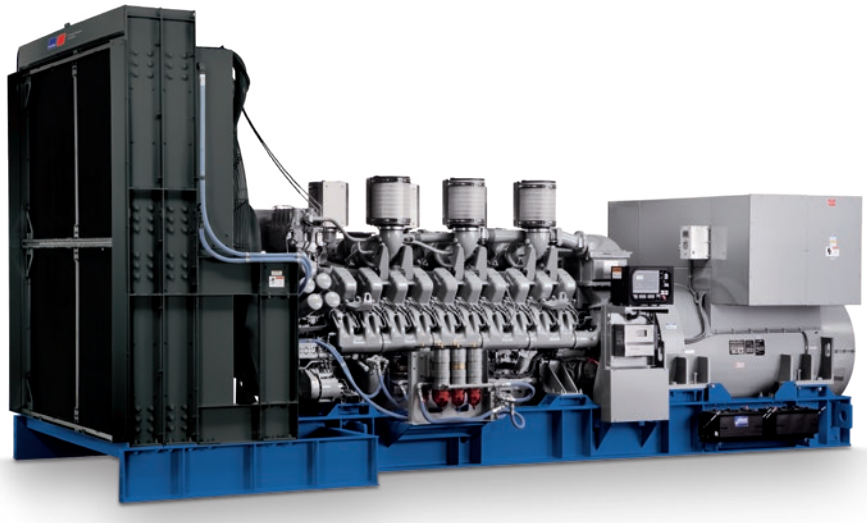

Power Generation

CODES AND STANDARDS FOR ONSITE POWER SYSTEMS

Generator sets and the companies that make them can be judged by how they measure up to codes and standards established by private industry and governmental groups. This ensures that all compliant generator set manufacturers measure performance the same way.

Some of these standards define how to measure horsepower, electrical output or hundreds of other parameters. In addition, a number of these codes set minimum levels of equipment performance and establish requirements intended to increase safety for users, service personnel, and the general public.

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Codes and standards also help ensure uniformity and quality of onsite power systems, although manufacturers such as MTU often exceed minimum requirements. Some codes and standards apply to all onsite power generation systems, while others apply only when required by a particular application or customer. Here is a closer look at standards for design, manufacturing, quality, safety and performance, as well as code compliance information specific to generator sets from MTU.

Design and manufacturing standards

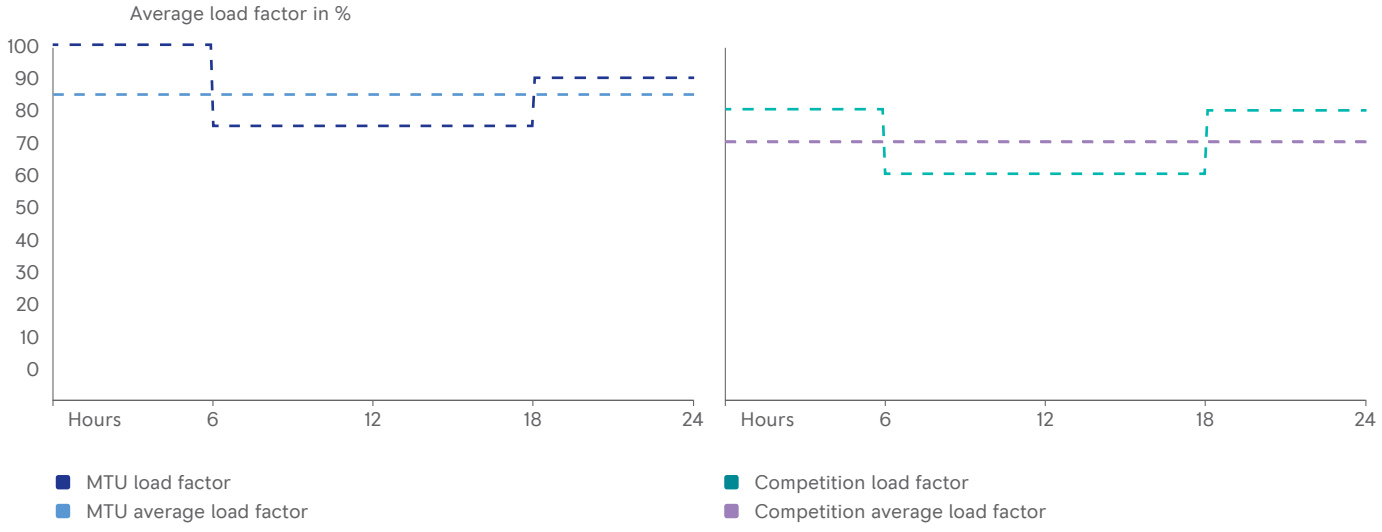
International Organization for Standardization (ISO)
Standards that apply to all generator sets include those from the International Organization for Standardization. ISO standards define how to measure and rate many quality and performance characteristics.

Some industry codes set minimum levels of equipment performance and establish criteria meant to increase safety for manufacturing workers, power-system operators and the general public.

ISO standards that are relevant to onsite power generation systems include:

- *ISO 8528* — Defines generator set applications, ratings and performance, and describes characteristics of engines, alternators, controls and switchgear. The ISO 8528 series also defines methods for functional tests, acceptance tests, and measurement of vibration and sound.
- *ISO 3046* — Addresses critical engine characteristics such as power ratings, fuel consumption, vibration and test conditions. Conformance to ISO 3046 is usually noted on a generator set's specification sheet.
- *ISO 9001* — Establishes requirements for policies, processes and procedures required for a quality management system. All MTU manufacturing facilities are ISO 9001:2015 certified.
- *ISO 14001* — Defines environmental management practices in manufacturing facilities. All MTU facilities are ISO 14001 certified.
- *ISO 17025* — Applies to testing and calibration of instruments used to measure performance and quality. All MTU inspection, test and measurement instruments are calibrated in accordance with this standard and are traceable to national standards.

Figure 1. Load-factor advantage



ISO 8528: Average load factor over 24 hours

One of the provisions of ISO 8528 sets a limit of the 24-hour average power output of emergency standby- and prime-rated generator sets to 70% of the nameplate kW rating, unless a higher average is agreed to by the engine manufacturer. This means that a 2,000 kW generator set meeting this standard must be able to provide an average of 1,400 kW over a 24-hour period.

In emergency standby applications, the average load factor affects generator set sizing considerations, especially in mission-critical facilities having less varying loads. Most generator set manufacturers meet the 70% average load factor. However, emergency standby generator sets from MTU are approved for a load factor of 85%, so a 2,000 kW generator can provide an average of 1,700 kW per hour over a 24-hour period. That is a 300 kW sizing advantage for MTU and a potential cost saving for standby power buyers. (See Figure 1.)

Safety and performance standards

Many codes and standards are applicable only in certain applications, geographic locations or as requested by the customer. Well-known standards of this type are those from Underwriters Laboratories (UL), the National Fire Protection Association (NFPA), the International Code Council (ICC) and the CSA Group. These organizations have established safety and performance-based requirements for onsite power generation systems throughout North America.

Underwriters Laboratories (UL)

Many regulatory agencies and codes require that equipment is listed by a nationally accredited testing and evaluation organization such as UL. UL tests and evaluates equipment to certify that it meets appropriate safety standards. UL also conducts periodic inspections of production of listed equipment to ensure that the UL listing mark is used as authorized. UL listings available from MTU include:

- *UL 2200* — Defines requirements for the design, construction, and performance of the entire generator set. UL 2200 requirements reduce the risk of electric shock, burns, fire and injury from moving parts. UL also requires manufacturers to load test their generator sets to verify that they can produce nameplate rated power levels.
- *UL 142* — Covers the design, construction and testing of aboveground steel tanks intended for storage of diesel fuel. Tanks covered by these requirements are fabricated, inspected and tested for leakage before shipment from the factory as completely assembled vessels.
- UL 1008 — Sets standards for safety and performance of automatic and manual transfer switches as required by the National Electrical Code.

National Fire Protection Association (NFPA)

This national industry organization sets fire-prevention standards. In addition, NFPA establishes safety and performance standards for transfer switches and addresses the performance of emergency standby generator sets in critical applications such as those in healthcare facilities. Equipment from MTU meets a number of NFPA standards, the most important being NFPA 110:

- *NFPA 110* — Specifies how long it should take a generator set to start and assume full-rated load in emergency standby power applications. The regulation can be met at several levels depending on how quickly the generator set can assume full-rated load. Type 10, the highest rating for engine-generator systems, goes to systems that can start and assume full-rated load in 10 seconds or less. All MTU emergency standby generator sets are capable of meeting this critical rating.
- *NFPA 70* — The National Electrical Code (NEC) was developed to standardize the installation of electrical systems in North America. The NEC has been adopted at the state or local level throughout the United States of America.
- *NFPA 37* — Establishes criteria for the installation and operation of stationary engines with regards to fire hazards and considers generator set rooms, engine fuel supplies, lubricating systems, exhaust systems, and engine control functions.
- *NFPA 99* — Defines requirements for electrical equipment and essential electrical systems used in healthcare facilities.

International Code Council (ICC)
International Building Code (IBC)

To obtain IBC seismic certification, generator sets must go through rigorous design and testing procedures to ensure their survivability in the event of an earthquake or equivalent natural disaster. In mission-critical applications, IBC-certified systems must be able to start and accept full rated load immediately after an earthquake. IBC also covers requirements for structures that house emergency standby generator sets and has requirements for wind loads, in extreme conditions, over 200 mph.

MTU has completed the necessary IBC seismic certification steps for its entire line of generator sets.

Other standards

Additional standards for onsite power generation equipment include those from the CSA Group and standards related to CE Marking.

CSA Group

- *CSA C22.1* — Canadian Electrical Code, Part 1 is the primary electrical safety standard for installations in Canada. Other parts of the code cover the design, construction, and safety of electrical components as well as complete generator sets. MTU offers CSA- certified generator sets and automatic transfer switches.
- *CSA C282* — Addresses the design, installation, operation, maintenance, and testing of emergency generators and related equipment.
- *CSA Z32* — Covers electrical safety and essential electrical systems in healthcare facilities.
- *CSA B139* — Covers the design and installation of engines, fuel systems, air supply and exhaust systems for generator sets.
- *CSA B149* — Covers the design and installation of natural gas and LP gas fueled equipment and systems.

CE Marking

The CE mark is a manufacturer's self-declaration that a product complies with essential requirements of laws and directives in the European Economic Area. Through a conformity assessment process, manufacturers apply design, safety, and testing requirements of ISO, IEC, and other adopted standards. The CE mark is not a safety certification mark and it does not demonstrate conformance to safety standards or compliance with installation codes in North America. Generator sets should be certified by accredited third party testing and evaluation organizations such as UL and CSA.

Conclusion

The performance, quality and safety of onsite power generation systems are covered by a number of recognized industry codes and standards. Generator sets from MTU not only meet these nationally recognized standards, but also in several cases exceed them. Work with your MTU distributor to determine what codes and standards apply to your onsite power application.

For more information:

www.csa.ca
www.iccsafe.org
www.iso.org
www.nfpa.org
www.ul.com

Rolls-Royce provides world-class power solutions and complete lifecycle support under our product and solution brand MTU. Through digitalization and electrification, we strive to develop drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems. These clean and technologically advanced solutions serve our customers in the marine and infrastructure sectors worldwide.

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