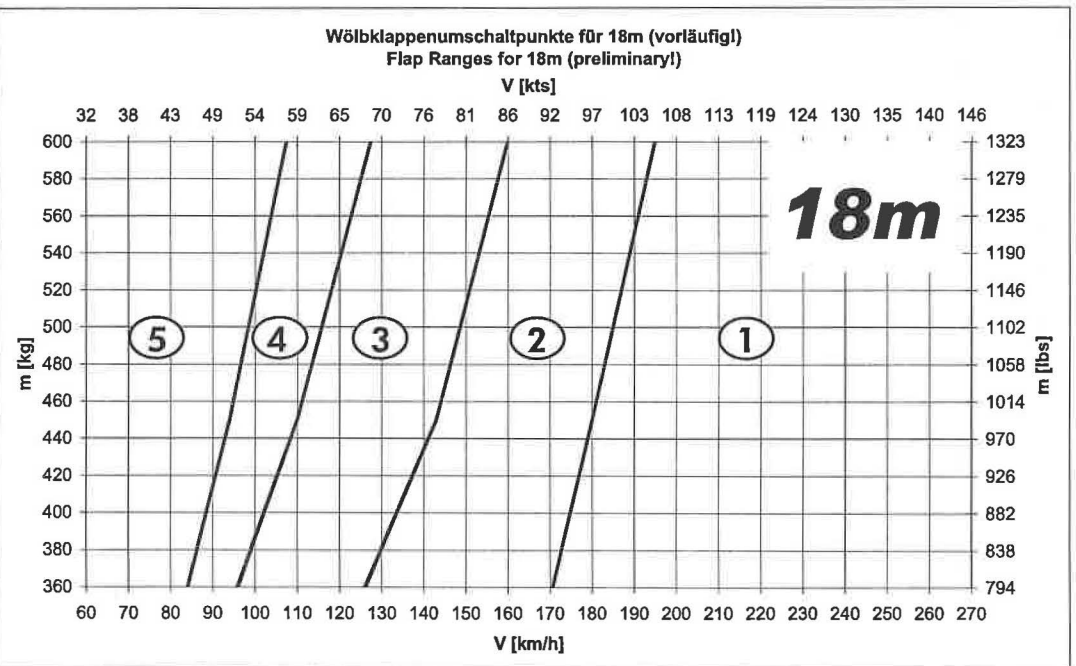


5.3.3 Flap Setting Ranges



Issue:

23.04.2007 Michael Greher

Revision:

The above diagrams describe the speed ranges of the various flap settings in straight flight, depending on the mass.

Flap Setting	L	6	5	4	3	2	1
Flap deflection	47°/12°	24°/22°	20°/19°	12°/11°	5°	0°	-2,5°
Description	Landing	Circling	Circling	Neutral	Gliding	Gliding	Gliding

Flap setting 5 has a smaller sink rate than flap setting 6 over most of its speed range. Therefore flap setting 6 is only advisable in tight circles and for landing patterns.

5.3.4 Influence of c.g.-position

To achieve the best gliding performance the horizontal tail surface must not produce up- or downward lift, for the wing with its high aspect ratio is much more efficient in producing lift at low induced drag than the horizontal tail with its compact plan form.

This optimum cannot be realized over the whole range of airspeeds. Therefore the best choice depends on the proportion of time spent in circling and in gliding.

Generally, a c.g.-range of 290 to 310 mm behind r.p. (11.42 – 12.2 inch) is beneficial. In the special case of flights with a large share of time in flap settings 1 and 2 (e.g. wave flights), a c.g. position of 260 mm may be more adequate.

As a matter of principle the c.g. position has a great influence on longitudinal stability. In forward c.g. positions, control deflections and hand forces gradients are larger. Thus it is advisable for inexperienced, light pilots to mount more lead on the (optional) attachment in front of the pedals than necessary to comply with the minimum cockpit load.

2.1 Introduction

Except for the rudder, all control surfaces and the airbrakes are actuated by means of push rods. Part of the levers and the short push rods are of welded steel construction. The long push rods are made of aluminium tube, with connecting components riveted into the ends. The remaining levers are machined from thick sheet aluminium. All push rods are supported in roller bearings or in linear ball race guides. Rubber bellows are fitted at the push rods in order to seal the wing. As the aluminium push rods are corrosion resistant, they are not surface treated.

Inspection holes for the wings are opened by removing the fairings of the aileron and flap actuators. Underneath these fairings are airtight bellows fixed to a second fairing, which seals the inside wing. Another bellows seals the air brake box at the actuator push rod.

NOTE: *Additional sealing to the wing root ribs is not allowed, as the wing will then no longer be ventilated!*

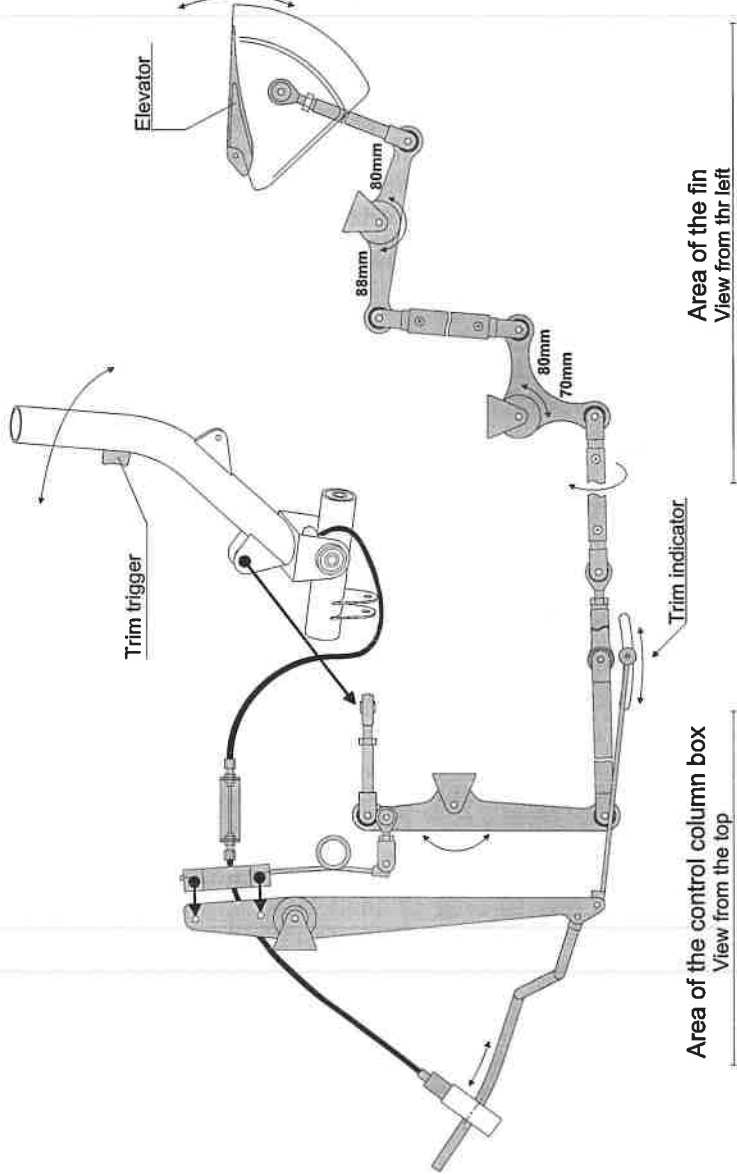
2.2 Control Systems

NOTE: *When play is found on the automatic control connections between wing and fuselage side, this can be adjusted by tightening the adjustment screws on the funnel type fittings on the fuselage side.*

2.2.1 Elevator Control System

The control column is mounted on a universal joint. A push rod extends from under the universal joint to drive a 180° aluminium alloy shift lever. The other end of this lever is situated close to the left-hand fuselage sidewall. From there a short steel push rod and a long aluminium push rod lead to the 90° aluminium alloy shift lever (bell crank) in the base of the fin. A Lead weight is bolted to this lever. From that lever a heavy plastic rod, which is part of the elevator mass balancing system, runs through the fin to a further crank that is connected by a short push rod to the elevator actuator, see fig. 2.2.1-1.

Fig. 2.2.1-1 Elevator Control System and Trim



When rigging the tail plane, the elevator tongue is inserted into this actuator and the control connection is thereby made automatically. The elevator stops are mounted on the front of the control column box and engage at the 180° aluminium alloy shift lever.

2.2.2 Elevator Trim System

Forward of the 180° shift lever, the elevator control linkage is linked to a short actuation rod from which two trim springs lead to an aluminium alloy crank. From the other end of the aluminium alloy crank - near to the left-hand fuselage wall - one push rod that carries the trim indicator, runs backwards to the gate in the seat pan and another trim fastening pushrod runs forwards to the trim locking brake. The trim trigger mounted on the control column operates this brake through a bowden cable, see fig. 2.2.1-1.

The trim system should be set up so that by actuating of the trim lever and totally elevator deflection towards ahead, the trim indicator has still 25 mm way to the forward stop. The trim setting can be corrected by adjusting the swivel head of the short driving rod.

2.2.3 Aileron Control System

From the universal joint of the control column, a short push rod leads to a 90° aluminium alloy shift lever (bell crank). From the outer end of this crank, near the left fuselage wall, a series of push rods lead to a second 90° aluminium alloy shift lever. From that crank, another short push rod leads to the aileron rocker. At each side of the rocker, a push rod goes to the automatic funnel-type connectors in the fuselage mounting area, see fig. 2.2.3-1.

From the automatically engaging lever at the wing root a series of push rods run to the inner and outer flap/aileron mixers. From the mixers short pushrods drive ailerons and flaps (see fig. 2.2.3-2). The aileron stops are located at the control column box in the fuselage at the left-hand end of the first 90° lever.

There are further stops inside the wing, which will just fail to engage when the aircraft is rigged, but which will protect the control linkage in the wing against overload when the wing is de-rigged

Fig. 2.2.3-1 Aileron Control System in the Fuselage

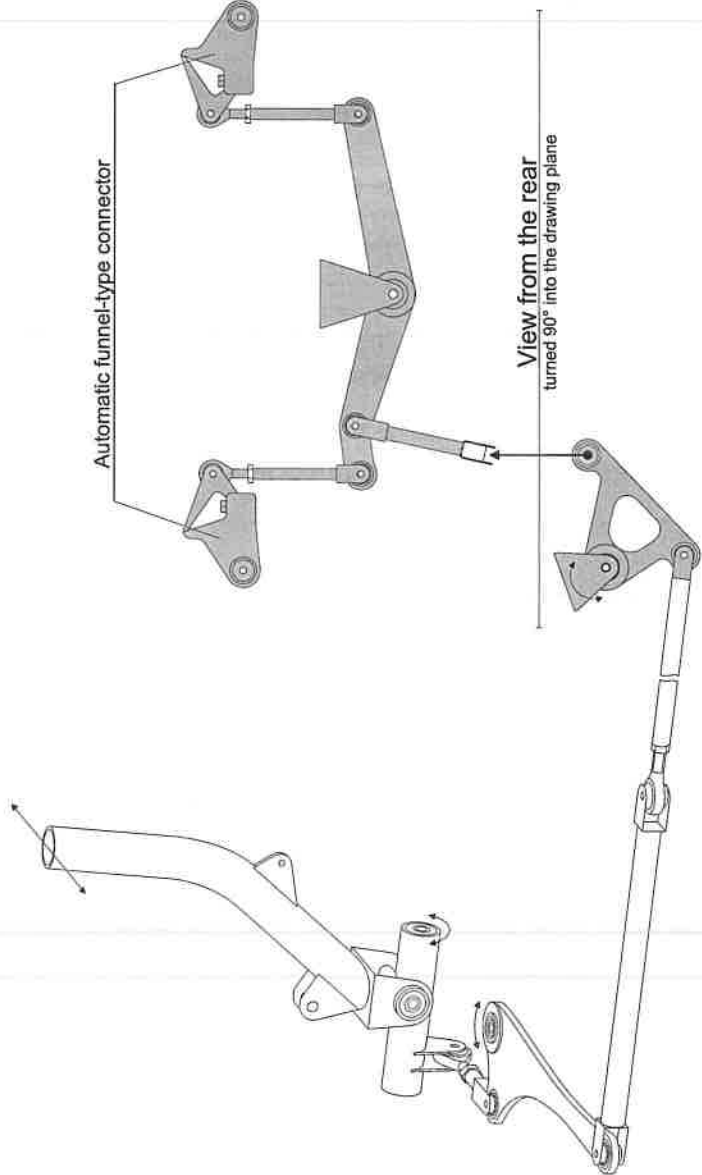
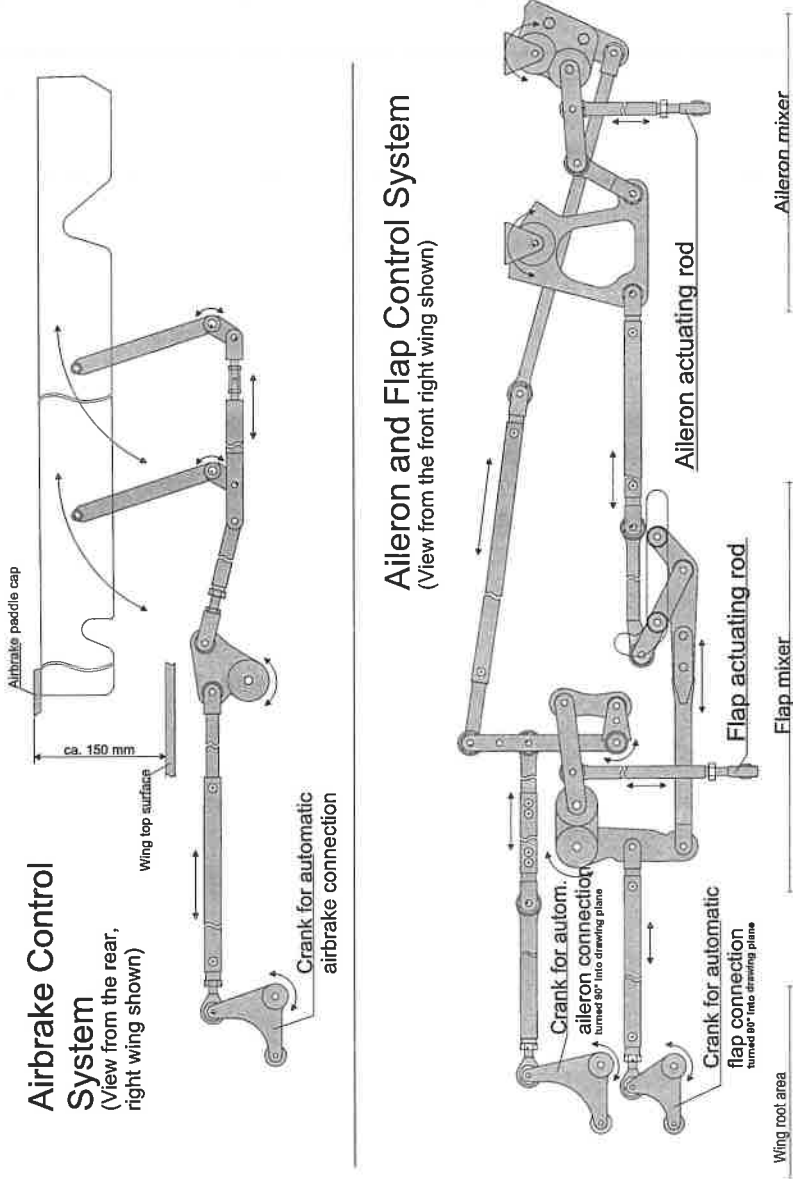


Fig. 2.2.3-2 Control Systems in the Wing



2.2.4 Flap Control System

The flap control lever is mounted on one pushrod and is unlocked with a rotation to the right. A second push rod drives a welded steel rocker. Two pushrods are connected to the latter and actuate the automatic funnel-type connectors in the root rib (see fig. 2.2.4-1). From these automatic connectors, an aluminum pushrod leads into the wing to the inner mixer, which superimposes the control deflections from the aileron and flap controls systems (see fig. 2.2.3-2).

Within this mixer a control gate mechanism differentiates the deflections of the flap and the aileron for the landing flap setting. Control linkages run from this mechanism to the outboard mixer, which then superimposes the deflections of the aileron and flap control systems for the outer aileron/flap.

The hat shaped shear web in front of the flap holds a stop acting onto a lever of the inner mixer and the control gate mentioned above acts as a stop in the other direction. At the outer mixer, levers have stops in form of grp plates attached to the mixer base.

2.2.5 Rudder Control System

The rudder is operated by 3,2 mm dia. (1/8" dia.) LN 9374 cables anchored to perforated plates attached to the left and right end of the front cross tube of the adjustable rudder pedals. This plate facilitates adjustment of minor inaccuracies of cable length and of pedal rake angle. From these perforated plates, the cables run upwards through the gooseneck guide tubes, and from their upper ends through Nylon tubes (fair leads), which guide them all way back to the rudder, see fig. 2.2.5-1.

At the rudder, the cables are attached directly to the lower rudder hinge by means of a bolt with lock pin.

Cable tension is maintained by springs at the rudder pedals. The rudder stops are located at the lower rudder hinge at the fin.

Fig. 2.2.4-1 Flap Control System in the Fuselage

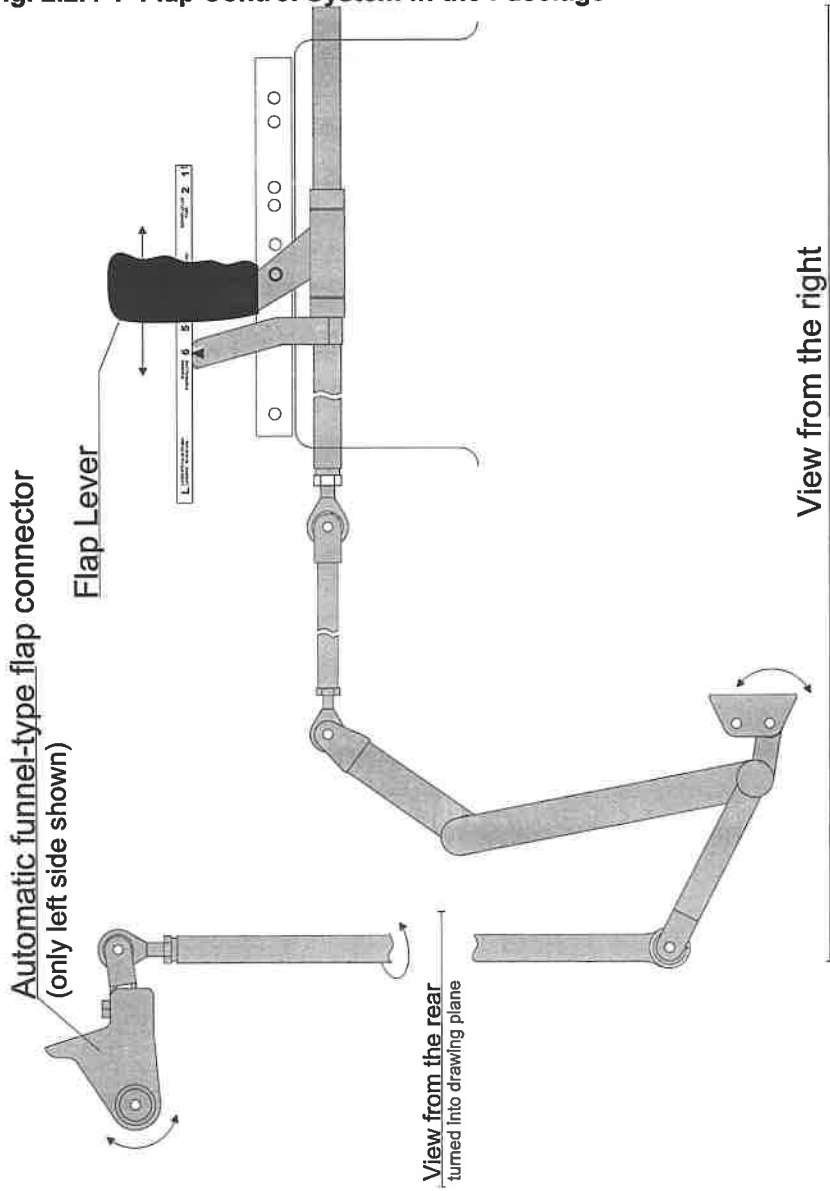
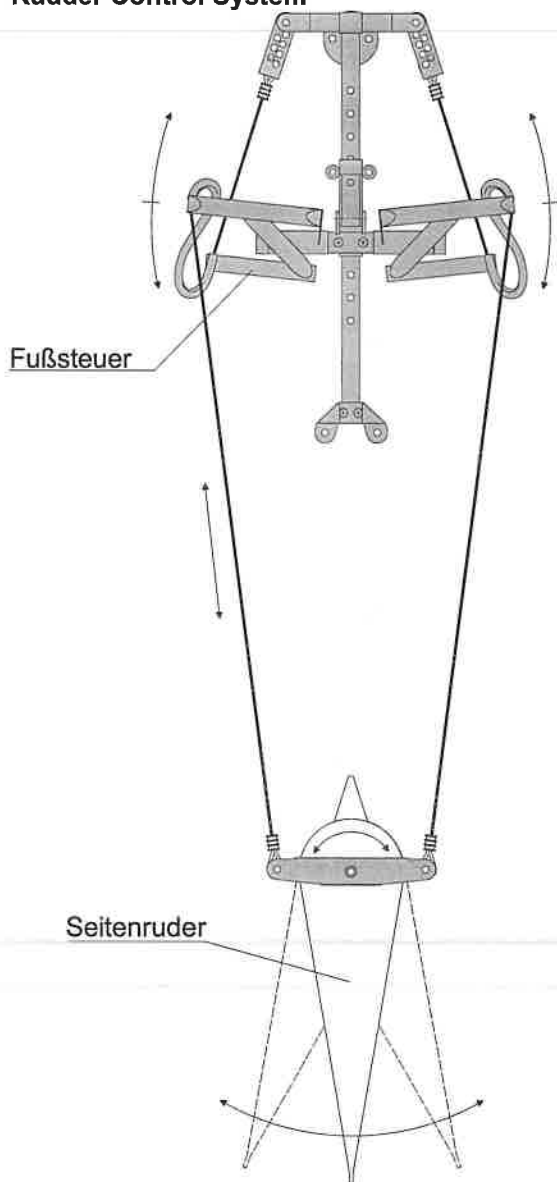


Fig. 2.2.5-1 Rudder Control System

2.2.6 Airbrake Control System

The airbrake control handle at the left-hand cockpit wall is mounted on a rod that runs in plastic sliders. The handle may be swivelled for ease of operation.

This rod is continued by a further rod which actuates a rocker-type crank assembly. This rocker crank is made of steel tube. From this mechanism, push rods lead to the automatic, funnel-type connectors at both root ribs (see fig. 2.2.6-1).

The right-hand connector also connects to and drives the main wheel master brake cylinder. This serves as the airbrake stop at the same time.

From the wing mounted, automatic hookup lever an aluminium push rod leads directly to the toggle lever in the airbrake box. A rubber bellow on this rod seals the airbrake box from the wing inside. From this toggle lever, a short rod drives the two airbrake swivel levers, connected by an adjustable rod. The three airbrake paddles are mounted on these swivel levers (see fig. 2.2.3-2).

Spring mounted cover plates on the upper airbrake paddles tilt forward when the airbrakes open. This helps to prevent sudden sucking out of the airbrakes at high speeds and lowers hand forces to retract the airbrakes.

2.6 Weight (Mass)

Span:		18m / 59ft	15m / 49ft
Maximum Take-Off Mass	with water ballast	600 kg	550 kg
		1322 lbs	1212 lbs
	for cloud flying	400 kg	400 kg
		882 lbs	882 lbs
Maximum Landing Mass:		600 kg	550 kg
		1322 lbs	1212 lbs
Max. mass of all non-lifting parts		285 kg	
		628.3 lbs	
Max. mass in the baggage compartment behind head-rest		12 kg	
		26 lbs	
Max. mass in the baggage compartment left side of landing gear box		5 kg	
		11 lbs	

NOTE: Water ballast in the fuselage belongs to the non-lifting parts !

2.7 Centre of Gravity

Centre of gravity range (for flight):

Span:	18m / 59ft	15m / 49ft	
foremost limit	217 mm 8.54 inch	213 mm 8.38 inch	aft of RP
rearmost limit	330 mm 12.6 inch	335 mm 13.1 inch	aft of RP

"RP" stands for "Reference Point"(Datum), which is located at the leading edge of the wing at the wing root rib. An example of a C.G. position calculation as well as a table of c.g. ranges at different empty weight is shown in Section 6.

2.8 Approved maneuvers

This sailplane is certified for use in normal gliding operation according to Airworthiness Category U, "Utility"; see also sections 2.7, 2.9, and 2.10.

Aerobatic figures are not approved.

5.2.2 Stall Speeds

Stall Speeds in km/h and kts Indicated Air Speed.

18m / 59ft			
Flap Set- ting	All up weight		
	355 kg / 783 lbs	450 kg / 992 lbs	600 kg / 1323 lbs
1	73km/h / 40kts	83km/h / 45kts	96km/h / 52kts
2	73km/h / 39kts	82km/h / 44kts	94km/h / 51kts
3	69km/h / 37kts	77km/h / 42kts	89km/h / 48kts
4	66km/h / 36kts	74km/h / 40kts	86km/h / 46kts
5	63km/h / 34kts	71km/h / 38kts	82km/h / 44kts
6	62km/h / 33kts	70km/h / 38kts	81km/h / 44kts
L	60 km/h / 32kts	68km/h / 37kts	78km/h / 42kts
L + Airbrake	67 km/h / 36kts	75km/h / 41kts	87km/h / 47kts

15m / 49ft			
Flap Set- ting	All up weight		
	345 kg / 760 lbs	440 kg / 970 lbs	550 kg / 1213 lbs
1	79km/h / 43kts	90km/h / 54kts	100km/h / 54kts
2	77km/h / 42kts	87km/h / 51kts	98km/h / 53kts
3	76km/h / 41kts	85km/h / 48kts	95km/h / 51kts
4	72km/h / 39kts	81km/h / 45kts	90km/h / 49kts
5	68km/h / 37kts	77km/h / 44kts	86km/h / 46kts
6	67km/h / 36kts	75km/h / 42kts	84km/h / 46kts
L	65km/h / 35kts	73km/h / 42kts	82km/h / 44kts
L + Airbrake	71km/h / 38kts	80km/h / 45kts	89km/h / 48kts

The speeds quoted are valid for the aerodynamically clean glider.

Stall warning in the form of buffeting will commence at about 7-10% above the indicated stall speeds.

Extension of air brakes increases the indicated stall speed in straight flight by 5 - 10km/h (3 - 5 kts). Extension of the landing gear has no influence.

Stall Speeds in Circling Flight

In circling flight the stall speeds increase due to the higher load factors.

Bank angle	0°	30°	45°	60°	75°
Stall speed in turns compared to straight flight	100%	107%	119%	141%	200%

Height loss and Pitch below Horizon

Height loss due to incipient spin from straight or circling flight depends largely on

- the all-up flight mass and c.g. position
- how quickly the pilot reacts
- the flap setting (more loss of height in more positive settings)
- turbulence of the air (lower stall speed achievable in still air, but more drastic wing drop)

Loss of altitude from straight flight: up to 70m (229 ft)

Loss of altitude from straight flight with airbrakes extended: up to 100m (330ft)

The cockpit nose may pitch 10° to 50° below the horizon.

Height loss from circling flight: up to 100 m (about 330 ft)

2.4 Water Ballast System

The nose section of the wing is directly used as water ballast tank (integrated tanks), extending over the complete span of the inner wing. Each wing can hold approximately 85 Litres (22.4 US-Gal), see fig. 2.4-1. The ventilation port is at the wing tip below the winglet, the ventilation line automatically connects to the outer wing. On the upper wing surface there is a filling opening, which is closed by a plug screwed in (see fig. 2.4-2). The drain port is situated about 0.3 m (1 ft) from the fuselage and about 23 cm (9 inches) behind the wing leading edge on the lower wing surface. There is a removable cover at each root rib, through which the valves can be accessed and the tank can be dried. When rigging the wings to the fuselage, the water ballast system is automatically connected.

At the nose of each root rib there is a drainage hole (fig 2.4-3), which has to be closed with a bolt before rigging. Gliders can be delivered with a foam plug on the fuselage side, which take over the function of these bolts automatically, but this makes rigging of the wings more difficult.

NOTE:

Even though fibres and epoxy resin have a very low diffusion rate, fibre reinforced plastic structures absorb moisture. Therefore it is important after flights with water, to dry out the interior of the wing tanks as well as possible. Otherwise the smooth surface of the wing deteriorates.

When the glider stays rigged after flights with water, open inlets and drain valves. When the glider was derigged, open the inlets and the drainage holes at the root rib or even the elliptic covers.

In the vertical fin, a water ballast tank of 5 Ltrs (1.3 US-Gal) can be installed as an option, to counteract the noseheavy moment of the wing ballast, see fig. 2.4-4. On the lower fuselage contour in front of the tail wheel the filling and dumping port is located. The valve sits directly above the port inside the fuselage. It is actuated with a Bowden cable. A ventilation port is found at left upper side of the fin.

A handle on the right-hand cockpit wall in the landing gear lever gate operates the valves of the wing water ballast. Two bowden cables lead to the fuselage sides opposite to the wing root ribs. When a fin water ballast tank is installed, its valve is also connected to this handle. The actuation of these valves by only one cockpit handle avoids inadvertent opening of one valve leading to asymmetric or tail heavy water load.

As an option a fuselage water tank of about 35 Ltr (9.25 US-Gal) can be installed, replacing the baggage compartment above and rear of the main spar. The filling and drain port of this tank is behind the landing gear doors. The valve is located on the fuselage inner side, right of the landing gear box. It can be accessed through the holes for the right battery and for the oxygen bottle. The ventilation is connected to a tube at the top of the canopy frame. This tank comes with an own handle and can be filled and drained independently from the wing and tail tanks.

CAUTION: *In order to avoid asymmetric water ballast the ballast valves must open equally and fully. This can only be checked with the glider rigged.*

CAUTION: *Grossly unequal filling of ballast can cause failure of the wing shells during a spin. Therefore, the water ballast system should be carefully maintained as follows:*

- Only clean water must be used for ballasting.
- Never fill direct from the water supply, by means of any pumps, or from a water tower. Even low pressures can damage the wing. A pressure head of about only 8 m = 0.8 bar (11.6 psi) will break the wing shells.

Water ballast tank in the wing

Inspection and dismantling of the valve (numbers refer to fig 2.4-2)

To access the water ballast valve in the wing unscrew the cover (2) on the root rib and the nut (1) at the end of the push-rod. The cover and the stainless steel tube (5) are connected with a bellow (3) on the inside. Therefore, after loosening the cover, primarily pull the stainless steel tube off from the brass rod (7) on which it is slid. Now, if necessary, you can change the gasket (9). To remove the valve assembly, unhook the spring (6) from the root rib and pull the axle (14). The axle is secured with two spring cotters (13), so you have to remove the one on the spar side with a pair of long nosed pliers first. Now the valve is loose and can be removed.

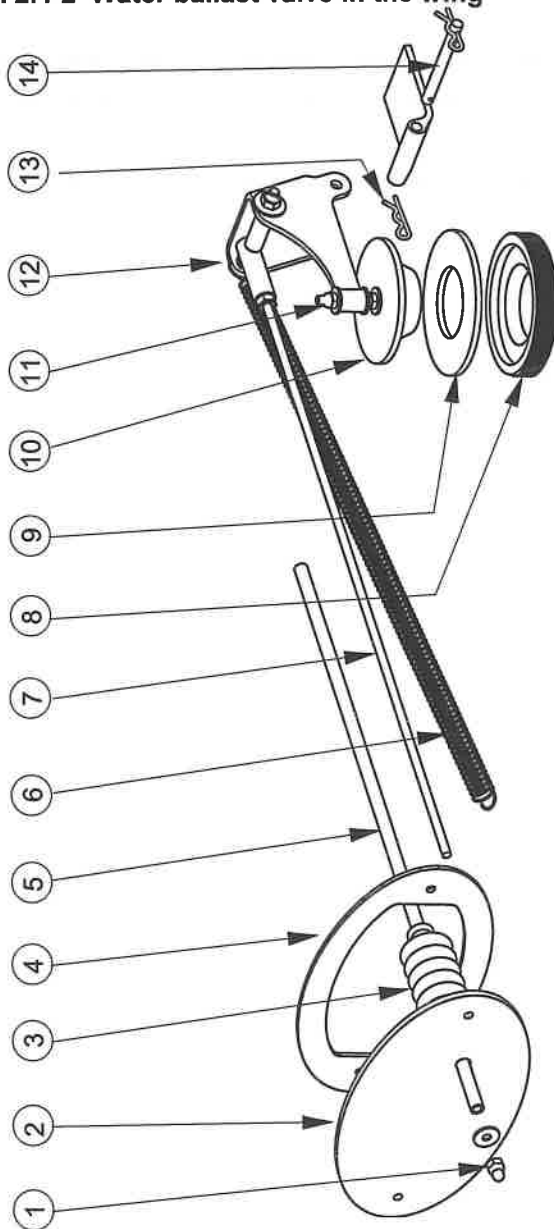
Refit the valve in reverse order.

Adjustments of the valve

In case that the water ballast valves in the wings drain uneven or do not open fully, they must be adjusted at the rockers in the fuselage by turning the lock nut at the threaded connector into or out of the Bowden cable.

If the valve is not tight, check the gasket (9) and the seal face (8) for damages. The plug (10) has some play and can compensate misalignments between seal face and valve lever (12). It can be helpful to allow more play for the plug by loosening the nut (11) on its top, but care must be taken, that it is not possible for the plug to swing so far that it jams with the seal face.

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Fig. 2.4-2 Water ballast valve in the wing

Testing for leakage

Low pressure leaking test with max. 0,1 bar (1.4 psi, 10 kPa).

Close the drain hole in the root rib nose, or better, rig the glider. Level the wings. Close the drain valve, fill the wing tanks with water and screw the plug in place. Insert a suitable connection into the ventilation hose at the end rib at the outer wing joint, air tight with an elastic and transparent hose of about 1m. Hold the hose in a vertical position and fill up a water column of max. 0,8 m (2.5 feet).

After one minute for setting the pressure, mark the level at the hose.

The water column must not go down for the following **ten minutes!**

When integrated water ballast tanks are leaking, the manufacturer of the sailplane has to be contacted.

Tail water ballast tank

Inspection

The valve and the tank are permanently installed in the tail. The valve can be inspected through the drain port. When the valve is open, its gasket can be exchanged with a pair of long nosed pliers.

Adjustments of the valve

The valve can be adjusted at the counter holder of the Bowden cable in the cockpit behind the handle

Testing for leakage

Attach the filling hose with its adapter to the filling/exit port in an airtight manner.

Open the valve and fill the fin tank with water until a column of about 1m (3.3 feet) is measured relative to the lower contour of the fuselage.

The ventilation port at the upper left fin surface must be closed air tight!

After one minute for setting the pressure, mark the level at the hose.

The water column must not go down for the following **ten minutes!**

When water ballast tanks or the valve in the fin is leaking the manufacturer of the sailplane should be contacted.

Fig. 2.4-3 Drainage hole in the root rib

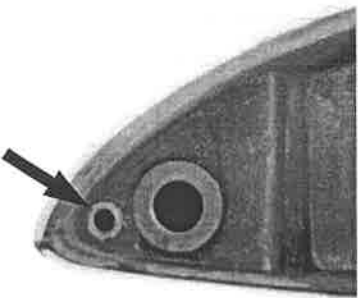
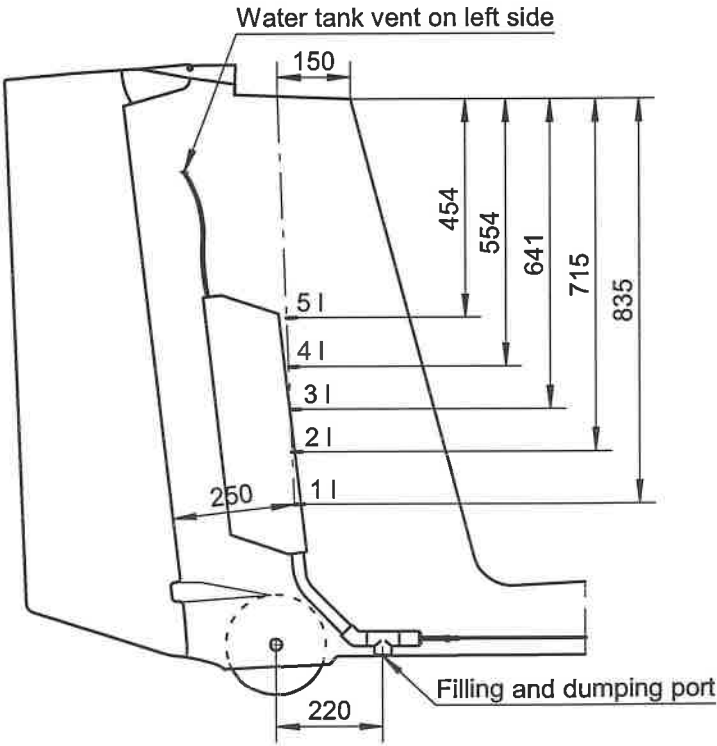


Fig. 2.4-4 Water tank in the fin



Fuselage tank

Removal of the fuselage water tank

Remove the hose clamp on the lower tank surface. Then screw off the fitting (one quarter bend) from the bottom of the tank. Remove four bolts (spanner 13 mm) at the rear canopy frame. Pull the tank carefully forward and out. Put the drain fitting back to the drain hose and safety with the hose clamp so that the drain hose cannot drop into the control gear below and jam it. Install baggage compartment partition above/rear of the spar.

Refit the tank in reverse order. Seal the thread of the bend with new Teflon sealing tape!

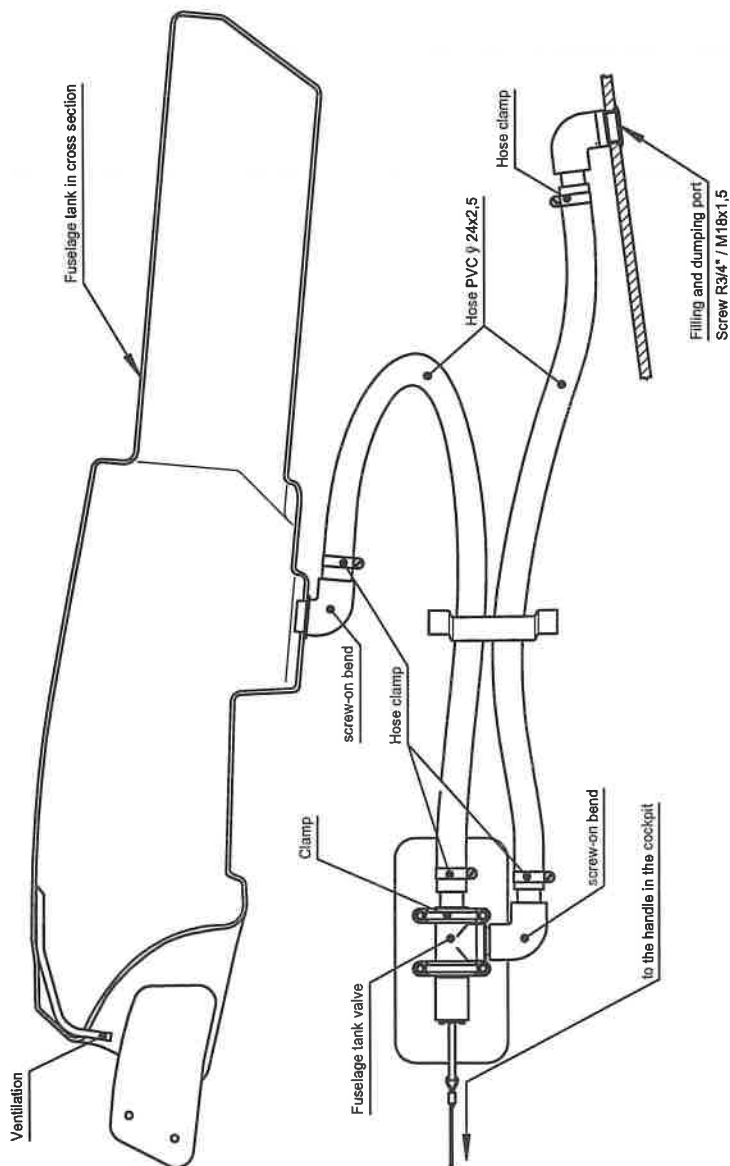
WARNING: *When the fuselage water tank is removed the baggage compartment floor above and behind the wing main spar must be installed, so that no loose items can get from the cockpit or the baggage compartment in front of the spar into the area full of control gear behind and below the spar.*

Inspection and dismantling of the valve

The valve is attached to the fuselage shell with two clamps. The hoses can simply be pulled off after loosening the hose clamps. If the assembly of the cockpit handles is screwed off from the gate of the landing gear handle, this gives more way for Bowden cable. The 90° elbow can be screwed off from the valve and its interior can be accessed.

For refitting of the valve, seal the thread of the elbow with Teflon sealing tape!

Fig. 2.4-5 Water tank in the fuselage



Adjustments of the valve

The valve can be adjusted at the counter holder of the Bowden cable in the cockpit behind the handle

Testing the fuselage water ballast tank

Fill the tank with water and close the valve. Connect an elastic and transparent hose of about 1m to the ventilation of the tank. Hold the hose in a vertical position and fill up a water column of max. 0,8 m (2.5 feet). After one minute for setting the pressure, mark the level at the hose.

The water column must not go down for the following ten minutes!

Fig. 2.4-6 Handles for water ballast

In case an optional fuselage water ballast tank is installed, its dumping valve is operated with an own handle:

