Chapter 5 CONVERSION TO PHOTO-RECONNAISSANCE ROLES

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General

1. The B/PR Mk. 1 and B/K/PR Mk. 1 aircraft are delivered to the Service in a basic condition (Table 1) together with the modification sets required to convert the aircraft to the various P.R. roles.

2. The basic P.R. aircraft differs initially from the bomber role aircraft in that it is provided with seven instead of six store hoists, and a covered window on each side of the fuselage at Stn. 783 for oblique cameras.

3. The Day role P.R. aircraft provides for the operation of eight main cameras with 36 in. lenses or four with 48 in. lenses, three cameras in the tri-installation for wide-angle cover and one survey camera. The main cameras and the centre camera of the tri-installation are fitted to the Day role camera crate in the bomb-bay, the port and starboard tri-installation cameras are fitted to oblique mountings at the rear end of the bomb-bay, and the survey camera to a mounting adjustable for aircraft drift and ◀ tilt in the rear fairing between the P.R. type bomb-bay doors and the deflector. Provision for main cameras with 48 in. lenses is made by Mod. 2722. For further details refer to Book 3, Sect. 5, Chap. 8, Group 3. ▶

4. The Night role P.R. aircraft can carry six F.89 Mk. 3 cameras and six Mk. 3 photo-cell units. There are three arrangements of these cameras as follows:—

Case 1.—For operating under uncertain target conditions, three of the cameras are fitted with 36 in. lenses and the other three with 24 in. lenses so that, when the target area is reached, either group of cameras can be used according to the prevailing conditions.

Case 2.—For high altitude photography under appropriate known target conditions, five cameras with 36 in. lenses are used.

Case 3.—For low altitude photography when known target conditions prevent Case 2 photography, five cameras with 24 in. lenses are used.

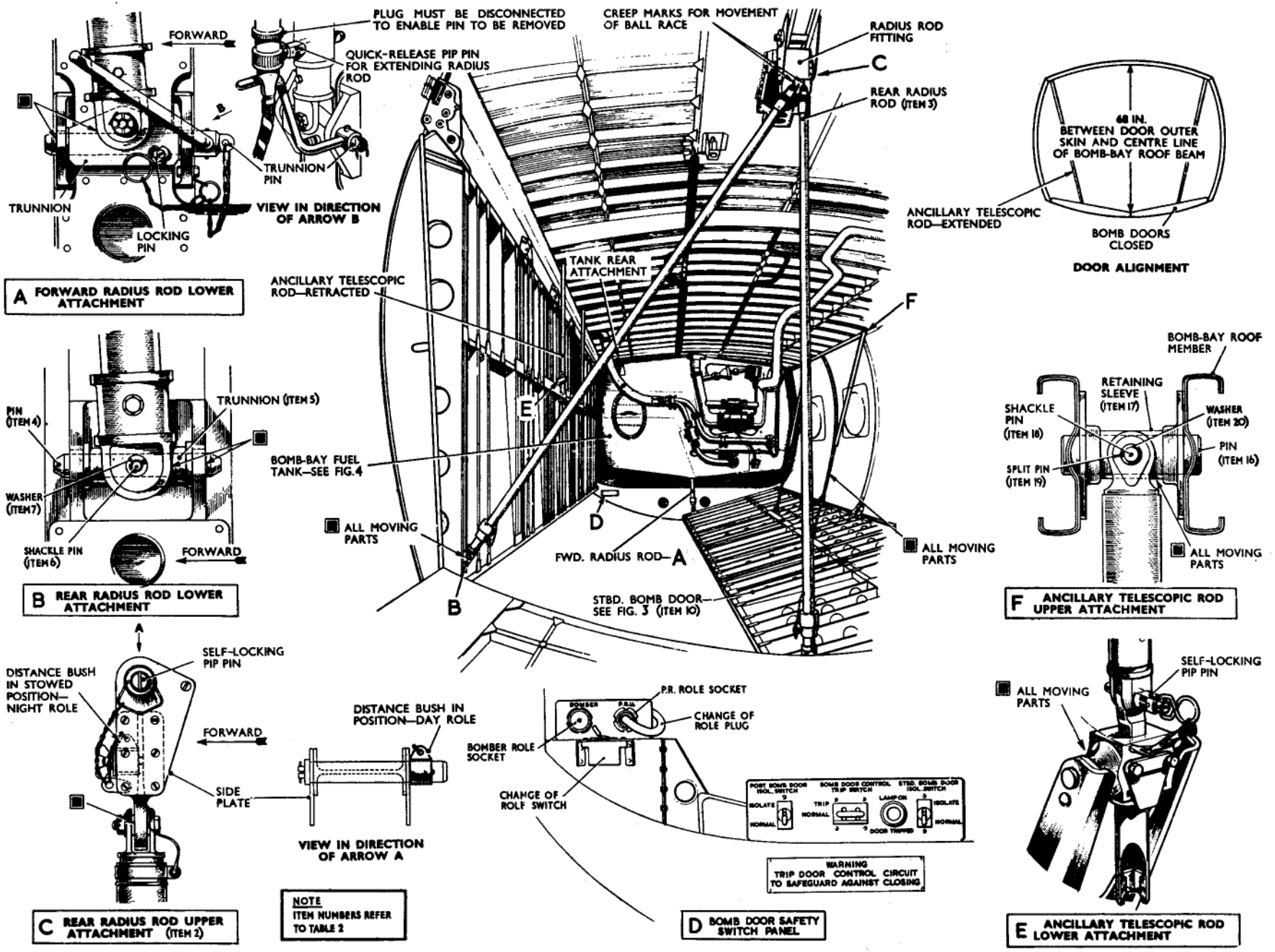

Fig. 1. P.R. type bomb-bay

Table 1. P.R. roles and equipment required

Item	Aircraft	Mod. No. and Equipment introduced by it	
1. Basic B/PR Mk. 1 = Basic B Mk. 1 Basic B/K/PR Mk. 1 = Basic B/K Mk. 1		+ Mod. 25	Fixed fittings
2. Day role	= Basic B/PR Mk. 1 or Basic B/K/PR Mk. 1	+ Mod. 26	Common removable equipment.
		+ Mod. 72 and all concurrent Mods.	Day role camera crate and accessories.
		+ Mod. 1514	Standard bomb-bay tank.
3. Night role	= Basic B/PR Mk. 1 or Basic B/K/PR Mk. 1	+ Mod. 2573 and all concurrent Mods.	Rearranged camera controls (fixed equipment) at bomb-aimer's station.
		+ Mod. 26	Common removable equipment.
		+ Mod. 73 and all concurrent Mods.	Night role camera crate and accessories.
		+ Mod. 1514	Standard bomb-bay tank.

Note . . . *For long range, underwing tanks may be fitted to all variants* (*Mods.* 1345, 1512 *and* 1513).

This aircraft also carries a photoflash crate with up to twenty-eight 8 in. photoflashes, in place of the rear fairing on the Day role aircraft. For further details refer to Book 3, Sect. 5, Chap. 8, Group 4.

Fixed and removable equipment

5. The basic P.R. aircraft are complete with fixed fittings (Mod. 25). The removal of certain items and the fitting of common removable equipment (Mod. 26) is dealt with in this chapter; these operations are summarized below (*see also Table* 2).

Remove:—

- Bomber type bomb-bay doors
- Bomber type rear radius rods
- Torque rods between door bogies No. 8 and 9 (numbered from front to rear)
- Rearmost racks and bogies
- Rack supports from the oblique camera window apertures
- Bomber type deflector
- No. 1, 2 or 3 bomb control panels from radio crate if Mod. 2645 or 2725 is incorporated.

Fit:—

- P.R. type bomb-bay doors
- P.R. type rear radius rods
- P.R. type deflector
- Bomb-bay fuel tank and venting system (*Sect.* 4, *Chap.* 2)
- Oblique camera windows, actuators and mountings
- P.R. sight-mounting brackets
- Optical flats in the P.R. type bomb-bay door camera windows
- Camera control panels (according to role, see Appendix 1 or 2)
- P.R. sights
- Rear fairing complete with camera mounting or flash crate (according to role)
- Camera crate (according to role)
- Panel No. 4, complete with tilt angle indicator, to the radio crate if Mod. 2645 or 2725 is incorporated.

Special equipment

6. Appendices 1 and 2 to this chapter give details of the special equipment required for the various P.R. roles.

Removal of bomber type bomb-bay doors

7. The removal of the bomber type bomb-bay doors is covered in Sect. 3, Chap. 1.

Removal of the bomber type deflector

8. For removal of the bomber type deflector refer to Sect. 3, Chap. 1.

Removal of rear racks and motorized bogies

9. Remove the port and starboard rear bomb-bay racks complete with motorized bogies, as follows:—

(1) Disconnect and remove torque rods between bogies No. 8 and 9.

(2) Remove the split pins from the top attachment pins and withdraw the pins.

(3) Starting at the top and working downward, remove the ten special bolts securing each rack to the bomb-bay wall, taking care to note the position of each shim.

(4) Connect a 28-volt supply to the brake motor to free the brake and move the bogie up the rack; this will reveal the lower pair of special bolts securing the rack to the bomb-bay wall. Remove these bolts.

Note . . .

A locally-made connector, comprising a suitable length of cable and a 3*-pin socket* (*using pin B* (+) *and pin A* (−)) *must be used to connect the* 28*-volt supply to the rear bogie motor brake unit.*

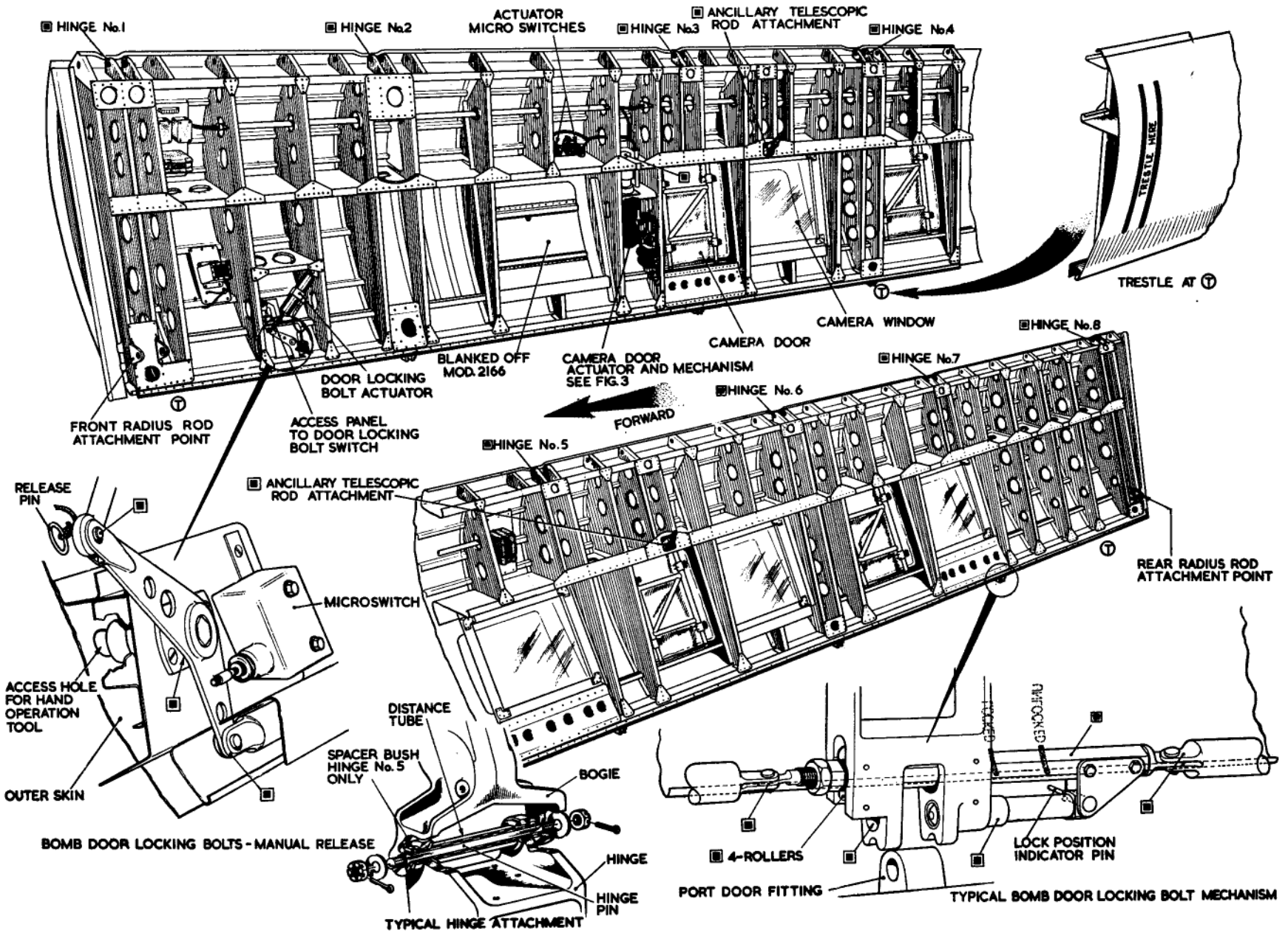

Fig. 2. Starboard door, P.R. role

(5) Remove the nuts from the lower attachment bolts and tap out the bolts, taking care to avoid damaging the thin gauge skin adjacent to the bolt heads. The racks are then free and must be removed complete with bogies; attach the shims (*operation* (3)) for safe storage (for use on reversion to bomber role).

Note . . .

The bogies must not be removed from their racks.

(6) Remove the bomb-bay door rack support from the port and starboard oblique camera apertures.

Note . . .

On conversion from bomber to P.R. roles the 3-pin electrical plug must be removed from the socket on the starboard front radius rod and connected to the stowage on the radius rod bracket. At the change of role plug-and-socket panel (fig. 1) at the front port side of the bomb bay, remove the electrical plug from the BOMBER *socket, select* PRU *on the* BOMBER/PRU *switch, and insert the plug into the* PRU *socket. Under these circumstances, the bomb-bay doors are operated from the* P.R. BOMB-BAY *switch at the external supply panel and NOT from the cabin.*

Fitting the P.R. type deflector (*Table* 2, *Item* 1)

10. To fit this deflector proceed as follows:—

(1) Remove the di-electric screen from the deflector by removing the peripheral screws.

(2) Offer up the deflector to its approximate position until it rests on the fuselage seals, and support with suitable trestles.

(3) Through the aperture gained in operation (1), insert the deflector hinge pip pins into the hinge brackets (*Sect.* 3, *Chap.* 1).

(4) Raise the deflector front end and connect the fork-ends to the rack eye-ends.

(5) Select NORMAL on the BOMB DOOR CONTROL TRIP SWITCH and select and hold CLOSED on the external power supply panel switch. The deflector will then lower to its closed position.

(6) Check for satisfactory operation of the "up" limit switches by selecting OPEN on the external supply panel switch.

Note . . .

The switches should operate correctly since the racks should not have been disturbed. If there is any fault, check the settings (*Sect.* 3, *Chap.* 1).

(7) Select CLOSED on the external supply panel switch, when the deflector will lower to the closed position.

(8) Return the BOMB DOOR CONTROL TRIP SWITCH to TRIP.

Fitting the P.R. type bomb-bay doors

11. The sequence for fitting these doors is as follows, the necessary items being listed in Table 2.

(1) Before offering up the P.R. type bomb-bay doors, remove the optical flats (*if fitted*) and store carefully to avoid damage. Position trestles under the bomb-bay port side and offer up the port bomb door (*item* 9).

Note . . .

It is recommended that the trestles should hold the bomb doors in the approximate "servicing" attitude (*Sect.* 3, *Chap.* 1) *and height as when fitted.*

(2) Offer up the door to the bogie fittings. Position the distance tubes and fit the pins, securing with nuts and washers at each end; lock with split pins (*fig.* 2).

Note . . .

Two spacer bushes (item 11) *must be fitted at No. 5 hinge attachment* (*fig.* 2).

(3) With the port front radius rod extended, connect it to the bomb-bay door with the quick-release pin, and secure with the locking pin (*fig.* 1, *A*).

(4) Connect the rear radius rods upper attachment fitting (*item* 2) to the rear drag link of No. 6 bomb hoist (at Stn. 734.18), using the quick-release pin and distance bush (*fig.* 1, *C*).

Note . . .

The bush is stowed on the attachment fitting when the flash crate hoist beam is fitted.

(5) Position the spherical bearing in the rear radius rod fitting, offer up the radius rod fork-end attachment and fit the securing bolt forward through the assembly. Fit the nut and washer to the bolt and lock with a split pin (*fig.* 1, *C*).

(6) At Stn. 521 and 608, fit an ancillary telescopic tie-rod (*item* 15) to the bomb-bay roof by positioning the retaining sleeve between the roof members, inserting the retaining pin, aligning the holes in pin, sleeve and tie-rod, inserting the shackle pin into the assembly, fitting the washer and locking with split pin (*fig.* 1, *F*).

(7) Repeat operations (1) to (6) on the starboard door (item 10).

(8) Remove the extension quick-release pip pin from the "servicing" position in the port front radius rod, lift the door to the "closed" position and replace the pin.

Note . . .

When lifting a bomb-bay door from the "servicing" to the "closed" position, great care must be taken to avoid damaging the spring-loaded seals at the door front end; they must be held tight against the door edge.

(9) Position the trunnion in the bomb-bay door rear radius rod attachment and insert the trunnion pin through the assembly. Align the holes in the trunnion and trunnion pin, position the rear radius

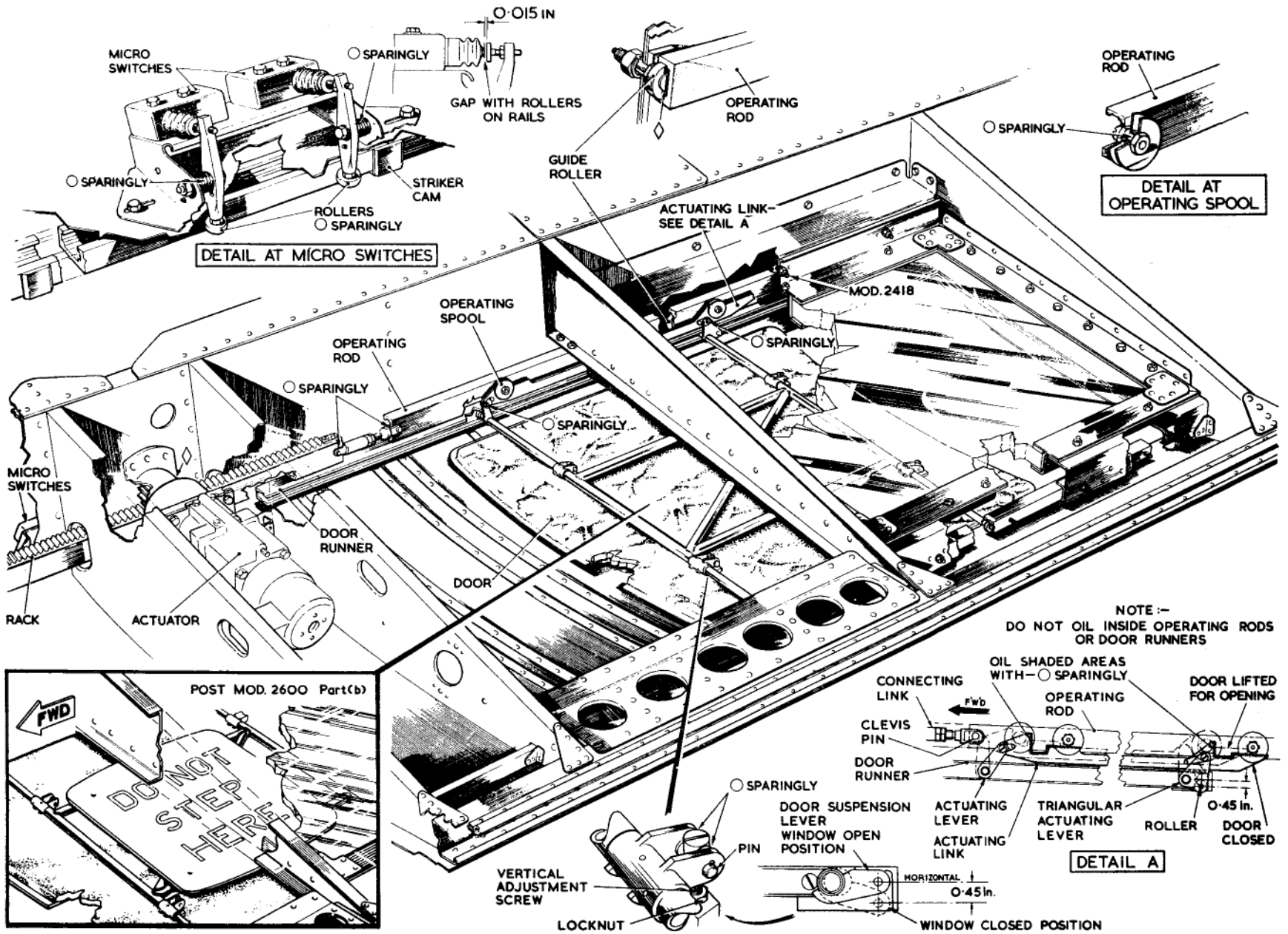

Fig. 3. Camera window door mechanism

rod fork-end on the trunnion, insert the locking pin into the assembly, fit the washer and lock with a split pin (*fig.* 1, *B*).
(10) Connect the ancillary telescopic tie-rod lower ends to the bomb-bay door and insert the self-locking pin (*fig.* 1, *E*).
(11) With the port door closed, a measurement of 68·0 in. should be obtained between its outer skin inboard edge and the underside of the bomb-bay roof beams at the centre line (*fig.* 1). Any warping of the door must be eliminated by adjusting the ancillary telescopic tie-rods, using extension bar 1L/3 and wrench 1L/10 until a uniform measurement along the length of the door is obtained.
(12) Connect the electrical plugs to the sockets on the port front radius rod (*Sect.* 5, *Chap.* 8, *Group* 5) and motorized bogies.
(13) Select NORMAL on the BOMB DOOR CONTROL TRIP SWITCH, and bomb doors OPEN on the external supply panel switch; the port door will then rise to the "open" position.
(14) Select ISOLATE on the PORT BOMB DOOR ISOL SWITCH and TRIP on the BOMB DOOR CONTROL TRIP SWITCH.
(15) Repeat operations (8) to (12) on the starboard bomb-bay door.
(16) Set both ISOL SWITCHES and the TRIP SWITCH to NORMAL. The closing sequence for the P.R. type doors differs from that of the bomber in that the starboard door closes first, followed by the port door and then the deflector. As the starboard door is already closed, the port door will begin to lower to the closed position. Inch this door down slowly by selecting CLOSED and switch OFF when the door is about two or three inches from fully closed, leaving the deflector up.

Note . . .

With the doors in this position, it is impossible to operate the ISOLATION *and* TRIP *switches; precautions must therefore be taken to prevent inadvertent operation of the bomb door switch on the external power supply panel.*

(17) Sight along the doors for alignment. Any necessary adjustment must be made on the port door ancillary telescopic tie-rod lower attachments.
(18) The motorized bogies may not fully close the doors from this position, therefore, door OPEN must be selected. When the doors are fully open, reselect doors CLOSED and allow them to fully close.
(19) The P.R. bomb-bay doors are locked in the closed position by three bolts on the starboard door, interconnected by operating rods, engaging three fittings on the port door. The three bolts are operated by an actuator on the starboard door front end. Control of the actuator is by a switch, access to which is gained through a spring-loaded panel in the door skin (*fig.* 2).
(20) The door lock bolts must be adjusted as follows:—
(a) With each bolt in the fully-open position, its end must be flush with or up to 0·05 in. below the inside face of the fitting.
(b) This is effected by loosening the locknut on the door bolt assembly operating bar, adjusting the eyebolt and securing with the locknut when satisfactory.
(21) The door lock OPEN microswitch must be adjusted by loosening the locknut, adjusting the operating bolt so that the microswitch operates over the last 0·1 in. of movement of the bolt operating rod, and securing with the locknut.
(22) Operate the actuator switch and check the engagement of the door bolts.

Note . . .

Only one person must operate the door and lock control switches.

(23) Each door bolt is provided with an indicator pin which protrudes between the port and starboard doors. The pin positions, between pairs of red lines painted on the door skin, indicate the degree of engagement of the bolts (*fig.* 2).
(24) Operate the door bolt actuator (*item* 25) and check for ease of operation. In the event of electrical failure of the actuator when in the locked position, the bolts can be opened manually by disconnecting the actuator link pip-pin (accessible through the actuator switch panel) and inserting a tool (*made locally from m.s. hexagon bar,* 0·52 *in. across flats, of suitable length and bent at right angles to form a lever*) through the bomb door skin, immediately below the bolt actuator switch panel, and into the internal hexagonal bore of the lever pivot.

Note . . .

When operating the P.R. type bomb-bay doors, check that the spring-loaded bomb door switch on the external supply panel is in the central OFF *position before the door lock is operated.*

(25) Carry out functional and electrical checks on the bomb-bay door and deflector installation. For any necessary adjustments refer to Sect. 3, Chap. 1.

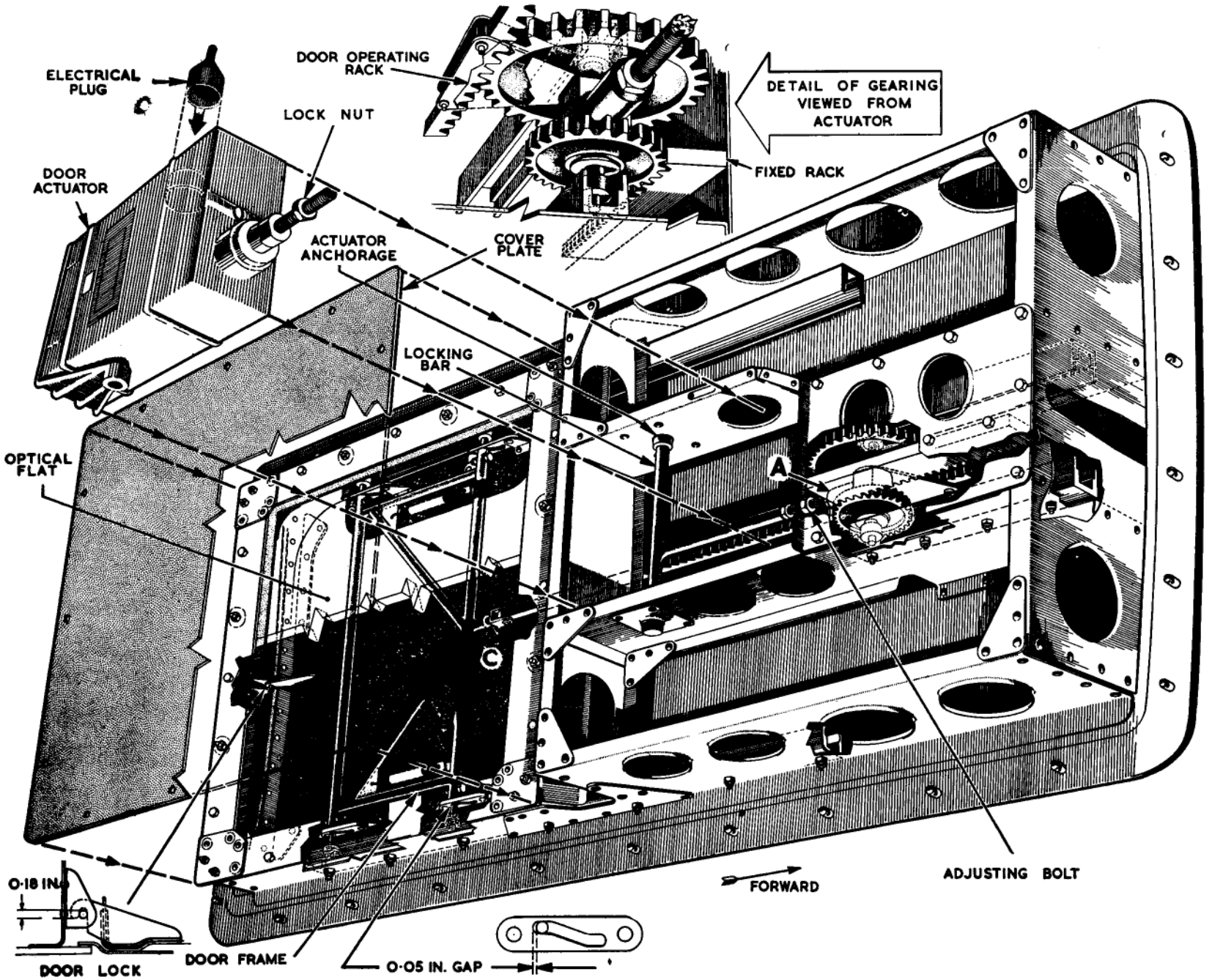

Fig. 4. Oblique camera window panel

Bomb-bay fuel tank

12. The tank is attached to the front end of the bomb-bay roof between Stn. 424·35 and 490·1. The venting system is connected between the bomb-bay tank and the normal aircraft fuel venting system. For installing the tank and venting system, refer to Sect. 4, Chap. 2.

Fitting the oblique camera window, optical flats and actuators (*fig.* 4)

13. The oblique camera window panels are single units, port and starboard; they are part of the standard P.R. aircraft equipment and require only the removal of the cover plates and the fitting of the optical flats and door actuators to prepare them for P.R. operation.

14. Each oblique camera window door is operated by a linear actuator which carries, on its operating shaft, two pinions of different diameters on a common spindle. The smaller pinion is meshed with a fixed rack and the larger one engages the door operating rack. As the operating shaft extends it rotates the smaller pinion in its fixed rack which in turn rotates the larger pinion at the same speed. The rotation of the larger pinion draws the door operating rack forward to the open position.

15. To prepare the window panels proceed as follows:

(1) Remove the window panel by unlocking the 30 Dzus fasteners securing it to the aircraft.

(2) Remove the optical flat cover plate from the window panel by withdrawing the twelve securing bolts.

(3) Remove the locking bar complete with adjusting bolt, which secures the sliding door in the closed position, by removing the two special bolts attaching this sub-assembly to the actuator anchorage.

(4) Ensure the safe storage of the cover plate, locking bar and adjusting bolt for reversion to bomber role.

(5) Fit the door actuator (*item* 26) to the adjuster screw body at A, fig. 4, and to the actuator anchorage, using the two special bolts removed in operation (3), and locking washers.

(6) Adjust the door and actuator at point A and /or C, so that a gap of 0·05 in. is obtained between the roller spindle and cam, with the door in the closed and locked position. The actuator adjusting screw must then be locked with the locknut.

(7) Fit the optical flat, using the 12 bolts removed in operation (2).

(8) Refit the complete panel assembly to the aircraft, and secure with the 30 Dzus fasteners.

(9) Connect the electrical plug to the actuator.

(10) Examine the assembly for security and carry out electrical checks (*Book* 3, *Sect.* 5, *Chap.* 8, *Group* 2).

P.R. sight-mounting brackets

16. Fit the P.R. sight-mounting brackets (*Table* 2, *item* 21 *and* 22) to the anchorage at the rear of the bomb-aimer's window panel.

Camera window door operation (*fig.* 3)

17. The main camera window doors are operated by a rotary actuator, the driving pinion of which is meshed with a rack. The doors are interconnected by operating rods, the foremost rod being connected to the rack. At each door position, the operating rods engage an actuating link which, in the opening sequence, first causes the door to lift 0·45 in. and then move forward along the runners to the open position. The mechanism is so designed that all the doors do not commence to open simultaneously, thus obviating an excessive peak load on the actuator and racks. Travel is limited in both directions by microswitches.

Camera window door adjustment (*fig.* 3)

18. With the door system "closed", adjust each door as follows:—

(1) Remove the pin from the vertical adjustment screw after removing the split pin and washer; this leaves the door free. Check that the door seals are in good condition and set the door in its correct position, resting on the seals.

(2) Set the triangular actuating lever so that the centre of the roller is 0·45 in. below its normal centre line when the roller is in the runner (*detail A*). (There will be a corresponding movement of 0·45 in. of the door suspension lever.)

(3) Turn the vertical adjustment screw until the pin can be re-inserted. If the pin holes are out of alignment, note that there must be no undue pressure on the seals; nevertheless, the screw must be adjusted to introduce pressure on the seals until the pin can be fitted. There should be no need to turn the screw more than 180 deg., this giving a 0·015 in. max. compression of the seal.

(4) Lock the vertical adjustment screw with the locknut, and refit the washer and split pin to secure the main pin.

(5) Disconnect the connecting link from the forward end of the operating rod.

(6) Pull the operating rod forward until the forward spool engages the shoulder of the actuating link and the forward actuating lever is vertical.

(7) Adjust the connecting link until the pin can be inserted to reconnect it to the operating rod.

Camera window door microswitches (*fig.* 3)

19. The open and closed positions of the doors are governed by two microswitches operated, through levers, by cams integral with the front operating rod. The bracket carrying the microswitches is slotted to provide adjustment for the actuator cut-off positions. With each microswitch lever bearing on the surface of the front operating rod, the microswitch gap must be adjusted to 0·015 in.

SERVICING

Deflector settings and adjustments

20. The deflector settings and adjustments for the P.R. role are the same as those described in Sect. 3, Chap. 1.

P.R. type bomb-bay door settings and adjustments

21. The P.R. type bomb-bay door settings and adjustments are the same as those detailed in Sect. 3, Chap. 1.

Lubrication

22. Lubrication details of the P.R. type bomb-bay and camera window door mechanisms are given in fig. 1 to 3.

Note . . .

Ensure that no grease is deposited on the camera door runners and operating rods, otherwise excessive grit and dirt would be picked up, causing parts of the mechanism to stick with possibly damaging consequences.

Reversion to bomber role

23. For reversion to bomber role, reverse the sequence of operations given in para. 5 to 16 inclusive. For replacing bomber type bomb-bay doors and deflector refer to Sect. 3, Chap. 1.

Table 2

Basic conversion parts

Item	Description	No. off	Part No.	Ref. No.
1	P.R. type deflector	1	71069 Sht.187	
2	Rear radius rods fitting	1	71079 Sht.51	
3	P.R. type rear radius rod	2	71079 Sht.225	26SR/8438
4	Trunnion pin	2	71079 1603	26SR/8440
5	Trunnion	2	71079 1599	26SR/8439
6	Shackle pin	2	S.P.4Y—D22	28P/1044
7	Washer	2	S.P.13—E	28W/12253
8	Split pin	2	S.P.9—C5	28P/12349
9	P.R. bomb-bay door (port)	1	71079 Sht.203	26SR/8418
10	P.R. bomb-bay door (starboard)	1	71079 Sht.201	26SR/8432
11	Spacer bush (for items 9 and 10)	4	71079 2139	26SR/11031
12	Distance tube	16	67457 527	
14	Hinge pin	16	66057 711	
15	Ancillary telescopic tie-rod	4	71079 Sht.473	
16	Pin (for item 15)	4	71079 3309	
17	Retaining sleeve (for item 15)	4	71079 3311	
18	Shackle pin	4	S.P.4Y—D19	28P/1041
19	Split pin	4	S.P.9—C5	28P/12349
20	Washer	4	S.P.13E	28W/12253
21	P.R. rear sight mounting bracket	1	71079 Sht.371	
22	P.R. forward sight mounting bracket	1	71079 Sht.369	
23	Actuator, camera door mechanism	2	5W/378	
24	Window frames c/w optical flats	9	71079 Sht.145	26SR/8419
25	Actuator, bomb-bay bolt locking	1	5W/317	
26	Actuator, oblique camera doors	2	5W/403	

Note . . . *For details of the bomb-bay tank, nitrogen and venting systems required for this role, refer to Sect. 4, Chap. 2.*

Appendix 1 INSTALLATION OF DAY ROLE CAMERA CRATE AND ACCESSORIES

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TABLE

	Table
Special conversion parts	1

1. In this Appendix, the operations necessary to complete the conversion of a basic B/PR Mk. 1 or B/K/PR Mk. 1 aircraft to its Day role are detailed. These operations cannot be effected until the work described in Chap. 5 has been completed. A list of the special conversion parts required is given in Table 1. Reference should be made to Vol. 1, Book 3, Sect. 5, Chap. 8 of this publication for details of the electrical installation and the various camera arrangements for this role.

Preparing the aircraft

2. The aircraft is prepared for the installation of the camera crate as follows:—

(1) Withdraw the bomb-bay door locking bolts by operating the switch at the front of the starboard door.

(2) Lower the bomb-bay doors to the "servicing" position (*Sect.* 3, *Chap.* 1).

(3) Blank off the forward heating inlet on the port and starboard bomb-bay wall at Stn. 435 (Mod. 2723a) as follows : —

(a) Remove the access panel in the bomb-bay wall adjacent to the inlet.

(b) Remove the diffuser (*fig.* 1) by removing the four nuts, washers, distance pieces and bolts securing it to the bomb-bay wall.

(c) Remove the four bolts, Pt. No. A26–2B, with nuts and washers, and retain for subsequent reversion to the bomber role.

(d) Fit the diffuser flush with the bomb-bay wall and, with the distance pieces fitted externally, secure with the attachments removed in operation (b) (*fig.* 1).

(e) Replace the access panel.

(4) Return the bomb-bay doors from the "servicing" to the "closed" position, following the procedure given in Sect. 3, Chap. 1, and observing the precautions in the relevant Note.

(5) Open the bomb-bay doors by operating the spring-loaded switch on the external supply panel.

(6) When the doors have opened set the BOMB DOOR ISOL SWITCHES and the BOMB DOOR CONTROL TRIP SWITCH to ISOLATE and TRIP respectively.

(7) Jack the aircraft at the inner main planes (using jacks and observing the relevant precautions detailed in Sect. 2, Chap. 4), to give a ground clearance of 77 in. measured from the deflector hinge pins (*fig.* 2).

Note . . .

This jacking allows the camera crate to be positioned beneath the hoisting gear. The aircraft MUST be lowered from the jacks before hoisting operations commence.

Main camera mountings

3. The main camera mountings are supported in the camera crate by tubular structures, the angularity of the cameras being determined by the use of different length struts and by the position of a locating pin in any of four holes in the camera mounting adapter (*fig.* 3). The F.49 tri-camera mounting is not adjustable and is fixed to maintain the camera vertically.

Installing the camera crate (*fig.* 2)

4. The camera crate, which has previously been fitted with all camera mountings (*fig.* 3), camera motors, cameras and wiring, is mounted in cradles on a transporter (26SR/

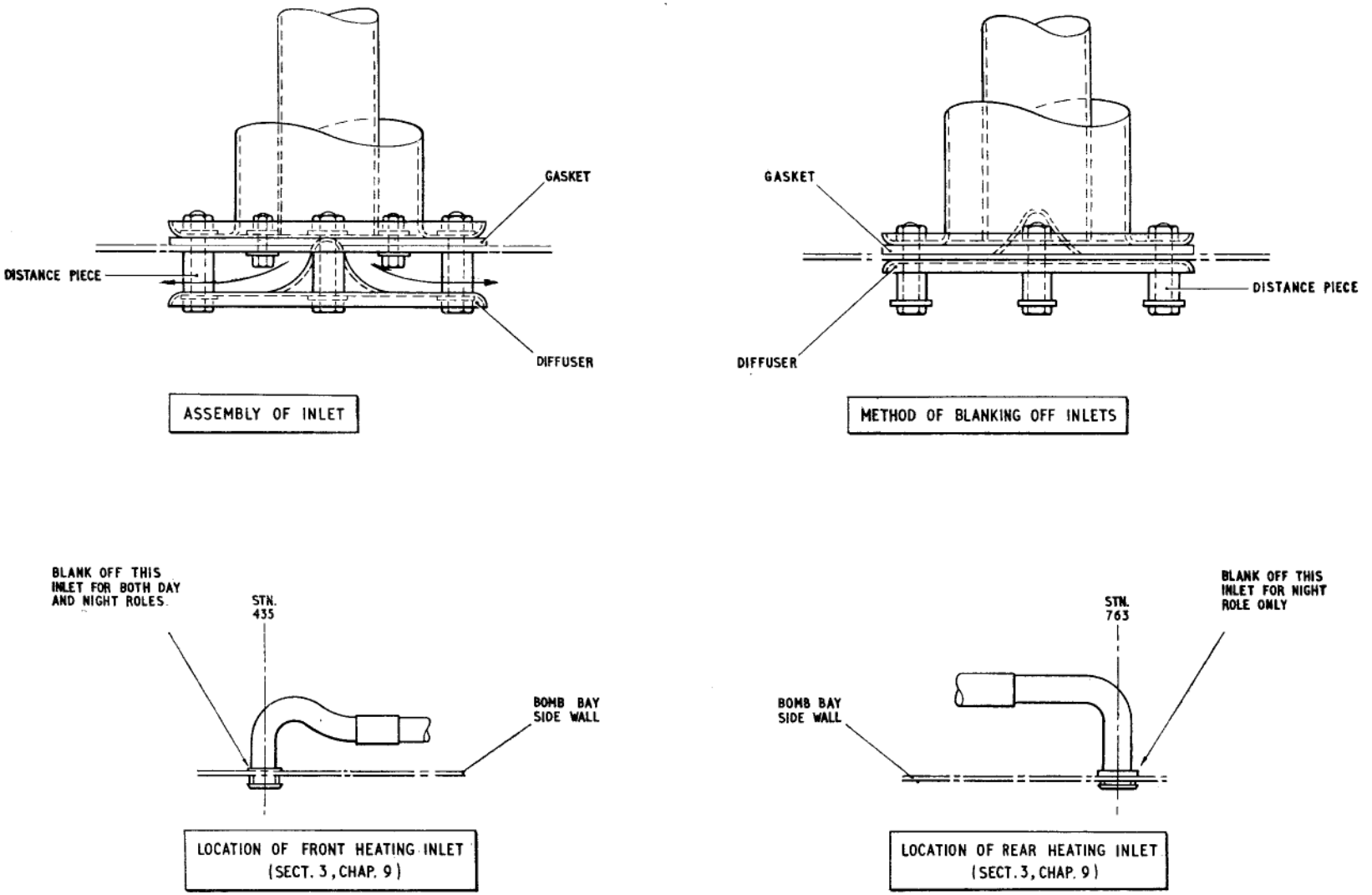


Fig. 1. Blanking off heating inlets

95418) and is loaded into the bomb-bay, using two bomb hoisting cranes (16A/1931 ◀or 2303) in conjunction with items 7 to 10 and item 12 in App. 2, Table 2.▶ The loading sequence is as described in A.P.2852B, Vol. 1 and A.P.1664D (2nd Edn.), Vol. 1, Part 1, Sect. 2, Chap. 8, 9 and ◀13. Gauge pressures should be preset to give a crutching load of 3000 lb at each hoist position.▶

Note . . .

Ensure that the lift is shared evenly between the two cranes.

5. Make the necessary electrical connections (*Book* 3, *Sect.* 5, *Chap.* 8).

Fitting the rear fairing (*fig.* 5)

6. The rear fairing (*Table* 1, *item* 1) is installed as follows : —

(1) Place the bomb-bay doors in either the "open" or the "servicing" position, with the deflector either up or down.

(2) Hold the spring-loaded seals at the rear end of the bomb-bay doors hard up against the door edges.

(3) Lift the rear fairing into position between the bomb-bay doors and the deflector.

(4) Secure with the quick-release pins at the four attachment points, two at No. 9 bomb door hinge points, and two at Stn. 807·5.

(5) To ensure a good seal between the bomb-bay walls and the rear fairing, adjustment is provided by simple bell-cranks and eyebolts which form the attachment points (*fig.* 5). This adjustment must ensure that the sealing rubbers on the walls are evenly compressed throughout their length.

Optical flat in rear fairing

7. The optical flat window frame is installed by securing it to the window aperture anchor nuts, using 4 B.A. bolts. FWD is stencilled on the window frame and must face forward. During the installation, great care must be exercised against damaging the optical flat by scratching or abrasion. It is advisable to leave the fitting of it until work on the camera crate is completed.

Rear fairing camera mounting (*fig.* 6)

8. To install, proceed as follows:—

(1) Bolt the vertical corner members of the mounting structure (*Table* 1) to the rear fairing longitudinal members.

(2) Bolt the camera mounting cast ring to the mounting structure at the four attachment points.

◀**Note . . .**

Mounting structures post-Mod. 2851 *are each fitted with adapters at the four attachment points to provide for the fitment of camera mounting Type* 125.▶

TABLE 1

Special conversion parts

Item No.	*Ref. No.*	*Part No.*	*Type*	*Description*	*Location*
1	—	71079 Sht.457	—	Rear fairing	Rear of bomb-bay doors
2	14A/–	—	80A	Rear fairing camera mounting	Rear fairing
3	26SR/8512	—	—	Optical flat and frame	Main camera positions
4	—	71079 Sht.431	104	F.49 oblique camera mounting, fixed	Fuselage walls at rear fairing
5	10AJ/164	—	—	Equiflex mounting	Camera mountings
6	—	71079 Sht.441/2	108	F52 oblique camera mounting, adjustable	Fuselage walls at rear fairing (alternative to item 4)
◀7	14A/5851	—	125	Camera mounting	Rear fairing
8	—	71079 Sht.5	—	Camera crate top section	
8	—	71079 Sht.3	—	Camera crate bottom section	
9	14A/5852	—	—	Adapter for F.49 Mk. 2 6 in. camera	Rear fairing camera mounting▶
10	14A/5853	—	—	Adapter for F.49 Mk. 3 12 in. camera	

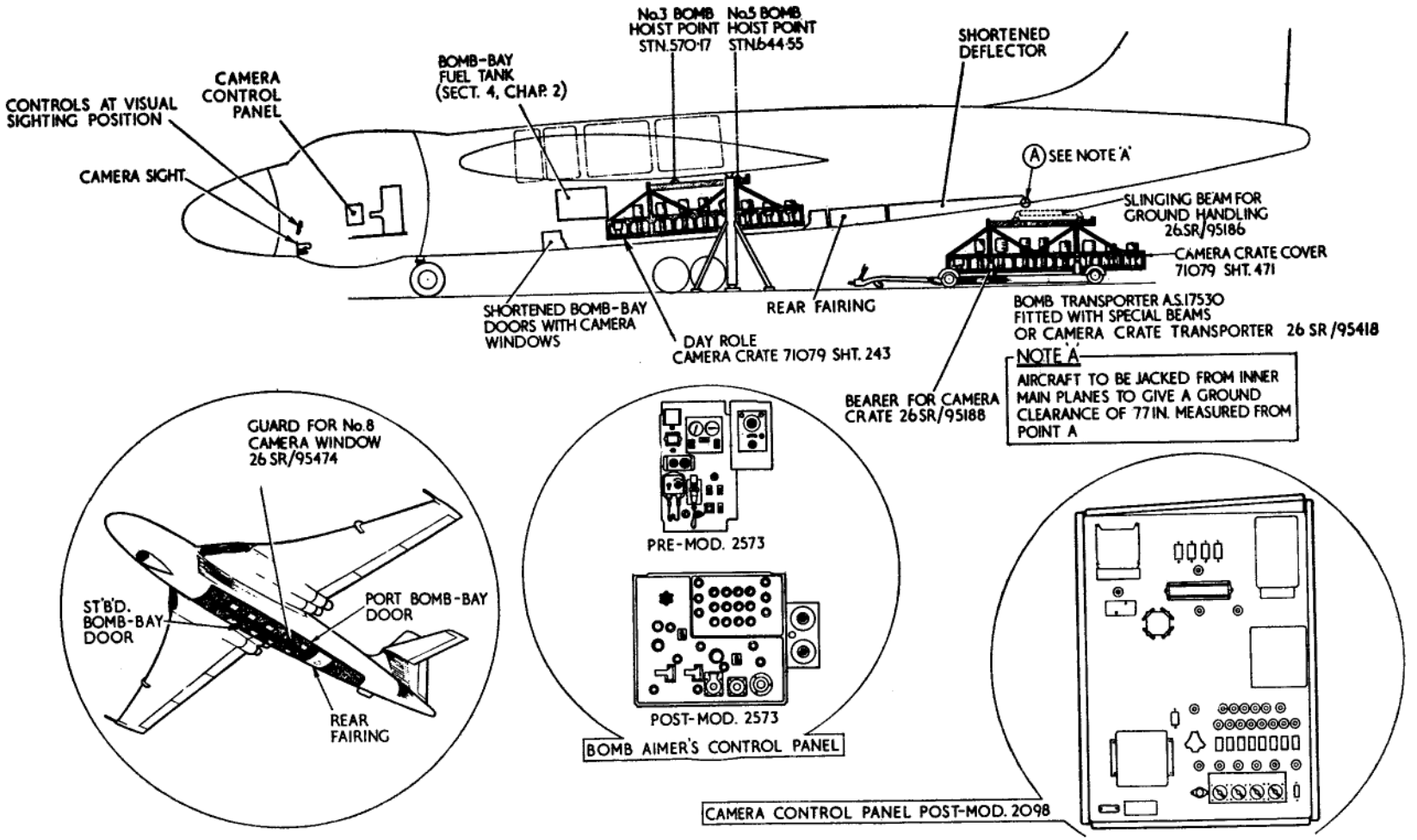


Fig. 2. Installation of day role camera crate and accessories

Rear fairing camera mounting operation

9. The rear fairing camera, which is the survey camera, is mounted on a Type 80 ◀or 80A mounting pre-Mod. 2851, or a Type 125 mounting post-Mod 2851. This▶ is adjustable to correct for aircraft drift and tilt by either of two controllers, one on the control panel and one on the bomb-aimer's P.R. panel, which operate actuators to compensate for deviation either laterally or fore-and-aft. The tilt and drift switches each have two positions and, when selected in the required "sense", operate their respective actuators.

10. There are desynn transmitters in the mounting for both tilt and drift corrections, recording on respective indicators at the controllers. When the correction angle is equal and opposite to the aircraft deviation angle, the control switches can be returned to OFF.

Rear fairing camera window door operation (*fig.* 5)

11. *Pre-Mod.* 2602.—The rear fairing camera window door is similar to the oblique camera window door and operates in a manner similar to that described in Chap. 5, para. 14.

12. *Post-Mod.* 2602.—This modification introduces a rotary actuator to replace the linear actuator, the open and closed positions being governed by two microswitches in a manner similar to that described in Chap. 5, para. 19. The microswitch cams must be adjusted to control the open and closed positions of the door, allowing 0·05 in. overtravel of the cam roller in the cam slot as shown in Chap. 5, fig. 4.

Oblique camera mounting (*fig.* 4)

13. *F.*49 (*Type* 104 *fixed mounting—Table* 1, *item* 4).—To install, proceed as follows: —

(1) Attach the tubular mounting structure to the four mounting brackets on the aircraft structure around the aperture in the fuselage wall, using 2 B.A. high tensile steel bolts.

(2) Bolt the equiflex mountings (*Table* 1, *item* 5) to the four mounting plates on the tubular structure.

(3) Attach the mounting ring casting by bolting the four legs to the equiflex mountings.

(4) Make the necessary electrical connections (*Book* 3, *Sect.* 5, *Chap.* 8).

14. *F.*52 (*Type* 108 *adjustable mounting—Table* 1, *item* 6).—To install, proceed as follows: —

(1) Insert the pivot bolts through the tubular structure into the fitting at each side of the camera aperture at Stn. 773 and 793 on the bomb-bay wall.

(2) Bolt the angle-adjusting struts on the top of the mounting structure to the lugs on the bomb-bay wall, above the camera aperture. The camera angle adjustment is effected by the use of different length struts according to the angle required.

Note . . .

It is unnecessary to remove the Type 104 *fixed mountings when installing an F.*52 *camera.*

Camera attachment brackets

15. The camera attachment brackets are carried on anti-vibration mountings in the Type 108 mounting frame (*fig.* 4).

Fitting the camera control panel

16. The camera control panel is secured by ten bolts to the wall structure on the starboard side of the aircraft, just forward of the second navigator's station. For electrical connections refer to Vol. 1, Book 3, Sect. 5, Chap. 8, Group 2.

17. Fit other necessary items of control equipment and the P.R. sight (*Sect.* 5, *Chap.* 8).

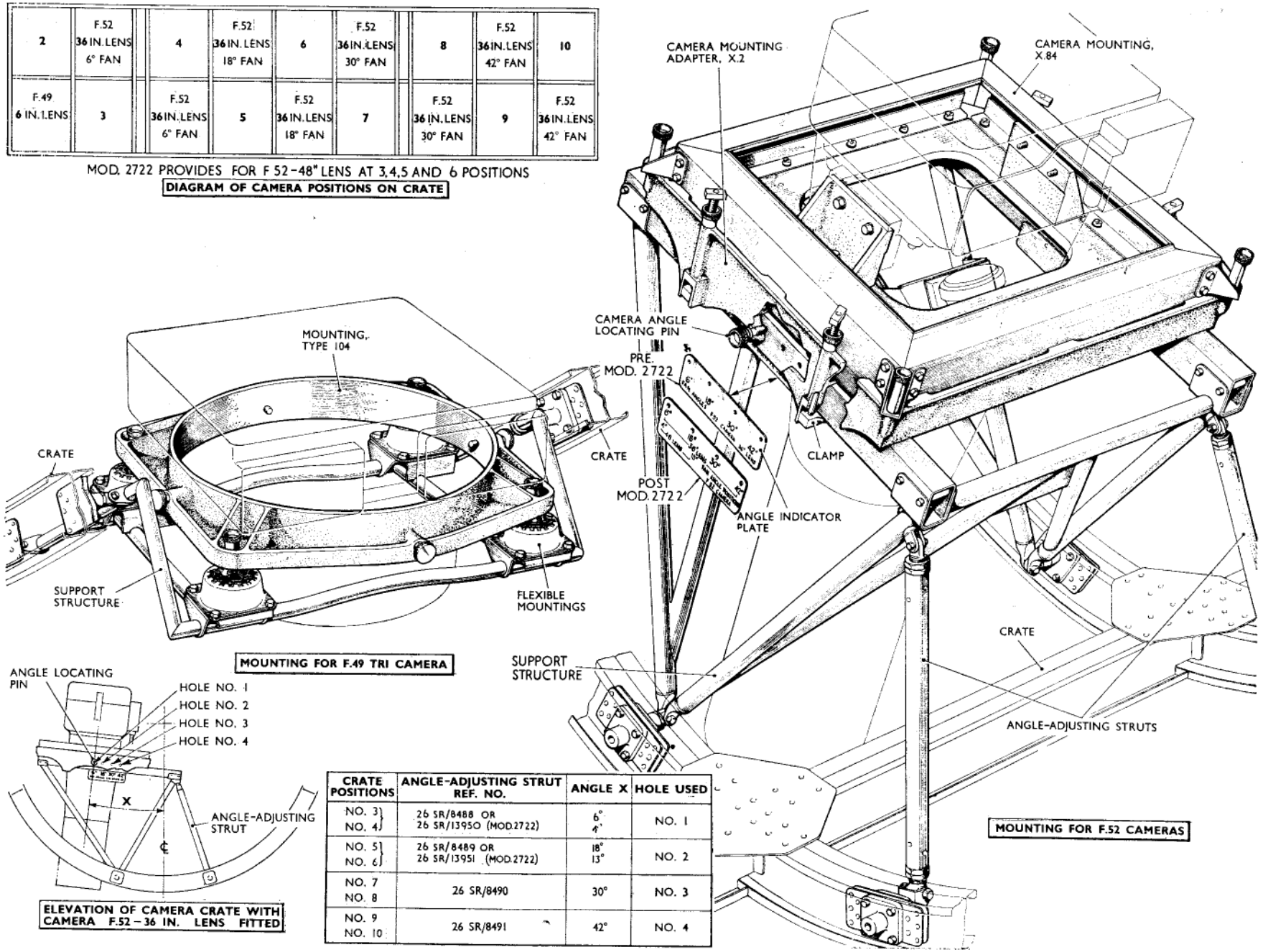
Reversion to basic P.R. role

18. For reversion to basic P.R. role, reverse the sequence of operations given in this appendix.

2	F.52 36 IN. LENS 6° FAN	4	F.52 36 IN. LENS 18° FAN	6	F.52 36 IN. LENS 30° FAN	8	F.52 36 IN. LENS 42° FAN	10
F.49 6 IN. LENS	3	F.52 36 IN. LENS 6° FAN	5	F.52 36 IN. LENS 18° FAN	7	F.52 36 IN. LENS 30° FAN	9	F.52 36 IN. LENS 42° FAN

MOD. 2722 PROVIDES FOR F 52–48" LENS AT 3, 4, 5 AND 6 POSITIONS

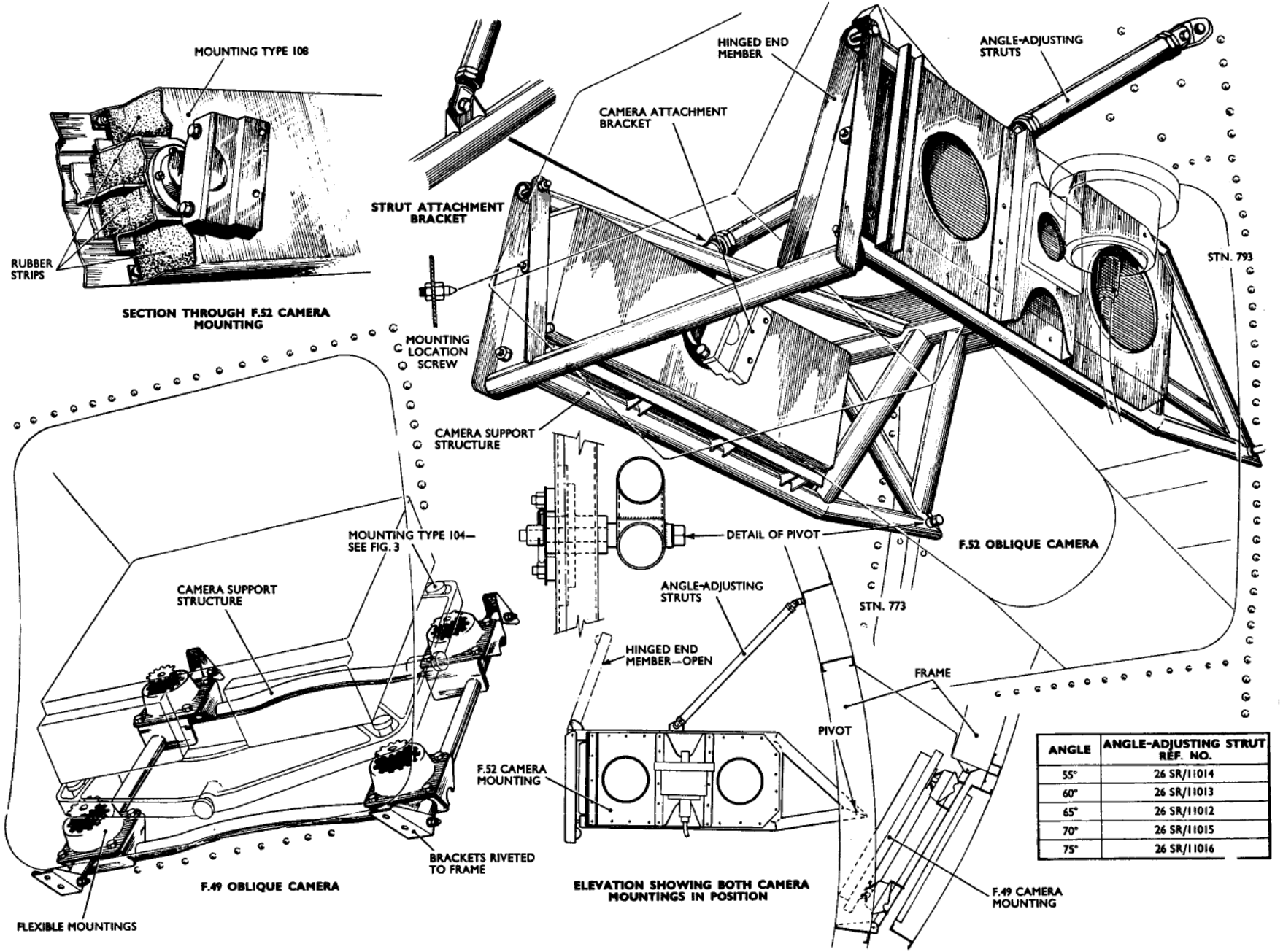
DIAGRAM OF CAMERA POSITIONS ON CRATE



ELEVATION OF CAMERA CRATE WITH CAMERA F.52 – 36 IN. LENS FITTED

CRATE POSITIONS	ANGLE-ADJUSTING STRUT REF. NO.	ANGLE X	HOLE USED
NO. 3 NO. 4	26 SR/8488 OR 26 SR/13950 (MOD.2722)	6° 4°	NO. 1
NO. 5 NO. 6	26 SR/8489 OR 26 SR/13951 (MOD.2722)	18° 13°	NO. 2
NO. 7 NO. 8	26 SR/8490	30°	NO. 3
NO. 9 NO. 10	26 SR/8491	42°	NO. 4

Fig. 3. Camera mountings in crate ◀Modified indicator plate▶



ANGLE	ANGLE-ADJUSTING STRUT REF. NO.
55°	26 SR/11014
60°	26 SR/11013
65°	26 SR/11012
70°	26 SR/11015
75°	26 SR/11016

Fig. 4. Oblique camera installations

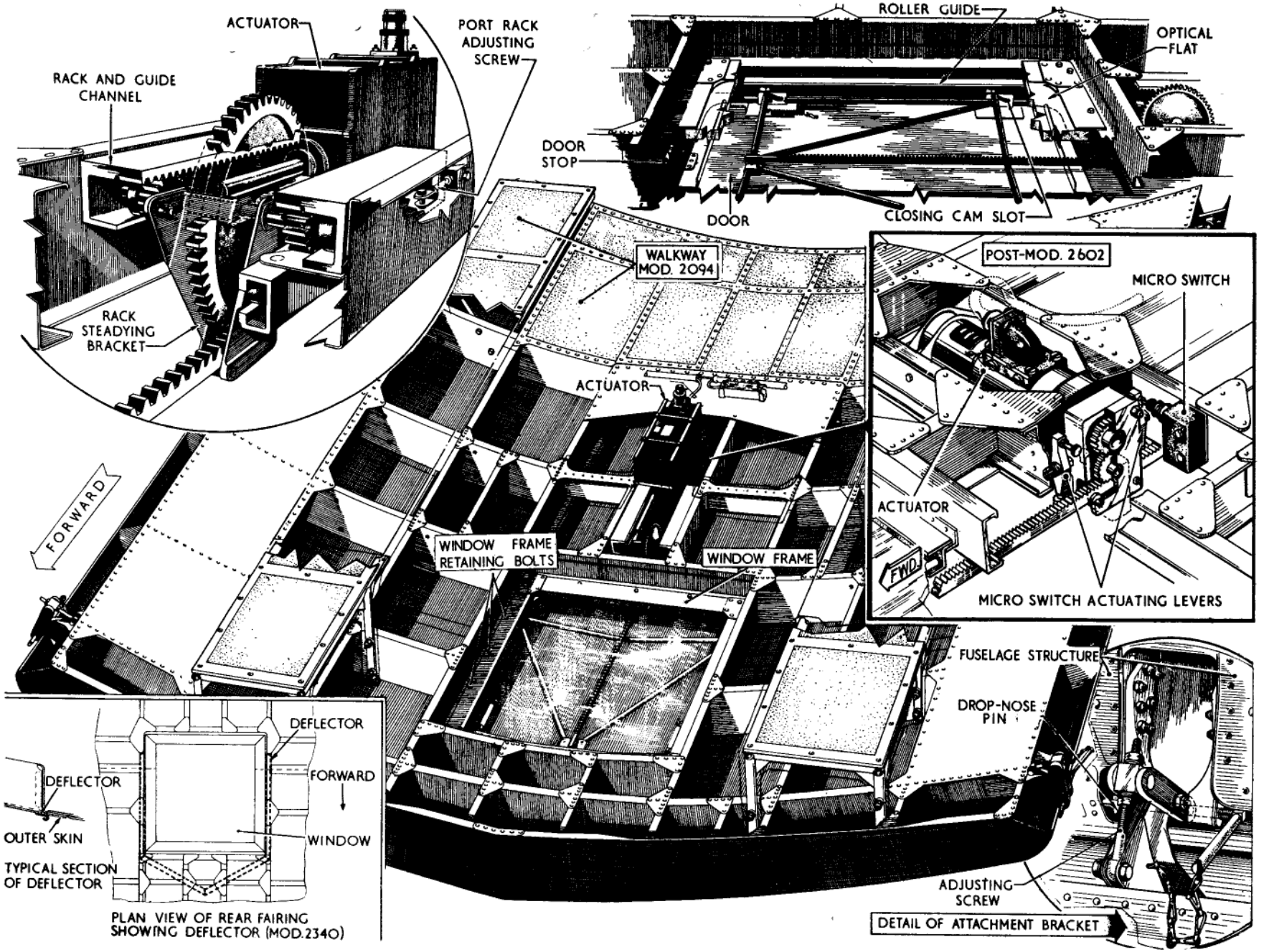


Fig. 5. Rear fairing

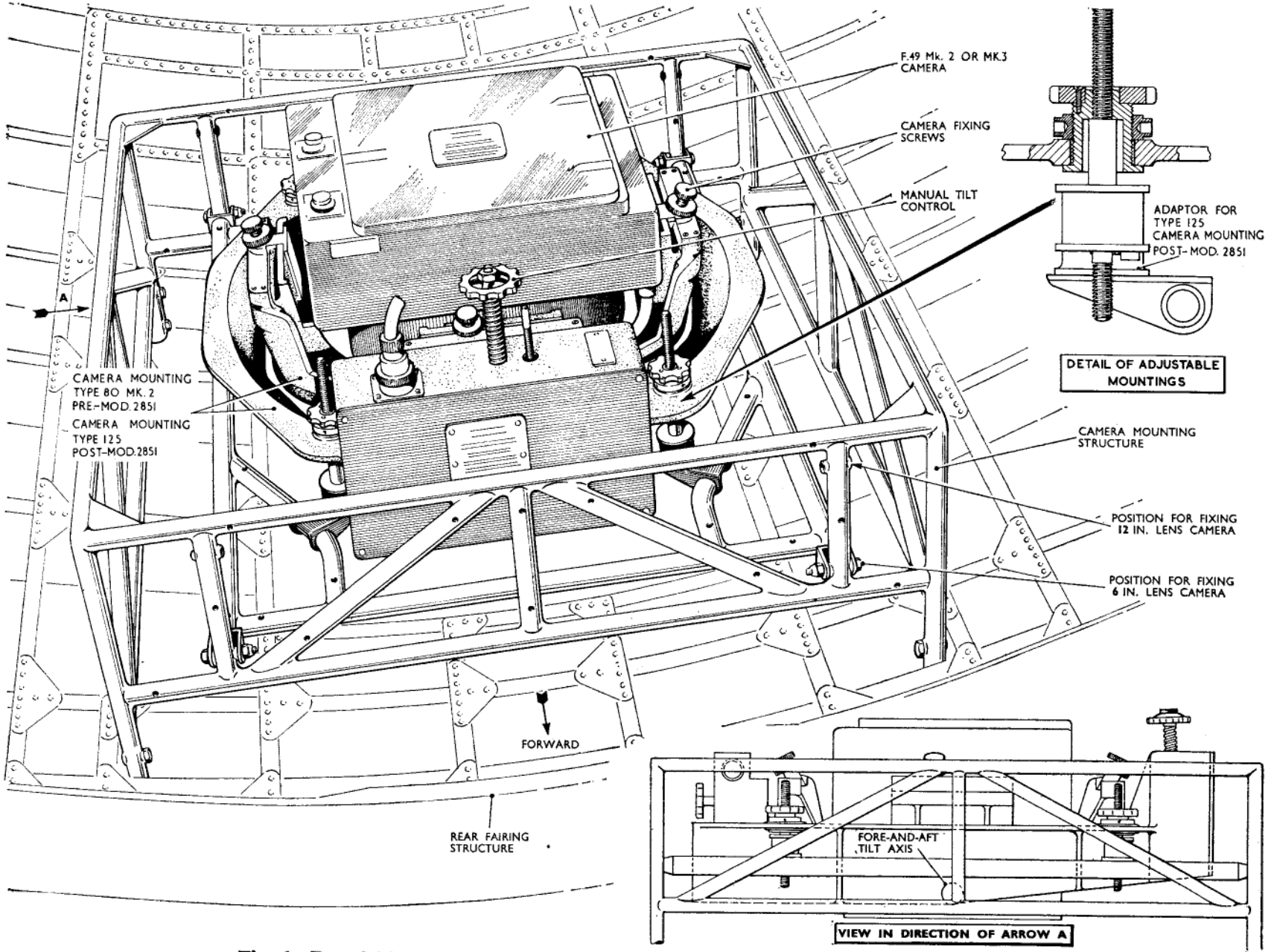


Fig. 6. Rear fairing camera mounting ◀Alternative camera mounting (post-Mod. 2851)▶

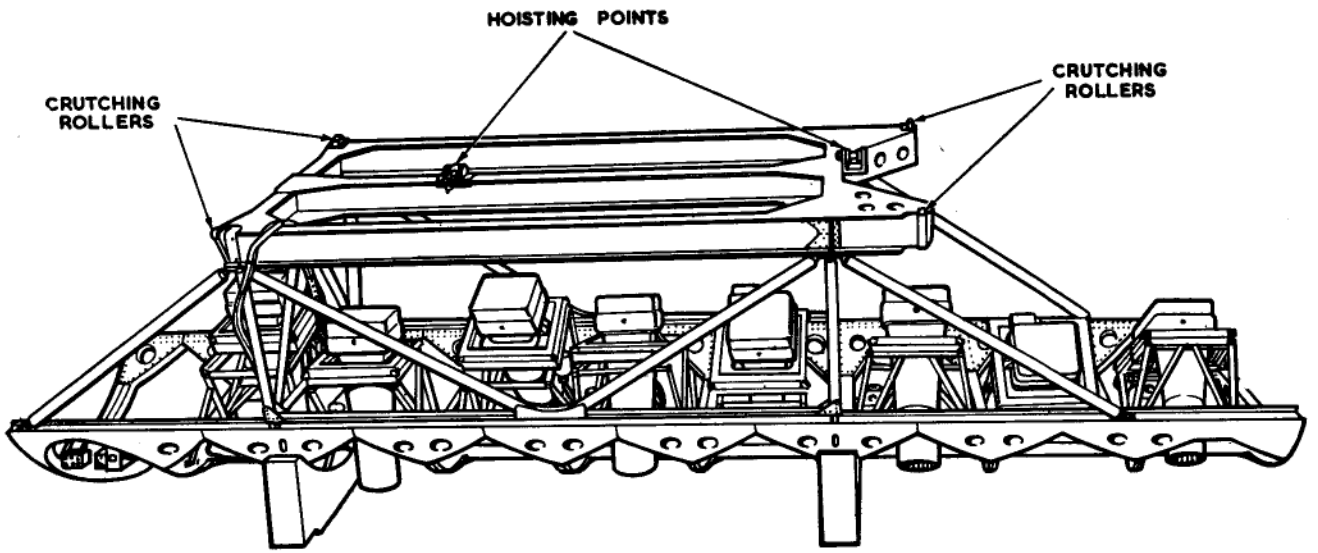


Fig. 7. Camera crate

Appendix 2 INSTALLATION OF NIGHT ROLE CAMERA CRATE AND ACCESSORIES

LIST OF CONTENTS

	Para.		Para.		Para.
Preparing the aircraft	2	*Flash crate*	6	*Isolating the rear transfer fuel tank*	10
Main camera mountings	3	*Fitting the flash crate crutches*	7	*Foot walk*	12
Photo-electric cells	4	*Fitting the flash crate hoist beam*	8	*Fitting the camera control panel*	13
Installing the camera crate	5	*Installing the flash crate*	9	*Reversion to basic P.R. role*	15

LIST OF ILLUSTRATIONS

	Fig.		Fig.
Night role camera arrangement	1	*Installation of night role camera crate and accessories*	4
Night role camera mounting in crate	2	*Fuselage flash crate*	5
P.E. cell mounting in crate	3		

TABLES

	Table
Angle adjusting struts (Night role camera crate)	1
Special conversion parts	2

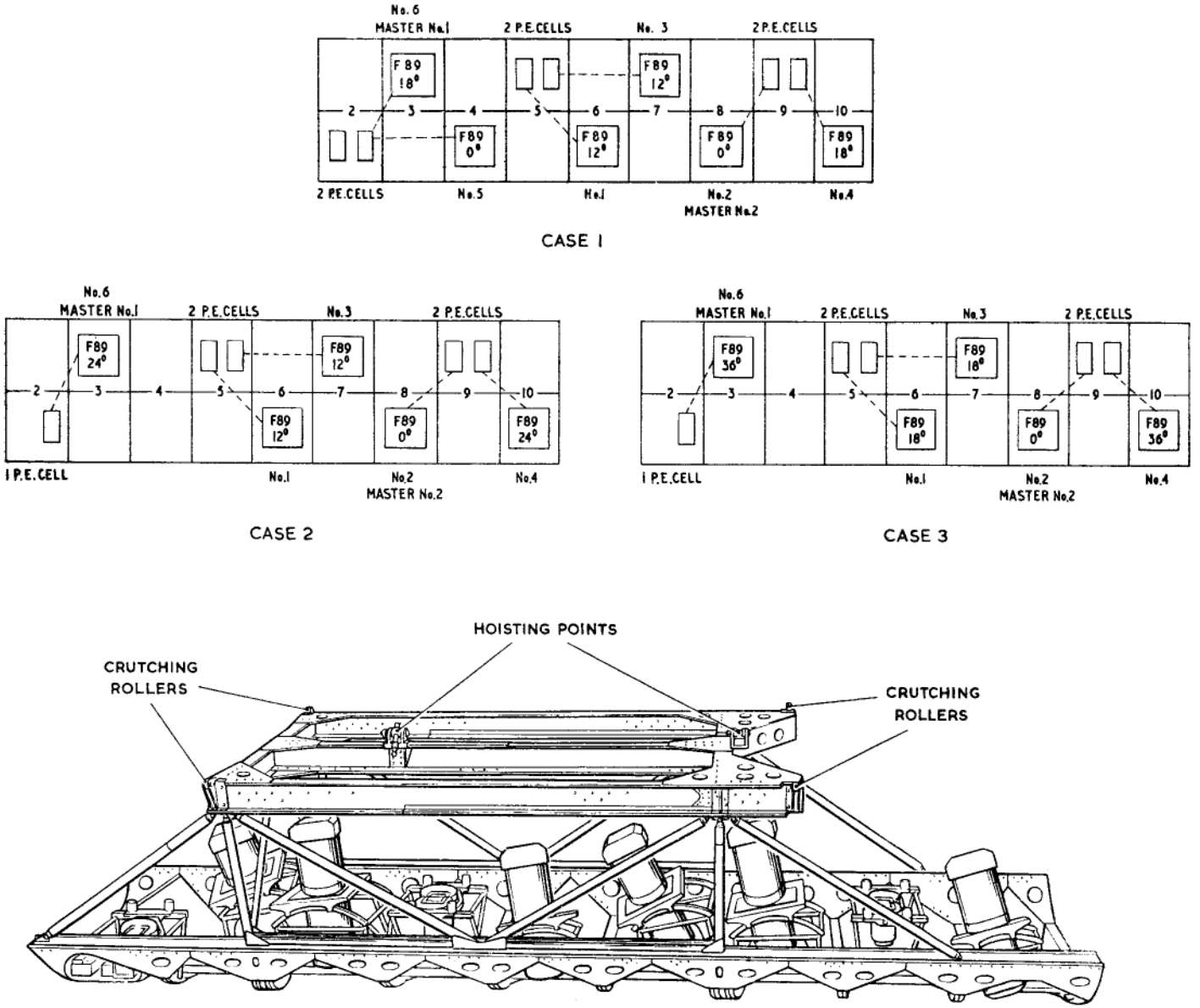


Fig. 1. Night role camera arrangement

1. In this Appendix the operations necessary to complete the conversion of a basic B/PR Mk. 1 and B/K/PR Mk. 1 aircraft to its Night role are detailed. These operations cannot be effected until the operations described in Chap. 5 have been completed. A list of the special conversion parts is given in Table 2, and fig. 4 shows the disposition of these items on the aircraft. Information on the electrical equipment and the various camera arrangements is contained in Vol. 1, Book 3, Sect. 5, Chap. 8.

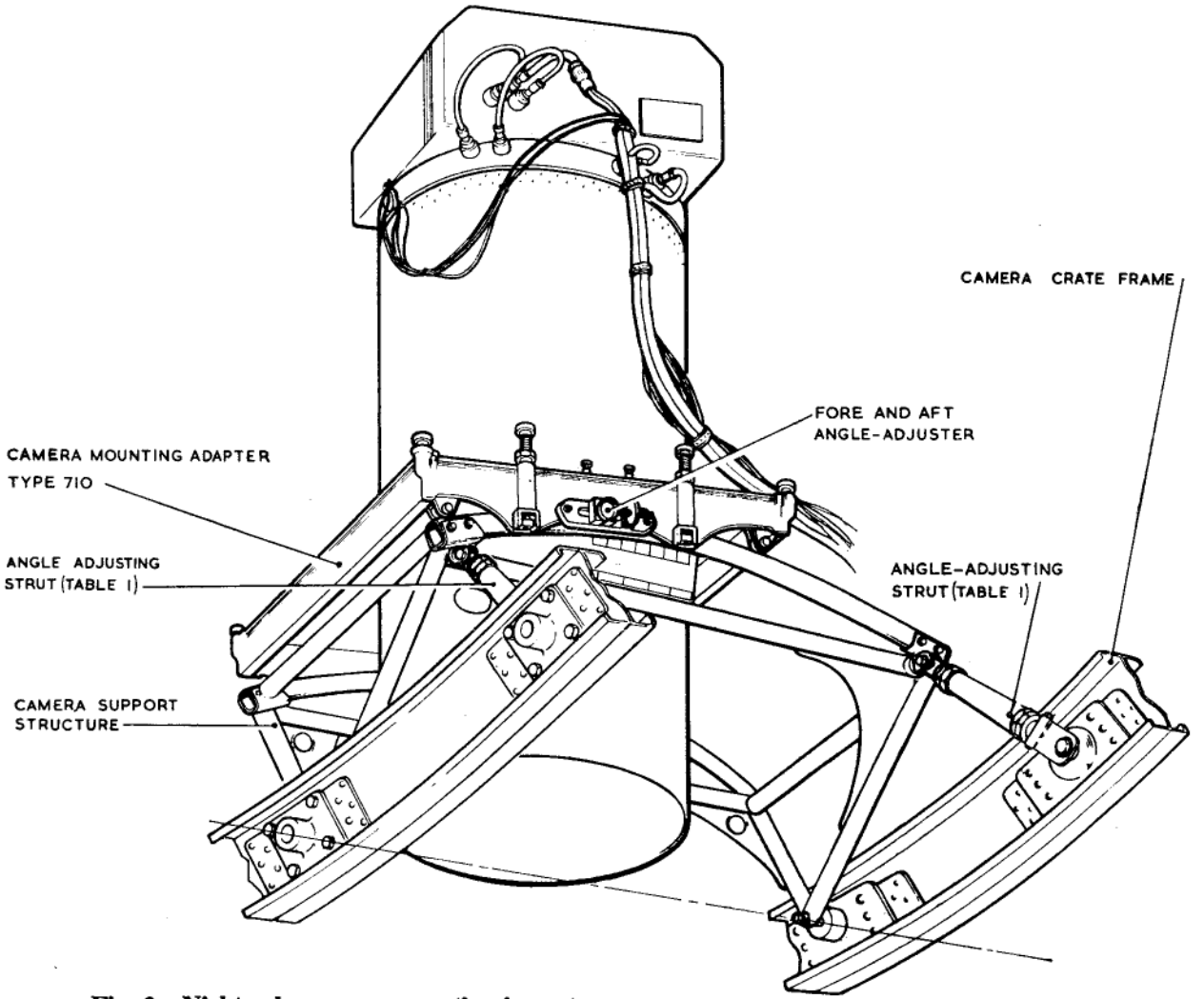


Fig. 2. Night role camera mounting in crate
◀Additional adjusting strut illustrated▶

Preparing the aircraft

2. The aircraft is prepared for the camera crate and fuselage flash crate installation as follows:—

(1) Effect the operations detailed in Appendix 1, para. 2, sub-para. (1) to (3) inclusive.

(2) Locate the rear heating inlet, port and starboard, at Stn. 763 (Mod. 2723b) and blank off in a manner similar to that described in Appendix 1, para. 2, sub-para. (3).

(3) Effect the operations detailed in Appendix 1, para. 2, sub-para. (4) to (7) inclusive.

Main camera mountings (*fig.* 2)

3. Each main camera mounting consists of a tubular structure, pivoted at its base, and carrying a camera adapter. The adapter is movable on the support structure curved rails, and may be locked to give the required fore-and-aft tilt according to its position relative to fixed angle-indicator plates. The athwartships angularity of the adapter, to suit the various Cases (*Chap.* 5) is governed by the lengths of the struts securing it to the camera crate frames ◀ (*Table* 1). A levelling bar (*Table* 2, *item* 14), used in conjunction with a clinometer, is provided for measuring the lateral angle when setting up the cameras. ▶

Photo-electric cells (*fig.* 3)

4. The photo-electric cell units, according to the various Cases (*Chap.* 5) are secured in *Type* 25 Mk. 2 mountings attached to the camera crate by tubular structures. Provision is made for tilt adjustment, both fore-and-aft and athwartships, knurled adjusting nuts being loosened and relocked at the required angles. These angles are indicated by a clinometer fitted to the cell upper surface and by a quadrant on the mounting.

Installing the camera crate (*fig.* 4)

5. The camera crate (*Table* 2, *item* 1), which has previously been fitted with all camera mountings, cameras, P.E. cells and wiring, is mounted in cradles on a transporter (26SR/95418) and is loaded as described in Appendix 1, para. 4.

Flash crate (*fig.* 5)

6. A flash crate, which can carry up to twenty-eight 8 in. photo-flashes, is fitted between the P.R. bomb doors and the deflector. The flash crate, fully described in A.P.1664A (2nd Edn.), Book 1, Sect. 2, must be loaded with flashes prior to hoisting into the aircraft.

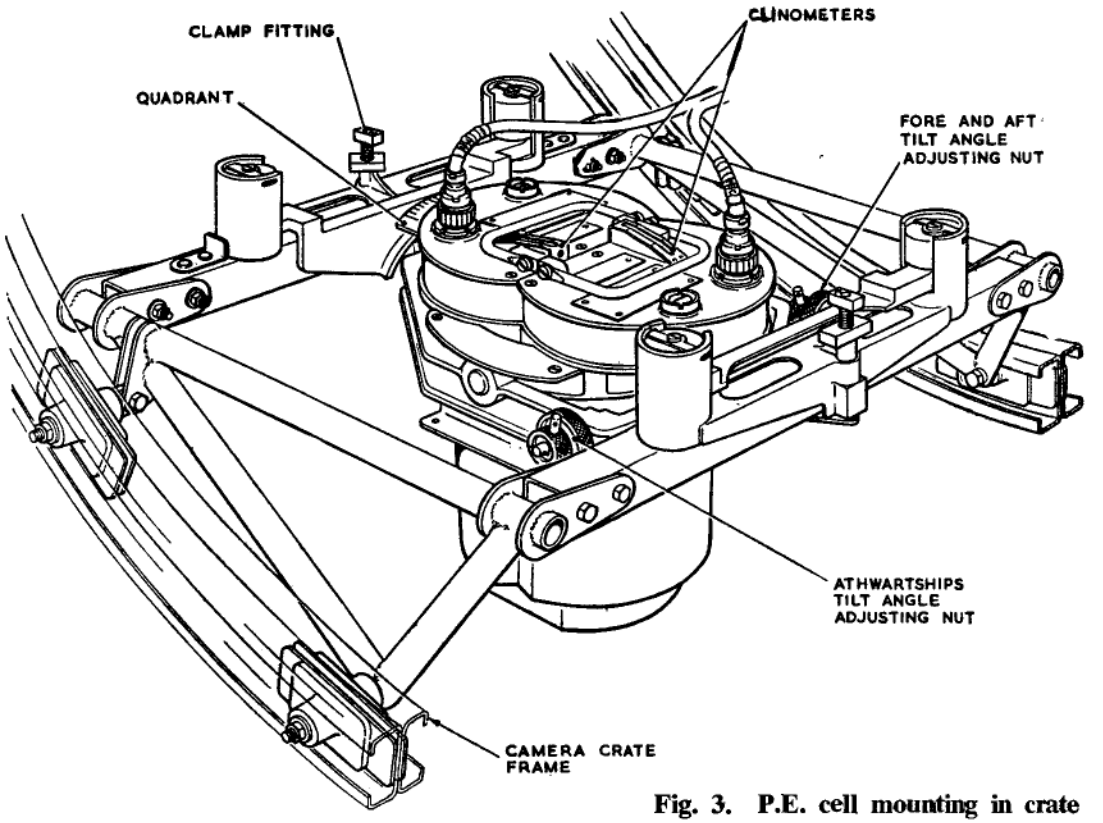


Fig. 3. P.E. cell mounting in crate

◀ **Table 1 Angle adjusting struts (night role camera crate)**

Position on crate	*Case (Fig. 1)*	*Camera*	*Strut Ref. No. Forward*	*Aft*	*Angle (deg.)*
No. 3	1	24 in.	26SR/10780	26SR/10781	18
	2	36 in.	26SR/10782	26SR/10783	24
	3	24 in.	26SR/10784	26SR/10785	36
No. 4	1	24 in.	26SR/10776	26SR/10777	0
No. 6	1 and 2	36 in.	26SR/10778	26SR/10786	12
	3	24 in.	26SR/10780	26SR/10787	18
No. 7	1 and 2	36 in.	26SR/10778	26SR/10779	12
	3	24 in.	26SR/10780	26SR/10781	18
No. 8	1 and 2	36 in.	26SR/10776	26SR/10777	0
	3	24 in.	26SR/12053	26SR/12053	0
No. 10	1	24 in.	26SR/10780	26SR/10781	18
	2	36 in.	26SR/10782	26SR/10783	24
	3	24 in.	26SR/10784	26SR/10785	36 ▶

Fitting the flash crate crutches

7. The rear crutches are *in situ* and located, port and starboard, at Stn. 793. The forward crutches (*Table* 2, *item* 2) are attached to the roof beam between Stn. 741 and 753 and are secured by quick-release pip-pins.

Fitting the flash crate hoist beam

8. The flash crate hoist beam (*Table* 2, *item* 3) is offered up and fitted to the bomb-bay roof beam strong points at Stn. 734·18 and 793; it is secured to the fixed fittings by pip-pins through the front and rear attachments. Access to the beam is then obtained through a panel in the bomb-bay roof.

Installing the flash crate (*fig.* 4)

9. The flash crate (*Table* 2, *item* 4), mounted on a transporter, is positioned in the bomb-bay rear end beneath No. 7 bomb hoist tunnel, and is loaded into position beneath the hoist beam, using a bomb hoisting crane, 16A/1931 or 2303, in conjunction with items 7, 8 and 11 in Table 2. The procedure for operating the crane and attaching the flash crate to the lifting eye is similar to that described in A.P.1664D (2nd Edn.), Part 1, Sect. 2, Chap. 8, 9 and 13. The gauge pressure ◀should be preset to give, at the hoist, a crutching load of 10,000 lb for a full crate, or 6000 lb if an empty crate is carried.▶

Note . . .

The aircraft must be jacked as in App. 1, para. 2, to allow the crate to be positioned beneath the hoisting gear, and must be lowered from the jacks before hoisting operations commence. In the final stages of hoisting care must be taken to avoid damaging the electrical connectors and housing.

Isolating the rear transfer fuel tank

10. When the flash crate is fitted there is a limitation on the amount of fuel which may be carried in the rear transfer fuel tank. When a full flash crate is carried, the transfer tank must remain empty. When the full flash load is not carried, fuel may be carried in the transfer tank provided that the total weight of fuel and flashes does not exceed the maximum permissible weight of flashes (*Sect.* 2, *Chap.* 3).

11. Mod. 2297 introduces a plug/socket joint at Stn. 807·15 in the electrical supply to the tank refuelling valve. When a full flash load is to be carried, this joint should be disconnected to ensure that the tank remains empty. Mod. 2818 introduces a separate refuelling switch at the fuselage port refuelling point for the rear transfer tank to enable partial loading to be more easily accomplished, the plug/socket (Mod. 2297) remaining connected.

Foot walk

12. Mod. 2724 introduces an improved cover, over the electrical cables along the centre beam of the night role camera crate, capable of taking the weight of servicing personnel when changing the camera magazines with the crate *in situ*.

Note . . .

Ensure that the above modification is incorporated before using the centre beam as a foot walk.

Fitting the camera control panel

13. The camera control panel is secured by ten bolts to the wall structure on the aircraft starboard side, just forward of the second navigator's station. For electrical connections refer to Book 3, Sect. 5, Chap. 8, Group 2.

14. Fit other necessary items of control equipment and the P.R. sight (*Sect.* 5, *Chap.* 8).

Reversion to basic P.R. role

15. For reversion to basic P.R. role, remove the items which were fitted as described in this Appendix.

TABLE 2

Special conversion parts

Item	*Description*	*No. off*	*Ref. No.*	*Part No.*
1	Camera crate (top section)	1		71079 Sht.5
	(bottom section)	1		71079 Sht.277
2	Front crutch fittings (flash crate)	2	11A/4425	71079 Sht.161
3	Flash crate hoist beam	1	11A/4424	
4	Flash crate	1	◀11A/4423▶	
5	Slinging beam for ground handling	1	26SR/95186	
6	Bearer for camera crate (Mod. GE.1944)	2	26SR/95188	
7	Load retaining mechanism	3	11A/4100	
8	Lifting eye	3	11A/4111	
9	Dummy slip	1	11A/4134	
10	"H" link	1	11A/4294	
11	Link fork c/w top pin (flash crate)	1	11A/4426	
12	Hoist link (camera crate)	1		71079 Sht.423
13	Cover	1	11A/4429	
◀14	Levelling bar (Mod. GE.2727)	1		71079 Sht.549▶

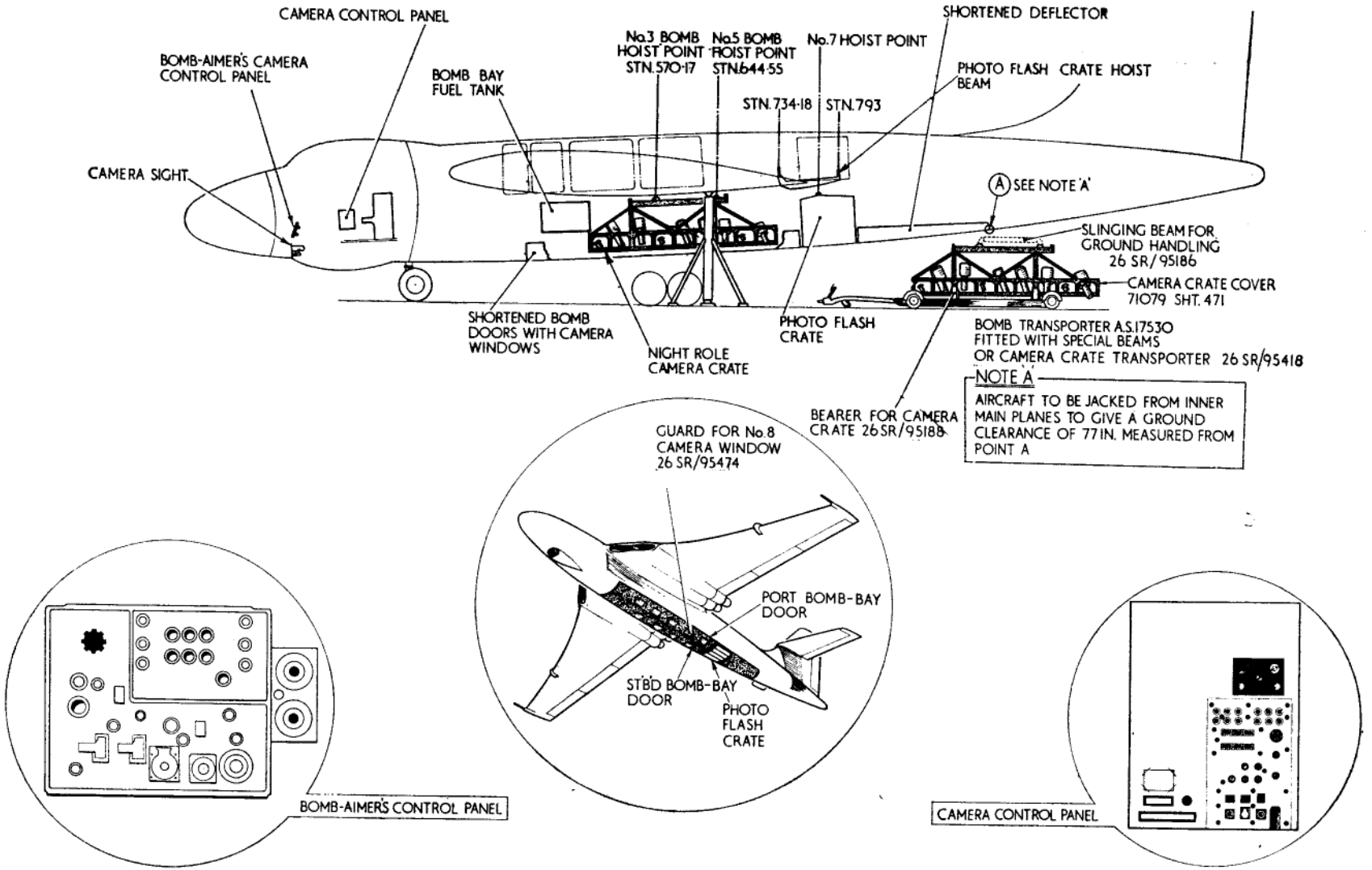


Fig. 4. Installation of night role camera crate and accessories

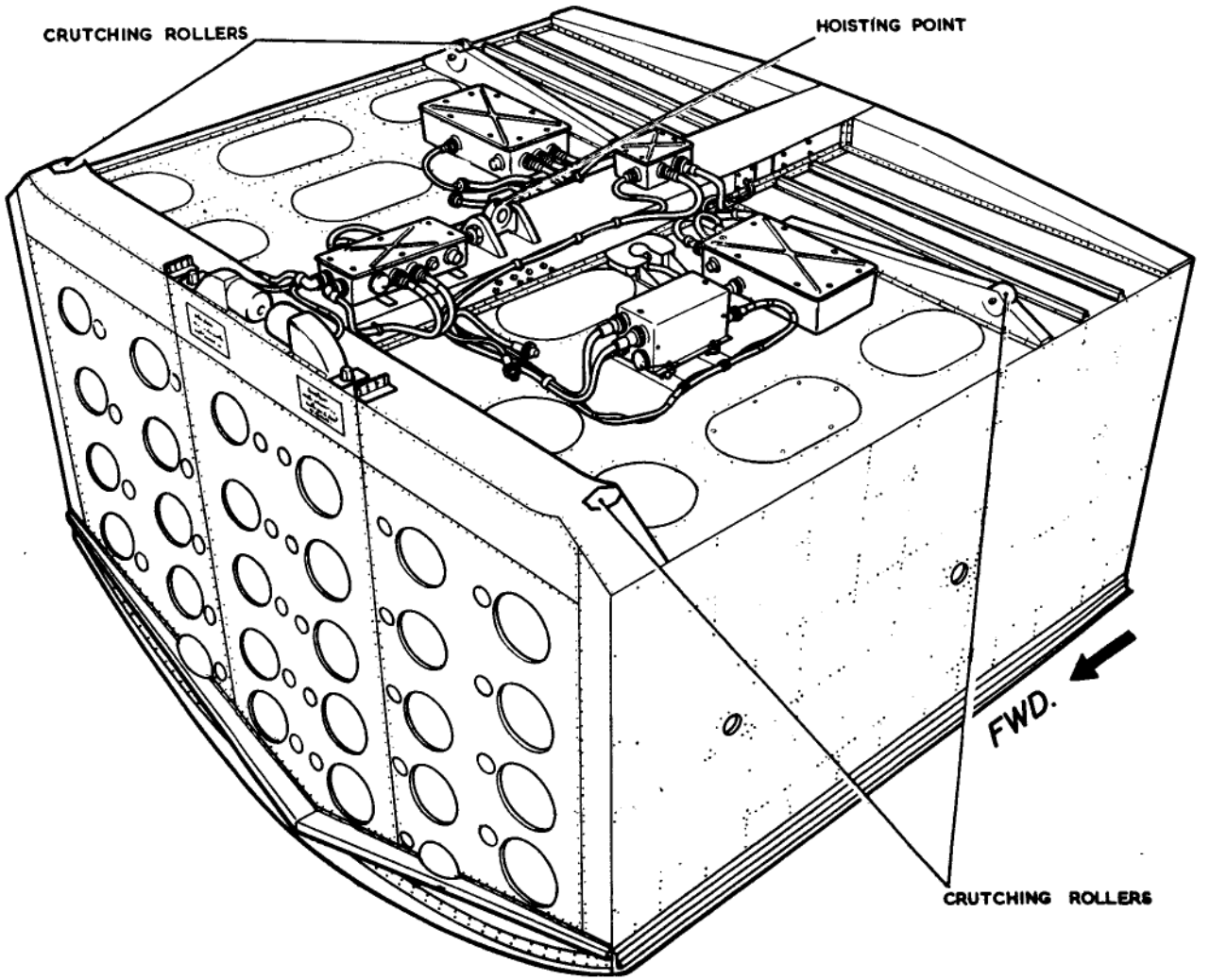


Fig. 5. Fuselage flash crate