SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1444

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Procedure for Evaluating Transient Response of Small Engine Driven Generator Sets

This document is similar to ISO 8528 part 2.

1. ***Scope*—**The scope of this SAE Recommended Practice is to provide a uniform practice for the testing of small engine powered alternating current generator sets. This document is limited to reciprocating piston engines of less than 14.9 kW (20 BHP).

2. ***References***

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1349—Engine Power Test Code—Spark Ignition and Diesel

3. ***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 shall be identified in the test log.

4. ***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.

5. ***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.

6. ***Correction Factor*—**SAE J1349 contain instructions for instrumentation and calculations for the ambient condition correction factor (see 7.2). The engine manufacturer will specify which of the documents should be referred to for each specific engine.

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7. Governor Performance Test

7.1 **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 152 mm/h and record all instrument readings including thermal instrumentation at maximum intervals of 10 minutes. The load, voltage, prime speed control (governor), and the speed and droop portions of the control may be adjusted at this time. Record adjustments to load, voltage, or frequency controls on the chart at the time of adjustment. The engine generator stabilization starts after the last adjustment and is considered stabilized when run continuously for a minimum of 1/2 hour at rated load.

7.2 After 20 minutes of the stabilization period has elapsed, the correction factor parameters will be measured and recorded on the data sheet Figure 1. The correction factor can then be calculated per SAE J1349 section 9.1. The generator load will then be adjusted from rated load to corrected rated load. This corrected rated load and fractions of it will then prevail for the remainder of the test.

$$\text{Corrected Rated Load} = \frac{\text{Rated Load}}{\text{Correction Factor}} \qquad \text{(Eq. 1)}$$

7.3 **Test—**The recording meter chart speed shall be not less than 2.54 mm/s (6 in/min) during this period.

After the generator set is stabilized, operate the set at each of the load conditions listed as follows 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
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

8. *Data Reduction*

8.1 Prepare the recording instrument chart according to Figures 1 and 2. Record all 26 steps in the loading sequence on the data sheet, 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 1—FREQUENCY REGULATION FORM EXAMPLE

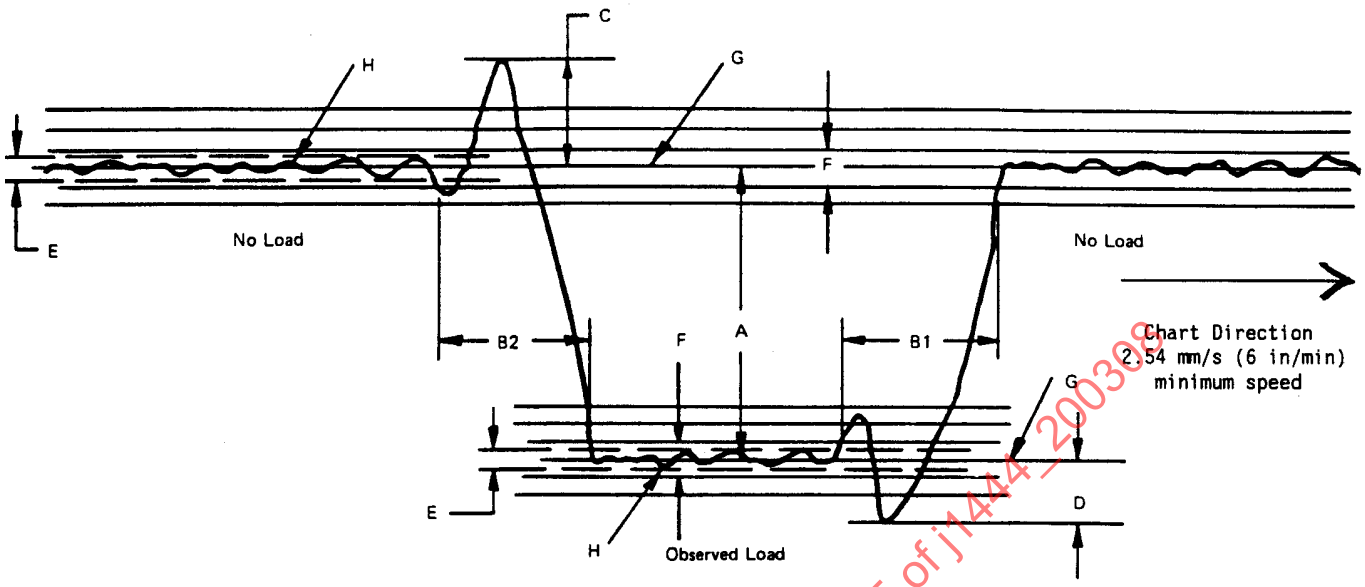

Diagram Illustraing Definition of Terms

A - Steady State Speed Regulation (Droop)
B1 - Recovery time from Increasing Load, time from leaving No Load speed band F to last entry into Observed Load speed band F
B2 - Recovery time from Decreasing Load, time from leaving Observed Load speed band F to last entry into No Load speed band F
C - Overshoot or Momentary Overspeed
D - Undershoot or Momentary Underspeed
E - Steady State Speedband - Observed
F - Allowable Steady State Speedband (refer 9)
G - Average frequency of 30 seconds within speed band F
H - Actual Instrument Trace of Function

FIGURE 2—DIAGRAM ILLUSTRATING DEFINITION OF TERMS

9. Prescribed Standards—(See Table 1.)

TABLE 1—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
F-Allowable Steady-State Speed Band	0.6 Hz	0.8 Hz
See Figure 2 for definition of terms.		