



Performance Standard For Generator Set Instrumentation, Control, and Auxiliary Equipment

EGSA 100G, 1992a

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TABLE OF CONTENTS

SECTION	PAGE
1.0 SCOPE	2
2.0 REFERENCE STANDARDS	2
3.0 DEFINITIONS	2
3.1 Hand Crank	2
3.2 Manual Start	3
3.3 Automatic Start	3
4.0 CLASSIFICATION	3
5.0 HAND CRANK	3
5.1 Instrumentation	3
5.2 Protective Devices	4
5.3 Start Controls	4
5.4 Stop Controls	4
5.5 Optional Instrumentation	4
5.6 Optional Protective Devices	4
6.0 MANUAL START	4
6.1 Instrumentation	4
6.2 Protective Devices	5
6.3 Start Controls	5
6.4 Stop Controls	5
6.5 Optional Instrumentation	5
6.6 Optional Protective Devices	6
6.7 Optional Start Controls	6
6.8 Cold Engine Starting Aids	6
7.0 AUTOMATIC START	6
7.1 Instrumentation	6
7.2 Protective Devices	7
7.3 Start Controls	7
7.4 Stop Controls	7
7.5 Optional Instrumentation	7
7.6 Optional Protective Devices	8
7.7 Optional Start Controls	8
7.8 Cold Engine Starting Aids	8

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PERFORMANCE STANDARD FOR GENERATOR SET INSTRUMENTATION, CONTROL & AUXILIARY EQUIPMENT

1.0 SCOPE

This standard describes instrumentation, protective devices, starting and stopping controls, engine cranking means, and auxiliary equipment associated with engine generator sets.

2.0 REFERENCE STANDARDS

EGSA 101S—1988	Guideline Specification for Engine Driven Generator Sets, Emergency or Standby
IEEE 241—1990	Recommended Practice for Electrical Power Systems in Commercial Buildings
IEEE 446—1987	Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications
EGSA 101E—1984	Glossary of Standard Industry Terminology and Definitions, Electrical
EGSA 101M—1984	Glossary of Standard Industry Terminology and Definitions, Mechanical
EGSA 100M—1992	Standard for Multiple Engine Generator Set Control Systems

3.0 DEFINITIONS

Since the need for the various controls is primarily related to the starting method, different standards have been established for each of the three common methods of engine starting.

- 3.1 **Hand Crank.** "Hand Crank" engine starting method is defined as an engine generator set starting system that requires externally applied engine cranking power (e.g., rope or crank). Due to the limitation of human energy, approximately 5 kW is the largest set in this category. The "Hand Crank" method is rarely used for diesel engines because of the high ratio of cranking power to engine output horsepower. The small physical size of these sets is ideal for portable applications involving electrical hand tools, heaters and lights. This slow starting method limits the standby power application to homes, farms, etc., where an approximate half-hour power outage is of no serious consequence. Due to all of the above, "Hand Crank" sets are not equipped with automatic starting controls. Protective devices and instrumentation, if any, are at a minimum. Engine supervision while running and stopping is controlled by the operator.

3.2 **Manual Start.** "Manual Start" engine starting method is defined as an engine generator set starting system that utilizes internally applied engine cranking power (e.g., battery, compressed air, hydraulic fluid), and a positive human operation to initiate engine cranking (e.g., depress pushbutton, pull lever, etc.) Since engine cranking power is provided by a non-human source, there is no limit to the physical size and kW rating of the set. However, an operator is necessary to manually initiate the engine cranking operation; hence, the word "manual" is used to describe this method of engine start. This engine starting method is also referred to as "Push Button Start". However, these words are not recommended since a toggle or selector switch may be used for electric (battery) start and a lever for compressed air or hydraulic fluid start.

"**Remote Manual Start**" is included in the general category of "Manual Start" since the engine crank initiation device (pushbutton, etc.) may be at a remote location. If the distance from the set proper is beyond the audible range, automatic crank disconnect controls must be provided. Protective devices and instrumentation may vary depending on engine size and whether the set is attended or unattended.

3.3 **Automatic Start.** "Automatic Start" engine starting method is defined as an engine generator set starting system that utilizes internally applied cranking power and initiates engine cranking upon receipt of an automatic signal (for example, loss of normal power supply voltage). Since engine cranking power is provided by a non-human source, there is no limit to the physical size and kW rating of the set. Since an operator is not required, the engine starting controls must include: 1) a means of initiating engine crank from an automatic signal, 2) a means of crank disconnect in the event of successful engine start, 3) a means of crank termination in the event of an unsuccessful engine start, and 4) a means to automatically stop the engine when the automatic signal is removed, or a sensed fault occurs such as low oil pressure, high water temperature or overspeed.

Since many of the sets in this category of engine start method are intended for continuous operation without an operator in attendance, more protective devices are generally required than for the other methods.

4.0 CLASSIFICATION

The previously defined starting methods describe the general requirements for each method of starting. Variations within each method are necessary to meet all market requirements. The following specifications are intended as guidelines to be considered when specifying basic generator control.

5.0 HAND CRANK

5.1 **Instrumentation.** Minimum Accuracy $\pm 5\%$ of full scale.

5.1.1 Voltmeter

5.1.2 Ammeter

5.2 **Protective Devices**

5.2.1 Low Lube Oil Pressure Switch if engine is equipped with a pressurized system.

5.2.2 High Engine Temperature

5.3 **Start Controls.** Hand Crank

5.4 **Stop Controls**

5.4.1 Manually operated device to remove spark ignition and/or fuel from the engine for normal shutdown.

5.4.2 Automatically operated device to remove spark ignition and/or fuel from the engine in the event of activation of an engine protective device.

5.4.3 Engine may be stopped by combustion air removal if approved by the engine manufacturer.

NOTE: Additional instrumentation and protective devices may be required by particular engine generator set applications; some typical devices available.

5.5 **Optional Instrumentation**

5.5.1 Frequency Meter

5.5.2 Voltage Light. Indicates voltage is within an acceptable range.

5.6 **Optional Protective Devices**

5.6.1 Overspeed

5.6.2 Low Lube Oil Level

5.6.3 Generator Overcurrent Protective Device

6.0 MANUAL START

6.1 **Instrumentation.** Minimum Accuracy +5% of full scale.

6.1.1 Voltmeter

6.1.2 Ammeter

6.1.3 Voltmeter/Ammeter Phase Selector Switch(s)

6.1.4 Frequency Meter

6.1.5 Lube Oil Pressure Gauge, if engine is equipped with a pressurized system.

6.1.6 Engine Temperature Gauge

6.2 **Protective Devices**

- 6.2.1 Low Lube Oil Pressure Switch, if engine is equipped with a pressurized system.
- 6.2.2 High Engine Temperature

6.3 **Start Controls**

- 6.3.1 Manually activated device (i.e., pushbutton) to apply power to the cranking means.

6.4 **Stop Controls**

- 6.4.1 Manually operated device to remove spark ignition and/or fuel from the engine for normal shutdown.
- 6.4.2 Automatically operated device to remove spark ignition and/or fuel from the engine in the event of activation or an engine protective device.
- 6.4.3 Engine may be stopped by combustion air removal, if approved by engine manufacturer.

NOTE: Additional instrumentation and protective device may be required by particular engine generator set applications; some typical devices available.

6.5 **Optional Instrumentation**

- 6.5.1 Kilowatt Meter
- 6.5.2 Power Factor Meter
- 6.5.3 Watt Hour Meter
- 6.5.4 Remote Annunciator and Alarms
- 6.5.5 Tachometer
- 6.5.6 Exhaust Gas Pyrometer
- 6.5.7 Battery Charging Ammeter
- 6.5.8 Elapsed Time Meter indicating total engine hours of operation
- 6.5.9 Synchronizing lights and/or other synchronizing devices
- 6.5.10 Where Engine Generator Set applications warrant, it may be advisable to improve minimum instrumentation accuracies to $\pm 2\%$ or $\pm 1\%$.

6.6 **Optional Protective Devices**

- 6.6.1 Overspeed Protection
- 6.6.2 Underspeed Protection

6.6.3 Under Frequency Protection

6.6.4 Generator Overcurrent Protective Device

6.7 **Optional Start Controls**

6.7.1 Automatic activated device to remove power from cranking means before it exceeds the maximum speed permitted by the cranking device manufacturer.

6.8 **Cold Engine Starting Aids**

6.8.1 Lube Oil Heater

6.8.2 Jacket Water Heater

6.8.3 Glow Plugs (when recommended by engine manufacturer)

7.0 AUTOMATIC START

7.1 **Instrumentation.** Minimum Accuracy $\pm 5\%$ of full scale.

7.1.1 Voltmeter

7.1.2 Ammeter

7.1.3 Voltmeter/Ammeter Phase-Selector Switch(s)

7.1.4 Frequency Meter

7.1.5 Lube Oil Pressure Gauge, if engine is equipped with a pressurized system.

7.1.6 Engine Temperature Gauge

7.1.7 Low Oil Pressure shutdown indication

7.1.8 High Water Engine Temperature shutdown indication

7.1.9 Overspeed shutdown indication

7.1.10 Failure to start "Overcrank" indication

7.2 **Protective Devices**

7.2.1 Low Lube Oil Pressure, if engine is equipped with pressurized system.

7.2.2 High Engine Temperature

7.2.3 Overspeed

7.2.4 "Overcrank" Lock Out

7.3 **Start Controls**

7.3.1 Device to apply power to the cranking means upon receipt of an external start signal such as a failure in normal power.

7.3.2 Device to remove power from the cranking means before it exceeds the maximum speed permitted by the cranking device manufacturer.

7.3.3 Device to remove power from the cranking means if the engine fails to start after a preset cranking time period.

7.3.4 Device (electro-mechanical or timed) to prevent a false low oil pressure shutdown before the engine has obtained normal operating pressure.

7.3.5 Device (pushbutton or toggle) to apply power to the cranking means for test and manual override.

7.4 **Stop Controls**

7.4.1 Device to remove spark ignition and/or fuel from the engine upon removal of the external start signal.

7.4.2 Device to remove spark ignition and/or fuel from the engine in the event of activation of an engine protective device. Once a protective shutdown has occurred, a manual reset is required before a restart can be initiated.

7.4.3 Device to remove combustion air; for overspeed protective shutdown, if approved by the engine manufacturer.

7.4.4 Device (pushbutton or toggle) to remove spark ignition and/or fuel from the engine for test and manual override.

NOTE: Additional instrumentation and protective devices may be required by particular engine generator set applications; some typical devices available.

7.5 **Optional Instrumentation**

7.5.1 Kilowatt Meter

7.5.2 Power Factor Meter

7.5.3 Watt Hour Meter

7.5.4 Remote Annunciator and Alarms

7.5.5 Tachometer

7.5.6 Exhaust Gas Pyrometer

- 7.5.7 Battery Charging Ammeter
- 7.5.8 Elapsed Time Meter indicating total engine hours of operation
- 7.5.9 Synchronizing lights and/or other synchronizing devices
- 7.5.10 Where engine generator set applications warrant, it may be advisable to improve minimum instrumentation accuracies to $\pm 2\%$ or $\pm 1\%$.

7.6 **Engine Protective Devices**

- 7.6.1 Underspeed Protection
- 7.6.2 Under Frequency Protection
- 7.6.3 Low Fuel Level
- 7.6.4 High Engine Temperature Pre-Alarm
- 7.6.5 Low Oil Pressure Pre-Alarm (Low Oil Pressure By-Pass as described in 7.3.4 is required.)
- 7.6.6 Generator Overcurrent Protective Device

7.7 **Optional Start Controls**

Cycle Crank: Device to apply and remove power to the cranking motor for preset cranking and rest time periods.

7.8 **Cold Engine Starting Aids**

- 7.8.1 Lube Oil Heater
- 7.8.2 Jacket Water Heater
- 7.8.3 Glow Plugs when recommended by engine manufacturer.

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