SPECIFICATION

GENERAL ELECTRICAL SPECIFICATION

(Inactive for Future Design after June 2, 1953)

Beech Specification BS 217C

ISSUED August 23, 1943

REVISED March 29, 1954

R. R. Jenner
Writer

Revised by
E. W. Rath

J. L. DeLapp
Project Engineer

A. S. Odevseff
Chief Project Engineer, Military

M. R. Terry
USAF Quality Control

E-370

A3

Seed Diesel Corporation

SPECIFICATION MS-217 C

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3. REQUIREMENTS (Continued)

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3. REQUIREMENTS (Continued)

1. SCOPE

1.1 Purpose.- The purpose of this specification is to establish procedure and material requirements for the installation and adjustment of general electrical items not otherwise covered by detail drawings or other specifications. Any deviation from this specification must be approved by the Engineering Department.

2. APPLICABLE PUBLICATIONS

2.1 Specifications:

Federal

QQ-S-571 Solder; Soft (Tin, Tin-Lead, and Lead-Silver)

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2.1 Specifications: (Continued)

Military

JAN-A-669	Anti-Seize Compound; White Lead Base, General Purpose (For Threaded Fittings)
JAN-T-152	Treatment, Moisture- and Fungus-Resistant, Of Communications Electronics, and Associated Electrical Equipment; General Process For
JAN-T-713	Twine, Lacing and Tying, Electrical and Electronic Equipment
MIL-I-7798	Insulation Tape; Electrical, Adhesive, Plastic

Beech

68 101	Specification for Bonding and Shielding of Beechcraft Models 17 - 18
BS 389	Bonding and Shielding on the Commercial Model 18, 35, and 50 and the USAF L-23A Airplanes

2.2 Drawings

44A9215	Connector - Cable Splice Two-Way

Beech Standard Drawings

106242	Tubing Extruded Insulating
114958	Method Insulation Tying
115013	Tape Identification

3. REQUIREMENTS

3.1 Electrical Cables:

3.1.1 Cable Identification:

3.1.1.1 Spacing.- Code all cables except as noted in Paragraph 3.1.1.1.1, not more than three inches from each terminal and at intervals of not more than 15 inches along the entire length of the cable.

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3.1.1.1.1 Exceptions.- All cables covered with flexible metal braid shall be coded at each end only. Shielded cables shall be identified at each end or as otherwise required by engineering drawings. Materials specified in Beech Standard Drawing 115013 may be used.

3.1.1.2 Marking.- Mark the cables by one of the following methods:

3.1.1.2.1 Machine Marking.- Print the cable identification number and gage on the insulation of the cables, using the cable marking machine manufactured by the Kingsley Gold Stamping Company, or an equivalent machine.

3.1.1.2.2 Numerical Tape.- Numerical tape which is equivalent to the cable marking machine may be used where machine marking is not practicable and if it complies with Beech Standard Drawing 115013 or with Paragraph 3.1.1.2.3.

3.1.1.2.3 Adhesive Tape Labels.- Make identification labels from adhesive tape such as Bayhesive, manufactured by Park-Davis and Company, when only a few numbers are required, as in the case of rework or if the coding does not fall within the specified limits from the end of the terminal. Use a typewriter for marking the label. Labels shall be of adequate width to accommodate the required identification and of sufficient length to permit 1-1/2 to 2 turns around the cable. Coat the label with clear lacquer.

3.1.1.3 Layout.- Layout of the cable identification shall conform to one of the systems illustrated in Figure 1.

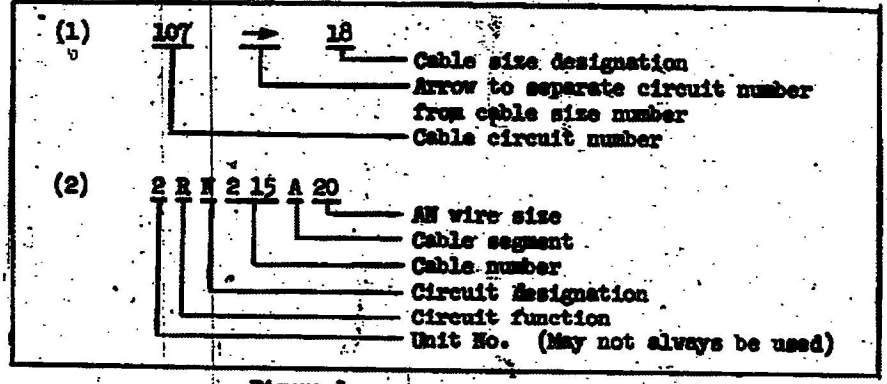

Figure 1

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3.1.2 Cable Preparation.- Take extra care to insure an ABSOLUTE MINIMUM OF NICKED STRANDS OF WIRE in the cable when stripping and preparing the cable ends for assembly.

3.1.3 Cable Connections:

*3.1.3.1 Safety-Wiring.- Safety-wire all electrical connectors, except those on equipment which is suitably shock-mounted, to prevent opening of the connector by vibration.

3.1.3.2 Junction of Cables.- Use approved terminal blocks or connector panels for the junction of cables. Splicing of cables and wires shall not be acceptable for production installations or for salvage except as provided by the Engineering Requirements Manual. Splicing in accordance with USAF Drawing 44A9215 is for repair of cables only.

3.1.3.3 Disconnect Splices and Terminals.- Assemble and install the disconnect splices and terminals as follows:

(a) Install the cable in the disconnect splice tip with an indentation for the cable conductor and another indentation to secure the cable insulation.

(b) Place insulating tubing over the splice and secure the tubing with a miller's knot as shown in Figure 2. Tie all insulating tubing on the "hot" side of the circuit at the disconnects to provide positive protection for the circuit in case the disconnects disengage.

(c) Install insulating tubing over the terminals at the ends of all 16-gage or heavier wires, excepting terminals with insulating hoods or pre-insulated terminals. Tie the insulating tubing according to the procedure in (b) of this paragraph. Insulating tubing installed on terminals at ends of 18-gage or smaller wires does not require tying.

3.1.3.4 Solder Connections:

3.1.3.4.1 Preparation.- All connections shall be cleaned and tinned before solder is applied. All threaded parts shall be lubricated before assembly with anti-seize compound as specified in Military Specification JAN-A-669.

* Not applicable to the SNB-5

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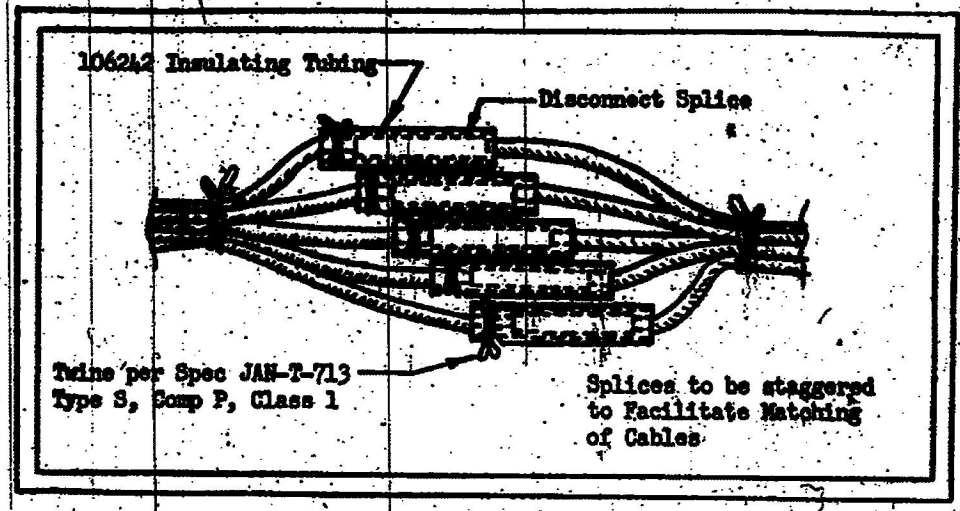

Figure 2

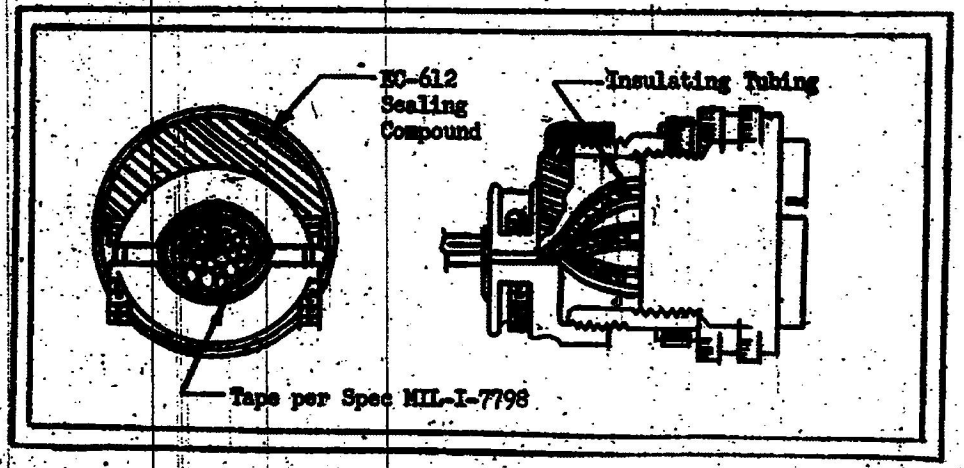

Figure 3

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3.1.3.4.2 Protection for Wires on Solder Cups.- Place insulating tubing over the solder cup connections for both plugs and receptacles. Secure the tubing as specified by Beech Standard Drawing 114958, using twine in accordance with Military Specification JAN-T-713, Type S, Composition P, Class 1, waxed as required in Military Specification JAN-T-152.

3.1.3.4.3 Insulating Tubing.- Place insulating tubing on all soldered connections in plugs in accordance with Beech Standard Drawing 114958 to prevent the cables from short circuiting if one of the connections breaks or becomes loose. Where practical, use insulating tubing on other solder connections, such as is used on relays, contactors, switches, fuses, and similar equipment.

3.1.3.4.3.1 Tubing Size.- Use the diameter of the solder cup to govern the size of the tubing where the plug or receptacle solder cup is appreciably larger than the wire gage. In cases where the maximum outside diameter of the wire insulation is larger than the terminal barrel, the diameter of the wire insulation shall govern the size of the tubing.

The following tables shall be used to determine the size of the insulation when used for plugs, splices, and wires.

TABLE I

Insulation - Beech Standard Tubing No.	AN-J-C-48 Cable Size	Packard Cable Size
106242-1-00104	22, 20, 18	22
106242-2-00104	16, 14	20, 18
106242-3-00104	12, 10	16, 14, 12, 10
106242-4-00104	8	8
106242-5-00104	6	6
106242-6-00104	4	4
106242-7-00104	2	2
106242-9-00104	0	0

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3.1.3.4.3.1 Tubing Size.- (Continued)

TABLE II

Insulation - Beech Standard Tubing No.	AN-J-C-48 Cable Size	Packard Cable Size
106242-1-00012	20, 18, 22	22
106242-2-00012	16, 14	20, 18
106242-3-00012	12, 10	16, 14, 12, 10

TABLE III

Terminal	Insulation
AN659-1 and AN659-2	106242-1A-00100
AN659-3 and AN659-4	106242-2A-00100
AN659-5 and AN659-6	106242-3-00100
AN659-7 and AN659-8	106242-5-00104
AN659-9 and AN659-10	106242-6-00104
AN659-11 and AN659-12	106242-7-00104
AN659-13 and AN659-14	106242-8-00104
AN659-15 and AN659-16	106242-9-00104
AN659-17 and AN659-18	106242-10-00108
AN659-19 and AN659-20	106242-10-00108
AN659-21 and AN659-22	106242-11-00108
AN659-23 and AN659-24	106242-11-00108
Disconnects	
A-57	106242-1A-00208
B-57	106242-2A-00208
C-58	106242-3-00208

3.1.3.4.4 Soldering Procedure.- Use the Composition Sn60 rosin core solder specified in Federal Specification QQ-S-571 to make all solder connections. Clean all the excess flux and any particles of solder and foreign material from all solder connections to prevent corrosion and potential short circuits. The rosin residue need not be removed.

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3.1.3.5 Clamps.- Wrap the cable group whenever clamps are used to relieve strain on electrical connections. Wrap with the tape specified in Military Specification MIL-I-7798, using sufficient tape to obtain solid clamping but leaving the clamp at least 1/16 inch from the bottoming on Type AN3057-6 through AN3057-40 adapters and at least 1/32 inch from the bottoming on Type AN3057-3 and AN3057-4 adapters. This is illustrated in Figure 3.

3.1.3.6 Adapters:

3.1.3.6.1 Sealing.- Seal all AN3057 adapters installed forward of the firewall in the engine compartment with EC612 sealing compound, manufactured by the Minnesota Mining and Manufacturing Company, to prevent dirt, gasoline, and oil from entering the AN plugs and to prevent fires. Figure 3 shows the EC612 sealing compound installed in the AN3057 adapter.

*3.1.3.6.2 Tightening.- Tighten the AN3057 adapters or the AN type connectors so there will be no strain on cable connections. No mechanical means other than "strap-type" wrenches shall be used to tighten knurled Army-Navy and Signal Corps electrical fittings.

*3.1.3.7 Connector Plugs.- Position all connector plugs to permit water to drain out of and not into the plug. If the location of the equipment does not allow proper positioning when AN3108 plugs are used, provide adequate drainage with a 1/8-inch diameter hole in the lower portion of the shell of the plug.

3.1.4 Cable Installation:

*3.1.4.1 Restrictions:

(a) Avoid any application of alcohol, gasoline, benzol, or carbon tetrachloride to cable insulation as it may dissolve the materials.

(b) Do not use adhesive tapes, including friction, medical, or rubber tapes, which will dry out in service, produce chemical reaction with cable insulation, or is moisture absorbent.

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3.1.4.2 Dimension Requirements:

3.1.4.2.1 Minimum Length.- All cables shall be of sufficient length for the following:

(a) To eliminate the necessity of replacing the entire cable when replacing terminals of cables in service.

(b) To provide drip loops in cables at connectors or plugs.

*(c) To prevent mechanical strain on cables, cable junctions, and cable supports.

*(d) To permit free movement of shock-mounted and vibration-mounted equipment.

3.1.4.2.2 Minimum Bend Radius.- The minimum bend radius of all cables shall be 10 times the outside diameter of the cable.

3.1.4.3 Terminal Connections.- Clean all terminal connections before assembly. All terminal connections shall make a good electrical connection.

3.1.4.3.1 Aluminum Terminals.- Cover the aluminum cable wires used for the assembly and installation of aluminum terminals with "No-Oxide" paste, manufactured by the Dearborn Chemical Company. Apply the paste as soon as insulation is stripped to prevent oxidation. DO NOT REMOVE THE NO-OXIDE PASTE FROM EITHER THE TERMINAL OR THE WIRES WHEN THE TERMINAL AND WIRES ARE ASSEMBLED TO EACH OTHER OR TO THE TERMINAL POST.

3.1.4.3.1.1 Assembly.- Insert a bimetal washer of aluminum and copper between the terminal and the terminal post when assembling the aluminum terminals to a terminal post or item of equipment. The aluminum face of the washer shall be adjacent to the aluminum terminal and the copper face of the washer adjacent to the copper or steel part of the equipment.

3.1.4.4 Cables Shielded with Flexible Metal Sleeving.- Prepare cables for the termination of shielding as follows:

(a) Make an opening in the metal sleeving approximately three inches from the end of the cable by pushing the sleeving back to expand it and inserting a pointed instrument between the metal strands to form a rounded opening. Pull the cable through the opening. Exercise caution to prevent breaking strands of the metal sleeving.

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3.1.4.4 Cables Shielded with Flexible Metal Sleeving.- (Continued)

(b) Stretch the sleeving to compact the strands and cut off three inches from where it separates from the cable, unless otherwise directed. Tie the shielding where it breaks away from the wire, using two turns of JAN-T-713 cord, Type 2, Composition P, Class 7. Apply the required terminals to the end of the shielding and wire.

(c) Where shielded cables pass through AN3057 type adapters, secure the terminal on the sleeving under one of the adapter screws. Make sure the surface of the adapter is clean. As many as four shielded cables may be terminated on each screw.

3.1.4.5 Cable Grouping:

3.1.4.5.1 Tying.- Tie groups of cables with a miller's knot where necessary, using twine specified in Military Specification JAN-T-713, Type S, Composition P, Class 1, and waxed in accordance with Military Specification JAN-T-152. Continuous lacing of cables may be used in distribution and junction boxes only.

3.1.4.5.2 Splicing.- Install permanent splices when called out by engineering drawings and contact orders. They may be used to avoid additional terminals posts and excessive solder connections. THEY SHALL NOT BE INSTALLED TO CORRECT ERRORS MADE IN INSTALLATION.

*3.1.4.5.3 Protection from Chafing.- Cover with insulating tubing any single cables or any groups of five or fewer cables located in the gas tank bay area or other areas where they may have a tendency to chafe against the aircraft structure or other parts. Use the smallest possible diameter tubing. Protect the larger groups by wrapping them with tape per Military Specification MIL-I-7798.

3.1.4.5.4 Grouping Limitations.- Electrical and radio cable groups shall not contain more than 25 cables except where the wiring leads to connectors which have more than 26 terminals. In that case the wiring may run as a single group provided all of the wiring is pertinent to a single item of equipment.

3.1.4.6 Cable Routing Requirements:

*3.1.4.6.1 Improper Cable Connections.- Route and support cables so improper connections cannot be made where similar connections are used in adjacent locations. If this requirement cannot be met, provide adequate marking or identification to avoid errors in connections.

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3.1.4.6.2 Cable Supports:

(a) Install supports for single cables or for cable bundles at intervals not less than 6 inches or more than 24 inches apart, except in distribution and junction boxes.

*(b) Install supports for cable groups in distribution and junction boxes in a neat and orderly manner.

*(c) Install cable groups so no strain will be imposed on terminals, no vibration will occur in cables or terminals, and no possibility of short circuiting exposed metallic parts will exist.

3.1.4.6.3 Routing Limitations.- Do not attach cables or groups of cables to the following lines or equipment: fuel lines, hydraulic lines, oil lines, alcohol lines, oxygen tanks, and related equipment.

*3.1.4.6.4 Cables Accessible During Flight.- Route cables which are accessible during flight in such a manner that rapid inspection can be made in case of fire.

*3.1.4.6.5 Cables to Flight Maintenance Equipment.- Group and route separately all cables to single items of equipment which operate to maintain flight of the aircraft under normal or emergency conditions. Such equipment includes electric propeller circuits, fuel pumps, and fuel boosters, required flight instruments, power sources for the instruments, etc.

3.1.4.66 A-C Cables.- Group and route a-c cables separately.

3.1.4.6.7 Audio Cables.- Route separately the groups of audio cables of the radio communication equipment unless otherwise specified.

3.2 Bonding:

3.2.1 Definition.- A bond is a good electrical connection which has a resistance approximately equal to that which would exist if the two parts being connected were integral. Bonding is required to make all parts of the airplane an integral electrical mass.

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3.2.2 Bonding Procedures:

3.2.2.1 Requirements:

(a) Accomplish all bonding in accordance with Beech Specification BS 101 or BS 389B as applicable.

(b) Use an un-anodized aluminum washer to separate dissimilar metals unless both the metals are corrosion-resistant steel, cadmium plated steel, copper, brass, bronze, or a combination of these specific metals.

3.3 Radio Interference:

3.3.1 Requirements.- These requirements apply to the entire frequency range of all installed electronic equipment and to all electronic equipment for which installation provisions have been made.

(a) There shall be no undesirable response from electronic receivers above the area noise level.

(b) There shall be no malfunctioning of other electronic equipment from radio interference produced by any or all electrical, electronic, and other equipment of the aircraft when tested as specified in Paragraph 3.3.2.

3.3.1.1 Exemption from Requirements.- Undesirable transient responses are exempted from the requirements specified when the following conditions apply:

(a) If they cause no malfunctioning and occur only during ground engine starting.

(b) If they cause no malfunctioning, are less than one second in duration, and do not recur more frequently than one every three minutes during normal operations.

(c) If their duration is less than three seconds and they do not occur more than once per flight.

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3.4 Regulation and Adjustment of Electrical Equipment:

3.4.1 Voltage Regulators:

3.4.1.1 Equipment.- Use a precision portable voltmeter with an 0-30 range. DO NOT USE THE VOLTMETER ON THE PILOT'S INSTRUMENT PANEL UNDER ANY CIRCUMSTANCES. The instrument panel voltmeter shall be used only as an indicator to determine whether the generators are operating. Connect the voltmeter in the following manner:

(a) Connect the negative voltmeter lead to a structural ground.

(b) Connect the positive voltmeter lead in accordance with the type of generator control equipment being used and as follows:

Control	Connection
94-32276-A Voltage regulator	B terminal
94-32163-C Control panel B-1-B	A terminal
Eclipse Type 1035, Model 2 Control panel	G+ terminal

3.4.1.2 Adjustment Procedure: The following procedures are applicable to the Model 18. Method I procedure is for the airplane which has the generator switch in the ouput lead, Method II is for the airplane which has the generator switch in the field circuit.

3.4.1.2.1 Model 18

Method I

(a) Run the generator with a small load, such as lamps or radio, for a period of 15 to 30 minutes to warm up the voltage regulators.

(b) Place the switches on both generators to the off position after the voltage regulators are warm.

(c) Increase the speed of the engine to 1800 rpm.

(d) Adjust the voltage regulator by turning the knurled knob on the voltage regulator until the voltmeter indicates 28 ±25 volts. Turning the knob to the right will increase the voltage and turning it to the left will decrease it.

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3.4.1.2.1 Model 18 (Continued)

(c) Make a final check on the bus voltage. The bus voltage shall not be greater than 28.25 volts. If it is greater than 28.25, the voltage regulator is to be readjusted to a lower voltage until the bus voltage is 28.25 volts.

Method II

(a) Run the generators with a small load, such as lamps or radio, for a period of at least 15 minutes to warm up the voltage regulators.

(b) Turn off the left generator and all possible electrical load. With the right engine running at 1800 rpm and with the right generator "on" adjust the voltage regulator rheostat knob so that the voltmeter reads 28 volts. Turning the knob to the right will increase the voltage and turning it to the left will decrease it.

(c) Turn off the right generator and all possible electrical load. With the left engine running at 1800 rpm and with the left generator "on" adjust the voltage regulator rheostat knob so that the voltmeter reads 28 volts. Turning the knob to the right will increase the voltage and turning it to the left will decrease it.

(d) Adjust the voltage regulator by turning the knurled knob on the voltage regulator until the voltmeter indicates 28.25 volts. Turning the knob to the right will increase the voltage and turning it to the left will decrease it.

3.4.1.2.2 Model 17:

(a) Run the generator with a small load, such as lamps or radio, for a period of 15 to 30 minutes to warm up the voltage regulators.

(b) Place all the generator switches in the off position after the voltage regulators are warm.

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3.4.1.2.2 Model 17: (Continued)

(c) Increase the speed of the engine to 1800 rpm.

(d) Adjust the voltage regulator by turning the knurled knob on the voltage regulator until the voltmeter indicates 14.25 volts. Turning the knob to the right will increase the voltage and turning it to the left will decrease it.

(e) Make a final check on the bus voltage. The bus voltage shall not be greater than 14.5 volts. If it is greater than 14.5, the voltage regulator is to be readjusted to a lower voltage until the bus voltage is 14.5 volts.

3.4.2 Reverse Current Relay:

3.4.2.1 Adjustment:

3.4.2.1.1 Model 18:

(a) Adjust the reverse current relay between 26 and 27 volts after the voltage regulator is adjusted. The voltage is varied for this test by the engine speed.

3.4.2.1.2 Model 17:

(a) Adjust the reverse current relay between 13.3 and and 13.7 volts after the voltage regulator is adjusted. The voltage is varied for this test by the engine speed.

3.4.3 Current Limiter Relay:

3.4.3.1 Adjustment:

3.4.3.1.1 Model 17:

(a) Adjust the current limiter so it will open at 30 amperes or more.

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3.4.4 Paralleling Generators.- Use the following procedure to parallel the generators after the voltage regulators and reverse current relays have been adjusted.

(a) Run the engines at 1800 rpm.

(b) Place the switches on both generators to the on position.

(c) Balance the load on the generator by increasing the load on the generator which is low and decreasing the load on the generator which is high by adjusting the knurled knob on the voltage regulator.

(d) Turn on the additional load, equal to approximately one-half the rating of one generator. Balance the load on the generator again.

3.4.5 28-Volt D-C Overvoltage Protection Systems:

3.4.5.1 Adjustment:

*3.4.5.1.1 Model C-45G and C-45H:

(a) Check to assure that all switches are in the off position.

(b) Install a temporary jumper from the A to the B terminal on the voltage regulator that controls the voltage of the generator being checked. Connect a voltmeter of known accuracy and with a 50-volt or more scale, between the B terminal and the ground.

(c) Place the generator control switch for the generator circuit being checked and for the battery switch in an on position.

(d) Start the aircraft engine.

(e) Increase the engine rpm gradually until the field control relay and/or overvoltage relay disconnects the generator from the main electrical distribution bus. If the installed overvoltage and field current relays function properly, the overvoltage warning light will

* Not applicable to the SNB-5

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*3.4.5.1.1 Model C-45G and C-45H:

(e) Light at an indicated voltage of 31 to 33 volts. When the overvoltage system disconnects the generator from the main distribution bus, the voltage should drop to approximately 2 volts. Do not allow the voltage to go higher than 35 volts. Shut off the engine IMMEDIATELY if the overvoltage and/or field relay does not disconnect the generator from the main electrical distribution bus after the maximum of 35 volts is reached. Disconnect the affected generator from the aircraft electrical system at an indicated voltage of 31 to 33 volts if the overvoltage and field current relays and the balance of the system have functioned properly. Repair and replace as necessary if the system operates at a voltage in excess of the 33-volt limit or completely fails to operate.

(f) Remove the temporary jumper from the voltage regulator that was previously connected between the A and B terminals. Also disconnect and remove the precision voltmeter.

(g) Momentarily place the generator control switch in a reset position then return the switch to an on position. Check the generator system for the specified voltage of 28 volts and for proper operation.

(h) The preceding check procedure is typical for all 28-volt d-c overvoltage protection systems. Check individually the generator circuit on each aircraft with such a system.

3.5 Plastic Tubing:

3.5.1 Prevention of Condensation in Tubing.- Prevent condensation in plastic tubing which is used to protect wiring from mechanical abrasion by the following means:

(a) Perforate all sections of tubing longer than six inches with two 1/8-inch diameter holes located diametrically opposite each other and spaced approximately every six inches.

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3.5.1 Prevention of Condensation in Tubing.- (Continued)

(b) Install the tubing in such a manner that any condensation will drain from the interior of the tubing.

3.6 Junction Boxes:

3.6.1 Drainage.- Provide a suitable hole as near 3/8 inch in diameter as possible and with a minimum diameter of 1/8 inch at the lowest possible point on the box to allow for drainage on the ground.

3.6.2 Prevention of Grounding of Terminals.- Apply No. 1201 Red Glyptol lacquer, as manufactured by the General Electric Company of Schenectady, New York, to the inside of the covers, bottoms, and sides of metal junction boxes to prevent the grounding of terminals.

4. INSPECTION

4.1 General.- Adequate inspection shall be performed to insure compliance with the requirements of this specification.

4.2 Tightness of Plugs.- Tightness of plugs shall be inspected by hand in a tightening direction only.

4.3 Radio Interference.- Applicable specifications shall govern the method of testing for radio interference.