



**MIDAMERICAN ENERGY TECHNICAL REQUIREMENTS  
FOR NEW TRANSMISSION INTERCONNECTIONS TO THE  
MIDAMERICAN ENERGY TRANSMISSION SYSTEM**

The MidAmerican Energy Technical Requirements may be accessed via the web at <http://oasis.midwestiso.org/oasis/MEC> or upon request to the Electric System Planning department at 106 E 2<sup>nd</sup> Street, Davenport, IA. 52801. Telephone contact (563-333-8162)

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## 1.0 Scope

These Technical Interconnection Requirements (“Requirements”) apply to all transmission interconnections (“Interconnection” or “Interconnections”), for which the point of interconnection is the MidAmerican Energy transmission system. These Requirements shall be applied on a comparable basis to all transmission interconnections within this scope. These Requirements specify the minimum technical requirements intended to ensure a safe, effective and reliable interconnection. The requirements outlined in this document may not cover all details in specific cases.

MidAmerican Energy reserves the right to revise these Requirements from time-to-time without advanced notice. MidAmerican Energy may revise these Requirements periodically to comply with new regulations from the Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Corporation (NERC), state, or other governmental authorities. MidAmerican Energy may require that all Interconnections comply with new regulations by implementing similar procedures and / or upgrades as would be expected on the MidAmerican Energy facilities in a non-discriminatory manner. If the Interconnection does not comply, MidAmerican Energy may disconnect the Interconnection after proper notification.

Note: A request for transmission interconnection does not constitute a request for transmission service. A customer desiring transmission service must follow the procedures of the Midwest ISO Tariff in requesting transmission service.

## 2.0 Purpose

These Requirements are considered to be supplemental technical requirements to the procedures and requirements set forth in the Midwest ISO Open Access Transmission, Energy and Operating Reserve Markets Tariff (“Midwest ISO Tariff”) and Midwest ISO Business Practice Manual for Transmission Planning, and the procedures and requirements set forth by FERC and NERC. To the extent that there is a conflict between these Requirements and the current requirements of the Midwest ISO Tariff, FERC, or NERC, then the Midwest ISO Tariff, FERC, or NERC requirements will govern.

In addition to the technical interconnection requirements provided in this document, the Interconnection shall comply with all applicable federal, state, and local requirements, environmental regulations, siting requirements, and Good Utility Practices.

These Requirements are intended to:

- i. Document MidAmerican Energy’s requirements and procedures for transmission interconnections to the MidAmerican Energy transmission system.
- ii. Provide a written summary of MidAmerican Energy’s plans to achieve required system performance according to the NERC, the Midwest Reliability Organization (MRO), Midwest ISO, and MidAmerican Energy criteria.

- iii. Document procedures for coordinated joint studies of new facilities to determine Interconnection impacts on the MidAmerican Energy and adjoining bulk power systems.
- iv. Document notification procedures to other entities responsible for bulk power reliability.

### **3.0 Procedures for Obtaining a Transmission Interconnection**

MidAmerican Energy has turned over functional control of its transmission facilities to the Midwest ISO; therefore, final approval of requests for transmission interconnections to these facilities will be determined by the Midwest ISO based upon Midwest ISO review of available studies of the proposed Interconnection completed by the interconnection customer or jointly by the interconnection customer and MidAmerican Energy, and as needed, Midwest ISO's own studies of the proposed Interconnection. A brief summary of the transmission interconnection process is provided below, and a process diagram has been attached as Appendix A.

**Interconnection Request:** In general parties wishing to establish a transmission interconnection to the MidAmerican Energy transmission system must submit an interconnection request to MidAmerican Energy using the following contact:

MidAmerican Energy Electric System Planning  
Attn: Interconnection Request  
106 E. 2<sup>nd</sup> St  
Davenport IA, 52801  
563-333-8162

The interconnection customer should provide details of the proposed transmission interconnection including:

- description of the need for the interconnection
- proposed point of interconnection
- conceptual diagram(s) of the transmission interconnection
- modeling details for the proposed facilities
- desired in-service date
- completed studies evaluating the proposed transmission interconnection (if available) and associated study models

A non-disclosure agreement will be executed if necessary to allow for the exchange of models and system data to evaluate the interconnection

A request for transmission interconnection is not required for transmission interconnections that are required as part of an upgrade plan for a generator interconnection request or a transmission service request under the Midwest ISO Tariff, as it is assumed that MidAmerican Energy has already participated in the system impact study and has completed a facilities study for the interconnection to its transmission system through the processes included in the Midwest ISO Tariff.

If the proposed transmission interconnection is a part of an upgrade plan for a generator interconnection request or transmission service request not under the

Midwest ISO Tariff, then in addition to making a transmission interconnection request, MidAmerican Energy and Midwest ISO should be included in the study group established to evaluate the generator interconnection request or transmission service request. Involving MidAmerican Energy and the Midwest ISO in the study process expedites the MidAmerican Energy and Midwest ISO approval of the transmission interconnection request; however, transmission interconnection requests can be made where a study has already been completed. The interconnection customer is responsible for submitting a study or conducting the study.

A transmission interconnection may be requested to accommodate other needs of the interconnection customer, such as a reliability need or as part of a regionally beneficial project.

**Required Studies:** At a minimum the interconnection customer must provide or complete a study evaluating steady-state system performance of the proposed transmission interconnection according to the latest NERC TPL standards. If MidAmerican Energy expects potential impacts beyond steady-state impacts, MidAmerican Energy may request additional studies be performed to evaluate the proposed transmission interconnection including but not limited to transient stability, voltage stability, short-circuit and small signal analysis

**MidAmerican Energy Review of Studies:** If the studies evaluating the transmission interconnection request included participation of MidAmerican Energy and the Midwest ISO in the study process, then study review will take place during the ad hoc review process.

Otherwise, if a study report is submitted to MidAmerican Energy which summarizes the evaluation of the proposed transmission interconnection, MidAmerican Energy will review the report to ensure adequate assessment of the MidAmerican Energy system. MidAmerican Energy may validate results using its own power flow models. If the transmission interconnection is shown to cause portions of the MidAmerican Energy system to violate MidAmerican Energy planning criteria, MidAmerican Energy will coordinate with the interconnection customer to identify potential mitigation plans. Following the development of upgrade plans, if necessary, MidAmerican Energy will submit the proposed transmission interconnection and associated upgrades for inclusion in the Midwest ISO transmission expansion plan (MTEP). Depending upon the requested in-service date, the projects may be submitted to the Midwest ISO under the standard MTEP review process or through an out-of-cycle request.

Part of MidAmerican Energy's study review process will involve informing MidAmerican Energy stakeholders of its FERC 890 Local Transmission Planning Process of the proposed interconnection and associated upgrades. Modifications to the plan may be suggested by stakeholders and MidAmerican Energy may choose to study additional alternatives as a result of stakeholder feedback, provided that those alternatives still meet the overall need of the interconnection customer. Any modifications to the proposed transmission interconnection and associated upgrades will be coordinated with the interconnection customer.

**Midwest ISO Approval:** The Midwest ISO will review all studies submitted by MidAmerican Energy including those prepared by the interconnection customer to ensure adequate assessment of the Midwest ISO system. The Midwest ISO may validate results using its own power flow models. If the transmission

interconnection is shown to cause portions of the Midwest ISO system to violate planning criteria of its members, the Midwest ISO will coordinate with MidAmerican Energy, the interconnection customer, and stakeholders of its planning process to identify potential mitigation plans. Following the development of upgrade plans, if necessary, the Midwest ISO will submit the proposed transmission interconnection and associated upgrades for approval into Appendix A of the MTEP by the Midwest ISO Board of Directors. Once approved in Appendix A of the MTEP, MidAmerican Energy has approval to construct the new facilities to be owned by MidAmerican Energy or modifications to the MidAmerican Energy system.

**Interconnection Agreement:** Following approval of the transmission interconnection in MTEP Appendix A, a transmission interconnection agreement between MidAmerican Energy, the interconnection customer and the Midwest ISO will be executed. The general form of the agreement will utilize the standard Midwest ISO transmission interconnection agreement, unless an existing interconnection agreement between MidAmerican and the interconnection can be suitably modified including the addition of the Midwest ISO as a signatory to the agreement. MidAmerican Energy and the interconnection customer will negotiate specific details of the interconnection such as facility ownership, construction, operation and maintenance of the facilities necessary to accommodate the interconnection. The negotiations and preparation of the interconnection may take place in parallel with Midwest ISO's review of the transmission interconnection through the MTEP process; however, the executed agreement shall contain a condition precedent such that MidAmerican will not be required to commence work on the transmission interconnection and associated upgrades until after such interconnection and upgrades have been approved in the Midwest ISO's MTEP as Appendix A projects.

The interconnection customer may request an engineering & procurement agreement to allow MidAmerican Energy to begin engineering or material procurement during the negotiation of the transmission interconnection agreement if an expedited schedule is required. MidAmerican will not commence physical construction activities under the terms of such engineering & procurement agreement.

The interconnection agreement appendices will include diagrams and descriptions of the interconnection facilities and other system upgrades, if necessary. To this end, the interconnection customer shall provide the required one-line diagram(s) and details of its facilities, if they have not already been provided as part of the interconnection application. A functional one-line diagram is required, including representation of both the major components of the interconnection (i.e. power transformers, circuit breakers, switches, reactive devices, etc) and the protective relaying including lockout relays. The protective relaying shall be shown using the following guidelines:

- i. The current and potential instrument transformer inputs of the protective relaying shall be shown in single-line format, and shall be connected to the functional element circle it is serving with a solid line.

- ii. The current and potential transformation ratios, along with polarity markings and secondary connection configuration, of all instrument transformers serving the protective relaying shall be specified.
- iii. Circuit breakers that the protective relaying trips either directly or indirectly through a lockout relay shall be indicated with a dashed line.
- iv. Circuit breakers for which the protective relaying provides supervisory synchronism checks shall be indicated with a dotted line.
- v. Each functional element of the protective relay scheme shall be shown with a circle inscribed with its IEEE device function number

## **4.0 Construction and Ownership**

Following the execution of the interconnection agreement, engineering, design and construction activities will commence according to the schedule included in the agreement. Throughout the implementation phase of the interconnection process, MidAmerican Energy will conduct regular status update conference calls to discuss progress on the MidAmerican Energy system upgrades and the interconnection customer's construction and to discuss any coordination of construction activities.

Unless specified otherwise in the interconnection agreement all facilities to be owned by MidAmerican Energy shall be constructed, owned, operated and maintained by MidAmerican Energy. MidAmerican Energy may, at its option, contract with a third party for construction of any of these facilities. The interconnection customer will normally construct, own, operate and maintain all facilities to be owned by the interconnection customer. Both MidAmerican Energy's and the interconnection customer's construction shall meet all applicable national, state and local construction and safety codes.

### **4.1 Permitting**

The interconnection customer shall be responsible for obtaining the required permits and regulatory approvals for the facilities that it will construct, and MidAmerican Energy shall be responsible for obtaining the required permits and regulatory approvals for the facilities to be constructed by MidAmerican Energy. In addition, regulatory approvals may be required to be obtained by neighboring systems if the Interconnection requires system upgrades on third party facilities.

### **4.2 Interconnection Substation Configurations**

An Interconnection to the MidAmerican Energy transmission system may be made at an existing MidAmerican Energy transmission substation or via a connection with breakers into an existing MidAmerican Energy transmission line. The configuration requirements of the Interconnection depend in part on the voltage level where the Interconnection is to occur. At a minimum,

- i. If the Interconnection is to a 345 kV facility on the MidAmerican Energy system, the minimum configuration will be a ring-bus. A straight bus configuration may be used if the Interconnection is to a facility rated below 345 kV.

- ii. Generally, MidAmerican Energy will not allow a straight bus configuration with greater than five breakers. Expansion beyond this level will require conversion of the station into a ring-bus design. MidAmerican Energy, at its sole discretion, may consider different configurations due to physical limitations at the site.
- iii. Generally, MidAmerican Energy will not allow a ring bus configuration with greater than eight breakers. Expansion beyond this level will require conversion of the station into a breaker-and-a-half design. MidAmerican Energy, at its sole discretion, may consider different configurations due to physical limitations at the site.
- iv. No Interconnection configuration will be allowed that creates a three terminal transmission line configuration.
- v. If the Interconnection is to an existing MidAmerican Energy transmission substation, the interconnection must conform, at a minimum, to the original designed configuration of the substation.

In any case, the Facilities Study will determine final configuration of the Interconnecting Facilities.

## **5.0 Interconnection Requirements**

### **5.1 General Requirements**

Throughout the remainder of the document a number of national standards and guidelines (e.g. ANSI/IEEE) are referenced, the latest revision of these standards and guidelines, or the applicable superseding standard, shall govern the requirements of the Interconnection. The Interconnection must also comply with the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements.

An Interconnection shall not violate nor cause the MidAmerican Energy electric system to violate the MidAmerican Energy Planning Reliability Criteria as documented in **Appendix B**, including those systems below 100 kV.

An Interconnection shall not violate nor cause the MidAmerican Energy electric system to violate equipment ratings as developed according to the MidAmerican Energy Company Transmission Facility Ratings Methodology as documented in **Appendix C**, including those systems below 100 kV.

An Interconnection shall not violate nor cause the MidAmerican Energy electric system to violate the applicable NERC reliability standards as documented in **Appendix C**.

An Interconnection shall not violate nor cause the MidAmerican Energy electric system to violate the applicable MRO Performance Standards as documented in **Appendix D**.

An Interconnection shall not violate nor cause the MidAmerican Energy electric system to violate MidAmerican Energy Flicker Standards as documented in **Appendix E**.

An Interconnection shall not violate nor cause the MidAmerican Energy electric system to violate MidAmerican Energy Harmonic Standards as documented in **Appendix F**.

In addition, the equipment associated with the Interconnection should be in accordance with the practices described in the latest revision of the following ANSI/IEEE Standards or Guides, or the applicable superseding standard. There may be additional special requirements imposed by MidAmerican Energy due to the specific project or application.

- IEEE Std 519, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- IEEE / ANSI C84.1 American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hz)
- IEEE 1543, Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems
- ANSI C84.1 Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
- ANSI / IEEE Std C37.90.1, IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
- ANSI / IEEE Std. C37.90.2, Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers
- IEEE 80, IEEE Guide for Safety in AC Substation Grounding Document Number
- IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems
- IEEE Standard 421.2, IEEE Guide for Identification, Testing, and Evaluation of the Dynamic Performance of Excitation Control Systems

## **5.2 System Protection Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for system protection.

The transmission interconnection shall incorporate equipment to detect system abnormalities or disturbances in either the interconnection customer's system or the MidAmerican Energy system. This equipment shall have the capability to isolate the sources of the disturbance. The interconnection customer is solely responsible for the system protection design that affects its facility; however, the interconnection customer's protective equipment must coordinate with existing MidAmerican Energy protective equipment and provide comparable levels of protection as practiced on MidAmerican Energy's System.

The Interconnection shall be able to withstand Electromagnetic Interference (EMI) environments in accordance with the latest revision of ANSI / IEEE Std. C37.90.2. The associated systems and protection systems shall not mis-operate due to EMI, including hand held communication devices.

The following interconnection relays would be required at a minimum:

- Over-voltage (59).
- Under-voltage (27).
- Over/Under Frequency (81O/81U).
- Two zone Distance, Phase and Ground, (21). On short transmission lines or installations where the MidAmerican Energy interconnection substation and the

customer's interconnection substation are adjacent differential relay(s) may be substituted.

The following additional protection functions may be suggested or required to coordinate with the protective systems of MidAmerican Energy:

- Out-of-Step (68).
- Breaker Failure Relay (50BF).
- Transfer-Trip (TT).
- Directional Overcurrent (67).

All protective relays shall be "Utility Industry Grade" protective relays. These relays have more stringent tolerances and more flexible, widely published characteristics than "industrial quality" relays.

All protective devices supplied to satisfy the requirements of this section shall be equipped with operation indicators (targets) or shall be connected to an annunciator or event recorder so that it will be possible to determine, after the fact, which devices caused a particular trip.

MidAmerican Energy facilities serving the interconnection facilities may be equipped with high speed reclosing to expedite returning the facilities to service following a fault of temporary nature. The protective devices installed by the interconnection customer and acceptable to MidAmerican Energy are intended to disconnect the generation from faulted or isolated lines before reclosing occurs. Depending on the installation, MidAmerican Energy may require "Hot Line Reclose Blocking" to be installed at the necessary points on MidAmerican Energy's system. If desired by the interconnection customer, a breaker auxiliary contact may be provided, at the customer's expense, to initiate transfer trip to protect the Interconnection from out-of-phase reclosing on the MidAmerican Energy system.

### **5.2.1 Redundant/Backup Relaying**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for redundant relaying.

Relays protecting the MidAmerican Energy system shall be designed to ensure that the failure of a single protective relay will not result in failure to clear the fault. The design shall provide the necessary backup that will meet the MidAmerican Energy standards and regional protection requirements.

MidAmerican Energy requires primary and secondary protective relaying, including independent primary and secondary communications paths for transmission lines operated at 345 kV.

### **5.2.2 Coordination & Testing of Protective Devices**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for coordination and testing of protective devices.

MidAmerican Energy shall review the interface equipment protection schemes and the setting and certified test records for these protective devices. The proposed settings for these devices shall be submitted no less than 60 days prior to implementation. Acceptance will not be unreasonably withheld. Any changes required by MidAmerican Energy shall be made prior to final acceptance, and MidAmerican Energy shall be provided with final copies of the reviewed drawings and settings.

The interconnection customer shall not make any substantial modifications or alterations to its facility or any modifications to the protective devices or setting of the devices without written notice and acceptance from MidAmerican Energy at least 60 days before the proposed change is to be made. All relaying equipment shall be kept under seal, which shall be broken only when the relays are to be tested or adjusted, or subject to inspection by MidAmerican Energy.

All protective devices supplied to satisfy the requirements of this section shall be tested by qualified personnel at intervals at least as frequent as those used by MidAmerican Energy for the relays protecting the facilities serving the interconnection facilities. Special tests may also be requested by MidAmerican Energy to investigate apparent misoperations. Each routine or special test shall include both a calibration check and an actual trip of the circuit breaker from the device being tested. A report of each test shall be prepared and sent to MidAmerican Energy listing the tests made and the “as found” and “as left” calibration values.

### **5.2.3 Synch-Check Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for synchronization of generators to the transmission system.

MidAmerican Energy requires sync-check relays to be installed on all points of interconnection between the MidAmerican Energy electric system and the interconnection customer’s system

A separate, independent, single-phase synchronism check relay shall be installed to supervise all manual and automatic synchronizing attempts. The synchronism check relay shall adhere to the following criteria:

- i. The output of the synchronism check relay must be wired directly in the breaker close path. Wiring the output of the synchronism check relay to supervise the breaker via a Programmable Logic Controller (PLC) is prohibited.

## **5.3 Frequency Control**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for frequency control.

The energy delivered to the MidAmerican Energy system must be 60 Hz sinusoidal alternating current matching the MidAmerican Energy standard voltage and phase rotation at the point of interconnection.

## **5.4 Insulation Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for equipment insulation levels.

The interconnection customer shall design the Interconnection such that it is adequately protected from surges. Industry standard Basic Insulation Level (BIL) ratings shall be used for the Interconnection and electric system interface equipment. The interconnection customer shall install additional surge protection devices (e.g. surge arresters) to achieve proper insulation coordination. The electric equipment shall meet surge withstand requirements identified in the latest revision of IEEE C62.41 or C37.90.1.

## **5.5 Grounding Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for substation and equipment grounding.

The Interconnection must be designed to provide adequate grounding. The ground grid must be designed according to the latest revision of IEEE 80. The interconnection customer shall provide MidAmerican Energy data on soil resistivity and a ground grid design prior to the construction of the ground grid. The Interconnection shall provide a ground current path that is acceptable to MidAmerican Energy. Where required, the ground path shall be effectively grounded according to the latest revision of IEEE 142 which specifies that the positive zero sequence reactance is greater than the zero sequence resistance ( $X1 > R0$ ) and zero sequence reactance is less than or equal to three (3) times the positive sequence reactance ( $X1 \leq 3 * X0$ ).

The Interconnection grounding scheme shall not cause overvoltages that exceed MidAmerican Energy equipment ratings or interconnection equipment ratings, and shall not disrupt ground fault protection coordination.

The Interconnection design shall be such that MidAmerican Energy will be able to ground and test any MidAmerican Energy owned or serviced equipment. This may require the interconnection customer to pay for and install approved grounding equipment at the facility.

## **5.6 Communications Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for communications.

Communication facilities to implement the protective systems at the transmission interconnection will be installed as necessary. The interconnection agreement will identify the specifics of the communication system(s) and responsibilities for its installation, ownership, operation and maintenance.

If required due to configuration of the interconnection substation, the Des Moines Control Center shall be provided with breaker control to allow the transmission interconnection to be disconnected from MidAmerican Energy transmission facilities. As necessary, during emergencies, MidAmerican Energy reserves the right to disconnect the transmission interconnection from the MidAmerican Energy electric system without prior notification.

## **5.7 Metering and Indication Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for metering and supervisory control and data acquisition (SCADA).

Suitable SCADA (metering and telemetering) equipment shall be provided to meter and to transmit real-time information at the point of interconnection to the MidAmerican Energy Des Moines Control Center. Such metering typically includes all watt-hour meters, VAR-hour meters, energy recorders, current and potential transformers and associated equipment at each point of interconnection for system control. Additional SCADA data that may be required includes but is not limited to breaker status, bus voltage, transmission line and/or transformer MW, MVAR, and Amp flows, alarms, etc.

All metering equipment shall be maintained and tested periodically as specified by the more restrictive of NERC or MidAmerican Energy criteria. Accuracy of registration shall be maintained in accordance with prudent utility practices and accepted industry standards. Modern solid-state meters should be calibrated to at least +/- 0.3% and hold that accuracy. Installation of electro-mechanical meters is not allowed. On request of either party, a special test may be made at the expense of the party requesting such special test. Representatives of both parties shall be afforded the opportunity to be present at all routine and special tests. If, as a result of any test, any meter is found to be registering more than one half of one percent (0.5%) above or below one hundred percent (100%) of accuracy, the registration of such meter shall be corrected for a period equal to one-half (1/2) of the elapsed time since the last prior test and adjustment, according to the percentage of inaccuracy so found, except that if the meter shall have become defective or inaccurate at a reasonably ascertainable time since the last prior test and adjustment of such meter, the correction shall extend back to such time. Should metering equipment fail to register, the electrical energy delivered shall be determined from the best available data. All metering equipment shall be kept under seal, which shall be broken only when the metering is to be tested, adjusted, or inspected by MidAmerican Energy.

## **5.8 Voltage Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for voltage performance.

### **5.8.1 Steady State Voltage**

The interconnection shall not cause the MidAmerican Energy electric system to violate the MidAmerican Energy voltage criteria or voltage ranges defined in the latest revision of ANSI Std C84.1 Range A (plus or minus 5% of nominal). If real-time voltage measurements violate the MidAmerican Energy voltage criteria, and the interconnection is causing or contributing to the violation, the interconnection will be disconnected if approved by the Midwest ISO. The interconnection will remain disconnected until it can be verified through real-time studies by MidAmerican Energy and Midwest ISO that the restoration of the Interconnection would not cause violation of the MidAmerican Energy voltage criteria.

The interconnection shall be designed such that VAR flow is minimized between the two systems under normal system conditions. This may require installation of switchable shunt capacitors. Switchable shunt reactors may also be required to offset the capacitive VARs produced during light load periods by new transmission lines associated with the interconnection. It is recognized the systems will provide voltage and VAR support to each as system conditions change and as outages occur on either MidAmerican Energy's transmission system or the interconnection customer's system.

The interconnection customer shall interconnect to the MidAmerican Energy electric system at the nominal voltage at the agreed upon point of interconnection. MidAmerican Energy, at its sole discretion, may elect to upgrade or change the voltage level of the MidAmerican Energy electric system serving the Interconnection. Any costs to upgrade or change the interconnection customer's facilities to maintain an interconnection with MidAmerican Energy shall be paid by the interconnection customer unless stated otherwise in the interconnection agreement.

## **5.9 Power Quality/Harmonics Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for power quality and harmonics.

The harmonic content of the voltage and current wave forms of both the Interconnection and MidAmerican Energy's system, when not interconnected, shall comply with the latest revision of the IEEE Std 519, IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems. MidAmerican Energy may install a power quality meter at the point of interconnection to monitor compliance with IEEE 519.

If high- or low-voltage complaints, transient voltage complaints, and/or harmonic (voltage distortion) complaints result from the Interconnection, the Interconnection shall be disconnected from MidAmerican Energy's system with approval by the Midwest ISO until the interconnection customer resolves the problem.

## **5.10 Fault Current**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for fault currents.

The facilities study will identify the level of available fault current at the point of interconnection. The interconnection customer's facilities should be designed to

accommodate reasonable increases in the available fault current, which may occur over time due to changes on the MidAmerican Energy transmission system.

Where the new transmission interconnection results in fault currents on the MidAmerican Energy electric system that are in excess of breaker or other interrupting device maximum rated interrupting capability, the interconnection customer shall be required to install and pay for fault limiting equipment or pay for circuit breaker or other interrupting device replacements.

## **5.11 Operating Requirements**

The generator shall be operated in accordance with the latest requirements of NERC, MRO, Midwest ISO, and MidAmerican Energy.

In addition to the voltage and harmonics operating requirements described previously, the interconnection customer shall control the electrical real power (MW) output such that it will not exceed the capacity of the interconnection facilities. The interconnection customer shall also operate its facilities in compliance with the latest revision of the National Electric Safety Code and applicable state codes. Failure to comply with said safety policies or failure to limit the output of the Interconnection to the approved level will result in the interconnection being opened. The interconnection will not be re-established until compliance has been determined.

The Interconnection shall also adhere to NERC and MRO Operating Standards, any Midwest ISO or MidAmerican Energy Operating Guides, and any additional operating requirements either stated herein or mutually agreed to elsewhere.

MidAmerican Energy and the interconnection customer shall each identify one representative to serve as a coordination contact to be the initial point of contact and coordinate communications between the parties for both normal and emergency conditions. MidAmerican Energy and the interconnection customer shall notify each other in writing of the personnel that it has appointed as its coordination contact.

MidAmerican Energy and the interconnection customer shall abide by their respective switching and tagging rules for obtaining clearances for work or for switching operations on equipment. Such switching and tagging rules shall be developed in accordance with OSHA standards. MidAmerican Energy and the interconnection customer shall develop mutually acceptable switching and tagging rules for MidAmerican Energy's and the interconnection customer's facilities that involve common clearance requirements. The interconnection customer shall not be permitted to energize a de-energized MidAmerican Energy circuit and will follow lockout / tagout procedures.

The interconnection customer will follow all MidAmerican Energy and Midwest ISO defined outage processes.

### **5.11.1 Abnormal/Emergency Conditions**

If required by Good Utility Practice to do so, MidAmerican Energy or Midwest ISO may require that the Interconnection be disconnected if the Interconnection could adversely affect the ability of MidAmerican Energy and/or Midwest ISO to safely and reliably operate and maintain the electric system. The interconnection customer shall be provided

with advance notice if possible, or in the absence of advance notice the interconnection customer shall be informed as soon as soon as practicable of the reasons for the curtailment, interruption, or reduction, and, if known, its expected duration. The interconnection customer shall comply with all operating instructions provided by the Midwest ISO under emergency conditions to the extent that such actions are within the capabilities of the Interconnection.

## **5.12 Maintenance/Inspection Requirements**

The Interconnection shall adhere to the latest revision, if any, of NERC, MRO, Midwest ISO, and MidAmerican Energy standards and requirements for maintenance and inspection.

The interconnection customer must complete field-testing of all their electrical equipment prior to energization. Testing of equipment must be completed by qualified personnel according to manufacturer's recommendations and shall include testing of all protective relays and control systems according to manufacturer's recommendations. MidAmerican Energy reserves the right to inspect the interconnection customer's facilities and witness test any equipment or devices associated with the Interconnection. The interconnection customer shall submit a written, detailed procedure with specific requirements for initial commissioning its interconnecting facilities for MidAmerican Energy approval.

The interconnection customer shall maintain its interconnecting facilities in good working order. MidAmerican Energy reserves the right to inspect the interconnection customer's facilities on a periodic basis or whenever it appears that the Interconnection is operating in a manner hazardous to MidAmerican Energy's system integrity

MidAmerican Energy and the interconnection customer may, in accordance with good utility practices, remove from service facilities or network upgrades as necessary to perform maintenance, test, and install or replace equipment. MidAmerican Energy and the interconnection customer will use reasonable efforts to coordinate outages for maintenance on dates and times mutually acceptable to both parties.

## **6.0 Procedures for Coordinated Joint Studies and Notifications**

The Midwest ISO transmission expansion planning process includes multiple opportunities for stakeholder input prior to approval of a transmission interconnection project into Appendix A of the MTEP. Similarly, the MidAmerican Energy local transmission planning process includes opportunities for stakeholders to comment on proposed plans and suggest alternative solutions. Between the two processes, and coordination with the interconnection customer, who may also participate in either the Midwest ISO or the MidAmerican Energy planning processes, a coordinated plan for the transmission interconnection will be developed and reviewed by both interested and potentially affected parties.

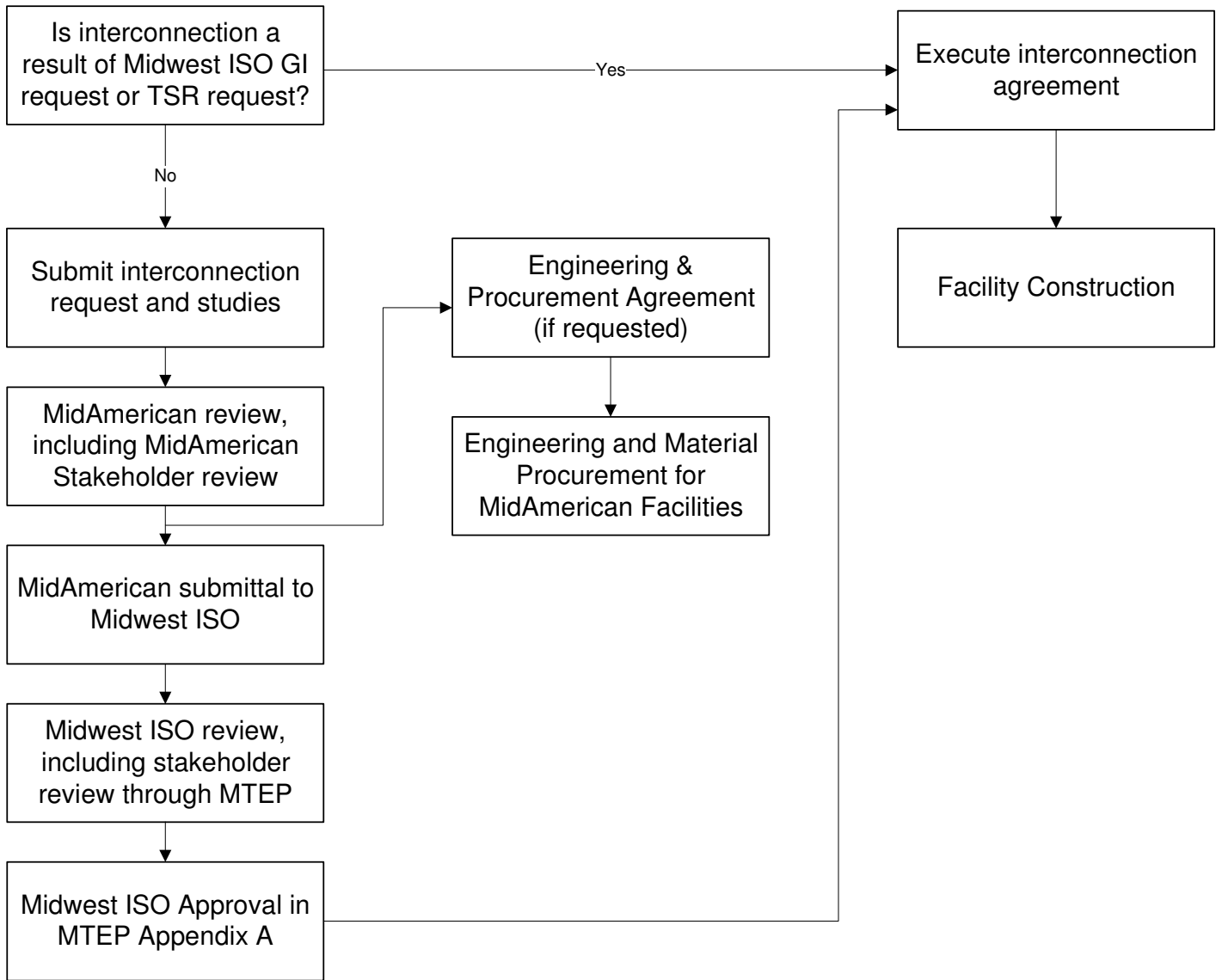
Upon completion of new facilities or upgrades to the MidAmerican Energy system associated with new transmission interconnections, MidAmerican Energy will inform the Midwest ISO as soon as practical for inclusion in its state estimator model. To the extent

that the MidAmerican Energy upgrade or new facility is part of a tie line to an adjacent transmission owner or transmission service provider, that third party shall be notified of the completion of the upgrade or new facility as soon as practical upon completion.

### **Program Document Change History**

<b>Version Date</b>	<b>Action</b>	<b>Change Date</b>
<b>10/15/10</b>	<b>Separated Transmission Interconnection Requirements from previous document containing generation, transmission, and load interconnection requirements</b>	<b>10/15/10</b>
<b>03/09/11</b>	<b>Corrected footer</b>	<b>03/09/11</b>
<b>03/23/11</b>	<b>Updates to Interconnection Agreement procedures in section 3.0</b>	<b>03/23/11</b>

**Appendix A**  
**MidAmerican Energy Transmission Interconnection Process Diagram**



## **Appendix B**

### **MidAmerican Energy Planning Reliability Criteria**

The MidAmerican Energy Planning Reliability Criteria may be accessed via the MidAmerican Energy page of the Midwest ISO OASIS at <http://oasis.midwestiso.org/oasis/MEC> or upon request to the Electric System Planning department at 106 E 2<sup>nd</sup> Street, Davenport, IA. 52801. Telephone contact (563-333-8162)

## Appendix C

### **MidAmerican Energy Company Transmission Facility Ratings Methodology**

The MidAmerican Energy Company Transmission Facility Ratings Methodology may be accessed via the MidAmerican page of the Midwest ISO OASIS at <http://oasis.midwestiso.org/oasis/MEC> or upon request to the Electric System Planning department at 106 E 2<sup>nd</sup> Street, Davenport, IA. 52801. Telephone contact (563-333-8162)

## **Appendix D**

### **NERC Reliability Standards**

The NERC Reliability Standards may be accessed via the web at  
<http://www.nerc.com/>

## **Appendix E**

### **MRO Planning Standards**

The MRO Planning Standards may be accessed via the web at  
[http://www.midwestreliability.org/STA\\_approved\\_mro\\_standards.html](http://www.midwestreliability.org/STA_approved_mro_standards.html)

## **Appendix F**

### **MidAmerican Energy Voltage Flicker Criteria**

The MidAmerican Energy Voltage Flicker Criteria may be accessed upon request to the Electric System Planning department at 106 E 2<sup>nd</sup> Street, Davenport, IA. 52801. Telephone contact (563-333-8162)

## **Appendix G**

### **MidAmerican Energy Harmonic Criteria**

The MidAmerican Energy Voltage Harmonic Criteria may be accessed upon request to the Electric System Planning department at 106 E 2<sup>nd</sup> Street, Davenport, IA. 52801. Telephone contact (563-333-8162)