7. SUPPLEMENTS

7.1 Introduction

7.2 List of inserted supplements

Date of insertion	Doc.No.	Title of inserted supplement
30.03.2010	304SJET/MMsup	**MAINTENANCE MANUAL SUPPLEMENT** **FOR Glasflügel 304S-JET**

7.3

MAINTENANCE MANUAL SUPPLEMENT

FOR THE SAILPLANE

Glasflügel 304 S - JET

7.3.1 BASIC TECHNICAL DATA

7.3.1.1 Turbine Basic Technical data

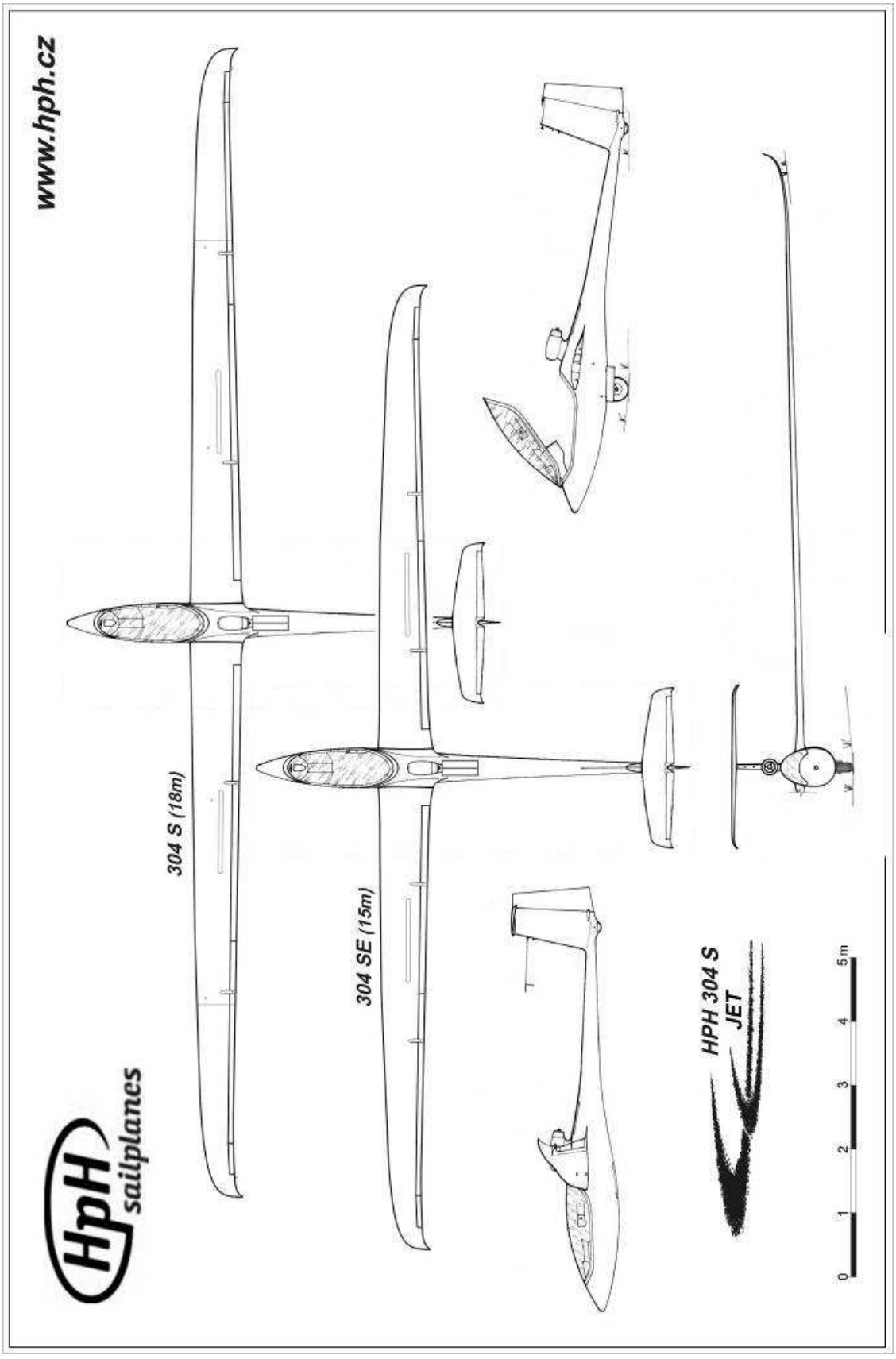
Max. thrust		420 N
Rated max. Thrust		400 N
Thrust to Weight Ratio		10.5
SFC		35 g / kN * s
Mass Flow		0.78 kg/s
EGT red line		720 ℃
Spools	1	
Bearings		Ceramic Hybrid with Squeeze-film Damping
Compressor		1R
Pressure Ratio	3.8	
Burner	Annular / air blast	
Turbine	Single Stage Axial	
Control	Full Authority Digital Electronic Control	
Max. Diameter	156mm	
Length	320mm	
Dry Weight		4 kg

NOTE
The thrust value is stated by the manufacturer for altitude of 0m MSA without the influence of the installation at the sailplane.

7.3.1.2 Technical Description

HPH 304S–Jet is a self-sustaining sailplane version of the HPH 304S–Shark. The propulsion unit used in the 304S – Jet sailplane is a light jet engine TBS400N-TJ42 with nominal thrust of 400N. The engine is fully retractable in the air and can provide full thrust within 30 seconds after switching the on-button. The turbine is placed in the engine bay in the rear part of the fuselage. The engine bay is covered by three-part hinged door at the top of the fuselage. The door allow the turbine to be extracted/retracted while keeping the top of the fuselage smooth and the engine bay covered at all time, both during powered and unpowered flight.

7.3.1.3 Three-view drawing



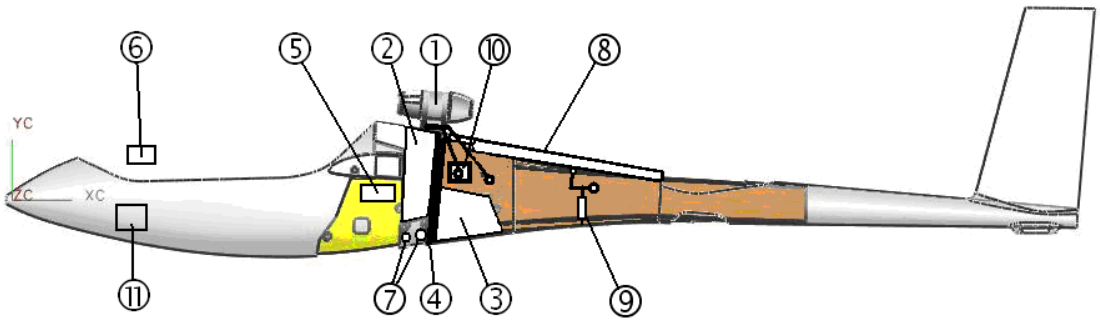
7.3.1.4 Sailplane systems

The propulsion system consists of these main parts:
- TBS400-TJ42 turbine unit
- retraction mechanism
- engine bay door operation mechanism
- electro installation (battery, wiring, safety circuits)
- control and display units
- fuel system (fuel tanks, refueling system and fuel feed system)

The turbine is placed in the engine bay in the rear part of the fuselage. It is separated from the cabin by firewall. The engine is retracted during the unpowered flight and extracted above the fuselage during the powered flight. The turbine is held in its position by retracting mechanism. The door bay is operated separately and is kept closed during the powered and unpowered flight.

① - Turbine
②③ - Fuel tanks
④ - Firewall
⑤ - DECU (control unit)
⑥ - EDD (display unit)

⑦ - Fuel lines, pumps
⑧ - Door
⑨ - Door actuation
⑩ - Retraction mechanism actuation
⑪- Battery



Mounted on the a/c, the turbine and it's adequate systems is covered by streamlined cowling made of composite.

Warning: The turbine parts are getting hot during operation!

The space between the cowling and the turbine body is ventilated. The air gets in through the NACA inlets in the nacelle and gets out in the rear part of the cowling through the gap around the nozzle. The ventilation is most efficient during flight.

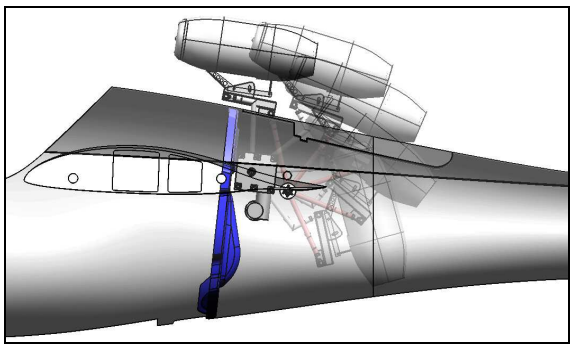
7.3.1.5 Retraction Mechanism

Main parts:
- SKF actuator
- front and rear lever
- engine fixation part
- fixation plates

The mechanism is a two lever parallelogram driven by actuator. The actuator is maintenance free, water, chemicals and dust resistant. It is operated electrically by 12VDC. The gear is self locking, ensuring the mechanism retain on any position. The traction is transferred to the front lever by a hub with groove-tongue system.

Rear lever is not actuated. It defines the kinematics of the retraction and holds the turbine in position. Both levers are connected at their top ends through the engine fixation part, which holds the turbine chassis and is normally hidden under a streamlined cowling.

The mechanism is held together by a pair of fixation plates. These plates are screwed by 8xM6 screws into rubber silencers, placed in the engine bay side walls.



NOTE

All rotational couplings are done by swing bearings. These bearings are maintenance free, but it is recommended to keep them clean and not to expose them to dust.

7.3.1.6 Engine Bay Door Mechanism

Main parts:
- actuator
- system of mechanical levers
- 3-piece hinged door

The door is operated independently by it's own linear actuator, which is placed at the rear end of the engine bay. The door consists of 3 pieces. The main door has two pieces and is operated outwards directly by a system of levers. This door keeps closed when the engine is operating. The front door is smaller and is operated inwards by a bowden cable and a pair of preloaded springs. This door keeps open, when the engine is operating.

The engine retraction has these phases:

door open → engine out → door closed

Actuator used in the door mechanism is maintenance free, but it is recommended to keep it clean and not to expose it to dust.

All rotational couplings are done by special industrial plastic swing bearings. These bearings are maintenance free, but it is recommended to keep them clean and not to expose them to dust.

All hinges are made of composite with metal pin axis. These hinges are maintenance free, but it is recommended to keep them clean and not to expose them to dust.

The exact sequence of door movement is adjusted by the producer. Changes made in the adjustment may result in impropriate function, blockage or excessive loading. In case some adjustment is necessary (excessive gaps, plays, loose door etc.), please, contact the producer for advice.

7.3.1.7 Electric installation

Main parts:

- battery
- wiring
- main switch
- fuses

BATTERY

The whole system is supplied with an independent 12V 17Ah battery placed under a cabin floor under the instrument panel. The battery containment is covered with a lid and is accessible after pressing and turning the metal knob.
The battery supplies with energy the DECU (control unit), EDD (display unit), retraction and door operation actuators, starter, fuel pumps, ignition lance and fire detector.

Fully loaded battery has enough capacity to perform 10 cycles of extraction→ start → retraction and to supply the turbine with fuel in volume of the full tanks. This applies to reference MSA atmosphere at the sea level.

Note: Main fuse of 40A is placed in the battery containment.

MAKE SURE THE BATTERY IS FULLY LOADED BEFORE FLIGHT!

ENGINE MAIN SWITCH

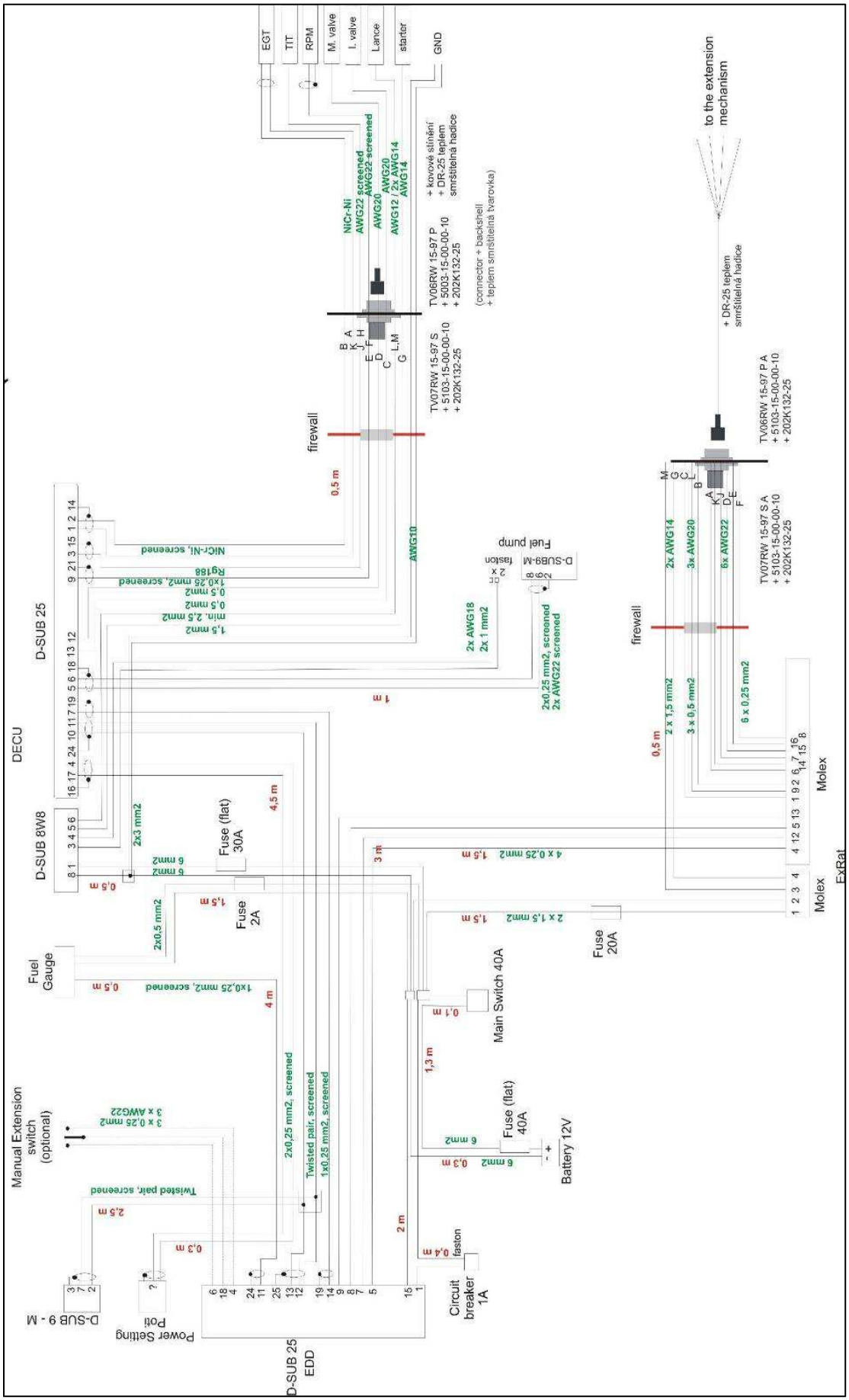
The main switch turns on/off the whole propulsion system, all actuators, fuel pumps, ignition etc., including the DECU (control unit) and EDD (display unit). The main switch is placed on the side wall panel on pilot's right hand side.

FUSES

There are 4 fuses used in the system, 1 main fuse placed in the battery containment a 3 sub fuses and 1 circuit breaker securing particular logical branches in the system. These fuses are placed in the rear part of the cabin and are accessible after leaning the seat back-rest forwards.

The 3 sub-fuses secure particularly three different circuit systems:
Fuse #1, 40A – main fuse
Fuse #2, 8A – Refuelling circuit
Fuse #3, 30A – retraction mechanism circuit
Fuse #4, 2A – Fuel gauge
Circuit breaker, 1A – EDD unit

Wiring plan


EGT
TIT
RPM
M. valve
I. valve
Lance
starter
GND
to the extension mechanism
+ DR-25 teplem smrštitelná hadice
TV06RW 15-97 P
+ 5003-15-00-00-10
+ 202K132-25
(connector + backshell
+ teplem smrštitelná tvarovka)
TV07RW 15-97 S
+ 5103-15-00-00-10
+ 202K132-25
+ kovová stínění
+ DR-25 teplem
smrštitelná hadice
NiCr-Ni
AWG22 screened
AWG22-screened
AWG20
AWG20
AWG12 / 2x AWG14
AWG14
firewall
0,5 m
AWG10
DECU
D-SUB 25
D-SUB 8W8
NiCr-Ni, screened
Rg188
1x0,25 mm2, screened
0,5 mm2
0,5 mm2
min. 2,5 mm2
1,5 mm2
2x AWG18
2x 1 mm2
2x0,25 mm2, screened
2x AWG22 screened
Fuel pump
D-SUB9-M
faston
2 x
1 m
2x3 mm2
6 mm2
6 mm2
Fuse (flat)
30A
4,5 m
0,5 m
2x0,5 mm2
1,5 m
Fuse
2A
Fuel
Gauge
1x0,25 mm2, screened
0,5 m
4 m
3 m
4 x 0,25 mm2
1,5 m
2 x 1,5 mm2
1,5 m
Fuse
20A
Main Switch 40A
0,1 m
1,3 m
Manual Extension
switch
(optional)
3 x 0,25 mm2
3 x AWG22
2x0,25 mm2, screened
Twisted pair, screened
1x0,25 mm2, screened
Twisted pair, screened
2,5 m
0,3 m
6 mm2
Fuse (flat)
40A
6 mm2
0,3 m
Battery 12V
2 m
0,4 m
faston
Circuit
breaker
1A
D-SUB 9 - M
Power Setting
Poti
D-SUB 25
EDD
firewall
2x AWG14
3x AWG20
6x AWG22
2 x 1,5 mm2
3 x 0,5 mm2
6 x 0,25 mm2
0,5 m
TV06RW 15-97 P A
+ 5103-15-00-00-10
+ 202K132-25
TV07RW 15-97 S A
+ 5103-15-00-00-10
+ 202K132-25
Molex
Molex
ExRat

7.3.1.8 Fuel system

Main parts:

- fuel tanks – 2pcs
- fuel lines
- feed pump
- refuelling pump
- refuelling control panel
- fuel gauge
- tank ventilation

Fuel system scheme is described by drawing 304S-80-81.
Refuelling control wiring plan is described by drawing 304S-80-81/B.

Fuel for the turbine is a mixture of standard kerosene JET-A1 with 5% AeroShell Turbine Oil 500.

Fuel tanks

There are 2 fuel tanks in the fuselage of total capacity 33l. The tanks are interconnected, but the fuel for the turbine is supply from the main fuel tam, which is placed lower. Fuel from the suplementary fuel tank is transported to the main tank by gravity. The supplementary fuel tank is placed higher and is ventilated.

Fuel lines

Fuel lining has two parts, low pressure and hight pressure part. In the low pressure part the fuel is transported between the tanks, fuel gauge, filters and fuel pumps. The lines are made of standard rubber fuel hoses with resistance to fuels. The high pressure part is between the feed pump and the turbine. In this part the fuel is transported under pressure of 5bar to the turbine. This lining is made of high pressure PTFE hose with metal binding.
The fuel lines are connected to the other parts of the fuel system by standard hose couplings.

Feed fuel pump
This pump feeds the turbine with fuel. It is connected directly to the high pressure fuel line. There's a filter on the suction side of the feed pump. The feed pump is connected to the DECU and is regulated in order to give right amount of power.

Refuelling fuel pump
This pump is used to fill the tanks with fuel. It fills both tanks at a time. The pump is operated by the Refuelling control panel, which is placed in the Engine bay. Special hose with coupling is used for refuelling. The fuel is filtered before it is filled to the tanks. Refer to chap. 9.3.4.3.7. for refuelling procedure.

Refuelling control panel
This panel is placed in the Engine bay and is accessible after opening the engine bay door. The panel consists of ON button, OFF button and a switch IN or OUT. This panel is used for refuelling and emptying the fuel tanks. Refer to chap. 9.3.4.3.8. for detailed info about the procedure.

Fuel gauge
Amount of fuel in the tanks is measured by active capacity fuel gauge. The gauge is powered from the engine battery and gives to EDD signal about fuel amount. The amount of fuel is then shown on the EDD display.

The fuel gauge has two dead bands, at its full end and its empty end.

Indication chart:

Fuel amount [l]	Indicated fuel amount [l]	
0-7	0	dead band
7	1	Measurable range
29	29	
29-33	29	dead band

When the indicated amount of fuel is under 10 l the fuel indication reports a LOW FUEL message.
When the indicated amount of fuel is 0 l the pilot is warned by blinking message. At this point there's an amount of fuel for maximum 5 minutes of powered flight. The pilot should expect engine failure due to depletion of fuel.

Tank ventilation
The tanks are ventilated are to the top fuselage surface. Fuel leakage may occur at this poind if the fuel tanks are full.

WARNING
Keep the ventilation outlet are clean. Avoid dirt to get into the fuel system. Avoid blockage of the outlet

7.3.1.9 Instrument panel

The instrument panel houses the EDD (Engine Data Display) instrument and a THRUST knob on the top right. There are a graphical information display and three control switches on the EDD.

EDD (Engine Data Display)

Graphical display	- shows all information and data necessary for operating the turbine.
EXTEND switch	- up possition – engine is extended - down possition – engine is retracted
ON switch	- up possition - starts the starting sequence and keeps the engine on - down possition – shuts the turbine off.
SET switch	- lists through the messages
THRUST knob	- Operating from left to right. Left limit refers to idle, right limit refers to max thrust.

7.3.2 HANGARING, TRANSPORT, GROUND HANDLING

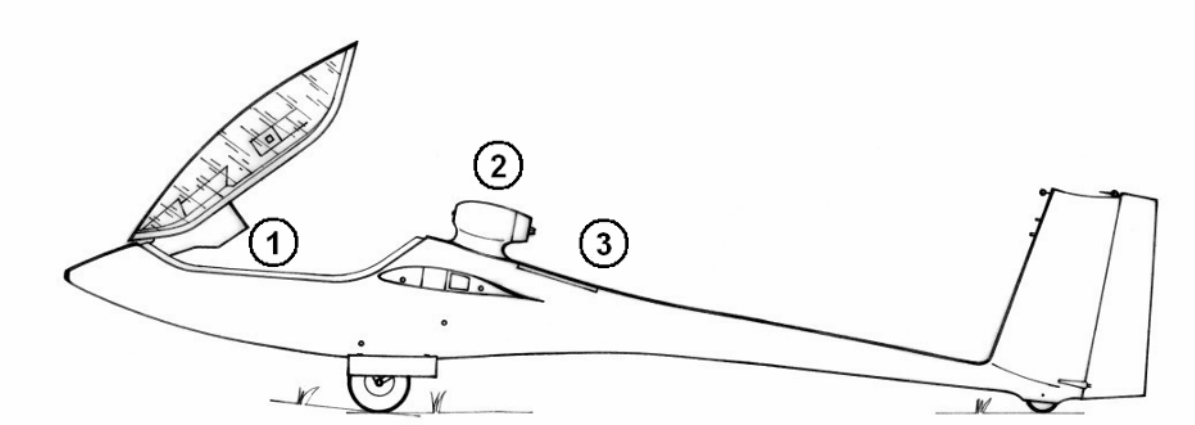
For storage, transport and ground handling keep the engine retracted.
For long term storage empty the fuel tanks.

7.3.3 MAINTENANCE

7.3.3.1 Mandatory Maintenance

7.3.3.1.1 Daily inspection

Daily inspection should be performed before each flight day opening, both after rigging the sailplane and parking in a hangar.
When inspecting the engine check the surface finish and visible parts for heat damage and the mechanism for extensive plays or unususal noise during extension/retraction. Also check EDD for error messages and. If in doubt, check with authorized, specialized personnel.



NOTE
Ground test is not a part of daily inspection.

1

a)Open the cockpit.
b)THRUST knob – turn through whole range, set idle.
c)“Extend” switch – set down.
d)“On” switch – set down.
e)Main switch – on.
f) Check EDD screen for messages.
g)“Extend” switch – up.
h)Check the extension sequence.
i) Check EDD screen for messages and indicated values:

- fuel volume
- battery voltage
- air temperature
- Use “service” switch for opening the engine bay door.

2

a) Check for extensive plays in the retracting mechanism by pressing against the engine inlet
b) Check the inlet for foreign particles
c) Check the cowling for cracks, heat damage or deformations.
d) Check the nozzle for deformations.
e) Check the free movement of the turbine axis by blowing to the inlet against the compressor. Do not touch the blades!

3

a) Check the engine bay for foreign particles and leaked fuel.
b) Do visual inspection of the retracting mechanism, check for loose nuts, cables, fuel line.
c) Do visual inspection of the bay door mechanism, check for plays, loose nuts, cables.
d) Check hinges for any damage.
Use the “service” switch to retract the mechanism. Check the closed door for gaps and steps in surface.
e) Check the fuel tank ventilation outlet.
f) Check the drainage outlet at the bottom of the engine bay.
f) In case of low fuel refuel (Check 304S-AFMsup chap. 9.3.4.3.7).

7.3.3.1.2 Post Flight Check

After each flight, when the engine was used, perform inspection in order to detect possible failures.

1) Check for fuel leakage on the fuselage surface including the tail part.
2) Extend the engine using the service switch (keep the bay door open).
3) Check for fuel leakage in the bay.
4) Check for plays in the mechanism.
5) Check the turbine cowling for heat deformation.
6) Clean all surfaces off the fuel.

7.3.3.1.3 Other check

After every 20 sailplane operating hours or 5 engine hours check all nuts and bolts in the retracting mechanism and the turbine holder. The securing paint should be intact to be sure, that the nuts or bolts are not loose. Retighten if necessary and mark position with red paint.

7.3.3.2 Regular Maintenance

This chapter is a subject to change according to further flight testing and ground handling exeprience.

The turbine maintanance period is 50 flight hours. Number of flight hours is visible on EDD initial screen after switching on the system. When the 50 hour limit is reached, the turbine must not be used and should be sent to the producer for inspection.

- Contact the producer.
- Remove the turbine.
- Pack and ship it to the producer.

7.3.3.3 Free Play in the Mechanism

This chapter is a subject to change according to further flight testing and ground handling exeprience.
For free play prevention follow instructions in chap. 7.3.3.1

7.3.3.4 Damage

This chapter is a subject to change according to further flight testing and ground handling exeprience. All damages must be reported to the manufacturer.
Check for cracks in weldings of the metal parts.
Check for deformed parts.
Check whether the engine geometry is correct when retracted and extended.
Check for strange sounds during retraction.

7.3.3.5 Repairs

All repairs must only be carried out by the manufacturer.

7.3.3.6 Removal and Re-Installation of the Turbine

For removing the turbine:

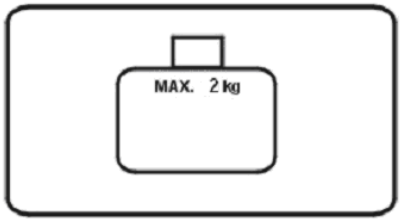
- Extend the mechanism.
- Unplug first the cable that leads from turbine to the connector in the firewall and make it loose from the mechanism by cutting the plastic straps.
- Make loose the reiforced fuel line.
- Remove the low part of the cowling (leg).
- Uplug the fuel pipe in the front of the holder.
- The turbine can be removed from the holder mechanism by unsrewing the two M6 bolts.

CAUTION
Disassembling can be done by authorised personel only.

CAUTION
When disassembling the mechanism, keep an eye on the spacing washers. Always mount back the original number when reassembling!

7.3.4 Placards and markings in the Cockpit

See also the Sailplane Flight Manual - Section 2, 7 and 9



MAX. LUGGAGE COMPARTEMENT

7.3.5 Cleaning and care

Clean the leaked fuel with dry cloth.
Exposure to moisture should be avoided

7.3.6 List of instruments

7.3.6.1 EDD (Engine Data Display)

Only EDD supplied by the TBS400-TJ42 turbine producer can be used.

7.3.7 AIRWORTHINESS LIMITATIONS

7.3.7.1 Service Time

TBO time of the turbine TBS400-TJ42 is limited to 50 engine hours. After this time is exceeded, contact the manufacturer. Do not use the turbine after this time limit.

The additional test inspections have no influence for other mandatory periodical inspections specified in sec. 7.3.3.1 and 7.3.3.2, which should be carried out in proper periods.

7.3.7.2 Life Limited Component Section

No serviceable parts are included in the system. In case any excessive wear or damage is detected, contact the producer.

7.3.8 INSTRUCTIONS FOR REPAIRSCHECKLIST

7.3.8.1 General

This chapter is a subject to change according to further flight testing and ground handling exeprience.