

400-CYCLE GROUND POWER UNIT PROVISIONS FOR AIRCRAFT ELECTRICAL
SYSTEM PROTECTION

Issued 1-15-63
Revised

1. Scope - This SAE Recommended Practice which defines the terms and tabulates the limits of the characteristics for various protective devices used in conjunction with 400-cycle ground power for civil aircraft is intended to assist the airlines in standardizing on 400-cycle protective systems. The limits found to be acceptable in the civil aircraft industry are presented.
2. Glossary of Terms - This glossary of terms is included as a part of this Recommended Practice, for information only, and is not to be considered a part of the recommended limits.
 - 2.1 Overvoltage Protection is the device which disconnects a 400-cycle ground power generator from the electrical system of the aircraft being serviced if the voltage of the generator exceeds a prescribed limit. This voltage is normally an inverse time value such that short time transients do not cause nuisance tripping.
 - 2.2 Undervoltage Protection is the device which disconnects a 400-cycle ground power generator from the electrical system of the aircraft being serviced if the voltage of the generator drops below a prescribed value for a specified time.
 - 2.3 Overfrequency Protection is the device which disconnects a 400-cycle ground power generator from the electrical system of the aircraft being serviced if the frequency of the output voltage exceeds a prescribed value.
 - 2.4 Underfrequency Protection is the device which disconnects a 400-cycle ground power generator from the electrical system of the aircraft being serviced if the frequency of the output voltage drops below a prescribed value.
 - 2.5 Overload Protection is the device which disconnects a 400-cycle ground power generator from the electrical system of the aircraft being serviced if the generator output exceeds a prescribed value. The overload device must operate on the inverse time delay feature so that heavy transient loads do not interrupt the flow of power to the aircraft.
 - 2.6 Phase Sequence Protection is the device which disconnects a 400-cycle ground power generator from the electrical system of the aircraft being serviced if the phase rotation of the generator output voltages are reversed. This protection, however, is normally not required as the phase rotation of each generator is checked before shipment from the manufacturer. A part of the overhaul procedure should be to check phase sequence of the generator before returning it to service.
3. Recommended Limits - These limits are a compilation of specifications for protective devices for use in conjunction with 400-cycle ground power for civil aircraft. The many different specifications from aircraft manufacturers and airlines were analyzed and the resulting limits listed below are recommended for general usage. Any protective device shall disconnect

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all output cables from the ground power unit when a fault occurs. Class I protective devices are suggested as the standard system for the many turbo-prop or turbojet aircraft having 400-cycle electrical systems. Class II protective devices are suggested when a monitored protective system is required. This more elaborate system affords the operator a much better idea of the particular fault that occurred and permits rapid diagnosis of the fault condition.

3.1 Class I Protective System

- a. The overvoltage protective system shall disconnect the electrical system of the aircraft from the ground power generator when any line-to-neutral voltage exceeds the inverse time curve shown on Curve Sheet #1.
- b. The undervoltage protective system shall disconnect the electrical system of the aircraft from the ground power generator when the average line-to-neutral voltage drops below 93-103-volts for longer than 5-seconds.
- c. The overfrequency protective system shall disconnect the electrical system of the aircraft from the ground power generator when the generator frequency exceeds 432-448-cycles.
- d. The underfrequency protective system shall disconnect the electrical system of the aircraft from the ground power generator when the generator frequency drops below 375-360-cycles.
- e. The overload protective system shall disconnect the electrical system of the aircraft from the ground power generator when the output exceeds 125% rated current for five minutes. Overload protection must have an inverse time characteristic and should operate instantaneously under short circuit conditions.
- f. The phase sequence protective system shall disconnect the electrical system of the aircraft from the ground power generator if the phase rotation of the generator output voltages are reversed. Proper phase rotation is A-B-C. This protective system is normally not required as a part of the standard protective package furnished with the ground power unit but may be stipulated if special conditions must be met.

3.2 Class II Protective System

- a. The overvoltage protective system shall disconnect the electrical system of the aircraft from the ground power generator when any line-to-neutral voltage exceeds the inverse time curve shown on Curve Sheet #1. A push-to-test light shall indicate that the overvoltage system has tripped the line contactor, or contactors. The light shall remain ON until the operator resets the system.