Diamond FLIGHT TRAINING

# Diamond DA42 **NG**

# Handout
# DA42 NG
# Systems

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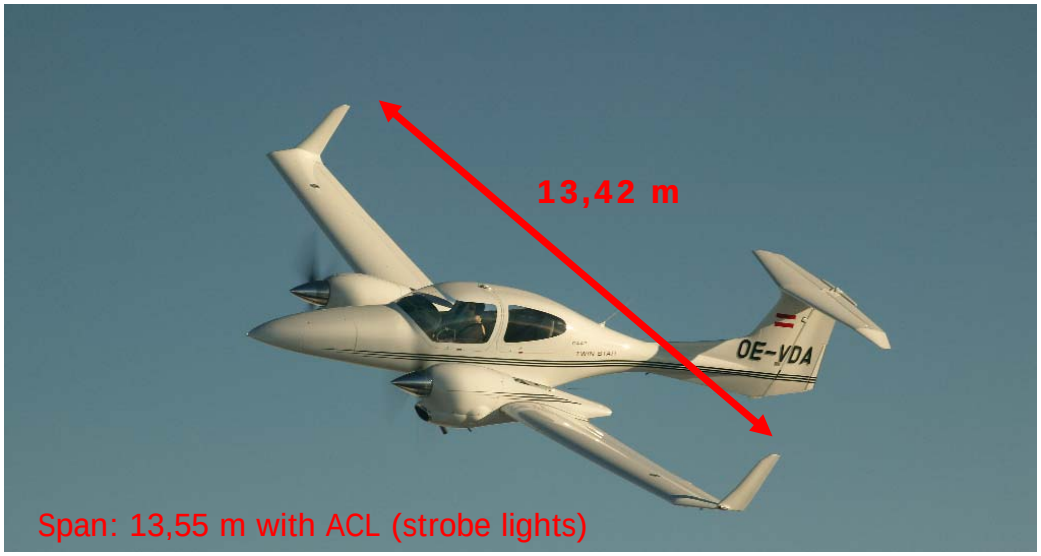
# Diamond DA42 **NG**

Vers. 4





# Dimensions



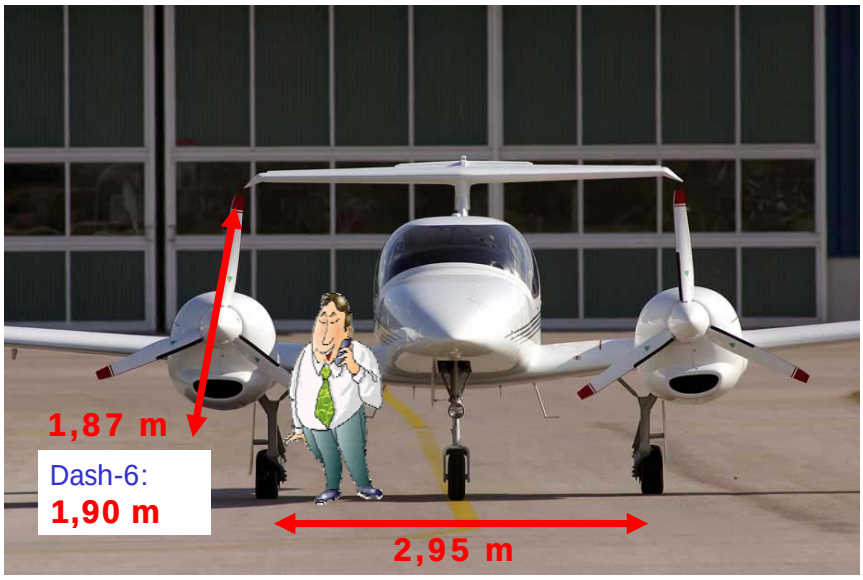

Span: 13,55 m with ACL (strobe lights)

# Dimensions



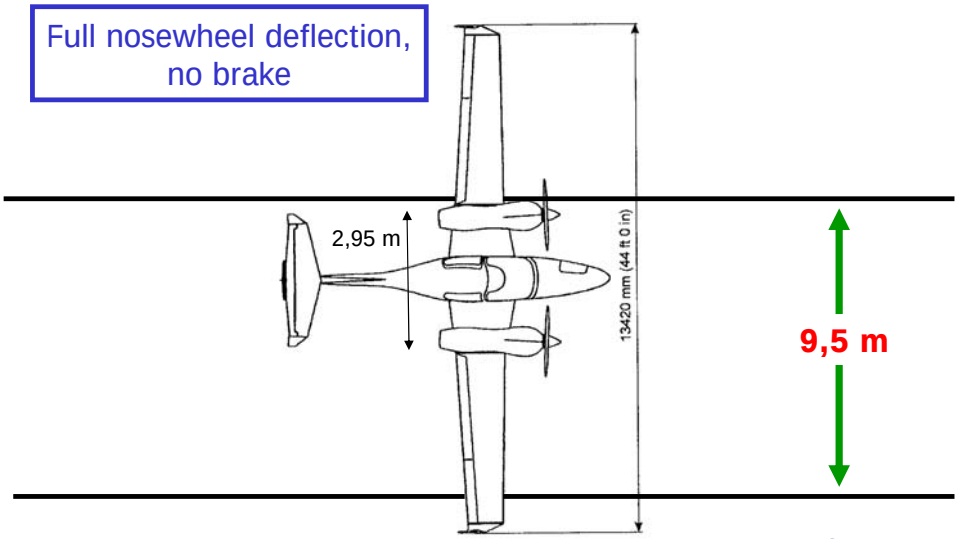


# Dimensions



# Minimum width for 180° turn

Full nosewheel deflection, no brake



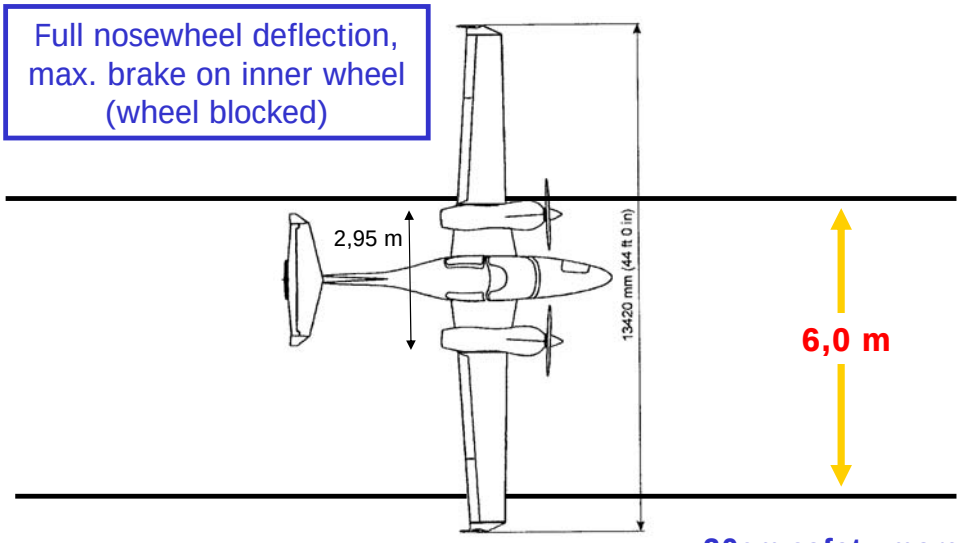

**46 cm safety margin**





# Minimum width for 180° turn

Full nosewheel deflection, max. brake on inner wheel (wheel blocked)




**30cm safety margin**

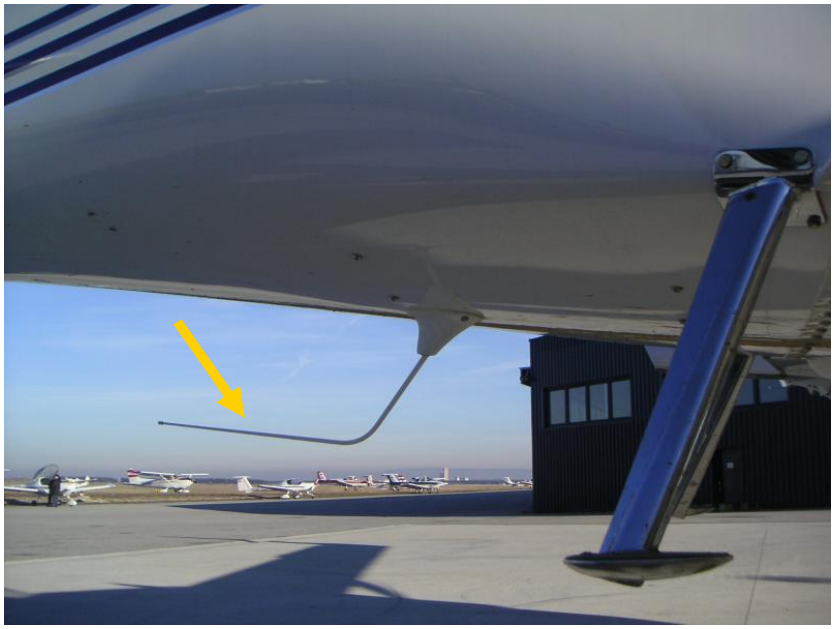
## Nose bagge compartment





## ELT and VHF COM 1 antenna

# VHF COM 2 antenna







# VHF NAV + GP antennas

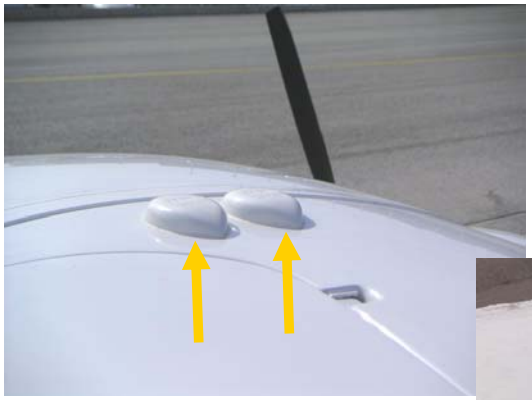
in the stabilizer

# Stormscope antenna





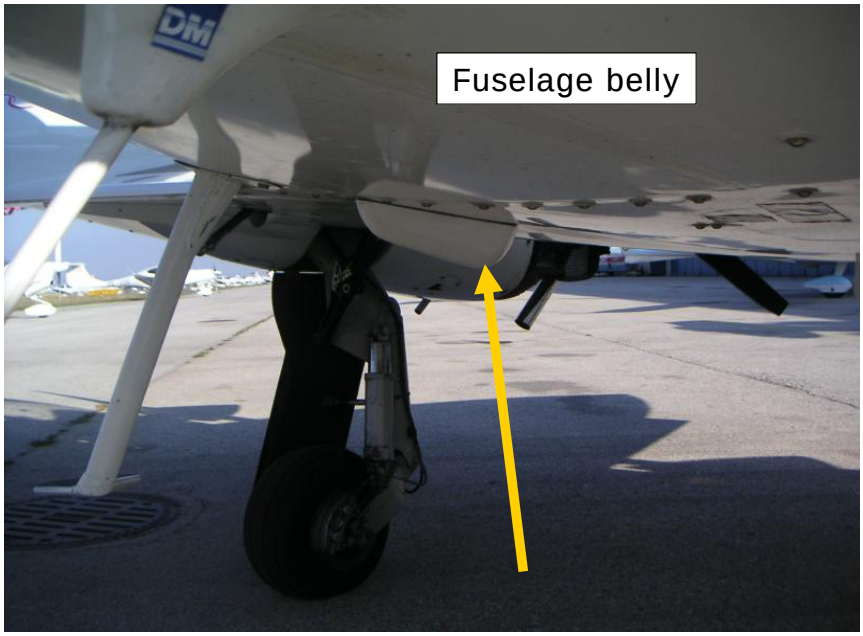
# GPS antennas



Cabin roof

With SBAS

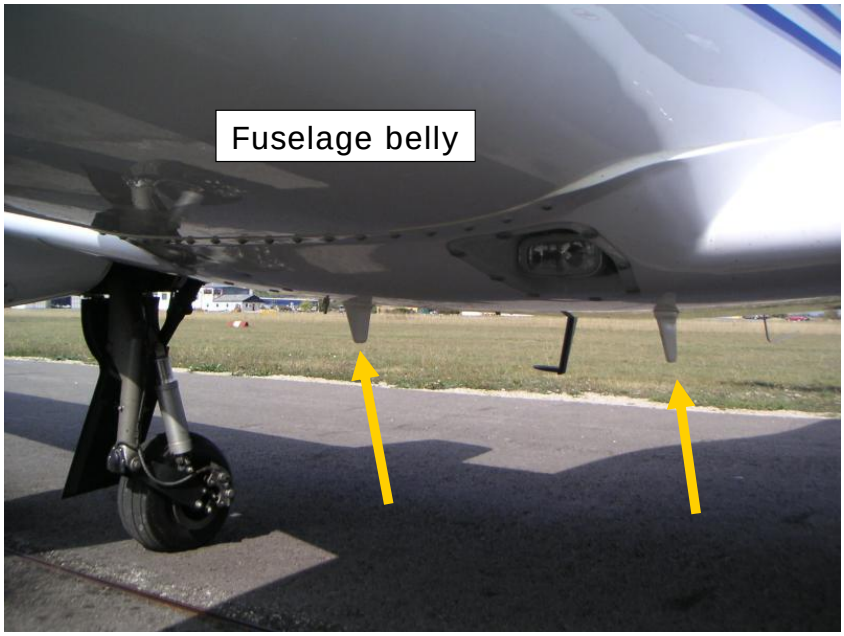
# Marker antenna



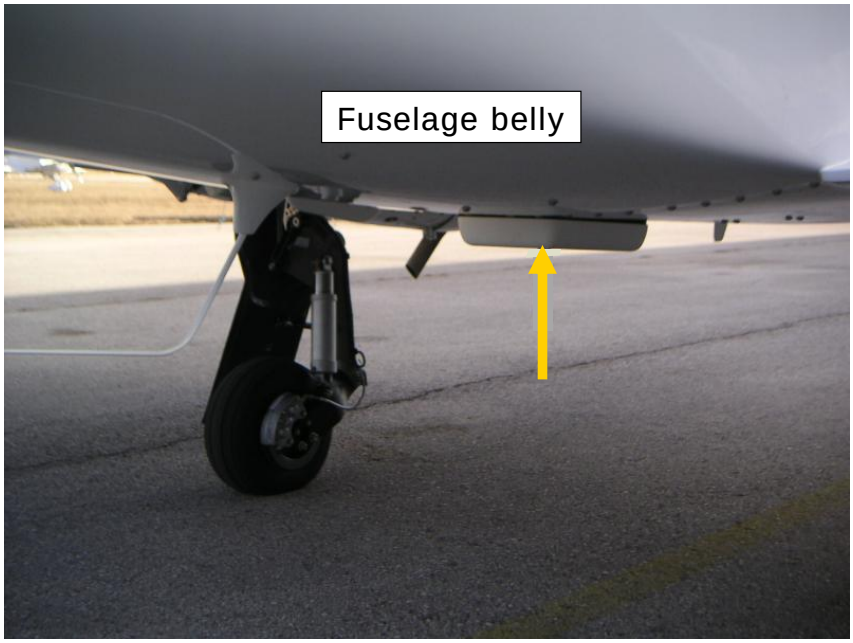




# DME, TXPDR antennas



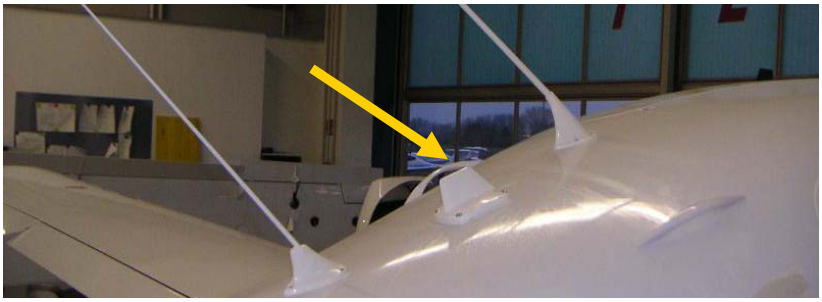
# ADF antenna

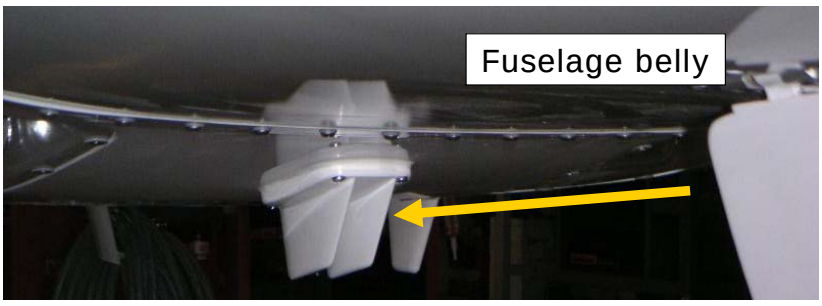




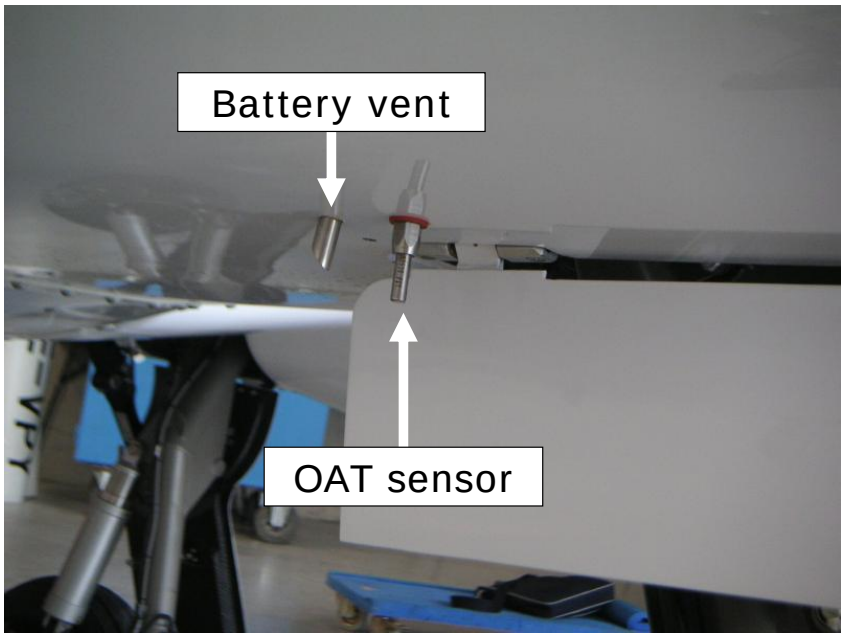


# TAS antennas





# OAT Sensor







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# Mass




## Mass (Weight)

| | |
|---|---|
| Empty (typical) | 1450 kg |
| Max TKOF | **1900** kg |
| Max Ramp | + 8 kg |
| Max Zero Fuel | 1765 kg |
| Max LDG | 1805 kg |
| Min for flight | 1510 kg |

!

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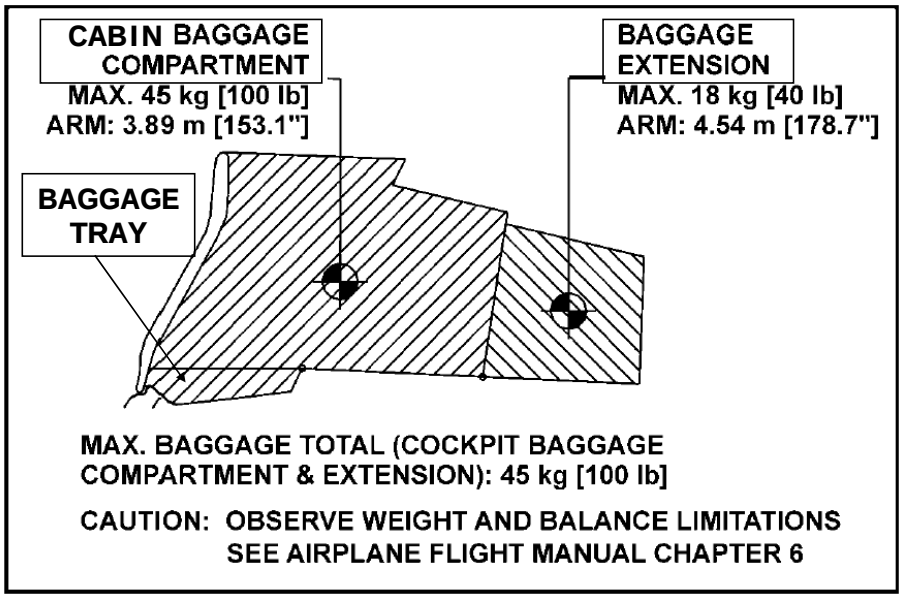
## Max Landing Mass

- Landing with a mass higher than 1805 kg is an „Abnormal Operating Procedure“
  - **However:**
- „Hard LDG Check“ only required after a hard LDG, regardless of LDG mass




## Max. Baggage Load

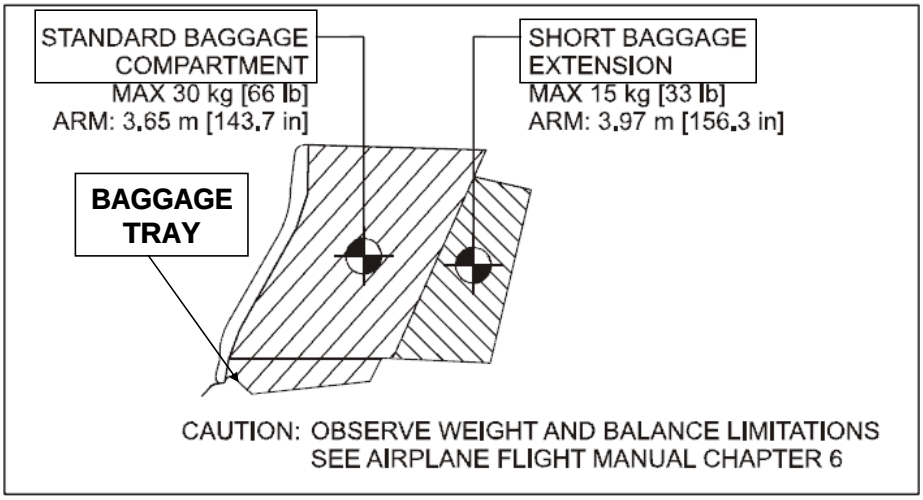
| Nose compartment | | 30 kg |
|---|---|---|
| | Standard | „Short“ Baggage Extension |
| Standard compartment | 45 kg | 30 kg |
| Baggage Extension | 18 kg | 15 kg |
| Total | 45 kg | 45 kg |







# „Short“ Baggage Extension



## Mass

# 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 |

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# Speeds





## Characteristic speeds

| | |
|---|---|
| $V_{NO}$ | 151 KIAS |
| $V_{NE}$ | 188 KIAS |
| $V_O$ | 112 KIAS |
| | 1700 kg |
| | 119 KIAS |
| | 1800 kg |
| | 122 KIAS |

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# Characteristic speeds

| | | |
|---|---|---|
| $V_{SO}$ | „NG“ | 62 KIAS |
| | „Dash-6“ | 62 KIAS |
| $V_{S1}$ | „NG“ | 69 KIAS |
| | „Dash-6“ | 68 KIAS |

| | | Flaps UP | Flaps APP |
|---|---|---|---|
| $V_{MCA}$ | „NG“ | 76 KIAS | 73 KIAS |
| | „Dash-6“ | 71 KIAS | 68 KIAS |

**For short field take-off**

| | |
|---|---|
| Vops ice | 118-156 KIAS |





# Characteristic speeds

**For short field take-off**

| | | Flaps UP | Flaps APP |
|---|---|---|---|
| $V_R$ | „NG“ | 80 KIAS | 76 KIAS |
| | „Dash-6“ | 76 KIAS | 71 KIAS |
| $V_X$ | „NG“ | --- | 82 KIAS |
| | „Dash-6“ | --- | 77 KIAS |
| $V_Y$ | | 90 KIAS | 85 KIAS |
| $V_{YSE}$<br>Vyse „ice“ | | 85 KIAS<br>88 KIAS | |
| $V_{CRZ\ CLB}$ | | 90 KIAS | |

# Characteristic speeds

| | |
|---|---|
| $V_{FE}$ (Flaps APP) | 133 KIAS |
| $V_{FE}$ (Flaps LDG) | 113 KIAS |
| $V_{LO\ E}$ (= $V_{NE}$) | 188 KIAS |
| Emergency extension | **152 KIAS** |
| $V_{LO\ R}$ (= ~$V_{NO}$) | 152 KIAS |
| $V_{LE}$ (= $V_{NE}$) | 188 KIAS |




# Characteristic speeds

## Approach Speeds

| | |
|---|---|
| $V_{REF}$ FLAPS UP | 86 KIAS |
| $V_{REF}$ FLAPS APP | 84 KIAS |
| $V_{REF}$ FLAPS LDG | 84 KIAS |
| $V_{GA}$ FLAPS UP | 90 KIAS |

# Diamond DA42 NG





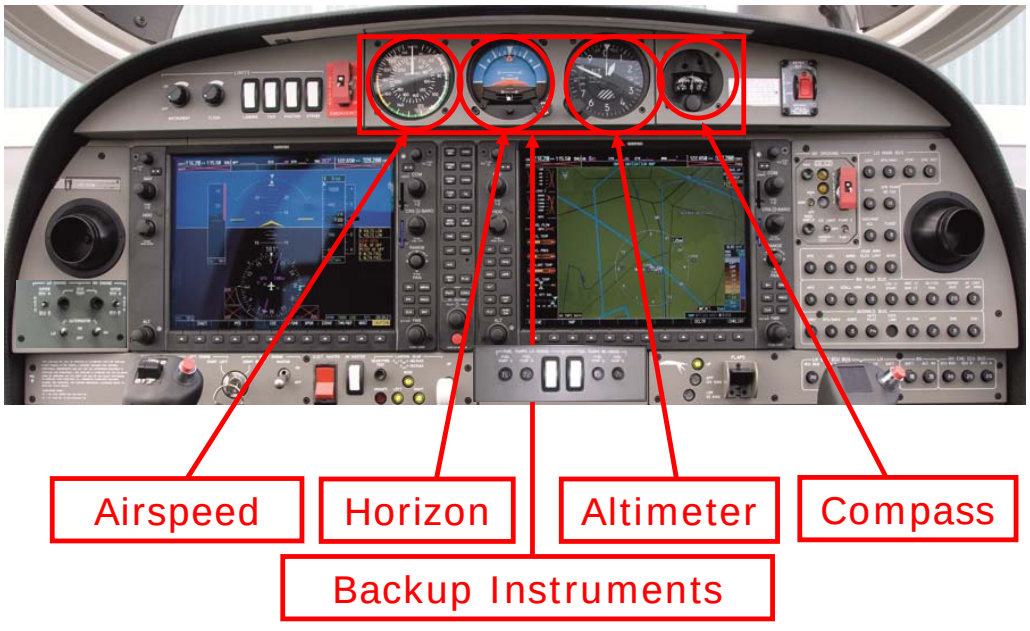

# Instrument panel

# Instrument Panel





# Instrument Panel



# Instrument Panel


IFR flights not permitted when seal on Emergeny Switch is broken





# Instrument Panel

# Instrument Panel






# Instrument Panel

Alternators + ECU Control

## Digital Engine Control

- **ECU (EECU)**
  - Engine Control Unit
  - Electric Engine Control Unit

this is a

- **FADEC**
  - Full Authority Digital Engine Control




## Digital Engine Control

*Will be explained in the „Power Plant“ chapter*

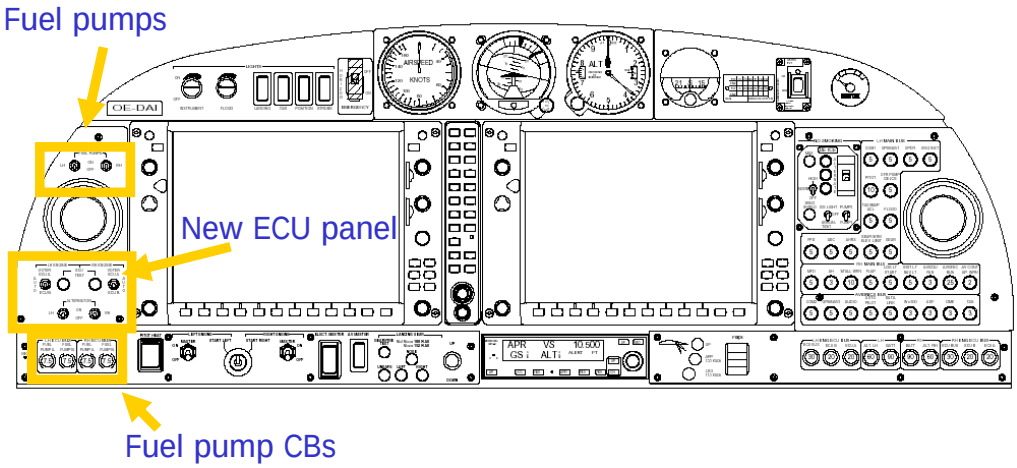
# Instrument Panel





# Instrument Panel

# Instrument panel („Upgrade NG“ with KAP140)








# Instrument panel („Upgrade NG“ with KAP140)

# Pitot probe





# Static ports

## Alternate static valve






## Lift detector (Stall warning)

# Diamond DA42 NG






# DA42 Garmin 1000

PFD
Primary Flight Display

MFD
Multi Function Display

# Garmin 1000 MFD

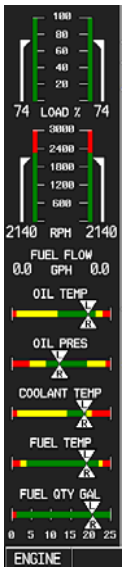
EIS / Engine Indication System





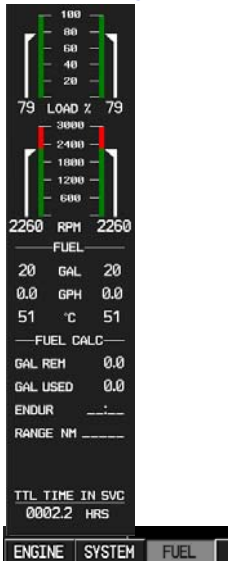

# Engine Indication System

**Default page**




**Display when pushing the SYSTEM softkey**


**Display when pushing the FUEL softkey**

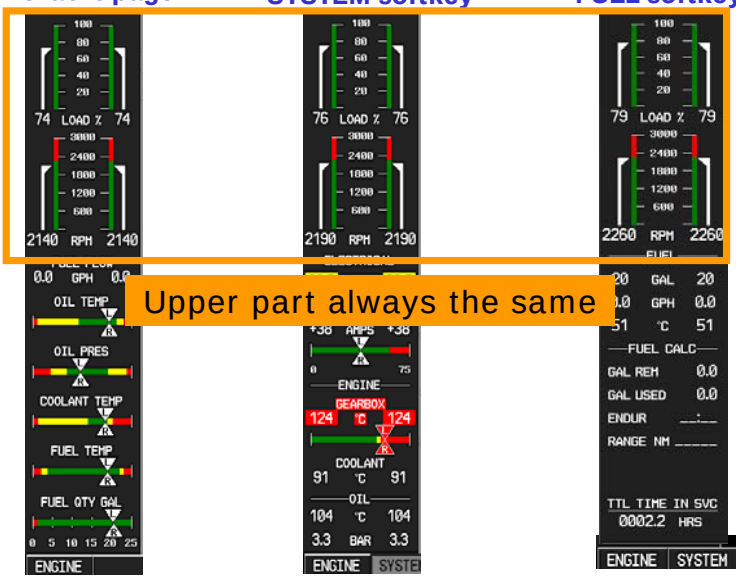


# Engine Indication System

Default page

Display when pushing the SYSTEM softkey

Display when pushing the FUEL softkey




Upper part always the same



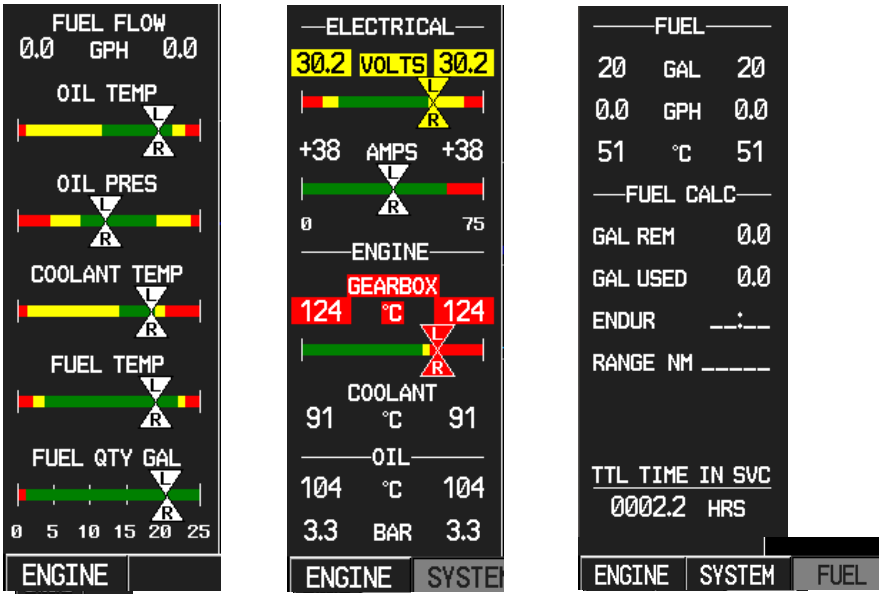


# Engine Indication System

Default

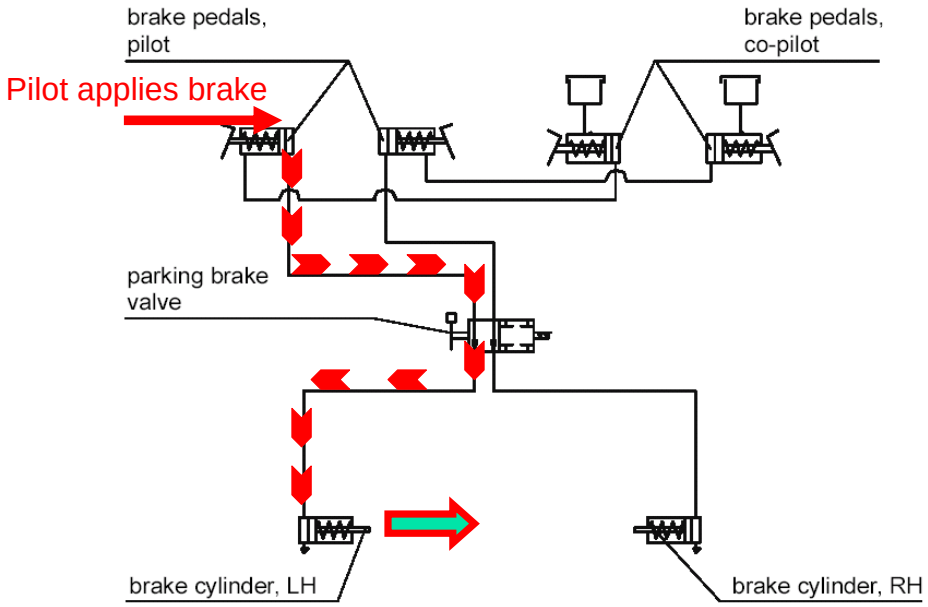
SYSTEM

FUEL



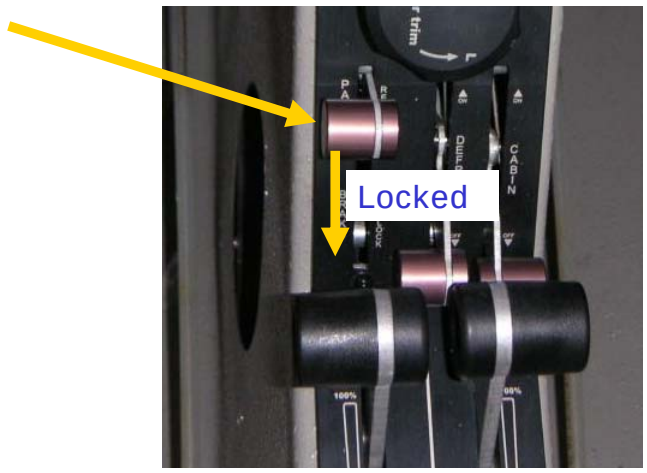



## Hydraulic brakes



# Hydraulic brakes

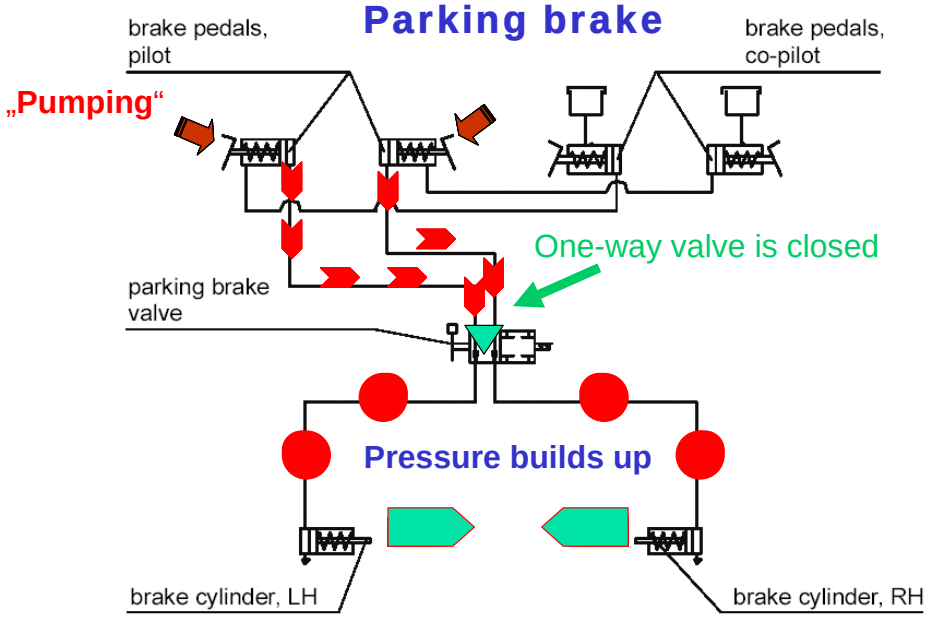
## Parking brake






# Hydraulic brakes

## Parking brake



## Landing gear





## Landing gear

- Hydraulically operated
- Electrically powered hydraulic pump
- Electrically actuated hydraulic valves operated by gear selector switch
- „Squat switch“ prevents retraction on ground

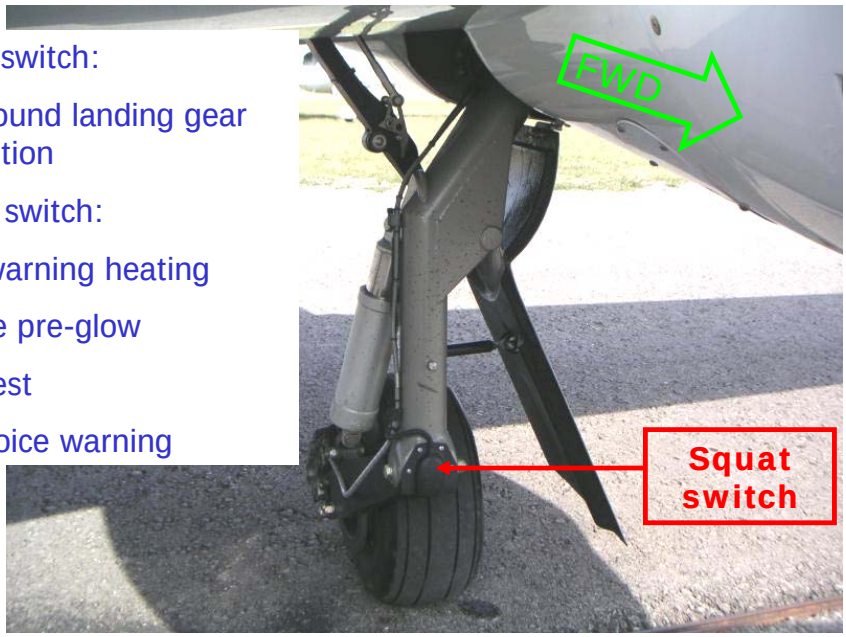
# Landing gear

LH squat switch:

- On ground landing gear protection

RH squat switch:

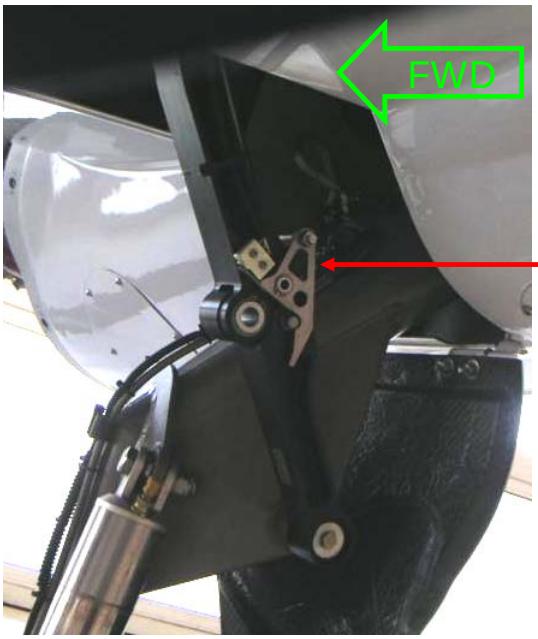
- Stall warning heating
- Engine pre-glow
- ECU test
- TAS voice warning







# Landing gear



## Landing gear

- Gear downlock = spring loaded
- Downlock released by hydraulic pressure for retraction
- Green lights = gear down and locked
- Red light = gear neither down nor up
- Gear held up hydraulically
- Emergency operation = free fall (by releasing hydraulic pressure)




## Landing gear

**LANDING GEAR UNSAFE WARNING**

If on for more than 20 seconds:

1 Airspeed..... max 152 KIAS 1

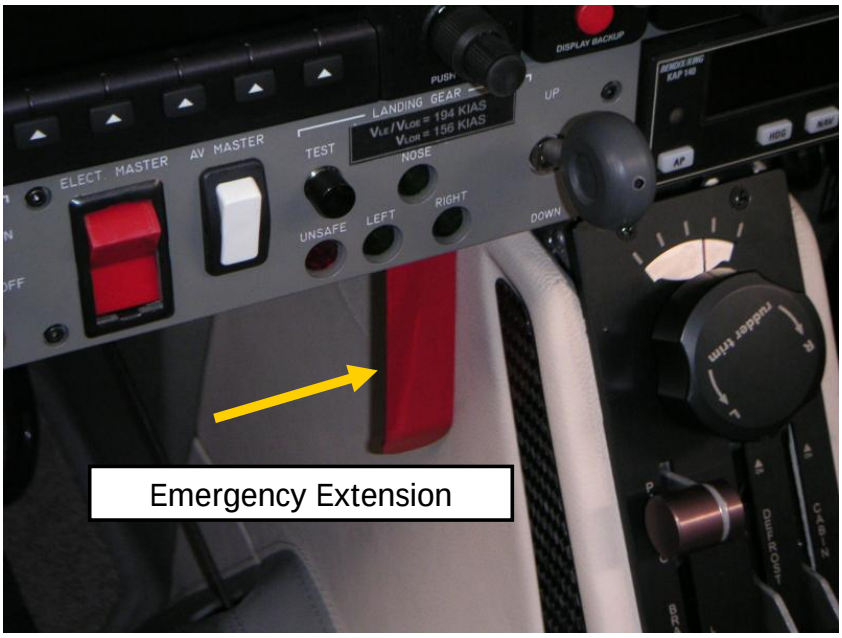
In cold temperature:

2 Airspeed..... max 110 KIAS 2

3 Gear selector ..... RECYCLE 3

- If landing gear **extension** unsuccessful:
  Continue with MANUAL EXTENSION
- If landing gear **retraction** unsuccessful:
  Consider flight with landing gear down

# Landing gear





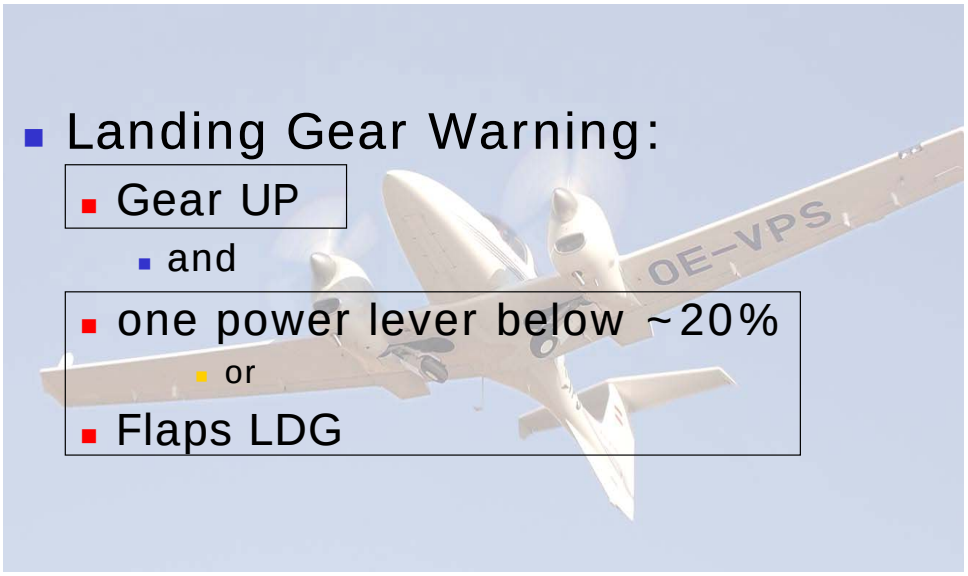


# Landing gear

## MANUAL EXTENSION OF LANDING GEAR

| | | | |
|---|---|---|---|
| 1 | Airspeed | max 152 KIAS | 1 |
| 2 | Gear indicator lights | TEST | 2 |
| 3 | Electric master | CHECK ON | 3 |
| 4 | Bus voltage | CHECK NORMAL | 4 |
| 5 | Circuit breaker | CHECK | 5 |
| 6 | Gear selector | DOWN | 6 |
| 7 | Manual extension handle | PULL | 7 |
| | If necessary | | |
| 8 | Airspeed | max 110 KIAS | 8 |
| | Apply moderate yawing | | |
| 9 | Gear indicator lights | CHECK 3 GREENS | 9 |

## Landing gear




- Landing Gear Warning:
  - Gear UP
    - and
  - one power lever below ~20%
    - or
  - Flaps LDG




## Nosewheel steering

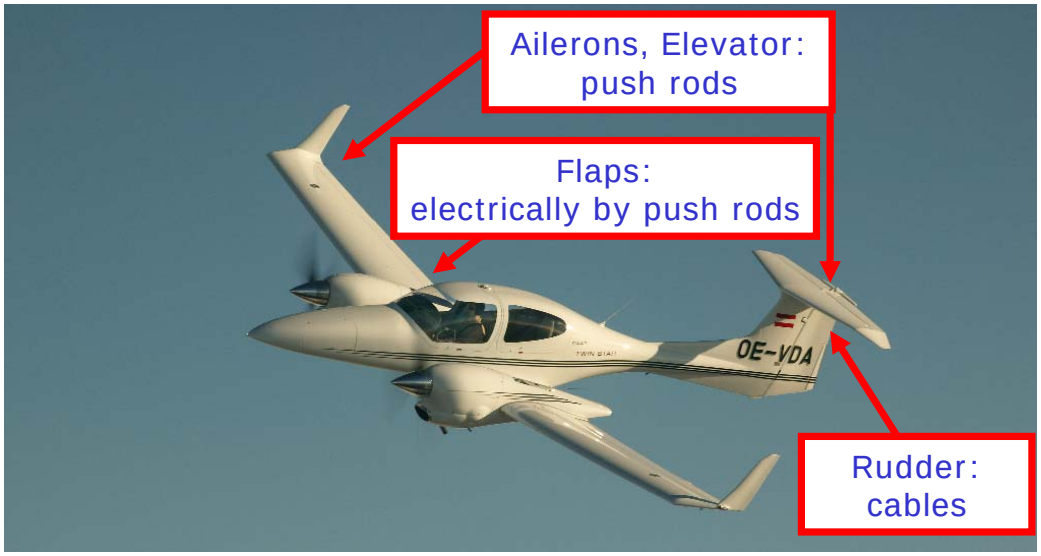
- Nosewheel steered with rudder pedals
- Steering angle:
  - 30° without use of brakes
  - 52° with one wheel fully braked

# Diamond DA42 NG






# Flight control operation



# Flight control operation





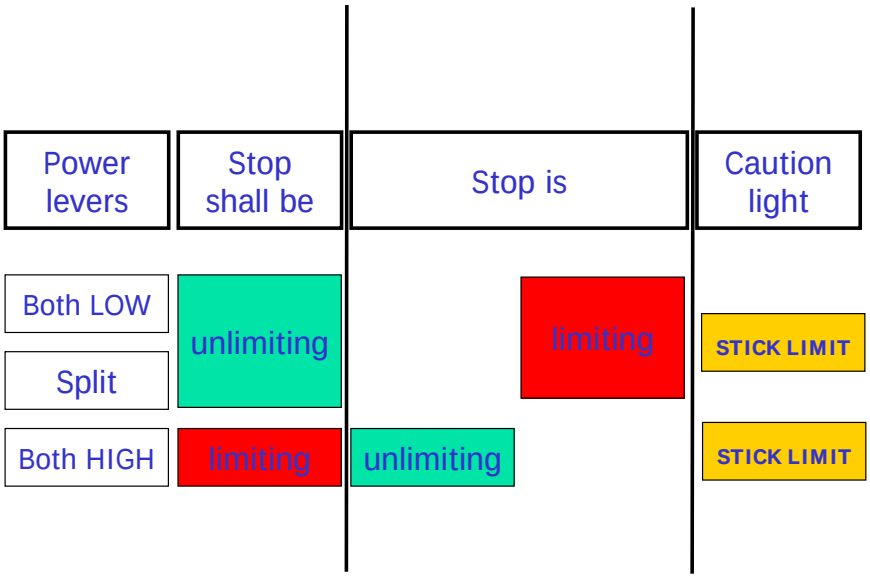
# Flap interconnection

## Variable elevator stop

- Normal elevator „up“ deflection: 15,5°
- Limited to „13° up“ when both power levers above 20% (approach power setting)
- Reason: With full elevator deflection in case of stalling the handling qualities and stall characteristics are degraded
- Preflight check of this device is mandatory!
- „STICK LIMIT“ caution when variable stop not in proper position




## Variable elevator stop



# Variable elevator stop Preflight check

**CHECK BEFORE ENGINE START continued**

| | | |
|---|---|---|
| 30 | Flaps ..... LDG | 30 |
| 31 | Variable elevator stop ..... CHECK | 31 |

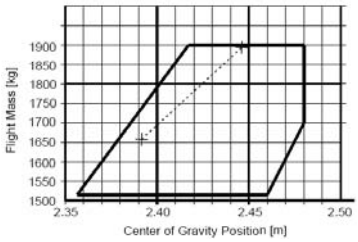
*Control stick ..... AFT and HOLD*
*Power levers ..... MAX*
*Check stop limit decreasing*
*Power levers ..... IDLE*
*Check stop limit increasing*

| | | |
|---|---|---|
| 32 | Flaps ..... UP | 32 |



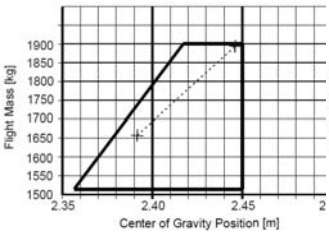

# Option: Removal of the Variable elevator stop

**Normal CG limits:**

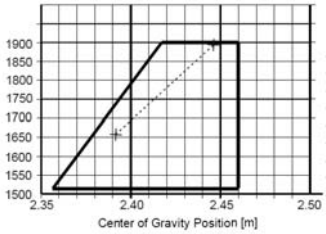



**Without variable elevator stop :**

**DA42 NG:**




**DA42 NG -VI:**

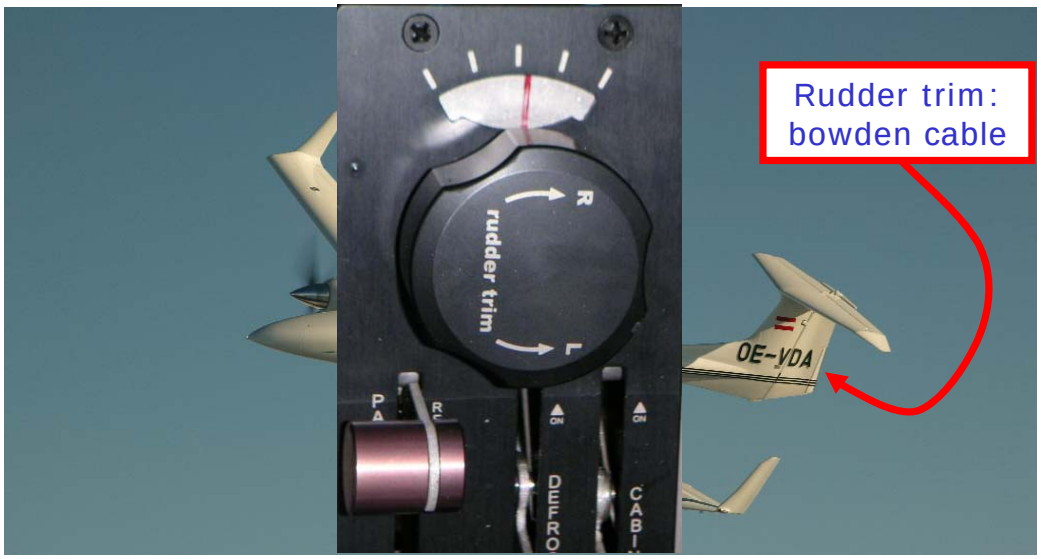


# Trim tabs






# Trim tabs



## Optional electric rudder pedal adjustment





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# Diamond DA42 NG






# Power plant

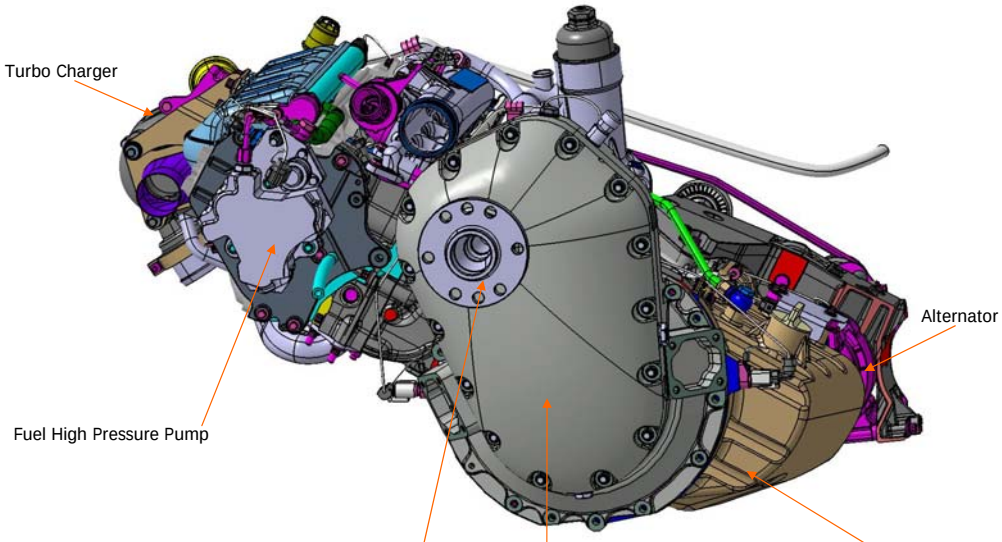
- 2 Austro Engines E4-B („Dash-6“: E4-**C**)
- Four cylinders, liquid-cooled
  - 1991 ccm
- Common-rail direct injection
- Reduction gear 1:1,69
- Dual digital engine control
- Turbocharger
- Torsion vibration damper isolates engine from propeller
- Max. power limitation: **100%, 2300 RPM**
  (5 minutes time limit)
  123,5 kW (165,6 DIN-HP)
- Max cont. power limitation: **92%, 2100 RPM**
  („Dash-6“: **2300 RPM**)
  113,6 kW (152,3 DIN-HP)

# Austro Engine E4-B



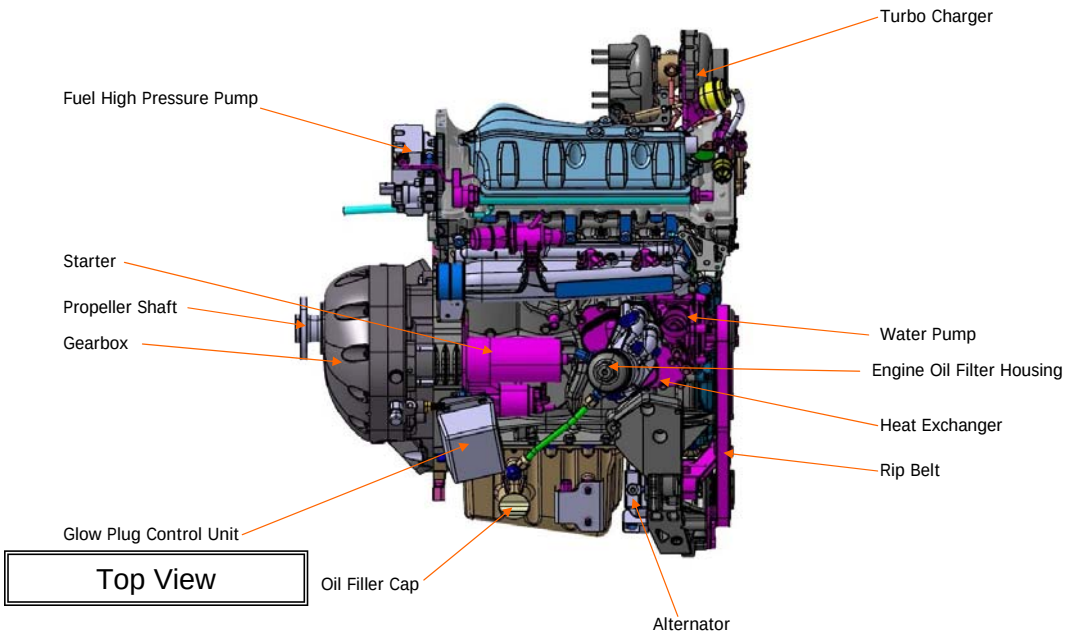


# Austro Engine E4-B




Front View

# Austro Engine E4-B

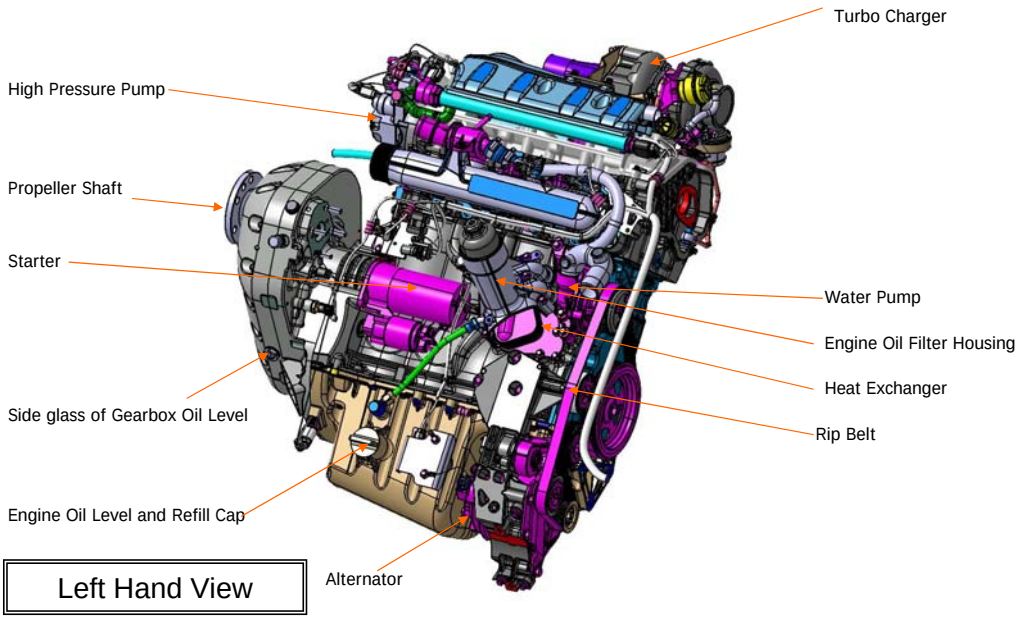



Top View



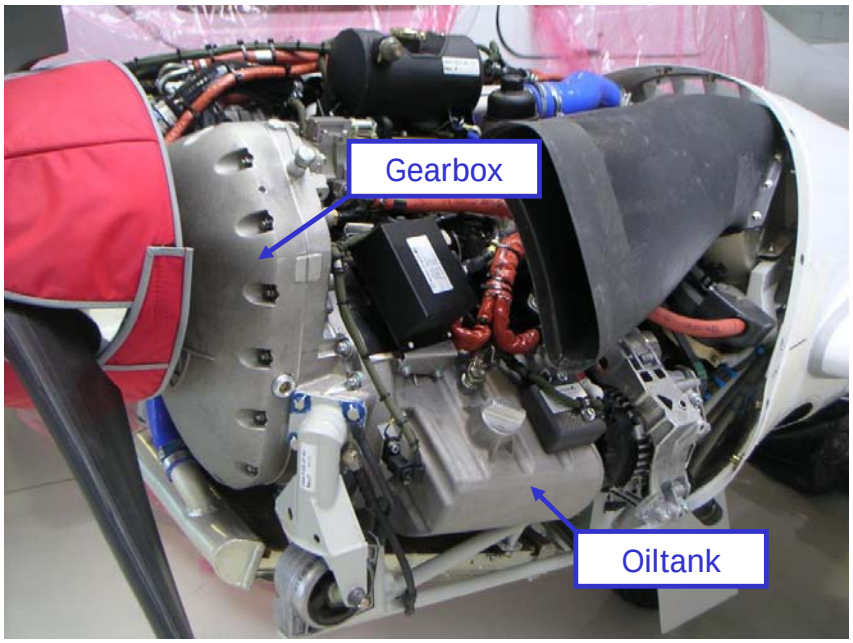


# Austro Engine E4-B




Left Hand View

# Austro Engine E4-B

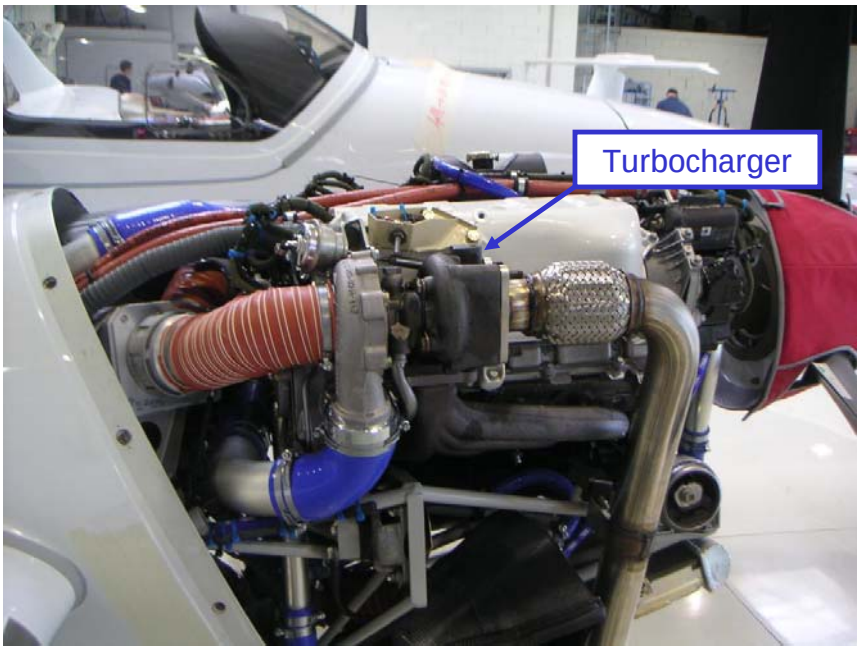






# Austro Engine E4-B

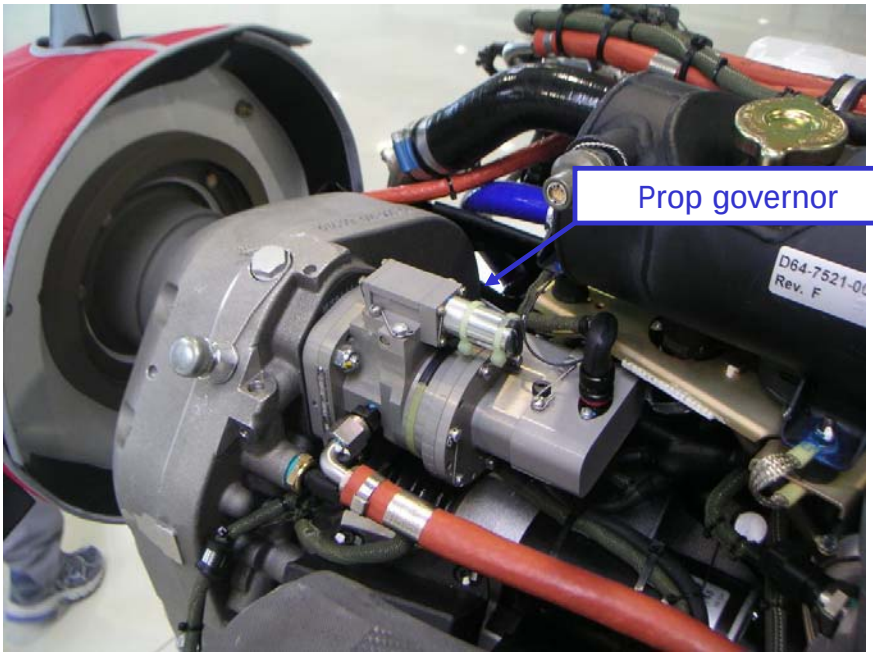
# Austro Engine E4-B








# Austro Engine E4-B



# ECU – Engine Control Unit

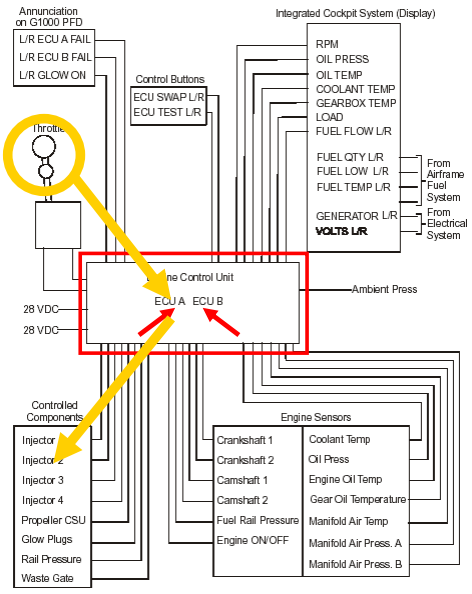
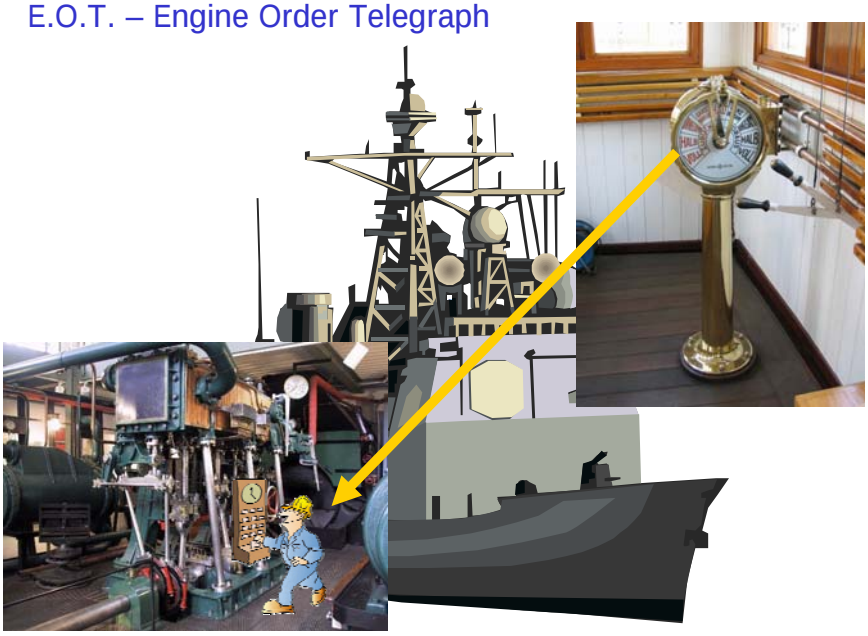



Figure 1: An Engine Control System Schematic Diagram





# E.O.T. – Engine Order Telegraph



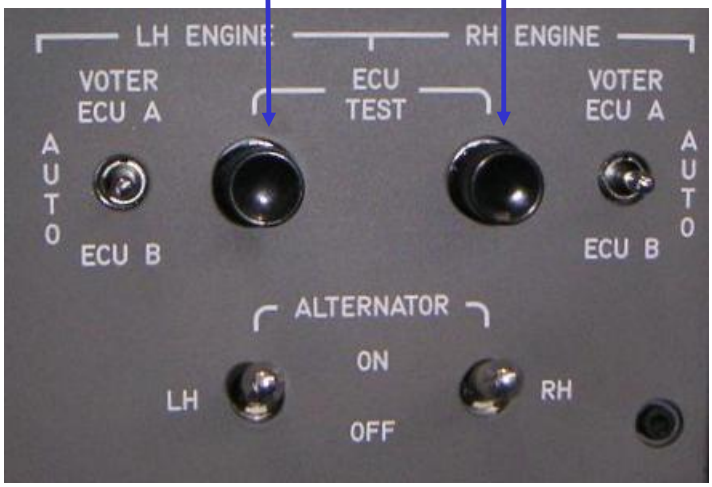
## Engine Control Unit

- ECU „VOTER switches“
- 3-position switches
- Normally in AUTO position
- Working ECU is automatically selected according operating hours or in case of malfunction




## ECU test buttons

Test on ground (PWR lever idle)



# ECU test

**BEFORE TAKE OFF CHECK**

| | | | |
|---|---|---|---|
| 14 | Power levers (2) | IDLE | 14 |
| 15 | MFD | EIS – SYSTEM | 15 |
| 16 | Engine instruments | CHECKED | 16 |

*Engine temperatures must be in green range before performing ECU test. (For gearbox min.38° recommended). For warm up max power 50%.*

| | | | |
|---|---|---|---|
| 17 | VOTER switches (2) | A, AUTO, B, AUTO | 17 |

***ECU TEST***

*ECU test buttons (2) ..... press and hold*
*"L/R ECU A/B fail" ..... ON*
*Props cycling*
*"L/R ECU A/B fail" ..... OFF*
*ECU test button ..... release*

| | | | |
|---|---|---|---|
| 18 | ECU test (2) | PERFORMED | 18 |

- ECU Test will not start when:
  - Power levers not in IDLE
  - VOTER switch not in AUTO
  - Gearbox temperature not in green range
  - „Air/Ground“ sensor transmits „aircraft in the air“




# ECU FAIL indication

An ECU FAIL CAUTION is caused by various types of malfunctions. These include internal ECU problems, sensor failures or insufficient performance of air-, fuel-, or electrical supply system (e.g. air filter icing).

# ECU Abnormal checklist

**L/R ECU A or B FAIL** **ON GROUND**

- **Discontinue operation, terminate flight preparation**

**L/R ECU A or B FAIL** **DURING FLIGHT**

*Remark: in case of ECU A or B fail the system automatically switches to the other ECU (B or A)*

- **Alternate Air: OPEN**
- **Fuel pumps L/R: ON**
- **Circuit breakers: CHECK, RESET if necessary**
- **Verify VOTER switch in position AUTO**
  - **If ECU caution remains:**
    - ⇒ **Land at nearest suitable airfield**
  - **If additional engine problems are observed:**
    - ⇒ **Go to Emergency Checklist page 7 ENGINE TROUBLESHOOTING**

**L OR R**
**ECU A FAIL and ECU B FAIL**
**SIMULTANEOUSLY**

- **Go to Emergency Checklist page 7 ENGINE TROUBLESHOOTING**




# Simultaneous ECU fail indication

**ENGINE TROUBLESHOOTING**

If

**L OR R**
**ECU A AND B FAIL**
simultaneously

and ALL of the following conditions exist:
- **indicated LOAD unchanged**
- **perceived thrust is reduced**
- **engine noise level changes or engine running rough**

1 POWER lever ..... IDLE for 1 second 1
2 POWER lever ..... slowly increase to 1975 RPM 2
- If engine shows power loss during the POWER lever increase

3 POWER lever ..... idle for 1 second 3
4 POWER lever ..... slowly increase 4
**stop prior to the RPM where former engine power loss was observed**

*Do not increase the POWER lever past the propeller speed of 1975 RPM or the setting determined in step 4. An increase of engine power beyond this setting leads into another power loss.*
*With this power setting the engine can provide up to 65% at the maximum propeller speed of 1975 RPM*

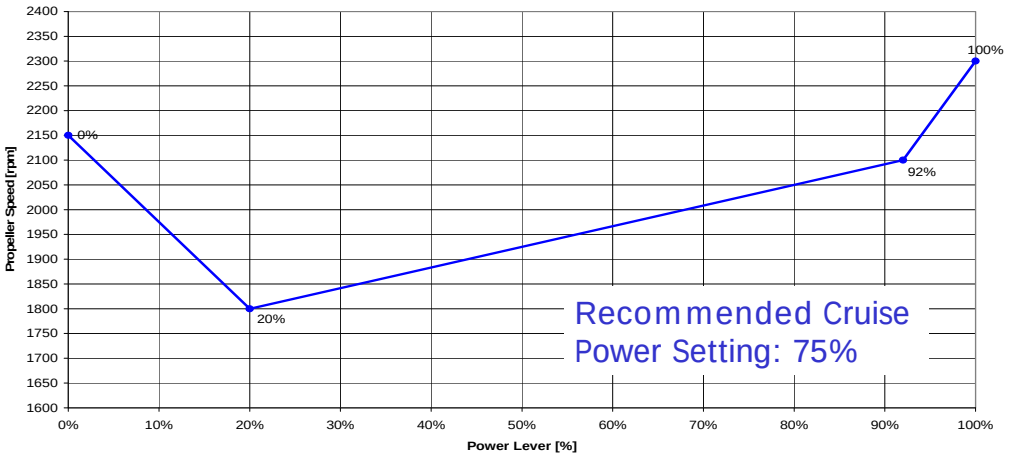
5 Land at nearest suitable airfield..... 5

End of Checklist

Otherwise:

# Power plant

- Power lever selects „LOAD“ in %
- RPM automatically determined by selected power







# Propeller

- 3-blade wooden propeller
- Constant speed, feathering
- Prop pitch set by ECU via an electro-mechanical actuator on the governor
- Governor operated by gearbox oil
  - Oil pressure up = pitch down = RPM up
  - Oil pressure down = pitch up = RPM down

## Feathering system

- Feathering by „Engine Master OFF“ if RPM above 1300
- Feathers when gear oil pressure is lost
- If RPM below 1300: prop pitch remains above high pitch lock
- Unfeathering:
  - With unfeathering accumulator:
    - by oil pressure from accumulator when Engine Master is ON
  - Without unfeathering accumulator:
    - by building up system oil pressure when cranking the starter




## RPM malfunctions

**OSCILLATING RPM**

1 Power lever ..... change setting 1
- If no success:
  Check G1000 for ECU FAIL caution
- If ECU FAIL caution indicated:

2 VOTER switch .....unaffected ECU 2
- If no success:

3 VOTER switch ..... AUTO 3
Land at nearest suitable airfield

**RPM OVERSPEED**

1 Power setting..... REDUCE 1
- If no success:
  Check G1000 for ECU FAIL caution
- If ECU FAIL caution indicated:

2 VOTER switch .....unaffected ECU 2
- If no success:

3 VOTER switch ..... AUTO 3
Land at nearest suitable airfield
Be prepared for ENGINE FAILURE IN FLIGHT

## Fuel pumps

- 1 engine driven pump
- this high pressure pump feeds the common rail
- (additional electrical fuel pumps are part of the fuel system)



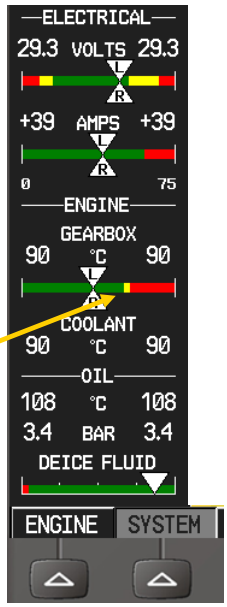

## Power plant limitations

- Max overspeed: 2500 RPM, max 20 sec.
- Oil pressure:
  - < 1500 RPM: min 0,9 bar
  - >= 1500 RPM: min 2,5 bar
  - Max: 6,5 bar
  - Normal: 2,5 – 6 bar
- Oil quantity (per engine): 5.0 – 7.0 liters
  - Max. oil consumption: 0.1 liters/hr
- Oil temperature: -30°C – 140 °C
  - Normal: 50°C – 135°C

# Power plant limitations

- Gearbox temperature:
  - Min: -30°C
  - Min at full load: 35°C
  - Max: 120°C
  - Normal: 35°C – 115°C

The yellow cautionary range is for information only. There is no time limit associated with the cautionary temperature range.
However, prolonged operation is not recommended







# Power plant limitations

- Coolant temperature:
  - min -30°C for start up
  - min 60°C full load
  - max 105°C
  - Normal 60°C – 95°C
- Fuel temperature:
  - min -30°C, max 60°C
  - Normal: -20°C – 55°C
- Fuel pressure:
  - min 4 bar, max 7 bar
    - no indication on G1000, but warning if below limit

## Power plant limitations

**AFM 3.7.4:**

**UNFEATHERING & RESTARTING THE ENGINE IN FLIGHT**

If the reason for the shutdown has been ascertained and there is no indication of malfunction or engine fire a restart may be attempted.

- Max. restart altitude:
  - 18.000 ft for immediate restart
  - 10.000 ft for restart within 2 minutes
- No restart attempt if shut down for more than 2 minutes!
- Restart airspeeds:
  - starter assisted restart:
    - Max 100 KIAS or stationary prop, whichever is lower
  - Windmilling restart (only possible when unfeathering accumulator is installed) :
    - 125 – 145 KIAS





## Power plant limitations

- Intentional negative-g manoeuvers are not permitted
- No intentional shutdown
  - below 3000ft AGL or above 10000ft PA
  - without unfeathering accumulator

## Starter limitations

- Normal operation on ground:
  - max 10 seconds
  - 60 seconds cool down time
- Restarting in the air:
  - max 5 seconds
  - 30 seconds cool down time
  - max 3 attempts




## Power plant fluid specifications

- Fuel:

JET A, JET A-1 (ASTM D 1655)
TS-1 (Russia, GOST 10227-86)
TS-1 (Ukraine, GSTU 320.00149943.011-99)
RT (Russia, GOST 10227-86)
RT (Ukraine GSTU 320.00149943.007-97)
No. 3 Jet Fuel (China, GB 6537-2006)
JP-8 (F34) (USA, MIL-DTL-83133G-2010)
and blends thereof

*Minimum cetane number of 37 (EN ISA 5165/ASTM D613) recommended*

## Power plant fluid specifications

- Oil:
  - SAE Grade 5W-30:
    - SHELL HELIX ULTRA
    - ADDINOL SUPER POWER MV 0537
    - BP VISCO 5000 5W-30
    - REPSOL ELITE COMMON RAIL 5W30
    - GULF FORMULA GMX
  - SAE Grade 5W-40:
    - SHELL HELIX ULTRA
    - LIQUI MOLY 5W-40 LEICHTLAUF HIGH TECH
    - MEGOL MOTORENOEL HIGH CONDITION
    - SYNTIUM 3000
    - LUKOIL LUXE SYNTHETIC
  - SAE Grade 0W-40:
    - CASTROL SLX PROFESSIONAL LONGTEC




## Power plant fluid specifications

- Gearbox oil: Shell Spirax GSX 75W-80
  Shell Spirax S6 GSXME 75W-80
- Coolant: Destilled water + cooler protection 1:1
  (BASF Glysantin Alu Protect Plus/G48)
  (freezing point –38 °C)

# Engine operation

## CHECK AFTER ENGINE START

| | | |
|---|---|---|
| 16 | Engine temperatures .....CHECKED | 16 |
| 17 | Parking brake .....RELEASED | 17 |

*Max power 50% until engine temperatures in green range*

End of Checklist

## BEFORE TAKE OFF CHECK

after line-up

Available power check (see pg.10)..... PERFORMED

**Available Power Check:**

10 sec. power MAX, RPM 2250 – 2300, min. load acc. table below

| | OAT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Altitude [ft] | -35°C | -20°C | -10°C | 0°C | 10°C | 20°C | 30°C | 40°C | 50°C |
| 0 | 99% | | | | | 97% | 96% | 93% | 91% |
| 2000 | | | | | | 97% | 96% | 93% | ----- |
| 4000 | | | | | | 97% | 96% | 93% | ----- |
| 6000 | | | | | | 97% | 96% | 93% | ----- |
| 8000 | | | 98% | 98% | 98% | 96% | 95% | 92% | ----- |
| 10000 | 98% | 97% | 97% | 95% | 94% | 92% | 89% | ----- | ----- |



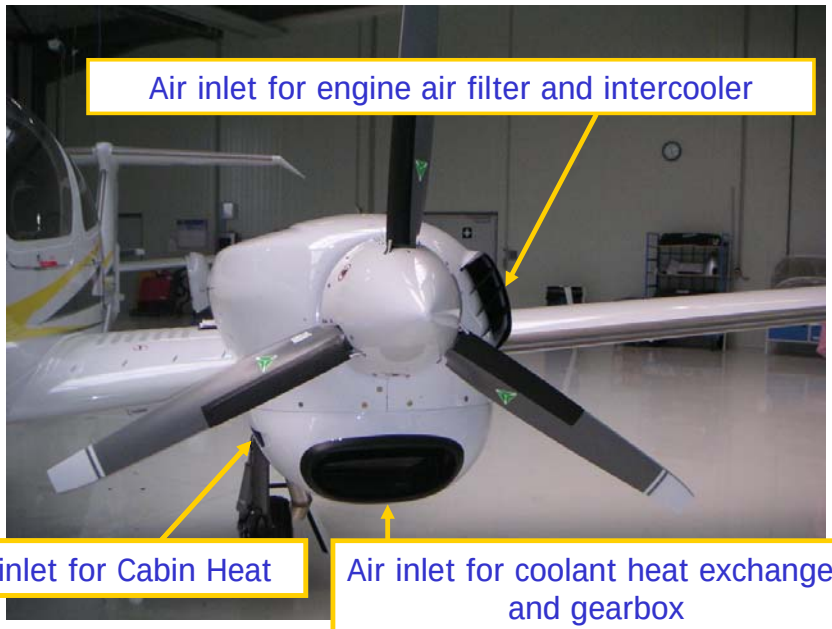


# Engine operation

## PARKING CHECK

| | | |
|---|---|---|
| 1 | Parking brake.....SET | 1 |
| 2 | Power levers (2) ..... max. 10% for 1 min. | 2 |
| 3 | ELT .....121,5 CHECKED | 3 |
| 4 | Engine / System page .....CHECKED | 4 |
| 5 | Engine / Fuel page ..... TTL TIME IN SVC NOTED | 5 |
| 6 | Avionic master.....OFF | 6 |
| 7 | Electrical consumers except ACL (strobe) .....OFF | 7 |
| 8 | Engine Masters (2) .....OFF | 8 |
| 9 | ACL (strobe) .....OFF | 9 |
| | *When engine indications x-ed out red:* | |
| 10 | Electric Master.....OFF | 10 |

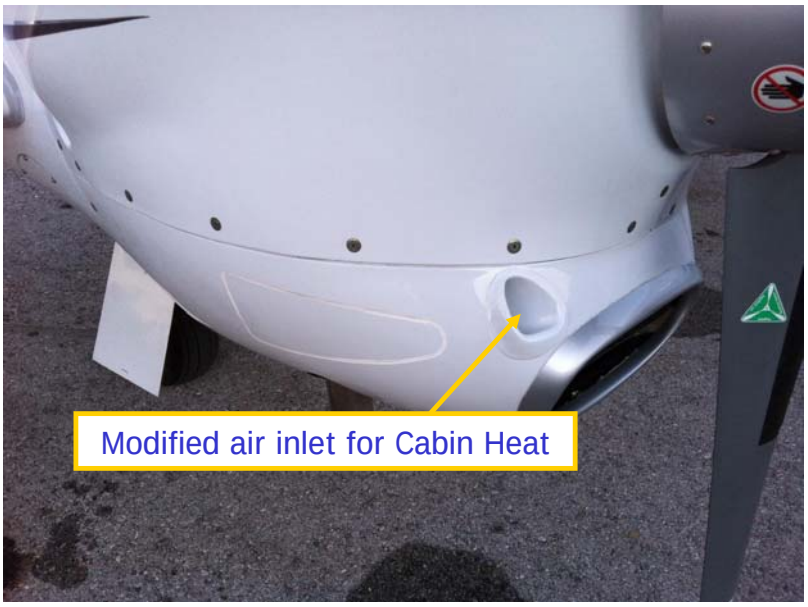
# Air inlets



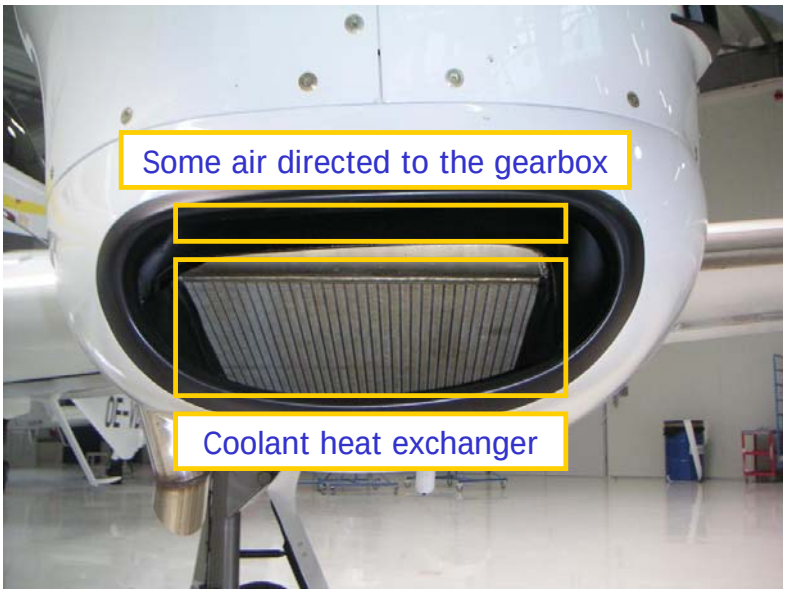




# Air inlets



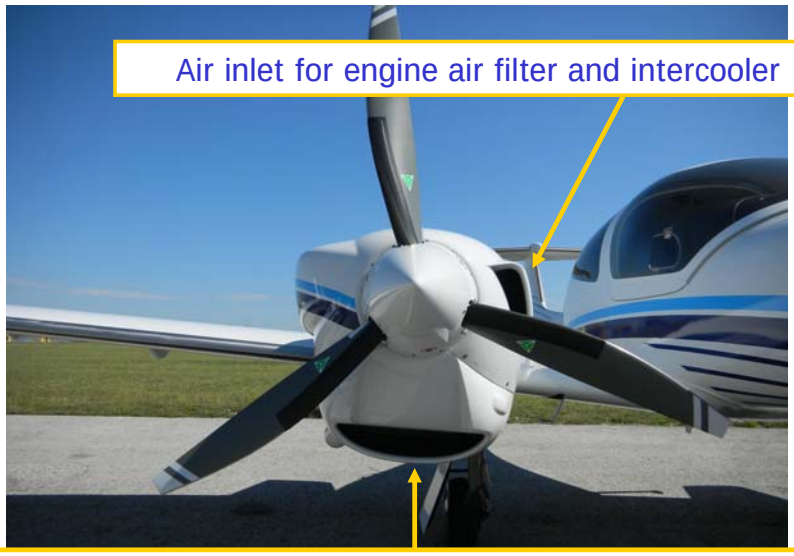
# Air inlets







# „Dash-6“ Air inlets



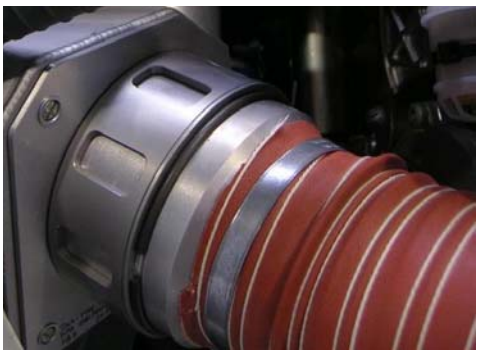
# Air outlet





# Alternate air


Alternate air lever



Alternate air valve

# Use of Alternate Air

**AFM:**

**4A.6.18 OPERATION IN RAIN, SNOW OR VISIBLE MOISTURE**

1. ALTERNATE AIR . . . . . OPEN

**CAUTION**

During operation on ground ALTERNATE AIR must be CLOSED.





# Use of Alternate Air

**ENGINE TROUBLESHOOTING**

8 Alternate air ..... OPEN 8

**ENGINE RESTART**

3 Alternate air ..... AS REQUIRED 3

**UNINTENTIONAL FLIGHT INTO ICING**

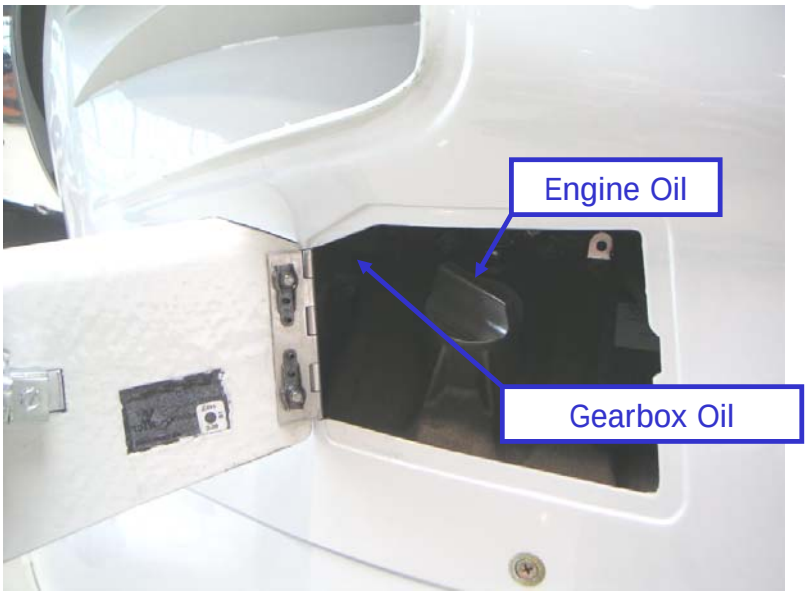
5 Alternate air..... OPEN 5

**L/R ECU A or B FAIL** **DURING FLIGHT**

*Remark: in case of ECU A or B fail the system automatically switches to the other ECU (B or A)*

- **Alternate Air: OPEN**
- **Fuel pumps L/R: ON**
- **Circuit breakers: CHECK, RESET if necessary**
- **Verify VOTER switch in position AUTO**
  - **If ECU caution remains:**
    ⇒ **Land at nearest suitable airfield**
  - **If additional engine problems are observed:**
    ⇒ **Go to Emergency Checklist page 7**
    **ENGINE TROUBLESHOOTING**

# Checking oil levels







# Checking oil levels

# Power plant warnings

**L/R OIL PRES** — **OIL PRESSURE LOW**

- Reduce power on affected engine
- Be prepared for loss of oil and an engine failure; land at nearest suitable airfield

**L/R OIL TEMP** — **OIL TEMPERATURE HIGH**

- Check oil pressure
  - If oil pressure too low (outside green range):
    - ⇒ Reduce power on affected engine
    - ⇒ Expect loss of engine oil
    - ⇒ Be prepared for an engine failure
  - If oil pressure in green range
    - ⇒ Reduce power on affected engine
    - ⇒ Increase airspeed
      - If oil temperature not returning to green range:
        - ⇒ Be prepared for an engine failure;

**L/R GBOX TEMP** — **GEARBOX TEMPERATURE HIGH**

- Reduce power on affected engine
- Increase airspeed
  - If gearbox temperature still in red range:
    - ⇒ Land at nearest suitable airfield
    - ⇒ Be prepared for an engine failure




# Power plant cautions

**OIL temperature high**

- Refer to Emergency Checklist page 3, "L/R OIL TEMP"

**OIL temperature low**

- Increase power
- Reduce airspeed

**OIL pressure high**

- On ground during warm up with low oil temperature
  - Reduce power until oil press. green, continue warm up at reduced power
- During flight
  - Check oil temperature
  - Check coolant temperature
    - If temperatures within green range
      - ⇒ Oil press. indication may be faulty; watch temperatures
    - If temperatures outside of green range
      - ⇒ Reduce power on affected engine;
      - ⇒ Land at nearest suitable airfield, be prepared for engine fail

**OIL pressure low**

- Refer to Emergency Checklist page 3, "L/R OIL PRES"

## Fire detection system

- Overheat detector in hot area of each engine
- Warning above 250°C
- Test button:





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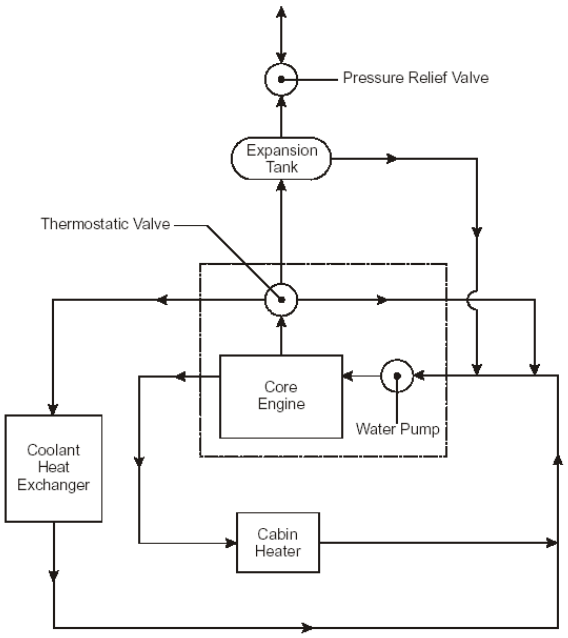
# Diamond DA42 NG

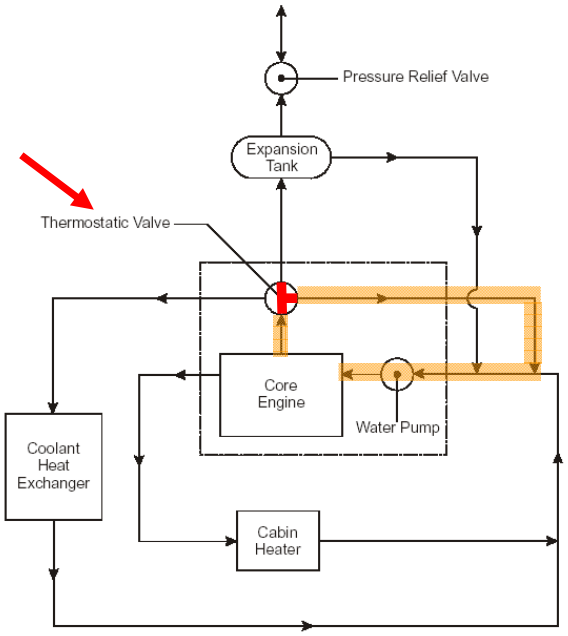





# Cooling system



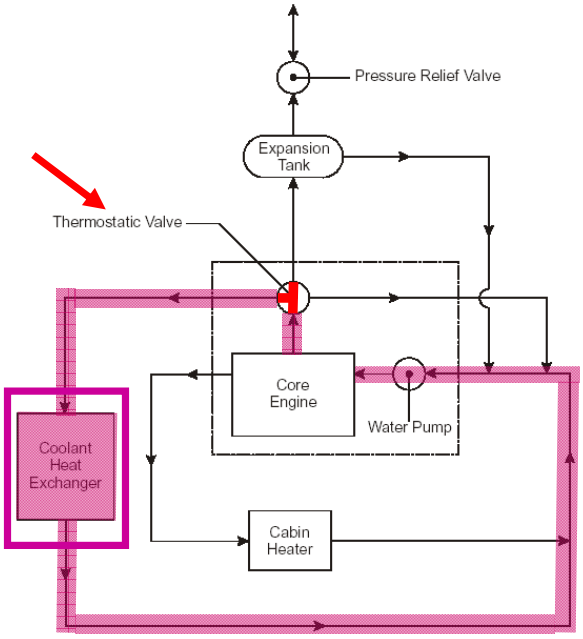
# Cooling system




Coolant Temp.
**< 88°**




# Cooling system




Coolant Temp.
**> 88°**

# Cooling system

**L/R ENG TEMP**

**COOLANT TEMPERATURE HIGH**

- **Check G1000 for LOW COOL LVL caution light**
  - **If LOW COOL LVL caution light OFF**
    - **During climb:**
      - ⇒ **Reduce power on affected engine by 10% or more as rqrd**
      - ⇒ **Increase airspeed by 10 KIAS or more as required**
        - **If coolant temp. not returning to green range within 60":**
          - ⇒ **reduce power on affected engine as much as possible and increase airspeed**
    - **During cruise:**
      - ⇒ **Reduce power on affected engine**
      - ⇒ **Increase airspeed**
        - **If coolant temp. not returning to green range:**
          - ⇒ **Be prepared for an engine failure; land at nearest suitable airfield**
  - **If LOW COOL LVL caution light ON**
    - ⇒ **Reduce power on affected engine**
    - ⇒ **Expect loss of coolant fluid**
    - ⇒ **Be prepared for an engine failure**





# Cooling system

**COOLANT temperature high**

- **Refer to Emergency Checklist page 4, "L/R ENG TEMP"**

**COOLANT temperature low**

*Remark: During low power descent from high altitude coolant temperature may decrease. Consider increasing power.*

- **Check G1000 for LOW COOLANT LVL caution light**
  - **If "LOW COOLANT LVL caution light" ON**
    - ⇒ **Reduce power on affected engine**
    - ⇒ **Expect loss of coolant fluid**
    - ⇒ **Be prepared for an engine failure**

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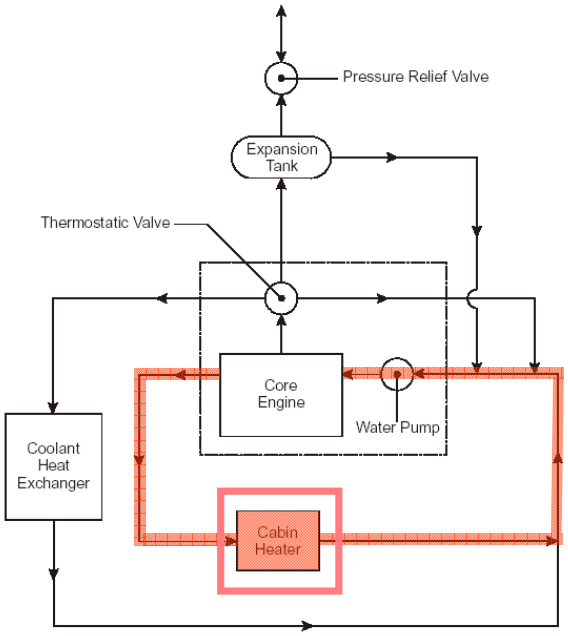
# Cooling system




Cabin Heat

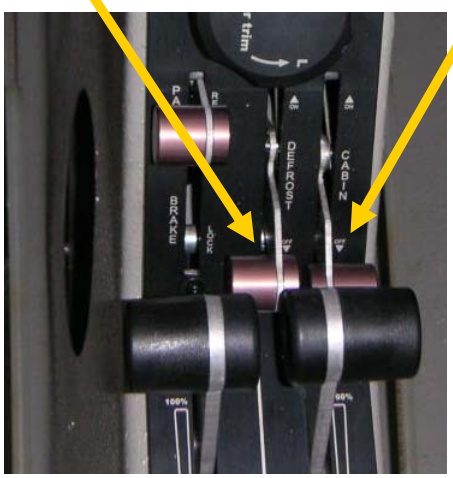




# Cabin heating and defrosting system

Defrost from LH Engine

Cabin Heat from RH Engine



# Ventilation

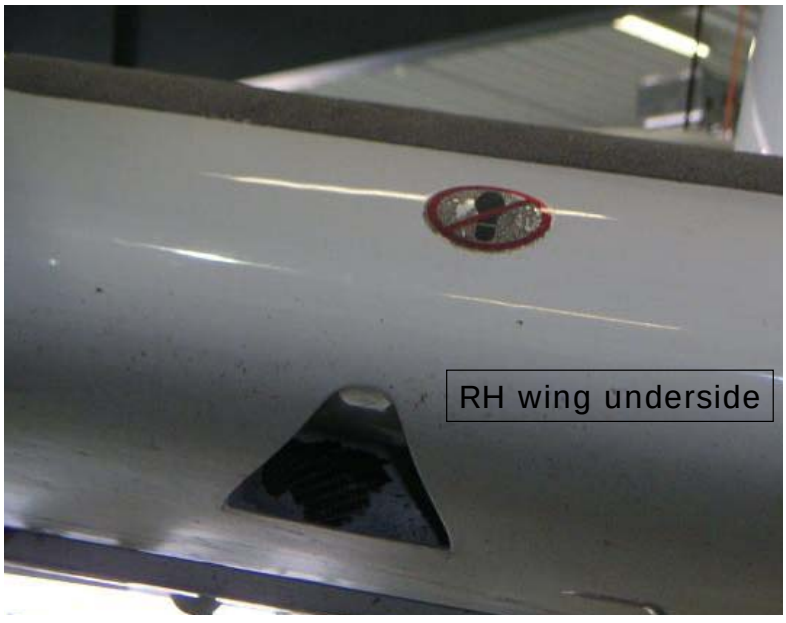
Cockpit

Cabin





# Ventilation inlet



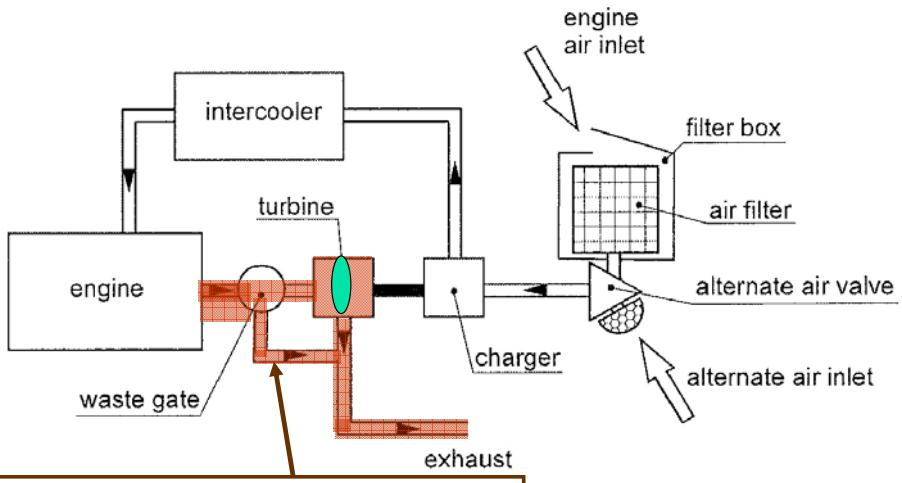
RH wing underside

# Diamond DA42 NG





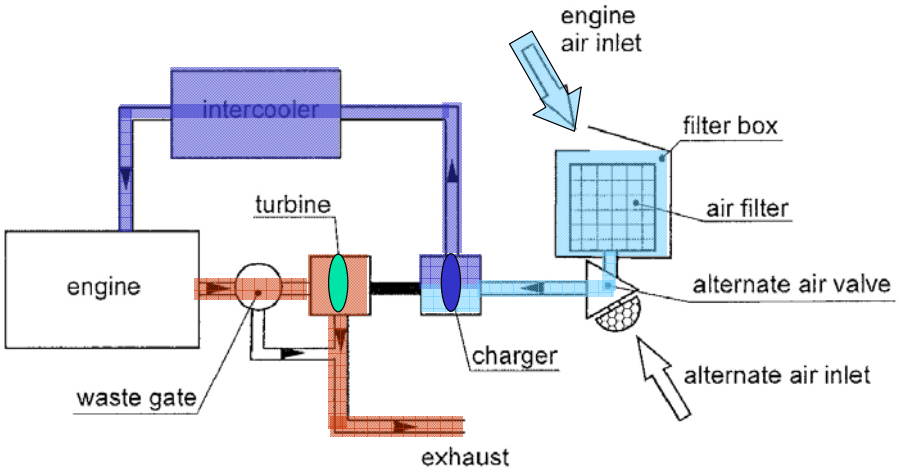

# Turbo charger




Bypass for excess exhaust gas

Exhaust gas drives turbine

# Turbo charger




Compressor compresses intake air

Exhaust gas drives turbine





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## DA42 Fuel system

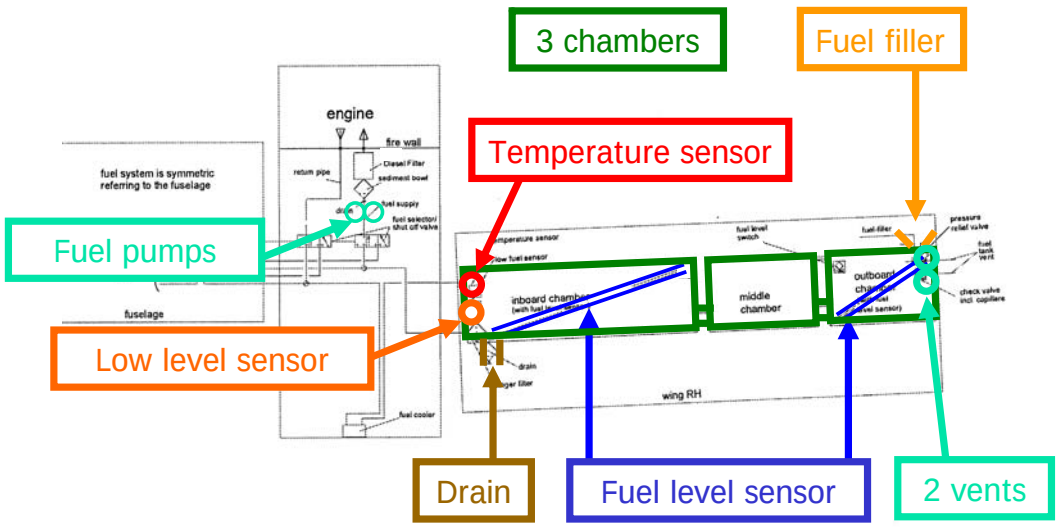
- 2 Tanks (left and right), each with 3 chambers:
- 2 x 26 USG capacity
- 2 x 25 USG usable
- = 50 USG (189 ltr)
- = 152 kg (at 0,80 kg/ltr)

# DA42 Fuel system

- Max unbalance: 5 USG
- Fuel temperature limits:
  - -30° C to +60° C




# DA42 Fuel system

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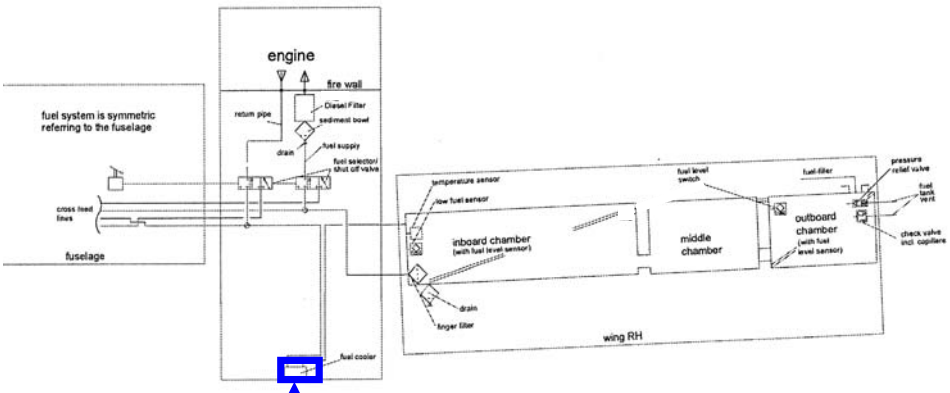
# DA42 Fuel system

Drain valve in nacelle (gascolator)



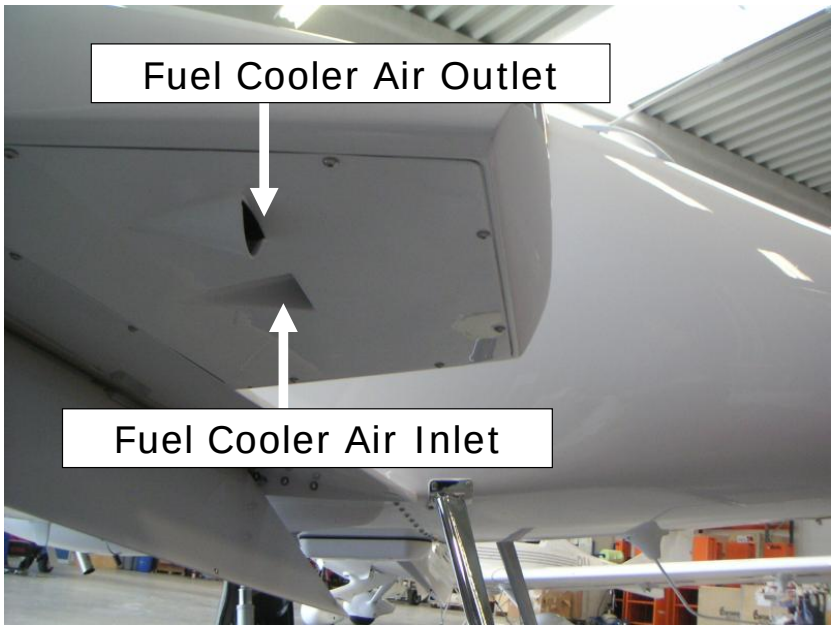


# DA42 Fuel system




Fuel cooler

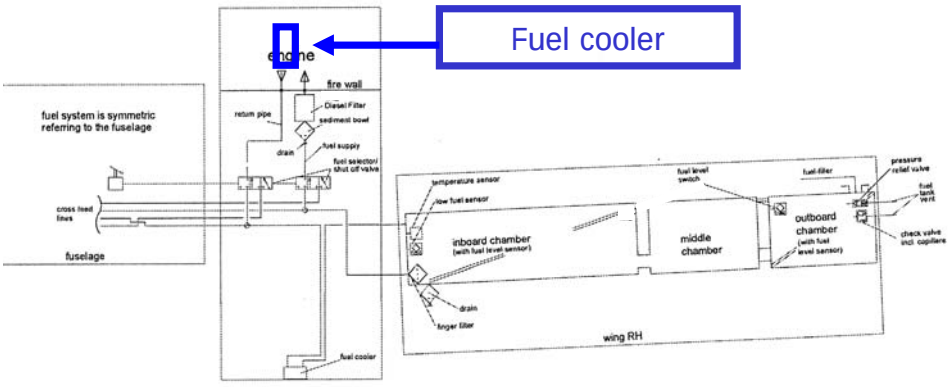
# DA42 Fuel system



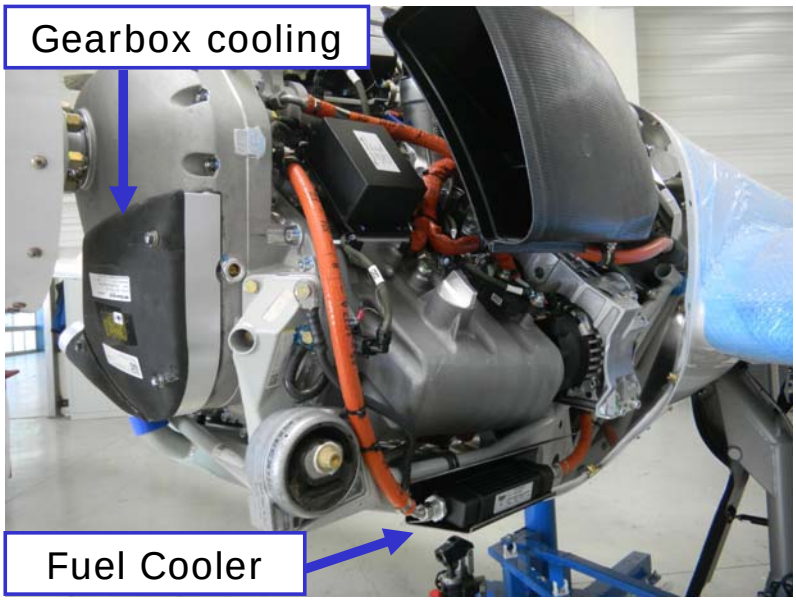





# „dash-6“ Fuel system



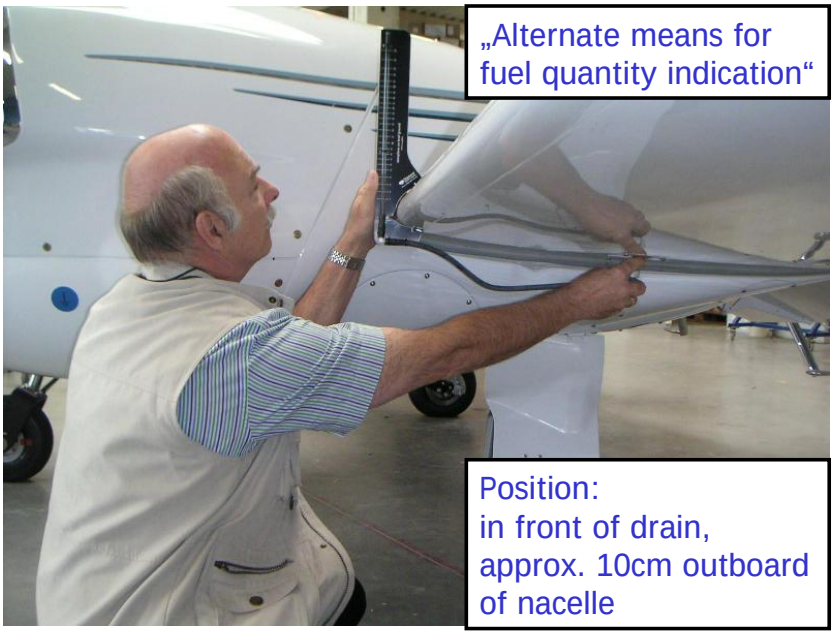
## „dash-6“
## Fuel Cooler, Gearbox cooling



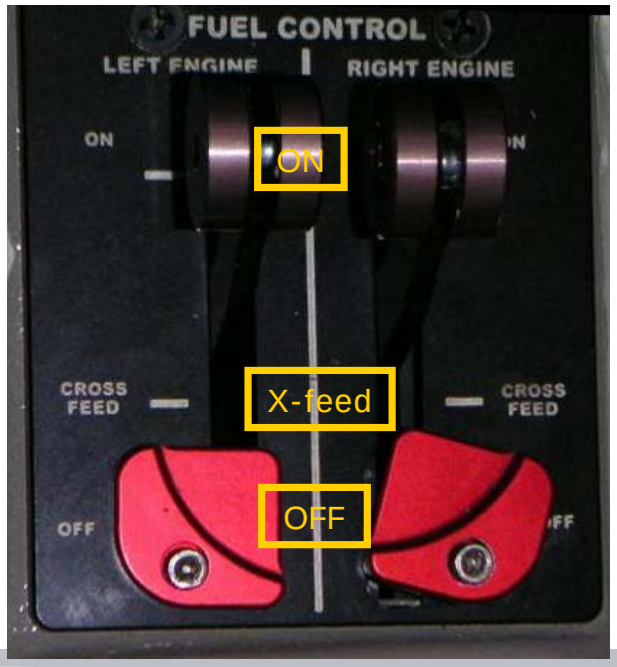




## DA42 Fuel system



# DA42 Fuel system

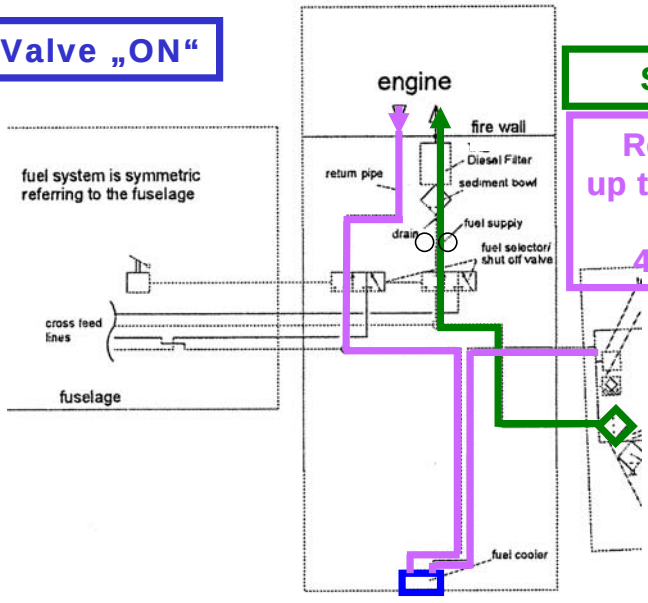






# DA42 Fuel system

**Fuel Valve „ON“**

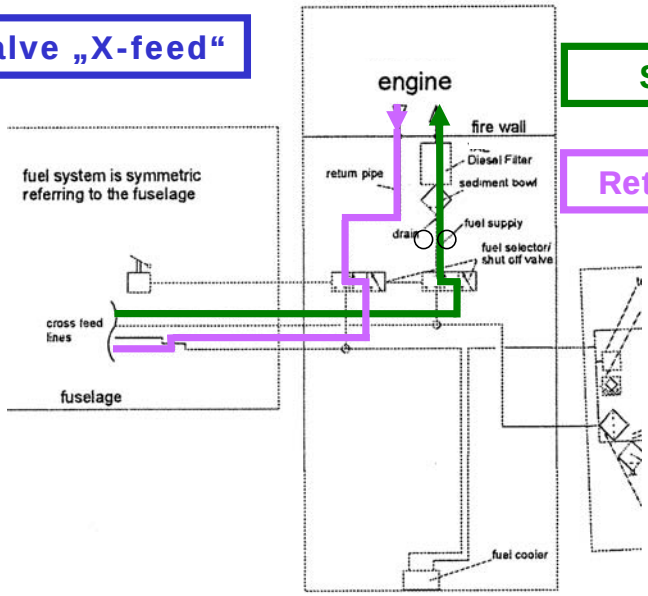



**Supply**

**Return flow up to 71 USG/hr Average 45 USG/hr**

# DA42 Fuel system

**Fuel Valve „X-feed“**




**Supply**

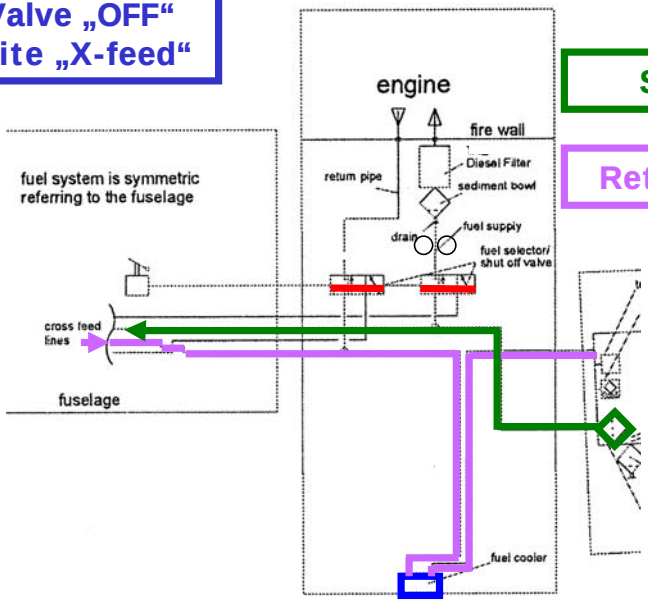
**Return flow**





# DA42 Fuel system

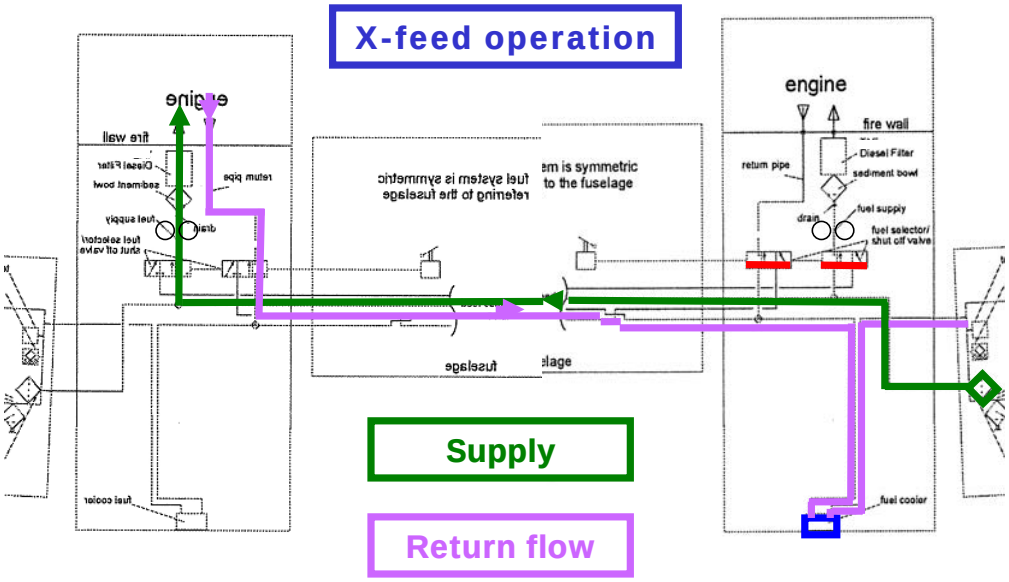
**Fuel Valve „OFF“ opposite „X-feed“**




**Supply**

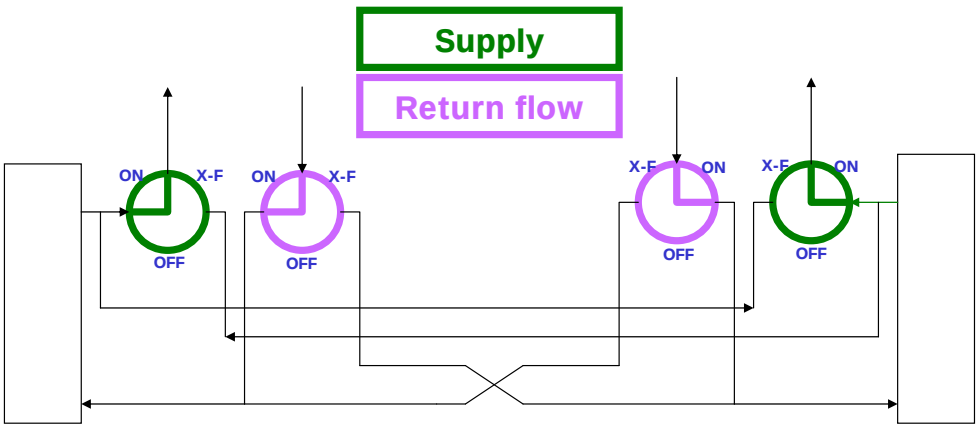
**Return flow**

# DA42 Fuel system





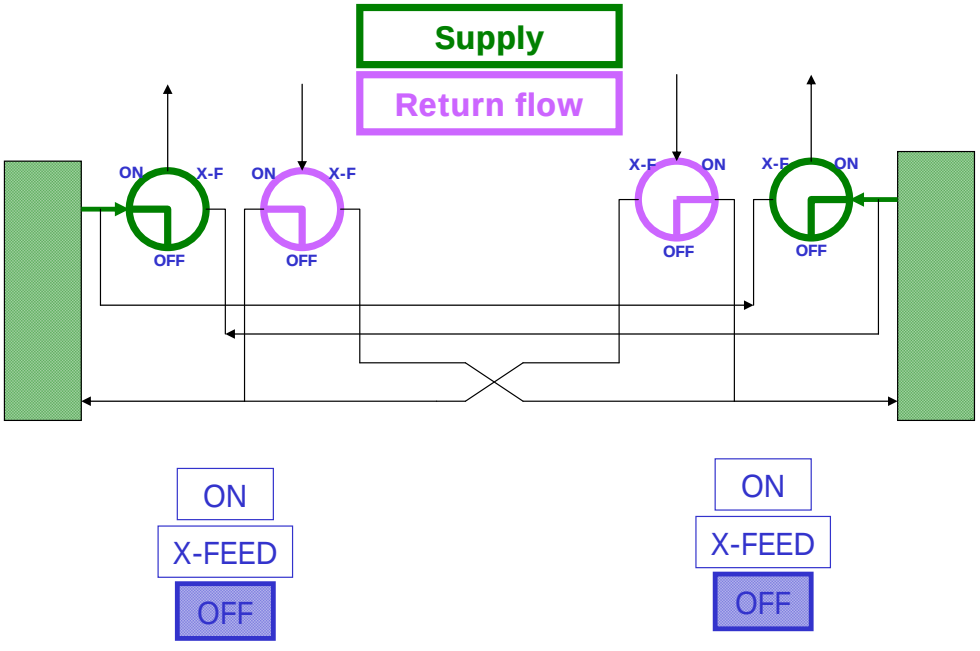

# Fuel valves schematic




ON
X-FEED
OFF

ON
X-FEED
OFF

# Both valves closed



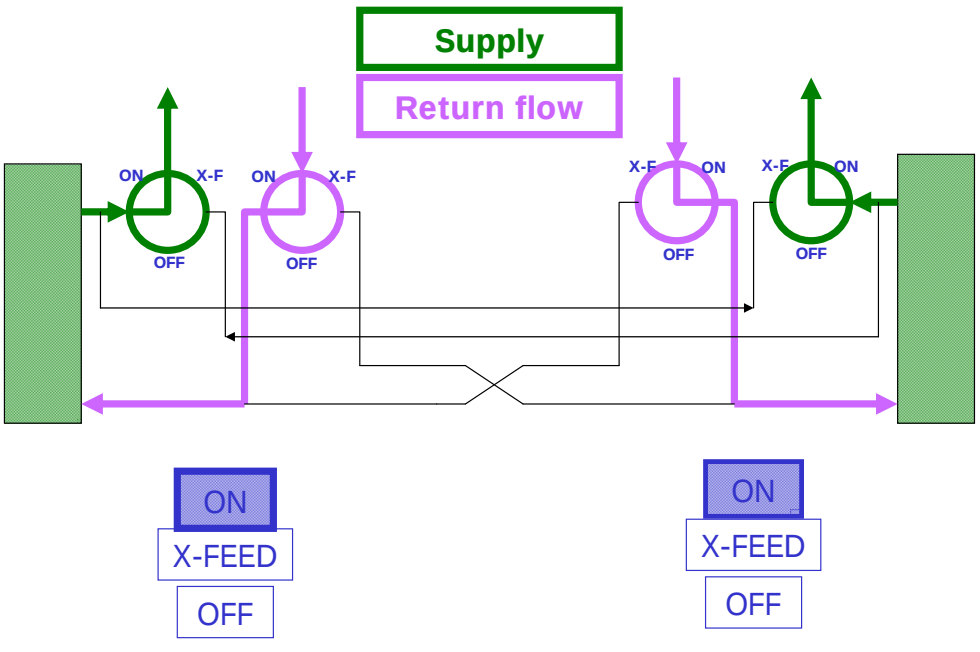

ON
X-FEED
OFF

ON
X-FEED
OFF





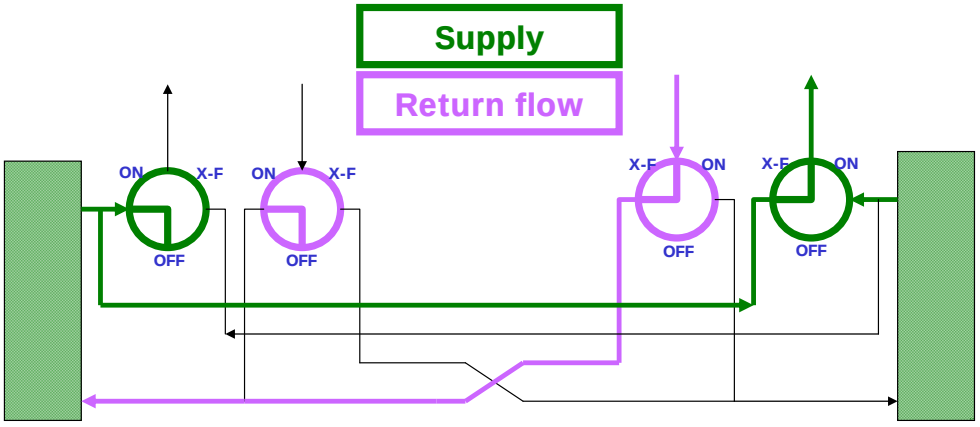
# Both engines running




ON
X-FEED
OFF

ON
X-FEED
OFF

# LH Eng. u/s, RH Eng. X-feed



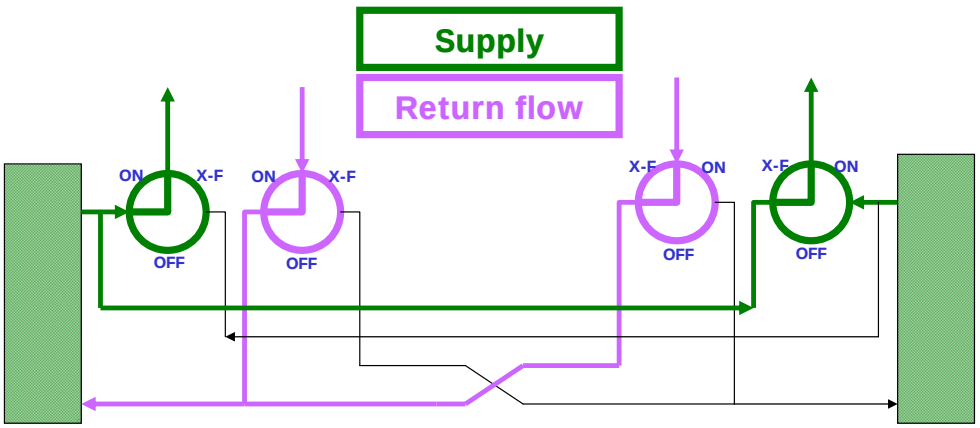

ON
X-FEED
OFF

ON
X-FEED
OFF





# Both engines from LH tank




ON
X-FEED
OFF

ON
X-FEED
OFF

# Fuel system

- For each engine: 2 parallel electrical low pressure fuel pumps
  - Normal Ops: only one pump working
- When pump fails (low fuel pressure): automatic switch over to other pump
  - When ECU switches over: fuel pumps switch over as well
- For TKOF, LDG and with fuel press failure: both pumps switched on manually with FUEL PUMP switch
- DA42NG (NOT for „Dash-6“):
  FUEL PUMP ON with CROSSFEED normally prohibited (only for emergency; special maintenance of high pressure pump required)




# Fuel pumps

# Fuel pumps

**CHECK BEFORE ENGINE START**

| | | | |
|---|---|---|---|
| 7 | Fuel pumps (2) | OFF | 7 |

**CHECK AFTER ENGINE START**

| | | | |
|---|---|---|---|
| 3 | Fuel pumps (2) | check OFF | 3 |
| 4 | Fuel selectors (2) | X-FEED | 4 |

**BEFORE TAKE OFF CHECK**

| | | | |
|---|---|---|---|
| 21 | Fuel pumps (2) | ON | 21 |
| 22 | Parking brake | RELEASED | 22 |

End of Checklist

***AFTER TAKE-OFF PROCEDURE***

*Brakes ..... APPLY*
*Gear ..... UP*
*Fuel pumps (2) ..... OFF*
*Climb power ..... 92% / 2100 RPM*
*Landing light ..... OFF*

**CLIMB TO CRUISE CHECK**

| | | | |
|---|---|---|---|
| 3 | Fuel pumps (2) | CHECKED OFF | 3 |

**DESCENT / APPROACH CHECK**

| | | | |
|---|---|---|---|
| 8 | Fuel pumps (2) | ON | 8 |

**AFTER LANDING CHECK**

| | | | |
|---|---|---|---|
| 3 | Fuel pumps (2) | OFF | 3 |




# Fuel pressure warning

- Warning annunciation:

  L/R FUEL PRES

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# Fuel pressure warning

**L/R FUEL PRES**

**FUEL PRESSURE LOW**

- **Check fuel quantity**
- **FUEL SELECTOR of affected engine: check ON**
- **FUEL PUMP of affected engine: ON**
  - **If warning remains:**
    - ⇒ **FUEL PUMP of affected engine: OFF**
    - ⇒ **FUEL SELECTOR of affected engine: CROSSFEED**
      - **If warning still remains:**
        - ⇒ **Be prepared for an engine failure**





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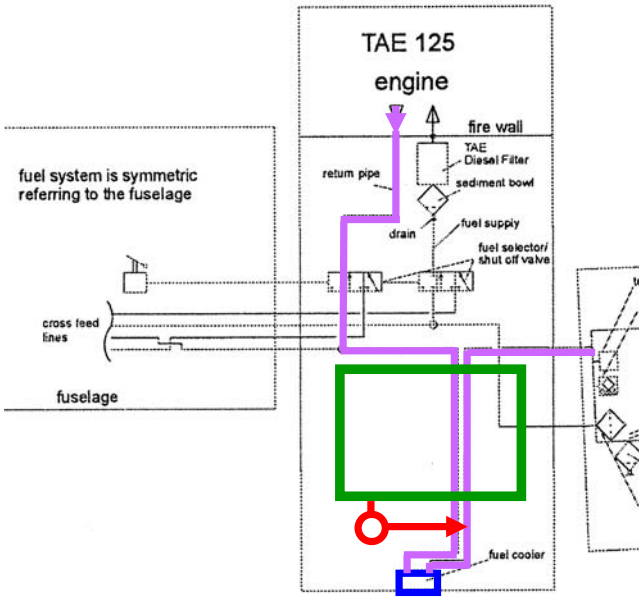
# Diamond DA42 NG






# Optional Auxiliary Fuel Tanks



## Optional Auxiliary Fuel Tanks

- One tank in each nacelle
- Capacity: 13,7 USG per side
- Useable: 13,2 USG per side




## Optional Auxiliary Fuel Tanks

- Electrical transfer pump (auxiliary pump, „AUX PUMP“) feeds fuel from the AUX tank to the main tank
- Transfer must be initiated manually
- Transfer in 2 steps:
  - First half when main tank 17 USG or less (up to full main tank)
  - Second half when main tank again 17 USG or less

## Optional Auxiliary Fuel Tanks

- AUX PUMP switched OFF automatically when:
  - Main tank is full
  - AUX tank is empty




## Optional Auxiliary Fuel Tanks

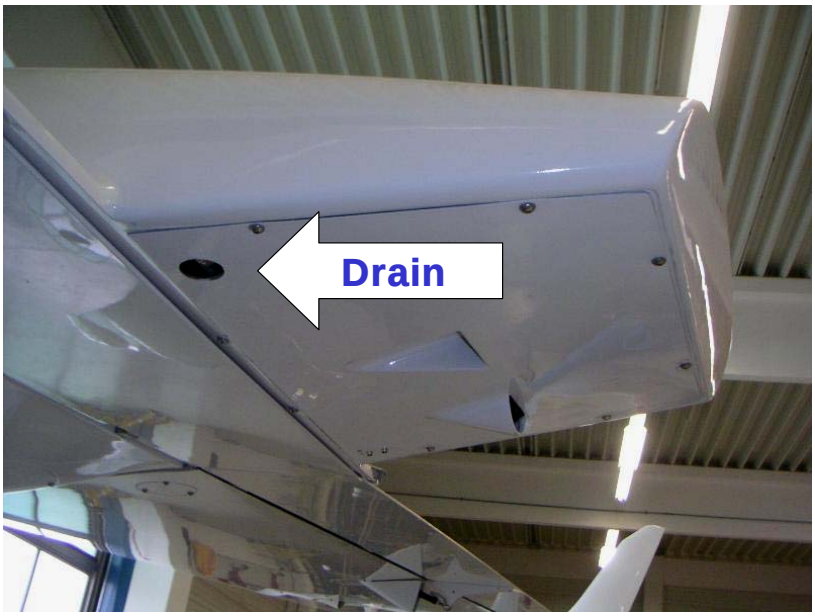
| Main tanks | AUX tanks | Total |
|---|---|---|
| 2 x 25 USG | 2 x 13,2 USG | 2 x 38 USG |
| 50 USG | 26,4 USG | 76,4 USG |
| Maximum unbalance between main tanks: | | |
| 5 USG | | |
| 1 USG if there is an unbalance between AUX tanks | | |

## Optional Auxiliary Fuel Tanks






## Optional Auxiliary Fuel Tanks



## Optional Auxiliary Fuel Tanks




## Optional Auxiliary Fuel Tanks

### CAUTION light

- L/R AUX FUEL E
  - L/R AUX tank empty and fuel transfer pump ON

## Optional Auxiliary Fuel Tanks

*DA42 Twin Star* *ABNORMAL PROCEDURES*

**L/R AUX FUEL E** **AUXILIARY FUEL TANK EMPTY**

⇒ **L/R auxiliary fuel pump OFF**





## Optional Auxiliary Fuel Tanks

In case of a L or R AUX pump failure:

(AUX PUMP does not operate)

- Use x-feed function to keep fuel balance
- Amend flight plan for reduced amount of available fuel

## Optional Auxiliary Fuel Tanks



**L/R Auxiliary fuel XFER FAIL**

- **Both AUX PUMPS: OFF**
- **Check fuel pumps OFF**
- **Check fuel quantity**
- **Use X-feed to keep main tank fuel unbalance within 1 USG**
- **Switch remaining x-fer pump ON**
- **Use X-feed to keep main tank fuel unbalance within 1 USG**
- **Amend flight plan to allow for reduced amount of available fuel**




## Optional Auxiliary Fuel Tanks

# Mass and Balance

| Item | Lever Arm (m) |
|---|---|
| Wing tanks | 2.63 |
| **AUX tanks** | **3.20** |

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## Fuel quantity check

- Verify AUX empty
  - Electrical Master ON
  - Fuel transfer ON
  - L/R AUX FUEL E CHECKED
- Verify AUX full
  - Visual check




Optional Auxiliary Fuel Tanks

***DA42 Twin Star*** ***PREFLIGHT PROCEDURES***

**PREFLIGHT INTERIOR + EXTERIOR.**

10 ** Fuel transfer ON – if L/R AUX FUEL E caution ON: AUX tank(s) empty Fuel transfer OFF

**PREFLIGHT EXTERIOR**

**Left engine nacelle**

** Check AUX tank full ?

**Right engine nacelle**

** Check AUX tank full ?

- Fuel quantity between „FULL“ and „EMPTY“ cannot be determined

## Preflight fuel management

- If possible transfer all AUX fuel to main tanks
  - Use external power or one engine running
  - Electrical Master ON
  - Fuel transfer ON

    until
  - L/R AUX FUEL E ON

    (will take 10 minutes or even longer)




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# DA42NG Diesel Operation

***The following item is added to the Modifications checklist:***

| Modification | Source | Installed | |
|---|---|---|---|
| Diesel Operation | OÄM 42-251 | □ yes | □ no |

## 9.2 LIST OF SUPPLEMENTS

***The following item is added:***

| Airplane S/N: | Registration: | | Date: | | |
|---|---|---|---|---|---|
| **Sup. No.** | **Title** | **Rev. No.** | **Date** | **applicable** | |
| | | | | **YES** | **NO** |
| O05 | Diesel Operation | 0 | 06-Dec-2013 | □ | □ |

## DA42NG Diesel Operation

- Fuel Temperature
  - Diesel Operation
    - Minimum: -30°C
    - Maximum: 60°C
  - Modified G1000 Software:

| Indi-cation | Red arc/bar = lower prohibited range | Yellow arc/bar = caution range | Green arc/bar = normal operating range | Yellow arc/bar = caution range | Red arc/bar = upper prohibited range |
|---|---|---|---|---|---|
| Fuel temp. | below -30°C | -30° to +4°C | +5° to 55°C | 55° to 60°C | above 60°C |




## DA42NG Diesel Operation

- Operational Limitations:

| No engine start below | No take-off below | Diesel Fuel Class |
|---|---|---|
| -5°C (+23°F) | +5°C (+41°F) | Diesel Fuel of unknown class or unknown fuel blend |
| -10°C (+14°F) | -5°C (+23°F) | Diesel Fuel Class C |
| -15°C (+5°F) | -10°C (+14°F) | Diesel Fuel Class D, E or F |

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## Diesel Fuel Classes (EN 590)

(„Temperate“ climatic zones)

| Property | Unit | Limits | | | | | |
|---|---|---|---|---|---|---|---|
| | | Class A | Class B | Class C | Class D | Class E | Class F |
| CFPP | ° C | +5 | 0 | -5 | -10 | -15 | -20 |
| CFPP | ° F | +41 | +32 | +23 | +14 | +5 | -4 |

CFFP ..... Cold filter plugging point

„Winter Diesel“: Class F

„Arctic“ climatic zones: other classes




DA42NG Diesel Operation

- Diesel Fuel or a blend of Diesel Fuel with JET Fuel is not permitted in the auxiliary tanks.
- If JET Fuel is used, make sure that no Diesel Fuel is remaining in the tanks.
- Otherwise the temperature limitations for Diesel Fuel operation must be observed.
- The fuel filter is not heated!

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## DA42NG Diesel Operation

- If the airplane is operated in a cold environment, it must be changed from Diesel Fuel operation to JET Fuel operation.
- To ensure that no blend of JET Fuel with Diesel Fuel is in one of the tanks, each tank must be refilled at least twice with more than 17.2 US gal (65 l) of JET Fuel. Otherwise both tanks must be drained before refueling with JET Fuel.

**NOTE**

- In order to provide information about the fuel grade it is recommended to enter the fuel grade in the airplane log each time fuel is refilled.




## DA42NG Diesel Operation

# Performance below 10° C OAT

| | |
|---|---|
| TKOF Ground Roll | (normal and short field) Add 7% |
| TKOF Distance | |
| Climb | (Flaps UP and Flaps APP) Reduce by 60 ft/min |
| 1-engine climb | Reduce by 30 ft/min |

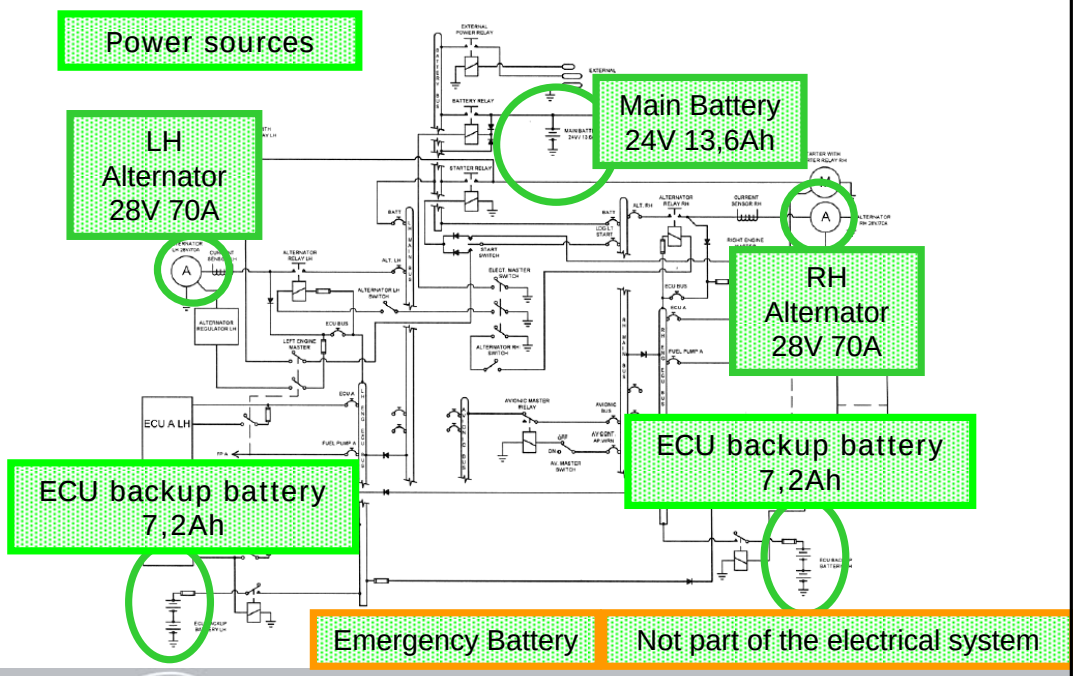
Make calculation from the basic AFM value before calculating additional corrections from other Supplements.

# Diamond DA42 NG

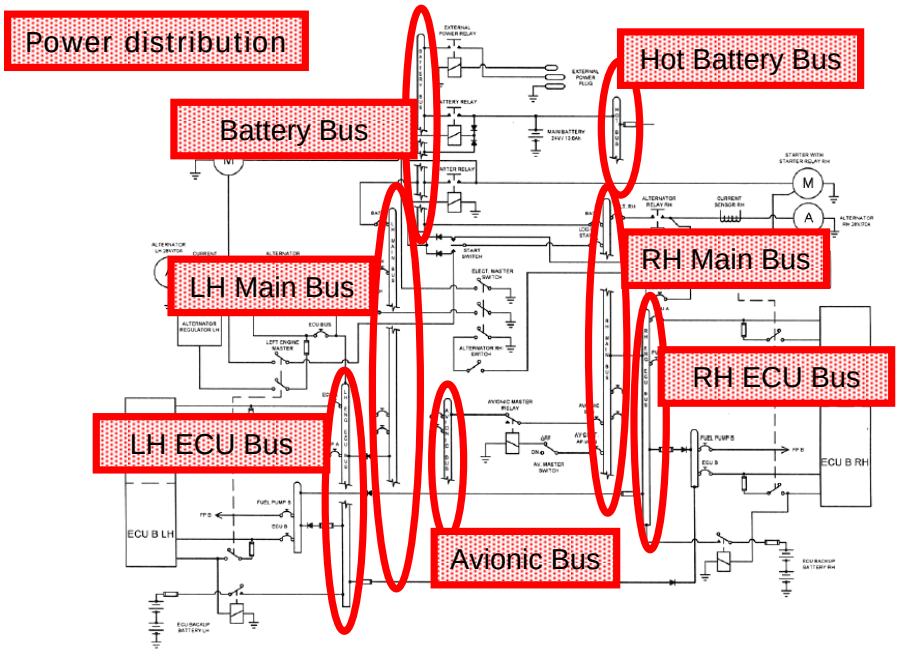





# Electrical system



# Electrical system








# Electrical system

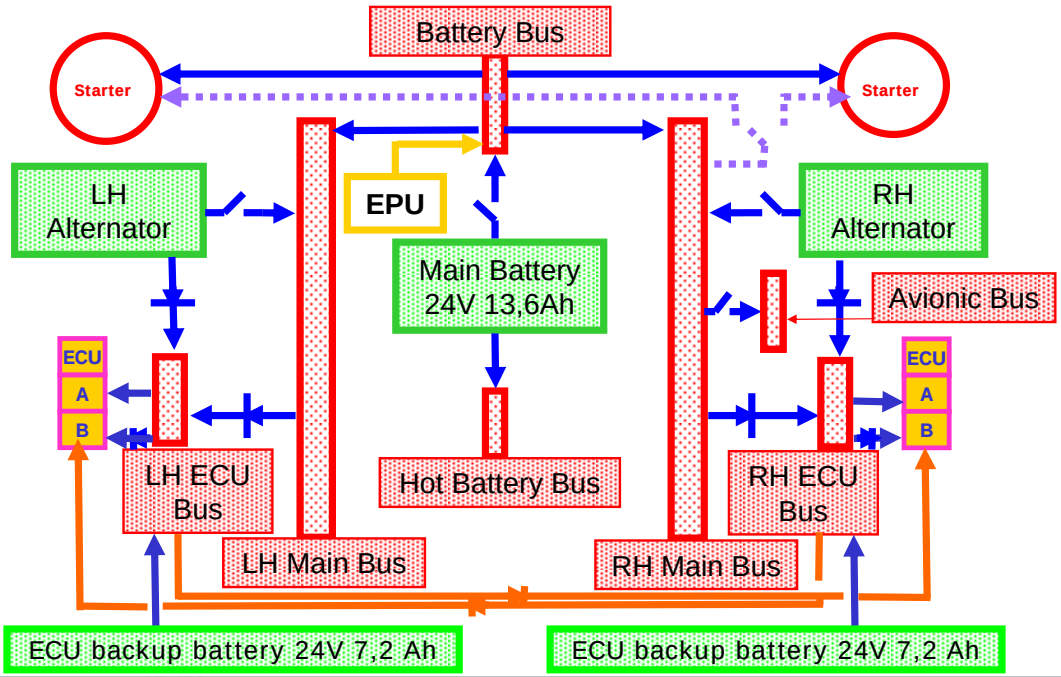
There are 2 versions of the electrical system

- „Modified electrical system“:

| | | | |
|---|---|---|---|
| Modification of the Electrical System | MÄM 42-403 | ☐ yes | ☐ no |

„Standard“ in the „Dash-6“

# „Modified“ Electrical system






# Hot battery bus

- Pilot map / reading light

**PARKING CHECK**

| | | | |
|---|---|---|---|
| 10 | Electric Master..... | OFF | 10 |
| 11 | Interior light ..... | CHECKED OFF | 11 |

## Battery bus

- LH / RH Main Bus
- LH / RH starter heavy duty power
- LH / RH ECU BUS (via diode)

# LH Main bus

- PFD
- Air Data Computer
- AHRS
- COM 1
- GPS/NAV 1
- Transponder
- Engine Instruments
- Pitot heating
- Oxygen system
- Gear control
- Gear warning
- Map light
- Flood light
- Taxi light
- Anticollision lights




# RH Main bus

- Avionic Bus
- MFD
- Horizon
- Starter control
- Flap system
- Avionic/ CDU cooling fan
- Stall warning
- Autopilot warning
- Landing light
- Navigation lights
- Instrument lights

## Avionic bus

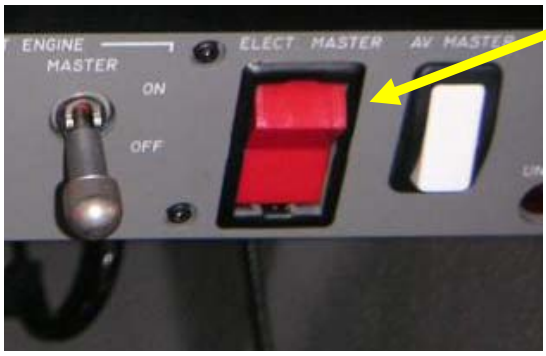
- COM 2
- GPS/NAV 2
- Audio panel
- Autopilot
- (Data Link)
- (WX 500)
- (ADF)
- DME
- (Weather Radar)




## Electrical system

### Electric Master

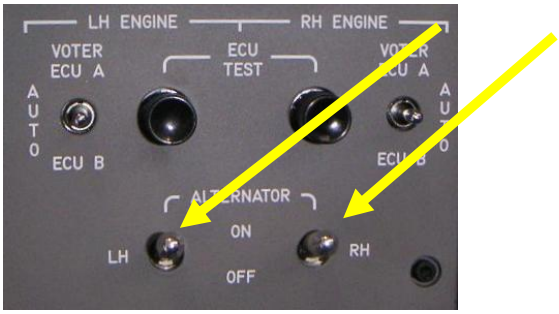
- Connects Battery Bus to Battery (Battery Bus powers L/R Main Bus)
- Enables Alternator Switches



# Electrical system

## L/R Alternator switch

- Connects L/R Alternator to L/R Main Bus
- (In normal operation Alternator switches are always ON)







# Electrical system

## L/R Engine Master

- Enables starter activation
- Connects L/R ECU (A+B) to L/R ECU Bus
- Provides power for „GLOW“ and unfeathering accumulator
- Connects L/R alternator field to the ECU Backup Battery

# Electrical system

## Avionic Master Switch

- Connects Avionic Bus to RH Main Bus





# External power connection

## Engine start with external power

DA 42 NG AFM | Diamond AIRCRAFT | Abnormal Operating Procedures

### 4B.8 STARTING ENGINE WITH EXTERNAL POWER

4. ENGINE MASTER . . . . . ON, LH side

12. Idle RPM . . . . . check, 740 ±30 RPM
13. External power . . . . . disconnect
14. RH engine . . . . . start with normal procedure




## Engine start with external power

### Checklist:

If starting with external power:

a Prop area ..... CHECK CLEAR a
b External power..... CONNECT b
21 Electric master ..... ON 21

***ENGINE START PROCEDURE***

***Normal sequence: first start LH engine***

If external power was used:

External power..... DISCONNECT

***Start RH engine, procedure as above***

## Engine start with external power

- Why?
  - With the start of the RH engine using the aircraft electrical system you check the battery status.
  - If the battery is too weak it will not „buffer“ the load of the RH starter motor, the LH alternator voltage will drop considerably, and the RH starter will not operate

No Night VFR or IFR with empty battery!
Therefore:
No Night VFR or IFR if engine start with external power was necessary.




## Electrical malfunctions

**COMPLETE ELECTRICAL FAILURE**

* Leave icing area

1 Circuit breakers..... CHECK all IN 1

- If no success:

2 Emergency switch .....ON 2
3 Flood light, if necessary.....ON 3
4 Power ..... SET 4
according power lever position and/or engine noise
5 Flaps .....VERIFY POSITION 5

Land at nearest suitable airfield
Landing gear may slowly extend
For landing apply "Manual extension of landing gear"

# Electrical malfunctions

**L/R ALTN FAIL** — **ALTERNATOR FAILED**

- **If in icing conditions:**
  - ⇒ **Leave icing area as soon as practicable**
- ➢ **Alternator on affected side OFF**
- ➢ **Monitor bus voltage**
- ➢ **Reduce electrical consumers**
  - **If both alternators failed:**
    - ⇒ **See Abnormal Checklist "Both Alternators failed", page 19**

**L/R VOLTS LOW** — **BUS VOLTAGE TOO LOW**

*Remark: possible reasons are*
*- fault in the electrical power supply*
*- Alternators OFF*

- ➢ **Continue with "Engine instrument indications outside of green range" – VOLTS low, page 19**




# Electrical malfunctions

**VOLTS low**

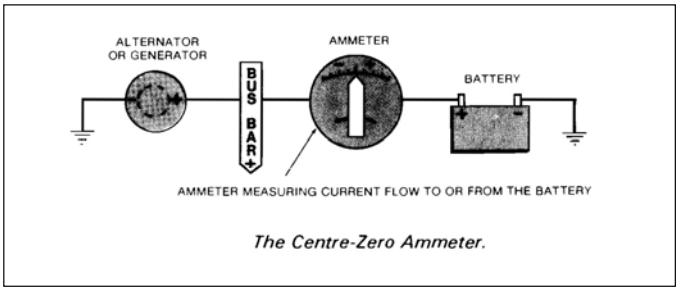
- ❖ **On ground:**
  - ⇒ **Check alternators ON**
  - ⇒ **Check circuit breakers**
    - **If LOW VOLTS CAUTION still indicated on the G1000:**
      - ⇒ **Discontinue operation; terminate flight preparation**
- ❖ **In flight:**
  - ⇒ **Check alternators ON**
  - ⇒ **Check circuit breakers**
  - ⇒ **Switch off unnecessary electrical equipment**
    - **If LOW VOLTS CAUTION still indicated on the G1000:**
      - ⇒ **Apply L/R ALTN FAIL caution procedure, page 15**

**Both alternators failed**

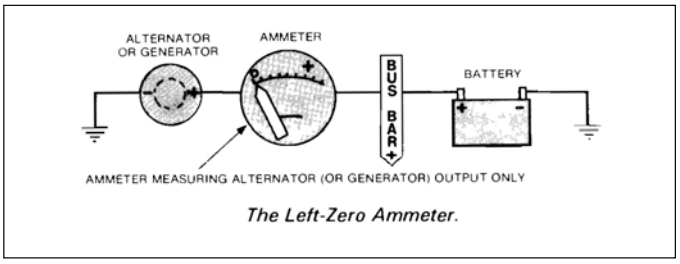
- ➢ **Avionic Master: OFF**
- ➢ **LH/RH Alternator: OFF**
- ➢ **Transponder: STBY**
- ➢ **Gear: DOWN**
  - **When down and locked:**
    - ⇒ **Pull manual gear extension handle**
- ➢ **Stall/Pitot heat: OFF**
- ➢ **All lights:OFF**
  - ⇒ **Expect battery power to last for 30 minutes**
  - ⇒ **Expect engine stoppage after this time**
    - ⇒ **Land ASAP**

# Electrical system

## 2 types of amperemeter:




*The Centre-Zero Ammeter.*



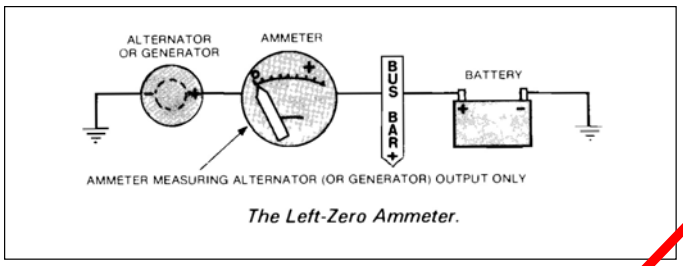

*The Left-Zero Ammeter.*



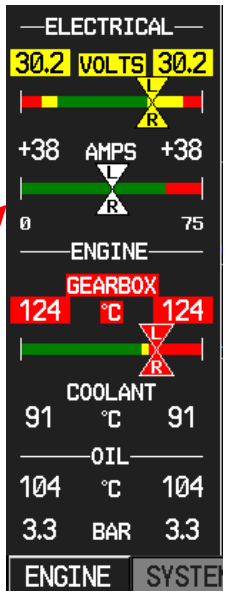


# Electrical system

## Amperemeter on the G1000:




*The Left-Zero Ammeter.*



# Diamond DA42 NG





# Oxygen system

- Continous Flow System
- Operation up to 18.000 ft
- Oxygen cylinder (system) pressure:
  MAX 1850 psi at 21° C
  (i.e. 50 cubic feet, 1.41 cubic meters)
- 4 cannulas plus 1 mask
- Acc. AFM to be used above 10.000 ft

# Oxygen system

Duration using masks and standard cannulas (hours)

| Number of users | 10,000 ft (MSL) | 15,000 ft (MSL) | 18,000 ft (MSL) |
|---|---|---|---|
| 1 | 20.3 | 16 | 7.4 |
| 2 | 10 | 8 | 3.7 |
| 3 | 6.8 | 5.3 | 2.5 |
| 4 | 5 | 4 | 1.8 |

Duration using Oxysaver® cannulas (hours)

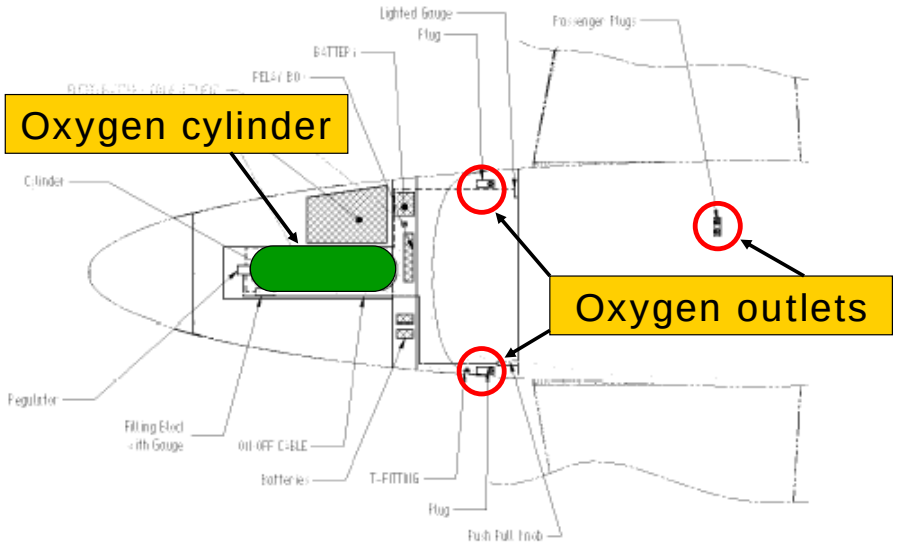
| Number of users | 10,000 ft (MSL) | 15,000 ft (MSL) | 18,000 ft (MSL) |
|---|---|---|---|
| 1 | 60 | 50 | 32 |
| 2 | 29.8 | 25 | 16 |
| 3 | 20 | 16.5 | 10.6 |
| 4 | 15 | 12 | 8 |




# Oxygen system

- Exact calculation of duration :
  - see AFM supplement
  - it depends on the
    - oxygen cylinder pressure
    - number of users and types of dispensing equipment
    - flight altitude

# Oxygen system








# Oxygen system

# Oxygen system





# Oxygen system

## Filling table

to chieve a cylinder (system) pressure of 1850 psi

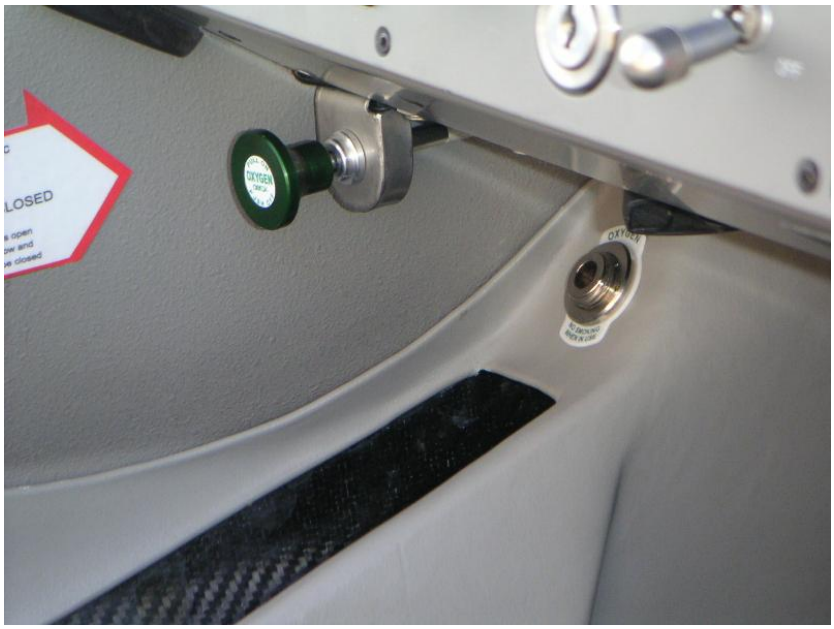
| Ambient Temperature °C (°F) | Filling Pressure [psi] | Ambient Temperature °C (°F) | Filling Pressure [psi] |
|---|---|---|---|
| -18 (0) | 1650 | 10 (50) | 1875 |
| -12 (10) | 1700 | 16 (60) | 1925 |
| -7 (20) | 1725 | 21 (70) | 1975 |
| -1 (30) | 1775 | 27 (80) | 2000 |
| 4 (40) | 1825 | 32 (90) | 2050 |

# Oxygen system

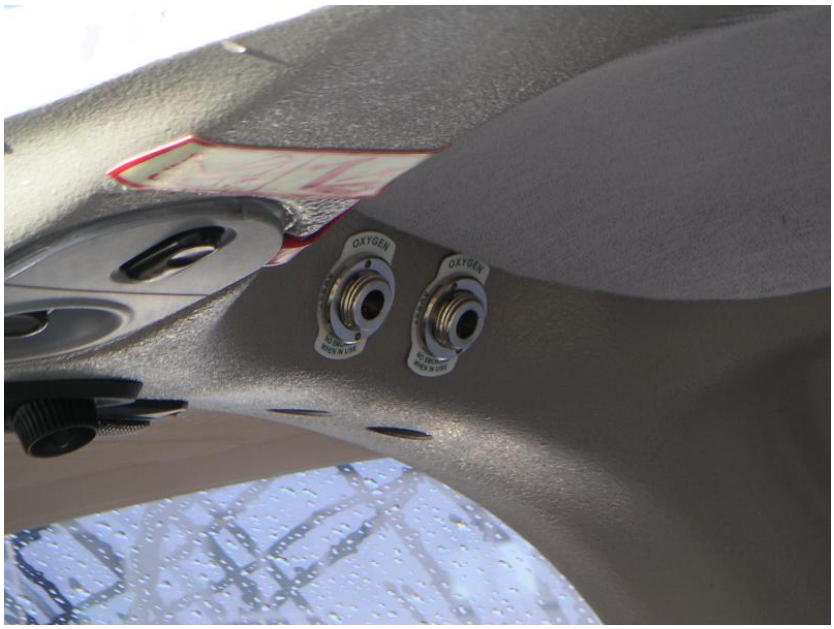





# Oxygen system



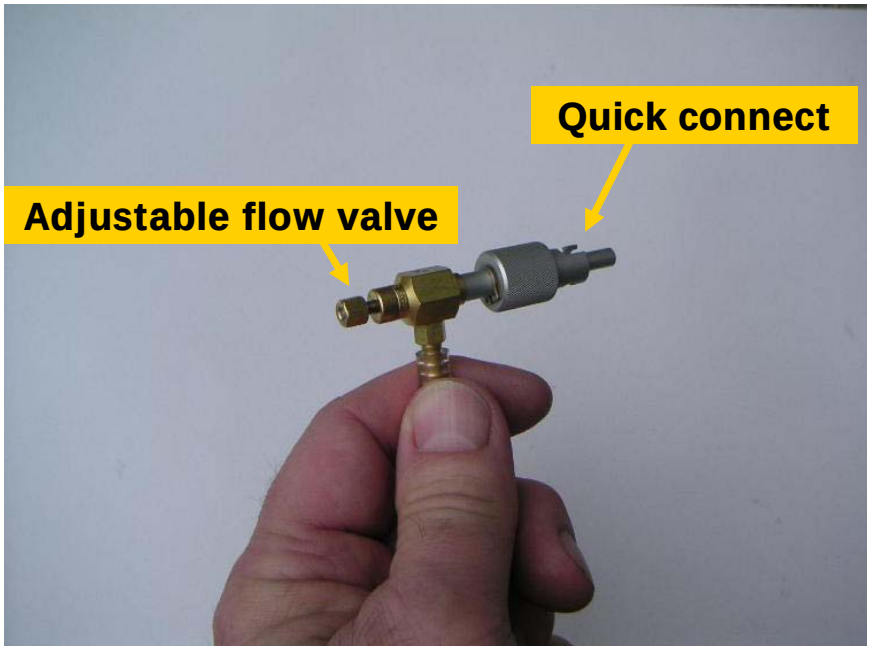
# Oxygen system





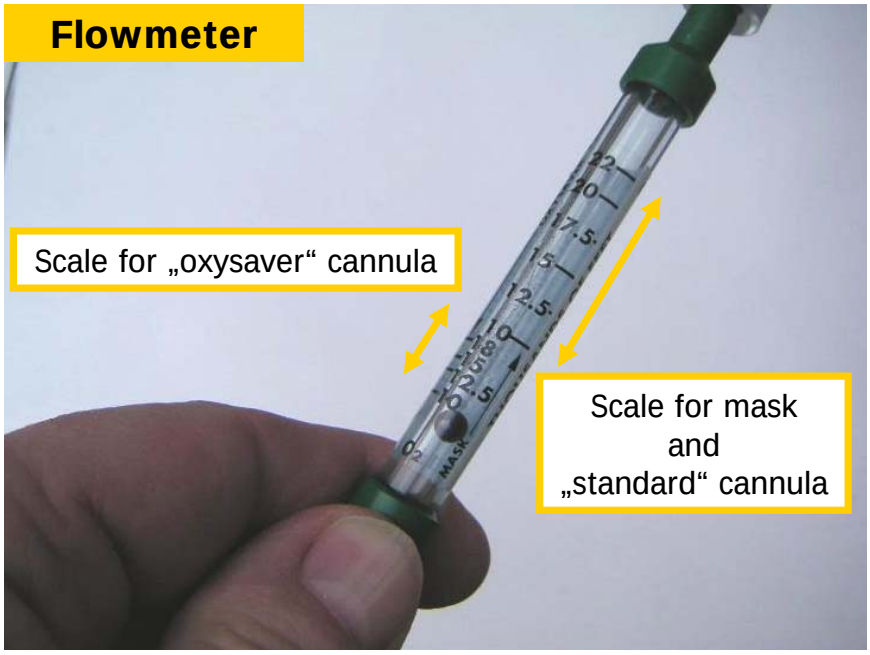


# Oxygen system



# Oxygen system

**Flowmeter**








# Oxygen system

# Mass and Balance

| Item | Lever Arm (m) |
|---|---|
| **Oxygen cylinder** | **0.82** |

In fact relevant for removal only.

Full Oxygen: CG moves FWD ~ 2mm





Oxygen system

If Oxygen System is installed

**CABIN SMOKE ABOVE 10.000 FT**

1 Oxygen ..... CHECK ON 1
2 Emergency descent ..... INITIATE 2
When passing 10.000 ft
3 Oxygen ..... OFF 3
Land at nearest suitable airfield

**CABIN FIRE ABOVE 10.000 FT**

4 Oxygen ..... PUSH OFF 1
5 Emergency descent ..... INTITIATE 2
Land at nearest suitable airfield

**OXYGEN PRESSURE LOSS ABOVE 10.000 FT**

1 Oxygen ..... PUSH OFF 1
2 Oxygen pressure ..... CHECKED, note down 2
3 Emergency descent ..... INTIATE 3
When passing 10.000 FT:
4 Oxygen pressure ..... CHECK AGAIN 4
If oxygen pressure constant: ..... Continue flight
If oxygen pressure dropped: .... Land at nearest suitable airfield

If Oxygen System is installed

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# Diamond DA42 NG





# Ice protection system

**Fluid ice protection system**

**Product of**

**CAV Aerospace Ltd**
**(Celtic Aerospace Ventures Ltd)**

**commonly knows as**
**„TKS“**

# „TKS“ Ice Protection General




## Ice protection system

- How does it work?
  - Protection fluid acts a „freezing point depressant“ (FPD)
  - Water droplets in the air combine with FPD fluid to form a mixture with a freezing temperature below the temperature of the ambient air

# Ice protection system

- Two means of FPD fluid application:
  - Spray nozzles (windshield, propeller)
    - Propeller:
      - Feeding into a „slinger ring“
      - Feeder tube to (rubber) leading edge
  - Porous skin panels




# Ice protection system

- Freezing point of glycol:
  - -12° C
- Freezing point of glycol/water mixture:
  - is lower !!!

**The „Eutectic-phenomenon“**

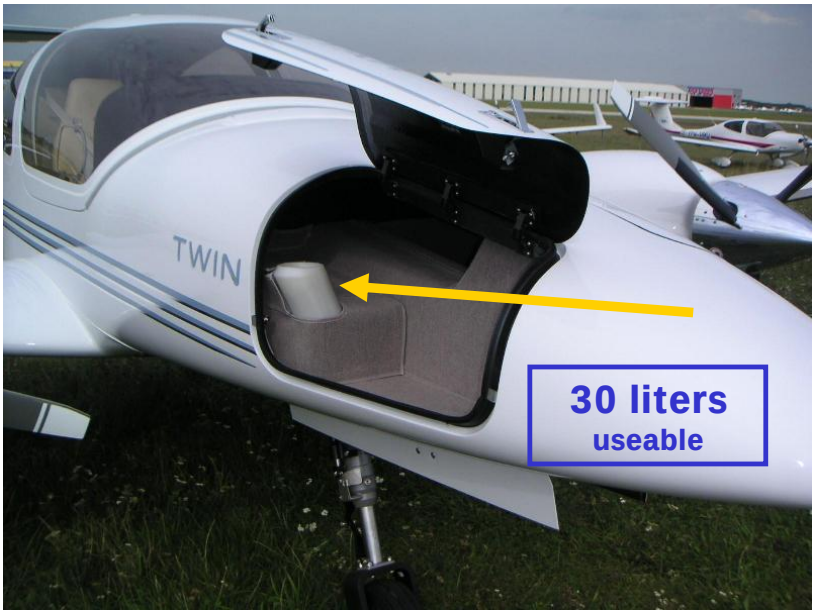
**Ethylene glycol freezing point vs. concentration in water**

| Weight Percent EG (%) | Freezing Point (deg F) | Freezing Point (deg C) |
|---|---|---|
| 0 | 32 | 0 |
| 10 | 25 | -4 |
| 20 | 20 | -7 |
| 30 | 5 | -15 |
| 40 | -10 | -23 |
| 50 | -30 | -34 |
| 60 | -55 | -48 |
| 70 | -60 | -51 |
| 80 | -50 | -45 |
| 90 | -20 | -29 |
| 100 | 10 | -12 |

# „TKS“ Ice Protection DA42




## Ice protection system

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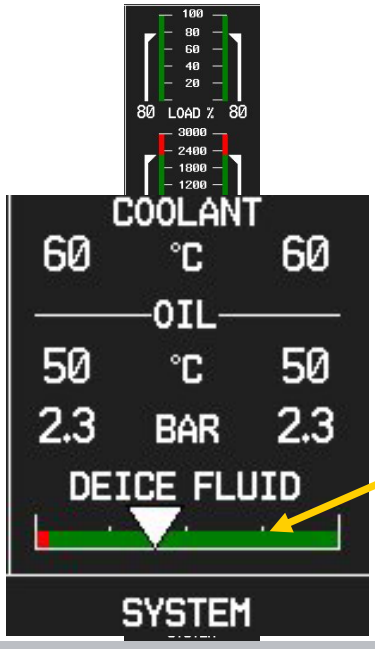
# Ice protection system





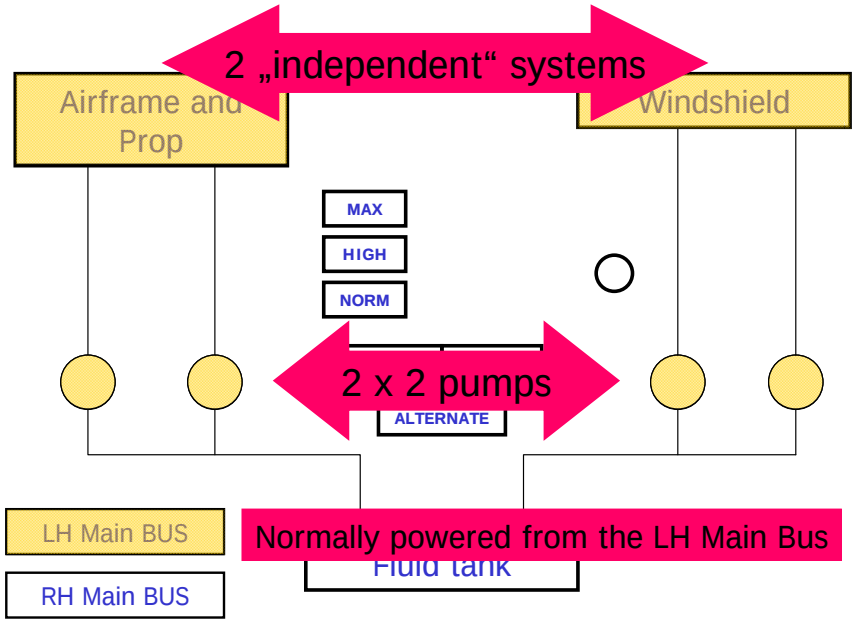
# Ice protection system




Minimum for dispatch:
22 liters

3/4

## Ice protection system







## Ice protection system

### Windshield ice protection

- 2 pumps for redundancy
- Only one pump operative at a time
- Operated for 5 seconds by a push button

## Ice protection system

### Operational modes

| Mode | Designed to | Selected when |
|---|---|---|
| **NORM** | cover the more frequent but less severe known icing conditions as defined by CS25/FAR Part 25, Appendix C | icing conditions are encountered and prior to ice formation |
| **HIGH** | cover all known icing conditions as defined by CS25/FAR Part 25, Appendix C | icing conditions are more demanding or ice has already accumulated |
| **MAX** | provide maximum possible protection for conditions outside the icing envelope as defined by CS25/FAR Part 25, Appendix C | |



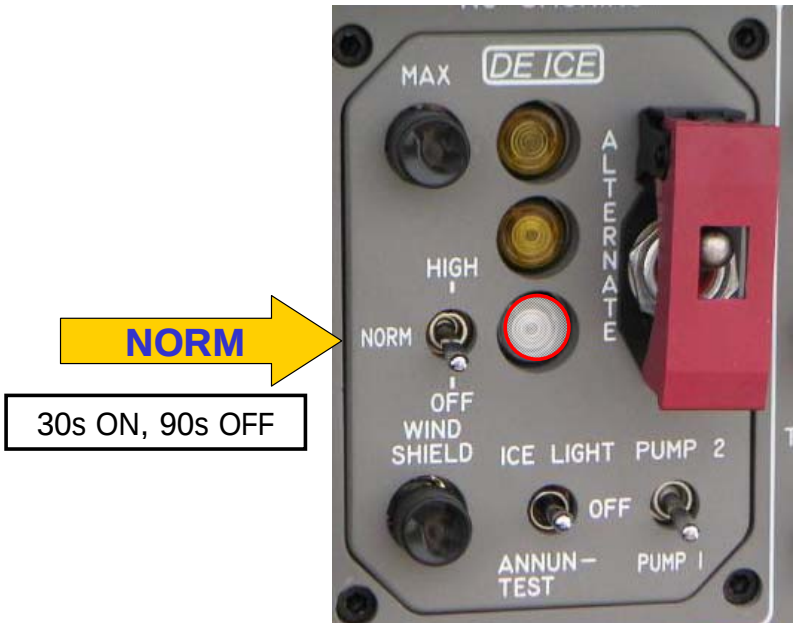

## Ice protection system

### Operational modes

| Mode | | | Operating mode | Operating time |
|---|---|---|---|---|
| **NORM *)** | Climb + Cruise | | 2 pumps simultaneously, but cycled 30 secs ON and 90 secs OFF | ~ 2,5 hrs |
| **HIGH **)** | | Approach | 1 pump continuously ON | ~ 1,0 hr |
| **MAX** | | | 2 pumps simultaneously ON for 2 minutes | ~ 0,5 hr |

| | |
|---|---|
| ***)** | If no shedding of the ice in NORM mode → HIGH |
| ****)** | If no shedding of the ice in HIGH mode → proceed with checklist INADVERTENT ICING ENCOUNTER & EXCESSIVE ICE ACCUMULATION |

# Ice protection system



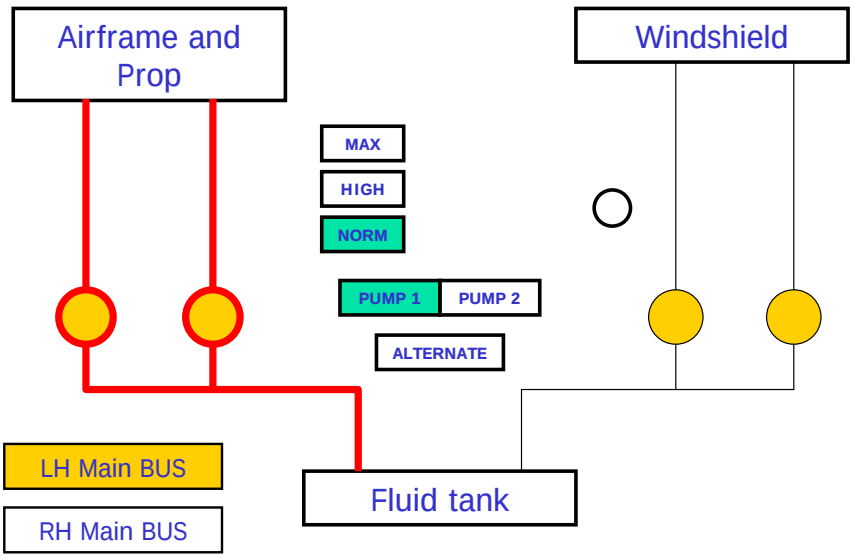

**NORM**

30s ON, 90s OFF

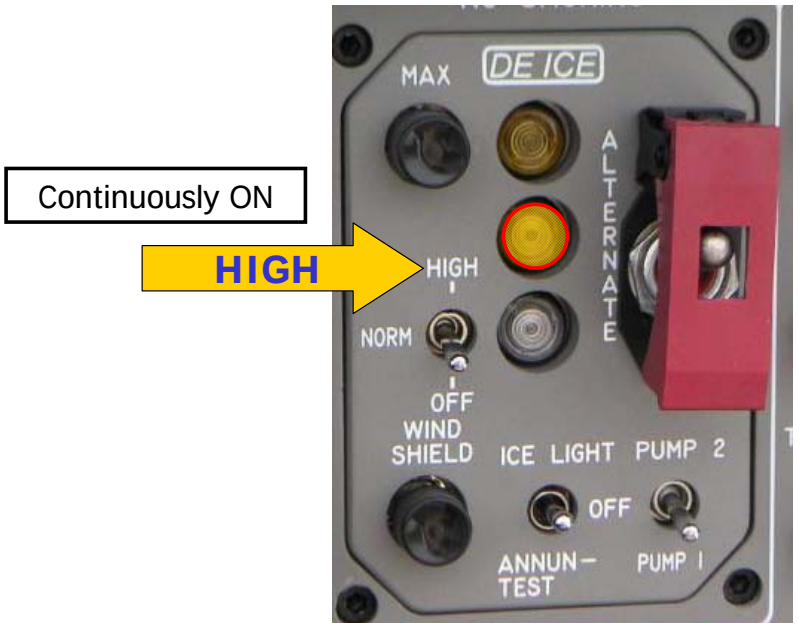




# Ice protection system



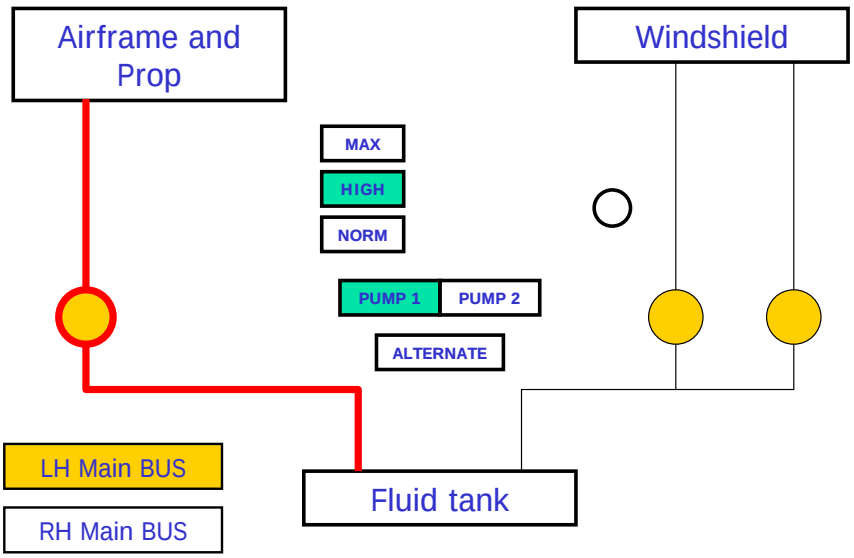
# Ice protection system







# Ice protection system



# Ice protection system

2 minutes ON

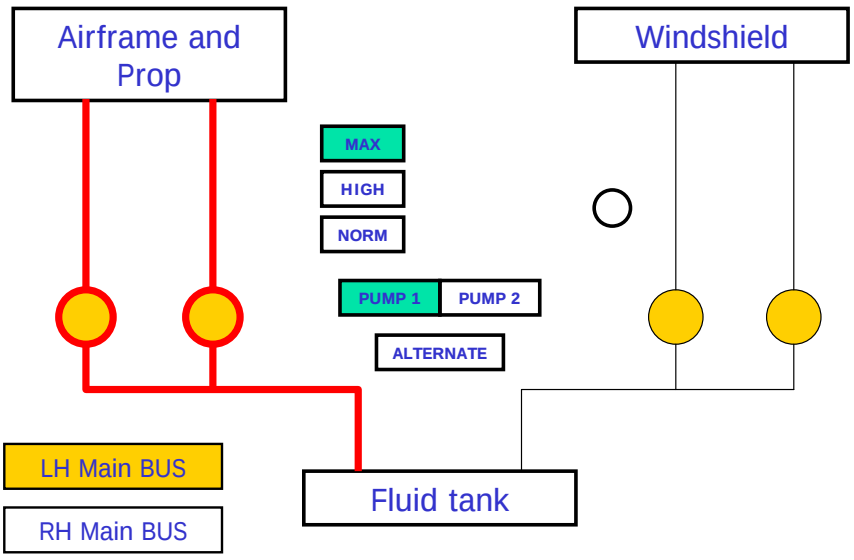
MAX

HIGH






# Ice protection system



# Ice protection system

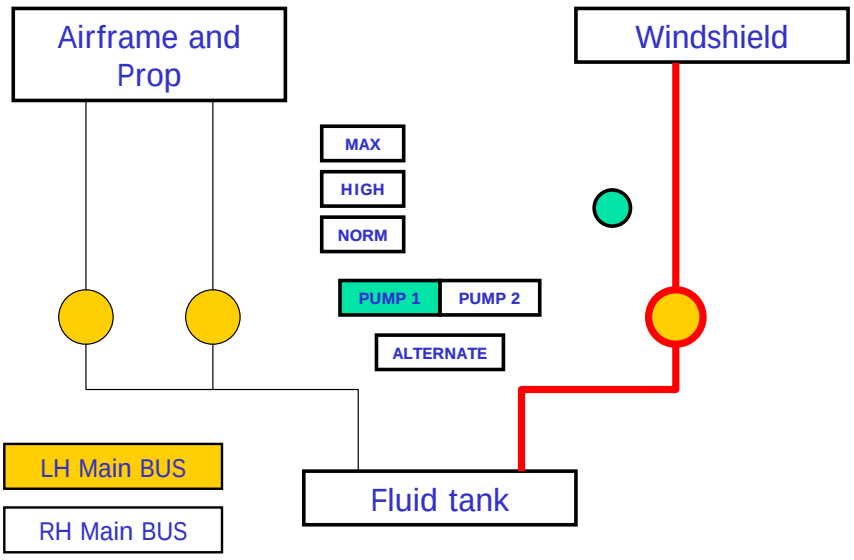

5 seconds

**Windshield deice**





# Ice protection system



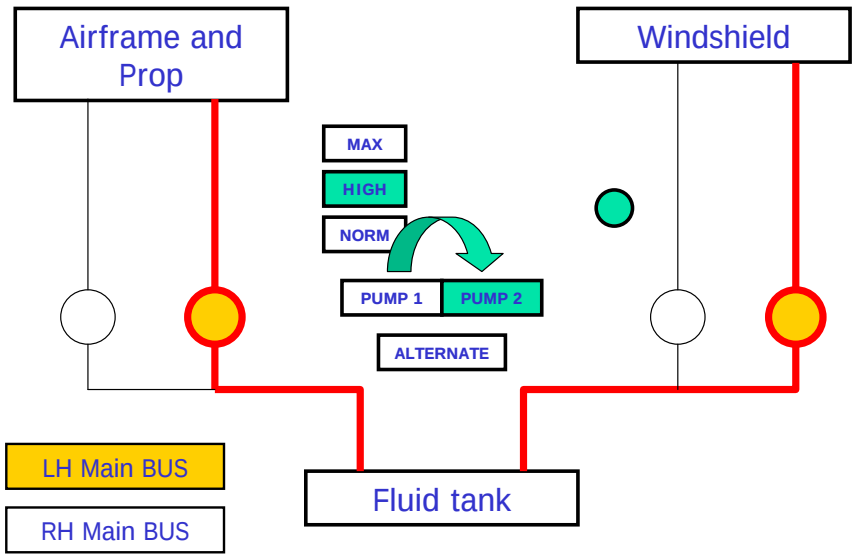
# Ice protection system


**Main and Windshield pump selector**





# Ice protection system



# Ice protection system

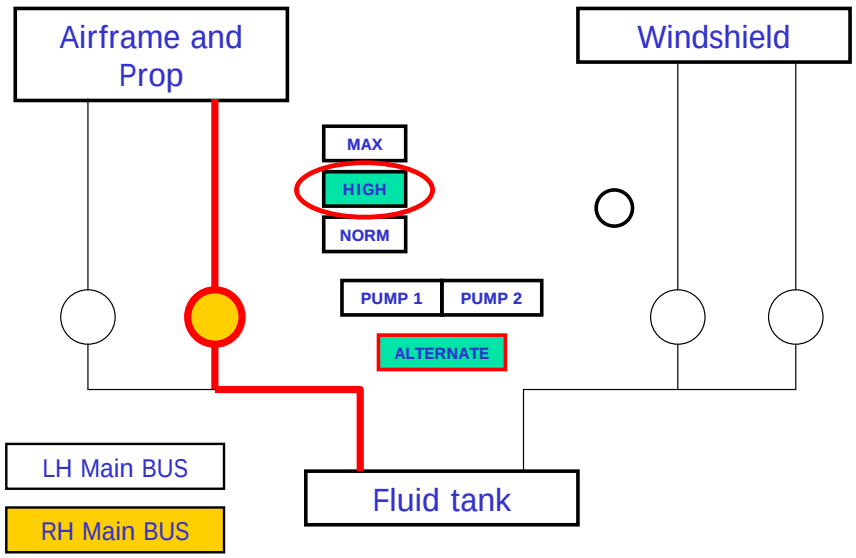

**ALTERNATE switch connects pump #2 directly to RH main bus**

System operates in HIGH mode





# Ice protection system



## Ice protection system





## Ice protection system

### CAUTION lights

- DEIC PRES LO
  - De-icing pressure is low
- DEIC PRES HI
  - De-icing pressure is high
- DEICE LVL LO
  - De-icing fluid level is low (below 10 ltrs)
    - max 45 mins in NORM mode,
      max 22 mins in HIGH mode

# Ice protection system


DEICE LVL LO light ON

DEIC PRES LO light ON
after 120 seconds

**Annunciator test**
(simulates system ON)




# Ice protection system

**CHECK BEFORE ENGINE START**

| | | |
|---|---|---|
| 27 | * De-ice ANNUN TEST ..... ON | 27 |
| 28 | * DEICE LVL LO caution ... CHECKED ON if applic. | 28 |
| 29 | * Windshield de-icing ..... PUMP 1 + 2 CHECKED | 29 |

**2 minutes**

| | | |
|---|---|---|
| 44 | * DEIC PRESS LO caution ..... CHECKED ON | 44 |
| 45 | * De-ice ANNUN TEST ..... OFF | 45 |

# Ice protection system

**PREFLIGHT INTERIOR + EXTERIOR.**

7 Electric Master ON

13 * Check de-ice fluid quantity
14 * Select de-ice pump 1
15 * De-ice HIGH/MAX
16 * Check DEIC PRES LO+HI out
17 * Select de-ice pump 2
18 * Check DEIC PRES LO+HI out
19 * Ice lights ON
20 * Check de-ice function
21 Check external lights
22 Check stall warning
23 Check pitot tube heat
24 Pitot heat OFF
25 External lights OFF
26 * De-ice, ice lights OFF
27 Electric Master OFF




# Ice protection system

**DEIC PRES LO** — **DE-ICING PRESSURE LOW**

- **Switch DE-ICE to HIGH**
  - **If DEIC PRES LO light still ON**
    - ⇒ **PUMP1 / PUMP2: select other pump**
    - ⇒ **If necessary prime pump by activating windshield pump**
      - **If DEIC PRES LO light still ON**
        - ⇒ **Activate ALTERNATE switch**
          - **If DEIC PRES LO light still ON**
            - ⇒ **Go to Emergency Checklist page 13 ICE PROTECTION FAILURE**

**If DEIC PRES LO light OFF**
- ⇒ **Continue flight (de-icing fluid flow: 30 lt/hr)**
- ⇒ **Monitor ice protection system operation**
- ⇒ **Check de-icing fluid level periodically**

**DEIC PRES HI** — **DE-ICING PRESSURE HIGH**

- **Possible reduced system performance**
- **Filter cartridge to be replaced at next scheduled maintenance**

## Ice protection system

**UNINTENTIONAL FLIGHT INTO ICING**

Leave icing area, continue with item 1

*** INADVERTENT ICING ENCOUNTER & EXCESSIVE ICE ACCUMULATION**

| | | | |
|---|---|---|---|
| 1 | Pitot heat | ON | 1 |
| 2 | Cabin heat & defrost | ON | 2 |
| 3 | Power | INCREASE PERIODICALLY | 3 |
| 4 | * De-ice systems | USE as appropriate | 4 |
| 5 | Alternate air | OPEN | 5 |
| 6 | Emergency windows | OPEN as required | 6 |

- * When de-ice system does not work properly: Continue with ICE PROTECTION FAILURE

*** ICE PROTECTION FAILURE**

| | | | |
|---|---|---|---|
| 1 | Airspeed | MIN 118 KIAS | 1 |
| 2 | Flaps | limited to APP position | 2 |
| 3 | Slip angle | MINIMIZE | 3 |
| 4 | Approach with residual ice | 90 KIAS | 4 |
| 5 | Landing distance | CHECK AFM | 5 |





## Ice protection system

### Approved fluids

- For use in the system:
  - AL-5 (DTD 406B)
  - Aeroshell Compound 07
- For de-icing on ground:
  - AL-5 (DTD 406B)
  - Aeroshell Compound 07
  - Kilfrost TKS 80

# Mass and Balance

| Item | Lever Arm (m) |
|---|---|
| **De-icing fluid tank** | **1.00** |

1 ltr: 1,1 kg

30 ltr: 33,0 kg





Ice protection system

- YES on panels
  - Water, soap
  - Isopropyl alcohol
  - Ethyl alcohol
  - Methylated spirit
  - De-icing fluids
  - AVGAS
  - Jet fuel

- NO on panels
  - Wax
  - Methyl ethyl ketone (MEK)
  - Lacquer thinner
  - Other thinners and solvents

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Ice protection system

## Operational considerations

- approved for flight into known icing conditions („fiki“)
- DA42 Ice protection system is
  - NOT a „de-icing“ system
  - but an „anti-ice“ system, preventing accretion of ice
- minimum operating temperature for the ice protection system: -30°C




Ice protection system

## Operational considerations

- what defines „icing conditions“?
  - visually detected ice
  - visible moisture and OAT +3°C or below

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Ice protection system

## Operational considerations

- what indicates conditions the system my be unable to cope with?
  - heavy ice accumulation on windshield
  - ice on side areas of canopy
  - rapid formation and shedding of bars thicker than 6mm from porous panels
- what to do?
  - select HIGH/MAX
  - leave icing conditions




Ice protection system

## Operational considerations

- flight in „freezing rain“ or „freezing drizzle“ is prohibited !
  - Exit icing conditions immediately
- how to detect freezing rain or freezing drizzle ?
  - unusually extensive ice where normally not observed
  - ice on upper surface of wing aft of protected area
  - ice on spinner further back than normally observed

## Operational considerations

- Autopilot
  - may be used in icing conditions, but:
    - disconnect every 10 – 15 minutes to detect out of trim conditions
  - PROHIBITED with
    - ice aft of protected area
    - unusual lateral trim
    - autopilot trim warning






## Operational considerations

- „Ice on unprotected areas“
  („normal“ in icing conditions)
    - not the same as:
- „Residual ice“:
  - Ice that remains on a protected surface immediately following the actuation of a deicing system

Ice protection system

## Operational considerations

Airspeeds with ice on unprotected areas

| | |
|---|---|
| Continuous operation in icing conditions (except TKOF, LDG and maneuvers) | 118 – 156 KIAS |
| Minimum continuous climb speed in icing conditions (flaps UP) | 118 KIAS |
| Stalling speeds | + 4-6 KIAS |

| App/Ldg Vref in icing conditions, 2-eng or 1-eng | |
|---|---|
| Flaps UP | 94 KIAS |
| Flaps APP | 90 KIAS |
| Flaps LDG | prohibited |





Ice protection system

## Operational considerations

- Flaps LDG prohibited:
  - in icing conditions (ice on unprotected surfaces)
  - with residual ice
- Intentional 1-eng operation under known or forecast icing conditions is prohibited

Ice protection system

## Operational considerations

Performance with residual ice or in icing conditions (ice on unprotected areas)

**Vyse: 88 KIAS**

One engine inoperative climb performance

| Rate of climb | reduced by |
|---|---|
| Up to 6000 ft | 150 fpm |
| 6000 – 12000 ft | 200 fpm |
| 12000 – 18000 ft | 250 fpm |
| positive ROC may not be achieved | |





Ice protection system

## Operational considerations

Performance in icing conditions (ice on unprotected areas)

Cruise performance

TAS -20 %

Max demonstrated crosswind component in icing conditions:
20 kts

Ice protection system

## Operational considerations

- Approach, landing in icing conditions (ice on unprotected surfaces):
  - Gear down
  - Flaps UP: Vapp min 94 KIAS
  - Flaps APP:Vapp min 90 KIAS
  - LDG distance acc. AFM !
- When ice protection system fails:
  - 118 KIAS until on final
  - approach with flaps APP, minimum slip
  - Vapp with residual ice min 90 KIAS
- Go around in icing conditions (ice on unprotected surfaces):
  - with Flaps APP, gear down, 1900 kg, 88 KIAS:
    - 8,2% (4,7°), 746 fpm climb





Ice protection system

## Technical considerations

- To avoid the need for repriming:
  - Maintain at least 2 ltrs in the tank
  - Operate system at least once a month
- Priming of the system:
  - main pumps:
    - primed by windshield pumps
  - porous panels:
    - MAX mode in intervals of 5 minutes until fluid dissipates from all panels

# Diamond DA42 NG





# Performance

- DA42 NG according CS 23:
  - Normal, Utility & Aerobatic category
    - Reciprocating engine
      - Weight $\leq$ 2722 kg
        - VSO $\leq$ 61 kt

## Performance

For commercial operation:

- DA42 NG according „Regulation Air Operations – OPS“:
  - Propeller driven
  - MAPSC max 9
  - Weight ≤ 5700 kg
- Performance Class B




## The „DA42“ 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

# Stalling speeds

Airspeeds in KIAS at idle power:

| 1510 kg (3329 lb) | | Bank Angle | | | |
|---|---|---|---|---|---|
| Gear | Flaps | 0° | 30° | 45° | 60° |
| UP | UP | 62 | 66 | 73 | 85 |
| DOWN | APP | 62 | 67 | 73 | 86 |
| DOWN | LDG | 58 | 63 | 70 | 83 |

| 1700 kg (3748 lb) | | Bank Angle | | | |
|---|---|---|---|---|---|
| Gear | Flaps | 0° | 30° | 45° | 60° |
| UP | UP | 66 | 70 | 77 | 90 |
| DOWN | APP | 64 | 69 | 75 | 89 |
| DOWN | LDG | 60 | 65 | 72 | 86 |

| 1900 kg (4189 lb) | | Bank Angle | | | |
|---|---|---|---|---|---|
| Gear | Flaps | 0° | 30° | 45° | 60° |
| UP | UP | 69 | 74 | 81 | 95 |
| DOWN | APP | 66 | 71 | 78 | 92 |
| DOWN | LDG | 62 | 67 | 75 | 89 |




# X-wind

Max demonstrated crosswind component:

Flaps UP: 25 kts

Flaps APP: 20 kts

**For short field take-off**

Max demonstrated crosswind component in icing conditions:

20 kts

# TOD, TOR tabular format

| values for ISA and MSL, at 1900 kg (4189 lb) | |
|---|---|
| Take-off distance to 50 ft (15 m) above take-off surface | 733 m (2405 ft) |
| Take-off ground roll | 458 m (1503 ft) |

**NOTE**

The rate of climb with a power setting of 100% is 1180 ft/min (6.0 m/s) at MSL and ISA standard conditions.

**Short Field TKOF, Flaps APP, 82 KIAS**

| values for ISA and MSL, at 1900 kg (4189 lb) | |
|---|---|
| Take-off distance to 50 ft (15 m) above take-off surface | 660 m (2165 ft) |
| Take-off ground roll | 458 m (1503 ft) |

**NOTE**

The rate of climb with a power setting of 100% is 1150 ft/min (5.84 m/s) at MSL and ISA standard conditions.





# TKOF distance

**Short Field TKOF, Flaps APP, 82 KIAS**

*Reduce Take-Off distance given in the Take-Off diagram by the following percentage:*

| T/O Weight | 1510 kg | | | 1700 kg | | | 1900 kg | | |
|---|---|---|---|---|---|---|---|---|---|
| Altitude / OAT | ISA -20°C | ISA | ISA +20°C | ISA -20°C | ISA | ISA +20°C | ISA -20°C | ISA | ISA +20°C |
| MSL | 7% | 8% | 7% | 8% | 9% | 8% | 9% | 10% | 10% |
| 5000 ft | 8% | 9% | 8% | 8% | 9% | 10% | 10% | 11% | 12% |
| 10000 ft | 8% | 10% | 8% | 8% | 10% | 12% | 11% | 14% | 17% |

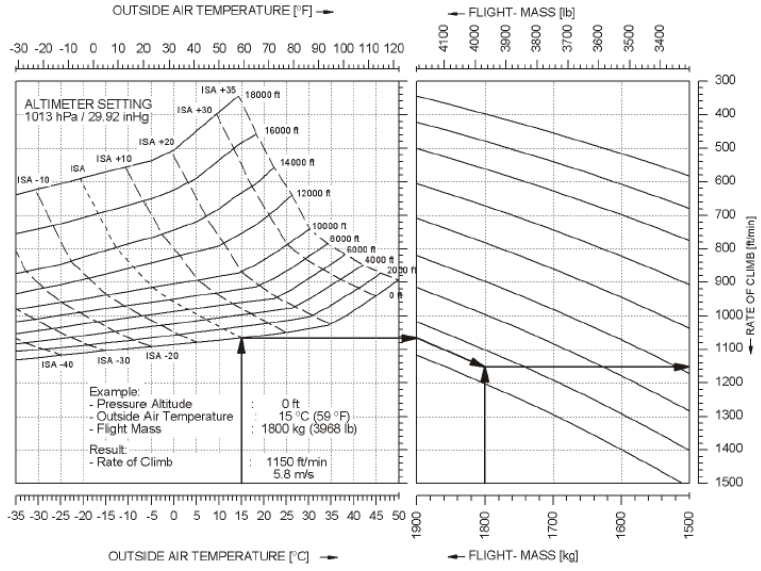
# Grass Runway

| Length of grass | TKOF roll | Wet grass |
|---|---|---|
| - 5 cm | + 10% | additional + 10% |
| 5 - 10 cm | + 15% | |
| >10 cm | + 25% | |
| > 25 cm | TKOF should not be attempted | |
| + 45% on soft ground ! | | |




# Climb performance 2-eng

DA 42 NG - CLIMB PERFORMANCE - TWO ENGINES




Conditions: Flaps: UP, Power: both @ 92%, Landing gear: retracted, Airspeed: 90 KIAS

Short field take-off (Flaps APP 85 KIAS):

Reduce climb performance by 30 ft/min

# LD, LR tabular format

| Values for ISA and MSL, at 1805 kg (3979 lb), approach speed 84 KIAS | |
|---|---|
| Landing distance from 50 ft (15 m) above the landing surface | 598 m (1962 ft) |
| Ground roll | 353 m (1158 ft) |

| Values for ISA and MSL, at 1900 kg (4189 lb), approach speed 84 KIAS | |
|---|---|
| Landing distance from 50 ft (15 m) above the landing surface | 618 m (2028 ft) |
| Ground roll | 369 m (1211 ft) |




# Go around

| Value for ISA and MSL, at 1805 kg (3979 lb) | 84 KIAS |
|---|---|
| Constant gradient of climb | 7.5 % (equals 4.3 climb angle) or 612 ft/min |

| Value for ISA and MSL, at 1900 kg (4189 lb) | 84 KIAS |
|---|---|
| Constant gradient of climb | 6.7 % (equals 3.8 climb angle) or 547 ft/min |

Required gradient acc. CS 23.77 (a): 3,3% at Sea Level

## ROC to gradient conversion

### Formula in AFM:

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



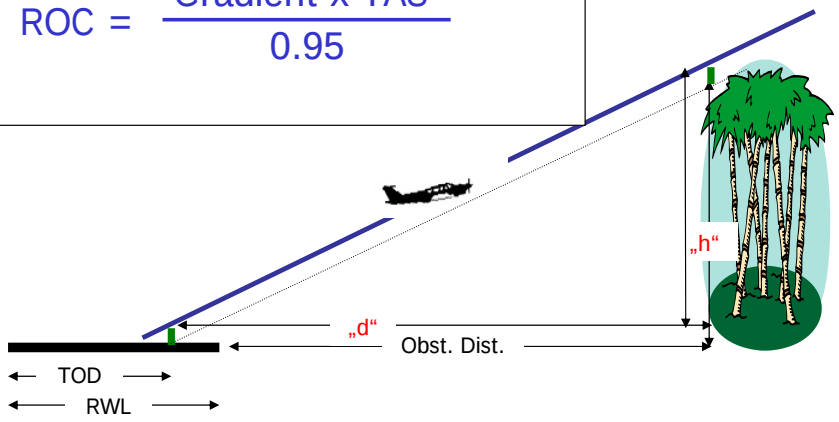

## Grass Runway

| Length of grass | LDG run | Wet grass |
|---|---|---|
| - 5 cm | + 5% | additional + 10% |
| 5 - 10 cm | + 15% | |
| >10 cm | min + 25% | |

# Obstacles ?

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

$$\text{ROC} = \frac{\text{Gradient x TAS}}{0.95}$$







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## Performance

- DA42 NG according CS 23:
  - Normal, Utility & Aerobatic category
    - Reciprocating engine
      - Weight ≤ 2722 kg
        - VSO ≤ 61 kt

## Performance

For commercial operation:

- DA42 NG according „Regulation Air Operations – OPS“:
  - Propeller driven
  - MAPSC max 9
  - Weight ≤ 5700 kg
- Performance Class B




## The „DA42“ 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

# Stalling speeds

| 1510 kg (3329 lb) | | Bank Angle | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0° | | 30° | | 45° | | 60° | |
| Gear | Flaps | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS |
| UP | UP | 61 | 59 | 66 | 64 | 72 | 71 | 84 | 84 |
| DOWN | APP | 58 | 57 | 63 | 62 | 69 | 68 | 81 | 81 |
| DOWN | LDG | 54 | 54 | 60 | 59 | 67 | 65 | 79 | 77 |

| 1700 kg (3748 lb) | | Bank Angle | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0° | | 30° | | 45° | | 60° | |
| Gear | Flaps | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS |
| UP | UP | 64 | 62 | 69 | 67 | 75 | 74 | 88 | 88 |
| DOWN | APP | 62 | 61 | 67 | 66 | 74 | 73 | 87 | 87 |
| DOWN | LDG | 59 | 58 | 64 | 63 | 71 | 69 | 86 | 83 |

| 1900 kg (4189 lb) | | Bank Angle | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0° | | 30° | | 45° | | 60° | |
| Gear | Flaps | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS |
| UP | UP | 68 | 66 | 72 | 71 | 80 | 79 | 93 | 94 |
| DOWN | APP | 65 | 64 | 70 | 69 | 78 | 77 | 91 | 91 |
| DOWN | LDG | 62 | 61 | 68 | 66 | 75 | 73 | 90 | 87 |

Most forward CG

Power OFF

KIAS values may not be accurate at stall





# TKOF, LDG Performance general

For temperatures, altitudes and weights between those provided, use a linear interpolation between the neighboring values.

For weights below 1700 kg (3748 lb), use data for the lowest weight.

For operation in outside air temperature lower than provided in these tables, use data for lowest temperature shown.

For operation in outside air temperature higher than provided in these tables, use extreme caution.

**Effect of wind**

The effect of 50% of the headwind component and 150% of the tailwind component is already incorporated in the head- and tailwind factors.

Headwind: minus 10% for each 14 kt

Tailwind: plus 10% for each 3 kt

**TKOF uphill slope, LDG downhill slope**

Increase the ground roll by 9% for each 1% (1 m per 100 m or 1 ft per 100 ft) slope.

# X-wind

Max demonstrated crosswind component:

Flaps UP: 25 kts

Flaps APP: 20 kts

**For short field take-off**

Max demonstrated crosswind component in icing conditions:

20 kts





# TKOF Roll, TKOF Distance

**Take-Off Distance - Normal Procedure - 1900 kg 4189 lb**

Weight: 1900 kg / 4189 lb — Flaps: UP

$v_R$: 76 KIAS — Power: MAX

$v_{50}$: 83 KIAS — Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 369 | 388 | 410 | 444 | 519 | 631 | 400 |
| | 15 m / 50 ft | 670 | 701 | 730 | 798 | 960 | 1202 | 716 |
| 1000 | Ground Roll | 388 | 410 | 435 | 473 | 566 | 685 | 417 |
| 305 | 15 m / 50 ft | 701 | 732 | 774 | 854 | 1053 | 1308 | 743 |
| 2000 | Ground Roll | 412 | 434 | 462 | 507 | 616 | 742 | 435 |
| 610 | 15 m / 50 ft | 732 | 769 | 819 | 914 | 1143 | 1420 | 773 |
| 3000 | Ground Roll | 433 | 457 | 490 | 547 | 670 | 805 | 456 |
| 914 | 15 m / 50 ft | 768 | 808 | 864 | 984 | 1243 | 1544 | 803 |
| 4000 | Ground Roll | 459 | 484 | 522 | 594 | 727 | 873 | 477 |
| 1219 | 15 m / 50 ft | 808 | 849 | 920 | 1074 | 1350 | 1667 | 838 |
| 5000 | Ground Roll | 486 | 514 | 558 | 649 | 788 | | 500 |
| 1524 | 15 m / 50 ft | 849 | 896 | 982 | 1172 | 1470 | | 874 |
| 6000 | Ground Roll | 514 | 547 | 596 | 709 | 855 | | 523 |
| 1829 | 15 m / 50 ft | 897 | 950 | 1048 | 1280 | 1595 | | 910 |
| 7000 | Ground Roll | 545 | 582 | 637 | 771 | 930 | | 549 |
| 2134 | 15 m / 50 ft | 947 | 1007 | 1122 | 1395 | 1732 | | 951 |
| 8000 | Ground Roll | 578 | 620 | 687 | 837 | 1007 | | 577 |
| 2438 | 15 m / 50 ft | 999 | 1071 | 1208 | 1518 | 1880 | | 995 |
| 9000 | Ground Roll | 615 | 661 | 752 | 919 | 1105 | | 606 |
| 2743 | 15 m / 50 ft | 1059 | 1143 | 1326 | 1674 | 2082 | | 1040 |
| 10000 | Ground Roll | 660 | 719 | 837 | 1028 | | | 638 |
| 3048 | 15 m / 50 ft | 1133 | 1249 | 1499 | 1907 | | | 1094 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

**Take-Off Distance - Normal Procedure - 1700 kg / 3748 lb**

Weight: 1700 kg / 3748 lb — Flaps: UP

$v_R$: 76 KIAS — Power: MAX

$v_{50}$: 83 KIAS — Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 324 | 342 | 360 | 389 | 455 | 552 | 350 |
| | 15 m / 50 ft | 574 | 598 | 625 | 680 | 810 | 1007 | 613 |
| 1000 | Ground Roll | 342 | 360 | 382 | 417 | 497 | 600 | 367 |
| 305 | 15 m / 50 ft | 598 | 625 | 663 | 728 | 885 | 1092 | 633 |
| 2000 | Ground Roll | 362 | 382 | 405 | 446 | 540 | 650 | 384 |
| 610 | 15 m / 50 ft | 625 | 657 | 698 | 778 | 962 | 1184 | 661 |
| 3000 | Ground Roll | 382 | 402 | 431 | 479 | 587 | 707 | 401 |
| 914 | 15 m / 50 ft | 659 | 691 | 739 | 837 | 1045 | 1283 | 689 |
| 4000 | Ground Roll | 404 | 427 | 457 | 523 | 638 | 763 | 420 |
| 1219 | 15 m / 50 ft | 693 | 728 | 784 | 910 | 1132 | 1389 | 717 |
| 5000 | Ground Roll | 427 | 452 | 490 | 571 | 691 | | 439 |
| 1524 | 15 m / 50 ft | 728 | 768 | 838 | 995 | 1231 | | 748 |
| 6000 | Ground Roll | 452 | 481 | 523 | 621 | 752 | | 461 |
| 1829 | 15 m / 50 ft | 768 | 814 | 893 | 1084 | 1334 | | 779 |
| 7000 | Ground Roll | 479 | 512 | 560 | 678 | 816 | | 483 |
| 2134 | 15 m / 50 ft | 810 | 864 | 952 | 1179 | 1448 | | 815 |
| 8000 | Ground Roll | 511 | 545 | 603 | 736 | 886 | | 507 |
| 2438 | 15 m / 50 ft | 855 | 918 | 1027 | 1281 | 1569 | | 853 |
| 9000 | Ground Roll | 541 | 582 | 661 | 807 | 970 | | 532 |
| 2743 | 15 m / 50 ft | 908 | 977 | 1130 | 1407 | 1731 | | 891 |
| 10000 | Ground Roll | 581 | 632 | 737 | 903 | | | 560 |
| 3048 | 15 m / 50 ft | 972 | 1064 | 1267 | 1591 | | | 935 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

# TKOF Roll, TKOF Distance

**Take-Off Distance - Short Field Procedure - 1900 kg / 4189 lb**

Weight: 1900 kg / 4189 lb — Flaps: APP
$v_R$: 71 KIAS — Power: MAX
$v_{50}$: 77 KIAS — Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 324 | 344 | 363 | 394 | 465 | 567 | 354 |
| | 15 m / 50 ft | 557 | 587 | 618 | 677 | 814 | 1023 | 603 |
| 1000 | Ground Roll | 344 | 364 | 386 | 424 | 508 | 621 | 371 |
| 305 | 15 m / 50 ft | 587 | 620 | 658 | 729 | 896 | 1124 | 630 |
| 2000 | Ground Roll | 364 | 384 | 411 | 454 | 557 | 677 | 388 |
| 610 | 15 m / 50 ft | 620 | 655 | 697 | 786 | 987 | 1234 | 657 |
| 3000 | Ground Roll | 386 | 409 | 439 | 493 | 607 | 738 | 407 |
| 914 | 15 m / 50 ft | 655 | 690 | 743 | 852 | 1082 | 1357 | 686 |
| 4000 | Ground Roll | 408 | 435 | 469 | 539 | 665 | 806 | 427 |
| 1219 | 15 m / 50 ft | 693 | 733 | 798 | 936 | 1190 | 1486 | 718 |
| 5000 | Ground Roll | 435 | 462 | 505 | 592 | 727 | | 448 |
| 1524 | 15 m / 50 ft | 735 | 780 | 856 | 1033 | 1308 | | 755 |
| 6000 | Ground Roll | 464 | 494 | 540 | 650 | 794 | | 472 |
| 1829 | 15 m / 50 ft | 778 | 832 | 923 | 1139 | 1439 | | 793 |
| 7000 | Ground Roll | 493 | 529 | 582 | 712 | 866 | | 496 |
| 2134 | 15 m / 50 ft | 826 | 889 | 996 | 1257 | 1585 | | 833 |
| 8000 | Ground Roll | 525 | 567 | 632 | 779 | 949 | | 524 |
| 2438 | 15 m / 50 ft | 881 | 952 | 1084 | 1384 | 1748 | | 877 |
| 9000 | Ground Roll | 562 | 607 | 697 | 860 | 1049 | | 551 |
| 2743 | 15 m / 50 ft | 943 | 1023 | 1206 | 1547 | 1972 | | 924 |
| 10000 | Ground Roll | 606 | 664 | 784 | 973 | | | 583 |
| 3048 | 15 m / 50 ft | 1016 | 1134 | 1379 | 1801 | | | 977 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

**Take-Off Distance - Short Field Procedure - 1700 kg / 3748 lb**

Weight: 1700 kg / 3748 lb — Flaps: APP
$v_R$: 71 KIAS — Power: MAX
$v_{50}$: 77 KIAS — Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 286 | 303 | 320 | 347 | 409 | 500 | 311 |
| | 15 m / 50 ft | 481 | 508 | 534 | 581 | 696 | 867 | 521 |
| 1000 | Ground Roll | 303 | 320 | 340 | 374 | 449 | 544 | 326 |
| 305 | 15 m / 50 ft | 508 | 536 | 569 | 627 | 767 | 950 | 544 |
| 2000 | Ground Roll | 322 | 341 | 362 | 401 | 490 | 595 | 342 |
| 610 | 15 m / 50 ft | 536 | 565 | 601 | 674 | 839 | 1039 | 567 |
| 3000 | Ground Roll | 341 | 360 | 387 | 434 | 534 | 648 | 358 |
| 914 | 15 m / 50 ft | 565 | 596 | 641 | 730 | 917 | 1137 | 592 |
| 4000 | Ground Roll | 361 | 383 | 413 | 475 | 584 | 706 | 376 |
| 1219 | 15 m / 50 ft | 596 | 633 | 687 | 801 | 1005 | 1242 | 622 |
| 5000 | Ground Roll | 384 | 408 | 444 | 520 | 639 | | 396 |
| 1524 | 15 m / 50 ft | 632 | 673 | 736 | 879 | 1100 | | 651 |
| 6000 | Ground Roll | 408 | 435 | 476 | 571 | 698 | | 416 |
| 1829 | 15 m / 50 ft | 673 | 717 | 793 | 968 | 1209 | | 684 |
| 7000 | Ground Roll | 435 | 466 | 513 | 626 | 762 | | 437 |
| 2134 | 15 m / 50 ft | 713 | 764 | 851 | 1066 | 1325 | | 719 |
| 8000 | Ground Roll | 465 | 499 | 556 | 685 | 831 | | 461 |
| 2438 | 15 m / 50 ft | 759 | 819 | 925 | 1167 | 1454 | | 755 |
| 9000 | Ground Roll | 496 | 535 | 612 | 757 | 921 | | 487 |
| 2743 | 15 m / 50 ft | 812 | 879 | 1025 | 1298 | 1626 | | 797 |
| 10000 | Ground Roll | 532 | 585 | 688 | 854 | | | 513 |
| 3048 | 15 m / 50 ft | 873 | 969 | 1163 | 1495 | | | 839 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.




# TKOF on Grass Runway

| Length of grass | TKOF roll | Wet grass |
|---|---|---|
| 5 cm | + 10% | additional + 10% |
| 5 - 10 cm | + 15% | |
| >10 cm | + 25% | |
| > 25 cm | TKOF should not be attempted | |
| + 45% on soft ground ! | | |

# Climb Performance 2-eng

**All Engines Operating Climb - Flaps UP**

Flaps: UP — Power: 92%
$v_Y$: 90 KIAS — Gear: retracted

| Weight [kg] / [lb] | Press. Alt. [ft] | Press. Alt. [m] | Rate of Climb - [ft/min] Outside Air Temperature - [°C] / [°F] -20 -4 | -10 14 | 0 32 | 10 50 | 20 68 | 30 86 | 40 104 | 50 122 | ISA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900 / 4189 | SL | | 1215 | 1212 | 1208 | 1205 | 1201 | 1195 | 1132 | 964 | 1203 |
| | 2000 | 610 | 1208 | 1205 | 1201 | 1193 | 1187 | 1183 | 1055 | 897 | 1193 |
| | 4000 | 1219 | 1201 | 1193 | 1186 | 1179 | 1172 | 1147 | 987 | 834 | 1181 |
| | 6000 | 1829 | 1186 | 1179 | 1172 | 1165 | 1159 | 1083 | 921 | | 1169 |
| | 8000 | 2438 | 1172 | 1164 | 1157 | 1150 | 1139 | 1018 | 862 | | 1158 |
| | 10000 | 3048 | 1157 | 1149 | 1138 | 1132 | 1083 | 906 | | | 1144 |
| | 12000 | 3658 | 1137 | 1125 | 1120 | 1114 | 936 | 759 | | | 1124 |
| | 14000 | 4267 | 1118 | 1113 | 1058 | 920 | 740 | 597 | | | 1113 |
| | 16000 | 4877 | 1108 | 1032 | 915 | 763 | 612 | | | | 1102 |
| | 18000 | 5486 | 984 | 892 | 789 | 639 | 486 | | | | 986 |
| 1700 / 3748 | SL | | 1389 | 1386 | 1382 | 1380 | 1376 | 1371 | 1299 | 1109 | 1378 |
| | 2000 | 610 | 1383 | 1380 | 1376 | 1369 | 1362 | 1358 | 1214 | 1035 | 1368 |
| | 4000 | 1219 | 1376 | 1369 | 1361 | 1355 | 1348 | 1320 | 1139 | 965 | 1357 |
| | 6000 | 1829 | 1362 | 1355 | 1347 | 1341 | 1335 | 1249 | 1066 | | 1345 |
| | 8000 | 2438 | 1347 | 1340 | 1333 | 1326 | 1314 | 1177 | 1001 | | 1334 |
| | 10000 | 3048 | 1333 | 1325 | 1314 | 1308 | 1252 | 1053 | | | 1320 |
| | 12000 | 3658 | 1313 | 1301 | 1296 | 1290 | 1089 | 890 | | | 1299 |
| | 14000 | 4267 | 1294 | 1290 | 1229 | 1075 | 872 | 710 | | | 1289 |
| | 16000 | 4877 | 1285 | 1201 | 1072 | 901 | 730 | | | | 1278 |
| | 18000 | 5486 | 1149 | 1047 | 933 | 764 | 591 | | | | 1151 |

For the rate of climb in [m/s] divide by 196.8 or multiply by 0.00508.

**All Engines Operating Climb - Flaps APP**

Flaps: APP — Power: 92%
$v_Y$: 85 KIAS — Gear: retracted

| Weight [kg] / [lb] | Press. Alt. [ft] | Press. Alt. [m] | Rate of Climb - [ft/min] Outside Air Temperature - [°C] / [°F] -20 -4 | -10 14 | 0 32 | 10 50 | 20 68 | 30 86 | 40 104 | 50 122 | ISA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900 / 4189 | SL | | 1165 | 1154 | 1144 | 1134 | 1124 | 1115 | 1054 | 888 | 1129 |
| | 2000 | 610 | 1145 | 1134 | 1124 | 1113 | 1104 | 1094 | 967 | 811 | 1112 |
| | 4000 | 1219 | 1124 | 1113 | 1103 | 1093 | 1079 | 1050 | 891 | 742 | 1096 |
| | 6000 | 1829 | 1103 | 1092 | 1077 | 1064 | 1054 | 979 | 822 | | 1073 |
| | 8000 | 2438 | 1077 | 1062 | 1048 | 1033 | 1020 | 906 | 751 | | 1049 |
| | 10000 | 3048 | 1047 | 1031 | 1017 | 1006 | 958 | 783 | | | 1024 |
| | 12000 | 3658 | 1016 | 999 | 989 | 978 | 802 | 629 | | | 998 |
| | 14000 | 4267 | 987 | 977 | 917 | 780 | 604 | 463 | | | 978 |
| | 16000 | 4877 | 965 | 887 | 769 | 618 | 467 | | | | 957 |
| | 18000 | 5486 | 835 | 739 | 632 | 481 | 329 | | | | 838 |
| 1700 / 3748 | SL | | 1331 | 1320 | 1309 | 1299 | 1289 | 1279 | 1211 | 1023 | 1294 |
| | 2000 | 610 | 1310 | 1299 | 1288 | 1278 | 1268 | 1257 | 1114 | 937 | 1277 |
| | 4000 | 1219 | 1289 | 1277 | 1267 | 1257 | 1242 | 1210 | 1030 | 862 | 1260 |
| | 6000 | 1829 | 1267 | 1256 | 1240 | 1226 | 1216 | 1131 | 953 | | 1236 |
| | 8000 | 2438 | 1240 | 1224 | 1209 | 1193 | 1180 | 1050 | 875 | | 1210 |
| | 10000 | 3048 | 1208 | 1192 | 1176 | 1165 | 1111 | 914 | | | 1184 |
| | 12000 | 3658 | 1175 | 1158 | 1148 | 1136 | 938 | 743 | | | 1156 |
| | 14000 | 4267 | 1146 | 1135 | 1069 | 916 | 718 | 558 | | | 1136 |
| | 16000 | 4877 | 1122 | 1036 | 907 | 737 | 566 | | | | 1114 |
| | 18000 | 5486 | 980 | 874 | 755 | 585 | 414 | | | | 983 |

For the rate of climb in [m/s] divide by 196.8 or multiply by 0.00508.





# Climb Performance 1-eng

**One Engines Inoperative Climb**

Flaps: UP — Power: feathered / 92%
$v_{YSE}$: 85 KIAS — Gear: retracted

| Weight [kg] / [lb] | Press. Alt. [ft] | Press. Alt. [m] | Rate of Climb - [ft/min] Outside Air Temperature - [°C] / [°F] -20 -4 | -10 14 | 0 32 | 10 50 | 20 68 | 30 86 | 40 104 | 50 122 | ISA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900 / 4189 | SL | | 324 | 312 | 300 | 289 | 278 | 268 | 240 | 171 | 284 |
| | 2000 | 610 | 301 | 289 | 277 | 266 | 255 | 244 | 191 | 127 | 265 |
| | 4000 | 1219 | 278 | 266 | 254 | 242 | 229 | 213 | 147 | 85 | 246 |
| | 6000 | 1829 | 254 | 242 | 227 | 214 | 202 | 171 | 105 | | 223 |
| | 8000 | 2438 | 227 | 213 | 198 | 184 | 172 | 126 | 61 | | 199 |
| | 10000 | 3048 | 198 | 182 | 168 | 155 | 132 | 57 | | | 175 |
| | 12000 | 3658 | 167 | 151 | 138 | 125 | 47 | -27 | | | 149 |
| | 14000 | 4267 | 136 | 123 | 86 | 17 | -59 | -119 | | | 126 |
| | 16000 | 4877 | 108 | 62 | -3 | -73 | -138 | | | | 101 |
| | 18000 | 5486 | 27 | -28 | -87 | -152 | -218 | | | | 29 |
| 1700 / 3748 | SL | | 407 | 394 | 382 | 371 | 360 | 348 | 317 | 238 | 365 |
| | 2000 | 610 | 383 | 371 | 359 | 347 | 336 | 324 | 263 | 189 | 346 |
| | 4000 | 1219 | 359 | 347 | 334 | 322 | 309 | 291 | 215 | 143 | 326 |
| | 6000 | 1829 | 335 | 322 | 307 | 293 | 281 | 244 | 168 | | 302 |
| | 8000 | 2438 | 307 | 291 | 276 | 261 | 249 | 195 | 121 | | 278 |
| | 10000 | 3048 | 276 | 260 | 245 | 231 | 206 | 119 | | | 252 |
| | 12000 | 3658 | 244 | 227 | 214 | 200 | 111 | 26 | | | 225 |
| | 14000 | 4267 | 212 | 198 | 158 | 81 | -6 | -75 | | | 201 |
| | 16000 | 4877 | 183 | 133 | 62 | -18 | -92 | | | | 176 |
| | 18000 | 5486 | 96 | 35 | -30 | -104 | -180 | | | | 98 |

Dark shaded areas indicate a climb rate of less than 50 ft/min.
For the rate of climb in [m/s] divide by 196.8 or multiply by 0.00508.

# ROC to Gradient conversion

## Formula in AFM:

$$Gradient\ [\%] = \frac{ROC\ [fpm]}{TAS\ [KTAS]} \cdot 0.98$$





# Cruising speed

**75 %**

**Cruise Performance - KTAS**

| Press. Alt. [ft] / [m] | Power % | Outside Air Temperature - [°C] ISA-10 | ISA | ISA+10 | ISA+20 | ISA+30 |
|---|---|---|---|---|---|---|
| 2000 610 | 92 | 163 | 165 | 167 | 171 | 168 |
| | 75 | 150 | 152 | 154 | 156 | 157 |
| | 60 | 137 | 139 | 140 | 142 | 143 |
| | 45 | 123 | 125 | 126 | 127 | 128 |
| 4000 1219 | 92 | 166 | 168 | 170 | 175 | 172 |
| | 75 | 153 | 155 | 157 | 159 | 160 |
| | 60 | 140 | 141 | 143 | 144 | 146 |
| | 45 | 125 | 127 | 128 | 129 | 130 |
| 6000 1829 | 92 | 169 | 172 | 174 | 178 | 176 |
| | 75 | 156 | 158 | 160 | 162 | 163 |
| | 60 | 142 | 144 | 145 | 147 | 148 |
| | 45 | 127 | 129 | 130 | 131 | 132 |
| 8000 2438 | 92 | 173 | 175 | 177 | 182 | 181 |
| | 75 | 159 | 161 | 163 | 165 | 167 |
| | 60 | 145 | 147 | 148 | 150 | 151 |
| | 45 | 125 | 127 | 128 | 129 | 130 |
| 10000 3048 | 92 | 176 | 179 | 181 | 186 | 183 |
| | 75 | 163 | 164 | 166 | 168 | 170 |
| | 60 | 148 | 149 | 151 | 152 | 154 |
| | 45 | 121 | 122 | 122 | 123 | 124 |
| 12000 3658 | 92 | 180 | 182 | 187 | 187 | 183 |
| | 75 | 166 | 168 | 169 | 171 | 173 |
| | 60 | 150 | 152 | 153 | 155 | 156 |
| | 45 | 117 | 118 | 118 | 118 | 119 |
| 14000 4267 | 92 | 186 | 189 | 189 | 185 | 180 |
| | 75 | 169 | 171 | 172 | 174 | 176 |
| | 60 | 153 | 154 | 156 | 157 | 159 |
| | 45 | 115 | 115 | 115 | 115 | 114 |
| 16000 4877 | 92 | 190 | 191 | 188 | 183 | 179 |
| | 75 | 172 | 174 | 176 | 177 | 179 |
| | 60 | 155 | 157 | 158 | 160 | 161 |
| | 50 | 136 | 137 | 138 | 139 | 140 |
| 18000 5486 | 85 | 188 | 188 | 187 | 182 | 179 |
| | 75 | 175 | 177 | 179 | 182 | 179 |
| | 60 | 158 | 160 | 161 | 162 | 164 |
| | 50 | 137 | 138 | 139 | 139 | 140 |

# LDG Roll, LDG Distance

## Flaps LDG

**Landing Distance - Flaps LDG - 1900 kg / 4189 lb**

Weight: 1900 kg / 4189 lb — Flaps: LDG
$v_{REF}$: 84 KIAS — Power: IDLE
Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 349 | 363 | 376 | 387 | 419 | 472 | 369 |
| | 15 m / 50 ft | 592 | 610 | 627 | 646 | 695 | 778 | 618 |
| 1000 | Ground Roll | 363 | 377 | 388 | 402 | 443 | 495 | 381 |
| 305 | 15 m / 50 ft | 610 | 628 | 647 | 666 | 729 | 817 | 634 |
| 2000 | Ground Roll | 377 | 389 | 403 | 417 | 465 | 523 | 390 |
| 610 | 15 m / 50 ft | 628 | 648 | 667 | 686 | 766 | 856 | 650 |
| 3000 | Ground Roll | 389 | 404 | 416 | 435 | 492 | 551 | 402 |
| 914 | 15 m / 50 ft | 649 | 669 | 689 | 715 | 804 | 900 | 667 |
| 4000 | Ground Roll | 404 | 417 | 432 | 460 | 519 | 578 | 415 |
| 1219 | 15 m / 50 ft | 669 | 691 | 711 | 751 | 847 | 945 | 684 |
| 5000 | Ground Roll | 417 | 433 | 449 | 486 | 545 | | 426 |
| 1524 | 15 m / 50 ft | 691 | 712 | 733 | 793 | 890 | | 702 |
| 6000 | Ground Roll | 434 | 451 | 466 | 512 | 577 | | 439 |
| 1829 | 15 m / 50 ft | 713 | 735 | 760 | 834 | 934 | | 720 |
| 7000 | Ground Roll | 457 | 471 | 489 | 546 | 614 | | 456 |
| 2134 | 15 m / 50 ft | 745 | 769 | 792 | 885 | 989 | | 749 |
| 8000 | Ground Roll | 486 | 504 | 527 | 595 | 668 | | 484 |
| 2438 | 15 m / 50 ft | 788 | 813 | 844 | 951 | 1062 | | 786 |
| 9000 | Ground Roll | 525 | 545 | 577 | 653 | 729 | | 519 |
| 2743 | 15 m / 50 ft | 838 | 864 | 915 | 1029 | 1149 | | 831 |
| 10000 | Ground Roll | 569 | 590 | 639 | 718 | | | 561 |
| 3048 | 15 m / 50 ft | 897 | 924 | 995 | 1118 | | | 882 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.





# LDG Roll, LDG Distance

**Landing Distance - Flaps LDG - 1805 kg / 3979 lb**

Weight: 1805 kg / 3979 lb — Flaps: LDG
$v_{REF}$: 84 KIAS — Power: IDLE
Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 334 | 347 | 360 | 370 | 401 | 451 | 353 |
| | 15 m / 50 ft | 573 | 590 | 607 | 625 | 672 | 753 | 598 |
| 1000 | Ground Roll | 347 | 360 | 371 | 384 | 423 | 473 | 364 |
| 305 | 15 m / 50 ft | 590 | 608 | 626 | 644 | 705 | 790 | 613 |
| 2000 | Ground Roll | 360 | 371 | 385 | 399 | 445 | 500 | 373 |
| 610 | 15 m / 50 ft | 608 | 627 | 645 | 663 | 741 | 827 | 629 |
| 3000 | Ground Roll | 372 | 386 | 400 | 415 | 470 | 528 | 385 |
| 914 | 15 m / 50 ft | 628 | 646 | 665 | 691 | 777 | 866 | 645 |
| 4000 | Ground Roll | 386 | 401 | 413 | 440 | 494 | 553 | 397 |
| 1219 | 15 m / 50 ft | 647 | 667 | 687 | 726 | 816 | 909 | 661 |
| 5000 | Ground Roll | 399 | 414 | 429 | 463 | 522 | | 407 |
| 1524 | 15 m / 50 ft | 668 | 689 | 709 | 764 | 856 | | 679 |
| 6000 | Ground Roll | 415 | 431 | 444 | 490 | 552 | | 420 |
| 1829 | 15 m / 50 ft | 690 | 710 | 732 | 803 | 898 | | 696 |
| 7000 | Ground Roll | 435 | 451 | 465 | 523 | 588 | | 437 |
| 2134 | 15 m / 50 ft | 719 | 741 | 764 | 852 | 952 | | 721 |
| 8000 | Ground Roll | 466 | 484 | 503 | 571 | 638 | | 465 |
| 2438 | 15 m / 50 ft | 760 | 783 | 814 | 917 | 1025 | | 758 |
| 9000 | Ground Roll | 506 | 522 | 556 | 626 | 703 | | 500 |
| 2743 | 15 m / 50 ft | 809 | 835 | 884 | 995 | 1109 | | 802 |
| 10000 | Ground Roll | 550 | 570 | 615 | 694 | | | 540 |
| 3048 | 15 m / 50 ft | 868 | 894 | 964 | 1082 | | | 855 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

**Landing Distance - Flaps LDG - 1700 kg / 3748 lb**

Weight: 1700 kg / 3748 lb — Flaps: LDG
$v_{REF}$: 84 KIAS — Power: IDLE
Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 318 | 330 | 341 | 353 | 379 | 427 | 335 |
| | 15 m / 50 ft | 549 | 565 | 583 | 599 | 646 | 723 | 575 |
| 1000 | Ground Roll | 330 | 341 | 354 | 363 | 401 | 451 | 345 |
| 305 | 15 m / 50 ft | 565 | 584 | 601 | 618 | 677 | 757 | 589 |
| 2000 | Ground Roll | 341 | 354 | 365 | 377 | 424 | 473 | 356 |
| 610 | 15 m / 50 ft | 584 | 602 | 620 | 637 | 710 | 794 | 603 |
| 3000 | Ground Roll | 355 | 365 | 379 | 396 | 445 | 499 | 364 |
| 914 | 15 m / 50 ft | 602 | 621 | 639 | 663 | 746 | 832 | 619 |
| 4000 | Ground Roll | 366 | 380 | 394 | 416 | 470 | 527 | 376 |
| 1219 | 15 m / 50 ft | 622 | 640 | 659 | 697 | 782 | 871 | 635 |
| 5000 | Ground Roll | 380 | 392 | 406 | 441 | 494 | | 388 |
| 1524 | 15 m / 50 ft | 641 | 661 | 680 | 732 | 822 | | 651 |
| 6000 | Ground Roll | 393 | 408 | 423 | 463 | 522 | | 397 |
| 1829 | 15 m / 50 ft | 662 | 682 | 702 | 770 | 862 | | 668 |
| 7000 | Ground Roll | 414 | 428 | 443 | 498 | 557 | | 416 |
| 2134 | 15 m / 50 ft | 689 | 711 | 732 | 816 | 914 | | 691 |
| 8000 | Ground Roll | 443 | 460 | 481 | 542 | 609 | | 441 |
| 2438 | 15 m / 50 ft | 731 | 753 | 782 | 881 | 984 | | 729 |
| 9000 | Ground Roll | 482 | 501 | 530 | 600 | 674 | | 477 |
| 2743 | 15 m / 50 ft | 780 | 804 | 851 | 957 | 1067 | | 773 |
| 10000 | Ground Roll | 527 | 547 | 592 | 665 | | | 521 |
| 3048 | 15 m / 50 ft | 839 | 864 | 930 | 1045 | | | 826 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

# LDG Roll, LDG Distance

## Flaps APP or UP

**Landing Distance - Abnormal Flap Position - 1900 kg / 4189 lb**

Weight: 1900 kg / 4189 lb — Flaps: APP or UP
$v_{REF}$: 86 KIAS — Power: IDLE
Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 482 | 499 | 515 | 533 | 577 | 647 | 508 |
| | 15 m / 50 ft | 813 | 837 | 863 | 887 | 954 | 1070 | 849 |
| 1000 | Ground Roll | 500 | 516 | 535 | 553 | 607 | 683 | 522 |
| 305 | 15 m / 50 ft | 837 | 864 | 889 | 913 | 1002 | 1121 | 871 |
| 2000 | Ground Roll | 516 | 536 | 553 | 572 | 642 | 718 | 538 |
| 610 | 15 m / 50 ft | 864 | 890 | 918 | 943 | 1051 | 1176 | 893 |
| 3000 | Ground Roll | 536 | 554 | 574 | 599 | 675 | 757 | 552 |
| 914 | 15 m / 50 ft | 891 | 919 | 946 | 981 | 1105 | 1232 | 917 |
| 4000 | Ground Roll | 554 | 575 | 594 | 631 | 710 | 796 | 569 |
| 1219 | 15 m / 50 ft | 920 | 948 | 977 | 1032 | 1161 | 1292 | 940 |
| 5000 | Ground Roll | 576 | 595 | 617 | 666 | 751 | | 587 |
| 1524 | 15 m / 50 ft | 949 | 979 | 1007 | 1086 | 1217 | | 963 |
| 6000 | Ground Roll | 596 | 619 | 639 | 704 | 790 | | 603 |
| 1829 | 15 m / 50 ft | 980 | 1010 | 1041 | 1141 | 1279 | | 990 |
| 7000 | Ground Roll | 627 | 648 | 672 | 751 | 845 | | 630 |
| 2134 | 15 m / 50 ft | 1024 | 1056 | 1087 | 1215 | 1357 | | 1027 |
| 8000 | Ground Roll | 669 | 694 | 722 | 818 | 915 | | 669 |
| 2438 | 15 m / 50 ft | 1087 | 1119 | 1164 | 1309 | 1464 | | 1082 |
| 9000 | Ground Roll | 721 | 746 | 793 | 894 | 1002 | | 714 |
| 2743 | 15 m / 50 ft | 1157 | 1194 | 1262 | 1421 | 1584 | | 1147 |
| 10000 | Ground Roll | 782 | 808 | 872 | 984 | | | 769 |
| 3048 | 15 m / 50 ft | 1242 | 1281 | 1381 | 1548 | | | 1224 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.





# LDG Roll, LDG Distance

**Landing Distance - Abnormal Flap Position - 1805 kg / 3979 lb**

Weight: 1805 kg / 3979 lb — Flaps: APP or UP
$v_{REF}$: 86 KIAS — Power: IDLE
Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 462 | 477 | 494 | 511 | 551 | 621 | 485 |
| | 15 m / 50 ft | 780 | 804 | 827 | 850 | 916 | 1025 | 816 |
| 1000 | Ground Roll | 477 | 495 | 513 | 528 | 582 | 652 | 500 |
| 305 | 15 m / 50 ft | 804 | 828 | 852 | 877 | 961 | 1076 | 835 |
| 2000 | Ground Roll | 495 | 514 | 530 | 548 | 613 | 688 | 516 |
| 610 | 15 m / 50 ft | 829 | 853 | 879 | 904 | 1010 | 1127 | 856 |
| 3000 | Ground Roll | 514 | 531 | 550 | 572 | 647 | 723 | 529 |
| 914 | 15 m / 50 ft | 854 | 881 | 906 | 942 | 1059 | 1182 | 879 |
| 4000 | Ground Roll | 532 | 552 | 569 | 605 | 681 | 763 | 546 |
| 1219 | 15 m / 50 ft | 882 | 908 | 936 | 989 | 1112 | 1239 | 901 |
| 5000 | Ground Roll | 552 | 571 | 591 | 638 | 720 | | 560 |
| 1524 | 15 m / 50 ft | 909 | 938 | 966 | 1041 | 1167 | | 925 |
| 6000 | Ground Roll | 572 | 593 | 612 | 675 | 757 | | 578 |
| 1829 | 15 m / 50 ft | 940 | 968 | 998 | 1093 | 1226 | | 948 |
| 7000 | Ground Roll | 599 | 622 | 642 | 720 | 810 | | 602 |
| 2134 | 15 m / 50 ft | 983 | 1013 | 1044 | 1165 | 1302 | | 987 |
| 8000 | Ground Roll | 643 | 667 | 694 | 786 | 880 | | 641 |
| 2438 | 15 m / 50 ft | 1044 | 1075 | 1118 | 1258 | 1406 | | 1041 |
| 9000 | Ground Roll | 693 | 719 | 762 | 862 | 963 | | 688 |
| 2743 | 15 m / 50 ft | 1116 | 1150 | 1217 | 1368 | 1527 | | 1104 |
| 10000 | Ground Roll | 755 | 783 | 844 | 953 | | | 742 |
| 3048 | 15 m / 50 ft | 1201 | 1236 | 1332 | 1494 | | | 1183 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

**Landing Distance - Abnormal Flap Position - 1700 kg / 3748 lb**

Weight: 1700 kg / 3748 lb — Flaps: APP or UP
$v_{REF}$: 86 KIAS — Power: IDLE
Runway: dry, paved, level

| Press. Alt. [ft] / [m] | Distance [m] | Outside Air Temperature - [°C] / [°F] 0 / 32 | 10 / 50 | 20 / 68 | 30 / 86 | 40 / 104 | 50 / 122 | ISA |
|---|---|---|---|---|---|---|---|---|
| SL | Ground Roll | 439 | 453 | 470 | 486 | 524 | 590 | 461 |
| | 15 m / 50 ft | 746 | 770 | 791 | 813 | 876 | 981 | 781 |
| 1000 | Ground Roll | 453 | 470 | 487 | 502 | 553 | 619 | 475 |
| 305 | 15 m / 50 ft | 770 | 792 | 815 | 839 | 919 | 1029 | 799 |
| 2000 | Ground Roll | 471 | 488 | 503 | 521 | 582 | 653 | 490 |
| 610 | 15 m / 50 ft | 793 | 816 | 841 | 865 | 965 | 1078 | 819 |
| 3000 | Ground Roll | 489 | 504 | 523 | 543 | 615 | 686 | 503 |
| 914 | 15 m / 50 ft | 817 | 843 | 867 | 901 | 1012 | 1131 | 840 |
| 4000 | Ground Roll | 505 | 524 | 540 | 575 | 646 | 724 | 518 |
| 1219 | 15 m / 50 ft | 844 | 869 | 895 | 946 | 1064 | 1184 | 861 |
| 5000 | Ground Roll | 525 | 542 | 561 | 606 | 683 | | 532 |
| 1524 | 15 m / 50 ft | 870 | 897 | 923 | 995 | 1115 | | 885 |
| 6000 | Ground Roll | 543 | 563 | 581 | 641 | 719 | | 549 |
| 1829 | 15 m / 50 ft | 899 | 926 | 954 | 1045 | 1172 | | 907 |
| 7000 | Ground Roll | 572 | 591 | 613 | 685 | 770 | | 575 |
| 2134 | 15 m / 50 ft | 939 | 969 | 997 | 1114 | 1245 | | 942 |
| 8000 | Ground Roll | 613 | 636 | 662 | 749 | 838 | | 611 |
| 2438 | 15 m / 50 ft | 1000 | 1031 | 1071 | 1205 | 1347 | | 998 |
| 9000 | Ground Roll | 666 | 688 | 732 | 825 | 925 | | 659 |
| 2743 | 15 m / 50 ft | 1071 | 1105 | 1168 | 1314 | 1465 | | 1061 |
| 10000 | Ground Roll | 727 | 753 | 812 | 917 | | | 714 |
| 3048 | 15 m / 50 ft | 1158 | 1192 | 1284 | 1440 | | | 1141 |

For the distance in [ft] divide by 0.3048 or multiply by 3.28.

# LDG on wet or Grass Runway

| | LDG roll | |
|---|---|---|
| Paved RWY WET | + 15% | |
| Length of grass | | Wet grass or soft ground |
| - 5 cm | + 10% | additional + 10% |
| 5 - 10 cm | + 15% | |
| >10 cm | min + 25% | |





# Go-Around

**Go-Around Climb Performance**

Flaps: LDG — Power: MAX

$v_{REF}$: 84 KIAS — Gear: extended

| Weight [kg] / [lb] | Press. Alt. [ft] | Press. Alt. [m] | Rate of Climb - [ft/min] Outside Air Temperature - [°C] / [°F] -20 -4 | -10 14 | 0 32 | 10 50 | 20 68 | 30 86 | 40 104 | 50 122 | ISA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1900 / 4189 | SL | | 735 | 718 | 702 | 686 | 670 | 605 | 472 | 328 | 678 |
| | 2000 | 610 | 703 | 686 | 669 | 653 | 620 | 527 | 377 | 242 | 652 |
| | 4000 | 1219 | 670 | 653 | 636 | 615 | 558 | 441 | 292 | 163 | 622 |
| | 6000 | 1829 | 637 | 614 | 592 | 560 | 486 | 348 | 210 | | 585 |
| | 8000 | 2438 | 592 | 569 | 546 | 505 | 414 | 266 | 134 | | 548 |
| | 10000 | 3048 | 545 | 521 | 487 | 417 | 291 | 136 | | | 509 |
| 1805 / 3979 | SL | | 794 | 777 | 760 | 744 | 728 | 659 | 518 | 366 | 735 |
| | 2000 | 610 | 761 | 744 | 726 | 710 | 675 | 578 | 420 | 276 | 708 |
| | 4000 | 1219 | 727 | 709 | 693 | 671 | 611 | 488 | 330 | 193 | 677 |
| | 6000 | 1829 | 693 | 670 | 647 | 614 | 536 | 390 | 244 | | 640 |
| | 8000 | 2438 | 647 | 623 | 600 | 557 | 462 | 304 | 165 | | 602 |
| | 10000 | 3048 | 599 | 574 | 539 | 465 | 333 | 169 | | | 562 |
| 1700 / 3748 | SL | | 866 | 848 | 831 | 814 | 797 | 725 | 575 | 413 | 805 |
| | 2000 | 610 | 832 | 814 | 796 | 779 | 743 | 640 | 471 | 317 | 777 |
| | 4000 | 1219 | 797 | 779 | 761 | 739 | 676 | 545 | 376 | 229 | 746 |
| | 6000 | 1829 | 762 | 738 | 714 | 680 | 598 | 442 | 286 | | 707 |
| | 8000 | 2438 | 714 | 689 | 665 | 620 | 520 | 351 | 202 | | 667 |
| | 10000 | 3048 | 664 | 639 | 602 | 524 | 383 | 208 | | | 626 |

For the rate of climb in [m/s] divide by 196.8 or multiply by 0.00508.

$$Gradient\ [\%] = \frac{ROC\ [fpm]}{TAS\ [KTAS]} \cdot 0.98$$

The angles of climb at MSL and ISA condition are:

- 4.7° for Maximum Take-Off Mass (1900 kg / 4189 lb)
- 5.1° for Maximum Landing Mass (1805 kg / 3979 lb).

Required gradient acc. CS 23.77 (a): 3,3% at Sea Level

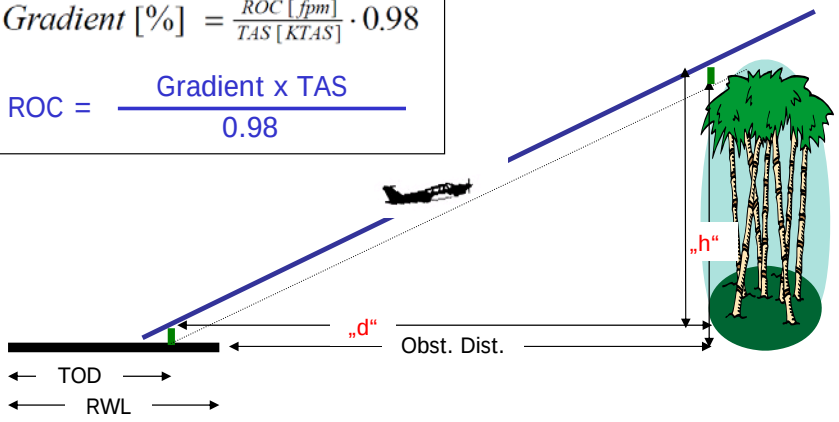
# Obstacles ?

„d“= (RWL + Obst.Dist.) - TOD

Gradient = („h“ / „d“) * 100

$$Gradient\ [\%] = \frac{ROC\ [fpm]}{TAS\ [KTAS]} \cdot 0.98$$

$$ROC = \frac{\text{Gradient x TAS}}{0.98}$$





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# Diamond DA42 NG

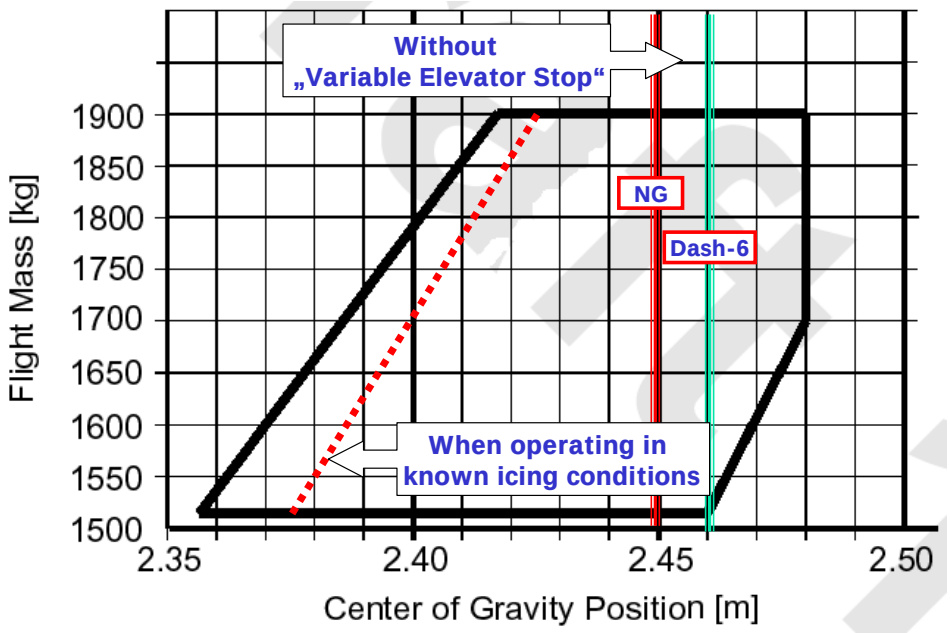





## Empty mass

- Empty Mass includes:
  - Equipment as per Equipment Inventory
  - Brake fluid
  - Hydraulic fluid
  - Engine oil (2 x 7.0 liters)
  - Coolant (2 x 7.5 liters)
  - Gearbox oil (2 x 2.1 liters)
  - Unusable fuel in main tanks (2 USG)
  - Unusable fuel in AUX tanks (1 USG)

# Center of gravity envelope








# Moment arms

| Item | Lever Arm (m) |
|---|---|
| Front seats | 2.30 |
| Rear seats | 3.25 |
| Wing tanks | 2.63 |
| AUX tanks | 3.20 |
| De-icing fluid | 1.00 |
| Nose baggage | 0.60 |
| Cabin baggage | 3.89 |
| Baggage Extension | 4.54 |
| „Short baggage extension“: | |
| Cabin baggage | 3.65 |
| Baggage Extension | 3.97 |

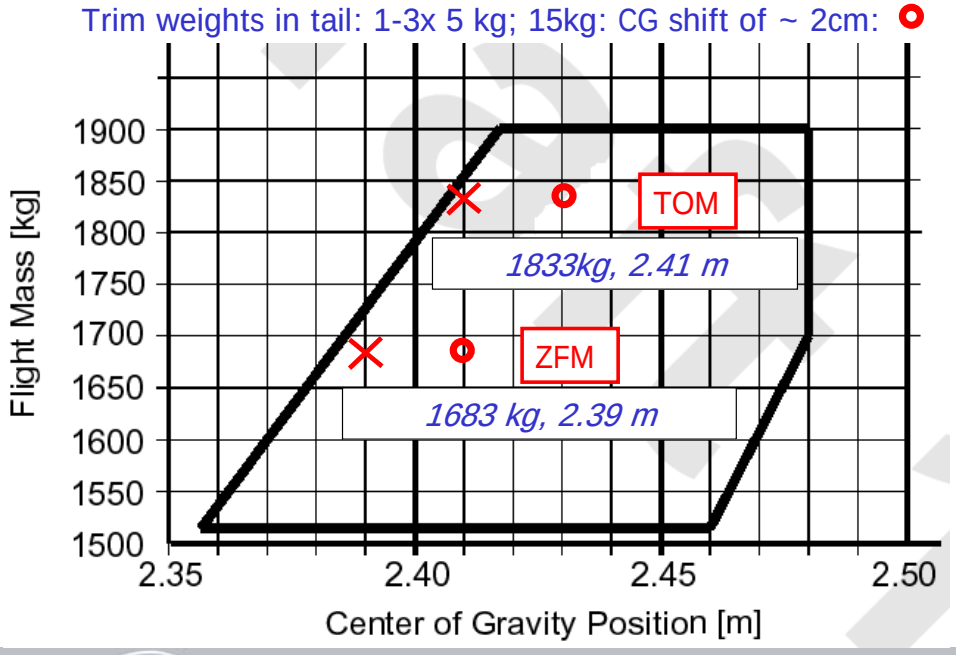
# M&B calculation

| | Lever arm | Mass (kg) | Moment (kgm) |
|---|---|---|---|
| Empty mass | | 1450 | 3488.0 |
| Front seats | 2.30 | 170 | 391.0 |
| Rear seats | 3.25 | 0 | 0.0 |
| Nose baggage | 0.60 | 0 | 0.0 |
| Cabin baggage | 3.89 | 30 | 116.7 |
| Baggage extension | 4.54 | 0 | 0.0 |
| De-icing fluid | 1.00 | 33 | 33.0 |
| Zero Fuel Mass | 2.39 | 1683 | 4028.7 |
| Fuel (main tanks) | 2.63 | 150 | 394.5 |
| Fuel (AUX tanks) | 3.20 | | |
| Total TKOF Mass | 2.41 | 1833 | 4423.2 |




# Center of gravity envelope

Trim weights in tail: 1-3x 5 kg; 15kg: CG shift of ~ 2cm:

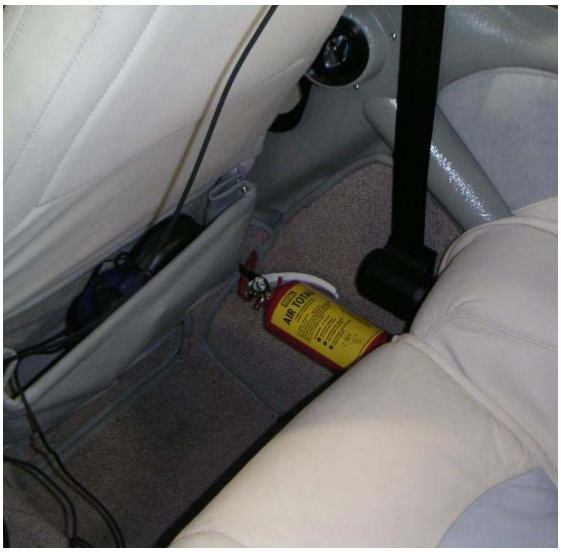


# Diamond DA42 NG

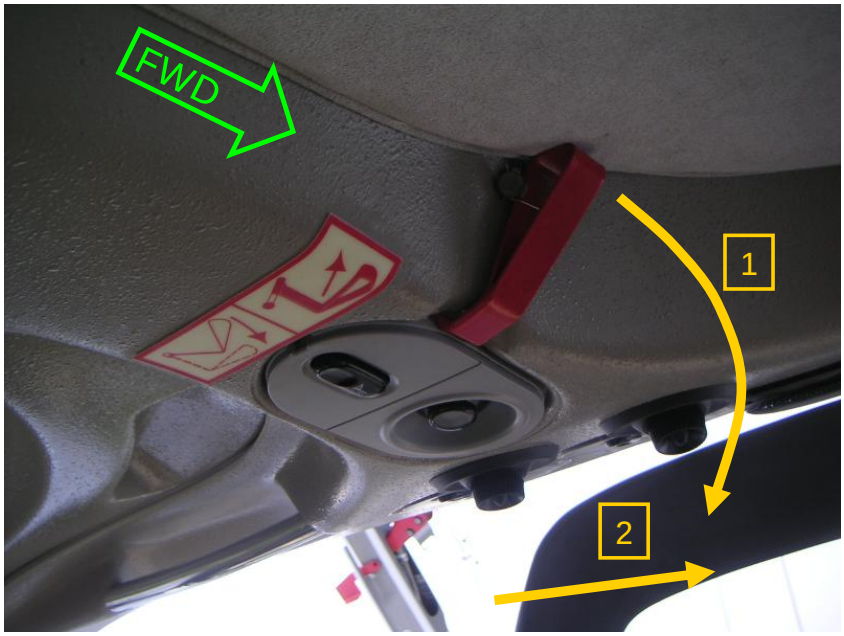





# Emergency equipment



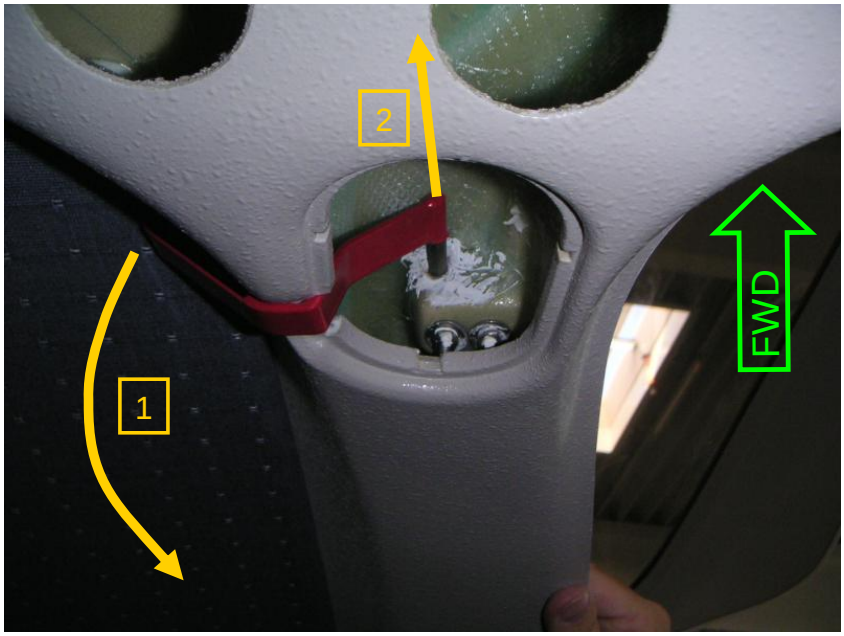
# Emergency Exit








# Emergency Exit

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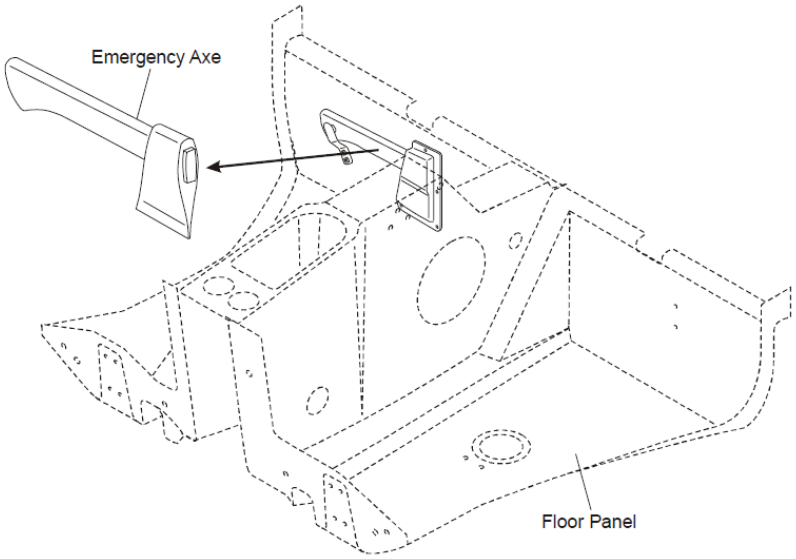
# (Optional) Emergency Axe







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# Diamond DA42 NG






## Kinds of Operation Equipment List KOEL

| | for daytime VFR flights | in addition for night VFR flights | in addition for IFR flights |
|---|---|---|---|
| Flight & navigation instruments | * airspeed indicator (on G1000 PFD or backup)<br>* altimeter (on G1000 PFD or backup)<br>* magnetic compass<br>* 1 headset, used by pilot in command | * vertical speed indicator (VSI)<br>* attitude gyro (artificial horizon; on G1000 PFD or backup)<br>* turn & bank indicator<br>* directional gyro<br>* VHF radio (COM) with speaker and microphone<br>* VOR receiver<br>* transponder (XPDR), mode A and mode C<br>* GPS receiver (part of G1000) | * second airspeed indicator (both, on G1000 PFD and backup)<br>* second altimeter (both, on G1000 PFD and backup)<br>* second attitude gyro (both, on G1000 PFD and backup)<br>* second VHF radio (COM)<br>* VOR-LOC-GP receiver<br>* second GPS receiver (part of G1000) |

## 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**.




## Kinds of Operation Equipment List KOEL

| | for daytime VFR flights | in addition for night VFR flights | in addition for IFR flights |
|---|---|---|---|
| engine instru-ments | * fuel qty. (2x)<br>* oil press. (2x)<br>* oil temp. (2x)<br>* coolant temp. (2x)<br>* coolant level indicator (2x)<br>* gearbox temp. (2x)<br>* load (2x)<br>* prop. RPM (2x)<br>* fuel temp. left & right tank | * ammeter<br>* voltmeter | |

## Kinds of Operation Equipment List KOEL

| | for daytime VFR flights | in addition for night VFR flights | in addition for IFR flights |
|---|---|---|---|
| lighting | | * position lights<br>* strobe lights (anti collision lights)<br>* landing light<br>* instrument lighting<br>* flood light<br>* flashlight | |




## 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 | * stall warning system<br>* variable elevator stop<br>* alternate means for fuel quantity indication (see Section 7.9)<br>* safety belts for each occupied seat<br>* Airplane Flight Manual | * Pitot heating system<br>* alternate static valve | * emergency battery (for backup attitude gyro and flood light) |

# Diamond DA42 NG





# Unscheduled maintenance

- Required after
  - Hard landings
  - Propeller strike
  - Engine fire
  - Lightning strike
  - Other malfunctions and damage

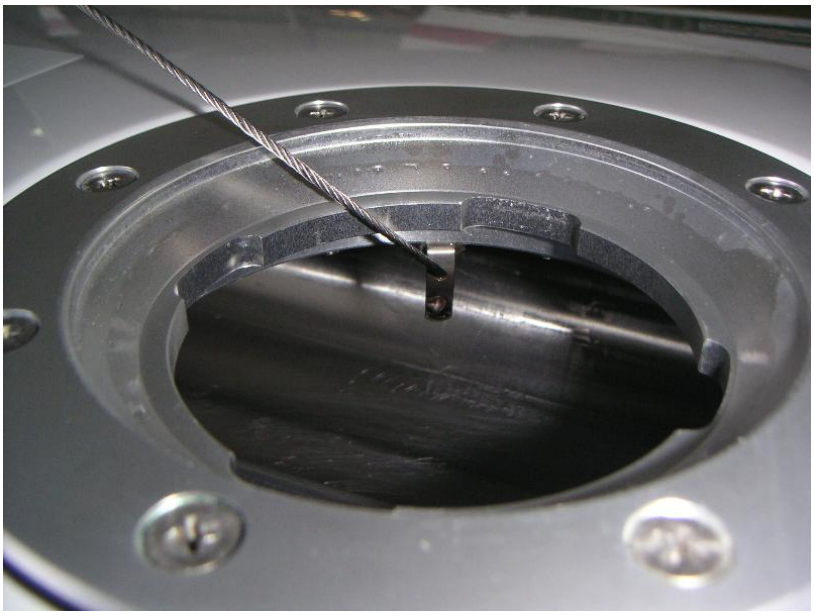
## Scheduled maintenance

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



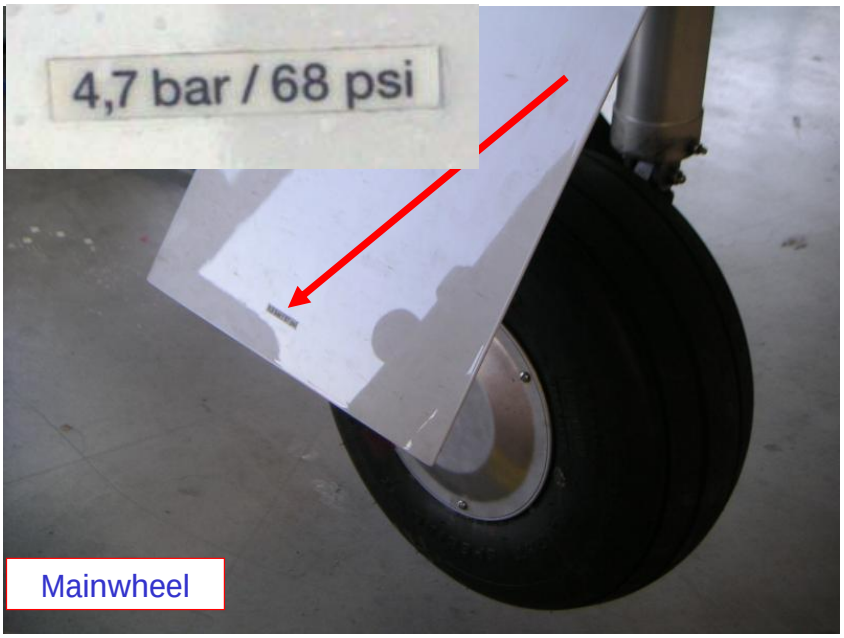

## Refuelling

# Refuelling

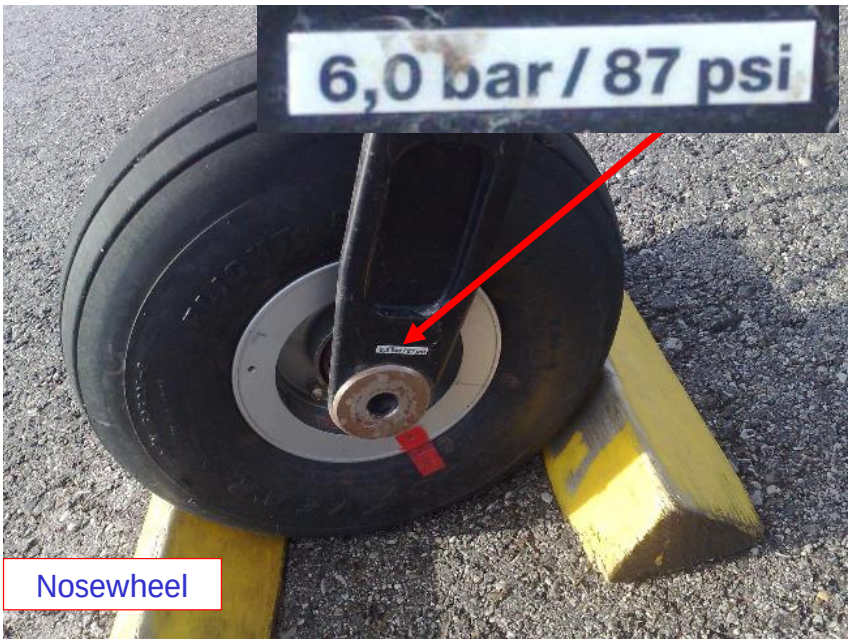





# Tire pressure



## Tire pressure







## De-icing

- Approved de-icing fluids:
  - Kilfrost TKS 80
  - Aeroshell Compound 07
  - AL-5 (DTD 406B)
- Procedure:
  - Remove snow with brush
  - Spray de-icing fluid
  - Wipe dry

# Tow bar






# Control surfaces gust lock

# Mooring





# Mooring