

DEFINITION OF TERMS

Acronyms

AES	Alternative Energy Suppliers
ANSI	American National Standards Institute
CT	Current Transformer, <i>also</i> Combustion Turbine
DG*	Distributed Generation
DR*	Distributed Resources
EPS*	Electric Power System
FERC	Federal Energy Regulatory Commission
IEEE	Institute of Electrical Electronic Engineers
IHD	Individual Harmonic Distortion
IPP	Independent Power Producers
MAPP	Mid-Continental Area Power Pool
MISO	Midwest Independent System Operator
NARUC	National Association of Regulatory Utility Commissioners
NEC	National Electric Code
NERC	National Electric Reliability Council
OATT	Open Access Transmission Tariff
PCC*	Point of Common Coupling
PURPA	Public Utilities Regulatory Policy Act
QF	Qualifying Facility
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
UL	Underwriters Laboratories
VT	Voltage Transformer

*Defined in the document

Terms and Definitions

The following are key terms used in the document, defined in context with the Filing. These definitions are not intended to be widely encompassing, but rather provide context on the use of a particular term here.

Accessible, Visible and Lockable Disconnect Device: A switching device that may be either opened or closed to either isolate or connect the generator and the utility service. It shall be of the appropriate voltage, basic insulation level and current ratings with a visual break of all the poles of the interconnection except the neutral. Visual means the openings between the blades must be clearly seen, without the use of special equipment. It must be accessible at all times to utility personnel and capable of being locked in the open position.

Alternative Energy Suppliers (AES): A supplier of energy that is not the company providing the distribution and transmission services to the customer.

Automatic Transfer Switch/Closed Transition: A switching device that functions using a make-before-break scheme when a customer's source of power is transferred from source 1 to source 2 and vice versa while momentarily connecting the two sources together. The customers' load is not interrupted during the transfer process.

Mechanically Interlocked: A transfer switch which has a mechanical interlock between the generation switch and the utility switch which physically prevents both switches from being closed at the same time.

Check Relaying: A procedure where a device operates in response to the position of a number of other devices, or to a number of predetermined conditions, to allow an operating sequence to proceed, to stop, or to provide a check of the position of these devices.

Closed Transition [Make-Before-Break] Transfer Switch: A device that uses a mode of operation in which the source of distributed generation is operated in parallel with the utility system for a brief period of time, to ensure that the load is maintained while being transferred from the utility to the generator or vice versa.

Co-generation: The concurrent production of electricity and heat, steam or useful work from the same fuel source.

Combustion Turbine (CT): A rotating device that is fueled by oil or gas to produce a rotating motion, which is used to drive an electric generator.

Continuous Parallel Grid Operation: A process where the distributed generation is constantly in parallel with the electric power system.

Current Transformer (CT): A device employing the principle of mutual induction to convert current in a primary circuit into variations of current in a secondary circuit intended for metering, protective, or control purposes.

Customer: An entity that is interconnected to the utility system for the purpose of receiving or exporting electric power from or to the Area Electrical System.

Direct/Indirect Costs: Direct costs are specifically identified with a particular project or activity, including salaries, travel, equipment and supplies directly benefiting a project or activity. Indirect costs are incurred by an organization for common or joint objectives, and which cannot be identified specifically with a particular activity or project.

Distributed Generation (DG)*: Electrical generation facilities of 10 MW of capacity or less connected to a utility through a Point of Common Coupling. A subset of Distributed Resources.

Distributed Resources (DR)*: Sources of electric power that are not directly connected to the bulk power transmission system. Distributed Resources include both generators and energy storage technologies.

Electric Power System (EPS)*: Facilities that deliver electric power to a load. The EPS includes both the Area and Local Electric Power Systems.

Electric Power System-Area*: An electric power system (EPS) that serves Local EPS's. Note: Typically an area EPS normally has primary access to public rights-of-way priority crossings of property boundaries, etc., and is subject to regulatory oversight. [Referred to as "utility" or "utility system" in the document.]

Electric Power System-Local*: An electric power system contained entirely within a single premises or group of premises. [Referred to as "customer" or "customer system" in this document.]

Federal Energy Regulatory Commission (FERC): An independent body within the Department of Energy regulating interstate transmission, prices of electricity and natural gas. The organization also licenses hydroelectric projects, interconnections, construction work in progress, rates for wholesale customers, utility accounting practices and procedures.

Voltage Flicker: A fluctuation in system potential that can result in observable changes in electric lamp illumination levels.

Generation*: Any device producing electrical energy, i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, etc.; or any other electric producing device, including energy storage technologies.

Generation System*: The interconnected Distributed Generation(s), controls, relays, switches, breakers, transformers and associated wiring and cables.

Individual Voltage Distortion (IHD): An individual harmonic voltage, apparent in waveform, other than the fundamental component of sinusoidal wave. The combination of the individual harmonics contributes to the total voltage distortion.

Independent Power Producer (IPP): Any person or entity, independent of a utility, which produces electric energy for commercial purposes.

Interconnection: The physical plant and equipment required to facilitate the transfer of electric energy between two or more entities.

Internal Combustion Engine: Any reciprocating engine in which a fuel-air mixture is burned in the engine proper so that the hot gaseous products of combustion act directly on the surfaces of its moving parts such as those of pistons.

Inverter Connection-Continuous Parallel: A continuous connection between a direct current machine, device, or system and the alternating current utility system.

Isolated Operation*: The procedure where the distributed generation unit is not operated in parallel with the Area EPS.

Marginal/Incremental Costs: The change in costs for serving any additional demand, volume, or customers over or beyond a previous pattern.

Mid-Continental Area Power Pool (MAPP): An association of electric utilities and other electric industry participants in the Upper Midwest with various responsibilities including planning for power availability by coordinating power exchanges between members such as investor-owned companies, municipal systems, rural cooperatives, and the federal Missouri Basin hydroelectric system.

Midwest Independent System Operator (MISO): A non-profit organization that serves the electrical transmission needs of much of the Midwest.

Momentary Parallel Grid Operation*: The process ranging from a few seconds up to a few minutes to facilitate the transfer of customer load from the Area EPS to the distributed generation unit or vice versa.

Monitoring: The local or remote metering or status indication of electrical, mechanical, or physical properties of the utility or distributed generation system.

Net billing: Billing for the excess of energy supplied by the utility above energy supplied by a customer with distributed generation during each billing period according to the utility's applicable rate schedule.

Net metering: Measuring, through more than one meter or metering element, the energy supplied by the utility and a customer's distributed generation facility.

Pure Net Metering: Measuring through one meter the net difference between energy supplied by the utility and a customer's distributed generation facility.

Open Transition [Break-Before-Make] Transfer Switch: A switching device designed to first disconnect the customer's system from the distribution system and then connect the customer's load to the source of distributed generation or vice versa.

Operating Limits: The electrical, mechanical, or physical range where a device or system performs its intended operations.

P-1547 (IEEE Draft Standard): The currently unapproved draft of the IEEE working group that focuses on establishing the criteria and requirements for interconnection of distributed resources with electric power systems.

Point of Common Coupling (PCC) *: The point where a Local EPS is connected to an Area EPS.

Pre-Certified: Equipment that has previously been tested to meet a certain standard by a Commission-approved testing organization or facility that is eligible for implementation without further review of the design by the facility.

Qualifying Facility (QF): A cogeneration or small power production facility which satisfies the conditions established in Code of Federal Regulations, title 18, section 292.101 (b) (1).

Quick Open Transition [Break-Before-Make] Transfer Switch: A switching device designed to first disconnect the customer system from the distribution system and then quickly connect the customer's load to the source of distributed generation.

Service Entrance Equipment: The necessary customer equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of the utility supply conductors to a building, structure, or otherwise defined area, and intended to constitute the main control and means of cutoff of the supply.

Soft Loading Switch Gear/Limited Parallel Operation: The process where the generator is paralleled with the distribution system for a limited time (less than 120 seconds) to gradually transfer the load from the distribution system to the generator, eliminating voltage and frequency problems by softly loading and unloading the generator.

Soft Loading Transfer Switch: A device that gradually increases the load applied to the generator over a pre-determined time. Gradual acceptance of the load over a short interval avoids problems with block loading and permits the machine to operate at its most efficient level.

Supervisory Control and Data Acquisition (SCADA): A system that refers to the combination of telemetry and data acquisition. It consists of collecting information, transferring it back to a central site, carrying out necessary analysis and control, and then displaying this data on a number of operator screens. Control may be automatic or can be initiated by operator commands.

Synch-Check Relaying: The process where a verification relay functions to operate when two input voltage phasors are within predetermined limits.

Telemetry: Remote metering and/or monitoring which may include automation, using instrumentation and communication systems to display the metered parameters at a remote location.

Type Testing: A test made on a machine that is identical in all essential respects with those supplied on an order, to determine that it complies with the standard.

Utility: Any public entity that sells electricity at retail in Minnesota.

Voltage Transformer (VT): A device employing the principle of mutual induction to convert voltage in a primary circuit into variations of voltage in a secondary circuit intended for metering, protective, or control purposes. Also commonly known as potential transformer (PT).

*Defined in the document

References

Sources used for the above definitions include:

1. IEEE Standard Dictionary of Electrical and Electronics Terms, 3rd Edition; 1984.
2. Interconnection Guidelines for Parallel Operation of Customer-Owned Generation, Northern States Power Company, July 1999.
3. Draft Standard for Interconnecting Distributed Resources with Electric Power Systems, IEEE Working Group, Draft 08, 2001.
4. Minnesota Rules Chapter 7835.
5. Public Utilities Report Guide, Public Utilities Reports, Inc.
6. Distributed Generation Interconnection Guidelines for Wisconsin Electric Utilities, Wisconsin DR Interconnection Group, August 8, 2001.
7. United States Department of Energy
8. Internet Web Sites
9. 1999 National Electrical Code, NFPA.

EXHIBIT E BIBLIOGRAPHY

- 1) Federal Energy Regulatory Commission (FERC) (<http://www.ferc.gov/>)
- 2) Midwest Independent System Operator (MISO) (<http://www.midwestiso.org/>)
- 3) State of California (<http://www.energy.ca.gov/distgen/index.html>)
- 4) State of Minnesota Public Utilities Commission (<http://www.puc.state.mn.us/>)
- 5) State of New York (<http://www.dps.state.ny.us/fileroom/doc7024.pdf>)
- 6) State of Texas
(<http://www.puc.state.tx.us/rules/rulemake/21220/21220arc/111899adt.doc>)
- 7) State of Wisconsin (<http://www.wisconsinindr.org/>)

- 8) Institute of Electrical and Electronics Engineers (IEEE) (<http://www.ieee.org/>)
 - (a) “Draft Standard for Interconnecting Distributed Resources with Electric Power Systems”, P-1547 – Draft 8
 - (b) "IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems", IEEE Std. 1001, 1988.
 - (c) “IEEE Recommended Practice for Utility Interconnection of Small Wind Energy Conversion Systems”, ANSI/IEEE Std. 1021, 1988.
 - (d) "Intertie Protection of Consumer-Owned Sources of Generation, 3 MVA or Less", IEEE Publication 88 THO224-6-PWR.
 - (e) "IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems", IEEE Standard 519-1992.
 - (f) “IEEE Guide for Safety in AC Substation Grounding”, IEEE 80-1986, published by the Institute of Electrical and Electronic Engineers Inc.
 - (g) “Recommended Practice for Utility Interface of Recommended Practice for Utility Interface of Photovoltaic (PV) Photovoltaic (PV) Systems”, IEEE 929–2000, (UL 1741)

9) ANSI (<http://www.ansi.org/>)

- (a) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems - "Buff Book:", ANSI/IEEE Std. 242-1986.
- (b) "National Electrical Safety Code", ANSI C2-1993, Published by The Institute of Electrical and Electronics Engineers, Inc.
- (c) "IEEE Standard Relays and Relay Systems Associated with Electric Power Apparatus", ANSI/IEEE C37.90, 1989.
- (d) "Guide for Protective Relaying of Utility - Consumer Interconnections", ANSI/IEEE c37.95, 1988.
- (e) Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications - "Orange Book", ANSI/IEEE Std. 446-1987.
- (f) "IEEE Standard Requirements for Instrument Transformers", C-57.13-1993
- (g) "IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus", ANSI/IEEE C37.90-1989
- (h) "IEEE Guide for Protective Relaying of Utility-Consumer Interconnections", ANSI/IEEE C37.95-1989.

10) Other

- (a) National Electrical Code, National Fire Protection Association, Quincy, MA 02269, NFPA-70-1999.
- (b) OSHA Regulations (Standards –29 CFR) The control of hazardous energy (lockout/tagout). - 1910.147
- (c) OSHA Regulations (Standards – 29 CFR) Electric Power Generation, Transmission, and Distribution. - 1910.269
- (d) "IEC Standard Voltages", IEC 60038 Ed. 6.0 b:1983

11) NERC/MAPP

- (a) "Reliability Considerations for Integrating Non-Utility Generating Facilities with the Bulk Electric Systems", North American Electric Reliability Council, Princeton, NJ 8540, April 1987.

**Appendix IX
Distributed Generation Interconnection Agreement
(Generation 20 kW or less)**

THIS AGREEMENT, made and entered into this _____(date) day of _____(month), _____(year) by and between _____(the electricity provider), hereinafter called the “Company³” and _____ hereinafter called the “Applicant”.

Technical Requirements

- 1) The generating and interconnection system must be compliant with all applicable national, state, local construction and safety codes, and performance standards, as stated in the Distributed Generation Interconnection Guidelines for Wisconsin Electric Utilities, in effect at the time of signing this agreement.

The following certifies that the distributed generation system’s interconnection systems meet all applicable performance requirements (as stated in the Distributed Generation Interconnection Guidelines for Wisconsin Electric Utilities). For type tested inverters/generators, the manufacturer’s representation that the interconnection system is type tested will suffice, and no signature is required.

Signed: _____
(Licensed Electrical Contractor, Professional Engineer or Municipal Electrical Inspector⁴)
Date: _____
Name (printed): _____
Wisconsin License Number: _____
Daytime Phone: _____
Mailing Address: _____

- 2) The Applicant shall furnish and install a manual disconnect switch that has a visual break as appropriate to the voltage and current levels, as stated in the Distributed Generation Interconnection Guidelines for Wisconsin Electric Utilities, accessible to Company personnel, and capable of being locked in the open position⁵. The disconnect switch shall be clearly labeled.
- 3) The Applicant shall notify the Company of any plans for material modifications⁶ to the facilities prior to actually undertaking such modifications. The Applicant agrees not to commence any such changes until the Company has approved the plans. The Company shall indicate its written approval or rejection of proposed changes within 30 days after the receipt of the Applicant’s notice of such proposed changes.

³ The Company is defined as “ _____ ” (the electricity provider), its parent, affiliates, and subsidiary companies their officers, agents, employees, successors, insurers, contractors and assignees.

⁴ When Wisconsin has instituted a distributed generation installer certification program(s) (e.g., the Institute for Sustainable Power program) installers certified by this process will also be to certify safety, construction and performance aspects of small (i.e., 20 kW and less) distributed generation systems.

⁵ In some circumstances this requirement may be waived with utility approval.

⁶ Material modifications are defined as changing maximum output or major components of interconnection equipment.

Liability and Indemnity

- 4) The Applicant shall carry throughout the term of this Agreement a general liability insurance policy that shall provide protection against claims for damages resulting from (a) bodily injury, including wrongful death, and (b) property damage arising out of the operation of the Applicant's generation system under this agreement.

The Applicant shall maintain general liability insurance with limits of at least \$300,000 per occurrence or prove financial responsibility. If the site owner or the operator is a different party than the applicant, then they shall also maintain general liability insurance with limits of at least \$300,000 per occurrence or prove financial responsibility.

The Applicant, (Site Owner and/or Operator, if different) shall provide a Certificate of Insurance, containing 30-day notice of cancellation, evidencing the above noted coverage to be in place.

- 5) Indemnification: _____ **Company** and **Applicant** _____ each agree to defend (with counsel acceptable to the Indemnified Party), protect, indemnify and hold harmless the Indemnified Party and its directors, officers, employees, affiliates and agents from and against any and all liabilities, obligations, losses, actions, judgments, suits, claims, costs (including attorney's fees and associated costs of litigation or other form of dispute resolution), expenses, and damages of any kind, including, but not limited to direct, indirect, incidental, consequential, special, punitive, loss of profits or business interruption damages, which may be imposed on, incurred by, or asserted against the Indemnified Party or its directors, officers, employees, affiliates or agents in any manner for personal or bodily injury, death, or damage to or destruction of property resulting from, and only to the extent attributable to, the fault, action, omission, negligence (including contributory negligence), strict liability, intentional or willful tort or misconduct of the non-Indemnified Party or its directors, officers, employees, affiliates or agents relating to or arising out of performance of this Agreement by the non-Indemnified Party or its directors, officers, employees, affiliates or agents.

The duty of each Party to so indemnify the other Party under this Section 5 shall continue in full force and effect notwithstanding the expiration or termination of this Agreement with respect to any event or condition that occurred prior to such expiration or termination.

Generation System Testing

- 6) The Applicant shall notify the Company in writing before the initial energizing or start-up testing of the Applicant's generating equipment.
- 7) The Company reserves the right to witness the testing of the interconnection system⁷.
- 8) Any initial Company testing shall be completed within ten (10) business days **after applicant has notified the Company (item 6) that the generation system's installation is complete. If the Company waives their right to test the interconnected system, the**

⁷ Testing of protective systems may include procedures to functionally test all protective elements of the systems up to and including tripping of the generator and/or Point of Interconnection. An automatic shutdown test maybe implemented to ensure that the unit shuts down with the loss of Utility service. Testing may verify all protective set points and relay/breaker trip timing.

Applicant may interconnect upon notification by the Company or ten business days after the applicant notified the Company that the system's installation is complete.

Access to and Disconnection and Reconnection of Generator

- 9) The Applicant shall permit Company employees to enter his/her property at any reasonable time for the purposes of inspecting or testing his/her interconnection equipment to ensure it's continued safe and satisfactory operation and the accuracy of meters. Such inspections shall not relieve the Applicant from his/her obligation to maintain his/her equipment in safe and satisfactory operating condition
- 10) When the Company so requests, the Applicant shall discontinue parallel generation operation and the Company may isolate the parallel generation system, without notice at times that:
 - (a) The Applicant's interconnection agreement has been terminated.
 - (b) The Applicant's generation system is non-compliant with the technical requirements.
 - (c) The Company's distribution system has an emergency.
 - (d) Company's distribution system requires routine maintenance, repairs, or modifications.
 - (e) The Applicant's application and interconnection agreement has not been approved.

The Applicant's parallel generation system shall remain isolated until, in the judgement of the Company, the Applicant's system meets the contractual and technical requirements, and the Company's distribution system in functioning in a safe manner.

Governing Law

- 11) The Applicant and the Company shall abide by and be subjected to the applicable tariffs of the Company as filed with and approved by the Public Service Commission of Wisconsin (PSCW), as well as the Wisconsin Statutes and the rules and regulations of the Wisconsin Administrative Code.
- 12) The Applicant may appeal to the PSCW should any requirements for interconnection of a parallel generating system be considered excessive or unreasonable.

Amendments, Modifications or Waivers

- 13) Any amendments or modifications to this agreement shall be in writing and agreed by both parties. The failure of any party at any time or times to require performance of any provision hereof shall in no manner affect the right at a later time to enforce the same.

Terms of Agreement

- 14) This agreement shall become effective immediately upon the execution hereof and shall continue in effect until terminated by either party upon thirty (30) days prior written notice given by the other party.
- 15) This agreement shall be binding upon the personal representatives, heirs, successors and assigns of the respective parties hereto.
- 16) By signing below, the applicant certifies that the installed generating equipment is accurately described in the attached "Application Form (Generation 20 kW or less)", and agrees to all terms in this interconnection agreement.

Applicant Signature

I agree to be bound by the terms of this Interconnection Agreement, and certify that, to the best of my knowledge, all the information provided in the attached Application, including all forms and attachments, is true and correct.

Applicant: _____ date: _____
(signature)

Company Signature

I hereby acknowledge receipt and completeness of this Interconnection agreement and the attached Application Forms.

Company: _____ By: _____
(signature)

Title: _____ Date: _____

Comparison of Texas PUC and Minnesota Utilities Technical Interconnection		
Texas		
Texas Code Reference	Functional Description	MN Utilities Filing Reference ¹
25.212 (a)	Purpose	
25.212 (a) (1)	Conditional Authority (to operate) May operate 60 Hertz (Hz), three-phase or single-phase generating equipment, ... in parallel with the utility system pursuant to an interconnection agreement, provided that the equipment meets or exceeds the requirements of this section.	
25.212 (a) (2)	Special Requirements Specific interconnection locations and conditions may require the installation and use of more sophisticated protective devices and operating schemes.	
25.212 (a) (3)	Utility Notification of Special Requirements The utility may require additional devices and operating schemes, and make those additional requirements known at the time the interconnection studies are completed.	
25.212 (a) (4)	Mutually Agreed Changes The customer and utility may agree to different requirements, or a party may petition the commission for a good cause exception, after making every reasonable effort to resolve all issues between the parties.	
25.212 (b)	General Interconnection and Protection Requirements	
25.212 (b) (1)	Code Compliance Required Generation and interconnection installation must meet all applicable national, state, and local construction and safety codes.	D4.5.G&H
25.212 (b) (2)	Generator Shall Not be Connected to a De-energized Circuit Shall be equipped with protective hardware and software to prevent the generator from being connected to a utility de-energized circuit.	D4.4.D; D4.9.3.ii
25.212 (b) (3)	Generator Shall Not be Connected to an Abnormally Operating Utility Circuit Generator shall be equipped with protective hardware and software to prevent connection or parallel operation with the utility system unless the utility system service voltage and frequency is of normal magnitude.	D4.5.F
25.212 (b) (4)	Pre-Certified Equipment May be installed with an approved interconnection control and protection scheme without further review of their design by the utility. When exporting using pre-certified equipment, the protective settings and operations shall be utility specified.	D4.8.V.1

¹ MN utilities reference number Exhibit#.Page#.Section#.Sub-section#...Sub-sub-sub-sub-section#

Comparison of Texas PUC and Minnesota Utilities Technical Interconnection		
Texas		
Texas Code Reference	Functional Description	MN Utilities Filing Reference ¹
25.212 (b) (5)	Customer is Responsible for Protecting its Generating Equipment Customer's protective equipment shall prevent unnecessary tripping of the utility system breakers.	D4.5.F
25.212 (b) (6)	Communications Channel Facilities greater than two megawatts (MW) may require a customer provided communication channel between the utility and the customer's facility.	D4.12.4.i.1
25.212 (b) (7)	Adequate Interrupting Capability Circuit breakers or other interrupting devices must be capable of interrupting maximum available fault current. Facilities larger than two MW and exporting shall have a redundant circuit breaker unless listed device suitable for the rated application is used.	
25.212 (b) (8)	Manual, Accessible, Lockable Disconnect Required Customer will furnish and install a manual disconnect device that has a visual break, is accessible to the utility personnel, and capable of being locked in the open position. Customer shall follow the utility's switching, clearance, tagging, and lockout procedures.	D4.8.2.v.2; D4.9.3.A.i
25.212 (c)	Prevention of Interference Customer's generator shall meet the following criteria:	
25.212 (c) (1)	Voltage The customer will operate its generating equipment in such a manner that the voltage levels on the utility system are in the same range as if the generating equipment were not connected to the utility's system. The customer shall provide an automatic method of disconnecting the generating equipment if: a voltage deviation in excess of +5.0 % or – 10% from nominal voltage persists for more than 30 seconds, deviation in excess of +10% or –30% from nominal voltage persists for more than ten cycles. Customer may reconnect when utility system voltage and frequency return to normal range and the system is stabilized.	D4.10.3.B.ii.a
25.212 (c) (2)	Flicker Customer's equipment shall not cause excessive voltage flicker of 3.0% or greater.	D4.11.3.B.ii.d
25.212 (c) (3)	Frequency Customer's generating equipment shall not deviate more than +0.5 Hertz (Hz) or –0.7 Hz from a 60 Hz base. Customer shall automatically disconnect within 15 cycles if this frequency tolerance cannot be maintained. Customer may reconnect when voltage and frequency return to normal range and the system is stabilized.	D4.10.3.B.ii.b

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Texas Code Reference	Functional Description	MN Utilities Filing Reference ¹
25.212 (c) (4)	<p>Harmonics</p> <p>Total harmonic distortion (THD) voltage shall not exceed 5.0% of the fundamental 60 Hz frequency nor 3.0% of the fundamental frequency for any individual harmonic.</p>	D4.10.3.B.ii.c
25.212 (c) (5)	<p>Fault and Line Clearing</p> <p>Customer shall automatically disconnect within ten cycles if the voltage on one or more phases falls below - 30% of nominal voltage. This disconnect timing also ensures that the generator is disconnected prior to automatic re-close of utility breakers. Customer may reconnect when voltage and frequency return to normal range and the system is stabilized. With the utility's approval, may employ a relay scheme with delayed tripping or blocking between customer and company.</p>	D4.11.3.B.ii.e; D4.11.3.B.iii
25.212 (d)	<p>Control, Protection and Safety Equipment Requirements Specific to Single Phase Generators of 50 kilowatts (kW) or Less Connected to the Utility's System</p> <p>Exporting may require additional operational or protection devices, will require coordination of operations with the host utility. Necessary equipment include an interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and a synchronizing check.</p>	D4.14.5 all
25.212 (e)	<p>Control, protection and safety equipment requirements specific to three-phase synchronous generators, induction generators, and inverter systems.</p> <p>Exporting may require additional operational or protection devices and will require coordination of operations with the utility.</p>	D4.14.5 all
25.212 (e) (1)	<p>Three Phase Synchronous Generators</p> <p>Generator circuit breakers and three-phase devices with electronic or electromechanical control. Customer is solely responsible for properly synchronizing its generator with the utility. Excitation system response ratio shall not be less than 0.5. Generator's excitation system(s) shall conform, as near as reasonably achievable, to the field voltage versus time criteria specified in American National Standards Institute Standard C50.13-1989 in order to permit adequate field forcing during transient conditions. For generating systems greater than two MW the customer shall maintain the automatic voltage regulator (AVR) of each generating unit in service and operable at all times. If the AVR is removed from service for maintenance or repair, the utility's dispatching office shall be notified.</p>	

¹ MN utilities reference number Exhibit#.Page#.Section#.Sub-section#...Sub-sub-sub-section#

Comparison of Texas PUC and Minnesota Utilities Technical Interconnection

Texas		
Texas Code Reference	Functional Description	MN Utilities Filing Reference ¹

25.212 (e) (2)	<p>Three-Phase Induction Generators and Inverter Systems Induction generation may be connected and brought up to synchronous speed (as an induction motor) if the initial voltage drop measured on the utility system is within the visible flicker standard. Otherwise, the customer may be required to install hardware or employ other techniques to bring voltage fluctuations to acceptable levels. Line-commutated inverters do not require synchronizing equipment. Self-commutated inverters shall be used in parallel with the utility system only with synchronizing equipment. Direct-current generation shall not be operated in parallel with the utility system.</p>	
25.212 (e) (3)	<p>Protective Function Requirements The protective function requirements for three phase facilities of different size and technology are:</p>	
25.212 (e) (3) (A)	<p>Ten kilowatts (kW) or less An interconnect disconnect device, a generator disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and a manual or automatic synchronizing check.</p>	D4.14.5 all
25.212 (e) (3) (B)	<p>Facilities of 10 kW but Not More Than 500 kW An interconnect disconnect device, generator disconnect device, overvoltage trip, under-voltage trip, over/under frequency trip, manual or automatic synchronizing check, either a ground over-voltage trip or a ground over-current trip, reverse power sensing if the facility is not exporting.</p>	D4.14.5 all
25.212 (e) (3) (C)	<p>Facilities More than 500 kW but Not More than 2,000 kW An interconnect disconnect device, a generator disconnect device, overvoltage trip, under-voltage trip, over/under frequency trip, either a ground over-voltage trip or a ground over-current trip, automatic synchronizing check, reverse power sensing if the facility is not exporting.</p>	D4.14.5 all
25.212 (e) (3) (D)	<p>Facilities More than 2,000 kW but Not More than 10,000 kW An interconnect disconnect device, a generator disconnect device, over-voltage trip, under-voltage trip, over/under frequency trip, either a ground over-voltage trip or a ground over-current trip, automatic synchronizing check and AVR stand alone capability, reverse power sensing if the facility is not exporting. A telemetry/transfer trip may also be required by the company.</p>	D4.14.5 all
25.212 (f)	<p>Facilities Not Identified For a specific unit or facility are not set out in this section, the company and customer may interconnect a facility using mutually agreed upon technical standards.</p>	

¹ MN utilities reference number Exhibit#.Page#.Section#.Sub-section#...Sub-sub-sub-sub-section#

Comparison of Texas PUC and Minnesota Utilities Technical Interconnection

Texas		
Texas Code Reference	Functional Description	MN Utilities Filing Reference ¹

25.212 (g)	<p>Requirements Specific to a Facility Paralleling for Sixty Cycles or Less (closed transition switching). An interconnect disconnect device, a generator disconnect device, an automatic synchronizing check for generators with stand alone capability, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and either a ground over-voltage trip or a ground over-current trip.</p>	D4.14.5 all
25.212 (h)	<p>Inspection and Start-up Testing Customer shall provide notice at least two weeks before the initial energizing and start-up testing the utility may witness the testing customer shall revise and resubmit the application with information reflecting any proposed modification that may affect the safe and reliable operation of the utility system.</p>	D4.18.7.B
25.212 (i)	<p>Site Testing and Commissioning Testing protection systems shall include procedures to functionally test all protective elements of the system up to and including tripping of the generator and interconnection point. Testing will verify all protective set points and relay/breaker trip timing. The utility may witness the testing of installed switchgear, protection systems, and generator. The customer is responsible for routine maintenance of the generator and control and protective equipment. The customer will maintain records of such maintenance activities, which the utility may review. For generation systems greater than 500 kW, a log of generator operations shall be kept. The log shall include the date, generator time on, and generator time off, and megawatt and megavar output. The utility may review such logs at reasonable times.</p>	D4.18.7.B
25.212 (j)	<p>Metering The utility may supply, own, and maintain all necessary meters and associated equipment to record energy purchases and energy exports. Customer shall supply at no cost to the utility a suitable location on its premises for the utility's meters and other equipment. If metering at the generator is required in such applications, metering that is part of the generator control package will be considered sufficient if it meets all the measurements criteria that would be required by a separate stand alone meter.</p>	D4.12.4 all

¹ MN utilities reference number Exhibit#.Page#.Section#.Sub-section#...Sub-sub-sub-sub-section#

in Requirements
Comments

1) This language describes the purpose and application of the "Technical Requirements" and will undoubtedly be part of the final codified requirements in MN. The MN utilities are not proposing this at this time, although they are also not in disagreement with it.

See 1) above

See 1) above

See 1) above

in Requirements
Comments

The MN utilities do not have a similar provision other than the reference to meeting all applicable codes.

n Requirements
Comments

in Requirements
Comments

all

There is no counterpart to this requirement in the MN rules.

1 MN utilities reference number Exhibit#.Page#.Section#.Sub-section#...Sub-sub-sub-sub-section#

n Requirements
<p style="text-align: center;">Comments</p>

There is no counterpart to this requirement in the MN rules.

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1 MN utilities reference number Exhibit#.Page#.Section#.Sub-section#...Sub-sub-sub-sub-section#

in Requirements
Comments