Distributed Energy Resource Standards for Distribution Interconnection

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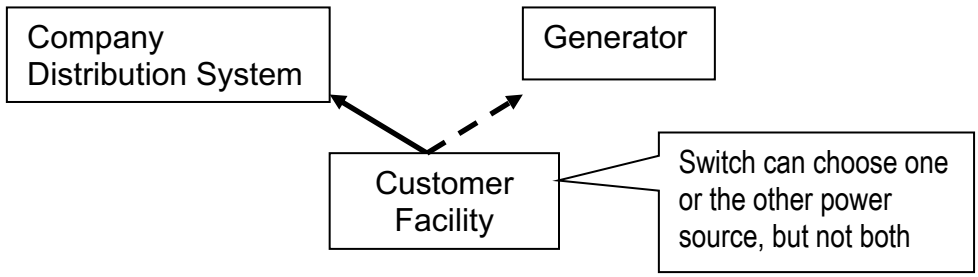
INTRODUCTION AND SUMMARY OF INTERCONNECTION TYPES

The Distributed Energy Standards for Interconnection contemplate seven distinct configurations (Cases) based on the project type that is connecting, planned to be connected, or facility additions and/or modifications to existing facilities interconnected to the Distribution System of one of the utility operating companies.

Distributed Energy Resources (DER) or generators installed within one of the Company's utility's service areas will fall into one of seven cases:

Case 1.	The Customer may build facilities that are NEVER connected to the Company Distribution System; some examples are: • A backup generator with automatic open-circuit transfer switch. • An emergency generator, where electric cords are run directly to the generator for essential lights and appliances. • A structure with a switch, rated for the Customer's generator size that does not allow electricity to flow from the generator into the facility when the facility is connected to the electric utility system. **No Interconnection Application is required unless the Customer is participating in a demand response program.**

Simple block diagram representing basic generator interconnection for Cases 1, 2, and 3.



Refer to your local electrical inspector in this case (if applicable).

Case 2.	The Customer may build facilities that are connected to their building or internal electrical system and are not intended to be connected to the Company's Distribution System. The Customer shall supply an open and visible break verifiable by Company personnel. The location shall be on the outside of the facility accessible to Company personnel at all hours. A main disconnect in the off position qualifies as an open break. It is recommended that the Customer tag the disconnect to help prevent accidental closing. • **Failure to have a visible Disconnect Switch is a reason for being disconnected** and may subject Customer to liability for resulting injury to people or property. • **No Interconnection Application is required.**
Case 3.	The Customer may build facilities that are NOT NORMALLY connected to the Company Distribution System. Total connection time is 10 CYCLES OR LESS (@60 cycles/second). Some or all loads' generated capacity could become displaced. No energy is sold or exported to the Company. • **No Interconnection Application is required with industry certified automatic sync and transfer controls.**
Case 4.	The Customer may build facilities that are connected to the Company Distribution System more than 10 cycles (may be hours, days, months, etc.). Some or all of the Customer's load may become displaced. Stand-by facilities may or may not be requested. No energy is sold or sent to the Company. • **An Interconnection Application is required.**
Case 5.	The Customer may build facilities that are normally connected to the Company Distribution System. Some or all of the Customer's load may become displaced. Stand-by facilities are requested. Depending on the jurisdiction, some form of contract with the Company may be required for Customer to export energy to the Company and to be credited or compensated for said energy deliveries. • **An Interconnection Application is required.**
Case 6	The Customer may build facilities that are normally connected to the Company Distribution System. The Customer has no significant on-site load (mainly station-service load). Depending on the jurisdiction, some form of contract with the Company may be required for Customer to export energy to the Company and to be credited or compensated for said energy deliveries. • **An Interconnection Application is required.**
Case 7.	The Customer may build facilities that are normally connected to the Company Distribution System. Depending on the jurisdiction and only if allowed by law, some form of contract is required with the Company for wheeling energy output to the transmission system under the functional control of Midcontinent Independent System Operator, Inc. (MISO) to participate in wholesale markets. The differentiation between Case 6 and Case 7 is Market Participation in MISO. • **An Interconnection Application is required.**

The interconnection of a DER between the Company and a Customer will not be allowed prior to the execution of a written Interconnection Agreement covering parallel operation.

The above provisions are the minimum requirements for any DER operating in parallel with the Company's Distribution System for voltages up to and including 34.5kV.

DERs of significant size on radial distribution systems can cause relaying and voltage control problems. The Company therefore retains the option to require upgrades where necessary to maintain reliable service or to refuse interconnection of any DER at distribution voltage if such DER will cause reliability issues that cannot be adequately mitigated. The scope of those upgrades is determined through the Interconnection Study process.

Permitted Interconnection Configurations

Interconnections of any DER to the Company's Distribution System shall be directly connected to electrical circuits/feeders configured in one of the following options:

Express Feeder – dedicated distribution circuit constructed to strictly support the proposed interconnected DER application.

Existing Feeder – existing distribution circuit/network. The Customer must request interconnection of the DER requiring evaluation in support of parallel operations and possibly the exporting of energy if the size of the DER and/or its configuration will lead to exports to the Company's Distribution System.

Hosting capacity for any existing feeder will be one of the determining factors for evaluating an Interconnection Application along with any required design changes and/or infrastructure upgrades specified in the Pre-Interconnect Study to support the Interconnection Application request.

Unintentional Islanding

Under no circumstances will a Customer's DER be allowed to sustain an island condition with any part of the Company's Distribution System beyond the Point of Common Coupling due to potential damage to Company or other Customers' equipment. The Customer's DER must be equipped with protection to sense a possible island and disengage from the Company's Distribution System within the 2-second time frame of the formation of an island condition as specified by Institute of Electrical and Electronics Engineers (IEEE) Standard1547-2018 (or any successor standard).

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1.0 Introduction

1.1 Purpose

The Distribution Interconnection Process is the overall process for queuing, processing, executing, and maintaining Interconnection Agreements for any DER 20 mega volt ampere (MVA) and smaller in size connecting to a Company utility via its Distribution System. The purpose of this standard is to describe the requirements for safe and effective connection and operation of a DER on the Company Distribution System.

- **Customers are encouraged to contact the Company early in the process and learn about interconnection requirements due to the size of the proposed DER, its configuration, and its location on the electric grid**.
  - Customers may call 1-800-ENTERGY to get a local engineer involved to assist with the interconnection process.
  - A Customer proposing to install a generator larger than 20 MVA or who would interconnect at transmission-level voltage (69kV and above) should contact the Company's Transmission organization.

A Customer shall operate 60 Hertz (Hz), three-phase or single-phase equipment in parallel with the Distribution System pursuant to an executed Interconnection Agreement, provided that the equipment meets or exceeds the Company standards.

The interconnection process is initiated by a Customer (or their designated representative) submitting a completed Interconnection Application signed by the Customer along with a single-line diagram of the proposed design of the interconnected DER.

This standard describes typical interconnection requirements. Certain specific interconnection locations and conditions may require more information from the Customer and/or the installation of infrastructure upgrades and use of more sophisticated protective devices and operating schemes.

If the Company concludes that an Interconnection Application describes a DER that may require additional infrastructure upgrades including devices and operating schemes, the Company shall make those additional requirements known to the Customer at the time any required interconnection studies are completed.

Certain Federal Energy Regulatory Commission (FERC) Qualifying Facilities or small power producers may have specified rates and requirements in each utility jurisdiction, allowing for the sale of energy to the Company.

Customers shall not inject energy onto the Company's Distribution System without an express written Interconnection Agreement with the Company.

1.1.1 Interconnection Agreement Requirements

A written Interconnection Agreement will be required between the Company and the Customer outlining the liability provisions, indemnities, payment of costs to modify the Distribution System (if not paid in advance), and other items affecting service under this standard. This Interconnection Agreement will explain in detail the authority or responsibilities of the parties involved.

The interconnection of a DER between the Company and a Customer will not be allowed prior to the execution of a written Interconnection Agreement covering parallel operation.

1.1.2 Explicit Criteria for Parallel Operation

These requirements apply to interconnecting a DER that is intended to operate in parallel with the Company's Distribution System and in some cases, export energy to the Company's Distribution System.

A Customer that produces energy may elect to operate a DER in parallel with the Company's Distribution System or as a separate system with the capability of non-parallel load transfer between the two independent electrical systems. The requirements provided in this standard are applicable to interconnect a DER intending to operate in parallel or non-parallel load transfer with some control of the Customer-owned DER by the Company subject to agreement with Customer.

1.1.2.1 Safety

The Customer's DER will be held to the same Standard of Care as the Company is required to maintain of its own facilities. In addition, the safety of the general public and the personnel and equipment of the Company shall in no way be reduced or impaired as a result of an interconnection.

The Customer's DER shall be equipped with Protective Functions designed to prevent the DER from being connected to a de-energized circuit owned by the Company.

The Customer's DER shall be equipped with the necessary Protective Functions designed to prevent connection or Parallel Operation of the Customer's DER with the Company's Distribution System unless the Distribution System service voltage and frequency are of normal magnitude. The design of some DERs provide these Protective Functions without adding equipment at the Point of Common Coupling (PCC). Each DER not providing additional protective devices at the PCC must be shown to be

capable of providing these Protective Functions without adding such equipment.

1.1.2.2 Customer Impact

The quality, reliability, and availability of service to the Company's other customers shall not be diminished or impaired as a result of the proposed interconnection. This standard describes typical interconnection requirements. Some DER installations, however, may require more extensive Interconnection Facilities, and will be addressed on a case-by-case basis. For example, this situation may be triggered when more than one Customer desires to connect a DER to the same transformer or on the same distribution feeder.

1.1.2.3 Protective Device Requirements

Operating a DER while interconnected to the Company's Distribution System requires that certain protective devices (relay, circuit breakers, isolation devices, etc.) must be installed at any location where a Customer desires to operate its DER. The purpose of these devices is to isolate faults from the Distribution System and promptly disconnect the Customer's DER from the Company's Distribution System when faults or abnormal operating conditions jeopardize the reliable operation of equipment or the safety of Company personnel or the public. Certain modifications to the Company's Distribution System and/or protective relays may also be required in order to accommodate parallel operation. The Company assumes no responsibility for determining protective equipment needed to protect the Customer's facilities.

1.1.2.4 Hazards

Distribution lines are subject to a variety of natural and human-made hazards. Among these hazards are lightning, storms, animals, fire, earthquakes, damage from vehicles, mischief, and human error. Customers that self-generate energy are subject to these same hazards, but not necessarily to the same degree since the Company's Distribution System has greater exposure to hazards given its configuration and location in public right-of-way.

The electric problems that can result from these hazards principally involve short circuits, grounded conductors, and broken conductors. These fault conditions require that damaged equipment be de-energized as soon as possible to ensure public safety and continued operation of the remaining Distribution System.

- The Company has the responsibility to install protective equipment as necessary to detect faulted equipment or other operating abnormalities and to isolate the problem from the remaining Distribution System.

A non-utility-owned DER interconnected to and operated in parallel with the Company's Distribution System can represent another source of power on the energized Distribution System.

- The Company requires that such DERs also have adequate protective devices installed to react to abnormal electric system conditions and isolate from the interconnected Distribution System to preserve the reliability of the distribution system.

The following are specific Distribution System hazards requiring response:

A. Unintended Islanding: **A DER operating in parallel with the Company's Distribution System must also be equipped to detect another condition referred to as "unintended islanding."** Unintended Islanding is the abnormal operating condition where a portion of the Company's Distribution System and loads become isolated from the remainder of the Distribution System while still connected to and receiving energy from one or more DERs within an electrical island.

- **When unintentional islanding occurs, all DERs within the electrical island must be disconnected to prevent continued operation and damage to the connected loads.**

The protective devices and other specified requirements are intended to provide protection against hazards associated with unintentional islanding by ensuring that DERs operating in parallel with the Company's Distribution System are disconnected when Abnormal Operating Conditions occur.

B. Loss of Phase: **A DER operating in parallel with the Company's Distribution System shall be equipped to detect a loss of any one phase for which an immediate shutdown is required.** The DER shall have the ability to detect, cease to energize, and trip all phases to which the DER is connected for any open phase condition occurring directly at the PCC.

- **The DER shall cease to energize and trip within 2.0 seconds of the open phase condition.**

C. Loss of Synchronization: Operation of the Customer's synchronous generator (or other DER) out of synchronization with the Company's Distribution System may cause large voltage fluctuations to other connected customers and may cause severe damage to the Customer's generator (or DER).

- In any situation in which a loss-of-synchronization (out-of-step) is likely to occur for a DER installation, a specific detection relaying scheme shall be required and implemented.

1.2 How to Interpret and Apply the Standards

When reading this document, the following terms will be interpreted as defined:

Shall: Any requirement that uses the term "shall" is mandatory and strictly enforced.

Should: Any requirement that uses the term "should" indicates that options may exist, but that the requirement specifies the best engineering expertise as written, but such requirements are not mandatory.

Recommend: Any requirement using the term "recommend" has more than one option, and the Company prefers that the Customer use the option given, but such choice is up to the Customer's discretion.

May: Any requirement using the term "may" means the Customer has discretion.

2.0 Definitions

Abnormal Operating Conditions – When the Company is operating the Distribution System in other than normal configuration or under conditions that do not normally exist. Examples of Abnormal Operating Conditions include: (1) peak load days when customers may be requested to conserve energy or, (2) switching feeders out of use for repairs and switching in alternate feeders to deliver energy to customers.

Ampere (Amp): The unit of measurement of the rate of flow of electricity. It is the unit of current produced in a circuit by one volt acting through a resistance of one ohm.

Agreement for Service (or Contract): The agreement between the Company and the Customer under which service is taken. Unless and until a written Agreement for Service has been signed, service rendered by the Company is subject solely to the provisions of the applicable Company's service regulations, policies, and applicable rate schedule and riders. The provisions of the Company's

standard application or terms of service will be presumed to apply. The supplying and taking of such service shall constitute an Agreement for Service.

Authority (Having Jurisdiction) ("AHJ"): The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure. Among other things, the role of an AHJ is to verify that a Customer DER installation complies with the National Electrical Code ("NEC"), Company policies and procedures, and requirements imposed by Company's Retail Regulator.

Central Business District ("CBD") Networks, Spot Networks and Downtown Underground Radially-Fed Installations: Typically located in downtown areas in cities including New Orleans, Baton Rouge, Lake Charles, West Monroe, Beaumont, Jackson, Little Rock, Pine Bluff, and Hot Springs. The common CBD setup is to have two or more transformers, each connected to a separate feeder and paralleled on the low voltage side through network protectors associated with each transformer. These protectors are commonly configured so that a small amount of fault current (usually in the range of one Amp) will cause the protector to trip. Injecting energy with a DER will have a negative effect on reliability. Also see Network Service.

Code: National Electrical Safety Code ("NESC"), current edition and any other applicable Codes and governmental regulations, such as Occupational Safety and Health Administration (OSHA) live working clearance rules. Also, the NEC provides the basis for proper installation and maintenance of electrical systems for the general public to be kept free from hazards and is also the basis for Entergy's Customer Installation Standards for Electric Service.

Company: An individual regulated utility Operating Company subsidiary of Entergy Corporation, including its officers, agents, employees, successors, or assigns.

Contract: See "Agreement for Service".

Converter (or Power Converter): An electrical or electro-mechanical device for converting electrical energy. It may be converting AC (single-phase) to AC (3-phase) or from DC to AC, or the voltage or frequency, or some combination of these.

Current: The rate of flow of electricity usually measured in amperes. The Company supplies alternating current (AC) and will not supply direct current (DC).

Customer: An individual, firm, partnership, association, corporation, organization, or governmental agency that is "taking service" as defined by the Company's Retail Regulator and that is seeking to interconnect and operate a DER. When used in lowercase form (i.e., "customer"), refers to all other Company customers who are

not seeking to interconnect, but who may be operationally or otherwise affected by the requested interconnection.

Customer's Facilities: In general, all the wires, appliances, devices or apparatus of any kind or character on the Customer's side of the Point of Delivery (or PCC) except the meters, metering devices and facilities of the Company that may be located on the Customer's side of the Point of Delivery used in providing Service to the Customer. The Customer's wiring and electrical equipment within or on the premises shall be installed and maintained in accordance with all applicable building and wiring codes, and local laws and ordinances.

Displaced Load: The Customer's entire electrical requirement or a portion of it that, except for the utilization of the Customer's DER, would have been served by the Company.

Distributed Energy Resource (DER): Distributed-scale resources connected to the grid at distribution-level voltage; or to the transmission network interconnected directly to a substation at distribution voltage-level. DER may be further defined by Company's Retail Regulator.

Distributed Energy Aggregated Resource (DEAR): Distributed-scale aggregated resources 100kW or above connected to the grid at distribution-level voltage; or to the transmission network interconnected directly to a substation at distribution voltage-level to participate directly in Regional Transmission Organization (RTO)/Independent Service Operator (ISO) markets.

Distributed Energy Resource Aggregator (DERA): Distributed-scale Provider connected to the grid at distribution-level voltage; or to the transmission network interconnected directly to a substation at distribution voltage-level to participate directly in Regional Transmission Organization (RTO)/Independent Service Operator (ISO) markets with an established DER and/or DERA as a type of market participant.

Distributed Generation (DG): See Distributed Energy Resource.

Distribution System: The Company's wires, equipment, and facilities with a voltage below 69kV to which the DER is interconnected.

Electric Distribution Company (EDC): The owner and/or operator of the Distribution System. See Company

Facility: An electrical generating installation consisting of one or more on-site distributed generation units, which includes a standalone energy storage system or other similar application. The total capacity of a facility's individual on-site distributed generation units may exceed 20 MVA. Units greater than 20 MVA will require consultation with Transmission.

Energy: The total work done as distinguished from the rate of doing work (power), usually measured in kilowatt-hours ("kWh"). Its amount depends upon the power and the time that the power is taken. For instance, a power rate of one kilowatt maintained for one hour is one kilowatt-hour of energy.

Generator: a dynamo or similar machine for converting mechanical energy into electricity. Prime mover includes diesel/gasoline/natural gas-fueled combustion engines and turbines, hydroelectric turbine, steam turbine, wind, etc.

Hertz: Unit of frequency in cycles per second. For example, the Company furnishes 60 Hertz alternating current (AC).

Induction Generator (or **asynchronous generator**) is a type of alternating current (AC) electrical generator that uses the principles of induction motors to produce electric power. Induction generators operate by mechanically turning their rotors faster than synchronous speed.

Interconnection: The physical connection of a DER to the Company's Distribution System in accordance with the requirements of this standard so that parallel operation can occur.

Interconnection Agreement: The written executed document that sets forth the contractual conditions under which the Company and a Customer agree that one or more DERs may be interconnected with the Company's Distribution System.

Interconnection Application: A document prepared by the Customer (or their designated representative) to facilitate an Interconnection Agreement in which specific capabilities of a Customer's DER are identified along with requirements to support any parallel operations based on hosting capacity of the Company's Distribution System.

Interconnection Facilities: All facilities installed solely to interconnect and deliver/receive energy from/to the Customer's DER to/from the Company's system including, but not limited to, connection, transmission, distribution, engineering, administration, transformation, switching, metering, and safety equipment. Interconnection Facilities shall include any additions and/or modifications to the Company's Distribution System deemed by the Company to be necessary to reliably and safely interconnect the Customer's DER.

Inverter: Equipment that converts DC power to AC power. Includes auxiliary devices such as transfer switches, alternate source transformers and regulators, input rectifiers (other than battery chargers), and isolation devices (e.g., blocking diodes).

Islanding: A condition in which a portion of a Distribution System is energized solely by one or more interconnected DERs through the associated Point of Common Coupling(s) while that portion of the area Distribution System is electrically separated from the rest of the area distribution system.

Load: The amount of electric power delivered or required by Customer at any specified point or points on the Company's Distribution System.

Meter: A device or devices together with auxiliary equipment used for measuring any of the following: apparent, real, and reactive power and/or energy, which are supplied to any Customer at a single Point of Delivery.

MISO: (Midcontinent Independent System Operator) is an independent, not-for-profit, member-based organization focused on managing the flow of high-voltage electricity across 15 U.S. states and the Canadian province of Manitoba.

Momentary Cessation: A protective mode when no current is injected into the Distribution System by the inverter during low or high voltage conditions outside of its continuous operating range. This is accomplished by blocking the power electronics' firing commands and the inverter does not produce real or reactive current.

Net Metering: Refers to a policy implemented by the Company's Retail Regulator that addresses interconnection, operation, and treatment of a qualifying DER on the Company's Distribution System. Refer to the Company's website for additional information governing interconnection and operation of a DER that may be eligible for Net Metering.

Network Service: Two or more primary distribution feeder sources electrically tied together on the secondary (or low voltage) side to form one power source for one or more customers. This configuration is designed to maintain service to customers even after the loss of one of these primary distribution feeder sources.

Ohm: The unit of measurement of electrical resistance or impedance. It is that resistance through which one volt will produce a current of one ampere.

On-site Distributed Generation (Distributed Generation or DG): An electrical generating facility located at Customer's Point of Delivery (Point of Common Coupling) with a generating capacity of twenty MVA (called "apparent power") or less and connected at a voltage less than or equal to 34.5 kilovolts (kV), which may also be connected in parallel operation to the Company's Distribution System.

Parallel Operation: The operation of DG by a Customer while the Customer's facilities are electrically connected to the Company's Distribution System.

Phase (or Number of Phases): Term which designates characteristics of alternating current. It is a term used in the electric industry relating to the characteristics of the electrical service available or supplied at a given location or required for the operation of a given electrical device.

Point of Delivery: (also called Point of Common Coupling or PCC): The physical location where the Customer's service terminals or wires are joined to the Company's facilities, or such other point specifically designated by written agreement.

Power: The time rate of doing work, generating, transferring, or using electric energy, usually expressed in kilowatts (kW).

Power Factor: The ratio of real power (kW) to apparent power (kVA) for any given load and time. Normally, power factor is expressed as a ratio and stated as a percentage.

Pre-Interconnection Study: A study or studies that may be undertaken by the Company in response to its receipt of a completed Interconnection Application for interconnection and parallel operation with the Company's Distribution System.

Protective Functions: A system that uses hardware (including switching devices), relay protection schemes, and software to prevent unsafe operating conditions from occurring before, during, and after the interconnection of the DER with the Company's Distribution System. Protective Functions may include isolating the Customer's DER or decoupling it from the Company's Distribution System.

Quality of Service: An operating state of the Distribution System that provides usable power to a Customer. This state of usable power includes the parameters specified for voltage flicker, voltage surges and sags, power factor, frequency, and harmonics.

Reactive-kilovolt-amperes (kVAR) (rkVA) (kilovar): The product of the applied voltage and the magnetizing or charging current, divided by 1,000. Reactive-kilovolt-amperes do no work but must be supplied to magnetic equipment, such as motors. Generators or capacitors supply it.

Retail Regulator: The political subdivision or government entity vested with authority to oversee the rates and operations of Company, e.g., the Arkansas Public Service Commission, the Council for the City of New Orleans, the Louisiana Public Service Commission, the Mississippi Public Service Commission, or the Public Utility Commission of Texas.

Ride-through: Ability to withstand voltage or frequency disturbances inside defined limits and to continue operating as specified.

Sag (Voltage Sag): A decrease in AC Voltage at the power frequency for duration of 0.5 cycles to 1 minute. Typical values are 0.1 to 0.9 per unit.

Service (or Electric Service): The availability of electric power and energy to the Customer, regardless of whether any power and energy is actually used. Supplying service by the Company consists of the Company maintaining at the Point of Delivery the approximate nominal voltage and frequency by means of facilities adequate for supplying the Customer's contracted load.

Stabilized: The Distribution System is considered stabilized when, following a disturbance, the system returns to the normal range of voltage and frequency for a duration of five minutes or a shorter time as mutually agreed to by the Company and Customer.

Standard of Care: A term defining the level of awareness to maintain workplace and public safety in the design, installation, and operation of a DER.

System Protection Facilities: The equipment required to protect the Company's Distribution System and Customers from unsafe operating conditions occurring at the Customers' locations. This includes inverter systems and any other devices provided with a DER that provides system protection functions.

Synchronous Generator (or alternator): An electrical machine which converts the mechanical power from a prime mover into AC electrical power at a particular voltage and frequency.

Transmission: High voltage (69kV and above) lines and facilities which begin outside of the substation fence (may include 34.5kV lines serving industrial customers; these lines are considered to be transmission lines if they are under direct control of the Transmission Operation Centers.)

Transmission Owner (TO): Manager of the Transmission System.

Trip: Inhibition of immediate return to service, which my involve disconnection.

Unsafe Operating Conditions: A situation that, if left uncorrected, would result in: (1) harm to any Company personnel and/or the public, damage to any equipment, (2) unacceptable system instability or, (3) operating outside legally established parameters affecting the quality of service to other customers connected to the Company's Distribution System.

Uninterruptible Power Supply (UPS): A device that provides battery backup AC power when the normal electrical power source fails or drops to an unacceptable voltage level.

Volt / Voltage: A unit of electrical pressure or potential or electromotive force which, if applied to a load of one-ohm resistance, will cause a current of one ampere to flow. Primary distribution and transmission voltages are usually designated in kilovolts (kV). One kilovolt is equal to 1,000 volts.

Volt-Ampere: kVA is 1,000 Volt Amperes (VA) and MVA is 1,000,000 VA. The unit of apparent power, volts times amperes, which is composed of both real and reactive power.

Watt: An electrical unit of power. Electrical appliances and lamps are rated in watts to indicate their capacity or rate of using power for doing work. For example, a 100-watt lamp used 10 hours will use one kilowatt-hour (kWh) of energy (1,000 watt-hours).

3.0 Details

3.1 The Electrical Distribution System

The Distribution System supplies power to the Company's low voltage network customers from area substations at IEEE medium voltage levels of 4kV, 12.47kV, 13.2kV, 13.8kV, 23.9kV and 34.5kV (phase to phase) for primary service. Note: 69kV and above are considered by Company as Transmission System Voltages. The majority of retail customers receive IEEE low voltage service directly from the Distribution System secondary voltage levels of single-phase (120V and 240V) and three-phase (120/208V and 277/480V). Grounded four-wire distribution (phase to neutral connected loads) is the Company's standard.

3.2 Multi-grounded Neutral Distribution Service

Generally, the following available multi-grounded neutral service is offered for interconnection:

- Single-Phase – 120/240 Volts, 3-wire
- 3-Phase – 120/208 Volts, 4-wire
- 3-Phase – 277/480 Volts, 4-wire
- 3-Phase – 2400/4160 Volts, 4-wire
- 3-Phase – 7200/12470 Volts, 4-wire
- 3-Phase – 7620/13200 Volts, 4-wire
- 3-Phase – 7970/13800 Volts, 4-wire
- 3-Phase – 13800/23900 Volts, 4-wire
- 3-Phase – 19900/34500 Volts, 4-wire

Consult the Company for further information on the availability of distribution voltages not listed.

3.3 Types of Allowed Generators

Single-phase or three-phase alternating current generating units can be operated in parallel with the Distribution System. They may be synchronous generators, induction generators, or inverter-controlled systems. Direct-current generation shall not be directly connected to the Company's alternating-current Distribution System. Typical capacity groups are:

- 15 KVA or Less (and depending on Retail Regulator policy), Single Phase only
- Above 15 KVA to below 150 KVA, Single Phase (study required)
- 150 KVA to below 300 KVA, Three-Phase only (study required)
- 300 KVA to 20 MVA, Three-Phase only (detailed study required)

3.3.1 Limits on Single-Phase Generators

Where necessary to avoid the potential for a generating facility to cause problems with the service of other customers, the Company may limit the capacity and operating characteristics of single-phase generators in a manner consistent with the Company's existing limitations for single-phase motors and local line equipment and configuration.

3.3.2 Limits on Three-Phase Generators

If three-phase service is not available in the area or if Company facilities must be upgraded or increased to enable the Customer to connect to these facilities, the Customer must bear the additional cost for such service or improvements as determined by the Company and in conformance with applicable policy of the Company's Retail Regulator. The Company reserves the right to refuse three-phase service under certain circumstances.

3.4 Pre-Installation Information

The Company can expedite service connection and minimize cost to both the Customer and the Company if the Customer consults the Company before the design phase of the installation has begun. The Company is not responsible for the cost of replacing any of the Customer's facilities that do not meet the requirements for service. Connection to the Company's Distribution System is not available prior to approval by the Company. The approval process may include, in addition to the execution of an Interconnection Agreement, the acquisition of permits and/or inspections by authorities having jurisdiction, including the Company's Retail Regulator. Consult the applicable Customer Installation Standards for more information.

3.5 Interconnection Agreement Required

The Customer must execute an Interconnection Agreement with the Company and receive the Company's express written permission before operating a generating facility in parallel with the Company's Distribution System. The

Company shall treat all interconnection requests in a non-discriminatory manner, on a first come – first served basis relative to when the completed documentation was received and reviewed by Company for completeness. The Company shall not unreasonably withhold its permission for parallel operation of the Customer's generating facility with the Company's Distribution System.

3.6 Pre-Interconnection Study

A study or studies may be undertaken by the Company in response to its receipt of a completed application for interconnection and parallel operation with the Company's Distribution System. These may include a meeting with the Customer (and/or its designated agent). The purpose of the meeting and studies is to determine if:

- Interference with the system protective equipment may occur;
- Electricity may flow back to the substation and impact transmission;
- Available fault current may be affected;
- Capacitor banks may be impacted;
- Frequency, and/or voltage may be affected under normal and worst-case situations; or
- Conductors/lines or other devices and elements must be resized or undergo settings changes as a result of the proposed interconnection.

If no impacts on the distribution or the transmission systems are identified, the proposed interconnection will be accepted and, depending on the desired operational configuration and relevant regulatory policy involved, Customer Service will engage with the Customer to determine next steps. Otherwise, Customer Service will share potential impacts and additional studies necessary, provide estimated costs of the chosen study(ies) and possibly provide order of magnitude estimates on costs for necessary upgrades and the interconnection. If Transmission is to be involved at this stage of the process, Customer Service will have Transmission contact the Customer and discuss what policies and/or procedures are involved as well as what transmission facilities may be impacted.

Pre-Interconnection studies may include, but are not limited to:

3.6.1 Scoping Meetings

- A fact-finding meeting/teleconference with Customer and discussion of Customer responsibilities and requirements and applicable policies. (Customer Service and Asset Planning). Company to gather information of the Customer project (size, type, role, etc.).

- Determining the minimum information for attaching a Distributed Energy Resource at a particular location on the Distribution System or identifying the necessity of further engineering studies or determining if transmission involvement is necessary.
- Certified inverter-based generating facilities rated 15 kVA or less and located on radial distribution systems may be eligible for direct interconnection without the need for a complete Feasibility Study.
- If the Company determines the interconnection request is eligible for direct interconnection, the application request shall be approved to proceed forward with the execution of an Interconnection Agreement.
- All other interconnection requests will be required to go through the Feasibility Study Initial Screening Review as well as any other supplemental reviews or studies as determined necessary.

3.6.2 Interconnection Initial Screening Review

- The Interconnection Initial Screening Review consists of high-level technical screens/analysis of all applications above 15 KVA; however, more in-depth engineering screens/analysis is typically required for DERs above 300 KVA.
- The Initial Screening Review addresses the following technical areas, including but not limited to:
  - DER size
  - Transformer capacity size
  - DELTA Transformer winding
  - Other DER interconnection(s)
  - Distribution Feeder analysis
- The output of this Interconnection Initial Screening Review will determine if the proposed interconnection request can proceed forward with the execution of an Interconnection Agreement or require a Feasibility Study be performed.

3.6.3 Feasibility Study

- The Feasibility Study consists of technical screens and power flow modeling and analysis, used to identify any issues that may arise from an interconnection application and determine if mitigations are necessary or if more detailed studies may be required.
- The Company requires a $1,000 deposit for the Feasibility Study. The study is done at actual cost and the Customer is responsible for any additional cost (or refund) depending on the specific requirements involved.

- The Feasibility Study addresses the following technical areas, including but not limited to:
  - Generator size and grounding
  - Generator installed location and line configuration
  - Line Penetration
  - Short Circuit Contribution and interrupt ratings

- The Supplemental Review Analysis will further analyze the following technical areas, including but not limited to:
  - Power Quality
  - Voltage
  - Maximum Line Penetration
  - Safety and Reliability
  - DELTA Transformer winding requirement and source grounding

- The output of the Feasibility Study will determine if the proposed interconnection request can proceed forward with the execution of an Interconnection Agreement, require a System Impact Study be performed, or require a Facilities Study be performed.

3.6.4 System Impact Study

- The System Impact Study is a detailed formal study intended to identify and detail the electric system impacts that would result if the proposed generating facility were interconnected without project modifications or electric system modifications, including identification of potential system upgrades required to allow the generating facility to interconnect to the Company's Distribution System.
- The System Impact Study will further analyze any potential impacts found within the Feasibility Study, and provide additional detailed analysis related to the following:
  - Power Flows
  - Voltage Deviations
  - Voltage Regulation/Tap Changers
  - DELTA Transformer Winding and source grounding requirements
  - Fault Protection and Coordination
  - Grounding and Overvoltage
  - Unintentional Islanding
  - Transfer Trip Analysis

- Transmission Impacts

- Additional Transmission Engineering Design review is required for any interconnection request that could result in impact on the Transmission system. Consideration of Transmission impact is required for Cases 4 through 7 with any interconnection request for a generator 5 MVA or greater. Company reserves the right (depending on the specific circumstances involved) to consider Transmission impact for any size generator.
- The output of the System Impact Study will determine if the proposed interconnection request can proceed forward with the execution of an Interconnection Agreement, or require a Facilities Study be performed based on the system upgrades and interconnection facilities identified by the System Impact Study.
- The Company requires a $20,000 deposit for the System Impact Study. The study is done at actual cost and the Customer is responsible for any additional cost (or refund) depending on the specific requirements involved.

3.6.5 Facilities Study

- A Facilities Study is an extensive study detailing the electric system infrastructure and the impacts to the Transmission and/or Distribution systems that would result if the proposed interconnection request were connected without project modifications or electric system modifications.
- This study shall specify and estimate the cost of the equipment, engineering, procurement, and construction work (including protection) needed to implement the conclusions of any System Impact Study(ies).
- The Company requires a deposit of the good faith estimated costs for the Facilities Study as determined by the Company. The study is done at actual cost and Customer is responsible for any additional cost (or refund) depending on the specific requirements involved.

3.6.6 MISO Affected System Study

The Midcontinent Independent System Operator (MISO) DER Affected System Study (AFS) is MISO's process to evaluate Transmission System impacts from DER interconnection requests., intended to evaluate the potential for DER and/or DER aggregation ("Distributed Energy Aggregated Resource" DEAR) newly proposed for interconnection to have the potential for net injection on the Transmission System exceeding one megawatt (1 MW).

- The Affected System Study is performed by MISO quarterly, based on the screening results of newly proposed interconnection projects

submitted by the relevant Transmission Owner, determined by the Transmission Owner to have the potential to impact the transmission system, as defined in MISO's DER Affected System Study Business Practices, referenced below.

- If a Study is required:
    - MISO has 90 calendar days to complete after study kickoff
    - Steady state analysis only (i.e., exclude short circuit and stability analysis):
        - Thermal analysis follows BPM-15, Section 6.1.1 (Thermal Analysis) with constraints evaluated using Section 6.1.1.1.8 (Criteria Used to Determine Constraints) for evaluating thermal constraints.
        - Steady state voltage analysis follows Section 6.1.1.2, which references Local Balancing Authority criteria.
- For Screening purposes, MISO expects the Electric Distribution Company (EDC) and Transmission Owner (TO) to include the proposed and existing DER behind a transmission/distribution substation to evaluate the potential for injection by a new DER seeking to interconnect.
    - The TO would screen for cumulative DER injection that exceeds substation peak load:
        - For 1 - 5MW injection, MISO will apply a 1% line-loading screen.
        - For injections above 5 MW, the substation will automatically move to the MISO Affected Systems study process.
- Minimum Data Required for each screening:
    1. Substation name and associated transmission bus number;
    2. DER capacity, in megawatts, categorized by fuel types (defined in MISO's BPM-015);
    3. equivalent short circuit impedance by fuel type; and
    4. reactive power control mode and settings by fuel type.
- The DER information shall be submitted in IDEV or PSSE (*.raw) format, representing the aggregate DER connected and proposing interconnection at the transmission bus using the data record for

generators. The DER information should include both newly proposed and existing DER.

- The entity submitting information may choose to submit assumptions for equivalent short circuit impedance by fuel type and reactive power control mode and settings by fuel type to be used for all DER submitted by that entity until further notice of assumptions changes by that entity.
- MISO's BPM-015, Section 8.3.2 describes the Modeling Assumptions Inputs and analysis:
    - DER will be modeled as generators, rather than a negative load, in peak and shoulder peak models.
    - DER will be dispatched against local area generators as defined by the MTEP model "area number."
    - MISO will perform thermal and voltage analysis that include each DER Substation qualifying for a DER AFS.
- MISO's DER AFS does not confer transmission rights or allow access to wholesale markets without further action on behalf of a DER and/or DER Aggregator (DERA) Provider.
- The cost assignment/collection for MISO Studies ($60k/study/substation). Cost allocation for system upgrades driven by cumulative impacts of DERs on a Transmission/Distribution Substation.

3.6.7 Market Services Registration Study

Subject to compliance with any the interconnection requirements contained in these Standards, and consistent **with retail policies relating to Wholesale Market Participation** by DERs, DER Customers with a valid Interconnection Agreement may participate in MISO's Energy and Ancillary services markets by registering as a MISO Market Participant, enrolling DER assets to offer market services the DER is eligible to provide and complying with the provisions described below.

- Capacity market participation requires the DER customer to secure appropriate transmission rights, which can be done by procuring (External) Network Resource Interconnection Service (NRIS) through MISO's Definitive Planning Phase generator interconnection process or by obtaining Firm Transmission Service but is predicated on the MP demonstrating deliverability to the MISO System.
- DERA market participation may not cause significant modifications or changes to the Transmission and/or Distribution systems operational systems or operational needs beyond what is approved for a newly

proposed DER interconnection; significant impacts to the distribution or transmission system will require mitigation.

- Planning coordination should consider both market rules as well as safety, reliability and maintaining safe work practices.
- Coordination and informational requirement for safety, reliability and maintaining safe work practices may exceed those required for market services alone.
- Services that pose a greater risk to the safe and reliable operation of the EDC system may need to be accounted for separately.
- Periods or triggers for re-registration should be consistent with the need to maintain safe and reliable operation of the EDC system.
- Entergy will need the following, at a minimum, for each DER seeking to offer services in MISO's market:
    - execution of an Interconnection Agreement
    - EDC account number
    - MISO EP Node/CP Node (i.e., Substation name and associated transmission bus number)
    - Market Services to be provided
        - Regulation would require additional information (ramp rate, etc.)
    - Plans for injection/withdrawals (retail/wholesale?)
    - For DERs registering as Demand Response Resources, forecasted load relief, baseline load and methodology used to determine both is required
    - Type of technology
    - Distance from the substation
    - Nameplate capacity in megawatts categorized by fuel type(s) and capacity participating in DER and/or DEAR
    - Reactive power control mode and settings by fuel type
    - Equivalent short circuit impedance by fuel type
    - DER availability (hours or time limitations)
    - Completion of any necessary MISO System Impact Studies
- For the Market Services Registration Study, the Company requires a deposit of the good faith estimated costs provided by the Company. The study is done at actual cost and Customer is responsible for any

additional cost (or refund) depending on the specific requirements involved.

3.7 Required Drawings

Adequate drawings of the Customer's proposed generation facility, which will include a one-line diagram and proposed relay systems, must be submitted to the Company for review during the planning stage. Additional drawings may be required on a case-by-case basis. The following exhibit is from the 2017 National Electrical Code, Article 690 "Solar Photovoltaic (PV) Systems" provides an example of what's expected on the required drawings:

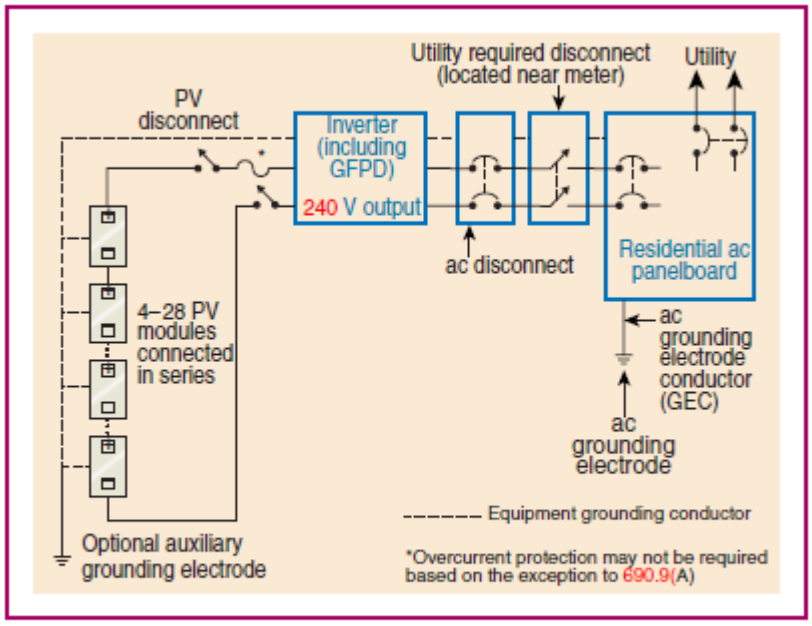


EXHIBIT 690.6 *Simplified circuit schematic of a rooftop grid-connected system.*

3.8 Allowable Tie Points

Typically, only one tie point between the Customer and the Company will be allowed at the Customer's location with any required communication available for utility interconnection at the Point-of-Common Coupling.

3.9 Central Business District Networks

The Company will not allow interconnections involving parallel operation of DERs in Central Business District Underground Secondary Networks and Spot Networks. In Central Business District Underground Secondary Networks and Spot Networks, the installation of a generator could have a negative effect on electric power quality and reliability and the safety of employees that maintain these systems. This policy will affect all Underground Secondary Networks and

Spot Networks installations including those in New Orleans, Baton Rouge, Lake Charles, West Monroe, Beaumont, Jackson, Little Rock, Pine Bluff, and Hot Springs. Note: backup generation is allowed only if it complies with the requirements of Cases 1, 2, or 3 and the back-up generator NEVER exports power onto the Company's Distribution System.

3.10 General Interconnection Requirements

The Customer's generation facilities shall meet the technical requirements as prescribed in this section and in the latest revision of IEEE 1547. Review of Customer equipment by the Company can be performed to determine acceptability due to revisioning in the latest versions of Underwriters Laboratories (UL) 1741-SA & SB and IEEE 1547.

3.11 Customer's Equipment and Interconnection Standards

The Customer's generation and interconnection installation must meet all applicable national, state, and local construction and safety codes. The Customer shall be responsible for the design, installation, operation, testing and maintenance of all equipment and facilities installed or that will be installed on the Customer's side of the Point of Common Coupling (PCC). Such design shall meet the latest standards of IEEE, National Electrical Manufacturers Association (NEMA), American National Standards Institute (ANSI), NEC, FERC, or other national codes and any local codes pertaining to the design and construction of electrical facilities. The Customer's generation shall be subject to the requirements of all authorities having jurisdiction and shall comply with all applicable codes and ordinances.

3.12 Rating of Customer's Equipment

The equipment selected by the Customer for interconnection shall be rated for continuous operation with the Company's Distribution System. Developers may oversize the total AC System Output using the minimum number of inverters required to meet the facility's proposed export capability while using internal controls for limiting system power output to the application requirements.

3.13 Protection of Customer's Equipment

The Customer will be responsible for protecting its generating equipment in such a manner that distribution delivery system outages, short circuits or other disturbances, including zero sequence currents and ferroresonance over-voltages, do not damage the Customer's equipment. The Customer's protective equipment shall also prevent unnecessary tripping of the Company's Distribution System breakers that would affect the Company's Distribution System's capability to provide reliable service to other Company customers.

3.14 Manually-Operated Load Break Switch / Reasons for Disconnect from the Company's Distribution System

In support of safe deenergized work plan practices for Electrical Works and Emergency Responders, the Customer's generation facilities shall have a manually-operated, visible-break isolation load break switch that is lockable in the open position. This manually operated load break switch shall be in a location accessible to the Company's personnel at all hours with no notice. (Pull-out type switches or breakers are not accepted). For a three-phase generator, this disconnect must be a group-operated device that through one operation will open/close all three phases simultaneously. As shown within the below 2017 NEC Handbook Exhibit, this utility required disconnect should be located near the meter but **must be within sight and within 10 ft of the equipment**. If the disconnecting means cannot be installed near the utility meter, then a plaque located within 3 ft of the utility meter is required describing the location and configuration with an arrow pointing to is stating distance (Example: 30kVA Solar PV System Disconnect, 5 ft.⇨)

EXHIBIT 690.3 *An interactive inverter. (Inverter courtesy of SolarEdge Technologies; Photo courtesy of Michael and Diane Mello)*

Customer shall label disconnecting means with type and size of distributed generation. Example:

AC PHOTOVOLTAIC
DISCONNECT
30 kVA, 240V

EXHIBIT 690.10 *PV system disconnect.*

Also, system disconnecting means where the line and/or load terminals may be energized in the open position, the device shall be marked with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

Permanently attached tags are required:
The lettering on each tag shall be 3/16 inch or larger and be either raised or incised on each tag. Each tag shall be riveted or glued to the disconnect switch.

For high single-phase current application up to 150 kVA or compartmental applications:

- Each system disconnecting means shall consist of not more than six (6) switches or six (6) sets of circuit breakers, or a combination of not more than six (6) switches and sets of circuit breakers, mounted in a single

enclosure, or in a group of separate enclosures with the above labeling requirements. Parallel feeder circuit isolation is not allowed.

- Each switch/breaker must isolate a dedicated section of the system and lockable in the open position, manually-operated with visible-break isolation. Note: a racked-out breaker meets this visible-break isolation requirement. Also, systems with more than a single disconnecting means require a plaque located within 3 ft of the utility meter describing the isolating operations (Example: Open all switches/breakers for isolation within enclosure label “Solar PV Disconnect”, 5 ft ⇨).

For large current applications:
A dedicated underground switchgear and/or switchgear with circuit breaker(s) is allowed that shall also be in a location accessible to the Company’s personnel at all hours with no notice. This separate switchgear also requires the above labeling requirements. Each switch/breaker must also isolate a dedicated section of the system and lockable in the open position, manually-operated with visible-break isolation. Note: a racked-out switch/breaker meets this visible-break isolation requirement.

The Company reserves the right, but has no responsibility either actual or implied, to open the disconnect switch without prior notice to the Customer for any of the following reasons:

A. Distribution System emergency,
B. Routine maintenance, repairs, and modifications,
C. Elimination of a safety hazard, protection of the public or on-site personnel, or if instructed to do so by public safety personnel (law enforcement, fire department, or other governmental personnel),
D. Inspection of Customer's generating equipment and protective equipment reveals a hazardous condition, a lack of scheduled maintenance or maintenance records,
E. The operation of the Customer's generating equipment results in a deteriorated quality of service or safety issue with other Customers or with the operation of the Company’s Distribution System, or

The Company may disconnect a Customer’s generation unit from the Company’s Distribution System under the following conditions:

A. Expiration or termination of interconnection agreement
B. Non-compliance with the technical requirements
C. Lack of approved application and Interconnection Agreement
D. Unauthorized modifications to the Customer’s interface equipment.

When possible, the Company shall provide the Customer with reasonable notice and reconnect the Customer as quickly as reasonably practical.

3.15 Remotely-Operated Load Break Switch / Reasons for Disconnect from the Distribution Delivery System

The Company reserves the right to require the Customer's generating facility to be isolated from the Company Distribution System through a dedicated remotely-operated load-break switch. The remotely-operated load-break switch shall be provided by the Company at the Customer's expense that meets the utility's Distribution Automation requirements. The purpose of the dedicated remotely-operated load-break switch is to (i) remotely isolate the generating facility at the Point of Common Coupling to avoid any severe power condition that could result in any negative consequence back onto the Company's Distribution System, transmission system, and/or other customers, and (ii) provide any operational support.

This remotely-operated load-break switch shall have the capabilities for communication of telemetry data along with receiving and responding to transfer-trip signals from the substation while isolating upon demand. The device shall be capable of establishing communication (i.e., SCADA) over existing company networks via fiber connection, radio, cellular, or Wi-Fi.

Typical Application: Remotely-Operated Isolation Device (i.e. Reclosure) is used for protection coordination within the Company's Distribution System design to guard against any negative results from active generators following the loss of the power grid. Situational examples include, but are not limited to:

- Unintentional islanding from generator providing back-fed power onto the Company's Distribution System that could result in damage to other connected customers' equipment.
- Excessive voltage transformations from generator providing undesired back-fed power onto the transmission system that could result in damage to Company-owned equipment.
- Any interconnection request in which the total proposed generator capacity (including any previously-approved interconnections) would exceed the minimum projected daytime running feeder load.

Operability: the failure of any Remotely-Operated Isolated Device (i.e. Reclosure) is considered a system failure that renders the system inoperable and cannot be placed in service manually.

Bypassing any remotely-operated isolation device is considered an Entergy operational violation and is considered a PENALTY FOR INTERCONNECTING WITHOUT COMPANY AUTHORIZATION in accordance with Section 3.53.

3.16 Direct Transfer Trip

As stated above, the Company reserves the right to require the Customer's generating facility to be isolated from the Company's Distribution System through a dedicated remotely-operated load-break switch. Only Direct Transfer Trip signal from the Company's Distribution System to the Customer shall be allowed for isolation protection. Any isolation protection installed by the Customer shall only operate the Customer's internal dedicated load-break device in isolating the Customer's generating equipment from the Company's Distribution System.

Typical Application:

Generator or other DER with capacity greater than 67% of the minimum daytime loading of the connected distribution circuit.

3.17 Customer's Owned Systems

Generation systems owned and managed by the Customer shall have no maintenance agreement with the Company for equipment including the step-up transformer supplied by the contracted vendor. The Customer shall perform periodic maintenance as necessary on Customer-owned and operated circuit breakers, relays, transformers, generators, inverters, batteries, and other equipment to meet the Company's specifications unless the manufacturer recommends a more frequent schedule for maintenance.

In the event it is necessary for the Customer to disconnect from Company service, the Customer shall notify the Company of the planned disconnection in advance of the disconnection. When interconnecting another Customer or other work such as routine maintenance will interrupt service to a Customer, the Company will contact the Customer to arrange a mutually-agreeable time, if possible, for such Company work to be performed. When interruption of service is required that impacts Customer, service will be restored as quickly as possible.

3.18 Company Partnerships or Company-Owned Systems

All new generators proposed to be interconnected to the Company's Distribution System regardless of size shall operate at the following generally available standard output voltage transformations (+/- 5% from the following nominal):

IEEE Offered Low Voltages:
Single-Phase Voltage: 120V or 240V
Three-Phase Voltage: 208V or 480V with 480V preferred.

IEEE Offered Medium 3-Phase Voltages:
4160V, 12.47kV, 13.2kV, 13.8kV, 23.9kV, or 34.5kV

3.19 Transformation Requirements

Customer is encouraged to contact the Company early in the process and learn about Customer-specific requirements due to the Customer's location (or desired point of interconnection) on the Distribution or Transmission System. Customer may call 1-800-ENTERGY to get a local engineer assigned.

Step-Up Transformer Winding Standard is Wye-Wye. System Impact Study at a minimum is required for Wye-Delta Transformer winding configurations.

If Customer's existing generation facilities need additional transformation, a different grounding system, or other upgrades, the Customer shall be required to design, pay for, and maintain all upgrades necessary to comply with Company's interconnection standards and other policies.

The Customer's grounding, transformer, relaying, and generator system shall be designed to handle the normal imbalance on the Company's Distribution System.

The Customer's additional generation-related transformation and other facilities should be owned, operated and maintained by the Customer. At the Company's option, a standard Company-specified transformer / transformer bank may be provided at the Customer's expense.

For Cases 3 through 7, the Customer shall monitor the Company's Distribution System and react based upon specifications in this Standard. Grounded Wye to Grounded Wye transformers are preferred with no impedance or resistance grounds.

System Impact Studies are required to design/specify a monitoring method (transfer trip or another method of reading the Company distribution feeder) if:

- Zero sequence path isolation occurs, some examples of which follow:
  - Impedance/resistance grounds limit fault current and fault signal.
  - Ungrounded connections/ configurations between the Customer's generator and the Company may not consistently detect faults on the Company's Distribution System.
- Delta configurations exist because they:
  - balance the Company's Distribution System load per phase, making the feeder difficult to monitor.
  - may be ungrounded.

3.20 Dedicated Distribution Transformer

The Company reserves the right to require the Customer's generating facility to interconnect to the Company Distribution System through a dedicated transformer. The transformer shall be provided by the Company at the Customer's expense, purchased from the Company by the Customer, or purchased from a third party if it conforms to the Company's specifications. The purpose of the dedicated transformer is to confine the Point of Common Coupling away from existing load and/or generation to support independent isolation and operational support.

3.21 Grounding

All generators 1 MVA and larger must have ground mats that shall be designed in accordance with good engineering practice per IEEE 80 "Guide for Safety in AC Substation Grounding." If local governmental requirements are more stringent (e.g., building codes), those requirements shall prevail. Customer shall perform appropriate tests, including soil resistivity test, to demonstrate that their ground grid design meets the standard. Mats should be tested at regular intervals to ensure their effectiveness.

3.22 General Equipment Design and Operating Requirements

From the perspective of interconnection, there are four main types of generation systems that interface to the distribution or transmission system. These include:

- Induction Generators (e.g., Combustion Engine-Driven, Hydro, Wind)
- Synchronous Generators (e.g., Flywheel, Motors, Motor-Generators)
- Static Power Converters (Inverters, Static Converters)
- Battery Storage (Inverter-Charger units)

Each type of generation system has its own specific characteristics regarding synchronization equipment, protective functions, starting practices, and electrical operating behavior. Whether the generation is a dynamo machine (i.e., windings) or electro-static (i.e. SCRs/diodes), there are specific common interface requirements that will always apply. There may also be additional specific requirements that may be identified as part of any study (or studies) conducted by the Company for a specific Customer location. Generating facilities operating in parallel with the Company's Distribution System shall be equipped with the following load control functions:

- Voltage and frequency ride-through
- Soft-start reconnection
- Ramp-rate controls
- Constant power factor mode
- Voltage-reactive power mode
- Active power-reactive power mode

- Constant reactive power mode
- Updated unintentional-islanding requirements when disconnected from parallel operations (excludes Synchronous Generators designed for extended ride-through loading)

  The following unintentional-islanding detection methods are approved by the Company:
  - **Active**: frequency shift
  - **Hybrid**: rate of change of frequency
- Communication
- Telemetry data
- Remote shutdown command capability
- All communication interfaces shall be available at the PCC.
- Under-voltage time delay for loss of power backup loading in support of designed reclosing (i.e., Reclosure) cycling.
- Reclosing lockout during parallel operations to block loss of synchronization (out-of-step) condition (excludes Synchronous Generators designed for extended ride-through loading)
- Loss of phase detection

3.22.1 General Equipment Protection Requirements

From the perspective of smart inverter functions, the following features shall be active in the priority listed unless otherwise defined by a Company-performed study:

1. Volt-VAR management
2. Volt-Watt
3. Soft Start
4. Constant power factor (1 MVA or greater)

3.22.2 Typical Volt/VAR, Volt/Watt Curves

Regarding smart inverter functions, the following Volt/VAR Curves should be established unless provided within a detailed study from the Company:

IEEE 1547-2018, Table 8 —Voltage-reactive power settings for normal operating performance Category B DER	
Default Settings	
Point	Vref, % of S(rating)
V1,Q1	(0.92, +44%)
V2,Q2	(0.98, 0)
V3,Q3	(1.02, 0)
V4,Q4	(1.08, -44%)
Open Loop Response Time	5 Seconds

IEEE Std 1547-2018
IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

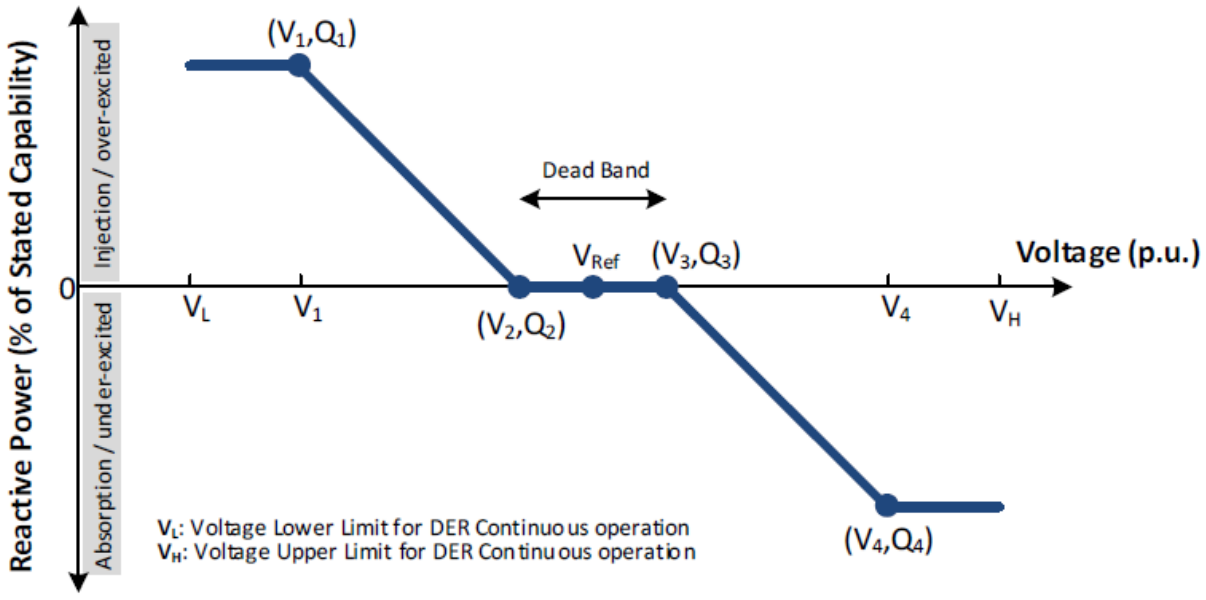


Figure H.4—Example voltage-reactive power characteristic

Regarding smart inverter functions, the following Volt/VAR Curves should be established unless provided within a detailed study from the Company:

IEEE 1547-2018, Table 10 —Voltage-active power settings for Category A and Category B DER	
Voltage-active power parameters	**Default settings**
V1	1.06 *V*N
P1	*P*rated
V2	1.1 *V*N
*P*2 (*applicable to DER that can only generate active power*)	0.2 *P*rated or *P*min (the minimum active power output in p.u. of the DER rating (i.e., 1.0 p.u.)
P'2 (*applicable to DER that can generate and absorb active power*)	0
Open Loop Response Time	10s

Note: VH = V + V(5%)

Figure H.5—Example active power-reactive power characteristic

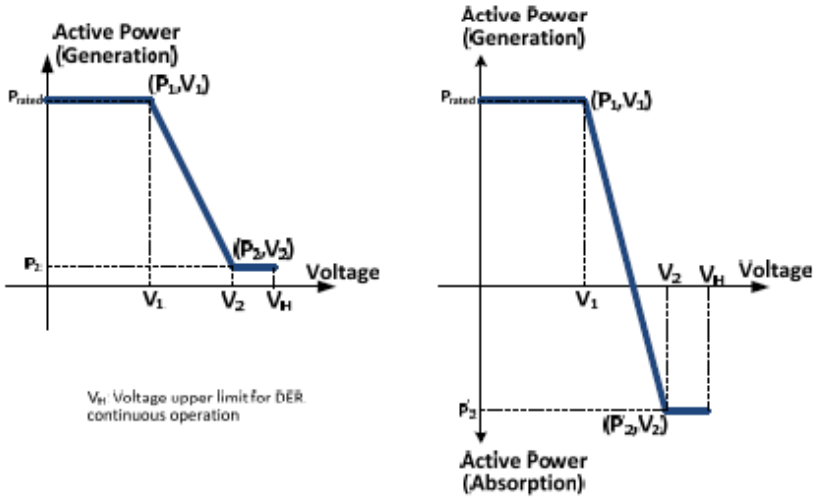


Figure H.6—Example voltage-active power characteristic

Note: Entergy requires a minimum setting of voltage-**reactive** power characteristic (Volt/VAR) with voltage-**active** power characteristic (Volt/Watt) as a backup setting.

3.22.3 Typical Types of Generation Systems

The following sub-sections describe the four main types of interconnected generation systems, which include figures that illustrate typical installation for equipment protection. These are the legends for IEEE device numbers referred to in the figures:

Legend

Protective Device Numbers and Description

2 - Time Delay Starting or Closing Relay

7 - Rate of Change Relay

24 - Volts per Hertz Relay

25 - Synchronizing or Synchronization Check Relay

27 - Under-voltage Relay

29 - Isolating Contactor or Switch

31 - Separate Excitation

32 - Power Direction Relay

40 - Loss of Field Detection Relay

46 - Reverse-phase or Phase-Balance Current Relay

47 - Voltage Phase Sequence Relay

50 - Instantaneous Overcurrent (Breaker Failure) Relay

51 - Time Over-current Relay

52 - AC Circuit Breaker

59 - Over-voltage Relay

60 - Voltage or Current Balance Relay

64 - Ground Detector Relay

67 - Voltage Restrained/Controlled Directional Time Overcurrent Relay

78 - Loss of Synchronization (Out-of-Step) Relay

79 - Reclosing Relay

81 - Over/Under-frequency Relay

85 - Communications, Carrier or Pilot-Wire Relay

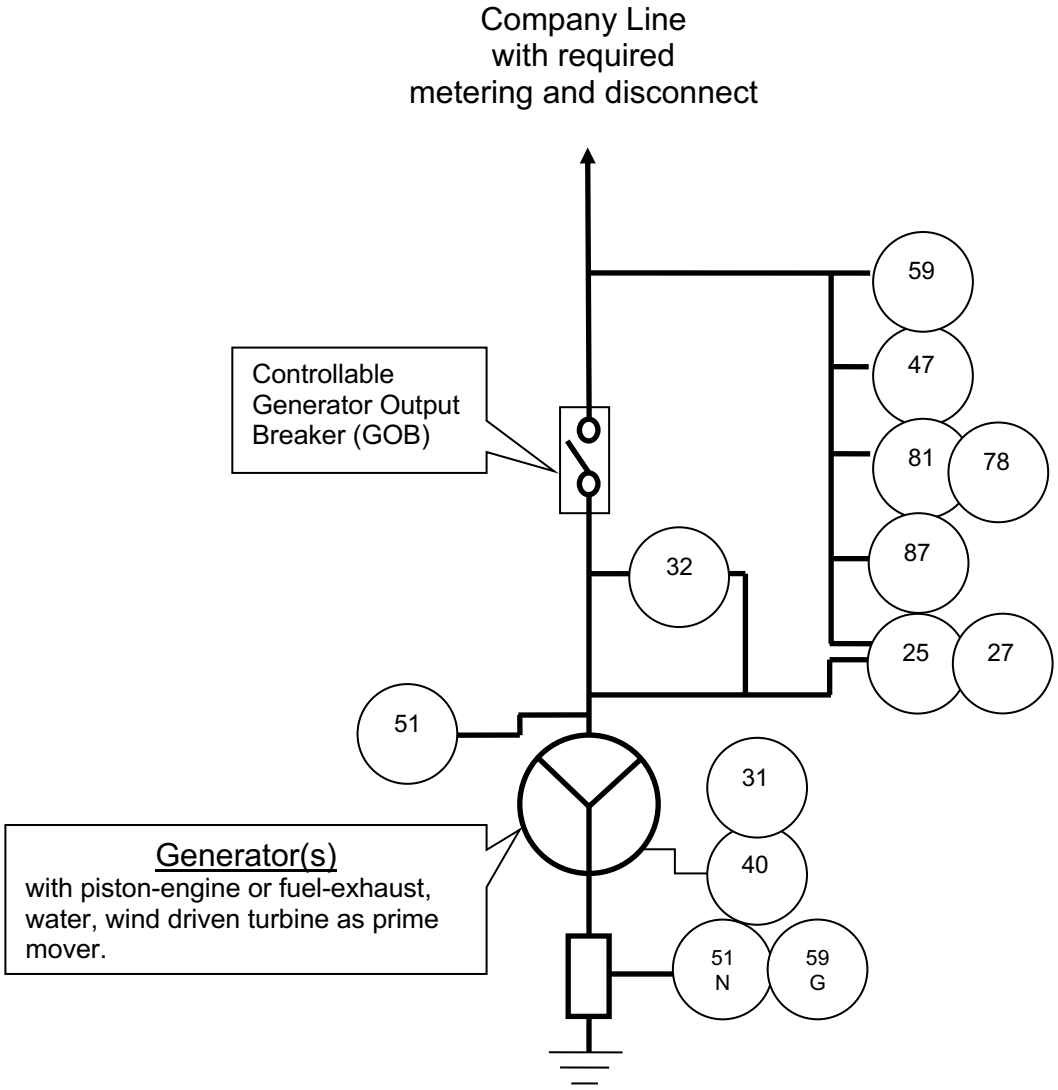
87 - Differential Protective Relay

NOTE: for additional information on device number, refer to ANSI C37.2.

3.22.3.1 Induction Generators

All new interconnected generators having suitable systems must comply with the Company's minimum operating reliability criteria for governor droop.

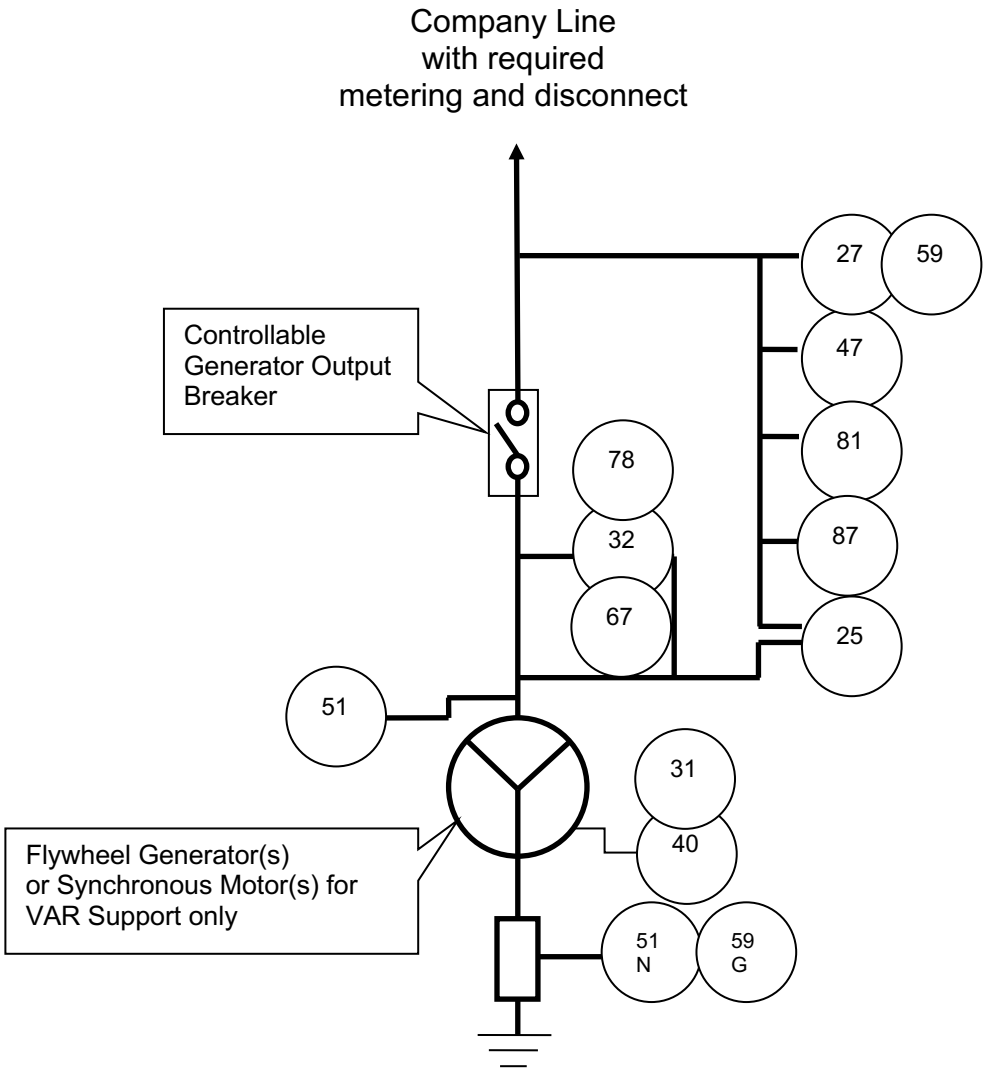
These requirements are necessary to provide an equitable and coordinated system response to load/generation imbalances. Governor droop typically ranges between 3% and 5% without excessive dead-bands and will be established based on designed study requirements.



3.22.3.2 Synchronous Generators

Synchronous Generators are to remain in-service during system faults (three-phase faults with normal clearing and single-line-to-ground with delayed clearing) unless clearing the fault effectively disconnects the generator from the system. During the transient period, the generator is required to remain in-service for the low voltage and frequency excursions as specified in the design requirements. The Generator may be tripped after the fault period if this action is intended for direct equipment protection.

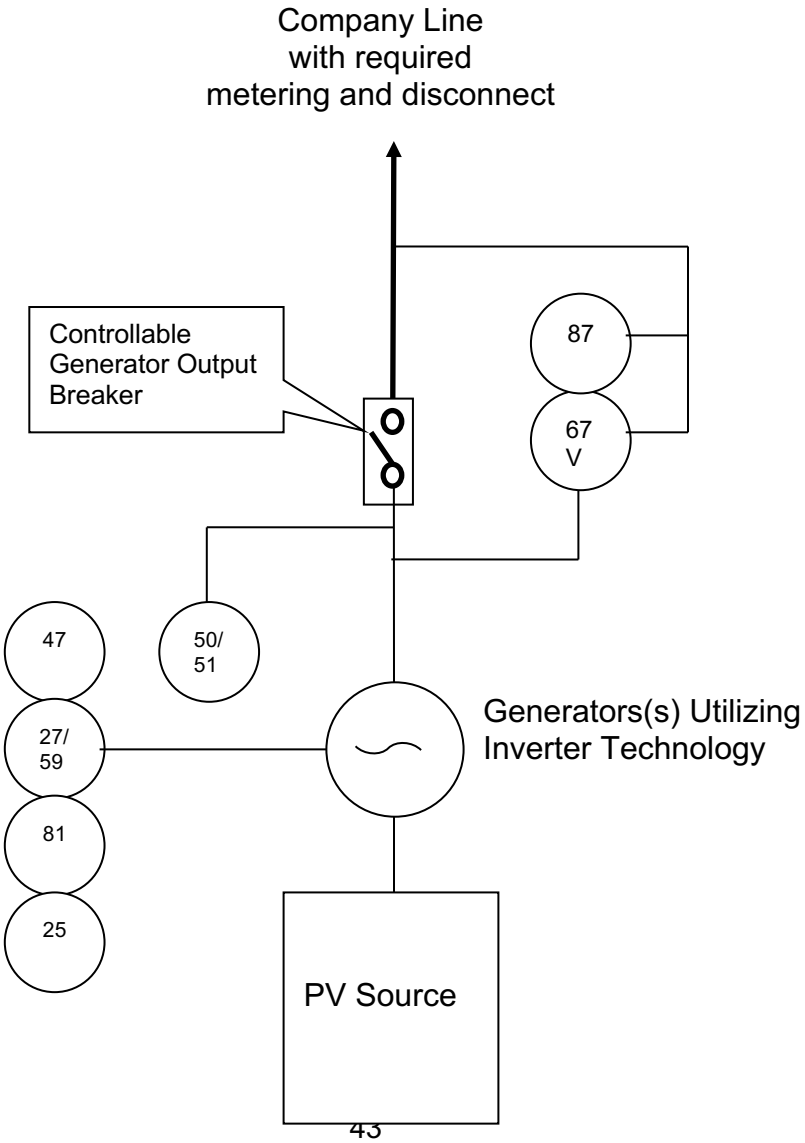
A separately excited excitation system is also required on these synchronous generators for additional reactive power (VAR) support during normal parallel/synchronous operation.



3.22.3.3 Static Power Converters / Inverter Technology

All electro-static power generation systems must use a smart inverter that complies with testing protocol UL 1741-SA and IEEE 1547 latest version. Functions of compliant inverters are noted in the above section: **General Equipment Design and Operating Requirements**; however, the following additional procurement requirements shall be included:

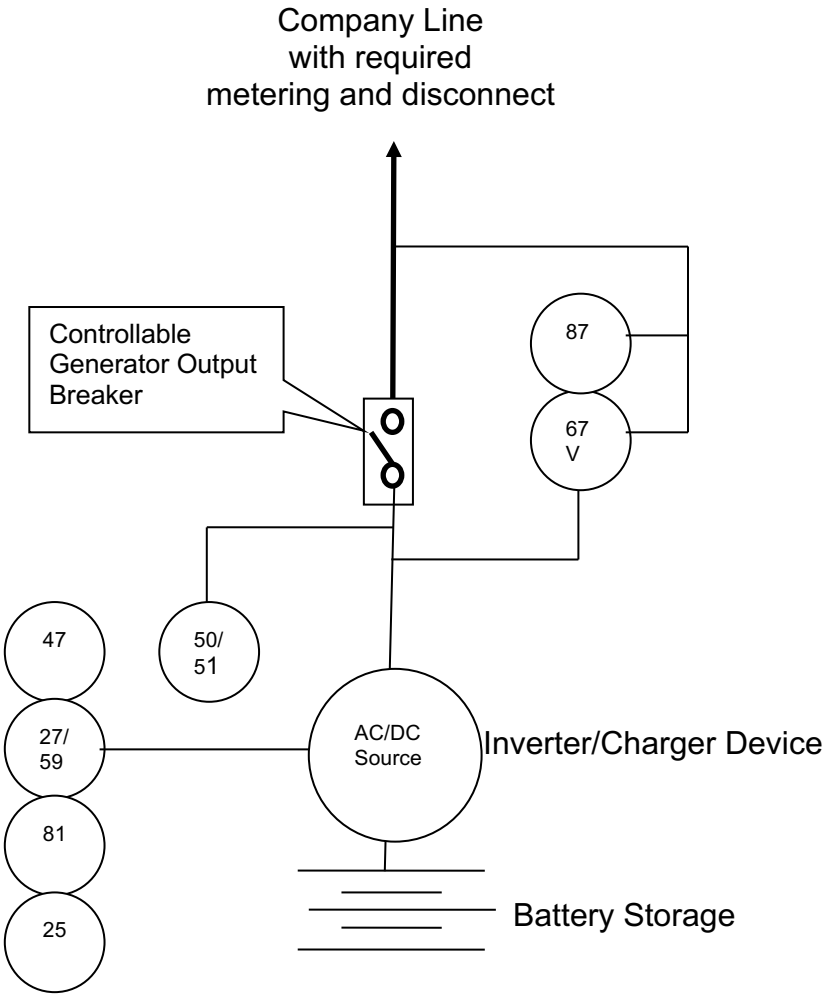
- UPS grade inverters requiring no additional filtering that support direct connection to breaker/fuse-protected loads or a standard distribution class Wye-Wye Transformer winding.



3.22.3.4 Battery Storage System using Inverter Technology

All typical Battery Storage Systems will use Inverter Technology; therefore, smart inverter functions shall be applied that complies with testing protocol UL 1741-SA and IEEE 1547 latest version. Functions of compliant inverters are noted above within the section: **General Equipment Design and Operating Requirements**; however, the following additional procurement requirements shall be included:

- UPS grade inverters requiring no additional filtering that support direct connection to breaker/fuse-protected loads or a standard distribution class Wye-Wye Transformer winding.



3.23 Synchronizing Requirements

The Customer shall be solely responsible for synchronizing and properly connecting and disconnecting its electrical system relative to parallel operation with the Company's Distribution System in accordance with the latest version of IEEE 1547. The Customer shall provide an automatic or semi-automatic synchronizing scheme to prevent the closing of its circuit breaker when the two electrical systems are out of synchronization.

3.24 Power Quality Parameters

Standard DZ02-04 "Power Quality Standards for Electrical Service" provides general guidelines on the quality of power a Customer can expect to receive at the point of delivery. Additionally, Standard DZ02-04 lists the restrictions the Company places upon the electrical distortion allowed on the power system that may be caused by a Customer's equipment. These requirements help ensure that the Company's and other customers' equipment will not be adversely impacted by a new Customer's generator or an existing Customer's planned expansion.

The Company should be consulted early in the design phase for new installations and load additions to address specific installation requirements for new facilities and planned expansions.

3.25 Energy Flow During Emergencies

Purchases of energy from or sales of energy to a Customer during periods of system emergencies may be discontinued according to the Retail Regulator's applicable rules and policies, and the Company's rates, riders, and/or contract with the Customer.

3.26 Power Factor

The power factor of the Customer's generation facilities at the interconnection point with the Company shall be maintained according to the applicable rate schedule for the Customer's installation.

3.27 Reactive Power Requirements

The Customer's generation facility shall be capable of injecting reactive power (over-excited) and absorbing reactive power (under-excited) for active power output levels greater than or equal to the minimum steady-state active power capability or per the latest version of IEEE 1547 rated active power, whichever is greater. Should the Customer be unable or unwilling to supply the reactive power, a separate rate schedule shall apply, and the installation shall be metered for VAR flow.

3.28 Voltage Flicker, Harmonic Distortion, Transients and other Power Quality Issues

The Customer's generator shall not create objectionable flicker, Harmonic Distortion, Transients, etc. for the Company's other Customers. The Customer should also consult Company's Power Quality Standards for Electric Service, the latest edition available on the Company web site at www.entergy.com. The Customer should select the appropriate state, then "Your Business", and the Builder Standards.

Minimum Individual DER Flicker Emission Limits (IEEE Std 1547)

Epst	Eplt
0.35	0.25

95% probability value should not exceed the emission limit based on a one-week measurement period.

3.29 Ride-Through Reliability Performance Requirements

3.29.1 Voltage Surges or Sags

The Customer will operate its generating equipment in such a manner that the voltage levels on the Company's Distribution System are in the same range as if the generating equipment were not connected to the Company's Distribution System. The Customer shall be liable for any damages done to their own facilities, the Company's facilities, or the facilities of other Customers due to any under voltage or over voltage contribution from the Customer's equipment.

The Customer shall provide an automatic method of disconnecting the generating equipment from the Company's Distribution System in accordance with Table 11, IEEE Std 1547 latest version.

Shall TRIP – Category I				
Shall TRIP Function	Default Setting		Ranges of allowable Settings	
	Voltage (pu of nominal voltage)	Clearing Time (s)	Voltage (pu of nominal voltage)	Clearing Time (s)
OV2	1.20	0.16	Fixed at 1.20	Fixed at 0.16
OV1	1.10	2.0	1.10 – 1.20	1.0 – 13.0
UV1	0.70	2.0	0.0 – 0.88	2.0 – 21.0
UV2	0.45	0.16	0.0 – 0.50	0.16 – 2.0

Shall TRIP – Category II				
Shall TRIP Function	Default Setting		Ranges of allowable Settings	
	Voltage (pu of nominal voltage)	Clearing Time (s)	Voltage (pu of nominal voltage)	Clearing Time (s)
OV2	1.20	0.16	Fixed at 1.20	Fixed at 0.16
OV1	1.10	2.0	1.10 – 1.20	1.0 – 13.0
UV1	0.70	10.0	0.0 – 0.88	2.0 – 21.0
UV2	0.45	0.16	0.0 – 0.50	0.16 – 2.0

Shall TRIP – Category III				
Shall TRIP Function	Default Setting		Ranges of allowable Settings	
	Voltage (pu of nominal voltage)	Clearing Time (s)	Voltage (pu of nominal voltage)	Clearing Time (s)
OV2	1.20	0.16	Fixed at 1.20	Fixed at 0.16
OV1	1.10	13.0	1.10 – 1.20	1.0 – 13.0
UV1	0.88	21.0	0.0 – 0.88	21.0 – 50.0
UV2	0.50	2.0	0.0 – 0.50	2.0 – 21.0

Voltage ride-through requirements for abnormal operating performance shall be in accordance with the latest version of IEEE Std 1547.

3.29.2 Frequency

When the operating frequency of the Customer's generating equipment deviates from the 60 Hz base, the Customer shall automatically disconnect the generating equipment from the distribution delivery system based upon the table below:

DER Response (shall TRIP) to Abnormal Frequencies:

Shall TRIP – Category I, II, and III				
Shall TRIP Function	Default Setting		Ranges of allowable Settings	
	Frequency (Hz)	Clearing Time (s)	Frequency (Hz)	Clearing Time (s)
OF2	62.0	0.16	61.8 – 66.0	0.16 - 1000
OF1	61.2	300.0	61.0 – 66.0	180.0 – 1000
UF1	58.5	300.0	50.0 – 59.0	180.0 – 1000
UF2	56.5	0.16	50.0 – 57.0	0.16 – 1000

Frequency ride-through requirements for abnormal operating performance shall be in accordance with the latest version of IEEE Std 1547.

3.30 MISO Ride-Through Reliability Requirements

Recommendation #1: MISO strongly recommends following the ride-through performances according to IEEE Std 1547-2018 as shown in Table 1. MISO strongly recommends to be notified of any exceptions at distribution company level.

Table 1 MISO recommendations for adopting DER performance categories

Technology	Category	Comments
Synchronous	I	Recommended minimum capabilities of Category I from IEEE Std 1547-2018.
Inverter-based generation and storage	III when amended or II	Preferred: minimum capabilities of Category III as shown in Figure 4. DER response to abnormal voltages and voltage ride-through requirements for DER of abnormal operating performance Category III of IEEE Std 1547a-2020. (adopted if published) Alternative: minimum capabilities of Category II with modifications as shown in Figure 3. DER response to abnormal voltages and voltage ride-through requirements for DER of abnormal operating performance Category II from the current IEEE Std 1547-2018.

MISO recommendations – **Recommended:** Specifications are expected to have medium bulk system reliability impact. **Strongly recommended:** Specifications are expected to have a high bulk system reliability impact.

Response to Abnormal Voltage Conditions – Mandatory Voltage Tripping Requirements.

Table 2: Voltage trip settings for synchronous generation assigned to Cat I
Table 3: Voltage trip settings for inverter-based generation & storage assigned to Cat II
Table 4: Voltage trip settings for inverter-based generators and storage to Cat III

Recommendation #2:

Table2. Synchronous generation voltage trip settings for Category I

Shall trip function	Recommended settings		Comparison to IEEE Std 1547-2018 Default settings and ranges of allowable settings for Category I		
	Voltage (p.u. of nominal voltage)	Clearing time (s)	Voltage	Clearing time	Within ranges of allowable settings?
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Identical	Yes
UV1	0.70	5.0	Identical	Longer (default is 2s)	Yes
UV2	0.45	0.32	Identical	Longer (default is 0.16s)	Yes

Recommendation #3a:

Table 3. Inverter-based generation and storage voltage trip settings for Category II

Shall trip function	Recommended settings		Comparison to IEEE Std 1547-2018 Default settings and ranges of allowable settings for Category II		
	Voltage (p.u. of nominal voltage)	Clearing time (s)	Voltage	Clearing time	Within ranges of allowable settings?
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Identical	Yes
UV1	0.70	5.0	Identical	Shorter (default is 10s)	Yes
UV2	0.45	0.32	Identical	Longer (default is 0.16s)	Yes

Recommendation #3b:

Table 3. Inverter-based generation and storage voltage trip settings for Category III

Shall trip function	Recommended settings		Comparison to IEEE Std 1547-2018 Default settings and ranges of allowable settings for Category II		
	Voltage (p.u. of nominal voltage)	Clearing time (s)	Voltage	Clearing time	Within ranges of allowable settings?
OV2	1.20	0.16	Identical	Identical	Yes
OV1	1.10	2.0	Identical	Shorter (default is 13s)	Yes
UV1	0.70	5.0	Lower (default is 0.88)	Shorter (default is 21s)	Yes
UV2	0.45	0.32	Lower (default is 0.50)	Shorter (default is 2s)	Yes

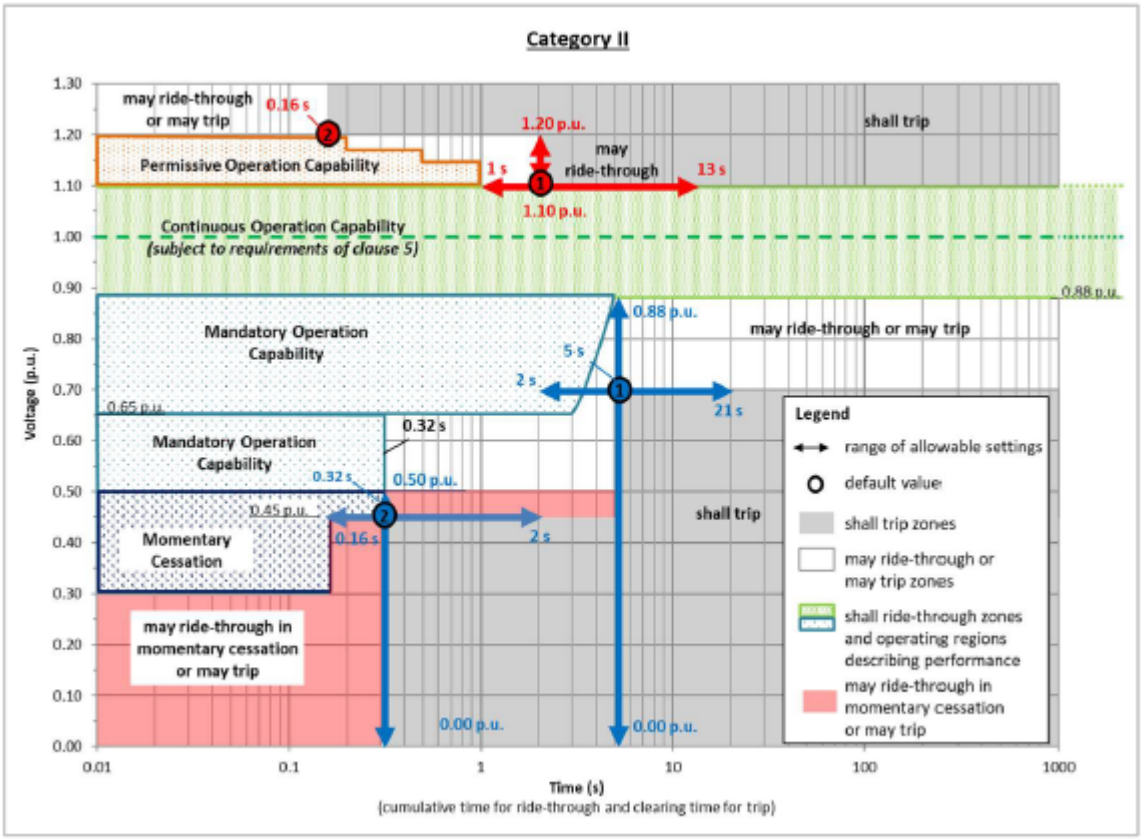
Recommendation #4

MISO recommends that voltage protective settings of distribution utility equipment coordinate with the ranges specified in IEEE Std 1547-2018 whenever the distribution grid is in normal configuration. MISO recommends the use of voltage protective settings outside the ranges of allowable settings, as specified in the standard, be limited to temporary use and limited geographic area, for example during substation of feeder maintenance.

Recommendation #5a

MISO strongly recommends that inverter-based generation and storage assigned to abnormal category II ride-through voltage conditions above 0.5 p.u. in Mandatory Operation and for voltage conditions equal to or less than 0.5 p.u. in Momentary Cessation as shown in Figure 3. DER response to abnormal voltages and voltage ride-through requirements for DER of abnormal operating performance Category II. MISO recommends to be notified of any exceptions at distribution company level.

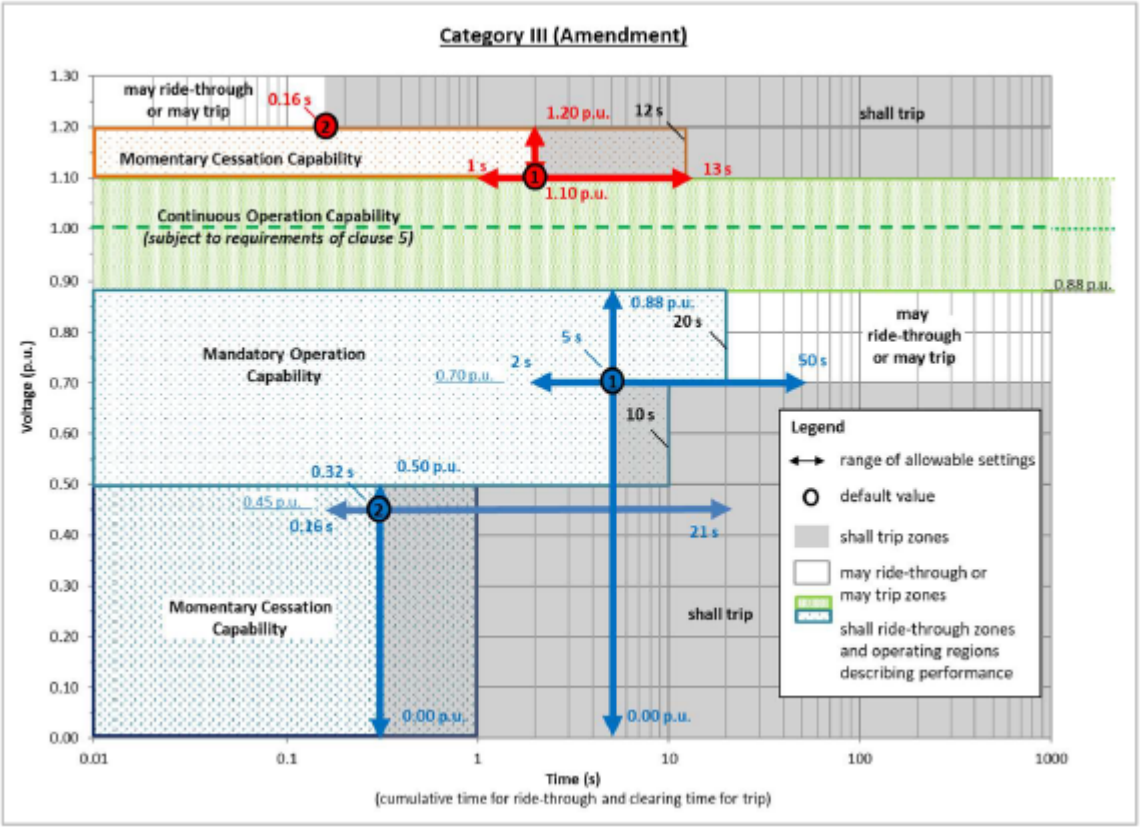
Figure 3



Recommendation #5b

MISO strongly recommends that inverter-based generation and storage perform during low voltage ride-through as specified in abnormal category III as shown in Figure 4. DER response to abnormal voltages and voltage ride-through requirements for DER of abnormal operating performance Category III. MISO recommends to be notified of any exceptions at distribution company level.

Figure 4



Recommendation #6

MISO strongly recommends following the voltage disturbances within continuous operating region requirements in Clause 6.4.2.2 of IEEE Std 1547-2018. MISO recommends to be notified of any exceptions at distribution company level.

Clause 6.4.2.2 – Voltage disturbances within continuous operating region

Clause 6.4.2.2 in IEEE Std 1547-2018 states that for voltage perturbations within the continuous operation region of the ride-through curves, DER must remain in operation and continue delivering available active power of magnitude at least as great as its pre-disturbance level, prorated by the per-unit voltage of the least phase voltage if that voltage is less than nominal.

Recommendation #7
MISO strongly recommends following the ride-through of consecutive voltage disturbances in Clause 6.4.2.5 of IEEE Std 1547-2018. MISO recommends to be notified of any exceptions at distribution company level.

Clause 6.4.2.5 – Ride-through of consecutive voltage disturbances
Clause 6.4.2.5 of IEEE Std 1547-2018 defines performance during consecutive voltage disturbances. It states that "the requirements for continued operation (ride-through) or restore output shall apply to multiple consecutive voltage disturbances within a ride-through operating region, for which the voltage range and corresponding cumulative durations are specified in Tables 14-16 of IEEE 1547-2018 for Category I, II, and III DER, respectively. These requirements are subject to the provisions that specify conditions in Table 5 (Table 17 of IEEE 1547-2018) for which a DER may trip."

Table 5. Voltage ride-through requirements for consecutive temporary voltage disturbances caused by unsuccessful reclosing for DER of abnormal operating performance Category I, Category II, and Category

Col. 1	Col. 2	Col. 3	Col. 4
Category	Maximum number of ride-through disturbance sets	Minimum time between successive disturbance sets (s)	Time window for new count of disturbance sets (min)
I	2	20.0	60
II	2	10.0	60
III	3	5.0	20

Recommendation #8
MISO strongly recommends that when the system frequency is in a range given below, and the fundamental-frequency component of voltage on any phase is greater than 30% of nominal, DER of any type shall cease to energize the Area EPS and trip within a clearing time as indicated in Table 6. MISO strongly recommends that no exceptions to these minimum requirements are granted.

Table 6. Recommended frequency trip settings for DER of any type

Recommended trip settings – IEEE Std 1547-2018 (2nd ed.)					
Shall trip function	Required settings		Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable settings for Category I, II and III		
	Frequency (Hz)	Clearing time (s)	Voltage	Clearing time	Within ranges of allowable settings?
OF2	62.0	0.16	Identical	Identical	Yes
OF1	61.2	300.0	Identical	Identical	Yes
UF1	58.5	300.0	Identical	Identical	Yes
UF2	56.5	0.16	Identical	Identical	Yes

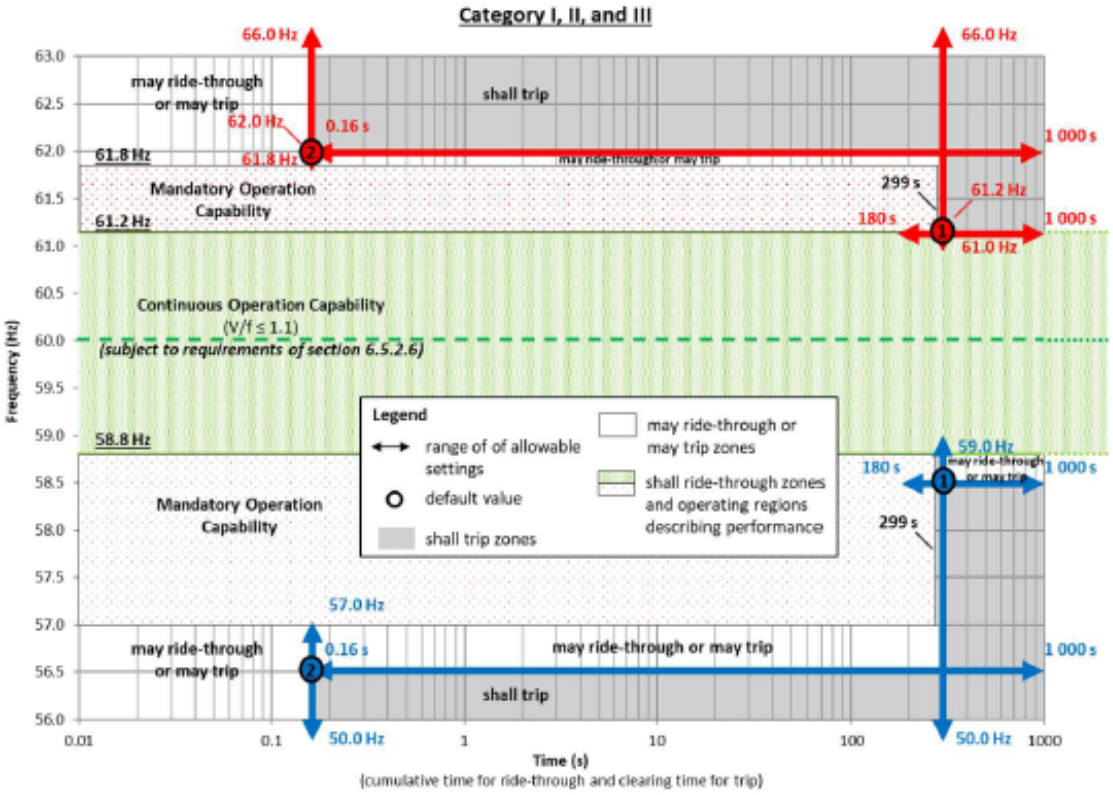
Recommendation #9

MISO recommends that frequency protective settings of distribution utility equipment conform to the ranges specified in IEEE Std 1547-2018 whenever the distribution grid is in normal configuration. MISO recommends the use of frequency protective setting outside the ranges of allowable settings, as specified in the standard, be limited to temporary use and limited geographic area, for example during substation or feeder maintenance.

Recommendation #10

MISO strongly recommends that DER of any type are capable of the unified frequency ride-through requirements specified in IEEE Std 1547-2018 and ride through abnormal frequency conditions as specified in Figure 5. MISO strongly recommends that no exceptions to these minimum requirements are granted.

Figure 5: DER default response to abnormal frequencies and frequency ride-through requirements for DER of abnormal operating performance Category I, II, and III



Recommendation #11

MISO strongly recommends following the rate of change of frequency (ROCOF) ride-through performance in Clause 6.5.2.5 of IEEE Std 1547-2018. MISO recommends to be notified of any exceptions at distribution company level.

Clause 6.5.2.5 Rate of change of frequency (ROCOF) ride-through

Clause 6.5.2.5 in IEEE 1547-2018 states that within the continuous operation region and ride-through operating regions, DERs (as assigned in Recommendation 1) shall not trip for frequency excursions having a magnitude of rate-of-change-of-frequency (ROCOF) that is less than or equal to the values specified in Table 7 (Table 21 of IEEE 1547-2018).

Table 7. Recommended ROCOF Ride-Through Performance

Recommended ROCOF Ride-Through Performance – IEEE Std 1547-2018 (2nd ed.)		
Category I	Category II	Category III
0.5 Hz/s	2.0 Hz/s	3.0 Hz/sec

Recommendation #12
MISO strongly recommends following the voltage phase angle changes ride through requirements in Clause 6.5.2.6 of IEEE Std 1547-2018. MISO recommends to be notified of any exceptions at distribution company level.

Clause 6.5.2.6 – Voltage Phase Angle Changes Ride-Through
Clause 6.5.2.6 describes the ride-through performance requirements for single-phase and multi-phase DER for sub-cycle-to-cycle phase angle changes (referred to as "phase jump") often caused by fault events or line switching operations on the distribution system or BPS:

Multi-phase DER shall ride through for positive-sequence phase angle changes within a sub-cycle-to-cycle time frame of the applicable voltage of less than or equal to 20 electrical degrees. In addition, multi-phase DER shall remain in operation for change in the phases angle of individual phases less than 60 electrical degrees, provided that the positive sequence angle change does not exceed the forestated criterion. Single-phase DER shall remain in operation for phase angle changes within a sub-cycle-to cycle time frame of the applicable voltage of less than or equal to 60 electrical degrees. Active and reactive current oscillations in the post-disturbance period that are positively damped or momentary cessation of the DER having a maximum duration of 0.5s shall be acceptable in response to phase angle changes.

Recommendation #13
MISO strongly recommends that inverter-based generation and storage assigned to abnormal categories II or III use the default settings specified in Clause 6.5.2.7.2 Frequency-Droop (Frequency/Power) Operation of IEEE Std 1547-2018(2nd ed.) as shown in Table 8. MISO strongly recommends that no exceptions are granted.

Clause 6.5.2.7.2 – Frequency-Droop (Frequency/Power) Operation
IEEE Std 1547-2018 requires the capability for the Frequency-Droop (Frequency/Power) function for all DER and does not allow the disabling of this function. Some distribution utilities, however, have raised concerns that this function may prolong run-on times (ROTs) of unintentional island if activated and may therefore desire to desensitize the function by widening the deadband values.

Table 8. Parameters of frequency-droop (frequency-power) operation for DER of abnormal operating performance Category I, Category II, and Category III

Parameter	Recommended settings			Comparison to IEEE Std 1547-2018 (2nd ed.) default settings and ranges of allowable settings		
	Category I	Category II	Category III	Category I	Category II	Category III
db_{OF}, db_{UF} (Hz)	0.036	0.036	0.036	Identical	Identical	Identical
k_{OF}, k_{UF}	0.05	0.05	0.05	Identical	Identical	Identical
$T_{response}$	5	5	5	Identical	Identical	Identical

MISO recommendations — Recommended: Specifications are expected to have *medium* bulk system reliability impact. Strongly recommended: Specifications are expected to have a *high* bulk system reliability impact.

Recommendation #14

MISO recommends that DER of any type use enter service / return to service voltage and frequency criteria identical to the default settings specified in Clause 4.10.2 (Enter Service Criteria, see Table 9) from IEEE Std 1547-2018. MISO recommends to be notified of any exceptions at company level.

Clause 4.10.2 – Enter Service / Clause 6.6 – Return to Service After Trip

Following a trip, or when entering service, DER is recommended not to energize the Area EPS until the applicable voltage and system frequency are within the ranges specified in Table 9 and the permit service setting is set to "Enabled".

Table 9. Enter service criteria for DER of Category I, Category II, and Category III

Enter service criteria for DER of Category I, Category II, and Category III (Table 4 in IEEE Std 1547™-2018)				
Enter service criteria		Default settings	Comparison to IEEE Std 1547-2018 (2nd ed.) allowable setting	Within ranges of allowable settings?
Permit service		Enabled	Identical	Yes
Applicable voltage within range	Minimum value	≥ 0.917 p.u.	Identical	Yes
	Maximum value	≤ 1.05 p.u.	Identical	Yes
Frequency within range	Minimum value	≥ 59.5 Hz	Identical	Yes
	Maximum value	≤ 60.1 Hz	Identical	Yes

MISO recommendations — Recommended: Specifications are expected to have *medium* bulk system reliability impact. Strongly recommended: Specifications are expected to have a *high* bulk system reliability impact.

Recommendation #15

MISO recommends that DER of any type use the default settings specified in Clause 4.10.3 (Performance during entering service) of IEEE Std 1547-2018 (2nd ed,):

- Minimum delay of 300 seconds.
- Duration of enter service period with linear ramp of 300 seconds.

MISO recommend to be notified of any exceptions at distribution company level.

Bother exceptions 1 and 2 are acceptable to MISO.

3.31 Specifying Protective Equipment

The Company will have the right to specify certain protective devices, including relays and circuit breakers that the Customer must install. The Company will specify all relay settings on the intertie. Settings of interconnection protective devices on the Customer's system will be specified by the Customer, but will be checked, coordinated with, and reviewed by the Company before application and subsequent modification.

3.32 Common Protection Requirements

Generating facilities operating in parallel with the Company's Distribution System shall be equipped with protective devices that will sense abnormal conditions on the Company's Distribution System and will cause the generating facility to automatically disconnect from the Company's Distribution System or will prevent the generating facility from being connected to the Company's Distribution System inappropriately. The Customer's equipment shall be capable of automatically disconnecting the generation upon detection of an islanding condition and upon detection of a Company Distribution System fault. These protective functions include:

1) Over- and under-voltage trip functions and over- and under-frequency trip functions.

2) A voltage and frequency sensing and time-delay function that will prevent the generator from energizing a de-energized Company Distribution System circuit and will prevent the generating facility from reconnecting with the Company's Distribution System unless the Company's Distribution System service voltage and frequency is within Company's "Power Quality Standards for Electrical Service" (DZ02-04).

3) A function to prevent the generating facility from contributing to the formation of an Unintended Island and cease to energize the Company's Distribution System within two seconds of the formation of an Unintended Island.

4) A loss of phase trip function.

5) Either a ground over-voltage or over-current trip relay scheme depending on the grounding system as specified by the Company.

The protection and control scheme shall be designed to ensure that the generator remains in operation when the frequency and voltage of the Company Distribution System are within the specified limits. Upon request from the Company, the Customer shall provide documentation detailing compliance with the specified operating ranges.

Unless otherwise directed by the applicable Retail Regulator, the generator will have, as a minimum, an automatic disconnect device(s) sized to meet all applicable local, state, and federal codes and operated by over and under voltage, and over- and under-frequency protection. For three-phase installations, the over- and under-voltage protection shall be included for each phase and the over- and under-frequency protection shall be required. All phases of the generator or inverter interface shall disconnect or cease export of power when directed by the protective devices. Voltage protection shall be wired according to the type of Distribution System ground. The Company will notify the Customer on the appropriate sensing arrangement based on the configuration of the Company Distribution System at the Point of Common Coupling.

3.33 Protection/Interface Requirements

Protecting both the Customer's facilities and the Company's facilities is of great importance. Proper protective systems shall be established in the design phase and confirmed prior to start-up of the Customer's generator. **An interconnection between the Company and the Customer will not be allowed prior to the proper coordination of protective devices.** The Customer shall be responsible for providing to the Company the necessary documentation certifying that maintenance and testing have been satisfactorily performed.

3.34 Service Interruption Equipment

Circuit breakers or other interrupting devices at the Point of Common Coupling must be capable of interrupting maximum available fault current. If facilities are larger than 1MVA and an inverter or similar system is used, consult the Company for additional requirements.

3.35 Fault Interrupting Device

A fault-interrupting device must be installed at the point of intertie between the Company and the Customer. The device could be single-phase fuses with a group operated load break switch or a three-phase breaker. The choice will be the Company's and will be made on a case-by-case basis depending on location, available fault current, and size of the Customer's generator.

3.36 Susceptibility to Transmission Faults

A Customer connected to the Company's Distribution System might be affected by faults occurring on the Company's transmission system. As necessary, a member of the Company's System Protection Department may

review the proposed interconnection to make recommendations concerning the Customer's susceptibility to transmission faults.

3.37 Changes to Company Fault Interruption Equipment

A generator source on the Distribution System will provide an additional source of fault current to the Company's distribution system. It is possible that the Customer's contribution will require the existing coordination of fault interrupting devices on the distribution feeder be changed. The Customer will be responsible for the cost of these changes to the Company's distribution system. It is also possible that the Customer's contribution will increase the available fault current on the Company's Distribution System beyond the interrupting capability of the existing devices on the Company's distribution system. The Customer may be required to limit their fault current. Should the Company also be required to make changes, the Customer shall pay the cost of the required changes. These issues will be examined on a case-by-case basis.

3.38 Equipment to Block Energizing Dead Circuits

Under no condition will the Customer be permitted to energize a non-energized Company distribution circuit. Equipment to effectively block the Customer from energizing a non-energized Company circuit shall be installed.

3.39 Communication Criteria for Requiring Telemetering

Communication protocols shall be in accordance with IEEE Std 1547 latest version with any interface made available at the Point of Common Coupling that meets the DER communication interface and cyber security requirements as specified within this document.

Telemetering requirements will be based on the cases described under **Interconnection "Case" Type based on the following capacity requirements:**

1. Cases 1 through 4, no telemetering will be required.
2. Cases 5 and 6 may or may not require telemetering depending on the output of the Customer's generating facility.

   All generators connected in parallel to the Company's Distribution System will require real-time monitoring in which the Customer shall be responsible for complying with all telemetry requirements.

   A. **For any Customer installation with capacity greater than 1 MVA, but less than 10 MVA:**

      The Customer shall furnish a telephone number that is manned during all hours of operation where the Company dispatcher can contact the Customer in the event of trouble on the distribution

circuit serving the Customer. Cellular and other wireless communication systems shall be allowed in lieu of standard wired or fiber linked communications, since this telemetry/transfer trip feature supports a backup function.

The Company **may** require a dedicated telephone circuit at the site of the Customer's intertie to provide communication with the Company based on evaluation requirements.

B. **For any Customer installation with capacity 10 MVA or greater:**

The Company and the Customer shall maintain operating communications at the Customer's expense with the Company's system dispatcher or the designated representative. The operating communications shall include, but not be limited to, system paralleling or separation, scheduled and unscheduled shutdowns, equipment clearances, and hourly and daily load schedules and reports.

An RTU (Remote Terminal Unit) shall be installed by the Customer to gather accumulated and instantaneous data to be telemetered to a specified Company control center. The Company shall approve the RTU and its configuration. Instantaneous analog Watt flow and VAR flow information and breaker/switch status must be telemetered directly to the Company's Distribution Operations Center. These signals will display the current status of the generation facility. Additionally, these signals will be used as input to the Company's control center computer system. These inputs could assist the Company in making decisions on economic dispatch for optimum system operation. Additional programs within the control center computer system will use the input data to assist in numerous other areas of system operation, such as load forecasting, generation scheduling and maintenance, contingency analysis, and training.

Voice communication requires local Person of Contact for Customer's System.

Aggregate Generation Facility Size	Real Time Telemetering	Voice
1 MVA and above, but below 10 MVA	**X***	**X****
10 MVA to 20 MVA	**X**	**X**

***** Centralized RTU or equivalent successor with cellular or wireless communication system allowed.

** Voice communication limited to remote designated Person of Contact for Customer System.

These interconnected facilities must comply with the Company's telemetry requirements to be properly integrated into the Company communication and control systems.

Case 7 will always require the Customer to install telemetering as described in Section 3.39(2)(B) above regardless of the size of the generator.

Telemetry Requirements Summary

<table>
<tr><th>Generator Size and Type</th><th>Data Acquisition Requirement</th></tr>
<tr><td>less than 1 MVA</td><td>No remote telemetry is required</td></tr>
<tr><td>1 MVA and above, but below 10 MVA</td><td>Wireless real-time telemetry for total generation. Note: Load data and hosting capacity limitations evaluation may recommend specific requirements.<table><tr><td>Volts</td><td>Amps</td></tr><tr><td>Watts</td><td>VARs</td></tr><tr><td>Line Voltage</td><td>GOB Status</td></tr></table></td></tr>
<tr><td>10 MVA to 20 MVA</td><td>Real-time (SCADA) telemetry for each individual generating unit 1 MVA and greater along with the following:<table><tr><td>Volts</td><td>Amps</td></tr><tr><td>Watts</td><td>VARs</td></tr><tr><td>Line Voltage</td><td>Individual GOB Status along with any single isolation breaker, switch, reclosure, etc.</td></tr></table></td></tr>
</table>

3.40 Metering Requirements

A bidirectional meter shall be applied for an interconnection less than 300 KVA unless specified by a Company study.

The Company has the option to install additional metering at its cost to monitor any non-Net Metered application in which a separate company standard meter shall monitor any connected load supplied from the Company's Distribution

System and distributed generation independently. The generator step-up transformer losses will be the Customer's responsibility; therefore, the metering shall be at the distribution voltage level.

3.41 Design Requirements

Many design requirements that the Customer must satisfy are common to all generator types. The common requirements include the disconnect switch, industry certification standards, industry power quality standards, voltage response tables, etc.

3.41.1 Distribution Circuit Models

The importance of the accuracy of the system model cannot be overemphasized; the more closely a system model represents an actual system, the more accurate the analysis. The system model should include both the distribution circuit configuration details and interconnected DER attributes.

3.41.2 Summary of Protective Function Requirements

The size, type, and expected operation of the Customer's generator dictates many of the functional requirements. The functions summarized below list the minimum protection requirements:

- an over-voltage trip,
- an under-voltage trip,
- an over/under frequency trip,
- a loss of phase trip,
- an unintentional islanding trip,
- Either a ground over-voltage or over-current trip relay scheme depending on the grounding system as specified by the Company.
- Requirements will be investigated based under minimum feeder load circumstances. This investigation may alter the requirements.
- For generating facilities under Case 3 that are operating under a testing protocol in which the exported power exceeds the minimum daytime loading or 50% loading of the connected distribution feeder circuit, a reverse power-sensing scheme is also required within the generator controls and/or external company owned device along with a direct transfer trip protection from the feeder breaker.

3.41.3 Facilities with Parallel Generation Under 300 KVA

Connecting Small Electric Generators to the Company Distribution System under 300 KVA.

- Applications 15 KVA and under would receive direct approval based on the hosting capacity of the interconnected transformer.

- Applications greater than 15 KVA and under 300 KVA would receive a Feasibility Study to evaluate the impact based on the available hosting capacity from previous interconnections.

3.41.4 Facilities with Parallel Generation 300 KVA to 20 MVA

Whenever possible, generators greater than 3 MVA should be constructed in blocks that support the use of generally available 2 or 3 MVA transformers while minimizing transformer energization inrush. Using such transformers would help mitigate total system outages during sectionalized outages taken to support maintenance. Although transformer standardization is recommended for all generators interconnected to the Company's Distribution System, this is a requirement for all Company-owned equipment (including equipment managed under partnership agreements) unless the System Impact Study or Facilities Study identifies otherwise.

A. Facilities Rated 300 KVA to Below 10 MVA

Power quality monitoring shall be included with all interconnect applications via a Company-approved device or direct telemetry from the generator. A remotely operated PCC Recloser may be required based on evaluation/study requirements for appropriate system protection and coordination. A Direct Transfer Trip (DTT) System to support a backup function for the latest version of IEEE 1547 automatic loss of grid/unintentional islanding detection features may be required based on evaluation/study requirements for ground fault overvoltage and unintentional islanding.

B. Facilities Rated 10 MVA and Above

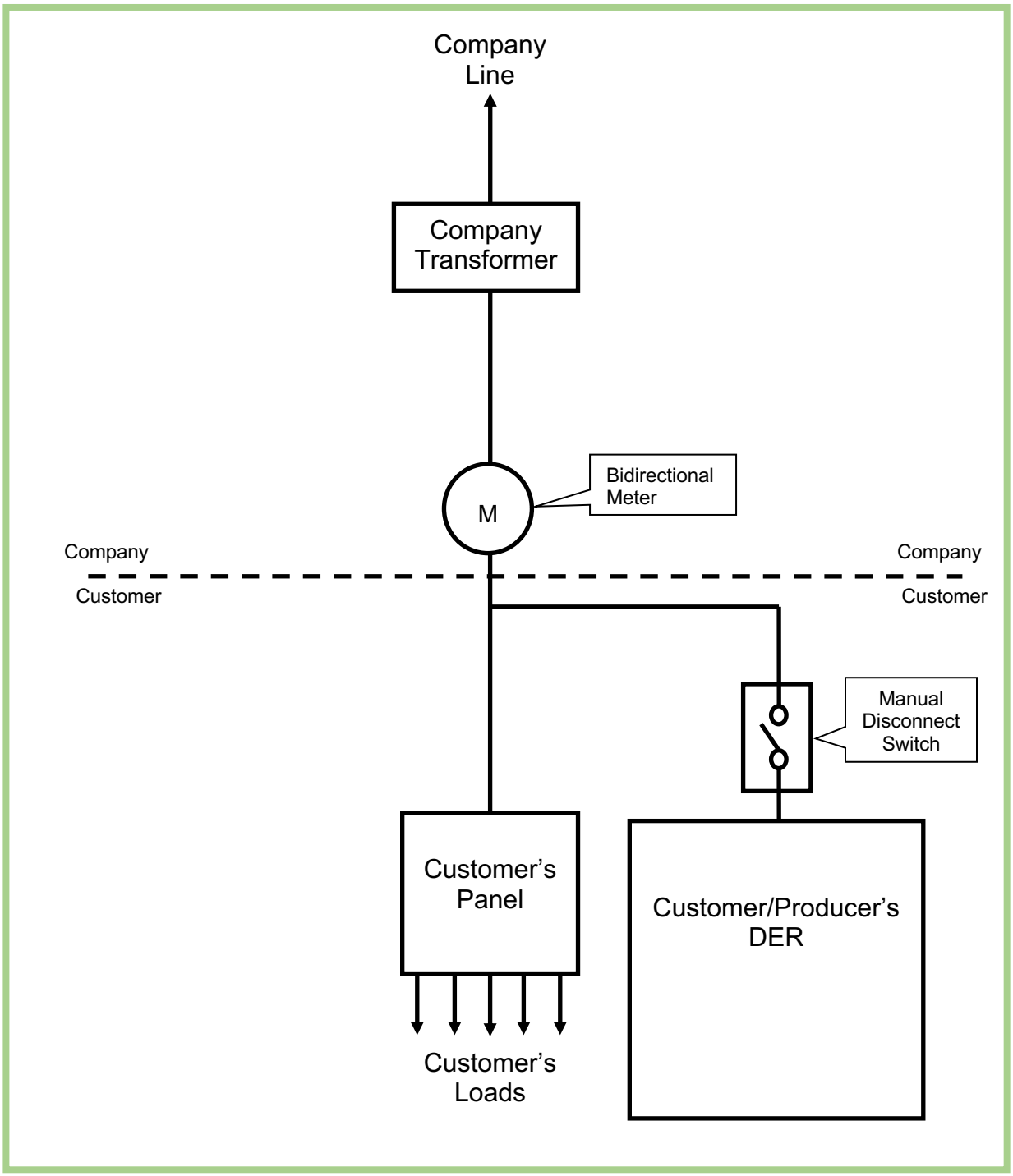
In addition to the above requirements, these facilities must include constant communication with the Distribution Operation Control Center and/or Distributed Energy Resource Management System (DERMS) along with any necessary Direct Transfer Trip (DTT) support requirements.

Also, to prevent protective feature isolations/trips of the Company's Distribution System upon transformer energizations, large generator (or DER) interconnections shall be sectionalized to limited initial transformer energization to a maximum of 10 MVA. Switchgear, manual gang switches, or a similar three-phase simultaneous switching device should be used to support these restricted transformer inrush limitations. This would also eliminate total system outages during sectionalized outages to support maintenance.

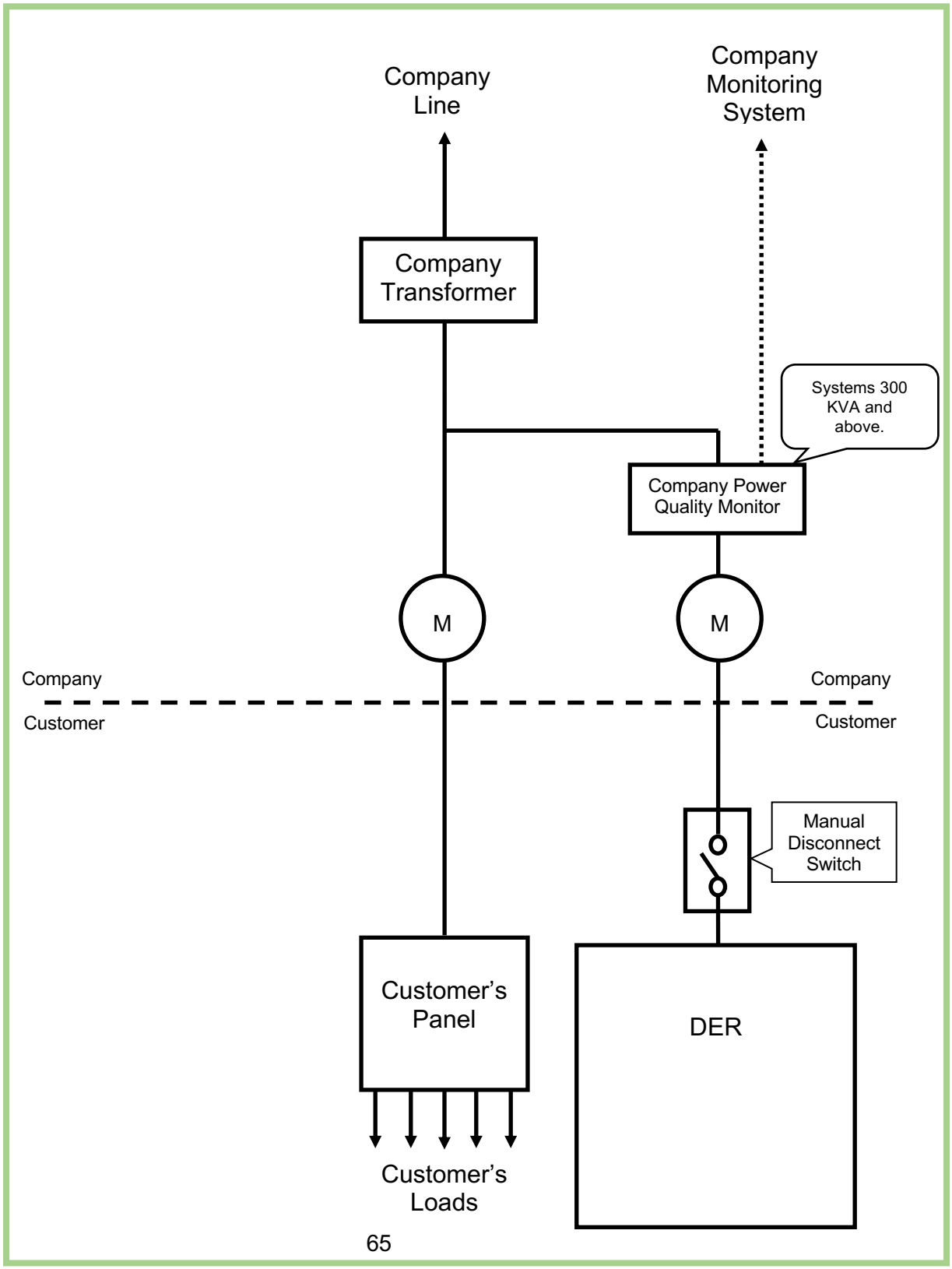
3.42 Examples for Distribution-Level Interconnections

The following categories for distribution-level interconnections exist for generators that are allowed to electrically parallel with the electrical power system through a single point of interconnection. Typical installations:

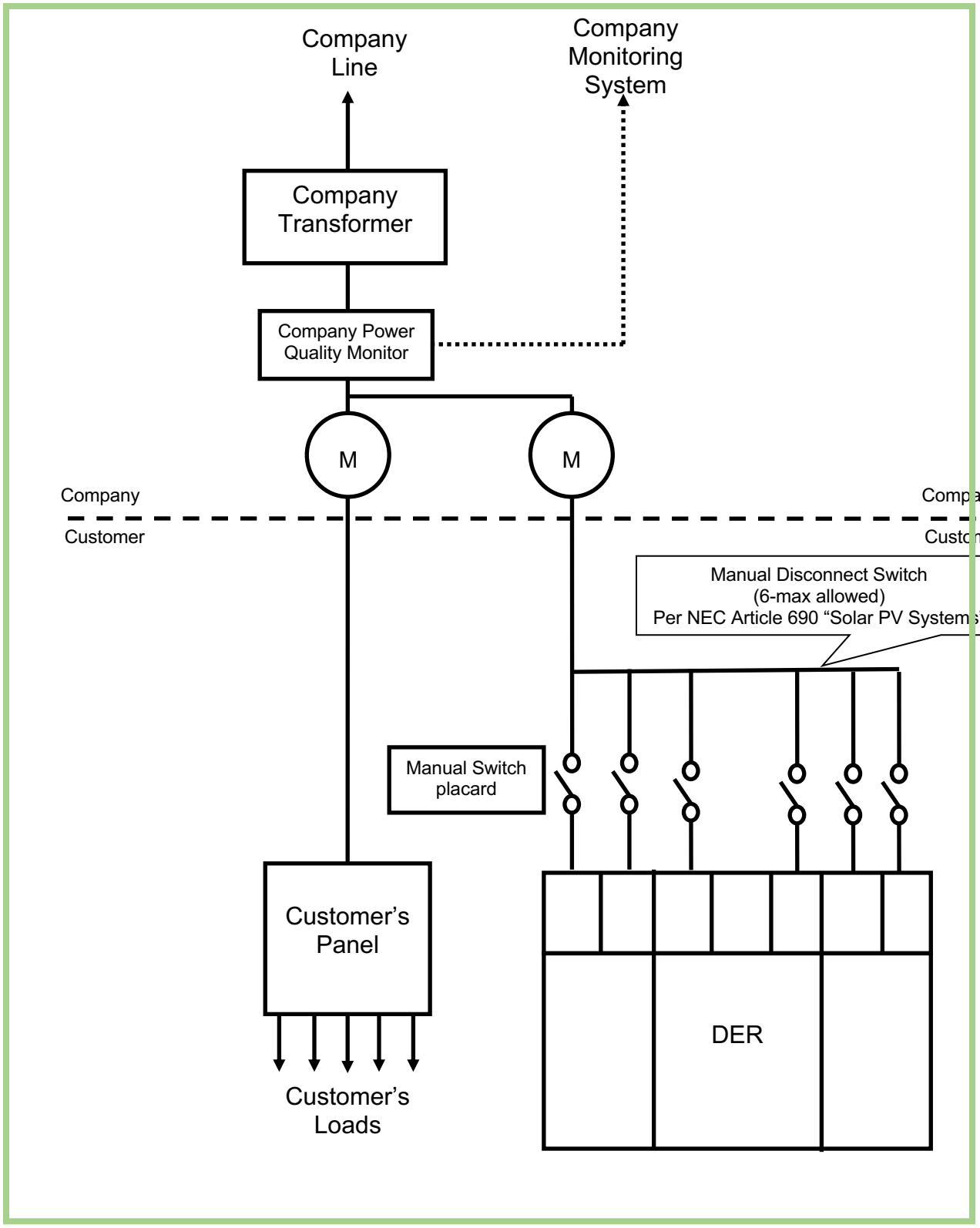
Example 1: Parallel Generation Under 300 KVA



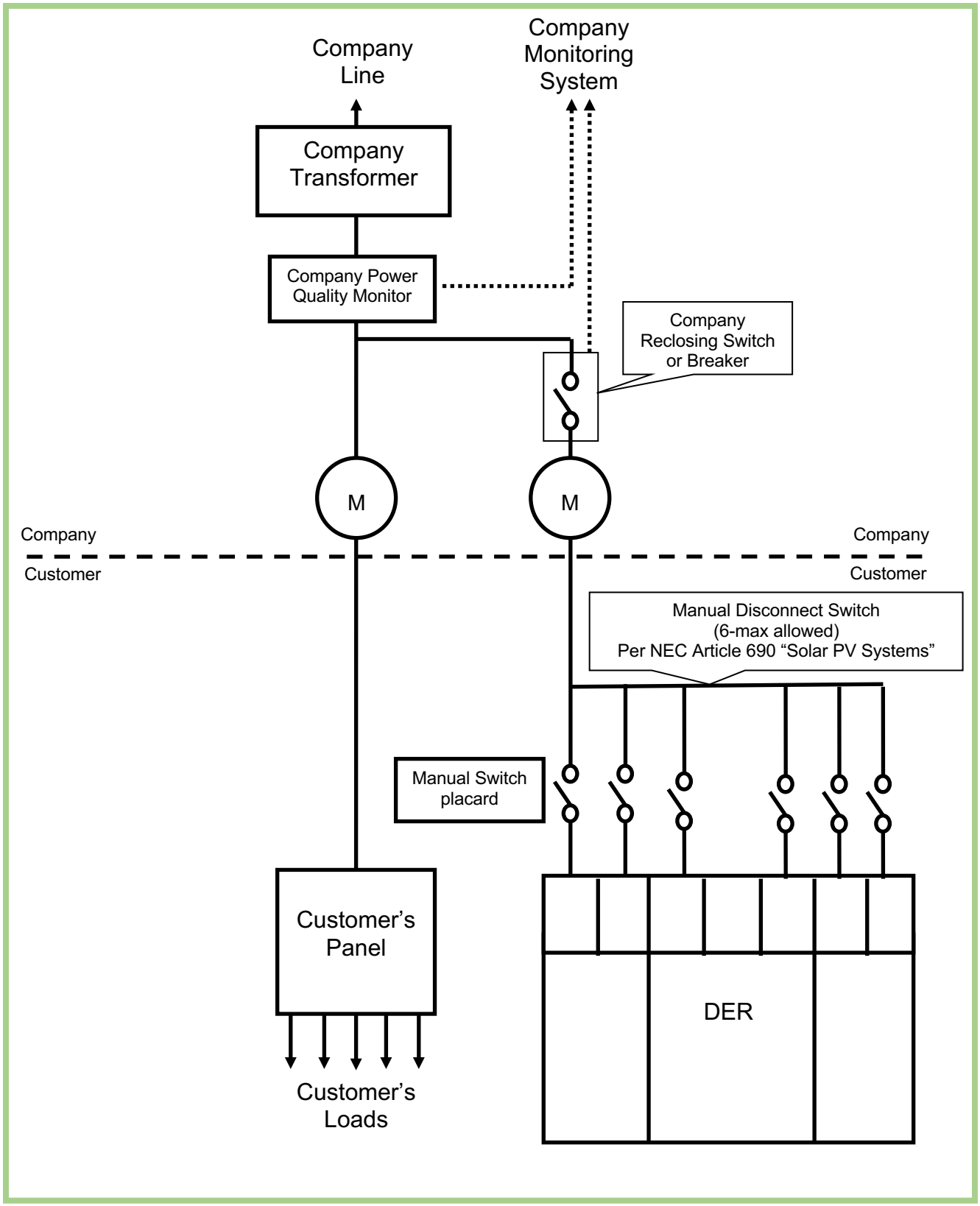
Example 2: Interconnection using existing transformer with single generation sources.



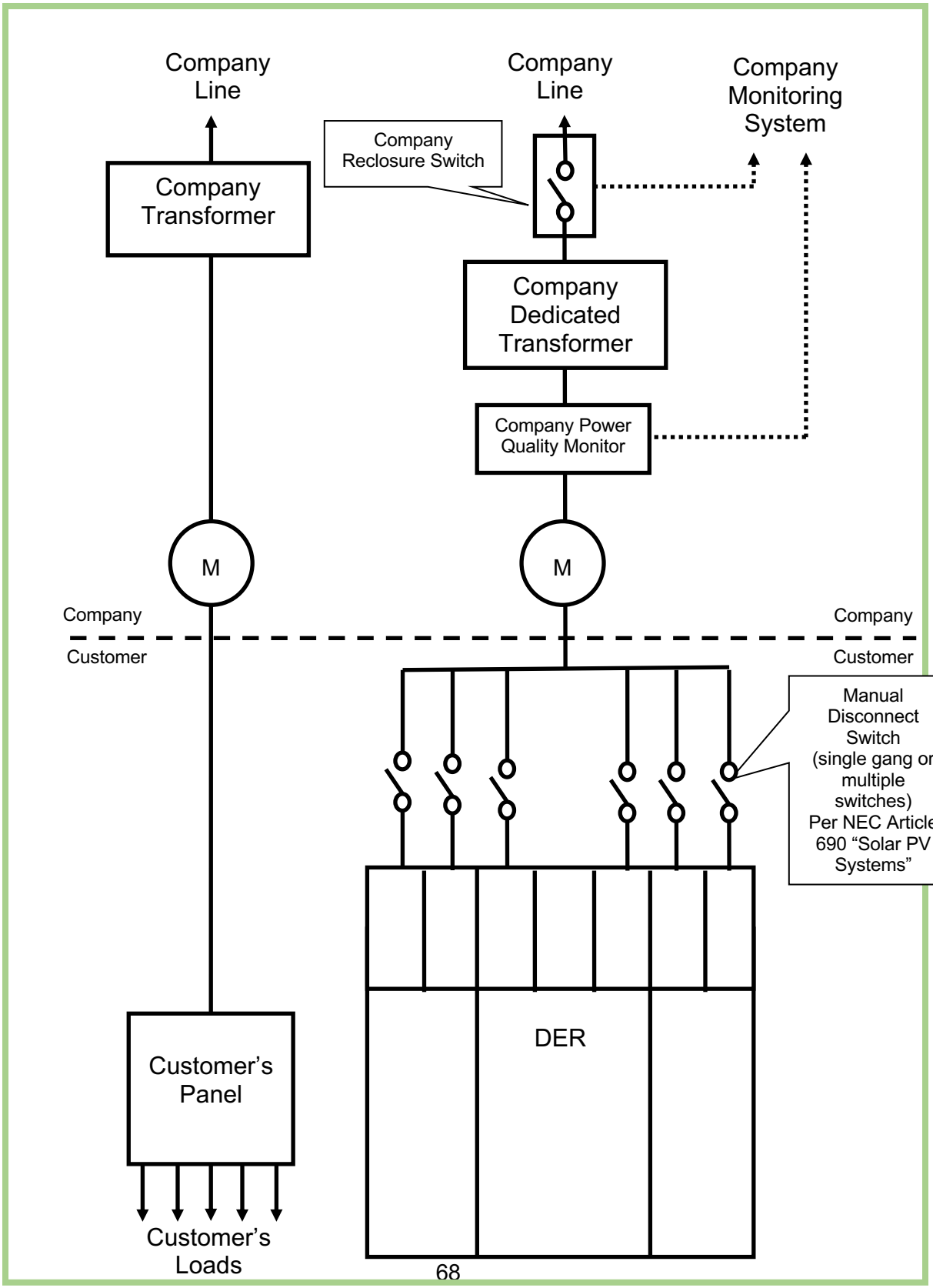
Example 3: Large commercial parallel generation with multiple generation sources.



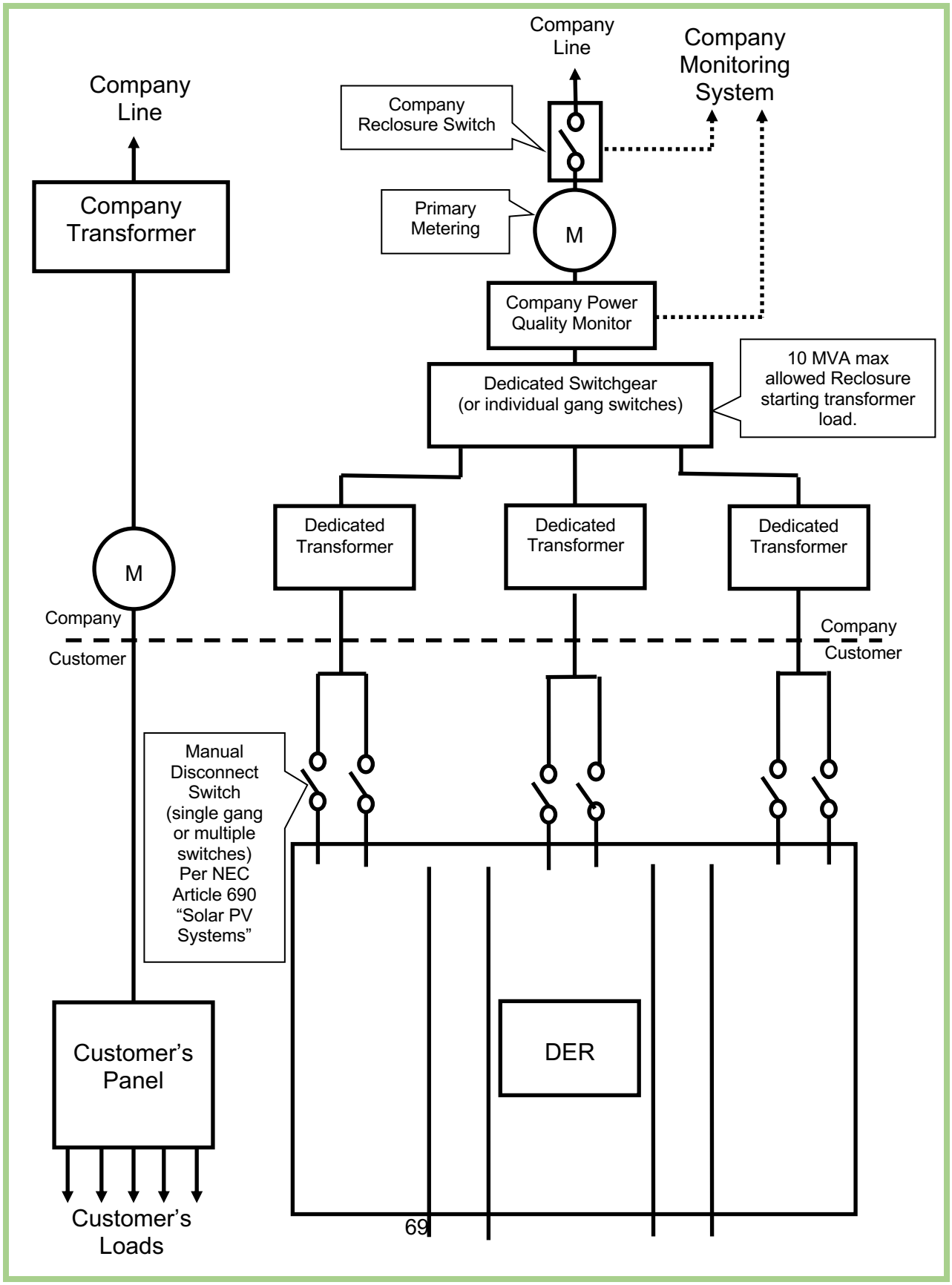
Example 4: Large commercial parallel generation with remote isolation device.



Example 5: Large commercial parallel generation with dedicated transformer



Example 6: Large commercial parallel generation greater than 10 MVA Up to 20 MVA with dedicated transformers



3.43 Tests of the Customer's Equipment

The Company reserves the right, but has no responsibility either actual or implied, to observe the Customer's tests and/or inspection of any of the Customer's protective equipment that is essential to the interconnection, including relays, circuit breakers, protective devices, and related equipment. Inspection shall include simulated test tripping of the Customer's interconnection breakers by the protective relays to verify all protective set points and relay/breaker trip timing prior to connection to the Company's Distribution System.

Unless a different time is otherwise prescribed by a Retail Regulator, the Customer shall provide the Company with notice at least two weeks before the initial energizing and start-up testing of the Customer's generating equipment so that the Company may witness the testing of any equipment and protective systems associated with the interconnection.

3.44 Pre-parallel Testing

Commissioning testing, where required, will be performed on-site to verify protective settings and functionality. Upon initial Parallel Operation of a generator, or anytime interface hardware or software is changed that may affect the functions listed below, a commissioning test must be performed. Individual qualified in-testing protective equipment (professional engineer, factory-certified technician, or licensed electrician with experience in testing protective equipment) must perform commissioning testing in accordance with the manufacturer's recommended test procedure to verify the settings and requirements per this standard.

The Company may require that a written commissioning test procedure be submitted at least 10 working days prior to the performance of the commissioning test. The Company has the right, but not obligation, to witness any commissioning test. The Company may also require written certification by the installer describing which tests were performed and their results. Protective Functions to be tested during commissioning, particularly with respect to non-Certified Equipment, may consist of the following:

- Over and under voltage (IEEE Devices 27 and 47)
- Company Distribution System fault detection / Short Circuit Protection (Devices 51 or 67, 51-Neutral or 59-Ground)
- Over and under frequency (Device 81 Over and Under)
- Loss of Phase (Devices 27 or 47, 87)
- Anti-Islanding Function (Device 27/59, 81O, 81U)
- Non-Export Function (if applicable) (Device 46 and/or 67 or 32)

- Inability to energize deadline (Device 27)
- Time delay on restart after utility source is stable (Devices 2, 24, 27, 81, 87)
- Synchronizing controls (if applicable) (Devices 25 and 78)
- Breaker Closing/Reclosing Control (Devices 25, 47/79)
- Other Interconnection Protective Functions that may be required as part of the Interconnection Agreement

Commissioning testing shall include visual inspections of the interconnection equipment and protective settings to confirm compliance with the interconnection requirements. Other checks and tests that may need to be performed include:

- Verifying final Protective Function settings
- Trip test
- In-service test

3.44.1 Certified Equipment

A generator qualifying for interconnection must incorporate UL Certified Equipment that has, at a minimum, passed the commissioning tests described in this standard and judged to have little or no potential impact on the Company's distribution system. For such generators, it is necessary to perform the following tests:

1) Protective Function settings that have been changed after commissioning testing will require field verification. Tests shall be performed using injected secondary frequencies, voltages and currents, applied waveforms, a test connection using a generator to simulate abnormal utility voltage or frequency, or varying the set points to show that the device trips at the measured (actual) utility voltage or frequency.

2) The non-exporting function shall be checked using secondary injection techniques. This function may also be tested by adjusting the generator output and local loads to verify that the applicable non-exporting criteria (i.e., reverse power or under power) are met.

The Feasibility Study and/or a System Impact Study may impose additional components or additional testing.

3.44.2 Non-Certified Equipment

Non-Certified Equipment shall be subject to the appropriate tests and any additional requirements as well as those described above. With the Company's approval, these tests may be performed in the factory, in the field as part of commissioning, or a combination of both. The Company, at its discretion, may also approve a reduced set of tests for a particular generator or, for example, if it determines it has sufficient experience with the equipment.

3.44.3 Verification of Settings

At the completion of commissioning testing, the Customer shall confirm all devices are set to Company-approved settings. Verification shall be documented in the commissioning test documentation.

3.45 Requirements for Commercial (Parallel) Operation

A Customer's generator and Interconnection Facilities shall be reasonably accessible to Company personnel as necessary for Company to perform its duties and exercise its rights in accordance with the Interconnection Agreement between Company and Customer.

Customer shall operate and maintain its generator and Interconnection Facilities in accordance with electrical practices and shall maintain compliance with approved Interconnection Agreement.

The Company may limit the operation, disconnect, or require the disconnection of a Customer's generator from the Company's Distribution System at any time, with or without notice, in the event of an emergency, or to correct unsafe operating conditions. In accordance with the Interconnection Agreement, the Company may also limit the operation, disconnect, or require the disconnection of Customer's generator from the Company's Distribution System upon the provision of reasonable written notice:

1) To allow for routine maintenance, repairs or modifications to the Company's distribution system;
2) Upon the Company's determination that a Customer's generator is not in compliance with this Standard and any applicable tariffs or rules that apply to the interconnection; or
3) Upon termination of the Interconnection Agreement.

Upon the Customer's written request, the Company shall provide a written explanation of the reason for such curtailment or disconnection.

3.46 Responsibility for Customer's Operations

The Company is not responsible for proper operations of the Customer's generation facilities connected to the Company's Distribution System.

3.47 Load Shed Responsibilities

If the Customer's generator drops offline in which an automatic load shed scheme is required, the Customer at this point shall shed the agreed upon load within 10 cycles of the generator dropping offline to prevent this additional load exceeding the available capacity of or causes excessive voltage sag on the distribution circuit. Such requirements shall be noted in the Interconnection Agreement and communicated to the appropriate Company's planning engineering organization.

For a Customer whose generator operations are described by Case 2, Case 3, or Case 4, and who also has a contract with the Company for stand-by or maintenance power, arrangements should be made in the design of the Customer's system to allow for load shed under emergency conditions on the Distribution System.

3.48 Reconnection to Distribution Delivery System

The Company may require the Customer to wait up to five minutes to reconnect after the Company's Distribution System voltage and frequency return to normal range and the system is stabilized. Consult the Company for details. (IEEE 1547 latest version)

3.49 Disconnecting Service to a Customer Facility

The Interconnection Agreement, tariffs, and applicable policies and procedures, including those of the Company's Retail Regulator, may state criteria for disconnection of Customer facilities which are interconnected to the Company's Distribution System. In general, Customer facilities may be curtailed or disconnected in emergency situations and/or if the Company determines that their continued operation creates a threat to personnel or the Distribution System.

3.50 Responsibility for Customer Maintenance

The Customer bears the sole responsibility for maintaining its electrical equipment. The Customer will maintain records of such maintenance activities, which the Company may review at reasonable times upon request.

For any generator greater than 300 KVA, a log of generator operations shall be kept by the Customer. At a minimum, the log shall include the date, generator time on, and generator time off, and megawatt and megaVAR output. Maintenance records should be made available for the Company's inspection upon request. The Company reserves the right to inspect the records but has no responsibilities for maintenance either actual or implied.

3.51 Alterations to Existing Service

The Company's facilities, including meters, transformers, and other equipment, are sized and installed to satisfy the Customer's requirements at the time service is initiated and are based on information supplied by the Customer. Consulting with the Company regarding any change in the Customer's requirements is required. It is essential that the Customer give adequate prior notice to the Company of any substantial additional load or capacity (e.g., a large motor or generator) that is to be connected to the Company's Distribution System. The Customer should not proceed to make these additions until after the Company has notified the Customer that it can either supply the increased load or the conditions under which the increased load or capacity can be accommodated. The Company is not liable for any damages incurred by the Customer connecting additional equipment without notice to the Company.

3.52 SYSTEM CHANGES

3.52.1 Company Changes to Distribution System

The Company's Distribution System is a dynamic and changing system. If the Company changes the distribution voltage that serves the Customer's location, the Customer will be responsible for paying for all modifications of its equipment that may be required for reconnecting to the Company's reconfigured Distribution System.

3.52.2 Customer Changes to Interconnection

The Customer shall notify the Company to obtain prior approval for any proposed modifications to the interconnecting scheme. This includes equipment and software/firmware updates.

3.53 PERIODIC TESTING

Per the latest version of IEEE-1547, periodic tests shall be performed according to a scheduled time period or other criteria to confirm the performance of any interconnected device or combination of devices forming a system. Unless otherwise specified, periodic testing for generators exporting 300 KVA or greater shall be required with a maximum interval between tests of 5 years. A log of the testing results shall be kept. All test results shall be submitted and added to the log within 30 days following the performance test. The log shall be made available to the Company upon request.

Periodic test requirements and intervals for all interconnection-related Protective Functions and any associated batteries shall be provided by equipment manufacturers or Company personnel.

Reverification of conformance with the interconnection and interoperability requirements of this Standard may be required when any of the following events occur:

- Functional software or firmware changes have been made.
- Any hardware component of the generator has been modified in the field or has been replaced or repaired with parts that are not substitutive components compliant with this Standard.
- Protection settings have been changed after factory testing.
- Protective Functions have been adjusted after the initial commissioning test process.

3.54 PENALTY FOR INTERCONNECTING WITHOUT COMPANY AUTHORIZATION

A Customer who interconnects a generator without the Company's prior written authorization will be: (1) liable and responsible for all damages (including any and all third-party damages) and expenses (including all legal fees) that result; (2) responsible for all of the Company's incurred expenses to ensure the safety and reliability of the Company’s Distribution System caused by the unauthorized interconnection of the Customer's generator; and (3) subject to surcharges or other penalties as permitted by the Company’s Retail Regulator.

4.0 References

- IEEE 1547-2018 Standard for Interconnecting and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
- UL 1741-SA
- California Rule 21
- Connecting Small Electric Generators to the Entergy Distribution System (less than 300kVA) (Latest Edition), Entergy Standard Number DR0702 (superseded by this Revision 17 of DR07-01)
- Connecting Large Electric Generators to the Entergy Distribution System (300kVA to 20MVA) (Latest Edition), Entergy Standard Number DR0701 (superseded by this Revision 17 of DR07-01)
- Distribution Inter-Connection Process (Latest Edition), Entergy Standard Number DR0703 (superseded by this Revision 17 of DR07-01)
- Distributed Generation Standards for Inter-Connection (Latest Edition), Entergy Standard Number DR0705 (superseded by this Revision 17 of DR07-01)
- Entergy Customer Installation Standards for Electric Service (Latest edition)
- Entergy Power Quality Standards for Electric Service, latest edition
- Midcontinent Independent System Operator, Inc. Open Access Transmission Tariff (OATT), latest version
- Operating Company Interconnection Agreements
- Applicable Retail Regulator rules, policies, and procedures
- MISO Guideline for IEEE Std 1547-2018 Implementation, November 2019
- MISO BPM 015 – Generation Interconnection

5.0 Responsibilities

5.1 Interpretation

Interpretation of this document is the responsibility of the Manager of Standards & Engineering Services or the Manager's designee with concurrence of the Asset Planning Department, the Distribution Business Department, and other Company personnel.

5.2 Deviation

The Manager of Standards & Engineering Services is responsible for ensuring that this document is written in accordance with federal, state, and national code requirements as well as consideration of applicable Retail Regulator rules, policies, and procedures. Any requested deviations must be reported to the Manager of Standards & Engineering Services to be considered for inclusion in this document.

In the event requirements for a specific design, configuration, or type of equipment are not set forth in this document, the Customer may interconnect using mutually-agreed upon technical standards, as authorized by the Manager of Standards & Engineering Services and Company personnel. Deviation from this document may be made only with the consent of the Manager of Standards & Engineering Services or the

Manager's designee in consultation with Company personnel. No other employee is granted independent authority to grant deviations.