SECTION 3. INSPECTION OF EQUIPMENT INSTALLATION

11-30. GENERAL. When installing equipment which consumes electrical power in an aircraft, it should be determined that the total electrical load can be safely controlled or managed within the rated limits of the affected components of the aircraft's electrical power supply system. Addition of most electrical utilization equipment is a major alteration and requires appropriate FAA approval. The electrical load analysis must be prepared in general accordance with good engineering practices. Additionally, an addendum to the flight manual is generally required.

11-31. INSTALLATION CLEARANCE PROVISIONS. All electrical equipment should be installed so that inspection and maintenance may be performed and that the installation does not interfere with other systems, such as engine or flight controls.

11-32. WIRES, WIRE BUNDLES, AND CIRCUIT PROTECTIVE DEVICES. Before any aircraft electrical load is increased, the new total electrical load (previous maximum load plus added load) must be checked to determine if the design levels are being exceeded. Where necessary, wires, wire bundles, and circuit protective devices having the correct ratings should be added or replaced.

11-33. ALTERNATOR DIODES. Alternators employ diodes for the purpose of converting the alternating current to direct current. These diodes are solid-state electronic devices and are easily damaged by rough handling, abuse, over heating, or reversing the battery connections. A voltage surge in the line, if it exceeds the design value, may destroy the diode. The best protection against diode destruction by voltage surges is to make certain that the battery is never disconnected from the aircraft's electrical system when the alternator is in operation. The battery acts as a large capacitor and tends to damp out voltage surges. The battery must never be connected with reversed polarity as this may subject the diodes to a forward bias condition, allowing very high current conduction that will generally destroy them instantly.

11-34. STATIC ELECTRICAL POWER CONVERTERS. Static power converters employ solid-state devices to convert the aircraft's primary electrical source voltage to a different voltage or frequency for the operation of radio and electronic equipment. They contain no moving parts (with the exception of a cooling fan on some models) and are relatively maintenance free. Various types are available for ac to dc or dc to ac conversion.

a. Location of static converters should be carefully chosen to ensure adequate ventilation for cooling purposes. Heat-radiating fins should be kept clean of dirt and other foreign matter that may impair their cooling properties.

b. Static power converters often emit unacceptable levels of EMI that may disrupt communication equipment and navigation instruments. Properly shielded connectors, terminal blocks, and wires may be required, with all shields well grounded to the airframe.

CAUTION: Do not load converters beyond their rated capacity.

11-35. ACCEPTABLE MEANS OF CONTROLLING OR MONITORING THE ELECTRICAL LOAD.

a. Output Rating. The generator or alternator output ratings and limits prescribed by the manufacturer must be checked against the electrical loads that can be imposed on the affected generator or alternator by installed equipment. When electrical load calculations show that the total continuous electrical load can exceed 80 percent output load limits of the generator or alternator, and where special placards or monitoring devices are not installed, the electrical load must be reduced or the generating capacity of the charging system must be increased. (This is strictly a "rule of thumb" method and should not be confused with an electrical load analysis, which is a complete and accurate analysis, which is a complete and accurate of the composite aircraft power sources and all electrical loads) When a storage battery is part of the electrical power system, the battery will be continuously charged in flight.

b. The use of placards is recommended to inform the pilot and/or crew members of the combination(s) of loads that may be connected to each power source. Warning lights can be installed that will be triggered if the battery bus voltage drops below 13 volts on a 14-volt system or 26 volts on a 28-volt system.

c. For installations where the ammeter is in the battery lead, and the regulator system limits the maximum current that the generator or alternator can deliver, a voltmeter can be installed on the system bus. As long as the ammeter never reads "discharge" (except for short intermittent loads such as operating the gear and flaps) and the voltmeter remains at "system voltage," the generator or alternator will not be overloaded.

d. In installations where the ammeter is in the generator or alternator lead and the regulator system does not limit the maximum current that the generator or alternator can deliver, the ammeter can be redlined at 100 percent of the generator or alternator rating. If the ammeter reading is never allowed to exceed the red line, except for short intermittent loads, the generator or alternator will not be overloaded.

e. Where the use of placards or monitoring devices is not practical or desired, and where assurance is needed that the battery will be charged in flight, the total continuous connected electrical load should be held to approximately 80 percent of the total generator output capacity. When more than one generator is used in parallel, the total rated output is the combined output of the installed generators.

f. When two or more generators and alternators are operated in parallel and the total connected system load can exceed the rated output of a single generator, a method should be provided for quickly coping with a sudden overload that can be caused by generator or engine failure. A quick load reduction system or procedure should be identified whereby the total load can be reduced by the pilot to a quantity within the rated capacity of the remaining operable generator or generators.

11-36. ELECTRICAL LOAD DETERMINATION. The connected load of an aircraft's electrical system may be determined by any one or a combination of several acceptable methods, techniques, or practices. However, those with a need to know the status of a particular aircraft's electrical system should have accurate and up-to-date data concerning the capacity of the installed electrical power source(s) and the load(s) imposed by installed electrical power-consuming devices. Such

data should provide a true picture of the status of the electrical system. New or additional electrical devices should not be installed in an aircraft, nor the capacity changed of any power source, until the status of the electrical system in the aircraft has been determined accurately and found not to adversely affect the integrity of the electrical system.

11-37. JUNCTION BOX CONSTRUCTION. Replacement junction boxes should be fabricated using the same material as the original or from a fire-resistant, nonabsorbent material, such as aluminum, or an acceptable plastic material. Where fire-proofing is necessary, a stainless steel junction box is recommended. Rigid construction will prevent "oil-canning" of the box sides that could result in internal short circuits. In all cases, drain holes should be provided in the lowest portion of the box. Cases of electrical power equipment must be insulated from metallic structure to avoid ground fault related fires. (See paragraph 11-7.)

a. Internal Arrangement. The junction box arrangement should permit easy access to any installed items of equipment, terminals, and wires. Where marginal clearances are unavoidable, an insulating material should be inserted between current carrying parts and any grounded surface. It is not good practice to mount equipment on the covers or doors of junction boxes, since inspection for internal clearance is impossible when the door or cover is in the closed position.

b. Installation. Junction boxes should be securely mounted to the aircraft structure in such a manner that the contents are readily accessible for inspection. When possible, the open side should face downward or at an angle so that loose metallic objects, such as washers or nuts, will tend to fall out of the junction box rather than wedge between terminals.

c. Wiring. Junction box layouts should take into consideration the necessity for adequate wiring space and possible future additions. Electrical wire bundles should be laced or clamped inside the box so that cables do not touch other components, prevent ready access, or obscure markings or labels. Cables at entrance openings should be protected against chafing by using grommets or other suitable means.

11-38.—11-46. [RESERVED.]