

UL 2200 3rd Edition, UL 6200, Functional Safety and Generator Set Controls

ABSTRACT

The UL 2200 3rd edition, effective March 31, 2026, enhances safety requirements for stationary generator sets, including medium-voltage units, with a focus on functional safety in compliance with bi-national United States of America and Canadian regulations.

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INTRODUCTION

In today's world, electronics are part of our daily lives. Technology continues to evolve at an ever-increasing pace and generator set control technology is no exception. Generator set controls have evolved from electro-mechanical control panels to the microprocessor-based controls of today providing digital monitoring and protection. Safe operation of the generator set is highly reliant on microprocessor hardware and software to function correctly and safely. Whether you rely on your generator set as a prime power source or standby power for critical life safety systems, you want to ensure your generator set meets the latest safety standards to protect both your equipment and those who interact with it. Safety standards have been evolving to keep up with the fast pace of technology.

UL (Underwriters Laboratory) is a global safety science organization that delivers testing, inspection, and certification services. UL gathers industry experts to draft best practices for manufacturing and testing the safety, security, and sustainability of products and systems. A UL certification mark indicates that a product has had a 3rd party evaluation of the tools, process, and design involved in a product and that it complies with the given UL standard.

American National Standard (ANSI)/Controller Area Network (CAN)/UL/ULC 2200, the Standard for Stationary Engine Generator Assemblies, is the safety standard that covers stationary engine generator set assemblies intended for use and installation in ordinary locations. Hazards addressed by this standard include electrical (energy, shock, and fire), mechanical (enclosures and moving parts), fuel containment and flow control for liquid and gaseous fuels, and prime mover related hazards.

SAFETY STANDARD

On September 29, 2020, UL published the requirements for the 3rd edition of UL 2200, with an effective date of March 31st, 2026, by which manufacturers need to comply with the updated safety standards. The 3rd edition comes with new requirements to address safety of hardware and software involved in generator set control. Product listings for stationary generators can be found on UL Product iQ database.

Key Revisions with the 3rd edition:

1. It will be a **bi-national standard** covering both the United States of America and Canada. A single C-UL-US mark will mean a product meets both ANSI and National Standard of Canada (NSC) regulations.
2. Removes the 600V cap of the previous revision and **allows for medium voltage generators (up to 15kV)** to be certified. The medium voltage requirements include safety interlock systems for medium voltage cabinets, protective barriers, and separation of medium and low voltage wiring.
3. The **functional safety** of both the hardware and the software to ensure safety system designs have a level of integrity suitable to the hazard they are intended to mitigate. (i.e. anticipating what could go wrong and reducing the risk to an acceptable level to protect end users from harm).
4. Integration of UL 6200 (The Standard for Controllers for Use in Power Production), which focuses on the generator controls safety. This includes evaluation of the generator control software and safety circuits that rely on software/firmware. Safety circuits that rely on embedded software are identified by microprocessor model and software version. UL 6200 also includes IEEE 1547/UL 1741 for grid interconnection compliance. See white papers "Generator Set Compliance with IEEE Standard 1547" and "Preparing for the Future of Grid-Code" for more information.

FUNCTIONAL SAFETY

Functional safety is a process for ensuring safety system designs have a level of integrity suitable to the hazard they are intended to mitigate. It provides assurance that safety related systems will perform their function in the intended manner and mitigate risks to an acceptable level. Hardware and software are both evaluated for functional safety. A system achieves functional safety when it complies with IEC 61508 (Functional Safety of electrical/electronic/programmable electronic safety-related systems Part 3: software requirements (minimum of SIL 1)) standard, has a safety integrity level (SIL), and passes a 3rd party review. A SIL is a measure of safety system performance, in terms of probability of failure on demand. Demand is defined as low demand (less than or equal to one failure per year) or high demand/continuous mode (SIL specifies the allowable frequency of dangerous failure.) There are four integrity levels associated with SIL: SIL-1, SIL-2, SIL-3, and SIL-4, each level corresponds to a range of likelihood of failures of a safety function. The higher the SIL level, the higher the safety measures needed, and the lower probability that a system will perform improperly.

The UL certification process includes a safety assessment that reviews the following:

1. In order to achieve a SIL level, a hazard analysis to identify safety circuits that perform mitigation of fire risk, electric shock, and other hazards that could cause personal injury is conducted. This analysis explores the potential effects, the severity of injury, the probability of its occurrence, and the frequency of exposure to the hazard. The assessment considers hardware failure, design faults, operator errors, and environmental impacts as part of the analysis. The guidelines for risk assessment are ISO 12100 Sections 5.4, 5.5, 6 (Safety of Machinery-General Principles for Design.)

2. The process will eliminate the hazard or provide sufficient risk reduction to reduce the impact of an accident.
3. When assessing generator controls, hazards identified include those involved in overvoltage, overcurrent, overspeed, fuel gas shutoff, and emergency stop, as example.
4. A SIL is achieved once defined targets for the maximum probability of dangerous failure are met. A minimum of SIL-1 is required to meet the standard.

With a UL 2200 3rd edition listing, you can feel confident that your stationary generator set has had a 3rd party safety evaluation of the tools, development process, devices, and design, in addition to, the rigorous design and testing conducted by the generator set manufacturer. It is important to keep in mind that any changes made to a UL 2200 3rd edition listed generator set after it has left the factory will require authority having jurisdiction evaluation to recertify and/or determine any additional safety requirements that must be met to maintain the UL 2200 certification. The integrator of the generator set in its final installation is liable for determining and implementing any additional safety requirements.

CATERPILLAR PRODUCTS

Many Caterpillar non-mobile generator sets sold into the US market have been UL 2200 certified. The intent is to continue this certification with the UL 2200 3rd edition, and this will now expand into the Canadian market as well. New Cat Energy Control System (ECS 100 and ECS 200) controls are designed to meet SIL-1 and should not limit a larger system from meeting SIL-2. This system software is also evaluated to UL 6200, ISO13849, and IEC 61508-3.

CONCLUSION

UL 2200 3rd edition becomes effective March 31, 2026. The standard for safety covers stationary generator sets for use in ordinary installation locations in accordance with the US National Electrical Code (NEC), National Fire Protection Association (NFPA): NFPA 70, 37, 99, and 110, and the Canadian Standards Association (CSA). Many Cat stationary generators have achieved UL 2200 3rd edition listing and are available to meet a UL 2200 3rd edition specification.

REFERENCES/ACKNOWLEDGEMENTS

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