

Building instructions

Grob G 109

RC motor-glider
Order No. 1340/00



Specification:

Wingspan	approx. 2770 mm
Length	approx. 1330 mm
Wing area	approx. 56.80 dm ²
Tailplane area	approx. 6.70 dm ²
Total surface area	approx. 63.50 dm ²
All-up weight with 12 cells	approx. 3200 g
Wing loading (wing only)	approx. 50.40 g/dm ²

RC functions:

- Elevator
- Ailerons
- Rudder
- Speed controller / throttle
- Model is prepared for installation of airbrakes

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Power system

Glow motor variant: 4-stroke motor, 5 cc to max. 10 cc (e.g. Saito FA 45)

Electric variant: 12 to 14 cells

actro 12-6 motor		Order No. 7002/06
Actro 35 mm / M8 hub		Order No. 7002/65
actronic 40-18 controller		Order No. 7002/52
CAMcarbon	12 x 8"	Order No. 7234/50
or	12.5 x 7.5"	Order No. 7234/53
or	12 x 6.5"	Order No. 7234/46

Introduction

Our model of the G-109 is drawn to a scale of 1:6. The dimensions of the model and the fuselage cross-sections are exact scale, i.e. an accurate reproduction of the original aircraft. The only substantial change we made is to the wing section, where we replaced the full-size airfoil with Eppler 107 - 205 sections in order to obtain more harmonious flying characteristics.

The kit features obechi-skinned styrofoam wing panels, and is designed to be powered by a 4-stroke motor, although an electric power train can be installed at the builder's discretion.

The original methods of retaining the wings, actuating the ailerons and airbrakes have been updated and improved since the plans were drawn. For this reason the wing plan differs from the kit contents.

Preparations for completing the fuselage

The GRP fuselage is supplied with a white pigmented surface finish, eliminating the need to paint the moulding white overall. If you intend to leave the fuselage in its natural state it is important to avoid scratching the surface during construction. Cut off the motor cowl using a fine-blade piercing saw (Order No. 8160/00), and cut out the two rear cabin window openings in the same way. Sand the cut edges of the windows, the cockpit and the motor cowl. Sand the inside of the fuselage thoroughly where parts are to be glued to provide a mechanical "key" for the epoxy.

Lightly sand the marked points of the root facing ribs moulded into the fuselage using fine abrasive paper, so that the position of the holes for the wing joiner rod (33) can be marked accurately from the wing root ribs. It is important that the holes for the incidence pegs (31) line up exactly with the holes in the wing roots. Cut out the holes for the wing joiner sleeve (32) and the servo cables using a small hand-held drill and a round file. Cut an opening in each side for the wing retainer (34) at a point about 15 - 20 mm in front of part (32).

At this early stage you need to decide how you wish to actuate the elevator and rudder. We recommend the following solution, although the details of the installation are left up to the builder: the rudder can easily be made removable (e.g. by fitting an aluminium tube pivot shaft), and can be operated by a servo installed in the cockpit using a rod-in-tube "snake". In this case you would need to relieve the tail post (28) for proper clearance. The plan shows the elevator operated by a bellcrank (12) and a forward-mounted servo, but there is plenty of space for a mini-servo at the bellcrank position which could operate the elevator directly. In this case you should cut away part (28) to provide access to the servo from the rear.

The wing joiner sleeve

Cut the brass sleeve (32) to the exact width of the fuselage, then roughen up both ends thoroughly and remove all traces of grease. Fit the sleeve (32) in the fuselage, slide the wing joiner rod (33) into it and check from the front that it is exactly horizontal. Hold a setsquare against the joiner and check from above that the angle between the projecting joiner rod (33) and the root facing ribs is exactly 90°. Glue the brass sleeve (32) to the fuselage using plenty of laminating resin thickened with chopped glass strands.

The wings

The wing panels are supplied in the kit almost finished; only the joiner rod sleeves (32) need to be installed. The wing roots feature accurately cut sockets for parts (32), and internal ribs are incorporated in the styrofoam cores to distribute the loads over the wing panels, transferring the forces to the glass cloth under the wing skins. A small bottle of PU adhesive is supplied in the kit for fixing the sleeves (32).

The first step is to roughen the surface of the sleeves (32) using abrasive paper, and seal one end of each by butt-gluing a piece of 2 mm plywood to the end using cyano. Sand back the excess wood. Cut two pieces of brass tube (31) around 30 mm long, de-burr the ends and glue them in the root ribs, leaving about 10 mm projecting. We can now assemble the model "dry" (no glue): fit the wing joiner rod in the fuselage, insert the joiner sleeves in the wings and slide the wings onto the joiner rod. The plan shows the correct dihedral - pack up both wingtips equally and check that the angle is correct. Check also that the wing roots are a snug fit against the fuselage, without gaps.

The next step is to glue the sleeves in the wings, but first the fuselage must be protected from excess glue, as the PU adhesive is almost impossible to remove, even from GRP. Allow at least an hour for this stage, so that you have plenty of time to check alignment while the glue is hardening.

Apply a light coating of Vaseline to the wing joiner rod and fit it in the fuselage sleeve. Apply the PU adhesive to the sockets in the wing roots using a piece of 5 - 6 mm Ø dowel at least 250 mm long - the whole inside surface of the socket must be coated with glue.

Apply a thin coating of adhesive to the joiner sleeve (32) and slip it onto the joiner rod. Carefully slide the wing onto the sleeve, removing the excess glue at the root rib gradually as you push the wing into place. Repeat the procedure with the other wing panel. With both wings positioned properly, set the correct dihedral again and tape both wing panels to the fuselage.

The "pot life" (working time) of the PU adhesive is around 30 - 45 minutes after application. Initially it assumes a honey-like consistency, but under the influence of humidity it starts to foam up, i.e. it increases in volume. At 20°C it hardens in two hours, but it takes 24 hours to develop full strength. This means: leave the model set up as described overnight. When the adhesive has cured fully, dismantle the model and clean all the surfaces carefully.

Glue the die-cut base plates (73) in the circular servo wells in the wings using thickened epoxy. Extend the servo leads as required - the cables must be long enough to reach the receiver with some slack - then install the servos in the wells. Each airbrake should be actuated by its own channel; we do not recommend using a Y-lead.

Install the wing retainer (34) as described in the instructions supplied with the unit. Trim the angle of the trailing edge fillets (75) to suit and tack-glue them to the wings using cyano. Glue the fillets in place permanently using laminating resin after removing the wings from the fuselage. Apply a strip of glass cloth over the joints for added strength, then sand back the face which meets the fuselage if necessary to achieve a snug fit.

Attach a new sheet of abrasive paper to your sanding block and sand all the wooden surfaces smooth and even, then apply a coat of thinned sanding sealer by brush. Rub down with 400-grit paper when dry and remove all traces of sanding dust.

If you intend to cover the model with iron-on film, we recommend that you give all the wooden surfaces a coat of heat-sensitive adhesive.

Installing the motor and fuel tank

This model is designed to be flown with a 4-stroke motor of 5 to 10 cc capacity; a 6.5 cc motor is ideal. The plan shows the installation of a SAITO FA 45. The centreline of the fuel tank should always be level with the carburettor, as shown on the plan. The tank is located transversely behind the motor bulkhead, and should be of around 300 cc capacity.

For all joints involving the fuselage please use UHU Plus Endfest 300 (24-hour epoxy) unless stated otherwise. Carefully trim the joint surfaces of the motor mount (3) and the bulkhead (2) to obtain a strong interlocking joint, and saw out the opening for the motor. Drill holes (1.5 and 3.0 mm Ø) for the screw-hooks (4) and the fuel lines (5).

Caution: do not glue the motor mount (3) and the bulkhead (2) in place until you have checked that they fit properly in the fuselage; they should slide easily into position without distorting the moulding. Fit a suitable propeller (11 x 7") and a 45 mm Ø spinner on the motor to enable you to mark the position of the holes for the screws (7) accurately. Solder the screws (7) to the brass plates (6) and glue the plates to the motor mount as shown. Cut and trim the aluminium sheet part (10) and part (11) to fit, with the motor already temporarily fitted. Fill the void behind the motor mount with self-expanding foam before gluing part (11) in place permanently.

The rudder and tailwheel

Assemble and install the bellcrank (12) as shown in the drawing on the plan, and glue the M3 x 15 screw (7) to the plywood washers (13) and (14). Cut down the M2 threaded rods (15) to a length of 55 mm and glue them in the ends of the elevator pushrod (16). Cut the vertical pushrod (15) to a length of 230 mm, bend the bottom end as shown and connect it to the bellcrank (12). Screw and glue the clevis (17) to the elevator pushrod (16) and connect it as shown. The bellcrank and its mounting plate (13) can now be glued to the right-hand inside face of the fuselage. Note that the captive nut (18) for the tailplane is not used in the normal way; instead it is glued in place "upside down", and clamped in position by lightly tightening the oiled screw (19) from above. Cut the rudder leading edge (20) and the top fillet (21) to shape as shown. Cut out the ABS rudder (22) and glue parts (20) and (21) in it using UHU Hart. Note that the leading edge (20) should project beyond the front face of the rudder so that it can be chamfered at an angle of around 30° on each side of the centreline. Cut out the tailwheel spat (24), drill the 2 mm Ø hole as shown and fit the spring strut (23) through the hole from the top. Fit the wheel (25) and the bottom collet (26) on the axle. Position the wheel spat carefully and glue it to the spring strut from the inside using UHU Hart. Fit the second collet and the brass tube (27) from the top, and only then bend the wheel axle to the correct angle. Glue the hinges (29) in the tail post (28), then glue part (28) in the fin; note that the recess for the rudder pushrod should be on the left-hand side. Glue the brass tube (27) (part of the tailwheel assembly) to part (28), and epoxy a strip of glass cloth (30) over the joint for extra strength. Cut notches and slots in the rudder leading edge (20) to accept the spring of part (23) and the rudder hinges (29). Trial-fit the rudder by fitting it on the projecting hinges, and make any adjustments required. Do not install it permanently (by gluing it to the hinges and the angled steel rod) until the model has been painted.

The main undercarriage

Trim the undercarriage support (35) and the fore-and-aft braces (38) to fit together neatly, together with the undercarriage legs (36), and glue them in place. Fit the screws (37) to secure the undercarriage legs. When the epoxy has cured apply a strip of glass cloth (39) over the undercarriage support. Screw parts (40) to (45) (wheel / spat assembly) to the undercarriage legs as shown in section A-A and apply glue for added security. File the nut (44) flat on one side. The leg fairings (45) can be omitted if you wish; this improves the resilience of the undercarriage. Otherwise glue the obechi strips (2 x 25) to the undercarriage legs and sand to profile. The legs should be free to move slightly inside the wooden fairings; tack them in place at the top only using silicone sealant.

The motor cowl and canopy

Glue the cowl mounting blocks (46) in place as shown. Cut out the oval opening in the cowl to clear the cylinder head and exhaust stub; the opening should be large enough at the rear to allow the fuel line to be pulled off the carburettor feed nipple in order to fill the fuel tank. Open up the cooling air intake opening on the front face of the motor cowl.

Place the motor cowl on the model, position it carefully and tape it in place. Drill 1.5 mm Ø holes for the screws (53), then remove the cowl and open up the holes in the moulding using a 2.5 mm Ø bit. Carefully cut away the front and rear face of the vacuum-moulded canopy so that it can be placed on the fuselage and taped in place. In this position it is possible to mark the cut lines accurately on the moulding. Cut out the rear windows, sand the joint surfaces thoroughly then glue them to the fuselage, leaving them taped in place until the glue has set hard. Laminate the plywood canopy brace (49) and round off the compass (51). Paint everything black, then glue the brace assembly inside the trimmed canopy. Glue the canopy latch (52) in place and mark the position of the hole on part (50). For added security we recommend that the canopy should also be screwed to the brace (49) using five screws (53); the screws should be spaced 50 mm apart.

The tailplane

The tailplane is of built-up construction in order to avoid unnecessary nose ballast. Use UHU Hart (cellulose cement) for this stage. Pin down the packing strips (U) over the plan followed by the trailing edge strip (56). The ribs (57) to (61) can now be glued in place. Attach the false leading edge (62) to the front of the ribs. Glue the blocks (63) between the central ribs (61) with the grain vertical. Allow the structure to dry out completely, then glue the elevator hinges (29) in place. Mark the position of the cut-out to clear part (67), then attach the tailplane skins (64) using contact cement. Parts (65) to (70) can now be glued in place, and the completed tailplane sanded to final section. Drill the hole for the tailplane retainer screw (19) and cut out the elongated opening in the bottom skin (64) as shown. The elevator should not be attached permanently until the tailplane has been painted.

Installing the radio control system

With the exception of the receiver battery the entire RC system is mounted on the plywood plate (80). Drill the screw holes required in the plate before installing it in the fuselage. If you adopt our suggested installation, i.e. mounting the rudder servo on the fuselage side, fix the "snake" (plastic tube with 2 mm Ø GRP pushrod) to the fuselage side at several points. Use thick cyano to tack it in place, then add thickened epoxy at each joint for reinforcement. Glue the plastic sleeve (81) in the tail boom to house the receiver aerial. The fueltank is held in position by a rubber band (82) fitted to the screw-hooks (4), with a piece of foam rubber between the tank and former (2). Bend the throttle pushrod (83) to the shape shown and install it. Drill a hole in the rudder for the horn (85) and glue it in place using UHU Hart (cellulose cement), as this adheres well to ABS. Stow the receiver battery between parts (38).

Final assembly

Glue the rudder and elevator onto the projecting hinges (29). We recommend using white hinge tape to attach the ailerons to the wings. Don't forget to connect the clevis (17) to the modified ball-link (71) before you screw the tailplane to the fin, or you will have no elevator control. The shape of the nose of the fin effectively prevents the tailplane swivelling. Secure the wings using the wing retainer (34).

Mark a point 70 mm aft of the wing leading edge at each wing root. This is the correct Centre of Gravity (CG), and the model must balance at this point when the fueltank is empty.

All control surface travels should be around 20° each side of neutral. Aileron differential is incorporated automatically due to the rearward offset of the aileron horns (87), i.e. the ailerons have more "up"-movement than "down"-movement.

The first flight

The main wheels are relatively small, and this means that the model should only be allowed to take off from smooth hard strips. Wait for a day with as little breeze as possible for the first flight, as this avoids unnecessary problems on take-off and landing. Give the transmitter and receiver batteries a full charge, and you are ready for the model's first flight, which we are sure will be successful.

We wish you loads of fun and many successful flights.

"aero-naut" Modellbau

PARTS LIST

No.	Description	No. off	Material	Dimensions [mm]	
1	GRP fuselage	1	GRP	Order No. 1340/02	Ready made
2	Bulkhead	1	Plywood	8	Machined
3	Motor mount	1	Plywood	8	Machined
4	Screw-hook	6	Steel	Order No. 7800/00	Ready made
5	Brass tube	2	Brass	3 Ø / 2.5 x 40	Brass tube
6	Brass plate	2	Brass	25 x 10 x 1	Brass sheet
7	Cheesehead screw	5	Steel	M3 x 20 7775/20	Ready made
8	Washer	5	Brass	7 Ø / 3.2 7780/23	Ready made
9	Self-locking nut, M3	5	Steel/Nylon	Order No. 7766/26	Ready made
10	Aluminium sheet	1	Aluminium	100 x 75 x 0.3	Alum. sheet
11	Cover	1	Plywood	3 mm	Die-cut
12	Bellcrank				
13	Washer	1	Plywood	40 Ø / 6 x 2	Die-cut
14	Washer	1	Plywood	25 Ø / 3 x 2	Die-cut
15	Threaded rod, M2	5	Steel	Order No. 7488/04	Ready made
16	Elevator pushrod				
17	Clevis	8	Steel	Order No. 7489/01	Ready made
18	Captive nut, M4	1	Steel	Order No. 7766/04	Ready made
19	Nylon screw, M4	1	Nylon	Order No. 7769/04	Ready made
20	Rudder leading edge	1	Balsa	300 x 25 x 25	Balsa strip
21	Rudder top fillet	1	Balsa	50 x 15 x 5	Not shaped
22	Rudder	1	ABS	290 x 80 x 25	Vac. moulded
23	Spring strut	1	Steel	2 Ø, as plan	Ready made
24	Tailwheel fairing	1	ABS	55 x 25 x 20	Vac.-moulded
25	Tailwheel	1	Plastic	Order No. 7352/01	Ready made
26	Collet	2	Plated brass	Order No. 5842/20	Ready made
27	Brass tube	1	Brass	3 Ø / 2.1 x 40	Brass tube
28	Brace	1	Plywood	3	Die-cut
29	Control surface hinge	6	Nylon	Order No. 7495/00	Ready made
30	Woven glass cloth	1	Glass	30 x 50	Ready made
31	Incidence peg	1	Brass	5 Ø / 4.1 x 210	Brass tube
32	Brass tube	1	Brass	9 x 210 / 9 x 150	Brass tube
33	Wing joiner rod	1	Steel	8 Ø x 498 mm	Ready made
34	Wing retainer	1	Plastic	No. 7329 / 55	Ready made
35	Undercarriage support	1	Balsa	18 x 160 x 55	Pre-shaped
36	Undercarriage leg	2	Steel	2 x 18 x 190	Ready made
37	Self-tapping screw	4	Steel	2.2 x 13 7768/00	Ready made
38	Fore-and-aft support	2	Plywood	3	Die-cut
39	Woven glass cloth	2	Glass	50 x 100	Glass cloth
40	Wheel spat	2	ABS	As plan	Ready made
41	Wheel axle	2	Steel	M4 x 35 7776/31	Ready made
42	Nut	6	Steel	M4 7774/04	Ready made
43	Wheel	2	Plastic	Order No. 7352/06	Ready made
44	Nut	2	Steel	M4, filed flat	Ready made
45	Undercarriage leg fairing	4	Obechi	95 x 25 x 2	Obechi strip
46	Cowl retainer block	4	Beech/obechi	10 x 10 x 15	Not shaped
47	Canopy	1	PVC		Vac. moulded
48	Window	2	PVC		Vac. moulded
49	Canopy brace	1+1	Plywood	3	Die-cut
50	Canopy brace cross-piece	1	Plywood	3 x 10 x 8	Die-cut
51	Compass side panel	2	Plywood	3 x 14 x 12	Die-cut
52	Canopy latch	1	Brass	Order No. 7329/00	Ready made
53	Self-tapping screw	9	Steel	2.2 x 6	Ready made
54	Airbrake, 250/10	2	Aluminium	7329/42	Ready made
55	Servo well cover	2	Plastic		Ready made

56	Tailplane trailing edge	1	Balsa	3 x 10 x 500	Balsa strip
57	Tailplane rib	2	Balsa	3	Die-cut
58	Tailplane rib	2	Balsa	3	Die-cut
59	Tailplane rib	2	Balsa	3	Die-cut
60	Tailplane rib	2	Balsa	3	Die-cut
61	Tailplane rib	2	Balsa	3	Die-cut
62	False leading edge	1	Balsa	3 x 8 x 500	Balsa strip
63	Centre block	2	Balsa	15 x 20 x 15	Not shaped
64	Tailplane skin	2	Obechi	1 x 130 x 500	Obechi sheet
65	Tailplane leading edge	1	Balsa	5x8x500 7541/10	Balsa strip
66	Tailplane tip	2	Balsa	15 x 15 x 75	Not shaped
67	Tailplane horn	1	Steel	2 Ø	Ready made
68	Elevator leading edge	1	Balsa	8 x 8 x 500	Triangular
69	Elevator joiner	1	Spruce	3 x 10 x 100	Not shaped
70	Elevator	2	Balsa	10 mm	Pre-shaped
71	Ball-link (modify as shown)	1	Nylon	Order No. 7489/05	Ball-link
72	Wing panels	1+1	Foam/obechi		Ready made
73	Servo well base plate	4	Plywood	50 Ø x 1	Die-cut
74	Root rib; trim as drawing	2	Plywood	2 mm	Die-cut
75	Wing root fillet	2	Plywood	2	Die-cut
76	Aileron end piece	8	Balsa	3 x 10 x 40	Balsa strip
77	Aileron recess lining strip	2	Balsa	3 x 10 x 650	Balsa strip
78	No part				
79	Wing tip plate	2	Balsa	25 x 25 x 130	Balsa strip
80	RC installation plate	1	Plywood	3 x 50 x 195	Not shaped
81	Sleeve	1	Plastic	3.5 Ø x 750	Ready made
82	No part				
83	No part				
84	Threaded coupler, M2	3	Brass	Order No. 7489/09	Ready made
85	Rudder horn	1	Brass	M 2	Ready made
86	Aileron cable	2	Steel	1.8 Ø x 1000	braided wire
87	Control surface horn	2	Nylon	Order No. 7491/03	Ready made
88	Brass tube	2	Brass	3 / 2.1 Ø x 50	Brass tube
89	Decals	1	Plastic	300 x 220	Ready made
90	PU adhesive	1		25 ml	Bottle
91	(formerly 34)	2	Steel	4 x 80	
U	Packing strip	2	Balsa	5 x 5 x 500	Balsa strip

To complete the model you will also need the following items which are not included in the kit:

	Order No.
UHU Plus Endfest 300	7633/02
UHU Hart	7631/02
Pattex	7639/01
Glutofix	7660/00
Aerofix sanding sealer	7666/05
Aero thinners	7675/05
Synthetic enamel spray can, white	7684/41
Synthetic enamel spray can, red	7684/45
Synthetic enamel spray can, blue	7684/46

Replacement parts available separately:

	Order No.
Ready-made GRP fuselage	1340/02
Canopy	1340/04
Ready-made wing panels	1340/05
1 set ABS wheel spats	1340/13