SECTION 2

2.1 Introduction

This Section contains operating limitations, instrument markings and cockpit placards required for the safe operation of the powered sailplane ASH 26 E and its systems, installations, and equipment provided as factory-standard.

The operating limitations included in this Section and in Section 9 are LBA-approved.

2.2 Air Speed

Air speed limitations and their operational significance are shown below:-

	SPEED	IAS km/h and (kts)	REMARKS
v_{NE}	Never exceed speed	270 (146)	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection.

v_{NE} must be reduced for altitudes above 10000 feet in accordance with the placard shown in section 4.5.8.
For US registered aircraft this v_{NE} placard has to be affixed next to the ASI.

v_{RA}	Rough air speed	184 (99)	Do not exceed this speed except in smooth air, and then only with caution. Examples of rough air are lee-wave rotor, thunderclouds etc.
v_A	Maneuvering speed	184 (99)	Do not make full or abrupt control movement above this speed, because under certain conditions the sailplane may be overstressed by full control movement.

v_{FE}	Max. Flap Extended Speed (if applicable give different flap settings) (WK = Flap)	WK1=270 (146) WK2=270 (146) WK3=270 (146) WK4=160 (86) WKL=140 (75.5)	Do not exceed these speeds with the given flap setting.
v_W	Max. winch launching speed	130 (70)	Do not exceed this speed during winch- or autotow-launching
v_T	Max. aerotowing speed	160 (86)	Do not exceed this speed during aerotow.

Approved Octane Rating: not less than 94 RON/ROZ

Approved fuel grades: **preferably** AVGAS 100LL

Fuel grades like Car Super, Euro-Super, and Super-plus are also permissible.
The US 94 octane rating complies with the minimum relative octane number required by the engine manufacturer.
For further data refer to the Engine Manual AE50R.

Engine oil: **Preferably** Silkolene Comp 2 Pre-mix.
However, Mobil Pegasus 485 or Castrol Aviation A545 or Spectro Oils of America "Golden Spectro" can also be used.

2.13 Minimum Equipment

Minimum Equipment consists of:

1 x ASI indicating up to 300 km/h = 162 kts
1 x Altimeter
1 x 4-part seat harness (symmetrical)
1 x Magnetic Compass
1 x ILEC engine control unit
1 x rear view mirror
1 x parachute or back cushion

For flights beyond the environs of the airfield at which the flight originates an aircraft radio is mandatory (for Germany). In addition, headphones should be worn when the engine is running.

Approved equipment is listed in the Maintenance Manual in Section 12.1.

2.14 Aerotow, winch- and autotow-launching

The maximum launch speeds are:

for aerotow	160 km/h (86 kts)
for winch- and autotow-launch	130 km/h (70 kts)

For both launching methods a weak link of 675 to 825 daN must be used in the launch cable or tow rope.

For aerotow, the tow rope must be not less than 40 m (135 feet) in length.

If the above points check out correctly, the fault cannot be rectified in flight, the propeller should be retracted and the ASH 26 E should from then on be operated as a pure sailplane.
Retract propeller in the normal manner in accordance with the check list.
If necessary, carry out a normal sailplane outlanding.
If the stoppage has been caused by lack of fuel in the fuselage tank, open the valve serving the wing fuel tanks, if fitted (see Section 7). After about 2 minutes, enough fuel will have flowed into the fuselage tank to allow the engine to be re-started in accordance with the checklist.

(2) Failure at Low Altitude

Check the points on the check list given in the previous para. The fuel from the wing tanks does not flow quickly enough that it would make sense to open the valve at this stage.

- Fuel Valve: SHUT! (Aft position)
- Ignition: OFF!
- Main Switch: OFF!
- Propeller Stop: ENGAGED! (bottom position)
- Leave the propeller extended.
- Initiate outlanding.

If the situation becomes so critical that a crash landing seems unavoidable because no landable terrain can be reached, the propeller stop should be engaged at a speed of about 90 km/h (49 kts) - even with the propeller still running. This will help to stop the propeller more quickly. Then the propeller must be retracted to a "halfway in" position minimum. This action not only improves the gliding performance (perhaps now a more suitable field can be reached), but also reduces the risk in case of a crash landing. In this case the main switch must not be turned off until the propeller has reached at least its partially retracted position.

(3) Heavy Vibrations of the Power-Plant

Comply with checklist. If no cause is found, shut down the engine and retract propeller in the normal manner. It is possible that the propeller has been damaged, causing an unbalance. Do not re-start the power-plant.

3.8 Fire

(1) Fire with propeller extended

A fire in the engine compartment is indicated by a red blinking diode in the instrument panel. Further details are given in Section 7.9

Comply with **Check List (4)** and land as quickly as possible. If possible, retract the propeller, as closing the engine doors will reduce the oxygen feed !
Smother fire with extinguisher or fire blanket (clothing).

SECTION 4

4.1 Introduction

This Section contains Check Lists for the daily inspection and pre-flight checks. It also describes normal operating procedures. Normal operation procedures associated with the sailplane, if equipped with various ancillary systems and equipment not included as standard equipment, are described in Section 9.

4.2 Rigging and Derigging

Rigging

The ASH 26 E can be rigged without use of rigging aids by three people, or by two people if a fuselage cradle and wing trestle are used.

1. Clean and lubricate all pins, bushings and control connections.

2. Support fuselage and keep upright. If the wheel is down, check that the landing gear is securely locked.

3. Set flap lever to Flap Setting 1 or 2.

4. Insert right wing spar fork into fuselage and watch the alignment of the automatic control linkage connectors. Hold the wing such that the wing-side levers of the automatic connectors will be guided into the angular funnel-type connectors at the fuselage. Only then a further assembly is possible.
   Now support the outer wing end with a trestle, if available.

   NOTE: The wing trestle must not obstruct the movement of the aileron !

Tank System (fuel and oil)

a) Check that hose connections to the wing tanks are secure and tight.

b) Check visually fuselage tank through wheel well for damage due to impact from stones and for leaks.

c) Press drainer and release any condensation if present. Watch carefully that the drainer afterwards closes tightly. The drainer is situated at the rear end of the left fuselage tank half.

d) Check fuel tank vent opening. This vent is fitted at the left-hand side of the fin above the tail wheel.

e) Check fuel contents for a safe take-off (min. 5 liters).

f) Check engine oil tank (between engine and exhaust silencer) for signs of leakage. Level check! Sufficient oil usage ? Always top up the oil tank to the indicated level.

4.4 Pre-Flight Checks

The following Check List containing the most important points is affixed within easy view of the pilot.

Pre flight check

1. Horizontal tail bolt and assembly pins secured ?
2. Check control forces and freedom of control movements !
3. (Clearance of control surface gaps min. 1,5 mm as viewed from trailing edge) ?!
4. Automatic parachute static line connected ?
5. Check the C.G. !
6. Observe the mass and balance data !
7. Water tank outlets and ventilation openings free ?
8. Fuel contents checked ?
9. Wing fuel tanks (if installed) connected ?
10 Engine checked as per the manual?

Pre take-off check:

1. Fasten parachute ?
2. Fasten safety harness ?
3. Landing gear locked ?
4. Airbrakes locked ?
5. Trim set in take-off position ?
6. Flap set in take-off position ?
7. Altimeter correctly set ?
8. Tail dolly removed ?
9. Check the wind direction !
10. Close and lock the canopy !

4.5 Normal Operation and Recommended Speeds

4.5.1 Power-Plant Control and Self-Launch

Checklist, extending propeller and starting engine

- Fuel valve: OPEN
- Main switch: ON
- Power-plant main switch: ON (ILEC responding)
- Switch "Extend Propeller" engaged upwards?
- Green LED "Propeller extended" on?
- Propeller stop disengaged?
- Ignition: ON
- Check fuel pump (must be heard)!

Cold and warm start on the ground (not too cold)

- Nobody/nothing within the arc of the propeller?
- Move Throttle 1/4 to 1/3 towards "WIDE OPEN"
- Push PRIMER button for 2 to 3 seconds
- Push STARTER button max. 5 seconds
- If engine does not fire, press PRIMER and then STARTER again at 15 second intervals with increasing amounts of priming fuel.
- Check ignition circuits
- If engine fires shortly and seems to stall again, re-press PRIMER only for a second.
- Allow engine to warm through at 4000 RPM for 3 to 4 minutes.

Cold start (very cold, strongly cooled engine)

- Nobody/nothing within the arc of the propeller?
- Set Throttle to "IDLE"
- Push PRIMER button for 2 to 3 seconds
- Push STARTER button max. 5 seconds
- If engine does not fire, press PRIMER and then STARTER again at 15 second intervals with increasing amounts of priming fuel.
- If engine does not fire on the third trial, it may be "overflooded":
  - do not press PRIMER any more
  - set throttle 1/3 towards "WIDE OPEN"
  - shut fuel valve
  - press starter until engine fires
  - re-open fuel valve immediately.
- Check ignition circuits
- Allow engine to warm through at 4000 RPM for 3 to 4 minutes.

Cold and warm start in flight

- Air speed 90 to 110 km/h (49 to 60 kts).
- Move throttle 1/3 towards "Wide Open"
- Push PRIMER button for 2 to 3 seconds
- Push STARTER button max. 5 seconds
- If engine does not fire, press PRIMER and then STARTER again at 15 second intervals with increasing amounts of priming fuel.
- If engine fires shortly and seems to stall again, re-press PRIMER only for a short instant.
- If possible, allow engine to warm through
- Reduce airspeed and move throttle to Wide Open Throttle (WOT). (Watch rate of revolutions!)

Checklist stopping engine and retracting propeller

- Air Speed: 90-100 km/h (49-54 kts)
- Throttle: IDLE (bottom position).
  Wait until low RPM have stabilized.
- Ignition: OFF
- Let engine revs. die down.
- Engage propeller stop lever (bottom position)
  When engaging the stop the propeller must not stand direct above the stop block.
- Wait until propeller runs against the propeller stop block.
- Check vertical position of the propeller by means of the mirror.
- Hold down switch "RETRACT" and let propeller retract only so far that its tip can no longer be seen in the rear view mirror. Then after about 2 min. or when the maximum liquid coolant temperature has dropped by 2°C, press again "RETRACT" until the ILEC LED "Propeller retracted" lights.
- Fuel valve: SHUT
- Switch off Power-Plant Main Switch by pushing the red lever next to it.

Revolution Rates (RPM) and Speeds

Best climb at v_Y = 95 km/h = 51 kts (blue line).
Cruising speed 130 to 140 km/h (70 to 76 kts) at 6900 rpm.
Maximum continuous revs: 6900 rpm.

The power-plant of the ASH 26 E gives the possibility to self-launch with good climbing performance, extending the operational range of a pure sailplane. It is advisable to familiarise oneself with the engine extending and starting procedures in the first instance within safe reach of an airfield, before attempting a cross country flight. The power-plant of a powered sailplane must not be regarded as a life insurance, for instance when crossing unlandable areas. One should always be prepared for the possibility that the power-plant will fail to deliver the hoped-for propulsion. This may not necessarily be due to a technical shortcoming, but might be caused by nervous tension of the pilot (mistakes in carrying out starting procedure). The engine and its reliability should be regarded in the same light of a sailplane pilot's experience as that a thermal is not necessarily found when it is most urgently needed. The engines of powered sail-planes are not subject to quite such stringent production and test regulations as normal aviation engines, and therefore cannot be expected to be quite so reliable.

A minimum safe height for extending the propeller and starting the engine must be met. The criterium is that it must be possible to retract the propell-er again and carry out a normal sailplane outland-ing if the engine cannot be started. A valid value for this minimum safe height is about 300 meters (980 feet); however, this is depending also strongly on pilot ability and geographic factors.

(1) Extending the Power-Plant

Proceed as per checklist.
Do not extend the propeller at higher g-loads.
G-loads can increase, for instance while circling, to such an extent that the electric jack can only extend the propeller very slowly, or fails to do so fully.
Speeds for retracting and extending the propeller are given in Section 2.

(2) Starting the Engine

WARNING: A test run of the power-plant must <u>under no circumstances</u> be performed <u>without</u> the aircraft being completely rigged and safely chocked. Also a competent person must be securely strapped in the cockpit.

CAUTION: The local conditions for a safe take-off should be checked prior to take-off in accordance with the data given in Section 5 of this manual

Proceed in accordance with checklist.
If the engine fails to start, check it over as recommended in the Engine Manual.
It makes no sense to press the STARTER button for more than 5 seconds because the engine fires only if sufficient fuel has been primed. Therefore, after the 5 seconds first fuel should be primed again. If the engine still does not fire, this should be repeated again at 15 second intervals with increasing amounts of priming fuel.
If however, white smoke is observed to come out of the exhaust silencer already on the third trial and still no firing happened, then the engine is "overflooded". You must not prime any more fuel. Instead move throttle to 1/3 towards "WIDE OPEN", shut the fuel valve, and press STARTER until engine fires. Then immediately re-open the fuel valve.

Check ignition circuits. The RPM must not drop by

more than 200 RPM.
Allow engine to warm through at 4000 RPM for 3 to 4 minutes on ground; the coolant temperature should then be around 60 °C (140 °F). This way it will be ensured that the engine will smoothly accelerate to max. RPM.

With temperatures below -10 °C (14 °F) the engine should not be started because there is the danger with a very cold engine that the lubricant oil is too thick and thus the oil feed into the engine could be interrupted.

(3) Self-Launch

For a safe self-launch maximum engine revolutions should come up to 5900 to 6300 rpm on the ground. With lower revolutions the pilot must face longer take-off distances than indicated in Section 5.2.3.

WARNING: If maximum revolutions on the ground are at 5600 rpm or below, the aircraft must not take off. First the carburettor adjustment must be checked and again a test run of the power-plant on the ground must be done.

Experienced pilots should start their take-off run at the most negative flap setting 1. This flap setting affords excellent lateral control. At an indicated air speed of about 50 km/h = 27 kts the flap should be increased to Flap 4 (+23 °). For the remainder of the climb Flap 4 should be maintained.

For pilots without experience of flapped aircraft, we recommend setting Flap 4 both during take-off and throughout the climb.

For the acceleration run and actual lift-off, the following practises apply for different runway characteristics:

- **Concrete runways:**
Accelerate with "Wide Open" throttle in flap setting 2 and slightly push the stick until the tail wheel is unloaded. Up to a speed of about 50 km/h (27 kts) acceleration continues on the main wheel, then set flap 4 and at the same time gently pull the stick until the aircraft lifts off. After lift-off, climb to between 1 m and 2 m (3 and 6 ft) and accelerate then slowly to v_Y.
But in case of crosswind the procedure differs and the tailwheel is loaded by slightly pulling the stick in order to increase directional stability during the ground run.

- **Soft surface runways:**
Use flap setting 2 and by pulling the stick try to keep the tail wheel in contact with the ground until the aircraft lifts off. This is in order to reduce the load on the main wheel.
As early as possible change to flap 4 and at the same time gently pull the stick until the aircraft lifts off. After lift-off, climb to between 1 m and 2 m (3 and 6 ft) and accelerate then slowly to v_Y.

Maximum acceptable crosswind components are stated in Section 5.3.1.

(4) Climbing Flight

During climbing flight, the engine should be run at maximum 7500 rpm at v_Y = 95 km/h = 51 kts (blue line on ASI scale).

(5) Cruising Flight

This can be carried out in a saw-tooth pattern (climb followed by straight glide with propeller retracted), or in horizontal flight at 6900 rpm and an air speed of 130 to 140 km/h (70 to 76 kts).
Monitor fuel reserves and open wing tank valve if appropriate.

CAUTION: The wing tank(s) valve will switch off automatically only if the tank selector switch is set to "AUTO" position. With manual position "ON" selected the valve will not close when the fuselage tank is full and fuel will be lost via the overflow vent! Therefore, the fuel level indicator must be monitored and the wing tank(s) valve closed in good time.

CAUTION: If wing fuel tank(s) are fitted, check that the oil supply is sufficient for the whole intended fuel contents. Monitor oil warning light!

A detailed description of the ILEC engine control unit is given under Section 7.9!

(6) Stopping the Power-Plant

CAUTION: To avoid damage to the propeller the procedures described hereafter must be met!

With normal outside air and engine temperatures the flight testing has shown that there is no need for a longer cooling run.

Only with very high engine and outside air temperatures it is actually necessary to do a longer cooling run which must then be done in fast level flight. The engine revs must be adjusted between 6600 and 6900 RPM at a speed of about 130 km/h (70 kts). Contrary to a cooling run with the engine idling, the cooling water pump and cooling air fan have still a sufficient function at these RPMs; as the throttle setting of about 50 % results in less combustion heat inside the engine, there is a good transport of the heat to the outside.
A longer cooling run at lower flight speeds and with the engine idling <u>must not</u> be done, because then the exhaust heats up strongly (the Venturi at the exhaust pipe does no longer supply sufficient cooling air through the Carbon fiber fairing of the exhaust).
Although the higher temperature of the exhaust silencer does not mean a problem per se for the structure of the fuselage, but if after this cooling run the propeller is at once completely retracted without waiting period, then the hot air from the exhaust may damage the propeller and impair its service life.

(7) Retracting the Propeller

Ony after the engine rpm's have almost completely died down and the propeller is only yet wind-milling the propeller stop block must be swivelled into the arc of the propeller.
Max. speed here is 120 km/h (65 kts).

In order to avoid damage to the propeller the pilot must not dispense with the progressive retraction of the propeller. This serves to better cool down the power-plant and the exhaust. Particularly with high outside air temperatures the pilot must not do without this.

In practical operation the following procedure has proven good:

After engine shut-off the liquid coolant temperature first increases a little, because the coolant is no longer circulated and the temperature sensor is fitted direct at the engine housing where it immediately indicates its temperature. As the degree of cooling down is indicated by this temperature, monitor this temperature and wait until the maximum value has dropped by about 2 °C. Only then the propeller may be completely retracted without any problems..

(8) Approach and Landing

Preferably carried out with propeller retracted.

If the electric power supply fails, it is possible to land with the propeller extended. Ignition and Power-Plant Main Switch must be OFF, the fuel valve CLOSED and the propeller stop lever ENGAGED.

If the propeller is still extended, the increased sink speed should be borne in mind. As a general guideline, a basic sink speed of about 1.5 m/sec (295.3 fpm), with propeller stationary and at flap setting 4 and 100 km/h, may be assumed. It may be possible to do without use of the air brakes during the landing, and a firmer round-out and hold-off will be needed.

4.5.2 Winch- and Autotow-launching

The C.G. tow release coupling must be used for winch launching and **Flap setting 3** (+10°) is recommended.

CAUTION: Because of its high positive deflection the flap setting 4 must not be used.

Trim should be set neutral to nose-heavy at any C.G. position. At this trim setting the ASH 26 E will assume a gentle climb attitude. With high-powered winches which tend to jerky accelerations, the trim should always be set nose-heavy. Above a minimum safe height the climb should be steepened by pulling the stick back.

A weak link of 675 to 825 daN must be incorporated in the launch cable.
Maximum acceptable crosswind component is 20 km/h = 10.8 kts.

NOTE: The wheel <u>CANNOT</u> be retracted during the launch.

CAUTION: Winch launching with water ballast is not recommended at less than 20 km/h = 10.8 kts headwind component. The winch driver must be informed of the total Take-Off Mass.

CAUTION: Before Take-Off, check seating position and that controls are within reach. The seating position, espe-

cially when using cushions, must preclude the possibility of sliding backwards during initial acceleration or steep climb.
The safe engagement of the adjustable back rest must also be checked.

WARNING: We expressly warn against attempting any launch by an under-powered winch in a tail wind!

4.5.3 Aero Tow

For aero tows only the nose tow release coupling must be used. This is a requirement of JAR 22.
The recommended flap setting for aero towing is **Flap 3.**
Trim should be set nose-heavy.
A tow rope of between 40 m and 60 m (135 ft and 197 ft) long, but not less than 40 m (135 ft) in length should be used.

Experienced pilots should start their take-off run at the most negative flap setting 1. This flap setting affords excellent lateral control. At an indicated air speed of about 50 km/h = 27 kts the flap should be increased to Flap 3 (+10 °) or, on short take-off runs or when carrying water ballast, to Flap 4 (+23 °). For the remainder of the tow, Flap 3 should be selected for reasons of trim loads.
For pilots without experience of flapped aircraft, we recommend setting Flap 3 both during take-off and throughout the aero tow.

For the actual lift-off, the following practise has proved satisfactory:

Try to keep the tail wheel in contact with the ground until the aircraft lifts off. This increases not only directional stability during the ground run, but helps the aircraft to lift off at the earliest possible moment.
After lift-off, climb to between 1 m and 2 m (3 and 6 ft) in order to avoid pitch oscillations caused by ground effect and slip stream turbulence from the tug.

NOTE: Inform tug pilot of minimum towing speed.

T/Off Mass	Recommended Towing Speed
430 kg (948 lb)	115 km/h (62 kts)
525 kg (1158 lb)	125 km/h (68 kts)

Maximum acceptable crosswind component: 20 km/h = 10.8 kts.

4.5.4 Free Flight

CAUTION: Flights in conditions conducive to lightning strikes must be avoided as aircraft certified under JAR 22 are not approved for such conditions.

Use of Flaps

Flap control allows improved adaptation of the aircraft to suit changing flight attitudes.
Flap settings 1, 2 and 3 are straight flight settings and are the best settings in high speed flight throughout overlapping speed ranges.

Flap setting 4 is purely for use while circling.
The optimum flap settings at various speeds depend very much on the wing loading. The effect of the take-off mass at any one time on the appropriate speeds for the various different flap settings is shown in the diagram in Section 5.3.4 (Optimum-Performance Flap-Setting Ranges).

As the flap setting will directly influence the amount of lift generated over the whole of the wing, a sudden, jerky operation of the flaps will cause a sudden drop or climb; therefore, care should be exercised in this respect, especially when flying close to the ground, or circling near other sailplanes.

When circling, remember that the stalling speed will increase compared to that in straight flight at the same flap setting.
As a general guideline, you should expect the stalling speed to increase by 10 % at about 30° bank, and by 20 % at about 45° bank.

Low Speed Flight and Stalling Behaviour

The ASH 26 E behaves normally in slow and stalled flight. With all C.G. positions flow detachment at the fuselage and horizontal tail buffeting will give warning of an impending stall.

With all C.G. positions, about half of maximum aileron deflection can still be applied, with rudder centralised, to maintain the aircraft in straight stalled flight. It would, of course, be more appropriate to control the aircraft by means of rudder alone, and to leave the ailerons centered.

Violent applications of rudder and aileron would result in a spiral dive, spinning or side slipping, depending on C.G. position.

CAUTION: Height loss due to incipient spin from straight or circling flight depends largely on the all-up flight mass:

Height loss from straight flight after prompt recovery action
≈ 40 m = 132 ft !

Height loss from circling flight:
up to 150 m = 495 ft !

More specifically, the following would apply:

C.G. Position	Flap	Rudder & Aileron Co-ordinated	Rudder & Aileron Crossed
rearmost	3-4	steady spin	steady spin
central	3-4	spin, leading to spiral dive	spin, leading to slipping turn
foremost	3-4	≈ half turn of spin, leading to spiral dive	slipping turn

See also Section 3.5 in this manual.

Wing drop from circling flight is not noticeably more violent than from straight flight. Height loss during one spin turn may come up to 150 m. For recovery from spinning up to 140 m will be required in the most unfavorable case.

4.5.5 Landing Approach

Make the decision to land in good time and, notwithstanding the high performance, select Flap 4 and lower the wheel at not less than 100 m = 300 ft above ground.
For the remainder of the circuit, maintain about 90 km/h [49 kts] (yellow triangle on ASI scale).
The aircraft should be trimmed to between 90 and 100 km/h [49 - 54 kts]. In turbulence, the approach speed should be appropriately increased.

CAUTION: Only when you are quite certain of being able to reach the boundary of the landing area in a straight approach should landing Flap L (+38°) be selected.

At air speeds above 100 km/h (54 kts) the control forces required to engage Flap L will noticeably increase. It is, therefore inadvisable to engage landing Flap L at more than 100 km/h. These high control forces are generated by the very positive camber of the flaps. These deflect downwards by 38°, whereas the outboard ailerons deflect to -6°. This marked wing wash-out greatly increases the natural sink of the aircraft, especially at air speeds between 120 and 130 km/h (65 and 70 kts).

By changing pitch attitude (forward or back stick pressure) the glide angle can be further varied to a large degree.

In addition, glide path control can, of course, be exercised in the normal way by means of the airbrakes.

NOTES:

- In a strong headwind, use of landing flap setting L is NOT recommended, due to the danger of undershooting the landing area !
- If you are not familiar with the use of the flaps as a landing aid, you should initially only use Flap 4 for a landing into a headwind.

CAUTION: The danger of a sudden drop makes it inadviseable to reduce flap setting near the ground. This also applies to a reduction from landing flap L to Flap 4.
Such a reduction of landing flap when in danger of undershooting must only be employed above a safe height (at least 40 m = 131 ft), a safe speed (at least 95 km/h = 52 kts), and after practising the maneuver at greater heights.

4.5.6 Landing

Before landing, water ballast must be jettisoned.

In an emergency (eg: abandoned take-off), structural strength will prove adequate to a landing at maximum all-up flight mass.

In normal service, however, it is on principle recommended to jettison water ballast prior to landing in order to increase the safety reserves.

If approaching in a steep attitude with landing flap L selected, remember to round out in time to allow a clean 2-point touch-down.
Immediately before touching down, the airbrakes setting may be reduced a little so as to avoid touching down with wheel brake too firmly applied.

In a crosswind, landing flap setting L is advised as it will help in controlling the crosswind effect.
During the ground run the stick should be held fully back for better directional stability in crosswinds, and to prevent the tail from lifting due to hard application of the wheel brake.
The flaps may be left in landing setting, as the negative aileron deflection will provide adequate lateral control until the aircraft comes to a stop. If Flap 4 was used for the landing, it is advisable to engage Flap 1 after touch-down.

When parking the aircraft, engage Flap 3 in order to save the elastic sealing strips over the wing control surface gaps from wear.

4.5.7 Flying with Water Ballast

For normal European weather conditions, the wing loading of the ASH 26 E is already at its best even without additional water ballast.
If achieved lift is markedly greater than 2 m/s = 400 ft/min, wing loading can be increased up to about 45 kg/m^2 = 9.2 lb/sqft by use of water ballast.

NOTE: Remember that ballast load will increase the stalling speeds and take-off runs. Also the rates of climb are reduced (see the tables in Sections 5.3.3 and 5.3.4.)
Ensure that the condition of the airfield, the length of take-off run available and the power of the tug or winch permit a safe launch.

Filling of Water Ballast

The water ballast lever at the right cockpit wall behind the landing gear lever opens the valves.

Start by filling the tank of the wing with its tip on the ground. The design of the tank vents will allow the wing to vent best in this position. When the tank is full, the filler opening must be sealed by means of the stopper with marking tape supplied, because both the corresponding left and right valves must remain open during filling. This is an important LBA requirement to prevent inadvertent draining of only one tank.

Now the other wing tip is put down while its tank is filled. The valves should then be closed and the stopper with marking tape removed from the wing whose tank was filled first.
With wings level, carry out a balancing test to check that the ballast loads are even. Should one wing prove to be heavier, block the opening of the lighter wing briefly by hand or stopper while opening the valves until equilibrium is achieved.

WARNING: It is expressly prohibited to use pressurised water (mains, immersion pumps etc.) for filling ballast tanks due to possible damage to the wing structure!
It is recommended to fill from slightly elevated, unpressurised containers (on wing or car roof etc.). If water under pressure is used, it is essential to interpose an open intermediate vessel (funnel etc.), to ensure that the head-of-pressure cannot rise beyond 1.5 m = 4,9 ft.
For **self launch** a take-off weight of 525 kg (1158 lbs) is allowed and as the take-off distance depends so strongly on the all-up weight, the amount of water filled into the bags must really be carefully checked (use calibrated containers or a water meter). See also **Maintenance Manual** Section 12.2.

If the wings are filled to capacity, it can happen that the tanks slowly drain through the vents while the aircraft is parked. In this case we recommend that the wingtips should be supported level, but on no account to tape up the vents !

The maximum water ballast volume can be calculated as follows:-

Maximum all up Weight	525[kg] (1158 lbs)
less Empty Weight	xxx[kg] (xxx lbs)
less Cockpit Load (incl.Fuel)	xxx[kg] (xxx lbs)
= max. water ballast volume in [kg=litres] or lbs	

You will find a table with precise values in Section 6.2.

Jettisoning of Water Ballast.

To jettison water ballast the lever at the right cockpit wall is pulled forwards.
Attention must be paid to symmetric flight behaviour. If no change is noticed, it is certain that water is draining from both open valves constantly.

We distinguish between two types of circumstance in which ballast is normally released.

1. Gradual reduction of wing loading:
   The mean rate of drainage amounts to 0.5 l/sec (0.13 US Gal/sec), higher if tanks are full, less if they are nearly empty. After an appropriate lapse of time the valves should be closed.

2. Rapid ballast jettison:
   The full tanks will take about 5 1/2 min., ie: approx. 340 seconds, to drain. The first half of the ballast will drain in about 2 minutes, while the remainder will take about another 3 1/2 minutes.

Should the ballast fail to drain as intended, the valves should be closed immediately. Try again to achieve even drainage by operating the valves again or, if icing is suspected, after descending into warmer air.
If this fails after several attempts, the situation should be regarded as an emergency, and instructions in Section 3.9 should be followed.

4.5.8 High Altitude Flight

Flutter tests were carried out at about 2000 m msl (6562 ft). As the ASI under-reads at increasing altitude, but since flutter limits for light aircraft are determined by the true air speed, the following limitations apply to high altitude flights :

Maximum Speed VNE in high altitude	
Flight Height msl	V_{max} Indicated
0-3000 m (9843 ft)	270 km/h (146 kts)
< 5000 m (16404 ft)	230 " (124 ")
< 7000 m (22966 ft)	210 " (113 ")
< 9000 m (29528 ft)	185 " (100 ")
<11000 m (36089 ft)	165 " (89 ")
<13000 m (42651 ft)	140 " (76 ")

If above airspeed limits given as IAS are regarded the true air speed above 3000 m altitude will remain constant at 300 km/h = 162 kts. Therefore, in spite of a considerably lower airspeed reading, the actual speed achieved relative to the ground will be adequate for penetrating even against strong headwinds at greater altitudes.

WARNING: Avoid long flights at temperatures below -25°C (-13 °F), as the anti-freeze in the liquid coolant is only effective until such temperature.

WARNING: Cold engine oil becomes so thick that the lubrication feed can fail.

When the engine has been running and is retracted, our experience is that its normal operating temperature will cool down only slowly and makes a short-time engine operation in colder air still possible.

WARNING: A too cold liquid coolant becomes thick and may obstruct the radiator. This would lead in a very short time to increased engine operating temperature. The engine must then be switched off and the pilot must wait until the warm power-plant components have warmed up the radiator.

WARNING: Flights in icing conditions are not advised, especially if the aircraft is wet before climbing through icing level. Experience suggests that drops of moisture on the surface will be blown back, lodge in the control gaps, and there dry comparatively slowly.
This may cause the controls to become stiff to operate, or in extreme cases, jam them. A single climb through icing level (0°C) with a previously dry aircraft, on the other hand, is not likely to impair the use of the controls even if heavy icing-up of wing and tail unit leading edges occurs.
When carrying water ballast, avoid flying above icing level due to the danger of iced-up outlet valves, or in extreme cases bursting of wings due to ice formation.

4.5.9 Flight in Rain

Rain drops, frost and ice impair the aerodynamic qualities and also alter the flying behaviour.
Therefore the quoted minimum speeds for straight and circling flight should, in such conditions, be increased by some 10 km/h = 5.5 kts. Air speeds should not then be allowed to drop below these values.

Rain drops must be removed from a wet aircraft before take-off.
Do not fly into icing conditions with a wet aircraft. In this context, see also para 4.5.8 above.

S_R = Take-off roll
S = Take-off distance to clear a 15m (50ft) obstacle

Take-Off Mass 525 kg (1158 lbs)

Airfield Elevation above msl		Temperature		Take-off roll distance				Take-off dist. to 50 ft height			
				Hard surface		Grass		Hard surface		Grass	
m	ft	°C	°F	m	ft	m	ft	m	ft	m	ft
0	0	-15	5	132	432	211	691	253	830	332	1089
0	0	+0	32	153	503	245	804	295	966	386	1268
0	0	+15	59	177	581	283	928	340	1115	446	1463
0	0	+30	86	203	665	324	1063	389	1277	511	1676
500	1640	-15	5	155	507	247	811	297	974	390	1278
500	1640	+0	32	180	590	288	944	346	1134	453	1487
500	1640	+15	59	208	681	332	1089	399	1308	523	1715
500	1640	+30	86	237	779	380	1246	456	1497	598	1963
1000	3281	-15	5	182	596	291	953	349	1145	458	1502
1000	3281	+0	32	211	693	338	1108	406	1332	532	1747
1000	3281	+15	59	244	799	389	1278	468	1535	614	2013
1000	3281	+30	86	279	914	445	1461	535	1756	702	2303
1500	4921	-15	5	214	701	342	1122	411	1347	539	1768
1500	4921	+0	32	248	815	397	1303	477	1566	626	2054
1500	4921	+15	59	286	939	458	1501	550	1804	721	2366
1500	4921	+30	86	327	1074	523	1716	629	2062	825	2705
2000	6562	-15	5	252	826	403	1321	484	1587	635	2082
2000	6562	+0	32	292	960	468	1534	562	1843	737	2418
2000	6562	+15	59	337	1105	538	1766	647	2122	849	2784
2000	6562	+30	86	385	1263	615	2019	739	2425	970	3181
2500	8202	-15	5	297	975	475	1558	571	1872	749	2456
2500	8202	+0	32	345	1131	551	1808	662	2173	869	2850
2500	8202	+15	59	397	1302	634	2081	762	2500	1000	3280
2500	8202	+30	86	453	1487	725	2377	871	2856	1142	3747
3000	9843	-15	5	351	1151	561	1840	674	2211	884	2900
3000	9843	+0	32	407	1335	651	2135	782	2565	1025	3364
3000	9843	+15	59	468	1536	748	2456	899	2950	1180	3870
3000	9843	+30	86	534	1754	855	2804	1027	3368	1347	4419

5.2.4 Flight Performance with Engine Running

Climb Rate:
At msl and normal atmosphere the ASH 26 E climbs at a rate of 3.0 m/s (590.55 ft/min) at the best climb speed of v_Y=95 km/h (51 kts) and at a maximum take off mass of 525 kg (1158 lb).

Cruise:
Cruise speed is v_H= 135 km/h (73 kts) at 6900 RPM.

Range:
With full fuselage fuel tank, at 6900 RPM and at v_Y = 95 km/h the engine running time is about 1 hour and 15 minutes. This corresponds to a flight distance of 118 km (73.34 miles). In saw tooth flight the height gain is about 11250 m (36910 ft). If this height is glided at the best L/D, another 562 km (349.3 miles) adds to the 118 km (73.34 miles). The maximum range is then 680 Km (422.6 miles) under optimum conditions with a fuel usage of 12.8 l/h (3.4 US Gal/h).
If fuel tanks are fitted in the wings, the fuel capacity is increased by each 15 liters (3.96 US Gal) per tank.

In cruise flight at v_H = 135 km/h (72.85 kts) and at 6900 RPM a flight time of two hours is reached when using 8 liters/h out of a full fuselage tank. This gives a range of 270 km (167.8 miles). Then there is no height gain which can be used for glide.

Fig. 7.11-2 Engine Electric Circuit

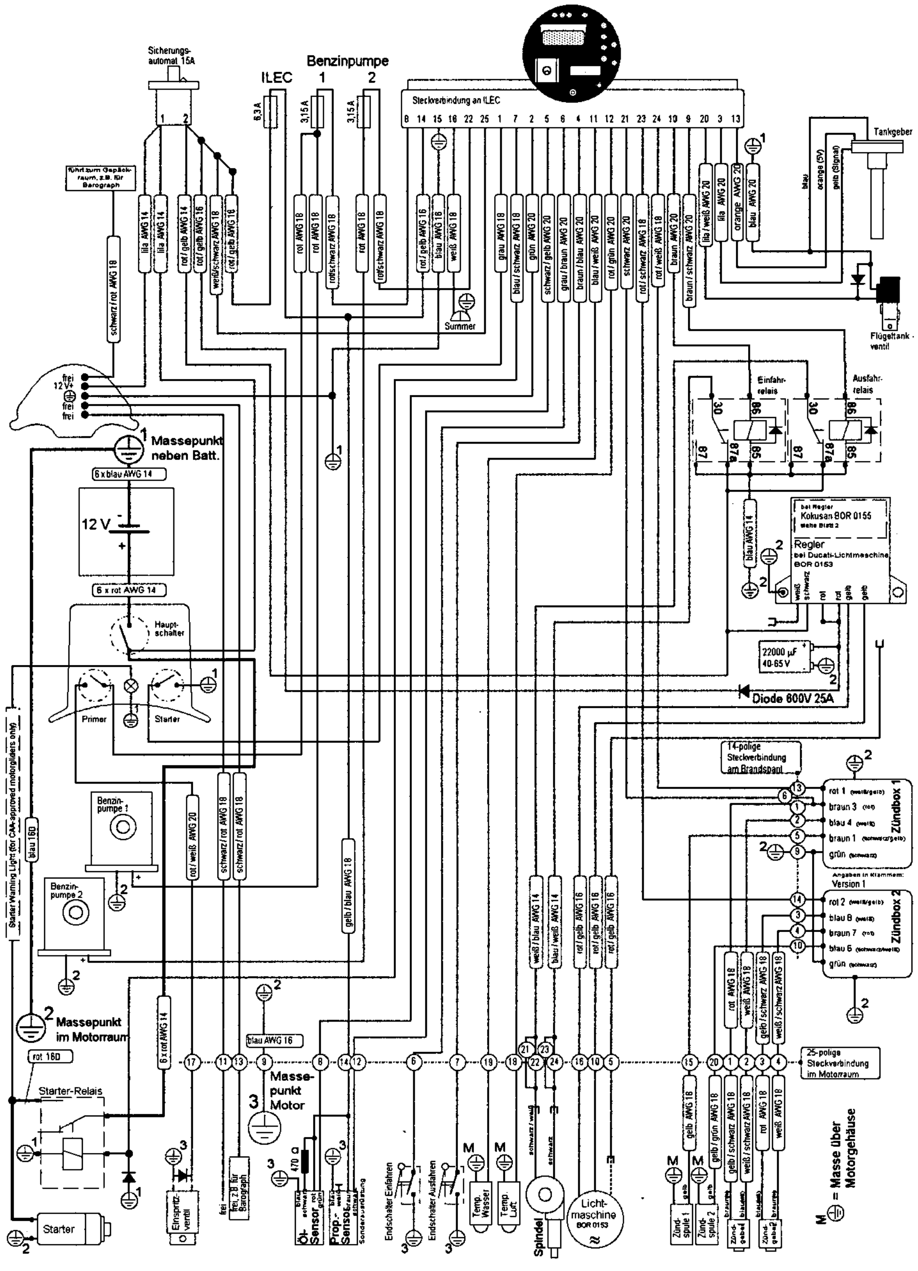
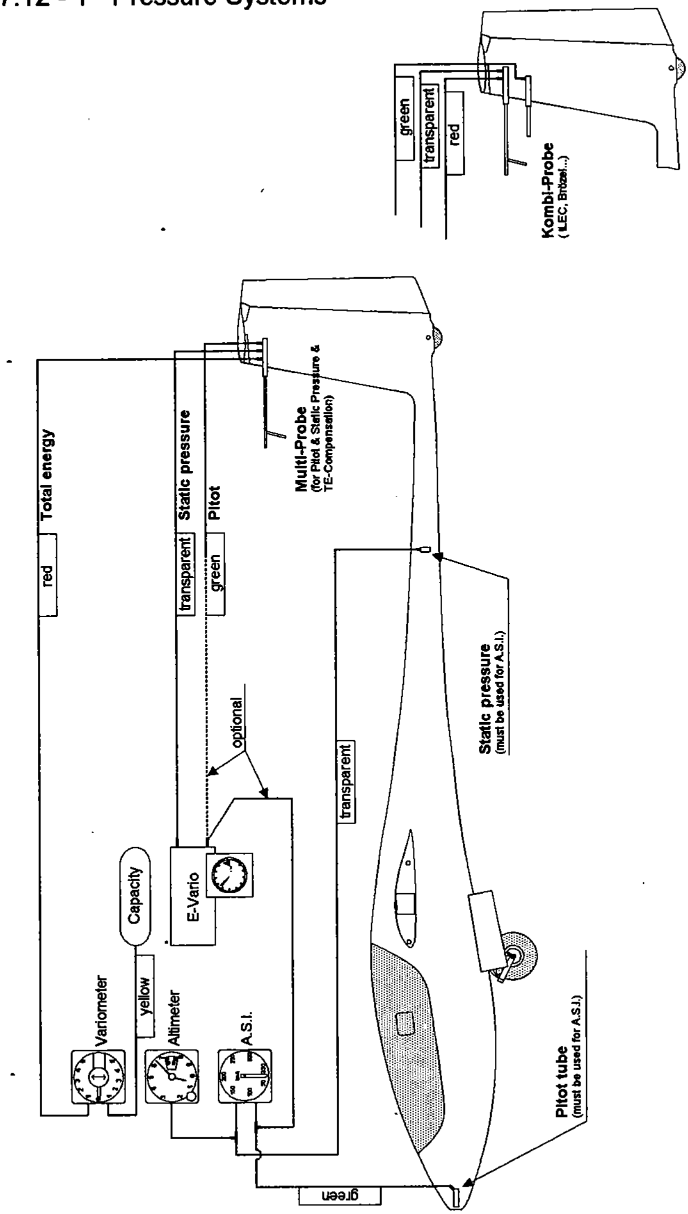


Fig. 7.12 - 1 Pressure Systems



- **Fuel system:**

Two electric fuel pumps provide the fuel supply; they are fitted in the fuselage in front of the fire bulkhead.
The fuel pressure at the carburettor inlet must meet the required tolerance; these values are given in the engine manual.

In order to be able to adjust the pump pressure independent of the pumps either a pressure reducer [48] or a throttle bypass line [49] is installed (see Fig.2.4-1).
The pumps are switched on at the same time when the ignition is ON (at the ILEC control unit).
The proper function of the fuel pumps can be checked when turning out either FUSE 1 or FUSE 2 of the pumps during an engine ground run. The RPM power of the engine should not alter by this action. If power loss is distinctly noticed, the corresponding pump must be replaced.

The electrically actuated primer valve [12] takes the fuel from the pressure side of the fuel system and injects it into the carburettor [13]. The primer works only if the fuel pumps work properly when the ignition is ON.

If problems with the carburettor mixture are experienced, you should consider also to check the primer valve for leaks. For this purpose the primer line [47] is disconnected from the carburettor (see Fig.2.3-9) and extended by a hose. With the ignition on (fuel pumps' running must be heard) it can be verified whether this valve is completely tight when NOT pressing the primer button in the cockpit.

In a second step it can also be tested if fuel flow through the valve is sufficient when pressing the Primer button.
If the primer valve is no longer completely tight, replace.

2.3.1.5 Ignition

The ignition system is described in Section 2.4 of the Engine Manual. The ignition wiring diagram is contained in the wiring diagram Fig.2.8-3.
In this aircraft the components are installed as follows:

Ignition Circuit 1:

Ignition trigger at the starter gear rim (flywheel), **right** top.
Left ignition box in front of the fire bulkhead.
Front HT coil. Front spark plug.

Ignition Circuit 2:

Ignition trigger at the starter gear rim (flywheel), **left** bottom.
Right ignition box in front of the fire bulkhead.
Rear HT coil. Rear spark plug.

If the ignition circuit test switch at the ILEC (see Flight Manual Section 7.9) is hold in setting 1, the circuit 2 is switched off and the engine is running only on the first circuit. Holding the switch in setting 2 will test the second circuit.

2.3.1.6 Cooling Systems

- Liquid cooling system:
The largest part of the heat is rejected via the liquid cooling system, the radiator [14] of which is pivoted into the air stream when the propeller is extended. The system is filled with a

Now proceed as prescribed under points 4.8(d) thru (j) in the engine manual, injecting the oil - as described before - through the carburettor.

- The air intake filter [20] is not re-assembled, the air intake is sealed by a plastic foil and rubber band. The same is done with the ram pipe end of the exhaust.
- When the propeller has been retracted, verify the timing belt for even loops in its fold-area. Where necessary, support the belt loop by a hard foam rubber or similar material at the inside of the loop.

Storage over 90 days:

The same treatment as described before is done and in addition the following:

- The fuselage tank must be emptied through the drainer and the engine should use up completely any fuel remaining in the lines and in the carburettor.
  Do NOT close the tank vent in the fin!
  On this occasion test the drainer for leaks and where necessary screw it out and clean.
- The outside of the engine needs no special protection as described in the engine manual under 4.9(d) on the condition that the engine compartment doors are airtight sealed by tape, in dry air.
  In regions with very humid climate in addition dry salt - as sold for caravan need - may be put into the barograph support box in the engine compartment.

Returning to service from storage

Proceed in accordance with Section 4.10 in the engine manual. The following actions must be done in addition or differently from what is described in the engine manual.

- Open manually the engine compartment doors and check the belt loops in the fold-area for kinks. This is advised as a precaution, as no experience is so far available with storage time longer than 6 months.
- Air intake and exhaust are re-opened and the air intake filter re-assembled. If the engine has been stored for more than six months, than the engine inside requires oiling as described under para "Storage over 30 up to 90 days".
- The spark plugs which were left screwed in, need not be removed, if the engine starts after a few tries.
- Carry out a full engine ground run according to the instructions in Section 6 in the engine manual and record the results in the form contained in the engine manual.

2.3.4 Dismantling and Re-Assembling the Power-Plant

The following paras describe how to dismantle and re-fit the power-plant. This may become necessary for maintenance, repair or weight reduction or compliance with competition rules. The only component groups left in the fuselage are the fuel system, and all cockpit engine controls.

5.3 Bolt Torque Settings Table

Table of maximum permissible torques for bolts in standard bolted connections.
These apply also to the bolted connections at the power plant unit but **NEITHER** to the engine AE50R itself, **NOR** to the groove nuts at the propeller shaft and engine drive shaft, **NOR** to the radial screws at the Centaflex-rubber coupling at the belt drive **NOR** to the six screws at the propeller!

Thread Size	daNm (mkp)
M4	0.18
M5	0.36
M6	0.64
M8	1.60
M10	3.20
M12	5.70
M14	9.20

Bolt Torque Settings for the groove nuts at the propeller shaft and at the engine drive shaft:

Groove Nuts	daNm (mkp)
M24*1,5 Propeller shaft	15,0
M38*1,0 Propeller shaft	12,0
M30*1,5 Engine drive shaft	12,0
M20*1,5 Engine crank shaft	12,0

Bolt Torque Settings for the radial screws at the Centaflex-rubber coupling at the belt drive:

Thread Size	daNm (mkp)
M10	5.00

Table of bolt torque settings of the engine:
see Engine Manual Appendix 4!

Table of bolt torque settings of the propeller:
see Propeller Manual Section 7.2!

7.2.1 Maintenance and Inspections

a.) Periodic Maintenance Tasks

Daily (Pre-Flight): See **Flight Manual** Section 4.3 !

Every 10 hours:

- Check fan belt for wear and pre-tension. Tension the belt such that it may be twisted between the belt pulleys through 90° without excess hand force.

Every 25 hours:

- Check coolant level and top-up where required. See also Section 2.3.1.6 in this manual.

- Re-tighten the six mounting bolts at the propeller flange. (After any re-installation this must be done already after one hour; observe the prescribed torque settings!).

- Examine the elastic tensioning cords of the engine compartment doors. Where necessary replace.

- With the propeller retracted the drive belt allows access to the guide pulleys [36]; check the bearing of the pulleys for play and friction by rotating them (ball bearing damaged?).

- Remove residuals caused by oil, exhaust gases and fuel from power-plant and engine compartment wherever access is possible with the power-plant installed.

- Replace fuel filter behind the left fuselage tank (e.g. with type Mercedes Benz 001 477 4201 or Pierburg PE 1569; on no account use paper filters!).

- Remove drainer valve and clean gaskets.

- Examine fuel hoses for condition, leaks and abrasions.

- Check condition of cables and electrical connections, watch for possible abrasions.

- Check control cables and their control levers etc. for stiffness and abrasions.

- If required, adjust idling speed (see Sect.2.3.1.8)

- Check secure seating of engine mounting bolts and re-tighten if necessary (observe torque settings listed in Section 5.3!). Check locking wires securing the bolts of the rear power-plant mounting in the fuselage.

- Inspect the extending spindle gas strut. If extending takes significantly more time than retracting, replace the gas strut.

- Examine the rubber elements of the power-plant suspension mounting for cracks or other changes.

- Check the engine compartment door hinges for secure seating and cracks.

- Check propeller stop block for correct functioning; replace if necessary.

- Check the 4 lateral set screws [33] at the propeller head and re-tighten.

- Check the secure seat of the lock nuts for the three tighteners [34].

- Check the propeller shaft for radial play at the bearing seating (i.e. by applying radial load onto the shaft).

- Oil the sliding fit of the front propeller bearing. This is done by applying oil onto the propeller shaft in front of the bearing when the propeller is in a position "almost fully retracted".

Every 50 hours:

- Inspect the engine in accordance with the engine manual. The Maintenance Schedule contained in the engine manual covers also some points referring to a gearbox; these are not applicable to this aircraft.

- Check drive belt for wear of cogs and of the belt sides.

- Check belt pulley for wear of teeth and condition of the hard coating of the aluminum pulleys. Minor wear is permissible.

- Do an engine ground run and watch the exhaust noise emmission.

Every 100 hours:

- Inspect the engine in accordance with the engine manual.

- Inspect the belt pulley bearings for play in the ball bearings.

Every 150 hours:

- Inspect the engine in accordance with the engine manual.

- Disassemble the exhaust silencer and then remove its CFRP fairing so that the exhaust silencer can be visually inspected for damages. Check the condition of the heat damming material in the CFRP fairing; if necessary replace.

- Check the elastic rubber coupling between crank shaft and lower drive pulley for cracks and replace where necessary.

After one year:

- Inspect the engine in accordance with the engine manual.
- Check coolant level and its anti-freeze contents.
- Remove residuals caused by oil, exhaust gases and fuel from power-plant and engine compartment wherever access is possible with the power-plant installed.

After three years:

- Inspection and maintenance works as prescribed in the engine manual.

After five years:

- Replace all rubber fuel hose lines.

b.) <u>Once-Only Maintenance Tasks</u>

After 1 hour and every time the propeller has been reinstalled respectively after 1 hour:

- Check and re-tighten the six mounting bolts of the propeller (observe the prescribed torque settings given in Section 5.3!).

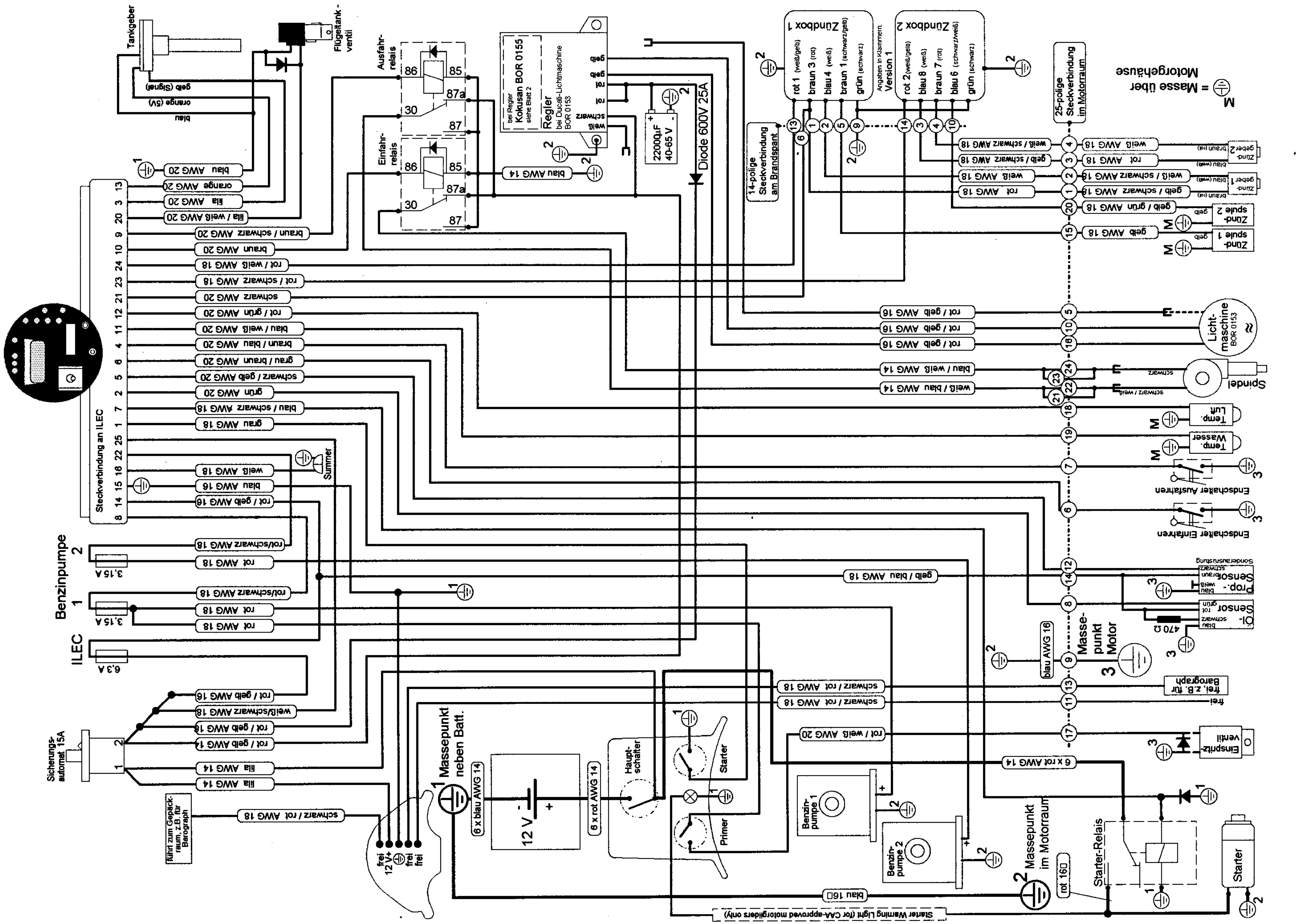


Fig. 2.8 - 3 Engine Circuit Diagram

ASH 26 E POWER-PLANT MAINTENANCE INTERVALS

Once-only Maintenance after 1 hour:	Retighten M8 bolts at prop.flange	1
Maintenance Task every 10 hours:	Check fan belt (for wear & pre-tension)	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150

Engine Hours Period				Years Period	
0 - 150	O	450 - 600	O	1 - 5	O
150 - 300	O	600 - 750	O	5 - 10	O
300 - 450	O	750 - 900	O	10 - 15	O

Wartungsarbeiten nach folgenden Intervallen:	Hour Intervals						Year Intervals				
	25	50	75	100	125	150	1	2	3	4	5
Coolant level check	O	O	O	O	O	O					
Retighten propeller bolts	O	O	O	O	O	O					
Check elastic tensioning cords of engine comptmt.doors	O	O	O	O	O	O					
Check guide pulleys	O	O	O	O	O	O					
Clean power-plant (while installed) & engine compartmt.	O	O	O	O	O	O					
Replace fuel filter	O	O	O	O	O	O					
Check fuel hose lines	O	O	O	O	O	O					
Disassemble and clean drainer valve	O	O	O	O	O	O					
Check electric wiring	O	O	O	O	O	O					
Inspect throttle control cables & prop. brake	O	O	O	O	O	O					
Check & adjust idling speed	O	O	O	O	O	O					
Check firm seating of engine mounting bolts	O	O	O	O	O	O					
Check locking wire for the rear engine mounting bolt	O	O	O	O	O	O					
Check gas strut/extending spindle	O	O	O	O	O	O					
Inspect rubber suspension buffers of engine mounting for cracks or other changes	O	O	O	O	O	O					
Check engine compartment door hinges for firm seat or cracks	O	O	O	O	O	O					
Check propeller stop block for function. If required, replace.	O	O	O	O	O	O					
Check & retighten 4 lateral set screws at the propeller head	O	O	O	O	O	O					
Check secure seat of the lock nuts for the 3 tighteners	O	O	O	O	O	O					
Check propeller shaft for radial play in the bearing seatings	O	O	O	O	O	O					
Oil sliding fit of front prop.bearing	O	O	O	O	O	O					
Inspect engine as per engine manual Section 5 Maintenance Schedule		O		O		O					
Check timing belt for wear		O		O		O					
Check belt pulleys for wear		O		O		O					
Check exhaust noise emission during engine ground run		O		O		O					
Inspect engine as per engine manual				O							
Inspect belt pulley bearings for play in the ball bearings				O							
Inspect engine as per engine manual						O					
Disassemble and check exhaust silencer and its CFRP fairing						O					
Inspect rubber coupling between crank shaft and lower drive pulley for cracks						O					
Inspect engine as per engine manual							O	O	O	O	O
Check coolant level and its anti-freeze contents							O				
Clean power-plant (while installed) & engine compartment							O				
Inspect engine as per engine manual									O		
Replace all rubber fuel hose lines											O