GROUND TEST INSTRUCTIONS

SECTION 10

FLYING CONTROLS

LIST OF CONTENTS

SECTION 10

FLYING CONTROLS

PART 1

GENERAL

Attention is drawn to the Special Note (preceding Sect.13) on cleanliness during Hydraulic System Servicing. These precautions are most essential when handling the Hydraulic components employed in Flying Control Systems.
When making Tests detailed in Part 2 onwards, the Settings of Cabin Controls, Control Surfaces and Flaps (given in Part 1) are referred to where applicable. These Settings must conform to the given limits.

1. POWER CONTROLS (Post Mods.686-7 single seat, Mods.811-2 two seat).

It is important that at all times after landing in POWER, that MANUAL be selected prior to the hydraulic pressure being dissipated, as otherwise the handpump will be rendered ineffective. If MANUAL is not thus selected, an external rig will be required to restore the necessary pressure and MANUAL selected before shutting off the rig. Ground crews are to ensure that controls are in MANUAL before commencing any cabin servicing.

2. CONTROLS RUNS

All Control Runs must be checked for full and free movement and smoothness of operation (they must reach their respective stops without binding).
Ensure that all adjustments are correctly locked.
The forces required on the Control Column and Rudder Bar (to overcome static friction in the relevant Circuit) when measured with a standard Spring Balance (Ref.21C/2165) must not exceed the following:—

RUDDER CIRCUIT	6 lb. (average figure for a new aircraft is 2½ lb.)
ELEVATOR CIRCUIT	(as detailed in 'Manual'
	(Adjustments of Parts
AILERON CIRCUIT	(2 and 3.

(S.P.970, Pt.2, Chap.207, Para.2.2.2. refers).

The Control Column and Rudder Bar must be checked for freedom of movement and correct range of travel.
(Settings and Limits are given in Para's. 3 and 4).

3. CONTROL SURFACES

Check the following Control Surfaces for freedom of movement and correct range of travel (Settings and Limits are given in Paras.5 and 6):–

AILERONS & AILERON TRIMMING TAB.
ELEVATORS.
RUDDER & RUDDER TRIMMING TAB.
FLAPS.
VARIABLE INCIDENCE TAILPLANE.

4. CONTROL COLUMN SETTINGS (Drg.No.E.202984).

The Control Column must operate within the permissible limits of the following Settings:–

NEUTRAL	–	9 deg. 30 min. (plus 30 min. minus ZERO) aft of vertical.
MAX. FORWARD	–	1 deg. 30 min. (plus or minus 30 min.) aft of vertical.
MAX. AFT	–	28 deg. (plus or minus 30 min.) aft of max. forward.
LATERAL	–	41 deg. (plus or minus ONE deg.) in both directions (Port and Starboard).

5. RUDDER BAR SETTINGS (Drg.No.E.202984)

The Rudder Bar must operate within the permissible limits of the following Settings:–

FORE	–	21 deg. 15 min. (plus or minus ONE deg.)
AFT	–	in both directions.

6. CONTROL SURFACE SETTINGS (Drg.No.E.202984)

The Control Surfaces must operate within the permissible limits of the following respective Settings:–

VARIABLE INCIDENCE TAILPLANE

NEUTRAL to FULLY UP – 2 deg. 36 min. (Max.) to 2 deg. 24 min. (Min.)

NEUTRAL to FULLY DOWN – 2 deg. 36 min. (Max.) to 2 deg. 24 min. (Min.)

ELEVATORS (with V.I. Tailplane in NEUTRAL.)

(a) POWER (with Spring Feel Unit CONNECTED)
- UP – 23 deg.
- DOWN – 9 deg.

(b) MANUAL
- UP – 22 deg. 30 min.
- DOWN – 8 deg. 30 min.

(plus 30 min. minus ZERO) for all settings.

RUDDER
- PORT – 20 deg.
- STBD – 20 deg.

(plus ZERO minus ONE deg.) for both settings.

RUDDER TAB.

7 deg. to 8 deg. for both port and stbd. directions.

6. CONTROL SURFACE SETTINGS (Contd.)

AILERONS

(a) POWER (with Spring Feel Unit 'CONNECTED')

UP – 13 deg.
DOWN – 13 deg.

(b) MANUAL

UP – 12 deg. 30 min.
DOWN – 12 deg. 30 min.

(plus or minus 30 min.) for all settings

AILERON TAB (Port only).

UP – 20 deg.
DOWN – 20 deg.

(plus or minus 2 deg.) for both settings.

7. FLAP SETTINGS (Drg.No.E.202984)

The Flaps must operate within the permissible limits of the following Table:–

FLAP STATION	DRUM SWITCH POSITION	SELECTED ANGLE (plus or minus 2 deg.)	MEASUREMENT FROM NEUTRAL (plus or minus 0.5")
A	1	15 deg.	6.80"
B	2	22 deg. 30 min.	10.10"
C	3	30 deg.	13.40"
D	4	37 deg. 30 min.	16.60"
E	5	45 deg.	19.80"
F	6	60 deg.	25.80"
G	7	80 deg.	33.10"

SECTION 10

FLYING CONTROLS

PART 2

FULL POWER FLYING CONTROLS

AND ELECTRIC FLYING TAIL

I.D. INSTRUCTION H207/4 (Issue 12)
(Incorporating Mod.No.A.S.H.680/53)

1. APPLICABILITY

This instruction covers Mks.4, 5, 6, 50, 51, 56 and 58 aircraft incorporating the following modifications:—

139, 151, 188, 202, 353, 360, 365, 368, 390, 416, 428, 433, 452, 457, 468, 473, 483, 486, 487, 497, 502, 514, 568, 569, 579, 597, 605, 629, 690, 696, 705, 781, 834, 903, 922, 961, 988, 996, 1004, 933.

2. INTRODUCTION

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

3. SECTION 'A' ADJUSTMENTS

Before the aileron units are installed in the wings it is necessary to check pawl engagement and set the release unit microswitches to I.D. Test Instruction H.207/5 (H.207/11 for Mk.58). The aileron booster units should be located at their neutral positions, on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'A' on the rigging plates, except on Mk.6 where the faces marked 'B' should be used. See I.D. Sk.439 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used. Check manually that the booster rams move freely in the release units at as early an assembly stage as possible.

4. MANUAL ADJUSTMENTS – AILERONS

(i) Disconnect 2 position jack at control rod A.206734.

(ii) With control column set to instructions on D.206791, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(iii) Set spring feel unit to neutral and lock control column in neutral.

(iv) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and reconnect A.206734 to 2 position jack.

(v) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399 .

4. MANUAL ADJUSTMENTS – AILERONS (Contd.)

(vi) Adjust control tubes A.169525 and connect to levers.

(vii) Adjust output rods so that the aileron trailing edges have approximately 0.2 in. upfloat.

(viii) Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the control column when the control column is moved without force (one finger on top of the control column).

(ix) Release the control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 5 lb. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D.Sk.439) and check that the load at the middle of the handgrip to move the control column in either direction is less than ½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Reconnect at YY after rectification.

(x) Adjust control column stops so that (temporarily) $\pm 6^{\circ}$ of aileron movement is obtained.

5. MANUAL ADJUSTMENTS – ELEVATOR

(i) Disconnect the elevator feel unit at forward end and tie up clear of elevator feel connecting lever. Disconnect the upper ends of the flying tail switchgear spring unit and connecting rod and tie clear of the elevator lever.

(ii) The tailplane main control switch should be 'OFF'.

(iii) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring control column to neutral.

(iv) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(v) Adjust and connect control tube B.215730 to booster assy. input lever.

(vi) Adjust output rod B.176196 so that elevator is trailing in neutral.

(vii) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

(viii) Lock input circuit at elevator booster. Check that the backlash at the top of the control column when moved without force does not exceed 1/16".

(ix) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of the control column must not exceed ¾" (elevator booster AH514, 9/16").

(x) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xi) Check that the load at the middle of the handgrip to move elevator 'up' is less than 2 lb. and elevator 'down' less than 5 lb. (elevator booster AH514, 4 lb.). Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

(xii) Adjust control column stops so that (temporarily) 8° down and 20° up movement is obtained.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power assisted control circuits MUST be passed through a 'Micronic' Filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control column is free.

(iv) Disconnect and blank the release units. With power on, move the control column and the rams should slide freely through the release units, if the vlaves are adjusted. No valve adjustment should be required for elevator. Check that the pressure required to move booster rams in either direction does not exceed 250 p.s.i.

(v) Set hydrobooster pawl microswitches to H.207/5, using the hand pump section of the main hydraulic rig.

(vi) For general functioning, use the power section of the main hydraulic rig.

(vii) Before any valve adjustments etc. are done the hydroboosters must be cleared of entrained air by repeated functioning.

(viii) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4347 section 3, chapter 4, paragraph 30 (or equivalent).

(ii) Check ailerons upfloat 0.2" in manual with control column neutral. Engage power and obtain full aileron movement by adjusting the control column stops: this should be $\pm 13^{o}$ as defined by drg.No.E.202984.

(iii) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving a control column from extreme position.

(iv) Put control column neutral, do not lock in position, adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are: Up, $\frac{1}{2}^{o}$, Down, 0^{o}.

(v) Check control surface movements, the full amount (see 2 above) should be available.

(vi) Lock selector valve tab-washer on both units.

(vii) Check controls for ease of movement: load to move control from central position in either direction to be 3 lb. max.

8. ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control column neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction. There should be no tendency for the control column to move on when released after gentle movement.

8. ELEVATOR (Contd.)

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust aft control column stop to give an elevator angle of $-22^{o}/21\frac{1}{2}^{o}$ and the forward stop to give an elevator angle of $+9\frac{1}{2}^{o}/9^{o}$.

(vi) On completion of adjustments lock servo valve eye-end.

(vii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch gear spring unit and connecting rod to elevator lever.

(viii) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(ix) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(x) With control column held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^{o}$ of elevator movement.

(xi) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving the control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{o} \pm \frac{1}{4}^{o}$ of elevator movement. If these limits are exceeded repeat item (x) and re-check: lock adjusting bolt on completion.

(xii) Re-connect datum trim actuator aircraft supply, andwith stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiii) Move control column aft and check the tailplane actuator begins to retract before elevator angle is $+2^{o}$ to $+3^{o}$ relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xiv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xv) Move tailplane selector switch to 'OFF' and with control column neutral check that full tailplane movement is obtainable on operating trim switch.

8. ELEVATOR (Contd.)

(xvi) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs; re-select 'OFF' and inch the actuator by operating the control column trim button sharply without disturbing the control column: then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xvii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xviii) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. SECTION 'B' INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with SECTION A above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

TESTS

10. POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the control column is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(iii) Measure force in pounds at stick grip to just move elevator from the central position up and down. This should be a maximum of 2 lb. up and 5 lb. down. Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 5 lb. maximum.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m. (3rd. gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With rig pump running, select aileron and elevator power 'ON', holding switches 'ON' until locks are engaged and indicators clear. Check that the boosters engage on moving the stick and the aileron indicator does not clear until both aileron locks are engaged and elevator indicator does not clear until the elevator lock is engaged.

(ii) Check that locks remain engaged, with indicators clear, on releasing switches. Select power 'OFF' and check that boosters disengage.

11. POWER ON (Contd.)

(iii) Hold stick deflected so that the aileron ram slots are misaligned with their pawls. Hold the aileron power switch 'ON' and engage one aileron lock by moving the aileron by hand. Release switch and check that both pawls are fully out. Repeat, engaging the other aileron lock. Select aileron power 'ON' and engage locks. Release switch. Press the emergency aileron power disengaged button momentarily and check that both pawls are fully out. Hold stick deflected so that the elevator ram slot is misaligned with the pawl. Select elevator power 'ON' and release switch. Check that the pawl is fully out.

(iv) Select elevator power 'ON' and engage lock. Release switch. Press the emergency elevator power disengaged button momentarily and check that the pawl is fully out. Select 'power on', re-engage lock, then measure force in pounds at the control column handgrip to just move elevator from the central position, up and down, (maximum 2 lb.). Measure force in pounds at the control column handgrip to just move ailerons from the central positions, port and starboard (maximum 3 lb.). Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other.

(v) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(vi) Measure aileron movement up and down, port and starboard. Check that, with control column neutral, there is no aileron down-float and not more than ½^{O} up-float. Check operation of 2-position jack by selecting aileron power 'ON' and 'OFF'.

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up, 3½^{O} min.). Repeat with control turned fully anticlockwise. Centralise feel knob.

(viii) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 min., check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 3. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. For elevator, commence by moving stick forward from neutral. Check that the changeover to manual takes place smoothly.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control column should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons.

(x) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xi) Check that aileron feel spring centres control column accurately when control column is deflected ½" from centre and released.

(xii) Repeat (x) above after rest periods of one minute, three minutes and five minutes, then check:—

(a) that initial control column load does not increase after one minute of rest.

(b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control column within 0.3" of central, after deflecting it with one finger on top of the grip.

11. POWER ON (Contd.).

(xv) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:–

Tailplane:	Neutral	Elevator:	22° up, $9\frac{1}{2}^{\circ}$ down
	Fully positive		25° up, 7° down
	Fully negative		$18\frac{3}{4}^{\circ}$ up, 13° down

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

(xvii) Push up the control column trimming switch, without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is $1\frac{1}{4}^{\circ} \pm {}^{1}/8^{\circ}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xviii) Measure tailplane and elevator angles, moving control column in the following sequence:–

(a) Fully forward.

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is $1\frac{1}{2}^{\circ}$ to 2°.

(xix) Push the trim switch, without biassing the stick, down until extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at 18(a), (b), (d) and (e).

(xx) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking the stick and letting go.

(xxi) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxii) Run hydraulic rig at a speed corresponding to 1950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators) while making the following selections:–

(a) Undercarriage down.

(b) Undercarriage up.

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

11. POWER ON (Contd.).

(xxiii) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be as shown below.

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	As max. t/p control OFF		7° down	$5\frac{1}{2}^{\circ}$ down
	Fully aft	As min. t/p control OFF		$18\frac{1}{2}^{\circ}$ up	17° up
2. Full Positive	(a) Fully forward	As max. t/p control OFF		7° down	$5\frac{1}{2}^{\circ}$ down
	(b) Moved aft until tailplane just moves.	As reading at (2.a)	+0, –2′	$1^{3}/8^{\circ}$ up	$1^{1}/8^{\circ}$ up
	(c) Moved aft to tailplane zero	0	0	8° up	7° up
	(d) Fully aft	$-1^{\circ} : 52'$	$-2^{\circ} : 12'$	$19\frac{1}{2}^{\circ}$ up	18° up
	(e) Moved forward until tailplane just moves.	As reading at (2.d)	+2′, –0	17° up	$15\frac{1}{2}^{\circ}$ up
	(f) Moved forward to tailplane zero	0	0	$6\frac{1}{2}^{\circ}$ up	$5\frac{1}{2}^{\circ}$ up
3. Full Negative	(a) Fully forward	+10′	–20′	$9\frac{1}{2}^{\circ}$ down	$8\frac{1}{2}^{\circ}$ down
	(b) Moved aft until tailplane just moves.	As reading at (3.a)	+0, –2′	$8\frac{1}{2}^{\circ}$ down	$7\frac{1}{2}^{\circ}$ down
	(d) Fully aft.	As min. t/p control OFF		$18\frac{1}{2}^{\circ}$ up	17° up
	(e) Moved forward until tailplane just moves.	As reading at (3.d)	+2′, –0	$2\frac{1}{2}^{\circ}$ down	$\frac{1}{2}^{\circ}$ down

SECTION 10

FLYING CONTROLS

PART 3

HYDROBOOSTER RELEASE UNIT

MICRO-SWITCHES

I.D. INSTRUCTION H207/5 (Issue 4)
(Incorporating Mod.No.A.S.H. 760/51)

1. APPLICABILITY

All marks, pre- and post-mods.H.452, 468, 514, 684, except Mk.58 and aircraft fitted with Mods.686, 687, 811 and 812.

2. EQUIPMENT REQUIRED

(i) Hydrobooster Cradle (as Drg.No.T.397388 – for aileron boosters only.

(ii) Hydraulic hand pump rig with micronic filter and calibrated pressure gauge.

(iii) Electrical rig to I.D.Sk.1696.

(iv) 6 to 8 volt Electrical supply.

(v) 0.035 in. x $^3/16$ in. wide slip-gauge, and

(vi) 0.040 in. x $^3/16$ in. wide slip-gauge.

Or,

(vii) 0.038 in. x $^3/16$ in. wide slip-gauge, and

(viii) 0.043 in. x $^3/16$ in. wide slip-gauge.

3. TEST METHOD WITH PYE SWITCHES

(i) Mount the hydrobooster jack and release unit (if of aileron type) in the cradle. Connect hydraulic and electrical rigs. Ensure that the ram slot and mating parts of the pawl, the microswitch button and its mating face are clean and grease-free.

It is important that their relative positions allow the pawl to seat squarely in the ram slot.

(ii) Apply a steadily-increasing pressure and check that by the time 650 p.s.i. is reached the pawl is fully engaged: i.e. the ram cannot move in the release unit.

(iii) Increase pressure to 2800 p.s.i. and after a few seconds reduce to 650 p.s.i. At this pressure check that the pawl is fully engaged and, for aileron and early elevator boosters, check that the gap between it and the bottom of the ram slot is within the limits 0.005 in. to 0.019 in. Record the value obtained. For AH.613 and AH.853 elevator boosters, ensure pawl is in contact with bottom of slot.

3. TEST METHOD WITH PYE SWITCHES (Contd.).

(iv) Release pressure and insert the 0.035 in. slip-gauge between the pawl and the bottom of the ram slot. Apply a pressure of 550 to 650 p.s.i. so that the slip-gauge is clamped by the pawl. Set the microswitch to indicate engagement: i.e. lamp 1 (and lamp 2, when used) should be alight: lamp 3 should be out. Lock adjustment bolt or bolts.

(v) Release pressure, reapply 550 to 650 p.s.i. and check that setting is unchanged.

(vi) Release pressure and replace the 0.035 in. slip-gauge by the 0.040 gauge. Apply 550 to 650 p.s.i., so that the slip-gauge is clamped, and check that switch does not operate; i.e. lamps 1 and 2 remain out and lamp 3 alight.

(vii) If switch operates repeat items (iv), (v) and (vi) until correct setting is attained.

(viii) Release pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot (disregard the "lead-in" to the slot).

(ix) Switch off and disconnect hydrobooster.

4. TEST METHOD WITH DOWMIC SWITCHES to F.230401

(i) Mount the hydrobooster jack and release unit in the cradle. Connect hydraulic and electrical rigs. Ensure that the ram slot and mating parts of the pawl, the micro-switch button and its mating face are clean and grease-free.

It is important that their relative positions allow the pawl to seat squarely in the ram slot.

(ii) Apply a steadily-increasing pressure and check that by the time 650 p.s.i. is reached the pawl is fully engaged: i.e. the ram cannot move in the release unit.

(iii) Increase pressure to 2800 p.s.i. and, after a few seconds, reduce to 650 p.s.i. At this pressure check that the pawl is fully engaged and that the gap between it and the bottom of the ram slot is within the limits 0.005 in. to 0.019 in.

(iv) Release pressure and insert the 0.043 in. slip-gauge between the pawl and the bottom of the ram slot. Apply a pressure of 550 to 650 p.s.i. so that the slip-gauge is clamped by the pawl. Move in the micro-switch by turning the knurled knob until lamps 1 and 2 just light. Move out the micro-switch until disengagement is indicated: i.e. lamps 3 and 4 should be alight and lamps 1 and 2 out. (If more than ¼ turn of the knob is needed on moving out, the switch should be inspected for excessive differential). Lock microswitch.

(v) Release pressure and reapply 550 to 650 p.s.i. with the 0.043" gauge still in place. Depress the micro-switch plunger by hand until lamps 1 and 2 are alight. Release plunger slowly and check that lamps 3 and 4 are alight and lamps 1 and 2 are out when the plunger is resting on the end of the release unit piston rod. Ensure by moving the plunger sideways that it is fully out.

(vi) Release pressure and replace the 0.043 in. slip-gauge by the 0.038 in. gauge. Apply 550 to 650 p.s.i. Depress the micro-switch plunger by hand until lamps 1 and 2 are alight. Release plunger slowly and check that lamps 1 and 2 remain alight and lamps 3 and 4 out when the plunger is resting on the piston rod end.

4. TEST METHOD WITH DOWMIC SWITCHES to F.230401 (Contd.).

(vii) If switch operates incorrectly, repeat items (iv), (v) and (vi) until correct setting is obtained.

(viii) Release pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot (disregard the "lead-in" to the slot).

(ix) Apply pressure slowly and check that by the time 500 p.s.i. is reached the micro-switch indicates engagement: i.e. lamps 1 and 2 are alight.

(x) Release pressure and disconnect rig and electrics.

I.D.S.K. 1696
SEE I.D. TEST
INSTRUCTION
H 207/5

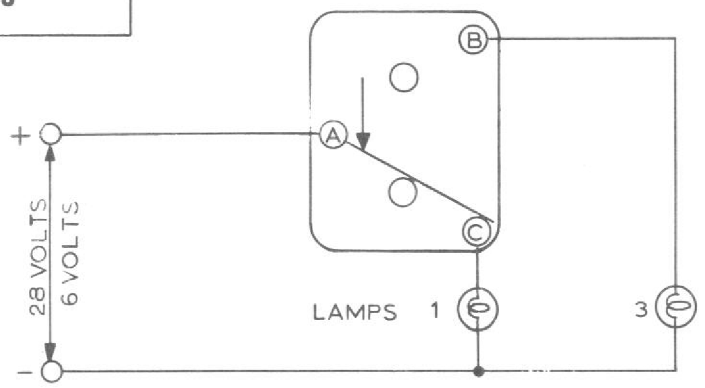

FIG. A. PORT AILERON BOOSTER - PRE & POST-MOD. H452
ELEVATOR & ST'B'D AILERON BOOSTER – PRE–MOD H 452

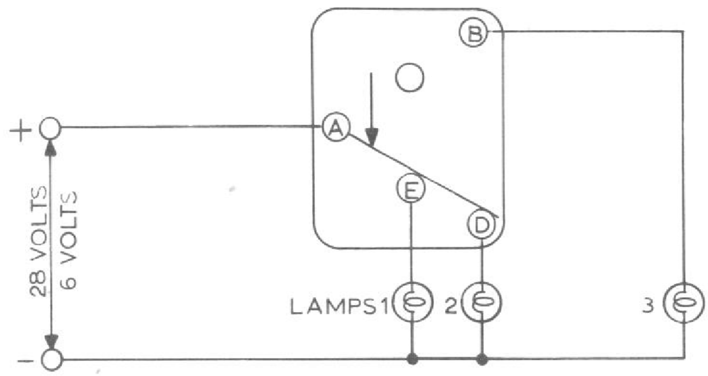

FIG B ELEVATOR & ST'B'D AILERON BOOSTER-POST-MOD H452

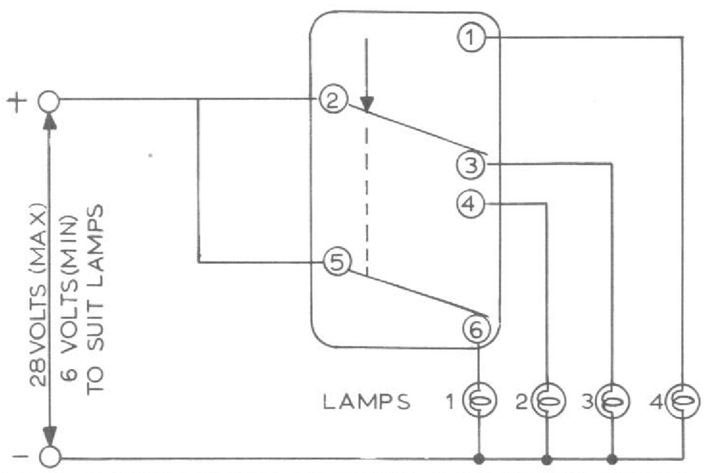

FIG C PORT & ST'B'D AILERON BOOSTERS-POST-MOD. H 684

HUNTER–WIRING DIAGRAM HYDROBOOSTER MICROSWITCH SETTING

NOTE: SWITCHES SHOWN ACTUATED —— PAWLS ENGAGED.

SECTION 10

FLYING CONTROLS

PART 4

FULL-POWER FLYING CONTROLS

AND ELECTRIC FLYING TAIL (Two Seater)

I.D. INSTRUCTION H207/6 (Issue 4)

1. APPLICABILITY

This instruction covers two-seater aircraft incorporating the following modifications:—

390, 473, 486, 487, 507, 514 (or 718 or 2373 or 2383) 568, 569, 579, 597, 605, 629, 684, 690, 696, 705, 781, 782, 834, 888, 903, 921, 922, 933, 961, 988, 996, 1004, 1041.

2. INTRODUCTION

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected, to prevent any dirt entering the system.

3. SECTION 'A' ADJUSTMENTS

Before the aileron units are installed in the wings it is necessary to check pawl engagement and set the release unit microswitches, to I.D. Test Instruction H.207/5. The aileron booster units should be located at their neutral positions on assembly by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'A' on the rigging plates. See I.D. Sk.1409 for a diagram of the aileron control system. (Note: Faces marked 'B' to be used on Mk.66 aircraft).

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out, before any hydraulics are used. Check manually that the booster rams move freely in the release units at as early an assembly stage as possible.

4. MANUAL ADJUSTMENTS — AILERONS

(i) Disconnect port control column at control rod A.207336 (see E.217039) and 2-position jack at control rod A.217043 (see C.217041).

(ii) With stbd. control column set to instructions on D.217279, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement. Ensure chain adjusters are in safety.

(iii) Lock stbd. control column handle in neutral using rigging fixture D.232208 and check that 2-position jack, retracted in manual, is horizontal. If necessary re-adjust the stbd. column chains and recheck for safety.

4. MANUAL ADJUSTMENTS – AILERONS (Contd.).

(iv) With port control column set to instructions on D.227983 adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(v) Set spring feel unit to neutral and adjust control rod A.207336 to bring port control column handle neutral. Do not connect control rod.

(vi) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and reconnect A.217043 to 2-position jack.

(vii) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(viii) Adjust control tubes A.169525 and connect to levers.

(ix) Adjust output rods so that the aileron trailing edges have approx. 0.2 in. upfloat.

(x) Remove setting locks in wings and fuselage and control column rigging fixture.

(xi) Unclamp 2-position jack. Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the starboard control column when the control column is moved without force (1 finger on top of the control column).

(xii) Reconnect port control column circuit at control rod A.207336, but do not lock. Check that port control column backlash is not more than 3/32" as in (xi) above.

(xiii) Disconnect port control column at control rod A.207336. Unlock linkage at stub wing and connect to linkage in wing.

(xiv) Release the starboard control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 4 1h. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D.Sk.1409) and check that the load at the middle of the handgrip to move the control column in either direction is less than ½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Reconnect at YY after rectification.

(xv) Adjust port control column stops so that (temporarily) $\pm 6^{o}$ of aileron movement is obtained.

(xvi) Free the port control column and check that the load at the middle of the handgrip to move the control column in either direction is less than 5 lb. If it exceeds this value check as in (xiv) above.

5. MANUAL ADJUSTMENTS – ELEVATOR

(i) Disconnect the stbd. control column at control rod A.207361.

(ii) Disconnect the elevator feel unit at forward end and tie up clear of elevator feel connecting lever. Disconnect the upper ends of the flying tail switchgear spring unit and connecting rod and tie clear of the elevator lever.

(iii) The tailplane main control switch should be 'OFF'.

(iv) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring port control column to neutral.

(v) Adjust and connect control rod A.207361 to bring stbd. control column to neutral.

5. MANUAL ADJUSTMENTS – ELEVATOR (Contd.).

(vi) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(vii) Adjust and connect control tube B.215730 to booster assy. input lever.

(viii) Adjust output rod B.176196 so that elevator is trailing in neutral.

(ix) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32' ; adjust control neutral if necessary.

(x) Lock input circuit at elevator booster. Check that the backlash at the top of both port and stbd. control columns when moved without force does not exceed 1/16".

(xi) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of either control column must not exceed ¾".

(xii) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xiii) Disconnect port control column at control rod B.165991 and check that the load at the middle of the stbd. handgrip to move the control column is less than 5 lb. for elevator down and 2 lb. for elevator up. Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

(xiv) Repeat (xiii) for port control column.

(xv) Adjust port control column stops to give, temporarily, 8° down and 20° up elevator movement.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power control circuits MUST be passed through a 'Micronic' Filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control columns are free.

(iv) Disconnect and blank the release units. With power on, move the control column and the rams should slide freely through the release units, if the valves are adjusted. No valve adjustment should be required for elevator. Check that the pressure required to move booster rams in either direction does not exceed 250 p.s.i.

(v) Set hydrobooster pawl microswitches to H.207/5, using the hand pump section of the main hydraulic rig.

(vi) For general functioning, use the power section of the main hydraulic rig.

(vii) Before any valve adjustments etc. are done the hydroboosters must be cleared of entrained air by repeated functioning.

(viii) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4347G, section 3, Chapter 4, Paragraph 33 (or equivalent).

5. MANUAL ADJUSTMENTS – ELEVATOR (Contd.).

(vi) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(vii) Adjust and connect control tube B.215730 to booster assy. input lever.

(viii) Adjust output rod B.176196 so that elevator is trailing in neutral.

(ix) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32' ; adjust control neutral if necessary.

(x) Lock input circuit at elevator booster. Check that the backlash at the top of both port and stbd. control columns when moved without force does not exceed 1/16".

(xi) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of either control column must not exceed ¾".

(xii) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xiii) Disconnect port control column at control rod B.165991 and check that the load at the middle of the stbd. handgrip to move the control column is less than 5 lb. for elevator down and 2 lb. for elevator up. Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

(xiv) Repeat (xiii) for port control column.

(xv) Adjust port control column stops to give, temporarily, 8° down and 20° up elevator movement.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power control circuits MUST be passed through a 'Micronic' Filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control columns are free.

(iv) Disconnect and blank the release units. With power on, move the control column and the rams should slide freely through the release units, if the valves are adjusted. No valve adjustment should be required for elevator. Check that the pressure required to move booster rams in either direction does not exceed 250 p.s.i.

(v) Set hydrobooster pawl microswitches to H.207/5, using the hand pump section of the main hydraulic rig.

(vi) For general functioning, use the power section of the main hydraulic rig.

(vii) Before any valve adjustments etc. are done the hydroboosters must be cleared of entrained air by repeated functioning.

(viii) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4347G, section 3, Chapter 4, Paragraph 33 (or equivalent).

7. AILERONS

(ii) Check ailerons upfloat 0.2" in manual with control columns neutral. Engage power and obtain full aileron movement by adjusting the starboard control column stops; this should be ± 13° as defined by Drg.No.E.202984.

(iii) Adjust the port control column stops to give full aileron movement.

(iv) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving a control column from extreme position.

(v) Put control columns neutral, do not lock in position, adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are: Up, ½°, Down, 0°.

(vi) Check control surface movements, the full amount **(see (ii) above)** should be available.

(vii) Lock selector valve tab-washer on both units.

(viii) Check controls for ease of movement; load to move control from central position in either direction to be 3 lb. max.

8. ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control columns neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction. There should be no tendency for the control columns to move on when released after gentle movement.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust port aft control column stop to give an elevator angle of −22°/21½° and the forward stop to give an elevator angle of +9½°/9°.

(vi) Adjust starboard control column stops to agree with setting of port stops.

(vii) On completion of adjustments lock servo valve eye-end.

(viii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch-gear spring unit and connecting rod to elevator lever.

(ix) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(x) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(xi) With control columns held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading 1¾° of elevator movement.

8. ELEVATOR (Contd.).

(xii) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving a control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{o} \pm \frac{1}{4}^{o}$ of elevator movement. If these limits are exceeded repeat item 11 and re-check: lock adjusting bolt on completion.

(xiii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiv) Move a control column aft and check the tailplane actuator begins to retract before elevator angle is $+ 2^{o}$ to $+ 3^{o}$ relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xvi) Move tailplane selector switch to 'OFF' and with control columns neutral check that full tailplane movement is obtainable on operating trim switch.

(xvii) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs; re-select 'OFF' and inch the actuators by operating a control column trim button sharply without disturbing the control column: then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xviii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xix) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. SECTION 'B' INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators which should be adjusted in accordance with SECTION 'A' above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

TESTS

10. POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the starboard and port control columns is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

10. POWER OFF (Contd.).

(iii) Measure force in pounds at starboard stick grip to just move elevator from the central position up and down. This should be a maximum of 2 lb. up and 5 lb. down. Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 5 lb. maximum.

(iv) Repeat (iii) for port control column.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m., (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With the rig pump running, select aileron power 'ON' using the pupil's switch. Check that the power remains 'OFF' until the instructor's switch is moved to the 'ON' position. With power 'ON' check that the ailerons cannot be moved by hand when a control column is held. Check that power selection reverts to manual when the pupil's switch and check control reverts to manual when the instructor's switch is moved to the 'OFF' position. Check the operation of the aileron indicators and 2-position aileron jack throughout.

(ii) Select elevator power 'ON' using the pupil's switch. Check that the power remains 'OFF' until the instructor's switch is moved to the 'ON' position. Hold pupil's switch 'ON' until lock is engaged. Check that booster engages on moving a stick and that the magnetic indicators clear when the lock is in. Check that the elevator indicators do not clear until elevator lock is engaged. Check that lock remains engaged on releasing the switch. Select 'OFF' on pupil's switch and check that booster disengages. Re-engage booster using the pupil's switch and check that the booster disengages when the instructor's switch is moved to the 'OFF' position.

(iii) Disengage aileron boosters and hold stick deflected so that the aileron ram slots are misaligned with their pawls. Hold the aileron power switch 'ON' and engage one aileron lock by moving the aileron by hand. Release switch and check that both pawls are fully out. Repeat, engaging the other aileron lock. Select aileron power 'ON' and engage locks. Release switch. Press the emergency aileron power disengaged button momentarily and check that both pawls are fully out. Hold a stick deflected so that the elevator ram slot is misaligned with the pawl. Select elevator power 'ON' and release switch. Check that the pawl is fully out.

(iv) Select elevator power 'ON' and engage lock. Release switch. Press the emergency elevator power disengaged button momentarily and check that the pawl is fully out. Select 'power on', re-engage lock, then measure force in pounds at the starboard control column handgrip to just move elevator from the central position, up and down, (maximum 2 lb.) Measure force in pounds at the starboard control column handgrip to just move ailerons from the central positions, port and starboard (maximum 3 lb.) Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other. Repeat for port control column.

(v) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

11. POWER ON (Contd.).

(vi) Measure aileron movement up and down, port and starboard. Check that, with control columns neutral, there is no aileron down-float and not more than ½^{o} up-float.

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up, 3½^{o} min.). Repeat with control turned fully anticlockwise. Centralise feel knob.

(viii) Stop hydraulic pump and, after 1 min., measure number of complete cycles for aileron, before pawl disengages, (2 cycles). Repeat for elevator circuit (2 cycles pre mod.468, 1½ cycles when Mod.468 is incorporated). Re-start pump to build up system pressure, stop pump, move controls gently and check that pawl remains engaged at 550 p.s.i. and disengages by 150 p.s.i. Check for both ailerons and elevator.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control columns should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons, and on both port and starboard control columns.

(x) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xi) Check that aileron feel spring centres control columns accurately when control column is deflected ½" from centre and released.

(xii) Repeat (x) above after rest periods of one minute, three minutes and five minutes, then check:
- (a) that initial control column load does not increase after one minute of rest.
- (b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control columns within 0.3" of central, after deflecting one with one finger on top of the grip.

(xv) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:–

Tailplane:	Neutral	Elevator:	22^{o} up, 9½^{o} down
	Fully positive		25^{o} up, 7^{o} down
	Fully negative		18¾^{o} up, 13^{o} down

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

(xvii) Push up the starboard control column trimming switch without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is 1¼^{o} ± $^{1}/8^{o}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xviii) Measure tailplane and elevator angles, moving control column in the following sequence:–
- (a) Fully forward.
- (b) Moved aft until tailplane just moves.
- (c) Moved aft until tailplane is at zero incidence.
- (d) Fully aft.
- (e) Moved forward until tailplane just moves.
- (f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (e) and (f) is 1½^{o} to 2^{o}.

11. POWER ON (Contd.).

(xix) Push the starboard trim switch, without biassing the stick, down until extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at xviii (a), (b), (d) and (e).

(xx) Repeat xvii and xviii using port control column trimming switch.

(xxi) Repeat xix using port control column trimming switch.

(xxii) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking a stick and letting go.

(xxiii) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxiv) Run hydraulic rig at a speed corresponding to 1950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators) while making the following selections:–

(a) Undercarriage down.

(b) Undercarriage up.

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxv) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be as shown below.

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	As max. t/p control OFF		7° down	$5\frac{1}{2}^{\circ}$ down
	Fully aft	As min. t/p control OFF		$18\frac{1}{2}^{\circ}$ up	17° up
2. Full Positive	(a) Fully forward	As max. t/p control OFF		7° down	$5\frac{1}{2}^{\circ}$ down
	(b) Moved aft until tailplane just moves.	As reading at (2.a)	+0, −2′	$1\frac{3}{8}^{\circ}$ up	$1\frac{1}{8}^{\circ}$ up
	(c) Moved aft to tailplane zero	0	0	8° up	7° up
	(d) Fully aft	$-1^{\circ} : 52'$	$-2^{\circ} : 12'$	$19\frac{1}{2}^{\circ}$ up	18° up
	(e) Moved forward until tailplane just moves.	As reading at (2.d)	+2′, −0	17° up	$15\frac{1}{2}^{\circ}$ up
	(f) Moved fwd. to tailplane zero.	0	0	$6\frac{1}{2}^{\circ}$ up	$5\frac{1}{2}^{\circ}$ up

11. POWER ON (Contd.)

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
3. Full Negative	(a) Fully forward	+10′	−20′	9½° down	8½° down
	(b) Moved aft until tailplane just moves.	As reading at (3.a)	+0, −2′	8½° down	7½° down
	(d) Fully aft.	As min., t/p control OFF		18½° up	17° up
	(e) Moved fwd. until tailplane just moves.	As reading at (3.d)	+2′, −0	2½° down	½° down

SECTION 10

FLYING CONTROLS

PART 5

FULL-POWER FLYING CONTROLS

WITH LOCKED RELEASE UNITS

AND ELECTRIC FLYING TAIL (Mk.6)

I.D. INSTRUCTION H207/7 (Issue 8)

1. APPLICABILITY

This Instruction covers Mk.6 aircraft and Naval Single Seat Trainer (Mk.11), incorporating the following modifications:

139, 151, 188, 202, 353 or 365, 360, 368, 390, 416, 428, 433, 452, 457, 473, 483, 486, 487, 497, 502, 568, 569, 579, 597, 605, 629, (687 and 686) or (811 and 812), 690, 696, 703, 705, 781, ▶ ◀ 888, 895, 903, 922, 933, 941, 961, 988, 996, 1004 and 1005

Mods.353, 888 and 941 are not applicable to Mk.11. Mods.353, 888 and 941 are not applicable to Mk.11. Mod.841 is applicable to all Mk.11 and S.O.O. Mk.6 aircraft.

2. INTRODUCTION

The hydroboosters covered by this instruction are permanently engaged: the pilot's effort, in manual, moves the booster body against the ram seal friction. When the supply pressure falls below 400 p.s.i. a by-pass valve connects the two booster chambers to prevent a hydraulic lock.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

3. SECTION 'A' ADJUSTMENTS

The aileron booster units should be located at their neutral positions on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'B' on the rigging plates. Alignment of booster jack and its release unit on assembly to aircraft should be checked by unscrewing release unit locking bolt and ensuring that the ram slides freely through release unit. On completion of adjustments, screw in locking bolt to an indicated torque of approx. 70 lb. in., ensuring that pawl is properly seated in ram slot; wire-lock bolt. See I.D.Sk.1942 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used.

4. MANUAL ADJUSTMENTS – AILERONS

(i) Disconnect 2 position jack at control rod A.206734.

(ii) With control column set to instructions on D.206791, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(iii) Set spring feel unit to neutral and lock control column in neutral.

(iv) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and reconnect A.206734 to 2 position jack.

(v) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(vi) Adjust control tubes A.169525 and connect to levers.

(vii) Adjust output rods so that the aileron trailing edges have approximately 0.2 in. upfloat.

(viii) Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the control column when the control column is moved without force (one finger on top of the control column).

(ix) Release the control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 9 lb. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D. Sk.1942), and check that the load at the middle of the handgrip to move the control column in either direction is less than 1½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Reconnect at YY after rectification.

(x) Adjust control column stops so that (temporarily) $\pm 6^{\circ}$ of aileron movement is obtained.

5. MANUAL ADJUSTMENTS – ELEVATOR

(i) Disconnect the elevator feel unit at forward end and tie up clear of the elevator feel connecting lever. Disconnect the upper ends of the flying tail switchgear spring unit and connecting rod and tie clear of the elevator lever.

(ii) The tailplane main control switch should be 'OFF'.

(iii) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring control column to neutral.

(iv) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(v) Adjust and connect control tube B.215730 to booster assy. input lever.

(vi) Adjust output rod B.176196 so that elevator is trailing in neutral.

(vii) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

(viii) Lock input circuit at elevator booster. Check that the backlash at the top of the control column when moved without force does not exceed 1/16".

(ix) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of the control column must not exceed ¾".

5. MANUAL ADJUSTMENTS – ELEVATOR (Contd.)

(x) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xi) Check that the load at the middle of the handgrip to move elevator 'up' is less than 9 lb. (8 lb.) and elevator 'down' less than 7 lb. (8 lb.). Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb. (1 lb. for stick forward and 3 lb. for stick aft). Pre-mod.941 loads as typed, post-mod.941 loads in brackets.

(xii) Adjust control column stops so that (temporarily) 8^{O} down and 20^{O} up movement is obtained.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power assisted control circuits <u>MUST</u> be passed through a 'Micronic' Filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control column is free.

(iv) For general functioning, use the power section of the main hydraulic rig.

(v) Before any valve adjustments etc., are done the hydroboosters must be cleared of entrained air by repeated functioning.

(vi) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4347, section 3, chapter 4, paragraph 30 (or equivalent).

(ii) Note the locks will be engaged throughout. Obtain full aileron movement by adjusting the control column stops: this should be $\pm 13^{O}$ as defined by drg. No.E.202984.

(iii) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving the control column from extreme position.

(iv) Put control column neutral, do not lock in position, adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are: Up $\frac{1}{2}^{O}$, Down 0^{O}.

(v) Check control surface movements, the full amount (see 2 above) should be available.

(vi) Lock selector valve tab-washer on both units.

(vii) Check controls for ease of movement; load to move control from central position in either direction to be 3 lb. max.

8. ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control column neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

8. ELEVATOR (Contd.).

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction (1 lb. for elevator down and 3 lb. for elevator up).

Pre-mod.941 loads as typed, post-mod.941 loads in brackets.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust aft control column stop to give an elevator angle of $-22^{o}/21\frac{1}{2}^{o}$ ($-21^{o}/20\frac{1}{2}^{o}$) and the forward stop to give an elevator angle of $+9\frac{1}{2}^{o}/9^{o}$. Pre-mod.841 angles as typed, post-mod.841 angles in brackets.

(vi) On completion of adjustments lock servo valve eye-end.

(vii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch-gear spring unit and connecting rod to elevator lever.

(viii) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(ix) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(x) With control column held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^{o}$ of elevator movement.

(xi) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving the control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{o} \pm\frac{1}{4}^{o}$ of elevator movement. If these limits are exceeded repeat item 10 and re-check; lock adjusting bolt on completion.

(xii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane; Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiii) Move control column aft and check the tailplane actuator begins to retract before elevator angle is $+2^{o}$ to $+3^{o}$ relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xiv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

8. ELEVATOR (Contd.)

(xv) Move tailplane selector switch to 'OFF' and with control column neutral check that full tailplane movement is obtainable on operating trim switch.

(xvi) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs; re-select 'OFF' and inch the actuator by operating the control column trim button sharply without disturbing the control column; then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xvii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xviii) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. SECTION 'B' INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with Section 'A' above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

10. TESTS – POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the control column is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(iii) Measure force in pounds at stick grip to just move elevator from the central position up and down. This should be a maximum of 7 lb. up and 9 lb. down (8 lb. up and down). Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 9 lb. maximum. Pre-mod.941 loads as typed, post mod.941 loads in brackets.

(iv) Post mod.895 – With aileron and elevator selected to power 'ON', switch off the electrical supply, operate the aileron and elevator manual selection push buttons and check that hydraulic pressure can be built up to 3,000 p.s.i. using the hand pump.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m., (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With rig pump running, select aileron power 'ON'. Check that ailerons cannot be moved by hand when stick is held. Check operation of aileron indicator.

(ii) Select elevator power 'ON'. Check that elevator cannot be moved by hand when stick is held. Check operation of elevator indicator.

11. POWER ON (Contd.)

(iii) Select 'Power ON', and measure force in pounds at stick grip to just move elevator from the central position, up and down, maximum 2 lb. (1 lb. for stick forward and 3 lb. for stick aft). Measure force in pounds at stick grip to just move ailerons from the central positions, port and starboard – maximum 3 lb.

(iv) Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other. Pre-mod.941 loads as typed, post-mod.941 loads in brackets.

(v) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(vi) Measure aileron movement up and down, port and starboard. Check that, with control column neutral, there is no aileron down-float and not more than ½° up-float. Check operation of 2-position jack by selecting aileron power 'ON' and 'OFF'.

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port and starboard up, 3½° min.) Repeat with control turned fully anticlockwise. Centralise feel knob.

(viii) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 min., check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 2½. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. For elevator, commence by moving stick forward from neutral. Check that the changeover to manual takes place smoothly.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control column should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons.

(x) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xi) Check that aileron feel spring centres control column accurately when control is deflected ½" from centre and released.

(xii) Repeat (x) above after rest periods of one minute, three minutes and five minutes, then check:–

(a) that initial control column load does not increase after one minute of rest.

(b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control column within 0.3" of central, after deflecting it with one finger on top of the grip.

(xv) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:–

Tailplane:		Elevator: Pre Mod.H.841	Post Mod.H.841
	Neutral	22° up, 9½° down	21° up, 9½° down
	Fully positive	25° up, 7° down	25° up, 6° down
	Fully negative	18¾° up, 13° down	18¾° up, 13° down

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

11. POWER ON (Contd.)

(xvii) Push up the control column trimming switch, without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is $1\frac{1}{4}^{\circ} \pm 1/8^{\circ}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xviii) Measure tailplane and elevator angles, moving control column in the following sequences:–

(a) Fully forward.

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is $1\frac{1}{2}^{\circ}$ to 2°.

(xix) Push the trim switch, without biassing the stick, down until extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at 18(a), (b), (d) and (e).

(xx) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking the stick and letting go.

(xxi) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxii) Run hydraulic rig at a speed corresponding to 1950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators) while making the following selections:–

(a) Undercarriage down.

(b) Undercarriage up.

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxiii) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be as shown below.

11. POWER ON (Contd.)

Pre Mod.H.841

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	As max. t/p control OFF		7^{o} down	$5\frac{1}{2}^{o}$ down
	Fully aft	As min. t/p control OFF		$18\frac{1}{2}^{o}$ up	17^{o} up
2. Full Positive	(a) Fully forward	As max. t/p control OFF		7^{o} down	$5\frac{1}{2}^{o}$ down
	(b) Moved aft until tailplane just moves.	As reading at (2.a)	+0, −2′	$1^{3}/8^{o}$ up	$1^{1}/8^{o}$ up
	(c) Moved aft to tailplane zero.	0	0	8^{o} up	7^{o} up
	(d) Fully aft	-1^{o} 52′	-2^{o} 12′	$19\frac{1}{2}^{o}$ up	18^{o} up
	(e) Moved forward until tailplane just moves.	As reading at (2.d)	+2′, −0	17^{o} up	$15\frac{1}{2}^{o}$ up
	(f) Moved forward to tailplane zero.	0	0	$6\frac{1}{2}^{o}$ up	$5\frac{1}{2}^{o}$ up
3. Full Negative.	(a) Fully forward	+10′	−20′	$9\frac{1}{2}^{o}$ down	$8\frac{1}{2}^{o}$ down
	(b) Moved aft until tailplane just moves.	As reading at (3.a)	+0, −2′	$8\frac{1}{2}^{o}$ down	$7\frac{1}{2}^{o}$ down
	(c) Fully aft	As min. t/p control OFF		$18\frac{1}{2}^{o}$ up	17^{o} up
	(d) Moved forward until tailplane just moves.	As reading at (3.c)	+2′, −0	$2\frac{1}{2}^{o}$ down	$\frac{1}{2}^{o}$ down

11. POWER ON (Contd.)
Post Mod.H.841

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	2^{o} 43′	2^{o} 13′	7^{o} down	$5\frac{1}{2}^{o}$ down
	Fully aft	As min. t/p control OFF		$19\frac{1}{2}^{o}$ up	18^{o} up
2. Full Positive	(a) Fully forward	As max. t/p control OFF		6^{o} down	$4\frac{1}{2}^{o}$ down
	(b) Moved aft until tailplane just moves.	As reading at (2.a)	+0, −2′	$5/8^{o}$ up	$3/8^{o}$ up
	(c) Moved aft to tailplane zero.	0	0	$9\frac{1}{2}^{o}$ up	$8\frac{1}{2}^{o}$ up
	(d) Fully aft	-1^{o} 35′	-1^{o} 55′	20^{o} up	$18\frac{1}{2}^{o}$ up
	(e) Moved forward until tailplane just moves.	As reading at (2.d)	+2′, −0	16^{o} up	$14\frac{1}{2}^{o}$ up
	(f) Moved forward to tailplane zero.	0	0	$7\frac{1}{2}^{o}$ up	$6\frac{1}{2}^{o}$ up
3. Full Negative.	(a) Fully forward	+36′	+16′	$8\frac{1}{2}^{o}$ down	$7\frac{1}{2}^{o}$ down
	(b) Moved aft until tailplane just moves.	As reading at (3.a)	+0, −2′	$7\frac{1}{2}^{o}$ down	$6\frac{1}{2}^{o}$ down
	(c) Fully aft	As min. t/p control OFF		$19\frac{1}{2}^{o}$ up	18^{o} up
	(d) Moved forward until tailplane just moves.	As reading at (3.c)	+2′, −0	$1\frac{1}{2}^{o}$ down	$\frac{1}{2}^{o}$ down

SECTION 10

FLYING CONTROLS

PART 6

FULL-POWER FLYING CONTROLS WITH LOCKED RELEASE UNITS AND ELECTRIC FLYING TAIL (two Seater)

I.D. INSTRUCTION H207/8 (Issue 5)

1. APPLICABILITY

This instruction covers 2-seater aircraft incorporating the following modifications:—

390	473	486	487	507 (or	718	or 2373)	568	569	579	597
605	629	690	696	705	781	782	791	796	811	812
888	895	903	921	922	933	961	988	996	1004	1005
1041.										

2. INTRODUCTION

The hydroboosters covered by this instruction are permanently engaged; the pilot's effort, in manual, moves the booster body against the ram seal friction. When the supply pressure falls below 400 p.s.i. a by-pass valve connects the two booster chambers to prevent a hydraulic lock.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected, to prevent any dirt entering the system.

3. SECTION 'A' ADJUSTMENTS

The aileron booster units should be located at their neutral positions, on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'A' on the rigging plates. Alignment of the booster jack and its release unit on assembly to aircraft should be checked by unscrewing release unit locking bolt and ensuring that ram slides freely through release unit. On completion of adjustments, screw in locking bolt to an indicated torque of approx. 70 lb.in., ensuring that pawl is properly seated in ram slot; wire-lock bolt. See I.D.Sk.2152 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt supply, the hydraulic rig and control surface movement boards will be required. To avoid damage, it is essential that manual rigging be carried out before any hydraulics are used.

4. MANUAL ADJUSTMENTS – AILERONS

(i) Disconnect port control column at control rod A.207336 (see E.217039) and 2 position jack at control rod A.217043 (see C.217041).

(ii) With stbd. control column set to instructions on D.217279, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement. Ensure chain adjusters are in safety.

(iii) Lock stbd. control column handle in neutral using rigging fixture D.232208 and check that 2-position jack, retracted in manual, is horizontal. If necessary re-adjust the stbd. column chains and recheck for safety.

(iv) With port control column set to instructions on D.227983 adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(v) Set spring feel unit to neutral and adjust control rod A.207336 to bring port control column handle neutral. Do not connect control rod.

(vi) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.217043 to 2-position jack.

(vii) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(viii) Adjust control tubes A.169525 and connect to levers.

(ix) Adjust output rods so that the aileron trailing edges have approx. 0.2 in. upfloat.

(x) Remove setting locks in wings and fuselage and control column rigging fixture.

(xi) Unclamp 2-position jack. Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the starboard control column when the control column is moved without force (1 finger on top of the control column).

(xii) Reconnect port control column circuit at control rod A.207336, but do not lock. Check that port control column backlash is not more than 3/32" as in (xi) above.

(xiii) Disconnect port control column at control rod A.207336. Unlock linkage at stub wing and connect to linkage in wing.

(xiv) Release the starboard control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 8 lb. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D.Sk.2152) and check that the load at the middle of the handgrip to move the control column in either direction is less than ½lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Reconnect at YY after rectification.

(xv) Adjust port control column stops so that (temporarily) $\pm 6^{\circ}$ of aileron movement is obtained.

(xvi) Free the port control column and check that the load at the middle of the handgrip to move the control column in either direction is less than 9 lb. If it exceeds this value check as in (xiv) above.

5. MANUAL ADJUSTMENTS – ELEVATOR

(i) Disconnect the stbd. control column at control rod A.207361.

(ii) Disconnect the elevator feel unit at forward end and tie up clear of elevator feel connecting lever. Disconnect the upper ends of the flying tail switch-gear spring unit and connecting rod and tie clear of the elevator lever.

(iii) The tailplane main control switch should be 'OFF'.

(iv) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring port control column to neutral.

(v) Adjust and connect control rod A.207361 to bring stbd. control column to neutral.

(vi) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(vii) Adjust and connect control tube B.215730 to booster assy. input lever.

(viii) Adjust output rod B.176196 so that elevator is trailing in neutral.

(ix) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

(x) Lock input circuit at elevator booster. Check that the backlash at the top of both port and stbd. control columns when moved without force does not exceed 1/16".

(xi) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of either control column must not exceed ¾".

(xii) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xiii) Disconnect port control column at control rod B.165991 and check that the load at the middle of the stbd. handgrip to move the control column is less than 9 lb. for elevator down and 7 lb. for elevator up. Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

(xiv) Repeat 13 for port control column.

(xv) Adjust port control column stops to give, temporarily, 8° down and 20° up elevator movement.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power control circuits MUST be passed through a 'Micronic' filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control columns are free.

(iv) For general functioning, use the power section of the main hydraulic rig.

(v) Before any valve adjustments etc. are done the hydroboosters must be cleared of entrained air by repeated functioning.

(vi) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4347G, section 3, chapter 4, paragraph 33 (or equivalent),

(ii) Obtain full aileron movement by adjusting the starboard control column stops; this should be $\pm$ 13^{o} as defined by drg.No. E.202984.

(iii) Adjust the port control column stops to give full aileron movement.

(iv) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving a control column from extreme position.

(v) Put control columns neutral, do not lock in position, adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are:— Up, ½^{o}, Down, 0^{o}.

(vi) Check control surface movements, the full amount (see (ii) above)should be available.

(vii) Lock selector valve tab-washer on both units.

(viii) Check controls for ease of movement; load to move control from central position in either direction to be 3 lb. maximum.

8, ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control columns neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction. There should be no tendency for the control columns to move on when released after gentle movement.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust port aft control column stop to give an elevator angle of $-22^{o}/21½^{o}$ and the forward stop to give an elevator angle of $+9½^{o}/9^{o}$.

(vi) Adjust starboard control column stops to agree with setting of port stops.

(vii) On completion of adjustments lock servo valve eye-end.

(viii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch-gear spring unit and connecting rod to elevator lever.

(ix) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(x) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(xi) With control columns held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^{\circ}$ of elevator movement.

(xii) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving a control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{\circ} \pm \frac{1}{4}^{\circ}$ of elevator movement. If these limits are exceeded repeat item 11 and re-check; lock adjusting bolt on completion.

(xiii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiv) Move a control column aft and check the tailplane actuator begins to retract before elevator angle is $+ 2^{\circ}$ to $+ 3^{\circ}$ relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xvi) Move tailplane selector switch to 'OFF' and with control columns neutral check that full tailplane movement is obtainable on operating trim switch.

(xvii) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs. Re-select 'OFF' and inch the actuators by operating a control column trim button sharply without disturbing the control column; then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xviii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xix) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with SECTION A above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

10. POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the starboard and port control columns is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(iii) Measure force in pounds at starboard stick grip to just move elevator from the central position up and down. This should be a maximum of 7 lb. up and 9 lb. down. Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 9 lb. maximum.

(iv) Repeat (iii) for port control column.

(v) Post Mod.895 – With aileron and elevator selected to power 'ON', switch off the electrical supply, operate the aileron and elevator manual selection push buttons and check that hydraulic pressure can be built up to 3,000 p.s.i. using the hand pump.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m. (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With the rig pump running, select aileron power 'ON' using the pupil's switch. Check that the power remains 'OFF' until the instructor's switch is moved to the 'ON' position. With power 'ON' check that the ailerons cannot be moved by hand when a control column is held. Check that power selection reverts to manual when the pupil's switch is moved to the 'OFF' position. Re-select aileron power 'ON' using the pupil's switch and check control reverts to manual when the instructor's switch is moved to the 'OFF' position. Check the operation of the aileron indicators and 2-position aileron jack throughout.

(ii) Select elevator power 'ON' using the pupil's switch. Check that the power remains 'OFF' until the instructor's switch is moved to the 'ON' position. With power 'ON' check that the elevators cannot be moved by hand when a control column is held. Check that power selection reverts to manual when the pupil's switch is moved to the 'OFF' position. Re-select elevator power 'ON' using the pupil's switch and check control reverts to manual when the instructor's switch is moved to the 'OFF' psoition. Check the operation of the elevator indicators throughout.

(iii) Select 'Power On' and measure force in pounds at the starboard control column handgrip to just move elevator from the central position, up and down, (maximum 2 lb.). Measure the force at the starboard control column handgrip to just move ailerons from the central position, port and starboard (maximum 3 lb.). Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other.

(iv) Repeat 3. for port column.

(v) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(vi) Measure aileron movement up and down port and starboard. Check that, with control columns neutral, there is no aileron down-float and not more than ½° up-float.

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up, 3½° minimum). Repeat with control turned fully anti-clockwise. Centralise feel knob.

(viii) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 minute, check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 3. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. For elevator, commence by moving stick forward from neutral. Check that the change-over to manual takes place smoothly.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control columns should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons, and on both port and starboard control columns.

(x) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xi) Check that aileron feel spring centres control columns accurately when control column is deflected ½" from centre and released.

(xii) Repeat (10) above after rest periods of one minute, three minutes and five minutes, then check:—

(a) that initial control column load does not increase after one minute of rest.

(b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control columns within 0.3" of central, after deflecting one with one finger on top of the grip.

(xv) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:—

Tailplane:	Neutral	Elevator:	22° up, 9½° down.
	Fully positive		25° up, 7 ° down.
	Fully negative		18¾° up, 13 ° down.

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

(xvii) Push up the starboard control column trimming switch without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is $1\frac{1}{4}^{\circ} \pm 1/8^{\circ}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xviii) Measure tailplane and elevator angles, moving control column in the following sequence:—

(a) Fully forward

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is $1\frac{1}{2}^{\circ}$ to 2°.

(xix) Push the starboard trim switch, without biassing the stick, down until extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at (xviii) (a), (b), and (e).

(xx) Repeat (xvii) and (xviii) using port control column trimming switch.

(xxi) Repeat (xix) using port control column trimming switch.

(xxii) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking a stick and letting go.

(xxiii) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxiv) Run hydraulic rig at a speed corresponding to 1950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators) while making the following selections:—

(a) Undercarriage down.

(b) Undercarriage up.

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxv) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be shown as below.

11. POWER ON (Contd).

Trim		Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral		Neutral	0	0	0	0
		Fully forward	As max. t/p control OFF		7° down	$5\frac{1}{2}^{\circ}$ down
		Fully aft	As min. t/p control OFF		$18\frac{1}{2}^{\circ}$ up	17° up
2. Full Positive	(a)	Fully forward	As max. t/p control OFF		7° down	$5\frac{1}{2}^{\circ}$ down
	(b)	Moved aft until tailplane just moves	As reading at (2.a)	+0, −2′	$1\,3/8^{\circ}$ up	$1\,1/8^{\circ}$ up
	(c)	Moved aft to tailplane zero	0	0	8° up	7° up
	(d)	Fully aft	-1° : 52′	-2° : 12′	$19\frac{1}{2}^{\circ}$ up	18° up
	(e)	Moved forward until tailplane just moves	As reading at (2.d)	+2′, −0	17° up	$15\frac{1}{2}^{\circ}$ up
	(f)	Moved forward to tailplane zero	0	0	$6\frac{1}{2}^{\circ}$ up	$5\frac{1}{2}^{\circ}$ up
3. Full Negative	(a)	Fully forward	+10′	−20′	$9\frac{1}{2}^{\circ}$ down	$8\frac{1}{2}^{\circ}$ down
	(b)	Moved aft until tailplane just moves	As reading at (3.a)	+0, −2′	$8\frac{1}{2}^{\circ}$ down	$7\frac{1}{2}^{\circ}$ down
	(d)	Fully aft.	As min. t/p control OFF		$18\frac{1}{2}^{\circ}$ up	17° up
	(e)	Moved forward until tailplane just moves	As reading at (3.d)	+2′, −0	$2\frac{1}{2}^{\circ}$ down	$\frac{1}{2}^{\circ}$ down

SECTION 10

FLYING CONTROLS

PART 7

FULL-POWER FLYING CONTROLS WITH LOCKED RELEASE UNITS AND REVISED-RANGE ELECTRIC FLYING TAIL (Mk.9)

I.D. INSTRUCTION H207/9 (Issue 7)

1. APPLICABILITY.

This instruction covers aircraft incorporating the following modifications:—

841, 888, 895, 903, 922, 933, 941, 961, 988, 996, 1004, and 1005.

2. INTRODUCTION

The hydroboosters covered by this instruction are permanently engaged: the pilot's effort in manual, moves the booster body against the ram seal friction. When the supply pressure falls below 400 p.s.i. a by-pass valve connects the two booster chambers to prevent a hydraulic lock.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

3. ADJUSTMENTS

The aileron booster units should be located at their neutral positions, on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'B' on the rigging plates. Alignment of the booster jack and its release unit on assembly to aircraft should be checked by unscrewing release unit locking bolt and ensuring that ram slides freely through release unit. On completion of adjustments screw in locking bolt to an indicated torque of approx. 70 lb. in., ensuring that pawl is properly seated in ram slot; wire lock bolt. See I.D.Sk.1942 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volts supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used.

4. AILERONS

(i) Disconnect 2 position jack at control rod A.206734.

SECTION 10

FLYING CONTROLS

PART 7

FULL-POWER FLYING CONTROLS WITH LOCKED RELEASE UNITS AND REVISED-RANGE ELECTRIC FLYING TAIL (Mk.9)

I.D. INSTRUCTION H207/9 (Issue 6)

1. APPLICABILITY.

This instruction covers aircraft incorporating the following modifications:—

841, 888, 895, 903, 922, 933, 941, 961, 988, 996, 1004, and 1005.

2. INTRODUCTION

The hydroboosters covered by this instruction are permanently engaged: the pilot's effort in manual, moves the booster body against the ram seal friction. When the supply pressure falls below 400 p.s.i. a by-pass valve connects the two booster chambers to prevent a hydraulic lock.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

3. ADJUSTMENTS

The aileron booster units should be located at their neutral positions, on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'B' on the rigging plates. Alignment of the booster jack and its release unit on assembly to aircraft should be checked by unscrewing release unit locking bolt and ensuring that ram slides freely through release unit. On completion of adjustments screw in locking bolt to an indicated torque of approx. 70 lb. in., ensuring that pawl is properly seated in ram slot; wire lock bolt. See I.D.Sk.1942 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volts supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used.

4. AILERONS

(i) Disconnect 2 position jack at control rod A.206734.

4. AILERONS (Contd).

(ii) With control column set to instructions on D.206791, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(iii) Set spring feel unit to neutral and lock control column in neutral.

(iv) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and re-connect A.206734 to 2 position jack.

(v) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(vi) Adjust control tubes A.169525 and connect to levers.

(vii) Adjust output rods so that the aileron trailing edges have approximately 0.2 in. upfloat.

(viii) Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the control column when the control column is moved without force (one finger on top of the control column).

(ix) Release the control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 9 lb. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D.Sk.1942), and check that the load at the middle of the handgrip to move the control column in either direction is less than 1½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Re-connect at YY after rectification.

(x) Adjust control column stops so that (temporarily) $\pm 6^{o}$ of aileron movement is obtained.

5. ELEVATOR

(i) Disconnect the elevator feel unit at forward end and tie up clear of the elevator feel connecting lever. Disconnect the upper ends of the flying tail switchgear spring unit and connecting rod and tie clear of the elevator lever.

(ii) The tailplane main control switch should be 'OFF'.

(iii) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring control column to neutral.

(iv) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(v) Adjust and connect control tube B.215730 to booster assy. input lever.

(vi) Adjust output rod B.176196 so that elevator is trailing in neutral.

(vii) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

5. ELEVATOR (Contd).

(viii) Lock input circuit at elevator booster. Check that the backlash at the top of the control column when moved without force does not exceed 1/16".

(ix) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of the control column must not exceed ¾".

(x) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xi) Check that the load at the middle of the handgrip to move elevator 'up' is less than 9 lb. (8 lb.) and elevator 'down' less than 7 lb. (8 lb.). Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb. (1 lb. for stick forward and 3 lb. for stick aft). Pre-mod 941 loads as typed, post-mod 941 loads in brackets.

(xii) Adjust control column stops so that (temporarily) 8° down and 20° up movement is obtained.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power assisted control circuits MUST be passed through a 'Micronic' Filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control column is free.

(iv) For general functioning, use the power section of the main hydraulic rig.

(v) Before any valve adjustments etc., are done the hydro-boosters must be cleared of entrained air by repeated functioning.

(vi) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4347, section 3, chapter 4, paragraph 30 (or equivalent).

(ii) Note the locks will be engaged throughout. Obtain full aileron movement by adjusting the control column stops: this should be $\pm 13^{\circ}$ as defined by Drg.No. E.202984.

(iii) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving the control column from extreme position.

(iv) Put control column neutral, do not lock in position, adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are: Up. $\frac{1}{2}^{\circ}$, Down, 0°.

(v) Check control surface movements, the full amount (see (ii) above) should be available.

7. AILERONS (Contd).

(vi) Lock selector valve tab-washer on both units.

(vii) Check controls for ease of movement: load to move control from central position in either direction to be 3 lb. max.

8. ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control column neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction (1 lb. for elevator down and 3 lb. for elevator up).

Pre-mod.941 loads as typed, post-mod.941. loads in brackets.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust aft control column stop to give an elevator angle of $-22^{\circ}/21\frac{1}{2}^{\circ}$ ($-21^{\circ}/20\frac{1}{2}^{\circ}$) and the forward stop to give an elevator angle of $+9\frac{1}{2}^{\circ}/9^{\circ}$. Pre-mod.841 angles as typed, post mod.841 angles in brackets.

(vi) On completion of adjustments lock servo valve eye-end.

(vii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch-gear spring unit and connecting rod to elevator lever.

(viii) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(ix) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(x) With control column held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^{\circ}$ of elevator movement.

8. ELEVATOR (Contd).

(xi) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving the control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{\circ} \pm \frac{1}{4}^{\circ}$ of elevator movement. If these limits are exceeded repeat item 10 and recheck: lock adjusting bolt on completion.

(xii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover, Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiii) Move control column aft and check the tailplane actuator begins to retract before elevator angle is $+2^{\circ}$ to $+3^{\circ}$ relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xiv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xv) Move tailplane selector switch to 'OFF' and with control column neutral check that full tailplane movement is obtainable on operating trim switch.

(xvi) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs; re-select 'OFF' and inch the actuator by operating the control column trim button sharply without disturbing the control column: then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xvii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xviii) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with SECTION A above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

10. POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the control column is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

10. POWER OFF (Contd).

(iii) Measure force in pounds at stick grip to just move elevator from the central position up and down. This should be a maximum of 7 lb. up and 9 lb. down (8 lb. up and down). Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 9 lb. maximum. Pre-mod.941 loads as typed, post mod.941 loads in brackets.

(iv) Post mod.895 – With aileron and elevator selected to power 'ON', switch off the electrical supply, operate the aileron and elevator manual selection push buttons and check that hydraulic pressure can be built up to 3,000 p.s.i. using the hand pump.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m., (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With rig pump running, select aileron power 'ON'. Check that ailerons cannot be moved by hand when stick is held. Check operation of aileron indicator.

(ii) Select elevator power 'ON'. Check that elevator cannot be moved by hand when stick is held. Check operation of elevator indicator.

(iii) Select 'Power ON', and measure force in pounds at stick grip to just move elevator from the central position, up and down, maximum 2 lb. (1 lb. for stick forward and 3 lb. for stick aft). Measure force in pounds at stick grip to just move ailerons from the central positions, port and starboard – maximum 3 lb.

(iv) Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other. Pre-mod.941 loads as typed, post-mod.941 loads in brackets.

(v) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(vi) Measure aileron movement up and down, port and starboard. Check that, with control column neutral, there is no aileron down-float and not more than ½° up-float, Check operation of 2-position jack by selecting aileron power 'ON' and 'OFF'.

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up, 3½° min.). Repeat with control turned fully anti-clockwise. Centralise feel knob.

(viii) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 min., check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 2½. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. For elevator, commence by moving stick forward from neutral. Check that the changeover to manual takes place smoothly.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control column should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons.

11. POWER ON (Contd).

(x) Check controls for ease of movement in all directions: check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xi) Check that aileron feel spring centres control column accurately when control column is deflected ½" from centre and released.

(xii) Repeat (x) above after rest periods of one minute, three minutes and five minutes, then check:–

(a) that initial control column load does not increase after one minute of rest.

(b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control column within 0.3" of central, after defecting it with one finger on top of the grip.

(xv) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:–

Tailplane:	Neutral	Elevator:	21° up, $9\frac{1}{2}^{\circ}$ down.
	Fully positive		25° up, 6° down.
	Fully negative		$18\frac{3}{4}^{\circ}$ up, 13° down.

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

(xvii) Push up the control column trimming switch, without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is $\frac{1}{2}^{\circ} \pm 1/8^{\circ}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xviii) Measure tailplane and elevator angles, moving control column in the following sequence:–

(a) Fully forward.

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is $1\frac{1}{2}^{\circ}$ to 2°.

(xix) Push the trim switch, without biassing the stick, down until the extreme trim(full negative) is obtained. Measure tailplane and elevator angles as at (xviii) (a), (b), (d) and (e).

11. POWER ON (Contd).

(xx) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking the stick and letting go.

(xxi) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxii) Run hydraulic rig at a speed corresponding to 1,950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators), while making the following selections:—

(a) Undercarriage down.

(b) Undercarriage up,

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxiii) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be as shown below.

	Control Column Position	Tailplane Incidence		Elevator Angle Rel. to Tailplane	
		Max.	Min.	Max.	Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	2° 43′	2° 13′	7° down	$5\frac{1}{2}^{\circ}$ down
	Fully aft	As min. t/p control OFF	$19\frac{1}{2}^{\circ}$	$19\frac{1}{2}^{\circ}$ up	18° up
2. Full Positive	(a) Fully forward	As max. t/p control OFF		6° down	$4\frac{1}{2}^{\circ}$ down
	(b) Moved aft until tailplane just moves.	As reading at (2.a)	+0, −2′	$5/8^{\circ}$ up	$3/8^{\circ}$ up
	(c) Moved aft to tailplane zero	0	0	$9\frac{1}{2}^{\circ}$ up	$8\frac{1}{2}^{\circ}$ up
	(d) Fully aft	-1° 35′	-1° 55′	20° up	$18\frac{1}{2}^{\circ}$ up
	(e) Moved forward until tailplane just moves	As reading at (2.d)	+2′, −0	16° up	$14\frac{1}{2}^{\circ}$ up
	(f) Moved forward to tailplane zero	0	0	$7\frac{1}{2}^{\circ}$ up	$6\frac{1}{2}^{\circ}$ up

11. POWER ON (Contd).

	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
3. Full Negative	(a) Fully forward	+36′	+16′	8½° down	7½° down
	(b) Moved aft until tailplane just moves	As reading at (3.a)	+0, −2′	7½° down	3½° down
	(d) Fully aft	As min. t/p. control OFF		19½° up	18° up
	(e) Moved forward until tailplane just moves	As reading at (3.d)	+2′, −0	1½° down	½° down.

SECTION 10

FLYING CONTROLS

PART 8

FULL-POWER FLYING CONTROLS WITH LOCKED RELEASE UNITS, REVISED-RANGE ELECTRIC FLYING TAIL, AND AILERON GEARING IN POWER (Mk.10)

I.D. INSTRUCTION H207/10 (Issue 7)

1. APPLICABILITY

This instruction covers aircraft incorporating the following modifications:–

841, 872, 888, 895, 903, 922, 933, 961, 988, 996, 1004, 1005.

2. INTRODUCTION

The hydroboosters covered by this instruction are permanently engaged: the pilot's effort, in manual, moves the booster body against the ram seal friction. When the supply pressure falls below 400 p.s.i. a by-pass valve connects the two booster chambers to prevent a hydraulic lock.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

3. ADJUSTMENTS

The aileron booster units should be located at their neutral positions, on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'B' on the rigging plates. Alignment of the booster jack and its release unit on assembly to aircraft should be checked by unscrewing release unit locking bolt and ensuring that ram slides freely through release unit. On completion of adjustments screw in locking bolt to indicated torque of approx. 70 lb.in., ensuring that pawl is properly seated in ram slot; wirelock bolt. See I.D.Sk.1942 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used.

4. AILERONS

(i) Disconnect 2 position jack at control rod A.206734.

4. AILERONS (Contd).

(ii) With control column set to instructions on D.206791, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(iii) Set spring feel unit to neutral and lock control column in neutral.

(iv) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and re-connect A.206734 to 2 position jack.

(v) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(vi) Adjust control tubes A.169525 and connect to levers.

(vii) Adjust output rods so that the aileron trailing edges have approximately 0.2 in. upfloat.

(viii) Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the control column when the control column is moved without force (one finger on top of the control column).

(ix) Release the control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 9 lb. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D.Sk.1942), and check that the load at the middle of the handgrip to move the control column in either direction is less than 1½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Re-connect at YY after rectification.

(x) Adjust control columns stops so that (temporarily) $\pm 6^{\circ}$ of aileron movement is obtained.

5. ELEVATOR

(i) Disconnect the elevator feel unit at forward end and tie up clear of the elevator feel connecting lever. Disconnect the upper ends of the flying tail switchgear spring unit and connecting rod and tie clear of the elevator lever.

(ii) The tailplane main control switch should be 'OFF'.

(iii) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring control column to neutral.

(iv) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(v) Adjust and connect control tube B.215730 to booster assy. input lever.

(vi) Adjust output rod B.176196 so that elevator is trailing in neutral.

(vii) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

5. ELEVATOR (Contd).

(viii) Lock input circuit at elevator booster. Check that the backlash at the top of the control column when moved without force does not exceed 1/16".

(ix) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of the control column must not exceed ¾".

(x) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xi) Check that the load at the middle of the handgrip to move elevator 'up' is less than 9 lb. and elevator 'down' less than 7 lb. Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

(xii) Adjust control column stops to that (temporarily) 8^{o} down and 20^{o} up movement is obtained.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power assisted control circuits MUST be passed through a 'Micronic' filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control column is free.

(iv) For general functioning, use the power section of the main hydraulic rig.

(v) Before any valve adjustments etc., are done the hydroboosters must be cleared of entrained air by repeated functioning.

(vi) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with A.4347, section 3, chapter 4, paragraph 30 (or equivalent).

(ii) Note the locks will be engaged throughout. Obtail full aileron movement by adjusting the control column stops: this should be $\pm 13^{o}$ as defined by drg.No. E.202984.

(iii) Ensure that jacks do not 'bottom'. This can be noticed by a sticking on moving the control column from extreme position.

(iv) Put control column neutral, do not lock in position, adjust port and starboard ailerons to neutral on the out put lines. Acceptable limits for neutral on each aileron are: up, $½^{o}$, Down, 0^{o}.

(v) Check control surface movements, the full amount (see (ii) above) should be available.

(vi) Lock selector valve tab-washer on both units.

(vii) Check controls for ease of movement: load to over control from central position in either direction to be 3lb. max.

8. ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control column neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movemnt; load to move elevator to be a maximum of 2 lb. in either direction. There should be no tendency for the control column to move on when released after gentle movement.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust aft control column stop to give an elevator angle of $-22^{o}/21\frac{1}{2}^{o}$ ($-21^{o}/20\frac{1}{2}^{o}$) and the forward stop to give an elevator angle of $+9\frac{1}{2}^{o}/9^{o}$. Pre-mod.841 angles as typed, post-mod.841 angles in brackets.

(vi) On completion of adjustments lock servo valve eye-end.

(vii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication, Re-attach switch-gear spring unit and connecting rod to elevator lever.

(viii) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(ix) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(x) With control column held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^{o}$ of elevator movement.

(xi) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving the control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{o} \pm \frac{1}{4}^{o}$ of elevator movement. If these limits are exceeded repeat item 10 and re-check: lock adjusting bolt on completion.

(xii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

8. ELEVATOR (Contd).

(xiii) Move control column aft and check the tailplane actuator begins to retract before elevator angle is +2° to 3° relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xiv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xv) Move tailplane selecter switch to 'OFF' and with control column neutral check that full tailplane movement is obtainable on operating trim switch.

(xvi) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs; re-select 'OFF' and inch the actuator by operating the control column trim button sharply without disturbing the control column: then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xvii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xviii) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with SECTION A above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

10. POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the control column is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(iii) Measure force in pounds at stick grip to just move elevator from the central position up and down. This should be a maximum of 7 lb. up and 9 lb. down. Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 9 lb. maximum.

10. POWER OFF (Contd).

(iv) Post Mod.695 – With aileron and elevator selected to power 'ON', switch off the electrical supply, operate the aileron and elevator manual selection push buttons and check that hydraulic pressure can be built up to 3,000 p.s.i. using the hand pump.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m., (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With rig pump running, select aileron power 'ON'. Check that ailerons cannot be moved by hand when stick is held. Check operation of aileron indicator.

(ii) Select elevator power 'ON'. Check that elevator cannot be moved by hand when stick is held. Check operation of elevator indicator.

(iii) Select 'Power ON', and measure force in pounds at stick grip to just move elevator from the central position, up and down, maximum 2 lb. Measure force in pounds at stick grip to just move ailerons from the central positions, port and starboard – maximum 3 lb.

(iv) Ensure that stick loads for full aileron deflection, port and starboard, are within 3lb. of each other.

(v) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(vi) Measure aileron movement up and down, port and starboard. Check that, with control column neutral, there is no aileron down-float and not more than ½$^{\circ}$ up-float. Check operation of 2-position jack by selecting aileron power 'ON' and 'OFF', and by selecting aileron GEARED and NORMAL. Check aileron travels and clearances with the jack in the shortened position. Reselect aileron power ON and aileron gearing NORMAL.

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up 3½$^{\circ}$ min.). Repeat with control turned fully anticlockwise. Centralise feel knob.

(viii) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 min, check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 1½. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. Check that the changeover to manual takes place smoothly.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control column should come to rest and not oscillate. This test should be carried out independently for elevator and geared and normal ailerons.

(x) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over fully range of aileron feel trimmer.

11. POWER ON (Contd).

(xi) Check that aileron feel spring centres control column accurately when control column is deflected ½" from centre and released.

(xii) Repeat (x) above after rest periods of one minute, three minutes and five minutes, then check:

(a) that initial control column load does not increase after one minute of rest.

(b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control column within 0.3" of central, after deflecting it with one finger on top of the grip.

(xv) Check that elevator angles relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:—

Tailplane:	Neutral	Elevator	21 ^{o} up, 9½^{o} down.
	Fully positive		25 ^{o} up, 6 ^{o} down.
	Fully negative		18¾^{o} up, 13 ^{o} down.

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

(xvii) Push up the control column trimming switch, without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is ½^{o} $\pm$ $^{1}/8^{o}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xviii) Measure tailplane and elevator angles, moving control column in the following sequence:—

(a) Fully forward

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is 1½^{o} to 2^{o}.

(xix) Push the trim switch, without biassing the stick, down until the extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at (xviii) (a), (b), (d) and (e).

(xx) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approx. 3½ secs. Check for system stability by jerking the stick and letting go.

(xxi) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

11. POWER ON (Contd).

(xx) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking the stick and letting go.

(xxi) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxii) Run hydraulic rig at a speed corresponding to 1,950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators), while making the following selections:—

(a) Undercarriage down.

(b) Undercarriage up,

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxiii) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be as shown below.

	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	2° 43′	2° 13′	7° down	$5\frac{1}{2}^{\circ}$ down
	Fully aft	As min. t/p control OFF	$19\frac{1}{2}^{\circ}$	$19\frac{1}{2}^{\circ}$ up	18° up
2. Full Positive	(a) Fully forward	As max. t/p control OFF		6° down	$4\frac{1}{2}^{\circ}$ down
	(b) Moved aft until tailplane just moves.	As reading at (2.a)	+0, −2′	$5/8^{\circ}$ up	$3/8^{\circ}$ up
	(c) Moved aft to tailplane zero	0	0	$9\frac{1}{2}^{\circ}$ up	$8\frac{1}{2}^{\circ}$ up
	(d) Fully aft	-1° 35′	-1° 55′	20° up	$18\frac{1}{2}^{\circ}$ up
	(e) Moved forward until tailplane just moves	As reading at (2.d)	+2′, −0	16° up	$14\frac{1}{2}^{\circ}$ up
	(f) Moved forward to tailplane zero	0	0	$7\frac{1}{2}^{\circ}$ up	$6\frac{1}{2}^{\circ}$ up

SECTION 10

FLYING CONTROLS

PART 9

SETTING OF HYDROBOOSTER RELEASE UNIT MICRO SWITCHES (Mk.58)

I.D. INSTRUCTION H207/11 (Issue 1)

1. APPLICABILITY

Mk.58 aircraft, pre and post mods: H.452; 468; 514; 684 and 834.

2. EQUIPMENT REQUIRED

(i) Hydrobooster Cradle to Drg.No. T.397388 – for aileron boosters only.

(ii) Hydraulic hand pump rig with micronic filter and calibrated pressure gauge.

(iii) Electrical Rig to I.D.Sk.1696.

(iv) 6 to 28 volt electrical supply.

(v) 0.055 in. x 3/16 in. wide setting slip gauge.

(vi) 0.050 in. x 3/16 in. wide checking slip gauge.

(vii) 0.060 in. x 3/16 in. wide checking slip gauge.

3. TEST METHOD WITH PYE SWITCHES.

(i) Connect hydraulic and electrical rigs. Ensure that the ram slot and mating parts of the pawl, the microswitch button and its mating face are clean and grease-free.

It is important that their relative positions allow the pawl to seat squarely in the ram slot.

(ii) Apply a steadily-increasing pressure and check that by the time 650 p.s.i. is reached, the pawl is fully engaged, i.e. the ram cannot move in the release unit.

(iii) Increase pressure to 2800 p.s.i. and after a few seconds reduce to 650 p.s.i. At this pressure check that the pawl is fully engaged and is in contact with bottom of slot.

(iv) Release pressure and insert the 0.055 in. slip gauge between the pawl and the bottom of the ram slot. Apply a pressure of 550 to 650 p.s.i. so that the slip-gauge is clamped by the pawl. Position microswitch tappet to indicate engagement, i.e. lamp 1 should be alight; lamp 3 should be out. Re-adjust tappet until disengagement is indicated, i.e. lamp 3 should be alight; lamp 1 should be out. Lock adjustment.

(v) Release pressure and release the 0.055 in. slip gauge by the 0.060 gauge. Apply 550 to 650 p.s.i. so that the slip gauge is clamped, and check that the switch does not operate, i.e. lamp 1 remains out and lamp 3 alight.

(vi) Release pressure and replace the 0.060 in. slip gauge by the 0.050 in. gauge. Apply 550 to 650 p.s.i. so that slip gauge is clamped, and check that switch operates, i.e. lamp 1 is alight and lamp 3 remains out.

3. TEST METHOD WITH PYE SWITCHES (Contd).

(vii) Release pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot (disregard the 'lead-in' to the slot).

(viii) Switch off and disconnect hydrobooster.

4. TEST METHOD WITH DOWMIC SWITCHES

(i) Mount the hydrobooster jack and release unit in the cradle. Connect hydraulic and electrical rigs. Ensure that the ram slot and mating parts of the pawl, the micro-switch button and its mating face are clean and grease-free.

It is important that their relative positions allow the pawl to seat squarely in the ram slot.

(ii) Apply a steadily increasing pressure and check that by the time 650 p.s.i. is reached the pawl is fully engaged; i.e. the ram cannot move in the release unit.

(iii) Increase pressure to 2800 p.s.i. and, after a few seconds, reduce to 650 p.s.i. At this pressure check that the pawl is fully engaged and that the gap between it and the bottom of the ram slot is within the limits 0.005 in. to 0.019 in.

(iv) Release pressure and insert the 0.055 in. slip-gauge between the pawl and the bottom of the ram slot. Apply a pressure of 550 to 650 p.s.i. so that the slip-gauge is clamped by the pawl. Move in the micro switch by turning the knurled knob until lamps 1 and 2 just light. Move out the micro-switch until disengagement is indicated, i.e. lamps 3 and 4 should be alight and lamps 1 and 2 out. (If more than ¼ turn of the knob is needed on moving out, the switch should be inspected for excessive differential). Lock micro-switch.

(v) Release pressure and replace the 0.055 in. slip gauge by the 0.060 in. gauge. Apply 550 to 650 p.s.i. so that the slip gauge is clamped. Depress the micro switch plunger by hand until lamps 1 and 2 are alight. Release plunger slowly and check that lamps 3 and 4 are alight and lamps 1 and 2 are out when the plunger is resting on the end of the release unit piston rod. Ensure by moving the plunger sideways that it is fully out.

(vi) Release pressure and replace the 0.060 in. slip gauge by the 0.050 in. gauge. Apply 550 to 650 p.s.i. so that the slip gauge is clamped. Depress the micro switch plunger by hand until lamps 1 and 2 are alight. Release plunger and check that lamps 1 and 2 remain alight and lamps 3 and 4 are out.

(vii) Release pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot (disregard the 'lead-in' to the slot).

(viii) Apply pressure slowly and check that by the time 500 p.s.i. is reached the micro switch indicates engagement, i.e. lamps 1 and 2 are alight.

(ix) Release pressure and disconnect rig and electrics.

I.D.S.K. 1696
SEE I.D. TEST
INSTRUCTION
H 207/11

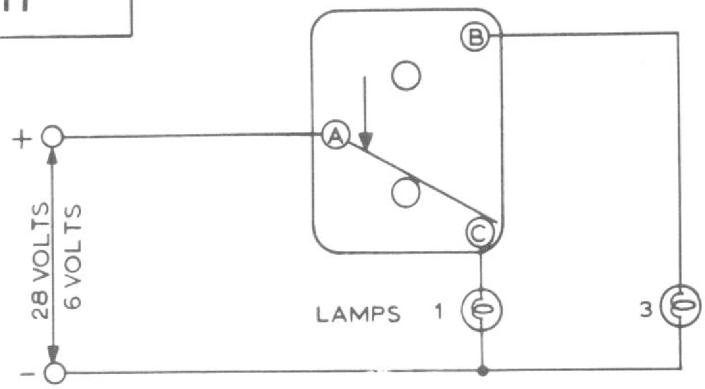

FIG. A. PORT AILERON BOOSTER - PRE & POST-MOD. H452
ELEVATOR & ST'B'D AILERON BOOSTER – PRE–MOD H 452

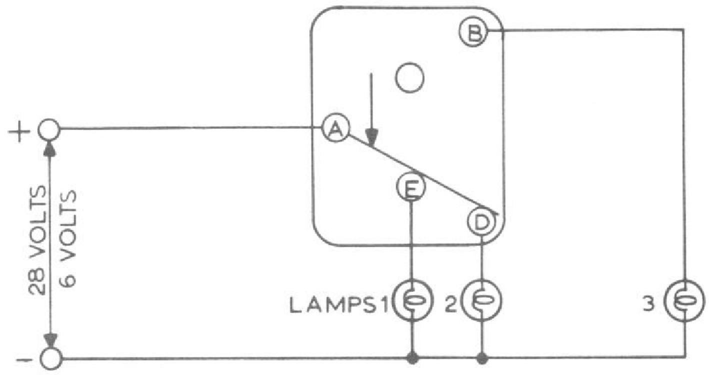

FIG B ELEVATOR & ST'B'D AILERON BOOSTER-POST-MOD H452

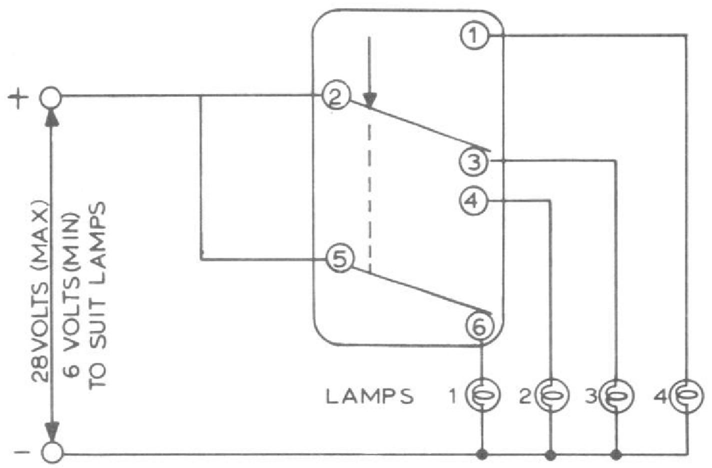

FIG C PORT & ST'B'D AILERON BOOSTERS-POST-MOD. H684

HUNTER-WIRING DIAGRAM HYDROBOOSTER MICROSWITCH SETTING
NOTE : SWITCHES SHOWN ACTUATED — PAWLS ENGAGED.

SECTION 10

FLYING CONTROLS

PART 10

HUNTER TWO SEATER FULL POWER FLYING CONTROLS WITH LOCKED RELEASE UNITS AND REVISED-RANGE ELECTRICALLY OPERATED FLYING TAIL

I.D. INSTRUCTION H207/12 (Issue 3)

1. APPLICABILITY

This instruction covers aircraft incorporating the following modifications:–

988, 996, 1005, 841.

2. INTRODUCTION

The hydroboosters covered by this instruction are permanently engaged: the pilot's effort, in manual, moves the booster body against the ram seal friction. When the supply pressure falls below 400 p.s.i. a by-pass valve connects the two booster chambers to prevent a hydraulic lock.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

3. SECTION 'A' ADJUSTMENTS

The aileron booster units should be located at their neutral positions, on assembly, by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'B' on the rigging plates. Alignment of the booster jack and its release unit on assembly to the aircraft should be checked by unscrewing release unit locking bolt and ensuring that ram slides freely through release unit. On completion of adjustments screw in locking bolt to indicated torque of approx. 70 lb. ensuring that pawl is properly seated in ram slot; wirelock bolt. See I.D. Sk.1942 for a diagram of the aileron control system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used.

MANUAL ADJUSTMENTS

4. AILERONS

(i) Disconnect port control column at control rod A.207336 (see E.217039) and 2 position jack at control rod A.217043 (see C.217041).

(ii) With stbd. control column set to instructions on D.217279, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement. Ensure chain adjusters are in safety.

4. AILERONS (Contd).

(iii) Lock stbd. control column handle in neutral using rigging fixture D.232208 and check that 2-position jack, retracted in manual, is horizontal. If necessary re-adjust the stbd. column chains and recheck for safety.

(iv) With port control column set to instructions on D.227983 adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(v) Set spring feel unit to neutral and adjust control rod A.207336 to bring port control column handle neutral. Do not connect control rod.

(vi) Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and reconnect A.217043 to 2 position jack.

(vii) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(viii) Adjust control tubes A.169525 and connect to levers.

(ix) Adjust output rods so that the aileron trailing edges have approx. 0.2 in. upfloat.

(x) Remove setting locks in wings and fuselage and control column rigging fixture.

(xi) Unclamp 2-position jack. Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the starboard control column when the control column is moved without force (1 finger on top of the control column.)

(xii) Reconnect port control column circuit at control rod A.207336, but do not lock. Check that port control column backlash is not more than 3/32" as in (xi) above.

(xiii) Disconnect port control column at control rod A.207336. Unlock linkage at sub wing and connect to linkage in wing.

(xiv) Release the starboard control column and check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 8 lb. If it exceeds this value disconnect the input circuit at the booster units (points YY on I.D.Sk.2152) and check that the load at the middle of the handgrip to move the control column in either direction is less than ½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Reconnect at YY after rectification.

(xv) Adjust port control column stops so that (temporarily) $\pm 6^{\circ}$ of aileron movement is obtained.

(xvi) Free the port control column and check that the load at the middle of the handgrip to move the control column in either direction is less than 9 lb. If it exceeds this value check as in (xiv) above.

5. ELEVATOR

(i) Disconnect the stbd. control column at control rod A.207361.

(ii) Disconnect the elevator feel unit at forward end and tie up clear of elevator feel connecting lever. Disconnect the upper ends of the flying tail switch-gear spring unit and connecting rod and tie clear of the elevator lever.

5. ELEVATOR (Contd).

(iii) The tailplane main control switch should be 'OFF'.

(iv) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring port control column to neutral.

(v) Adjust and connect control rod A.207361 to bring stbd. control column to neutral.

(vi) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(vii) Adjust and connect control tube B.215730 to booster assy. input lever.

(viii) Adjust output rod B.176196 so that elevator is trailing in neutral.

(ix) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

(x) Lock input circuit at elevator booster, Check that the backlash at the top of both port and starboard control columns when moved without force does not exceed 1/16".

(xi) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of either control column must not exceed ¾".

(xii) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(xiii) Disconnect port control column at control rod B.165991 and check that the load at the middle of the starboard handgrip to move the control column is less than 9 lb. for elevator down and 7 lb. for elevator up. Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

(xiv) Repeat (xiii) for port control column.

(xv) Adjust port control column stops to give, temporarily, 8° down and 20° up elevator movement.

6. POWER ADJUSTMENT

(i) All hydraulic oil supplied to any of the power control circuits MUST be passed through a 'Micronic' Filter element. A dirty system may cause excessive stick loads.

(ii) All hydraulic pipe lines must be flushed prior to connecting to the booster unit.

(iii) Ensure that the control columns are free.

(iv) For general functioning, use the power section of the main hydraulic rig.

(v) Before any valve adjustments etc. are done the hydroboosters must be cleared of entrained air by repeated functioning.

(vi) The tailplane and datum trim actuators should have been tested.

7. AILERONS

(i) Adjust booster valves in accordance with AP.4346G, section 3, chapter 4, paragraph 33 (or equivalent)

(ii) Obtain full aileron movement by adjusting the starboard control column stops; this should be $\pm 13^{\circ}$ as defined by drg.No. E.202984.

7. AILERONS (Contd).

(iii) Adjust the port control column stops to give full aileron movement.

(iv) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving a control column from extreme position.

(v) Put control columns neutral, do not lock in position; adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are:– Up, $\frac{1}{2}^{\circ}$, Down, 0°.

(vi) Check control surface movements, the full amount (see 2 above) should be available.

(vii) Lock selector valve tab-washer on both units.

(viii) Check controls for ease of movement; load to move control from central position in either direction to be 3 lb. maximum.

8. ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control columns neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction. There should be no tendency for the control columns to move when released after gentle movement.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust port aft control column stop to give an elevator angle of $21^{\circ}/20\frac{1}{2}^{\circ}$ and the forward stop to give an elevator angle of $+9\frac{1}{2}^{\circ}/9^{\circ}$.

(vi) Adjust starboard control column stops to agree with setting of port stops.

(vii) On completion of adjustments lock servo valve eye-end.

(viii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch gear spring unit and connecting rod to elevator lever.

(ix) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(x) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the standby control switch cover). Fully extend datum trim actuator.

(xi) With control columns held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at TB.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ON) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^{\circ}$ of elevator movement.

8. ELEVATOR (Contd).

(xii) Move tailplane selector switch to 'ON' and elevator booster switch to 'POWER ON'. By moving a control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^{\circ} \pm \frac{1}{4}^{\circ}$ of elevator movement. If these limits are exceeded repeat item 11 and re-check: lock adjusting bolt on completion.

(xiii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiv) Move a control column aft and check the tailplane actuator begins to retract before elevator angle is $+2^{\circ}$ to $+3^{\circ}$ relative to tailplane. If angle exceeds this value, lengthen spring unit B.211414 as required.

(xv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xvi) Move tailplane selector switch to 'OFF' and with control columns neutral check that full tailplane movement is obtainable on operating trim switch.

(xvii) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs, Re-select 'OFF' and inch the actuators by operating a control column trim button sharply without disturbing the control column; then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xviii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper microswitch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xix) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

9. INSTALLATION TESTS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with SECTION A above. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

10. POWER OFF

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the starboard and port control columns is a maximum of 1/16".

10. POWER OFF (Contd).

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(iii) Measure force in pounds at starboard stick grip to just move elevator from the central position up and down. This should be a maximum of 7 lb. up and 9 lb. down. Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 9 lb. maximum.

(iv) Repeat (iii) for port control column.

(v) Post Mod.895 – With aileron and elevator selected to power 'ON', switch off the electrical supply, operate the aileron and elevator manual selection push buttons and check that hydraulic pressure can be built up to 3,000 p.s.i. using the hand pump.

11. POWER ON

For these tests the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m., (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

(i) With the rig pump running, select aileron power 'ON' using the pupil's switch. Check that the power remains 'OFF' until the instructor's switch is moved to the 'ON' position. With power 'ON' check that the ailerons cannot be moved by hand when a control column is held. Check that power selection reverts to manual when the pupil's switch is moved to the 'OFF' position. Re-select aileron power 'ON' using the pupil's switch and check control reverts to manual when the instructor's switch is moved to the 'OFF' position. Check the operation of the aileron indicators and 2-position aileron jack throughout.

(ii) Select elevator power 'ON' using the pupil's switch. Check that the power remains 'OFF' until the instructor's switch is moved to the 'ON' position. With power 'ON' check that the elevators cannot be moved by hand when a control column is held. Check that power selection reverts to manual when the pupil's switch is moved to the 'OFF' position. Re-select elevator power 'ON' using the pupil's switch and check control reverts to manual when the instructor's switch is moved to the 'OFF' position. Check the operation of the elevator indicators throughout.

(iii) Select 'Power On' and measure force in pounds at the starboard control column handgrip to just move elevator from the central position up and down, (maximum 2 lb.). Measure the force at the starboard control column handgrip to just move ailerons from the central position, port and starboard (maximum 3 lb.). Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other.

(iv) Repeat (iii) for port control column.

(v) With controls in power disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(vi) Measure aileron movement up and down port and starboard. Check that, with control columns neutral, there is no aileron down-float and not more than ½$^{\circ}$ up-float.

11. POWER ON (Contd).

(vii) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up, 3½° minimum). Repeat with control turned fully anti-clockwise. Centralise feel knob.

(viii) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 minute, check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 2½. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. For elevator, commence by moving stick forward from neutral. Check that the change-over to manual takes place smoothly.

(ix) Re-start pump, check for system stability by jerking control column and then letting go: the control columns should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons, and on both port and starboard control columns.

(x) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xi) Check that aileron feel spring centres control columns accurately when control column is deflected ½" from centre and released.

(xii) Repeat (x) above after rest periods of one minute, three minutes and five minutes, then check:

(a) that initial control column load does not increase after one minute of rest.

(b) that it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xiii) Re-attach elevator spring feel unit.

(xiv) Check that the elevator spring feel unit returns the control columns within 0.3" of central, after deflecting one with one finger on top of the grip.

(xv) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:—

Tailplane:	Neutral	Elevator:	21° up,	9½° down.
	Fully positive		25° up,	6° down.
	Fully negative		18¾° up,	13° down.

(xvi) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft.

(xvii) Push up the starboard control column trimming switch without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is $1\frac{1}{4}^{\circ} \pm \frac{1}{8}^{\circ}$ up. If it is not, trim slightly down and fully up again, until this angle is obtained.

11. POWER ON (Contd).

(xviii) Measure tailplane and elevator angles, moving control column in the following sequence:–

(a) Fully forward.

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is $1\frac{1}{2}^{\circ}$ to 2°.

(xix) Push the starboard trim switch, without biassing the stick, down until extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at (xviii) (a), (b), (d) and (e).

(xx) Repeat (xvii) and (xviii) using port control column trimming switch.

(xxi) Repeat (xix) using port control column trimming switch.

(xxii) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approx. 3½ seconds. Check for system stability by jerking a stick and letting go.

(xxiii) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

(xxiv) Run hydraulic rig at a speed corresponding to 1,950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators), while making the following selections:–

(a) Undercarriage down.

(b) Undercarriage up.

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxv) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON' and with the A.1607 actuator fitted, should be as shown below.

	Control Column Position	Tailplane Incidence		Elevator Angle Rel. to Tailplane	
		Max.	Min.	Max.	Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	$2^{\circ}\ 43'$	$2^{\circ}\ 13'$	7° down	$5\frac{1}{2}^{\circ}$ down
	Fully aft	As min. t/p control OFF		$19\frac{1}{2}^{\circ}$ up	18° up

11. POWER ON (Contd).

	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
2. Full Positive	(a) Fully forward	As max. t/p control OFF		6° down	4½° down
	(b) Moved aft until tailplane just moves	As reading at (2.a).	+0, −2′	5/8° up	3/8° up
	(c) Moved aft to tailplane zero.	0	0	9½° up	8½° up
	(d) Fully aft	−1° 35′	−1° 55′	20° up	18° up
	(e) Moved forward until tailplane just moves	As reading at (2.d).	+2′, −0	16° up	14½° up
	(f) Moved forward to tailplane zero.	0	0	7½° up	6½° up
3. Full Negative	(a) Fully forward	+36′	+16′	8½° down	7½° down
	(b) Moved aft until tailplane just moves	As reading at (3.a).	+0, −2′	7½° down	6½° down
	(d) Fully aft	As min. t/p control OFF		19½° up	18° up
	(e) Moved forward until tailplane just moves	As reading at (3.d).	+2′, −0	1½° down	½° down

SECTION 10

FLYING CONTROLS

PART 11

SETTING OF HYDROBOOSTER RELEASE UNIT MICROSWITCHES (Mk.58A)

I.D. INSTRUCTION H207/13 (Issue 1)

1. APPLICABILITY

Hunter F.Mk.58A aircraft, to the basic build standard defined by D.O.I. H.2561/1.

2. EQUIPMENT REQUIRED

Hydrobooster Cradle to Drawing No.T.397388 – for aileron boosters only.

Hydraulic hand pump rig with micronic filter and calibrated pressure gauge.

Electrical Rig to I.D.Sk.1696.

6 to 28 volt electrical supply.

0.055 in. x 3/16 in. wide setting slip gauge.

0.050 in. x 3/16 in. wide checking slip gauge.

0.060 in. x 3/16 in. wide checking slip gauge.

3. TEST METHOD WITH PYE SWITCHES (ELEVATOR BOOSTERS)

(i) Connect hydraulic and electrical rigs. Ensure that the ram slot and mating parts of the pawl, the microswitch button and its mating face are clean and grease-free.

It is important that their relative positions allow the pawl to seat squarely in the ram slot.

(ii) Apply a steadily-increasing pressure and check that by the time 650 p.s.i. is reached, the pawl is fully engaged, i.e. the ram cannot move in the release unit.

(iii) Increase pressure to 2800 p.s.i. and after a few seconds reduce to 650 p.s.i. At this pressure check that the pawl is fully engaged and is in contact with bottom of slot.

(iv) Release pressure and insert the 0.055 in. slip gauge between the pawl and the bottom of the ram slot. Apply a pressure ot 550 to 650 p.s.i. so that the slip-gauge is clamped by the pawl. Position microswitch tappet to indicate engagement, i.e. lamps 1 and 2 should be alight; lamp 3 should be out. Re-adjust tappet until disengagement is indicated, i.e. lamp 3 should be alight; lamps 1 and 2 should be out. Lock adjustment.

(v) Release pressure and replace the 0.055 in. slip gauge by the 0.060 gauge. Apply 550 to 650 p.s.i., so that the slip gauge is clamped, and check that the switch does not operate, i.e. lamps 1 and 2 remain out and lamp 3 lights.

(vi) Release pressure and replace the 0.060 in. slip gauge by the 0.050 in. gauge. Apply 550 to 650 p.s.i. so that slip gauge is clamped, and check that switch operates, i.e. lamps 1 and 2 are alight and lamp 3 remains out

3. TEST METHOD WITH PYE SWITCHES (ELEVATOR BOOSTERS) (Contd.)

(vii) Release pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot (disregard the "lead-in" to the slot.

(viii) Switch off and disconnect hydrobooster. Regrease ram and pawl with XG.275.

4. TEST METHOD WITH DOWNIC SWITCHES TO F.230401 (AILERON BOOSTERS)

(i) Mount the hydrobooster jack and release unit in the cradle. Connect hydraulic and electrical rigs. Ensure that the ram slot and mating parts of the pawl, the micro-switch button and its mating face are clean and grease-free.

It is important that their relative positions allow the pawl to seat squarely in the ram slot.

(ii) Apply a steadily increasing pressure and check that by the time 650 p.s.i. is reached the pawl is fully engaged; i.e. the ram cannot move in the release unit.

(iii) Increase pressure to 2800 p.s.i. and, after a few seconds, reduce to 650 p.s.i. At this pressure check that the pawl is fully engaged and that the gap between it and the bottom of the ram slot is within the limits 0.005 in. to 0.019 in.

(iv) Release pressure and insert the 0.055 in. slip-gauge between the pawl and the bottom of the ram slot. Apply a pressure of 550 to 650 p.s.i. so that the slip-gauge is clamped by the pawl. Move in the micro-switch by turning the knurled knob until lamps 1 and 2 just light. Move out the micro-switch until disengagement is indicated, i.e. lamps 3 and 4 should be alight and lamps 1 and 2 are out. (If more than ¼ turn of the knob is needed on moving out, the switch should be inspected for excessive differential). Lock micro-switch.

(v) Release pressure and replace the 0.055 in. slip gauge by the 0.060 in. gauge. Apply 550 650 p.s.i. so that the slip gauge is clamped. Depress the micro-switch plunger by hand until lamps 1 and 2 are alight. Release plunger slowly and check that lamps 3 and 4 are alight and lamps 1 and 2 are out when the plunger is resting on the end of the release unit piston rod. Ensure by moving the plunger sideways that it is fully out.

(vi) Release pressure and replace the 0.060 in. slip gauge by the 0.050 in. gauge. Apply 550 to 650 p.s.i. so that the slip gauge is clamped. Depress the micro-switch plunger by hand until lamps 1 and 2 are alight. Release plunger and check that lamps 1 and 2 remain alight and lamps 3 and 4 are out.

(vii) Release pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot (disregard the "lead-in" to the slot).

(viii) Apply pressure slowly and check that by the time 500 p.s.i. is reached the micro-switch indicates engagement, i.e. lamps 1 and 2 are alight.

(ix) Release pressure and disconnect rig and electrics. Regrease ram and pawl with XG.275.

SEE TEST INSTRUCTION H 207/13

SETTING OF HYDROBOOSTER RELEASE UNIT MICROSWITCHES

NOTE – SWITCHES SHOWN ACTUATED, PAWLS ENGAGED.

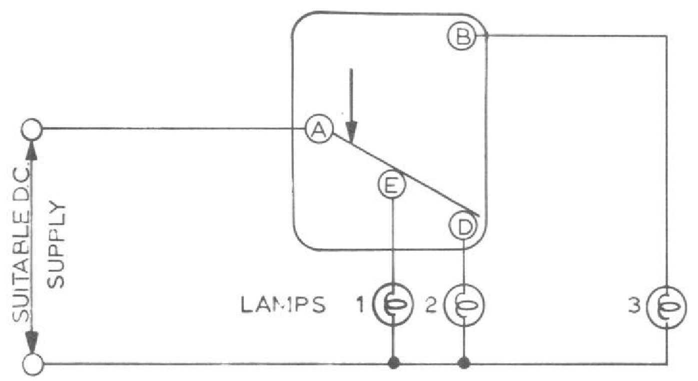

FIG. A – ELEVATOR HYDROBOOSTERS.

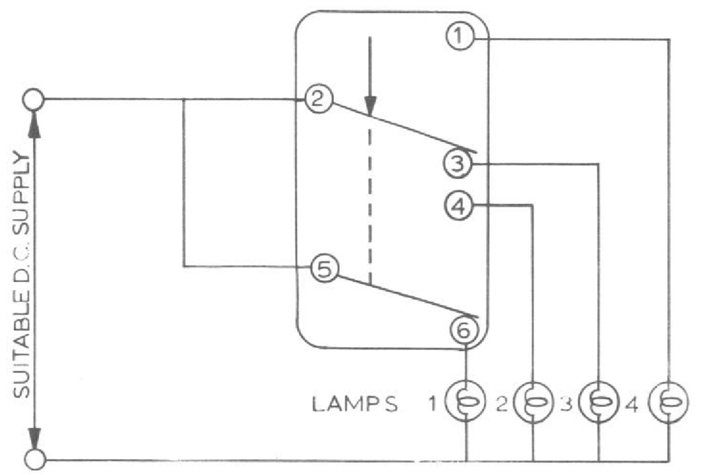

FIG. B – PORT & STARBOARD AILERON HYDROBOOSTERS

SECTION 10

FLYING CONTROLS

PART 12

FULL–POWER FLYING CONTROLS AND ELECTRICALLY OPERATED FLYING TAIL (Mk.58A)

I.D. INSTRUCTION H207/14 (Issue 1)

1. APPLICABILITY

The basic build standard of Swiss F.Mk.58A Hunter aircraft defined by D.O.I. H.2561/1.

2. INTRODUCTION

This mark of aircraft is fitted with hydroboosters which incorporate release units to permit manual operation of the flying controls.

The hydroboosters are pieces of precision machinery and must be kept scrupulously clean; a blank must immediately be fitted to the connections, both on the booster unit and on the aircraft, when any part of the system is disconnected to prevent any dirt entering the system.

The aircraft should be complete with ailerons and elevators, the tailplane set at zero incidence. A 24 volt d.c. supply, the hydraulic rig and control surface movement boards will be required. To avoid damage it is essential that manual rigging be carried out before any hydraulics are used. Check manually that the booster rams move freely in the release units at as early an assembly stage as possible.

3. MANUAL ADJUSTMENTS – AILERON

Before the aileron units are installed in the wings it is necessary to check pawl engagement and set the release unit micro-switches to M.S. Test Instruction H.207/13.

(i) Assemble each hydrobooster unit into the wing, it should be located at its neutral position by aligning the rear face of the valve body (where the valve spindle exits the valve body) with a straight-edge placed across the faces marked 'B' on rigging plate F.205947 which is affixed to the wing structure.

(ii) Disconnect 2 position jack at control rod A.206734. With control column set to instructions on D.206791, adjust the chains sufficiently to take up backlash but not enough to cause lumpiness in the control column movement throughout the spring feel adjustment range. Ensure chain adjusters are in safety.

(iii) Set spring feel unit to neutral and lock control column in neutral. Fit aileron lock A.201031 to idling link between frames 23 and 24, adjust control rod A.209620 and reconnect A.206734 to 2 position jack.

(iv) Fit setting locks RT.353499 and 353462/3 to details A/B and C on D.181483/4. Adjust control tubes A.191584 and connect to levers B.181399.

(v) Adjust control tubes A.169525 and connect to levers. Adjust output rods so that the aileron trailing edges have approximately 0.2 in. upfloat.

3. MANUAL ADJUSTMENTS – AILERON (Contd.)

(vi) Lock linkage in stub wing. Check that the backlash is not more than 3/32" at the top of the control column when the control column is moved without force (one finger on top of the control column).

(vii) Release all setting locks. Check that the load at the middle of the handgrip to move the control column in either direction from neutral is less than 5 lb.

If it exceeds this value disconnect the input circuit at the booster units, and check that the load at the middle of the handgrip to move the control column in either direction is less than ½ lb. Check for friction at the aileron hinges by ensuring that, with output disconnected, ailerons readily upfloat. Reconnect control tubes after rectification.

(viii) Adjust control column stops so that (temporarily) ± 6° of aileron movement is obtained.

4. MANUAL ADJUSTMENT – ELEVATOR

(i) Disconnect the elevator feel unit at forward end and tie up clear of elevator feel connecting lever. Disconnect the upper ends of the flying tail switch gear spring unit and connecting rod and tie clear of the elvator lever.
The tailplane main control switch should be 'OFF'.

(ii) Fit elevator rigging lock A.201030 to idling link between frames 23 and 24, adjust control tube A.209620 to bring control column to neutral.

(iii) Centre the elevator booster by aligning the forward face of the blanking plug on the booster body with the rigging lug/s on the channel.

(iv) Adjust and connect control tube B.215730 to booster assembly input lever.
Adjust output rod B.176196 so that elevator is trailing in neutral.

(v) Adjust control column stops to their limits and check that clearance between control column and instrument panel, with switch guards up, is not less than 3/32"; adjust column neutral if necessary.

(vi) Lock input circuit at elevator booster. Check that the backlash at the top of the control column when moved without force does not exceed 1/16".

(vii) Remove lock in input circuit and lock elevators neutral at trailing edge. Movement at the top of the control column must not exceed ¾".

(viii) Unlock one elevator and check that elevator universal joint backlash does not exceed 0.13", measured at the trailing edge.

(ix) Check that the load at the middle of the handgrip to move elevator 'up' is less than 2 lb. and elevator 'down' less than 5 lb. Any excess friction must be eliminated. Control column loads with linkage disconnected at booster input must not exceed 2 lb.

4. MANUAL ADJUSTMENT – ELEVATOR (Contd).

(x) Adjust control column stops so that (temporarily) 8° down and 20° up movement is obtained.

5. POWER ADJUSTMENT – GENERAL

(i) All hydraulic oil supplied to any of the power-operated control circuits must be passed through a Micronic filter element. A dirty system may cause excessive control column loads.

(ii) All hydraulic pipelines must be flushed out with clean hydraulic fluid prior to being connected to the booster units, the oil used for the purpose afterwards being discarded.

(iii) Ensure that the controls are free.

(iv) Disconnect and blank off the release units. Put power on, move the control column and the rams should slide freely through the release units, if the valves are adjusted. No valve adjustment should be required for the elevator. Check that the pressure required to move the booster rams in either direction does not exceed 250 p.s.i.

(v) Before any valve adjustments, etc. are made, any air that may exist in the system must be expelled be repeated functioning.

(vi) The tailplane and datum trim actuators should have been tested.

6. POWER ADJUSTMENTS – AILERON

(i) Adjust booster valves in accordance with AP.4347, section 3, chapter 4, paragraph 30 (or equivalent).

(ii) Check ailerons upfloat 0.2" in manual with control column neutral. Engage power and obtain full aileron movement by adjusting the control column stops; this should be ± 13° as defined by drawing No.E.202984.

(iii) Ensure that jacks do not 'bottom'. This can be noticed by a stickiness on moving a control column from extreme position.

(iv) Put control column neutral, do not lock in position, adjust port and starboard ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are: Up, ½°, Down 0°.

(v) Check control surface movements, the full amount (see 2 above) should be available.

(vi) Lock selector valve tab-washer on both units.

(vii) Check controls for ease of movement; load to move control column from central position in either direction to be 3 lb. max.

7. POWER ADJUSTMENTS – ELEVATOR

(i) Check that the servo valve eye-end is screwed in sufficiently to register in the safety hole.

(ii) With tailplane at zero incidence, hold control column neutral and check booster and elevator are neutral; if necessary re-adjust on the input and/or output links.

(iii) Check controls for ease of movement; load to move elevator to be a maximum of 2 lb. in either direction. There should be no tendency for the control column to move on when released after gentle movement.

(iv) Ensure there is no free movement between the eye-ends of the elevator spring feel unit. Adjust its length to suit attachment positions with elevator neutral and tailplane at zero incidence. Re-attach spring feel unit, but do not lock.

(v) Adjust aft control column stop to give an elevator angle of $-22^\circ/21\frac{1}{2}^\circ$ and the forward stop to give an elevator angle of $+9\frac{1}{2}^\circ/9^\circ$.

(vi) Ensure that the jack does not 'bottom'. On completion of adjustments lock servo valve eye-end.

(vii) Check all moving parts of flying tail switch-gear for full and free movement and correct lubrication. Re-attach switch gear spring unit and connecting rod to elevator lever.

(viii) Disconnect aircraft electrical supply to datum trim actuator and connect separate supply. The tailplane selector switch should be 'OFF', the elevator booster switch at 'Power Off' and the tailplane at neutral.

(ix) Trip the main tailplane actuator circuit breaker on the port cockpit shelf (by raising the stand-by control switch cover). Fully extend datum trim actuator.

(x) With control columns held at neutral, contact E on the upper microswitch will be made (a lamp (1) connected from terminal D to earth should be ON) and contact E on the lower microswitch broken (a lamp (2) between D and earth should be OFF). Connections may be made at T.B.79, terminals 5 and 4 respectively. Raise elevator by hand until the upper microswitch just opens (lamp (1) OFF) and read elevator angle. Raise elevator further until the lower microswitch just closes (lamp (2) ONN) and read elevator angle. Adjust microswitch adjusting screw F.211420 to make the difference in reading $1\frac{3}{4}^\circ$ of elevator movement.

(xi) Move tailplane selector switch to 'ON' and elevator booster switch to "POWER ON". By moving the control column, re-check the elevator angular movement in both directions between opening one microswitch and closing the other. The backlash must be $1\frac{3}{4}^\circ \pm \frac{1}{4}^\circ$ of elevator movement. If these limits are exceeded repeat item 10 and re-check: lock adjusting bolt on completion.

(xii) Re-connect datum trim actuator aircraft supply, and with stick free and tailplane selector switch 'ON' close stand-by switch cover. Ensure elevator remains neutral relative to tailplane. Check that tailplane moves to fully positive incidence and remains there. If tailplane stops short of fully positive, shorten spring unit B.211414 as required.

(xiii) Move control column aft and check the tailplane actuator begins to retract before elevator angle is $+2^\circ$ to $+3^\circ$ relative to tailplane. If angle exceeds this value lengthen spring unit B.211414 as required.

7. POWER ADJUSTMENTS – ELEVATOR (Contd.)

(xiv) Trim to fully negative incidence, stick free. Ensure elevator remains neutral. Check the tailplane remains in this position when trim switch is released. If fully negative incidence is not obtained, lengthen spring unit as far as possible consistent with obtaining fully positive incidence. Secure spring unit lock nut.

(xv) Move tailplane selector switch to 'OFF' and with control column neutral check that full tailplane movement is obtainable on operating trim switch.

(xvi) Move the tailplane selector switch to 'ON', control column free, and note any tailplane movement that occurs; re-select 'OFF' and inch the actuator by operating the control column trim button sharply without disturbing the control column; then, with stick free, select 'ON' and note tailplane movement. Repeat this cycle six times. The greatest tailplane movement that occurs on a selection of 'ON' must not exceed fifteen minutes of arc.

(xvii) At neutral trim and with tailplane selector and elevator booster switches 'OFF', raise elevator by hand until upper micro-switch is open; then lower slowly and check that when the switch closes there is a clearance of at least 0.015" between the pin F.219509 and the upper edge of the hole in the switch carrier side plate A.220794.

(xiv) Disconnect spring feel unit at forward end and tie up clear of elevator feel connecting lever.

8. COMPLETE SYSTEM CHECKS

The aircraft should be complete with ailerons and elevators, which should be adjusted in accordance with the above sections. The aircraft should be on jacks and these tests should preferably commence following the main hydraulic functioning tests.

For these initial checks the hydraulic rig should be run at a speed equivalent to 1,350 pump r.p.m. (3rd gear on SE.599). Check accumulators are charged correctly. The main hydraulic pressure should not fall below 2,700 p.s.i. when functioning the controls normally.

Commence with ALL POWER SERVICES OFF.

(i) With tailplane neutral and tailplane main control switch 'OFF', lock elevator input linkage at valve and check that the backlash at the control column is a maximum of 1/16".

(ii) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.

(ii) Measure force in pounds at stick grip to just move elevator from the central position up and down. This should be a maximum of 2 lb. up and 5 lb. down. Measure force in pounds at stick grip to just move the ailerons from the centre position, port and starboard. This should be 5 lb. maximum.

(iv) With rig pump running and electrics ON, select aileron and elevator power 'ON', holding switches 'ON' until locks are engaged and indicators clear. Check that the boosters engage on moving the stick and the aileron indicator does not clear until both aileron locks are engaged and elevator indicator does not clear until the elevator lock is engaged.

8. COMPLETE SYSTEM CHECKS (Contd.)

(v) Check that locks remain engaged, with indicators clear, on releasing switches. Select power 'OFF' and check that boosters disengage.

(vi) Hold stick deflected so that the aileron ram slots are misaligned with their pawls. Hold the aileron power switch 'ON' and engage one aileron lock by moving the aileron by hand. Release switch and check that both pawls are fully out. Repeat, engaging the other aileron lock. Select aileron power 'ON' and engage locks. Release switch. Press the emergency aileron power disengaged button momentarily and check that both pawls are fully out. Hold stick deflected so that the elevator ram slot is misaligned with the pawl. Select elevator power 'ON', and release switch. Check that the pawl is fully out.

(vii) Select elevator power 'ON' and engage lock. Release switch. Press the emergency elevator power disengaged button momentarily and check that the pawl is fully out. Select 'power on', re-engage lock, then measure force in pounds at the control column handgrip to just move elevator from the central position, up and down, (maximum 2 lb). Measure force in pounds at the control column handgrip to just move ailerons from the central positions, port and starboard (maximum 3 lb). Ensure that stick loads for full aileron deflection, port and starboard, are within 3 lb. of each other.

(viii) With controls in power, disconnect electrical ground supply and check that both ailerons and elevator remain in power. Reconnect electrical ground supply.

(ix) Measure aileron movement up and down, port and starboard. Check that, with control column neutral, there is no aileron down-float and not more than ½° up-float. Check operation of 2-position jack by selecting aileron power 'ON' and 'OFF'.

(x) Turn aileron feel knob fully clockwise and check aileron angles, stick free (port down and starboard up, 3½° min.). Repeat with control knob turned fully anti-clockwise. Centralise feel knob.

(xi) Stop hydraulic pump and dissipate main system pressure by selecting flap: after 1 min., check that number of complete stick cycles for aileron, before pressure-failure dolls-eye operates, exceeds 3. Repeat for elevator circuit (1¼ cycles). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral. For elevator, commence by moving stick forward from neutral. Check that the changeover to manual takes place smoothly.

(xii) Re-start pump, check for system stability by jerking control column and then letting go: the control column should come to rest and not oscillate. This test should be carried out independently for elevator and ailerons.

(xiii) Check controls for ease of movement in all directions; check that system is free from any sluggishness, lumpy or jerky movements or other undesirable effects. Check aileron controls over full range of aileron feel trimmer.

(xiv) Check that aileron feel spring centres control column accurately when control column is deflected ½" from centre and released.

8. COMPLETE SYSTEM CHECKS (Contd.)

(xv) Repeat (xiii) above after rest periods of one minute, three minutes and five minutes, then check:

(a) That initial control column load does not increase after one minute of rest.

(b) That it does not exceed a maximum of 6 lb. for a rest period of 5 mins.

(xvi) Re-attach elevator spring feel unit.

(xvii) Check that the elevator spring feel unit returns the control column within 0.3" of central, after deflecting it with one finger on top of the grip.

(xviii) Check that elevator angles, relative to tailplane, do not exceed the following, with tailplane neutral, fully positive and fully negative:–

Tailplane:	Neutral	Elevator:	22° up,	9½° down
	Fully positive		25° up,	7° down
	Fully negative		18¾° up,	13° down

(xix) Move the tailplane selector switch to 'ON' and with neutral trim, measure tailplane and elevator angles at control column fully forward and fully aft. See 8 (xxvi).

(xx) Push up the control column trimming switch, without biassing the stick, until extreme (full positive) trim is obtained. Move control column aft until tailplane just moves, and check that elevator is 1¼° ± 1/8° up. If it is not, trim slightly down and fully up again, until this angle is obtained.

(xxi) Measure tailplane and elevator angles, moving control column in the following sequence: See para. 8, (xxvi).

(a) Fully forward

(b) Moved aft until tailplane just moves.

(c) Moved aft until tailplane is at zero incidence.

(d) Fully aft.

(e) Moved forward until tailplane just moves.

(f) Moved forward until tailplane is at zero incidence.

Check that the difference between elevator readings at (c) and (f) is 1½° to 2°.

(xxii) Push the trim switch, without biassing the stick, down until extreme trim (full negative) is obtained. Measure tailplane and elevator angles as at (xxi) (a), (b), (d) and (e).

(xxiii) Trim neutral and check for smooth operation over the stick movement range, moving control column at a constant speed giving a time of operation from stick stop to stop of approximately 3½ seconds. Check for system stability by jerking the stick and letting go.

(xxiv) Move the tailplane selector switch to 'OFF' and ensure that the tailplane remains locked during elevator movement.

8. COMPLETE SYSTEM CHECKS (Contd.)

(xxv) Run hydraulic rig at a speed corresponding to 1950 pump r.p.m. (2nd gear on SE.599). Move controls at approximately one stir per 2 seconds (a stir is a circular movement of the top of the control column combining extreme travel of both ailerons and elevators) while making the following selections:—

(a) Undercarriage down.

(b) Undercarriage up.

(c) Undercarriage up, flaps up.

(d) With undercarriage and flaps up, airbrake out and in.

Hydraulic pressure at all these conditions must not fall below 1,100 p.s.i.

(xxvi) Tailplane and elevator angles with tailplane selector and elevator power switches 'ON', and with the A.1612 actuator fitted, should be as shown below:

Trim	Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
1. Neutral	Neutral	0	0	0	0
	Fully forward	As max., t/p control OFF		7° down	5½° down
	Fully aft.	As min., t/p control OFF		18½° up	17° up
2. Full Positive	(a) Fully forward	As max., t/p control OFF		7° down	5½° down
	(b) Moved aft until tailplane just moves	As reading at (2.a) +0, −2′		1 3/8° up	1 1/8° up
	(c) Moved aft to tailplane zero	0	0	8° up	7° up
	(d) Fully aft	−1°: 52′	−2°: 12′	19½° up	18° up
	(e) Moved forward until tailplane just moves	As reading at (2.d) +2′, −0		17° up	15½° up
	(f) Moved forward to tailplane zero	0	0	6½° up	5½° up

8. COMPLETE SYSTEM CHECKS (Contd.)

Trim		Control Column Position	Tailplane Incidence Max.	Tailplane Incidence Min.	Elevator Angle Rel. to Tailplane Max.	Elevator Angle Rel. to Tailplane Min.
3. Full Negative	(a)	Fully forward	+10′	−20′	9½° down	8½° down
	(b)	Moved aft until tailplane just moves	As reading at (3.a) +0, −2′		8½° down	7½° down
	(c)	Fully aft	As min., t/p control OFF		18½° up	17° up
	(d)	Moved forward until tailplane just moves.	As reading at (3.c) +2′, −0		2½° down	½° down


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