

**SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR
SMALL POWER PRODUCERS OF MINNESOTA POWER
COMPANY**

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REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

Revision 4.0

Effective date: February 18, 2009

Page 1

Table of Contents:

1. AUTHORITY HAVING JURISDICTION AND APPLICABLE STANDARDS	3
2. APPLICABILITY OF THIS STANDARD	3
3. APPLICATION PROCESS.....	4
4. INTERCONNECTION STUDIES.....	6
5. INTERCONNECTION REQUIREMENTS	6
6. CLASSIFICATION OF CUSTOMER GENERATION INSTALLATIONS	8
7. PROTECTIVE DEVICES.....	9
8. PRE-PARALLEL REQUIREMENTS AND INSPECTION.....	12
9. OPERATING GUIDELINES.....	13
10. REFERENCES	14
APPENDIX A: Preliminary Application for operation of Customer-Owned Generation	1
APPENDIX B: Final Application for Parallel Operation of Customer-Owned Generation.....	1

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

Revision 4.0

Effective date: February 18, 2009

Page 2

1. AUTHORITY HAVING JURISDICTION AND APPLICABLE STANDARDS

Generator interconnections with Minnesota Power's transmission and distribution system will meet the requirements of the published standards of the Authority Having Jurisdiction (AHJ) over the interconnection. Such Authorities include, but are not limited to, the Midwest Independent System Operator (MISO), the State of Minnesota Department of Commerce (MDPC), and Minnesota Power. Each AHJ may publish interconnection standards that Minnesota Power will follow in designing the requirements for a particular interconnection request. Once the AHJ has been identified for a particular interconnection, the prospective Generator can apply directly to that authority. Alternately, the prospective Generator can submit to Minnesota Power the "Preliminary Application for Operation of Customer-Owned Generation" (appendix A) included in this standard and Minnesota Power will identify the AHJ over the proposed interconnection and advise the Generator how to proceed.

Minnesota Power is a member of the MISO, which has jurisdiction over generation interconnections that are interconnected to the bulk transmission system within any of its member utilities' control areas. This includes all interconnections at 50 kV or above. The MISO also has jurisdiction over any interconnection where the prospective Generator plans to engage in a sale for resale in interstate commerce, regardless of the interconnection voltage.

The MDPC is in the process of developing interconnection standards that are intended to have jurisdiction over small generation interconnected to the distribution systems in Minnesota. With just a few exceptions, this will include all interconnections within Minnesota Power's Minnesota control area that are not under the jurisdiction of the MISO. The MDPC interconnection standards are expected to be issued in final form sometime in 2004.

All interconnections within Minnesota Power's control area that are not under the jurisdiction of another AHJ will be under the jurisdiction of Minnesota Power and this standard will apply.

2. APPLICABILITY OF THIS STANDARD

These requirements were developed by Minnesota Power to serve as a reference for establishing MP/Customer interconnections for customers having generation equipment which is operated in parallel with the MP system. Generation equipment is defined as any device that produces electrical energy, such as rotating generators driven by steam turbines, gas or diesel engines, hydraulic turbines, windmills, photovoltaic or batteries through a DC to AC converter, or any other electrical generating device.

This document defines the minimum requirements for the safe and effective operation of this interconnection, and provides both administrative and technical guidelines to assist in establishing the interconnection in an effective and consistent manner. These requirements clarify and supplement the requirements of industry standards referenced (see "REFERENCES" below).

The generation owner will be required to pay for any change or new equipment required on the company's system due to increased fault current levels, increased load levels, increased feeder imbalance, or special operating conditions caused by the generation owner.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

Revision 4.0

Effective date: February 18, 2009

Page 3

The requirements stated in this guide are intended to achieve the following:

- Ensure the safety of the general public and MP personnel.
- Minimize the possibility of equipment damage.
- Minimize adverse operating conditions to other customers.
- Permit the customer to operate generating equipment in parallel with the Minnesota Power system in a safe and efficient manner.

In order to achieve these goals, certain protective devices must be installed to promptly disconnect the customer's generating equipment for the Minnesota Power system when a fault or abnormality occurs. The determination of what type of protective devices are required depends on three major factors:

- The type and size of the generating equipment.
- The location and voltage level of the connection to the Minnesota Power system.
- The configuration and planned operating mode method of the customer's generating equipment.

In addition to the protective devices, certain modifications and/or additions may be required to the Minnesota Power system due to the addition of the customer's generating equipment. Each request for interconnection will be handled individually, and the final determination of the protective devices, modifications, and/or additions required will be made by Minnesota Power. Minnesota Power will work with the customer to achieve an installation which meets the requirements of both the customer and Minnesota Power.

The customer is solely responsible for protecting his equipment in such a manner that faults, imbalances, reclosing, or other events on the Minnesota Power system do not cause damage to the customers equipment.

The customer is also responsible to comply with all applicable electrical and safety codes and recognized operating standards.

3. APPLICATION PROCESS

In order to process interconnection requests in an efficient and consistent manner, the following procedures will be followed:

The customer shall contact Minnesota Power and indicate the desire to operate generating equipment. A Minnesota Power representative will contact the customer to discuss the request and work with the customer to complete a "Preliminary Application for Operation of Customer-Owned Generation" (Appendix A). A preliminary one-line electrical diagram of the generating equipment and the host facility shall be developed by the customer. This diagram should include as much information as is available including generator/transformer connection & rating data. If the generating facility is connected to the Minnesota Power system at a voltage less than 46KV, this information will be forwarded to Minnesota Power's representative in distribution engineering with a copy to the Manager of System Performance. If the connection is made at a voltage of 46KV or more, the information will be forwarded to the Manager of System Performance.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

The completed application and one-line diagram will be used by Minnesota Power to perform a preliminary interconnection review. During this review, additional details of the proposed facility may be requested from the customer as needed.

A determination will be made of whether the generation will be operated in parallel with the power system. If the generation is even momentarily operated in parallel with the power system such as in a bumpless transfer, it is classified as parallel generation.

If the preliminary interconnection analysis indicates that the customer's generation is not operated in parallel with the Minnesota Power system, the installation may proceed according to the requirements of the preliminary interconnection analysis. The MP representative will work with the customer to insure that the final design cannot result in the generator being paralleled with the Minnesota Power system. Minnesota Power reserves the right to inspect the customer's facilities after the installation of the generation to insure that the design and operation of this equipment is in accordance with these requirements, the preliminary interconnection analysis and the service agreement.

If the preliminary interconnection analysis indicates that the customer's generation can be operated in parallel with the Minnesota Power system, the customer shall provide the following additional items to the Minnesota Power Customer Service Representative:

- A completed "Final Application for Parallel Operation of Customer Owned Generation" (Appendix B).
- A detailed one-line diagram of the proposed facility.
- All applicable elementary diagrams.
- Equipment specification and details of the generators, transformers, circuit breakers, protective relays, current transformers, potential transformer etc.
- All other appropriate drawings or documents necessary for the proper design of the interconnection and the proper coordination of the customer's generation with that of the Minnesota Power system.

The MP Customer Service Representative will coordinate the initiation of a Final Interconnection Study.

Upon completion of the Final Interconnection Study and approval of the "Final Application for the Parallel Operation of Customer Owned Generation" installation of the generating equipment may proceed. Any modification to the Minnesota Power system will be performed concurrently by Minnesota Power as determined by the condition of the service agreement. The customer shall inform Minnesota Power of any changes in design or schedule which may occur. Design changes which may affect the interconnection must be reviewed and approved by Minnesota Power.

Prior to the initial parallel operation of the customer's generation equipment, final approval must be obtained from Minnesota Power in order to coordinate the commissioning of the installation.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

Revision 4.0

Effective date: February 18, 2009

Page 5

4. INTERCONNECTION STUDIES

Minnesota Power will perform, at the customer's expense, the interconnection studies to determine the additions and/or modifications required to the Minnesota Power system prior to the operation of the customer's generation equipment. An interconnection study will address items such as: protective relay requirements, equipment ownership, possible equipment upgrades, right of way acquisition, and factors introduced by the proposed generation equipment on the operating conditions (voltage regulation, harmonic distortion, ampacity, changes in short circuit current, system stability, changes in line losses, effect on other customers in the area) of the Minnesota Power system. The interconnection study will be based upon the guidelines and requirements outlined in this document.

5. INTERCONNECTION REQUIREMENTS

The following requirements apply to all generating equipment operated in parallel with the Minnesota Power system. This applies to all three-phase and single-phase generators or inverter installations.

A. OPERATING LIMITS

In order to minimize objectionable and adverse operating conditions on the electric service provided to other customers on the Minnesota Power system, the customer's generating equipment shall meet the following operating criteria:

1. **VOLTAGE**

The customer's generating equipment shall not cause excessive voltage excursions. The customer shall operate their generation at a level stated in the service contract. The customer shall provide an automatic means of disconnecting his generating equipment from the Minnesota Power system within one second if nominal voltage cannot be maintained.

2. **FLICKER**

The customer shall not exceed the limitations as set forth in ANSI/IEEE standard 141-1993 as it relates to flicker.

3. **FREQUENCY**

The customer's generating equipment shall operate at 60Hz. The customer shall provide an automatic method of disconnecting his generating equipment from the Minnesota Power system within 0.2 seconds if synchronism is lost.

4. **POWER FACTOR**

The customer's load, in conjunction with his generating equipment, shall have a power factor within the range as determined by the interconnection study and applicable operating contracts.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

5. HARMONICS

The customer's equipment shall not introduce excessive distortion into the Minnesota Power voltage or current wave forms. The harmonic distortion as measured at the point of interconnection between the customer and Minnesota Power's system shall meet the specifications of the current version of IEEE standard 519.

B. ISOLATION TRANSFORMER

In order to provide the maximum operating flexibility for the customer's generation and to minimize possible adverse effects on other Minnesota Power customers, a power transformer is usually required between the customer's generation equipment and Minnesota Power owned equipment. This transformer is usually connected in such a manner as to isolate the zero sequence circuit of the customer from the zero sequence circuit of Minnesota Power. The final interconnection study will determine the transformer connection and grounding configuration required, and whether a dedicated transformer will be required to serve the customer. Upgrading of Minnesota Power's transformer insulation levels and lightning arrestors to a higher voltage may be required due to the addition of the customer's generating equipment.

C. ENERGIZATION OF MINNESOTA POWER EQUIPMENT BY THE CUSTOMER

The customer shall not energize a de-energized Minnesota Power circuit. The necessary control devices shall be installed by the customer to prevent the energization of a de-energized Minnesota Power circuit by the customer's generation equipment. Such equipment shall be approved by Minnesota Power.

A switch shall be installed to disable the automatic or manual closing of the interconnecting switch or breaker. This switch shall be accessible to, and be operated by Minnesota Power personnel to obtain the necessary safety requirements when Minnesota Power crews are working on associated equipment or lines.

D. SYNCHRONIZATION OF CUSTOMER GENERATION

The customer is responsible for the synchronization of his generation equipment to the Minnesota Power system.

E. DISCONNECTING DEVICE

A disconnecting device shall be installed to electrically isolate the Minnesota Power system from the customer's generation equipment. This device shall provide a visible air gap between the customer's generating equipment and the Minnesota Power system in order to establish the required safety requirements for maintenance and repair work on the Minnesota Power system. The disconnecting device shall be readily accessible to, and allow padlocking by, Minnesota Power personnel. If this disconnect is owned by the customer, it may be required to be designed to allow the application of safety grounds on the Minnesota Power side of the disconnecting device.

F. METERING

Modifications to the revenue metering are usually required due to the installation of customer generating equipment. The modifications include, but are not limited to, the following:

- a. The customer does not desire to sell energy to Minnesota Power (one-way feed). The existing watt-hour meter will be replaced with a watt-hour meter containing detents to prevent reverse operation of the meter.
- b. The customer desires to sell energy to Minnesota Power. The existing watt-hour meter will be replaced with bi-directional metering

In addition, energy metering may be required to meter the generator output separate from the customer load.

G. INTERCONNECTION POWER APPARATUS

The power apparatus associated with the interconnection shall be determined by the interconnection study.

6. CLASSIFICATION OF CUSTOMER GENERATION INSTALLATIONS

The classification of a customer's generation will be made by Minnesota Power during the preliminary interconnection study. The determination of what type of protective devices are required will primarily depend upon three major factors:

1. The type and size of the customers generation equipment.
2. The location of the customer on the Minnesota Power system (interconnection point – transmission or distribution).
3. The manner in which the installation will operate (one way or two way power flow).

In general, an increased degree of protection is required for large generation installations due to the greater magnitudes of short circuit currents from these installation. These larger installations therefore require more sensitive and faster protection schemes to minimize the damage and insure safety. A second consideration for large generation installations is the possibility that a portion of the Minnesota Power system may become islanded. Islanding is an undesirable situation where a portion of the Minnesota Power system, which includes the customer having generation and possibly containing other MP customers, becomes disconnected from the rest of the Minnesota Power system but continues to operate as an isolated power system. This condition may cause various operating and safety problems and is not tolerable.

7. PROTECTIVE DEVICES

Various protective devices are required to insure a safe and proper operation of the interconnection. Determination of the protective device requirements will be made by Minnesota Power during the interconnection studies. The installation, settings and maintenance of all protective equipment required by the interconnection shall be subject to Minnesota Power verification. The customer shall provide Minnesota Power proposed relay settings of interconnection protective devices for MP review and approval. In addition, written evidence of initial testing and periodic maintenance of the interconnection protective devices shall be provided to Minnesota Power.

A. RELAYS

Protective relays are required to promptly sense abnormal operating or fault conditions and initiate the isolation of the faulted area. Protective relays may be discrete devices or may be functions incorporated into the generation interconnection equipment. Protective relays can generally be categorized into two major groups: industrial grade and utility grade. Utility grade relays have a higher degree of reliability and accuracy, and are required in most cases. The use of Minnesota Power approved industrial grade relays may be permitted on generation installations classified as extremely small (rated at less than 100KVA).

B. CIRCUIT BREAKERS

The interconnection study shall determine requirements for the intertie circuit breaker. Upgrading or replacement of existing circuit breakers within or outside of the area of the interconnection may be required due to the increased fault current levels.

C. SINGLE PHASE DEVICES (FUSES/CIRCUIT RECLOSERS)

It may be necessary to replace single phase devices (line fuses, single phase automatic circuit reclosers, etc.) installed between the Minnesota Power source substation and the customers location with three phase devices. This is to minimize the possibility of single-phasing a customer's three phase generator. Single phase sectionalizing equipment may be installed on the main circuit past the customer location, or on radial circuits that tap the main circuit between the Minnesota Power source substation and the customers location.

D. AUTOMATIC RECLOSING/VOLTAGE CHECKING SCHEMES

Minnesota Power normally applies automatic reclosing to all transmission and overhead distribution lines, and the customer must insure that the generation is disconnected from the Minnesota Power system prior to automatic reclosing. It may be necessary to install voltage check schemes at various locations on the Minnesota Power system to prevent automatic reclosing in the event that a customer generator remains connected to an isolated, unfaulted section of the Minnesota Power system. These voltage check schemes may be located at the interconnection point, at oil circuit reclosers on the line feeding the customer, and/or at Minnesota Power source substation feeder breakers. These schemes may also be required on alternate circuits which may be used to feed the customer. Details of any modifications to Minnesota Power reclosing practices and/or addition of voltage check schemes will be determined during the interconnection studies. Minnesota Power shall assume no responsibility for damage to a customer's equipment due to out-of-phase reclosing.

E. COMMUNICATION CHANNEL

Minnesota Power may require that a communication channel be installed as part of the protective scheme. This channel may consist of power line carrier, pilot wire circuit, fiber optic cable, radio, or other means. The communications channel is required in cases where it is necessary to remotely send a signal to remove the customer's generation from the Minnesota Power system due to a fault or other abnormal conditions which can not be sensed by the protective devices at the customer's location. A second possible need for a communication channel is for monitoring or control purposes. The interconnection study will determine the communication channel requirements.

F. INSULATION COORDINATION

The insulation level (BIL) of all interconnection facility equipment shall be coordinated with the transmission system and the over-voltage protection shall have MCOV ratings consistent with expected system operating voltages. Special attention shall be given to MCOV ratings on systems subject to delta operation.

G. CUSTOMER OWNED INTERCONNECTION PROTECTIVE DEVICES

Any interconnection protective devices owned by the customer (as determined by the Final Interconnection Study) shall be maintained and tested by qualified personnel. A summary of the interval and type of the maintenance and testing required shall be as follows:

Circuit Breakers:

1. Visual Inspection
Interval: Not to exceed one week.
Visual inspections of bushings for cracks, leaks, discoloration due to heating, etc.
Read and record operation counter.
2. Operation Inspection
Interval: Not to exceed six months.
Testing/Maintenance: General inspection of breaker including lubrication of operating mechanism, check oil levels, Trip test breaker, etc.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

3. Major inspection
Interval: Not to exceed two years.
Testing/Maintenance: All requirements of an operational inspection, plus megger test of insulation, mechanical/hydraulic/pneumatic systems check, electrical connection checks, oil sampling testing, tank removal and inspection of contact alignment, operation and wear, filtration/replacement of oil.

Protective Relays:

1. Visual Inspection
Interval: Not to exceed one week.
Testing/Maintenance: All interconnection protective relays should be visually inspected (not removed from their case or physically disturbed) for any obvious signs of damage or inoperability. Any indication of relay inoperability shall be reported to MP immediately and may require the suspension of generation. The operation of any relay targets shall be reported to MP immediately.
2. Operation inspection
Interval: Not to exceed three years
Testing/Maintenance: Relays shall be tested by applying appropriate currents, voltages, or frequencies to verify proper operation. Items to be checked include, but are not limited to:
 - Minimum pickup value
 - Time delay at specified multiples of minimum pickup
 - Phase angle characteristics

Control Batteries:

1. Visual Inspection
Interval: Not to exceed one week
Testing/Maintenance: Visual inspection of all cells for cracked jars, cracked plates, leaking electrolyte, condition of terminal posts, connections and cell electrolyte levels. Add water to cells with low electrolyte levels.
2. Operation Inspection

Interval: Not to exceed 6 months
Testing/Maintenance: Check of electrolyte specific gravity and temperature, voltage of each individual cell and total battery, charging current, etc. Corrections of any abnormal conditions must be made immediately.

Further details of the maintenance and testing requirements, including MP contact information, will be included as part of the service contract if the customer owns any protective devices associated with the interconnection. Proper maintenance of the protective devices will be a requirement for continued operation of the customer's generating equipment.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

Copies of all test reports from Operational and Major Inspections shall be forwarded to the Minnesota Power Division Operating Manager (name and address to be provided) at the appropriate intervals.

Minnesota Power maintains the right to verify on demand the calibration and operation of all interconnection equipment. The customer is responsible for providing the necessary test accessories such as relay test plugs, instruction manuals, wiring diagrams, etc. required to allow Minnesota Power to test these protective devices. Verification may include the tripping of the intertie breaker.

If Minnesota Power is required to do work on the customer's premises, an inspection of the work area may be made by Minnesota Power operating personnel. If hazardous working conditions are detected, the customer shall be required to correct the unsafe conditions before Minnesota Power will perform the work required.

8. PRE-PARALLEL REQUIREMENTS AND INSPECTION

Prior to the parallel operation of customer owned generation with the Minnesota Power system, all applicable service contracts shall be in place and signed, and all equipment modifications and/or additions shall be complete. Having satisfied these requirements, an inspection shall be performed by Minnesota Power test personnel to insure the proper installation and operation of the interconnection protective devices. This inspection applies to both Minnesota Power and customer owned interconnection equipment. The inspection shall include, but not be limited to the following items:

- Verification that the installation is in accordance with the service contract and the final interconnection study.
- Verification of the proper operation of the protective schemes.
- Verification that the proper voltages and currents are applied to the interconnection protective relays.
- Verification of proper operation and settings of the interconnection protective relays.
- Verification of proper voltage and phase rotation.
- Trip testing of the breaker (s) tripped by the interconnection relays.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS
OF MINNESOTA POWER COMPANY

Upon performance and acceptance of the pre-parallel inspection by Minnesota Power personnel, the customer shall be granted approval for operation of his generating equipment in parallel with the Minnesota Power system. Neither the inspection nor the granting of approval to the customer shall serve to relieve the customer of any liability for injury, death or damage attribute to the negligence of the customer.

9. OPERATING GUIDELINES

The customer shall operate his generating equipment within the guidelines of this document and any special requirements set forth by the service contract. Minnesota Power reserves the right to open the intertie circuit breaker or disconnect device for any of the following reasons:

- Minnesota Power system emergency.
- Inspection of a customer's generating equipment and protective equipment reveals a hazardous condition, or a lack of scheduled maintenance and testing.
- Failure of the customer to provide maintenance and testing reports to Minnesota Power at the required intervals.
- The customer's generating equipment interferes with other customers or with the operation of the Minnesota Power system.
- The customer has modified his generating equipment or protective devices without knowledge or approval of Minnesota Power.
- Parallel operation of any unapproved customer generating equipment.
- Minnesota Power Personnel or the general public safety is threatened.

Failure of MP to open the intertie circuit breaker or disconnect device shall not serve to relieve the customer of any liability for injury, death or damage attributable to the negligence of the customer.

The customer should also be aware that changes to the Minnesota Power system, or the addition of other customers with generation in the vicinity, may require modifications to the interconnection protective devices. If such changes are required, the customer may be subject to future charges for these modifications.

10. REFERENCES

" National Electrical Safety Code ", ANSI C2-1987, Published by The Institute of Electrical and Electronics Engineers, Inc.

"Standard for Interconnecting Distributed Resources with Electric Power Systems", IEEE P1547, 2003.

"IEEE Standard Relays and Relay Systems Associated with Electric Power Apparatus", ANSI/IEEE C37.90, 1989.

" Guide for Protective Relaying of Utility-Consumer Interconnections", ANSI/IEEE C37.95, 1988.

"IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems", IEEE Std. 1001, 1988.

" Intertie Protection of Consumer-Owned Sources of Generation, 3 MVA or Less", IEEE Publication 88 THO224-6-PWR.

" Reliability Considerations for Integrating Non-Utility Generating Facilities with the Bulk Electric Systems" , North American Electric Reliability Council, Princeton, NJ 08540, April 1987.

Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems- "Buff Book", ANSI/IEEE Std. 242-1986.

Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications-"Orange Book", ANSI/IEEE Std. 447-1987.

The National Electrical Code, National Fire Protection Association, Quincy, MA, 02269, 1987 Edition.

"Recommended Practice for Utility Interface of Photovoltaic (PV) Systems", IEEE Std. 929, 2000.

APPENDIX A: Preliminary Application for operation of Customer-Owned Generation

WHO SHOULD FILE THIS APPLICATION: Any customer expressing interest to install generation on their premises. This application should be completed as soon as possible and returned to the MP Marketing representative in order to begin processing the request.

INFORMATION: This application is used by the Minnesota Power Company to perform a Preliminary Interconnection Study to determine the interface requirements at the customers' service point. The applicant should attempt to fill in as much of the form as possible. The applicant will receive a preliminary estimate for the utility interface requirements that may be used in calculating the overall project requirements.

FURTHER ACTION: The Preliminary Interconnection Study will determine the need to submit a copy of the Final Application for Parallel Operation of Customer-Owned Generation.

OWNER / APPLICANT INFORMATION

Company:

Mailing Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____ Representative: _____

PROJECT DESIGN / ENGINEERING (ARCHITECT) (as applicable)

Company:

Mailing Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____ Representative: _____

ELECTRICAL CONTRACTOR (as applicable)

Company:

Mailing Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____ Representative: _____

Appendix A: Preliminary Application.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS OF
MINNESOTA POWER COMPANY

Revision 3.0

Effective date May 10, 2007

Page A1

Information below to be completed by Minnesota Power Company

To be filled out by Marketing Representative

Division _____

Marketing Representative: _____ *Phone Number* _____

Name of Project: _____

Street Address: _____

City: _____ *County* _____ *Phone Number* _____

MP service point location: _____

(attach service map if available)

COPY OF APPLICATION AND ATTACHMENTS TO:

Division Operating Manager

Division Transmission & Distribution Manager(s)

Division Marketing Manager

System Protection & Control – Protection Engineering Manager (General Office)

Industrial Marketing – Market Applications Manager (General Office)

Original to be placed in Division Marketing Customer File

Appendix A: Preliminary Application.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS OF
MINNESOTA POWER COMPANY

Revision 3.0

Effective date May 10, 2007

Page A3

APPENDIX B: Final Application for Parallel Operation of Customer-Owned Generation

WHO SHOULD FILE THIS APPLICATION: Customers defined by the Preliminary Interconnection Study Performed by MP as having generation capable of operating in parallel with the MP system. This application should be completed as soon as possible and returned to the MP Marketing representative in order to begin the final processing.

ADDITIONAL REQUIREMENTS: This application is used by the Minnesota Power Company to perform a Final Interconnection Study to determine the required equipment configuration for the MP/customer interface. Every effort should be made to supply as much information as possible.

ADDITIONAL REQUIREMENTS: In addition to the items listed on this form, please attach a detailed one-line diagram of the proposed facility, all applicable elementary diagrams, major equipment (generators, transformers, inverters, circuit breakers, protective relays, etc.) specifications, test reports, etc. Any other applicable drawings or documents necessary for the proper design of the interconnection.

OWNER / APPLICANT INFORMATION

Company: _____
Mailing Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____ Representative: _____

PROJECT DESIGN / ENGINEERING (ARCHITECT)

Company: _____
Mailing Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____ Representative: _____

ELECTRICAL CONTRACTOR (as applicable)

Company: _____
Mailing Address: _____
City: _____ County: _____ State: _____ Zip Code: _____
Phone Number: _____ Representative: _____

Appendix B: Final Application.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS OF
MINNESOTA POWER COMPANY

Revision 3.0

Effective date May 10, 2007

Page B1

PRIME MOVER (Complete all applicable items)

Unit Number: _____
Type: _____
Manufacturer: _____
Serial Number: _____ Date of Manufacture: _____
H.P. Rated: _____ H.P. Max: _____ Inertia Constant: _____ lbs. - ft. squared.
Energy Source (steam, hydro, wind, etc.): _____

GENERATOR TRANSFORMER (Complete all applicable items)
TRANSFORMER (between generator and utility system)

Generator unit number: _____ Date of Manufacture: _____
Manufacture: _____
Serial Number: _____
High voltage: _____ KV, Connection: _____ delta _____, Neutral Solidly grounded? _____
Low voltage: _____ KV, Connection: _____ delta _____, Neutral Solidly grounded? _____
Transformer Independence (Z): _____ % on _____ KVA base.
Transformer Resistance (R): _____ % on _____ KVA base.
Transformer Reactance (X): _____ % on _____ KVA base.
Neutral Grounding Resistor (if applicable): _____

INVERTER DATA (if applicable)

Manufacturer: _____
Model: _____
Rated Power Factor (%) _____ Rated Voltage (Volts): _____ Rated Amperes: _____
Inverter Type (Ferroresonant, step, pulse-width modulation, etc.): _____
Type commutation: _____ forced _____ line
Harmonic Distortion: Maximum Single Harmonic (%) _____
Maximum Total Harmonic (%) _____
Note: Attach all available calculations, test reports, and oscillographic prints showing inverter output voltage and current waveforms.

POWER CIRCUIT BREAKER (if applicable)

Manufacturer: _____
Model: _____
Rated voltage (kilovolts): _____ Rated ampacity (Amperes): _____
Interrupting rating (Amperes): _____ BIL Rating: _____
Interrupting medium / Insulating medium (ex: vacuum, gas, oil) _____ / _____
Control Voltage (Closing): _____ (Volts) _____ AC _____ DC
Control Voltage (Tripping): _____ (Volts) _____ AC _____ DC _____ Battery _____ Charger Capacitor
Close energy: _____ Spring _____ Motor _____ Hydraulic _____ Pneumatic Other: _____
Trip energy: _____ Spring _____ Motor _____ Hydraulic _____ Pneumatic Other: _____
Bushing Current Transformers: _____ (Max. ratio) Relay Accuracy
Class: _____
Multi ratio? _____ No _____ Yes: (Available taps) _____

Appendix B: Final Application.

SAFETY STANDARDS AND INTERCONNECTION
REQUIREMENTS APPLICABLE TO GENERATORS AND/OR SMALL POWER PRODUCERS OF
MINNESOTA POWER COMPANY

Revision 3.0

Effective date May 10, 2007

Page B2

