INSTRUCTIONS FOR CONTINUED AIRWORTHINESS (ICA) OF THE BC 433-H permanent magnet generator with PMR3 Regulator and 505-1PM/OV kit

Currency of this document is maintained by replacement in its entirety upon revision. The latest revision may be viewed at www.Luscombe.org, once FAA approval is granted, or obtained by contacting the STC holder of record with the FAA.
Pages are numbered X of Y (where X = the page number of Y pages), so that the user may determine that he possesses all of the relevant information to maintain the product and installation.

REVISION LEVEL	CHANGES	DATE
New	new release	December 12, 2006
A	Changed Wiring Diagram	March 26, 2008

1. AIRWORTHINESS LIMITATIONS

Paragraph (5), *Periodic Inspections*, and paragraph (8), *Maintenance Scheduling*, of this ICA establish those maintenance requirements, and comprise the Airworthiness Limitations Section required for the installed product.

The Airworthiness Limitations Section is FAA Approved and specifies maintenance required under 14CFR §§ 43.16 and 91.403 unless an alternative program has been FAA approved.

2. Installation Interface:

The BC 433-H permanent magnet generator is a direct replacement for the Delco Remy Generators, or Prestolite alternators installed on Continental engines with a 3 stud rear accessory housing drive pad. Interface with the engine is accomplished using the same three mounting studs on the engine, and utilizing the Continental drive gear assembly specified by the engine manufacturer to mesh with internal gears. The specified drive gear assembly incorporates a shear link and rubber biscuits that are designed to fail in the unlikely event that the drive shaft were to seize. The 5/16" nuts on the generator mounting studs are torqued to 180-220 in/lbs upon installation. Torque on the generator drive nut is 175-200 in/lbs. [Torque values extracted from Continental Motors form X-30010, pages 118 (table of limits), and 119 table XXIV.]

The regulator and over voltage module are mounted on or near the firewall (cabin side), near the original regulator mounting location. Wiring meeting MIL-W-22759/16 is used to connect components as depicted on the wiring schematic, drawing BC433-H, sheet 4.

Wires or wire bundles should be supported at no more than a 12" interval, and wire bundles should be secured together at approximately a 6" interval during installation. Chapter 11 provides excellent reference material for this installation. Routing of wires shall avoid antennas and unshielded radio installations in order to minimize Electro Magnetic Interference (AC43.13-1B, at paragraphs 11-106 & 11-107).

3. ICA distribution: ICA will be distributed with each original STC package. The STC Instructions recommend that it also be filed with a 337 completed by the installer so that it remains available as part of the permanent aircraft record.

Revisions to the ICA will be available at www.Luscombe.org, or may be requested from Endowment Enterprises LLC., or the current ATC owner on file with the FAA. Notification of any changes to ICA will be undertaken by mailing or Emailing the affected purchasers of the STC, at those addresses registered and filed with Endowment Enterprises LLC., when the installation is completed. The ICA is Appendix A to the STC manual used for installing the BC 433-H permanent magnet generator (PMG). That manual is prepared in American English.

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4. Introductory information: The installation of the BC433 PMG system replaces the original electrical power generating system. No change to the existing aircraft electrical system is required downstream of the electrical buss for the proposed installation.

ADVANTAGES: This installation improves safety by using modern electrical components to replace worn and tired generators and regulators. Low RPM electrical production using alternator technology improves both charging and radio utilization on the ground and at low power settings, and results in lighter weight which improves useful load and aircraft utility.

There are no unusual characteristics or adapters required for the installation, and no special tools. The PMG system is designed to accept the standard Continental driven gear and mounting hardware without modification. Regulator and PM/OV components mount to the firewall inside, on the glove box, or elsewhere under the instrument panel. The generator control/interrupt switch and the load limit breaker are installed prior to the existing aircraft distribution bus.

5. Periodic Inspections

Annual and 100 hour inspections of the installation should include the security of mounting to the engine, inspection of circuit protection devices and wiring for cracks, breaks and chafing. Inspection of all wiring is required for mounting security. A functional check of the system should also be accomplished during engine start and shutdown.

During engine run-up, actuate the generator switch “ON”.

The warning light should extinguish, indicating the system is operating. Note ammeter for charging output.

Activate a heavy load device like landing light(s).

Note ammeter needle moves, indicating the regulator has compensated for the electrical demand.[1]

Gentle rotation of the PMG housing by hand will test for drive backlash pursuant to the Continental Motors Service document, SB95-3A .

The regulator and over-voltage module should be inspected and cleaned free of dust and foreign matter during each inspection.

6. Location and access

The PMG unit is installed on the left hand rear accessory pad of the engine under the cowl. The wiring penetrates the firewall where the over voltage module and regulator are located under and behind the instrument panel, accessible from the cockpit. See also Aircraft Interface above.

7. Basic Control and operation

The pilot controls the system by a 2 Amp circuit breaker switch powered from the aircraft buss. The pilot moves the switch to actuate the regulator and over-voltage module via an electrical relay. Those in turn automatically control the PMG output to meet electrical demand of the aircraft system. Electrical power is then delivered to the aircraft buss through a 25 Amp current limiting breaker or fuse link whenever the engine is turning the PMG.

The system status is monitored by use of an “GEN OFF” light. The generator warning lamp is normally illuminated when the circuit breaker switch is “OFF” or when the regulating/over-voltage module has tripped. There are no special procedures for operation, and the system is limited to 30 Amps of output.

8. Maintenance scheduling

Only the Continental drive gear assembly is user serviceable.

Every 500 hours of time in service, or more frequently, the drive gear assembly must be checked for backlash per Continental service instructions. This may be done by manual manipulation of the external PMG housing that rotates with the gear. The drive gear assembly may be serviced in the field by replacement of any required parts per Continental Motors service documents. Refer to Continental Motors service bulletin SB95-3A.

[1] Note that due to the method of ammeter wiring, the ammeter indication may momentarily decrease (ammeter wired to buss); or it may increase (ammeter wired into buss feed line). An appropriate change for the wiring method used must be considered by the mechanic undertaking the test.

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The BC433 PMG, (excluding the drive gear assembly) requires no recurrent maintenance during its service life of 2000 hours. It is recommended that at 2000 hours time in service, or during engine overhaul (whichever is sooner), that the generator and drive gear assembly be returned for factory evaluation and overhaul.

The regulator and over-voltage protection modules furnished with the BC433 PMG require no recurrent maintenance and have an indefinite service life. Field adjustment of the regulating voltage may not be accomplished on the PMR-3 by field personnel. Repairs are by replacement only.

Failure or malfunction due to broken wires, damaged connectors, loose connections, wire chafing or other connection difficulties may be repaired using wire meeting MIL-W-22759/16, and AMP plasti-grip vinyl connectors, with guidance from AMP application specification 114-2161, reference figure 7, on the following pages. [2]

9. Maintenance Troubleshooting

The BC433-H PMG is simple and extremely reliable. Occasionally harsh environments or improper installation may cause the system to not work properly. This trouble shooting guide addresses the most frequent areas of problems and provides some theory of operation to aid in diagnosis of the system. Refer to Figure 1, which is a simplified schematic depicting only one of the 3 phases in the PMG. The complete electrical diagram is attached and labeled BC433-H, sheet 4.

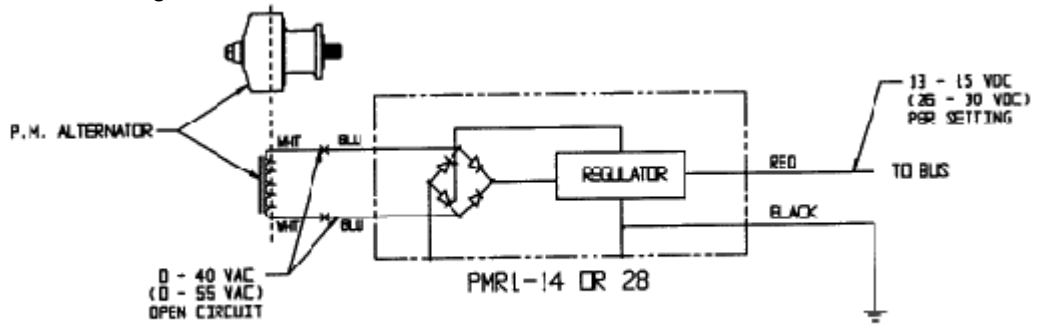

Figure 1

The BC433-H incorporates fixed stators around which a permanent magnet (PM) housing revolves to generate electrical energy. Since the winding is stationary, there are no brushes required to transfer electrical energy. This makes the generator extremely reliable. Continuity of the winding may be checked with an ohmmeter to detect any broken wires in the leads or winding. Also check the drive coupling to make sure that the magnetic housing rotates with the engine crankshaft. If the housing rotates and the wiring is continuous there must be A.C. output. The A.C. output varies with RPM.

The PMR-3 regulators are simple and solid state in design. They consist of a full-wave bridge rectifier and regulator circuitry for controlling the bridge. The PMR-3 changes the Alternating Current output to rectified D.C. for the bus at the set point. The black wire exiting the PMR-3 case is connected to the case internally and should be connected to the negative (-) side of the battery. The red wire should go through the relay and over voltage module, then via a breaker and switch to the aircraft electrical BUSS to which the positive (+) terminal of the battery is connected.

Note that battery voltage must be applied across the red and black wires to power the regulator portion of the circuit before it is able to switch the bridge rectifier ON. The PMR-3 set point is adjusted to 14.5 V before it leaves the factory. The regulator should not need to be adjusted at installation, and is not field adjustable.

[2] Also found in its entirety at http://ecommas.tycoelectronics.com/commerce/DocumentDelivery/DDEController?Action=showdoc&DocId=Specification+Or+Standard%7F114-2161%7FA%7Fpdf%7FEnglish%7FENG_SS_114-2161_A.pdf

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The BC433-H PMG system should reach minimum speed for regulation somewhere near run-up (1700 engine RPM). Rated output will not be achieved until approximately cruise engine RPM (5500 generator RPM). Typically, any increase in BUS voltage after engine start would indicate that the system is working. As the load on the system increases, the bus voltage will decrease from the set point. The system should reach the set voltage point at less than 2 amps load. Rated load is based on a voltage of 13 volts or more.

Following are some trouble shooting hints:

NO OPERATION:

1. The shear coupling may be broken, evidenced by the magnetic housing not turning with the engine (or the housing able to spin with the engine stopped).
2. The battery may be disconnected from the regulator (switch off, over voltage trip, or broken wire) thereby disabling the regulator circuitry.
3. The connectors, splices, or terminal blocks may not be making a good connection. Connectors may have been damaged by engine cleaning solvents, excessive temperatures or contamination by oil. Occasionally, nylon wire ties used to lock connectors together will tension the connectors in such a way as to break the connection. If necessary, remove the connectors and use positive “butt splices” to make the connections.
4. Engine speed too low. Check for output at a higher speed.
5. Regulator failed. Replace the regulator.
6. Open circuited generator (least likely).

LOW VOLTAGE:

1. Engine speed too low.
2. Battery very low. A very low battery will take a relatively long period of time to charge to full voltage with this small generator. Successive short flights coupled with hard starts will gradually deplete the battery and seem to indicate charging system faults.
3. Bad battery. A shorted cell will decrease the BUSS voltage. This may be reflected as undetected generator load.
4. Loads applied in excess of generator rating.

HIGH VOLTAGE:

1. Bad battery. A battery that is open or has “sulfated” plates acts as a poor filter. The solid state regulator will regulate the voltage higher if there is little filtering on its output. This is caused by the regulator trying to maintain the average output voltage above the set point. Try a new battery and/or check battery connections for looseness or corrosion.
2. Regulator adjustment failure / Bad regulator. Replace regulator.

Since the PMG generator does not have a controllable field, regenerative over-voltage failures are not possible unless a very rapid load change occurs. Over voltage protection is provided in the Crowbar O.V. module installed along with the capacitor filter used on the BC433-H as an automatic fail-safe for over-voltage protection in the system.

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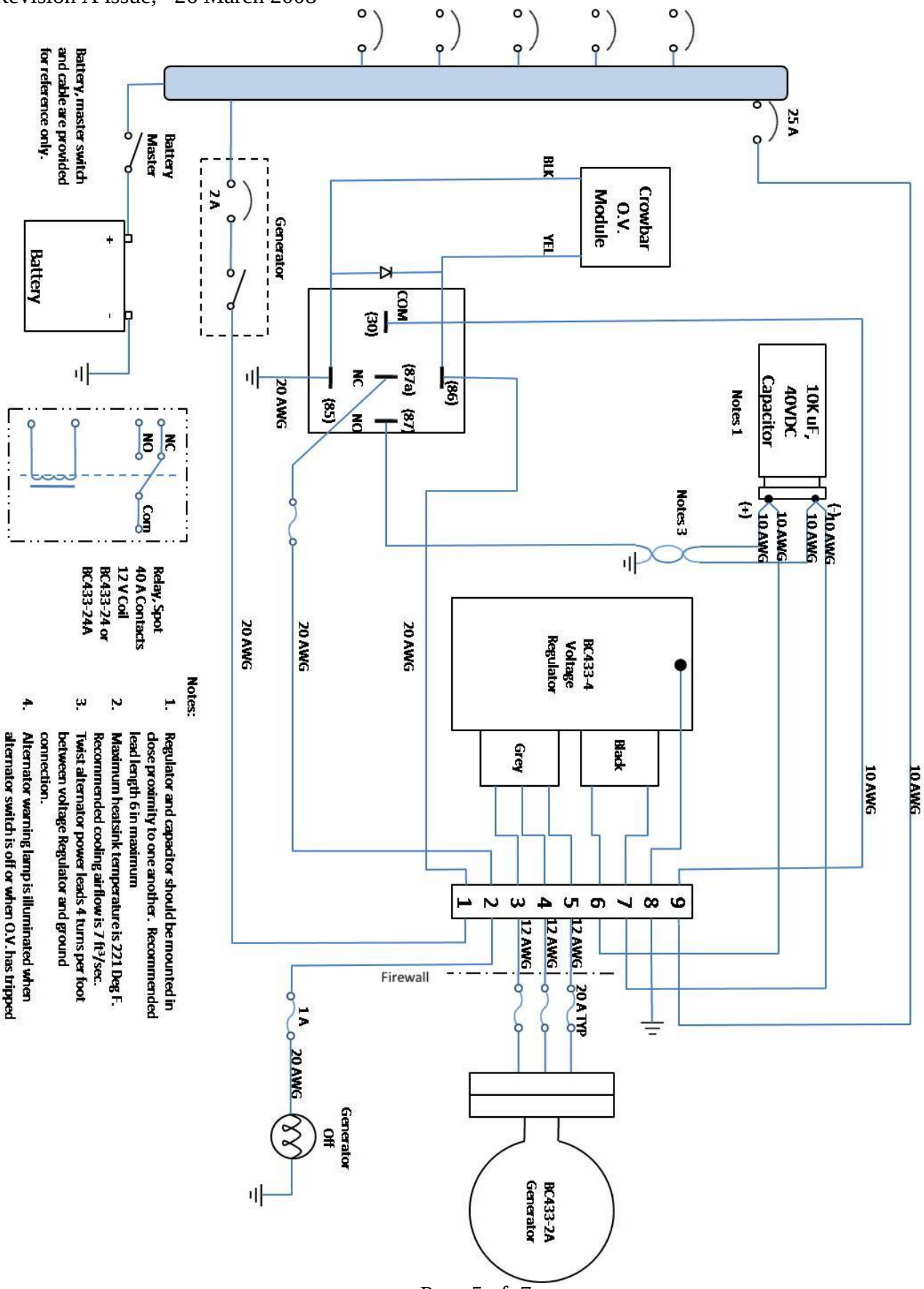

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Application Specification

114–2161

13 JAN 05 Rev A

PLASTI–GRIP* Terminals and Splices

NOTE *All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of ±0.13 [±.005] and angles have a tolerance of ±2°. Figures and illustrations are for identification only and are not drawn to scale.*

1. INTRODUCTION

This specification covers the requirements for application of PLASTI–GRIP terminals and splices for commercial applications. The terminals and splices consist of precision formed metal wire barrel insulated with vinyl with a maximum operating temperature of 90°C [194°F] for the splices and 105°C [221°F] for the terminals. The ring tongue terminals and butt splices are also available insulated with PVF2 (polyvinylidene fluoride); these terminals and splices can withstand a temperature range of –65 to 150°C [149 to 302°F]. The terminals are also available in heavy duty (HD) for extra mechanical strength. The terminals and splices accept solid or stranded wire for single applications. The flared end of the insulation allows insertion of wires that meet maximum voltage ratings: 600 V for building wiring and 1,000 V for fixture and sign wiring.

The terminals and splices are color coded to provide a visual reference applicable to the wire size range suitable for the terminal or splice. In addition, terminals are marked on the tongue with the wire size range. The serrations or dimples inside the wire barrel provide maximum contact and tensile strength after crimping. The terminals suitable for mounting accept stud sizes M2 [2] through M12 [.50] (a diameter range of 2.18 through 12.7 [.086 through .500]). The terminals and splices are available in loose–piece for terminating with manual and pneumatically–powered hand–held tools, and in tape–mounted form for terminating with semi–automatic hand–held tools and electrically–powered machines.

When corresponding with personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

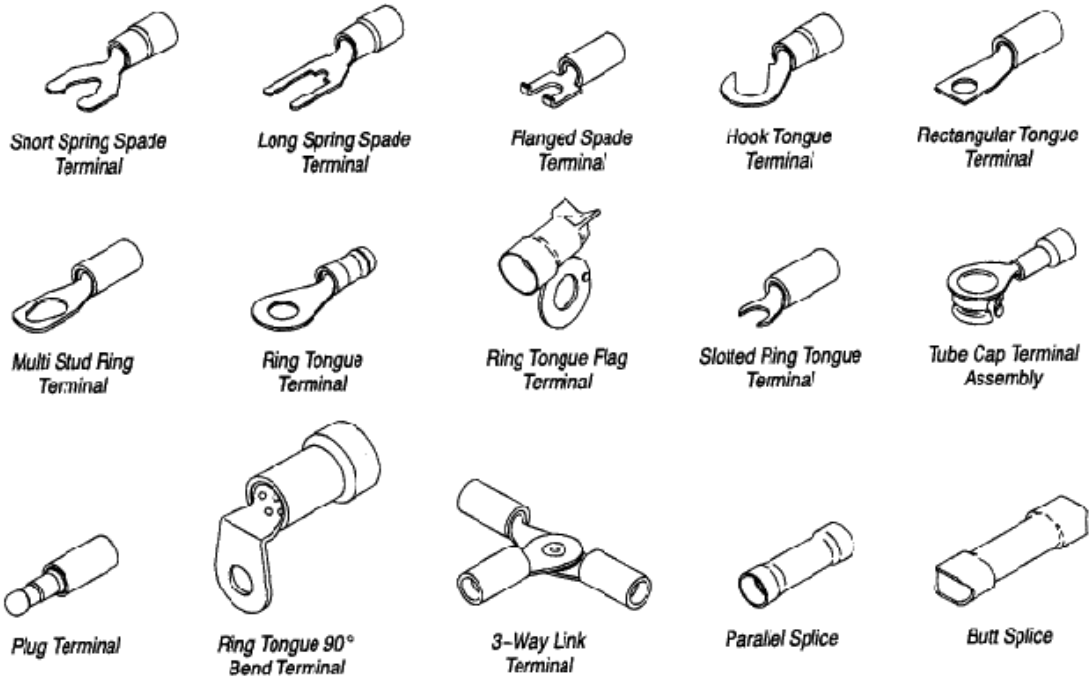

Figure 1

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6. VISUAL AID

The illustration below shows a typical application of PLASTI-GRIP terminals and splices. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

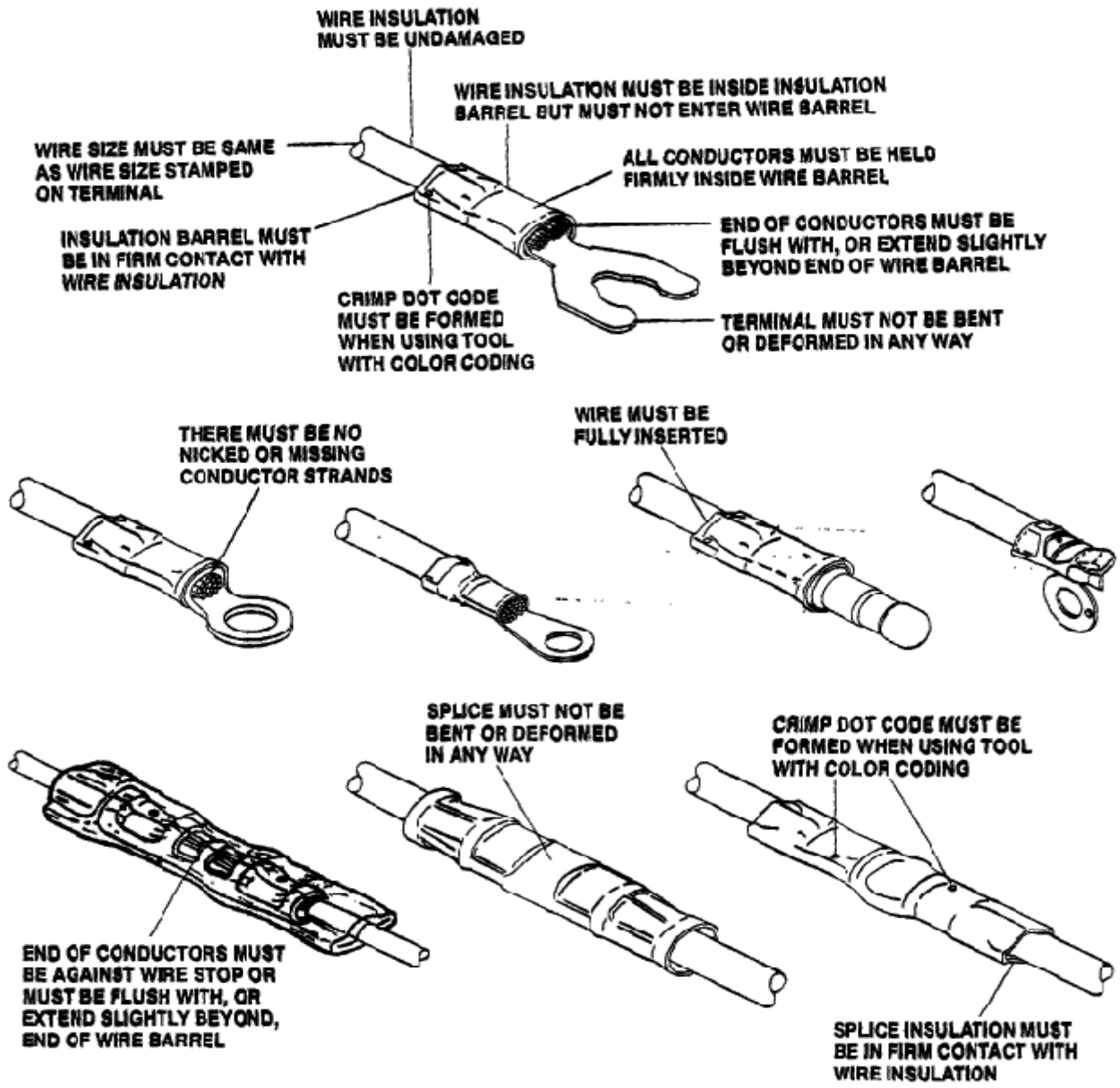

FIGURE 7. VISUAL AID

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