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Flight Manual

for the motorglider

DG-400

This manual belongs to the Motorglider DG-400
and is always to be carried on board

German Data Sheet No.: 826

Factory Serial No.:	
Year of Contruction:	
Registration No.:	

Owner: .....
.....
.....

Issued: Sept. 1982

The original German Language edition of this manual has been approved as operating instruction according to "§ 12(1) 2. of Luft-Ger Po"

LBA approved: Nov. 22-1982

Manual ammendments

No.	Page	Description	Date	Sign.
1	17,18,19, 22a,22b, 37,38,40, 44,46,47, 59,60	supplementations and corrections	May 83	O.
2	2a,9,19, 25,64,65	Manual revisions TN 826/6	June 84	O.
3	19	Increased weight of non lifting parts TN 826/8	July 84	O.
4	13,35	Fast method to start the engine TN 826/9	July 84	O.
5	17,20,21,25, 31,33,34,58, 62	Manual revision TN 826/10	July 84	O.
6	13,14 15	fuel gauge calibration	Aug.84	O.
7	3,11,17,18, 19,22a,b,26, 31,33,35,37, 38,40,44,47, 59,61,64,65	manual revisions, see TN 826/12	Sept.85	O.
8	10,24	Marking of canopy emergency release and ventilation TN 826/16	June 86	O.
9	9,11,15,17, 25,26,28,29, 31,35,40,45, 46,47,48, 50,50a,59	Manual revision TN 826/17	Febr.87	O.
10	29	Engine extension-retraction TN 826/18	Febr.87	O.
11	1,2,17a, 20,23,28,42, 46,47,50,50a	Manual revision TN 826/20	April 88	O.

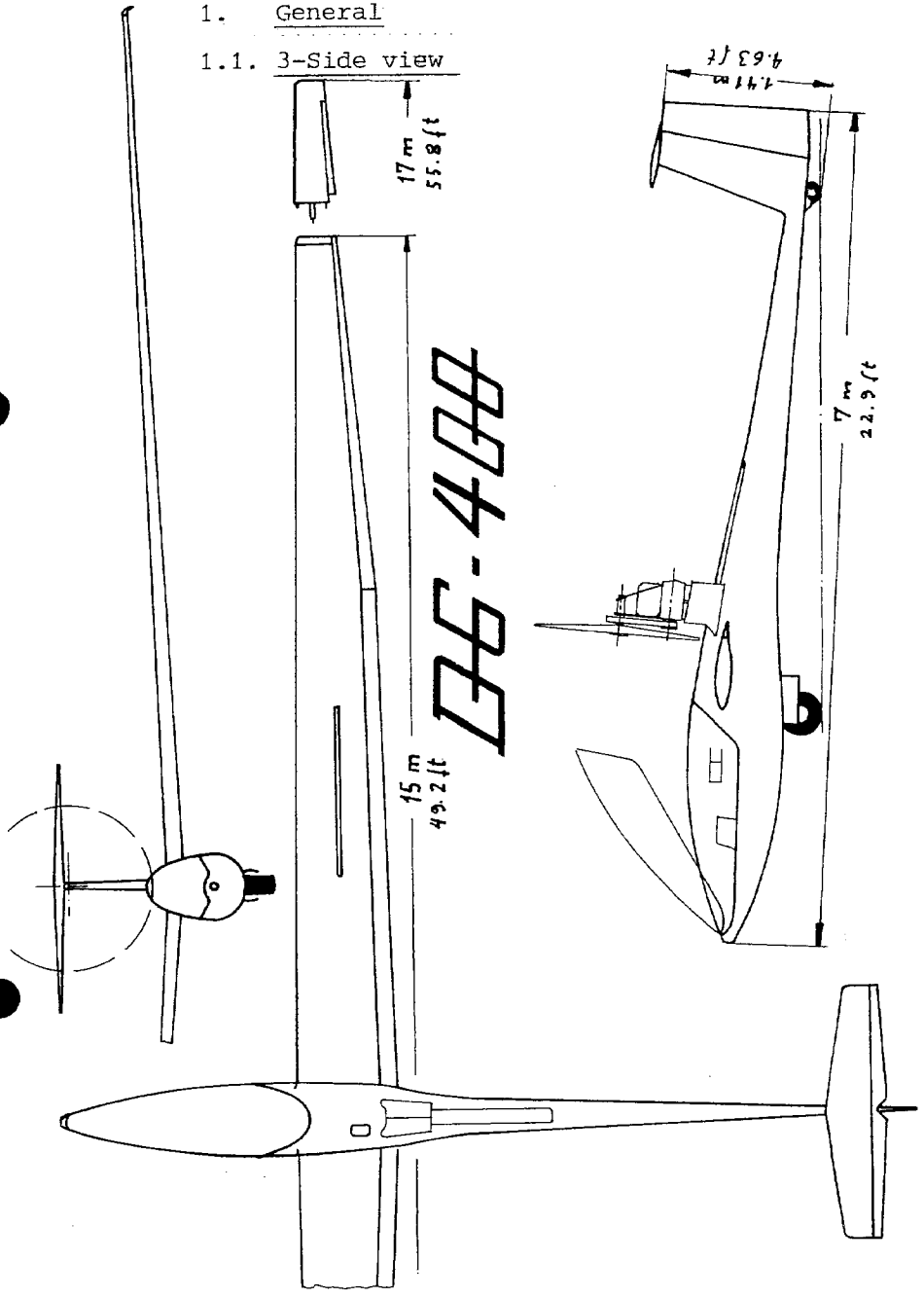
Manual ammendments

No.	Page	Description	Date	Sign.
12	23,36,61	Additional tow hook for aerotow TN 826/21	Oct. 89	
13	6,7,9,11,12, 29,31,34,35, 35a	Option BEA automatic propeller brake - engine retraction TN 826/23	Sept.90	
	These ammendments must be included only if a BEA is installed.			
14	1,2,2a,19, 23,28,37, 43,45,59, 61,62,64	Manual revision TN 826/24	Aug. 91	
15	2,2a,26,28, 45,61,65 remove page 17a	Manual revision TN 826/26	Aug. 92 Nov. 92	
16	19	Manual revision TN 826/35	Mar. 97	
17	1,6	Propeller (Option) TN 826/36	June 97	
	These ammendments must be included only if TN 826/36 has been executed.			
18	9a	Parking brake combined with an airbrake securing device (Piggott-Hook) TN 826/40	Jan. 01	

End of JAR 22 required and LBA approved part

1. General

1.1. 3-Side view



1.2 Description

The DG-400 is a single place self launching high performance sailplane with retractable power plant.
With 15 meter wingspan - FAI Racing class or with insertable wing tips for open class flying with 17 m wingspan.
Apart from the engine installation, the DG-400 has the same layout, handling and performance as the DG-202/17C (carbonfibre).

Technical Details

Wingspan	m (feet)	15 (49,2)	17 (55,8)
Wingsurface	m^2 (ft^2)	10 (107,6)	10,57 (113,8)
Aspect Ratio	/	22,5	27,34
Fuselage			
length	m (feet)	7 (22,90)	
width	m (feet)	0,63 (2,07)	
height	m (feet)	0,81 (2,66)	
Max.Water ballast	kg(lbs)	90 (198) (option)	
Wing fuel tanks	lit(US gal.)	30 (8) (option)	
Fuselage fuel tank	lit(US gal.)	20 (5 1/4)	
Unusable fuel	lit(US gal.)	0,3 (.08)	
Max.weight	kg (lbs)	480 (1058)	460 (1014)
Wing loading with weight 390 kg (860 lbs)	kg/m^2 (lbs/ft^2)	39 (8)	36,9 (7,56)
Max.wing loading	kg/m^2 (lbs/ft^2)	48 (9,83)	43,5 (8,91)
Flap settings		-10° to +12° (L1)	

Description of the components

Wings and Flaps	:	CFRP-foam-sandwich-skin. CFRP-Rovings
Ailerons - Elevator	:	CFRP-skin
Fin and Rudder	:	GFRP-foam-sandwich-skin
Fuselage	:	GFRP-skin, in engine bay strenthened with CFRF

Undercarriage : Retractable assisted by a gas strut, spring mounted

Tyre : 5.00 - 5 (Ø 362 mm), internal drum brake 4 PR or 6 PR fully sealed (landing gear box).

Tailwheel: Stearable tailwheel - Tyre 200 x 50 2 PR.

Cockpit: In flight adjustable rudder pedals and adjustable seat back for either automatic or manual parachutes, adjustable head rest.
Large single piece clear plexiglas canopy, hinged at the nose supported by a gas strut.
Instruments and instrument panel covered by a housing which is held on by 6 screws - easily removable for unhindered access to instruments.
Controls for undercarriage, dive brakes and flaps are on the left hand side of the cockpit.
Parallelogram control column stick for the elevator. This eliminates PIO's in rough air.
Release lever for elevator trim on control stick.
Controls for throttle , choke and propeller brake are on the left hand side of the instrument panel.
Digital engine instrumentation and electrical switches are all in one housing in the instrument panel (DEI). Main switch and engine elapsed time indicator are in a panel on the right hand side.
Switch for engine extension/retraction is on the control stick.

Dive Brakes: Schempp-Hirth dive brakes on the upper wing surface.

Tailplane: T-Tail with conventional stabilizer-elevator and spring trim.

Engine: Rotax 505 with dual electronic ignition.Manufacturer: Bombardier-Rotax in Gunskirchen, Austria.
Type:-aircooled 500 cubic cm. 2 cylinder two-stroke engine. Drive belt reduction 2:1.
Take-off power (for 5 min.max.) - 31,7 kw (43 HP) at 6200 RPM.

Propeller: HO 11 F - 128 B 84
1280 mm diam.
Manufacturer: Hoffmann Rosenheim Germany
or as an Option
MT 136 R 75 - 1 B 1360 mm diam.
Manufacturer: MT-Propeller Straubing Germany

Engine noise level:
With the Hoffmann propeller, the DFVLR's official noise - level reading was 51.9 dB(A) (at max.continuous power - 6100 RPM).
The official german maximum allowable noise level is 68 dB(A).

Engine retraction mechanism:
Electric spindle drive with ball screw shaft. The opening and closing of the engine bay doors is automatic.

Fuel system: Fuselage Tank - 20 litre (5 1/4 US gal.) usable fuel.
Wing fuel tanks are available as options with 15 lit. (4 US gal.) in each wing.

Water ballast system:
45 litre (11.8 US gal.) water ballast bags are available as options. Both water ballast bags and wing fuel tanks can be installed in the wings.

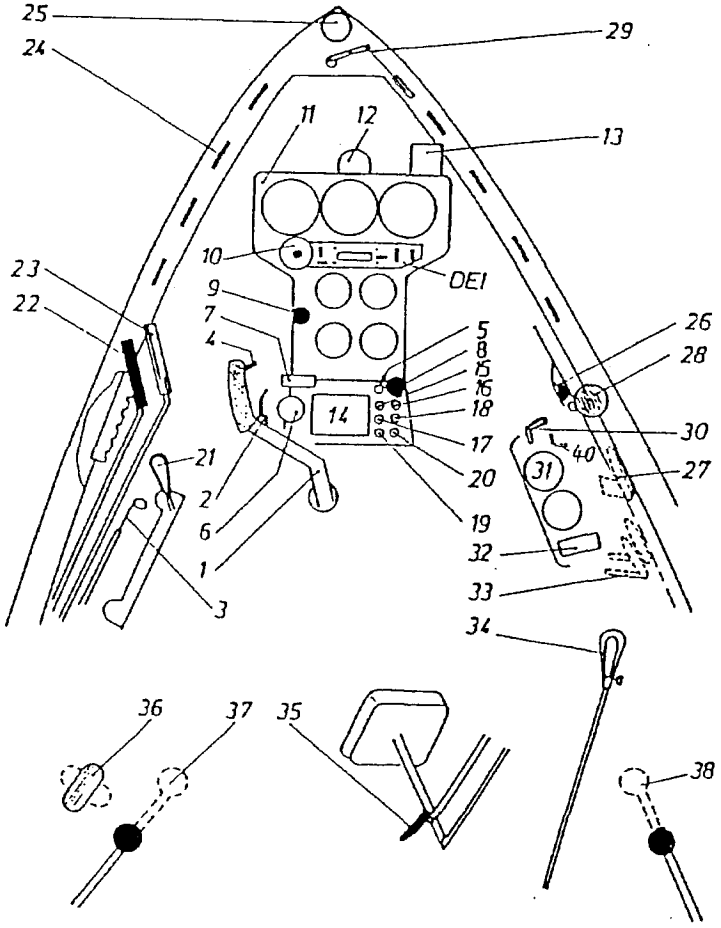
Colour: White - registration numbers grey (RAL 7001)

Option BEA automatic propeller brake - engine extension retraction

With the BEA Option the following functions are different from the DG-400 standard.

1. The extension - retraction switch at the control stick is not necessary in flight. If this switch is operated, the engine travels into the end position, even if you release the switch. Stopping the engine travel in an intermediate position is possible by lifting the red coverplate of the emergency switch.
2. Engine extension-retraction in flight is by operating the ignition switch. Ignition on = engine extension
   Ignition off = engine retraction
3. The propeller will be stopped by an electric brake, when the ignition is switched off.
   As soon as the propeller moves in the retraction position, the engine retracts by itself. This means, that it is not necessary to operate the manual propeller brake and the extension - retraction switch at the control stick.
   The electric propeller brake can be switched off in case of malfunction with the switch 40 see page 12.
   Note: The BEA is only working with the DEI switched on (Avionik + engine).

1.3 Description of the cockpit, the controls and details



1) Control Column - Parallelogram type

2) Release lever for the trim mechanism - green.
To change the aircraft trim, the release lever should be pulled back, the control column brought to the required position and the release lever allowed to spring forward again.

3) Trim position indicator and trim preselection lever

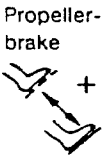
If the automatic trim mechanism (see 2 above) needs further adjusting (high speed flying), loosen the release lever and adjust by pushing forward the indicator lever.

4) Actuating switch for the engine extension - retraction mechanism
left = retract
right = extend

5) Circuit breaker for the extension - retraction motor 7,5 A.

6) Tow release knob - yellow.

7) Propeller brake lever - grey



8) Rudder pedal adjustment knob - black
By pulling on the knob, the locking pin will be disengaged and the rudder pedals can be pulled back towards the pilot or pushed forward away from the pilot.

9) Choke (black)

pulled out = choke on
pushed in (forward) = no choke

10) Throttle lever with starter button (see DEI description)

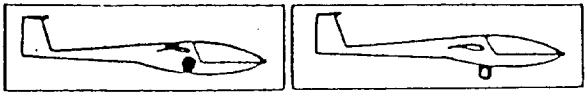
) Instrument Panel

After removing the side screws at the base 2 x M 6 and the screws attaching the cover to the panel 4 x M 4, the cover can be removed towards the nose. The instrument panel remains attached to the aircraft.

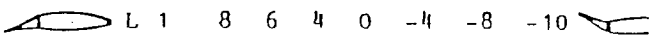
12) Compass installation position.
13) Rear view mirror for checking propeller position. Can be folded down towards the pilot during soaring flight.
14) Radio installation position.
15) 1,6 A fast fuse - engine control and indication circuit.
16) 10 A medium fuse - battery charging circuit, protection against overcharging (voltage regulator) failure).
17) 2,5 A medium fuse - radio.
18) 1 A medium fuse - electric vario.
19) 4 A medium fuse - socket in baggage compartment.

Option BEA: The electric propeller brake is protected by this fuse.

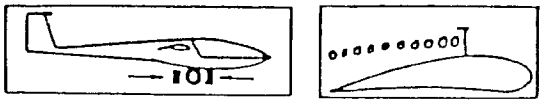
20) 2,5 A medium fuse - turn and bank or artificial horizon (gyros). All the above fuses 15 - 20 are G fuses 250 V with indicator 5 x 25 mm. The coloured indicator can be easily seen through the glass top of the fuse when it is blown.
21) Undercarriage retraction - extension lever.
black forward - undercarriage down
back - undercarriage retracted
The undercarriage is locked in the extended position by an overcentre locking arrangement, and an additional safety catch at the handle. The handle is to be turned to the cockpit wall.



22) Flap handle - black.



23) Airbrakes handle - blue
The wheel brake is operated at the end of the air brake handle travel.



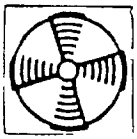
23cont.)

Optional: parking brake combined with an airbrake securing device (Piggott-Hook):

Pull the airbrake handle back to actuate the wheelbrake and push the handle to the cockpit wall. A detent will engage in one of 4 notches to hold the system in this position.
In case the airbrakes mistakenly haven't been locked, a detent engages in one of 4 notches to avoid inadvertent deployment of the airbrakes. To open and to close the airbrakes the operating handle must be rotated into the cockpit so far, that the detent passes the notches.

24) Constantly open anti fooging air vents

25) Main air vent



26) Air vent operating knob - pushed in - closed
pulled out- open

27) Canopy opening lever - red
towards the nose - closed
into cockpit - open

28) Emergency canopy release - red
pull to release.
Note: for emergency release first open the canopy opening 27) and second the release knob 28). The spring will open the canopy at the nose far enough to be blown away by the oncoming air.

29) Locking mechanism for the emergency canopy release.
towards the front - locked.

Checking the emergency release on the ground:
Pull the emergency release knob, the canopy should spring open 1 - 2 cm at the nose, even with the normal canopy opening lever closed.

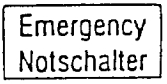
Reinstalling the canopy:
Pull the canopy hinge into the open position, replace the emergency release spring, two people are required to hold the canopy - one at the nose the other at the rear. The emergency release locking mechanism should be in the open position, place the canopy on the hinge and press down - relocate the locking mechanism.

30) Main switch - red.
towards the nose - on
towards the tail - off

The whole electrical system will be mechanically isolated by switching off the main switch. Without the key in place, the DG-400 cannot be operated.

31) **Engine elapsed time indicator**
The engine elapsed time indicator is connected to the generator and operates only when the engine is running and when the generator fuse is in. Installation can also be in the instrument panel or in the relais compartment access cover when oxygen system instrumentation is installed in the side panel.

32) Emergency switch - red.



By lifting the red switch cover, the black emergency extension - retraction slide switch can be operated. - This switch should only be used in an emergency. See emergency procedures (part 3).
Note: Do not operate the sliding switch with the red cover not switched up.

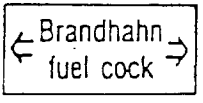
Option BEA: The automatic engine extension - retraction is switched off by lifting the red cover plate.
To execute the preflight inspection or maintenance work use the emergency switch to extend the engine to an intermediate position.
After this work extend the engine completely.
Don't forget to switch down the red cover plate again.

33) Water ballast dump levers - silver
upper lever - right hand water bag
lower lever - left hand water bag
forward - valve closed
into the cockpit - valve open

34) Squeeze pump for backrest adjustment airbag - with air release screw.
The airbag backrest adjustment should only be used for minor comfort adjustment. For major backrest adjustment a harder material like a foam block approximately 300 mm x 250 mm should be used.

35) Adjustment lever for the head rest. Should the clamping force not be strong enough, tighten the other three mounting bolts.

36) Fuel cock - red
Set in the same direction as the fuel line - open.
Perpendicular to the fuel line - closed.

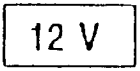


37) Left wing fuel tank selector rod - black

towards the nose - open
towards the tail - closed

38) Right wing fuel tank selector rod - black

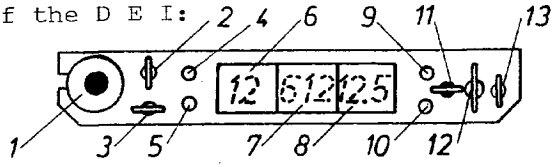
39) (Not shown on sketch). Socket in the rear bulkhead of the baggage compartment for battery charger connection and external power supply for fuel pump etc. Only activated with the main switch on.



40) **Option BEA**
Switch for the electric propeller brake
To operate the switch the toggle has to be pulled out first (safety lock against inadvertant operation).
Switch in position "auto" = toggle to the front (normal position)
The propeller will be braked automatically when the ignition is switched off.
Switch in position "off" = toggle to the rear
The electric propeller brake is switched off.
Use the manual brake.
Only to be used in case of malfunction (e.g. brake is activated with ignition "on").

Note: Even in the "off" position of switch 40 the extension and retraction of the engine is automatic when operating the ignition switch.

Description of the D E I:



throttle Starter

1. Throttle,
The starter button is located in the centre of the throttle. The starter button activates the starter relay only when : 1. The ignition is switched on, 2. The engine is extended, 3. The engine is not running.

2) Ignition switch ignition up = on ⇒ 1. Ignition on 2. Retraction circuit isolated, 3. Starter circuit on. 4. Fuel pump on.
down = off ⇒ 1. Ignition off
2. Extension retraction circuit free, 3. Starter circuit isolated, 4. Fuel pump off.
To operate the switch, the toggle has to be pulled out first - (safety lock against inadvertent operation).

3) Test switch for the two ignition circuits test
Switch in the middle I+II - both ignition circuits activated
Switch to the left I - No I ignition circuit activated
Switch to the right II - No II ignition circuit activated.
The switch is spring loaded such that it will always return to the middle position. (I + II).

4) Warning light engine door off - rear engine compartment door closed, flashing yellow light - rear engine compartment door open. This light indicates if the engine is in fully extended or retracted position.

5) Start Warning light. - Green light = engine can be started - ie starter circuit is free.
Light is off - engine cannot be started (e.g. engine not fully extended, ignition switch is off, or engine is already running).

6) Digital display for the fuel level in the fuselage tank - in liters.To set the fuel gauge see item 14).
Fuel liter

7) Digital display for engine RPM's x 10 engine speed
RPM x 10 ie 602 means 6 020 rpm.

By exceeding the maximum continuous RPM of 6100 rpm, a blinking double point will appear before the last digit in the display ie 6 1:1
By exceeding the maximum RPM of 6800 RPM, the whole display will start blinking.

ie 6 8:1

8) Digital display for cylinder head temperature CHT in °C and battery voltage - switching from one readout to the other is done via switch 11.
C H T °C Battery V
When the maximum allowable CHT of 250°C is exceeded or when the battery voltage exceeds 14,7 V or is lower than the minimum allowable 11 V, the whole display will start blinking regardless of which readout is selected.
(Note, the CHT readout disappears when the temperature is below 0°C - this is not an instrument failure).

9) Red warning light for propeller position Prop L
(propeller level).

Warning light blinking	- propeller is not in the vertical position - engine cannot be retracted
Warning light out	- propeller is in the vertical position - engine can be retracted.

The engine retraction circuit is interlocked with the warning light circuit. Should the propeller move out of the allowable vertical positioning range during retraction, the warning light will start blinking and retraction is automatically stopped.

The engine should then be fully extended and the propeller positioned vertically again.
In an emergency the engine can be retracted with the propeller not in the vertical position or even running using the emergency switch.

10) Control light [Gen]

on-red = Generator is not loading the battery
off = Generator loading

11) Digital readout selector switch - CHT or battery voltage.
left [CHT] = cylinder head temperature readout
right [batt] = battery voltage readout

12) Change over switch from static pressure to total energy pressure for the variometer.

up [stat] = Vario operating on static pressure
= for engine running flight
down [T E] = Vario operating total energy probe
= soaring flight

13) Change - over switch - soaring flight - engine on flight

up [Avionik + engine] = The total electrical system is on line

down [Av] = only soaring flight instrumentation on line
radio and electrical plug in baggage compartment included.

14) Fuel gauge calibration device
To get a correct reading a calibration is necessary with every filling. Therefor the tank is to be filled completely.
Two different systems are existing:
a) manual system: turn the adjustment screw in hole 14 with a small screw drives until "21" is displayed.
b) half automatic system: press the set button in hole 14 with a pin or a ball pen for a short moment. The gauge will display "21" or "22".

2. Operating Limitations

2.1. Airworthiness Category "U" Utility (Airworthiness-requirements JAR 22).

2.2. Approved Flight Regimes

1. Flights according to VFR (day light)
2. Cloud flying is permitted when properly instrumented see 2.3 (Not permitted in the USA and Canada)
3. Simple aerobatics
   The following aerobatic manoeuvers are approved:

   Spins
   Inside Loop
   Stall turn
   Lazy Eight
   Chandelle

   Aerobatics are only allowed without ballast in the wings and with the engine retracted.

2.3. Required minimum equipment

As required minimum equipment only the instruments and equipment specified in the equipment list (maintenance manual section 6) or in the master equipment list are to install.

Airspeed Indicator
Range: 0-300 km/h (0-165 kts)
Speed range markings:

Green arc	90-190 km/h	48-103 kts.
White arc	82-190 km/h	44-103 kts.
Yellow arc	190-270 km/h	103-146 kts.
Redline at	270 km/h	146 kts.
Red "L" at	150 km/h	80 kts.

(max. speed with wing flaps in the landing setting L 1)

Yellow triangle	100 km/h	54 kts.

(recommended approach speed)

Blue radial line	90 km/h	48 kts.

(V_y best climb speed power on)

Note: The airspeed indicator is to be connected to the front static ports.

Altimeter
Measuring range 6000 m or 10000 m, 1 turn max. 1000 m
20000 ft. or 33000 ft, 1 turn max.3000 ft.

Engine speed indicator

Fuel gauge
These 2 instruments are incorporated in the DEI (digital engine indicator). Measuring range and markings see 1.3.

Magnetic compass (compensated in the aircraft)

Engine elapsed time indicator (connected to the generator, to count only when the engine is running).

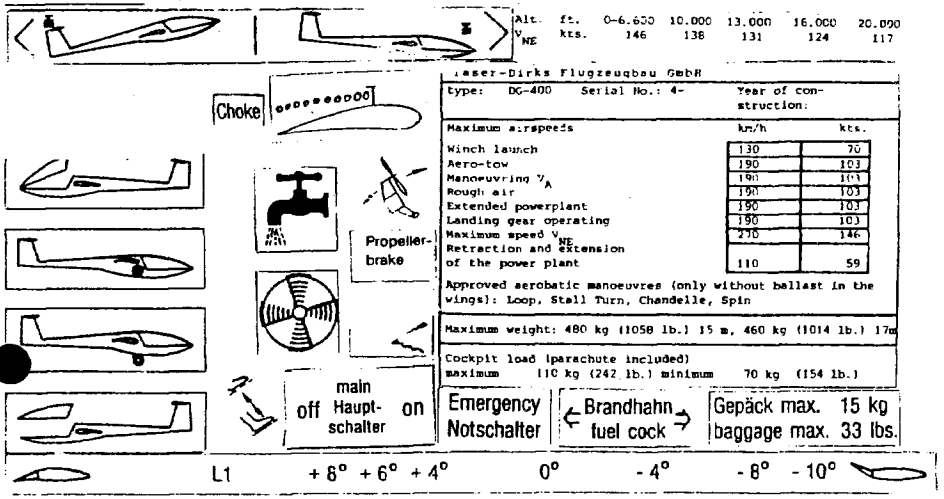
Rear view mirror

Four piece symmetrical safety harness

VHF-transceiver with noise absorbing earphone

Parachute automatic or manual type or a back cushion approximately 8 cm (3 inches) thick.
Required placards, check lists and this flight manual

Placards: (position of the placards s.Maint.manual diagr.11)



Glaser-Dirks Flugzeugbau GmbH

type: DG-400 Serial No.: 4- Year of construction:

Maximum airspeeds	km/h	kts.
Winch launch	130	70
Aero-tow	190	103
Manoeuvring v_A	190	103
Rough air	190	103
Extended powerplant	190	103
Landing gear operating	190	103
Maximum speed v_{NE}	270	146
Retraction and extension of the power plant	110	59

Approved aerobatic manoeuvres (only without ballast in the wings): Loop, Stall Turn, Chandelle, Spin

Maximum weight: 480 kg (1058 lb.) 15 m, 460 kg (1014 lb.) 17m

Cockpit load (parachute included)
maximum 110 kg (242 lb.) minimum 70 kg (154 lb.)

In addition for cloud flying (Not permitted in the USA and Canada)

Variometer
Turn and bank
Experience has shown that the installed airspeed system may be used for cloud flying.

2.3 ctd. **Required minimum equipment**

RPM-Indicator

Range	0	-	7000 rpm
green arc	2000	-	6100 rpm
yellow arc	6100	-	6800 rpm
red line at			6800 rpm

type VDO Cockpit 333 230 026 016
or VDO 333 230 105 002

This RPM-Indicator must be installed additionally to the DEI, until the DEI will have been approved by the LBA.

remove / unserviceable

2.4 Airspeed Limits

The following indicated airspeeds are not to be exceeded.

		km/h	kts.
Maximum permissible airspeed	V_{NE} =	270	146
Maximum airspeed with the engine extended	V =	190	103
Maximum airspeed in rough air	V_B =	190	103
Manoeuvring Speed	V_A =	190	103
Maximum airspeed for flap settings + 4°, + 8°	V_{FE} =	190	103
Maximum airspeed for flaps in landing position	V_{FE} =	150	80
Maximum airspeed for landing gear operating	V_{LO} =	190	103
Maximum airspeed for aero tow	V_T =	190	103
Maximum airspeed for winch launch	V_W =	130	70
Maximum airspeed for retraction and extension of the power plant	V =	110	59

Remarks:

Rough air is air motion such as wave rotors, storm cloud turbulence, dust devils and turbulence that one often encounters near mountain tops.

The manoeuvring speed is the highest speed at which it is allowed to apply full control deflections. At maximum airspeed only deflections of up to 1/3 full deflection are allowable.

Attention must be paid to the fact that at higher altitudes the true airspeed is greater than the indicated airspeed.

This fact has no influence on the strength and the aerodynamic loads on the sailplane. But for flutter prevention the following indicated airspeeds are not to exceed:

Altitude in meters	0-2000	3000	4000	5000	6000
V_{NE} indicated km/h	270	256	243	230	218
Altitude in ft.	0-6600	10000	13000	16000	20000
V_{NE} indicated kts.	146	138	131	124	117

2.5. Engine operating limitations

Take off RPM (for 5 minutes max.)	6200 RPM
Max. RPM (transient)	6800 RPM
Max. continuous RPM	6100 RPM
Idle RPM	2500 RPM
Max. cylinder head temperature (CHT)	250°C

2.6 Fuel

Approved fuel grades: Car super gasoline leaded or unleaded, min. 95 octane (RON)

or: AVGAS 100 LL (only if car super gasoline is not available)

or: mix 50% AVGAS 100 LL and 50% Car super gasoline unleaded min. 92 octane (RON)

mixed with self mixing Super quality two stroke oil - specifiation TSC 3 respective API TC or higher quality. Mixing ratio 1:50.

Caution: Empty the fuel tank for extended storage periods (more than 3 months). Don't use this fuel in the glider again.

2.6. Maximum G-Loadings

The following G-Loadings are not to be exceeded:

at Manoeuvring airspeed	VA	+ 5.3	- 2.65
at Maximum airspeed	VNE	+ 4	- 1.5

2.7 Weights

Empty weight without instruments	approx. 296 kg	652 lbs	15 m
	approx. 300 kg	661 lbs	17 m
Maximum weight	480 kg	1058 lbs	15 m
	460 kg	1014 lbs	17 m

The maximum weight without ballast in the wings has to be calculated as follows:

G = GNT + G(wings) see weight record page 21

maximum weight for the nonlifting parts:

GNT = 320 kg 705 lbs for 15 and 17 m wing span.

2.8 Center of gravity locations

The permissable in-flight center of gravity range is

250 mm to 390 mm
9,84 inches to 15,35 inches

behind datum (leading edge of the wing root rib)

this is 36 % to 56 % of the mean aerodymamic wing chord.

2.9 Loading chart

With the cockpit loads as specified in the table of page 21, the C.G. limits will not be exceeded. With lower pilot mass necessary lead ballast must be added in the seat. Ballast put on the seat (lead ballast cushion) must be fastened at the connections of the seat belts.

To determine the empty weight C.G. and its limits consult the maintenance manual page 47 and 48.

The maximum weight is not to be exceeded.

The maximum weight of the nonlifting parts will not be exceeded if you don't exceed the max. weight without waterballast as specified in the table of page 21.

Baggage: Maximum 15 kg (33 lbs)
Heavy pieces of baggage are to be secured to the baggage compartment floors (screwing to the floors or with belts). Each floor can support 7,5 kg (16,5 lbs).

Waterballast (Option) and **fuel in the wingtanks** (Option)

Each wing water tank has a capacity of 45 l or 11,8 US gal. The permissable maximum amount of water ballast and fuel in the wings is dependent on the actual empty weight and the fuselage loading and must comply with the diagram 1 (ballast chart) limits.

Flight with the engine removed
For this purpose no extra C.G. determination is necessary if you follow the instructions in section 6.3

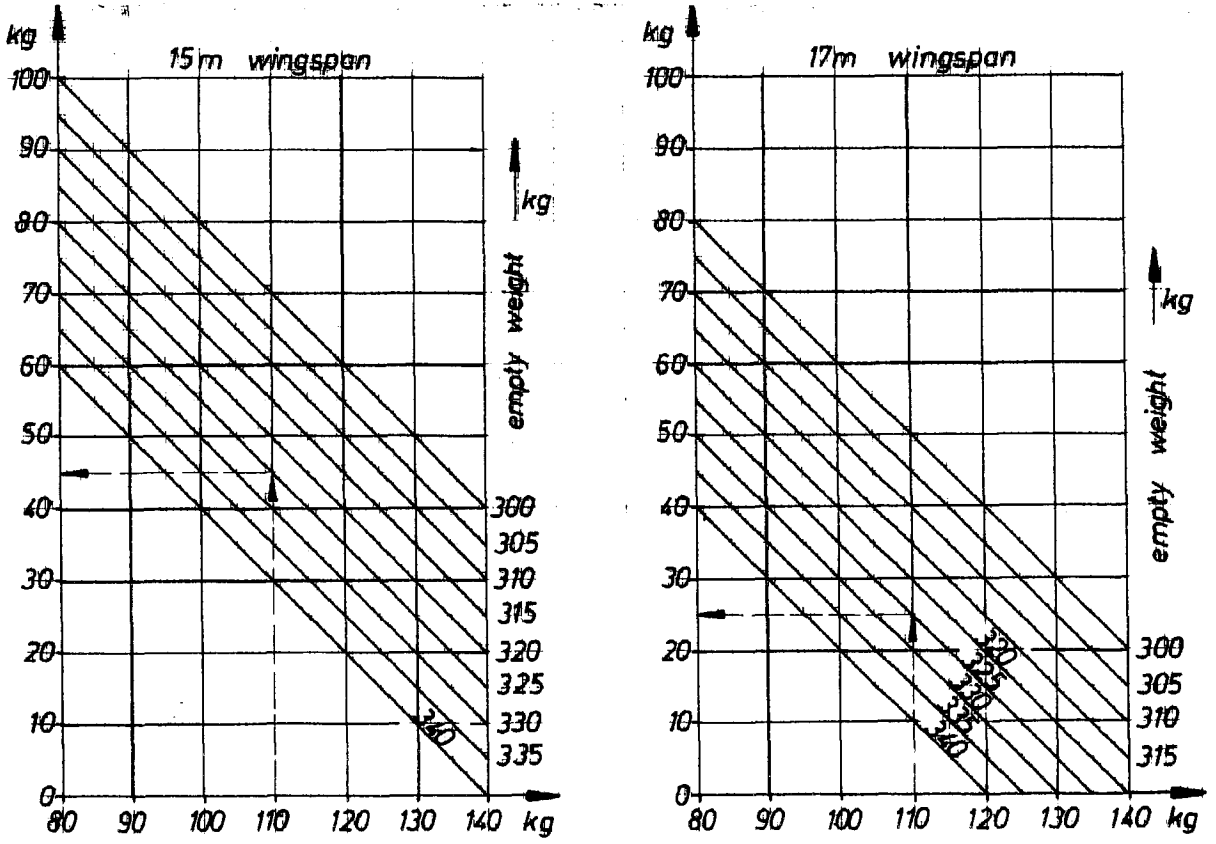
2.9 Record of weight and ballance

Weighed on:			
Mechanic:			
Equipment list dated:			
Empty weight:	15m	kg lbs	
	17m	kg lbs	
Empty weight C.G. behind datum	15m	mm inch	
	17m	mm inch	
Maximum weight wing without wing ballast	15m	kg lbs	
	17m	kg lbs	
Minimum cockpit load		kg lbs	70 154
Maximum cockpit load		kg lbs	110 242

The result of every new weight and balance (see maintenance manual page 47 and 48) is to enter into this table.

DG-400 ballast chart diagram 1 a

for determination of max. waterballast and fuel in the wings metric



fuselage load (pilot, parachute, baggage, fuel (max. 14 kg))

max. waterballast fuel + fuel

22 a metric

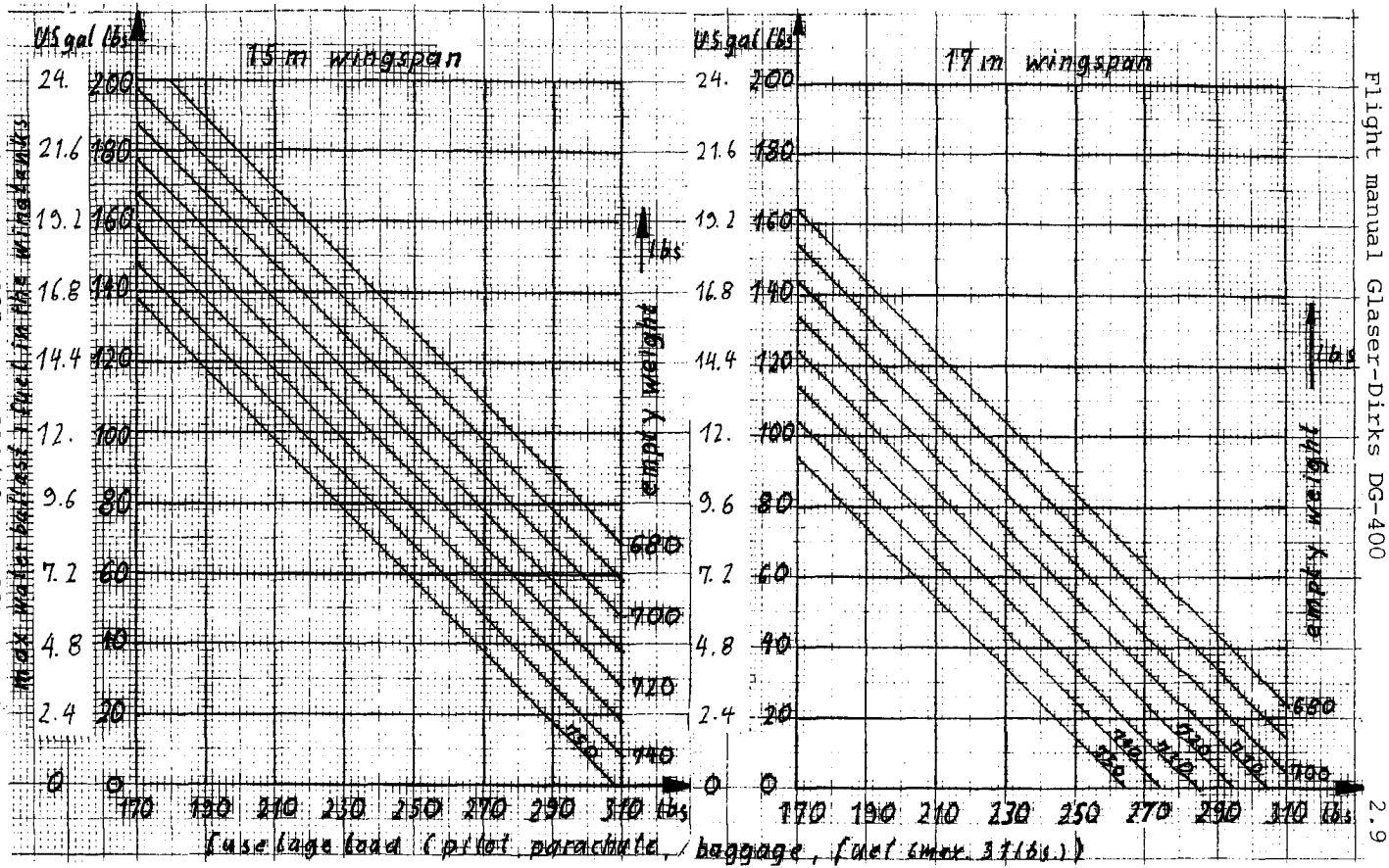
LBA approved Sept. 1985 TN 826/12

DG-400 ballast chart

for determination of max. waterballast and fuel in the wings

diagram 1 b

english measures



LBA approved Sept. 1985 TN 826/12 22b english measures

2.10 Tow Release

Special tow release "SH 72" for winch launch and aero tow (Version SH 72 DG).
Additional as option "Nose release E 75" or "E 85" only for aerotow (installed underneath the instrument console) (Version E 85/1-85).

2.11 Weak Links

Winch launch and aero tow nominal strength	5000 ± 500	N
	500 ± 50	daN
	1100 ± 110	lbs

2.12 Tire Pressure

Mainwheel	3	bar (42 PSI)
Tailwheel	2	bar (28 PSI)

2.13 Crosswinds

The maximum crosswind component according to the airworthiness requirements for take-off and landing is 15 km/h (8 kts).
For take-off with crosswind refer to section 4.3.4.

2.14 Length of the towing cable

Length of the towing cable for aerotow 30 - 70 m (100 - 230 ft.).

2.15 Max. air temperature for self launch

The max. air temperature at sea level for which engine cooling was demonstrated is 38°C (100,4° F).

3. Emergency Procedures

3.1. Spin Recovery

Apply rudder opposite to spin direction, pause, then ease stick forward, after rotation has stopped neutralize the controls and carefully pull out of the dive. The ailerons should be kept neutral during recovery. Pushing the flaps to -10° expedites spin recovery when spinning with positive flap settings. Waterballast in both wings does not influence recovery.

3.2. Canopy jettison/Bail out

To bail out open the red canopy opening lever and pull the red emergency release knob. The canopy will be opened by a spring and blown away by the oncoming air. The low sides of the cockpit allow for a quick push-off exit.
To bail out the engine should be retracted. If there is no time for a normal engine retraction you may retract the engine with the propeller still turning via the emergency switch (see section 3.8).

3.3. Recovery from unintentional cloud flying

Spins are not to be used to lose altitude. In emergency, pull out the spoilers fully before exceeding a speed of 190 km/h and fly at 190 km/h (103 kts) until leaving the cloud.
At higher speeds pull out the spoilers very carefully by reason of high aerodynamic and g-loads.

3.4. Landing wheel up

Even on soft fields the DG-400 can be landed with the landing gear extended. With the stick pulled back during roll out there is no danger of nosing over. Only in the case of an extremely short landing field the pilot should choose to land wheel up.
After a gear up landing the tow release and its cable deflectors must be checked for damage. All damaged parts must be replaced before the next take off.

3.5. Rain and Icing

1. Influence on flight characteristics
   Rain and light icing raise the stall speed and landing approach speed slightly. The sink speed is raised remarkable. The climbing speed is reduced by 1/3.

2. **Water ballast**
When the OAT (outside air temperature) sinks under 0° C (32° F) there is a danger that the water ballast may freeze. It must be dumped before possibly freezing and damaging the wings!

3.6 **Landing with only one tank filled**
If you suspect, that water did not flow out of one tank, or if you have emptied only one wing fuel tank, you have to set the flaps to -10° after touch down.

Approach should be done with +12° flap setting.

3.7 **Starting the engine with the starter not working:**

In flight:
Extend the engine, pull out the choke halfway, push in the throttle 1 cm (1/2 inch), switch on the ignition , speed up as fast as possible to ca. 170 km/h (92 kts) until the engine starts. Then flair out with max. 2 g. From the beginning of speeding up to the lowest point of the procedure you need ca. 150 m (490 ft). Therefor you should not start this procedure below 400 m (1300 ft) above ground. Otherwise a safe outlanding is to prefer.

On the ground:
If the starter relay is defective you may start with external power (e.g. from your car battery): Fix a cable from the negative pole of the external battery to the screw connection of the starter at the rear propeller mounting plate. Hold a cable from the positive pole onto the positive pole of the starter. The starter will turn immediately.

Note: Keep clear from the propeller.
The same procedure may be executed when the aircraft batteries are emptied.
Do not press the starter button during this procedure!

Handstarting the engine is prohibited.

3.8 Retraction or extension of the power plant with the normal mechanism not working

Switch the red emergency switch cover on the right side panel up. Now the black sliding switch normally covered by the emergency switch is free.
Slide to the front = extension
Slide to the rear = retraction
This procedure is only to follow in an emergency as all safety devices (e.g. against retraction of the engine while running) are bypassed.
Note: Do not operate the sliding switch with the red cover not switched up.

3.9 Engine failure

3.9.1 Power loss during take off

Push the control stick forward immediately, watch the airspeed indicator!

Sufficient runway
- land normally straight ahead with engine extended
- flaps L 1
- airbrakes as desired

Insufficient runway
- judge based on position, terrain and height
- turn off fuel cock, switch off ignition and main switch
- engine reduces L/D to 13!

3.9.2 Power loss during flight

Push the control stick forward immediately, watch the airspeed indicator!

Check
- fuel quantity?
- fuel cock position?
- choke closed?

If no change, retract the engine or land with extended engine.

3.10 Fires

3.10.1 In engine during take off on the ground

- switch off main switch and turn off fuel cock.
- keep engine extended
- use extinguisher, cloth or suitable external means

3.10.2 In engine during starting in flight
- switch off main switch and fuel cock
- open throttle
- close choke
- keep the engine extended
- land as soon as possible
- extinguish fire

3.10.3 In the fuselage
Front fuselage (electrical fire)
- search for the source
- main switch off
- close ventilation, open side window
- land as soon as possible if the fire is not damped (circuits are effective protected by fuses)

Rear fuselage (engine)
- main switch and fuel cock off
- if smoke prevents flying open ventilation
- land as soon as possible
- extinguish fire

3.11. Loss of electrical power in flight

3.11.1 With the engine retracted:
Continue flying as a sailplane.

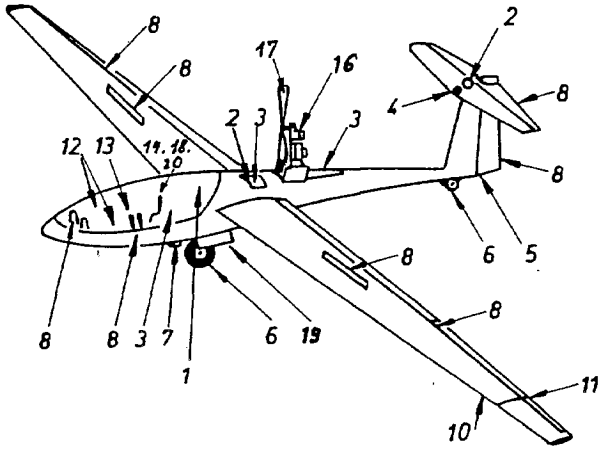
3.11.2 With the engine extended not running:
Look for a landing field to do a safe outlanding.

3.11.3 With the engine extended and running:
Don't stop the engine.
Fly to the next airfield and land with the engine running.
If you fly with car super-gasoline the fuel supply may be unsufficient over 2000 m (6600 ft) due to vapour bubbles in the fuel line.
Then reduce throttle and fly at lower altitude.

4. Normal operation

4.1 Daily Inspection

1. Are the main wing pins in and secured?
2. Are the control quick connections properly fastened?
   Check fuel filter for dirt and sludge.
3. Any foreign objects?
4. Is the stabilizer secured?
5. Check the rudder for hinge play and proper locking of connections.
6. Check the tire and landing gear.
   Dirt in the front strut can hinder the landing gear from locking over center the next time!
7. Hook-up check. Is the tow release clean?
8. Check all control surfaces for free movement and play.
9. Look for flaws such as bubbles, holes, bumps and cracks in the surface.
10. Are the removeable wing tips rigged correctly? Are the locking pins completely engaged (flush with wing surface)?
11. Are the wing tip ailerons correctly connected?



12. Are the batteries installed? Flight without the batteries is not allowed due to C.G. reasons.
13. Are the battery fuses OK ?
14. Check fuses and circuit breaker (see sect. 1.3 No's. 5, 15-20).
15. Check extension-retraction mechanism by running it in both directions. The extension time should not exceed 13 sec.!
    Note: If you cannot extend the engine with the switch at the control stick nor with the emergency switch check the circuit breaker first. Otherwise see page 64 No. 1 (power plant trouble shooting).

16. Visual check of the engine (extend engine)
    Extending the engine to an intermediate position is possible with the emergency switch see page 11 item 32.

    a) Check all bolts and screws and their respective safety locking.
    b) Check the proper functioning of the throttle, choke and propeller brake.
    c) Check the ignition boxes, ignition cables and sparkplug connections for tightness.
    d) Check the drive belt for any wear.
       Check the drive belt tensioning.
       A sudden loosening of the drive belt tension could indicate damage at some point of the engine assembly.
    e) Engine retaining cables and their connections in the engine compartment should be checked.
    f) Check for any signs of wear on fuel lines, electrical cables or structural parts etc.
    g) Check the muffler, engine mount assembly and accessories for any cracking.
    h) Apply strong forward pressure on the propeller shaft, thereby check if the screwed connection of the propeller mount to the engine block became loose or damaged.

17. Visual check of the propeller, check if the propeller became loose.
18. Check the fuel level.
19. Drain condensed water from the fuel tank. The drainer is located in the undercarriage box on its rear wall.
20. Check function of instrumentation and radio. Also check the fuel gauge if the read out corresponds to the amount of fuel in the tank.

4.2. Cockpit Check

1. Lead ballast (for under weight pilot)?
2. Parachute worn properly?
3. Safety harness buckled?
4. Seat back and pedals adjusted?
5. All controls and knobs in reach?
6. Altimeter?
7. Dive brakes cycled and locked?
8. Control check? (One person at the control surfaces).
9. Trim?
10. Canopy locked?

Additional checks before self launching

11. Fuel level
12. Canopy open - propeller clear?
13. After starting the engine - close canopy.
14. Check magnetos.
15. Check engine RPM.
16. Check the fuel flow.

For items 14 - 16 above - see section 4.3.1.

4.3 Self launching

4.3.1 Starting the engine on the ground

a) Ignition - off.
b) Main switch - on.
c) Switch on DEI to Avionik + Engine
d) Engine extension switch on control stick to the right and hold in position until the extension mechanism motor stops, release the switch.
The extension time should not exceed 13 sec.!
Note: If you cannot extend the engine with the switch at the control stick nor with the emergency switch check the circuit breaker first. Otherwise see page 64 No. 1 (power plant trouble shooting).
Option BEA: To extend the engine it is sufficient just to kick the switch at the control stick to the right.
The engine will fully extend.
Note: The extension procedure can also be activated by switching on the ignition. This should only be done when the engine shall be started immediately after extension.
e) Check that the engine door warning light is off.
f) Ignition switch - on (note: the toggle has to be pulled out for switching).
With the ignition on, the green control light in the DEI must be on.
g) Pull choke out fully for a cold engine, otherwise only half.
h) Push throttle approx. 1.5 cm (.6 in.) in.
i) Check that the propeller is clear.
j) Press the starter button until the engine starts.
Doing so move the throttle in and out a little.
k) Increase the throttle a little.
l) Push the choke in slowly so that the RPM increases. Push the throttle in a little more.
m) Increase the RPM to 3000, check each ignition circuit (magnetos). A maximum drop of 300 RPM is allowed.
n) Check the full engine RPM - thereby a helper is needed to push against the nose of the aircraft. Min. 5800 RPM.
o) Check the fuel flow.
With the engine running at full throttle switch over to Avionik (thereby the electric fuel pump is switched off). If a drop in engine RPM can be heard, you should not take off. The fuel filter is too dirty and should be either replaced or cleaned. See maintenance manual page 32 sect. 3.4.1 point 3.

4.3.2. Starting problems

a) If the engine (mostly in a half warm condition) does not start within 10 sec, it could probably be flooded. In such a case, push the choke back in fully, apply full throttle and press the starter button. When the engine starts, slowly reduce the throttle setting. If the engine should still not start within 10 sec, try again using the normal starting procedure.

b) If the engine starts normally but runs with under 2000 RPM, and when the throttle is increased the RPM's drop still further, the engine is running on only one cylinder. Not enough fuel is being delivered to the other cylinder. First pull the choke out until the engine almost stops running, then slowly push the choke back in and increase the throttle. This procedure might have to be followed several times until the problem clears up.

4.3.3. Start roll

Set the flaps at -4° and trim in the middle. The start can be made with one wing on the ground. With a crosswind, the intowind wing should be on the ground if there is no helper to assist with the start. Apply throttle slowly until the aircraft is rolling, then slowly apply full throttle. By applying full throttle right from the start, especially with a soft field, the DG-400 will end up resting on its nose rather than rolling forward. Should this occur, reduce the throttle slowly, so that the tailwheel gets slowly back to the ground to prevent from high impact loads.

4.3.4. Take off

Lift the wing thats on the ground using aileron when the speed is high enough to make them effective. With the wings level, the flaps can then be set at +6°. With soft grass strips the lift off can be enhanced by setting the flaps to landing position. After lift off, the flaps should once again be slowly brought back to +6° for the climb.

When starting with crosswind, use full back stick and a flap setting of -10° to keep the tailwheel on the ground until the airspeed is high enough for the rudder to be fully effective, then use the above normal procedures for take off.

4.3.4. After take off the DG-400 should be trimmed to 90 km/h (49 kts) and the climb should proceed at this airspeed. After attaining a safe altitude, retract the undercarriage. During climb maintain full throttle for smooth engine run.
If the engine speed is to high (6200 RPM allowed for 5 minutes!) decrease the airspeed accordingly, but not below 80 km/h (43 kts.)

Take off distance:

Data for dry grass, no wind, proper condition of engine, propeller and sailplane.

S_R = take off roll S = Take off distance to 15 m (50 ft.) height

Altitude M S L	ground temperature		15m 480kg 1058				17m 460kg 1014			
			S_R		S lbs.		S_R		S lbs.	
	°C	°F	m	feet	m	feet	m	feet	m	feet
0	-15	5	208	682	277	909	154	505	244	800
	0	32	219	719	292	958	162	532	257	843
	15	59	230	754	307	1007	170	558	270	886
	30	86	243	797	324	1063	179	587	285	935
500 m	-15	5	219	718	292	958	162	531	257	843
	0	32	230	754	307	1007	170	558	270	886
1640 feet	15	59	245	804	327	1072	191	627	288	945
	30	86	257	843	343	1125	190	623	302	991
1000 m	-15	5	230	754	307	1007	170	558	270	886
	0	32	246	807	328	1076	182	597	289	948
3280 feet	15	59	260	853	347	1138	192	630	305	1001
	30	86	274	899	366	1201	202	663	322	1056
1500 m	-15	5	246	807	328	1076	182	597	289	948
	0	32	261	856	348	1142	193	633	306	1004
4920 feet	15	59	276	905	368	1207	204	669	324	1063
	30	86	290	951	387	1270	214	702	340	1115

Note 1: Concrete runway shortens the take off by 10%.
Note 2: 10 km/h (5,4 kts.) headwind shortens the take off by 25%
Note 3: 10 km/h (5,4 kts.) tailwind increases the take off distance by 35%.
Note 4: 50 kg (110 lbs.) reduction in weight shortens the take off by 30%.

4.3.5 Stopping and retracting the engine in flight

1. Lift the rear view mirror so that half the upper drive belt pulley is visible at the top edge of the mirror.
2. Bring the throttle back to idle.
3. **Option BEA:** Check if the switch for the propeller brake is in "auto" position (normal position).
4. Fly at approx. 90 km/h 849 kts.). Set flaps at 0°.
5. Switch the ignition switch off. Slow down the engine using the propeller brake. During the last rotations the propeller should turn very slowly as with a sudden stop the propeller may stop beyond the desired vertical position.
   Option BEA: With the electric propellerbrake switched on it is not necessary to operate the manual brake. The following items 6, 7 and 9 must not be regarded.
   The propeller will be braked automatically and will be turned by the airstream into the retraction position. The engine retracts automatically.
   Note: After retraction of the engine the controllight "engine door" must stop shining.
   If this is not the case (the limit switch does not switch) the BEA does not cut off the current to the spindle drive and the 7.5 A circuit - braker will pop out.
   Remidial measures: Switch off the DEI (position "Avionik") directly when the engine is retracted or retract the engine with the emergency switch according to sect. 3.8.
   Press in the circuit braker when popped out.
   Adjust the limit switch after landing.
6. If the propeller should stop in any other position, release the propeller brake and increase the airspeed to 100-110 km/h (54-59 kts) until the propeller starts turning again. Stop the propeller in the vertical position using the propeller brake, ensuring the propeller warning light is no longer flashing. Should the propeller brake not work properly (weak), the airspeed should be reduced when the propeller is brought to the vertical position.

4.3.5 ff.

7. Keep the propeller brake on during the entire engine retraction. (The warning light should not come on). The engine is retracted by pushing the switch on the control stick to the left. Hold the switch in this position until the retraction motor stops. Should the switch be kept in the extension or retraction position too long after the motor has stopped, the 7,5 A circuit breaker will pop out.
8. Set the switch on the DEI to "Avionik". With only short gliding flights ie. saw tooth cross country flights, the switch can be left on the "Avionik + engine" setting.
9. **Note:** The fastet method to retract the engine is to press the retraction switch already when turning the propeller into the vertical position.
   As soon as the propeller comes into the vertical position the retraction motor starts. Hearing this you have to pull the propeller brake.

4.4. Restarting the engine in flight

1. With the engine extended but not running, the rate of sink at 90 km/h (49 kts) increases to 1.8 - 2 m/s (3.6 - 4 kts.).
   this is a glide angle of 13!
   Therefore restarting the engine should only be done over landable terrain and not below 500 m (1650 ft) above ground. But it is better to restart the engine at 200 m (660 ft) over a landable field rather than at 500 m (1650 ft) over a forest or unlandable scrub. Should a flight be conducted over a wide expanse of unlandable terrain, the engine should then be restarted at 1000 m (3300 ft) above ground level so that if the engine does not start, all the emergency starting procedures can be followed in peace including retraction of the engine if necessary.
2. In a normal restarting situation the loss of altitude from starting the extension procedure until the engine is running is only about 20 m (70 ft).

4.4 ff.

3. Extension: Fly at 90 km/h (49 kts) with flap -set setting 6°. Main-switch on. Switch on DEI to "Avionik + engine", engine extension switch on control stick to the right and keep it there until the extension motor stops. Release the switch.
Note: If the switch is kept on too long after the extension motor stops, the 7,5 A circuit breaker will pop out.
Option BEA:
It is not necessary, to operate the switch at the control stick. Instead you switch on the ignition. By this the engine extends automatically. Press the starter button already during extension, so that the starter motor engages as soon as the engine is in the extended position (similar to item 6 operation without BEA).
4. Pull the choke out fully when the engine hasn't been used for a longer time (cold) otherwise only half or no choke with a warm engine (ie saw tooth flight see sect. 4.6.2.). Push throttle 1-2 cm (.4-.8in). in, switch the ignition switch on (note the toggle has to be pulled out for switching). With the ignition on, the green control light in the DEI must be on.
Press the starter button. As soon as the engine starts apply more throttle. Push the choke back in, apply full throttle and rotate to climbing attitude. With starting problems see sect. 4.3.2.
Engine starting can also be done with the 7,5 A circuit breaker popped out.
5. If the circuit-breaker is popped out, it must be pushed in again after some seconds.
6. **Note:** The fastest method to extend and start the engine is to switch on the ignition and press the starter button already during engine extension. When the engine is nearly fully extended, the starter motor will start working. Make shure that you press the extension switch until the engine door light stops flashing.

4.5 Aerotow-winch launch

Due to the towhook position in the middle of the fuselage (underside) and due to the excellent effectiveness of the ailerons and rudder, the possibility of wing dropping or ground loops, even on a slow starting aerotow is reduced. Take-off with strong crosswind is possible.

Aerotow

a) If only a C.G. release is installed, then the aerotow is to be executed with this release. Set the trim full nose down for aerotow.

b) If an additional tow release for aerotow is installed, only this release should be used for aerotow. Adjust the trim for aerotow so that the indicator is 1 cm (0.5 inch) behind the forward position.

c) General: Set the wing flaps to -4°.
Hold the stick in the trimmed position.
As soon as aileron control is achieved, set the flaps to 4°. Don't try to lift off before you reach an airspeed of 80 km/h (43 kts) (without ballast).
On a rough airfield hold the control stick tight. The undercarriage can be retracted at safety height during the tow.
Normal towing speed is 120-130 km/h(65-70 kts).
For a cross country tow the speed can be as high as 200 km/h (108 kts), the flaps should be at a negative setting (see sect. 4.6.3).

Winch launch (only allowed at the C.G. release)
Set the wing flaps to + 8°.
Set the trim nose down for a winch launch.
Use the normal winch launch procedure.
After reaching 60 m (200 ft) gradually pull back some on the stick so that the glider will not pick up excessive speed.
After reaching release altitude pull the tow release knob.
Recommended winch launch airspeed 110-120 km/h (60-65 kts).

Caution: Don't fly with less then 90 km/h (49kts) and not more than 130 km/h (70 kts).

4.6 Free flight

4.6.1 Stall characteristics (engine extended and retracted)

At stall speed the DG-400 begins to mush, there is no abrupt stall. The ailerons remain effective. Pulling up will induce the DG-400 to stall forward or over one side. A little forward stick and if necessary, opposite rudder will recover the sailplane with minimum loss of height. Rain influences these characteristics negligibly and stall recovery is accomplished without losing more than 40 m (130 ft) altitude.
With the engine extended, the resulting turbulences at the tail will cover up most of the stall warning.

Stall airspeed in knots

Wing loading		flap setting							
lbs	**kg**								
ft²	m²	L1		+8		0°		-10°	
		km/h	kts	km/h	kts	km/h	kts	km/h	kts
7.8	38	67	36	69	37	72	39	82	44
8.2	40	69	37	71	38	74	40	84	45
9.2	45	73	39	75	41	78	42	89	48
9.8	48	75	41	77	42	81	44	92	50

4.6.2 Cross country flight with the engine

a) The engine assisted cross country flight should be made in the sawtooth profile if possible. Climb at 90 km/h (49 kts) up to 2000m(6500 ft) MSL. Retract the engine and glide. You should at least glide down 500 m (1600 ft) to be economical. The maximum range will be obtained by using a Mc Cready ring setting of 0 ie 110 km/h (59 kts) air speed. Under optimum conditions you can fly 19 km per litre fuel at an average speed of 102 km/h (55 kts).

19 km/l = 39 nm/US gal.
= 45 stat.m/US gal.

A more practical cross country flight can be achieved by using a Mc Cready ring setting of 1m/s (2 kts) ie 140 km/h (76 kts). Thereby under optimum conditions you can fly 16 km per litre (39 nm/gallon) at an average speed of 120 km/h (65 kts).
Extension of the engine for a restart should only be done over landable terrain and at an altitude of at least 500 m (1600 ft).

b) If the use of the sawtooth cross country flight technique is not possible due to low cloud cover or airspace restrictions, a normal engine on cruise flight can be carried out. The cruising speed would be between 135-140 km/h (73-76 kts) at 6100 RPM with a fuel consumption of 18-19 litre/h. This results in approx. 7,5 km/litre (18 stat.m./US gallon) or (15 nm/US gallon).
Flap setting -4°.

Please make the choise of flight route and altitude so as to always be within reach of a landable terrain should the engine fail. The airworthiness requirements for the engines of powered sailplanes are not so severe as those for aircraft and so you can't expect the same reliability.

4.6.3 High speed flying: Flap settings 0°, -4°, -8°,-10°.

The parallelogram stick configuration adds to the stable flight characteristics of the DG-400. It helps to reduce the possibility of pilot induced oscillations. The DG-400 may be trimmed at any speed up to maximum. At high speeds the stick should be held at all times.

Do not exceed the maximum airspeed of 270 km/h (146 kts).
Do not exceed 190 km/h (103 kts) with the flaps in the +4° or +8° settings or with the engine extended.

In engine on flight over 140 km/h (76 kts), the throttle should be reduced. The max. allowable engine RPM are not to exceed. Longer sinking flight with the engine at idle should not be done since the supply of lubricating oil in the engine is too small. Should such sinking flight be unavoidable, then throttle should be applied every 60 sec so that enough lubricating oil is supplied to the engine.

4.6.4. Thermaling

Use flap settings +4° and +8° (6.1). Thanks to the long fuselage the DG-400 is directionally very stable.

Uneven lift can be optimized because of the excellent roll rate (45° to 45° in 3,5 -4 sec.). The DG-400 is docile at slow speeds for centering in thermals.

4.7. Cloud flying (not permitted in the US and Canada)

Take care to fly cleanly. Do not induce a spin as a method for losing altitude in the clouds. In case of emergency, pull out the dive brakes fully before exceeding a speed of 190 km/h and dive at 190 km/h (103 kts) to leave the cloud. Set the flaps on 0°.

4.8. Simple aerobatics Flap setting 0°

Permissible only with the engine retracted and without ballast in the wings.

Execute only the approved manoeuvres. At the recommended entry airspeeds there is no need to pull up abruptly, unnecessarily stressing the aircraft. The following manoeures are easy to execute.

Approved manoeuvres

1. Spins		
2. Inside Loop	Entry Speed 170-180 km/h	(92-97 kts)
3. Stall turn	Entry Speed 170-180 km/h	(92-97 kts)
4. Chandelle	Entry Speed 170-180 km/h	(92-97 kts)
5. Lazy Eight	Entry Speed 170-180 km/h	(92-97 kts)

(see next page)

Stall Turn
The stall turn is especially graceful when the pilot uses a touch of aileron along with the rudder deflection to lead into the turn. At the top a little opposite aileron should then be deflected.

Spins
Water ballast and or fuel in both wings do not influence spin characteristics but increases the nose down pitch during spin recovery. It is not necessary to **extend** the dive brakes during spin recovery. The DG-400 shows a very large **nose down pitch** after leaving spin. So you have to **flare** out correspondingly.

With the CG position forward or in the middle of the CG limits the DG-400 will not remain in a spin regardless of stick position. Trying to induce a spin in the usual manner will result in a slip or a stall over one wing with the DG-400 recovering after a quarter turn.
With the CG further aft the pilot can induce a spin by the standard method. Spinning with engine running under full power is not possible.

Inducing the spin (normal procedure):
Gradually bring the sailplane into a stall. When it starts to burble, pull the stick back completely and kick in full rudder in the spin direction.

Recovering from the spin:
Opposite full rudder, pause, then ease stick forward. After the spin has stopped neutralize the controls and carefully pull off excess speed. Pushing the flaps to -10° expedites spin recovery when spinning with positive flap settings. Height loss of 60-90 m (200-300 feet) occurs during spin recovery.

4.9. Approach and Landing

4.9.1 With the engine retracted

Flap setting L1 (12°)

It is recommended to jettison all water ballast before landing. In calm weather, approach at 100 km/h (54 kts). The very effective Schempp-Hirth dive brakes make a short landing possible. The DG-400 side slips well and the side slip may be employed as a landing technique, but is not necessary. While slipping the rudder is sucked in its displaced position. So it is recommended to train the slip at higher altitudes. Strong crosswind offer no problem.

Do not approach too slowly with fully extended dive brakes otherwise the aircraft may drop during flare out.

When flaring out keep the airbrake - setting you were using, opening them further may drop the sailplane.

Clean the landing gear and tow release after landing in a muddy field. Dirt in the front strut can keep the landing gear from locking over center next time. Simply hosing with water is the best cleaning method.

4.9.2 With the engine extended and running

Flap setting L1.

Follow the instructions in sect. 4.9.1 above except that no side slipping should be done. Should a long time be spent in sinking flight with the engine in idle, ensure that the throttle is applied every 60 sec to ensure proper engine lubrication.

4.9.3 With the engine extended and stopped

Flap setting L1.

Due to the high drag from the extended engine, the approach should be made using as little dive brake as possible. Just before flaring out, the dive brakes should be fully retracted if possible. Fully extended dive brakes will result in a very uncomfortable heavy landing.

If possible avoid landing with the engine extended and stopped.

4.10 Flight with water ballast

4.10.1 Wing tanks

A few hints for optimizing the wing loading:
No water: When the average rate of climb is below 1.5 m/sec. (300 fpm, 3 kts.).
Approx. 11 U.S. gal., 40 ltr. water:
When the average rate of climb is approx. 2-4 m/s (400-800 fpm, 4-8 kts.).
Maximum water ballast:
When the average rate of climb is 4 m/sec(800 fpm, 8 kts.) or more. Do not exceed the maximum gross weight when loading the water ballast. The maximum quantity of water allowed is dependent on the empty weight and the cockpit load. It must concur with Diagram 1. (sect. 2.9)
In flight the water drains at approx. 0.6 ltr./sec (1 1/3 lbs./sec.). By timing the jettison the pilot can lighten the aircraft as he needs.

Warning: If there is a risk of freezing, dump the water before you reach freezing altitude or descend to lower altitudes.

Water ballast raises the approach speed, so it is recommended to dump the water before landing. Dump the ballast before an outlanding in any case.

If you suspect a tank is leaking, dump all water immediately.

4.10.2 Filling of the tanks see sect. 5.4

After filling level the wings and check if the dump valves are tight. It is not allowed to fly with leaking watertanks as this may result in an asymmetric loading condition.

4.10.3 Dumping of the waterballast

Open both wing ballast tanks together. Do not empty 1 wing tank after the other. This avoids asymmetric loading conditions.

Note: If you suspect that water did not flow out of one tank, you have to set the flaps to -10° after touch down. Approach should be done with flap setting L1.

4.10.4 Valves leaking, servicing

Please refer to the maintenance manual sect. 1.8 and 4.7.

4.11 **Flight at high altitude and at low temperatures**
With temperatures below 0°C (32°F) for instance when wave flying or flying in winter, it is possible that the control circuits could become stiffer. Special care should be taken to ensure that there is no moisture on any section of the control circuits to minimize the possibility of freeze up.
It could be advantageous to apply vaseline along all the edges of the airbrake cover plates to minimize the possibility of freezing closed.
Apply the controls in short periods.
It is not allowed to carry waterballast.

Caution:
1. At temperatures below -20°C (-4°F) there is the risk of cracking the gelcoat.
2. Attention must be paid to the fact that at higher altitudes the true airspeed is greater than the indicated airspeed.
The max. speed VNE is reduced. See the following table:

Altitude in meters	0-2000	3000	4000	5000	6000
VNE indicated km/h	270	256	243	230	218
Altitude in ft.	0-6600	10000	13000	16000	20000
VNE indicated kts	146	138	131	124	117

3. Dump the water ballast before you reach freezing altitude at +2°C (36°F) or descend to lower altitudes.

4.12 **Flight in rain:** (also see sect. 3.5)
With rain, the stall speed and landing speeds are increased. The rate of sink of the aircraft also increases remarkably.

With the engine running
In normal rain, the rate of climb will be reduced by 1/3. The cross country cruising speed will also be reduced by approx. 10 km/h (5 kts). Take off in rain should only be done with a long enough airfield and attention given to safety. A take off should not be attempted in heavy rain. Rain increases the wear on the leading edges of the propeller so that any flight in rain should be kept to the absolute minimum.

4.13 Taxiing

Taxiing without assistance can be done due to the steerable tailwheel with one wing on the ground (wing tip wheel). Set flaps at -10°, trim full tail down. Dive brake handle and the associated wheelbrake operated with the left hand while the throttle is operated by the right hand.
The turning radius can be reduced by using the wheelbrake and applying a little more throttle. Should the tail rise by this procedure, reduce the throttle very slowly so as to reduce shock loads on the tail wheel when the tail settles back on the ground.

Note: For taxiing always use engine speed so that the engine runs smoothly. This prevents vibration damage at the engine mount.
On concrete it may be necessary to apply a little wheel brake to reduce taxi speed.

4.14 Flight using the wing fuel tanks

The wing fuel tanks have no fuel level indication. Therefore it is best to fly the main fuselage tank almost empty and then to transfere the fuel from one wingtank into the fuselage tank.
Should the fuselage tank become completely empty and the engine RPM's begin to drop, set the throttle immediately to idle and open one wing tank valve. After about 45 sec. there should be enough fuel in the main tank to apply full throttle again.
Another aid in determining fuel levels is the engine elapsed time indicator as with normal flight fuel consumption of 20 litres/h and knowing how much fuel was in the aircraft at take off, the amount of fuel left can easily be calculated. The engine hour reading should therefore be noted before take off.
2o l/h = 5.3 US gal/h.

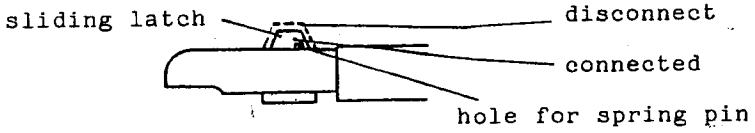
4.15 Flight with the engine removed from the aircraft

See sect. 6.3.

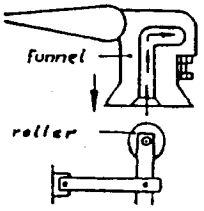
5. Rigging and derigging

5.1 Rigging (only with engine retracted)

1. Open the canopy and open the access cover with a srewdriver.
2. Clean and lube the pins, bushings and the ball ends of the control rod quick connects.
   Note: There should be no grease at the sliding latch of the hotellier quick connects (see 4.)!
3. With a helper on the wingtip, lead the wings into place. Sight through the wing main pin bushings to determine aligment. Push the main pins in as far as possible. Turn the handles up to the fuselage wall. Therefor pull out the white securing knob. Set the knob back in its locking position. The wing flaps connect automatically. The best method for rigging is to set the flap handle on 0° and to hold the flap in the 0° position.
4. Connect aileron and spoiler controls. Spoilers are best connected in the closed but not locked position. When connecting check for proper spring force of the sliding latch.
   Warning: Don't replace or fix damaged or kinked springs. Exchange the complete quick connect in such case.
   After connecting the quick connectors, check if the sliding latch has returned as far as it can locking the ball end in place. The hole must be visible. Fit a diameter 1 mm spring pin (500 30 771) in the hole to secure the connect. At the airbake quick connectors securing sleeves may be used alternatively to the spring pins, see service information 0-4/92 (enclosure to main-e-tenance manual).



   Attach access cover plate.
5. Rigging of the stabilizer
   Set the trim nose down.
   Set the stabilizer on, so that the roller at the fuselage side push rod is inserted into the funnel at the elevator.
   Watch carefully the procedure.
   When the stabilizer is set down laying on the fin push it back.
   The roller will slide forward in the funnel if you will hold the elevator in the pertinent position.



Use an 8 mm wrench (supplied with your glider) to tighten the front mounting bolt. Turn it so, that the securing spring engages into the slit of the bolt.

Check for correct elevator control connection by looking through the plexiglas window at the upper surface of the stabilizer.

6. Tape the gaps of the wing-fuselage junction.
7. Positive control check.

5.2 Rigging of the 17 m insertable wing tips

1. Disassemble the small 15 m wing tips. Use a diameter 6 mm pin for pressing in the locking pin on the wings bottom side.
2. Insert the 17 m wing tip into the wing. Press in the locking pin with your finger. Insert the wing tip as far as the aileron connector starts to slide into the ailerons slot.

5.3 Disassembling of the wing tip

This has to be done analogous to the small 15 m wing tips.
The rigging of the small 15 m wing tips has to be done analogous to the 17 m wing tips.

5.4 **Filling the water ballast tanks**

For filling the water ballast pull back the lever (top-right tank, bottom-left tank) in the cockpit.
Place one wingtip on the ground. Attach the hose supplied with your glider in the water outlet on the lower surface of the wing.

Warning: Fill the hose from your water containers but never from a mains pressure water supply. Filling the wing tanks with excessive pressure (more than 0.2 bar, 3 psi) will definitely burst the wing shell!
Fill the desired amount of water, remove the hose and close the valve with the water ballast lever. Place the other wingtip on the ground and fill the other tank.
In case the valve leaks slightly, you may try to pull out the PVC pushrod of the valve to tigthen it. If this cannot be done succesfully refer to maintenance manual sect. 1.8.2 and 4.7.
After filling the tanks, check to see if the wings are balanced. If one wing is heavy, release enough water to balance the wings.

5.5. **Filling the Fueltanks**

5.5.1 Fuel is transfered from a can where the correct amount of oil is added and mixed prior to filling.

5.5.2 It is recommended to use the required super two stroke oil in handy o,2 litre (o,o44 USgal.) plastic containers which can also be carried in the aircraft.

5.5.3 The best is to transfer the mixed fuel from the can into the fuselage tank with an electric fuel pump and filter. It is recommended to carry this pump system always on bord. The pump system is available from Glaser-Dirks. The power supply socket is located on the luggage compartment rear bulkhead - note the master switch has to be switched on.

5.5.4 Filling the wing fuel tanks can only be done using the above mentioned electric pump system.

1. Close the fuselageside valves.
2. Attach the quick connector of the pump system to its suction side hose and connect it to the wing fuel tank and pump the air which may be in the tank out for about 1 minute.
3. Reverse the connections and fill the wing tank.
4. After filling the wing tank connect the fuselageside connector to the wingside connector.

5.5.5. In case there is no can available for premixing the fuel and oil for filling the wing tanks, the fuselage tank can be used. Transfere approx. 5 litres of fuel into the fuselage tank, fill in the oil and then fill the tank completely with fuel. Fill the wing tanks from the fuselage tank then.

5.6. **Tie Down, Parking**

There are holes in the 15 m wingtip skids for securing the sailplane. The fuselage should be tied down just ahead of the fin. Water ballast can be left in the wings, for a few days only; but not when there is the possibility of freezing.

Don't park the glider overnight with the wing fuel tanks not emptied.

On sunny days the cockpit should be closed and covered.

Note: Longer parking with exposure to sun and humidity will cause premature aging of the skin of your sailplane.

5.7. **Derigging**

Derigging follows the reverse of rigging.

Water ballast - and fuel tanks in the wings must be emptied before. Fuel in wing tanks can be simply transfered to the fuselage tank or emptied directly using the pump system (see 5.5.3) in reverse.

5.8. Trailering

It is recommended to carry this valuable sailplane in a factory approved trailer.

Approved fitting points:

Wings:
1. Wing spar as close to wing root rib as possible or a rootrib wing cradle.
2. A wing cradle where the aileron begins.

Stabilizer: Cradles as desired.

Fuselage:
1. A felt lined fiberglass nose cap which does not extend over the canopy, secured to floor.
2. Fuselage dolly in front of the tow hook or a support attached to the lift pins Ø 16 mm (use plastic or brass bushings).
3. Tail wheel well in trailer floor. Secure fuselage with a belt in front of the fin.

All aircraft structures should not be subject to any unusual loads. With high temperatures that can occur inside trailers, these loads in time can warp any fibre reinforced plastic sailplane.
The trailer should be well ventilated so as to prevent moisture build up which could result in bubbles forming in the gelcoat.

5.9 Service and Care

Exterior surfaces of the fibrereinforced plastic parts

The surfaces are coated by a UP-gelcoat. This gelcoat is protected by a hard wax coating which has been applied during production with a rotating disc ("schwabbel" procedure). Do not remove the wax, this would lead to shading, swelling and cracking of the surface. In general the wax coat is very resistant. As soon as the wax coat is demaged or worn a new coat has to be applied (see maintenance manual sec. 3.1). If you store your aircraft often outside, this may be necessary every half year!

Hints for care:

- Wash the surface only with clean water using a sponge and chamois.
- The adhesive remains of tape may be removed with petroleum ether (pure petroleum spirit) which should be applied for some seconds only, otherwise this may lead to swelling of the gelcoat.
- More stubborn dirt which cannot be removed by washing may be cleaned off with siliconefree, waxcontaining car polishes (e.g. 1Z Extra)
- Longterm dirt and shading can be removed by applying a new hard wax coat (see maintenance manual sec. 3.1).
- Never use alcohol, acetone, thinner etc.. Do not use detergents for washing.
- Protect the surface from intense sunlight.
- Protect the aircraft from water and moisture, see also sec. 5.6 and 5.8.
- Remove water that has entered and allow the aircraft to dry out.
- Never store your wet aircraft in a trailer.
- Clean off remains of fuel and oil from the surface with a soft cloth after each flight.

Care of the horizontal tailplane

By diffusion of humidity and fuel or residue of fuel into the painted surface it is possible that small bubbles will form in the gelcoat.

Therefore you should carefully clean the tailplane after each flight. In addition you should preserve the tailplane every three months by applying a silicon free liquid wax as used for cars.

Should bubbles occur nevertheless, you have to store the tailplane in a dry and warm room and to clean it carefully. Some liquid may come out of the bubbles.

After drying out the tailplane the bubbles will mostly disappear.

Then you should preserve the tailplane as described above.

Plexiglass canopy:

- Use clear water and a chamois for cleaning.
- Stubborn dirt and small scratches can be removed by use of the "schwabbel procedure" (see maintenance manual sec. 3.1).

Metal parts:

The pins and bushes for rigging the aircraft are not surface protected and must be covered with grease at all times.
The other metal parts, especially the control stick and all handles should be preserved with metal polishes occasionally.

Powerplant

The engine-compartment, the engine and especially the ignition system and cables should be cleaned with a rag to remove any excess oil and dirt etc. after every flying day.

5.10 **Charging the batteries**

With long gliding- and short engine time it is necessary to charge the batteries occasionally with a charger. Please refer to maintenance manual sect. 1.12.19.

6. Additional Information

6.1. Gliding Performance

To maximize the DG-400's performance, the flaps should be operated accordingly.
Flap setting

L1	(12°)	for Landing approach.
+8		for thermaling in strong thermals with high wing loading.
+6		for climbing under power.
+4		for thermaling in weak thermals and for aero tow
0		cruising
-4		Cruising, cruising under power
-8		fast Cruising
-10		high speed flying (ie Start-finish gates).

Performance

wing span:		17 m		15 m	
wing loading	kg/m²	38	45	40	48
	(lbs/ft²)	7,8	9,2	8,2	9,8
min.sink	m/s	0,54	0,6	0,62	0,68
	(ft/min)	106	118	122	134
at V	km/h	80	87	80	88
	(kts)	43	47	43	48
with flap	(°)	0	0	0	0
best glide angle		1:44,5	1:45	1:41,5	1:42
at V	km/h	110	120	112	122
	(kts)	59	65	60	66
with flap	(°)	-4	-4	-4	-4

A variation in speed by ± 10 km/h (5 kts) from the above will decrease the best glide angle by 0,5 glide points and increase the min. sink rate by 1 cm/sec. (2 ft/min).

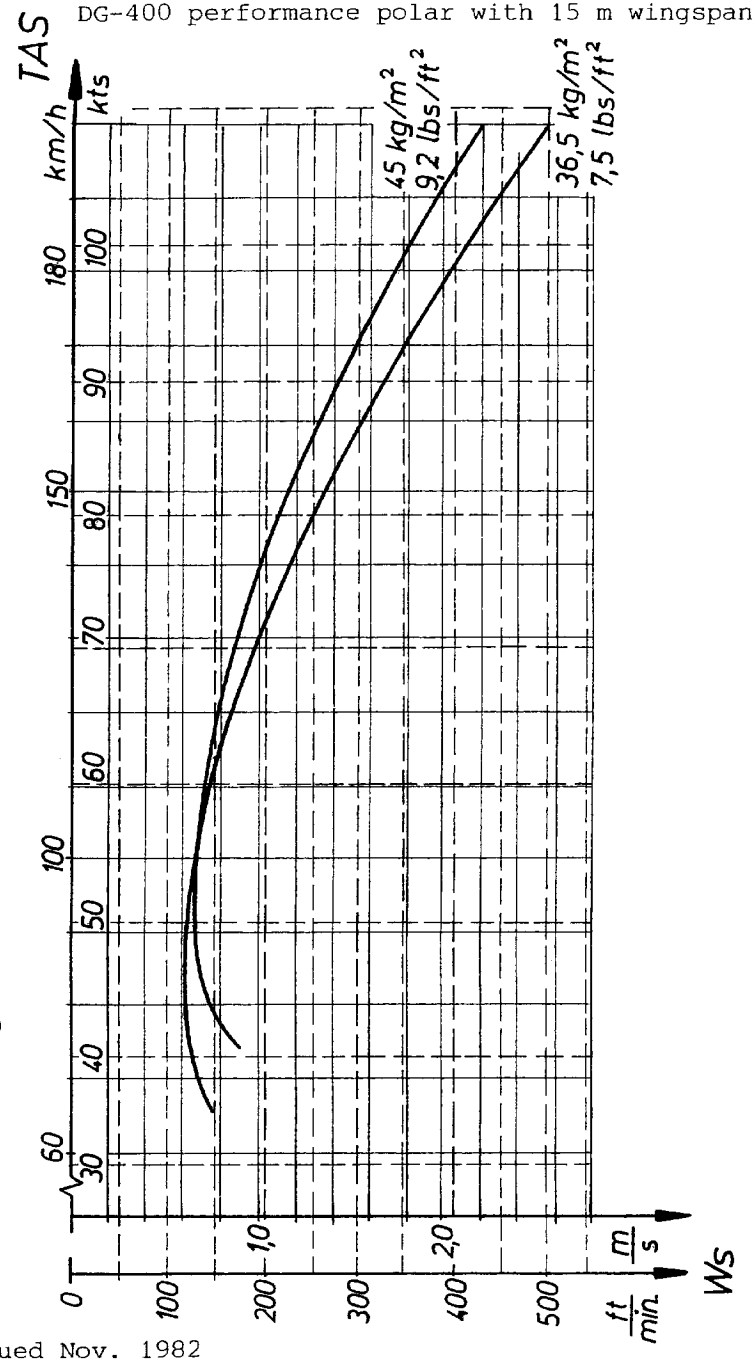
The following flap settings should be used for optimum performance for the speed ranges and wing loadings specified:

Wing loading kg/m² (lbs/ft²)	40 (8,2)		45 (9,2)	
	km/h	kts	km/h	kts
Flap setting +8	- 85	-46	- 90	-49
0	85-105	46-57	90-110	49 -60
-4	105-155	57-84	110-160	60 -86
-8	155-170	84-92	160-180	86 -97
-10	over170	over92	over180	over97

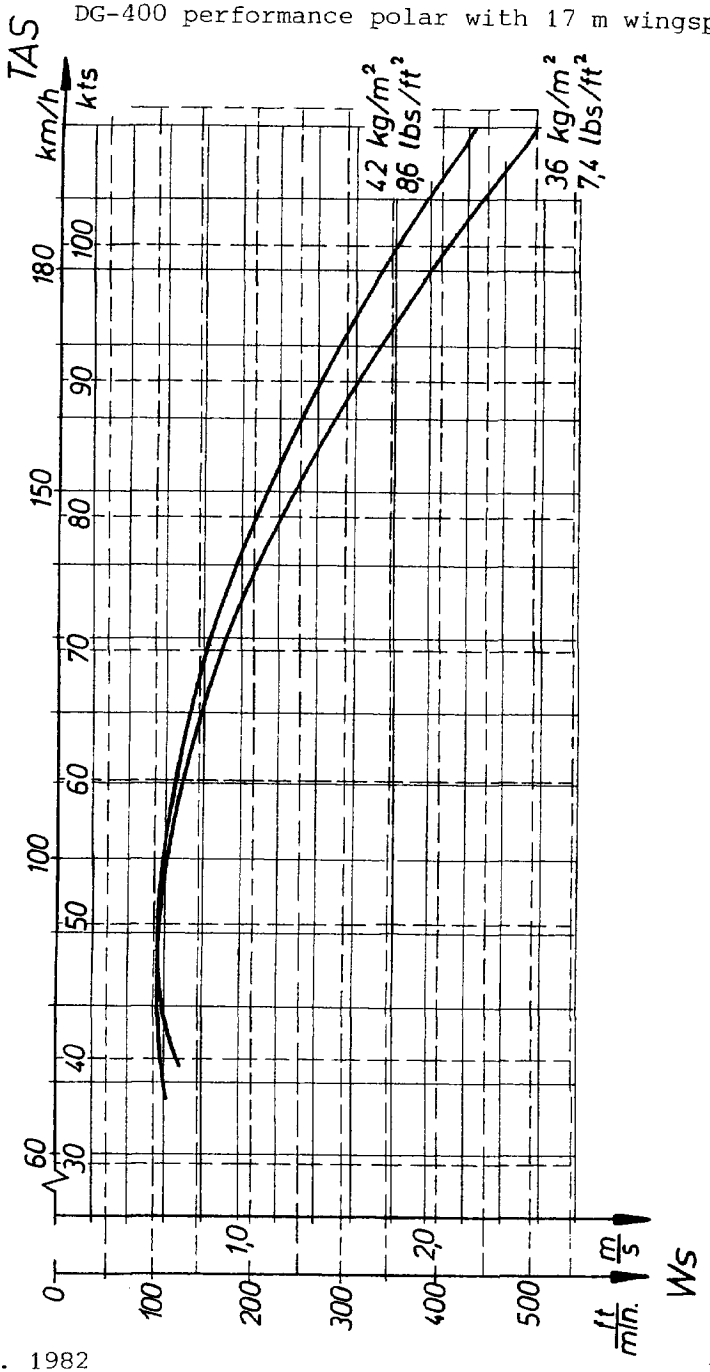
To accelerate or flatten out always use flaps and elevator simultaneous.
Set the flap earlier in its position for the speeds listed above because flattening out raises the wing loading and speeding up lowers it.
Set the flaps earlier, the higher the g-loads. Flatten out with 1.5 g or speeding up with 0,5 g changes the optimal speed approximately 15 km/h (8kts) at low speeds and 30 km/h (16 kts) at high speeds.

The polar curves can be seen on diagrams 2 and 3.
For optimum performance, the aircraft should be flown with a c.g. towards the rear of the allowable range. This especially improves thermalling performance.
However the aircraft will be more pitch sensitive.
The wing fuselage joint and the tailplane locking bolt hole should be taped up and the aircraft thoroughly cleaned to obtain maximum performance.
The polars on pages 53 and 54 apply to a "clean" aircraft. With dirty wings or flight in rain, the performance drops accordingly.

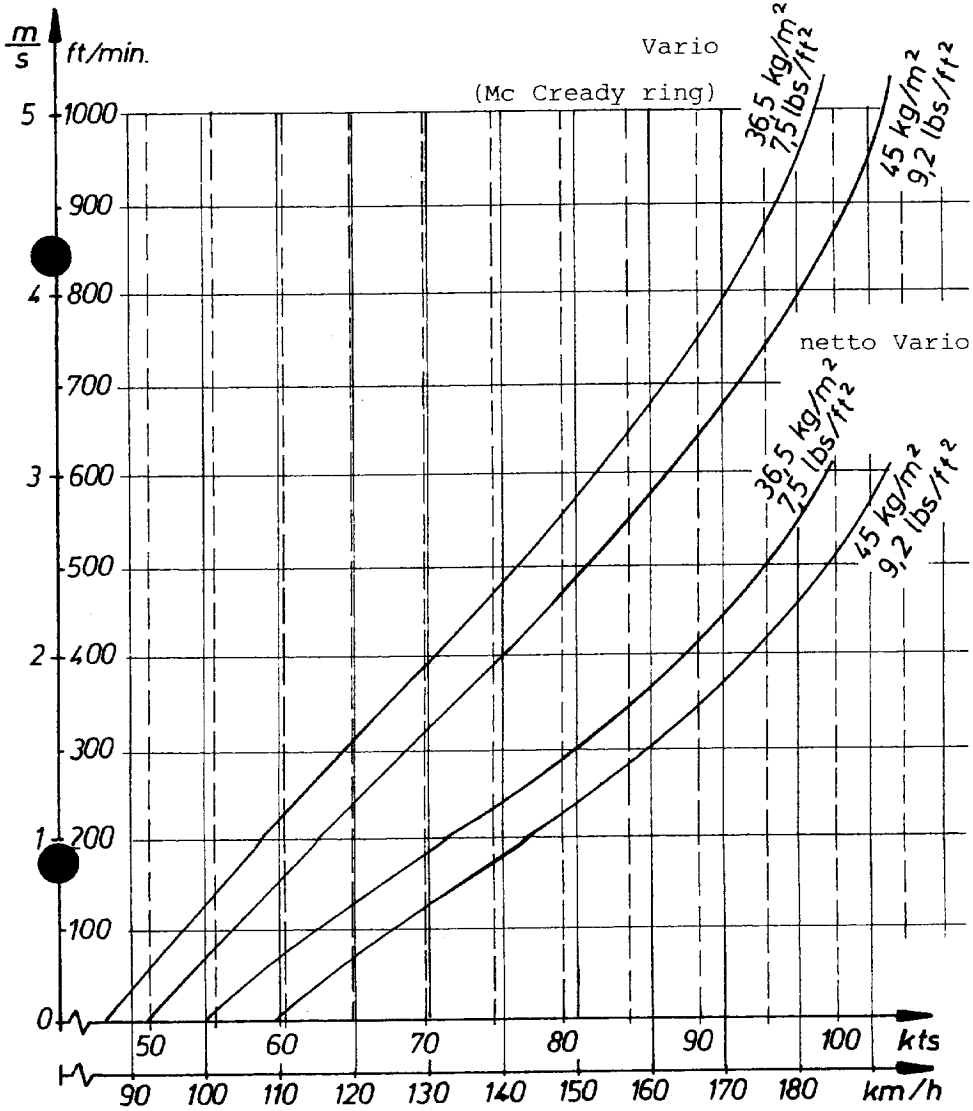
DG-400 performance polar with 15 m wingspan



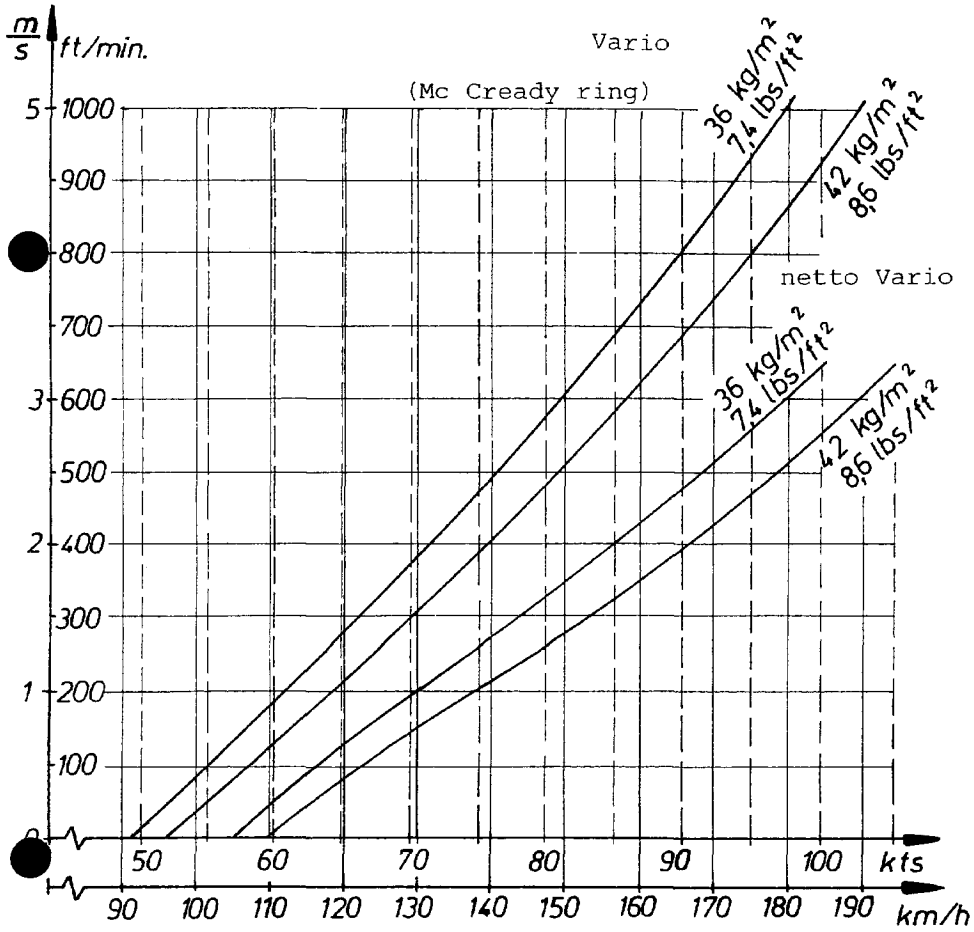
DG-400 performance polar with 17 m wingspan



DG-400 Mc Cready polars
with 15 m wingspan



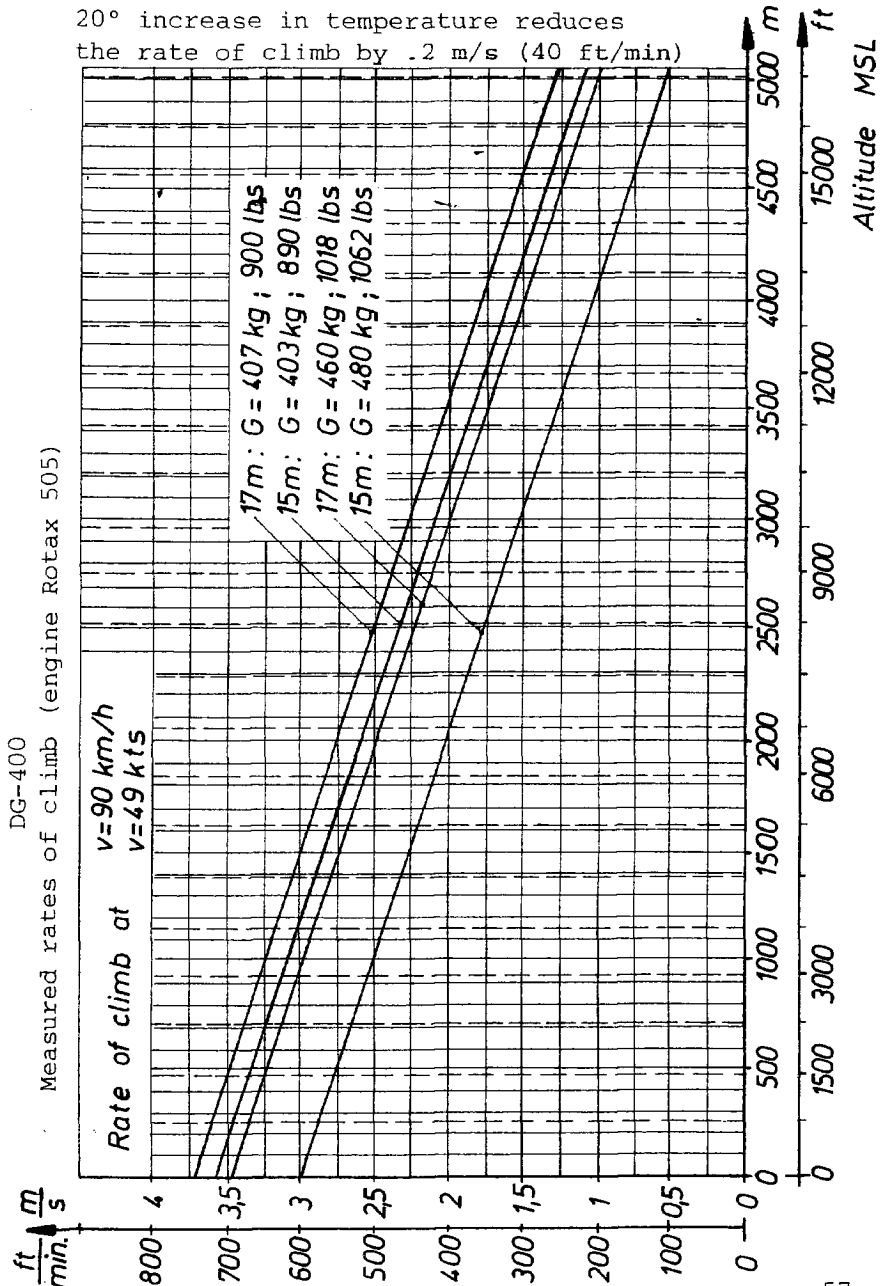
DG-400 Mc Cready polars
with 17 m wingspan



6.2. Performance under power

6.2.1. Rate of climb

Diagram for 15°C at mean sea level.
20° increase in temperature reduces the rate of climb by .2 m/s (40 ft/min)



6.2.2. Take off distance:

Data for dry grass, no wind, proper condition of engine, propeller and sailplane. The take off procedures should be as detailed in section 4.

S_R= take off roll S= Take off distance to 15 m (50 ft) height

Altitude M S L	ground temperature		15m 480kg 1058 lbs.				17m 460kg 1014 lbs.			
			S_R		S		S_R		S	
	°C	°F	m	feet	m	feet	m	feet	m	ft
0	-15	5	208	682	277	909	154	505	244	800
	0	32	219	719	292	958	162	532	257	843
	15	59	230	754	307	1007	170	558	270	886
	30	86	243	797	324	1063	179	587	285	935
500 m	-15	5	219	718	292	958	162	531	257	843
	0	32	230	754	307	1007	170	558	270	886
1640 feet	15	59	245	804	327	1072	191	627	288	945
	30	86	257	843	343	1125	190	623	302	991
1000 m	-15	5	230	754	307	1007	170	558	270	886
	0	32	246	807	328	1076	182	597	289	948
3280 feet	15	59	260	853	347	1138	192	630	305	1001
	30	86	274	899	366	1201	202	663	322	1056
1500 m	-15	5	246	807	328	1076	182	597	289	948
	0	32	261	856	348	1142	193	633	306	1004
4920 feet	15	59	276	905	368	1207	204	669	324	1063
	30	86	290	951	387	1270	214	702	340	1115

Note 1: Concrete runway shortens the take off by 10%.

Note 2: 10 km/h (5,4 kts) headwind shortens the take off by 25%.

Note 3: 10 km/h (5,4 kts) tailwind increases the take off distance by 35%.

Note 4: 50 kg (110 lbs) reduction in weight shortens the take off by 30%.

6.2.4. Cruising Flight

The cruising speed is 135-140 km/h (73-76 kts) with maximum continuous power 6100 RPM. For further details see sect. 4.6.2.

6.2.5. Maximum operational altitude

The maximum operational altitude is more than 5000 m (16000 ft) MSL (see sect. 6.2.1.).

For continuous operation at higher altitudes, the manufacturer recommends smaller main nozzles to be used in the carburettors.

6.2.6. Maximum Range (without reserve)

1. At cruising speed
   with full fuselage tank (20 l, 5 1/4 US gal)=
   150 km, 93 stat. miles, 81 nm.
   This is 7,5 km/l; 17,6 stat.m./USgal.;
   15,3 nm/USgal.

2. With sawtooth flight technique Mc Cready o
   with full fuselage tank (20 l, 5 1/4 US gal)=
   max. 380 km; 236 stat.m.; 205 nm.
   This is 19 km/l, 45 stat.m/US gal.;39 nm/USgal

These values can only be achieved with still air and exact speed control.

3. With sawtooth flight technique Mc Cready 1
   with full fuselage tank (20 l, 5 1/4 US gal)=
   max. 320 km; 199 stat.m.; 173 nm.
   This is 16 km/l,38 stat.m/US gal.;33 nm/USgal.

   The values for sawtooth technique are for begin of the climb at 600 m (1970 ft) MSL and a climb of 1000 m (3280 ft).

6.2.7. Maximum level flight speed

The maximum level flight speed is 155 km/h (84 kts) with 6800 RPM.
Note: With full trottle the maximum allowable engine RPM of 6800 will be exceeded.

6.3. Flight with the engine removed from the aircraft

The DG-400 can be flown without the engine ie when the engine is sent to a major overhaul, or removed to decrease the aircraft empty weight for competition flying.

The following items should be noted: (see sect. 4.6.3. in the DG-400 maintenance manual).

1. Remove the engine together with the propeller mounting. See the maintenance manual. The engine extension-retraction mechanism as well as the engine mounts remain in the aircraft.

2. Remove the batteries, insulate the battery connector cables. Switch to Avionic on the DEI. Install one 12 V 6.5 A battery in the baggage compartment and connect to the socket on the rear bulkhead. A battery holder and cable are available from Glaser-Dirks.

3. To obtain a favourable C of G position, a 1,5 kg (3,3 lbs) weight has to be installed in the rear fuselage under the lower rudder hinge. The lead weight and the bolt are available from the Glaser-Dirks factory.

4. The weight reduction is as follows:

Engine	-48 kg	- 1o5,8 lbs
Batteries	-6,7 kg	- 14,8 lbs
+ one 6 A battery	+2,7 kg	+ 6 lbs
+ rear trim weight	+1,5 kg	+ 3,3 lbs
	-50,5 kg	- 111,3 lbs

5. The aircraft C.G. must not be checked if points 1-4 are completed as described above.

6.4 Maintenance

The "Instructions for continued airworthiness (maintenance manual) for the DG-400" have to be followed.

Before each rigging all the connecting pins and bolts should be cleaned and greased. This includes the Hotellier quick connectors. Every 3 month, all the bearings and hinges should be cleaned and greased. See the greasing programme section 3.3 of the maintenance manual. Each year the control surface displacements, adjustments and general condition must be checked.
(See the maintenance manual).

Maintenance of the engine see maintenance manual sect. 3.4.

6.5 Alterations or repairs

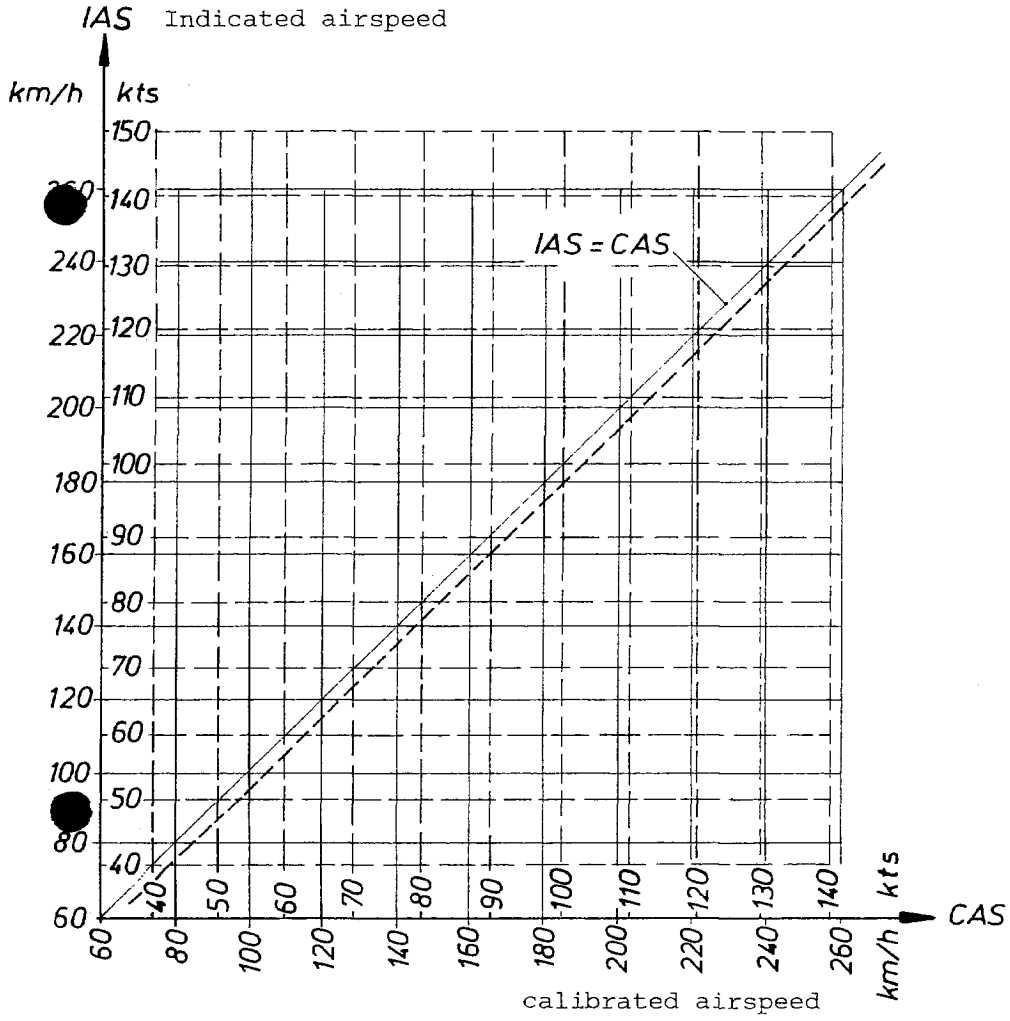
It is essential, that the responsible airworthiness authority be contacted prior to any alterations on the airplane to ensure, that the airworthiness of the sailplane is not impaired.
It is prohibited to execute the alteration without the approval of the airworthiness authority. The manufacturer will not be liable for the alteration or for damages resulting from changes in the characteristics of the aircraft due to alteration.
So it is strongly recommended to execute no alternatives which are not approved by the aircraft manufacturer.
External loads such as external camera installations are to be regarded as alterations!
Repair instructions can be found in the DG-400 M repair manual.
No repairs should be carried out without referring to the manual.

6.7 **Maintenance instructions for equipment**
see maintenance mnaual DG-400 sect. 1.02

6.10 **3000 hour inspection and maximum total service time**
see sect. 2.4 of the DG-400 maintenance manual.

6.11. Airspeed calibration

The ASI is connected to the front static ports



Power plant trouble shooting

1. **Extension and retraction doesn't work**
   A. Blocked retraction - extension mechanism although the electrical system still working:

      refer to maintenance manual sect. 1.10.4 page 15

   B. Faulty electric
      Defective relay
      Defective switch at control stick or defective cables
      Defective DEI

      In all cases use the emergency switch see flight manual sect. 3.8 page 25.

2. **Engine starting problems**
   Refer to flight manual sect. 4.3.2 page 32

3. **Starter motor doesn't work**
   see flight manual sect. 3.7 page 25

4. **Engine doesn't reach ground test RPM**

   A. The most frequent reason is the carburettor needle valve is not shutting off completely.
   Disassemble the needle valve referring to maintenance manual sect. 1.11.5 no. 2 page 17.
   Switch on the ignition so that a jet of fuel comes out of the valve hole to clean the valve seat. Assemble the needle valve again (the dirt particles may be so small that you won't see them).

   B. Dirt in the main nozzles.
   see maintenance manual sect. 1.11.5 no. 1 page 17.

   C. Dirt in the fuel filter
   Replace or clean the filter, see maintenance manual sect. 3.4.1 no. 3.

   D. Throttle or choke butterfly valves don't open fully.
   Lubricate the bowden cables or replace them if bent.

   E. Faulty ignition see 7.

   F. Fuel lines clogged or kinked. Check fuel flow rate see maintenance manual sect. 1.11.3.

5. **Fuel leaks out of the carburettors**
see 4 A

6. If the engine can't be accelerated from idle to full throttle and cleaning the carburettors (see 4 A and B) doesn't help, you should exchange the carburettor membranes and their gaskets.

7. **Loss of electrical power**
see flight manual see 3.11 page 27

8. **Ignition problems**

No sparks:

- **on 1 spark plug of one ignition circuit:**
spark plug, ignition cable or electronic box defective.

- **on both spark plugs of one ignition circuit:**
Too low starting r.p.m.; weak battery;
shorting cable or ignition switch having ground connection;
electronic box defective: if after interchanging the boxes with the other ignition circuit the trouble appears on the other ignition circuit; if not, armature plate (in the engine) or cables may be defective.

- **on none of the spark plugs:**
too low starting r.p.m.; weak battery;
shorting cable or ignition switch having ground connection;
cable defective;

If after interchanging the boxes with the other ignition circuit one circuit will funtion again, one electronic box and the armature plate are defective.

9. **Sudden power loss at full throttle**

Check pistons and cylinders for seizing marks, see maintenance manual sect. 3.1 item 11b.