The Engineering Society
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Procedure for Evaluating the Governor Response of Small Engines for Use on Electric Generator Sets

SAE Recommended Practice
Issued December 1983

an American National Standard

The Engineering Society For Advancing Mobility Land Sea Air and Space®
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HIGHWAY VEHICLE RECOMMENDED PRACTICE

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PROCEDURE FOR EVALUATING THE GOVERNOR RESPONSE OF SMALL ENGINES FOR USE ON ELECTRIC GENERATOR SETS

1. PURPOSE AND SCOPE:

The purpose of this document is to provide a uniform practice for the testing and rating of small engines for use in engine powered alternating current generator sets. The small engines addressed are the reciprocating piston type of 20 hp or less.

2. TEST SET-UP:

The engine and generator set shall be assembled as a complete unit and connected to a 100% resistive load bank with a maximum of 5% light bulb load. The engine fuel and oil shall be consistent with the recommendations of the engine manufacturer. The type of fuel used shall be recorded on the test log. The lubricating oil should also be identified in the test log by manufacturer, brand name, API duty rating, and SAE viscosity rating.

3. INSTRUMENTS:

The principal instruments for measuring the performance of an engine generator set are a recording frequency meter, a volt meter, and either an ammeter or watt meter, or both. All electrical meters should be laboratory quality RMS reading instruments with accuracy within ±0.75% of full scale value.

4. ENGINE RUN-IN:

If the engine is new, it must be run-in and stabilized according to the engine manufacturer's recommendation prior to the test run.

5. CORRECTION FACTOR:

SAE J607a and J1349 contain instructions for instrumentation and calculations for the ambient condition correction factor (Ref. paragraph 6.2). The engine manufacturer will specify which of the documents should be referred to for each specific engine.

6. GOVERNOR PERFORMANCE TEST:

6.1 Stabilization: Start and operate the generator set and allow the set to stabilize at rated load, rated voltage, and rated frequency. During this period, operate the recording frequency meter at a chart speed of not less than 6 in/h and record all instrument readings including thermal instrumentation at maximum intervals of 10 min. Adjustments to the load voltage and frequency must be made to maintain corrected rated load at rated voltage and frequency. Adjustments to the voltage and frequency shall be limited to those adjustments available to the operator, specifically adjustments to the voltage or frequency adjust devices. On sets with a droop type speed control system as the prime speed control, the speed and droop portions of the control may be adjusted. Adjustments to load, voltage, or frequency controls shall be recorded on the recording meter chart at the time of adjustment. The engine generator set is considered stabilized when run continuously for a minimum of 1/2 h at rated load.

6.2 After 20 min of the stabilization period has elapsed, the correction factor parameters will be measured and recorded on the data sheet (Fig. 2). The generator load will then be reduced from rated load to corrected rated load. This corrected rated load and fractions of it will then prevail for the remainder of the test.

$$\text{Corrected Rated Load} = \frac{\text{Rated Load}}{\text{Correction Factor}}$$

6.3 Test: The recording meter chart speed shall be not less than 6 in/min during this period.

After the generator set is stabilized, operate the set at each of the load conditions listed below in the sequence indicated. Running time at each load condition shall be the recovery time plus at least 10 s.

The loading sequence is:

1. Corrected Rated Load
2. No Load
3. Corrected Rated Load
4. No Load
5. 3/4 Corrected Rated Load
6. No Load
7. 3/4 Corrected Rated Load
8. No Load
9. 1/2 Corrected Rated Load
10. No Load
11. 1/2 Corrected Rated Load
12. No Load
13. 1/4 Corrected Rated Load
14. No Load
15. 1/4 Corrected Rated Load
16. No Load
17. Corrected Rated Load
18. No Load

6.3 (Continued):

19. 1/4 Corrected Rated Load
20. 1/2 Corrected Rated Load
21. 3/4 Corrected Rated Load
22. Corrected Rated Load
23. 3/4 Corrected Rated Load
24. 1/2 Corrected Rated Load
25. 1/4 Corrected Rated Load
26. No Load

7. DATA REDUCTION:

7.1 Prepare the recording instrument chart according to Figs. 1 and 2. Record all 26 steps in the loading sequence on the data sheet, Fig. 2.

8. PRESCRIBED STANDARDS:

	Governor Performance Class "A"	Governor Performance Class "B"
A-Steady-State Speed Regulation Droop	3 Hz	4 Hz
B1-Recovery Time, Increasing Load	4 s	8 s
B2-Recovery Time, Decreasing Load	4 s	8 s
C-Overshoot	3 Hz	5 Hz
D-Undershoot	3 Hz	5 Hz
E-Steady-State Speed Band	0.6 Hz	0.8 Hz

NOTE: See Fig. 1 for definition of terms.

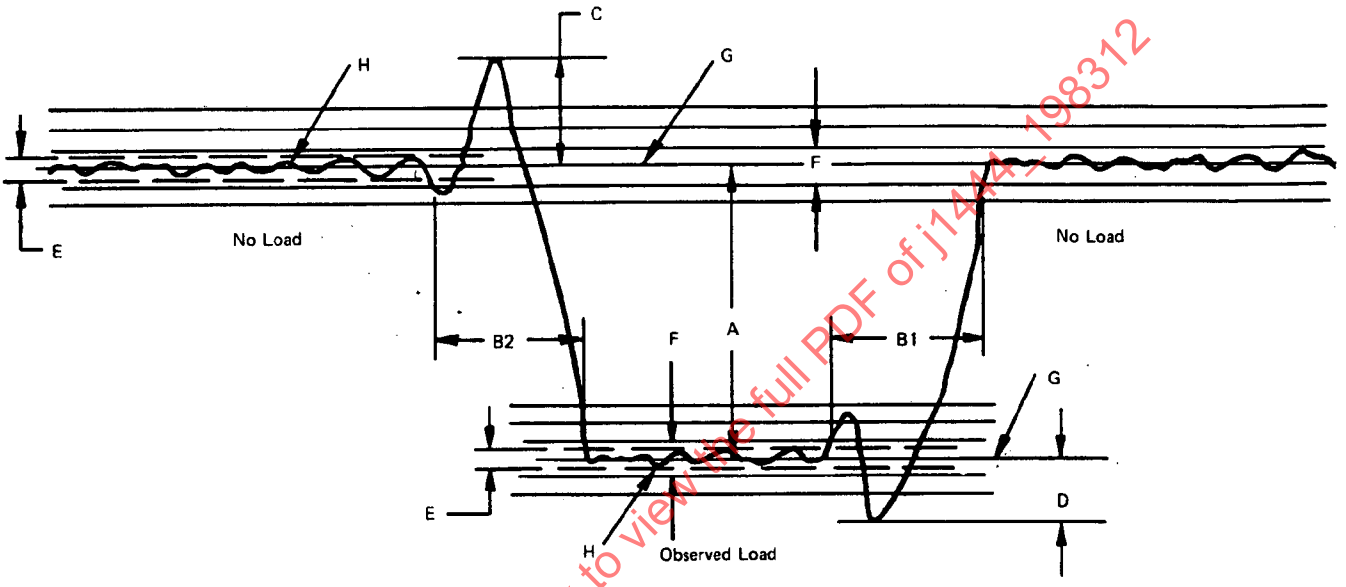

Diagram Illustrating Definition of Terms

A – Steady State Speed Regulation (Droop)
B1 – Recovery Time, Increasing Load
B2 – Recovery Time, Decreasing Load
C – Overshoot or Momentary Overspeed
D – Undershoot or Momentary Underspeed
E – Steady State Speedband – Observed
F – Allowable Steady State Speedband (Ref. 8)
G – Median of Observed Speedband
H – Actual Instrument Trace of Function

FIGURE 1

FREQUENCY REGULATION DATA

Seq.	Obs. Watts	Corr. Watts	Volts	G Hz	A Hz	B1, 2 Sec.	C, D Hz	E Hz	Remarks
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									

Test Date _____
Tester Name _____
Test Number _____
Sheet Number _____
Generator _____
Engine _____
Rated Load _____ kW
Rated Speed _____ rpm
Type of Fuel _____
Oil _____
Duty _____ Visc. _____
Corrected Barometer _____
Obs. _____ Temp. _____ True _____
Wet Bulb _____ Dry Bulb _____
Air Temp.–Intake _____ Amb. _____
Correction Factor _____

A–Frequency Regulation
B–Recovery Time
C–Overshoot or Undershoot
E–Steady State Frequency Band
G–Median of Frequency Band

FIGURE 2