

GROUP A1

SYSTEM DETAILS

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*To be issued later

Introduction

1. This group contains a general description of the electrical system as a whole, together with wiring details and general servicing information. Tables listing the ratings and Stores References of the circuit breakers and filament lamps are also given, together with a loading chart including a circuit index. Illustrations showing the wiring of the junction boxes, panels and shelves including the fuse details will also be found in this group. For detailed information on the standard items of equipment, reference should be made to the appropriate Air Publications, a list of which will be found at the beginning of this volume.

2. The system is of the 24-volt, single-pole, earth return, voltage regulated type. It is supplied by two Type 515 generators, connected in parallel and stabilized by two Type C, 12-volt, 25-amp. hr. batteries, which are connected in series and float across the output of the generators. The batteries are provided with a protective cover. The wiring cable assemblies are run between junction boxes and panels located at points convenient for distribution to the equipment and for breaking down the aircraft. The majority of the cable assemblies are provided with fully weatherproof multi-pole plug and socket breakdown points. Whenever possible the cable connections to the plug and socket pins are crimped. To facilitate servicing and testing, the earth return connections are restricted, being taken to a number of earth studs, shown on the cable assembly layout (Group A3, fig. 1).

3. The generators are mounted on, and driven by, the auxiliary gearbox, situated in the engine bay. Their control equipment is mounted on a panel located on the starboard

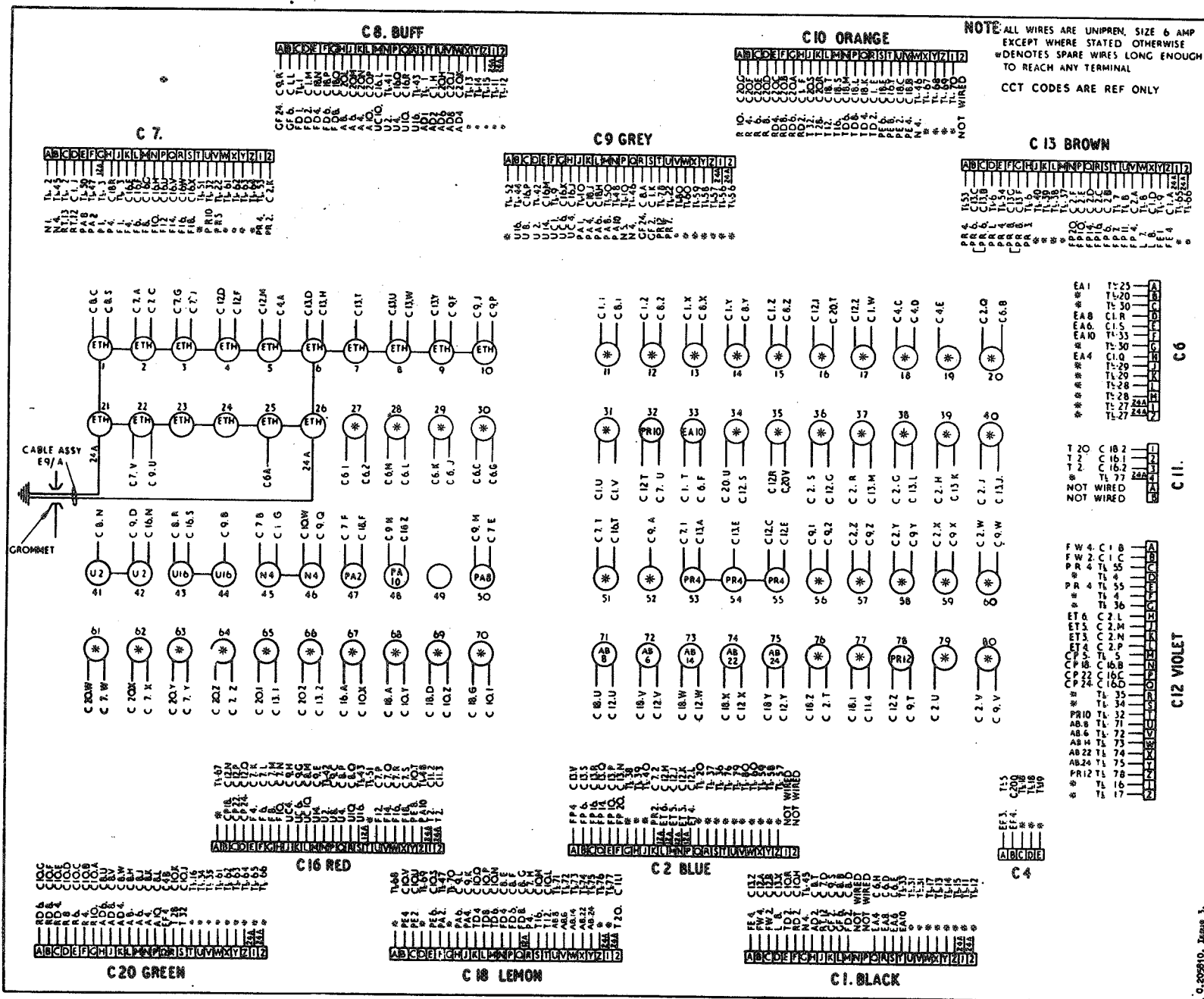


Fig. 4. Wiring of J.B.1

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side of the radio bay. The batteries are mounted on a platform, also in the radio bay. The supply from the generators and batteries to the fuse bus-bars is shown, together with the earth return points, on fig. 1 of this group.

REFERENCING AND GENERAL SERVICING OF COMPONENTS

Junction boxes

4. These are of welded aluminium, water-proof construction with the insides suède-finished to obviate chafing and condensation. They contain the terminal blocks and certain other equipment and, apart from the A.C. junction box, are referenced numerically, the numbers being preceded by the letters J.B. or, in the case of the armament junction boxes, with the additional letters ARM. Each box contains a wiring diagram, a copy of which will be found in this group. The terminals in the boxes are numbered and may be identified by reference to the wiring diagrams. Spare terminals are starred. Where a cable passes through a box without connecting to a terminal, the cable is wired pin to pin between its associated plugs, i.e., pin A to pin A or pin B to pin B, etc. The cable outlets of J.B.1 are mainly of the multi-pole plug and socket type, while at J.B.2 the outlets are of the rubber grommet type. Junction box number 1 is the major box and is located at the bottom of the centre fuselage on the rear face of the main spar. Junction box 2 is located on the port side of the front fuselage above the cockpit shelf between frames 11 and 12, and is used mainly for distribution to the equipment of the port side of the cockpit. The A.C. junction box is mounted aft of the cockpit starboard shelf and used to supply the flight instruments and radar installation. Junction box ARM J.B.1 is located on the fuel tank access door on the forward face of frame 19 above the battery platform, while ARM J.B.2 is mounted aft of the cockpit port shelf. Both these junction boxes are used as breakdown and distribution points for the armament services.

Servicing of junction boxes

5. The junction boxes should be examined regularly to ensure that they are correctly

supported, clean and undamaged. All the components in the boxes should also be examined for security, and an examination of the wiring and terminals made for damage and corrosion.

6. The junction boxes have readily detachable lids and have been designed for ease of removal, being supported on quick-release mountings. When major servicing is necessary, it is recommended that the boxes are removed from the aircraft and replaced with fully serviced components, thus reducing the time for which the aircraft is unserviceable. The faulty boxes should then be serviced, on the bench, and returned to store to be held as spares. The method of removing the boxes is given in Group A2 of this chapter.

Generator control and supply panels

7. These two panels are located together between frames 16 and 19 on the starboard side of the radio bay in the front fuselage. The supply panel is outboard of the generator control panel and is curved to conform with the inside contour of the fuselage skin, being attached by studs on frames 17 and 18, which engage with channel members on the panel. The panel carries a number of terminal blocks, fuse boxes and relays, together with plugs for the cable assemblies to and from the panel. The generator control panel is hinged to the top longeron and fits over the supply panel to form a lid, being attached to the latter panel by four Dzus fasteners along its lower edge. The panel contains all the generator control components, fuse boxes and testing equipment. When raised, for access to the supply panel, the generator control panel may be retained in position by a ring attached to a length of chain secured to the radio mounting structure.

Leg panel

8. This panel is a box bolted to the cockpit floor, below the centre instrument panel and just forward of the control column. It has a hinged door on the port side and a sloping plate carrying the plugs for the cable assemblies on its forward face. The rear face carries the oil pressure gauge, generator power failure warning lamps, ignition and starter switches,

together with the gyro gun-sight circuit breaker and a number of control switches. The box contains relays, terminal blocks, a resistance unit and fuse blocks, these latter components being mounted on the inside face of the door for easy accessibility.

Cockpit port shelves

9. The cockpit port shelf, as a whole, extends between frames 8 and 12, and the two portions about to be described form removable parts of the structure. The forward portion is located just inboard of the throttle lever at the forward end of the structure, while the rear portion extends aft from just behind the high-pressure fuel cock to the end of the structure. Each portion is attached to the fixed structure by a number of screws and Dzus fasteners and is in the form of a panel with

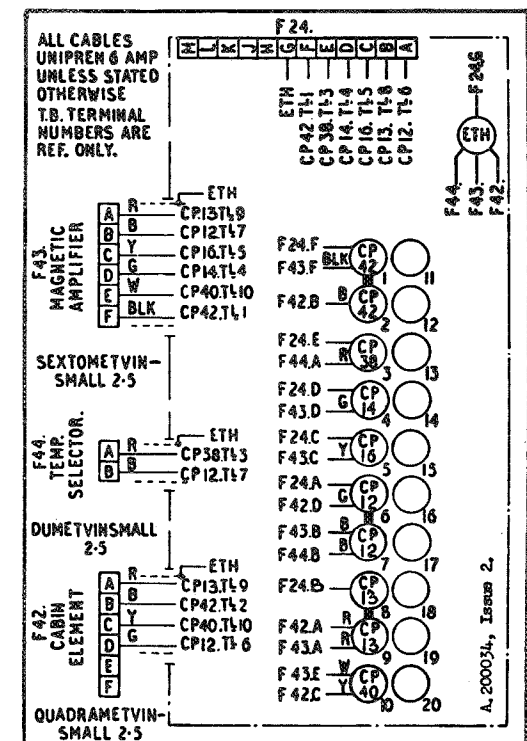


Fig. 5. Wiring of J.B.2

a side member. The rear portion is also provided with an end plate which carries the plugs for connection with the cable assemblies to and from this shelf. The panels carry the radio controllers, control switches, warning lamps and indicators, while below a hinged door, in the top surface of the rear portion, are a number of terminal and fuse blocks supplying the equipment.

Cockpit starboard shelf

10. This shelf, of which the removable portion about to be described is the major part, extends between frames 8 and 12. The removable portion is attached to the fixed structure by a number of Dzus fasteners and is in the form of a panel with a side member and end plate. The end plate carries the plugs for the cable assemblies to and from the shelf and the panel incorporates a number of switches and circuit breakers, together with the fuel gauges, while below a hinged door, at its rear end, are a number of fuse and terminal blocks supplying the equipment.

Gun-firing panel

11. This panel is bolted below the radio mounting structure on the port side of the front fuselage and carries the gun-firing equipment, consisting of an inverter and a number of relays, together with terminal and fuse blocks supplying the equipment.

Radio relay box

12. This box is mounted on the fuselage bottom longeron below the radio mounting structure just aft of frame 16 and contains the radio supply fuses and control relays, together with a number of plugs for the radio connectors to and from the box. For further details of this box, references should be made to Sect. 6, Chap. 1 of this volume.

Servicing of panels and shelves

13. The equipment panels and cockpit shelves should be regularly examined to ensure that they are correctly supported, clean and undamaged. All the components should likewise be examined for security, and an examination of the wiring and terminals made for signs of damage and corrosion. The Dzus fasteners securing these panels and shelves should also be examined to ensure that they

are correctly engaged and not damaged or distorted in any way, paying particular attention to the springs. Any fasteners found to be unlocked must be re-engaged and any found defective replaced as described in A.P.1464B, Vol. 1, Part 2, Sect. 6, Chap. 3. When major servicing is necessary to these panels and shelves, it is recommended that they are removed from the aircraft and replaced with fully serviced components, thus reducing the time for which the aircraft is unserviceable. The faulty panel or shelf should then be serviced, on the bench, and returned to store to be held as a spare. The method of removing these components is given in Group A.2 of this chapter.

Cable assemblies

14. These consist of a number of cables assembled together, most of which are fitted at each end with multi-pole plugs or sockets. The assemblies are referenced numerically, the number being prefixed with a letter denoting their location in the aircraft or, with special circuits, the service which they supply. Front fuselage cable assemblies are prefixed by the letter F, centre fuselage assemblies by the letter C and rear fuselage assemblies with the letter R. Cable assemblies in the port wing are prefixed by the letter P, while those in the starboard wing carry the letter S. The artificial horizon, G.4F compass and armament cable assemblies are prefixed with the letters AH, GC and A respectively. Nypren insulated cables are used in the engine bay hot zones.

15. A periodical examination of the cable assemblies should be made for signs of oil soakage and to ensure that they are properly supported and not chafing, cut or damaged in any way. Damaged cables must be renewed and all slack support clips re-tightened.

Cables

16. The ends of each cable are identified, in one of two ways, by means of rubber sleeves. At equipment the sleeve gives the item and terminal to which the cable core is connected, while at terminal blocks the sleeve gives the equipment and terminal from where the cable core originated. For the type of cable employed in the various circuits, refer-

ence should be made to the routing diagrams and the table of cable abbreviations following para. 37. The method of servicing and repairing the cables is contained in A.P.4343, Sect. 12 and A.P.4343C, Vol. 1, Sect. 5.

Multi-pole plugs and sockets

17. Plessey standard and pressure-proof plugs and sockets, together with the Mk. 4 miniature types are used on the cable assemblies, junction boxes and panels, etc. These are fully described in A.P.4343C, Vol. 1, Sect. 5, Chap. 1 and 8, and consist of internal mouldings, holding the plug pins and socket inserts, which float in fully weatherproof metal housings. The plug pins and socket inserts are each identified by a letter or number on the internal moulding and are arranged in a pattern so as to prevent incorrect assembly with their associated component, thus preventing cross-connection or short circuiting. Those plugs and sockets fitted to cable assemblies outside junction boxes and panels, etc., are provided with rubber sleeves and bungs, which seal the cable entry to prevent the ingress of moisture. The sleeves and bungs are retained in position by inner and outer ferrules locked by a coupling nut. Each socket may be identified by the cable assembly to which it is attached, the reference being printed on the rubber sleeve, and each plug is also identified by its associated cable assembly reference which is painted on the junction box or panel to which the plug is attached. Where two or more identical plugs or sockets are situated together, they are coloured for easy identification.

18. Before an attempt is made to remove a socket from its associated plug, the coupling nut, retaining the sleeve and bung assembly to the socket, must be slackened. This is necessary as the coupling nut also serves to lock the socket when it is mating with its plug. It should also be noted that this nut should be slackened before fitting the socket, the socket being screwed in by hand and assisted home by pushing on the back. A spanner or undue force must NOT be used, or damage will result.

19. The plugs and socket should be examined periodically for signs of corrosion,

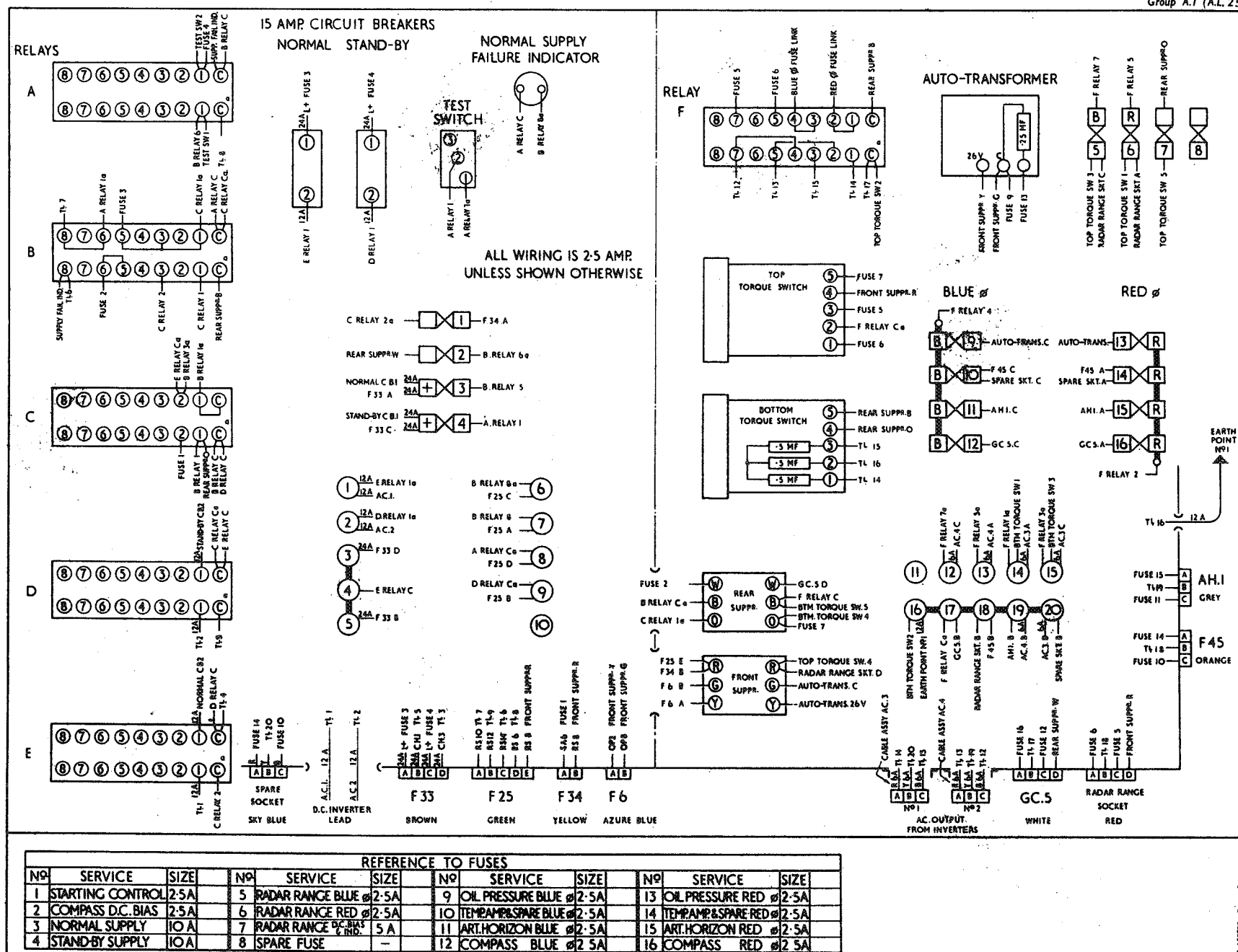


FIG. 6 WIRING OF A.C. I.B.

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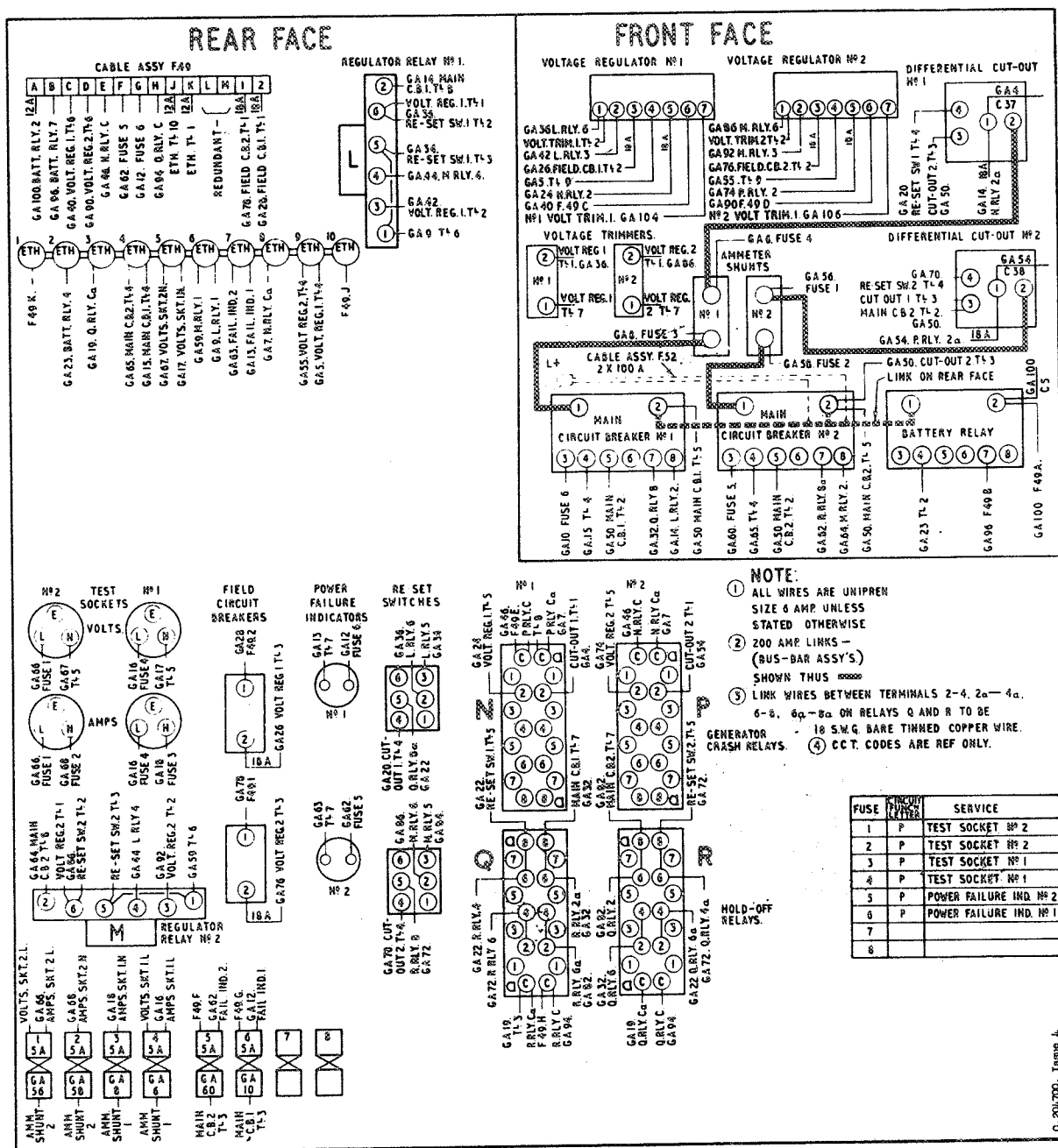


FIG. 7. WIRING OF GENERATOR CONTROL PANEL

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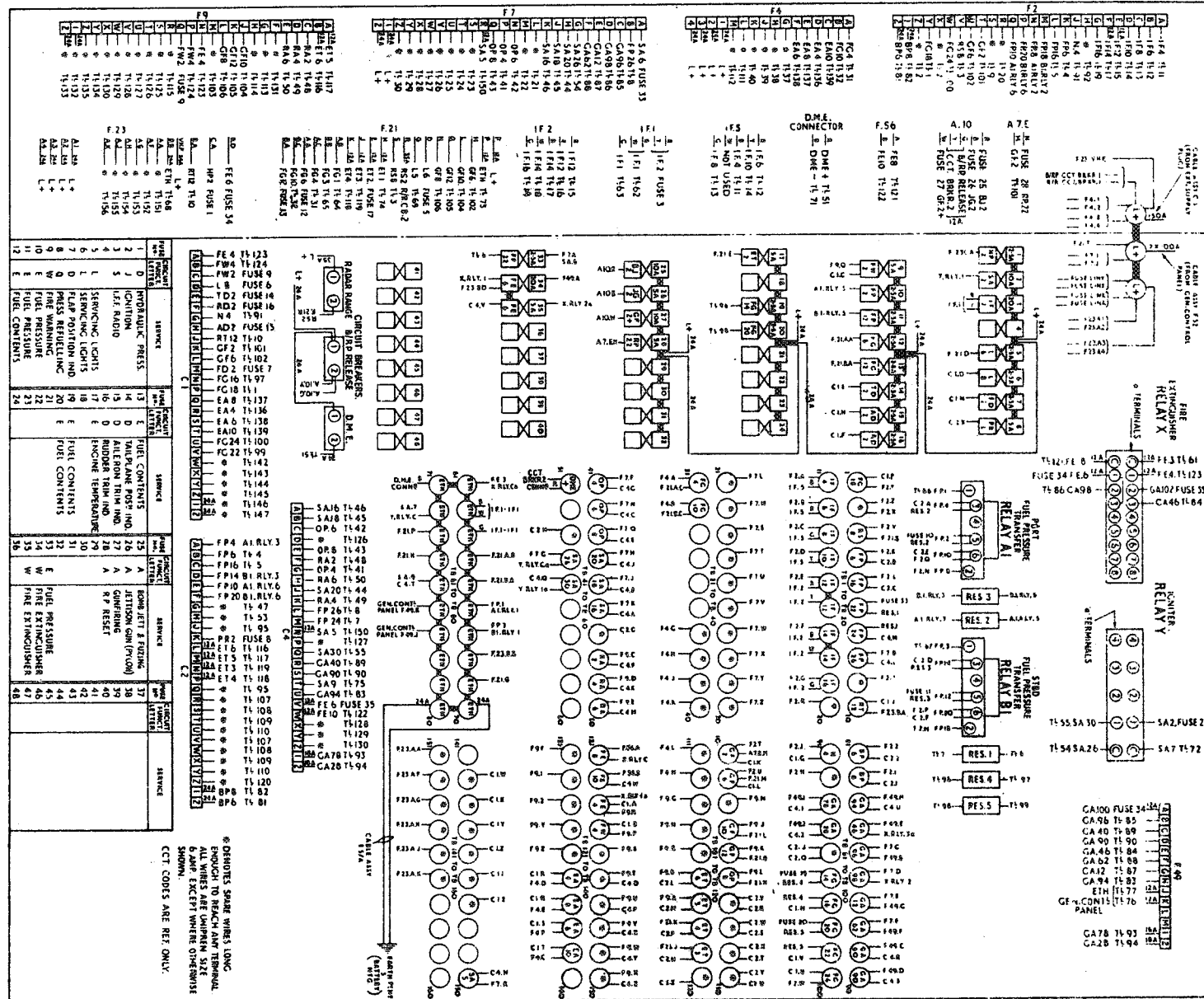


FIG. 8 WIRING OF SUPPLY PANEL

which, if found, must be removed without delay. The importance of cleanliness and the need for regular lubrication of the plug and socket screw threads cannot be over-phasized if seizing of these threads is to be avoided. Low temperature grease XG-275 (Stores Ref. 34B/100512) is to be used and all excess wiped off. On no account should a lubricant with a graphite base be employed. When examining or servicing the cable connections the plugs and sockets incorporating rubber sleeves and bungs, access may be gained by releasing the sleeve at the coupling nut and rolling it back until clear of the connections.

Fuses

20. The circuit fuses are contained in quick-release fuse blocks in the A.C. junction box

and attached to the various panels and cockpit shelves carrying the electrical equipment. They are referenced numerically, each panel and shelf having its own series of numbers. In most instances, these numbers, together with the fuse amperage and the code letters of the circuit it serves are given on a small plate in the block adjacent to each fuse, but in certain instances this information is given on a photographic label attached to the appropriate fuse block. The majority of the fuses are of the Type S series, but a few Type 5 fuses are also used and reference should be made to the panel and shelf wiring diagrams for the Stores References, ratings and fuse numbers. The fuses should be examined periodically to ensure that they are serviceable and of the correct value.

Circuit breakers

21. All the circuit breakers, apart from those on the generator control and gun-firing panels, which are located in the radio bay, are accessible from the cockpit. They are not referenced, but may be identified by the name of the circuit that they protect, this being given adjacent to each breaker. The interior of the circuit breakers is inaccessible and servicing is therefore restricted to the functional and insulation tests given in A.P.4343B, Vol. 1, Sect. 10, Chap. 6. Table 1 gives a list of all the circuit breakers together with their ratings and Stores References.

TABLE 1
Circuit Breakers

Circuit	Rating (amp.)	Stores Ref.
Gun firing	5	5CY/2559
Gunsight mounting	10	5CY/2560
No. 1 generator, field	10	5CY/2560
No. 2 generator, field	10	5CY/2560
Flight instrument control		
Normal	15	5CY/2561
Stand-by	15	5CY/2561
Tail plane control	25	5CY/2562
Hood control	25	5CY/2562
	15	or (Mod.325) 5CY/2561
Tank pumps		
Port	25	5CY/2562
Starboard	25	5CY/2562
Engine starting	45	5CY/2564
D.M.E.	10	5CY/2560
Radar ranging	45	5CY/2564
No. 1 generator, main	200	5CY/2853
No. 2 generator, main	200	5CY/2853
Bomb release	10	5CY/2560

Relays

22. The relays are located in the junction boxes and on the various panels and shelves carrying the electrical equipment. They are referenced alphabetically, the letters being given adjacent to each unit and on the wiring diagrams. The relays should be inspected at

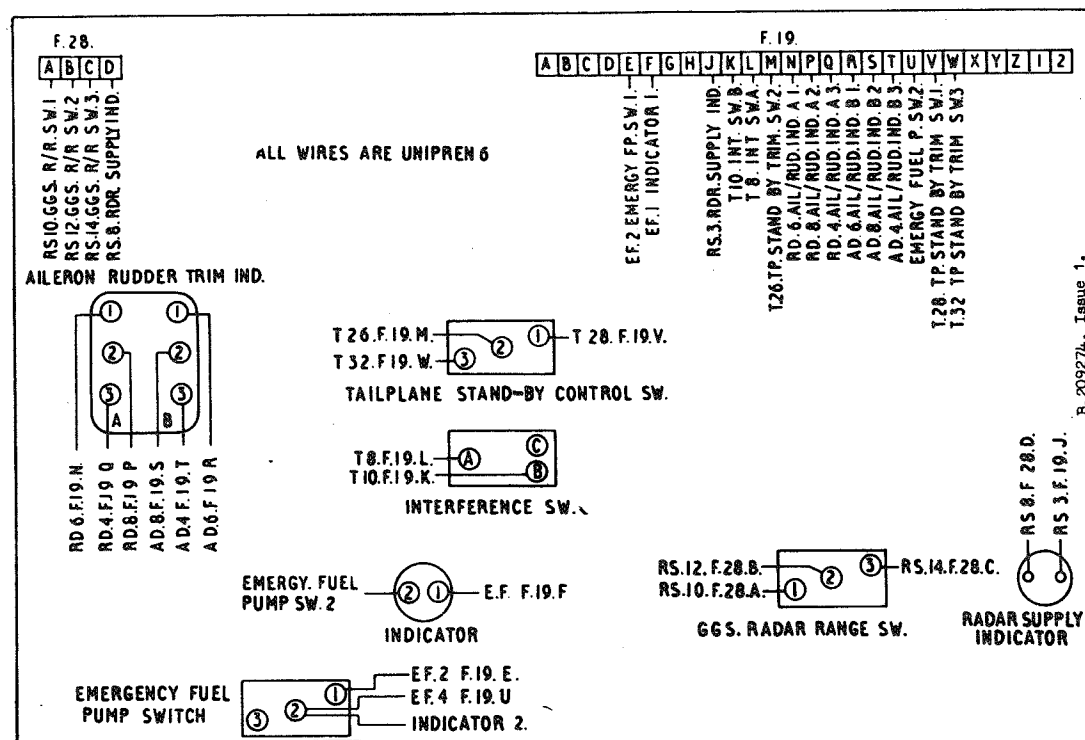


Fig. 10. Wiring of cockpit port shelf (forward portion)

regular intervals to ensure that the contacts are kept clean and that the units are undamaged and secure. They should also be subjected periodically to the functional tests given in A.P.4343C, Vol. 1, Sect. 3, Chapters 5 and 8. ►

Switchboxes

23. If signs of corrosion appear on the contacts of the switchboxes, these must be cleaned and smeared lightly with lanolin.

Terminal blocks

24. Apart from those inside junction boxes and on the panels carrying electrical equipment, terminal blocks are also used as distribution and breakdown points throughout the aircraft. These are of the Plessey quick-release, 2, 3, 5, 10 and 20-way type and are referenced numerically, the numbers being preceded by the letters T.B. Each terminal carries a coding plate on which is marked the circuit code letters, as given in the wiring

diagrams. The terminal blocks may be located on the cable assembly layout and location diagrams contained in Group A3 of this chapter.

Filament lamps

25. When renewing filament lamps, reference should be made to Table 2 to ensure that the correct type is used.

Earth points

26. Apart from the guns, engine starter, inverters, suppressors and the V.H.F. and I.F.F. radio sets, which are earthed internally or adjacent to their mountings, all the other earth leads are grouped, for ease of servicing and insulation resistance testing, and connected to the aircraft structure at a number of stud-type main earth points. Each main earth point is referenced numerically and may be located on the cable assembly layout in Group A3 and on the supply and earth routing chart (fig. 1) of this group. When

refitting earth leads care must be taken to ensure that the surfaces in contact are perfectly clean and, in particular, free from grease and paint. Completed assemblies should be protected against corrosion by applying one coat of blue oil-base paint to D.T.D. Spec. 62B.

GENERAL SERVICING OF SYSTEM

External supply socket

27. This is mounted on the battery support structure below the batteries; access is gained by opening the radio access doors or, on later aircraft, by removing a small access panel in the port radio access door. It is used to connect an external supply to the aircraft services by means of a standard plug, and it is most important that, when servicing, the external supply is used to prevent the aircraft batteries from being discharged. When the external supply is in use, the generators are automatically isolated to prevent a reverse feed (Group B1) and it is recommended that the battery master switch, located on the leg panel, is placed in the OFF position to prevent discharge of the aircraft batteries should the external supply voltage fall below that of the batteries.

Rendering aircraft electrically safe

28. When not required for flight and during any servicing operations not requiring electrical supply, the aircraft must be rendered electrically safe to eliminate the possibility of a short-circuit resulting in the accidental operation of the guns, hydraulic units, etc., with consequent damage to the aircraft or injury to personnel. When electrical power is required during servicing, an external supply should be used. To render safe, it is recommended that the leads from the batteries be disconnected and stowed on the adjacent dummy terminals, as operation of the battery master switch will not render the system completely safe. Also ensure that the external supply is disconnected.

Use of spare cables for emergency servicing

29. A routing diagram of the available spare cables incorporated in the cable assemblies is given in fig. 2. These are provided for future modifications and additions to the existing installation, but may also be used, in an emergency, to replace a defective cable should a circuit fail for this reason. Under

TABLE 2
Filament lamps

Lamp	Circuit	No. Off	Voltage	Wattage	Inter-Service Ref.
Power failure	Generators and batteries	2	24	2.8	5L/X 951230
Engine pumps isolated	Emergency fuel pumps	1	24	2.8	5L/X 951230
Fuel pressure	Fuel pressure	1	24	2.8	5L/X 951230
Cabin pressure warning	Cabin press. and temp. control	1	24	2.8	5L/X 951230
Alighting gear indicator	Alighting gear indicator	9	24	2.8	5L/X 951232
Alighting gear warning	Alighting gear indicator	1	24	2.8	5L/X 951230
Ultra-violet lamps	Cabin lighting	2	12	7.5	5L/X 952261
Red lamps	Cabin lighting	8	24	2.8	5L/X 951263
Red stand-by lamps	Cabin lighting	2	2.5	0.3	5L/X 951134
Wing-tip navigation	Navigation lamps	2	28	24	5L/X 952431
Tail navigation	Navigation lamps	1	24	10	5L/X 952276
Service lamps	Service lamps	3	24	6	5L/X 952254
Gun sight	Gun sight	4	22	12	5L/X 951260
Hydraulic pressure	Hydraulic pressure indicator	1	24	2.8	5L/X 951230
V.H.F. control	V.H.F. radio	2	2.5	0.5	5L/X 951122
Tele-briefing	V.H.F. radio	1	24	2.8	5L/X 951230
Radar locked-on	Radar ranging and supply	1	24	2.8	5L/X 951230
Fire warning	Fire warning and extinguisher	1	24	2.8	5L/X 951232

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this condition, having found the defective portion of cable, refer to fig. 2 to find a similar cable which can be used. At suitable points modify the existing cable run to use the spare cable and isolate the defective cable. Amend the junction box, panel and shelf wiring diagrams to agree and note the fact of this change in the aircraft log book, with the instruction that the cable assembly containing the defective cable must be changed or repaired at the next available opportunity.

Note . . .

The above procedure is only to be adopted as a temporary measure to keep the aircraft operational; it must not be allowed to carry on indefinitely.

Insulation resistance testing

30. (To be issued later).

INTERPRETATION OF DIAGRAMS

General

31. The wiring of all the circuits is shown in routing and theoretical diagrams. The routing diagrams show the complete wiring for each individual circuit and the physical relationship between the electrical components. The diagrams are divided into columns corresponding to the junction boxes and equipment panels through which the wiring passes and also the circuit code, connector pin references, and cable type, together with all break points and termination. Plug and socket connections are shown by small semi-circles embracing a black dot; the semi-circle denotes the socket insert and the black dot the plug pin. Terminals in the junction boxes and on equipment panels are represented by small circles with their reference numbers enclosed; the fuses are referenced numerically and, in most instances, shown in the equipment panel columns. These numbers refer to the terminals and fuses in the box or on the panel concerned, each unit having its own series of numbers, as shown on the diagrams. The TERMINATION columns show the external connections of the equipment in the correct relationship, but the internal wiring is not shown as this is given in the theoretical diagrams.

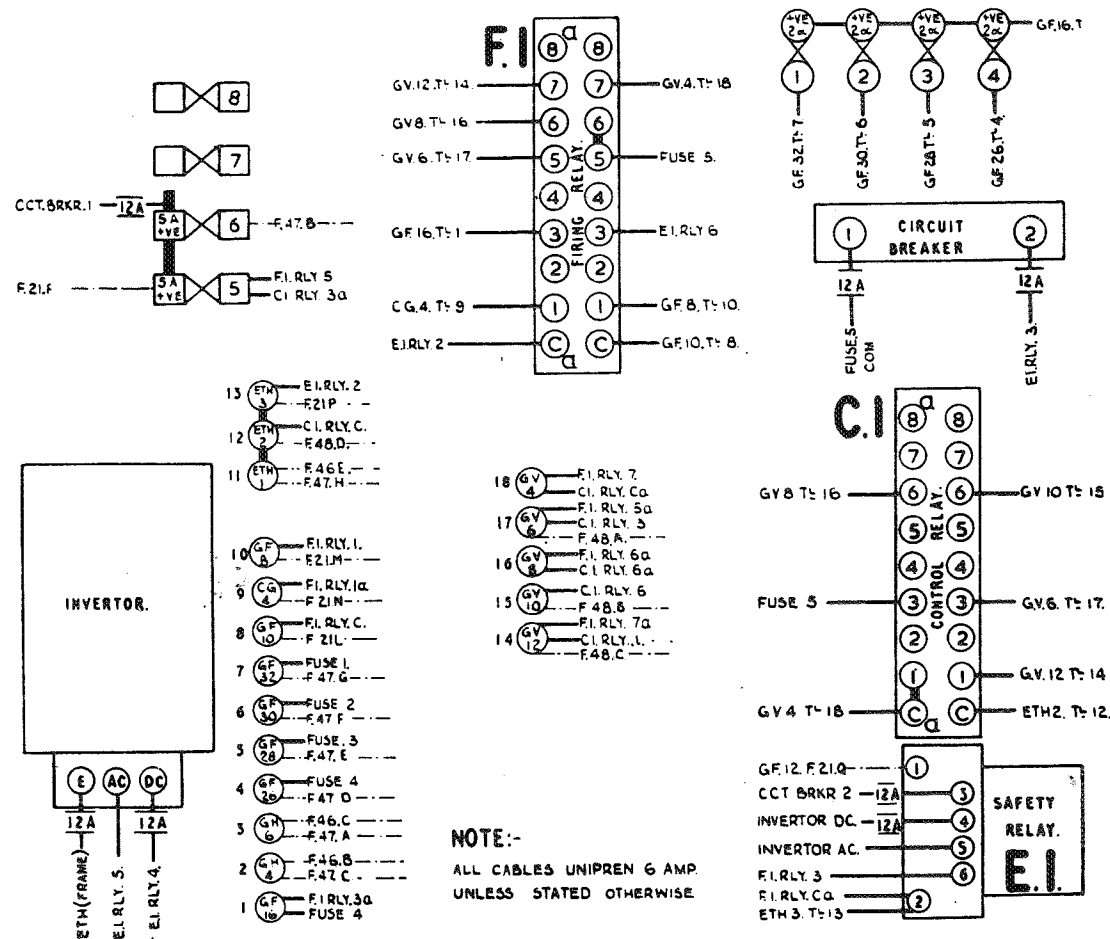


Fig. 13. Wiring of gun-firing panel

32. In the theoretical diagrams the equipment is shown by symbol, each being complete with internal wiring; brief explanatory notes are also given where necessary. As the diagrams are drawn for ease of reading, the symbols are not given in their correct physical relationship, but are positioned to give a straightforward presentation, the connections being arranged to assist in this direction. The fuse rating is given adjacent to each fuse and each section of the circuit is referenced at

suitable points with the circuit code. It will assist when reading theoretical and routing diagrams to refer to the cable assembly layout in Group A3 and to note that all positive cables are given an even numbered reference, while all negative cables bear an odd number.

33. Unless otherwise stated, all the routing and theoretical diagrams are drawn with the circuits in the condition found when the aircraft is at rest on the ground with its alighting

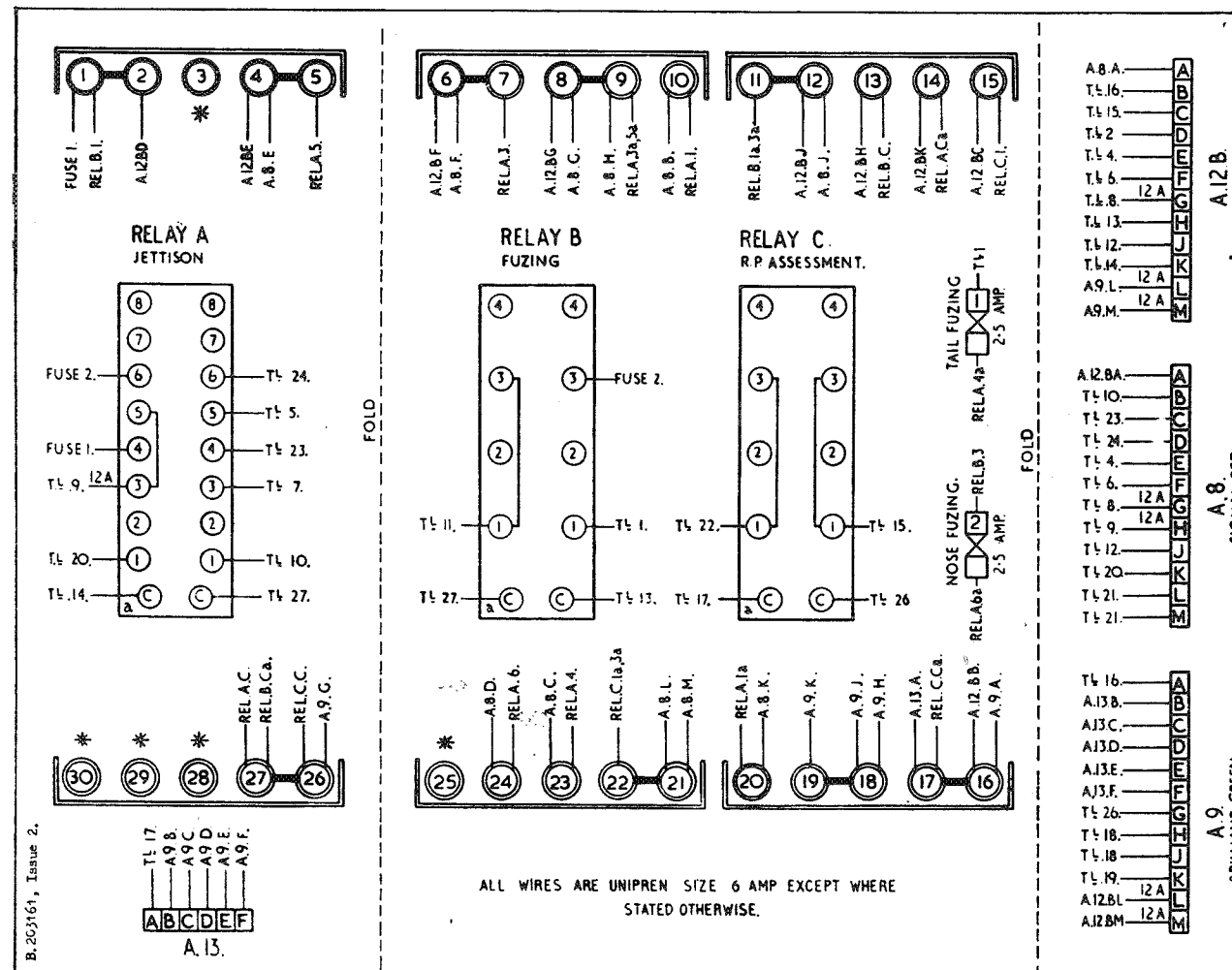


Fig. 15. Wiring of ARM J.B.2

terminal 1 of the switch, a further unipren 12 cable, referenced P4, connects with pin Q of plug F17, which is mounted on the leg panel. Cable assembly F17 mates with this plug and a further unipren 12 cable, also referenced P4 and connected to pin Q of the socket, continues the supply to pin R of a plug and socket break at frame 14. After this break the cable assembly number changes to F18 and the unipren 12 cable, still refer-

enced P4, is connected to pin R and continues to another plug and socket break at frame 19. At this point the cable assembly number changes to C18 and the unipren 12 cable, still referenced P4 and connected to pin R, continues to pin R of plug C18 attached to J.B.1. The cable leaves the junction box, still referenced P4, via pin H of plug C7, which is also attached to the box. Cable assembly C7 mates with this plug and runs

to the port wing plug and socket break. After this break the cable assembly number changes to P1 and the unipren 12 cable, still referenced P4, is connected to pin H of the socket on this cable assembly and continues to a terminal of T.B.22 in the port wing tip. From this terminal the red core of the pressure head heater cable continues the supply to the heater element. The negative return from the heater is the blue core, which is con-

nected to another terminal of T.B.22 and a unipren 12 cable, referenced P1, from the terminal block enters cable assembly P1 and is connected to pin G of the plug and socket break in the port wing. After this break the cable assembly number changes to C7 and the cable, still referenced P1, is connected to pin G of the plug on this cable assembly and runs to J.B.1, where it is connected to pin G of plug C7 attached to the junction box. From the plug a further length of unipren 12 cable connects with earthed terminal number 3 in J.B.1.

Cable abbreviations

37. The following table should be used in conjunction with the cable type and size column on the routing charts to define the type of cable employed in the various circuits of this aircraft.

TABLE 3
Cable Abbreviations

Abbreviation	Cable type
U/P	Unipren
D/P	Dupren
T/P	Tripren
D/P SHEATH	Duprensheath
T/P SHEATH	Triprensheath
Q/P SHEATH	Quinprensheath
U/PM	Uniprenmet
D/PM	Duprenmet
T/PM	Triprenmet
U/NYP	Uninypren
U/FIRE	Unifire

Loading chart and circuit index

38. This chart (*fig. 3*) contains the loading for each circuit and remarks giving the duration of load, together with the total power available. An analysis of the maximum load and the power used during the duration of flight is also given. The chart may also be used as a circuit index as it gives the circuit titles and codes.

Junction box, panel and shelf wiring diagram

39. To facilitate servicing, each junction box, equipment panel and shelf of this aircraft contains a diagram of its electrical wiring. These diagrams give the cable size, terminal numbers and plug references, together with the fuse numbers, ratings and Stores References. Copies of the diagrams will be found in *fig. 4* to *15* inclusive at the end of this group.

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