Group G.1

ARMAMENT SUPPLIES AND CONTROL

◀ (All relevant Mods. included up to Mod.1350) ▶

CODE GF, GV, BR, BJ, BF, RP, CG, GS, TT

LIST OF CONTENTS

TABLE 1

Equipment type and Air Publication reference

Equipment	Air Publication
Armament safety plug, Thorn Conn, Type PT 05 SE	A.P.4343C, Vol.1, Book 1, Sect. 5
Circuit breakers, Type LGA.12-B1, LGA.18-B1 and A6	A.P. 113D–0903–1
Gun firing and ventilation	
◀ Control column handgrip, Type A.C.63682 (*post Mod.1295*) or A.C.64618 (*Mod.1350*)	A.P. 113D–1609–1 ▶
Compression switches, Dowty, Type C.18317 Mk.2	A.P.4343C, Vol.1, Book 1, Sect. 1
Control panel switches, Honeywell, Type 1TL1 and 2TL1	A.P.4343C, Vol.1, Book 1, Sect. 1
Inverter, Type 300	A.P.4343B, Vol.1, Book 3, Sect.16
Ventilation actuator, Type CZ.72257	A.P.4343D, Vol.1, Book 3, Sect.14
Control box relays, Type S3, 9B and SM5A-M4	A.P.4343C, Vol.1, Book 2, Sect. 3
Circuit breaker, Type A.1	A.P.4343B, Vol.1, Book 2, Sect.10
Bomb release, fuzing and jettison	
Ejector release units, No.1, Mk.2	A.P.1664E, Vol.1, Part 1, Chap.2
Control panel switches, Honeywell, Type 1TL/3F and 2TL1/10F Jettison push-switches, Type B Fuzing selector rotary switch, Type B	A.P.4343C, Vol.1, Book 1, Sect. 1
Practice/normal switches, three-pole, change-over, Type N.S.F.7614/K.2	A.P.113D–1110–1
Practice bomb carriers	A.P.1664A, Vol.1, Book 1, Sect.1, Chap.4
Nose and tail fuzing units	A.P.4343X, Vol.1, Sect. 5
Relays, bomb/R.P. selection J.B. Type 10B No.15 Relays, bomb/R.P. and Camera J.B., Type 10B No.15 Relays, pylon C and D, Type SM5A-H19 Relays, pylon RF, Type 5D/2242 Inboard pylon relays C and D, Type SM5A-M4 *(post Mod.1288)*	A.P.4343C. Vol.1, Book 2, Sect. 3
R.P. firing	
Salvo selection switch, Type 5D/1760 Distribution box	A.P.4343X, Vol.1, Sect.16
Master switch, Type 1TL1/3F Mode switch, Type 2TL1/10A Re-set push-switch, Type B	A.P.4343C, Vol.1, Book 1, Sect. 1
Re-set indicators, Type A.2	A.P.4343E, Vol.1, Book 4, Sect.18
Rippling relay, Type SM5-H12	A.P.4343C, Vol.1, Book 2, Sect.13
M.A.T.R.A. launchers, Type 116M or 115M	◀ A.P.110G–0505–125G ▶
Cameras	
Camera gun, Type G.90	◀ A.P.112P–0407 & 0408–1 ▶
Master switch, Rotax, Type D.5406 ◀ Bright/dull switch. C.W.C., Type XD.757, No.2 Test switch, C.W.C., Type XD.786, No.3 ▶	A.P.4343C, Vol.1, Book 1, Sect. 1
Run indicator lamp, Type A	A.P.4343E, Vol.1, Book 4, Sect.18
Recorder camera Mk.3	A.P.1355D, Vol.1, Sect. 3

Introduction

1. This group contains the description and operation of the armament supply and control circuits, together with information on the servicing required to maintain the installations in an efficient condition. Routeing and theoretical circuit diagrams are included. The aircraft's electrical system is described in Groups A.1, A.2 and A.3 of this chapter. Additional information on the camera recorder is given in Chap. 2, Group 4A. Detailed information on the standard items of equipment used in the circuits will be found in the Air Publications listed in Table 1.

DESCRIPTION

Armament electrical supplies

2. The armament electrical main supply is taken from the 45 amp armament services circuit-breaker located in the aircraft supply panel in the radio bay. This supply is routed direct through the armament safety plug, prominently mounted on the starboard glare shield in the cabin, to the armament services circuit-breaker panel on the cabin port side. The panel comprises five circuit-breakers each supplying its respective armaments service—bombs (12 amp)—jettison 1 (12 amp)—jettison 2 (12 amp)—R.P. (18 amp)—guns (12 amp). When the safety plug is disconnected all armament circuits are isolated from the supply.

3. The positive supply to the armament switches in the control column handgrip is routed from the 10 amp fuse 19 in the supply panel via two alighting gear compression switches, one in each undercarriage leg. This arrangement prevents the guns or R.P. being fired, the camera operated or the bombs being released while the aircraft is on the ground. For the purpose of firing the guns at the butts, however, the undercarriage leg switches can be by-passed by the use of the ground test switch (*butt switch*) which is mounted at the cabin starboard arch panel.

Gun firing and ventilation

4. The 30 mm. Aden guns are controlled and fired electrically via a junction box on each gun and are provided with a selective firing system which enables all four guns to be fired together or the inboard or outboard guns to be fired separately. A gun firing control panel, incorporating the guns master switch (GUNS/OFF), the guns selector switch (INBD/OUTBD/ALL) and the butt test switch, is mounted at the cabin starboard arch panel. The gun firing operation is initiated by a trigger operated switch on the forward face of the control column handgrip. The handgrip also incorporates two push-switches and a tailplane switch. The push-switches are at the top of the handgrip, under two spring loaded flaps. One of the switches is used for independent operation of the camera and the other for bomb release or R.P. firing. The flap over the camera switch forms a gun safety catch and must be lifted before the switch can be operated. The flap is, however, cut away locally to enable the camera switch to be pressed without lifting the flap.

5. Gun firing current is provided by an inverter mounted on the rear face of frame 12, at the starboard side. The d.c. supply to the inverter is fed from the guns circuit breaker in the cabin, through a 5 amp circuit breaker and the safety relay E.1 on the gun firing panel, thence to the inverter. Relay E.1 is controlled by the guns master switch and the safety catch switch (*para. 4*) and its contacts, besides connecting d.c. to the inverter, also connects the inverter a.c. output to the guns circuits via gun firing relay F.1. Each gun circuit is fused and the circuits to the outboard guns include the closed contacts of the de-energized relay A and the circuits to the inboard guns include the closed contacts of the de-energized relay B. Guns selection relays A and B are controlled by the gun selector switch (*para. 4*). All relays and fuses are contained in the gun firing panel in the radio bay.

6. The gun package is automatically ventilated whenever the guns are fired, by the opening of a small shutter incorporated in a gun access door located in the under-surfaces of the front fuselage between frames 11 and 12. This shutter is opened and closed by an actuator also mounted on the access door. The supply to the actuator is taken through the contacts of relay C.1 which is controlled by relay F.1. The ventilation shutter must be fully open in 3·5 seconds after the commencement of the guns firing and close in 3·5 seconds after the end of the guns firing.

7. As the aircraft becomes airborne the weight is taken off its alighting gear, thus allowing the compression switches on each undercarriage leg to make contact and feed the positive supply to the switches in the control column handgrip. With the guns master switch selected to GUNS, it is necessary then to raise the safety catch flap when it is required to fire the guns. This action completes the circuit to the gun firing trigger switch and energizes the safety relay E.1. Relay E.1 controls the input and output of the gun firing inverter positive supply from the circuit breaker to supply the inverter via its contacts 3–4. As the firing trigger is pressed it closes the firing switch to energize the firing relay F.1, the contacts 3–3a of which complete the supply from the inverter through contacts 5–6 of the energized relay E.1 and the closed contacts of the de-energized relays A and B, to the gun fuses, and the guns fire. As the guns fire, the ventilation shutter commences to open (*para. 9*) and the cameras operate to photograph the target (*para. 42 and 51*). When the firing trigger is released, relay F.1 is de-energized, thus isolating the supply from the gun firing inverter and the guns cease firing. As the safety catch is replaced over the camera gun switch, the safety switch will open and de-energize relay E.1. With relay E.1 de-energized the supply to the gun firing inverter is broken and the inverter ceases operation.

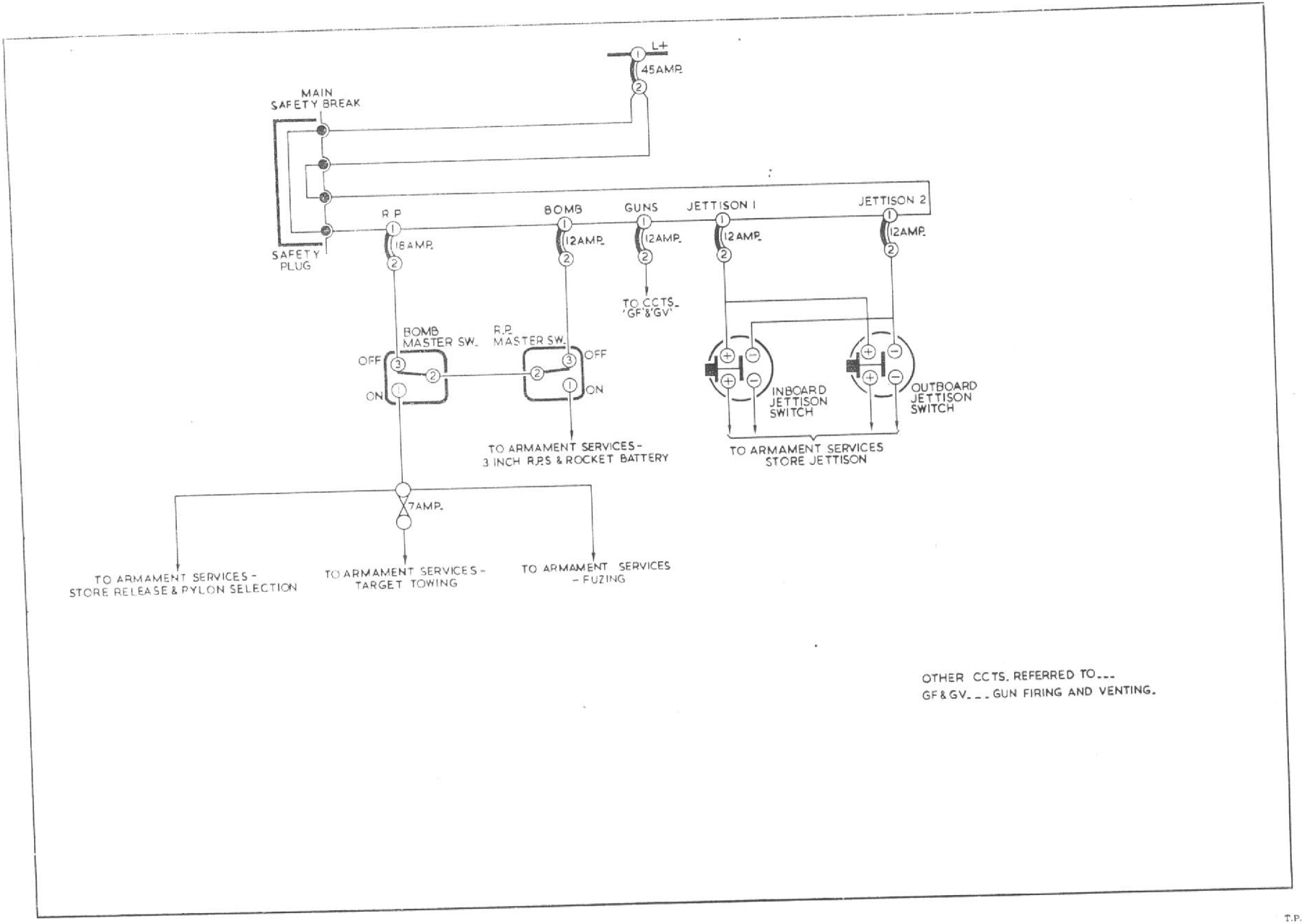

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Fig.1. Armament services power supplies (theoretical)

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8. The coils of the guns selection relays A and B are energized from the guns main supply, through the guns selector switch. When the switch is selected to INBD guns, relay A is energized and its contacts open to break the circuits to the outboard guns, leaving only the inboard guns, supplied through the closed contacts of the de-energized relay B, available for firing. Moving the guns selector switch to OUTBD guns, breaks the circuit to the coil of relay A, which de-energizes thus allowing its contacts to close to make a firing supply available to the outboard guns. At the same time relay B is energized and its contacts open to break the supply to the inboard guns. With the guns selector switch in the ALL guns position the circuits to the coils of both relays, A and B, are broken and they remain de-energized with their contacts closed to supply current to all guns.

9. When the guns are fired, the relay F.1 is energized, breaking its contacts 6–6a supplying contacts 6–6a of the gun ventilation relay C.1 which feed the 'close' field coil of the ventilation shutter actuator. At the same time contacts 5–5a of relay F.1 close to complete the circuit to the actuator 'open' field coil. The actuator will, therefore, start to open the shutter and contacts 5–5a and 7–7a in relay F.1 complete the supply to relay C.1, via the 'open' limit switch of the actuator. Should the firing trigger be released and relay F.1 be de-energized before the actuator completes its full travel, relay C.1 will be maintained in its energized state by a hold-on circuit fed direct from the circuit fuse, through its own contacts 3–3a, the actuator 'open' limit switch and its contacts 1–1a.

10. When the actuator completes its full travel, the 'open' limit switch will be broken, thus stopping the actuator and de-energizing relay C.1. If, however, relay F.1 is still energized, the actuator will remain stationary, thus keeping the shutter open. When relay F.1 is de-energized the circuit to the 'close' field coil of the actuator will be completed via contacts 6-6a of relays F.1 and C.1. The actuator will now close the shutter until switched off by the 'close' limit switch.

11. Provision is made in the circuits to operate the G.90 cine-camera whenever the guns are fired. When the firing trigger is pressed, the firing relay will energize to pass a supply through contacts 1–1a and contacts 2–2a of the de-energized bomb/R.P. release relay to operate the coil of the camera relay, contacts 3–3a of which close to connect a supply from the camera master switch to operate the camera. When the firing trigger is released, the firing relay will de-energize to open its contacts 1–1a to break the supply to the camera relay. The relay will de-energize and open its contacts 3–3a to disconnect the supply to the camera. Additionally, the camera recorder, when mounted on the gyro gunsight, is also brought into circuit. When the guns fire and the camera relay is energized its contacts 5–5a close to supply the recorder which will photograph the gunsight graticule until its supply is disconnected on release of the firing trigger.

Inboard pylons

12. The inboard pylons are fitted with ejector release units (E.R.U.'s) and the pylon equipment makes provision for either drop fuel tanks, bombs, practice bomb carriers, target containers or rocket launchers to be carried. In each pylon, two relays, C and D, are wired to 4-pin butt connectors on the E.R.U.'s via double plocket type safety breaks. The C and D relays function to pass supplies to detonate the ejector cartridge and thus jettison the store carried. Each pylon also contains a practice/normal switch. This switch is selected to the NORMAL position when drop tanks, rocket batteries or bombs are being carried or to the PRACTICE position when target containers or practice bomb carriers are fitted. The practice/normal switch is connected to the equipment being carried by a two-pin plocket connector. When drop tanks are fitted this plocket connects the tank fuel high level switch with the pressure refuelling circuit (*Group C.5*), for target streaming it connects with the stream microswitch in the target container (*Group G.2*), while for practice bombing it connects to the Type Q.1 relay on the carrier. A second two-pin plocket connector from the pylon connects the rocket carrier to its firing circuit and also provides an earth return connection for the stream microswitches when target containers are fitted.

13. Provision is made for the selection of the pylon to be operated by switches mounted on the bomb control panel at the cabin port arch. The switches are connected to pylon selector relays, C (*starboard outboard*), D (*starboard inboard*), E (*port outboard*) and F (*port inboard*), mounted in the bomb/R.P. selector J.B. located in the fairing aft of the hood. The stores release circuit lines from the practice/normal switches are routed through the appropriate pylon selection relay to contacts on a bomb/R.P. firing relay, contained in the bomb/R.P. release and camera J.B., located at the cabin port side between frames 12–13. The release circuit is connected to the supply, via the master switches, when the bomb/R.P. firing relay is energized by the operation of the bomb/R.P. release switch on the control column.

14. Modification 1270 incorporates electrical fuzing to the stores on the inboard pylons in addition to the existing mechanical fuzing. A three position fuzing selector switch (OFF/TAIL/NOSE and TAIL) is included on the cabin bomb control panel. Two fuzing relays, A (*outboard*) and B (*inboard*) are mounted in the bomb/R.P. selection J.B., together with a 5 amp nose and 5 amp tail fuzing fuse and the four pylon selector relays (*para. 13*). Operation of the fuzing selector switch energizes the fuzing relays to pass a current, in the selected fuzing mode,

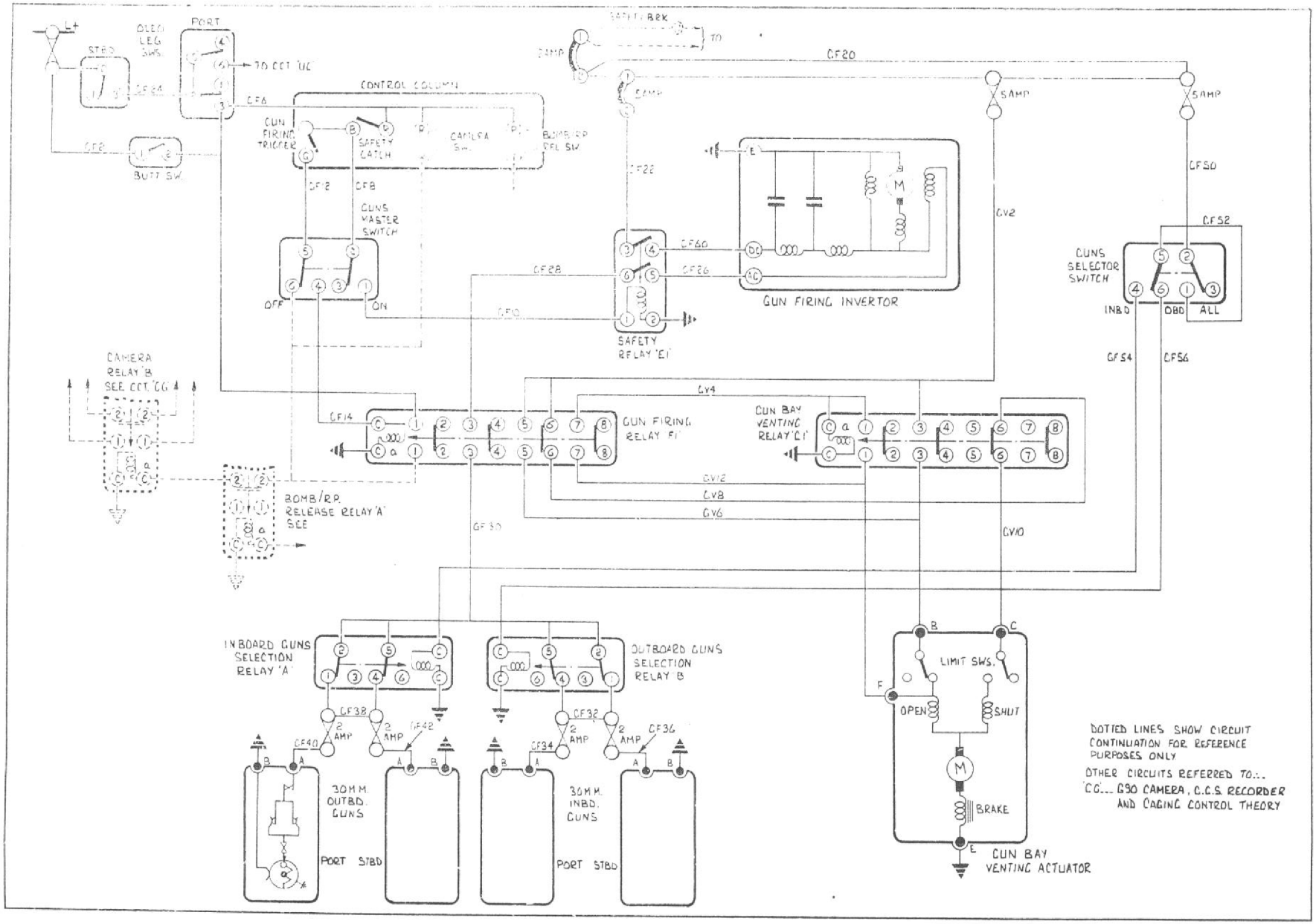

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Fig.2. Gun firing and venting (theoretical)

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to a T.B. in the pylon and thence to the fuzing units via two-pin connectors and S.S.D. (*supplementary safety device*) sockets.

15. For practice bombing, a practice bomb carrier is crutched up to the aircraft pylon. Two streamlined pylons on the carriers hold the practice bombs. The electrical release mechanism is housed in the streamlined container of the carrier and incorporates a relay Q.1 and an auto-selector switch. The bomb release mechanism is connected to the aircraft bomb release circuits via the drop tank fuel high level plocket in the pylon. When the relay Q.1 is energized its contacts close and pass the supply to the bomb carrier auto-selection circuit.

Outboard pylons

16. The outboard pylons are fitted with ejector release units (*E.R.U.'s*) and are equipped for the carriage of a drop fuel tank, bombs, Matra launcher, rocket launcher rail B, or a practice bomb carrier. Each pylon contains a practice/normal switch which must be in the PRACTICE position for the operation of practice bomb carriers and in the NORMAL position for the operation of the other cleared armament services. Relays C and D in the pylons connect a supply from the store jettison circuits, via a pylon safety break connector, to a four-pin butt connector on the E.R.U. to fire the ejector.

17. Selection of the pylon to be operated is as for the inboard pylons and described in para. 13 above. Modification 1245 provides for nose and tail fuzing units in the outboard pylons. The function of the fuzing equipment is as for the inboard pylons described in para. 14 above. Provision is also made on the outboard pylons for S.N.E.B./Matra rocket pod launchers to be carried. A relay RF mounted on the pylon, when energized by a supply routed through the R.P. master switch, the energized R.P. firing relay, the rocket selector switch and the selected pylon relay (*C or F*), will pass a firing current to the rocket pod through a 4-pin plocket type connector. Rocket launcher rails A, B, C and D are mounted on the underside of the outer wings. Rails A, C and D are attached to pairs of mounting posts attached to the wing structure, while rail B is secured to an adapter on the outboard pylons. The rockets are fed with a firing current through 4-pin plocket type connectors in the wings from supplies obtained via the R.P. firing and distribution box located at frame 19. When practice bomb carriers are fitted to the outer pylons, connection is made to the bombs release circuit, for operation of the carrier, through the drop tank fuel high level plocket connector attached to a T.B. in the pylon.

Practice bomb fuzing and release

18. The release of practice bombs is initiated by operating the bomb/R.P. release push-switch in the control column handgrip after the requisite preliminary switch selections have been made. Practice bombs are manually fuzed prior to take-off but, to ensure that the correct bombing drill is carried out, a fuzing selection must be made before the practice carriers can operate. The supply to effect the bomb selection is taken from the 12 amp bomb circuit-breaker through the bomb and R.P. master switches. With the bomb master switch on the bomb control panel selected ON, it is necessary that the R.P. master switch on the R.P. control panel be in the OFF position to make supplies available at contacts 1a, 3a and 5a of the bomb/R.P. firing relay, at the pylon selection switches on the bomb control panel and at terminals 2 5 of the fuzing selector switch.

19. When the fuzing selector is switched to TAIL, a supply energizes the coil of the fuzing relay, which closes to provide a circuit from the selector switch, through a 5 amp tail fuse and relay contacts 1 1a, to terminal 7 on the practice/normal switch. For practice bombing the practice/normal switch is in the PRACTICE position. The switch provides a circuit through terminals 7 8 to pin 2 of the carrier plocket connector, to take a supply to relay Q.1 on the carrier, which closes its contact arm to put the auto-selector switch and release solenoids in circuit to await a release current.

20. With the aircraft airborne and the leg switches of the undercarriage closed (*para. 3*), when the release push-switch on the control column is pressed, the bomb/R.P. firing relay is energized and its contacts 1–1a (*inboard pylons*) and 3–3a (*outboard pylons*) close to provide a release current at terminal 1 of each of the pylon selection relays. Selection of the required pylon is made by switching on the appropriate pylon selector on the cabin bomb control panel, which will provide a supply from the bomb 12 amp circuit breaker to energize the coil of corresponding pylon selection relay. The selected relay closes its contacts 1–1a to bring the current to terminal 2 of the practice/normal switch. The switch being in the PRACTICE position, provides a circuit through the contacts of the carrier relay Q.1, already energized by the fuzing action (*para. 18*), to the auto-selector to operate the release solenoid and the bomb is released.

Store release, fuzing and pylon selection

21. Stores mounted on the inboard and outboard pylons and attached to the ejector release units (*E.R.U.'s*) are released, after the requisite necessary switching selections, by operating the bomb/R.P. release push-switch in the control column handgrip.

22. The three position fuzing selector switch on the cabin bomb control panel provides for 'tail' or 'nose and tail' fuzing. With the bomb master switch ON, it is necessary that the R.P. master switch be in the OFF position in order that a supply from the bomb 12 amp circuit breaker be applied to terminals 2 5 of the fuzing selector switch. Selecting the fuzing switch to TAIL energizes the coils of both the inboard and outboard fuzing relays which are located in the bomb/R.P. selection junction box. Their contacts close

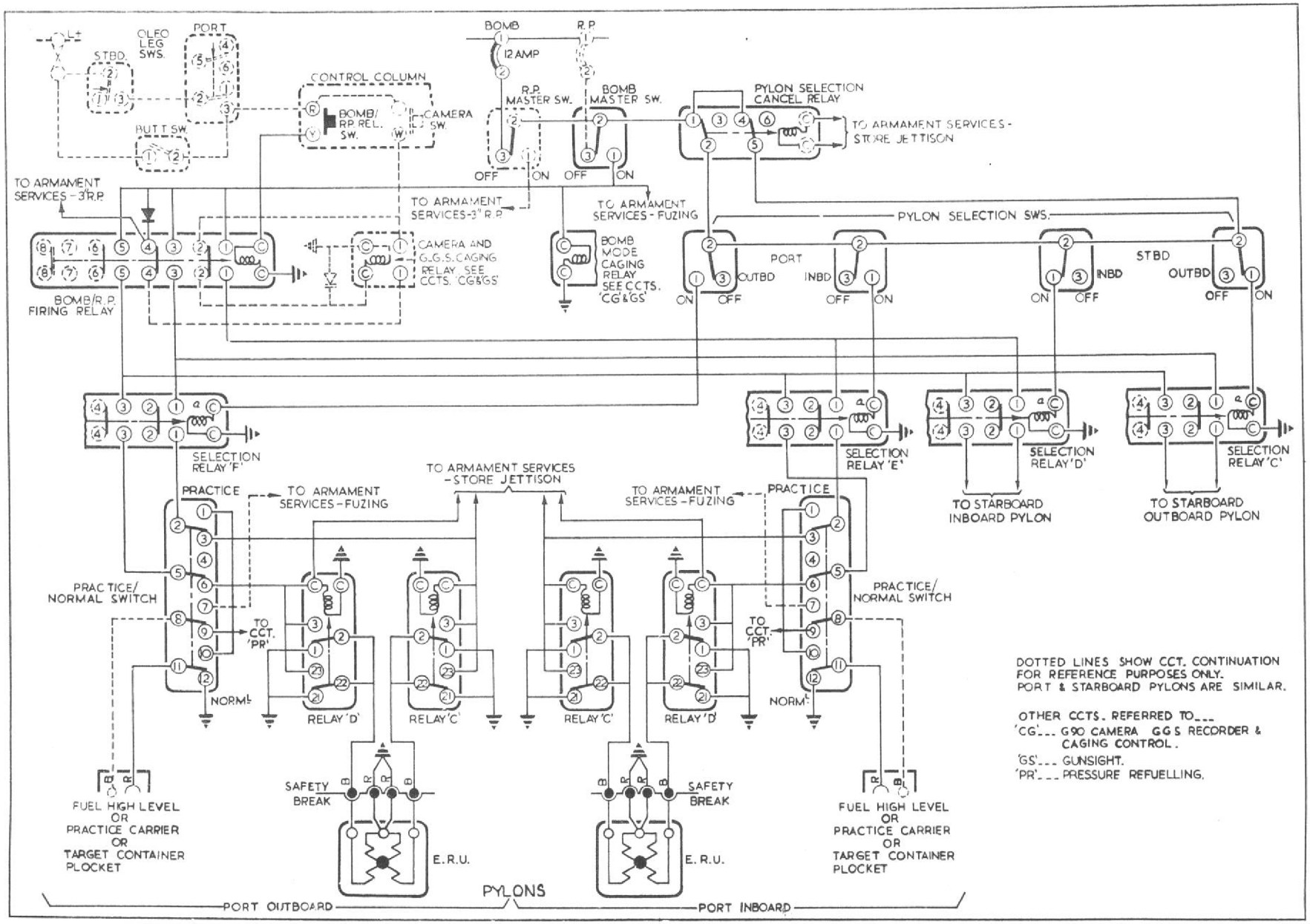

Fig.3. Store release and pylon selection (theoretical)

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to provide a circuit, through the 5 amp tail fuzing fuse and contacts 1–1a, to a T.B. in the pylon. From the terminal block, connectors Type 5D/1986 complete the tail fuzing circuit to the tail fuzing units and S.S.D. sockets.

23. Further selection of the fuzing selector to the NOSE and TAIL position leaves the coils of the selection relays energized and provides an additional circuit, through contacts 3–3a and the nose fuzing fuse, to terminal blocks in the pylons where connection is made to the nose fuzing unit and the S.S.D. socket by Type 5D/1986 connectors. Current is therefore available at the fuzing units to operate the fuzing devices as the store falls away from the aircraft.

24. With the aircraft airborne and the leg switches of the undercarriage closed (*para. 3*), when the bomb/R.P. release push-switch is pressed, the bomb/R.P. firing relay is energized and its contacts 1–1a (*inboard pylons*) 3–3a (*outboard pylons*) close to provide a release current at terminal 1 of each of the pylon selection relays. Selection of the pylon to be operated is made by switching on the appropriate selection switch on the cabin bomb control panel which will provide a supply from the bomb 12 amp circuit-breaker to energize the coil of its corresponding selection relay. The relay will close its contacts and the firing current is fed, through contacts 3–3a of the firing relay and contacts 1–1a of the selection relay, to terminal 2 of the practice/normal switch. At the same time a duplicate circuit is made through contacts 5–5a of the firing relay and contacts 3–3a of the selection relay to terminal 5 of the practice/normal switch The practice/normal switch, selected to the NORMAL position, continues the duplicated release circuit to energize the coils of two relays, C and D, mounted in the pylon. Switch terminals 2–3 are circuited to relay C and terminals 5–6 to relay D. The energized relays C and D each close their contacts 2–3 and 22–23, thus providing a dual circuit through each relay. The relays then separately feed the duplicated firing current, through a safety break, to the E.R.U. 4-pin butt connector. The firing current supplied through either or both of the duplicated firing circuits will then fire the cartridge to operate the ejector and so release the store.

Store and drop tank jettison

25. The E.R.U.'s on the inboard and outboard pylons may be actuated by the use of the inboard and outboard pylon stores jettison push-switches mounted on the cabin bomb control panel, pressed separately or operated simultaneously by the use of the clear aircraft bar which mechanically depresses both switches. The jettison circuits are arranged so that the bomb fuzing selector switch must be in the OFF position before supplies can be fed to the E.R.U.'s to fire the ejector and release the store, thus ensuring that the stores are jettisoned in the safe, unfuzed state. A pylon selection cancel relay is incorporated in the circuit to override any pylon selection already made and so ensure that a jettison release supply is fed to the E.R.U.'s when the jettison switches are pressed.

26. The jettison circuits, outboard and inboard, are each arranged in duplicate. One release circuit originates at the 12 amp jettison 1 circuit breaker, which feeds one pair of contacts in each jettison push-switch. Operation of the push-switch takes the supply to contacts 6–6a of the de-energized fuzing relay. Should the fuzing relays be energized by a selection of the fuzing switch, contacts 6–6a and 8–8a will be open and no circuit available for jettison release. Contacts 6–6a take the supply to terminals 4–4a of the pylon selection relays. The coils of any selected pylon relays de-energize when operation of a jettison push-switch energizes the pylon selection cancel relay, whose contacts open to break the supply to all pylon selection relays. The supply now passes through contacts 4–4a of the de-energized selection relays to the coils of relays D in the pylons, which energize to close their contacts 2–3 and 22–23 to take the jettison release current through the safety breaks and butt connectors to fire the E.R.U. ejectors.

27. The duplicate jettison release circuit originates at the 12 amp jettison 2 circuit breaker which feeds a second pair of contacts in each of the jettison push-switches. Operation of the push-switch takes the supply to terminals 8–8a of the de-energized fuzing relay and thence to the coils of the relays C in the pylons, which energize to take the current through their contacts 2–3 and 22–23 to the safety breaks and butt connectors to fire the ejectors.

28. A system of blocking diodes is incorporated in the circuits between the inboard and outboard jettison push-switches and the coil of the pylon selection cancellation relay. The diodes, D1–D5, are mounted on a bracket behind the bomb control panel in the cabin. They are inserted to prevent the inboard jettison circuits being activated when the outboard release push-switch is pressed and vice versa.

29. Additionally, blocking diodes D5–D8, are mounted in the bomb/R.P. selector J.B. and inserted, one in each jettison circuit to relays C in the pylons. Their function is to oppose the release current which would flow to the companion pylon (*inboard or outboard*) when a store is selected and released by the control column release switch in the normal manner (*para. 24*).

Target banner towing

30. Provision is made, by utilizing armament services circuits, for the streaming and release of towed banner targets. Targets are carried and streamed from containers mounted on the inboard pylons. They are streamed by the operation of the stream switches (*incorporated with the stream indicators*), mounted as a group above the gyro

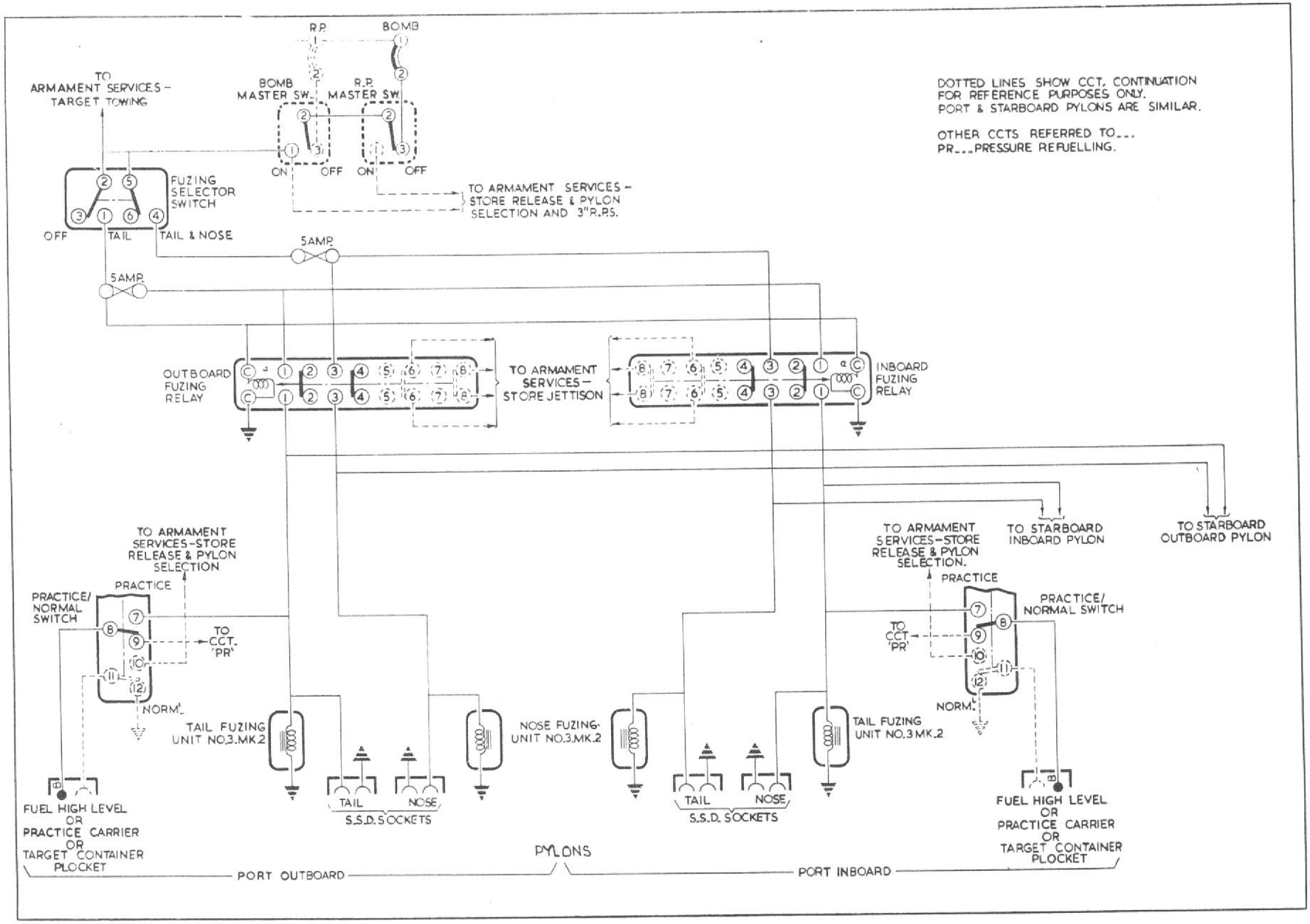

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Fig.4. Store fuzing (theoretical)

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gunsight in the cabin, after certain other switching selections and cable connections have been made. A target towing control box is mounted at frame 17, adjacent to the supply panel, and contains the launch selector switch, relays and fuses and instructions for transferring certain cable connections to effect the target towing role. The target towing cables are attached to two target towing release slips mounted on the underside of the centre fuselage. The targets, when streamed, remain attached to the release slips until released by operating either the bomb/R.P. release push-switch in the control column handgrip, the target standby release push-switch or the inboard jettison switch.

31. Targets are also launched by the drag launch method in which the stream wing launch containers are not used. In this method the towing cable is attached to the release slip while the aircraft is on the ground and the target is dragged off the runway.

32. Interconnection with the air brake control circuit (*Group D.7*) is arranged to ensure that the air-brake is retracted when the target banners are streamed and remains inoperative until the cables have been released.

33. A full description of the target towing circuits and their operation is contained in Group G.2.

R.P. firing

34. To operate the aircraft in its ground attack role provision is made for two methods of rocket projectile firing. In one system, 3 in. rockets are launched from rails under the outer wings and in the other, 68 mm. SNEB projectiles, in a Matra pod launcher holding 19 rockets, are launched from the outer pylons (*para. 17*). Modifications 1260 and 1258 retain the rocket battery release circuits to the inner pylons, available for future requirements. Its plocket connector is used to provide an earth return circuit for the stream indicator lamps, when in the target towing role. Each installation is operated by electrical power from the 18 amp R.P. circuit-breaker (*para. 2*) and the firing sequence is initiated by the use of the bomb/R.P. push-switch on the control column handgrip, after certain other switching selections have been made. The circuits are arranged to allow the target to be photographed by the G.90 camera and for a record to be taken from the gunsight graticule (*para. 42 and 51*) up to the moment of firing, at which instant a further circuit is introduced to cage the gyro gunsight to prevent wander of the graticule during the R.P. attack manoeuvre (*para. 54*).

35. The 3 in. projectiles are carried on four sets of Mk. 12, Type 3 launchers located beneath each outer wing. The firing system employed is the Type 2 uniselector system, which is designed to fire up to 24 projectiles in salvoes of 2, 4, 6 or 8. The size of the salvoes is selected by use of the R.P. selector switch located on the R.P. control panel on the cabin port coaming. The selector is a four position rotary switch, marked 2, 4, 6 and 8. The installation employs a firing distribution box and has two modes of operation, normal and ripple firing. These are selected by a rocket mode switch marked RIPPLE–SALVO–PODS, also mounted on the R.P. control panel together with the R.P. master switch.

36. The R.P. firing distribution box is mounted adjacent to the R.P. J.B. on the starboard fuel tank access door on frame 19. The control circuit connections are made via an unmarked plug. Two other plugs on the box are used for connecting the firing circuits and are marked PAIRS and SINGLES. On Hunter aircraft, only the singles plug is used, the other is covered by a protective cap and should not be connected, since in certain circumstances its use can result in an incorrect firing sequence, with the possibility of damage to the aircraft. A reset push-switch, used for resetting the distribution box, and a magnetic indicator are contained in the R.P. J.B.

37. In order that the system may be activated when the firing release switch is pressed, it is necessary that the R.P. master switch be in the ON position and the bomb master switch be in the OFF position to make a supply available from the 18 amp R.P. circuit breaker. With the aircraft airborne power supplies are available at the bomb/R.P. release push-switch and at the camera switch in the control column handgrip. When the release switch is pressed, the bomb/R.P. firing relay is energized and closes its contacts 7–7a to take the operating supply from the master switch to the rocket mode switch. With this switch selected to SERVO, supplies will pass to the distribution box. The size of the salvoes, 2, 4, 6 or 8 projectiles, is selected by the R.P. selection switch which routes a supply through the selected circuits to the distributor box, which operates to fire the projectiles.

38. When the firing push-switch is pressed, with the rocket mode switch in the RIPPLE position, the supply passes to the firing distribution box via contacts on the rippling relay in the R.P. J.B. The uniselector and relay then operate together, as described in A.P.4343X, Vol. 1, Sect. 16, so that projectiles are fired continuously in salvoes, in accordance with the selection made on the selection switch, i.e. 2, 4, 6 or 8 at a time, until the armament is expended or the firing switch released.

39. The reset switch is used to reset the uniselector in the firing distribution box prior to re-arming. The indicator will operate when resetting is complete and will be de-energized when the reset switch is released.

40. The 68 mm. SNEB projectiles are fired from Matra launcher pods holding 19 rockets, attached to the outboard pylons. The circuits to the pods form the alternative

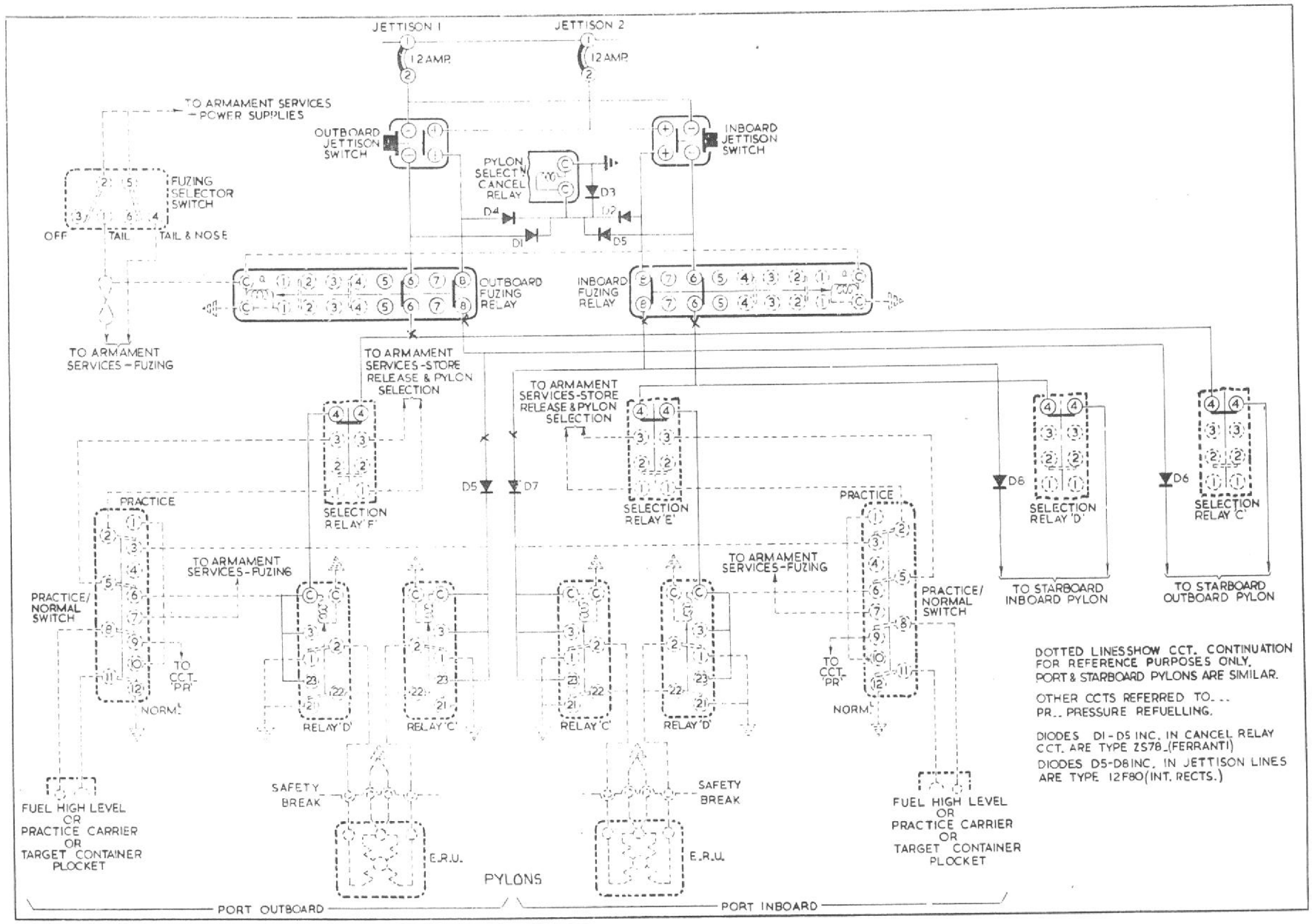

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Fig.5. Store jettison (theoretical)

RESTRICTED

system of R.P. firing on the aircraft. Selection of the pylon to be operated is made by the appropriate pylon selection switch which energizes its corresponding relay (*para. 24*). With the bomb master switch OFF and the R.P. master switch ON, a supply is taken through contacts 5–5a of the selected pylon relay to the 4-way pod plocket connector. When the aircraft is airborne and the bomb/R.P. release push-switch pressed, the coil of the firing relay is energized (*para. 37*). Its contacts 7–7a close to pass current from the R.P. master switch, through the rocket mode switch, which is selected to PODS, to contacts 7 of the pylon selection relays. The selected relay has closed its contacts 7–7a and the supply passes to energize the rocket firing relay R.F. which operates to take the firing current to the 4-pin pod connector plocket. The electrical circuit of the Matra rocket pod launcher will appear in the appropriate Air Publication when issued.

41. Circuits are incorporated in the R.P. system to control the operation of the G.90 camera and the gyro gunsight recorder camera, during an R.P. attack, through the camera relay circuits (*para. 42 and 53*). Additionally, the camera relay circuit provides for the gunsight moving graticule to be caged on operation of the R.P. firing push-switch and to become uncaged on the operation of the camera push-switch on the control column handgrip (*para. 54*).

G.90 camera

42. The 16 mm. cine camera Type G.90, incorporating an internal overrun control unit, is located on a mounting platform inside the fuselage nose structure at the top just forward of the frame 3 and is focused through a vision tube riveted around an orifice in the skin. The camera is normally controlled by the gun firing relay (*para. 7*), being operated whenever the gun firing trigger is pressed to fire the guns or, independently of the guns, by the operation of the camera push-switch at the top of the control column handgrip. During an R.P. attack the camera is also used to photograph the target up to the moment that the projectiles are released.

43. The camera body heater, which is thermostatically controlled, is supplied via the camera master switch located on the leg panel. An iris selection switch, marked BRIGHT and DULL, used to select the correct iris opening according to bright or dull weather conditions is located on the starboard instrument panel.

44. To enable the camera to be tested and serviced before flight, a switch marked NORMAL and TEST, together with a camera run indicator lamp, is provided in a test box situated in the fuselage nose. When placed in the TEST position the test switch supplies the camera direct from the camera master switch. The camera run indicator lamp is controlled by contacts in the camera and will flash on and off as the film passes through the magazine to indicate that the camera is operating correctly.

45. The camera body heater is supplied from the 10 amp fuse 6 on the leg panel when the camera master switch is closed, the heater being thermostatically controlled to maintain the camera at its correct operating temperature. A supply is also made from the camera master switch, through the closed contacts of the de-energized iris relay to the iris coil in the camera. The supply to the camera push-switch on the control column handgrip is taken from the gun firing fuse 19 on the supply panel, via the alighting gear compression switches (*para. 3*).

46. The camera may be operated independently of gun firing. When the aircraft is airborne, the compression switches make contact to bring a supply to the camera push-switch. Thus, when the switch is pressed to operate the camera independently of the guns, the supply is fed to the coil of the camera relay via contacts 2–2a of the de-energized firing relay. With the camera relay energized, contacts 3–3a will complete the supply from the camera master switch to pin C of the camera.

47. Pin C of the camera is in internal connection with the overrun indicator solenoid, overrun clutch solenoid and the camera motor, via the overrun selector when in the non-overrun position. The camera will, therefore, run with the overrun mechanism inoperative, i.e. clutch disengaged and overrun indicator retracted until switched off when the camera push-switch is released to de-energize the camera relay.

48. When the overrun selector is in the overrun position, pin C of the camera feeds the overrun indicator solenoid and the overrun clutch solenoid as before, but the feed to the camera motor is taken from pin D of the camera, via the overrun microswitch and overrun selector. When the camera push-switch is released to de-energize the camera relay, the overrun indicator and overrun clutch solenoids will be de-energized, but the camera motor will continue to run until the overrun microswitch is operated. The overrun microswitch is operated by a cam, driven via the clutch from the camera layshaft. When de-energized, the clutch is allowed to engage with the layshaft and rotate the cam to operate the microswitch. The operation of this switch will cut off the supply to the camera motor and the camera will stop, having overrun for approximately two seconds after the camera push-switch was released. When the overrun indicator solenoid is de-energized it will allow the overrun indicator pointer to appear in the film gate aperture so that it will be visible in that section of the film exposed during the overrun period.

49. To operate the camera with gun firing, when the firing switch is pressed and the firing relay is energized, a supply is fed through its contacts 1–1a and contacts 2–2a of the de-energized bomb/R.P. release relay to energize the camera relay. With the

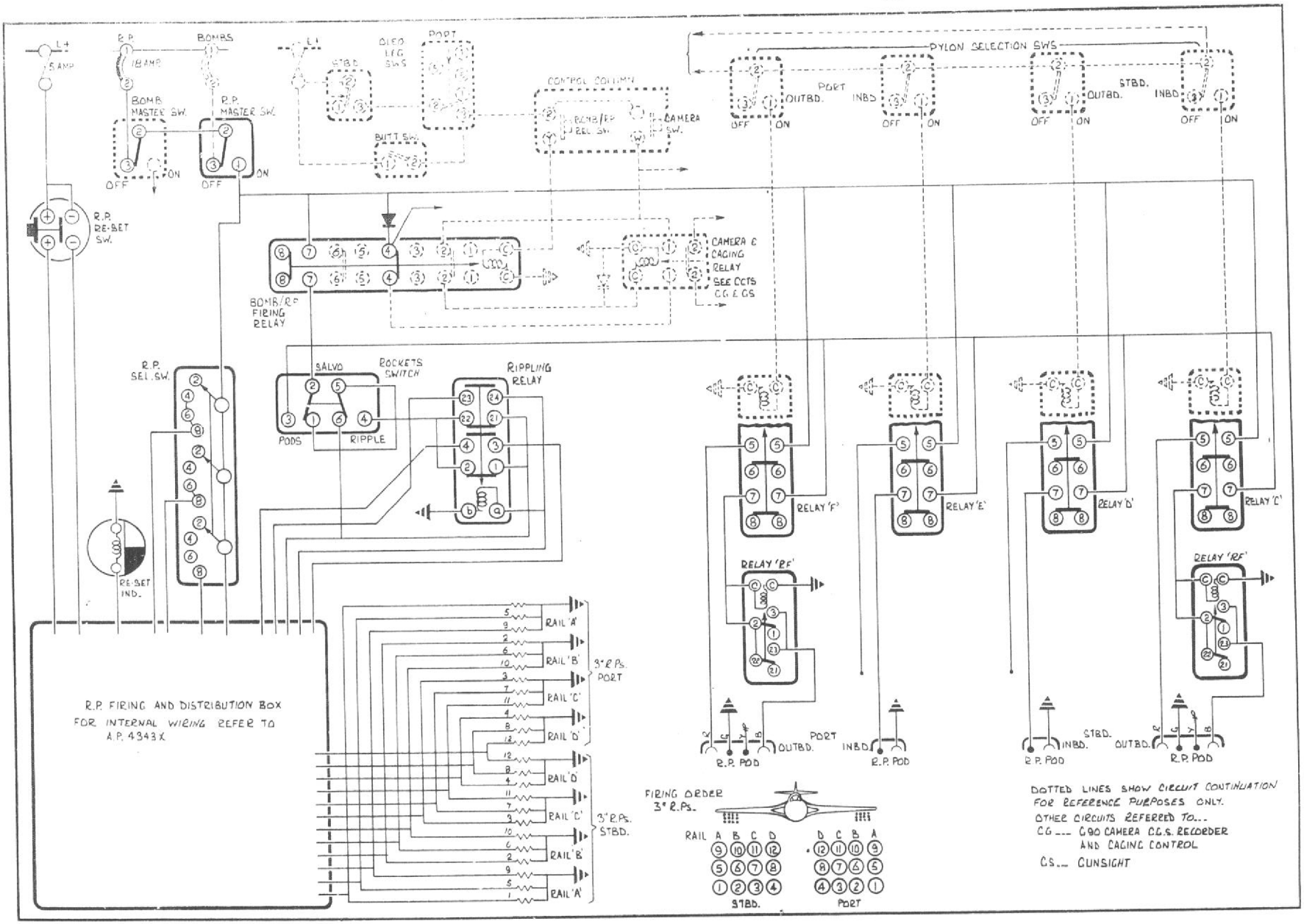

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Fig.6. R.P. services (theoretical)

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camera relay energized a supply is fed to the camera in the manner as described in para. 46–48. The camera will therefore operate to photograph the target as the guns are fired. As the firing trigger is released, the relays will de-energize to break the supply to the camera.

50. When making an R.P. attack, the tactics employed are to photograph the target up to the moment that the projectiles are released, and thus it is necessary to start the camera before firing the projectiles and keep it operating until the projectiles are fired. This is accomplished by a hold-on circuit through the bomb/R.P. release relay. Operation of the camera push-switch will energize the camera relay via contacts 2–2a of the de-energized bomb/R.P. relay. With the R.P. master switch selected ON a hold-on supply is made to the camera relay through contacts 2–2a and 4–4a of the de-energized bomb/R.P. relay and contacts 1–1a of the energized camera relay. The camera will thus continue to operate after the camera push-switch is released. On firing the rocket projectiles, by pressing the bomb/R.P. release push-switch in the control column handgrip, the bomb/R.P. relay is energized to break the hold-on supply to the camera relay and its contacts 3–3a open to break the supply to stop the camera. To start the camera in preparation for a further attack, the camera push-switch must be operated again.

Camera recorder

51. The camera recorder is an electrically driven cine camera used in conjunction with the pilot's gyro gunsight to photograph a target as reflected in the gunsight graticule. The camera is mounted on the gunsight and used during gun firing and R.P. attacks.

52. In a gun firing attack, as the trigger is pressed, the gun firing relay is energized to close contacts 1–1a to complete a supply via contacts 2–2a of the de-energized bomb/R.P. relay to operate the camera relay. Contacts 5–5a of the camera relay then close to complete a circuit from fuse 14 in the leg panel to supply the recorder and the camera will operate as described in Chap. 2. Group 4A. On release of the trigger, the relays are de-energized to break the supply to the recorder.

53. In an R.P. attack, on pressing the camera push-switch, as described in para.50 above, the camera recorder, when fitted, will operate co-incidentally with the G.90 cine camera, being supplied through contacts 5–5a of the camera relay.

Gyro gunsight caging

54. During the initial stages of an R.P. attack a restricting influence is placed on the gyro gunsight moving graticule to prevent wander. This is known as caging and is achieved by feeding into the range coils of the sight, an electrical current strong enough to eliminate the wander when the caging circuit is made. At the commencement of the attack the gunsight control unit selector switch is set to an R.P. setting. When the camera push-switch is pressed the camera relay hold-on circuit will operate as described in para.50. Its caging contacts 2–2a are held open and as the caging current is passed through a resistance, the sight is in the uncaged condition. When the bomb/R.P. push-switch on the control column handgrip is pressed to release the projectiles, the camera relay will de-energize and close its caging contacts 2–2a, to complete a supply to relay E in the sight unit. Relay E will energize and close its contacts 22–23 to route a strong positive supply, cutting out the resistance, to the range coils to cage the sight. The gunsight will uncage on further pressing the camera push-switch. Further information on the gyro gunsight is contained in Group 4A and in Air Publication 1275E, Vol. 1, Sect. 5.

SERVICING

General

55. For general servicing of the electrical system reference should be made to Group A.1 of this chapter. All the components should be kept clean and examined periodically for signs of damage and to ensure that they are securely mounted. Apart from the standard routine serviceability and bench testing of the components as described in the appropriate Air Publications quoted in Table 1, no further servicing should be necessary.

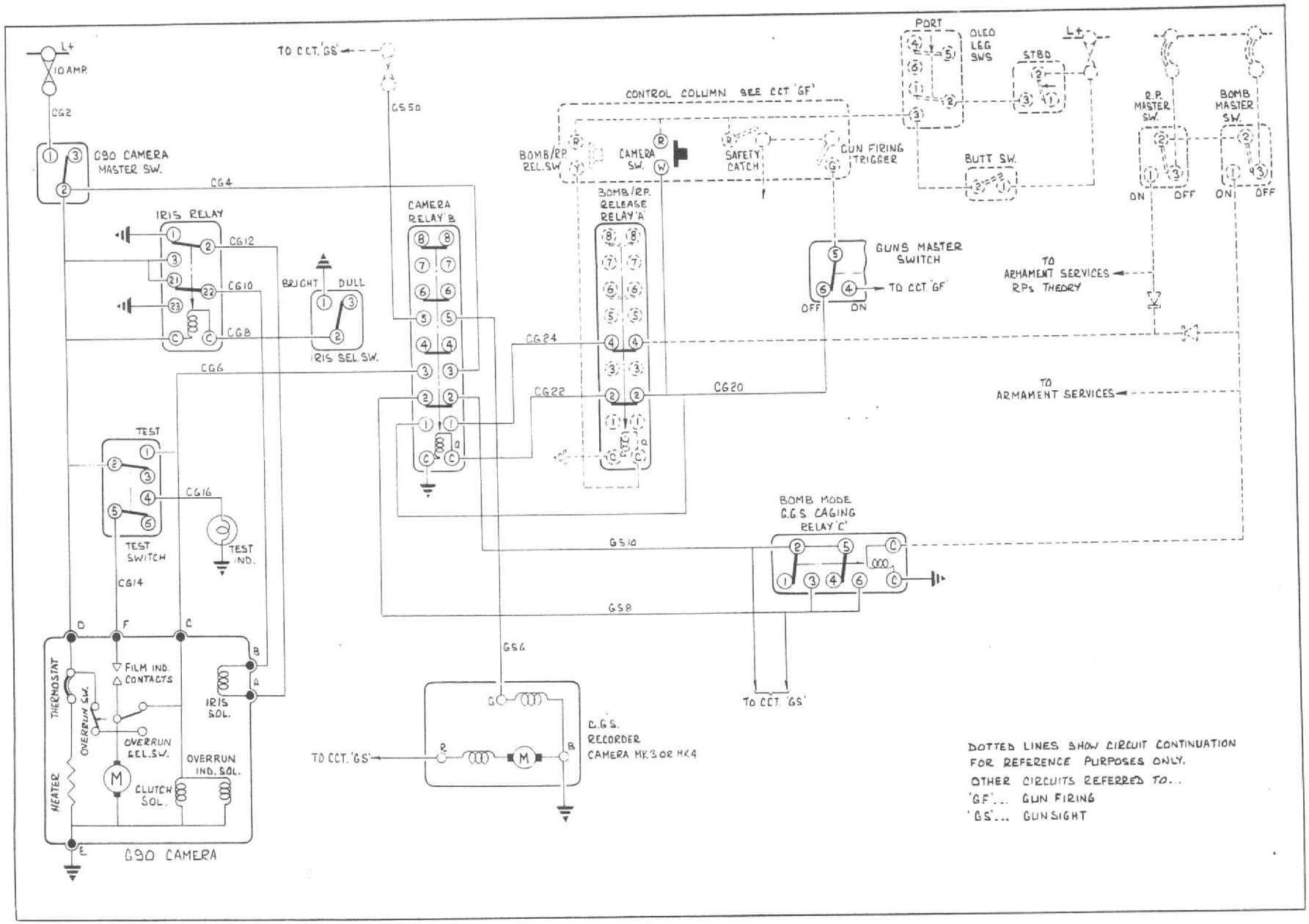

Fig. 7 G90 camera, GGS recorder and caging control (theoretical)

◀ **55A.** The Bomb/R.P. push switch, Part No. ACM 22556/6, *(initial fitting to control handle Part No. AC 63682)*, is subject to failure by jamming. When necessary, switch Part No. 24484/7 *(Mod.1335)* is fitted. Mod. 1350, by conversion, replaces the above control handle with Part No. A.C.64618 to overcome instances of brake lever restriction due to loosening of the screws securing the lever assembly to the control handle.

Mod.1288

56. Mod.1288 introduces new firing relays with improved earthing facilities for inboard pylons of the following Part Numbers

Port inboard pylon	Stbd. inboard pylon
D 243127	D 243128
D 250720	D 250721
D 267584	D 267585
E 263811	E 263812
E 263850	E 263851

▶

Testing ejector release circuits

57. The procedure for testing the ejector release circuits is given in the following paragraph:-

(1) *Condition*

With the aircraft on the ground and no external stores fitted, check that the following items are *disconnected.*

(a) Armament safety plug.
(b) Gun package.
(c) Safety plockets in both inboard and outboard pylons.
(d) Butt connectors from inboard and outboard E.R.U.'s.
(e) External supply.

(2) *Preparation*

(a) In the cockpit select the following switches as shown:-

Battery master	OFF
Bomb master	OFF
R.P. master	OFF
Gun master	OFF
Pylon selector	OFF
Fuzing selector	OFF
Butt test	OFF
Rocket selector	SALVO
R.P. salvo selector	2

(b) Ensure that all armament circuit breakers are 'out'.

(c) Ensure the practice/normal switches in all pylons are set to NORMAL.

(d) Connect the pylon safety plockets.

(3) *Pre-arming tests*

Using a Voltage Detector Unit of suitable sensitivity connected at each E.R.U. butt connector, check for 'no volts' or 'supply volts' at these points when the bomb release and jettison circuits are selected in sequence *(1 to 17)*, as shown in Table 2.

(4) *On completion*

Disconnect the safety plockets in the inboard and outboard pylons.

Arming ejector release unit

58. The procedure for arming the ejector release units is as follows:-

(1) *Condition*

As in para. 56, sub-para. (1).

(2) *Preparation*

As in para. 56, sub-para. (2) but leave the safety plockets in the pylons disconnected.

(3) *E.R.U. arming procedure*

Using a Bridge Megger in the 'bridge' condition and ensuring that slip speed is maintained, with the earth terminal connected to pin D of the armament safety socket and the line terminal connected to earth, check for the correct position of the E.R.U. firing circuit relay contacts as detailed below.

(a) Depress and hold outboard jettison switch. Reading obtained should be between 140 and 155 ohms.

(b) Trip jettison 2 circuit breaker. Reading obtained should be between 225 and 250 ohms.

(c) Release the outboard jettison switch and depress the inboard jettison switch. Reading obtained should be between 225 and 250 ohms.

(d) Reset jettison 2 circuit breaker. Reading obtained should be between 140 and 155 ohms. Release the inboard jettison switch.

(e) At the outboard pylons, using a low voltage ohmeter between the poles of safety plockets C and D *(free ends)*, check for closed back contacts of E.R.U. firing relays. Reading obtained should be zero.

(f) At the inboard pylons, using a 250 volt Megger, check for open relay contacts between the red and blue pins of plockets C and D *(free*

TABLE 2

PRE-ARMING TESTS ON E.R.U. CIRCUITS

OP.	SAFETY PLUG	EXTL. SUPPLY	CIRCUIT BREAKERS						BOMB MASTER	FUZING SELECTOR	R.P. MASTER	ROCKETS SEL. SW.	R.P. SALVO SEL. SW.	BUTT TEST SW.	BOMB R.P. REL. SW.	OUTBD JETT. SW.	INBD. JETT. SW.	PYLON SELECTOR SWS.				E.R.U. BUTT. CONNS.			
			MASTER	BOMB	JETT. 1	JETT. 2	R.P.	GUNS										PORT OUTBD.	PORT INBD.	STBD INBD.	STBD OUTBD.	PORT OUTBD.	PORT INBD.	STBD INBD.	STBD OUTBD.
1	CONND.	ON	OUT	OUT	OUT	OUT	OUT	OUT	OFF	OFF	OFF	SALVO.	2	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	NO VOLTS	NO VOLTS	NO VOLTS	NO VOLTS
2	"	"	IN	IN	"	"	IN	IN	ON	"	ON	"	"	"	"	"	"	"	"	"	"	"	"	"	"
3	"	"	"	"	"	"	OUT	OUT	"	"	OFF	"	"	"	ON	"	"	"	"	"	"	"	"	"	"
4	"	"	"	"	"	"	"	"	"	"	"	"	"	ON	HOLD	"	"	"	"	"	"	SUPPLY VOLTS	"	"	"
5	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	ON	"	"	"	NO VOLTS	SUPPLY VOLTS	"	"
6	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	OFF	ON	"	"	"	NO VOLTS	SUPPLY VOLTS	"
7	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	"	OFF	ON	"	"	"	NO VOLTS	SUPPLY VOLTS
8	"	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	"	"	OFF	ON	"	"	"	NO VOLTS
9	"	"	"	"	"	"	"	"	"	"	"	"	"	"	OFF	ON	ON	"	"	"	OFF	"	"	"	NO VOLTS
10	"	"	"	OUT	IN	"	"	"	OFF	"	"	"	"	OFF	"	OFF	"	"	"	"	"	"	SUPPLY VOLTS	SUPPLY VOLTS	"
11	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	ON	OFF	"	"	"	"	SUPPLY VOLTS	NO VOLTS	NO VOLTS	SUPPLY VOLTS
12	"	"	"	"	"	IN	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
13	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	OFF	ON	"	"	"	"	NO VOLTS	SUPPLY VOLTS	SUPPLY VOLTS	NO VOLTS
14	"	"	"	IN	"	"	"	"	ON	TAIL	"	"	"	"	"	ON	ON	ON	ON	ON	ON	"	NO VOLTS	NO VOLTS	"
15	"	"	"	"	"	"	"	"	ON	TAIL & NOSE	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
16	"	"	"	"	"	"	"	"	"	OFF	"	"	"	"	"	"	"	"	"	"	"	SUPPLY VOLTS	SUPPLY VOLTS	SUPPLY VOLTS	SUPPLY VOLTS
17	DIS.	OFF	"	"	"	"	IN	IN	OFF	"	"	"	"	"	"	OFF	OFF	OFF	OFF	OFF	OFF	NO VOLTS	NO VOLTS	NO VOLTS	NO VOLTS

NOTE : *Operations 10 and 11, supply volts should appear on one contact only of each butt connector*

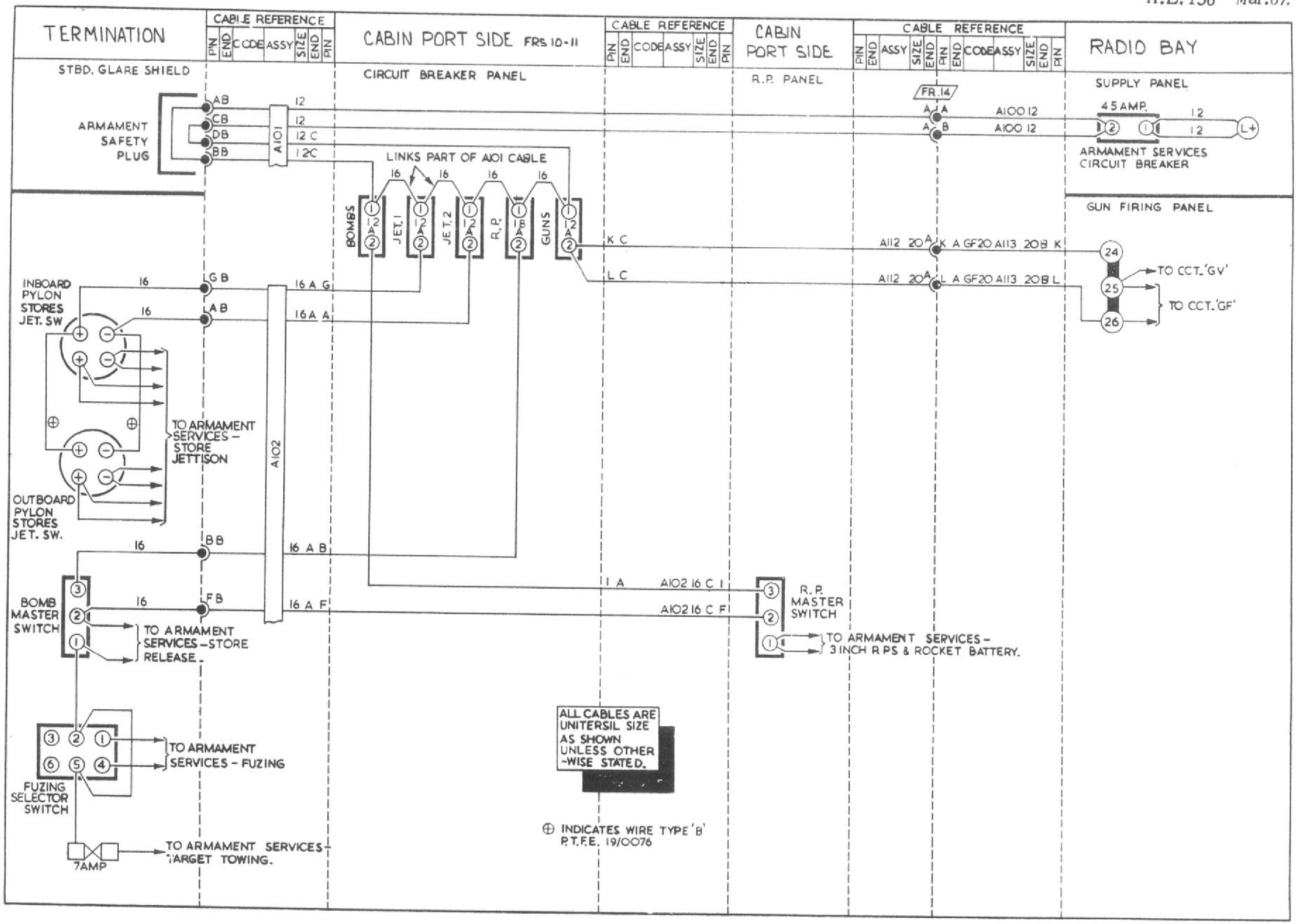

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Fig.8. Armament services power supplies (routeing)

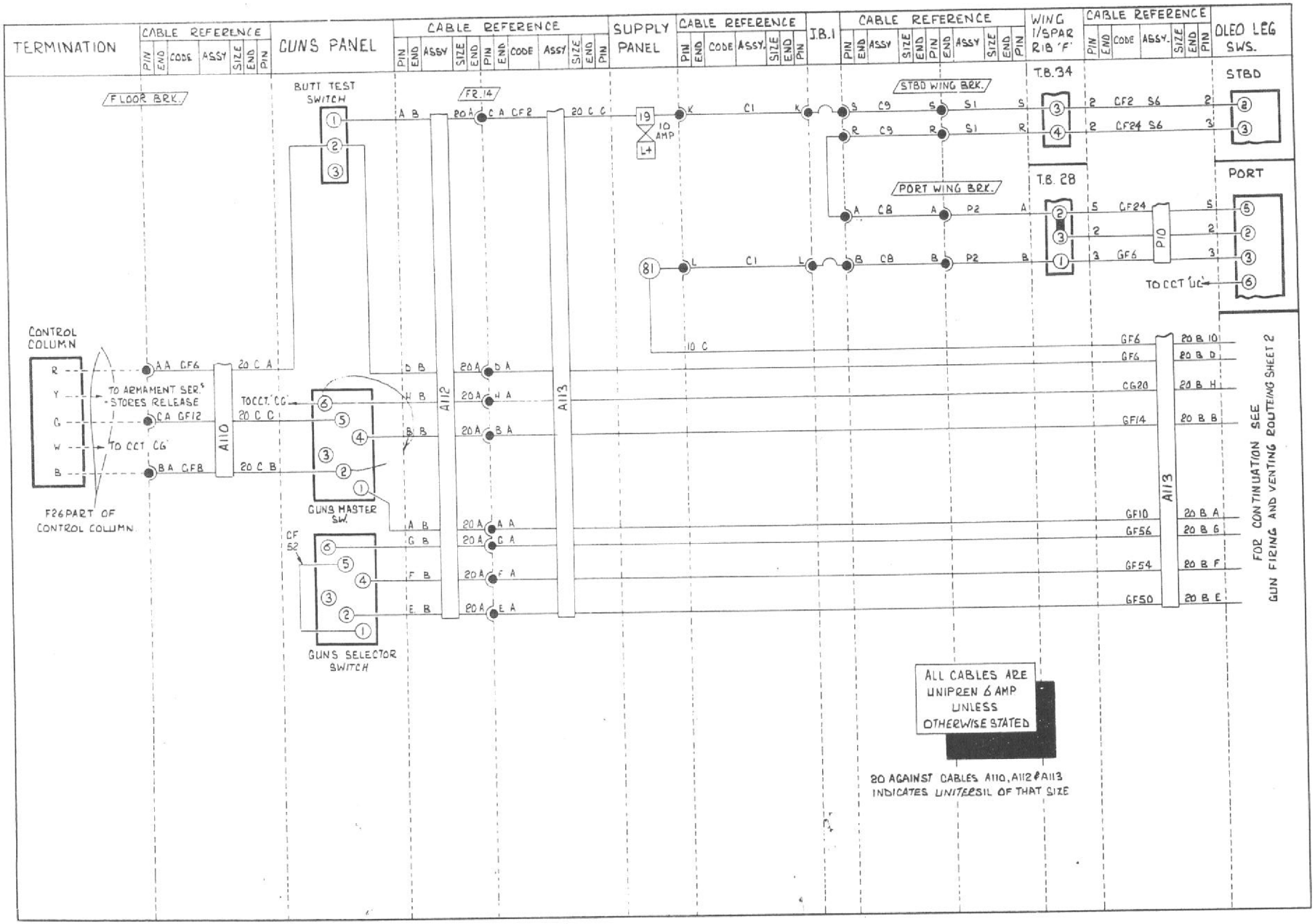

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Fig.9. Gun firing and ventilation (routeing 1)

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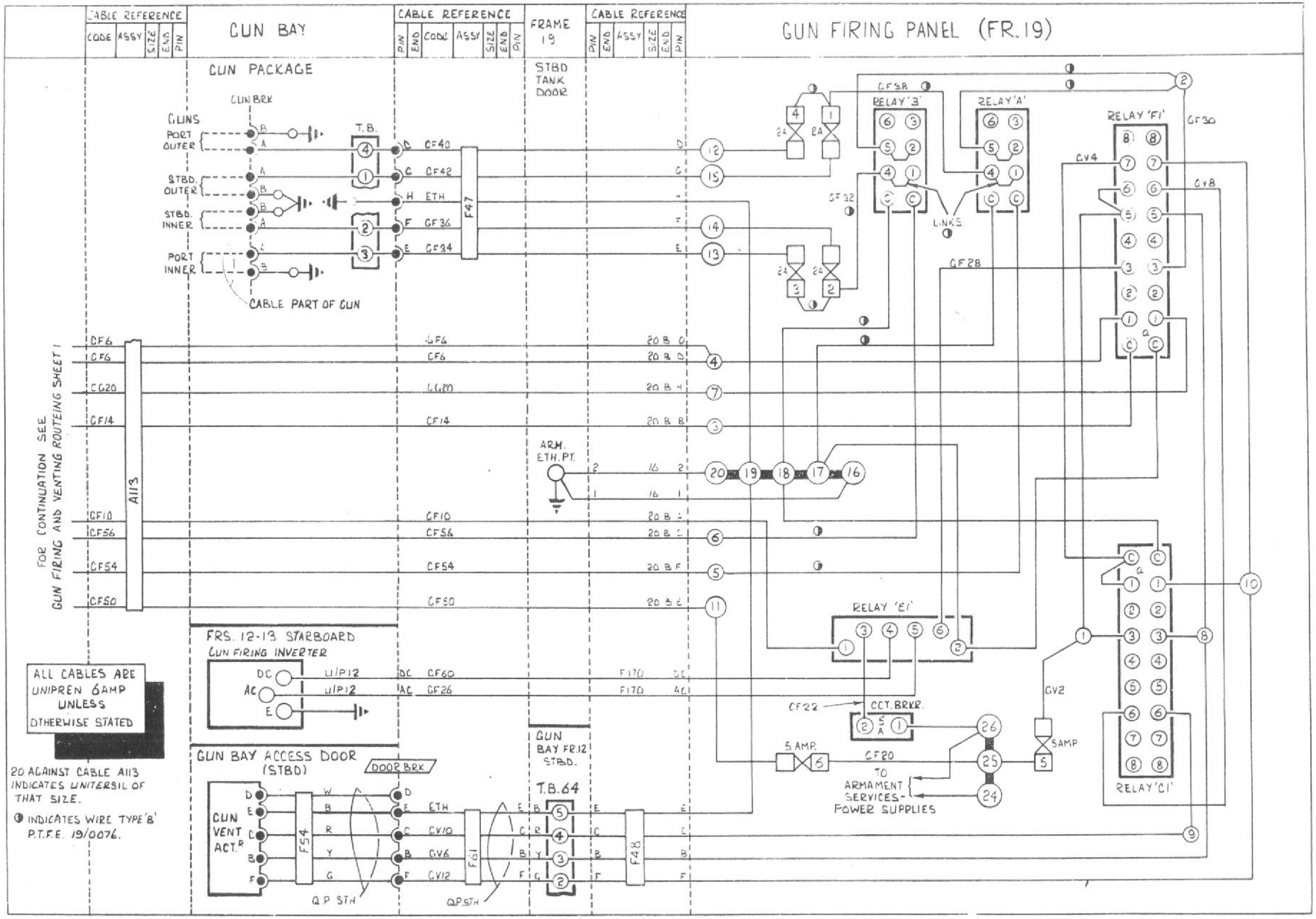

Fig.10. Gün firing and ventilation (routeing 2)

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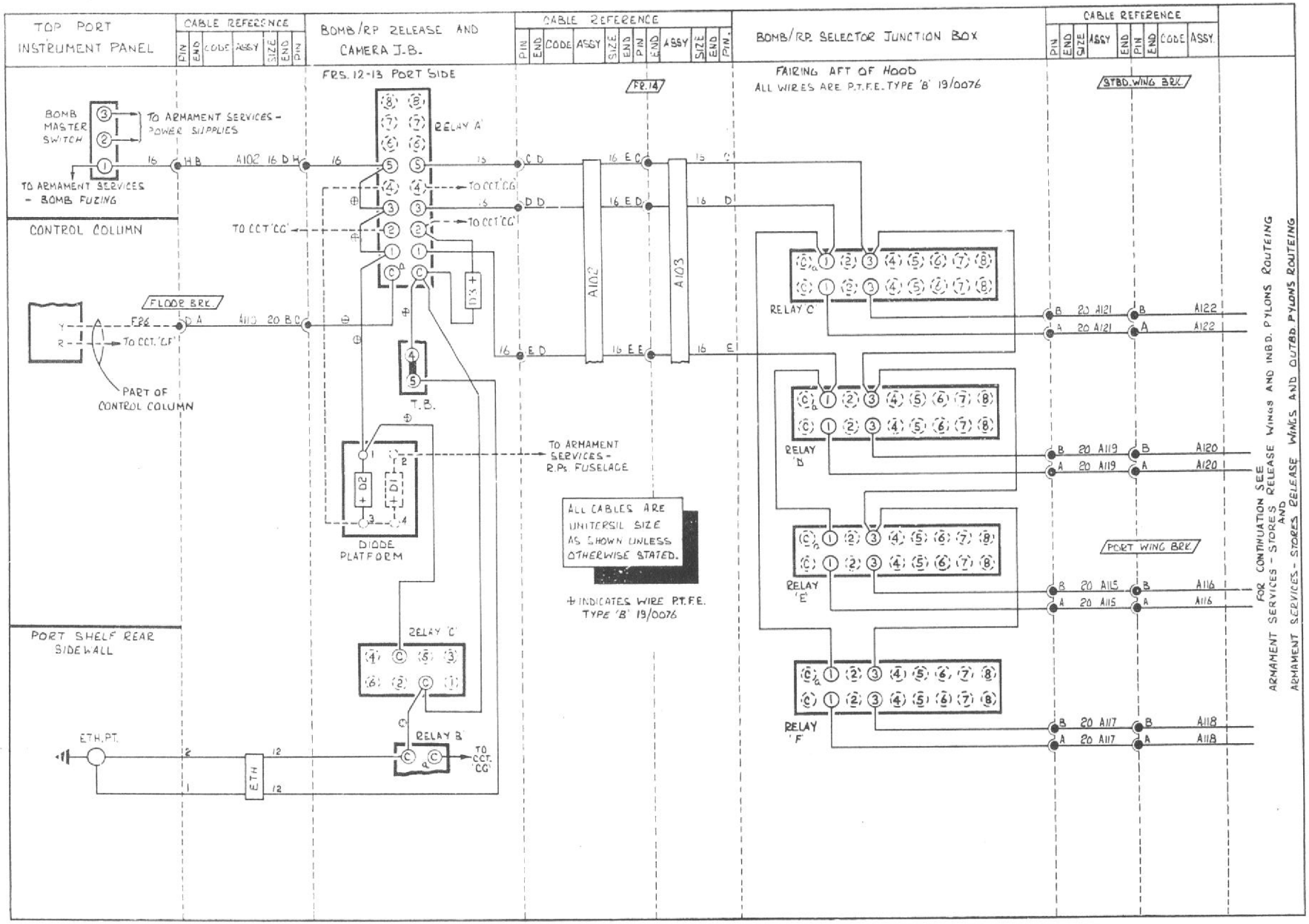

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Fig.11. Store release (routeing - fuselage)

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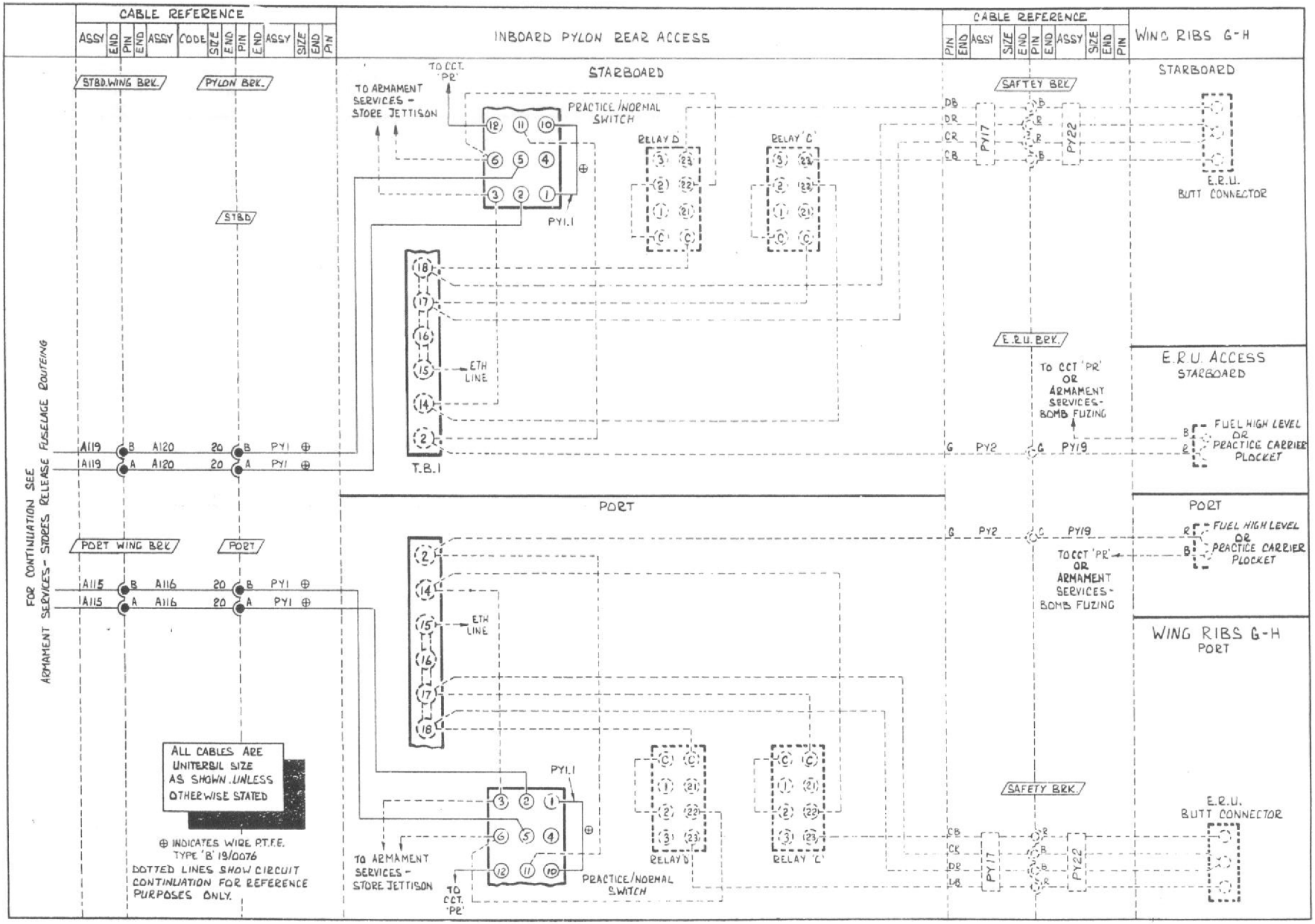

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Fig.12. Store release (routeing - wings and inboard pylons)

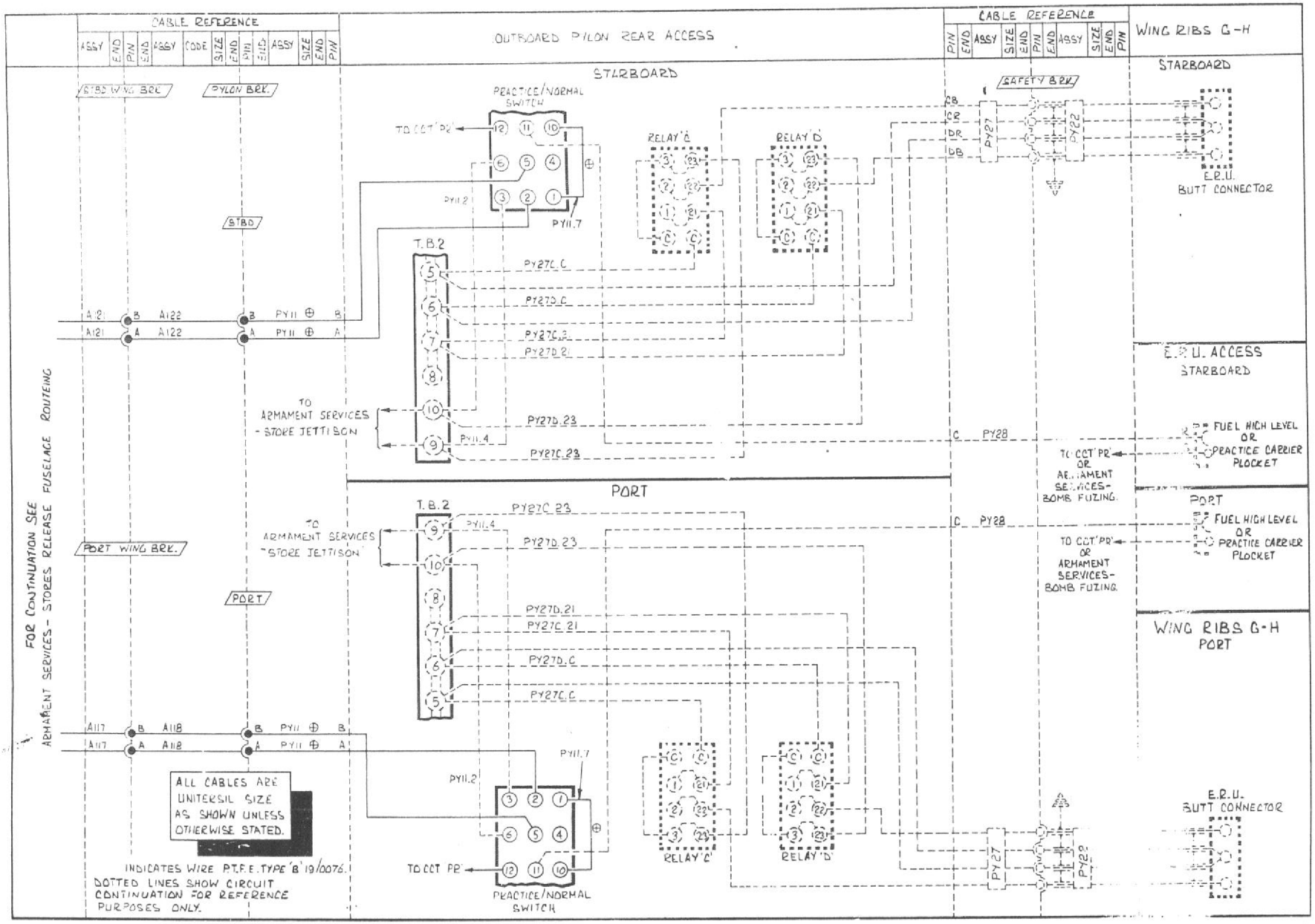

Fig. 13. Store release (routeing - wings and outboard pylons)

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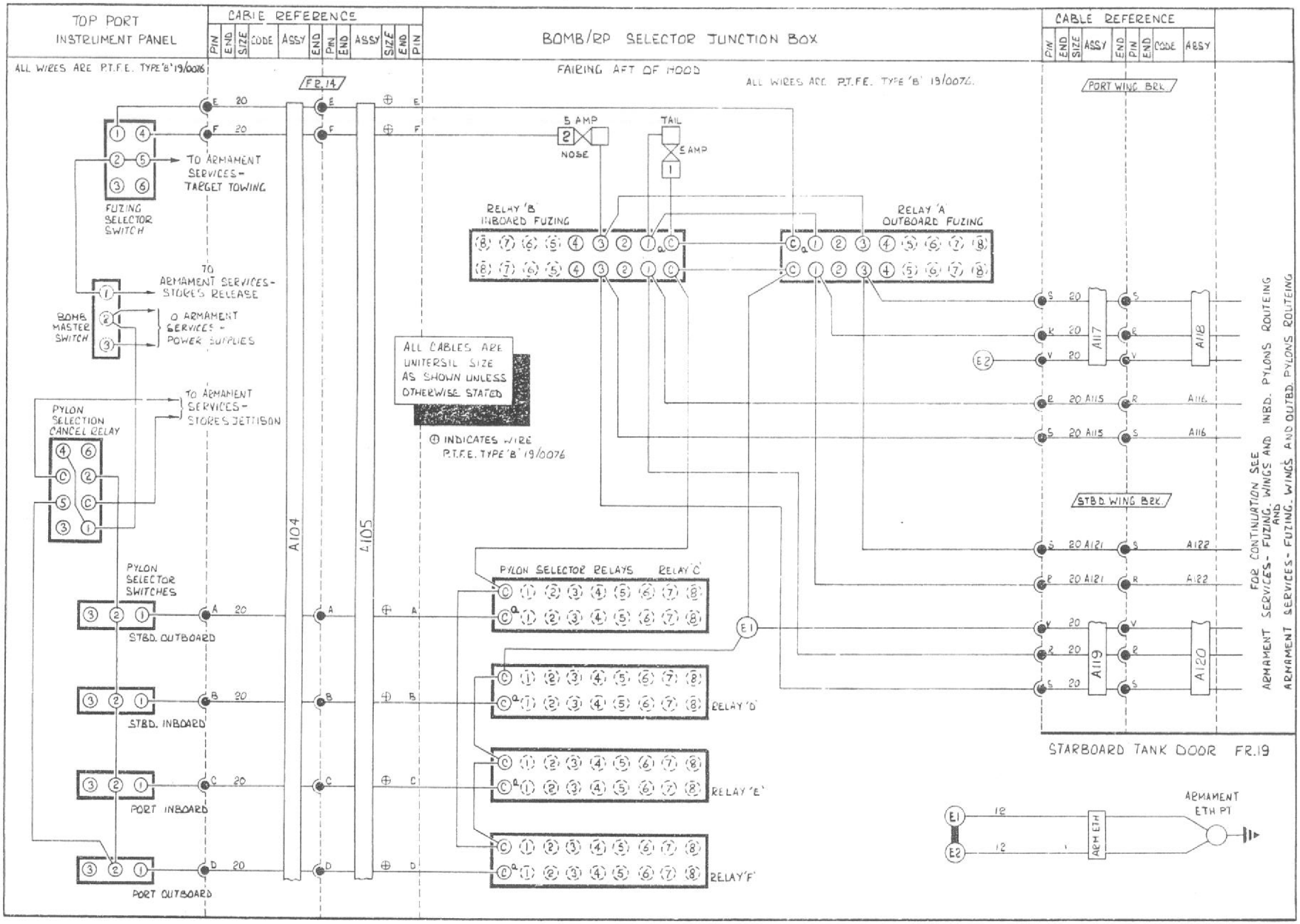

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Fig.14. Store fuzing and pylon selection (routeing - fuselage)

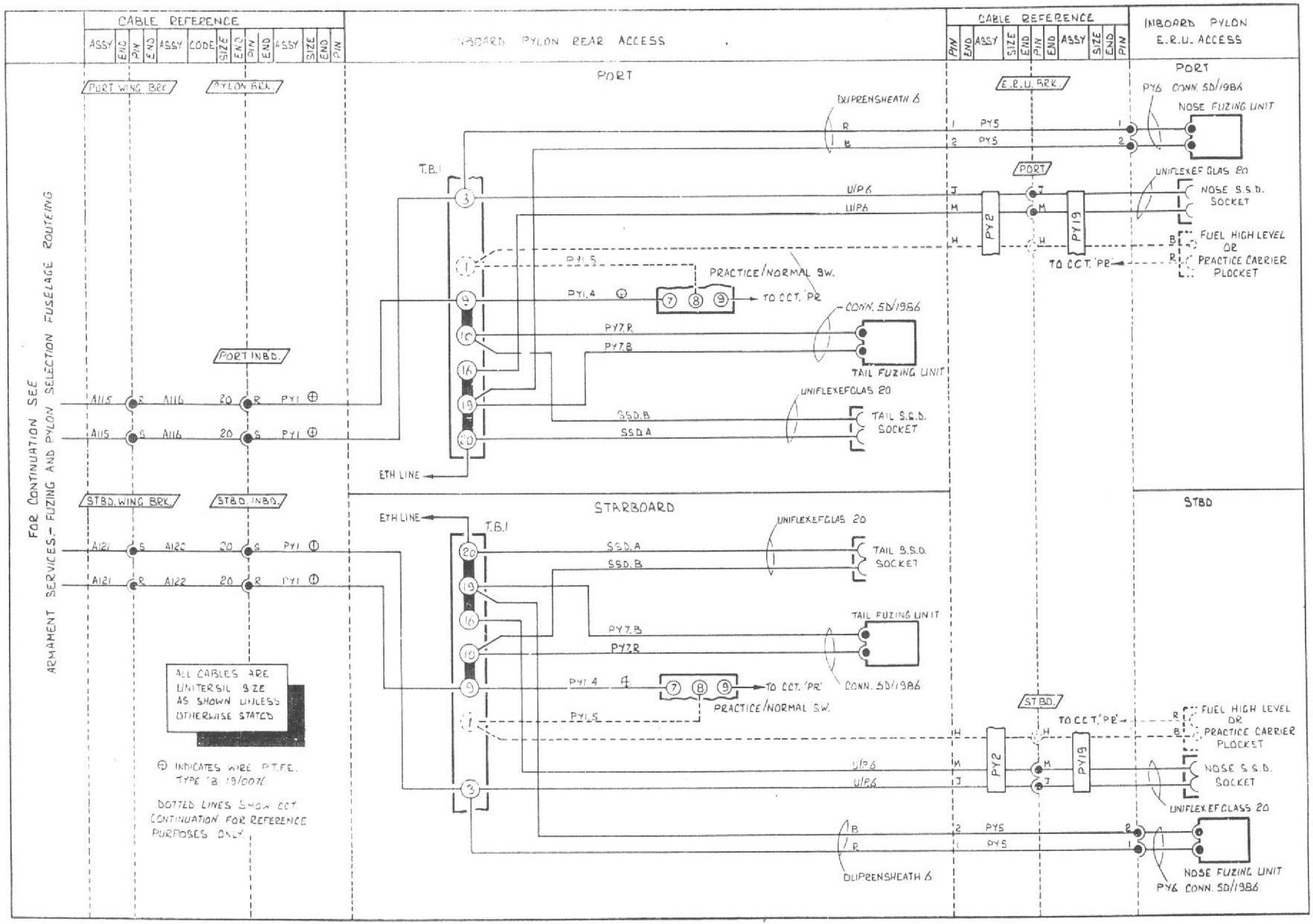

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Fig. 15. Store fuzing and pylon selection (routeing - wings & inboard pylons)

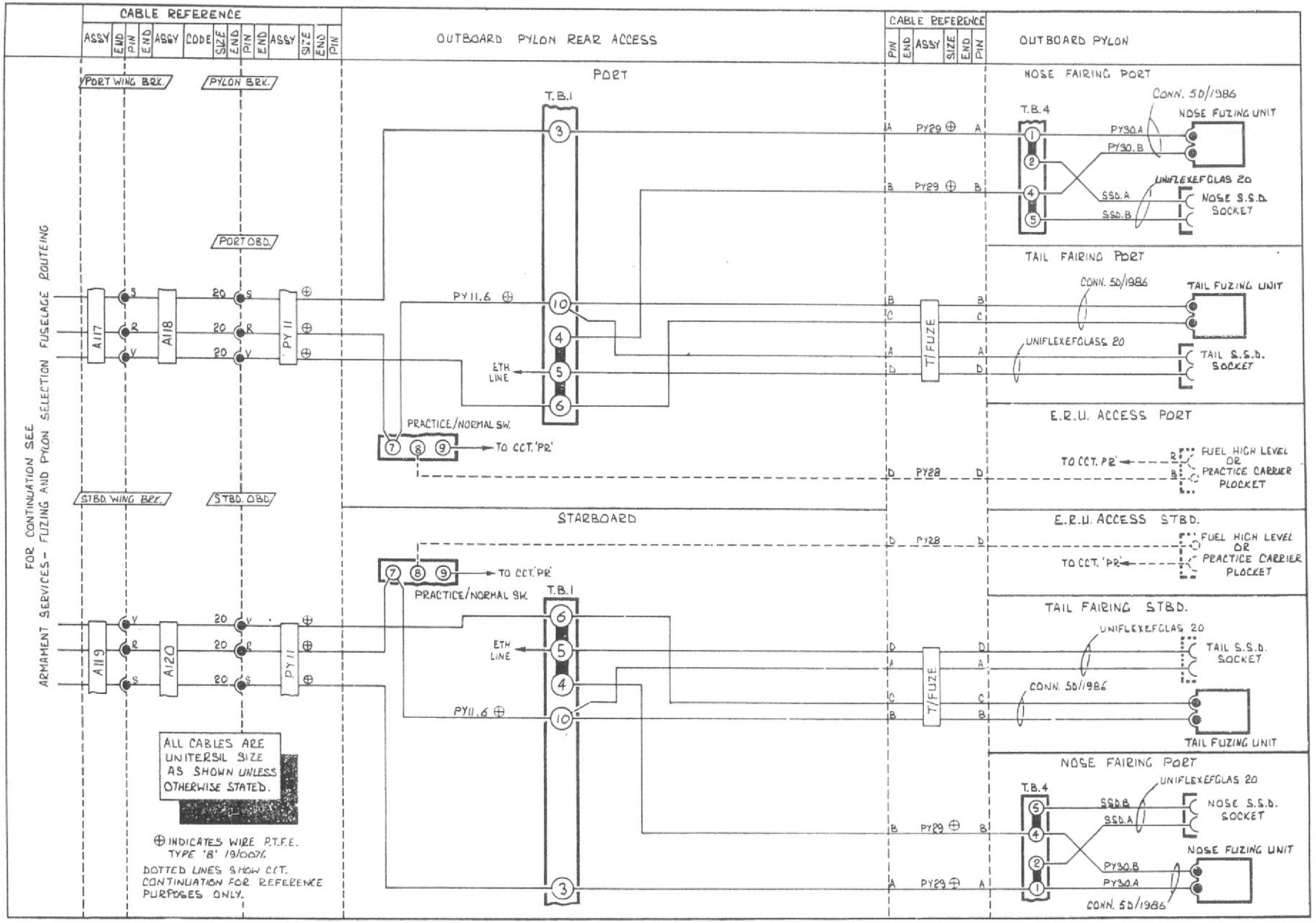

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Fig.16. Store fuzing and pylon selection (routeing - wings & outboard pylons)

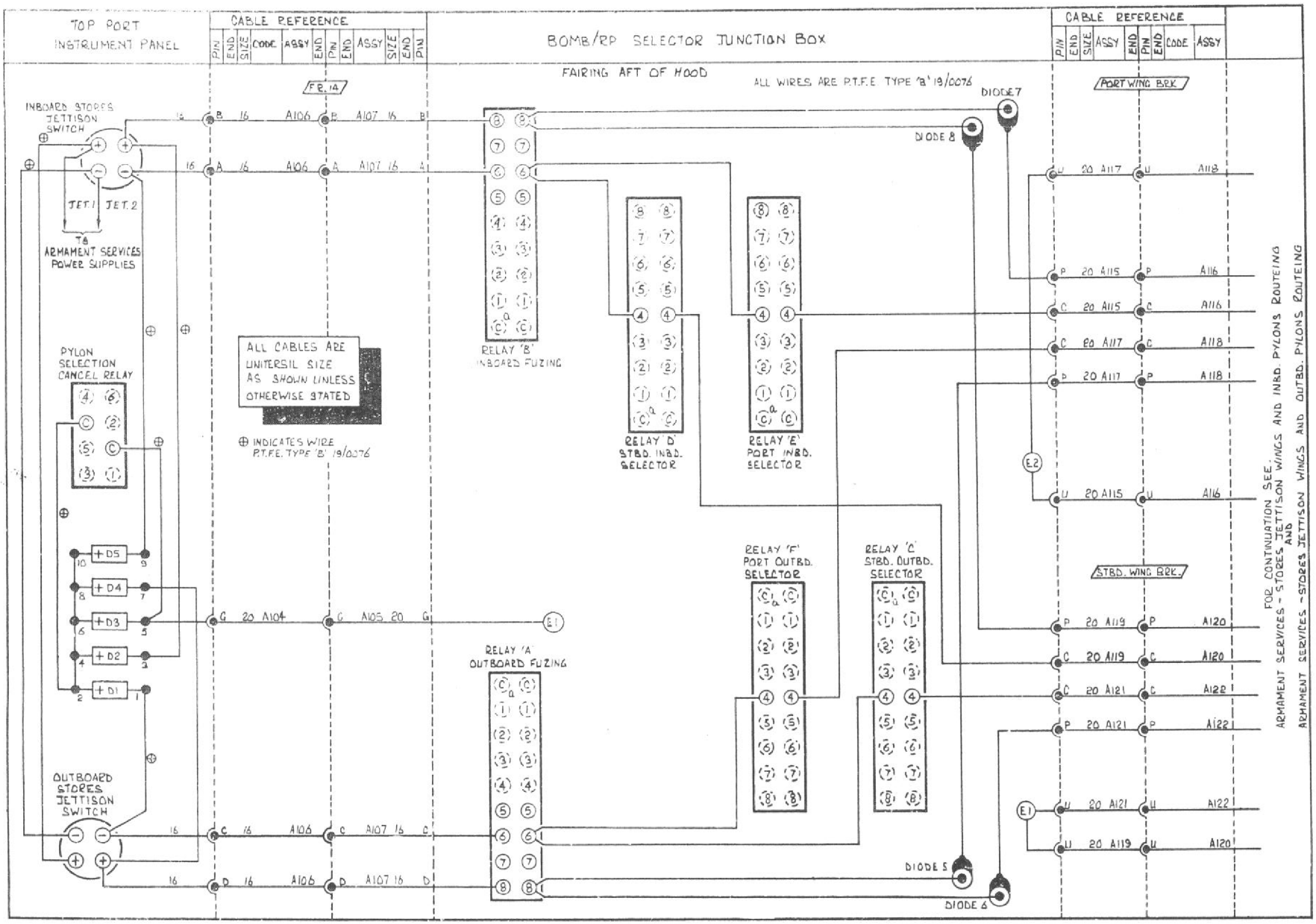

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Fig. 17. Store jettison (routeing - fuselage)

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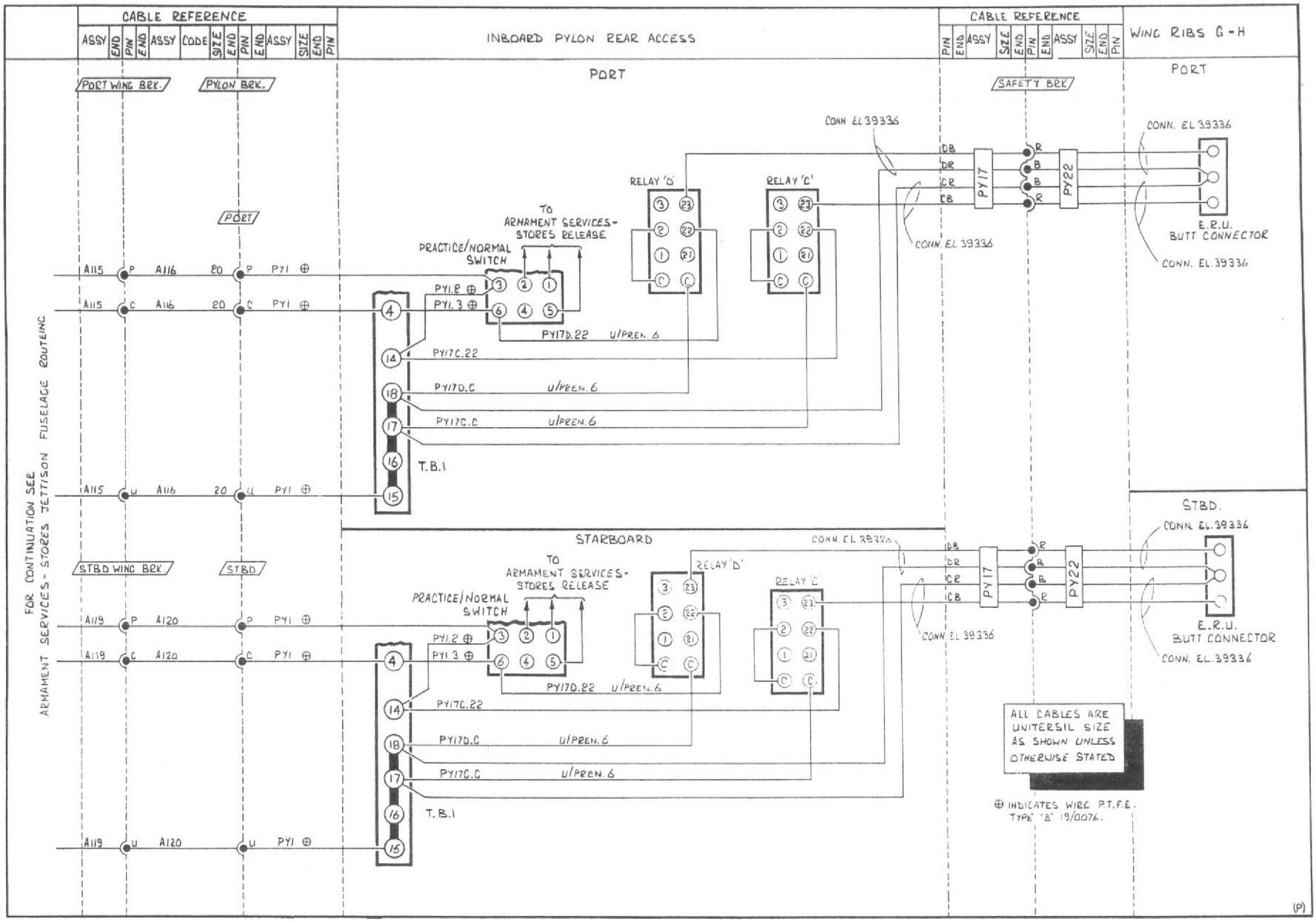

Fig. 18 Store jettison (routeing-wings and inboard pylons) (pre Mod.1288)

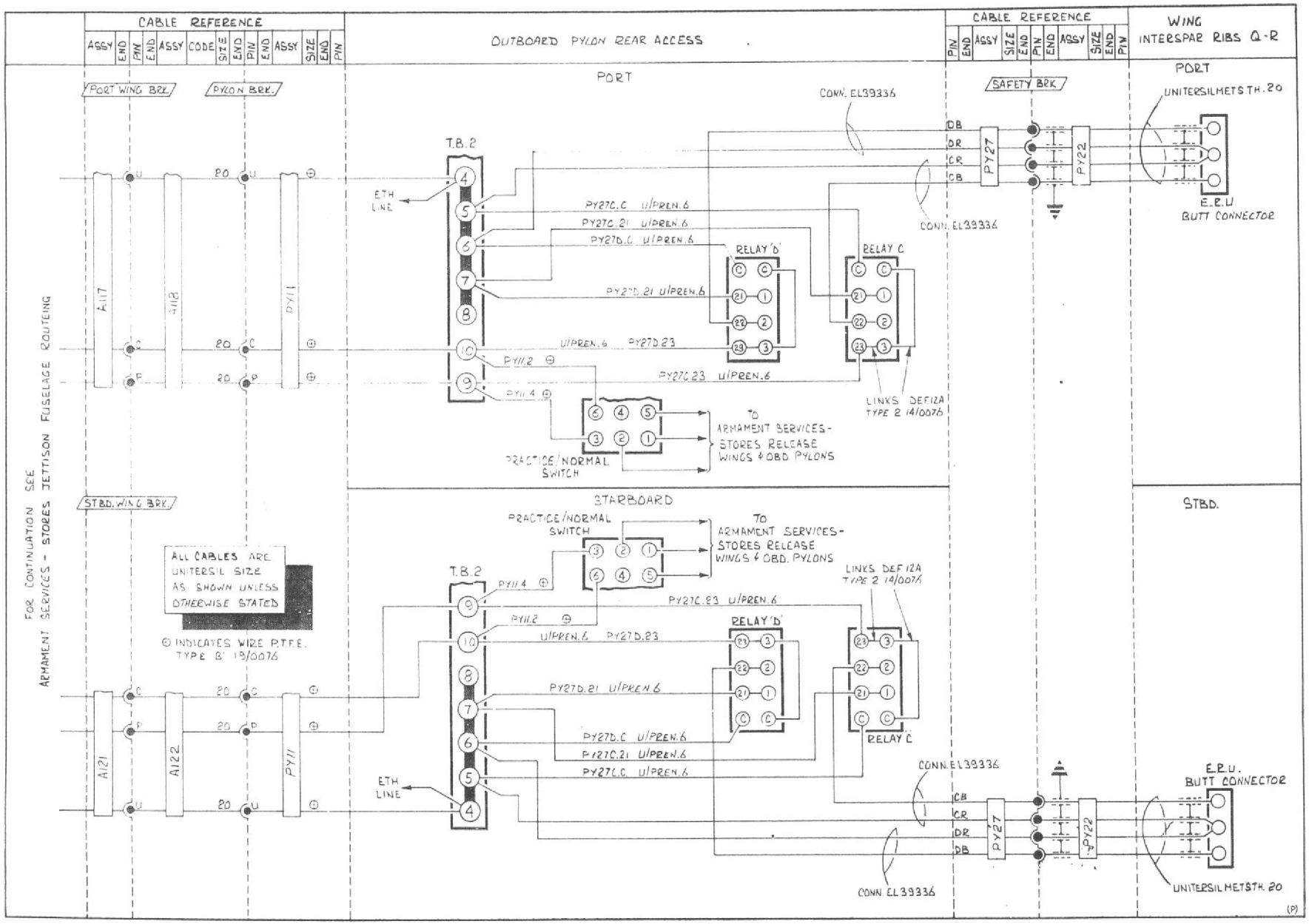

Fig. 19 Store jettison (routeing - wings and outboard pylons)

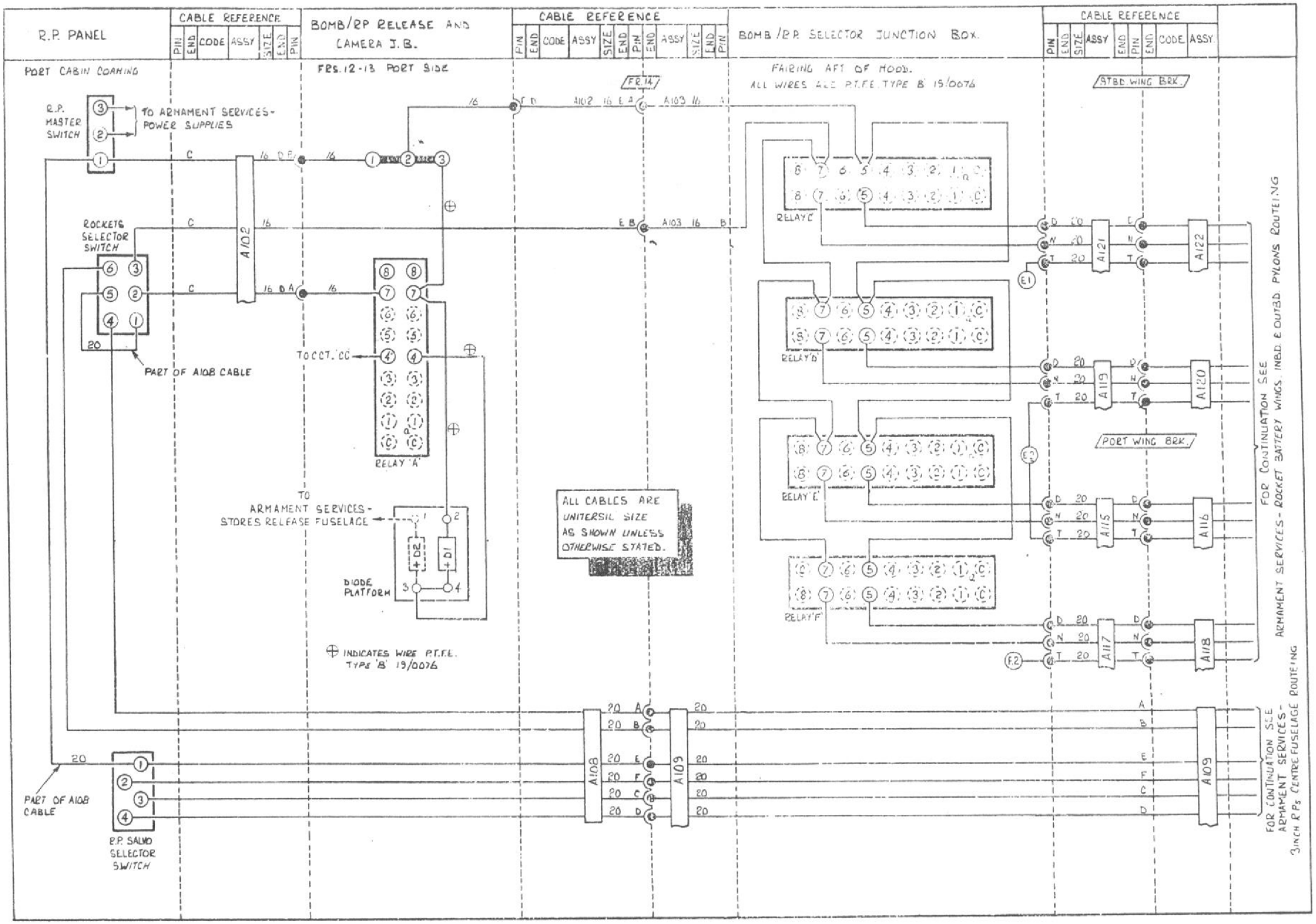

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Fig.20. Rocket battery and 3in. R.P. (routeing - fuselage)

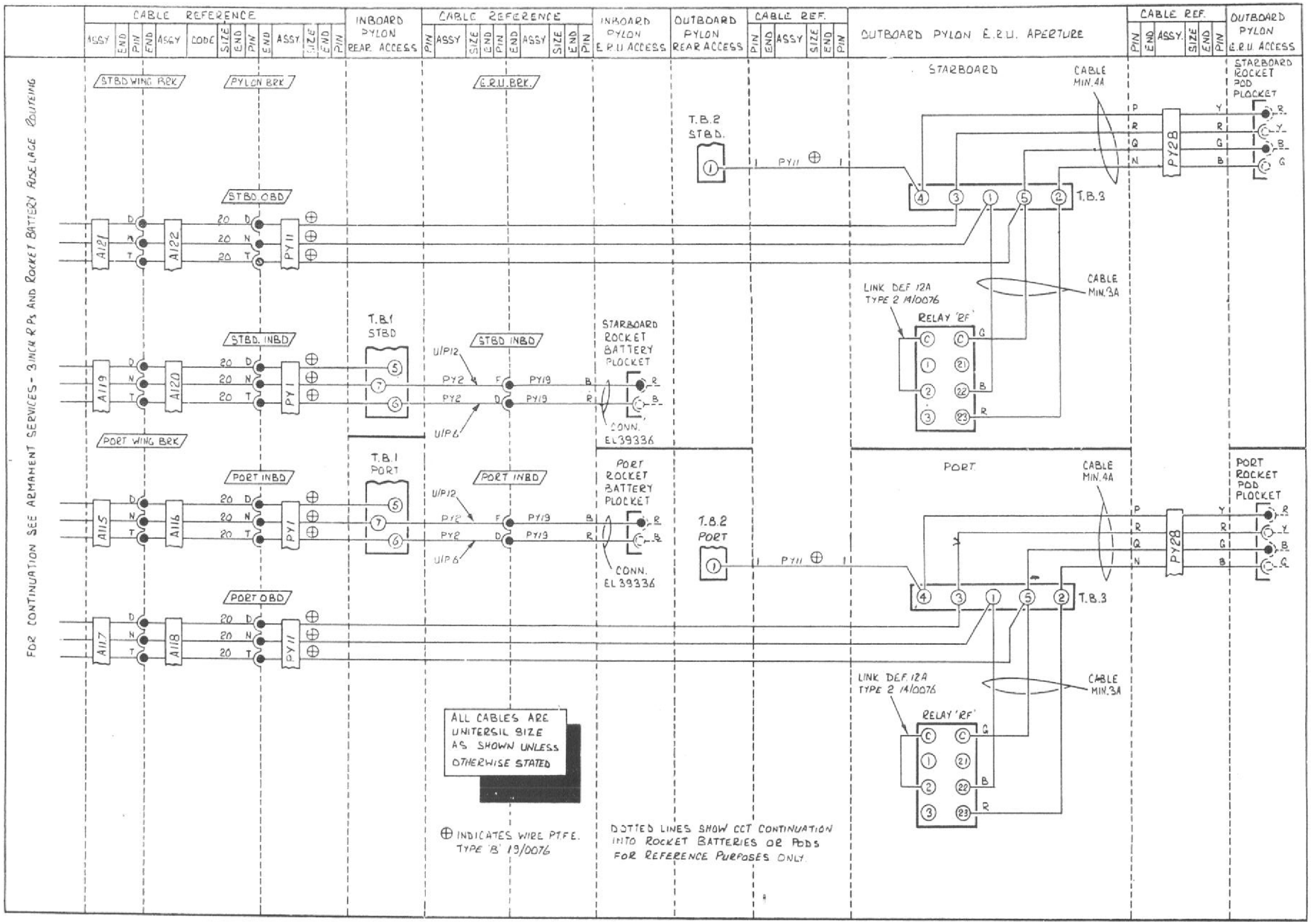

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Fig.21. Rocket battery (routeing - wings and inboard and outboard pylons)

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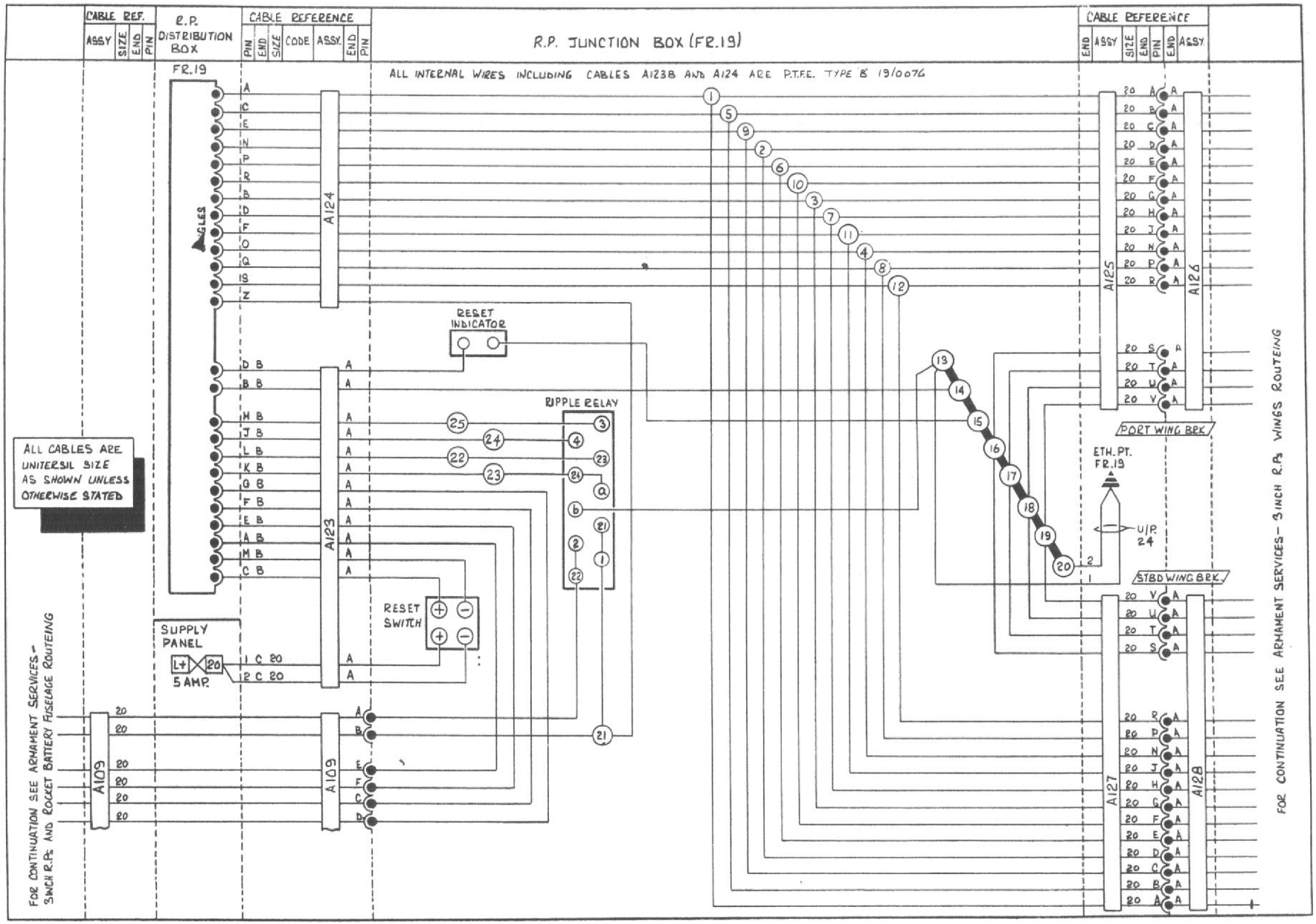

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Fig.22. 3 inch R.P. (routeing - centre fuselage)

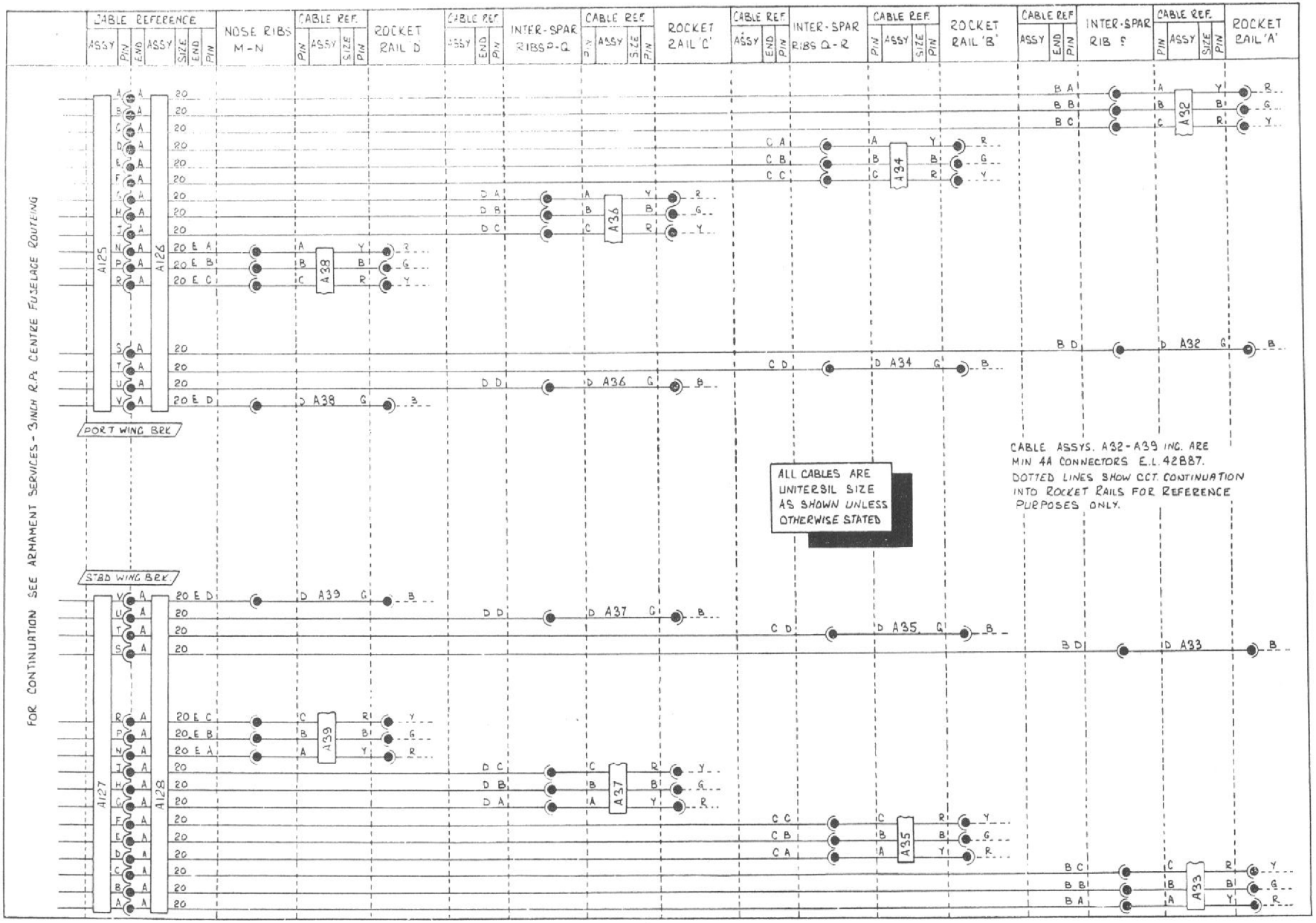

Fig.23. 3 inch R.P. (routeing - wings)

RESTRICTED

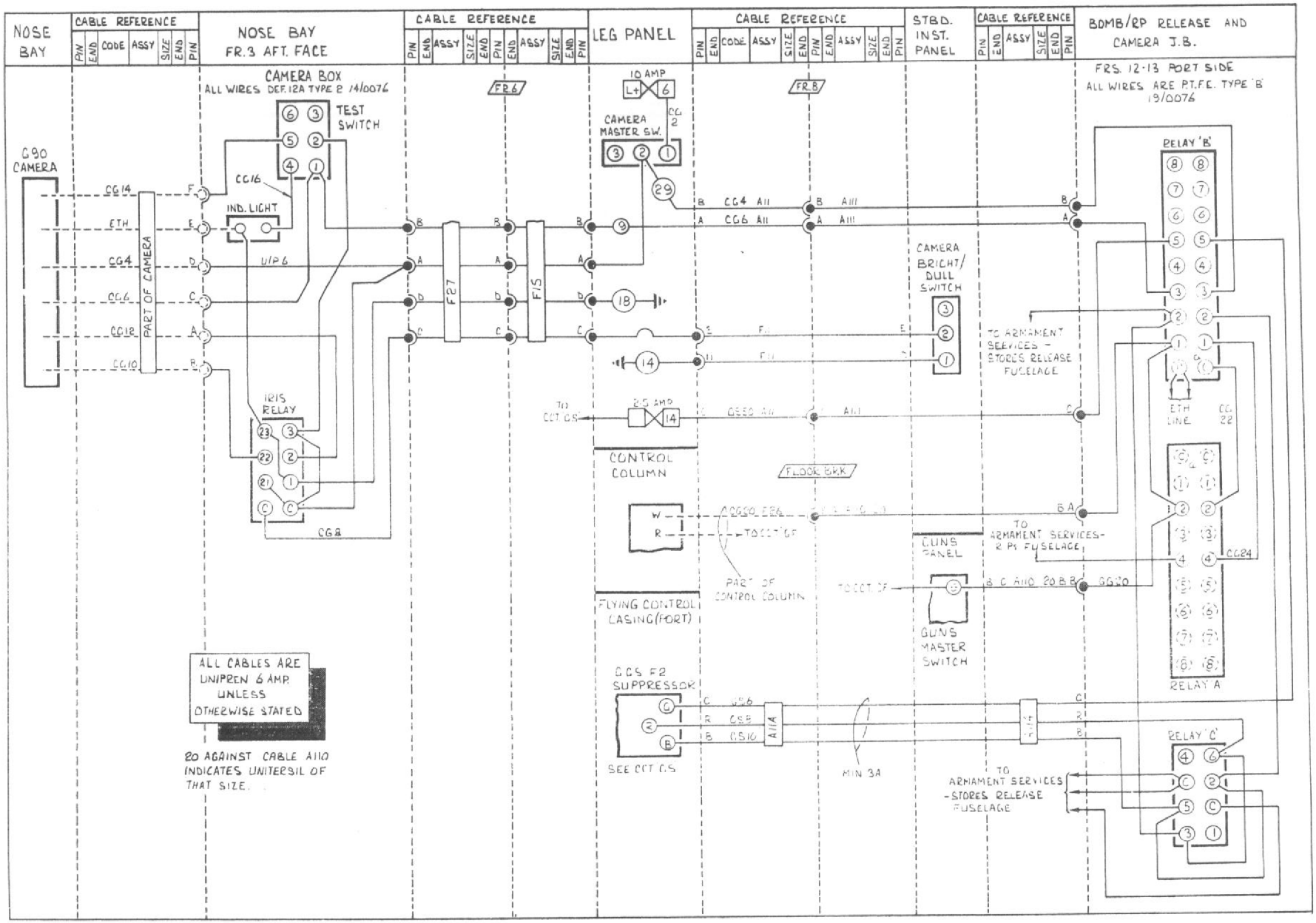

Fig. 24 G90 camera, GGS recorder and caging control (routeing)

ends). Reading obtained should be between 20 megohms and infinity.

(g) Fit a cartridge in each E.R.U. Ensure that the top cap of the cartridge, top and bottom contact pins of the breech cap and contacts of the butt connections are clean and free from grease.

(h) Assemble the breech cap and butt connector to the E.R.U.

(j) Using a suitable safety ohmeter *(0–500 ohms scale)* between the poles of safety plockets C and D *(fixed ends)*, check the resistance of the cartridge fuze circuits. The reading obtained should be between 15 to 500 ohms.

(k) Reconnect plockets C and D prior to flight.

Note . . .

The arming of E.R.U.'s must be carried out in accordance with local orders which concern the safety of aircraft and personnel. The armament safety plug must only be re-connected just prior to butt test or flight.

REMOVAL AND ASSEMBLY

General

59. Once access has been obtained, the removal and assembly of the components forming the armament services should present no difficulties. The removal of the gun firing panel and ARM junction boxes, which carry the majority of the components is fully described in Group A.2. The location of and access to all the components is indicated in Group A.3. The removal of the guns is covered in Sect.7, Chap.3 and the removal of the pylons in Sect.3, Chap.2.

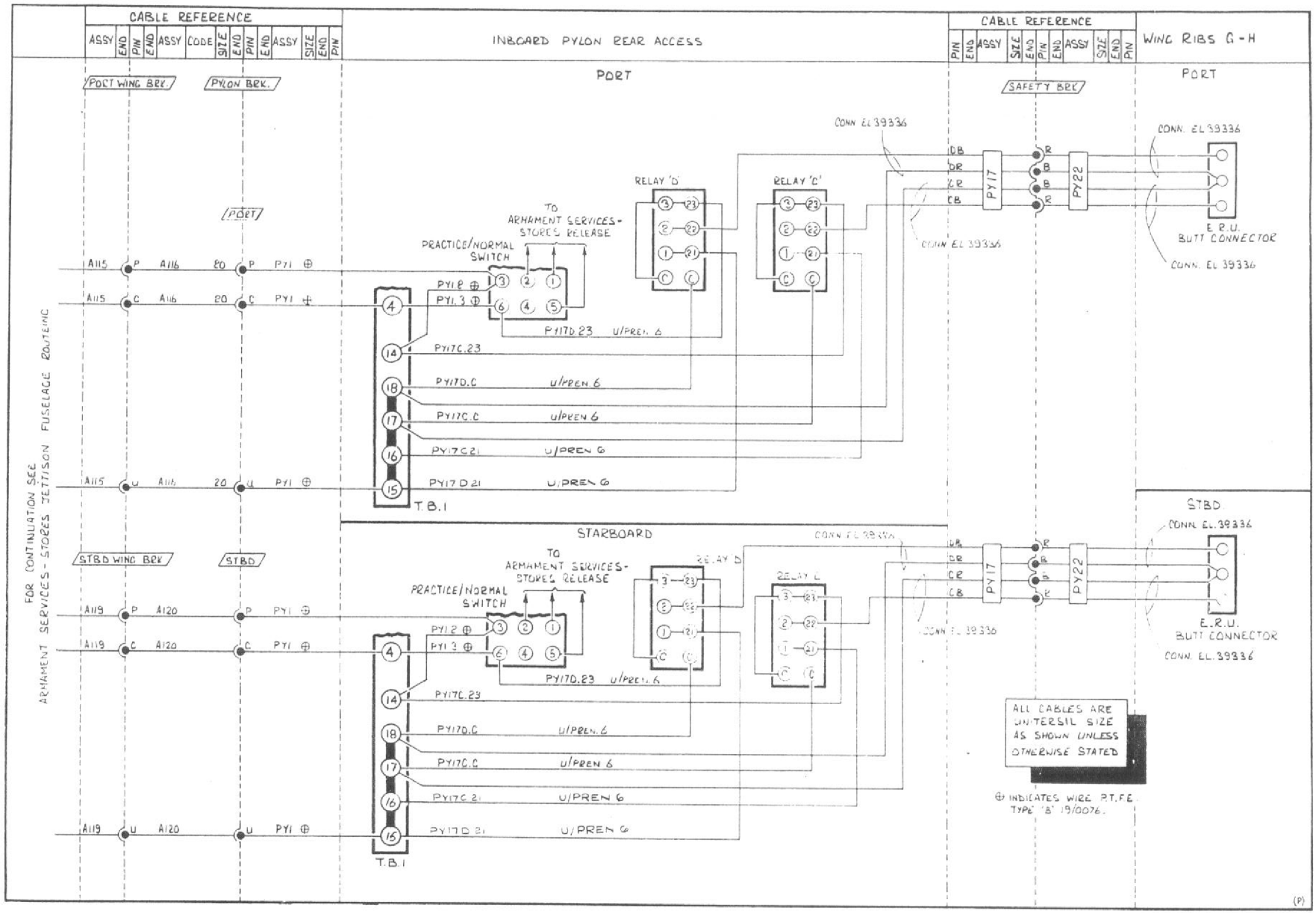

Fig. 25 Store jettison (routeing-wings and inboard pylons) (post Mod.1288)

Appendix 1 — MODIFICATION 1331

(Camera Delay Unit)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. This appendix contains the description and operation of components associated with the G90 camera circuits, which are affected by the introduction of Mod.1331. Minor changes in circuitry are shown in Figs.1 to 6, and the major changes, which are in the camera control and operation circuits, in Fig.7.

Equipment employed

2. The additional equipment introduced by this modification and all positioned in the Bomb/R.P. release and camera J.B., will be found in Table 1.

DESCRIPTION

Mod.1331

3. This modification introduces a 1 second delay unit into the gyro gun sight and camera circuits, which, in the R.P. mode, delays re-

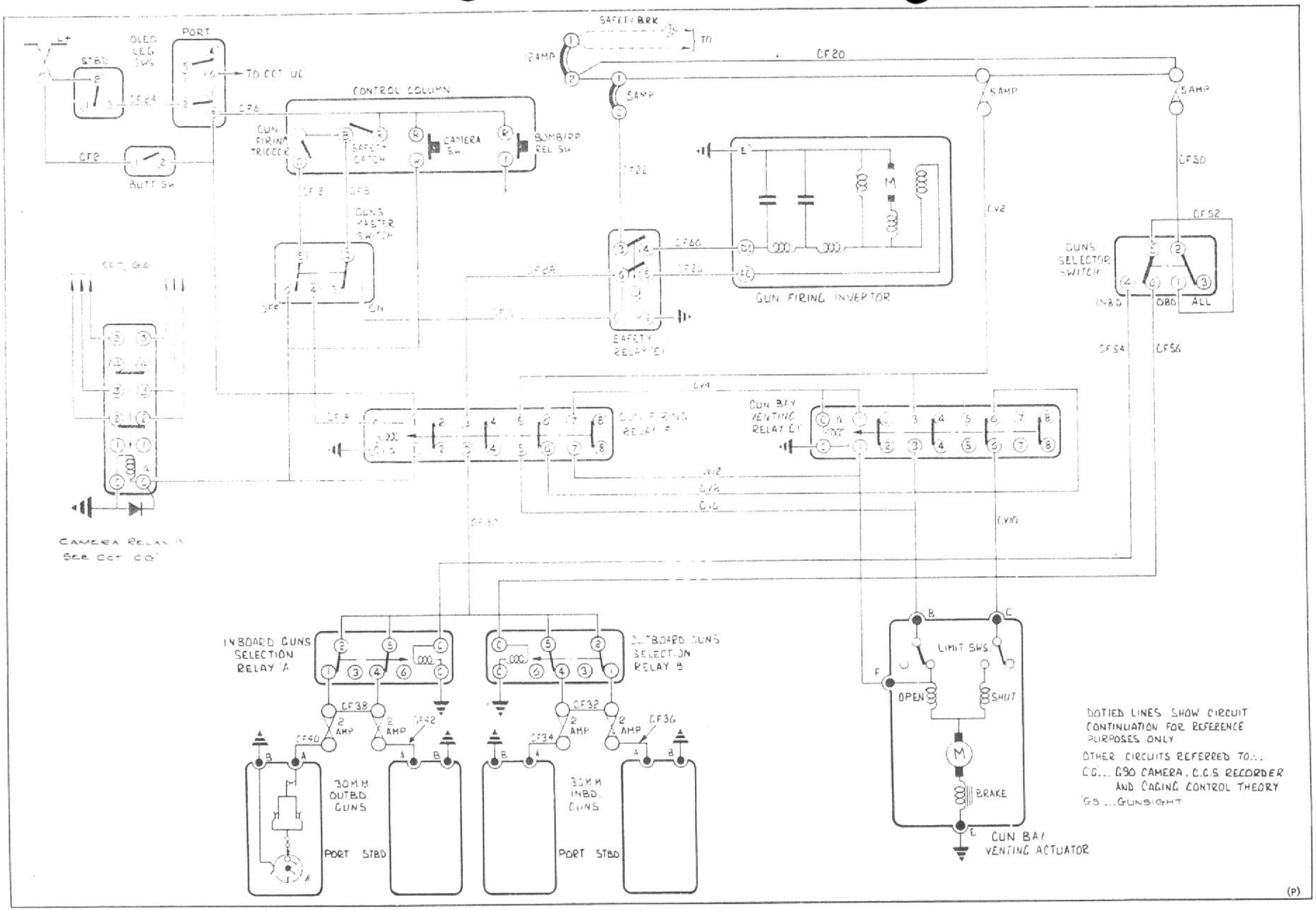

Fig. 1 Gun firing and ventilation (theoretical)

T.P.(E)11348

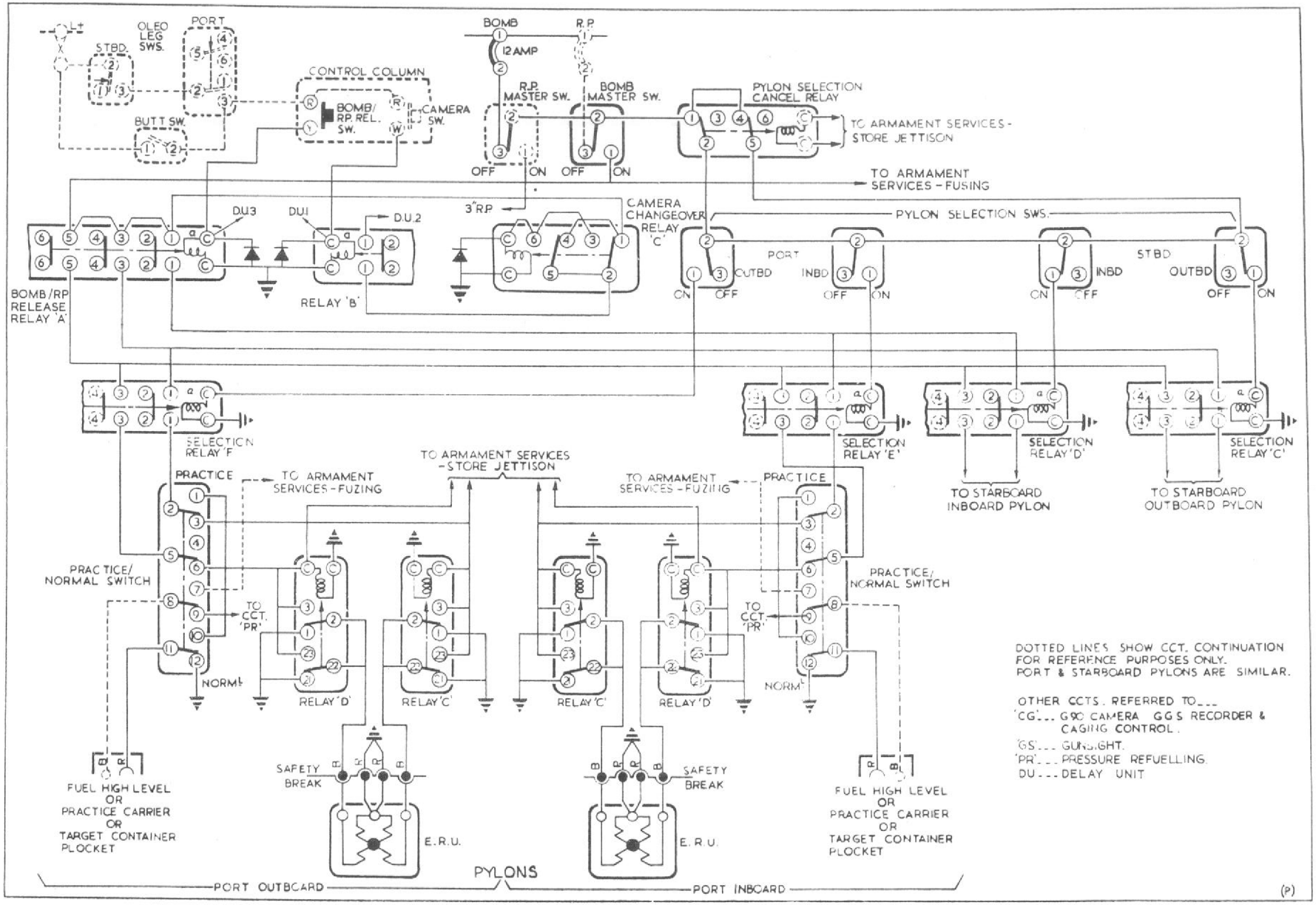

Fig. 2 Store release and pylon selection (theoretical)

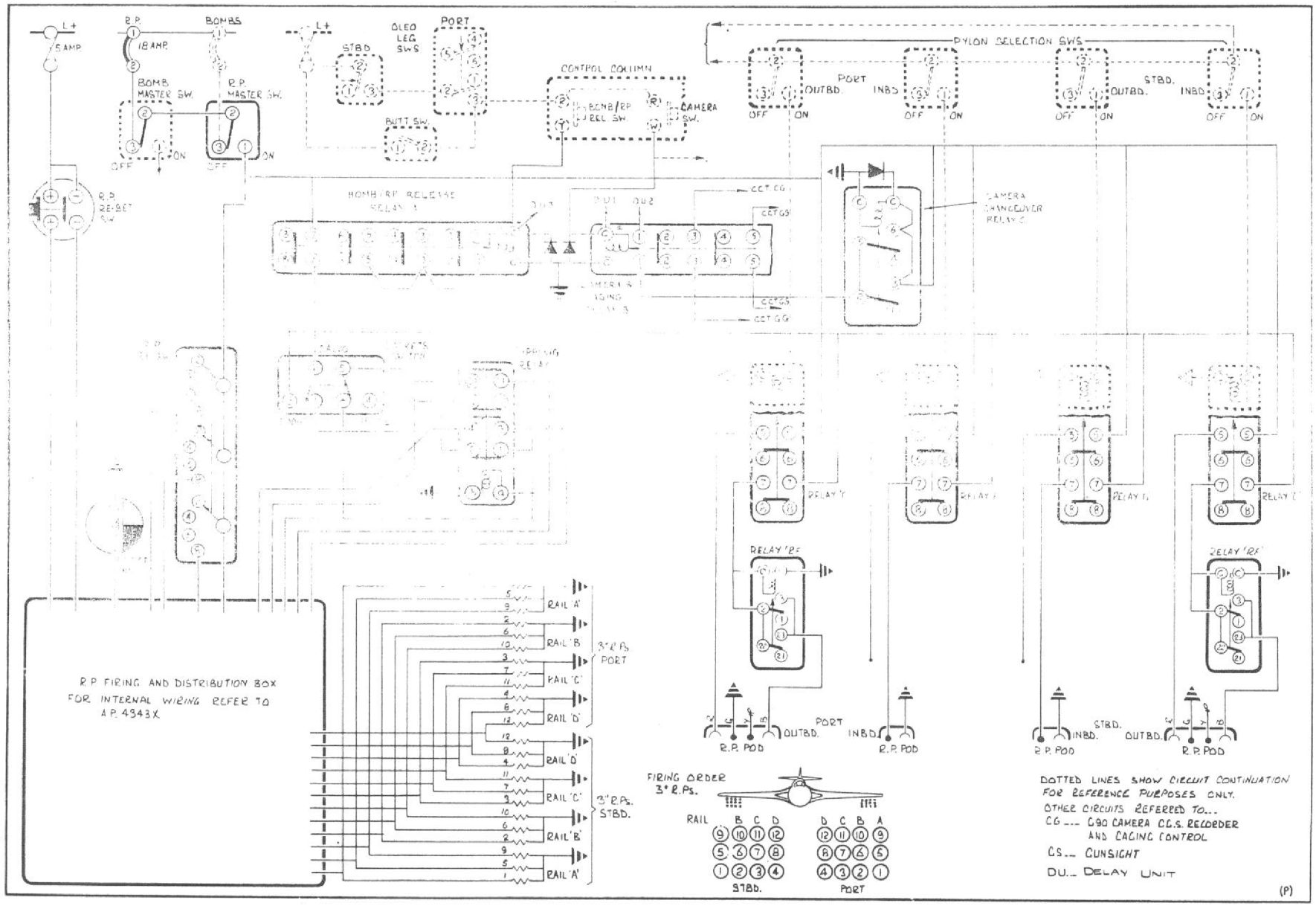

Fig. 3 R.P. services (theoretical)

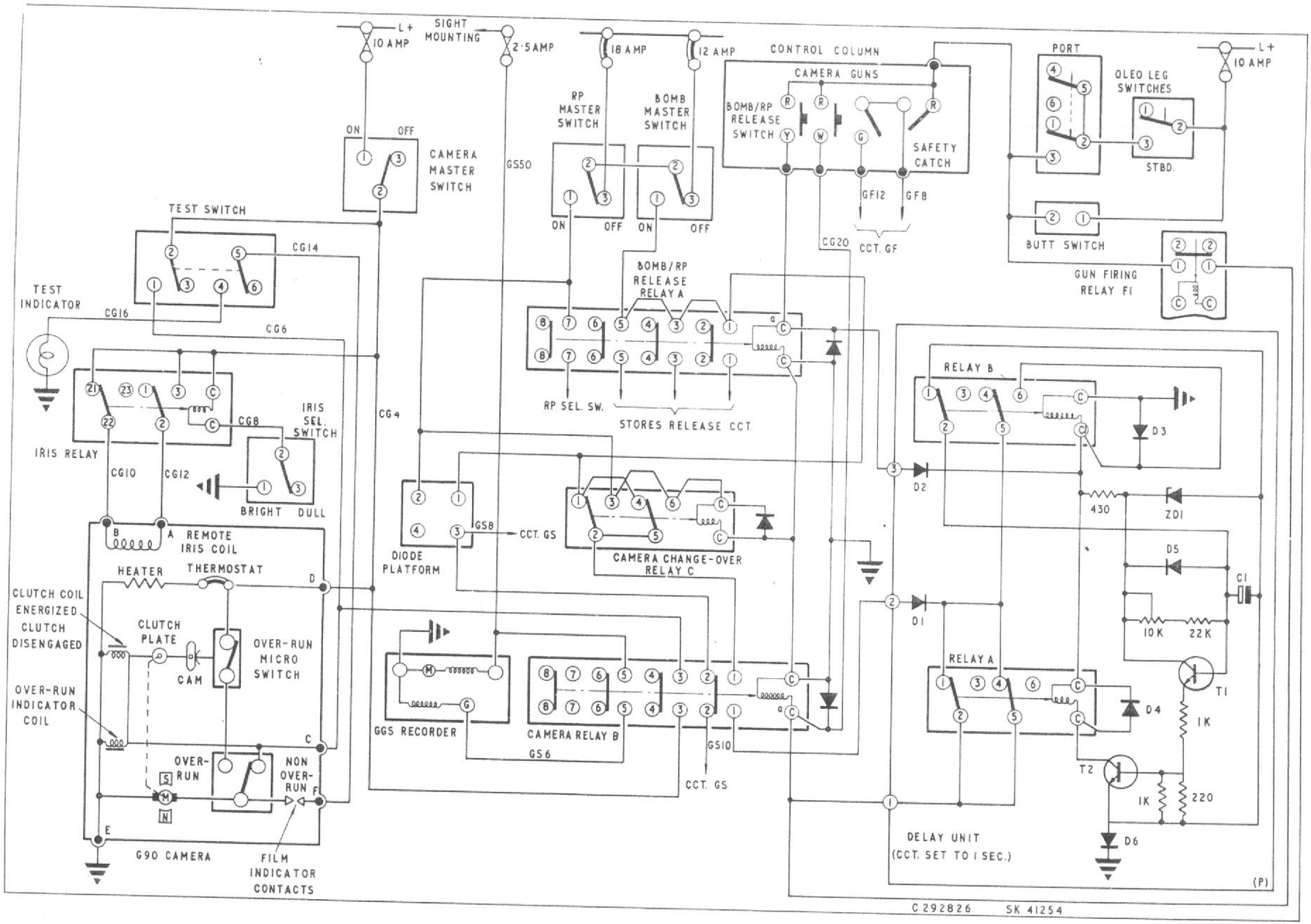

Fig. 4 G90 camera and associated circuits (theoretical)

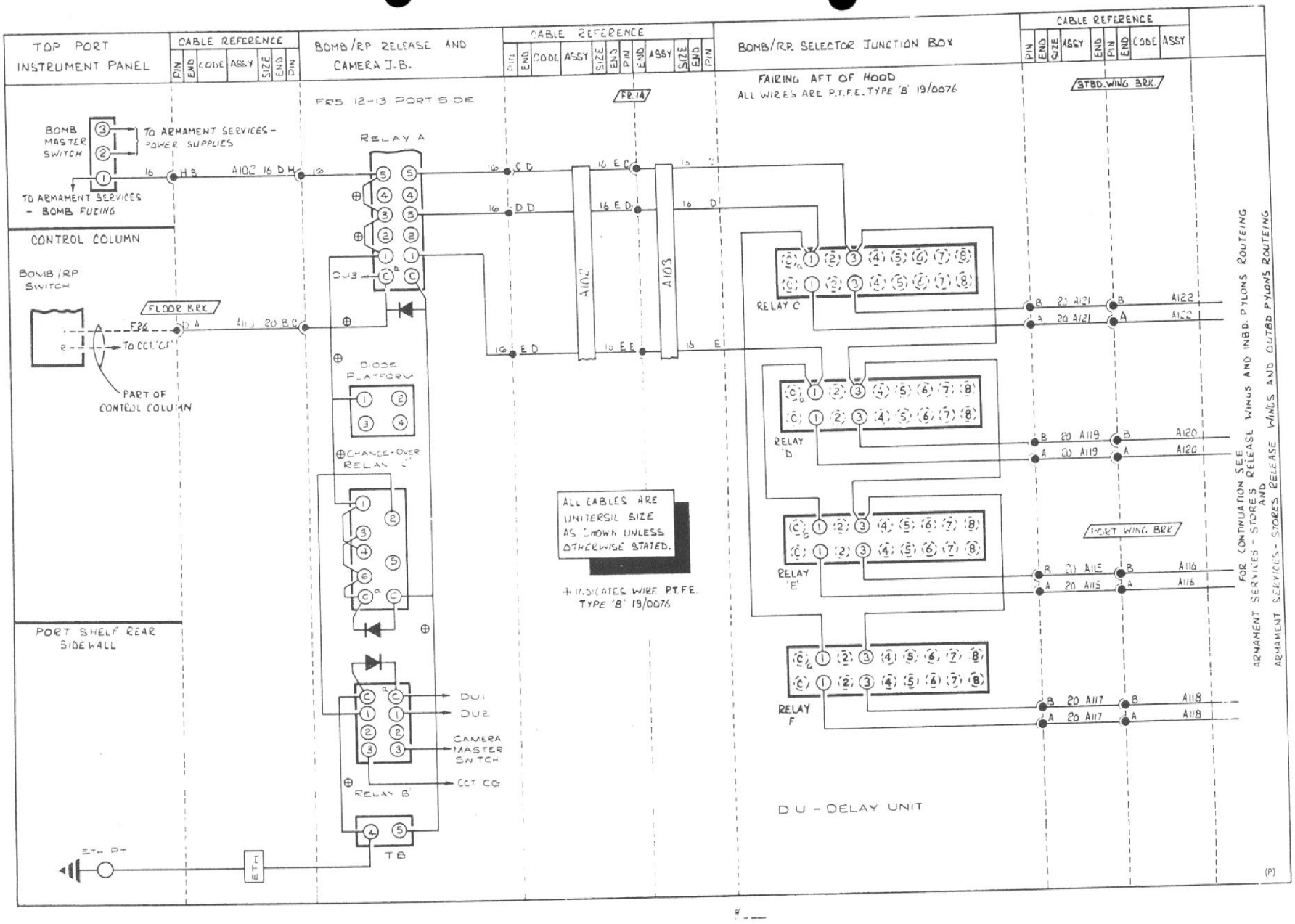

Fig. 5 Store release (routeing fuselage)

T.P.(E)11352

caging of the G.G.S. and allows the camera to continue running for 1 second after the rocket projectiles are released. This 1 second delay in recaging the G.G.S. enables the pilot to follow the target through the ripple firing sequence. Mod.1331 also deletes the caging of the G.G.S. in the bomb mode.

General

4. The power supplies and control of the main armament services remain as described in paras.1-41 of Group G1 in this A.P. Minor changes in circuit routeing are shown in relevant Figs. in this Appendix. Changes in the controlling of the gyro gunsight and G90 camera brought about by the introduction of this modification are described in the following paragraphs.

G90 camera

5. The general description and internal operation of the G90 camera, in paras.42-48 of Group G1 is unaltered, except that the camera now operates for 1 second after the rocket projectiles are released and independent camera operation is as in the following paragraph.

Independent camera operation

6. When the aircraft is airborne, the compression switches make contact to bring a supply to the camera push-switch. With this push-switch depressed, a supply passes directly to the coil of camera relay B, to energize it, and close contacts 3-3a. When the camera master switch is selected to ON, a supply will pass across these contacts direct to pin C of the camera, causing the camera to operate. Releasing the push switch will de-energize relay B and stop the camera.

Camera operation with gun firing

7. When the aircraft is airborne, the compression switches make contact to bring a supply to the gun safety catch on the control column. With the safety catch closed and the gun firing trigger pulled, gun firing relay F1 is energized to fire the guns. When this relay is energized, supply will also pass across its contacts 1-1a from the oleo leg compression switches to energize the coil of camera relay B. Contacts 3-3a of relay B then supply pin C of the camera as described in para.6. The camera will now operate to photograph the target. Releasing the gun firing trigger will de-energize relay F1, stop the gun firing and break the supply to the coil of relay B, which in turn will open its contacts 3-3a and stop the camera.

R.P. photographic tactics

8. When making an R.P. attack, the tactics employed are to start the camera photographing the target during the run in, and keep it operating until 1 second after the projectiles are released. This is accomplished by a hold-on circuit supplied through relay C and the delay unit (D.U.), and controlled by the Bomb/R.P. master switch and the delay network in the D.U. With the R.P. master switch set to ON and the bomb master switch OFF, a supply is fed from the 12 amp circuit breaker to contacts 3, and 6 and to the coil of camera change-over relay C. Relay C is thus energized closing contacts 3-2 and 6-5 and passing a supply to contact 1 of camera relay B in readiness for the hold-on circuit when the camera push switch is pressed.

9. With the camera push switch pressed, relay B is energized as described in para.6 and the camera will commence to operate. The hold-on circuit is now also completed across contacts 1-1a of relay B, through terminal 2 and contacts 1-2 and 4-5 of relay A in the delay unit, out through terminal 1 and back through the coil of camera relay B, so forming a circuit to keep relay B energized and the camera operating, when the camera push switch is released.

10. With conditions as in the previous paragraph, when the R.P. release button is pressed, supply is passed from the compression switches to energize the coil of the Bomb/R.P. release relay A to fire the projectiles. Supply is also fed through terminal 3 of the delay unit to energize relay B in the delay unit and start the 1 second delay network. Relay B in the delay unit has a hold-on circuit through contacts 1-1a of camera relay B, terminal 2 of the delay unit and its own contacts 5-6. This ensures the full delay time if the R.P. release switch is released within 1 second of firing the projectiles. One second after pressing the Bomb/R.P. release switch, transistor T2 in the delay network will start to conduct, energizing relay A in the delay unit momentarily. This breaks the hold-on circuit to camera relay B, which opens, so stopping the camera and allowing the G.G.S. to re-cage. The hold-on circuit to relay B in the delay unit

TABLE 1

Equipment employed and Air Publication Reference

Equipment Type	Air Publication
Delay unit and T.B. assembly	Hawker design
Diodes, Ferranti Type ZS 78 (fitted to relays A and B)	

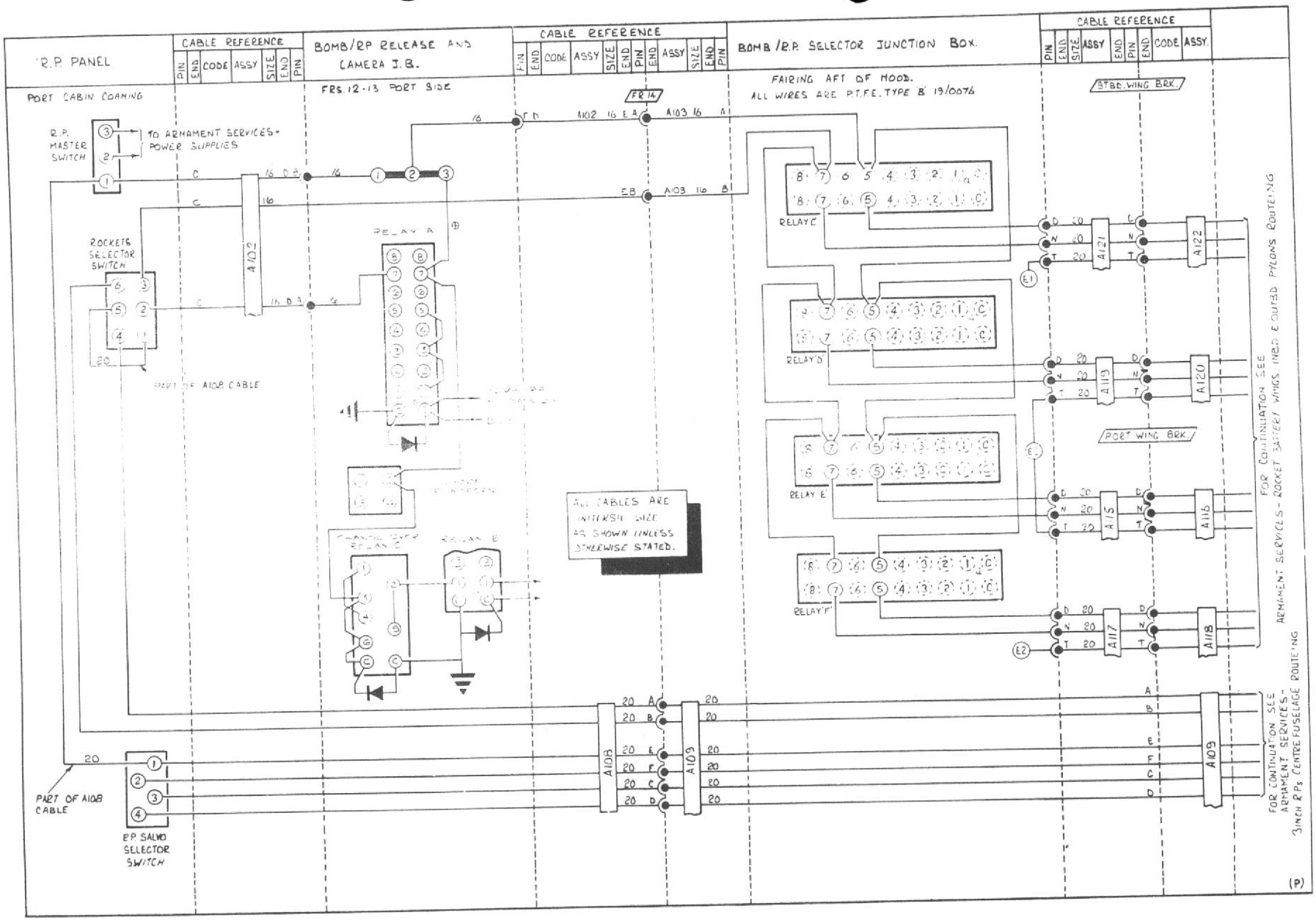

Fig. 6 Rocket battery and 3 inch R.P. (routeing fuselage)

T.P.(E)11354

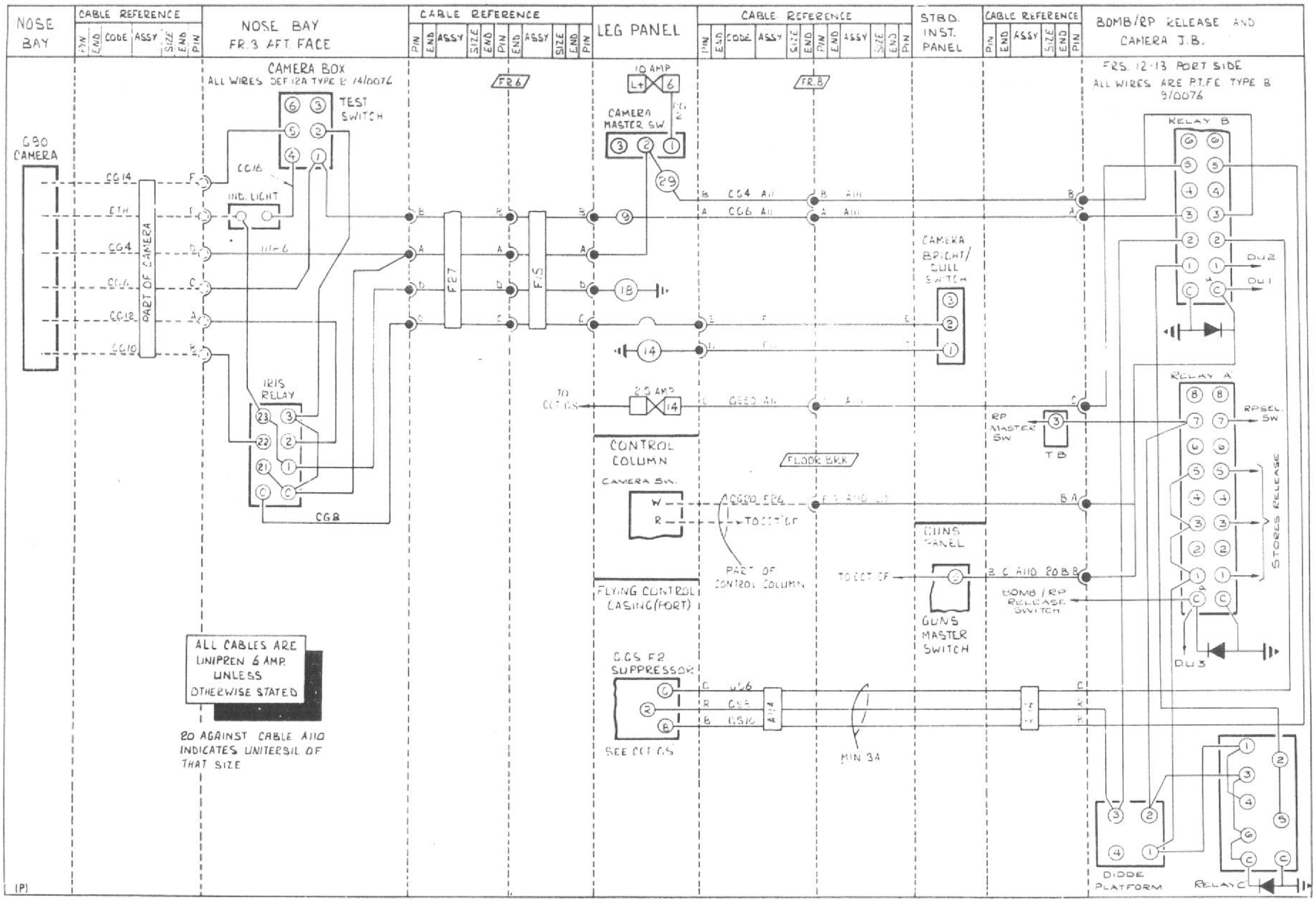

Fig. 7 G90 camera (routeing)

T.P.(E)11355

is also broken. Relay A in the delay unit de-energizes, and the circuit is set for a new cycle.

Camera and bomb mode

11. With the bomb master switch selected ON and R.P. master switch selected OFF, supply is available from the 18 amp circuit breaker to contact 5a of the Bomb/R.P. release relay. Since 5a, 3a and 1a are linked, supply will pass on across contacts 1-2 and 4-5 of camera change-over relay C to contact 1 of camera relay B, to form the hold-on circuit when the camera push switch is pressed. If the camera switch is pressed then the sequence of events and routeing of supply is as described in paras.9 and 10 above.

Camera recorder

12. The camera recorder is an electrically driven cine camera used in conjunction with the pilot's gyro gunsight to photograph the target superimposed on the gunsight graticule. The recorder is mounted on the gunsight and used during gun firing, R.P. or bomb attacks.

13. In a gun firing attack, as the trigger is pressed, the gun firing relay F1 is energized to close contacts 1-1a and complete a circuit to energize the coil of camera relay B. This will close contacts 5-5a and make supply available from fuse 14 in the leg-panel, through the F2 suppressor to the solenoids of the camera recorder claw mechanism. This claw mechanism will then draw the film across the lens, thus recording the target and graticule display in the gunsight reflector.

14. With either the R.P. or bomb master switch selector to ON, the camera recorder will operate co-incidentally with the G90 camera when the camera push switch is subsequently pressed. The G90 camera additionally requires the camera master switch to be selected to ON.

SERVICING

15. Servicing remains as described in para.55 of Group G.1. The serviceability of the delay unit may be checked by the procedure laid down in Sect.5, Chap.2, Group 4A, App.1 of this A.P.

REMOVAL AND ASSEMBLY

General

16. Removal and assembly of components remains as described in para.58 of Group G.1 in this A.P.

Appendtx 2 – Mod.1219

(Special store – pre. Mod.1260 aircraft only)

LIST OF CONTENTS

Introduction

1. This Appendix contains the description and operation of Modification 1219 when embodied on Hunter FGA Mk.9 on a Special Order Only basis to four specified aircraft. The aircraft specified to have this Mod. embodied must be of pre Mod. 1260 standard as the control circuits cable routeing for Mod.1219 does not relate to aircraft post Mod.1260.

DESCRIPTION

General

2. Modification 1219 equips the aircraft for the carriage of a Special Store on each inboard pylon. The store is non-jettisonable and re-allocation of the outer pylon jettison circuit also renders this circuit inoperable. In addition, the modification requires the cartridges to be removed from the E.R.U.'s and the butt connectors to be stowed. This Appendix includes theoretical and routeing diagrams of the Special Store control circuits and on Fig.3 will be found a list of the armament cables in the inboard pylons which are disconnected and stowed when Mod.1219 is embodied.

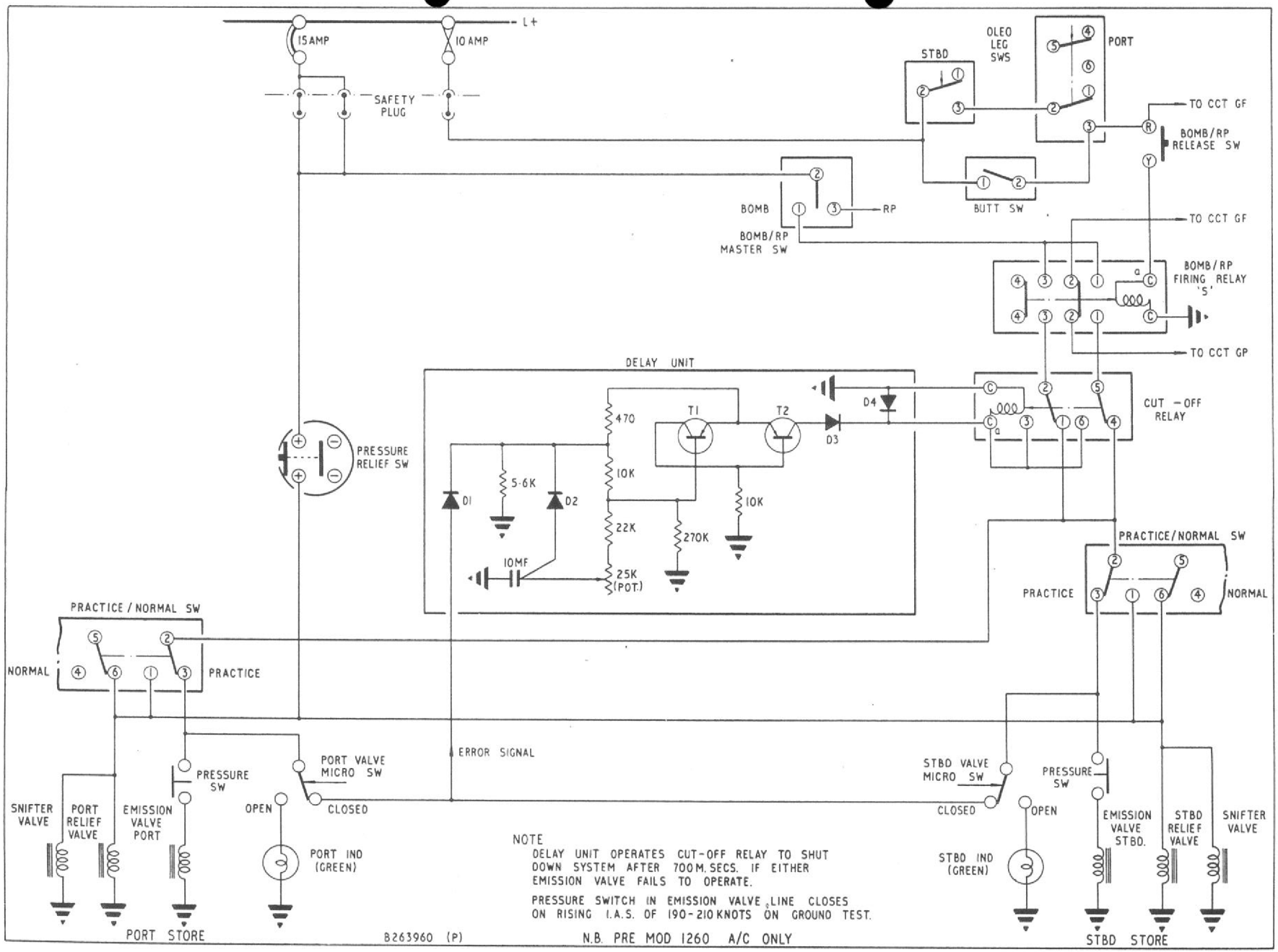

Fig.1 Special store control (theoretical)

Containers

3. The special store is a liquid container or spray tank similar in size and shape to a 230 gallon drop tank. The containers, one carried on each inboard pylon, are self contained units, each containing its own relief and emission valves, indicator microswitch, pitot operated pressure switch and air supply for pressurizing.

Controls

4. The controls for the special store installation comprise:-

(1) The BOMB/R.P. master switch.

(2) The BOMB/R.P. release switch.

(3) The PRESSURE RELIEF switch. *(This is the outboard pylon jettison switch re-labelled).*

(4) The PORT and STBD. SPRAY TANKS EMISSN. indicator lamps mounted on the starboard glare shield.

(5) A time delay unit which utilises the mounting normally occupied by the R.P. distribution box in the radio bay. *(The R.P. distribution box is removed when this Mod. is embodied).*

These controls provide the following facilities:-

(1) BOMB/R.P. MASTER switch
When this switch is selected to BOMB it provides the 28v supply for the special store control system and indicator lights.

(2) BOMB/R.P. release switch
When this control column switch is depressed it initiates emission from the tanks and also provides the shut-down facility should one or both tanks fail to emit.

(3) PRESS. RELIEF switch
When this switch is depressed it opens the relief valves in each tank and completely depressurizes the system in approximately 20 seconds.

(4) PORT and STBD. EMISSN. indicators
These two green indicator lamps when illuminated show emission is taking place from both tanks, or, if only one is illuminated for approximately ¾ sec. at the start of emission, that one tank has failed and the system has been shut down by the time delay unit.

(5) Time Delay unit
This transistorised timing unit, set to operate at ¾ sec. after receiving an error signal from the faulty tank, operates a cut-off relay which closes down the system so preventing the assymetric loading condition which would occur if only one tank was completely discharged.

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Time delay unit	H.S.A. design
Cut-off relay *(part of delay unit)*	
Clare, Type F	
Indicator lamps Rotax, Type B	A.P.113F-0235-1

OPERATION

General

5. The special store emission control circuits are shown theoretically in Fig.1. Figs.2 and 3 show the routeing of the control circuits and Fig.4 gives the wiring of the time delay unit and cut-off relay.

Supply

6. With the Bomb/R.P. circuit breaker in the supply panel closed and the BOMB/R.P. MASTER switch selected to BOMB, 28v supply via the safety plug is available

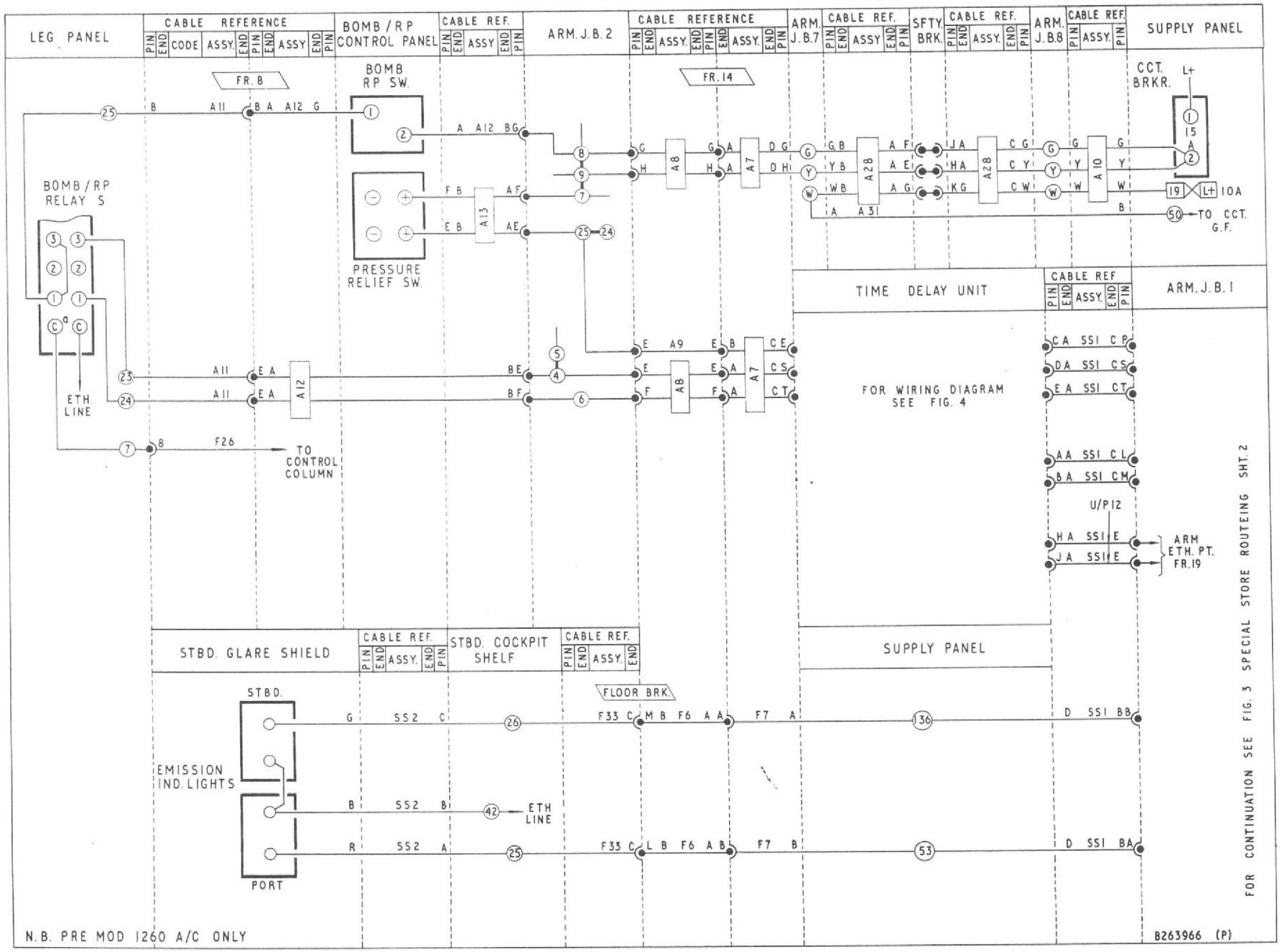

Fig.2 Special store control (routeing sheet 1)

at the BOMB/R.P. firing relay S for operation of the system. Supply from this circuit breaker is also used to operate the tank pressure relief valves to depressurize the system when the PRESS. RELIEF switch is pressed.

7. To start emission from the spray tanks the BOMB/R.P. release switch on the control column is pressed and 28v supply from the gun firing fuse in the supply panel *(Fuse 19)*, via the oleo leg switches, energizes the coil of relay S. Supply can now pass across contacts 1 - 1a and 3 - 3a of this relay and contacts 2 - 1 and 5 - 4 of the de-energized cut-off relay, to the port and starboard PRACTICE/NORMAL switches in the pylons. The PRACTICE/NORMAL switches are set to the PRACTICE position when this Mod. is embodied; and supply will pass across contacts 2 - 3 of each switch to open the emission valve in each spray tank via the tank pressure switch.

Pressure switches

8. The pressure switch in each tank circuit to the emission valve is a safety feature to ensure emission cannot take place accidentally while the aircraft is stationary. The switch, operated by a pitot head in the nose of each spray tank, is held open to isolate the emission valve until the forward speed of the aircraft reaches 190 - 210 kts. when pitot pressure will close the switch and complete the circuit to the emission valve.

Indicators

9. The two green indicator lamps, one annotated PORT and the other STBD., are mounted on the starboard glare shield. They are operated by individual microswitches, one in each tank, which close when the emission valve in their related tank opens, so illuminating the indicator lamp to show emission is taking place.

Time delay unit

10. This is a transistorised timing device whose object is to break the circuit to both emission valves should a fault occur in either valve, during, or at the start of emission. It is mounted adjacent to ARM. J.B.1 on the mounting normally occupied by the R.P. distribution box. The delay unit is set to operate 700 m.sec. after the receipt of an error signal, and this time delay must not be altered.

11. The error signal to initiate the action of the delay unit is passed to it by the closing of either valve microswitch while the BOMB/R.P. RELEASE switch is depressed, the most likely cause being a faulty emission valve or pressure switch. On completion of the pre-set delay period of the unit, transistors T1 and T2 will start to conduct, so energizing the coil of the cut-off relay, breaking its contacts 2 - 1 and 5 - 4 and cutting off supply to the spray tanks. The cut-off relay will remain energized so long as the BOMB/R.P. RELEASE switch is held depressed, by the hold-on circuit through its coil via contacts 2 - 3 and 5 - 6.

Relief valves

12. To assist emission of the special store, each tank is pressurized to 400 – 500 lbs./in.^{2} during the operation, but must be depressurized completely before landing. Depressurization is accomplished by having two solenoid operated valves in each tank which open when the PRESS. RELIEF switch in the cabin is pressed. Completely exhausting the pressure in the tanks takes approx. 20 sec. Of the two valves in each tank, one is a normal electrically operated relief valve and the other called a snifter valve in addition to operating electrically will open partially under the influence of any excess pressure in the tank above the normal operating pressure, and so prevent damage to the tank.

Functional checks

General

13. The special store installation may be checked for correct operation on the ground by the following series of tests:-

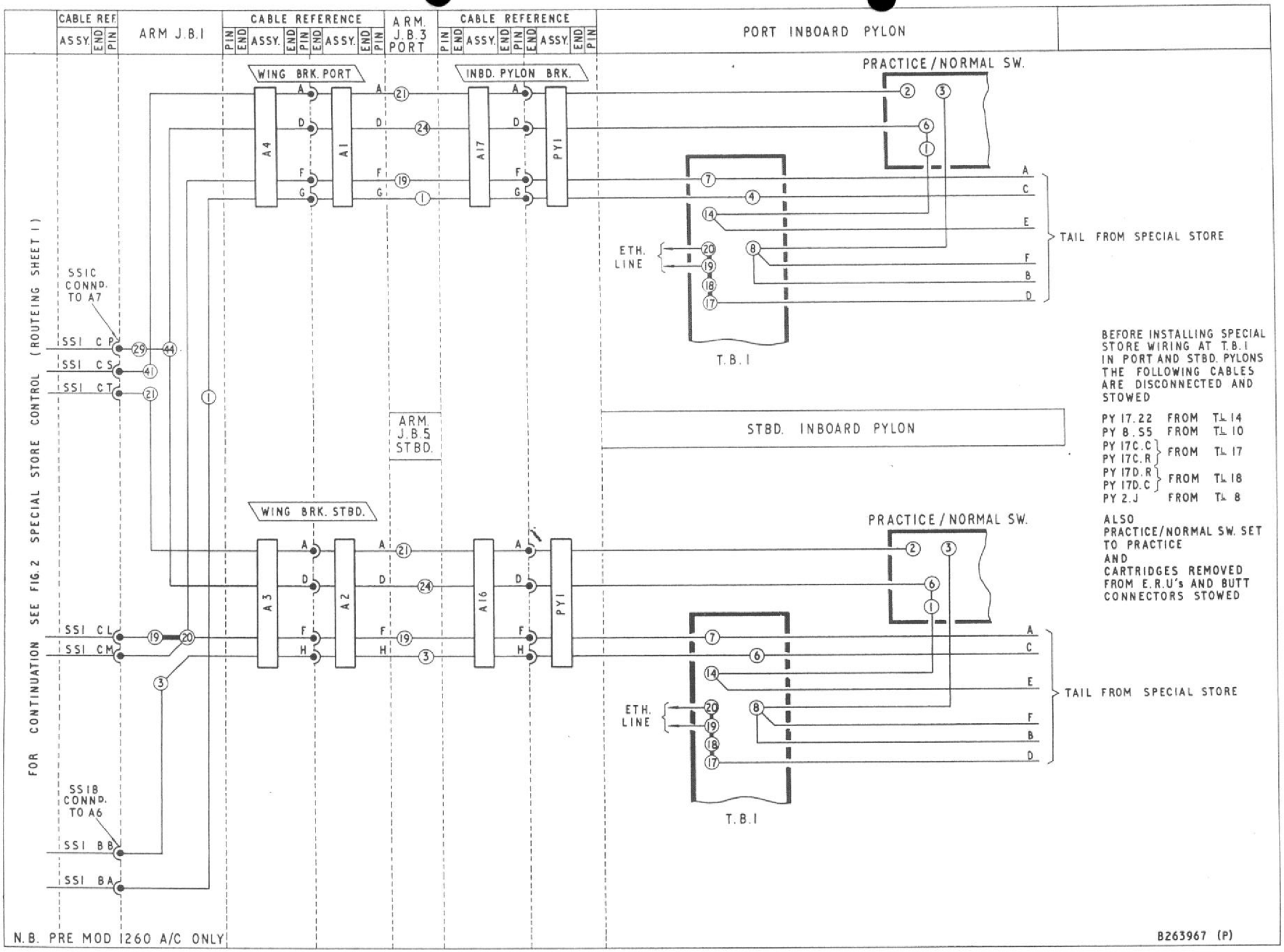

Fig.3 Special store control (routeing sheet 2)

T.P

WARNING...

Before commencing the functional checks refer to the LETHAL WARNING card at the beginning of this book and observe all safety precautions and instructions laid down by C.D.E.E. PORTON.

Condition

14. Before starting the tests ensure that Mod.1219 is fully and correctly embodied, that the outboard drop tanks are removed, gun package disconnected and that the air systems for both special store tanks are fully charged to between 400 and 500 lbs./in.^{2}

Preparation

15. Preparation for the tests is as follows:-

(1) At T.B.1 in both port and starboard inboard pylons connect a test lamp between terminals 8 and 20.
(2) At T.B.1 in both port and starboard inboard pylons disconnect special store cable coded 'A' from terminal 7.
(3) Connect A.S.I. test sets to the pitot pocket in the nose of each special store tank by means of adaptor bungs.
(4) In the cabin select the BOMB/R.P. MASTER switch to BOMB and all other armament switches to OFF or NORMAL.
(5) Connect armament safety plug.
(6) Connect an external 28v d.c. supply to the aircraft and select BATTERY MASTER switch ON.
(7) Select BUTT switch to ON.

Tests

16. To test the installation, proceed as follows:-

(1) Depress and hold BOMB/R.P. RELEASE switch on control column. PORT and STARBOARD EMISSN. INDICATORS should not illuminate.
(2) At the port tank steadily apply and hold pitot pressure. Note the I.A.S. on test set at which the PORT INDICATOR is illuminated. *(This should be between 190 and 210 kts.).*
(3) Repeat test (2) for the starboard tank.
(4) Release the BOMB/R.P. switch. Release the A.S.I. pressure from the port tank. Reconnect special store cable coded 'A' to terminal 7 of T.B.1 in both inboard pylons.
(5) Depress and hold the BOMB/R.P. switch. Test lamps at both pylons should be illuminated together with starboard tank indicator for approximately ¾ sec. only. Release BOMB/R.P. switch.
(6) Release the A.S.I. pressure from the starboard tank. Re-apply and hold A.S.I. pressure to port tank.
(7) Depress and hold BOMB/R.P. switch. Test lamps at both pylons should be illuminated together with port tank indicator for ¾ sec. only. Release BOMB/R.P. switch.
(8) Re-apply and hold A.S.I. pressure to starboard tank.
(9) Depress and hold BOMB/R.P. switch. Test lamps at both pylons and both EMISSION INDICATORS in the cabin should be illuminated and remain so until the BOMB/R.P. switch is released. The valves in the tanks should be heard to shuttle over. Release the A.S.I. pressure from both tanks.
(10) Transfer the test lamps at T.B.1 in pylons from terminals 8 and 20 to terminals 14 and 20.
(11) Depress PRESS. RELIEF switch in the cabin. The test lamps at the pylons should be illuminated and remain so while the switch is depressed. The valves in the tanks should also be heard to shuttle over.

On completion

17. When the tests are completed:-

(1) Remove the test lamps from T.B.1 in both pylons and replace lid and access panel.
(2) Remove A.S.I. test sets and adaptor bungs from the nose of each tank.
(3) Return BOMB/R.P. MASTER, BATTERY MASTER and BUTT TEST switches to the OFF position.
(4) Disconnect armament safety plug.
(5) Disconnect external d.c. supply.
(6) Re-charge air bottles in both special store tanks.

SERVICING

General

18. General servicing of the electrical equipment remains as described in Group G.1 but low voltage ohmeters only must be used for continuity checks when the time delay unit is fitted.

REMOVAL AND ASSEMBLY

General

19. Removal and assembly of the additional electrical components incorporated in the armament circuits by this modification, namely the time delay unit and the emission indicator, will be self evident once access to them is gained and no difficulty should be experienced.

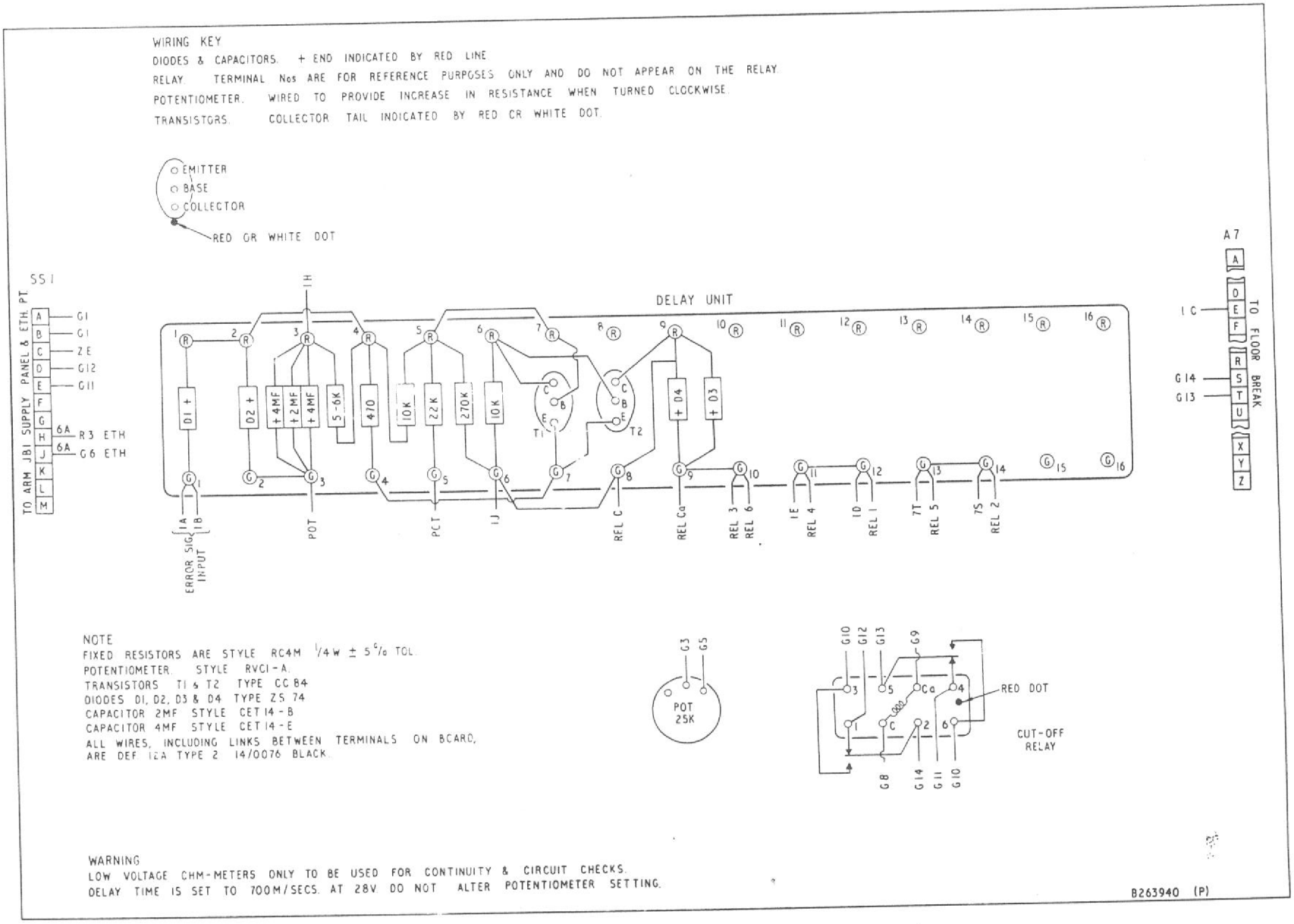

Fig.4 Special store delay unit and cut-off relay wiring