MUSCATINE POWER & WATER

FACILITY CONNECTION REQUIREMENTS

3/30/17
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Reviewed by: MPW's Engineering Department

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I. SCOPE

This document discusses the requirements to properly interconnect new or modify an existing interconnection to Muscatine Power & Water's (MPW) system to avoid degrading the reliability of the electric system to which it is connected. This document applies to all voltage levels. To avoid adverse impacts on reliability, generation and transmission owners and electricity end-users must meet facility connection and performance requirements as specified herein. This document is intended for general distribution. It will be reviewed whenever system changes warrant by MPW's Engineering Department no more than two years after the current revision date.

If new equipment, Special Protection System (SPS), Under Frequency Load Shedding (UFLS), Under Voltage Load Shedding (UVLS), procedures, or processes are added that are not covered by this document they must meet the appropriate NERC, MRO, MISO, and MPW requirements for ratings, reliability, documentation, and reporting.

This document also includes MPW facility rating methodology (Section IV.D.), MPW Planning Criteria (throughout document, particularly Sections IV.C. and IV.I.), MPW Planning, Operating, and Data Submittal Procedure - Attachment K (Section IX.), and MPW's Unit 8 and 8A operating criteria (Section VIII.G.).

This document is posted on MPW OASIS site:
http://www.oatioasis.com/mpwm/index.html

II. INTRODUCTION

MPW is a municipal electric, water, and telecommunication utility serving 24 square miles in and around Muscatine, Iowa. MPW has prepared this Facility Connection Requirement document to describe its design, operating, and reliability standards and requirements for its facilities. These standards and requirements are intended to promote safe and reliable operation of MPW's electric system and to provide guidance to parties desiring to establish interconnections with MPW's electric system. The goal is always to provide the best possible reliability to MPW's Customers.

III. DEFINITIONS AND ACRONYMS

Board of Water, Electric, and Communications Trustees of the City of Muscatine, IA – Is a municipal electric, water, and telecommunication utility serving 24 square miles in and around Muscatine, Iowa doing business as Muscatine Power & Water. Referred to in this document as "Board" or "MPW".

Connecting Party – This is the party requesting to interconnect or modify an existing interconnection to MPW's system. This can include a generator owner, transmission owner requesting interconnect, end-users including MPW Customers, or MPW itself.

CROW – Control Room Operation Window – MISO requires two years (ie –for 2008 data submittal report requires 2009 and 2010) of scheduled outage data from each Balancing Authority on their generators and transmission lines scheduled outage according to MISO BPM on timing requirement.

EIA – Energy Information Administration is the statistical information collection and analysis branch of the Department of Energy.

"Electric Customer Service Handbook" – This handbook includes in more detail the type and class of service that MPW will provide to MPW customers (end-users) including details on service extensions, metering, billing, customer communications, and customer obligations. This document is available to our customers when they apply for service.

FERC – Federal Energy Regulatory Commission is a commission under the U.S. Department of Energy responsible for ensuring U.S. utilities under their jurisdiction follow all U.S. regulations. MPW is not under FERC jurisdiction.

FTR – Financial Transmission Rights – FTRs are financial instruments whose values are determined by the transmission congestion charges that arise in the Day-Ahead Energy Market.

GADS – Generating Availability Data System is a NERC database containing generating unit reliability data.

GUT – Generator Utilization Team – The GUT ensures that native system energy needs are reliably and cost effectively met through the optimum use of MPW owned generation and transmission, sales and purchase of energy, transmission access, fuel, and transportation services.

GVTC – Generation Verification Test Capacity – The real power Net Capacity of each generator is based on MISO Module E GVTC Testing procedure and is corrected by circulating water temperature correction curves using maximum temperatures coincident with MISO peaks averaged from the previous five years. GVTC tests are conducted annually between Sept 1 of previous year and August 31 of current year. Data is due October 31 of the current year for the Planning Year Capacity Auction. (Also known as URGE – Uniform Rating of Generating Equipment by some.)

IUB – Iowa Utility Board is the Iowa State regulating body responsible for regulating the Utilities in Iowa according to the laws of Iowa.

MISO – Midcontinent Independent System Operator is an organization responsible for the security and operation of the bulk power transmission system in 15 states and one Canadian province. MPW is a member of MISO.

MISO EMS – Energy Management System is the Energy Management System used by MISO.

MPW – Muscatine Power & Water – See definition of Board of Water, Electric, and Communications Trustees of the City of Muscatine, IA above. Can also be written MP&W and MPWM.

"MPW Attachment K" – This document provides additional details about MPW and the regional study procedures. The Attachment K is located in Section IX. of this document.

MPW Customer – Is the end user of electricity within MPW's service territory with no generation or transmission facilities.

MRO – Midwest Reliability Organization is one of eight regional entities in North America operating under their delegated authority from NERC in the United States and Canada committed to safeguarding the reliability of the bulk electric power system in the north central region of North America.

NERC – North American Electric Reliability Corporation is the organization responsible for the overall security and operation of the bulk electric system on the North American continent.

"Parallel Operation of Generation Requirements" includes additional details for connecting generation to MPW system. The document was formally known as the "Cogeneration Interconnection Requirements".

SCADA – Supervisory Control and Data Acquisition – Computer driven system that provides MPW's System Control with the real-time status of MPW's system including but not limited to breaker control and status, generation, transmission, and distribution facility loading, and automatic generation control (AGC).

Stakeholder – Any entity using the transmission system including but not limited to Load Serving Entities, transmission providers, Transmission Using Member, Transmission Owning Members, and Independent Power Producers.

System Performance Requirements – The studies discussed in this document shall be completed in accordance with NERC Reliability standards, MRO, MISO, MPW, and surrounding utilities performance requirements, as outlined in this document. Any voltage or facility violation shall be addressed by either adding and/or upgrading facilities or developing an operating guide to correct the violation(s) and review the guide as needed or at least yearly. When adding and/or upgrading facilities, a written summary of the plans to achieve the required system performance throughout the

planning horizon and a schedule of implementation must be maintained.

"System Restoration Plan" – This plan includes in more detail than provided in this document the procedures, responsibilities, and sequence of events that will occur in the event of a system collapse and restoration. This document has limited distribution to ensure system security.

"Water and Electric Rate Pamphlet" – This pamphlet discusses MPW customers' water and electric rates in detail including the power factor penalty. It is provided to our customers upon request.

"Watthour Meter and Associated Equipment Inspection and Testing Program" – This program discusses the details of how the KWH and KVARH meters and associated equipment will be inspected and tested including the accuracy desired and how often they will be tested.

IV. GENERAL REQUIREMENTS

Connecting Party's facilities, and their modifications, shall be planned and integrated into the interconnected transmission systems in compliance with NERC Reliability Standards, applicable regional, subregional, power pool, state, and individual system planning criteria, guides, and facility connection requirements. If conflicts exist between these documents and MRO, MISO, NERC, or the IUB, then the most stringent requirement applies, where applicable.

A. MPW APPROVALS

MPW's approvals described herein shall not be construed as a warranty of safety, durability, or reliability of the Connecting Party's interconnection, generation, service facilities, control devices, or protective devices. The Connecting Party shall be solely responsible for protecting its equipment in such a manner that faults or disturbances do not cause damage to the Connecting Party, MPW, or MPW Customer's equipment.

B. SYSTEM SECURITY CRITERIA

MPW's system will be designed to operate at all load levels without interruption of load due to violation of transient voltage limits, instability, or cascading under the conditions outlined in the MISO documentation, MRO standards, NERC standards, and this document. These conditions can include fault, sudden loss of any element, and misoperation.

C. RELIABILITY CRITERIA

In accordance with System Performance Requirement definition, MPW's system should be able to meet the following conditions:

1. With the system in the normal conditions, the voltages and facility loadings must remain within the normal limits discussed in the facility ratings and voltage criteria sections (IV.D. and IV.E.) below. (NERC TPL-001-4, Category P0)

2. During the outage of a single element and before system readjustment, the voltages and facility loadings must be within outage limits discussed in the facility ratings and voltage criteria sections below. During the outage, the transmission system must be capable of readjustment so that all voltages and facility loadings are within the normal limits discussed in the facility ratings and voltage criteria sections below. (NERC TPL-001-4, Category P1 and P2)

3. After system readjustment to restore system security during the loss of a single element, the system must be capable of tolerating the loss of a second element, if appropriate. Before system readjustment, the voltages and facility loadings must be within outage limits discussed in the facility ratings and voltage criteria sections below. During the outage, the transmission system must be capable of readjustment so that all voltages and facility loadings are within normal limits discussed in the facility ratings and voltage criteria sections below. Studying the loss of a second element is appropriate when it is likely a second element will be outaged before the first element can be replaced or repaired (for example generators or 161/69 kV transformers) (NERC TPL-001-4, Category P3, P4, P5, P6, and P7)

As used above, elements can be any one of the following:

a. Generator
b. Substation transformer
c. Substation main bus
d. Single line (between breakers)
e. Single line section (open line section between switches and/or breaker)
f. Double circuit line
g. Lines within the same right-of-way

As used above, outage can be a planned (maintenance) or forced outage.

As appropriate, extreme events should be assessed and evaluated for risk and consequences. (NERC TPL-001-4, Category P7)

D. FACILITY RATINGS CRITERIA

The information below provides an overview as to how MPW determines its facility ratings. The rating of MPW facilities (i.e.; generation, transmission line, distribution line, transformer, etc.) shall not exceed the rating of the most limiting series element in the circuit or path of the facility, including terminal connection and associated equipment. As appropriate, MPW uses manufactures design ratings, and/or IEEE, ANSI, or other standards, as described below. (Transmission ratings files located directory: G:\EN\NERC\MPW FACILITIES RATES.)

The Facility Ratings Methodology/Criteria shall be provided to requesting entities within 15 business days of the request. The request should be documented with the requesting date, name, and that it was provided within 15 business days.

If written comments on the technical review of the Facility Ratings Methodology/Criteria are received, a written response will be provided to the commenting entity within 45 calendar days of receipt of comments. The response will indicate whether a change will be made to the Facility Ratings Criteria and if not, the reasons why. Documentation of having provided the response to the commenting entity within the mandated time period shall be sent to MPW's Manager, Reliability Standards Compliance for filing.

1. OVERHEAD LINE RATINGS

Overhead line ratings are calculated with a computer program based on the AIEE article "Current-Carrying Capacity of ACSR" by House and Tuttle, dated February 1959 under the following conditions:

a. Conductor temperature = 75 degrees C
b. Ambient air temperature = 30 degrees C summer, 0 degrees C winter
c. Wind velocity = 2 feet/sec
d. Latitude = 40 degrees north.
e. Elevation = 700 feet.
f. Thermal emissivity constant = .5
g. Solar absorption coefficient = .5
h. Altitude of sun = 73 degrees summer, 50 degrees winter
i. Total solar energy received = 97.2 watts/foot^2 summer, 91.89 watts/foot^2 winter, both times a 1.021 heat transmission factor

2. UNDERGROUND LINE RATINGS

The normal underground line ratings are obtained from the manufacturer under the following conditions:

a. Conductor temperature = 90 degrees C
b. Earth ambient = 20 degrees C
c. Earth rho = 90
d. Load factor = 100%
e. Conductor spacing
f. Installed in duct or direct buried

When multiple circuits are within 10 feet of each other, a derating will be applied to the normal ratings based on the number of circuits and expected loading under peak conditions.

3. TRANSFORMER RATINGS

The transformer ratings are the manufacturer's nameplate rating of the transformers with all cooling equipment (fans, oil pumps, etc.) running

and are the same for both the winter and summer seasons. The ratings are based on a 24 hour average ambient temperature of 30ºC and using the highest average winding temperature rise of 55ºC or 65ºC, depending on the nameplate.

4. GENERATOR RATINGS

The generator ratings are the lower of manufacturer's nameplate ratings, Generation Verfication Test Capacity (GVTC), or generator testing results conducted according to MISO Module E GVTC Testing procedure.

5. OTHER EQUIPMENT RATINGS

Relay Load Limits (RLL) shall be calculated as outlined below for any relays that can limit the facilities rating. The RLL is the lowest value calculated.

a. Overcurrent type relays RLL with nominal voltage shall be:

   RLL = 0.8 * Minimum pickup value (MVA)

b. Distance type relays RLL with nominal voltage shall be:

   RLL = 0.9 * minimum pickup value (MVA) at 90% power factor

Other equipment such as current transformers, breakers, shunt capacitors, wavetraps, bushings, risers, bus conductors, and switchgear ratings are provided by manufacturers under the conditions specified by the manufacturer. The maximum continuous rating, unless otherwise specified by the manufacturer, will be based on the following conditions:

a. Ambient air temperature = 30 degrees C summer, 0 degrees C winter

b. Earth ambient = 20 degrees C

c. Load factor = 100%

d. Current transformer (CT) ratings are the setting (ie. A setting of 600/5 would be 600 amps) times the rating factor of the CT. If the rating factor isn't known, a rating factor of 1.0 will be used.

e. Bus conductors are based on the appropriate table in Anderson Electric "Technical Data A Reference for The Electrical Power Industry" which is based on a 30 degree C rise over a 40 degree

C ambient, 2 foot/second, normal oxidized surface (e=0.5). If not known, the lowest rated Schedule 40, 6061-T6 alloy will be used.

f. SCADA limits are the maximum flow the SCADA can display for the facility. This is determined based on the limitations of the transducer and RTU. There can also be a multiplier if a resistor is installed on the transducer. This limit is normally not a true limit but prevents the SCADA system from displaying the true flow of the line which could lead to an overload if another source for the reading isn't available.

6. EMERGENCY RATINGS

MPW does not use emergency ratings for planning purposes for our facilities under outage conditions because of the short-term characteristics of these ratings and our high load factor. If the load exceeds the normal ratings, steps are taken to correct the overload condition.

7. JOINTLY-OWNED FACILITIES RATINGS

The rating for jointly-owned facilities will be agreed on between the owning parties and are reviewed annually to ensure accuracy. The procedure to ensure proper coordination for jointly owned facilities follows:

a. The individual responsible for submitting MPW's Joint-Owned Transmission Facility Ratings data to the MISO Model on Demand (MOD) for the current model effort shall request that each owner review their data using the forms from MPW FacilityRatings.xlsm workbook.

b. The reviewed and updated data from the owners will be submitted to the individual responsible for submitting the Joint-Owned Transmission Line data.

c. The ratings used in the MISO models shall not exceed the rating of the most limiting series element in the circuit or path of the facility, including terminal connections and associated equipment. In cases where protection systems and control settings constitute a loading limit on a joint owned facility, this limit shall become the rating for that facility.

d. Documentation of having sent the request to the joint owners along with their response shall be entered in the

FacilityRatings.xlsm workbook and sent to MPW's Manager, Reliability Standards Compliance for filing.

8. SYSTEM OPERATING LIMITS (SOL) AND INTERCONNECTION RELIABILITY OPERATING LIMITS (IROL)

The SOL process starts with the facilities ratings defined as the maximum operating limits. Planning studies then look at the normal and emergency conditions affecting the system to determine whether lower operating limits are needed to handle the conditions defined by NERC and MRO.

Within the scope of the study, planning studies shall look for and identify any SOL and IROL using the latest version of the MISO "SOL (IROL) Methodology for the Planning Horizon Definitions" in MISO BPM-020-r15, Appendix L. If possible, system improvements should be developed to correct any SOL and IROL discovered in the MPW system.

The completed report shall provide a list of the SOL and IROL and associated contingencies that result in thermal, voltage, or transient stability limits.

The list of SOL and IROL shall be provided to Planning Authorities, Transmission Planners, Transmission Operators, Transmission Service Providers, Reliability Coordinators, and other interested parties that are within our area. At a minimum, this will include MRO, MISO, MidAmerican Energy Company (MEC), Central Iowa Power Cooperative (CIPCO), and ITC Holdings (ITC).

9. FACILITY RATING METHOD

As ratings are determined using the criteria above they are entered into MPW FacilityRatings.xlsm spreadsheet along with supporting information under Data History at the bottom of the spreadsheet when available. This spreadsheet will determine the most limiting series element in the circuit or path of the facility. The ratings are entered in the table in MVA or a formula is entered in the table to calculate the MVA based on the data entered to the right of the table. The results are summarized in the sheet: "TRANSMISSION RATING SUMMARY". This sheet contains the names of the MPW Facility Data sheets in the right side of the table that can be clicked to go to the details for that facility.

10. USE OF FACILITY RATINGS

The facility ratings developed using the procedures above are used by many entities. They are mainly distributed by submitting the ratings to MISO using MISO's MOD model building process. These models are used to perform studies to ensure reliability requirements are met. Also, ratings are provided to System Control for their System Operator's Guide Book and SCADA alarm limits to help ensure the system is operated reliably. In addition, upon request, the ratings will be provided to other entities including surrounding utilities and other Connecting Parties.

Data submissions along with the request and updates to the System Operator's Guide Book and SCADA alarm limits shall be sent to MPW's Manager, Reliability Standards Compliance for filing. SCADA support staff shall verify to Manager, Reliability Standards Compliance that the ratings updates have been made to SCADA. Manager, Control Center shall confirm to Manager, Reliability Standards Compliance that ratings have been updated in System Operator's Guide Book. This documentation shall be maintained for a minimum of 12 months per the data retention requirements of FAC-009-1.

E. VOLTAGE CRITERIA

To ensure adequate customer service voltage, MPW Voltage Criteria is based on ANSI C84.1 which provides for the service voltages listed in Table IV-1 as a percent (%) of nominal voltage under normal and outage conditions. The service voltage is the voltage at the point where the electric system of MPW and the customer are connected (Point of Common Coupling). It is located at the meter for residential and commercial customers and at the load side of the distribution transformer for Industrial customers.

TABLE IV -1: MPW'S SERVICE VOLTAGE CRITERIA

CONDITION	MINIMUM VOLTAGE	MAXIMUM VOLTAGE
	CUSTOMER	CUSTOMER
NORMAL (Range A)	95%	105%
OUTAGE (Range B)	92%	106%

Occurrence of service voltages outside the normal range should be infrequent and corrective measures will be taken in a reasonable amount of time to bring the voltages back within the normal range.

To ensure the customer service voltage is maintained generation voltage criteria in Section V, transmission voltage criteria in Section VI, and primary distribution voltage criteria in Section VII shall be followed.

F. CRITERIA SUMMARY

The criteria outlined in this document shall be used in conjunction with engineering judgment and any applicable standards and guides to determine the appropriate course of action.

Existing facilities at the time this document is approved are grandfathered. However, every effort should be made to bring the facilities up to the standards of this document.

G. INSULATION COORDINATION (SURGE PROTECTION)

All equipment connected to MPW's system shall have a Basic Insulation Levels (BIL) of at least the value given in Table IV-2 below. The BIL describes the equipment's ability to withstand lightning and switching surges.

To keep surges to a minimum level, lightning arrestors shall be installed at all breakers, switches, and transformers with a Maximum Continuous Operating Voltage (MCOV) shown in Table IV-2 below for a solidly grounded system.

TABLE IV-2: INSULATION COORDINATION

NOMINAL VOLTAGE	BIL	MCOV
161 kV	750 kV	106 kV
69 kV	350 kV	48 kV
13.8 kV	95 kV	8.4 kV

H. REACTIVE POWER REQUIREMENTS

Reactive power requirements shall not put an undue burden on the system. See Specific Generation, Transmission, and Distribution Criteria sections for the specific requirements.

I. STUDY REQUIREMENTS

It is the responsibility of the transmission or generator owner requesting interconnection to ensure that all study requirements and data are submitted to the appropriate bodies to ensure the needed local and regional approval of the project. The studies will include, but not be limited to, power flow, system stability, and short circuit/system protection studies if deemed necessary. Power flow analysis will include 10-year load or resource growth projections and the planned facilities needed to satisfy such requirements. Currently, MISO West Subregional Meeting SPM and surrounding utilities must be notified as soon as feasible of the Connecting Party intent to add

transmission or generation facilities to the system. It is the obligation of the connecting party to provide a written summary of its plans to achieve the requirements specified in Section IV.B. and IV.C. MPW, the surrounding utilities, MISO West SPM, MISO SPA, MISO DPP, and other groups as required must review and approve all studies before facilities can be connected to the system. A minimum of 60 days should be allowed for study approval. MPW will be held harmless if approvals are not obtained. (Additional details of MPW and the regional study procedures are provided in "MPW Planning, Operating, and Data Submittal Procedure - Attachment K" Section IX. of this document.)

If the new facility causes operational problems on the local or regional system, even if studies have shown problems would not develop, it is the responsibility of the Connecting Party to correct any operational problems that develop after the facility is in service.

The cost of studies, MPW's cost for review of the studies, and upgrade costs shall be borne by the Connecting Party regardless of whether the studies are prepared by the Connecting Party, MPW, MISO, or consultant.

Study documentation and evidence that documents were provided will be maintained for a minimum of three (3) years or until the study is obsolete, whichever is longer. Submit to MRO or NERC within 30 calendar days upon request and maintain evidence that documentation was provided.

J. OBLIGATION OF CONNECTING PARTY

1. Connecting Party is obligated to pay any interconnection costs including but not limited to:

    a. Materials used to make interconnect (wire, insulators, etc.)
    b. Protective equipment such as protective relays, circuit breakers, cutouts, switches, etc.
    c. Transformers
    d. Metering, monitoring, and telemetry devices
    e. Installation labor
    f. Engineering costs

    MPW shall be reimbursed by the Connecting Party for the interconnection costs at the time the costs are incurred. Should the Connecting Party request reimbursement be made over a reasonable period of time and good cause shown, such request may be granted by the Board; provided, however, that no other customers of MPW bear any of the costs of interconnection.

2. Connecting Party shall be required to provide energy to MPW during

system emergencies only to the extent provided by agreement between Connecting Party and MPW. MPW may discontinue Connecting Party purchases and sales during system emergencies when they would contribute to the emergency and when discontinuance is on a non-discriminatory basis.

3. Each Connecting Party shall be required to interconnect to MPW's distribution or transmission system in parallel unless such connection is considered by MPW not to be safe or feasible.

K. INTERCONNECTION FACILITIES

1. Interconnections between Connecting Party and MPW shall be equipped with devices to protect either system from abnormalities or component failures that may occur within the Connecting Party or MPW's system.

2. Determination of Interconnection Requirements

   a. Initial Planning Data

      The Connecting Party shall submit an "Application for Parallel Operation with Utilities Services" which shall include a preliminary one-line electrical diagram and specified information regarding the electrical and physical characteristics of the interconnect including the proposed generating facilities and equipment, if applicable. Manufacturer's certified test data shall be supplied when received.

   b. Interconnection Plan

      The interconnection facilities, including substation equipment, metering and protective devices, shall be designed to meet MPW operating and reliability criteria and shall be in conformance with MPW's current revision of the "Parallel Operation of Generation Requirements", MPW's engineering and construction standards and practices, the National Electric Safety Code and any other applicable codes. The Connecting Party shall prepare an interconnection plan for the facilities based on studies of planned operating modes.

   c. Considerations in Development of the Interconnection Plan

      The plan for the (MPW/Connecting Party) interconnection shall, at a minimum, include consideration of the following design factors for effective and reliable operation under all reasonably expected system conditions:

(1) Personnel and public safety
(2) Supervisory control and data acquisition
(3) Telemetering and metering
(4) Normal and emergency communications
(5) Voltage control and power factor
(6) Equipment ratings
(7) Breaker duty
(8) Interconnection voltage level
(9) Real and reactive power requirements
(10) Short circuit conditions
(11) Transient stability limitations
(12) Capability to handle normal and emergency loading
(13) Protective relaying and automatic control equipment
(14) Facility maintenance coordination and inspection
(15) Load swings
(16) Reliability requirements
(17) Normal operating practices and procedures
(18) Emergency operating practices and procedures
(19) Special needs of the interconnection.
(20) Connecting Party backup requirements
(21) Synchronizing facilities
(22) Abnormal frequency and voltage operation (beyond +/- 5%)
(23) System grounding
(24) Responsibilities during emergency conditions
(25) Access to facilities
(26) For Connecting Party generator (if applicable) consider:
    (a) Generator controls
    (b) Governor response
    (c) Synchronous operation
    (d) Automatic Voltage Regulation (AVR)
    (e) Isolation transformer

Connecting Party's interconnection plan must adhere to Section VIII – System Operations.

d. Land and right-of-way easements

The Connecting Party is responsible for obtaining or providing the necessary land and right-of-way easements for the interconnection and generation facilities and connecting lines.

e. Connecting Party Substation Design

This section deals with specific requirements and design of the Connecting Party's substation and related equipment.

(1) MPW Review

Design of Connecting Party's facilities shall be reviewed and approved in writing by MPW or designated representative for suitability for safe, compatible, and reliable synchronous operation which will not reduce or adversely affect the quality of electric service being provided to MPW's customers.

(2) Review of Modifications

Connecting Party shall submit, in writing, for MPW’s or designated representative review and approval any change in Connecting Party facility that might affect performance of the interconnection prior to actual modification.

(3) Notification

MPW shall be notified in writing by Connecting Party at least 30 days before initial energization and start-up testing of Connecting Party's facility so that MPW or designated representative can inspect such facility's equipment and devices associated with the interconnection that might affect MPW's operation or adversely affect the quality of service MPW provides to its customers.

(4) Safety and Reliability

MPW shall have the right to inspect all facilities in Connecting Party's substation for MPW employee safety and reliability of service.

f. MPW Interconnection Facilities

Any necessary additions or modifications to MPW's system necessitated by the interconnection shall be made in conformance with current MPW engineering and construction standards and practices. Cost of any required additions or modification shall be borne by Connecting Party.

g. Capacity Requirements/Transfer Limits

The capability of the interconnection facilities, due to equipment loading, stability, voltage or other reasons, shall be determined by studies and approved by MPW or designated representative. Expected normal voltage levels and reasonable deviations shall be specified by MPW. Contingency capability shall be consistent with normal MPW reliability criteria (Section IV.B and C.).

h. Telemetering/Metering

Telemetering/metering shall be specified in the interconnection plan which will assure accurate and timely recording of interchange flows.

L. INFORMATION AND DATA EXCHANGE

It is important that the planned mode of operation of Connecting Party's facilities, the planned mode of operation of MPW's facilities, and the problems of operation be easily communicated between MPW and the Connecting Party. Depending on the intended use and/or contractual obligations, requirements for communication equipment for routine and emergency operations shall be included in the interconnection plan.

M. SYSTEM PROTECTION

When facility changes can impact the coordination of MPW, surrounding utilities, or other Connecting Parties, they shall be notified as soon as possible so appropriate protection coordination studies can be completed in accordance with PRC-001 and changes, if needed, completed before Connecting Party's system is put in service. Any affected party shall be allowed to participate in the study process. Cost of studies shall be borne by the Connecting Party.

The Connecting Party's protective relaying system shall be consistent with industry standard relaying practices for ready determination, isolation, communication, coordination, and correction of problems. Design of Connecting Party protective scheme shall be reviewed and approved in writing by MPW or designated representative for consistency with industry standard relaying practices. Safety to employees and public, limiting damage to equipment, controlling spread of interruption, limiting outage facilities, and simplicity of design shall be principles followed in the design of the protective relaying system.

All new and existing protective devices (breakers, fuses, etc.) shall be rated for the expected voltage ranges, maximum protected equipment continuous load, short circuit current, and duty cycle. Any existing equipment which

cannot meet the new conditions created by Connecting Party's system modifications must be upgraded or replaced.

Any necessary additions or modifications to the system due to increases in the available fault current caused by Connecting Party facilities shall be made in conformance with facilities owners engineering and construction standards and practices. Cost of any required additions or modifications shall be borne by Connecting Party.

The surrounding utilities and Connecting Parties will be notified when changes are made to the system that may affect their system coordination. These changes could include, but not be limited to, changes to the fault study and/or relay settings. Documentation shall include evidence of notification or agreement to changes as needed and sent to MPW's Manager, Reliability Standards Compliance for filing.

N. SYSTEM GROUNDING

1. TRANSMISSION AND DISTRIBUTION LINE GROUNDING

Transmission and distribution lines shall be grounded using driven ground rods driven until a resistance of 5 ohms is reached or the driving of rods becomes impossible. Grounds shall be installed at:

a. Every transmission pole
b. Every transformer location
c. Every lightning arrestor location
d. Every line tap, break in insulation, transition to different construction, or every 500' when using spacer cable

Crimpits shall be used for ground connections.

2. SUBSTATION GROUNDING

Substations shall be grounded according to ANSI/IEEE# 80 "IEEE Guide for Safety in AC Substation Grounding". Cadweld shall be used for ground connections.

O. SYNCHRONIZING FACILITIES

A synchroscope shall be located at every interconnection and generation facility. A MPW approved autosynchroninzing relay is also acceptable.

P. HARMONIC

The Connecting Party shall meet or exceed the recommended practices and requirements outlined in IEEE 519 – 1992 Recommended Practices and Requirements for Harmonic Control in Electric Power System. It is the responsibility of the Connecting Party or Parties that are the source of the harmonics to correct any harmonic violation that may develop.

Q. VOLTAGE FLICKER AND SAG

Voltage flicker associated with the sudden addition or removal of a load should be kept to a minimum. It is preferred that Connecting Party flicker be below the Border Line of Visibility curve in Figure 10.3 in IEEE 519 – 1992. Connecting Parties flicker must be below the Border Line of Irritation curve in Figure 10.3 in IEEE 519 – 1992. It is the responsibility of the Connecting Party that is the source of the voltage flicker to correct any voltage flicker problems that may develop.

Voltage sags due to fault shall be kept to a minimum. Automatic reclosing of a faulted facility shall be limited to one (1) reclosing on the transmission system and three (3) reclosing on the distribution system. Repeated reclosing on a faulted facility to “burn a fault clear” or “test” to see if the fault is clear is unacceptable and will not be tolerated. The fault should be either cleared or switching completed to isolate the fault before reclosing is attempted.

R. DISCONNECTION

If MPW or its customers experience problems of a type that could be caused by the presence of harmonics or voltage flicker, MPW shall be permitted to open and lock the interconnection switch pending a complete investigation of the problem. Where MPW believes the condition creates a hazard to the public or to property, the disconnection may be made without prior notice. However, MPW shall notify the operator of the Connecting Party by written notice and where possible, verbal notice as soon as practical after the disconnection.

S. METERING

1. CURRENT TRANSFORMERS

Current transformers used in metering applications shall meet the accuracy standards, as specified under the ANSI C57.13, for an accuracy class of 0.3 percent at all burdens. The current transformers shall at least be able to carry the maximum load (normal and emergency) of the circuit being measured.

2. VOLTAGE TRANSFORMERS

Voltage transformers used in metering applications shall meet the accuracy standards, as specified under ANSI C57.13, of 0.3 percent accuracy at all burdens.

3. INTERCONNECT METERING

Interconnect metering shall, unless other arrangements have been made, consist of in and out KWH meters with pulse initiators. The pulses will be sent to a MPW local pulse accumulator, MPW SCADA, and, if required, the Connecting Party pulse accumulator and SCADA.

4. CUSTOMER METERING

MPW customer metering shall consist of at least a KWH meter and, if needed, a KVARH meter to determine power factor penalty. See MPW "Electric Customer Service Handbook" for further information.

5. METER TESTING

All meters will be tested by the meter owner. MPW tests its meters according to its "Watthour Meter and Associated Equipment Inspection and Testing Program".

The testing party will notify the other party of the date, time, and place of the interconnect meter test to allow the other party to witness the test. (Only MPW Contract Customers and transmission and generator interconnect require notification of meter testing.)

T. MAINTENANCE COORDINATION

The requirement for maintenance and replacement of equipment is the sole responsibility of the owner. The equipment must be operated, maintained, and replaced in accordance with prudent utility practices and applicable environmental and safety standards. It is the responsibility of the owner to maintain their equipment adequately to ensure that other MPW customers will not be affected by Connecting Party equipment. Failure to do this will result in disconnection until corrective action is taken.

1. MAINTENANCE

Generation and transmission owners:

a. Facilities shall be designed to permit safe and routine or emergency maintenance to all components. Where intended use and/or contractual obligations of capacity and energy requires comparable reliability of supply to that of MPW's equipment, redundant facilities may need to be provided.

b. Shall furnish to MPW a long-term preventive maintenance program for each major item of equipment in their facilities which reflects planned outages for inspection, repair, maintenance, and overhaul.

c. Shall furnish to MPW its annual protective relay preventive maintenance program and schedule. MPW shall witness the calibration and testing of protective relays associated with Connecting Party's generation and interconnection facilities annually.

d. “Scheduled outages” of facilities are agreed to in advance by all parties involved. All outages must be approved by MISO.

2. INSPECTIONS

a. Connecting Party shall adopt a program of inspection of its facilities for potential maintenance problems so corrective maintenance can be performed before reliability is affected to ensure capacity factor requirements are met.

b. As contractually agreed, representatives of MPW shall have access at reasonable hours to specified interconnection equipment for inspection and testing purposes.

U. SAFETY

The Connecting Party shall comply with applicable safety laws and building and construction codes, including provisions of applicable Federal, State, or local safety, health, or industrial regulations or codes, and MPW's Safety Manual and programs.

V. CONTRACT

1. TERMS

a. Connecting Party shall sign an Electric Service Contract (Contract) provided by MPW and, except as otherwise provided in the Contract, after one (1) year from date of Contract, or as otherwise ordered by the Utilities Division of the Iowa Department of Commerce, either party may terminate the Contract on one year advanced written notice. Should the Connecting Party terminate the Contract, the costs of removal of the interconnection facilities shall be borne by the Connecting Party.

b. Contracts offered pursuant to this section may contain provisions and stipulations acceptable in the practice of contract law, and not inconsistent with the lawful rules or orders of the Utilities Division of the Iowa Department of Commerce. A negotiated Contract shall be established pursuant to this division, and applicable state and federal regulations, prior to establishing interconnection between the Connecting Party and MPW.

2. CONTRACT NEGOTIATION

a. Items to be considered during contract negotiations will include, but are not limited to the following:

(1) Backup requirements for energy and capacity
(2) Reliability requirements
(3) Wheeling losses
(4) Excess facilities charges
(5) Rights to lease or purchase
(6) Incentives
(7) Damages
(8) Insurance
(9) Protective relaying
(10) Indemnity
(11) Fuel supply and storage capabilities
(12) Firmness of energy and capacity

(13) Reserved capacity
(14) Metering
(15) Emergency availability
(16) Maintenance program and scheduling
(17) Reporting requirements
(18) Rates:
    (a) Power factor penalty
    (b) Backup power
    (c) Maintenance power
    (d) Supplemental power
    (e) Facilities use

V. SPECIFIC GENERATION CRITERIA

This section establishes criteria for the safe, effective, and reliable parallel operation of generation facilities within MPW's service area. It is the responsibility of the generation owner to complete or pay for the necessary studies required to add generation to the system according to the criteria set forth in this document and the requirements of MISO.

A. FACILITY RATINGS CRITERIA

It is the generator owner's responsibility to complete all necessary testing (such as GVTC tests) required by MISO, MRO, and NERC.

B. VOLTAGE CRITERIA

The generator will be required to maintain the bus voltage on its regulating bus as dictated by MPW's System Control. The typical range under normal conditions is provided in Table V-1 below. This is the voltage typically on the high side of the generator step-up transformer (regulating bus) when the unit is on under normal conditions (no outages).

TABLE V -1: MPW'S TYPICAL HIGH SIDE GENERATOR VOLTAGE CRITERIA WHEN UNIT IS ON

CONDITION	NOMINAL kV	MINIMUM VOLTAGE	MAXIMUM VOLTAGE
NORMAL	69.0	100%	105%
NORMAL	161.0	100%	105%

The voltage can actual vary based on Table V-2 – MPW's Transmission Voltage Criteria. This is the same as Table VI-3.

TABLE V–2: MPW'S TRANSMISSION VOLTAGE CRITERIA

CONDITION	MINIMUM VOLTAGE	MAXIMUM VOLTAGE
CONDITION	CUSTOMER	CUSTOMER
NORMAL	95%	105%
OUTAGE	92%	110%

C. REACTIVE POWER REQUIREMENTS

The generator shall not burden the system due to its reactive power requirements.

D. RELIABILITY CRITERIA

MPW and the Connecting Party shall initially determine the anticipated mode of operation of the generation facility, including the expected forced outage rate, hourly pattern of generation, and use of the generation facility's capacity and energy. Each generator shall be maintained in good working order.

1. SCHEDULED OUTAGES

Scheduled outages of the Connecting Party's facilities shall be agreed to annually in advance by both parties.

2. FORCED OUTAGE RATE

If the Connecting Party's generating facility is to be used to provide capacity and energy to MPW, the generation facility shall be capable of operating with a forced outage rate comparable to that of MPW's equipment. The Connecting Party shall attempt to meet or exceed the agreed upon forced outage rate by making modifications, if necessary.

E. STANDARDS FOR INTERCONNECTION, SAFETY, AND OPERATING RELIABILITY

1. The Connecting Party shall meet the standards as determined by Current American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineer (IEEE), Iowa Administrative Code (IAC), Underwriters Laboratory Standards (UL), National Electric Code (NEC), National Electric Safety Code (NESC) publications, and MPW standards shall be used for guidelines in determining these standards. Applicable publications could include but are not limited to the following:

    a. Requirements for Salient Pole Synchronous Generators and Condensers, ANSI C50.12.

    b. Requirements for Cylindrical-Rotor Synchronous Generators, ANSI C50.13.

    c. Iowa Electrical Safety Code, as defined in Iowa Administrative Code (IAC) (199).

    d. National Electric Code, ANSI/NFPA No. 70.

    e. National Electric Safety Code, ANSI C2.

    f. Underwriters Laboratory Standards, UL 1703 & 1741.

2. Connecting Party shall submit to MPW, data on the manufacturer, type of device, and output current wave form (at full load) and the output voltage waveform (at no load and at full load) for review and approval prior to interconnection.

3. Connecting Party is responsible to provide all data requested by MISO for modeling purposes, such as generator, exciter, and governor characteristics, and reporting requirements.

F. GENERATOR PROTECTION

MPW's approvals described herein shall not be construed as a warranty of safety, durability, or reliability of the Connecting Party's generation, service facilities, control devices, or protective devices. The Connecting Party shall be solely responsible for protecting its equipment in such a manner that faults or disturbances do not cause damage to the Connecting Party, MPW, and MPW Customer's equipment.

Interconnections between Connecting Party and MPW shall be equipped with devices, as set forth below, to protect either system from abnormalities or component failures that may occur within the Connecting Party or MPW's system. Inclusion of the following protective systems shall be considered as a minimum standard of accepted good practice unless otherwise specified by MPW:

1. The Connecting Party shall submit an "Application for Parallel Operation with Utilities Services" which shall include a preliminary one-line electrical diagram and specified information regarding the electrical and physical characteristics of the interconnect including the proposed generating facilities and equipment. Manufacturer's certified test data shall be supplied when received.

2. The interconnection shall include overcurrent devices to automatically disconnect the Connecting Party's generator from MPW's system at all current levels exceeding the full-load current rating of the generator.

3. The Connecting Party must be equipped with automatic disconnection for loss of MPW supplied voltage, reverse current relaying, and other protective equipment as determined by MPW and Connecting Party.

4. The Connecting Party shall furnish and install a manually operated isolating switch with visible break for the purpose of isolating its generator from MPW's system at a location specified by MPW, accessible by only MPW personnel, and capable of being locked in both the open and closed position by MPW personnel only.

In addition to MPW controlled isolating switch specified above, the Connecting Party should furnish and install a manually operated isolating switch with visible break for the purpose of isolating the Connecting Party's generator from MPW's system at a mutually agreed to location, accessible and controlled by Connecting Party personnel, and capable of being locked in the open position by Connecting Party personnel. The Connecting Party shall have access to this interconnection isolating switch at all times.

5. A generator that produces a terminal voltage prior to paralleling with MPW shall provide automatic synchronism-check devices to prevent paralleling out of synchronization with MPW's system.

6. The Connecting Party's generator shall be isolated from MPW's system by a power transformer that is connected in such a way as to isolate MPW's zero-sequence network from that of the generator's. MPW shall specify the transformer connection on MPW's side of the transformer.

7. Connecting Party's generator frequency protections, if used, must meet NERC, MRO, MISO, and MPW requirements. Generator underfrequency protection must coordinate with underfrequency load shedding discussed in Sections VIII.C. and IX.A.1.d., cannot operate at frequencies greater than 58.5 Hz, be under the Generator Underfrequency Trip Modeling Curve in PRC-006-2, Attachment 1, and doesn't require the shedding of additional load. Overfrequency protection, if used, must meet NERC, MRO, MISO, and MPW requirements and must not trip before 61.5 Hz and be over the Generator Overfrequency Trip Modeling Curve in PRC-006-2, Attachment 1.

G. ESSENTIAL EQUIPMENT

MPW shall have first rights to acquire the Connecting Party's generating facility as may be required for continued operation of the integrated system should Connecting Party cease operation of its generating facility.

H. CONNECTING PARTY POWER PLANT

The power plant shall meet all national, state, and local construction and safety codes. Design of the power plant shall be subject to review and approval in writing by MPW (or designated representative) and MISO as to suitability for safe, compatible, and reliable synchronous operation with MPW's and the surrounding system so as to not reduce nor adversely impact the quality of service being provided by MPW to its customers.

1. LOAD FOLLOWING CAPABILITY

The intended use of Connecting Party's generation facility capacity and energy will determine the need for Connecting Party to provide load-following capability of the plant. Connecting Party's generation facility may be included in MPW's control area provided suitable interconnection metering and control methods are employed by both systems.

2. PRESCHEDULED DISPATCH

Depending on the intended use and/or contractual obligations, the Connecting Party's generation facility shall be able to follow a prescheduled loading pattern set by MPW.

3. FUEL SUPPLY AND STORAGE CAPABILITIES

The intended use and/or contractual obligations of Connecting Party's generation facility will determine the required firmness of capacity and energy. Since the fuel supply is a major factor in the firmness of the capacity and energy of the facility, these factors will be considered and reviewed by MPW. After reviewing the Connecting Party's fuel supply, backup storage or a supplementary fuel supply may be requested of Connecting Party by MPW.

4. VOLTAGE AND REACTIVE CONTROL

The Connecting Party shall provide suitable automatic voltage regulating equipment compatible with MPW's system for controlling the voltage specified by MPW's System Control. The limits of voltage variation and required reactive capability of the unit shall be specified by MPW. If the Connecting Party's generator is unable to maintain the scheduled voltage, Connecting Party shall provide other reactive control devices necessary to control the voltage level.

Unless exempt, a detailed report must be maintained by Connecting Party showing the date, duration, and reason for each period when the generator was not operated in the automatic voltage control mode. Any time the unit is not operated in the automatic voltage control mode, the incident will be reported to MPW's System Control verbally and in writing. Generation will maintain a summary report, by unit, indicating the number of hours each unit was not operated in the automatic voltage control mode. Both the detailed report and the summary report must be retained for a rolling 12-month period.

5. EMERGENCY AVAILABILITY

a. Depending on the intended use and/or contractual obligations, the Connecting Party's generation facility shall be able, during emergencies, to perform in a manner similar to MPW's resources by:

(1) Quickly coming on-line.
(2) Quickly adjusting generation output.
(3) Remaining in operation and connected to MPW's system.
(4) Quickly coming off-line where Connecting Party's generation would contribute to overloading facilities.
(5) Assist in maintaining stability of regional system.

b. Connecting Party shall be required to provide energy to MPW during system emergencies only to the extent provided by agreement between Connecting Party and MPW. MPW may discontinue Connecting Party purchases and sales during system emergencies when they would contribute to the emergency and when discontinuance is on a non-discriminatory basis.

I. GOVERNOR RESPONSE

The Connecting Party shall verify the ability of its generating unit to respond automatically to normal upsets in the frequency of the system and contribute its part in maintaining the stability of the interconnected system. MPW, MISO, and MRO may prescribe certain overspeed protection or stabilizing device for Connecting Party's generation facility.

J. GENERATOR MODELS & TESTING

It is the responsibility of the Connecting Party (generator owner) to provide the necessary steady state, dynamic, short circuit, and any other modeling data to correctly represent the generating facilities. This includes preforming the required tests and ensuring the accuracy of the data as specified by NERC/MRO, MISO, MPW, and other governing body requirements.

K. PROTECTIVE RELAYING SYSTEMS

The protective relaying system of the Connecting Party's power plant shall be sufficient to prevent or limit equipment damage for contingencies both within the plant and external to the plant on MPW's and surrounding system. Underfrequency relaying, if utilized, shall be set as specified by MRO, NERC, and MPW requirements.

L. CAPACITY REQUIREMENTS AND LIMITATIONS

Depending on the intended use and/or contractual obligations, the Connecting Party's power plant equipment shall provide for the expected mode of operation without undue maintenance or life reduction. Controls within Connecting Party's power plant shall be provided to permit all reasonably expected modes of operation.

M. INTERCONNECTION VOLTAGE

Voltage at the point of interconnection shall be specified by MPW’s System Control.

N. HARMONICS

Connecting Party’s generation shall not exceed MPW's specifications for harmonic content as discussed in the General Requirements (Section IV) above.

O. COMMUNICATIONS

Communications equipment shall be provided for normal and emergency voice and data communication between Connecting Party's power plant operation personnel and MPW's System Operations personnel. Backup communication facilities shall also be provided to ensure adequate communications during failure of primary communication equipment.

P. REPORTING REQUIREMENTS

Routine reporting requirements, such as voltage level, line flows, amperes, unit loading, etc., shall be developed and procedures established before the interconnection is established between the Connecting Party and MPW.

Q. RATES FOR PURCHASE

Rates for purchase of electrical power shall be determined by MPW and the Connecting Party in accordance with requirements established by federal and state regulations.

VI. SPECIFIC TRANSMISSION CRITERIA

This section applies to the transmission system, which is used to transfer generation to MPW's distribution substations and to and from the bulk transmission system. On MPW's system, the transmission voltages are currently 69 kV and 161 kV.

A. FACILITY RATINGS CRITERIA

MPW Transmission facility ratings should be determined as outlined in the General Requirement (Section IV.D.). Every effort shall be made to ensure the conductor is the limiter, however, the rating will be the lesser of all series elements. Conductor ratings are provided in Tables VI-1 and VI-2 below. The actual ratings for the facilities are available in the MISO models.

TABLE VI-1: TRANSMISSION CONDUCTOR RATINGS		
	CONDUCTOR RATINGS	
CONDUCTOR SIZE	SUMMER (AMP)	WINTER (AMP)
336.4 kcmil ACSR 18/1	489	655
636 kcmil ACSR 26/7	743	1001
954 kcmil ACSR 45/7	938	1243
1590 kcmil ACSR 45/7	1258	1716

TABLE VI-2: TRANSMISSION UNDERGROUND RATINGS	
CONDUCTOR SIZE	RATING (AMP)
1000 kcmil COPPER DUCT	760
750 kcmil AL DIRECT BURIED	620

It is the transmission owner responsibility to provide the modeling data for their facilities according to their facility ratings criteria.

B. VOLTAGE CRITERIA

The voltage criteria to ensure adequate voltage to MPW customers as outlined in the General Requirements (Section IV.E.) are shown in Table VI-3 below. These values should be used in all studies associated with determining the adequacy of MPW transmission system.

TABLE VI–3: MPW'S TRANSMISSION VOLTAGE CRITERIA		
CONDITION	MINIMUM VOLTAGE	MAXIMUM VOLTAGE
CONDITION	CUSTOMER	CUSTOMER
NORMAL	95%	105%
OUTAGE	92%	110%

C. REACTIVE POWER REQUIREMENTS

Reactive power flow on the transmission system should be kept to a minimum to avoid undue burden on the transmission system. Reactive power requirements should be supplied at the load. It is MPW's intent that reactive load requirements will be met at the distribution level.

D. TRANSMISSION LINE DESIGN

Transmission lines shall be designed and constructed according to the latest edition of the National Electrical Safety Code (NESC) minimum requirements for strength, clearances, and loads together with other applicable codes and guides. All transmission lines shall have overhead ground wire(s) shielding over the entire length and shall be adequately grounded at each pole to ensure lightning outage occur no more than once in three years.

E. RELIABILITY CRITERIA

MPW and Connecting Party transmission facilities shall be designed and maintained to obtain a high degree of reliability while addressing the concerns in this document and Connecting Party's reliability requirements.

VII. SPECIFIC DISTRIBUTION CRITERIA

This section applies to the distribution system, which is used to serve MPW Customers' load. On MPW's system, the distribution voltages are currently 13.8 kV and below.

A. FACILITY RATINGS CRITERIA

Distribution facility ratings should be determined as outlined in General Requirements (Section IV.D.).

B. VOLTAGE CRITERIA

The primary distribution voltage must be within the limits stated in Table VII-1 below. (The 0.01 pu difference in primary voltage requirements between the Commercial II/Industrial and Residential/Commercial customer is due to the Residential/Commercial customer having long secondary runs. The Commercial II/Industrial customer service point, however, is located at the transformer with minimum secondary runs.) Where three phase service is provided, the maximum deviation between the highest and lowest phase voltages should be within 2.0%.

TABLE VII-1: MPW'S PRIMARY DISTRIBUTION VOLTAGE CRITERIA

	PEAK LOAD		LIGHT LOAD
CONDITION	RESIDENTIAL/ COMMERCIAL I	COMMERCIAL II/ INDUSTRIAL	ALL
	CUSTOMER	CUSTOMER	CUSTOMER
NORMAL	99%	98%	105%
OUTAGE	96%	95%	106%

C. REACTIVE POWER REQUIREMENTS

The distribution customer should strive to have the best power factor possible to avoid putting an undue burden on the distribution system. Failure to do this will result in a power factor penalty as outlined in MPW's "Water and Electric Rate Pamphlet".

D. DISTRIBUTION LINE DESIGN

Distribution lines shall be designed and constructed according to the latest edition of the National Electrical Safety Code (NESC) minimum requirements for strength, clearances, and loads together with other applicable codes and guides.

E. RELABILITY CRITERIA

MPW and Connecting Party shall initially determine Connecting Party's reliability requirements. The distribution facilities shall be designed and maintained to obtain a high degree of reliability while addressing the concerns in this document and Connecting Party's reliability requirements.

VIII. SYSTEM OPERATION

The day-to-day operation of MPW's system is the responsibility of MPW's System Control using MPW, NERC, MISO, and MRO policies, procedures, and guidelines.

A. COMMUNICATION DURING NORMAL AND EMERGENCY CONDITIONS

System Control can be contacted for any questions about MPW's system operations at:

Muscatine Power & Water
3205 Cedar Street
P.O. Box 899
Muscatine, IA 52761
Phone: (563) 263-2631

B. RESPONSIBILITIES DURING EMERGENCY CONDITIONS

System Control dictates the restoration procedures under emergency conditions based on MPW's "System Restoration Plan", NERC, MISO, and MRO criteria.

C. ABNORMAL FREQUENCY OPERATION

MPW's system operates at a frequency of 60 Hz. As required by MISO, NERC, and MRO, MPW maintains underfrequency relays which are required to shed approximately 10% load at each of three steps when frequency deviations occur for a total of at least 30%. These steps are 59.3 Hz, 59.0 Hz, and 58.7 Hz. If frequency is still below 59.5 Hz even after the three steps of the UFLS have occurred, MPW will coordinate additional manual load shed amounts with their Reliability Coordinator (MISO).

Additional generator underfrequency protection can also be used as discussed in Section V.F.7. provided it coordinates with the underfrequency load shedding, cannot operate at frequencies greater than 58.5 Hz, be under the Generator Underfrequency Trip Modeling Curve in PRC-006-2, Attachment 1, and wouldn't require the shedding of additional load.

D. VOLTAGE AND POWER FACTOR CONTROL

The voltage and power factor of MPW's system is controlled by System Control with generation and capacitor banks.

E. ABNORMAL VOLTAGE OPERATION

In order to ensure the system operates within the voltage criteria as outlined in this document, System Control will use the available capacitor banks, generators, contact surrounding utilities, and shed load to ensure voltages are maintained within acceptable limits.

F. PROCEDURE TO CHANGE GENERATION TRANSFORMER TAPS

When tap changes are necessary, the owner/operator of synchronous generators will be notified via a written report specifying required tap changes and a technical justification for these changes. MPW does not anticipate granting any exemptions from this reporting requirement.

Generator transformer taps should be set to ensure that the generator is providing its share of VAR support to the system while providing adequate generator terminal and station service voltages. All transformer tap settings shall be mutually agreed to by both generator owner and MPW. The following procedure should be followed in order to initially set or change generator transformer taps.

1. Transformer owner shall provide MPW and generator owner with available tap ranges and impedance data for generator step-up and auxiliary transformers. MPW shall provide generator owner with electric system voltage requirements. Generator owner shall provide MPW with generator terminal and station service voltage requirements.

2. Proposed transformer tap setting(s) by either MPW or generator owner shall be provided to MPW and generator owner for review and approval. A minimum of 20 days shall be allowed for review.

3. Once transformer tap setting(s) changes are agreed to by both generator owner and MPW, the transformer owner shall set the transformer tap(s) to the agreed to setting(s) at an agreed upon time, generally the next time the unit is taken off-line. (Initial transformer tap setting(s) must be agreed to and installed before the unit is connected to the system.)

4. In emergency situations where deviation from the above procedures and timing requirements, communication between MPW and the generator owner must continue and final approval of settings will be expedited to ensure network security.

5. Documentation of the time and settings before and after will be provided to MPW for filing purposes in Technical Services and Engineering.

G. MPW'S UNITS 8 AND 8A OPERATING CRITERIA

This operating criteria explains how MPW's Unit 8 (Bus 633008, ID: 8) and Unit 8A (Bus 633408 ID: A) operate since they share a common boiler. The criteria should be used when setting up operating and/or planning studies. Typically, MPW sets up base case models so that the higher winter Unit 8A output of 18 MW with Unit 8 at 20 MW will be in the MISO Spring (SPR) and Winter (WIN) peak models. The lower summer Unit 8A output of 15 MW and Unit 8 at 25.4 MW are used in the MISO Summer (SUM), Shoulder (SSH or SU), Fall (FAL), and Light Load (LL or SLL) models. If needed and the capacity is available, Unit 8A can be operated at the higher winter output anytime of the year.

Either unit can operate without the other unit running. Unit 8's Pmax is approximately 75 MW without Unit 8A on and Unit 8A's Pmax is approximately 18.8 MW without Unit 8 on. (Current Pmax ratings are in the MISO models and MISO MOD.) Unit 8 cannot generate its full output of 75 MW when Unit 8A is on. The criteria in the first paragraph should be used when Unit 8A is on.

Currently, Units 8 and 8A will not be running during the summer months of May 1 to October 1.

IX. MPW PLANNING, OPERATING, AND DATA SUBMITTAL PROCEDURE - ATTACHMENT K

Muscatine Power & Water (MPW) is a municipal utility with approximately 33 miles of 161 kV lines and 33 miles of 69 kV lines with three – 161/69 kV substations and seven – 69/13.8 kV substations. The service territory is approximately 24 square miles. Our last system peak was 149.9 MW on July 29, 1999 with a more recent peak of 146.9 MW on July 17, 2006 with generating capacity of approximately 261 MW from three units.

This procedure is an overview of the planning, operating, and data submittal process at MPW; many of the working files contain additional instruction. (Note that stated times/timeframes are typical and subject to change.) Part A. discusses Model Building, Part B. discusses MPW Transmission studies, Part C. discusses Regional Transmission Planning, and Part D. discusses Other Data Submittals completed on a regular basis. These processes are mainly completed by the Mechanical Engineer, Planning Engineer, and Electrical Engineer with input from other individuals as required.

A. MODEL DATA REQUEST

MPW will provide model data as requested. MPW provides data through theMISO model building process as discussed below. The data, unless indicated otherwise, is located at: G:\MODEL BUILDING. (NOTE: MRO no longer requests model data, however, data will be provided, if requested, per MRO instructions.

1. MISO MODELS REVIEW

As needed provide and/or review the following models:

a. MISO planning model data is maintained in MISO Model on Demand (MOD). As models change MOD should be updated to reflect the change. All project updates should be provided to MOD when data becomes available. The project data should also be provided to the Planning Portal. The MISO status reports come from the data in the Planning Portal. Quarterly updates are due at the end of the quarter in the Planning Portal.

b. MISO Transmission Expansion Plan (MTEP)
As requested, provide updated model data for the MISO MTEP models. The data submittal is sent in August but is subject to change each year. Follow the MISO instructions each year. The initial project and loadflow data are due in September. The models are reviewed when MISO provides them for review using the appropriate SAV files created during the initial loadflow model building process. Generation and load may vary from SAV files since MISO may have economically dispatched the model and loads may have been updated since the initial loadflow data was

submitted. Typically, four passes are provided for review into the next year. The models and data for MTEP are kept in directory: G:\MODEL BUILDING\MISO\MISO MTEP in a separate subdirectory for each year.

c. MISO PROMOD MODEL
MPW doesn't have the PROMOD program, as such, we can't review the details of the model. However, we can review the basic assumptions and topology of the model as MISO request, typical in September.

d. MISO ENERGY MANAGEMENT SYSTEM (EMS), COMMERCIAL MODEL, NETWORK MODEL
As requested, review MISO EMS network, particularly when topologic changes are being made in MPW network. The network is reviewed quarterly and due to 15th of the month of March, June, September, and December. Changes are made using the WebTool. . Note: MISO EMS network model is a net real time model. Generation and load comes from real time data and will not be accurate in the WebTool. The data for these models are kept in directory: G:\MODEL BUILDING\MISO\MISO EMS

e. MISO BASE CASE
As needed, review MISO base case monthly, particularly if there is a MPW project that will impact the monthly model. Request comes from the MISO MOD Admin Team. Let them know if there are any errors. The projects should show up in the base case when they are put in service. The models are downloaded and review in directory: G:\MODEL BUILDING\MISO\BASECASE

f. MISO TRANSACTION PARTICIPATION FACTOR (TPF) MODEL
As needed, review MISO TPF model and matrix and let MISO know if there are any issues. Normally, completed twice a year. When reviewed the data is kept in directory: G:\MODEL BUILDING\MISO\TPF MODEL

g. MISO COORDINATED SEASONAL ASSESSMENT (CSA) MODEL
Review model and results based on Coordinated Seasonal Transmission Assessment scope for Summer, Winter, and any other seasons requested. Typically, the Summer assessment is started in November and finished by May of the next year, while the Winter assessment is started in May and finished by October of each year. The data is kept in directory: G:\MODEL BUILDING\MISO\MISO CSA with a subdirectory for each season.

h. SYSTEM PLANNING & ANALYSIS (SPA) AND DEFINITIVE PLANNING PHASE (DPP) MODELS
As needed, review models and results of System Planning & Analysis (SPA) and Definitive Planning Phase (DPP) for the additional of new generator(s) to the system. MPW participates in these studies when the new generation(s) is close enough to MPW system to impact it.

i. MISO UNDERFREQUENCY LOAD SHEDDING (UFLS) REQUEST
MPW maintains an UFLS program as required by MRO and MISO and as defined by MRO in its guideline, “MRO Under-Frequency Load Shedding (UFLS) Program”. Our program uses underfrequency relays set at either 59.3 Hz, 59.0 Hz, or 58.7 Hz and trips some of our 13.8 kV breakers at several substations. At each frequency, approximately 10% of our load is tripped for a total of at least 30%. MPW underfrequency relays are set for a 25 cycle delay and have a 2.82 cycle relay pickup time and 3 cycle breaker trip time for a total time of 30.82 cycles (0.51 seconds).

MPW provides MISO the data they request for MPW’s underfrequency load shedding program. This data is located at G:\MODEL BUILDING\UFLS\UFLSyyyy where yyyy is the 4 digit year. MPW reviews on an annual basis, its UFLS program when a new directory is created each year and the latest file UNDERFREQUENCY_yy.xls is copied into it and updated with the latest load data from the SCADA system and adjusted, as needed, to provide the data for the spreadsheet that MISO provides to submit the underfrequency load shedding information.

MPW will analyze any UFLS operations and misoperations within our system and provide any information requested to allow others to analyze their UFLS operations and misoperations. This will include, at a minimum, a description of the event, review of UFLS set points and tripping times, and a summary of the findings. Any UFLS event would likely cover a wide area with MPW being a small part. We do not have tools to simulate the event but would work with others to simulate the event. The analysis summary report will be completed within 90 days of the event and upon request MPW will provide the report to MRO or NERC.

Additional generator underfrequency protection can also be used as discussed in Section V.F.7. provided it coordinates with the underfrequency load shedding, cannot operate at frequencies greater than 58.5 Hz, be under the Generator Underfrequency Trip Modeling Curve in PRC-006-2, Attachment 1, and wouldn't require the shedding of additional load.

The data is kept in directory: G:\MODEL BUILDING\UFLS with a subdirectory for each year. MISO typically requests the data in the April/May timeframe.

j. MISO UNDERVOLTAGE LOAD SHEDDING (UVLS) REQUEST
MPW doesn't have any UVLS. When the data is requested, typically in the beginning of the year fill in the data request as needed indicating MPW doesn't have any UVLS. The data is kept in directory: G:\MODEL BUILDING\UVLS with a subdirectory for each year. Typically requested in January/February timeframe.

k. MISO SHORT CIRCUIT REQUEST
MISO typically request short circuit breaker duty data in the summer/fall timeframe. MPW review the breaker duty data each year and provides it to MISO upon request per their instructions. The data is kept in the directory: G:\MODEL BUILDING\MISO\MISO_Short_Circuit with a subdirectory for each year.

3. OTHER MODELS REVIEW

MPW will review and/or provide data for models others request.

B. MPW TRANSMISSION STUDIES

1. PLANNING STUDIES

Generally, five and ten year loadflow and protection studies are completed every three years (or more often if system conditions warrant) by a consultant to ensure MPW's local system continues to meet NERC, MRO, and MISO requirements during summer peak and off peak conditions. Summer peaks are studied since that is when MPW's system peaks and off-peaks are studied when MPW's Units 8 or 9 are down for planned maintenance.

2. STABILITY STUDIES

Dynamic studies are completed when system changes require a study to ensure MPW's local system continues to meet NERC, MRO, and MISO requirements for system stability. MPW stability studies are completed with the loadflow planning studies above.

3. COORDINATION STUDIES

System Protection Coordination studies are generally completed when new or materially modified changes occur on MPW system or outside MPW system if it has a sufficient impact on our system and could impact relay settings. This can include:

- Addition of generator, line, transformer, or transmission termination to a facility.
- Addition of circuit breakers or switching devices that change the topology,
- Change of impedance.

What is not considered materially modified are:

- Change in rating of element that constitute the facility.
- Delta connected distribution transformer.

Generally, Coordination studies are completed by a consultant to ensure MPW's local system continues to meet NERC, MRO, and MISO requirements to ensure faults are cleared with the minimum amount of facilities outaged. The studies are completed more or less often as system conditions warrant. Consultant contacts the surrounding utilities to ensure the short circuit model is accurate and determine what future changes will be made to the system. Any system changes to MPW system are provided to the surrounding utilities as requested. The surrounding utilities will be notified when changes are made to the system that may affect their system coordination. These changes could include, but not be limited to, changes to the fault study and/or relay settings. Documentation shall include evidence of notification or agreement to changes as needed and sent to MPW's Manager, Reliability Standards Compliance for filing.

4. ECONOMIC PLANNING STUDIES

These studies are those requested by an outside party. MPW will work with the requestor to define the study, determine how to perform, data requirements, priority, and cost sharing before the study starts. It is anticipated that these studies will be completed at the same time the above studies are done, particularly Item IX.B.1. Whenever possible, multiple requests will be grouped for cost efficiency and to fit the schedule. Surrounding stakeholders will be notified of upcoming studies

so they can provide input for their planning study needs and participate if desired. This notice will be included in the request for contact information for model updates.

5. STUDY SUMMARY

The studies in Items IX.B.1, IX.B.2., IX.B.3., and IXB.4. above will be done more or less often based on load growth, system changes, study requests, and results of MISO studies. MPW outsources these studies to a consultant. The studies are completed based on MPW Facility Connect Requirements document, Consultant's Request for Proposal (RFP), and this document. The consultant is provided the necessary MPW and MISO model data and contact information for the surrounding utilities to obtain updated model data from them. MISO, surrounding utilities, MPW System Operators, and other stakeholders are given an opportunity to participate in the study process. Based on the study recommendations, surrounding utilities, MPW System Operators, MISO, and other groups are made aware of any system changes, as appropriate. Any additional studies needed to gain regional approval to implement the improvement(s) are run and sent to the appropriate groups for approval. Stakeholders will be supplied an electronic copy of the report when completed. Study documentation and evidence that documentation was provided will be maintained for a minimum of three (3) years or until the study is obsolete, whichever is longer. Submit to MRO or NERC within 30 calendar days upon request and maintain evidence that documentation was provided. Documentation shall be sent to MPW's Manager, Reliability Standards Compliance for filing.

6. COST SHARING

Cost sharing for the studies in Items IX.B.1., IX.B.2., IX.B.3., IX.B.4., and IX.B.5. above will be determined before the study starts. The allocation will be based on who benefits and priority of the study(s).

7. BULK SYSTEM REVIEW

Annual bulk system reviews are conducted by MISO in Section IX.C. below.

8. SHORT-TERM

As needed, work with MISO and the surrounding utilities for any operating studies that may be required due to planned outages, particularly multiple planned outages, in MPW's and/or the surrounding system. Ensure that the appropriate seasonal model is being used and that the equipment ratings and load levels in the model are correct for the expected time frame of the outage(s). Once the appropriate cases are run, determine if there are any violations and either explain the violation(s) or propose corrective action, such as an operating guide or moving one or more of the planned outage to a different time.

9. REAL TIME

If issues develop in real time contact the surrounding utilities or Reliability Coordinator (MISO – Eagan, MN), as needed, and determine the cause and if corrective action is needed. The Planning Engineer or one of the other MPW Engineers can also be contacted, if needed, to answer questions or help determine cause and whether corrective action is needed. (See System Control detailed procedures listed in SO-140)

10. OPERATING GUIDES/CRITERIA

System Control's Operating Guides/Criteria should be updated with any changes or additions from the above studies and distributed to System Control and other entities, as needed.

11. SYSTEM OPERATING LIMITS (SOL) AND INTERCONNECTION RELIABILITY OPERATING LIMITS (IROL)

The SOL process starts with the facilities ratings defined as the maximum operating limits. Planning studies then look at the normal and emergency conditions affecting the system to determine whether lower operating limits are needed to handle the conditions defined by NERC and MRO.

Within the scope of the study, planning studies shall look for and identify any SOL and IROL using the latest version of the MISO "SOL (IROL) Methodology for the Planning Horizon definitions" in MISO BPM-020-r15, Appendix L. If at all possible, system improvements should be developed to correct any SOL and IROL discovered in the MPW system.

The completed report shall provide a list of the SOL and IROL and associated contingencies that result in thermal, voltage, or transient stability limits.

The list of SOL and IROL shall be provided to Planning Authorities, Transmission Planners, Transmission Operators, Transmission Service Providers, Reliability Coordinators, and other interested parties that are within our area. At a minimum, this will include MRO, MISO, MidAmerican Energy Company (MEC), Central Iowa Power Cooperative (CIPCO), and ITC Holdings (ITC).

C. REGIONAL TRANSMISSION PLANNING (BULK TRANSMISSION PLANNING)

1. REGIONAL MODELS

As requested or required, review all regional models (MISO, , etc.) to ensure that the models are current before studies are started. The models can be checked with SAV files created during the model building process in Item IX.A.1.b. above.

2. REGIONAL STUDY RESULTS

As requested or required, review all study results (MISO etc.) to ensure that the results do not have any MPW violations. If violations exist, determine if they are valid and either explain the violation(s) or propose corrective action.

3. MISO PLANNING PROCESS

Since MPW has joined MISO we are participating in the MISO MTEP process based on the latest MTEP Information Exchange Schedules and Requirements. The process generally starts in August with a first draft report available in August of the following year. The schedule should be reviewed each year to determine what information needs to be provided and when. Generator Owners, Transmission Owners, Distribution Providers, and Load Serving Entities which includes MPW will submit data to MISO for the assessment.

D. OTHER DATA SUBMITTALS

This is a chronological overview of the process; many of the working files contain additional instruction. (Note that stated times/timeframes are typical and subject to change.)

1. NERC GADS – GENERATING AVAILABILITY DATA SYSTEM (QUARTERLY)

MPW provides mandatory data to the GADS database in accordance with NERC requirements. Indices are calculated for each generator each month based on IEEE Standard 762 definitions for Service, Availability, Outage, Unavailability and Reliability. Data concerning the date, time and nature of events which affect Unit availability are collected by the Generation Engineering Department. Data concerning performance of MPW's generators are collected from the Generation Performance and Operating Statistics Report. The event data and the indices produced from the data are reviewed by Manager, Power Generation and Chief Plant Engineer, and forwarded to the Executive Officers and the Board of Directors. The performance and event data are supplied to GADS quarterly by the Mechanical Engineer via upload

to NERC OATI GADS Database where the indices are available to legitimate interested parties as per GADS security protocols.

2. MISO POWER GADS (QUARTERLY)

MPW provides the GADS data via MISO's Market Portal/Customer Service/Midwest ISO GADS/Login following the steps outlined in MPW's GADS Data Input SOP – GADS Data Workbook.xls User's Guide. Currently the Mechanical Engineer is authorized to use MISO's Power GADS application.

3. EIA – 923M COST AND QUALITY OF FUELS FOR ELECTRIC PLANTS DATA (MONTHLY)

MPW provides data to the EIA Form 923M database in accordance with FERC requirements. The monthly data is fuel receipts, the source and quality of the fuel and the cost. The monthly data is collected by the Generation Engineering Department and the Accounting Supervisor and furnished to the Mechanical Engineer. The Mechanical Engineer submits the data via the web-based Form 923M. Plant Engineer Dept. maintains access credentials for the web-based EIA data system.

4. GENERATION PERFORMANCE AND OPERATING STATISTICS REPORT (MONTHLY).

The Generation Performance and Operating Statistics Report is the summary of fuel, generation and reliability statistics for each Unit, reported on a monthly basis. The plant data is accumulated, reduced and reviewed by the Generation Engineering Department before it is published for review and use by the remainder of MPW.

5. MISOPERATION REPORT (QUARTERLY DUE WITHIN TWO CALENDAR MONTHS OF THE END OF THE QUARTER)

MPW Tech Services, Electrical Engineer, and the Planning Engineer review all faults and trips to ensure there are no misoperations by reviewing the Outage Report targets and location of the fault. If a misoperation is suspected, the digital fault records, relay event records, fault studies, and other available information are reviewed as needed to determine if there is a misoperation. Effort will be made to determine the cause of the misoperation within a month of the event. Confirmed misoperations will be added to the misoperation database in the G:\TS\DFRS\Fault2000.mdb by Planning Engineer and/or Electrical Engineer using the frmMISOPERATION form. As needed, a corrective action plan will be developed with a time line by MPW Tech Services to avoid future misoperation of a similar nature.

If the misoperation is on the 100 kV and above system and resulted in a false trip or failure to operate for a fault correctly, then the misoperation

must be reported. A transmission (above 100 kV) or generation (Unit 9) reportable misoperation includes:

a. The failure of a Protection System element to operate when a fault or abnormal condition occurs within its zone of protection.
b. Any unnecessary Protection System operation for a fault not within the zone of protection.
c. Any unnecessary Protection System Operation when a fault or other abnormal condition has occurred.

The report is due to NERC's Misoperation Information Data Analysis System (MIDAS) website . The Administrative Assistant will request the information two weeks before the due date so there is time to enter the data. A misoperation report for jointly owned facilities shall be coordinated with the lead being taken by the owner of the equipment causing the misoperation. Normally, all owners need to submit a separate misoperation report, particularly when they are impacted. If there are no misoperations, then the email should state that there are no misoperations for the quarterly report. The Administrative Assistant will submit the data in the MIDAS website per the instructions for the submittal.

The G:\EN\NERC\PRC-004\MISOP_TRACKER.xlsm spreadsheet tracks the misoperations internal process when there is a BES operation to determine whether a misoperation occurred. Misoperation data and corrective action plans, when developed, will be maintained for a minimum of 36 months or until the Corrective Action Plan (CAP) has been executed, whichever is later by the Manager, Reliability Standards Compliance.

6. <u>TRANSMISSION AVAILABILITY DATA SYSTEM – TADS (DUE QUARTERLY WITHIN 45 DAYS OF THE END OF THE QUARTER)</u>

Submit the unplanned transmission outage data for outages greater than 1 minute and 100 kV. This data is submitted to the Administrative Assistant quarterly on or before the requested date. The Administrative Assistant will submit the data in the TADS website per the instructions for the submittal. The data is maintained in directory: G:\EN\PLANNING\PRIVATE\TADS

7. <u>MPW's RELIABILITY REPORT (QUARTERLY)</u>

System Control, Administrative Assistant, and the Planning Engineer maintains the outage database to report the System Reliability Indices for MPW. These indices are reported to MPW Executive Staff and MPW's Board of Directors on a quarterly basis and provided to others as requested.

8. **MPW's MANUAL LOAD SHEDDING PROCEDURE (DUE JAN/FEB)**
MPW's manual load shedding program shall be reviewed annually and updated as needed.

9. **EIA – 860 ANNUAL ELECTRIC GENERATOR REPORT (DUE FEB).**
Form EIA-860 collects data on the status of existing electric generating plants and associated equipment in the United States, and those scheduled for initial commercial operation within five years of the filing of this report. The data collected on this form is used to monitor the current status and trends of the electric power industry and to evaluate the future of the industry. The Mechanical Engineer assembles the data. The completed EIA Form 860 is reported via the EIA web-based Form 860. Generation Engineering Dept. maintains access credentials for the web-based EIA data system.

10. **MPW FERC 715 DATA SUBMITAL (DUE FEB/MAR)**
MPW FERC 715 data submittal is submitted to FERC by MISO for MPW. The process is completed per MISO instructions by the Planning Engineer and/or Electrical Engineer similar to the "FERC 715 Authorization Report" procedure in Alchemy. It typically starts at the end of January with a request from MISO whether MPW will participate. The process ends around April 1 with a confirmation from MISO that the data has been sent to FERC. This data is maintained in directory: G:\MODEL BUILDING\MISO FERC715 with a subdirectory for each year.

11. **FORECASTING (DUE MAR/APR)**
MPW's load and energy forecasts are reviewed annually by the Forecasting Committee consisting of Accounting Supervisor, Mechanical Engineer, Energy Services Advisor, Project Engineer, Electrical Engineer, and Planning Engineer (Project Leader). Forecasts are completed for MPW native system customers based on customer surveys, anticipated growth, and historical trends. The process begins in January and completed with a report being submitted to MPW Staff in March or April of each year.

12. **ANNUAL MISO GVTC (DUE OCT)**
The GVTC results are based on real net capability for MPW's units used as planning resources in the MISO market. The test requirements are based on MISO's Module E GVTC Testing procedure. The results are forwarded to the Mechanical Engineer for review. The Coincident Maximum Circulating Water Temperature table is updated and the GVTC Net capacities are corrected using turbine-generator Thermal Kits to produce Net Maximum Capacities that are coincident with MISO peaks and corrected by coincident maximum circulating water temperatures. The corrections are reviewed by Generation Engineering

Dept. and Manager, Power Generation. The results are uploaded by the Mechanical Engineer via MISO Market Portal Power GADS. Director, Power Production and Supply, the Manager, Power Generation, the Supervisor, Control Center, and Plant Engineering are notified when the results have been uploaded.

13. **MPW GENERATION MAINTENANCE OUTAGE SCHEDULE (DUE OCT)**
MISO requests the generator maintenance schedule for the next two years in September. An Excel workbook is used to furnish System Control with the necessary scheduled outage data on MPW units for the next two years. System Control then uses the MISO CONTROL ROOM OPERATION WINDOW (CROW) to submit the data for the next two years. The workbook is based on current GVTC data, Maximum Continuous Rating Data as it appears in Section 6.A of the Generation Utilization Team (GUT) reference manual, and the current Load Forecast Study data.

14. **MISO MODULE E CAPACITY TRACKING (MECT) APPLICATION (DUE DEC 31 AND MAR 1)**
MPW provides capacity and system demand data to MISO via the MISO Portal using Module E Capacity Tracking (MECT) Application tool. The Manager, System Control and the Supervisor, Control Center supply this data.

DOCUMENT CHANGES HISTORY

Board approved – 10/31/00

Changes made version 11/27/00:

Section IV.D.4.: Added bushings, risers, bus conductors to second paragraph of this section.

Section IV.D.: Added paragraph at the end of this section concerning ratings for jointly-owned facilities.

Changes made version 5/31/01:

Section IV.B.: Added MAPP Reliability Handbook and NERC Standards to list of references to design system to.

Section IV.D.6: Added jointly-owned facilities ratings procedure to this section.

Section IV.G.: Added "Insulation Coordination" section.

Section IV.I.: Added notification and approval process to first paragraph of this section.

Section IV.M.: Added second paragraph about equipment ratings.

Section VIII.E.: Added "Procedure to Change Generator Transformer Taps" section.

Changes made version 6/8/01:

Section I: Added last sentence about review schedule.

Section V.H.4.: Added last paragraph about reporting when generator is not operated in automatic voltage control mode.

Changes made version 11/9/04:

Moved Board approval date from title page to Initial document change history above.

Section I.: Added “or whenever system changes warrant” to last sentence in first paragraph.

Added MISO definition Section III and added MISO and where applicable to last sentence in first paragraph, Section IV.

Section IV.D.: Added last sentence in first paragraph about the location of the transmission ratings files.

Section IV.G.: In Table IV-2 changed the 161 kV and 69 kV MCOV to 106 kV and 48 kV.

Changes made version 11/16/04:

Section IV.G.4.: Added “shunt capacitors” to other equipment paragraph.

Changes made version 2005:

Section I.: Changed last sentence to read: It will be reviewed whenever system changes warrant.

Changes made version 7/19/06:

Section IV.G. Added (SURGE PROTECTION) to section heading

Section IV.K.2.c. Added “Breaker duty” to list after “Equipment ratings” and added “Real and” to “Reactive power requirements”

Changes made Version 3/8/07:
Section IV.D.4.: Added generator ratings criteria. Board approval 10/31/00.

Changes made Version 4/3/07:
Added revision and next revision dates to title page. Revised last sentence in Section I. to review at least every two years by Engineering & added “Revision: “ to bottom of page. Added MPW’s Board name and MAPP/MRO in Section III., NERC Category reference in Section IV.C., and last paragraph in Section IV.E.

Approval of changes Made from October 31, 2000 through April 3, 2007

Jay Logel

Date: 4/10/07

Jay Logel
General Manager

Changes made Version 4/1/09:
Added many clarifications throughout document including, but not limited to, MAPP and MRO responsibilities, MPW Attachment K, changes to Jointly-Owned Facilties Ratings procedure, and document references.

Approval of changes Made from April 3, 2007 to April 1, 2009

Sal LoBianco Date: 4/28/09

Sal LoBianco
General Manger

Changes made version 12/14/09
Added Section IV.D.8.
Added First Paragraph in Section IV.M.

Changes made version 2/4/10
Added System Performance Definition in Section III
Added several reference to documents handling in Sections IV.D., IV.D. 7. IV.I.
Added additional reference to MISO throughout document since we have joined MISO.
Change NERC Planning Standards to NERC Reliability standards.
Added Sections IV. D. 9 and IV.D. 10.
Added "Reliability requirements" to Sections IV.K.2.c.(16) and IV.V.2.a.(2).
Added first and last paragraph in Section IV.M.
Added "Reliability Criteria" sections at Sections VI.E. and VII.E.
Phone number area code in Section VIII.A.
Added Abnormal Voltage Operation section in Section VIII.E.

Approval of changes made from April 1, 2009 to February 4, 2010

Sal LoBianco Date: 2/15/10

Sal LoBianco
General Manager

Changes made version 2/5/12
Added Attachment K to this document (Section IX) and combining Attachment K definitions in Section III.
Removed Statistical Specialist.
Removed MAPP and associated references where needed.
Added Section VIII.G. MPW'S Units 8 and 8A Operating Criteria
Clarifications in Section I. along with others throughout document

Approval of changes made from February 4, 2010 to February 5, 2012.

Sal LoBianco Date: 3/2/12
Sal LoBianco
General Manager

Changes made version 3/18/13
Clarifications with new items Sections IV.D.5.d, IV.D.5.e, IV.D.5.f. V.F.7. IX.A.2.h. and clarifications in Sections IV.I., IV.K.2.c., IV.M., VIII.C., IX.A.1.d., IX.D.5. along with other clarifications throughout document.

Approval of changes made to 3/18/13 Version

Sal LoBianco Date: 4/5/13
Sal LoBianco
General Manager

Changes made version 3/30/15
Updated Section IV.C. for the new TPL standards.
Clarified the Generation Voltage Criteria in Section V.B.,
Added Section V.J. Generator Models and Testings to ensure generator owner is responsible for providing their data.
Add paragraph to Section VI.A. to ensure transmission owner is responsible for providing their data
Moved the Underfrequency Load Shedding discussion from Section IX.A.1.d. to Section IX.A.2.i since MISO now request the data not MRO.
Change the frequency of study in Section IX.B.1. and IX.B.3 from five to three years according to the new requirements of NERC/MRO.

Added many clarifications throughout document.

Approval of changes made to 3/30/15

Sal LoBianco Date: 5/13/15

General Manager
Sal LoBianco

Changes made version 3/30/17
Clarified the Generation Voltage Criteria in Section V.B.,
Updated Sections VII.G. and IX. removing the MRO study requirements and adding additional data about MISO process.
Removed MRO GVTC/URGE tests and replaced with MISO Module E Testing procedure.
Removed remaining MAPP references.
Updated Units 8 and 8A operation in Section VIII.G.
Added many clarifications throughout document.
Updated new NERC Standard versions throughout the document.

Approval of changes made to 3/30/17

Sal LoBianco **Date:** 5/26/17

General Manager
Sal LoBianco