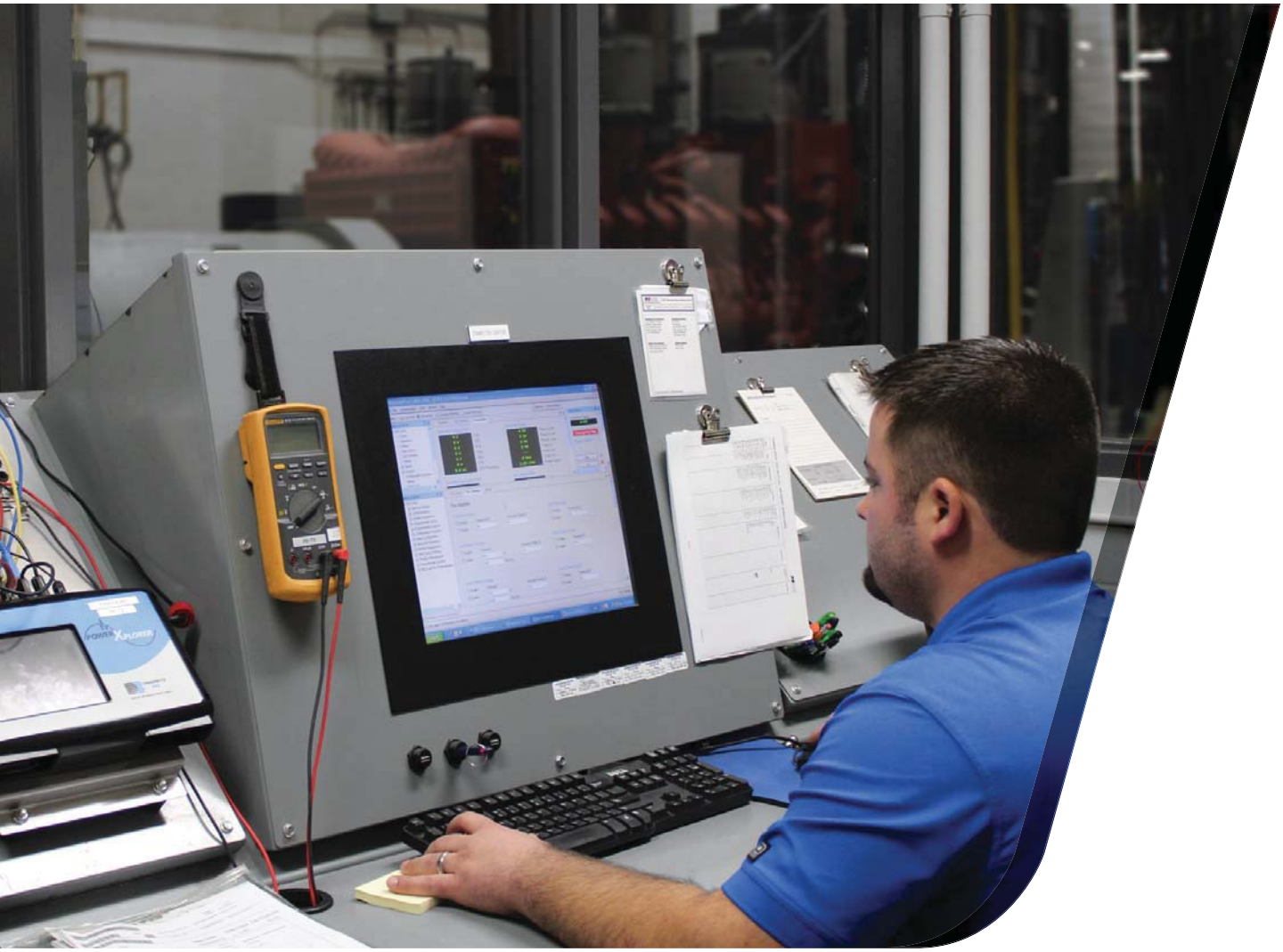

PERFORMANCE ASSURANCE CERTIFICATION

mtu onsite energy

PROTOTYPE TEST
PROCEDURES AND METHODS

MTU Onsite Energy has been producing superior engine-generator sets for more than six decades. We understand the importance of reliable cost-effective products, and have developed industry-leading test procedures to ensure we exceed this criteria. Our testing program confirms that our customers will receive products of the highest quality.

The Performance Assurance Certification provided by MTU Onsite Energy certifies that every engine-generator set undergoes rigorous prototype testing including the following:

Prototype test procedures

- **Rated Load** (NFPA 110)
  MTU Onsite Energy certifies that all engine-generator set models will produce the name-plated load within the design tolerance of the generator set.
- **Extended-run Testing**
  MTU Onsite Energy certifies that all engine-generator set prototypes have been subjected to extended run-time testing.
- **Transient Response Analysis** (ISO 8528-5)
  MTU Onsite Energy certifies that all new generator set models have undergone transient response analysis per ISO 8528-5.
- **Torsional Analysis**
  MTU Onsite Energy certifies that all engine-generator-set models have undergone torsional stress analysis.
- **Engine Cooling System**
  MTU Onsite Energy certifies that all generator set models will cool sufficiently within the ambient design conditions per each model.
- **Anticipatory Alarms and Shutdowns**
  MTU Onsite Energy certifies that the pre-alarms and alarms function appropriately to protect the engine-generator set from any foreseen unnecessary failures.
- **Vibrational Analysis** (ISO 8528-9)
  MTU Onsite Energy certifies that all new engine-generator-set models have undergone vibration analysis to ensure that each engine-generator coupling is balanced and that there is no destructive resonant vibration.
- **Noise Analysis** (ISO 8528-10)
  MTU Onsite Energy certifies that all engine-generator sets undergo airborne noise analysis using the enveloping surface method.

Test standards

MTU Onsite Energy engine-generator sets are compliant with many different codes and standards. MTU Onsite Energy's validation philosophy and performance are regularly reviewed to ensure continuity with these codes and standards: *UL2200, CSA, EPA, NFPA 99–Health Care Facilities, NFPA 70–National Electrical Code, NFPA 110–Standard for Emergency and Standby Power Systems, Department of Labor and Industry, NEMA MG 1–Motors and Generators, and MIL-STD-705-c.*

FACTORY ACCEPTANCE TESTING PROCEDURES

MTU Onsite Energy's factory testing is performed with the same extreme diligence and attention to detail that is given to the prototype testing process. Every engine-generator set receives a complete factory acceptance test that certifies and ensures that the set will function in accordance to every specific application.

Test metering will have an accuracy of 1.3% or better. This metering is calibrated a minimum of once per year and is directly traceable to the Bureau of Standards.

Factory acceptance testing procedures:

- **Insulation Resistance Inspection** (301.1c)*
- **High Potential Test** (302.1b)*
- **Alternator Overspeed** (1 min.)*
- **Engine Inspection**
- **Generator Inspection**
- **Resistances Inspection** (401.1b)
  - Exciter Field Stator
  - Alternator Armatures
- **Mounting and Coupling Inspection**
- **Engine Fuel Oil System Inspection**
- **Engine Lube Oil System Inspection**
- **Engine Cooling System Inspection**
- **DC Charging System Inspection**
- **Circuit Breaker Inspection**
- **Anticipatory Alarms and Shutdowns Inspection** (505.2b, 515.1b, 515.2b)
- **Optional Equipment Inspection** (513.2a)
- **Load Test Inspection**
  - Full Name-plate Rated Load
  - Regulator Range Test (511.1d)
  - No Load Inspection
  - MAX Load @ 1.0 P.F. (640.1d)
  - MAX Load @ 0.8 P.F.
  - Block Loads @ 0–25%, 0–50%, 0–75%, 0–100%
- **Phase Balance and Sequence Inspection** (507.1d, 508.1d, 516.1a)

* Performed by Alternator OEM

Rating Tolerance

MTU Onsite Energy certifies that all generator set models will produce the name-plated load at the standard conditions within the design tolerance (see table below) of the generator set.

Diesel Genset Product Family	Rating Tolerance
MTU 3R0096 DS30 to MTU 6R0120 DS200	+/- 5%
MTU 6R1600 DS230 to MTU 12V1600 DS600	+/- 2%
MTU 12V2000 DS650 to MTU 20V4000 DS3250	+/- 2%

Gas Genset Product Family	Rating Tolerance
MTU 4R0075 GS30 to MTU 8V0071 GS60	+/- 5%
MTU 10V0068 GS75 to MTU 10V0068 GS125	+/- 3%
MTU 6R0135 GS150 to MTU 12V0183 GS400	+/- 5%

OPTIONAL TEST PROCEDURES

Extended-run factory acceptance testing:
In some cases, extended-run testing may be requested. Unless specified otherwise, extended-run testing will be performed in the following manner.

// **Full name-plate rated load**
// **Standard readings taken every 15 minutes**

STANDARD READINGS RECORDED DURING LOAD TEST INSPECTION

// Run Time	// Frequency
// AC Voltage	// Exciter Field Voltage
// AC Amperage	// Exciter Field Current
// kVA	// Lube Oil Pressure
// kWe	// Engine Coolant Temperature
// Power Factor	// Ambient Temperature

Witnessed factory acceptance testing
Witnessed factory tests must be scheduled and approved at least four weeks prior to the engine-generator set's scheduled shipping date. Any requests for witnessed factory testing after this four-week period must be approved by the Regional Sales Manager and are subject to additional fees.

Witnessed extended-run factory acceptance testing
Witnessed extended-run tests must be scheduled and approved at least four weeks prior to the engine-generator set's scheduled ship date. Any requests for witnessed extended-run testing after this four-week period must be approved by the Regional Sales Manager and are subject to additional fees.

Additional factory acceptance testing
Additional testing is available upon request. The following is a list of supplementary tests which can be performed on MTU Onsite Energy engine-generator sets. Non-standard testing is subject to additional charges.

Additional test methods:

// **Start and Stop Test** (MIL-STD-705c 503.1c)
// **Remote Start and Stop Test** (MIL-STD-705c 503.2c)
// **Overspeed Protective Device Test** (MIL-STD-705c 505.2b)
// **Circulating Current Test** (MIL-STD-705c 505.2b)
// **Insulation Resistance Test** (MIL-STD-705c 301.1c)*
// **Open Circuit Saturation Curve Test** (MIL-STD-705c 410.1b)
// **Temperature Rise Test** (MIL-STD-705c 680.1c)
// **Frequency Range Adjust Test** (MIL-STD-705c 511.2c)
// **Low Oil Pressure Protective Device Test** (MIL-STD-705c 515.1b)
// **Over-temperature Protective Device Test** (MIL-STD-705c 515.2b)
// **Controls, Direction, and Rotation Test** (MIL-STD-705c 516.1a)
// **Frequency and Voltage Regulation, Stability, and Transient Response** (MIL-STD-705c 608.1b)
// **Voltage and Frequency Regulation** (MIL-STD-705c 614.1b)
// **Voltage Dip and Rise for Rated Load Test** (MIL-STD-705c 619.2c)
// **Maximum Power Test** (MIL-STD-705c 640.1d)
// **Fuel Consumption Test**
// **Vibration and Mechanical Balance Test** (ISO 8528-9)
// **Sound Test** (ISO 8528-10)

* Testing conducted by generator OEM

A Rolls-Royce Power Systems Company

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