Group 4—NIGHT ROLE

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Cross references:

Title	Reference
Bomb aimer's controls (common fixed wiring) (post Mod. 2573)	Group 2, fig. 21
Common fixed wiring in bomb bay (post Mod. 2691)	Group 2, fig. 19
Bomb aimer's controls (post Mods. 2229, 2249 and 2645), Chap. 3	Group 1, fig. 19

CAMERA INSTALLATION

Note . . .

The aircraft cannot be converted to the night role unless Mod. 2573, 2691 *and* 2800 *are incorporated. The following description assumes that these Mods. are incorporated.*

1. The night role camera crate has six F89 Mk. 3 cameras and six photo-cell units Mk. 3. There are three arrangements of these cameras as follows:—

(1) *Case* 1—for operating under uncertain target conditions, three of the cameras are fitted with 36-in. lens and the other three cameras with 24-in. lens, so that when the target area is reached, photography can be carried out using either group according to the prevailing conditions.

(2) *Case* 2—for high altitude photography under appropriate known target conditions, all six cameras are fitted with 36-in. lens.

(3) *Case* 3—for lower altitude photography when known target conditions prevent case 2 photography, all six cameras are fitted with 24-in. lens.

2. Two of the cameras are known as master cameras (*No.* 2 *and No.* 6) and supply pulses for releasing the photo-flashes. In case 1 there is a master camera in each group whilst in cases 2 and 3 either one of the two cameras may be used for flash pulsing. A selector switch on the control panel is provided to enable the selection of either camera to be made.

3. By the effect of a light flash on the photo-cell units, the photo-flashes are responsible for operating the camera shutters which work on the open-close-open cycle. A cam switch in the magazine of a master camera is used to pulse the flashes and is arranged to give 60 per cent picture overlap.

4. The photo-flashes are carried in a flash crate (*see A.P.*1664*A*, *Vol.* 1) which has a maximum capacity of 28 × 8-in. photo-flashes. The crate has to be loaded with flashes prior to being hoisted into the aircraft where it fits between the camera bay doors and the deflector. When carrying the flash crate, fuel must not be carried in the transfer tank; post Mod. 2297, a 2-pin connector has been fitted in the refuelling valve circuit for this tank (*see Chap.* 4, *Group* 2) and this must be disconnected before loading the flash crate.

5. All the cameras are provided with compensation for image movement over the focal plane during exposure. This is obtained by moving the film at a speed commensurate with the aircraft's ground speed and altitude, so that, during the exposure, the film is stationary to the ground image. Adjustments for aircraft ground speed and altitude are made on a common, remote controller on the control panel. A selector switch is provided on the panel so that the image movement compensation (I.M.C.) control circuits in any camera can be set up from the controller. In order to set up the cameras before photography is started, a MAGAZINE TEST switch is provided on the control panel. Once photography has been started, a continuous indication of the I.M.C. setting is given on the controller for any camera selected on the CAMERA SETTING SELECTOR switch. After each exposure, the film is moved rapidly to the next frame and as it does so, it pulses green lamps on the control panel and on the bomb aimer's panel. The lamps on the bomb aimer's panel are mounted on a detachable panel (Mod. 2702) secured to the main panel by the caps of six of the buried, edge-lighting lamps. When converting to the night role, a similar panel for the day role has first to be removed and then the night role panel fitted. The circuits to the lamps are broken, at a plug and socket break point mounted on a bracket secured to the back of the main panel. When converting back to either day role or bomber role, the night role panel must be replaced by the day role panel.

6. A FRAME WIND switch is provided on the control panel to enable the film to be wound at any time to the next frame. Since the shutters operate open-close-open, film is exposed as soon as the camera window doors are opened, thus by using the frame wind switch this exposed frame can be cleared before photography commences. There is no frame wind facility for individual cameras. The film contents indicator is combined with the ground speed indicator and reads on the correct scale when the 'film contents' button is depressed on the I.M.C. controller.

7. The flash release pulses from the master cameras also light the flash pulsing indicator lamps and energize the FLASHES PULSED counters on the control panels. The pulsing indicators give a quick indication that the system is working smoothly and the counters record the number of flash release signals made. As the flashes burst, the camera shutters operate and for each shutter operation the exposure counters are energized so that a record of the number of exposures is made. A single FLASHES REMAINING indicator on the control panel keeps a record of the flashes remaining in the flash crate.

8. Due to the time taken for the flashes to fall to burst altitude, it is necessary to stop photography in two stages. Both FLASH STOP and CAMERA STOP switches are provided. The FLASH STOP switch is operated first to

prevent any more flashes being released. When the required number of flashes have been released the FLASH STOP switch should be operated. After all these flashes have burst the CAMERA STOP switch can be operated. The number of unburst flashes in the air is given by the difference in readings of the flashes pulsed counter and the exposures counter.

9. The camera control is electrically interlocked with the flash crate doors and the camera window doors. There is no power on the camera control circuits until the camera window doors are open and the cameras and flash release cannot be started until the flash crate doors are open. Each camera has a selector switch so that any camera can be selected or stopped individually as required.

10. The main and bomb aimer's control panels and the camera lamp panel on the bomb aimer's panel are illuminated on the edge-lighting principle by lamps buried in the panels which are made of 'Cobex'; for the circuit description see Group 2.

SEQUENCE OF OPERATION

11. The following have to be determined before flight.

(1) Fitting of cameras with 24-in. or 36-in. lenses to suit case 1, 2 and 3 as applicable.

(2) Setting up the cameras to the correct fore-and-aft tilts according to the proposed speed and altitude of the aircraft (*for settings, see A.P.1355C, Vol. 1; for method of adjusting the camera angles see Book 1 of this A.P.*).

(3) Setting up the photo-cell units to point at flash burst according to the proposed speed and altitude of the aircraft and the ballistics of the flashes to be used (*for settings see A.P.1355C, Vol. 1; for method of adjusting the photo-cell unit angles see Book 1 of this A.P.*).

(4) Setting the FLASHES PULSED and EXPOSURES counters to zero and the FLASHES REMAINING counter to the number of flashes being carried.

(5) Setting up the I.M.C. by selecting the MAGAZINE TEST switch to TEST and then setting up ground speed and altitude for each camera in turn, as selected by the CAMERA SETTING SELECTOR switch, by adjusting the appropriate controls on the I.M.C. controller. It should be noted that for case 1 photography the I.M.C. settings will be different for the two groups of cameras.

(6) Setting up the FILM CONTENTS counter to the length of film to be carried in the camera magazines.

12. Assuming that the sighting head is to be used, the sequence of operation is as follows:—

(1) Adjust the illumination of the control panels to suit by means of the dimmers provided.

(2) Switch on the sight gyro.

(3) Switch on and adjust the sight lighting.

(4) Using the sight and repeater compass to obtain correct track, open the camera window doors, using either switch, on approaching the target. This will close all the camera master supplies.

(5) Check the I.M.C. settings for all cameras against the aircraft's actual ground speed and altitude. Adjust if necessary.

(6) Close the camera selector switches as required for case 1, 2 or 3.

(7) Select the master camera required on the MASTER CAMERA switch.

Note . . .

The correct master camera must be selected for the group to be used in case 1 photography.

◄ (8) Item deleted. ►

(9) Open the flash crate doors by selecting the BOMB DOOR switch to OPEN.

(10) If thought necessary, operate the FRAME WIND switch immediately prior to commencing photography.

(11) Close either CAMERA START AND FLASH RELEASE switch when approaching the target area according to aircraft altitude, speed and flash ballistic requirements.

(12) The flash pulsing indicator lamp will pulse steadily as flashes are released and the FLASHES PULSED and FLASHES REMAINING counters will count simultaneously.

(13) As the camera shutters operate the EXPOSURES counters will count up. After each exposure the frames are wound over and the green lamps for the cameras in use should pulse. The amount of film left in the magazine of any camera can be checked at any time, by selecting the camera concerned on the CAMERA SETTING SELECTOR switch and depressing the FILM CONTENTS push-switch on the I.M.C. controller. The amount of film will be indicated on the appropriate scale of the ground speed indicator on the I.M.C. controller.

(14) Photography can be stopped at any time by first operating either FLASH STOP switch and then, when the number of exposures equals the number of flashes released as shown on the counters, by operating either CAMERA STOP switch.

(15) Photography can be recommenced by re-operating either START switch.

(16) The FLASHES ALL GONE indicator will show when all the flashes have been released; photography is then complete. The STOP switches should then be operated and the flash crate doors closed.

(17) It is important that the camera window doors are closed when photography is completed as this ensures that all camera supplies are isolated.

(18) All flashes may be jettisoned at any time before or during photography by operating the BOMB JETTISON switch on the control pedestal.

FLASH CRATE DOORS (*fig.* 1)

13. The flash crate doors are controlled by the bomb door control switch or the bomb jettison control switch, both on the control pedestal. The circuits are electrically interlocked with the camera control circuits so that the cameras cannot operate unless the doors are open.

Normal open (*fig.* 1 *and Group* 2, *fig.* 1)

14. When the BOMB DOOR control switch is selected OPEN (*Group* 2, *fig.* 1), it connects a supply from panel D via the bomb door trip switch and the jettison switch, both in their NORMAL position, through the change-of-role plug and socket at P.R. (Pin E) through the flash crate door *open* limit switch E (*made across* 2-1) to the normal open relay R1 in the flash crate (*fig.* 1).

15. Contacts R1/1 of this relay close to connect a supply from panel Z to the *open* coil R5 of door motor A reversing relay, whilst contacts R1/2 close to connect a separate supply from panel Z to the *open* coil R7 of the door motor B reversing relay. Both the reversing relays are on the flash crate.

16. The two reversing relays operate to connect separate 112-volt supplies from panel J to their respective motors. It should be noted that the motors rotate in opposite directions.

17. When the open position is reached, the door open limit switch E is operated to make on its contacts 2-3 thus disconnecting the normal *open* relay R1. This relay drops out, in turn, to disconnect the reversing relay *open* fields and hence disconnect and stop the motors.

Normal close (*fig.* 1 *and Group* 2, *fig.* 1)

18. When the door control switch is selected CLOSE, its supply is connected through the flash crate door *close* limit switch G (made across 5-4 when the doors reach the ' open ' position) to the coil R2 of the normal *close* relay.

19. The normal *close* relay closes its contacts R2/1 and R2/2 to connect separate supplies to the motor A and motor B reversing relay *close* coils R6 and R8. These close in turn to connect 112-volt supplies to their respective motors. The motors rotate in opposite directions to close the doors.

20. On reaching the closed position, the door *close* limit switch G is operated to make on its contacts 5-6, so disconnecting the normal *close* relay R2 and, in turn, the reversing relay *close* coils and the two motors.

Jettison open (*fig.* 1 *and Group* 2, *fig.* 1)

21. Under jettison conditions, when it is required to jettison the flashes in an emergency, the doors come under the control of the bomb door time switch which is mounted, together with its associated auto-close relay, Type S2, on the 24-volt battery control panel at the forward end of the bomb bay.

22. When the BOMB DOOR JETTISON switch (*Group* 2, *fig.* 1) is placed to JETTISON, a supply from panel E is connected to the positive side of all the contacts of the auto-close relay R1 (*Group* 2, *fig.* 1). The same supply is permanently connected to the positive side of contacts A and B of the time switch (terminal 2).

23. One of the two normally closed contacts R1/2 of the auto-close relay is connected to the time switch motor which closes contact A within 10 seconds of starting. This contact A which remains closed until 40 seconds from the time of the switch starting, provides a hold-in supply to the time switch motor during the complete sequence of the bomb jettison operation.

24. The other normally closed contact R1/4 of the auto-close relay is connected to the flash crate flash jettison relays via the door *open* limit switches, which are *made* when the doors reach the open position. Contact R1/4 is also connected, via pins D and F of the change-of-role plug and socket at P.R. through the flash crate door *open* limit switch F (made across 5-4 with the doors closed) to the jettison *open* relay R3 on the flash crate.

25. The jettison *open* relay closes its two contacts R3/1-2 to connect separate supplies from panel Z to motors A and B reversing relay *open* coils R5 and R7. The reversing relays operate to connect separate 112-volt supplies from panel J to their respective motors. The motors rotate in opposite directions to open the doors.

26. Door limit switch F is made across 5-6 when the doors reach the open position, so disconnecting the jettison *open* relay R3 and, in turn, the reversing relay *open* coils and the two motors.

Note . . .

Mod. 2484 *introduces an extra* JETTISON *switch connected in series with pole* 4-5-6 *of the original switch. This switch is mechanically linked to the original switch.*

Jettison close (*fig.* 1 *and Group* 2, *fig.* 1)

27. The flashes will be jettisoned automatically as the doors reach the open position. Whilst the doors have been opening, the time switch has been operating, contact B closing 20 seconds after it started. This allows sufficient time for the doors to open and the flashes to be jettisoned. When contact B closes, it connects the supply from the jettison switch to the coil of the auto-close relay R1 (*Group* 2, *fig.* 1). Contact R1/2 and 4 open, and R1/1 closes to maintain a hold-in supply for coil R1.

28. Contact B of the time switch also connects its supply (maintained via contact R1/1 of the auto-close relay) to the flash crate door *close* limit switch H (made across

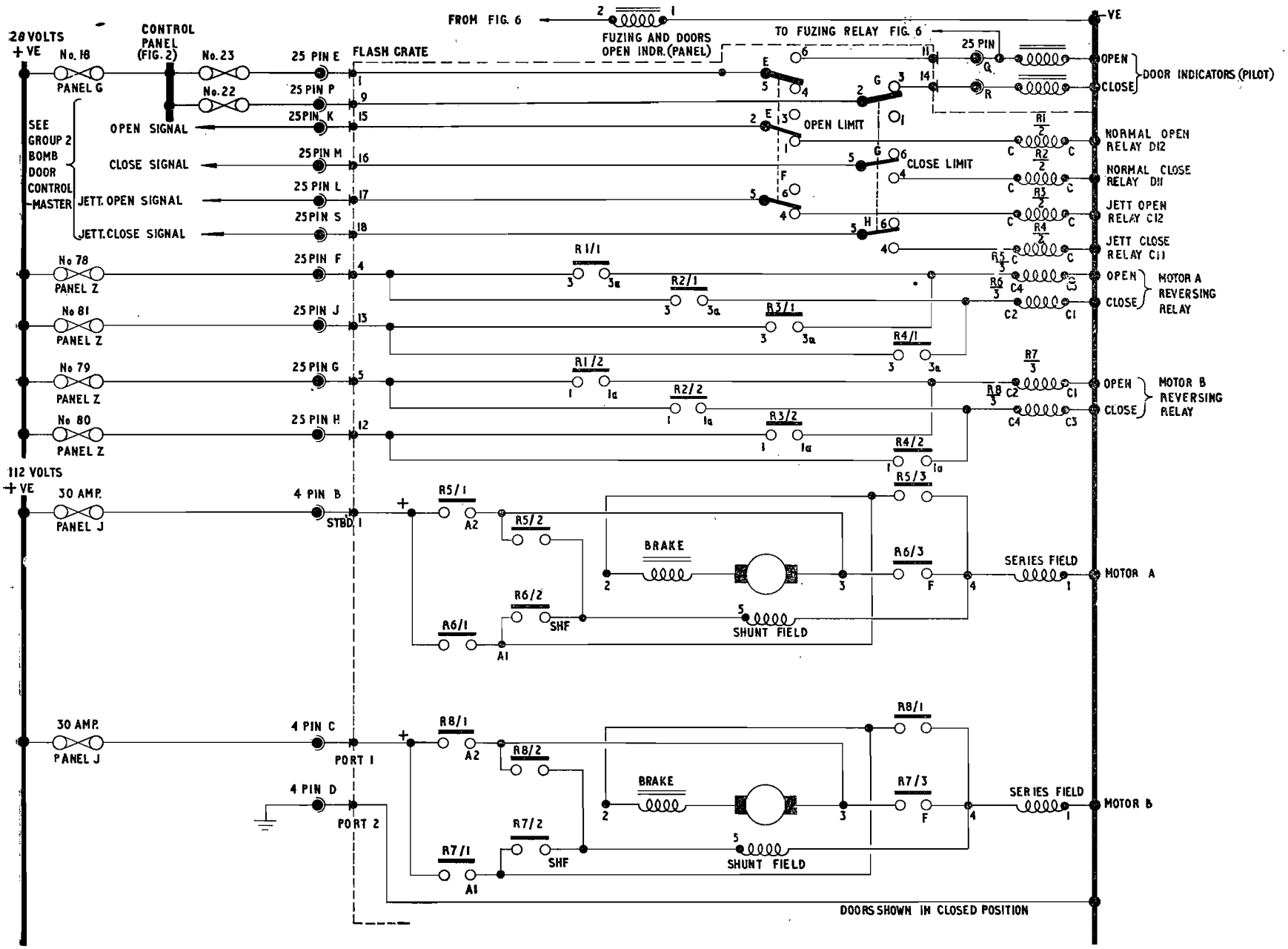

Fig. 1. Flash crate doors

5-4 when the doors are open) to the jettison *close* relay R4 on the flash crate.

29. The jettison *close* relay closes its contacts R4/1 and R4/2 to connect the supplies from panel Z to the motor A and B reversing relay *close* coils R6 and R8. These close in turn to connect 112-volt supplies to their respective motors. The motors rotate in opposite directions to close the doors.

30. On reaching the closed position, the door close limit switch H is operated to make on its contacts 5-6 so disconnecting the normal close relay R4, and, in turn, the reversing relay *close* coils and the two motors. The time switch which is still operating opens its contacts B and A, 25 seconds and 40 seconds respectively after starting. When contact A opens, the time switch is stopped. The auto-close relay holds-in until the JETTISON switch is selected NORMAL thus preventing repetition of the jettison cycle.

Indicators (*fig.* 1)

Note . . .

The indicators, open and closed (pre-Mod. 2645 *or* 2725), *provided on the starboard side of the radio crate for the flash crate are not in circuit and are consequently not operational.*

31. Open and closed position indicators of the magnetic type are provided below the fuel panel for the pilot and a single OPEN/CLOSED indicator is provided on the control panel. The pilot's open indicators and the panel OPEN/CLOSED indicator are in parallel, controlled by the door *open* limit switch E, which makes on 5-6 when the doors are open, to connect the supply from fuse 23 on panel Z.

31A. The doors OPEN/CLOSED indicator on the control panel is also used to indicate that the flash fuzing strips in the flash crate are 'live'. Reference to fig. 6 shows that door limit switch E (4, 5, 6) controls the fuzing relay in addition to the pilot's doors open indicator; it can therefore be implied that if the fuzing strips are 'live' the doors must be open. The indicator supply is obtained via the contacts of the flash fuzing relay D10 on the flash crate so that when the doors have opened and the fuzing relays are energized the indicator will be energized to show white.

32. The pilot's CLOSED indicator is controlled by the door *closed* limit switch G, which makes on 2-3 when the doors are closed, to connect the 28-volt supply from fuse 22 on the control panel. All indicators show black—closed and white—open.

33. Since the pilot's flash crate door open indicator circuit and the bomb bay door OPEN/CLOSED indicator circuit are required to feed signals to the fuzing protective relay unit pin E (panel K, connection BH.2) for fuzing requirements, it is necessary to break either one of these circuits when operating as a bomber or as a P.R. aircraft in order to prevent feedback signals from energizing both sets of indicators when only one set of doors is operated.

34. This is achieved by the change-of-role plug and socket and connections made by fitting the night role control panel. When operating as a P.R. the bomb bay door indicator circuit is broken by pin G of the change-of-role plug when fitted to the P.R. socket and the flash crate door open indicator circuit is completed when the night role control panel is fitted.

35. When converting back to a bomber, the flash crate door open indicator circuit is broken when the night role panel is removed, and the bomb bay door indicator circuit is complete when the change-of-role plug is fitted to the *bomber* socket.

CAMERA CONTROL POWER SUPPLIES (*fig.* 2)

36. Apart from fuses 16-18 on the main control panel, all the camera control supplies are interlocked with the camera window doors. These supplies are obtained from fuses 1-15 on the control panel and main cameras circuit-breakers on the change-of-role panel in the battery bay.

37. Fuses 16, 17 and 18 on the control panel are supplied, in parallel with the window door control switch, from a fuse on panel G. Fuses 19-24 on the control panel are supplied from fuse 33 on panel G. When the camera window doors are selected open, the supply from panel G is connected to the DOORS SELECTED OPEN AND POWER ON indicators and to the coil R2 of relay A. This supply is maintained by the contacts of the door master relay (*see Group* 2) via the normally closed contact R1/1 of relay B.

38. Relay A contact R2/1 closes to connect a supply from fuse 18 on panel G to the coil R3 of the camera supply circuit-breaker type D in the battery bay. Contact R3/1 of this circuit-breaker opens to introduce an economy coil in series with the pull-in coil R3. Contact R3/2 (incorporating a thermal element) closes to connect a supply direct from the 28-volt battery line to the main cameras circuit-breakers on the change-of-role panel and to fuses 1-15 on the control panel. The thermal element in the circuit-breaker is the only main power protection for the complete camera system.

39. These supplies are maintained under all normal conditions until the WINDOW DOORS switch is selected CLOSE. This energizes the coil R1 of relay B, the contact R1/1 of which opens to break the hold-in supply to the coil R2 of relay A. Relay A thus de-energized opens its contact R2/1 to break the supply to the camera supply circuit-breaker R3 and the main supplies are thereby isolated.

CAMERA CONTROL (*fig.* 3)

Notes . . .

(1) *A schematic diagram of the F*89 *Mk.* 3 *camera internal wiring is given in fig.* 3 *to assist in understanding the circuits and is not necessarily subject to amendment action following possible modifications to the cameras. Reference should always be made to A.P.*1355*C, Vol.* 1, *Sect.* 2, *Chap.* 6, *when tracing circuits in the*

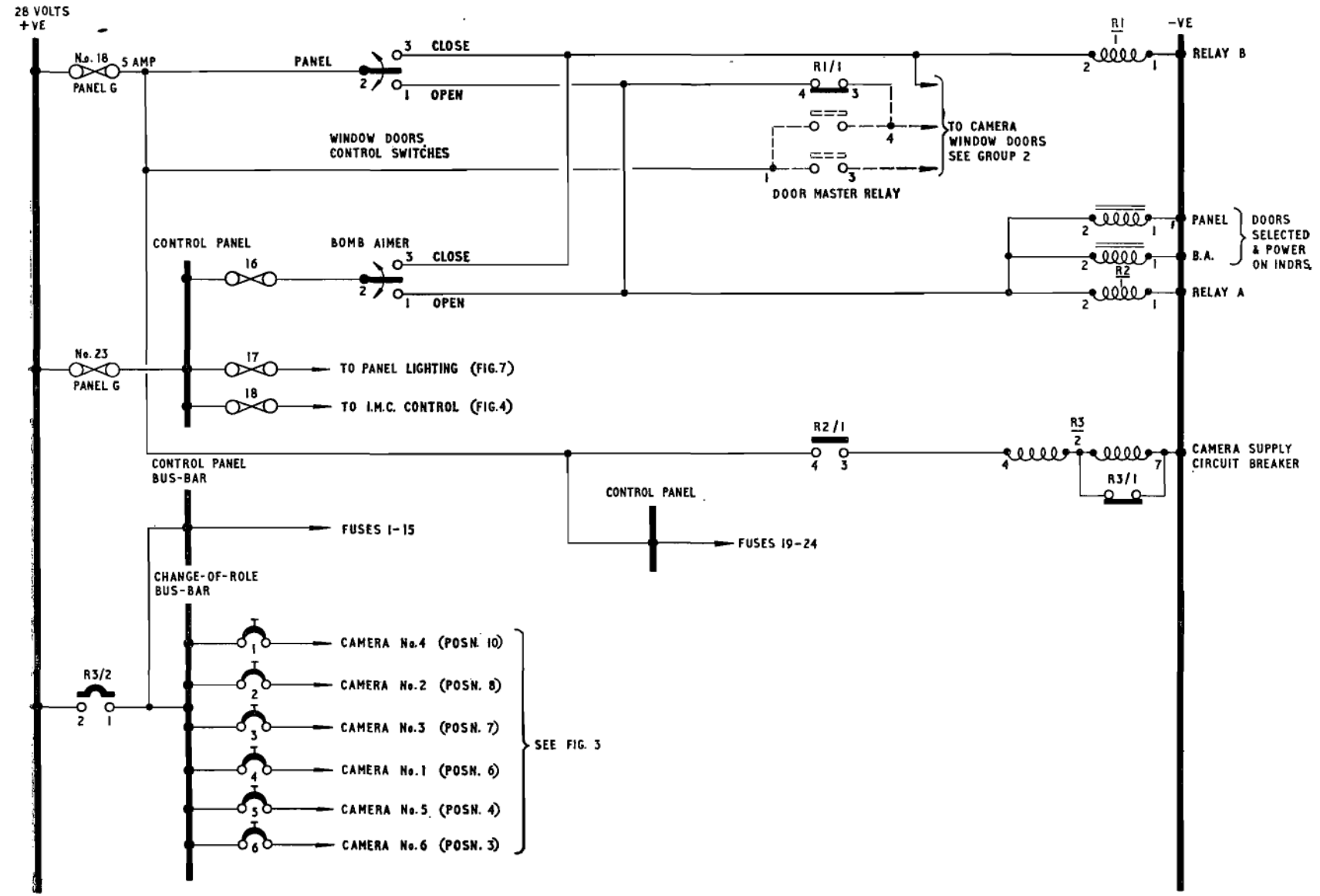

Fig. 2. Camera power supplies

camera. It should be noted that the internal wiring of the P.E. cell unit is not shown.

(2) *A complete list of the functions of all the relays associated with the camera circuits is given in Table 2. For obvious reasons, all the contacts of all these relays are not shown in the schematic diagrams. Where a number of relays have similar functions for individual cameras a representative circuit is shown for one of the relays only.*

40. None of the cameras can be operated until the flash crate doors are fully open. This is achieved by means of relay G which is energized via the door limit switch E. When the flash crate doors reach the open position, limit switch E is made across its contacts 5-6 to connect a supply (from ◀ fuse 23 on the control panel) to the coil R4 of relay G. Pre Mod. 2917, this supply was routed through the fuzing protective relay unit (pins E and H) or the stowage for the connector to the unit. When the protective relay unit was not fitted, pins E and H of the mating connector are shorted by the stowage for this connector (post Mod. 1980) or by linking together terminals BH.1 and BG.8 on panel J (pre Mod. 1980). ▶

41. Relay G, thus energized, closes its contact R4/1 to close the circuit between the start switches and the coils R5, R6 and R7 respectively of relays F, H and J. Unless this relay is energized relays F, H and J cannot be energized and the cameras cannot be operated.

42. Once the flash crate doors and the camera window doors are open, the cameras can be operated, the cameras to be used being selected by the camera selector switches. Pole 1, 2, 3 of each selector switch controls the film drive, I.M.C. control and wind-over supply to its relative camera and is separately fused at the control panel bus-bar. Pole 4, 5, 6 of each selector switch controls the photo-electric cell supplies and is fed in parallel from fuse No. 1 at the control panel bus-bar; these supplies are otherwise unswitched and are connected when the camera window doors are opened.

43. When a CAMERA START AND FLASH RELEASE switch is operated, a supply from the control panel bus-bar is connected via contact R4/1 of relay G (closed with the flash crate doors open) to the coils R5, R6 and R7 respectively of relays F, H and J. The supply to these relays is maintained when the start switch is released by contact R7/1 of relay J via the two CAMERA STOP switches in series. Contacts of relays H and J close (*see table* 2) to connect the positive supplies from poles 1, 2, 3 of the camera master switches to their respective camera film drive and I.M.C. control circuits as illustrated in fig. 3 for camera No. 1 by contact R7/2 of relay J.

44. The camera shutter supplies are unswitched and are connected via circuit-breakers on the change-of-role bus-bar as soon as the camera window doors are open. All camera negative return circuits are connected to earth on the camera crate.

Film indicators (*fig.* 3)

45. Contact R5/1 of relay F closes to connect a supply from the control panel bus-bar to the I.M.C. control camera selector switch (*fig.* 4) and to the FILM INDICATOR lamps. There are two green FILM INDICATOR lamps for each camera, one on each control panel, the circuit being switched in the negative line by a micro switch in the camera magazine as the film is wound over from frame to frame. The lamps should pulse steadily as exposures are made.

Frame wind (*fig.* 3)

46. The frame wind switch enables the film in all cameras in use to be wound over simultaneously to the next frame at any time as long as the camera window doors are open. When the switch is operated, a supply from the control panel bus-bar is connected to the coils R9 and R10 of relays X and Y respectively. Contacts of these relays close (*see table* 1) to connect supplies from poles 1, 2, 3 of the camera selector switches to their respective camera frame wind rotary solenoids as illustrated in fig. 3 for camera No. 1 by contact R9/1 of relay X. The switch should be operated only momentarily, that is, until the green FILM INDICATOR lamps have pulsed.

Camera stop (*fig.* 3)

47. The cameras can be stopped at any time by operating either CAMERA STOP switch. Normally, however, the flashes are stopped first, followed by the cameras so that no unburst flashes will be wasted. When the cameras are stopped the complete installation is shut down. The camera and flash main control relays F, H and J are held-in after the START switch has been operated by a supply via contact R7/1 of relay J and the two STOP switches in series. Thus when either STOP switch is operated, the hold-in supply is broken and relays R5, R6 and R7 are de-energized, contact R7/1 of relay J opening so that the relays will remain de-energized when the STOP switch is released. Relays R5, R6 and R7 break the supplies to the camera and flash pulsing circuits so that the complete photographic operation is stopped. Individual cameras can be stopped at any time by selecting the relative camera selector switch to OFF.

47A. It should be noted that the cameras will continue to run on until the flash release cam-operated switch has been depressed into the flash release position (no flash will be released as the 'flash stop' switch has previously been operated). The supply to maintain the camera motor running is from the circuit-breaker on the change-of-role bus-bar connected via the camera body. The supply is broken by the cam-operated switch and the camera then stops. The circuits are then set for releasing a flash immediately the 'camera start and flash release' switch is operated and thereby avoids wastage of film.

Image movement compensation (*fig.* 4)

48. Setting up the I.M.C. for the cameras can be carried out at any time without first having to open the camera window doors or flash crate doors. During photography the

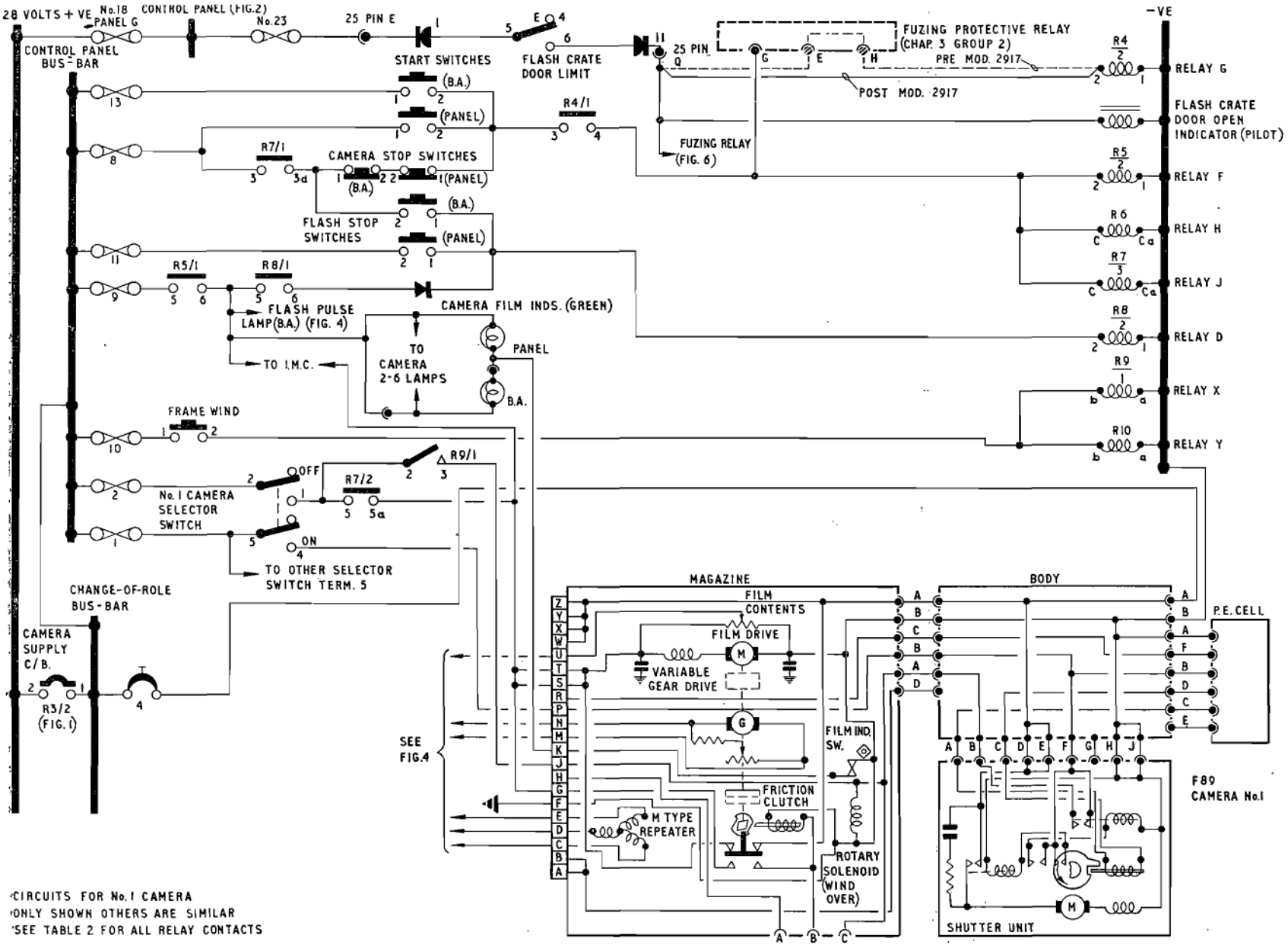

Fig. 3. Camera control

I.M.C. settings for any camera can be checked, the settings being recorded continuously for the camera selected. For setting up on the ground or before photography commences, a switch has been provided on the control panel and is labelled MAGAZINE TEST; it is spring-returned to the OFF position.

49. When the MAGAZINE TEST switch is selected ON and held, pole 4-5 of the switch connects a supply from fuse No. 18 on the control panel to one segment of the CAMERA SETTING SELECTOR switch. This provides the positive supply to the selected camera film drive motor. Pole 1-2 of the switch connects the same supply to the *ground speed setting* M Type transmitter in the I.M.C. controller (which can be removed and fitted without removing the main control panel) and to the other segment of the CAMERA SETTING SELECTOR switch which provides the positive supply to energize the selected camera I.M.C. relays K-W (*see table* 2).

50. With the CAMERA SETTING SELECTOR switch at No. 1, the positive supply from fuse No. 18 is connected to the No. 1 camera film drive motor and to the coils R16 and R22 of relays Q and W; so long as the MAGAZINE TEST switch is held ON, the supply is also connected to the M Type transmitter. Relays Q and W close their contacts R16/1-4 and R22/2 to connect the output of the a.c. generator driven by the film drive motor, to the GROUND SPEED indicator on the I.M.C. controller and to connect the M Type transmitter to the repeater in the camera magazine.

51. The M Type repeater controls the variable gear ratio between the film drive motor and the film drive mechanism and hence controls the output of the a.c. generator which is driven from the film drive mechanism. The ALTITUDE setting control, graduated in thousands of feet, alters the setting of a variable resistor connected in series with the GROUND SPEED indicator; which is in fact a voltmeter calibrated in hundreds of knots, and film contents on separate scales. After setting the ALTITUDE control to the height required, the GROUND SPEED control is operated until the indicator reads the ground speed required. By this means the speed of the film drive is adjusted to give the correct amount of image movement compensation for the required altitude and ground speed.

52. This process is repeated for each camera in turn, the ground speed indicator showing the previous setting of a camera as it is selected for setting up. When all the cameras have been set up, the MAGAZINE TEST switch can be allowed to return to OFF and the CAMERA SETTING SELECTOR switch selected to OFF.

53. During photography, i.e. at any time after either START switch has been operated, the I.M.C. setting of any camera can be checked, without having to operate the MAGAZINE TEST switch, by selecting the camera concerned on the CAMERA SETTING SELECTOR switch. Under these conditions, the supply to the camera film drive motor is connected via the camera selector switch and the now closed contacts of the appropriate relay (H *or* J, *see table* 2) represented by contact R7/2 for camera No. 1 on fig. 3. The positive supply to the M Type transmitter and to the segment of the CAMERA SETTING SELECTOR that controls the I.M.C. relays (K-W) is maintained by contact R5/1 of relay F which is closed when either START switch is operated (*fig.* 3).

Film contents indication (*fig.* 4)

54. Film contents indication is given on a special scale on the I.M.C. ground speed indicator, the reading being selected by depressing the push-switch button marked FILM CONTENTS on the I.M.C. controller. Indication of film contents can be read at any time for any camera by selecting the camera on the CAMERA SETTING SELECTOR switch and then by depressing the FILM CONTENTS push-switch. The voltage output from a camera, proportional to the amount of film in the magazine, is fed via contacts 2-3 of relays R-W to the FILM CONTENTS push-switch on the I.M.C. controller. With the CAMERA SETTING SELECTOR switch at No. 1, the positive supply from fuse No. 18 is connected, when the MAGAZINE TEST switch is selected to TEST and held, to the coils R16 and R22 of relays Q and W. Contacts R16/1-4 and R22/2 operate as described in para. 53, but the contact R22/1 of relay W closes to connect the FILM CONTENTS voltage from camera No. 1 to the film contents push-switch. When this switch is depressed, the film contents voltage is connected to the ground speed indicator, which is in fact a voltmeter, and the quantity of film left in the magazine can be read off on the appropriate scale; the push-switch simultaneously disconnects the output from the a.c. generator in the magazine from the ground speed indicator (*see para.* 51). During photography it is not necessary to operate the magazine test switch, the supply from fuse 9 on the control panel to the CAMERA SETTING SELECTOR switch for energizing relays R-W is maintained by contact R5/1 of relay F (closed when either START switch is operated) (*fig.* 3).

Note . . .

The film contents/ground speed indicator is a voltmeter capable of reading a.c. or d.c. voltages; the ground speed indication is a.c. and the film contents is d.c.

FLASH RELEASE (*fig.* 5)

55. Flashes are released by signal pulses from either one of the two master cameras; a MASTER CAMERA selector switch on the control panel provides for the selection. Flashes cannot be released unless the cameras are operating, i.e. until either START switch is operated, the interlock being provided by a contact of relay J. To stop the photographic operation, the flash release pulses have to be stopped before the cameras are stopped, so that any falling unburst flashes are not wasted; FLASH STOP switches are provided on both control panels for this purpose. Provision is made for E.M. tail fuzing for all flashes and the supply is not switched other than by the normal bomb fuzing relays. Flashes are required to be jettisoned live, accordingly an independent fuzing supply is connected by contacts of the flash jettison relay when jettison is selected, since the normal bomb fuzing line

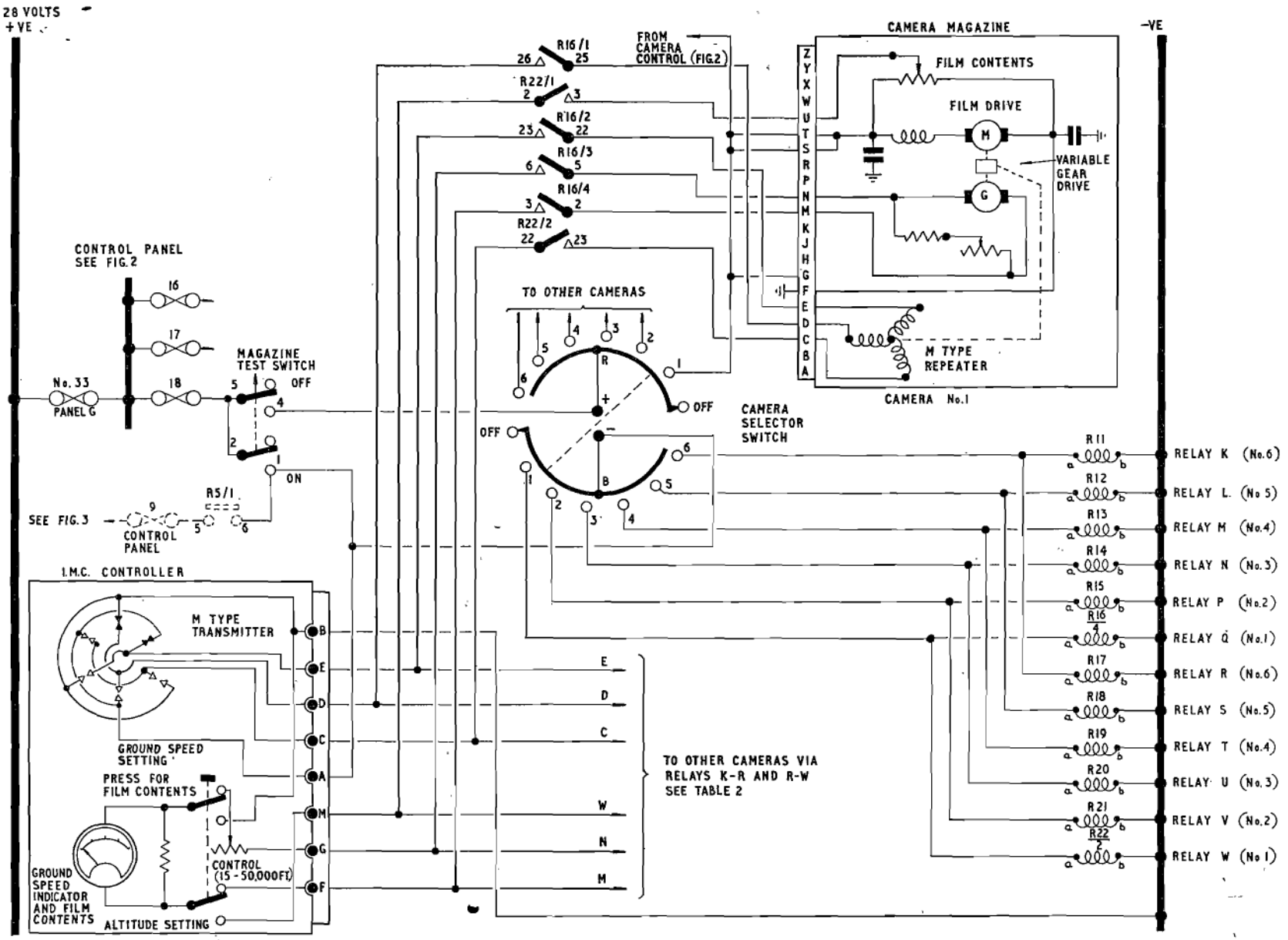

Fig. 4. Image movement compensation and film contents indication

is broken under these conditions. Two sets of counters are provided, these giving a record of the number of flashes pulsed and the number of flashes actually remaining in the crate, the former being operated from the flash release pulsing circuit and the latter by six, parallel connected, micro switches in the flash crate, one to each tier of flashes.

Release pulsing (*fig.* 5)

56. The pulses are obtained from the cam-operated switch in the magazine of the selected master camera. The positive supply to these switches is obtained from pole 1, 2, 3 of the selector switch for the camera concerned via contacts of relays H or J (*see table* 2). From the cam-operated switches the supply is pulsed via pin B of the 3-pin plug on the camera magazine, through the *master camera* switch (pole 4, 5, 6), the normally closed contact R8/2 of relay D and the now closed contact R7/3 of relay J to the coils R24 and R25 of relays C and Z respectively and to the selector control in the flash distributor on the flash crate via 20-way butt connector pin 7 (contact R7/3 of relay J is closed when either start switch is operated, *see para.* 43). Immediately the camera start and flash release switch is operated, a flash release pulse is made as the camera circuits are so arranged that the cameras stop with the cam-switch set for immediate release of a flash (*see para.* 47*A*).

57. The main positive supply to the flash distributor selector coil and contacts is obtained from fuse 21 on the control panel and is connected by contact R4/2 (5-6) of relay G, energized when the flash crate doors are open. As each release pulse reaches the distributor, a relay connects one of these supplies to the selector coil and the selector switches the other supply to the release slip of the next flash to be pulsed. The flashes are carried in six tiers and the release circuits for the flashes in each tier are interlocked so that a flash cannot be released unless the flash immediately below it has already been released.

Pulsing indicators (*fig.* 5)

58. Two amber pulsing indicators are provided, one on the main control panel and the other on the bomb aimer's control panel. The lamp on the main control panel is connected directly to the flash release pulse line, in parallel with the coils R24 and R25 of relays C and Z, and pulses once for each flash release signal. The lamp on the bomb aimer's panel is supplied from fuse No. 9 on the main control panel via contact R5/1 of relay F which is energized whenever the camera system is started (*fig.* 3). The negative return from this lamp is connected via contact R25/1 of relay Z. Relay Z is energized by each flash release pulse so that the lamp is negatively switched to pulse once for every flash release signal.

Flashes pulsed counters (*fig.* 5)

59. Two FLASHES PULSED counters are provided, one on each control panel. They are controlled by contacts R24/1 and R24/2 of relay C and are fed by a common supply from fuse No. 15 on the main control panel. The coil of relay C (R24) is energized by each flash release pulse so that for each release signal the counters are pulsed once to count one up.

Exposures counters (*fig.* 5)

60. Two EXPOSURES counters are provided, one on each control panel. Since they are indirectly actuated by the bursting flashes, they also give an indication of failure of any flashes to burst, the difference in readings of the FLASHES PULSED and EXPOSURES counters giving the indication of the total number of failures, if any. The counters are controlled by contacts R23/1 and R23/2 of relay E, the coil of which is energized via relay RL.2 in the shutter unit of the master camera being used.

61. As each flash bursts, the photo-cell unit of the master camera passes a signal to operate the camera shutter magnet. As the shutter is released, a cam is operated to close a pair of contacts which connect a positive supply from the selector switch (pole 4, 5, 6) via the camera magazine and body to the coil of relay RL.2 in the shutter unit. This relay closes its contacts to connect the same supply through the camera body and magazine to the MASTER CAMERA switch and thence through contact R5/2 of relay F to the coil R23 of relay E. Thus for each flash burst, relay E closes its contacts R23/1-2 to connect a supply from fuse No. 12 on the main control panel to energize the counters which thus count up one. Contact R5/2 of relay F is closed whenever the camera system is started (*fig.* 3).

Flashes remaining counter (*fig.* 5)

62. Only one FLASHES REMAINING counter is provided and is fitted to the main control panel. Its main purpose is to record the number of flashes remaining after a photographic operation so that before commencing a second operation, the duration and probable coverage of the run can be assessed. A secondary purpose of the counter is to provide an indication of a probable 'hang-up' of a flash, for if the reading from the FLASHES PULSED counter is subtracted from the total number of flashes carried, the number of flashes remaining is determined. If the reading from the FLASHES REMAINING counter is in excess of this number of flashes then the difference indicates the number of flashes hung-up. The reading from the FLASHES PULSED counter should always be checked with the EXPOSURES counter before arriving at a definite conclusion as to whether flashes have hung-up or not.

63. One micro switch is fitted in the flash crate for each tier of flashes, making a total of six switches in all. These switches are connected in parallel so that a flash falling from any tier operates one of these micro switches to connect a positive supply momentarily to the counter. The counter is subtractive, and for each flash that leaves the crate, the counter is pulsed to subtract one; the total number of flashes being carried is set up on the counter before flight.

Flashes all gone indicator (*fig.* 5)

64. Only one 'flashes all gone' indicator lamp (blue) is provided and is fitted to the main control panel. The indicator is controlled by the interlocks of the top row of flash release slips in the flash crate and is energized to show blue when all the flashes have been released. The circuit is supplied from fuse 14 on the control panel. As the

top flash from each tier is released, its associated slip interlock is closed (makes 1-2). The six interlocks are connected in series, so that the supply to the indicator is completed only when all the flashes have been released.

Fuzing (*fig.* 6)

65. The fuzing circuit is duplicated, one line being used under normal release conditions and the other being used under jettison conditions. The reason for this is that whereas normal bombs are jettisoned *safe*, flashes have to be jettisoned *live*, and as the normal fuzing circuit, which is used for the flashes, is broken when the BOMB JETTISON switch is operated, an independent fuzing circuit is necessary to provide fuzing under these conditions. Provision is made for E.M. tail fuzing only, this being achieved by six fuzing strips, one strip for each tier of flashes. There is a contact at the bottom of each fuzing strip so that as the fuzing wire passes down the strip, it makes momentary contact to inject a positive supply into the photo-flash.

66. Under normal release conditions, the flash crate door open limit switch E closes to make across its contacts 5-6 when the doors are open to connect a supply from fuse 23 on the control panel to the coil R26 of the fuzing relay (standard to all aircraft, *see Chap.* 3, *Group* 2) and via the fuzing protective relay unit or its stowage connector—pre Mod. 2917 (pins E and H—*see para.* 40) to the coil R4 of relay G. Contact R4/2 of relay G closes to connect a supply from fuse 21 on the control panel to energize the coil R27 of the flash fuzing relay D10 on the flash crate. Contact R26/1 of the fuzing relay connects the fuzing supply from panel G, through the normally closed contact R28/1 of the jettison safe relay to the two, parallel connected, contacts R27/1-2 of the flash fuzing relay and thence to the six fuzing strips in the flash crate. With relays R26 and R27 energized (contacts made) the fuzing strips are 'live' and the supply is also fed to the FUZING AND DOORS OPEN indicator on the control panel. Since fuzing cannot be applied until the doors are open the fact that the fuzing strips are 'live' implies that the doors must be open and the indicator thereby serves a double purpose (*see para.* 31*A*). The fuzing supply is broken on completion of photography by relays R26 and R27 which are de-energized when the flash crate doors are closed.

67. Under jettison conditions, selection of the BOMB JETTISON switch to JETTISON, connects a supply from panel E to the coil R28 of the jettison safe relay (standard to all aircraft, *see Chap.* 3, *Group* 2) and to the flash crate door jettison open circuits (*see para.* 21). As the doors reach the open position, door open limit switch F is operated to make across its contacts 2-3 to connect the supply from the BOMB JETTISON switch, via contacts 4-4a of the bomb door auto-close relay (*see Group* 2), to the coil R29 of the flash jettison relay C10 on the flash crate.

68. At the same time the normal fuzing relays are operated by door limit switch E as described in para. 66 but the fuzing circuit is isolated by contact R28/1 of the now energized jettison safe relay. Contacts R29/2-4 of the flash jettison relay are connected in parallel and close to connect the supply from the BOMB JETTISON switch to the six fuzing strips in the flash crate to maintain the fuzing as the flashes are jettisoned. This fuzing line is broken on completion of the jettison cycle when the flash crate doors close and limit switch F opens to isolate the flash fuzing relay R29.

Flash stop (*fig.* 3 *and* 5)

69. To stop photography, the FLASH STOP switch is operated first. When either switch is operated, a supply is connected to the coil R8 of relay D (*fig.* 3). The bomb aimer's switch is supplied from fuse No. 8 on the main control panel via contact R7/1 of relay J and the main panel switch is supplied from fuse No. 11 on the main control panel. Contact R8/1 of relay D closes to connect a hold-in supply to its coil from fuse No. 9 on the main control panel via contact R5/1 of relay F (closed when the START switch was operated) and a bank of six parallel connected rectifiers. These rectifiers are provided to prevent a feedback from the main panel FLASH STOP switch if it is operated inadvertently when the cameras are not running, i.e. when relay F (R5) is not energized.

70. Contact R8/2 (*fig.* 5) of relay D opens to break the flash pulsing signal circuit between the MASTER CAMERA switch and flash distributor and the coils R24 and R25 of relays C and Z. Thus the flash release signals are isolated although the cameras are still operating and the FLASH PULSING indicator and FLASHES PULSED counters are isolated.

Flash jettison (*fig.* 6)

71. The flashes may be jettisoned at any time by operating the BOMB JETTISON switch on the control pedestal. When operated, this switch connects a supply from panel E to the flash crate door jettison open circuits (*para.* 21) and via the wing bomb and flash auto-selector junction boxes to the flash crate door open limit switch F. When the doors reach the open position, limit switch F is operated to make across its contacts 2-3 to connect the supply to the coil R29 of the flash jettison relay C10, Type S5, on the flash crate.

72. Contact R29/1 of the flash jettison relay closes to connect the same supply to the port and starboard jettison solenoids whilst contacts R29/2-4 close to connect the fuzing supply (*see para.* 66 *and* 67). The jettison solenoids operate the mechanical releases for all the slips.

Note . . .

The Type S5 relay has its contact 1-1*a* (R29/1) *rated at* 10 *amps and the remainder at* 2 *amps. It is important that the jettison solenoid supply is controlled by contact* 1-1*a; each solenoid is rated at* 5 *amps.*

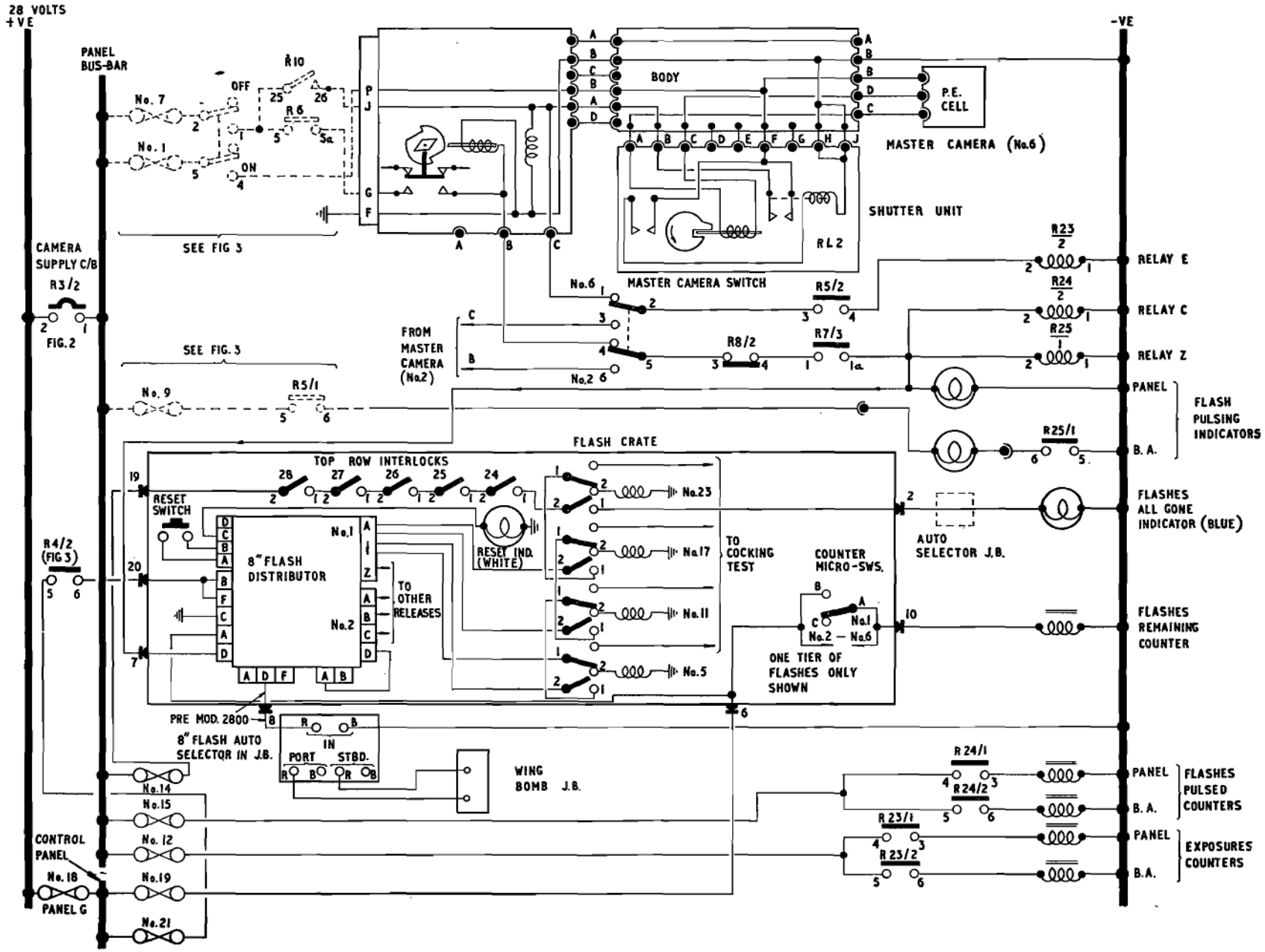

Fig. 5. Flash release

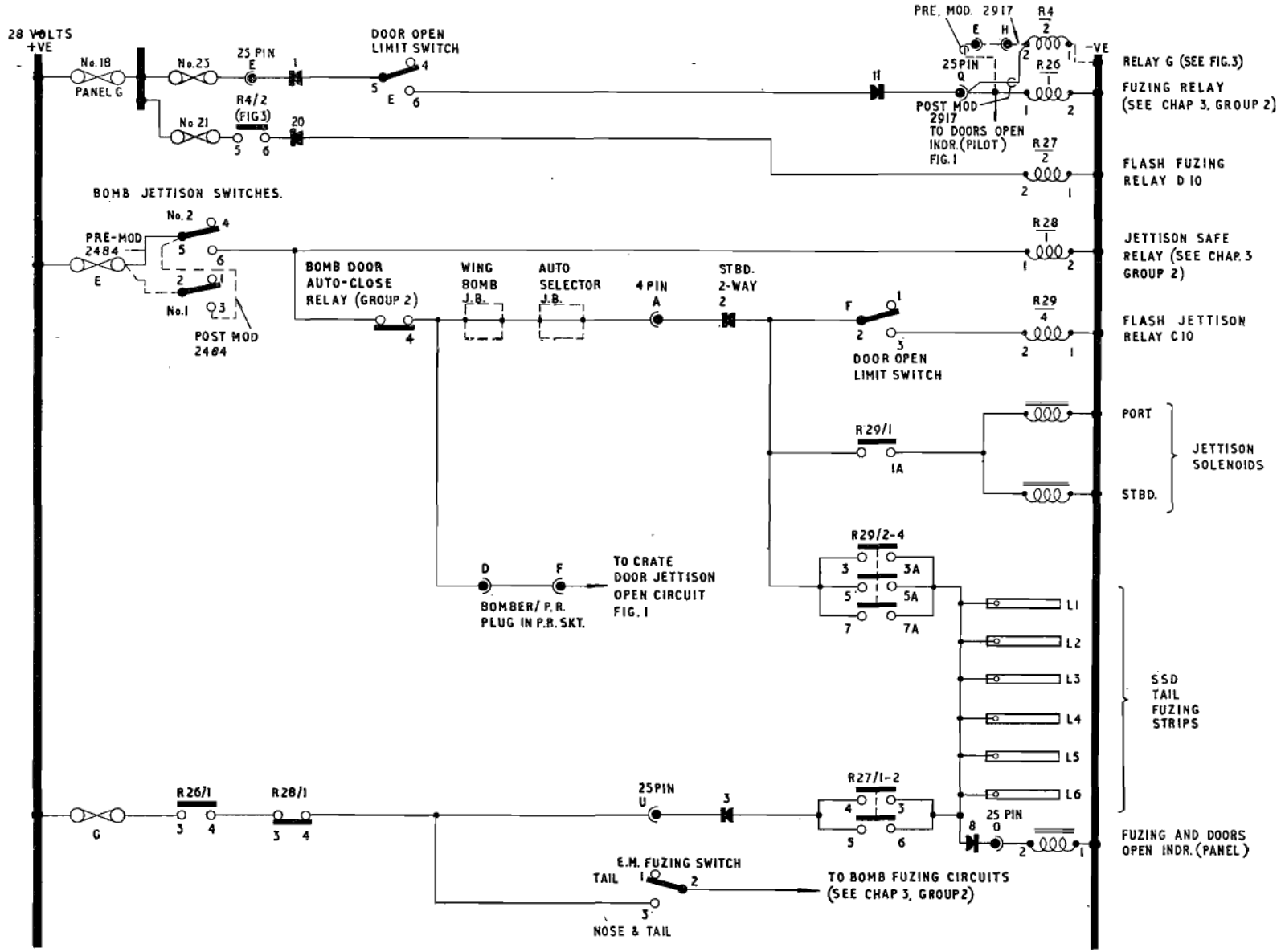

Fig. 6. Flash fuzing and jettison

PANEL LIGHTING

73. The main control panel is illuminated by the edge-lighting system. The panel is covered by a COBEX panel in which are buried seventeen small lamps fitted with P type filaments. The lamps are controlled by a dimmer switch on the panel and the circuit is supplied from fuse No. 17. Also supplied from fuse No. 17 is the I.M.C. controller lighting which is built into the controller and also works on the edge-lighting principle. One buried lamp and one dimmer switch are provided. The lighting of the bomb aimer's panel is described in Group 2 since this is common to both day and night roles.

SERVICING

Warning

Voltages in excess of 100 *volts, either a.c. or d.c., can be dangerous under certain circumstances. Personnel should therefore ensure that the electrical system is electrically safe before any servicing is attempted. Where it is essential that tests or adjustments be made with the electrical power switched on, the greatest care must be exercised.*

Introduction

74. Reference should be made to the General Information Group at the front of this Section (*Book* 2) for the general principle of servicing and fault finding, for information on the care of equipment and for general precautionary measures.

75. The following notes are intended to assist in the servicing of equipment and are not intended to provide a complete fault finding analysis. If a circuit goes unserviceable, the routine fault finding procedures should be adopted to locate the fault.

FUNCTION TESTING THE CAMERA CIRCUITS

76. Ground test equipment is provided for testing the cameras on the crate before the crate is loaded onto the aircraft. An earth bolt on the crate is provided adjacent to the connections to the aircraft for use with this

Table 1

Relay location

Relay	Type or Ref. No.	Schematic reference	Location
A	9B No. 1	R.2	Back of main control panel
B	9B No. 2	R.1	
C	9B No. 1	R.24	
D	9B No. 2	R.8	
E	9B No. 1	R.23	
F	9B No. 1	R.5	
G	S.3	R.4	
H	S.3	R.6	
J		R.7	
K		R.11	
L		R.12	
M	Type B, 4-pole C/O	R.13	
N		R.14	
P		R.15	
Q		R.16	
R		R.17	
S		R.18	
T		R.19	
U	Type B, 2-pole C/O	R.20	
V		R.21	
W		R.22	
X		R.9	
Y	Type B, 4-pole C/O	R.10	
Z	9B No. 1	R.25	
Camera supply circuit-breaker	Type D, 5C/3946	R.3	Battery bay
Fuzing relay	Q No. 1	R.26	In radio crate, behind Bomb Control Unit
Flash fuzing relay (D.10)	9B No. 1	R.27	On flash crate
Jettison safe relay	Q No. 3	R.28	In radio crate, behind Bomb Control Unit
Flash jettison relay	S.5	R.29	On flash crate

equipment. With the crate installed in the aircraft the complete camera system can be functioned from the aircraft controls with the aid of a specially wired plug which fits into the 25-pin socket for the connections to the flash crate. This plug is to be locally manufactured and has its pins E and Q linked together to simulate flash crate doors open condition.

Note . . .

A 100-amp. earth terminal is provided on the camera crate as an earthing point for the test rig.

77. To function the cameras on the aircraft, proceed as follows:—

(1) If a flash crate is fitted, disconnect the 25-pin and 4-pin butt connector adaptors from their respective sockets at bomb bay roof station 713.

(2) Connect the specially wired plug to the 25-pin socket.

(3) Check that all the camera connections are satisfactorily made between the camera crate and the aircraft. Check that all the necessary circuit-breakers on the change-of-role panel at the forward end of the bomb bay are ' set '.

(4) Connect up both 112-volt and 28-volt external supplies and select the 24-volt battery switch to ON. Close and lock the bomb bay doors if not already so.

(5) Check panel lighting and dimmer.

(6) Check I.M.C. controller lighting and dimmer.

(7) (a) Switch CAMERA SETTING SELECTOR to No. 1.

(b) Select MAGAZINE TEST switch to TEST and hold, check that No. 1 camera FILM INDICATOR lamp blinks and check the I.M.C. indication.

(c) Still holding the MAGAZINE TEST switch to TEST, adjust the ground speed and altitude on the I.M.C. controller and check the range of control; finally, set the adjustments to the required values.

Table 2

Relay operation

Relay	Contact	Schematic reference	Function
A	3-4	Fig. 2 R2/1	Camera supply circuit-breaker coil supply
B	3-4	Fig. 2 R1/1	Camera window doors selected open and power on indicator hold-in
C	3-4	Fig. 5 R24/1	Control panel FLASHES PULSED counter
	5-6	Fig. 5 R24/2	Bomb aimer's FLASHES PULSED counter
D	3-4	Fig. 5 R8/2	Isolates flash pulsing circuit
	5-6	Fig. 3 R8/1	Relay D coil hold-in when FLASH STOP is operated
E	3-4	Fig. 5 R23/1	Control panel EXPOSURES counter
	5-6	Fig. 5 R23/2	Bomb aimer's EXPOSURES counter
F	3-4	Fig. 5 R5/2	Relay E coil supply
	5-6	Fig. 3 R5/1	Camera pulsing lamps, bomb aimer's flash pulsing lamp and I.M.C. supply
G	3-4	Fig. 3 R4/1	Camera/flash crate interlock
	5-6	Fig. 5 R4/2	Flash release distributor supply and flash fusing relay
H	1-1a	Coil R6 shown on Fig. 3. Contacts not shown, but operate as relay J contact R7/2 for camera No. 1	Camera No. 3, film drive supply
	3-3a		Camera No. 4, film drive supply
	4-4a		Camera No. 5, film drive supply
	5-5a		Camera No. 6, film drive and flash pulse supply
J	1-1a	Fig. 5 R7/3	Flash pulsing supply
	3-3a	Fig. 3 R7/1	Relays F, H and J hold-in
	5-5a	Fig. 3 R7/2	Camera No. 1, film drive supply
	7-7a	Operates as contact R7/2	Camera No. 2, film drive and flash pulse supply
K	2-3	Coils R11 to R15 shown on Fig. 4. Contacts not shown but operate as for relay Q contacts R16/1-4	Camera No. 6, I.M.C.
L	5-6		Camera No. 5, I.M.C.
M	22-23		Camera No. 4, I.M.C.
N	25-26		Camera No. 3, I.M.C.
P			Camera No. 2, I.M.C.
Q	2-3	Fig. 4 R16/4	Camera No. 1, I.M.C. altitude setting
	5-6	Fig. 4 R16/3	
	22-23	Fig. 4 R16/2	Camera No. 1, I.M.C. ground speed setting
	25-26	Fig. 4 R16/1	

(d) Still holding the MAGAZINE TEST switch to TEST, depress the FILM CONTENTS push-switch and check that the reading corresponds with the quantity of film loaded into the camera magazine.

(e) Release the MAGAZINE TEST switch, FILM INDICATOR should stop blinking.

(8) Repeat item 7 for camera Nos. 2, 3, 4, 5 and 6, then return the CAMERA SETTING SELECTOR switch to OFF. Remember to select the appropriate camera on the CAMERA SETTING SELECTOR switch.

(9) Select the CAMERA WINDOW DOORS switch to OPEN, check:—

(a) Main panel POWER ON indicator shows white.

(b) Bomb aimer's panel POWER ON indicator shows white.

(c) DOOR OPEN indicators, port and starboard, both show white.

(10) (a) Select the CAMERA SETTING SELECTOR switch to No. 1, then:—

(b) Select No. 1 camera selector switch to ON and wait one minute approx. for the P.E. cell to warm up.

(c) Press panel START switch and check that No. 1 camera FILM INDICATOR starts to blink and that the I.M.C. setting is as set under item 7 (c).

(d) Press the FRAME WIND switch and check that No. 1 camera FILM INDICATOR blinks rapidly.

(e) Energize No. 1 camera P.E. cell by means of the approved ground set or by means of a torch and check that No. 1 camera FILM INDICATOR blinks rapidly.

Warning

On no account should cigarette lighters or any other device which produces or might produce a spark be used.

(f) Press CAMERA STOP switch and check that No. 1 camera FILM INDICATOR stops blinking and goes off and that the I.M.C. indicator reads zero.

(g) Select No. 1 camera selector switch and CAMERA SETTING SELECTOR switch to OFF.

Table 2—*continued*

Relay	Contact	Schematic reference	Function
R	2-3	Coils shown on Fig. 4. Contacts not shown but operate as for relay W contact R22/1 and R22/2	Camera No. 6, film contents indicator
	22-23		Camera No. 6, I.M.C.
S	2-3		Camera No. 5, film contents indicator
	22-23		Camera No. 5, I.M.C.
T	2-3		Camera No. 4, film contents indicator
	22-23		Camera No. 4, I.M.C.
U	2-3		Camera No. 3, film contents indicator
	22-23		Camera No. 3, I.M.C.
V	2-3		Camera No. 2, film contents indicator
	22-23		Camera No. 2, I.M.C.
W	2-3	Fig. 4 R22/1	Camera No. 1, film contents indicator
	22-23	Fig. 4 R22/2	Camera No. 1, I.M.C. ground speed setting
X	2-3	Fig. 3 R9/1	Camera No. 1, frame wind supply
	22-23	Contact not shown but operates as R9/1 of relay X	Camera No. 2, frame wind supply
Y	2-3	Coil R10 shown on Fig. 3. Contacts not shown but operate as contact R9/1 of relay X	Camera No. 3, frame wind supply
	5-6		Camera No. 4, frame wind supply
	22-23		Camera No. 5, frame wind supply
	25-26		Camera No. 6, frame wind supply
Z	5-6	Fig. 3 R25/1	Bomb aimer's flash pulse indicator lamp
Camera supply circuit-breaker	1-2	Fig. 2 R3/2	Change-of-role bus-bar and control panel bus-bar fuses 1-15 main supply
	4-7	Fig. 2 R3/1	Economy coil circuit of circuit-breaker
Fusing relay	3-4	Fig. 6 R26/1	Fusing supply (*see also Chap.* 3, *Group* 2)
Flash fusing relay D10	3-4	Fig. 6 R27/1	Make fusing supply to flashes and FUSING AND DOORS OPEN indicator on control panel in series with fusing relay R26/1
	5-6	Fig. 6 R27/2	
Jettison safe relay	3-4	Fig. 6 R8/1	Breaks normal fusing supply when jettison is selected (*see also Chap.* 3, *Group* 2)
Flash jettison relay	1-1a	Fig. 6 R29/1	Makes supply to jettison solenoids
	3-3a	Fig. 6 R29/2	Makes fusing supply to flashes when jettison is selected
	5-5a	Fig. 6 R29/3	
	7-7a	Fig. 6 R29/4	

(11) Repeat item 10 for camera Nos. 3, 4 and 5, remembering to select the camera concerned on the CAMERA SETTING SELECTOR and camera selector switches.

(12) Select the MASTER CAMERA switch to No. 2 then:—

(a) Select the CAMERA SETTING SELECTOR switch to No. 2.

(b) Select No. 2 CAMERA SELECTOR switch to ON and wait one minute approx. for the P.E. cell to warm up.

(c) Press the panel START switch and check that No. 2 camera FILM INDICATOR starts to blink and that the I.M.C. setting is as set under item 7 (c).

(d) Check that the FLASH PULSING indicator flashes on and off.

(e) Check that the FLASHES PULSED counter numerals add one every time the FLASH PULSING indicator flashes on.

(f) Energize No. 2 camera P.E. cell (*see item* 10 (e)) and check that No. 2 camera FILM INDICATOR blinks rapidly and that the EXPOSURES counter adds one every time the P.E. cell is energized.

(g) Press the FRAME WIND switch and check that No. 2 camera FILM INDICATOR blinks rapidly.

(h) Press the panel FLASH STOP switch and check that the FLASHES PULSING indicator stops flashing.

(j) Press the panel CAMERA STOP switch and check that No. 2 camera FILM INDICATOR stops blinking and goes off and that the I.M.C. indicator reads zero.

(k) Select No. 2 camera selector switch and CAMERA SETTING SELECTOR switch to OFF.

(13) Repeat item 12 for camera No. 6, remembering to select all controls to camera No. 6 in lieu of No. 2.

(14) Select CAMERA WINDOW DOORS switch to CLOSE, check:—

(a) Main panel POWER ON indicator shows black.

(b) Bomb aimer's panel POWER ON indicator shows black.

(c) DOOR OPEN indicators, port and starboard, both show black.

(15) Leaving the main control panel, enter the bomb aimer's compartment and using

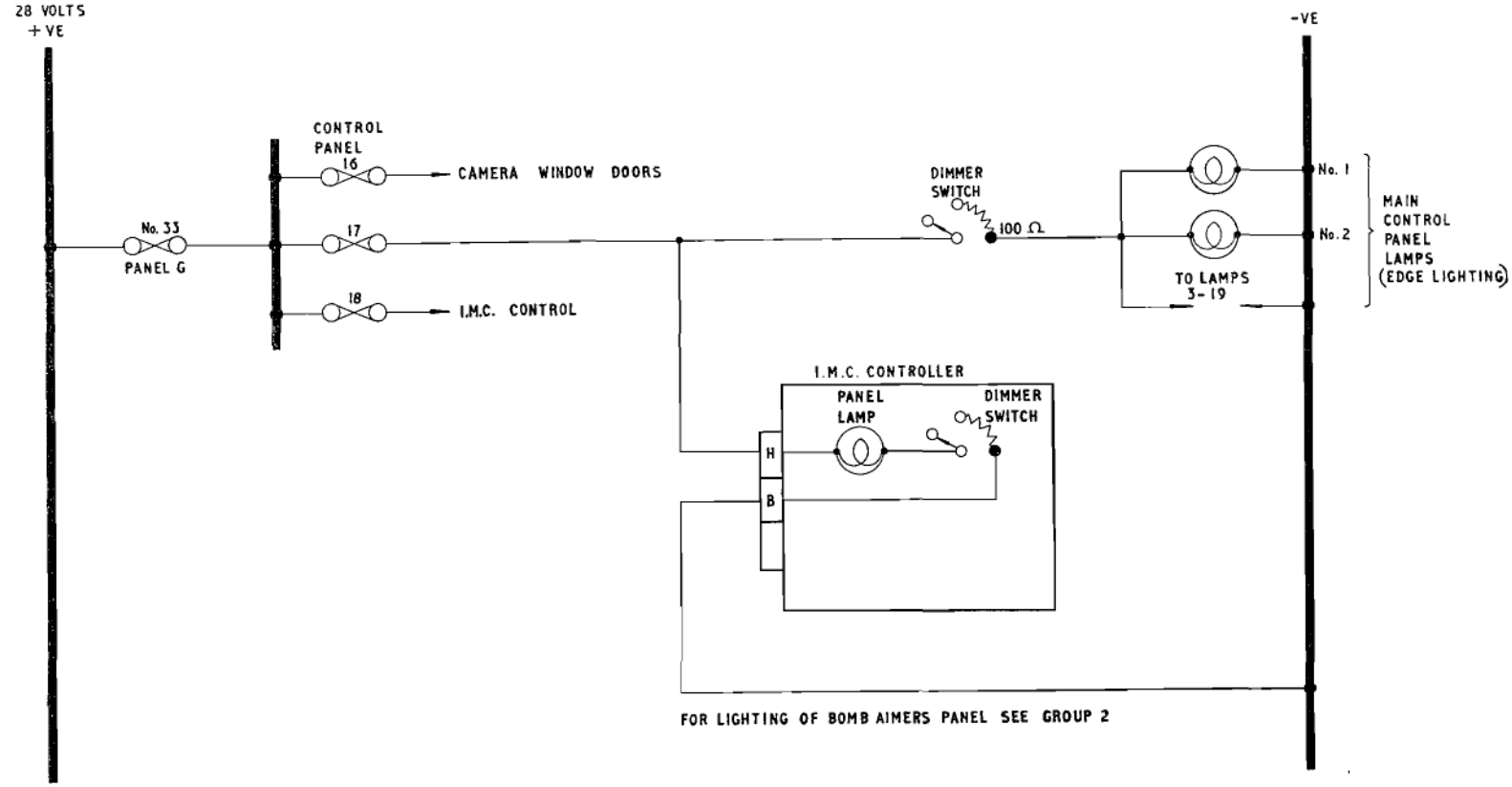

Fig. 7. Panel lighting

the controls and indicators on the bomb aimer's panel proceed as follows:—

(16) Select the CAMERA WINDOW DOORS switch to OPEN and check:—

(a) POWER ON indicator shows white.

(b) Main panel POWER ON indicator shows white.

(c) DOOR OPEN indicators, port and starboard, on main panel show white.

(17) Select all camera selector switches on main control panel to ON (if only five cameras are fitted as in case 2 or 3 photography, select the five cameras only), then check:—

(a) FILM INDICATORS for cameras selected start blinking.

(b) FLASH PULSING indicator is flashing on and off, when either No. 2 or No. 6 is selected on the MASTER CAMERA switch on the main control panel.

(c) FLASHES PULSED counter adds one every time the FLASH PULSING indicator flashes on, when either No. 2 or No. 6 is selected on the MASTER CAMERA switch on the main control panel.

(d) With No. 2 selected on the MASTER CAMERA switch on the main control panel, energize the P.E. cell for No. 2 camera (*see item* 10 (e)) and check that each time the cell is energized the EXPOSURES counter adds up one. Repeat for No. 6 camera.

(18) Press the bomb aimer's FLASH STOP switch and check:—

(a) The FLASH PULSING indicator stops flashing.

(b) The FLASHES PULSED indicator stops counting.

(19) Press the bomb aimer's CAMERA STOP switch and check that the individual camera FILM INDICATOR lamps remain steady, on or off.

(20) Select CAMERA WINDOW DOORS switch to CLOSE and check:—

(a) POWER ON indicator shows black.

(b) Main panel POWER ON indicator shows black.

(c) All selected camera FILM INDICATOR lamps go out unless they are already out (*see item* 19).

(d) DOOR OPEN indicators on main control panel, port and starboard, show black.

(21) Select all camera selector switches to OFF.

(22) Check illumination of bomb aimer's panel.

(23) Check all circuits are switched off then disconnect external supplies.

FUNCTION TESTING THE FLASH CRATE CIRCUITS

78. Test lamps and probes should not be used on the 25-pin and 4-pin flash crate sockets in the bomb bay roof with live circuits otherwise there is a danger of producing sparks in an area that may be contaminated with fuel vapour; it should be remembered that the flash crate connections are immediately below the rear transfer tank. The standard armament test vehicle is used for testing the flash crate, before loading with flashes. The flash crate circuits in the aircraft should be tested by loading an empty flash crate into the aircraft (*for procedure, see Book* 1, *Sect.* 2, *Chap.* 5, *App.* 2).

79. With an empty flash crate installed in the aircraft, proceed as follows:—

(1) Check that all release units are cocked and fitted with loading units.

(2) Connect up both 112-volt and 28-volt external supplies, select 24-volt battery switch to ON.

(3) Close and lock the bomb bay doors, if not already so.

(4) Select camera window doors open.

(5) Select the BOMB DOORS switch on the control pedestal to OPEN, check:—

(a) Flash crate doors open.

(b) Flash crate DOORS OPEN indicator on pilot's fuel panel shows white.

(c) Flash crate DOORS CLOSED indicator on pilot's fuel panel shows black.

(d) Flash crate doors OPEN/CLOSED indicator on main control panel shows white.

(e) FLASHES ALL GONE indicator on main control panel shows black.

(6) Set FLASHES REMAINING counter on main control panel to 28.

(7) Select CAMERA WINDOW DOORS switch to OPEN.

(8) Select MASTER CAMERA switch to No. 2 or No. 6, select No. 2 or No. 6 camera selector switch to ON accordingly. The selected camera FILM INDICATOR should blink.

(9) The FLASH PULSING indicators should flash on and off, and simultaneously with each flash one release unit should open and the FLASHES PULSED counter should count one up.

(10) After 28 flash release pulses, the FLASHES PULSED counter should read 28 and all the release units should have opened and the contacts of the top row subsequently closed to energize the FLASHES ALL GONE indicator on the main control panel; check that this indicator now shows blue.

(11) Disconnect the 112-volt external supply.

(12) Operate each flashes remaining micro switch once, one to each tier of flashes, and check that for each operation the FLASHES REMAINING counter counts down one, i.e. after operating each switch once, the counter should read 22.

(13) Re-cock all the release units, load with loading units and reset flash distributor on flash crate. Check that the FLASHES ALL GONE indicator on the main control panel shows black.

(14) Reconnect 112-volt external supply.

(15) Select BOMB DOORS switch on control pedestal to CLOSE, check:—

(a) Flash crate doors close.

(b) Flash crate DOORS OPEN indicator on pilot's fuel panel shows black.

(c) Flash crate DOORS CLOSED indicator on pilot's fuel panel shows white.

(d) Flash crate doors OPEN/CLOSED indicator on main control panel shows black.

(16) Select the BOMB JETTISON switch on the control pedestal to JETTISON, check:—

A4173. Wt. 48193/7765. 625. 11/60 McC. 999/225.

(a) Flash crate doors open.

(b) Door indicators as item 5 (b), 5 (c) and 5 (d). Item 5 (d) also indicates that fusing strips are ' live '.

(c) All release units operate in rapid sequence by mechanical means.

(d) When all release units have operated, check that the FLASHES ALL GONE indicator shows blue.

(e) 20 seconds approx. after selecting JETTISON, the flash crate doors should close, 20 seconds approx. later, the time switch will have completed its cycle and any time after this the BOMB JETTISON switch should be selected NORMAL. As soon as the doors have closed, check the indicators as item 15.

(17) Repeat items 5 (except sub-item (e)) and 15.

(18) Ensure all circuits are switched off, then disconnect the external supplies.

(19) Remove flash crate (*see Book* 1, *Sect.* 2, *Chap.* 5, *App.* 2).

Note . . .

There is no means of checking that a supply is reaching the contacts on the fusing strips in the flash crate other than with a test lamp and probe. As test probes and lamps are not recommended for use on this installation, also it is dangerous for personnel to enter the flash crate during the jettison cycle, no attempt should be made to check these supplies whilst the crate is in the aircraft. The fusing circuits on the crate will have to be checked with the crate removed from the aircraft, before loading with flashes.

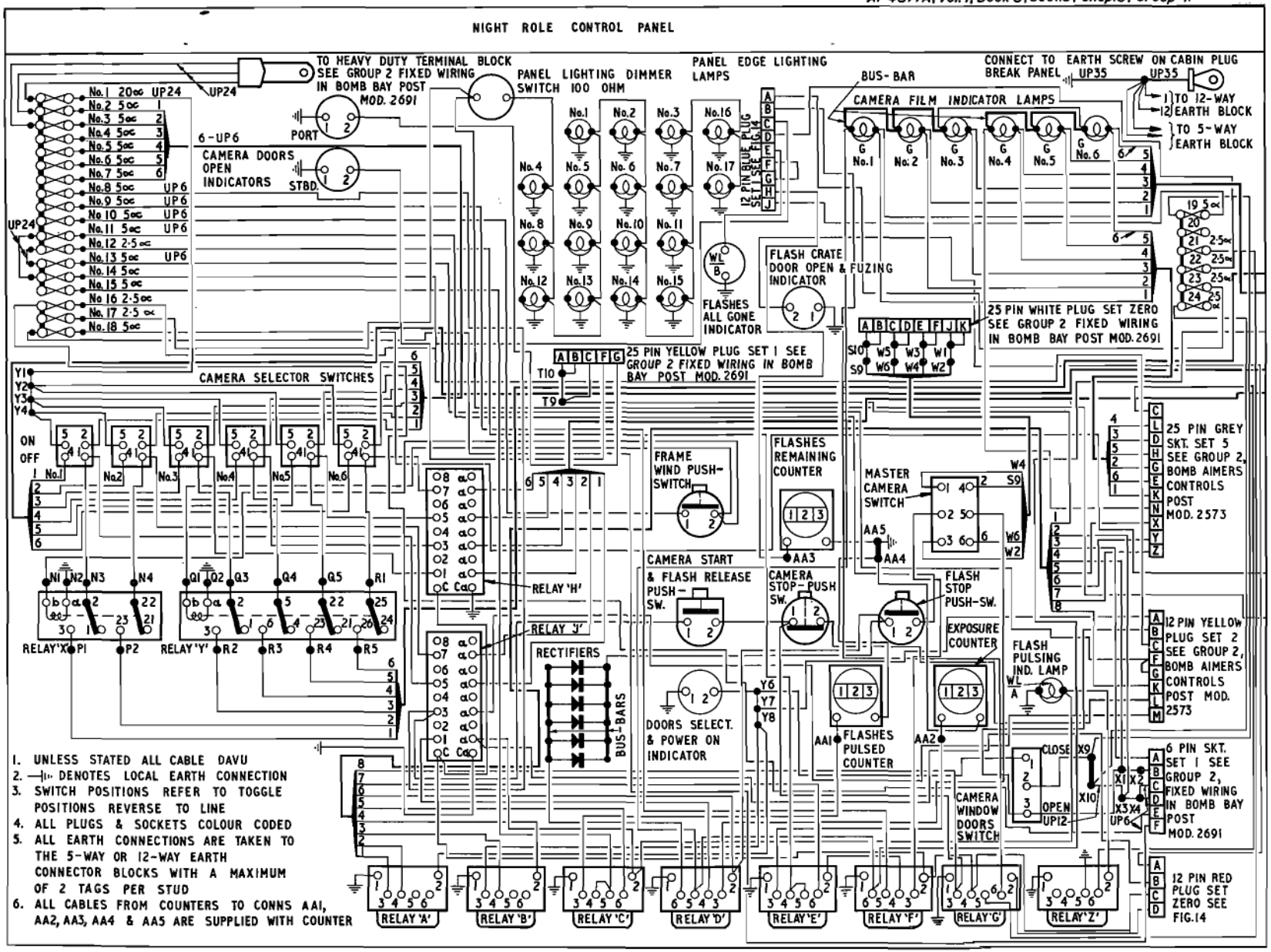

Fig. 8 (1) Control panel

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(A.L.8 NOV. '59)

71079 SHT. 113-AD

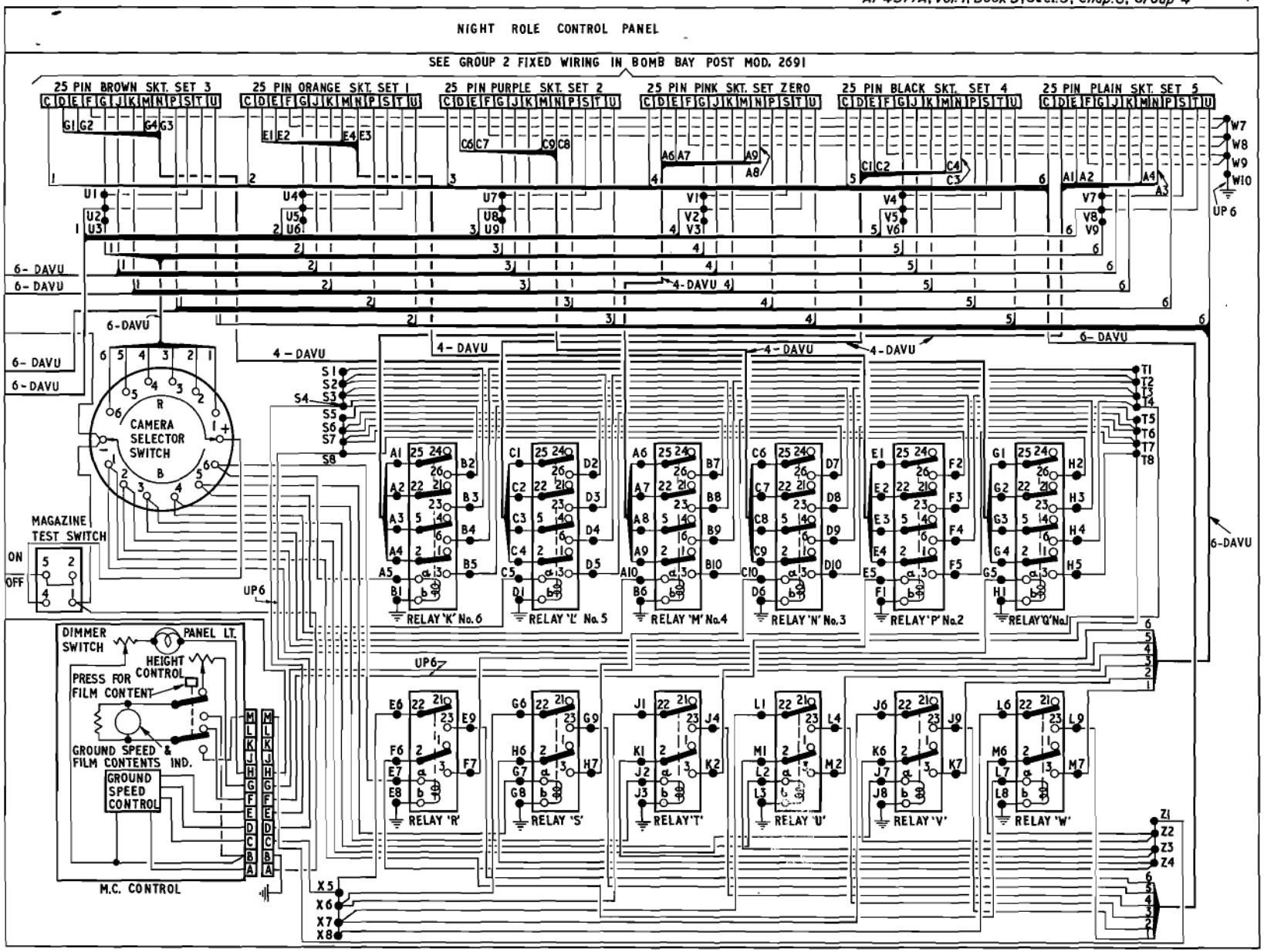

Fig. 8 (2) Control panel

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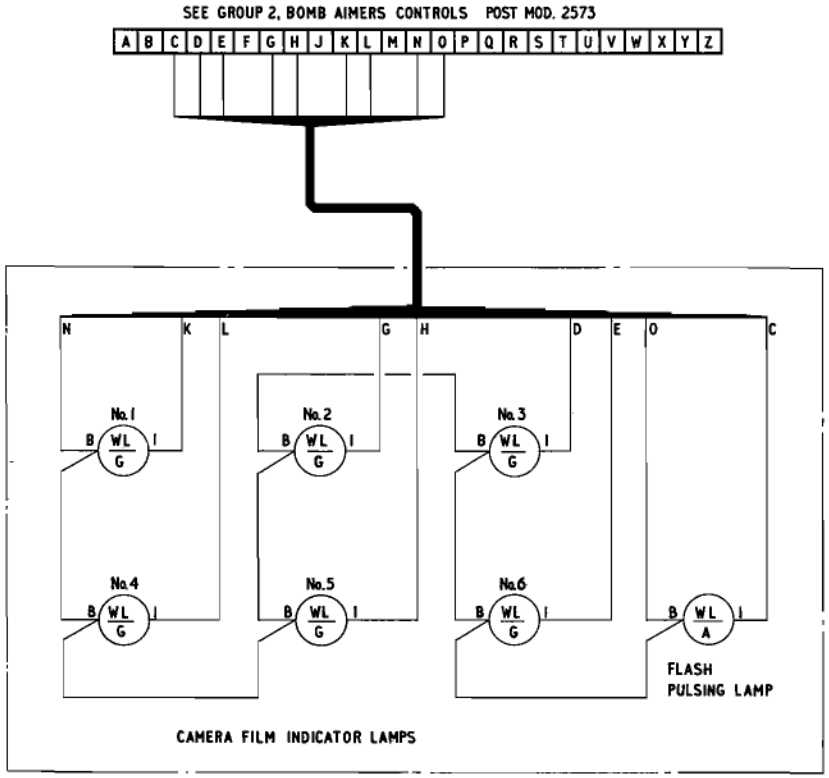


MOD 2702

ALL CABLES UNIPREN 6
UNLESS OTHERWISE STATED

Fig.9 Camera film indicator lamp panel (removable equipment) Mod 2702

RESTRICTED

71079 SHT633-A

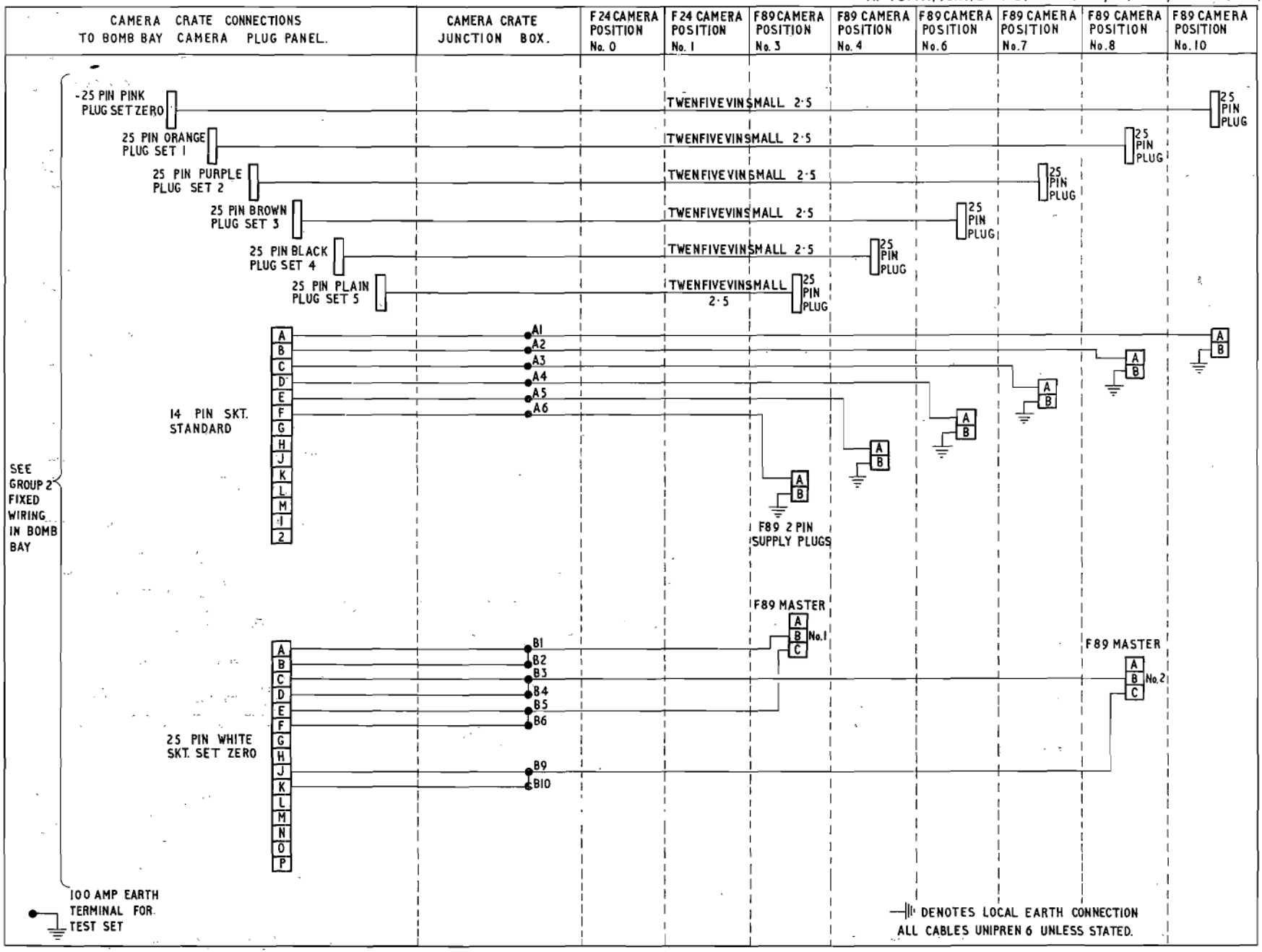


Fig. 10 Camera crate wiring

RESTRICTED

71079 SHT. 115-J

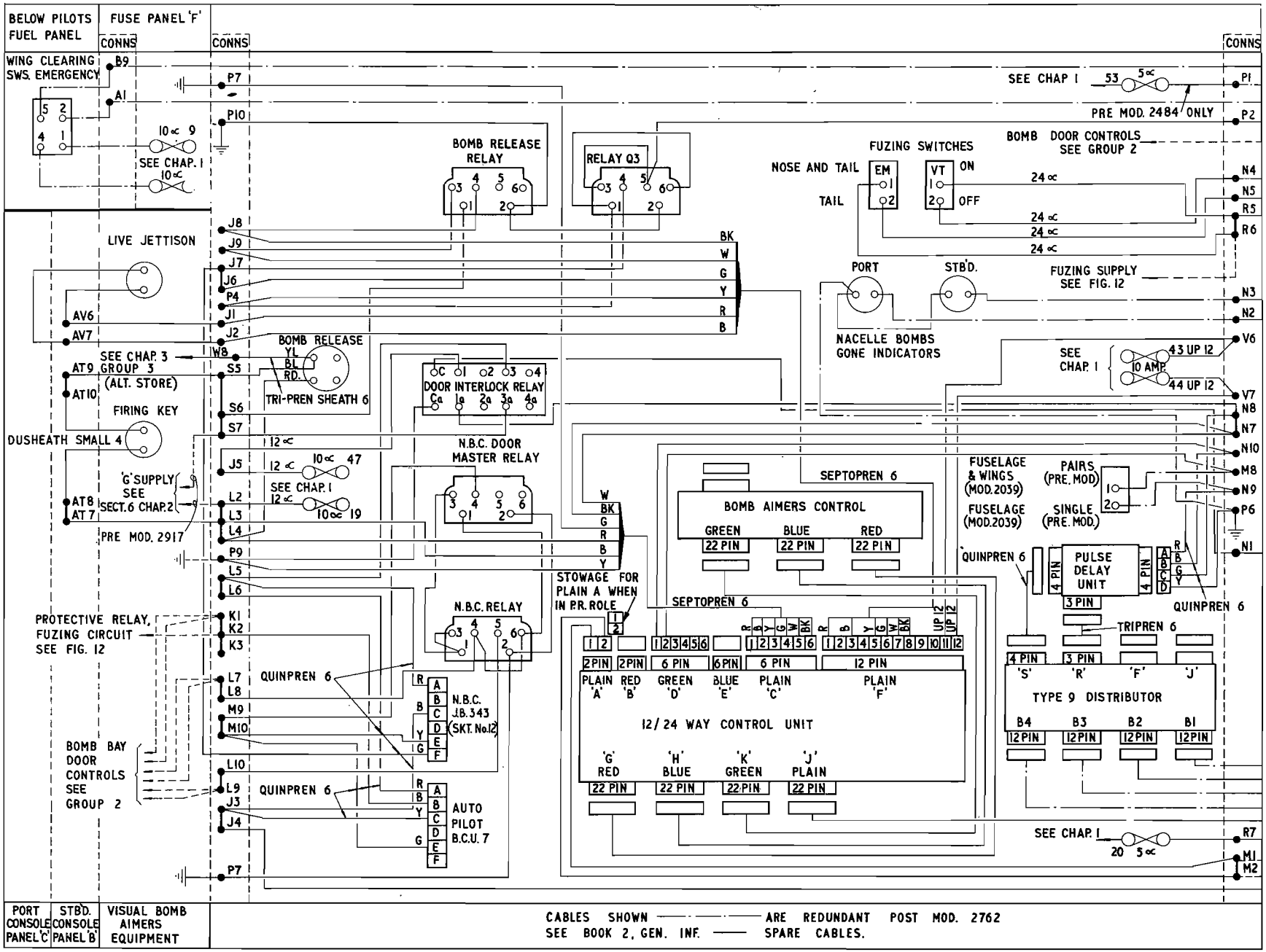
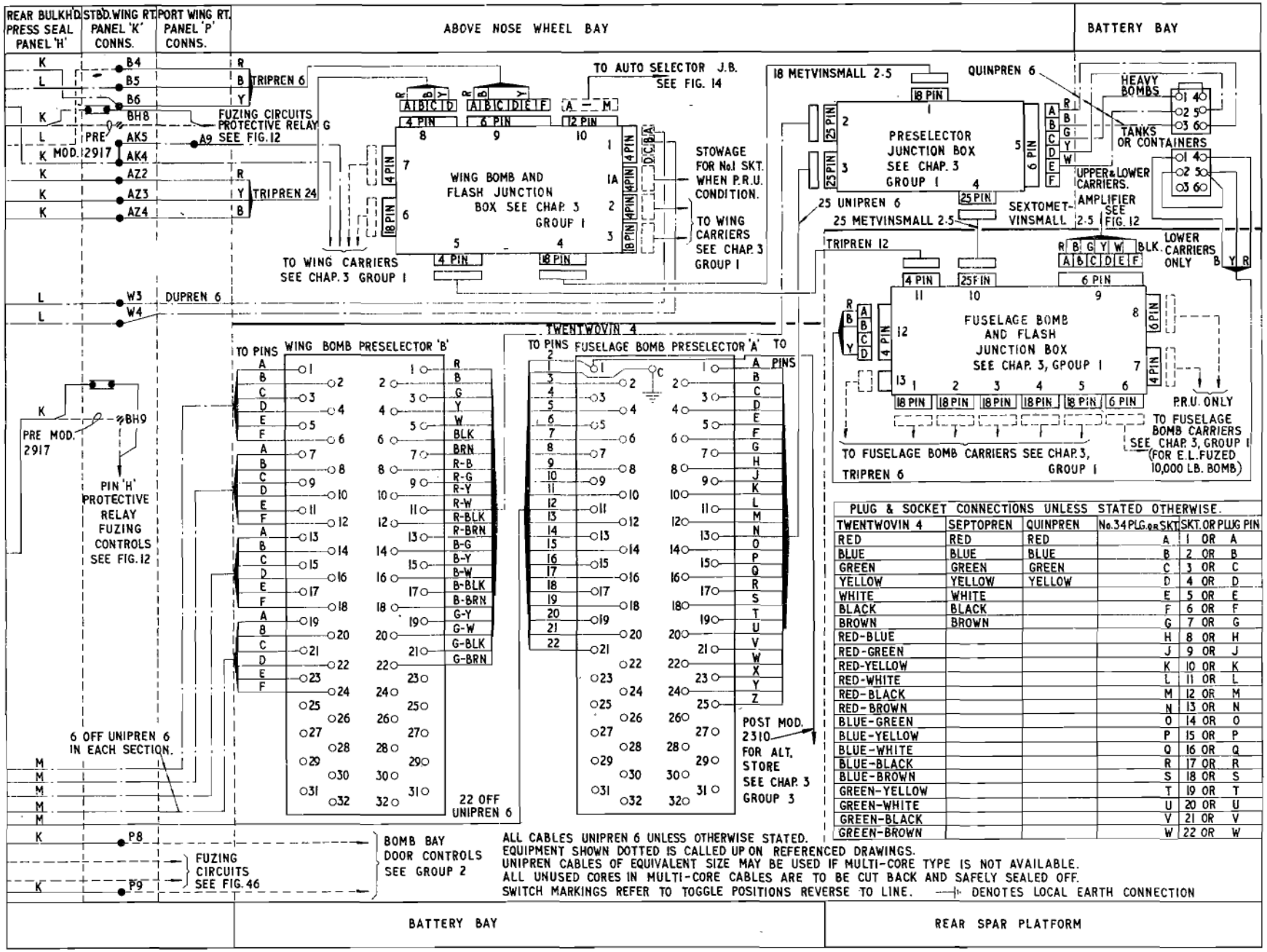


Fig. 11 (1) Bomb release and controls (post Mods. 2229 and 2249, pre Mod. 2645 or 2725)

RESTRICTED

71036 SHT. 105-AC
(EXCLUDING V
SEE FIG. 17)



PLUG & SOCKET CONNECTIONS UNLESS STATED OTHERWISE.

TWENTWOVIN 4	SEPTOPREN	QUINPREN	No.34 PLG. or SKT.	SKT. OR PLUG PIN
RED	RED	RED	A	1 OR A
BLUE	BLUE	BLUE	B	2 OR B
GREEN	GREEN	GREEN	C	3 OR C
YELLOW	YELLOW	YELLOW	D	4 OR D
WHITE	WHITE		E	5 OR E
BLACK	BLACK		F	6 OR F
BROWN	BROWN		G	7 OR G
RED-BLUE			H	8 OR H
RED-GREEN			J	9 OR J
RED-YELLOW			K	10 OR K
RED-WHITE			L	11 OR L
RED-BLACK			M	12 OR M
RED-BROWN			N	13 OR N
BLUE-GREEN			O	14 OR O
BLUE-YELLOW			P	15 OR P
BLUE-WHITE			Q	16 OR Q
BLUE-BLACK			R	17 OR R
BLUE-BROWN			S	18 OR S
GREEN-YELLOW			T	19 OR T
GREEN-WHITE			U	20 OR U
GREEN-BLACK			V	21 OR V
GREEN-BROWN			W	22 OR W

Fig. 11 (2) Bomb release and controls (post Mods. 2229 and 2249, pre Mod 2645 or 2725)

RESTRICTED

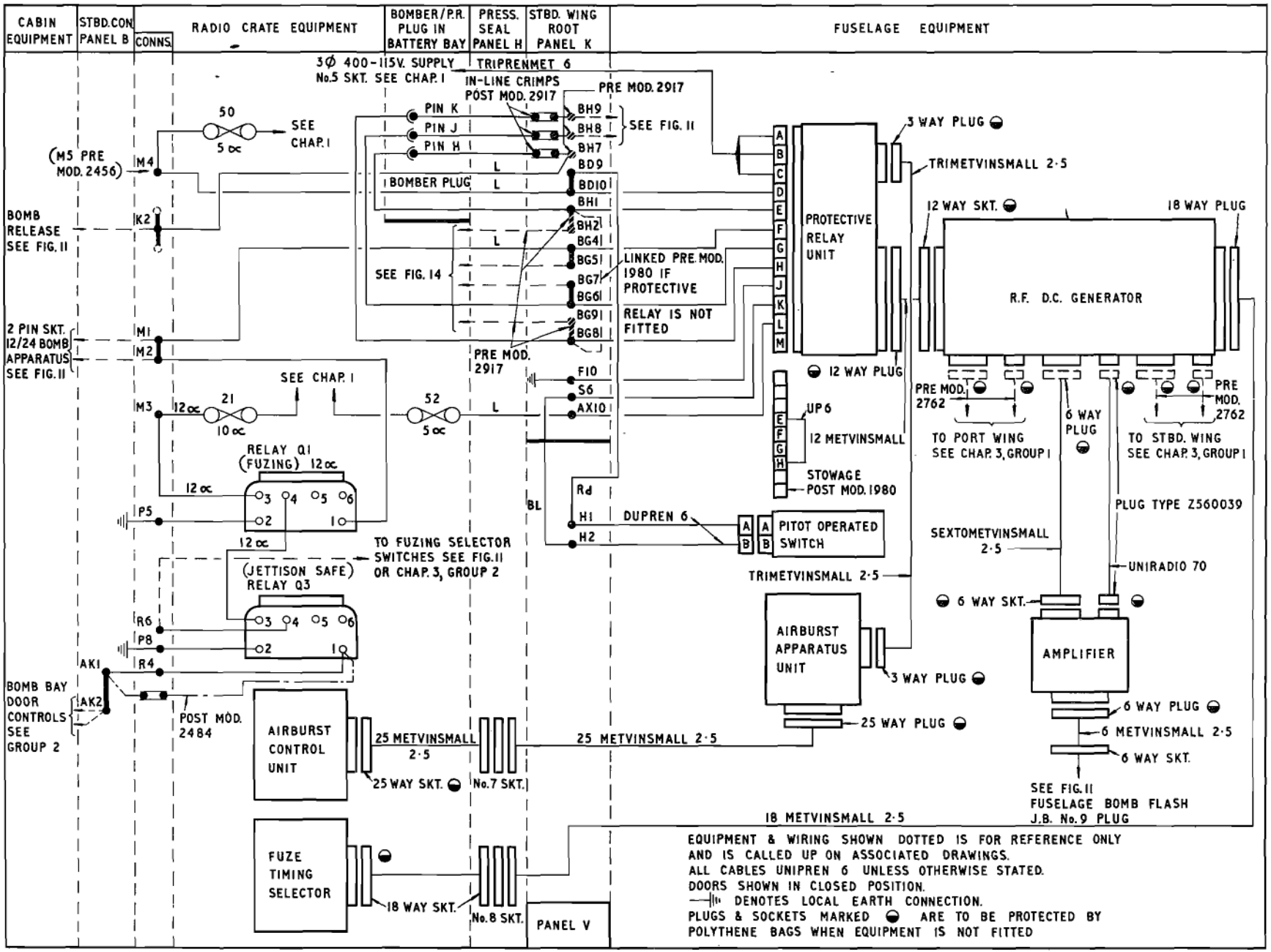


Fig. 12 Fuzing supplies (post Mod. 2229)

RESTRICTED

71036 SHT. 191-Q

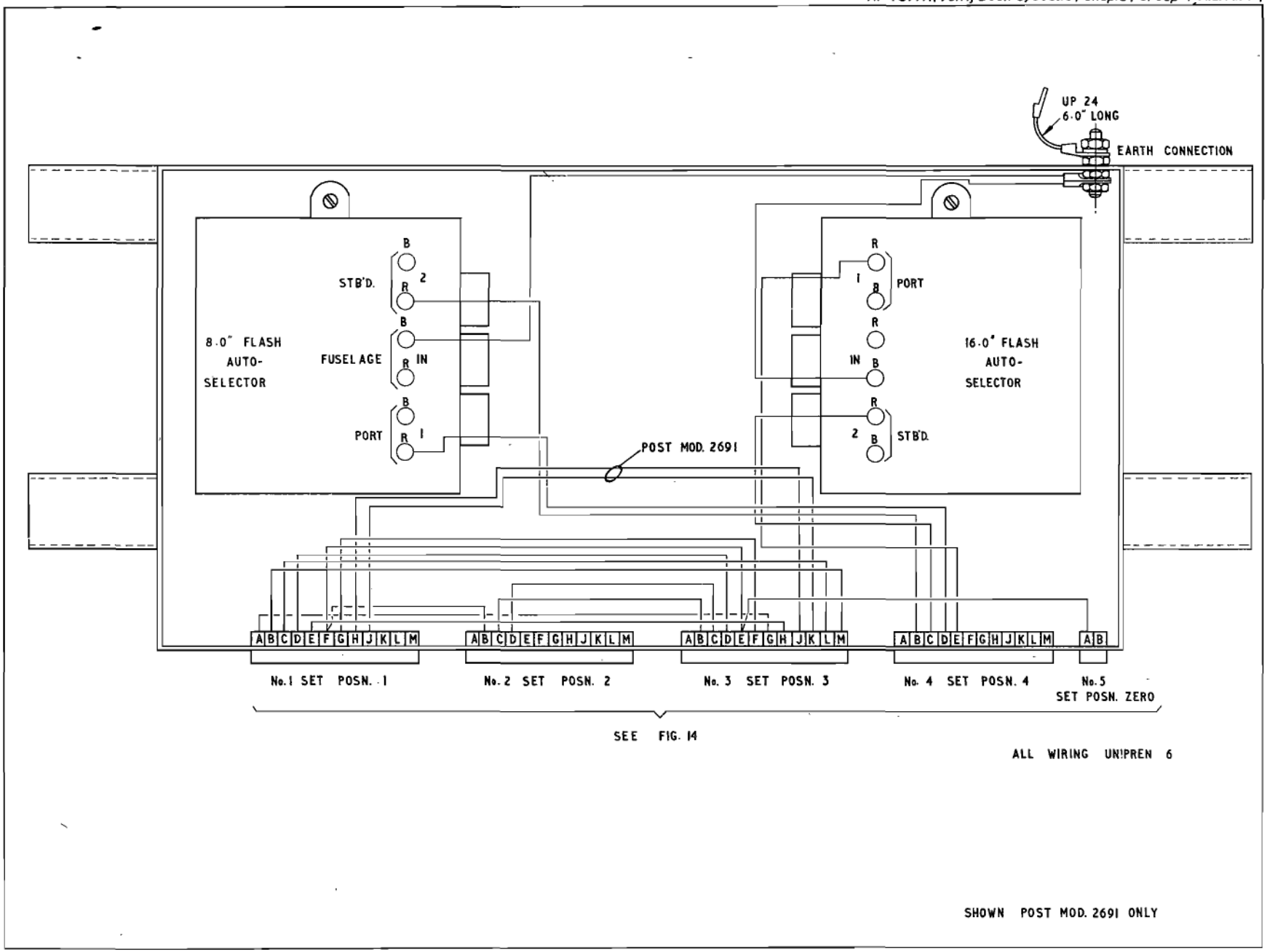


Fig. 13 Auto-selector junction box

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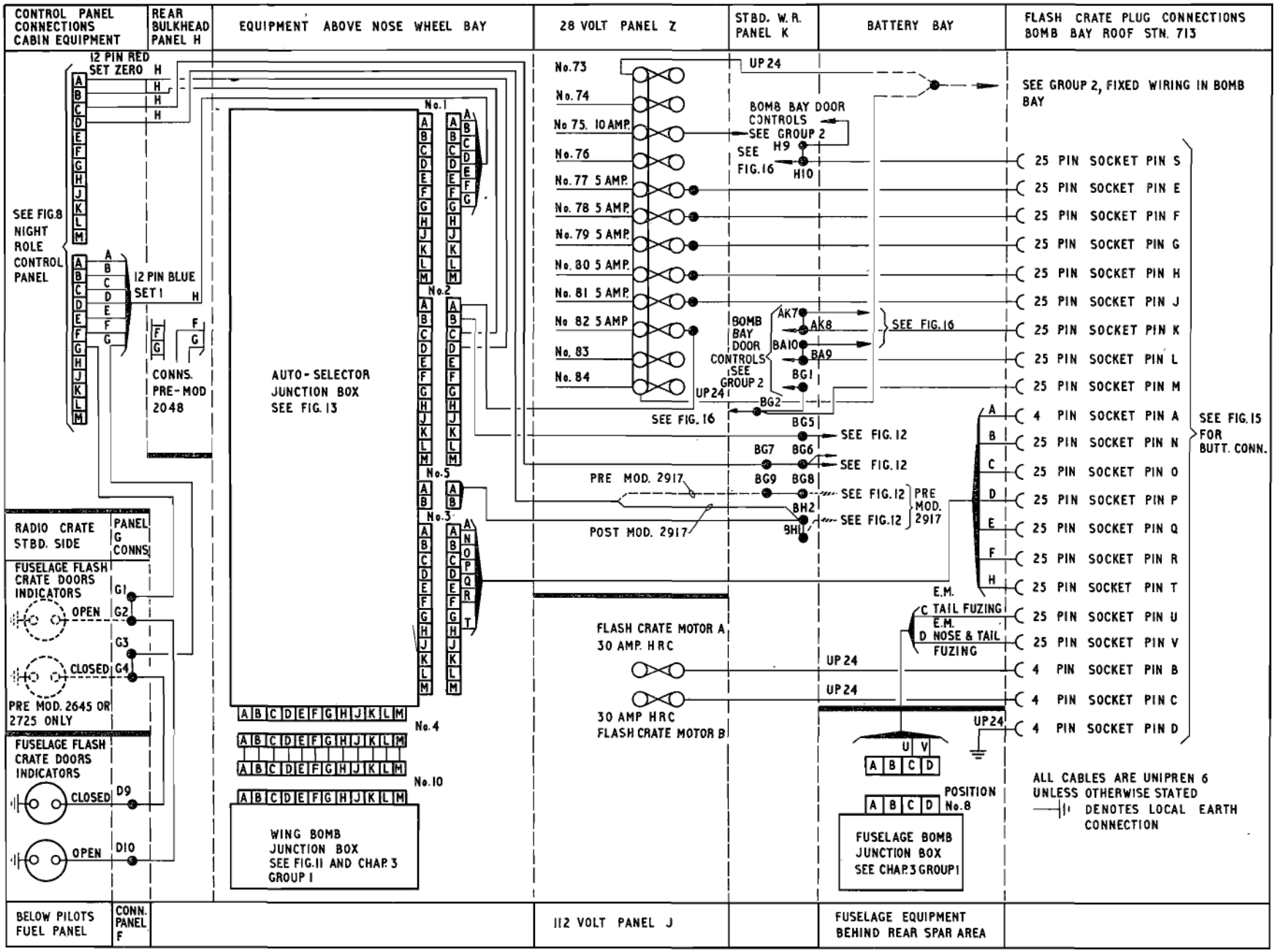

Fig. 14 Fixed wiring, flash crate doors and flash release (post Mod 2229 pre Mod 2691)

RESTRICTED

71036 SHT. 158A-P

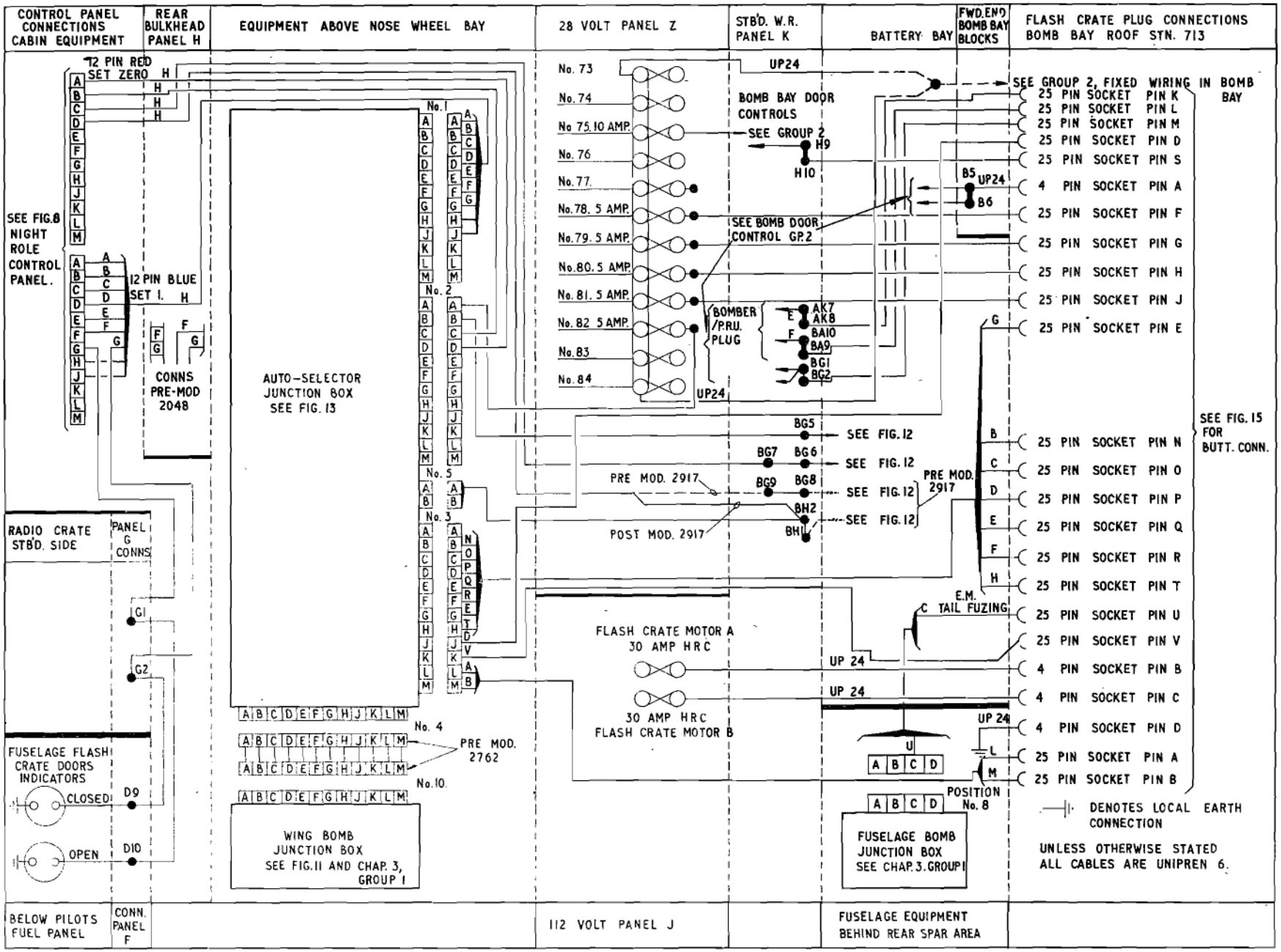

Fig. 14A Fixed wiring flash crate doors and flash release (post Mod 2229 and 2691)

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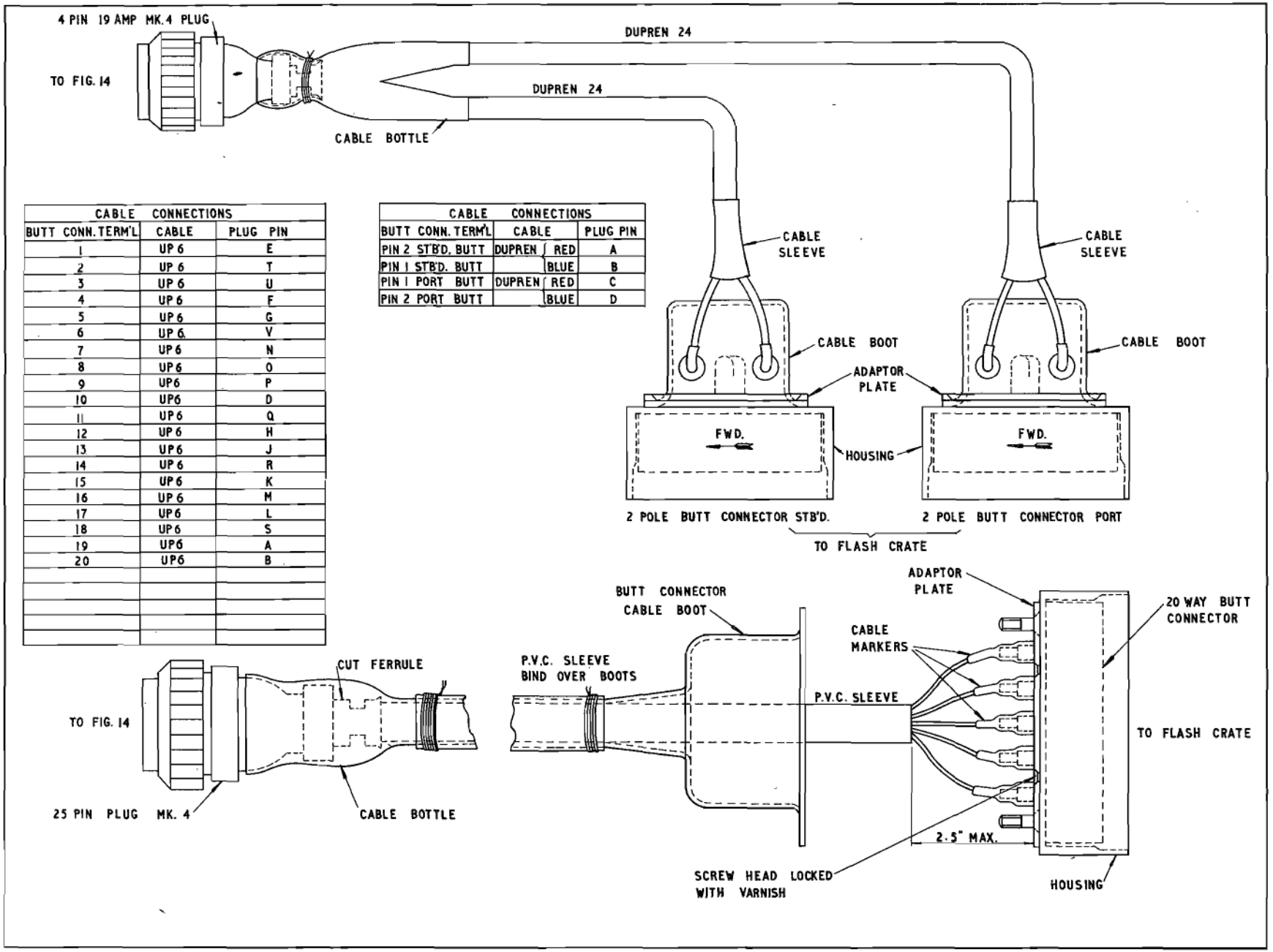

CABLE CONNECTIONS		
BUTT CONN. TERM'L	CABLE	PLUG PIN
1	UP 6	E
2	UP 6	T
3	UP 6	U
4	UP 6	F
5	UP 6	G
6	UP 6	V
7	UP 6	N
8	UP 6	O
9	UP6	P
10	UP6	D
11	UP 6	Q
12	UP 6	H
13	UP 6	J
14	UP 6	R
15	UP 6	K
16	UP 6	M
17	UP 6	L
18	UP 6	S
19	UP6	A
20	UP6	B

CABLE CONNECTIONS			
BUTT CONN. TERM'L	CABLE		PLUG PIN
PIN 2 ST'B'D. BUTT	DUPREN	RED	A
PIN 1 ST'B'D. BUTT		BLUE	B
PIN 1 PORT BUTT	DUPREN	RED	C
PIN 2 PORT BUTT		BLUE	D

Fig. 15. Flash crate butt connector adaptors

RESTRICTED

71079 SHT. 507-C
71079 SHT. 505-F

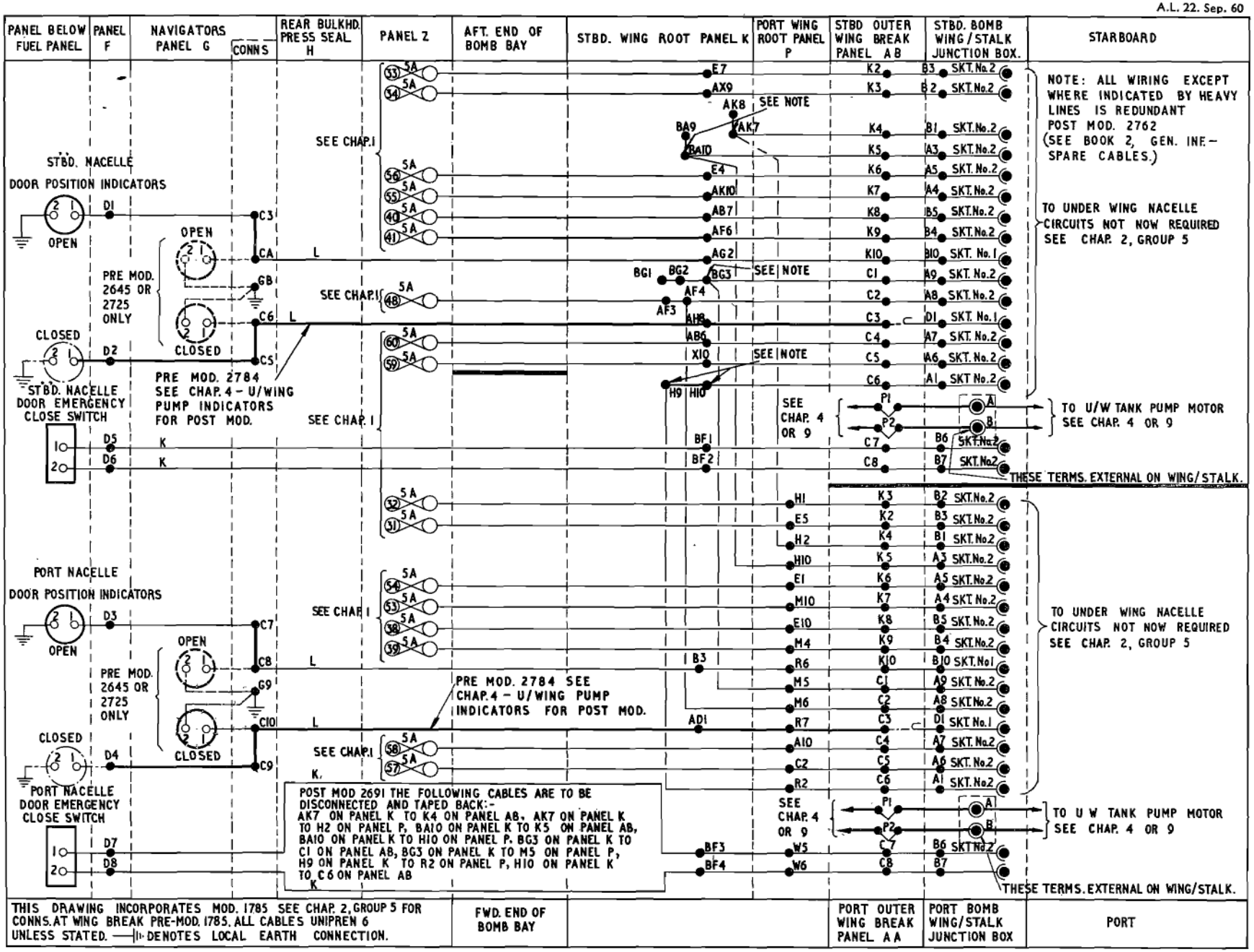

Fig. 16 Flash crate door supply circuits.

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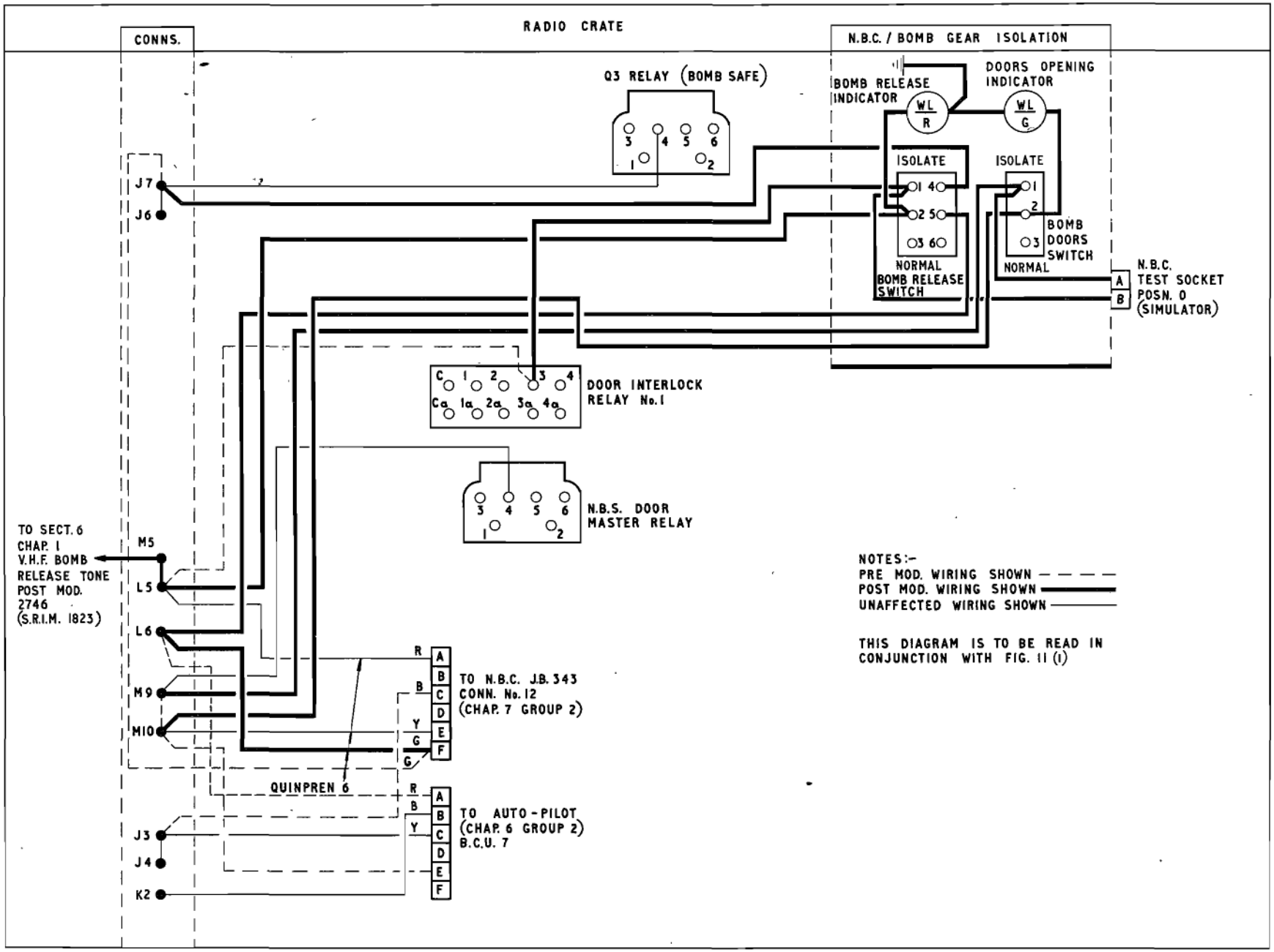

Fig. 17 N.B.C. / Bomb gear interconnections (Mod. 2456)

RESTRICTED

EXTRACT FROM 71036 SHT. 105 FOR ISSUE V,Y&Z