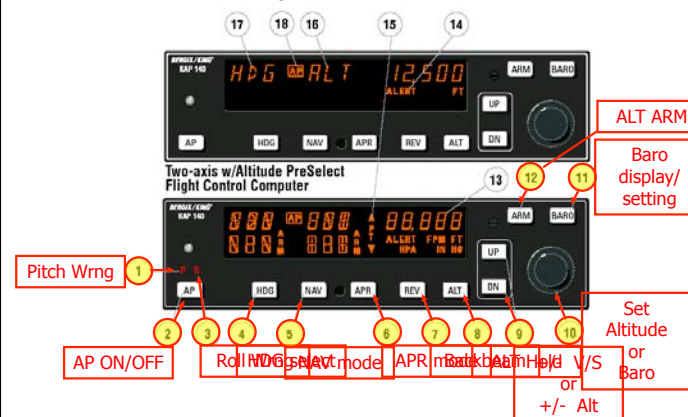
### Limitations for KAP 140 Autopilot System:

Do not use AP if "Alternate Static" is open.  
 Conduct AP and trim check prior to each flight (see AFM).  
 Autopilot OFF during take-off and landing.  
 Maximum speed for autopilot operation is 165 KIAS.  
 Minimum speed for autopilot operation is 70 KIAS.  
 Minimum altitude for autopilot operation:  
 Cruise, Climb, Descent and Maneuvering: 800 feet AGL  
 Approach: 200 feet AGL

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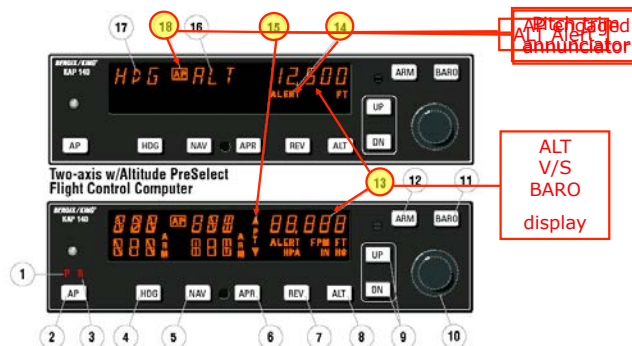
## Autopilot



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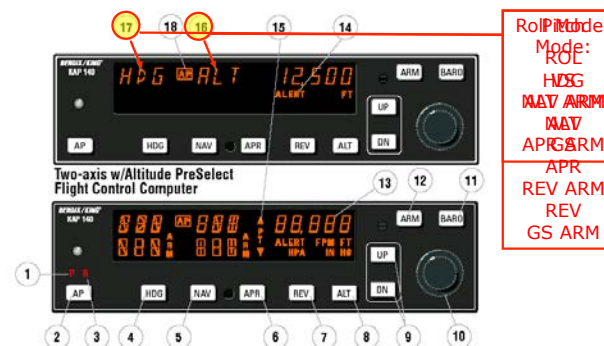
## Autopilot



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## Autopilot



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## Autopilot



### Vertical Speed Mode



Toggles between ALT HLD and V/S

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Compiled by Peter Schmidleitner

## Autopilot



### Altitude Hold Mode



Toggles between ALT HLD and V/S

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## Autopilot



### Altitude Preselect



Select Altitude

ALT ARM



Select V/S

Change to V/S



ALT Hold and  
ALERT

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## Autopilot



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## Diamond DA40-TDI G1000



## Performance

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## The „DA 40 TDI“ and „Density Altitude“



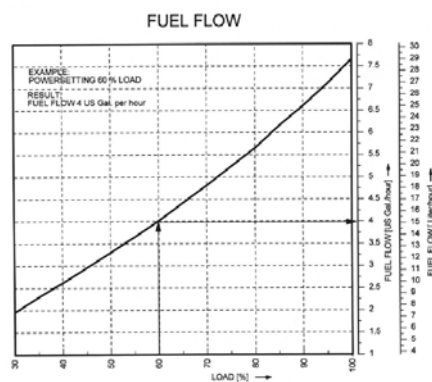
## ■ Attention!

- Performance data which are engine-power dependant cannot be determined by just using „Density Altitude“!
- Reason: the engine power output does not correspond to density altitude but pressure and temperature have their own, independent influence
- This is a feature of the ECU controlled, turbocharged Diesel-engine

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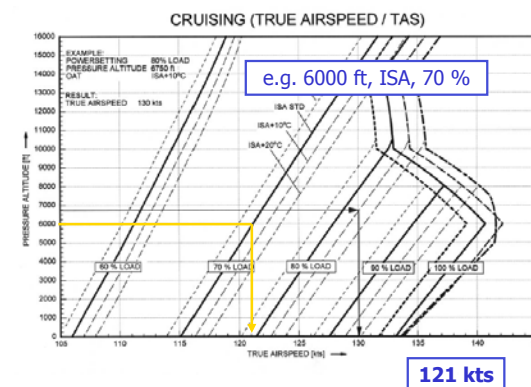
## Cruise Power Setting



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## Cruising Speed



121 kts

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## TOD



### WARNING

For a safe take-off the available runway length must be at least equal to the take-off distance over a 50 ft (15 m) obstacle.

SL, ISA, 1150 kg: 640 m

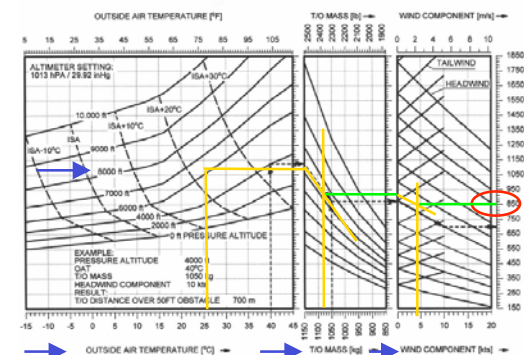
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## TKOF Distance



### TAKE OFF DISTANCE OVER 50 FT OBSTACLE



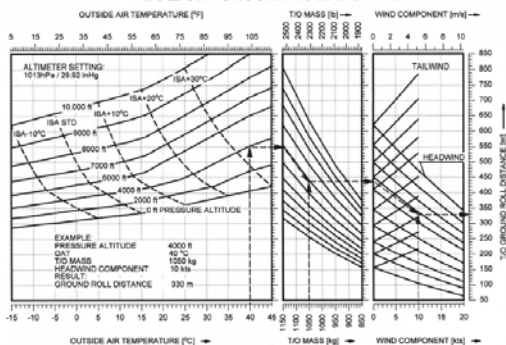
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## TKOF Run



### TAKE OFF GROUND ROLL DISTANCE



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## Grass Runway



Length of grass	TKOF roll	Wet grass
- 5 cm	+ 10%	may be significantly longer
5 - 10 cm	+ 15%	
>10 cm	min + 25%	

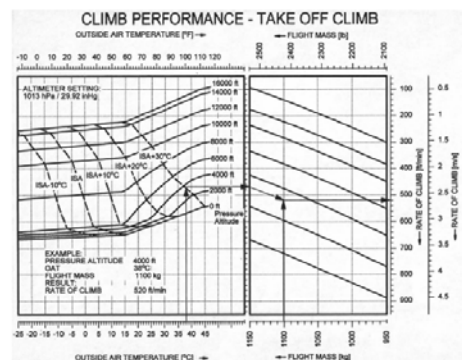
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## Take off climb



66 KIAS



Attention!  
Increasing  
downward

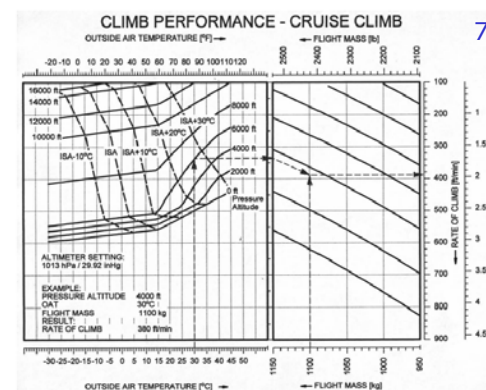
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## Cruise Climb



73 KIAS



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## ROC to gradient conversion



$$\text{Gradient [\%]} = \frac{\text{ROC [fpm]}}{\text{TAS [KTAS]}} \cdot 0.95$$

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## LD, LR tabular format



Flaps LDG  
V<sub>REF</sub> 71 KIAS

values for ISA and MSL, at 1150 kg (2535 lb)	
Landing distance over a 50 ft (15 m) obstacle	744 m (2441 ft)
Ground roll	287 m (942 ft)

Flaps UP  
V<sub>REF</sub> 73 KIAS

values for ISA and MSL, at 1150 kg (2535 lb)	
Landing distance over a 50 ft (15 m) obstacle	916 m (3005 ft)
Ground roll	304 m (997 ft)

### WARNING

For a safe landing the available runway length must be at least equal to the landing distance over a 50 ft (15 m) obstacle.

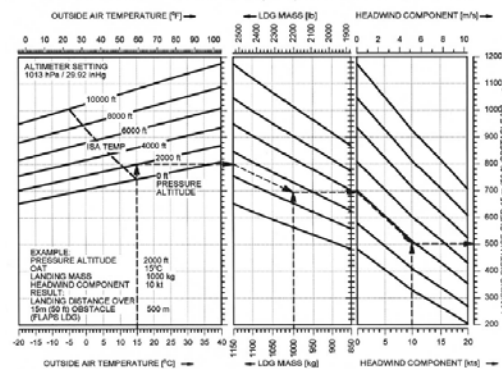
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## Landing Distance



### LANDING DISTANCE OVER 15 m (50 ft) OBSTACLE / FLAPS LDG



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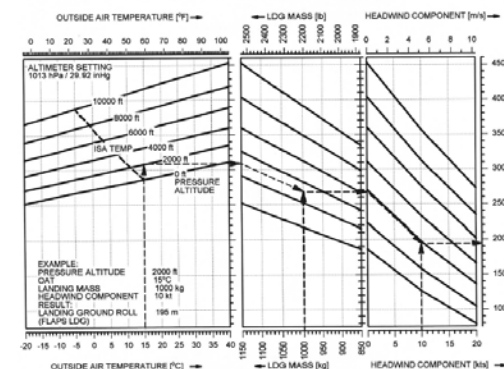
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## Landing Run



### LANDING GROUND ROLL / FLAPS LDG



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## Grass Runway



Length of grass	LDG run	Wet grass
- 5 cm	+ 5%	may be significantly longer
5 - 10 cm	+ 15%	
>10 cm	min + 25%	

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## Go Around



### 5.3.13 GRADIENT OF CLIMB ON GO-AROUND

The DA 40 D reaches a constant gradient of climb of 4.86 % (conforming to an angle of 2.8°) in the following condition:

- Mass ..... max. flight mass (1150 kg, 2535 lb)
- Power lever ..... MAX
- Flaps ..... LDG
- Airspeed ..... 70 KIAS
- ISA, MSL

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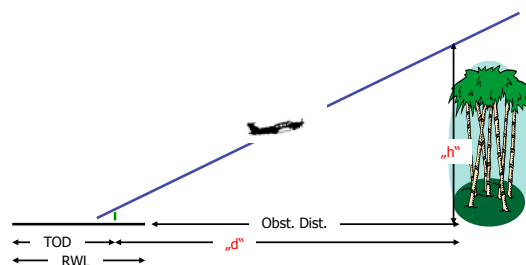
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## Obstacles ?



$$„d” = (RWL + Obst. Dist.) - TOD$$

$$Gradient = („h” / „d”) * 100$$



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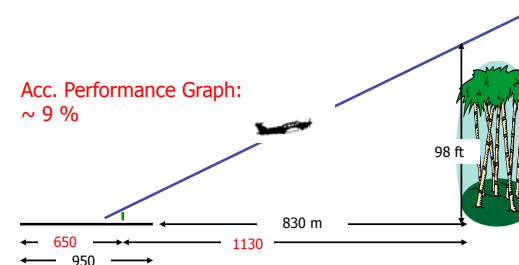
## Vöslau RWY 31



$$„d” = (950 + 830) - 650 = 1130$$

$$Gradient = (30 / 1130) * 100 = 2,65 \%$$

Acc. Performance Graph:  
~ 9 %



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## Diamond DA40-TDI G1000



### Mass and Balance



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## Empty Mass



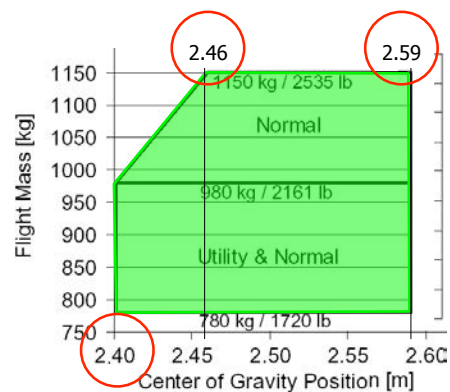
- Empty Mass includes:
  - Equipment as per Equipment Inventory
  - Brake fluid
  - Coolant fluid
  - Gear oil
  - Engine oil
  - Unusable fuel (2 x 1,0 USG)

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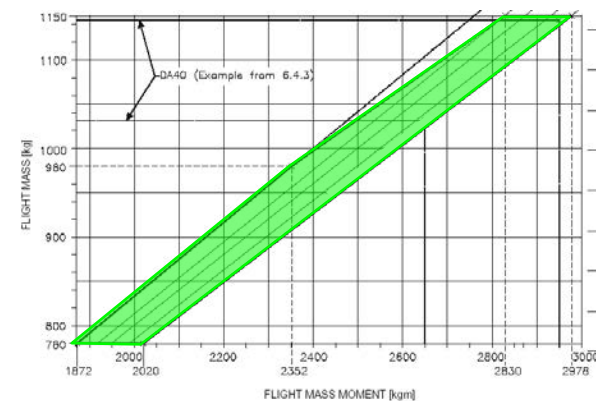
## Center of Gravity Envelope



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## Moment Envelope



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## Moment Arms



Item	Lever Arm (m)
Front seats	2.30
Rear seats	3.25
Wing tanks	2.63
Fwd. baggage	3.89
Aft baggage	4.54

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## Typical M+B data



	Empty mass	Moment	CG arm
„IFR“-version (ADF, WX500)	833,5	2057,7	2,469
„N-VFR“-version	826,2	2032,3	2,460

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## M&amp;B Calculation



	Lever arm	Mass (kg)	Moment (kgm)
Empty mass	2.47	830	2050.1
Front seats	$170 \times 2.30 = 391.0$		391.0
Rear seats	$80 \times 3.25 = 260.0$		260.0
Fwd. Baggage	3.89	10	38.9
Zero Fuel Mass		1090	2740.0
Fuel ~20 USG	2.63	60	157.8
Total TKOF Mass		1150	2897.8

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## M&amp;B Calculation

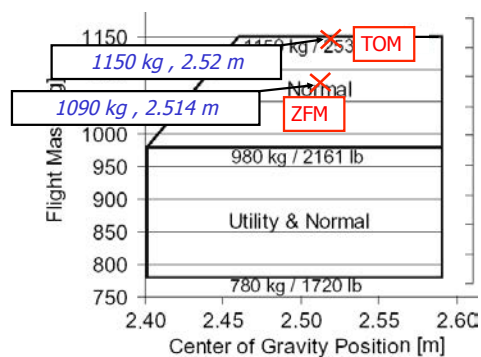


	Lever arm	Mass (kg)	Moment (kgm)
Empty mass	2.47	830	2050.1
Front seats	2.30	170	391.0
Rear seats	3.25	80	260.0
Fwd. Baggage	3.89	10	38.9
Zero Fuel Mass	2.514	1090	2740.0
Fuel	2.63	60	157.8
Total TKOF Mass	2.52	1150	2897.8

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## Center of Gravity Envelope



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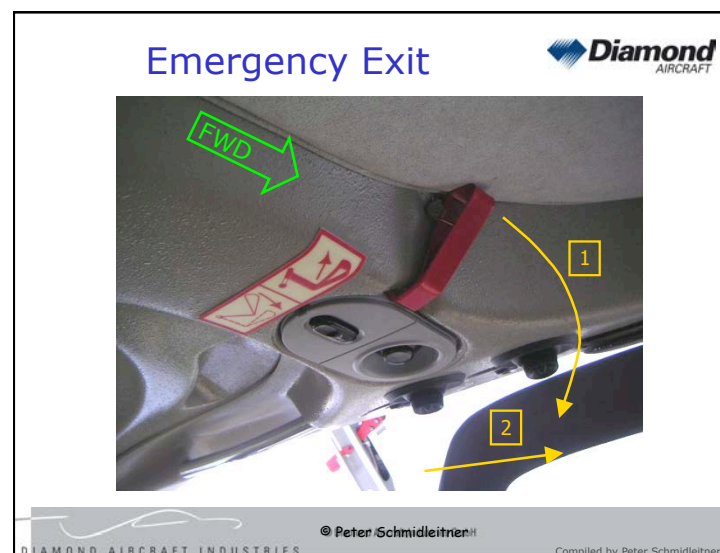
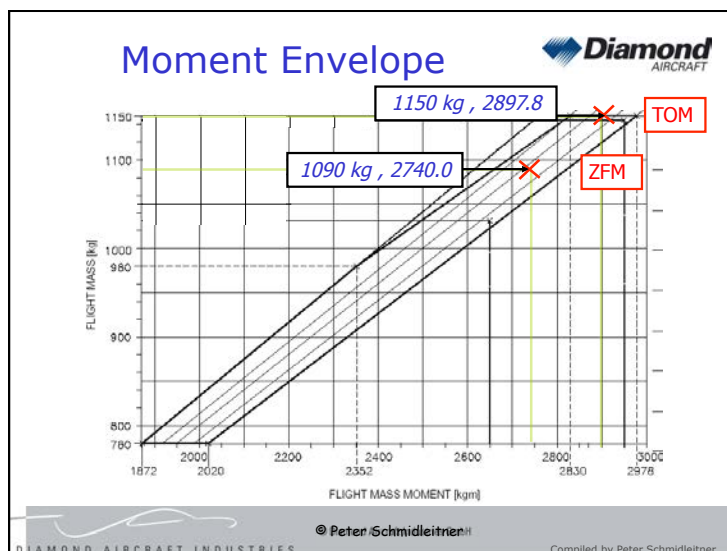
## M&amp;B Calculation



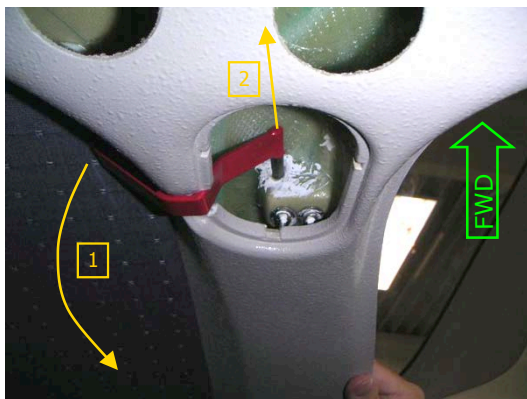
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Rear seats	3.25	80	260.0
Fwd. Baggage	3.89	10	38.9
Zero Fuel Mass		1090	2740.0
Fuel	2.63	60	157.8
Total TKOF Mass		1150	2897.8

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## Emergency Exit



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## Diamond DA40-TDI G1000

Kinds of Operation  
Equipment List  
(KOEL)

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Kinds of Operation Equipment List  
KOEL

	for daytime VFR flights	in addition for night VFR flights	in addition for IFR flights
Flight & navigation instruments	<ul style="list-style-type: none"> <li>• airspeed indicator (on G1000 PFD or backup)</li> <li>• altimeter (on G1000 PFD or backup)</li> <li>• magnetic compass</li> <li>• 1 headset, used by pilot in command</li> </ul>	<ul style="list-style-type: none"> <li>• vertical speed indicator (VSI)</li> <li>• attitude gyro (artificial horizon; on G1000 PFD or backup)</li> <li>• turn &amp; bank indicator</li> <li>• directional gyro</li> <li>• VHF radio (COM) with speaker and microphone</li> <li>• VOR receiver</li> <li>• transponder (XPDR), mode A and mode C</li> <li>• GPS receiver</li> </ul>	<ul style="list-style-type: none"> <li>• second airspeed indicator (both, on G1000 PFD and backup)</li> <li>• second altimeter (both, on G1000 PFD and backup)</li> <li>• second attitude gyro (both, on G1000 PFD and backup)</li> <li>• second VHF radio (COM)</li> <li>• VOR-LOC-GP receiver</li> <li>• second GPS receiver</li> </ul>

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Kinds of Operation Equipment List  
KOEL

	for daytime VFR flights	in addition for night VFR flights	in addition for IFR flights
engine instruments	<ul style="list-style-type: none"> <li>• fuel qty.</li> <li>• oil press.</li> <li>• oil temp.</li> <li>• coolant temp.</li> <li>• coolant level indicator</li> <li>• gearbox temp.</li> <li>• load</li> <li>• prop. RPM</li> <li>• fuel temp. left &amp; right tank</li> </ul>	<ul style="list-style-type: none"> <li>• ammeter</li> <li>• voltmeter</li> </ul>	

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### Kinds of Operation Equipment List KOEL



	for daytime VFR flights	in addition for night VFR flights	in addition for IFR flights
lighting		<ul style="list-style-type: none"> <li>• position lights</li> <li>• strobe lights (anti collision lights)</li> <li>• landing light</li> <li>• instrument lighting</li> <li>• flood light</li> <li>• flashlight</li> </ul>	

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### Kinds of Operation Equipment List KOEL



	for daytime VFR flights	in addition for night VFR flights	in addition for IFR flights
other operational minimum equipment	<ul style="list-style-type: none"> <li>• stall warning system</li> <li>• alternate means for fuel quantity indication (see Section 7.9)</li> <li>• safety belts for each occupied seat</li> <li>• Airplane Flight Manual</li> </ul>	<ul style="list-style-type: none"> <li>• Pitot heating system</li> <li>• alternate static valve</li> </ul>	<ul style="list-style-type: none"> <li>• emergency battery (for backup attitude gyro and flood light)</li> <li>• ECU-Backup Unsafe Warning Light</li> </ul>

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### Kinds of Operation Equipment List KOEL



Additional minimum equipment for the intended operation may be required by **national operating rules** and also depends on the **route to be flown**.

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### Diamond DA40-TDI G1000



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## Scheduled maintenance



- Every
  - 100 hours
  - 200 hours
  - 1000 hours
  - 2000 hours
- Annually

## Refuelling



## De-icing



- Approved de-icing fluids:
  - Kilfrost TKS 80
  - Aeroshell Compound 07
- Procedure:
  - Remove snow with brush
  - Spray de-icing fluid
  - Wipe dry

## Control surfaces gust lock



## Mooring



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## Mooring



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## Tow bar



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## Diamond DA40-TDI G1000



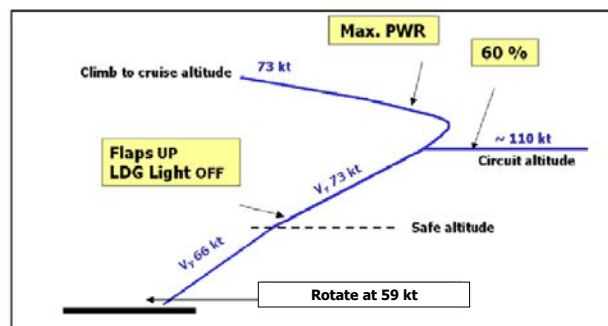
## Flight Procedures



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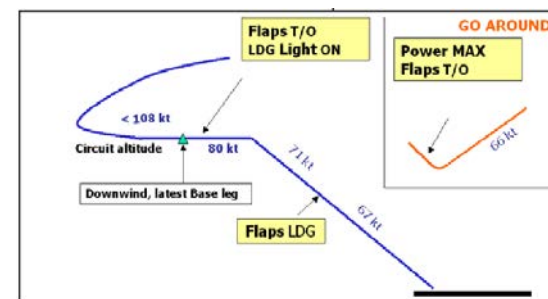
## TKOF Profile



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## LDG Profile



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## Checklists



This checklist is compiled according the guidelines of GAMA Specification No.1, SECTION 4, para 4.5. The "Amplified Normal Procedures" according GAMA Specification No. 1 are in the DA 42 Airplane Flight Manual Chapter 4A.

The checklists are not part of the AFM, and they are not „officially Diamond-endorsed“.

They are a recommendation for „Operator Checklists“ published by „Diamond Aircraft Flight Training Division“.



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Thank you for your attention!



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