

Chapter 4 FLYING CONTROLS

LIST OF CONTENTS

	Para.		Para.		Para.
Introduction	1	Functioning checks for power controls	27	Checking flap synchronizing jacks...	42
Description		<i>Manual Adjustments</i>		Adjustment of flap position transmitter and drum switch	43
General	2	Ailerons	28	Air brake, jack adjustment	44
Control column and linkage	3	Elevators	29	Air brake, forward micro switch (ground test)	45
Rudder bar	4	<i>Power adjustment</i>		Air brake, rear micro switch (indicator)	46
Control tubes	6	General	30	Air brake, undercarriage emergency air valve micro switch	47
Spring feel units	7	Ailerons	31	Aileron spring feel unit	48
Tail plane incidence control	13	Elevators	32	Elevator spring feel unit	49
Elevator hydraulic booster controls	15	<i>Installation tests</i>		Setting of hydro-booster release unit micro switches	50
Aileron hydraulic booster controls	16	Power off	33	Replacement of aileron trim tab Desynn position transmitter	51
Operation of booster jacks	18	Power on	34	Replacement of aileron trim tab actuator	52
Rudder trimming tab	19	Power control stability check	35	Adjustment of aileron trim tab and Desynn position transmitter—Post Mod. 568	53
Aileron trim tab	20	Control surface settings	36	Adjustment of the aileron trim tab and Desynn position transmitter—Pre Mod. 568	54
Landing flaps	21	Rudder	37	Aileron neutral position indicator setting	55
Air brake	22	Rudder trimming tab	38		
Servicing		Aileron trimming tab	39		
General	25	Replacement of safety catch for aileron/rudder trim switch	39A		
Lubrication	26	Tail plane incidence	40		
		Landing flaps	41		

LIST OF TABLES

	Table
Aileron adjustments	1

LIST OF ILLUSTRATIONS

	Fig.		Fig.
Flying controls, with lubrication points (1)	1	Aileron feel unit	5
Flying controls, with lubrication points (2)	2	Aileron control stops	6
Assembly of aileron levers at rib R	2A	Elevator control stops	7
Identification lettering on flying control tubes in fuselage	2B	Adjusting aileron booster units	8
Flying controls, with lubrication points (3)	3	Rigging fixture	9
Controls in tail plane, fin and rudder	4	Rudder control stops	10
		Control surface settings	11
		Flap synchronizing jack adjustment	12
		Setting of hydro-booster release unit micro switches	13
		Elevator feel unit	14
		Fitting of aileron trim tab actuator and Desynn position transmitter	15

Introduction

1. This Chapter contains a general description of the flying controls, together with control surface adjustment, lubrication and servicing information necessary to maintain the controls in an airworthy condition. For a description of the Desynn transmitters and indicators, together with details of their operation and servicing, reference should be made to A.P.1275A, Vol. 1.

DESCRIPTION

General

2. Normal stick and rudder bar type flying controls with push-pull rod transmission are installed in this aircraft and, in addition, the tail plane incidence may be varied by an electric actuator. Booster jacks, operated by the aircraft hydraulic system are provided to fully augment the pilot's effort when operating the ailerons and elevators. Separate switches in the cabin are provided for Power

On and Off selection of both ailerons and elevators, the switches initiating electrically the operation of the electro-hydraulic control valves which, in turn, control the flow of hydraulic fluid to the booster jack servo valves. They are also automatically disconnected in the event of hydraulic failure. When disconnected, the booster jack units function as normal control rods, thus enabling manual operation of the control surfaces to be effected.

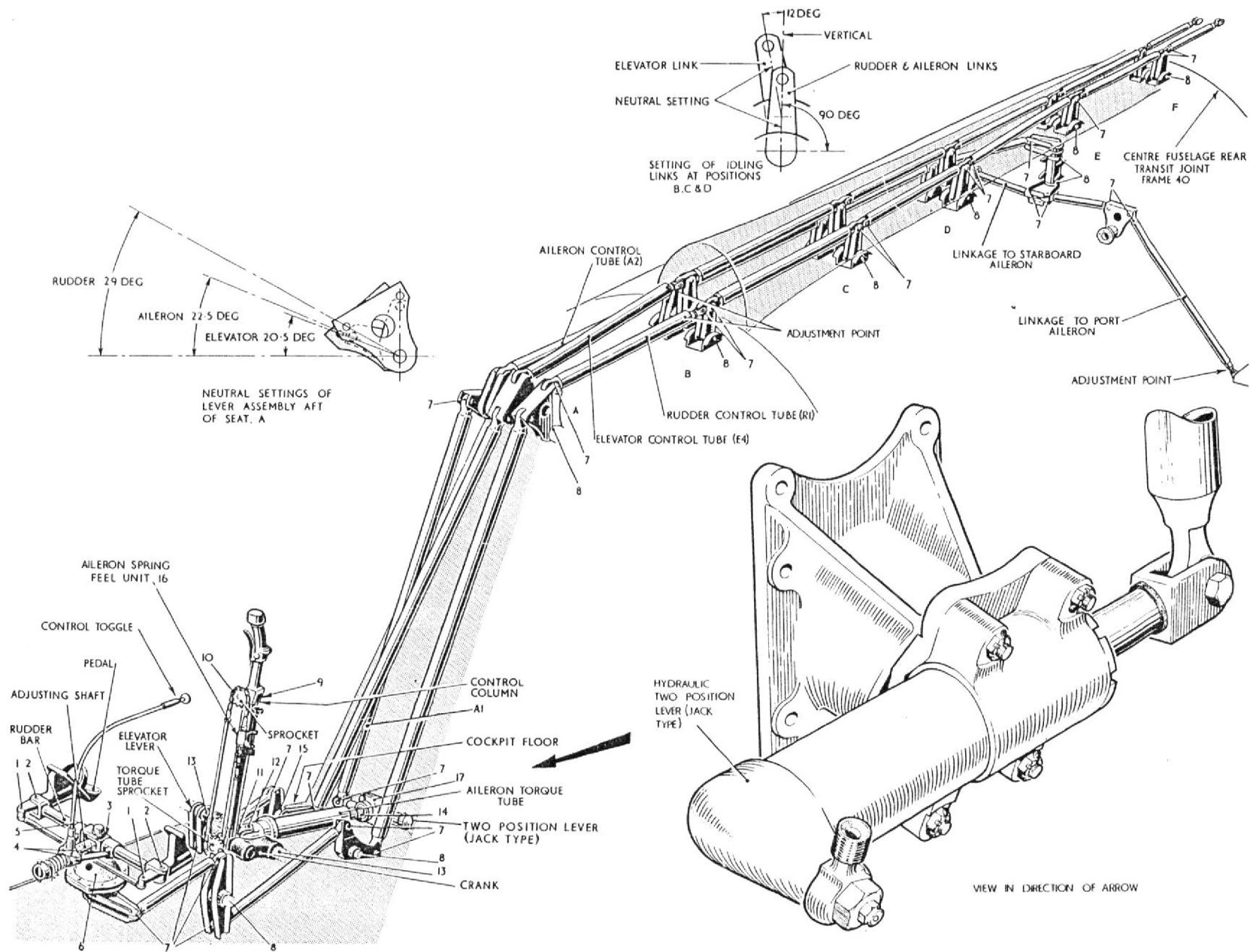


Fig.1 Flying controls with lubrication points (1)

TP.16264

RESTRICTED

F.S./2

KEY TO FIG. 1, 2 and 3
Flying Controls, with Lubrication Points

- 1 Rudder bar connecting link pins
- 3 Rudder bar centre bearings
- 4 Rudder bar adjustment link pins
- 10 Chains and sprockets
- 18 Trim tab hinge pin
- 20 Trim tab actuator pin
- 21 Trim tab lever
- 24 Elevator feel unit anchorages
- 40 Transmitter lever shackle pin
- 45 Desynn transmitter rod shackle pins
- 46 Aileron hydraulic booster linkage pins

OIL OX-14

- 2 Rudder bar pedal bolts
- 12 Torque tube universal joint pins
- 16 Aileron spring feel unit bearings and gears
- 19 Hydraulic booster jack ram
- 23 Pivot pin for input and output levers
- 25 Tail plane actuator pivots
- 26 Rudder hinges
- 27 Tail plane pivot
- 30 Elevator spring feel unit spindle
- 39 Elevator universal joint
- 44 Elevator inner hinge

GREASE XG-275

- 6 Rudder bar pedestal bearings
- 7 Control tube bearings
- 8 Control link and lever bearings
- 9 Control column head joint
- 11 Control column bearings
- 13 Crank bearings
- 14 Torque tube bearings
- 15 Elevator shaft bearings
- 17 Hydraulic two-position lever (jack type) bearings
- 22 Aileron bearings
- 29 Elevator outer hinge

Packed with grease on assembly.
Further lubrication not required,
but where accessible, remove any
moisture which may have accumulated.

- 5 Rudder bar adjustment cables
- 41 Rudder tab Desynn transmitter Bowden cable
- Aileron tab Desynn transmitter Bowden cable

GREASE XG-273

Note . . .

On re-assembly of flying control and idling links incorporating shielded bearings, care must be taken to ensure that these bearings are free from sealing compound and are well packed with grease. For lubrication of flap controls refer to Sect. 3, Chap. 2, fig. 15, 16, 17 and 18.

Item numbers 28, 31, 32, 33, 34, 35, 36, 37, 38, 42 and 43 not used.

RESTRICTED

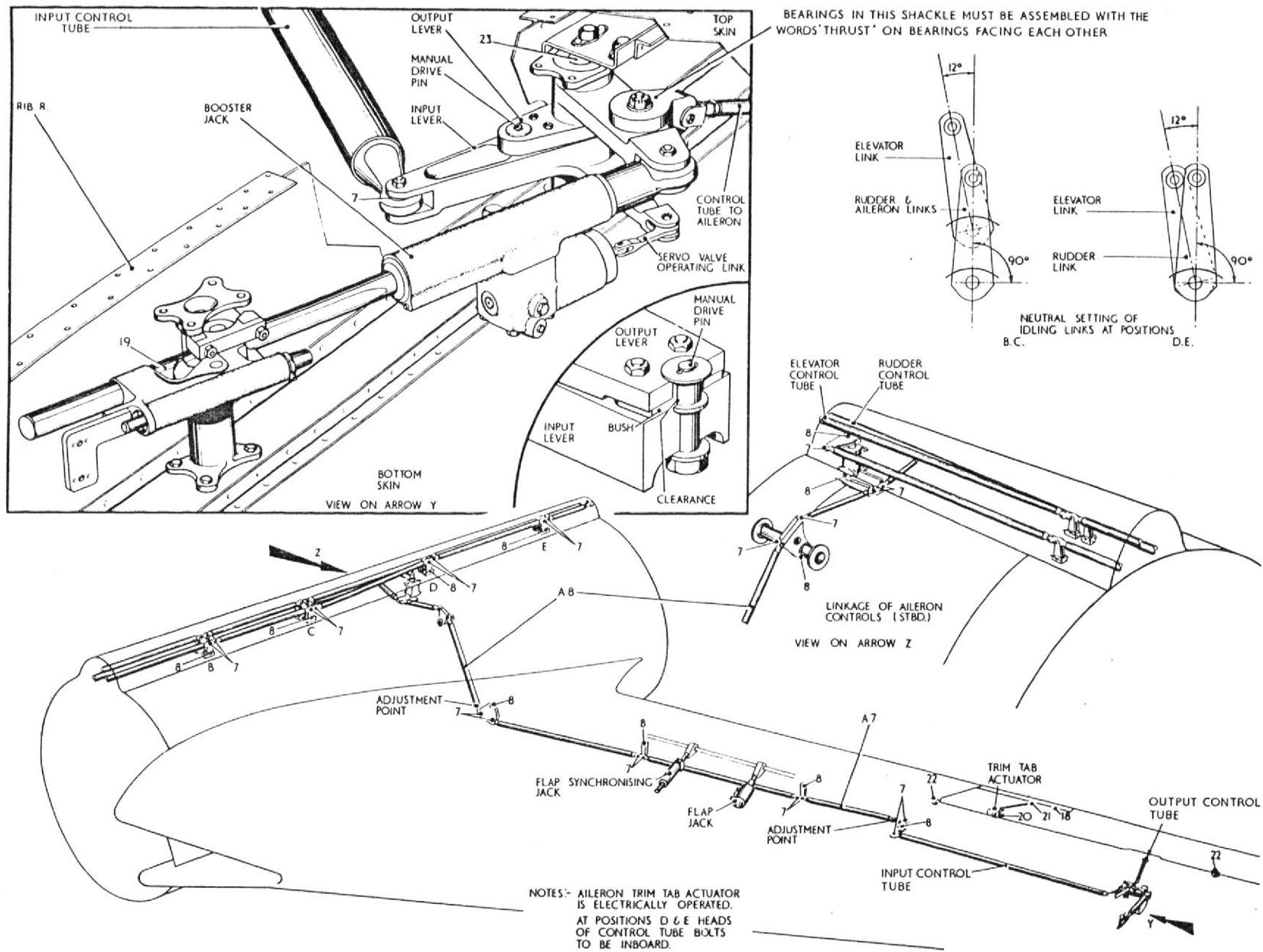
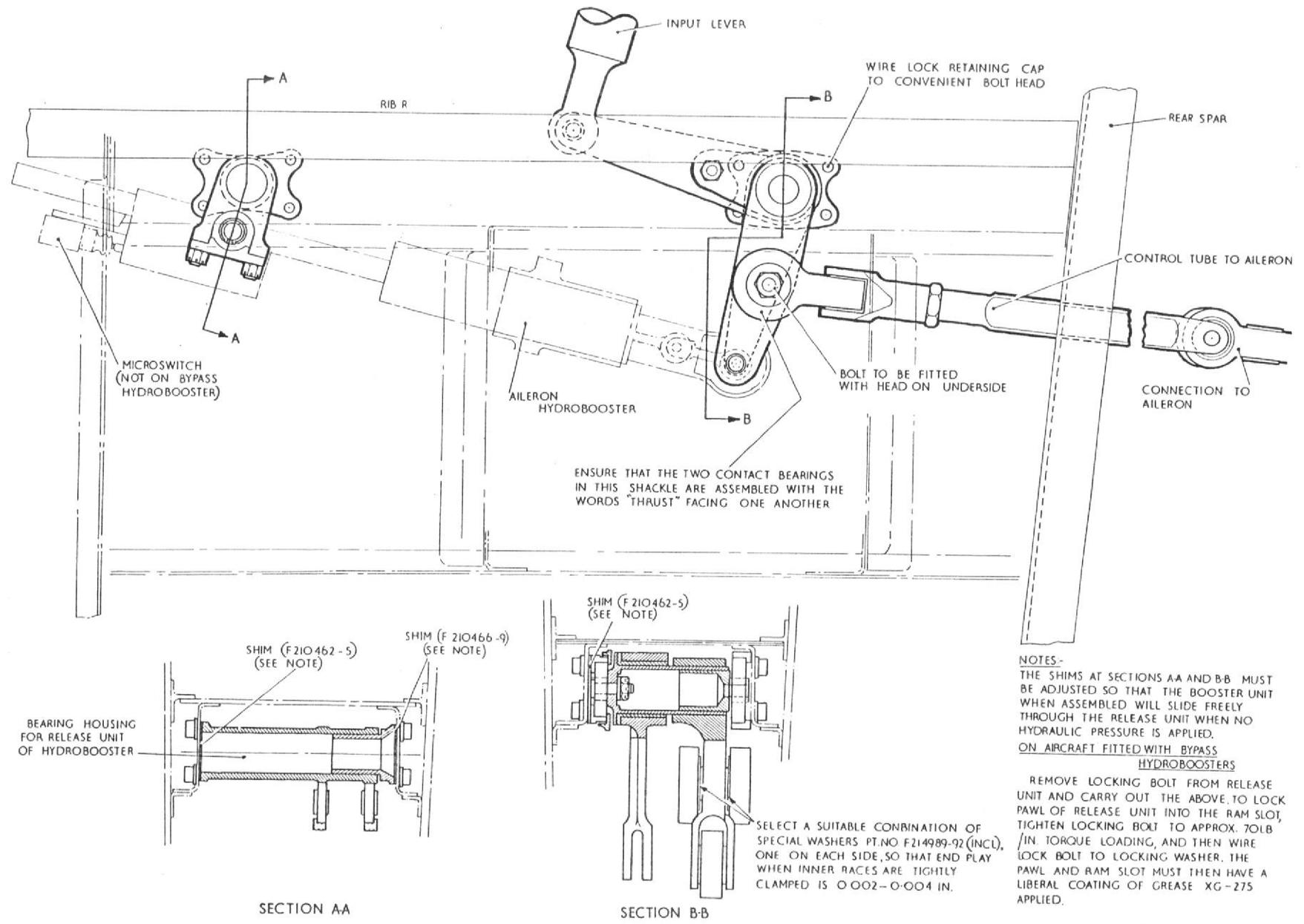
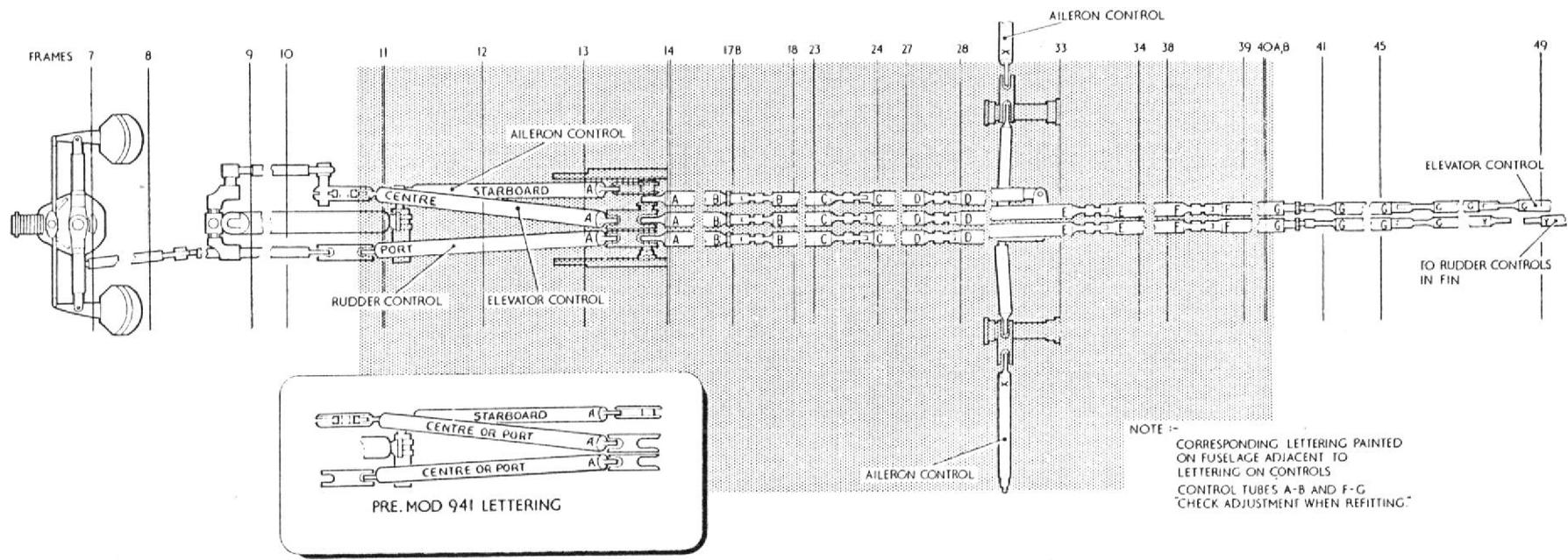


Fig. 2 Flying controls with lubrication points (2)

RESTRICTED



◀ Fig. 2A Assembly of aileron levers at Rib R. ▶
RESTRICTED



◀ Fig. 2b Identification lettering on flying control tubes in fuselage ▶

RESTRICTED

Control column and linkage (fig. 1)

3. The control column has a pivoted upper portion which moves laterally and independently to control the ailerons, while both portions move as one complete unit fore and aft to control the elevators. The upper portion carries a handgrip which accommodates the gun firing, camera and other control switches, together with the wheel brake lever. A sprocket is attached to the upper portion, at the knuckle joint, to transmit the lateral movement to an aileron torque sprocket at the bottom of the column via a chain and link system enclosed in a guard on the forward face of the column. The chain and link system incorporates an adjustable spring feel unit (fig. 1 and 5) which is described in paras. 7-11. The lower portion of the control column incorporates the aileron control stops (fig. 6) and is terminated by an inverted tee-shaped plug-end bolted to two cranks which are themselves bolted to small torque shafts carried in bearings at both sides of the fuselage keel member below the cabin floor. The starboard shaft is longer than that on the port side and carries a lever which is connected to a control tube extending aft to a further lever system located in bearings on the starboard side of the keel member between frames 10 and 11; from this point the control tubes extend upwards behind the seat and aft to the elevators. The lower portion of the control column also incorporates the aileron torque tube sprocket which is carried at the forward end of a shaft passing through the tee-shaped plug-end and connected to the aileron torque tube by a universal joint. The aileron torque tube is carried in bearings attached to the underside of the cabin floor and frame 11. Assembled to the aileron torque tube is a two-position hydraulic jack which acts as the lever to transmit the motion of the torque tube to further control tubes which extend upwards behind the seat and aft to the ailerons.

The jack is spring-loaded so that it is fully extended against the spring by hydraulic pressure when the ailerons are in power, but is automatically retracted by the pressure of the spring when the ailerons are in manual and hydraulic power is not available at the boosters. It also retracts automatically in the event of hydraulic failure. Thus, aileron control in manual is effected through a shortened lever (*jack retracted*) to reduce the effort required from the pilot to operate them and, consequently, the range of movement of the ailerons in manual will be considerably less than the range of movement obtained when the ailerons are in power. The elevator spring feel unit (*para. 12*) is fitted in the dorsal fin, but whereas it is similar in principle to that of the aileron feel unit, it is not adjustable in flight.

Rudder bar (fig. 1)

4. The rudder bar is mounted on a vertical spindle which is free to rotate in a pedestal casting secured to the cabin floor. The spindle incorporates an adjustable stop (fig. 10) which protrudes through a slot in the pedestal and so limits the rudder bar movement. The rudder bar consists of two separate arms with a fork at each end, the inboard forks interlacing to fit over the spindle, while the outboard forks carry the foot pedals. A rudder bar adjusting shaft is splined to the top of the spindle, between the inboard forks of the rudder bar arms, and carries a slide with a spring-loaded plunger which engages with one of a number of holes in the adjusting shaft. This slide is attached to each rudder bar arm by a short link, and a spring is located between the slide and a stop on the forward end of the adjusting shaft.

The rudder pedals, which consist of light alloy stampings, are provided with bearings to fit the outboard forks of the rudder bar, and each pedal extends forward to form a lever which is connected by a link rod to a support plate projecting forward from the pedestal. These link rods are provided to maintain the pedals in the same angular position relative to each other when the rudder is operated. Movement of the rudder pedals is transmitted to the operating lever at the bottom of the spindle through the short links, slide and adjusting shaft.

5. The rudder bar is adjusted for leg reach by means of a control lever in the cabin. The lever is connected to the spring-loaded plunger in the slide on the adjusting shaft by a Bowden cable. Operation of the lever disengages the plunger from its hole in the adjusting shaft, thus permitting the rudder bar arms to be swung forwards against the pressure of the spring, or swung backwards by the spring. When adjustment is completed, the lever is released to allow the plunger to engage with the nearest hole in the adjusting shaft, thus locking the rudder bar in the desired position.

Control tubes

6. Apart from the lateral movement of the control column, which is transmitted to the aileron torque tube below the cabin floor by means of a sprocket and chain system, all movement of the control column and rudder bar is transmitted to the control surfaces by a series of control tubes carried on idling links which are hinged to the aircraft structure. The run of the control tubes is illustrated in fig. 1, 2, 3 and 4.

Spring feel units

7. The aileron and elevator control systems are each provided with a spring feel unit to give artificial feel to the controls when they are operated in power. The aileron spring feel unit (fig. 1 and 5) consists of a cylindrical casing which contains a spring-loaded spindle, the spring when assembled, being adjusted to a nominal load of 7 lb. by means of an adjuster nut on the lower end of the spindle.

8. The spindle is free to move in either direction in the casing against the spring, and the unit is mounted on the lower portion of the control column in such a manner that the spring-loaded spindle of the unit forms part of the chain and link system between the upper and lower sprockets of the column, while the cylindrical casing is anchored to the mounting by which the unit is attached to the column itself. Thus, while the casing remains fixed in relation to the column, the spindle is free to move against the spring to give artificial feel to the controls when the ailerons are being operated in power.

9. Since the anchorage of the spring feel unit casing to the mounting on the column is in the form of a screw thread, it follows that the datum point will be dependent upon the amount the unit is screwed into the mounting, and this has been utilized to form a means of adjusting the datum point to which the control column and ailerons are centred.

10. Adjustment is by means of a control spindle which is fitted parallel to the spring feel unit in its mounting. Turning a knob at the top of the spindle rotates the spindle together with an integral pinion at its base which, being in mesh with an integral gear on the outer periphery of the spring casing, rotates the casing in the threaded bore of the mounting, thus varying the datum point to suit individual requirements in flight.

11. The unit is initially adjusted so that, when the spring is at its nominal load of 7 lb., the control knob is in the neutral position (i.e., the dowel in the housing registering in the

depression on the top face of the pinion at the base of the spindle) and the white (neutral) line on the top of the control knob facing forward.

12. The elevator spring feel unit (fig. 3 and 14) is fitted in the dorsal fin between the flying controls idling links in the region of frame 49 and a lever assembly which is linked to the junction of the tail plane actuator and tail plane lever. In principle, the elevator spring feel unit is similar to that provided for the ailerons, but unlike the aileron feel unit, the elevator feel unit is not adjustable in flight.

Tail plane incidence control (fig. 3 and 4)

13. To enable the tail plane incidence to be varied in flight, the tail plane is hinged at the rear spar to a pivot at the top of frame 55 and a projection on its leading edge picks up with the operating rod of an electrically-operated actuator mounted in the dorsal fin below the tail plane and between two beams extending from the top of frame 51 to frame 52. The actuator incorporates internal non-adjustable limit switches to control its range of movement and is provided with a standby motor to maintain operation should the main motor or main electrical circuit fail.

14. The main motor is controlled by a switch on the control column, and the standby motor by a separate control circuit energized by a switch located under a guard cover in the cabin. Raising this guard cover enables the switch to be used and, at the same time, automatically isolates the control column switch circuit. The incidence of the tail plane is shown on an indicator located in the cabin. The operation and circuit details of the actuator and indicator is described in Sect. 5, Chap. 1.

Elevator hydraulic booster controls (fig. 3 and 4)

15. The elevator hydraulic booster jack and linkage system is located between frames 52 and 55 just below the tail plane. The assembly is carried in a channel-sectioned beam bolted to cast brackets mounted on the frames and

consists of a hydraulic booster jack, release unit, servo valve, and operating link, an input lever and an output lever. The elevator control tube from the control column is connected to the extreme end of the input lever, and the control tube from the elevator is connected to the output lever. A switch, located in the cabin, is provided for Power On and Off selection, and an indicator is provided to show that power is disengaged. In the event of hydraulic failure, an accumulator in the circuit provides power to give at least 2 control column reversals. When the accumulator is exhausted, control of the elevator automatically reverts to manual. On aircraft in which Mod. 502 is embodied, to permit reversion to manual in the event of electrical failure an emergency power disengaged push button switch is provided, the circuit being energized by a small battery. The operation and circuit of the cut-off switch, indicator and standby manual control is described in Sect. 5, Chap. 1.

Aileron hydraulic booster controls (fig. 2)

16. Each aileron hydraulic booster jack and linkage system is located in the outer wing in a bay formed by ribs R and S, a diaphragm and the rear spar (Sect. 3, Chap. 2), the assembly being carried on two sets of mountings bolted to a beam attached to the skin and to the outboard face of rib R. Apart from the hydraulic booster unit, the linkage consists of an input and output lever assembly mounted on one set of mountings and a release unit and micro switch assembly which supports the booster unit, carried on the second set of mountings. The input and output levers, although mounted on the same bearings in the mountings, are not directly connected; and interconnection, for the purpose of manual operation in the event of hydraulic failure, is derived by a manual drive pin protruding upwards from the input lever into an integral bush on the output lever. There is a diametrical clearance between the pin and bush to provide lost motion for valve operation. The aileron control tube from the control column is connected to the extreme end of the input

lever and the control rod to the aileron is connected by a fork-end to a shackle approximately mid-way along the output lever. *It should be noted that the contact bearings in this shackle must be assembled with the words 'THRUST' on the bearings facing each other.* The servo is operated by a link attached to a subsidiary lever integral with the input lever.

17. A switch is provided for selecting Power On and Off, the switch being adjacent to the switch used for elevator power selection. An indicator, fitted adjacent to the elevator indicator, is also provided and operates at the same pressure. The emergency operation by means of energy stored in an hydraulic accumulator and on aircraft Post Mod. 502, the reversion to manual in the event of electrical failure, is similar to that for the elevator control system described in para. 15 of this chapter. At least 2 control column reversals are available before the accumulator is exhausted. The operation of the booster jack, control valve and release unit is the same as that for the elevators (described in para. 15).

Operation of booster jacks

18. The operation of the elevator and aileron booster jacks is similar and is described in A.P.4601A, Vol. 1.

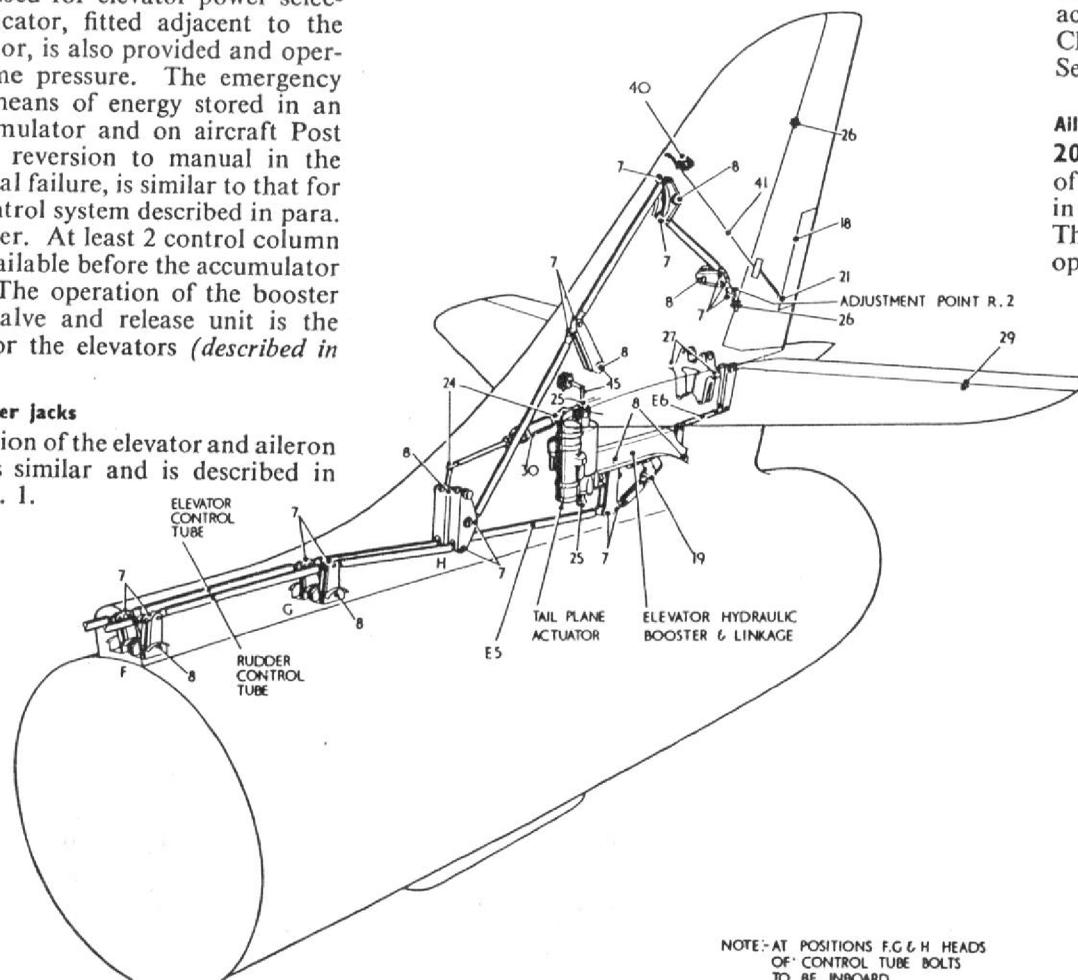


Fig. 3. Flying controls with lubrication points (3)

RESTRICTED

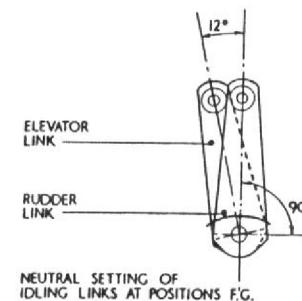
Rudder trimming tab (fig. 3 and 4)

19. The rudder trimming tab is located in the trailing edge of the rudder and is controlled by a small electrically-operated actuator bolted to the forward face of the rudder spar just above the operating lever. The actuator is controlled by a combined aileron and rudder trim switch in the cabin and a

shaft within the rudder transmits the movement to a small lever attached to the rudder trimming tab. The tab position is shown on a combined aileron and rudder tab position indicator located adjacent to the trim switch in the cabin. The rudder portion of this indicator is operated by a Desynn transmitter bolted to nose rib F in the leading edge of the fin, the transmitter being actuated by a Bowden cable attached to a lever on the actuator. The operation and circuit of the actuator assembly is described in Sect. 5, Chap. 1, and that of the Desynn system in Sect. 5, Chap. 2.

Aileron trim tab (fig. 2)

20. A small tab to enable fine adjustments of lateral trim to be made in flight is provided in the inboard trailing edge of the port aileron. The tab is controlled by a small electrically-operated actuator bolted to the forward face



SCRAP VIEW ON STBD SIDE
SHOWING RUN OF CABLE R.19

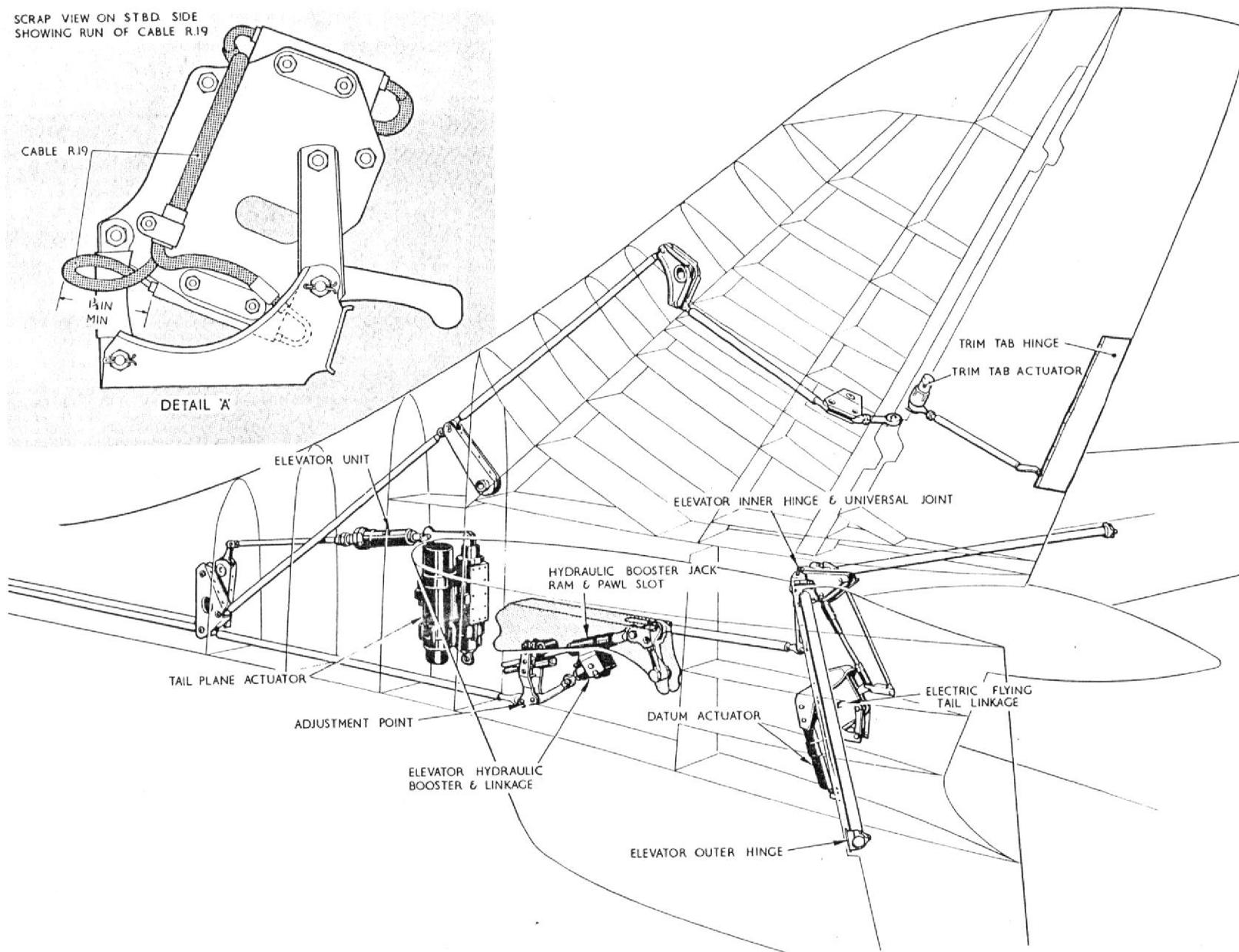
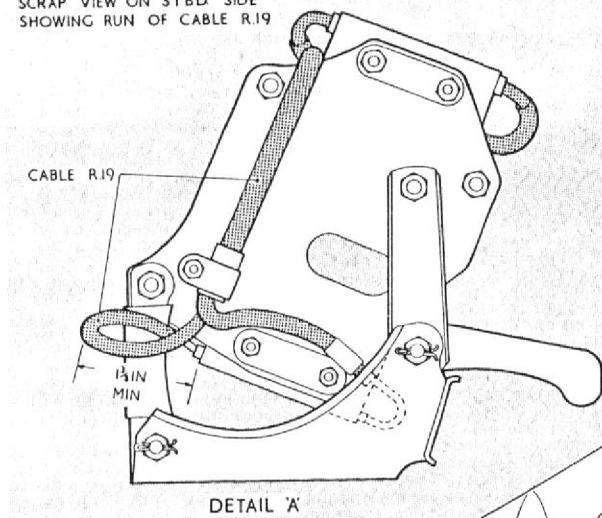


Fig. 4 Controls in tail plane, fin and rudder

14967

RESTRICTED

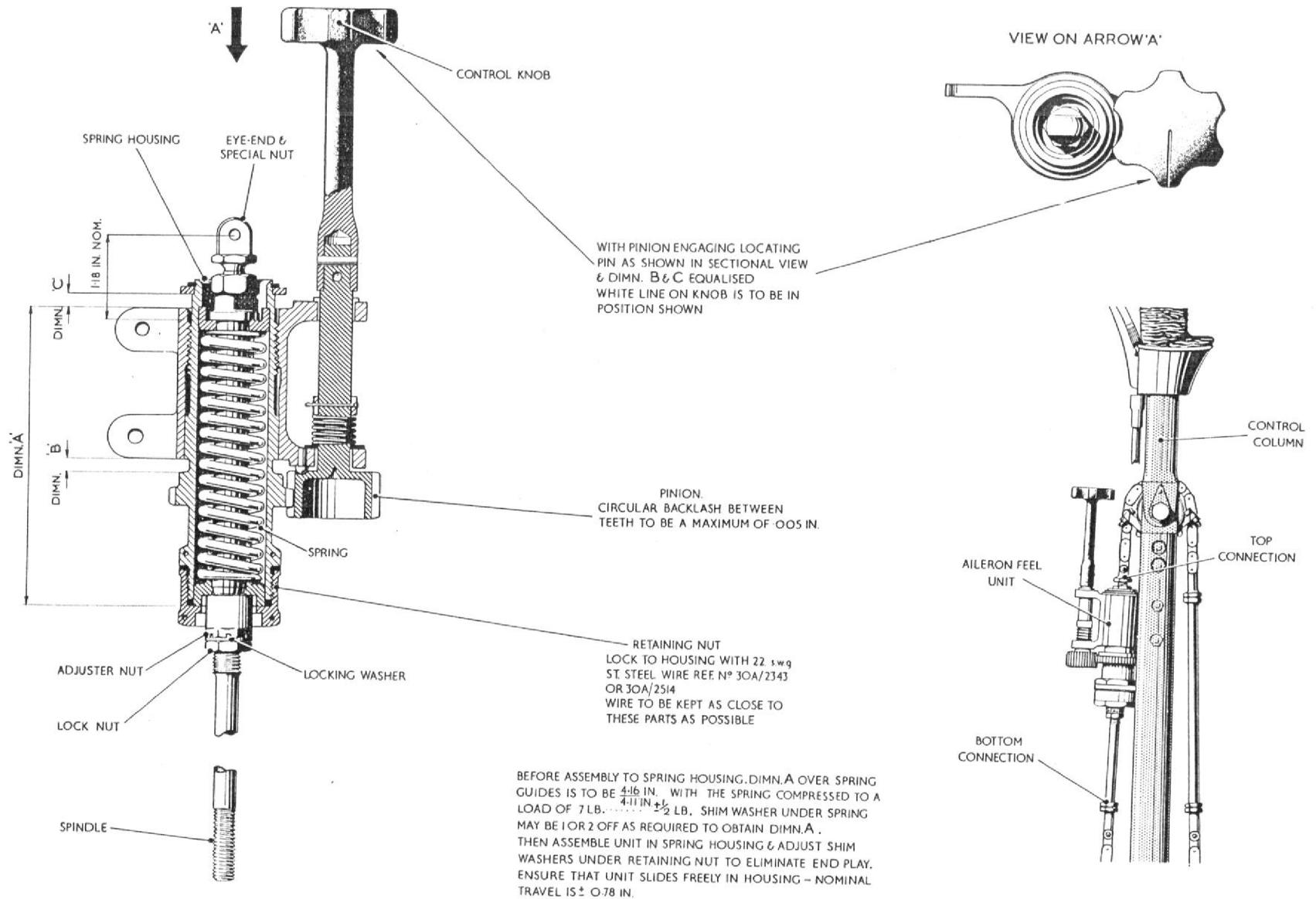


Fig.5 Aileron feel unit

RESTRICTED

of the aileron spar between ribs 2 and 3. An operating rod, within the aileron, transmits the movement to a small lever attached to the tab. The actuator is controlled by the combined aileron and rudder trim switch situated in the cabin. The trim switch control knob may be locked by a pivoted lever carried on a mounting bracket attached to the switch. This lever is shaped so that, when in the locked position, it grips the control knob spindle to prevent sideways movement. The lock does not interfere with rotation of the knob for rudder tab control, as it is only intended to prevent inadvertent operation of the aileron tab when flying in power. The lever is retained in the locked or unlocked position by a spring-loaded plunger which is carried on the mounting bracket and engages with holes in the lever. The setting of the tab is shown on the combined aileron and rudder tab position indicator in the cabin, the aileron portion being operated by a Desynn transmitter located adjacent to the actuator. The transmitter is operated by a Bowden cable attached to a lever on the actuator. The operation of the actuator and Desynn system is described in Sect. 5, Chaps. 1 and 2 respectively.

Landing flaps

21. Hydraulically-operated landing flaps extend along the undersurface of each outer wing from the root to just inboard of the aileron and are controlled by a lever type selector switch located in the cabin. This switch operates an electro-hydraulic solenoid valve, located in the port wheel bay, through a follow-up drum switch situated in the port wing root. A flap position indicator in the cabin is operated by a Desynn transmitter located in the port wheel bay and connected to the flap and follow-up gear by a Bowden cable. The flaps are synchronized by a hydraulic interconnection which is described in Sect. 3, Chap. 6, and the operation of the flap control gear, together with circuit details, is given in Sect. 5, Chap. 1.

Air brake

22. A hydraulically-operated air brake flap is mounted on the underside of the rear fuselage by two extended hinges pivoted in channel fittings located one on either side of the fuselage between frames 45 and 46. The flap, which embraces the underside of the fuselage when in the UP position, is extended and retracted by a hydraulic jack housed in a sealed-off cut-away extending from frame 47 to frame 50 in the bottom of the fuselage.

23. The installation is controlled by a thumb switch incorporated in the end of the throttle twist grip, which operates two electro-hydraulic solenoid valves. A magnetic indicator in the cabin controlled by a micro switch, is provided to indicate when the air brake is extended. To prevent damage, due to the limited ground clearance, the control circuit is electrically inter-connected with the undercarriage in such a manner that it is impossible to extend the air brake while the undercarriage is down. If undercarriage down is selected while the air brake is extended, the interconnection will automatically retract the air brake. The same condition is also obtained when the undercarriage emergency lowering system is used by the action of a micro switch operated by the undercarriage emergency air valve.

24. It should be noted that air brake 'in' must not normally be obtained by selecting undercarriage down. To enable the installation to be tested on the ground with the undercarriage down, a spring return test switch is incorporated on the air brake control relay box in the cabin. Operation of this switch permits partial extension of the air brake and operation of the magnetic indicator by means of a micro switch, which shows whether the installation is operating satisfactorily or not. The operation of the air brake hydraulic circuit is described in Sect. 3, Chap. 6. A description of the electrical control circuit will be found in Sect. 5, Chap. 1.

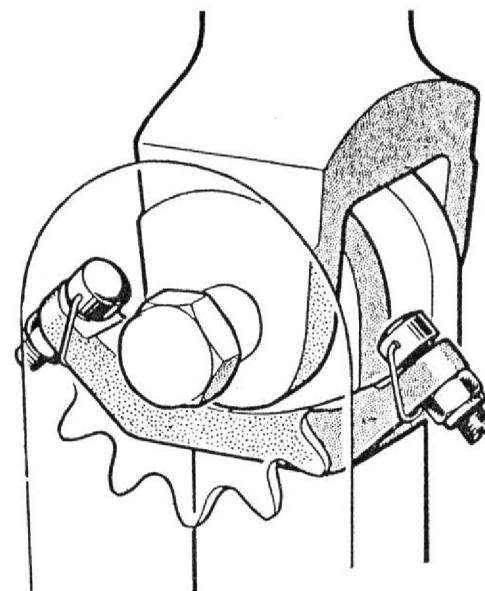


Fig. 6. Aileron control stops

SERVICING

General

25. When carrying out any servicing of the flying controls, absolute cleanliness must be observed. In particular, the hydro-boosters provided for operation of the ailerons and elevators must be kept scrupulously clean. When disconnected during servicing, all pipe ends and unions on the units must be blanked off immediately to prevent the ingress of dirt or moisture. After servicing, the booster system must be primed and bled as described in Sect. 3, Chap. 6.

Lubrication

26. The lubrication points for the flying controls are indicated by numerals on figs. 1, 2 and 3, and in Sect. 3, Chap. 2, fig. 15, 16, 17 and 18, the type of lubricant to be used at each point is given on the key to the illustrations. All shielded ball bearings are packed with anti-freeze grease before assembly and, apart from the removal of any moisture that may have collected, they should not require further attention.

Functioning checks for power controls

27. To ensure that the aileron and elevator power controls are operating satisfactorily, the aircraft should be jacked up with its wheels clear of the ground (*Sect. 2, Chap. 4*) and the following tests carried out, preferably following the main hydraulic functioning tests.

Note . . .

Before carrying out the functioning tests, ensure that the hydro-booster release unit micro switches have been checked and adjusted as described in para. 50. To avoid damage, it is essential that manual adjustments be carried out before hydraulic power is applied. Check manually that the booster rams move smoothly and freely in the release units at as early an assembly stage as possible if new units are being fitted, or existing units are being replaced. It should be noted that the operations described below are grouped for convenience under their various systems and do not, therefore, necessarily constitute the order in which they are to be carried out. The sequence to be followed will be determined by the stage of servicing being effected and local command instructions.

MANUAL ADJUSTMENTS**Ailerons**

28. The procedure for the manual adjustment of the ailerons is as follows:—

- (1) With the two-position aileron jack retracted (*i.e. in MANUAL*), disconnect control tube A.206734 (*fig. 1, item A1*) from the jack.
- (2) Adjust the chain connecting rod of the control column to take up backlash but

not too tight to cause stiffness in the control column movement, as checked throughout the full range of the aileron spring feel unit. Ensure that the chain rod is in safety and tighten the locknuts.

Note . . .

The universal fork, to which the lower chain sprocket is keyed, is set at $4\frac{1}{2}$ deg $\pm \frac{1}{2}$ deg from the vertical, measured clockwise looking forward, with the control column handgrip in the neutral position.

- (3) Lock the handgrip of the control column in the neutral position, using Rigging Fixture Ref. 26FX/95144 and set the aileron spring feel unit to its neutral position. (*White line on knob pointing forward*).
- (4) Fit the Aileron Rigging Lock Ref. 26FX/95307 on the aileron idling link and control tube between frames 23 and 24 and adjust the aileron control tube A.209620 (*fig. 1 item A2*) (first horizontal control tube aft of the cabin) as necessary to allow the control tube A.206734 (*fig. 1, item A1*) to be re-connected to the two-position jack.
- (5) The idling links and levers in the wings are set in the neutral positions during initial assembly by the manufacturer, using special tools and adjustment of control tube A.191584 (*fig. 2, item A7*), any subsequent change of this control tube must therefore be made by setting the replacement tube to the exact pin centre length of the tube being replaced.
- (6) Set the aileron booster units in the neutral position by aligning the rear face of the valve body with a straight-edge placed across the faces marked 'A' of the neutral setting rigging plates. With the input control tubes to the boosters connected, adjust the sloping control tubes A.169525 (*fig. 2, item A8*), between frames 32 and 33, as necessary to connect to the levers in the wings.
- (7) Adjust the booster output control tubes to the ailerons so that the trailing edge has approximately 0.2 in. up float.
- (8) Remove the Rigging Fixture from the control column and check that the back lash at the top of the control column, when it is moved without force (by one finger on the top of the control column), is not more than $\frac{1}{32}$ in.
- (9) Remove the Rigging Lock from the controls between frames 23 and 24 and check that the load at the middle of the control column handgrip to just move it in either direction from neutral is less than 5 lb. If it exceeds this value, disconnect the input control tube to the booster assembly and check that the load required to just move the control column in either direction is now less than $1\frac{1}{2}$ lb. Check for friction at the aileron hinges by ensuring that, with the output control tube to the aileron lever disconnected, the ailerons readily up-float. Re-connect control tubes.
- (10) Adjust the control column stops so that (temporarily) 6 deg up and down aileron movement is obtained.

WARNING

When making adjustments to the elevator servo valve, spanners must only be used on the eye-end flats and the lock-nut, NOT on the flats of the valve spindle. An examination must always be made to ensure that the pin locking the two halves of the two-piece spindle has not been sheared during the process of adjustment.

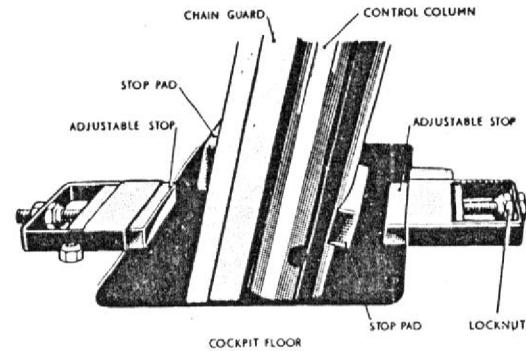


Fig. 7 Elevator control stops

Elevator

29. The procedure for the manual adjustment of the elevators is as follows:—

- (1) Disconnect the elevator spring feel unit (fig. 3, item 30) at the forward end and tie up clear of the lever.
- (2) Fit the Elevator Rigging Lock Ref. 26FX/95306 to the elevator idling link and control tube between frames 23 and 24 and adjust the elevator control tube (fig. 1, item E4), just aft of the cabin, to set the control column in the neutral position.
- (3) Disconnect the input control tube to the booster assembly lever and centre the booster by aligning the forward face of the blanking plugs on the booster body with the neutral setting marker plate on the channel.
- (4) Adjust as necessary and re-connect the input control tube (fig. 3, item E5) to the booster assembly.
- (5) Adjust the output control tube (fig. 3, item E6) to the elevator lever to bring the elevator to the neutral position.
- (6) Remove the Rigging Lock from the elevator controls between frames 23 and 24.
- (7) Adjust the elevator stops on the control column to their outer limit and check that the clearance between the control column and the instrument panel (with switch guards up) is not less than $\frac{3}{32}$ in. Adjust the control column neutral setting, if necessary, to obtain this clearance.
- (8) Lock the input circuit at the booster and check that the back lash at the top of the control column, when moved without force, does not exceed $\frac{1}{16}$ in.
- (9) Remove the lock from the input circuit and lock the elevator in the neutral position at the trailing edge. The movement at the top of the control column must not exceed $\frac{1}{4}$ in. ($\frac{9}{16}$ in. Pre Mod. 468).
- (10) Remove the lock from one elevator and check the movement in the elevator universal joint. This must not exceed 0.20 in. as measured at the trailing edge of the elevator.
- (11) Check that the load measured at the middle of the handgrip to move the control column is less than 5 lb (4 lb Pre Mod. 468) for elevator down and less than 2 lb for elevator up. Any excess friction must be eliminated. The control column load with the linkage disconnected at the booster input must not exceed 2 lb for control column moved forward and for control column moved aft.
- (12) Adjust the control column stops to give (temporarily) 8 deg down and 20 deg up elevator movement.

POWER ADJUSTMENT**General**

30. When making power adjustments to the aileron and elevator controls, the following procedure should be adopted:—

- (1) 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.*
- (2) 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.
- (3) Ensure that the controls are free.
- (4) 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 lb/in².
- (5) For the setting of the micro switches, the handpump section of the main hydraulic rig may be used. For general functioning, use the power section of the rig.
- (6) Before any valve adjustments, etc. are made, any air that may exist in the system must be expelled by repeated functioning.

Ailerons

31. After the operations described in para. 28 have been completed, the booster unit servo valves must be brought into adjustment with their respective lost motion bush

assemblies. This adjustment is made at the servo valve spindles while the valves are under hydraulic pressure maintained by an external supply rig. The procedure for the adjustment of the servo valves and power adjustment of the ailerons is as follows:—

Preliminaries

- (1) Open the tab washers and unscrew the locknuts of the port wing servo valve units and attach a dial spanner and indicator (*Part No. A.214535—A.227530 Post-Mod. 703—and A.214536 respectively*) to the servo valve spindle and threaded eye-end respectively (*fig. 8*).
- (2) The spring feel unit must be operating normally and the control column must be free in manual for the full range between the lateral stops on the control column.
- (3) Switch on the hydraulic rig. Engage locks by easing up or down on the aileron trailing edges. (*If the system is maladjusted to the extent that the control*

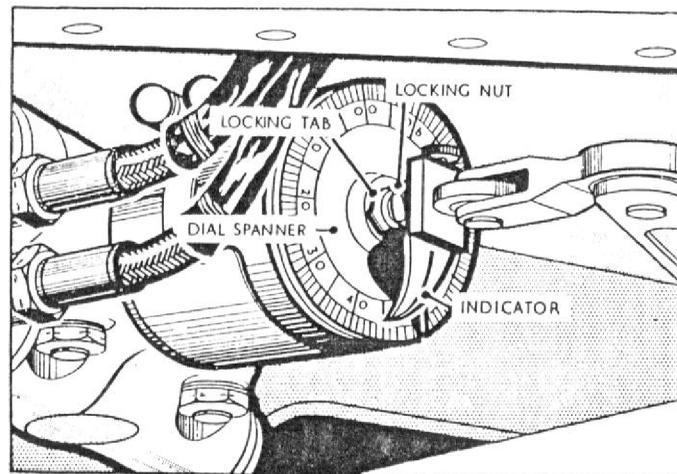


Fig. 8 Adjusting aileron booster units

column will not operate the ailerons in power, make temporary adjustments at the valve spindles to render operation possible.)

- (4) Operate the ailerons through 20 full reversals to expel any air that may exist in the circuit.

Adjustments

- (1) Turn the dial anti-clockwise, causing the aileron concerned to rise. When the aileron trailing edge is about 2½ in. above its neutral position, halt it by a small clockwise movement of the dial.
- (2) Turn the dial anti-clockwise again until the aileron begins to creep up slowly. While it is still creeping, read the dial and record in Column A of a form such as that shown in Table 1.
- (3) By means of a small clockwise movement of dial, return the aileron to the position of 2½ in. above the neutral setting and repeat operations (1) and (2) until a series of three readings within 0.03 of a turn are obtained. (*Inconsistent readings indicate that the aileron is being allowed to creep at different speeds, or that air is still present in the system.*) Record the readings and enter the average figure at the foot of Column A.
- (4) Once again halt the aileron 2½ in. above the neutral position and then turn the dial clockwise a little until the aileron creeps down towards the neutral position, at the same time ensuring that the same creep speed is maintained throughout the operation. Read and record in Column B. Repeat to obtain consistent readings and enter the average reading at the foot of Column B.
- (5) Calculate the mid-point between Columns A and B and record in the panel below them.

(6) Rotate the dial through approximately $2\frac{1}{2}$ turns. (The aileron will come down to neutral in the first half-turn.) Halt the aileron about $2\frac{1}{2}$ in. below neutral and repeat operations (2) to (4) for this position in the lower sector. (While turning clockwise, 100 must be added to the reading each time the 'zero' passes the indicator.) Calculate the mid-point between Columns C and D and record in the panel below them.

(7) Finally calculate the mid-point between the final figures obtained in operations (5) and (6). (The difference between the mid-point of Columns A and B and the mid-point of Columns C and D should be between 230 and 290.) Record at the foot of the form. Check the figure by adding up Columns A, B, C and D and dividing by four. Turn the dial back (anti-clockwise), about $1\frac{1}{2}$ turns, on to this reading. Tighten up the locknut and turn over the tab washer.

(8) Transfer the dial spanner and indicator to the other (starboard) wing and repeat operations (1) to (7).

Final setting

(1) Obtain full aileron movement by adjusting the control column stops: this should be 13 deg. up and 13 deg. down.

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

(3) Put control column neutral, do not lock in position, adjust the ailerons to neutral on the output links. Acceptable limits for neutral on each aileron are:— UP, $\frac{1}{2}$ deg. DOWN, 0 deg. (i.e. no downfloat is permissible).

(4) Check control surface movements, the full amount as in sub-para. (1) should be obtained.

(5) Lock servo valve tab washer on both units.

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

(7) Select Manual and ensure that 7 deg. (2.54 in.) minimum up and down aileron movement is obtained.

(8) The maximum allowable difference between Port and Starboard movement is 1 deg. The maximum allowable difference between up and down is also 1 deg.

TABLE 1
Aileron adjustments

ADJUSTMENT OF SERVO-VALVE SPINDLE				ADJUSTMENT OF SERVO-VALVE SPINDLE			
PORT WING				STARBOARD WING			
Aileron in UPPER SECTOR		Aileron in LOWER SECTOR		Aileron in UPPER SECTOR		Aileron in LOWER SECTOR	
Spindle turned Anti-clockwise (PANEL) A	Spindle turned Clockwise (PANEL) B	Spindle turned Anti-clockwise (PANEL) C	Spindle turned Clockwise (PANEL) D	Spindle turned Anti-clockwise (PANEL) A	Spindle turned Clockwise (PANEL) B	Spindle turned Anti-clockwise (PANEL) C	Spindle turned Clockwise (PANEL) D
MID-POINT OF ABOVE 2 SETS OF READINGS		MID-POINT OF ABOVE 2 SETS OF READINGS		MID-POINT OF ABOVE 2 SETS OF READINGS		MID-POINT OF ABOVE 2 SETS OF READINGS	
.....						
MID-POINT OF ABOVE TWO READINGS (i.e. FINAL SETTING OF ADJUSTMENT)				MID-POINT OF ABOVE TWO READINGS (i.e. FINAL SETTING OF ADJUSTMENT)			
.....						
DATE.....			DATE.....		

Elevator

32. The procedure for adjusting the elevators in power is as follows:—

- (1) Operate control column to move ram. Check ram clearance to adjacent structure and ensure correct functioning of the jack in both directions.
- (2) Reconnect release unit and engage lock by applying hydraulic pressure.
- (3) Check pawl engagement and set micro switch on release unit as described in para. 50.
- (4) Check that the valve eye-end is screwed in sufficiently to register in the safety hole. (See warning at para. 29).
- (5) With the tail plane at zero incidence hold control column neutral and check elevator is neutral; if necessary, re-adjust on the output link.
- (6) Check the 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 movement.
- (7) Ensure that 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 tail plane at zero-incidence. Re-attach spring feel unit, but do not lock.
- (8) Adjust the control column stops so that the booster jack does not bottom.
- (9) Check control surface movement to details given in fig. 11.
- (10) On completion of adjustments, lock servo valve tab washer.

INSTALLATION TESTS**Power OFF**

33. Prior to these tests, the aircraft should first be adjusted as described in para. 27 to 32 inclusive. The aircraft should be jacked up (*Sect. 2, Chap. 4*) and these tests should preferably commence following the main hydraulic functioning tests. The procedure for installation testing with power off, is as follows:—

- (1) Disconnect the elevator spring feel unit at the forward end and tie up clear of the elevator feel connecting lever.
- (2) Lock the elevator input linkage at the valve and check that the backlash at the control column is a maximum of $\frac{1}{16}$ in.
- (3) Measure elevator movement up and down. Measure aileron movement up and down, port and starboard.
- (4) Measure force in pounds at the control column handgrip to just move the 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 control column handgrip to just move the ailerons from the central position, port and starboard. This should be a maximum of 5 lb.

Power ON

34. The installation tests with power on are effected as follows:—

- (1) For these tests the hydraulic rig should be run at a speed equivalent to a pump speed of 1350 r.p.m. Check that the accumulators are fully charged. The main hydraulic pressure should not fall below 2700 p.s.i. when functioning the controls normally.
- (2) With the rig pump running select ailerons and elevator power ON, holding the switches on until the locks are engaged. Check that the boosters engage on moving the control column and that the magnetic indicators clear when the locks are in. Check that the aileron indicator does not clear until both aileron locks are engaged. Check that the locks remain engaged on releasing the switches. Select power OFF and check that the boosters disengage.
- (3) Hold the control column 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 the switch and check that both pawls are fully out. Repeat engaging the other aileron lock.
- (4) On aircraft in which Mod. 502 is embodied select aileron power ON and engage the locks. Release the switch. Press the emergency power control disengaged push button switch momentarily and check that both pawls are fully out.
- (5) Hold the control column deflected so that the elevator ram slot is misaligned with the pawl. Select elevator power ON and release the switch. Check that the pawl is fully out.
- (6) On aircraft in which Mod. 502 is embodied, select elevator power ON and engage the lock. Release the switch. Press the emergency elevator power control disengaged push button switch momentarily and check that the pawl is fully out.
- (7) Select aileron and elevator power ON, re-engage locks, then measure the force in pounds required at the control column handgrip to just move the elevator from the central position, up and down. This should be a maximum of 2 lb.
- (8) Measure the force to just move the ailerons from the central position, port and starboard. This should be a maximum of 3 lb. Ensure that the control column load for full aileron deflection, port and starboard, are within three pounds.
- (9) With the controls in power, disconnect the electrical ground supply and check that both ailerons and elevator remain in power. Re-connect the electrical ground supply.
- (10) Measure the aileron movement up and down, port and starboard. Check that, with the control column at neutral, there is no aileron downfloat and not more than $\frac{1}{2}$ deg. up-float. Check for full and free movement of the two-position aileron jack lever on selecting power OFF and ON.
- (11) Turn the aileron spring feel unit control knob fully clockwise and check the aileron angles, control column free (*port down and starboard up, $3\frac{1}{2}$ deg. minimum*). Repeat with the spring unit control knob turned fully anti-clockwise. Centralise spring feel unit knob.
- (12) Stop the hydraulic pump; after 1 minute check that the number of complete control column cycles, for ailerons, before pawls disengage, exceeds $2\frac{1}{2}$. Repeat for elevator circuit (*$1\frac{1}{2}$ cycles*) (*2 cycles—Pre-mod. 468*). A complete cycle consists of neutral to one extreme, back through neutral to the other extreme and back to neutral.
- (13) Restart the hydraulic pump to build up the system pressure, stop the pump, move the controls gently and check that the pawls remain engaged at 550 p.s.i., and disengage when the pressure falls to 150 p.s.i. Check for ailerons and elevators.
- (14) Restart the hydraulic pump and check for system stability by jerking the control column and then letting go; the control column should come to rest and not oscillate. This test should be carried out independently for elevators and ailerons.
- (15) Check the controls for ease of movement in all directions. Check that the system is free from any sluggishness, jerky movements or other undesirable effects. Check the aileron controls over the full range of the aileron spring feel trimmer.
- (16) Check that the aileron spring feel unit centres the control column accurately when the control column is deflected $\frac{1}{2}$ in. from the centre and then released.
- (17) Repeat operation (15) after rest periods of one, three and five minutes, then check that:—
 - (a) the initial control column load does not increase after one minute rest.
 - (b) it does not exceed a maximum of 6 lbs. after a rest period of five minutes.
- (18) Re-attach the elevator spring feel unit.
- (19) Check that the elevator spring feel unit returns the control column to within 0.3 ins. of central, after deflecting it with one finger on the top of the control column handgrip.
- (20) Measure the elevator movement up and down with the tail plane neutral, fully positive and fully negative. Return the tail plane to neutral.

RESTRICTED

(2/) Run the hydraulic rig at a speed corresponding to 1950 pump r.p.m. Move controls at approximately one stir per two 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:—

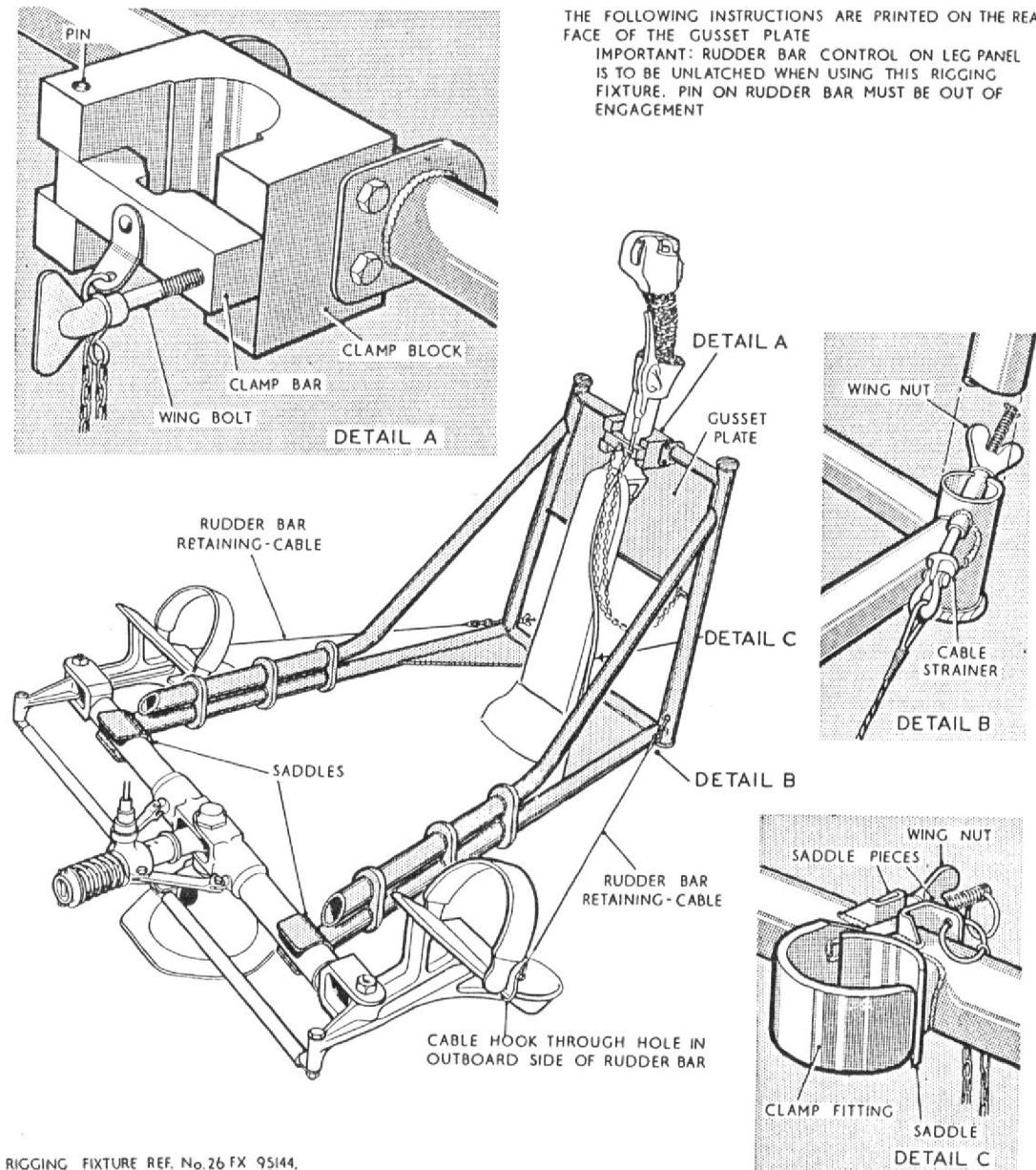
- (a) Undercarriage down.
- (b) Undercarriage up.
- (c) Undercarriage up, flaps up.
- (d) With undercarriage and flaps up, air brake out and in.

Hydraulic pressure at all these conditions must not fall below 1,000 p.s.i.

Power control stability check

35. A stability check of the power controls should be made after any adjustment of the hydraulic booster units or control runs have been made. A simple method of carrying out this check is as follows:—

- (1) Connect a hydraulic ground rig to the aircraft external test connections and, with the ground pump running at a speed equivalent to the engine idling speed, select power operation for the ailerons and elevators.
- (2) Hit the control column *hard* over in all directions.
- (3) Stable operation will be indicated by the control column returning smoothly to neutral with no tendency to travel through its full range.



RIGGER FIXTURE REF. No.26 FX 95144.

Fig. 9 Rigging fixture

RESTRICTED

- (4) Instability will be immediately apparent by the behaviour of the aircraft, which will vibrate with a noise similar to that of a knocking water pipe.
- (5) In the case of instability switch off the power immediately and investigate the cause by re-adjustment of the hydraulic booster units.
- (6) Check the controls for ease of movement in all directions. Check that the system is free from any sluggishness or jerky movements, or other undesirable effects.

Control surface settings

36. The angular and linear ranges of the control surfaces and tabs, together with their tolerances, are given in fig. 11. After any adjustment of the controls, care must be taken to ensure that there is no friction at any point as the presence of such will impair the handling qualities of the aircraft. Static friction figures for the ailerons and elevators are given in para. 35. The adjustment of the control surfaces is given in the following paragraphs.

Rudder

37. To adjust the setting of the rudder and rudder bar, proceed as follows:—

- (1) Fit the flying control rigging fixture (fig. 9) to the controls.
- (2) Disconnect the adjustable end of the first horizontal rudder control tube (fig. 1, item R1), behind the cabin and fit the rigging lock (Part No. A.201031) to the rudder controls between frames 23 and 24 in the fuselage spine.
- (3) Adjust the eye-end (fig. 3, item R2) connected to the rudder lever to bring the rudder to the neutral position.

- (4) Adjust the control tube disconnected in sub-para. (2), as necessary, to enable it to be reconnected.
- (5) Remove the rigging lock from the rudder controls in the spine, check the rudder for neutral and remove the flying control rigging fixture.
- (6) Check the rudder bar for full range of movement as given in fig. 11. Shim the stops (fig. 10) on the rudder bar pedestal, as necessary, to achieve the correct movement.
- (7) Check that the rudder pedals are clear of the surrounding structure, with full rudder bar movement to port and starboard when the pedals are in the extreme forward and aft positions.

- (8) Check all control tubes for security, safety and locking and check for full range of rudder movement.

Rudder trimming tab

38. The rudder trimming tab is adjusted after the test flight to the correct tab angle to give neutral handling in the air with the cabin indicator set to neutral, and this angle is quoted in the aircraft Servicing Form. Normally no further adjustment should be necessary, but the normal operation of the tab should be checked as follows:—

- (1) Set the rudder bar in the neutral position by means of the rigging fixture (fig. 9).
- (2) Connect an external electrical supply (Sect. 5, Chap. 1) to operate the tab without discharging the aircraft batteries.

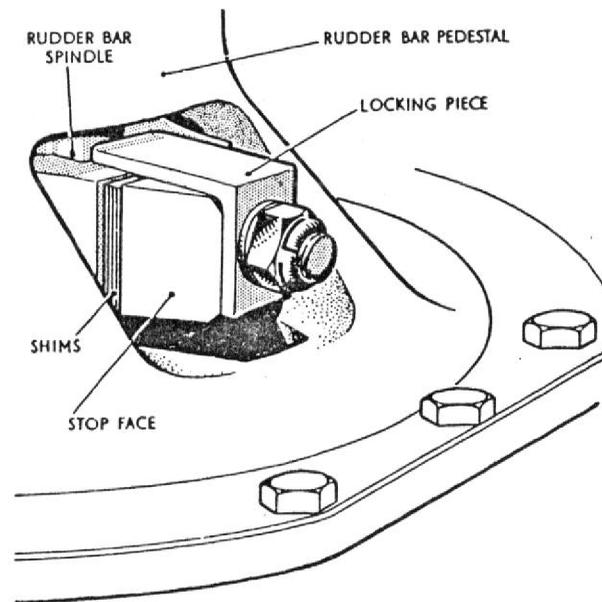


Fig. 10 Rudder control stops

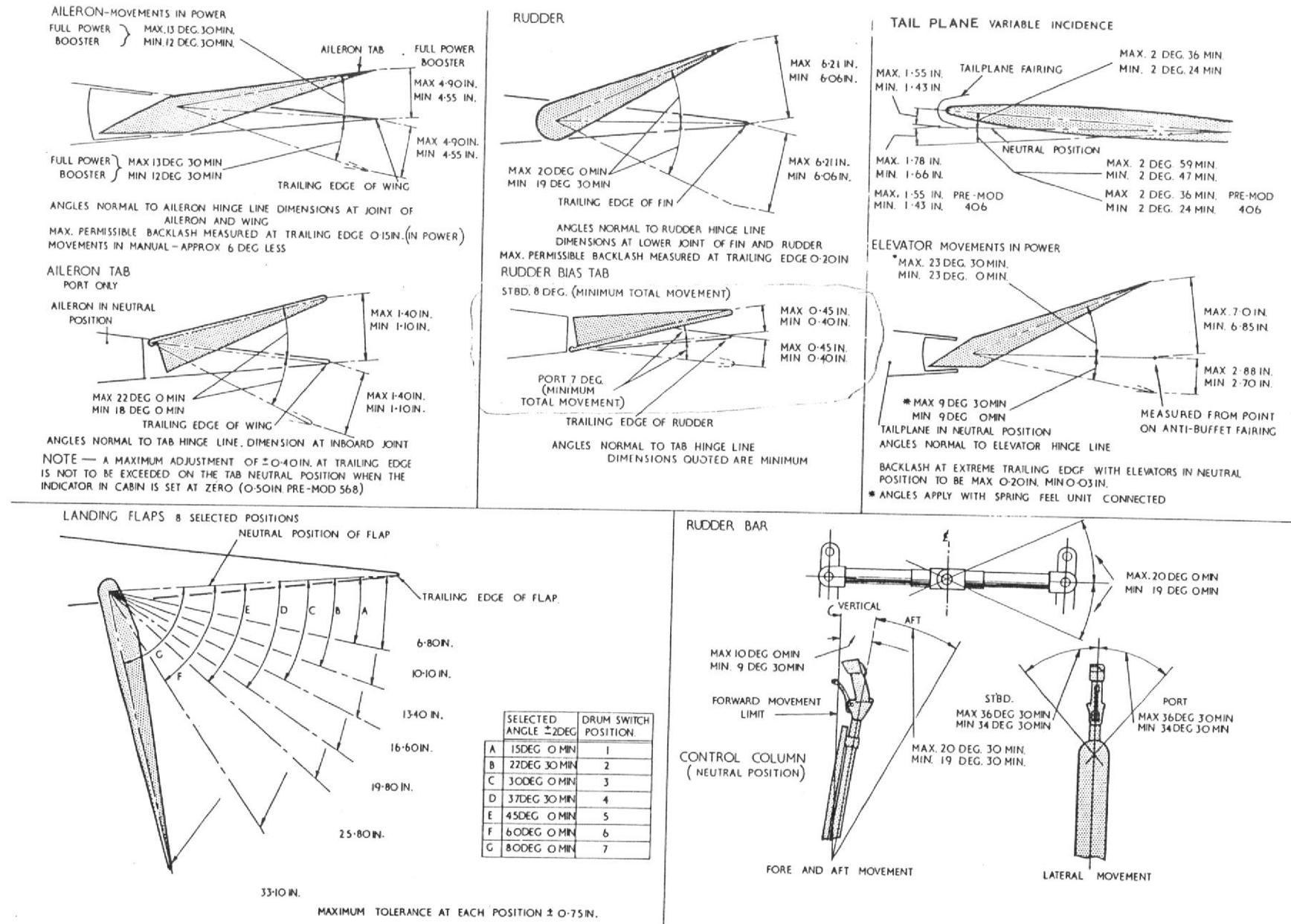


Fig. 11 Control surface settings

RESTRICTED

- (3) Operate the trim tab to port and check that its travel corresponds with the figure given in fig. 11.
- (4) Operate the trim tab to starboard and check that its travel corresponds with the figure given in fig. 11.
- (5) Set the tab to the angular position as given in the aircraft Servicing Form, using the cabin control, and check that neutral is registered on the indicator in the cabin. If the indicator is in error, refer to A.P.1275A, Vol. 1 for details of adjustment.
- (6) Return all switches to OFF, disconnect the external electrical supply and remove the rigging fixture.

Aileron trimming tab

39. The trimming tab in the trailing edge of the port aileron is adjusted after test flight to the angle noted by the pilot to give neutral handling in the air with the cabin indicator set to neutral, and this angle is quoted in the aircraft Servicing Form. Normally, no further adjustment should be necessary, but the operation should be checked as follows:—

- (1) Set the control column at neutral with the aid of the rigging fixture (fig. 9).
- (2) Connect an external electrical supply (Sect. 5, Chap. 1) to operate the tab actuator without discharging the aircraft batteries.
- (3) Operate the tab to the UP position and check that its travel corresponds to the figure given in fig. 11.
- (4) Operate the tab to the DOWN position and check that its travel corresponds to the figure given in fig. 11.
- (5) Using the cabin control, trim the tab until the Desynn indicator in the cabin reads zero and check that the trim tab is set to the correct angular position as given on the aircraft Servicing Form. If it is not, adjust the control rod connected to the trim tab until the correct setting is obtained. (On aircraft Pre Mod. 568, if the indicator setting is more than a needle thickness from neutral, reset by removing the needle and replacing it in the neutral position. Ensure that the needle is tight on its spindle, using shellac if necessary.)

Repeat these procedures wherever an aileron trimming tab is replaced or if any adjustment is made to the aileron trim circuit. If a new indicator is fitted, ensure that the needle is at zero with the trimming tab at the basic setting.

WARNING

When setting the Desynn Indicator to neutral, the trim tab must not exceed the limits of ± 0.40 in. (Pre Mod. 568, ± 0.50 in.) from neutral with the aileron at its neutral setting.

Replacement of safety catch for Aileron/Rudder trim switch

39A. On fitment of a replacement safety catch for the aileron trim movement of the Aileron/Rudder trim switch, the assembly should be checked to ensure that full movement of the safety catch is possible without any fouling of the boss of the trim switch and that the operating knob of the switch is free to return after selection of trim. Where the operation of the safety catch is found to be unsatisfactory the 'cut-out' of the catch should be filed locally to give a minimum satisfactory clearance.

Tail plane incidence

40. The tail plane actuator is designed to give the required range of travel for incidence control and, as internal limit switches are incorporated, no further adjustment may be made. The following operational checks, however, should be carried out to ensure that the correct travel is obtained:—

- (1) Jack the aircraft with the wheels off the ground as shown in Sect. 2, Chap. 4, and rig the tail plane to the neutral position.
- (2) Connect an external electrical supply (Sect. 5, Chap. 1) to operate the tail plane by means of cabin controls without discharging the aircraft batteries.
- (3) Operate the control column switch to increase incidence to the upper limit and check that the tail plane position corresponds to the figure given in fig. 11.
- (4) Operate the control column switch to decrease the incidence to the lower limit and check that the tail plane position corresponds to the figure given in fig. 11.

- (5) Operate the control column switch to set the tail plane in the neutral position and check that the Desynn indicator in the cabin registers neutral.
- (6) Raise the guard from over the emergency switch in the cabin and, using this switch, repeat sub-para. (3), (4) and (5).

Note . . .

If, with the tail plane in the neutral position, the cabin indicator is not registering neutral, adjust the rod connecting the Desynn transmitter to the actuator by screwing the rod in or out as required. If, at operations (3) and (4), the indicator does not register correctly adjust the transmitter lever to obtain the correct indication. On completion lock all adjustments. When disconnecting the transmitter from the connecting rod the lever must be restrained to prevent the transmitter wiper arm springing back against the internal stop as such an impact will necessitate re-setting and recalibration of the transmitter and indicator. If the setting of the lever arm, connecting rod and clip are disturbed during dismantling they should be adjusted to the assembly dimensions shown on Sect. 3, Chap. 3, fig. 11.

Landing flaps

41. Check that the landing flaps open to the dimensions given in fig. 11 and check that they close just as the operating jack pistons reach the limit of their stroke. If necessary, adjust the jack piston rods for length by slackening off the lock-nuts and screwing the eye-bolts in or out as required. After adjustment, ensure that the lock-nuts are securely locked. When making this adjustment, it is also necessary to check the flap synchronizing jacks (described in para. 42). The drum switch and flap position indicator transmitter linkage should also be checked and adjusted (described in para. 43).

Checking flap synchronizing jacks

42. To ensure that the flap synchronizing jacks do not bottom before the flaps are fully up; after the flap operating jacks have been correctly adjusted (described in para. 41) and with the flaps down, it is necessary to check that the dimension given in fig. 12 is obtained. If not, proceed as follows:—

- (1) Disconnect each synchronizing jack from the flap levers.
- (2) Fully extend the synchronizing jacks by use of the handpump and check that the dimension given in fig. 12 is obtained between the points indicated.
- (3) Slacken off the lock-nuts and adjust the eye-end of each jack piston rod until the holes coincide with the holes in the flap levers. Tighten the lock-nuts.
- (4) Re-assemble the jacks to the flap levers.
- (5) Provided that the above instructions are correctly carried out, the synchronizing jacks will not bottom before the flap jacks when the flaps are fully up.

Note . . .

If the dimension given in fig. 12 cannot be obtained when the jacks are fully extended, the affected jack or jacks must be removed from the aircraft and replaced with fully serviceable components.

Adjustment of flap position transmitter and drum switch

43. After ensuring that the flap movements are satisfactory, the flap position transmitter and drum switch should be checked and, where necessary, the linkage adjusted. The procedure is as follows:—

- (1) Lower the flaps to their fully down position.
- (2) Check that the flap position indicator in the cabin is indicating fully down.
- (3) If not, adjust the length of the cable between the flap transmitter lever arm and the levers connected to the flap and drum switch, located in the port wing just inboard of tail rib C, until the correct indication is obtained.
- (4) With the flaps still fully down, check that the line on the drum switch indicator plate is in line with the figure '3' on the switch cover.

- (5) If not, slacken off the lever on the drum switch spindle and turn the spindle until the indicator line and figure '3' coincide. Re-tighten the lever on the spindle.
- (6) Raise the flaps to their fully up position and check that the flap position indicator is registering up.
- (7) If not, lengthen or shorten the lever arm of the flap position transmitter until the correct indication is obtained.

Note . . .

It is recommended that the indication obtained in sub-para. (6) is noted as a guide to the adjustment required. If the indicator overshoots the UP position, lengthen the lever arm. If it fails to reach it, shorten the arm.

- (8) Check the operation of the flap position indicator and drum switch by lowering the flaps to each position in turn, and, using the information given in fig. 11, check that the flap angle shown on the position indicator agrees with the dimensions obtained.

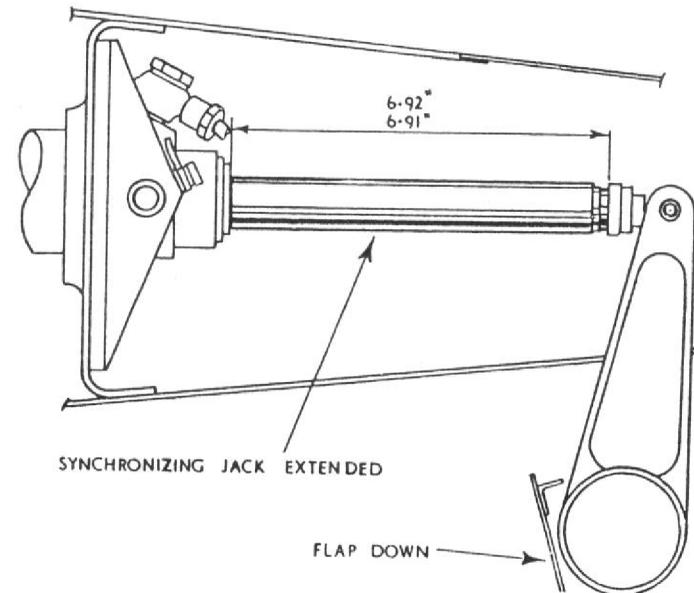


Fig. 12. Flap synchronizing jack adjustment

Air brake, jack adjustment

44. To ensure that the air brake structure is not strained, by contact with the fuselage before the hydraulic operating jack is fully retracted, it is essential that a nominal gap of 0.05 in. is maintained at the nearest point between the air brake and fuselage structure when the jack is fully retracted. This gap is obtained by adjustment of the jack piston rod as follows:—

- (1) Jack up the aircraft, as described in Sect. 2, Chap. 4, and retract the undercarriage.
- (2) After ensuring that the area below the air brake is free from obstruction, select air brake out by operation of the control on the throttle twist grip and operate the handpump until the air brake is fully extended.
- (3) Select air brake in to release the hydraulic pressure from the jack and slacken off the lock-nut at the bottom of the jack piston rod.
- (4) Retract the airbrake by use of the hand-pump and check that there is a clearance of 0.90 in. between the inside of the airbrake skin covering, at the trailing edge, and the undersurface of the fuselage, measured as near the centre line of the airbrake as possible. Adjust the length of the jack piston-rod, as necessary, to obtain this clearance, by rotating the rod in the required direction with a spanner on the spanner grip at the end of the piston-rod.
- (5) After adjustment, re-tighten the lock-nut on the jack piston rod, retract the air brake, lower the undercarriage and remove the jacks from the aircraft.

In addition, there must be a gap of 0.07 in. to 0.12 in. between the leading edge of the airbrake and its fairing. The leading edge may be filed to obtain this clearance but care must be taken to maintain a 30 deg. chamfer (*as measured from the vertical*) throughout the length of the leading edge.

Air brake, forward micro switch (ground test)

45. This micro switch is operated by the air brake port hinge via a small lever pivoted to a bracket attached to the port hinge fitting. The switch controls the operation of the air brake when testing the installation on the ground when the undercarriage is down, and permits partial extension of the air brake to check that the installation is functioning satisfactorily. The switch is adjusted on initial assembly so that it operates when the air brake is extended approximately 10 to 15 degrees (*i.e. sufficient to enable the indicator micro switch to operate and give indication in the cabin by means of the magnetic indicator*). If, when checking the operation of the air brake with the undercarriage down as described in Sect. 3, Chap. 6, these conditions are obtained, no further adjustment of the switch should be necessary.

Air brake, rear micro switch (indicator)

46. This micro switch is operated by a plunger which is supported in a tube attached to the fuselage skin just forward of frame 47. The switch plunger is actuated by a leaf spring riveted to the inside of the air brake structure, which contacts the micro switch when the air brake is in the retracted position. The switch controls the operation of the magnetic indicator in the cabin, which gives a black indication when the air brake is

retracted, and white when extended. The switch is mounted in a bracket attached to frame 47 and is adjusted so that, with the air brake closed under full hydraulic pressure and the indicator showing black, the switch plunger can be depressed a further 0.06 in.—0.12 ins.

Air brake, undercarriage emergency air valve micro switch

47. This micro switch is operated by the lever of the undercarriage emergency air valve. The switch controls the automatic retraction of the air brake should the air brake be in the extended position when the undercarriage emergency lowering system is employed.

Aileron spring feel unit

48. The aileron spring feel unit should be adjusted as described in fig. 5.

Elevator spring feel unit (fig. 14)

49. Dismantling of this unit is not recommended. Should this, however, become necessary, it must be re-assembled *exactly as before* with the same shims between the adapter and spring housing, in order to maintain the original adjustment. The overall length of the unit between pin centres is set to a nominal dimension of 28.25 ins., this dimension may vary under load between 27.75 ins. and 29.25 ins. and the unit must operate smoothly between these limits.

Setting of hydro-booster release unit micro switches

50. If either an aileron or elevator booster, or a release unit micro switch is changed, or is being replaced after removal, the release unit micro switches must be adjusted and set as follows:—

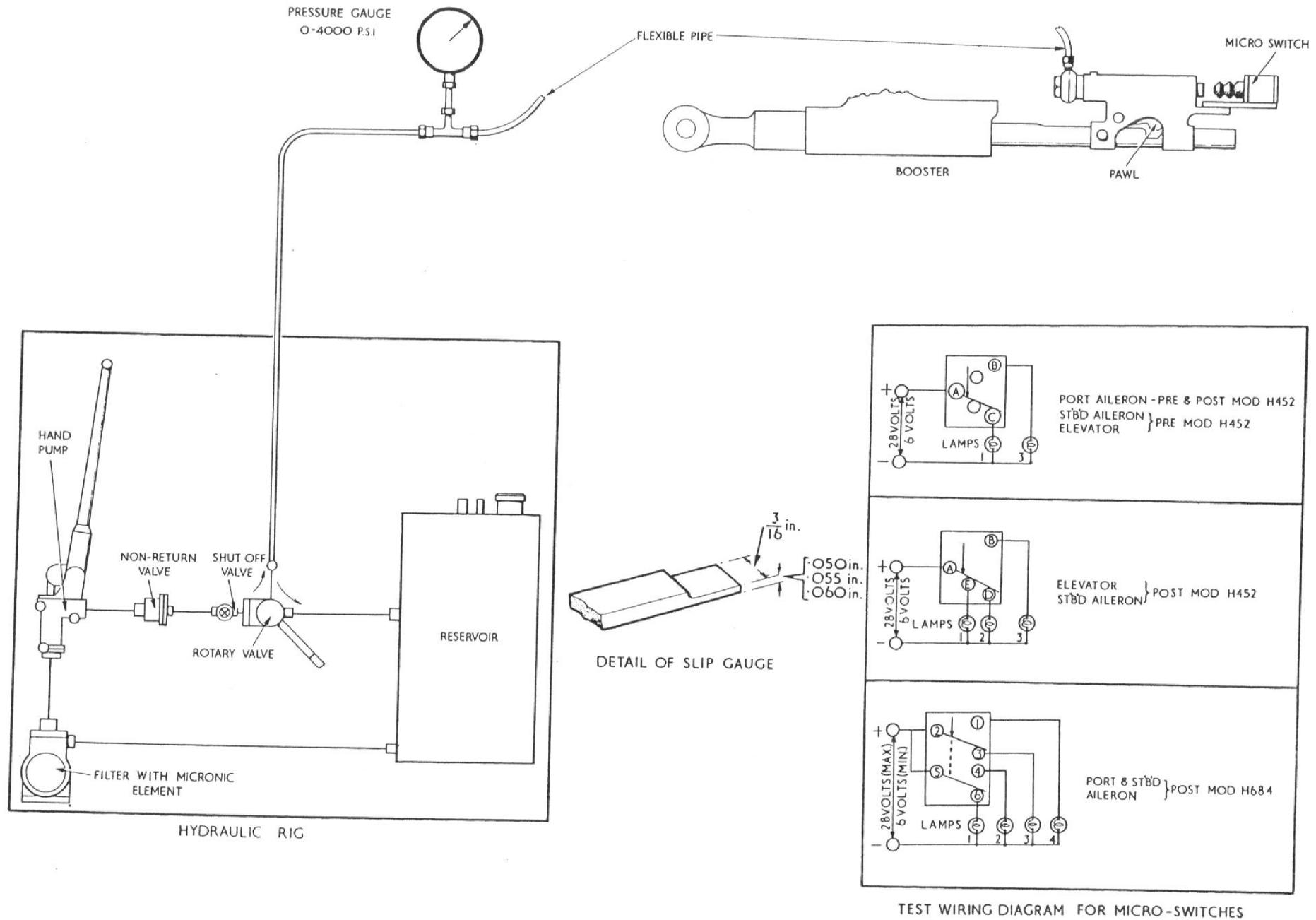


Fig. 13 Setting of hydro-booster release unit micro switches.

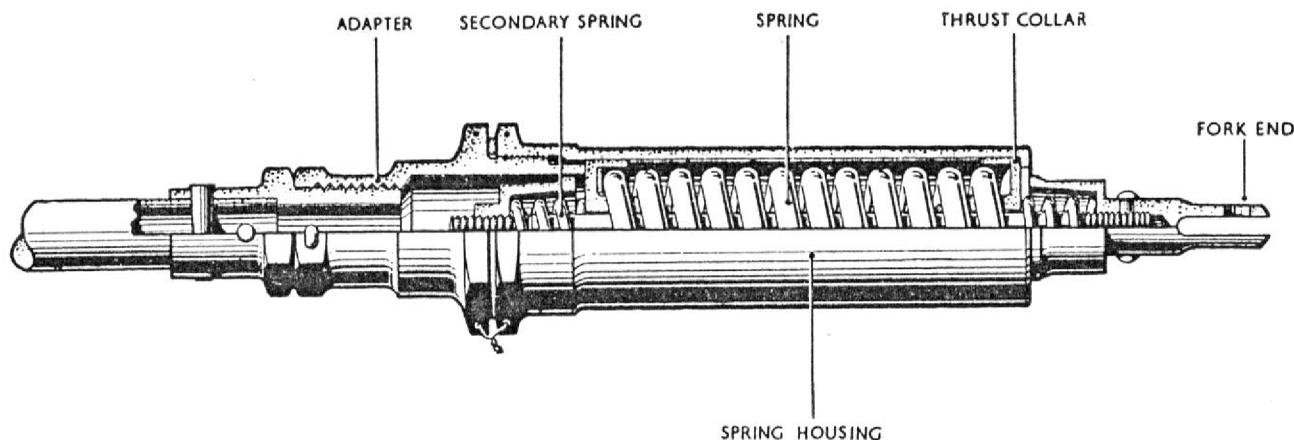


Fig. 14 Elevator feel unit

Pye type switches

- (1) Render the aircraft electrically safe (Sect. 5, Chap. 1).
- (2) Remove the access panels as necessary to gain access to the unit.
- (3) Disconnect and blank off the hydraulic pipe to the release unit.
- (4) Connect up hydraulic and electrical rigs (fig. 13). Ensure that the ram slot and mating parts of the pawl, the micro-switch button and its mating face, are clean and free from grease.
- (5) 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.)
- (6) Increase pressure to 2800 p.s.i. and after a few seconds reduce the pressure to 650 p.s.i. At this pressure check that the pawl is fully engaged and is in contact with the bottom of the slot.
- (7) Release the pressure and insert the 0.055 in. slip gauge (fig. 13) 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 just clamped by the pawl. Set the micro switch tappet to indicate engagement (i.e. lamp 1—and 2 if used—

should be illuminated. Lamp 3 should be out.) Re-adjust tappet until disengagement is indicated (i.e. lamp 3 should be illuminated and lamp 1—and 2 if used—out). Lock adjustment.

- (8) Release pressure and replace the 0.055 in. slip gauge with the 0.060 in. gauge. Apply a pressure of 550-650 p.s.i. so that the gauge is clamped by the pawl and check that the switch does not operate (i.e. lamp 1—and 2 if used—remain out, and lamp 3 is illuminated).
- (9) Release the pressure and replace the 0.060 in. slip-gauge with the 0.050 in. gauge. Apply a pressure of 550 to 650 p.s.i. so that the gauge is clamped and check that the switch operates (i.e. lamp 1—and 2 if used—illuminated and lamp 3 out).
- (10) Release the pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot, disregarding the lead-in to the slot.
- (11) Switch off, disconnect the test equipment, and restore the system to normal. Top up the hydraulic reservoir and bleed the circuit. Check the reservoir for correct level and top up again, if necessary. Lubricate the ram and pawl slot with grease XG275.

Dowmic type switches to F230401 standard (Mod. 684)

- (1) Render the aircraft electrically safe (Sect. 5, Chap. 1).
- (2) Remove the access panels as necessary to gain access to the unit.
- (3) Disconnect and blank off the hydraulic pipe to the release unit.
- (4) Connect up hydraulic and electrical rigs (fig. 13). Ensure that the ram slot and mating parts of the pawl, the micro-switch and its mating face are clean and free from grease.
- (5) 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).
- (6) Increase pressure to 2800 p.s.i. and after a few seconds reduce the pressure 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.
- (7) Release the pressure and insert the 0.055 in. slip gauge between the pawl and the bottom of the ram slot. Apply a pressure of 550-650 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 illuminate. Move out the micro switch until disengagement is indicated (i.e. lamps 3 and 4 should be illuminated, and lamps 1 and 2 out). (If more than $\frac{1}{4}$ turn of the knob is required on moving the micro switch out, the switch should be examined for excessive differential.) Lock the micro switch.
- (8) Release pressure and replace the 0.055 in. slip gauge with the 0.060 in. gauge. Apply a pressure of 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 illuminated. Release plunger slowly and check that lamps 3 and 4 are illuminated 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.

- (9) Release pressure and replace the 0.060 in. slip gauge with the 0.050 in. gauge. Re-apply a pressure of 550-650 p.s.i. so that the slip gauge is clamped and depress the micro-switch plunger by hand until lamps 1 and 2 are illuminated. Release plunger and check that lamps 1 and 2 remain illuminated and that lamps 3 and 4 are out.
- (10) Release the pressure slowly and check that at 150 p.s.i. the pawl is clear of the ram slot, disregarding the lead-in to the slot.
- (11) Apply pressure slowly and check that by the time 550 p.s.i. is reached the micro-switch indicates engagement (*i.e. lamps 1 and 2 are alight*).
- (12) Switch off, disconnect the test equipment and restore the system to normal. Top up the hydraulic reservoir and bleed the circuit. Check the reservoir for correct level and top up again, if necessary. Lubricate the ram and pawl slot with grease XG.275.

Replacement of aileron trim tab Desynn position transmitter (fig. 15)

51. The procedure for the replacement of the aileron trim tab Desynn position transmitter is as follows:—

- (1) Render the aircraft electrically safe (*Sect. 5, Chap. 1*).
- (2) Remove the port aileron as described in Sect. 3, Chap. 2.
- (3) Remove the screws securing the access panel in the aileron leading edge and remove the panel.

- (4) Remove the position transmitter return spring.
- (5) Disconnect the bowden cable from the position transmitter. Do not allow the lever to fly back uncontrolled as this can cause internal damage to the instrument.
- (6) Remove the position transmitter location pin.
- (7) Remove the bolt securing the clamp around the position transmitter and partially remove the transmitter. Disconnect the cable from the transmitter and remove the transmitter.
- (8) The fitment of the position transmitter is the reverse of sub-para. (1) to (7). Before clamping the position transmitter on the mounting bracket, locate the transmitter, by fitting the location pin in the aft hole in the mounting bracket and the hole in the flange of the transmitter case.
- (9) Operate the trim tab and check the function of the indicator.

Replacement of aileron trim tab actuator (fig. 15)

52. The procedure for the replacement of the aileron trim tab actuator is as follows:—

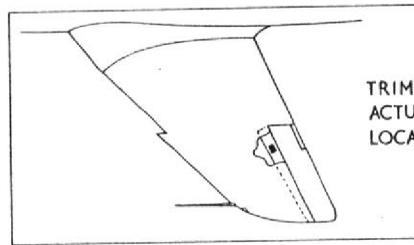
- (1) Remove the trim tab position transmitter as described in para. 51, sub-para. (1) to (7).
- (2) Remove the split pin, washer and shackle pin securing the aileron trim tab control rod to the aileron trim tab. On Post-Mod. 568 aircraft, do not alter the adjustment of the control rod.
- (3) Remove the bowden cable from the stop bracket and actuator mounting bracket.

- (4) Remove the bolts securing the actuator mounting bracket to the aileron spar and partially remove the mounting bracket, complete with the actuator, from the aileron, so that the end angle can be removed.
- (5) Remove the bolts securing the end angle and remove the end angle, then remove the shaft, complete with trim tab control rod and bowden cable, from the actuator.
- (6) Remove the actuator and mounting bracket from the aileron and withdraw the cable through the duct.
- (7) Remove the bolts securing the actuator to the mounting bracket.
- (8) Fit the replacement actuator to the mounting bracket using a new locking plate (*Part No. F.217716*). After tightening the bolts, lock with the tabs of the locking plate and, if necessary, file down the ends of the tabs to ensure that they do not protrude beyond the bolt heads.

Note . . .

Before fitting the replacement actuator, inspect the mounting bracket for signs of cracks or fracture at the attachment lugs.

- (9) Position the actuator mounting bracket and actuator in the aileron and thread the actuator cable through the duct.
- (10) Connect a 28 volt D.C. supply to the actuator through switches, as illustrated in A.P.4343D, Vol. 1, Book 5, Sect. 16, Chap. 1, App. 7, fig. 2 and motor the actuator to the maximum clockwise position, then disconnect the supply.
- (11) With the actuator in the maximum clockwise position, fit the shaft, complete with trim tab control rod and bowden cable, on to the actuator, so



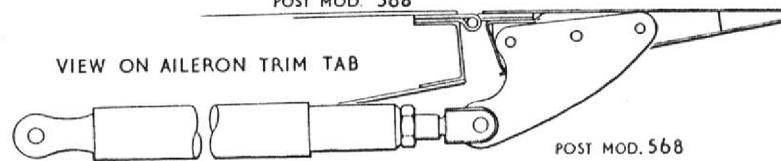
TRIM TAB
ACTUATOR
LOCATION

PRE. MOD. 568

NOTE: FULL TAB MOVEMENT 20 Deg. \pm 2 Deg.
ABOVE OR BELOW MAXIMUM NEUTRAL
POSITION OF 0.50 in. ABOVE OR
BELOW TRUE NEUTRAL

POST MOD. 568

VIEW ON AILERON TRIM TAB



POST MOD. 568

NOTE - THE ADJUSTABLE ROD ALLOWS FULL TAB MOVEMENT
20 Deg. \pm 2 Deg. ABOVE OR BELOW MAXIMUM
NEUTRAL POSITIONS OF 0.40 in. ABOVE OR BELOW
TRUE NEUTRAL IN ALL CASES, SCREWED END OF ROD
MUST BE IN SAFETY

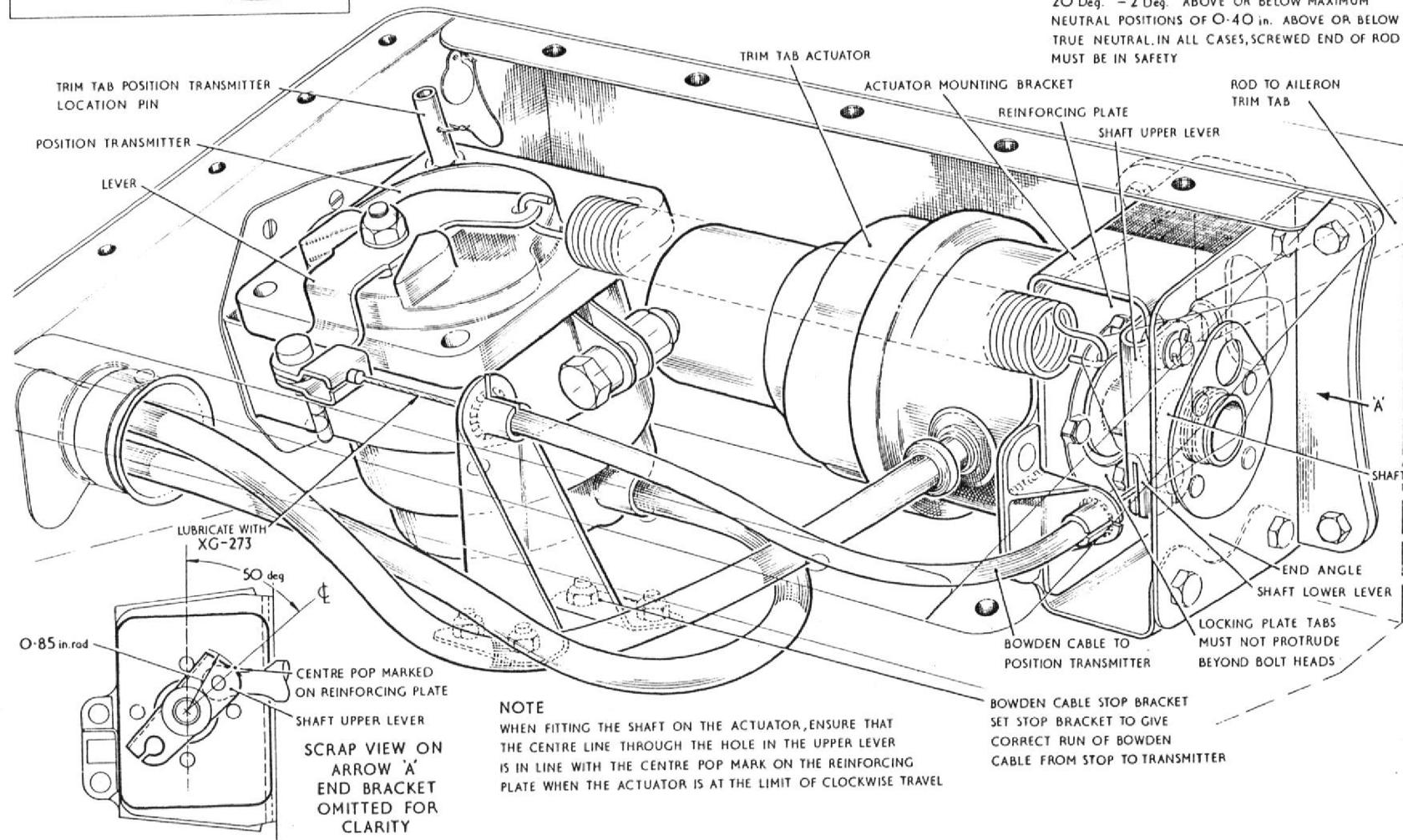


Fig. 15 Fitting of aileron trim tab actuator and Desynn position transmitter

RESTRICTED

that a line through the centre of the actuator shaft and the centre of the shackle pin securing the control rod to the shaft upper lever is in line with the centre pop mark on the reinforcing plate (See scrap view fig. 15) on the inside of the mounting bracket.

Note . . .

The head of the shackle pin must be adjacent to the actuator mounting bracket reinforcement plate.

- (12) Retain the shaft in the position obtained in sub-para. (11), ensure that the bowden cable is correctly fitted to the shaft lower lever, then fit the end angle on to the shaft and mounting bracket and secure to the mounting bracket with the bolts removed in sub-para. (5).
 - (13) Fit the actuator mounting bracket on to the aileron spar, whilst easing the control rod through the aileron, then fit the light alloy packing pieces, with the radiused edge on the bend line of the mounting bracket using the bolts removed in sub-para. (4) and secure to the aileron spar.
- Note . . .**
- The special bolt (Pre-Mod. 956) or the long bolt and distance piece (Post-Mod. 956) is/are fitted at the lower inboard attachment hole.*
- ◀ (14) Reconnect the trim tab control rod to the aileron trim tab using the shackle pin and washer removed in sub-para. (2) and secure with a split pin.
 - (15) Reconnect the 28 volt D.C. supply (sub-para. 10). Ensure that the trim tab is clear of obstruction and motor the actuator until it is in the neutral position i.e., with the shaft halfway between full clockwise and full anti-clockwise positions.

- (16) Refit the position transmitter as described in para. 51 sub-para. (8), but leave the access panel off and do not fit the aileron.
- (17) Refit the bowden cable to the mounting bracket stop and bowden cable stop bracket. The bowden cable stop bracket should be adjusted to provide the correct run of the cable between the stop bracket and the transmitter lever.
- (18) Lubricate the assembly in accordance with fig. 2 and 15.
- (19) Ensure that the trim tab is not obstructed and using the 28 volt D.C. supply, operate the actuator and ensure that the assembly functions freely throughout its range. Set the actuator in its neutral position [sub-para. (15)] and disconnect the electrical supply.
- (20) Refit the access panel, replacing all screws securely.
- (21) Refit the aileron as described in Sect. 3, Chap. 2.
- (22) Check the operation of the trimming tab in accordance with para. 39.

Adjustment of the aileron trim tab and Desynn position transmitter Post Mod. 568

53. Following the fitment of a replacement position transmitter (para. 51) no adjustment is required. Following the replacement of an aileron trim tab actuator (para. 52) no adjustment of the trim tab should be necessary provided that the adjustable control rod has not been altered, if it has been altered, adjust the trim tab as follows:—

- (1) With the actuator set to neutral [para. 52, sub-para. (15)], set the control column to neutral with the aid of the rigging fixture (fig. 9).

- (2) Slacken the locknut on the aileron trim tab control rod.
- (3) Remove the split pin, washer and shackle pin securing the aileron trim tab to the control rod.
- (4) Hold the aileron trim tab at the trim neutral position recorded on the aircraft Servicing Form and adjust the control rod for length until the shackle pin can be fitted in the control rod fork end and aileron trim tab. On completion, ensure that the fork end registers in the control rod safety hole.
- (5) Fit the shackle pin and washer, and secure with a split pin. Lock the fork end with the locknut.
- (6) Check the operation of the trim tab and check that the up and down movement from trim neutral is $20^\circ \pm 2^\circ$ or Max. 1.40 in., Min. 1.10 in.

When a mainplane, aileron, aileron trim tab, or aileron trim tab control rod is replaced the aileron trim tab must be adjusted as follows:—

- (7) Set the control column at neutral with the aid of the rigging fixture (fig. 9).
- (8) With the trim tab actuator set to neutral [para. 52, sub-para. (15)], adjust the aileron trim tab control rod to set the trim tab at neutral i.e., with the trailing edge in line with the aileron trailing edge.
- (9) Remove the rigging fixture.
- (10) Following a test flight, set the control column at neutral with the aid of the rigging fixture. Connect a ground supply and using the aileron trim switch, motor the actuator to set the aileron trim tab position indicator to neutral trim. Measure the trim tab position at the

trailing edge relative to the aileron trailing edge and record this measurement. This should not be more than 0.40 in. above or below the aileron trailing edge.

- (11) Motor the actuator to set the aileron trim tab at neutral as in sub-para. (8).
- (12) Slacken the locknut on the aileron trim tab control rod.
- (13) Remove the split pin, washer and shackle pin connecting the trim tab to the trim tab control rod.
- (14) Hold the trim tab at the position noted in sub-para. (10) and adjust the trim tab control rod by screwing the fork-end in or out to lengthen or shorten the control rod until the shackle pin can be fitted to the rod fork-end and the trim tab without moving the trim tab. On completion, ensure that the fork-end registers in the control rod safety hole.
- (15) Fit the shackle pin and washer and secure with a split pin. Lock the fork-end with the locknut.
- (16) Check the operation of the trim tab and check that the up and down movement from the trim neutral position [sub-para. (10)] is: $20^{\circ} \pm 2^{\circ}$ or Max. 1.40 in., Min. 1.10 in.
- (17) Record the trim neutral position [sub-para. (10)] in the aircraft Servicing Form.

Adjustment of the aileron trim tab and Desynn position transmitter Pre Mod. 568

54. Following the fitment of a replacement position transmitter (para. 51) it will be necessary to check and if necessary reset the position of the indicator pointer (para. 39). Following the replacement of an aileron trim tab actuator no adjustment should be necessary. When a mainplane, aileron,

aileron trim tab or aileron trim tab control rod is replaced, the aileron trim tab and position indicator must be adjusted as follows:—

- (1) Set the control column at neutral with the aid of the rigging fixture (fig. 9).
- (2) With the trim tab actuator set to neutral [para. 52, sub-para. (15)] the trim tab should be approximately neutral. Check the position of the indicator needle; if it is more than a needle width from neutral, reset by removing the needle and refitting it in the neutral position.
- (3) Remove the rigging fixture.
- (4) Following a test flight, set the control column at neutral with the aid of the rigging fixture. Connect a ground supply and using the aileron trim switch, motor the actuator to set the indicator needle in the position noted by the pilot for neutral trim. Measure the trim tab position at the trailing edge relative to the aileron trailing edge and record this measurement. This should not be more than 0.50 in. above or below the aileron trailing edge.
- (5) Motor the actuator to the neutral position on the indicator, thereby ensuring that the actuator is in the neutral position.
- (6) Remove the trim tab actuator shaft as described in para. 51, sub-para. (1) to (5). Before removing, mark the lever shaft and actuator shaft. Turn the lever shaft either clockwise or anti-clockwise in order to set the aileron trim tab in the neutral trim position and re-engage the lever shaft with the actuator shaft.

Note . . .

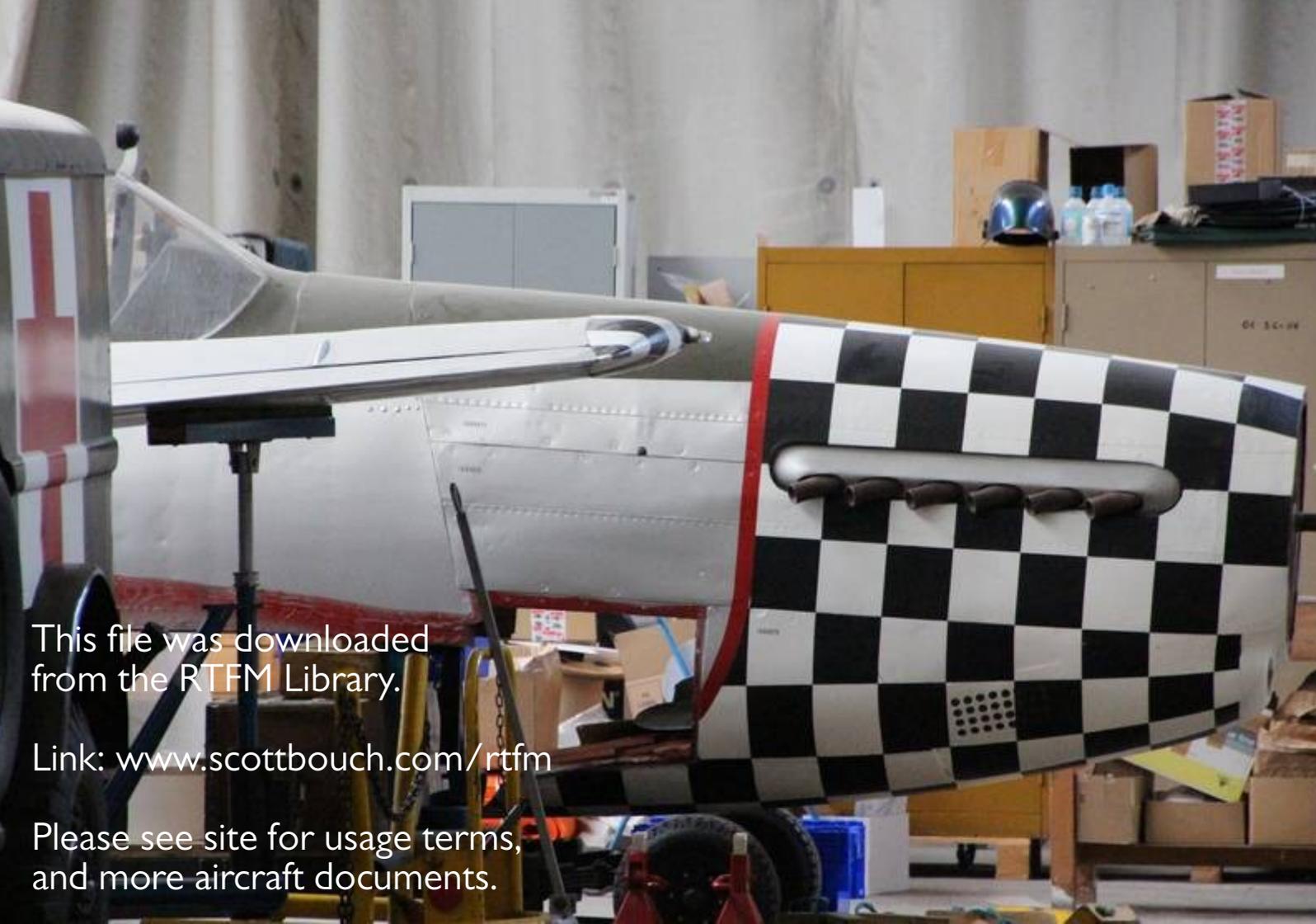
Turning the lever shaft through one serration moves the aileron trim tab approximately 0.30 in. at the trailing edge.

- (7) Retain the lever shaft in the new position on the actuator obtained in sub-para. (6), ensure that the bowden cable is correctly fitted to the shaft lower lever, then fit the end angle on to the shaft and mounting bracket. Secure to the mounting bracket with the attachment bolts.
- (8) Complete the refitment of the trim tab actuator in accordance with para. 52, sub-para. (13), (14), (16) to (21).
- (9) Reposition the indicator needle to neutral, with the trim tab actuator neutral.
- (10) Check the operation of the trim tab in accordance with para. 39 and check that the up and down movement from neutral trim is: $20^{\circ} \pm 2^{\circ}$ or Max. 1.40 in., Min. 1.10 in.

Aileron neutral position indicator setting

55. A white disc is painted on the instrument panel for alignment of the control column to neutralize the ailerons in the event of an accidental spin. The position of the disc is determined as follows:—

- (1) Set the control column neutral with the ailerons in power.
- (2) Move the control column forward, ensuring that the ailerons are not displaced from neutral.
- (3) Stick a one inch disc of white self-adhesive tape on the instrument panel so that it aligns with the top of the control column when viewed from the pilot's seat, with the control column as at (2).
- (4) Adjust the position of the disc until it is visible at the extremes of seat adjustment, with the control column as at (2).
- (5) Mark the position obtained, remove the disc and paint the marked position with a one inch disc in matt white paint.



This file was downloaded
from the RTFM Library.

Link: www.scottbouch.com/rtfm

Please see site for usage terms,
and more aircraft documents.