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Salt River Project

Facility Connection Requirements (FCR)

Effective Date: November 7, 2023

Version 13

Responsible Departments	Responsible Sections
Apparatus Engineering	4.0, 6.0, 7.0, 10.0, Appendix 1
Control Engineering	5.0
Engineering and Planning Division	9.0
Meter Engineering	5.0
Policies, Procedures and Standards	2.0
Power Quality Testing and Inspections	9.0
Substation Design Construction and Maintenance	12.0, 14.0
System Protection	4.0
Telecommunication Performance Engineering	5.0
Transmission Analysis	2.0, 8.0
Transmission and Generation Operations	3.0, 8.0, 11.0, 13.0, 15.0
Transmission Participation and Interconnection Projects	1.0-18.0

This document is published at http://www.oasis.oati.com/SRP/index.html

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APPENDIX 1 - DESIGN REQUIREMENTS FOR SURGE ARRESTORS

1 INTRODUCTION

Salt River Project (SRP) has prepared this Facility Connection Requirements (FCR) to outline the minimum requirements for all generation facilities, transmission facilities, and End-User facilities connecting to (i) the SRP transmission system, (ii) an existing SRP generation facility that is connected to the SRP transmission system, (iii) a transmission system operated by SRP, or (iv) an existing generating facility that is connected to a transmission system operated by SRP (collectively a connecting entity). For purposes of this FCR, generation facilities and transmission facilities may be collectively referred to as an Interconnection. End-User shall be any customer or load connected to the SRP transmission system.

These requirements, as well as the planning procedures and criteria described in the SRP document, Guidelines for Electric System Planning, are consistent in content and application to those requirements used by SRP when connecting its own new or modified generation, transmission, or End-User facilities. In addition to the specifics in this document, all connecting entities shall comply with applicable codes, standards (including the North American Electric Reliability Corporation [NERC] and the Western Electricity Coordination Council [WECC]), federal and state regulations, environmental regulations, citing requirements, contracts, operating agreements, and the NERC/WECC reporting requirements. Additional details can be found in the following SRP documents:

- SALT RIVER PROJECT STANDARD GENERATOR INTERCONNECTION PROCEDURES (GIP)
- SALT RIVER PROJECT STANDARD GENERATOR INTERCONNECTION AGREEMENT (GIA)
- GUIDELINES FOR ELECTRIC SYSTEM PLANNING

This FCR and all referenced SRP documents are available upon request (within 5 business days) and are available on the SRP Open Access Same-Time Information System (OASIS) site. All three interconnection types (generation, transmission, and End-User facilities) use the same application form, which is in Appendix 1 to the GIP.

Background

In the present electric utility environment, there is wide recognition that electric system reliability, safety and quality of service must be maintained. Maintaining reliability, safety and quality of service in a changing environment places additional challenges on the planning and operation of electric systems. Each request to connect to the SRP transmission system will be reviewed to identify the facility impacts and necessary system improvements on the system. These reviews ensure that comparable treatment is given to all users, and that reliability, safety, and quality of service is maintained.

Scope

This document informs entities seeking facility connections to the SRP transmission system or to an SRP generation facility connected to the SRP transmission system of the connection requirements. The scope of this document is limited to the technical requirements for connected facility design and operation. These requirements do not

preclude the need for specific Interconnection Agreements between SRP and entities connecting to the transmission system.

The scope of this document satisfies the NERC Planning Standards by identifying requirements for connections to the Bulk Power System at voltages generally 69 kV and above. Requirements applicable for all types of facilities, regardless of voltage level and capacity, are covered. The minimum requirements pertaining to connected facilities are contained herein.

The requirements for initial facility connection apply equally to continued operation of existing connected facilities. Therefore, any upgrades, additions, enhancements, or changes of any kind to an existing connected facility are subject to SRP's review to ensure continued compliance with these requirements.

The scope of these documents is limited to the technical requirements for connected facility design and operation. Customers interested in the terms of transmission service should refer to the SRP OATT.

The information contained in this document is supplementary to and does not intentionally conflict with or supersede the National Electric Safety Code (NESC) as approved by the American National Standards Institute (ANSI) or such federal, state and municipal laws, ordinances, rules or regulations as may be in force within the cities, towns or communities in which SRP furnishes electric service. In the event there is any conflict with this document and the NESC, the NESC governs. It is the responsibility of the entity connecting with SRP to conform to all applicable national, state and local laws, ordinances, rules, regulations, codes, etc.

Objectives

SRP, in its role as a transmission provider, has prepared this document based on the following objectives:

a) Maintain system reliability, personnel and equipment safety, and quality of service as new facilities are added to the transmission network and existing facilities are modified to meet customer load demands.

b) Ensure comparability in the requirements imposed upon the various entities seeking to connect facilities to the transmission network.

c) Satisfy compliance with the NERC Planning Standard FAC-001-3 pertaining to documentation of facility connection requirements by those entities responsible for system reliability.

d) Inform those entities that seek facility connections to the SRP transmission system of the various requirements for system reliability, safety of personnel and equipment, and quality of service.

e) Facilitate uniform and compatible equipment specification, design, engineering, and installation practices to promote safety and uniformity of service.

2 Study Procedures, Coordination and Notification

When evaluating connection requests, near-term and long-term studies are necessary to ensure required system performance is achieved throughout the planning horizon. Required studies generally include: short circuit (fault duty), stability, power flow, post transient (reactive margin) and power factor analyses. A detailed discussion of each type of study can be found in the SRP document titled: Guidelines for Electric System Planning. The criteria and guidelines described in SRP's OASIS, Attachment K and in this document are intended to ensure required system performance is achieved and all applicable standards (including all Transmission Planning standards) are met. The criteria and guidelines are applied for all studies relating to both internal and external requests for connection and studies performed as part of the normal planning process. A general description of each type of study follows:

Power Flow Analysis

Power flow analysis is conducted to examine the impact of the proposed facility on transmission lines and transformers, and voltage profiles. Contingencies consisting of single or multiple outages of lines and/or transformers are considered in this analysis. Where the analysis indicates that transmission upgrades are necessary, alternative plans may be devised and evaluated to accommodate the proposed facility. Equipment voltage limits, both transmission provider and customer are analyzed both steady state and single contingency conditions as described in Section 3.2 of the Guidelines for Electric System Planning.

Short Circuit Analysis

Short circuit analysis (fault current or fault duty study) is conducted to examine the impact of the proposed facility on equipment fault duties. This analysis will be used to determine the impact of the connection (often relating to a generator connection) on the fault duty (i.e., interrupting capability or rating) of previously installed equipment such as circuit breakers or switches. Increased fault duties may require the need to upgrade existing equipment. The study results can also be used to help select the size or ratings of the proposed facilities to be connected.

The incremental short circuit impact that an connecting entity creates at Palo Verde and Hassayampa 500 kV buses will also be studied and monitored.

Transient Stability Analysis

Transient stability analysis may be performed to determine a transmission system's response to a sudden change in the state of the system due to faults and unit outages. Specifically, the analysis will evaluate the transmission system in the area of the added generation as well as the generator's response following system faults. Stability studies may also be required to evaluate transmission or End-User connection requests. Transient voltage dips, and transient frequency dips are analyzed as described in Section 3 of the Guidelines for Electric System Planning.

Post Transient (reactive margin) Analysis

Post transient analysis is performed to evaluate voltage stability and available reactive margins for the time periods from half a minute to several minutes following a disturbance. The voltage stability criteria for positive reactive power margin is found in WECC Criterion TPL-001-WECC-CRT-3 and shall apply equally to studies of interfaces and load areas.

Power Factor Analysis

Power factor analysis is performed to evaluate whether the interconnecting generating facility can maintain a dynamic power delivery at continuous rated power output at the Point of Interconnection (POI) at a power factor within the range of 0.95 leading to 0.95 lagging.

Additional Analyses

Other analyses may be required based on power flow analyses and depending on the nature of the proposed connected facility and its location within the transmission network. This could include power quality analyses for End-User load that could potentially cause harmonic current or voltage and/or telephone interference, and voltage deviation studies. When adverse sub synchronous torsional interaction is possible (for End-User's equipment such as arc-furnaces and/or cycloconverters to be located in close electrical proximity to existing generation) additional analyses may be required.

Specific Generation Connection Study Procedures & Communication

The SRP Large Generator Interconnection Procedure describes the various studies and procedures required to evaluate a generation connection request. A detailed interconnection study will generally require the creation of an ad-hoc study group consisting of SRP and potentially impacted neighboring systems. Additional details regarding coordinated study efforts, communication, and notification can be found in the SRP documents titled Guidelines for Electric System Planning and Attachment K posted to the SRP OASIS.

Specific Transmission & End-User Study Procedures & Communication

A plan of service is developed to provide for the physical connection between the transmission system and a proposed connected facility. The electrical configuration of the connection equipment are determined which include transformers, switchgear and other station equipment, and required transmission line sections. The physical layout of equipment and right-of-way needs are determined in the plan of service as well. A multi-step approach may be considered in the plan of service to accommodate a multi-step increase in load for the connected facility. Normally, the expense of developing a plan of service is the responsibility of the Transmission End-User.

In order to assess the impact of a proposed facility connection on system reliability, system impact studies need to be conducted. These system impact studies, as a minimum, examine the transmission line and transformer loading, voltage profiles and schedules, and power quality impacts of the proposed facility for a range of expected seasonal loading and power transfer conditions. The effect of the proposed facility on short circuit duties is examined for all proposed transmission connections. A multi-step approach to the proposed facility may be considered where the impact of each step is assessed separately.

The SRP transmission planning department will also interface with the regional and sub-regional entities. In addition, SRP coordinates planning studies through WECC.

For interconnection on its transmission systems with voltage levels that meet WECC Criteria, SRP coordinates with affected systems through WECC processes. These include the Regional Planning Project Review, Project Rating Review, and Progress Reports. The Regional Planning Project Review is intended to inform others entities of the opportunity to participate in or review a project and solicit participation. The Project Rating Review is intended to ensure that new projects are integrated into the existing system while recognizing protected ratings of other facilities. The Progress Reports allow SRP to report potential significant additions and changes to the interconnected system; WECC members can review and comment on the additions or changes. The objectives of these WECC processes are to:

a) Adequately communicate project plans, performance and limitations to all affected parties during the period from project inception to commercial operation.

b) Provide the opportunity for owners of existing or future facilities that may be affected by the project to participate in review of the project studies.

c) Integrate projects into the existing system in a manner that will preserve interconnected system reliability and operating efficiency.

Joint studies are included, and these WECC processes apply to the interconnection of generation, transmission, and load.

The Western Arizona Transmission System (WATS) Task Force consists of various utilities and acts as the planning and operating technical study group for Mead-Phoenix, Arizona Nuclear Power Projects (ANPP) and Navajo System Projects. The task force reviews all study work and provides technical feedback for any proposed interconnection to the transmission systems within WATS. The task force is to maintain all projects' capability while allowing all interconnections that do not adversely impact capability. SRP is involved in the WATS Task Force as it operates and owns some of the transmission systems within WATS. Through this task force, SRP implements joint studies to ensure that any new interconnections of generation, transmission or load do not negatively impact reliability.

If joint studies for interconnection do not fall within the realm of the aforementioned WECC processes and WATS Task Force, SRP will coordinate with affected systems in a review that is similar to the WECC.

The system impact studies will be coordinated with neighboring transmission system owners/operators as appropriate. As a minimum, all interconnected neighbors and other impacted parties will be notified of significant transmission system additions or modifications upon execution of an Interconnection and Operating Agreement (or other contract or legal document that indicates the intent to proceed with the system addition or modification). In addition, significant additions and modifications will be reflected in the power flow models as submitted by SRP to the regional reliability organization. These additions and modifications will also be identified in the regional transmission system assessments as appropriate. More details concerning coordination, study procedures, and criteria used to determine

acceptable performance can be found in SRP document Guidelines for Electric System Planning.

The scope of all the above system impact studies will be determined by SRP based on the type, location, and power level of the proposed facility. Normally, SRP will perform the system impact studies. The cost of these studies will be chargeable to the Interconnection or End-User in accordance with SRP OATT. Report(s) documenting the assumptions, results, and conclusions of the system impact studies are made available to the Interconnection or End-User.

SRP must be notified of new facilities, upgrades, or additions such as an increase in load or generating capability to existing facilities connected to the transmission system within the SRP balancing Area. System impact studies are to be conducted to determine the need for any upgrades of transmission equipment or transmission system addition to accommodate the changes in the connected facility.

Information Required for Connecting Entity

As soon as available, the connecting entity wishing to connect to SRP shall provide the following information for review and comment by both the Transmission Planning and the Transmission and Generation Operations groups at SRP.

a) Connecting entity Information – company name, mailing address, contact representative and phone number

b) Project Design/Engineering Information – company name, mailing address, contact representative and phone number

c) Requested in-service date for the transmission connection, and a date for temporary service to test facilities prior to formal in-service

d) Plot plan or description showing exact location and orientation of the proposed facilities and point of electric service delivery

e) One-line, schematic diagrams, plan and elevation drawings of the proposed facilities showing dimensions, clearances, and grounding layout

f) Information on characteristics of load, including initial load build-up, 5 and 10 year load projections, and power factor of such loads

g) Information concerning the power factor correction equipment. This information should include size and amount of fixed or switched capacitors, or other power factor correction equipment and methods used for operation.

At least three months before starting electrical construction of the proposed facility, the connecting entity must provide the following additional information to SRP's Manager of System Operations and SRP's System Protection Supervisor. Failure to provide this information in a timely manner may delay the connecting entity's facility in-service date.

h) Data on equipment to be installed

i. High side interrupting and sectionalizing devices – Manufacturer, type, voltage rating, and current ratings

ii. High side relaying equipment – Complete manufacturer's data

iii. Power transformer – Complete nameplate and test report data, including manufacturer, serial number, high and low side voltage taps, kVA ratings, high and low side connections, low side grounding (if used), load loss watts and positive-and zero-sequence impedances between the high-low, high-tertiary, and low-tertiary transformer windings (as applicable) at each tap.

iv. Inverters – Complete nameplate and test report data, including manufacturer, model (including quantity of each type), voltage rating, kVA ratings, grounding connections and Voltage Controlled Current Source model for ASPEN short circuit modeling software. Short circuit response test data (to include positive and negative sequence current as well as positive and negative sequence power factor angles for associated positive sequence voltage values in 0.1 steps from 1.0 – 0.1), control mode (e.g., fault ride through, reactive power, power factor, or voltage control) and any associated priorities, and a complete list of inverter set points (as related to the latest version of IEEE 1547).

v. Synchronous generator – Complete nameplate and test report data, including manufacturer, model, serial number, voltage rating, kVA ratings, grounding connection and grounding transformer, and synchronous, transient, sub-transient positive, negative and zero sequence impedances.

vi. Transmission line – Complete line data, including tower types, phase and ground conductor types, shielding method (if underground) and geometrical spacing between conductors, line length, and calculated positive, negative, and zero sequence line impedance and susceptance.

i) Data on low voltage protection equipment, including fuses, breakers, relays, and relay settings

The information in subsections h) and i) is required to perform coordination selectivity studies in a timely manner. Any disagreement in this regard must be resolved prior to energization.

Depending upon the nature of the connecting entity equipment to be installed, the following data may be required to complete the portion of the system impact studies addressing power quality and/or subsynchronous torsion interactions.

j) Data on the harmonic and sub-harmonic current/voltage spectra of the equipment to be installed under three phase balanced and unbalanced conditions

k) Maximum magnitudes (Mega Watt [MW] and Mega Volt-Ampere Reactive [MVAr]) of sudden load swings at the point of connection and the number of such fluctuations per second, minute or hour

l) Data on Static Var Compensator (SVC) equipment and harmonic filters if applicable

m) Maximum expected MW and MVAr demand at the point of connection

Initiating a Connection or Facility Change

The following table outlines the SRP personnel to be contacted with regard to any request for a new facility connection or significant change to an existing connected facility.

Type of Customer to be Connected	Service or Activity Required from SRP	SRP Contact
Interconnection (generation or transmission)	Joint Transmission Planning Studies	Manager of Transmission Participation and Interconnection Projects
End-User	Initial Contact to Request a Connection or Study	Manager of System Operations

Following the initial contact regarding a proposed Interconnection or End-User facility connection, when the proposed location and power level are established, a plan of service is prepared and system impact studies are undertaken by SRP. The information needed to develop a plan of service and to conduct the system impact studies is identified in this document and should be provided to SRP at this point. The system impact studies may, as noted above, identify additional requirements for reliability beyond the minimum requirements covered by this document.

SRP approval of a proposed facility or facility change is contingent upon a design review of the proposed connected facility. Operation of a connected facility is also subject to continuing compliance with all applicable construction, maintenance, testing, protection, monitoring, and documentation requirements described herein, as well as the applicable NERC Standards and WECC Documents noted herein.

Interconnection and End-Users will be responsible for the costs associated with connecting to the SRP transmission system. Interconnection and End-Users who opt to engineer, procure, and construct (EPC) new facility connections shall use Good Utility Practice as required by the SRP GIP, approved equipment vendors, and use standards, technical requirements and specifications provided by SRP. In addition, Interconnection and End-Users shall meet all business practices and general conditions applicable to Option to Build.

The information contained herein is subject to change and may be revised at any time.

Breaker Duty

SRP will be responsible for supplying the ultimate fault duty for appropriate sizing of Power System Breakers. The fault duty that is given by SRP will be the maximum fault duty determined by the final 6-year system plan or study. The responsibility for future upgrades that may increase this fault duty and thus require either upgrading or replacing the existing breakers will be the responsibility of the party requesting the system upgrade.

Short Circuit Data & Interrupting Device Ratings

The following estimated short circuit levels will be provided by SRP at the point of delivery:

Estimated Initial Short Circuit Levels (Year)

3 Phase Fault = _____MVA ANSI X/R Ratio = _____

Phase-to-Ground Fault* =_____ MVA ANSI X/R Ratio = _____

Estimated Future Short Circuit Levels (Year)

3 Phase Fault = _____MVA ANSI X/R Ratio = _____

Phase-to-Ground Fault*=_____ MVA ANSI X/R Ratio = _____

*Note: Phase-to-ground fault values are calculated assuming the connecting entity's transformers have either an ungrounded-Wye or Delta connected high side. For Wye grounded transformers, the transformer contribution to the total fault current will have to be taken into account and the fault values recalculated.

Interconnection and End-Users' equipment should have adequate interrupting and momentary ratings for the existing and future short circuit conditions listed above.

While SRP will endeavor, where possible, to anticipate system changes which may affect these values, it does not assume responsibility or liability with respects to such protective devices, nor guarantee their continuing adequacy against increased interrupting capacity requirements resulting from system changes. Interconnection and End-Users who use this information should periodically review existing and future fault conditions and equipment ratings for adequacy. Any equipment replacements or upgrades to maintain adequacy of the interconnection or End-Users' facilities will be at the interconnection or End-Users' expense.

All gas insulated protective devices within the connecting entity's facility having a direct connection to an SRP transmission line shall be equipped with a low gas pressure alarming/tripping/lockout scheme as appropriate for the particular device.

3 VOLTAGE LEVEL, MW, AND CAPACITY/DEMAND

Load Following/Remote Control Functions/Automatic Generation Control (AGC)

SRP will consider specific provisions for load following and/or remote control functions on a case-by-case basis. When related to a transmission service request, the SRP Open Access Transmission Tariff (OATT) will apply. If any generator is to provide load following services to SRP, the output must be remotely controllable under direction of the SRP Automatic Generation Control (AGC) in response to system needs. The generator owner must provide an interface compatible with SRP's AGC control mechanism. Provisions for AGC should be included in an Interconnection Agreement between the connecting entity and SRP. Supervisory Control and Data Acquisition (SCADA) telemetry will be required to support AGC.

Reactive Power Output and Power Factor

In order to maintain transmission voltages on transmission facilities of SRP within acceptable limits, generating facilities and non-generation resources capable of providing reactive power that are under the control of the balancing area operator must be operated to produce (or absorb) reactive power as required by SRP transmission facilities. All transmission customers taking service from SRP under the OATT must obtain reactive supply and voltage control from generation or other sources service from SRP for each transaction on SRP transmission facilities. The amount of reactive supply and voltage control from generation or other sources service that must be supplied with respect to the transmission customer's transaction will be determined based on the reactive power support necessary to maintain transmission voltages within limits that are generally accepted in the region and consistently adhered to by SRP. In general, generating facilities power factor design limitation minimum requirement shall be a reactive power capability sufficient to maintain a composite power delivery at the Points of Interconnection at a power factor between 0.95 leading and 0.95 lagging.

Capacitor additions at the generator switchyard may be necessary to meet the reactive requirements. The use of capacitors will require specific studies and be evaluated on a case-by-case basis.

In addition, individual generators in the generation facility must make available the full steady-state over- and under-excited reactive capability given by the manufacturer's generator capability curve at any MW dispatch level. This requirement should be considered in all internal generator designs (including transformer ratings/taps/impedances, cooling systems, generator/exciter rating). In general, the generation facility must be capable of continuous non-interrupted operation within a steady-state voltage range during system normal and single facility outage conditions. This range is from 91.7% to 105.8% range.

All reasonable measures should be taken to avoid tripping of the generation facility due to high or low voltage. Specification of the generator voltage schedule will be determined under the direction of the SRP Control Center. A steady-state deviation from this schedule between +0.5% to –0.5% of the nominal voltage will be permissible.

Transmission interconnected equipment shall have the tap ranges and self-regulation necessary to accommodate the transmission system's reactive power flow requirements.

Minimum Operating Capability

The minimum operating capability required will be determined based on limits that are generally accepted in the region and consistently adhered to by SRP.

Black Start Capability

The provision of black start capability may be required or desirable. A black start capable generation facility is one that can be started without the aid of off-site power supplied from the transmission system.

Automatic Underfrequency Load Shedding

SRP may require automatic under frequency load shedding relaying on connected loads to comply with the NERC and/or the WECC requirements or other system stability considerations. SRP, as a WECC member, is obligated to have an automatic under frequency load shedding plan in effect that meets WECC requirements. Connecting parties without an automatic under frequency load shedding plan meeting WECC requirements may need to install under frequency relaying at the request of SRP. The amount of load to be shed and the frequency set-points will be specified by SRP as required meeting WECC under frequency load shedding compliance.

Manual Load Shedding

End-User facilities may be subject to SRP's Emergency Operating Plan that can require interruption of load to deal with generation deficiencies and/or transmission system emergencies. It is noted that interrupting of load will only be done in extreme conditions that would result in a more serious degradation of system performance than if the load were not shed.

Other Load Shedding

Other load shedding such as over-voltage is not required at this time. However, other automatic load-shedding system may be required in the future.

Power System Stabilizer

Studies may identify the need for the use of power system stabilizers, depending on the plant size, excitation system type and settings, facility location, area transmission system configuration and other factors.

Excitation Control

All generation control system settings should be coordinated with, and approved by, SRP. It may be necessary to coordinate generator settings to ensure proper operation of the SRP under frequency load shedding program. In addition to the normal excitation system and automatic voltage regulation equipment, the following controls are also required for each synchronous generator.

Overcurrent Limiter: The excitation system is to be provided with a current limiting device which will supersede or act in conjunction with the Automatic Voltage Regulator (AVR) to automatically reduce excitation so that generator field current is maintained at the allowable limit in the event of sustained under-voltages on the transmission system. This device must not prevent the exciter from going to and remaining at the positive ceiling for 0.1 seconds following the inception of a fault on the power system.

Under Excitation Limiter: A limiter to prevent instability resulting from generator under excitation is required.

Speed Governing: All synchronous generators shall be equipped with speed governing capability. This governing capability shall be unhindered in its operation consistent with overall economic operation of the generation facility. Over speed protection in the event of load rejection is the responsibility of the connecting entity.

Sub-Synchronous Torsional Interactions or Resonances: The provision of high speed reclosing following transmission line faults may result in excessive torsional duties. The connecting entity must provide SRP with immunity from damaging torsional oscillations resulting from all SRP transmission system operations, and insure the turbine generator is not excited into resonance by normal system operations.

Mode of Frequency/Voltage Control

The connecting entity's generating facility shall operate with its speed governor and voltage regulators in automatic operation. If the connecting entity's speed governor and voltage regulators are not capable of such operation, the connecting entity shall immediately notify SRP.

Speed Droop Setting

The droop setting of any generator connecting to the SRP system will be considered on a case-by-case basis and shall be coordinated with SRP.

Generator Step-Up Transformers

SRP has the right to require tap changes be made to step-up and auxiliary transformers to ensure voltage schedules and reactive requirements can be met. Additionally, the main power transformer(s) used to connect to the SRP transmission system must have a grounded connection on the high side (for example, Wye-Delta-Wye configuration).

Coordination with Appropriate Operating Entity

Any entity connecting to the SRP transmission system must coordinate appropriate data, processes, operating procedures, and any other information as necessary to reliably operate the system and to comply with applicable codes, standards (including the NERC and the WECC), federal and state regulations, environmental regulations, citing requirements, contracts, operating agreements, and the NERC/WECC reporting requirements.

Generator Frequency Range

The connecting entity's generating facility will provide a balanced, symmetrical, three phase interchange of electrical power with the SRP transmission system at a nominal frequency of 60 Hertz (Hz). The generation facility must be capable of continuous, non-interrupted operation in the frequency range of 59.5 to 60.5 Hz. Limited time, non-interrupted operation is also expected outside this frequency range in accordance with the generator manufacturer's recommendation.

Transmission System Frequency Range

The SRP transmission system typically operates at a nominal 60 Hz with a variation of +0.05 Hz to –0.05 Hz. Under certain emergency conditions, the transmission system may operate for a period of time outside of this range. The connecting entity is responsible for providing any frequency sensing equipment required to protect their facility during abnormal frequency operation.

Transmission Impacts

All proposed connections shall consider the impact on adjacent areas voltage and reactive power flow requirements. These impacts should be identified in the study process and discussed or coordinated with the potentially impacted system(s). Any additional upgrades required to mitigate these impacts will be the responsibility of the connecting entity.

4 SYSTEM PROTECTION

System Protection and Coordination

SRP has established protection standards in the System Protection Relay Design Standards. These standards include redundant and backup protection systems. SRP's standards require 3 independent Line Relaying Protection Systems for 525 kV Lines with a minimum of two independent communication paths. It also requires dual primary redundant systems for 230 kV Lines, 230/69 kV Transformers, 500/230 kV Transformers and all Generators over 20 MVA. These standards should provide guidance for requirements that any project would have to meet in order to interconnect with SRP's grid. SRP has used several relay manufacturers, but our standard is General Electric (GE) or Schweitzer Engineering Laboratories (SEL) relays. SRP requires that the relays have equivalent functionality to these relays such as a non-proprietary communication interface for both local and remote communications. However, every project will need to be evaluated prior to design start to verify that there are not unusual configurations that would require special protection systems such as Remedial Action Schemes or special transfer schemes.

Protective Relay settings must be provided and coordinated with SRP prior to commissioning. These settings should be provided in electronic format and documented by SRP for achieving compliance with PRC-027-1 Req. 3.1 and 3.2. SRP will provide any necessary resources to review and provide technical assistance for establishing proper coordination of these settings. SRP will not allow a project to start the commissioning process without complete agreement on these issues. SRP reserves the right to deny energization of the project if it feels that the protective relay settings and systems do not meet the minimum standards and would place our system and or customers at risk.

SRP will provide functional specifications and relay settings for all protective relays at the connecting entity's facility that have a potential impact on the reliability of the SRP transmission system. The criteria for these functional specifications and settings will be based on existing SRP protection practices. SRP reserves the right to specify the type and manufacturer for these protective relays. The specific recommendations and requirements for protection will be made by SRP based on the individual substation location, voltage and configuration. While SRP will endeavor, where possible, to anticipate system changes which may affect system protection needs and requirements, SRP does not assume responsibility or liability with respects to such protective devices nor guarantee their continuing adequacy against increased interrupting capacity requirements resulting from system changes. Any equipment replacements or upgrades to maintain adequacy of the protection system will be at the connecting entity's expense.

The resulting system protection system must provide the highest level of public safety possible and prevent or minimize equipment damage. The protection system should be designed to minimize equipment outage time, to minimize the outage area, and to minimize system voltage disturbances.

All protection system requirements, including maintenance and testing, apply to equipment used for protecting the system during normal and abnormal conditions.

To ensure the proper design of the protection system, system studies and other analyses will be necessary prior to placing any new facilities in service. These studies may include grounding, short circuit, stability, power quality, and coordination of protective devices. These studies will be performed by SRP or under the direction of SRP. The cost will typically be the responsibility of the connecting entity. Specific communication and Remote Terminal Unit (RTU) information can be found in Section 5.0.

SRP and the connecting entity will jointly perform end-to-end testing of all intertie protection during the commissioning of the connecting entity's interconnection.

System Protection

The connecting entity is responsible for providing adequate protection to SRP facilities for conditions arising from the operation of the connecting entity's facilities under all SRP transmission system operating conditions. The connecting entity is also responsible for providing adequate protection to their facility under any SRP transmission system operating condition whether or not their generation is in operation. Conditions may include but are not limited to:

a) Single phasing of supply

b) Transmission system faults

c) Equipment failures

d) Abnormal failures

e) Lightning and switching surges

f) Excessive harmonic voltages

g) Excessive negative sequence voltages

h) Separation from supply

i) Synchronizing generation

j) Re-synchronizing the Owner's generation after electric restoration of the supply

Parallel Generation Facility

The following utility-grade relays shall be provided by the connecting entity for protection of the SRP system. All relays specified for the protection of the SRP system, including time delay and auxiliary relays, shall be approved by SRP. Relay operation for any of the listed functions shall initiate immediate separation of the connecting entity's generation from the SRP transmission system.

Relay	Function

Frequency	To detect under frequency and over frequency operation.
Overvoltage	To detect overvoltage operation.
Undervoltage	To detect undervoltage operation.
Ground Detector	To detect a circuit ground on the SRP system (applicable to three phase circuits only).
Directional Overcurrent	To detect the directional flow of current in excess of a desired limit.
Transfer Trip Receiver	To provide tripping logic to the generation for isolation of the generation upon opening of the SRP supply circuits.
Directional Power	To detect under all system conditions, a loss of SRP primary source. The relay shall be sensitive enough to detect transformer magnetizing current supplied by the generation.

The purpose of these relays is to detect the connecting entity's energization of an SRP circuit that has been disconnected from the SRP system, to detect the generation operating at an abnormal voltage or frequency, or to detect a fault or abnormal condition on the SRP system for which the connecting entity shall separate their generation.

Output contacts of these relays shall directly energize the trip coil(s) of the generator breaker or an intermediate auxiliary tripping relay which directly energizes the breaker trip coil(s). The relaying system shall have a source of power independent from the AC system or immune to AC system loss or disturbances (e.g., Direct Current (DC) battery and charger) to assure proper operation of the protection scheme. Loss of this source shall cause removal of the generation from the SRP system.

The protective relays required by SRP and any auxiliary tripping relay associated with those relays shall be utility-grade devices.

Utility-grade relays are defined as follows:

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

b) Have relay test facilities to allow testing without unwiring or disassembling the relay.

c) Have appropriate test plugs/switches for testing the operation of the relay.

d) Have targets to indicate relay operation.

SRP will specify settings for the SRP-required relays to assure coordination between the generation protective equipment and the SRP system relays. It is the connecting entity's responsibility to determine that their internal protective equipment coordinates with the required SRP protective equipment and is adequate to meet all applicable standards to which the generation is subject. SRP further reserves the right to modify relay settings when deemed necessary to avoid safety hazards to utility personnel or the public and to prevent any disturbance, impairment, or interference with SRP's ability to serve other connecting entities.

Prior to commencing parallel operation, connecting entity shall obtain the written approval of SRP regarding all protective relay equipment and direct transfer trip equipment it proposes to install for the protection of the SRP transmission system. Prior to granting or denying such approval, SRP or the connecting entity shall inspect and calibrate the system protection facilities in accordance with the relay setting data issued by SRP. Inspection and calibration must either be performed or witnessed by SRP personnel at connecting entity's expense. Connecting entity shall record the actual settings and inspection data on the relay setting document furnished by SRP, and return such document for approval, which approval shall not be unreasonably denied if it meets applicable standards. After the commencement of parallel operation, SRP shall have the right, but shall have no obligation or responsibility to:

a) observe connecting entity's tests and/or inspection of any of connecting entity's system protection facilities

b) review the settings of connecting entity's system protection facilities

c) review connecting entity's maintenance records relative to the facility and/or connecting entity's system protection facilities.

The foregoing rights may be exercised by SRP from time to time as deemed necessary upon reasonable notice to connecting entity. However, the exercise or non-exercise by SRP of any of the foregoing rights of observation, review, or inspection shall be construed neither as an endorsement or confirmation of any aspect, feature, element, or condition of the facility or connecting entity's system protection facilities or the operation thereof, nor as a warranty as to the fitness, safety, desirability, or reliability of same.

Fault event data (at a minimum resolution of 1kHz) shall be captured and made available in an industry-standard format (for example, COMTRADE files) from each generating source (such as each inverter) and the associated interrupting device. The generation operating authority for the interconnection shall also report, evaluate, and correct any abnormal operations related to any transmission system faults.

Transfer Trip Capabilities

If at any time SRP determines that the use of the above relay systems cannot provide adequate protection to the SRP system, the connecting entity shall furnish and install upon the request of SRP, a transfer trip receiver(s) at its facility to receive tripping signals originating from an SRP location(s). This additional protection would also necessitate the purchase and installation of transfer trip equipment at the SRP location(s) and a communication channel between the SRP location(s) and the generation facility.

Other Protection Requirements

The following items should be coordinated with each other:

a) Volts/Hertz and over excitation protection/limiting

b) Loss-of-excitation and under excitation limiting

Any required remote trip schemes must be closely coordinated and approved by SRP. In addition, under frequency load shedding schemes, under voltage load shedding schemes, and/or special protection schemes may be required to meet the NERC, the WECC, or other regulatory requirements. Any such protection scheme will require close coordination with SRP as well as SRP approval prior to placing any such facilities in service. connecting entity shall provide energization procedures (transmission operations and protection) for review prior to facilities going in service.

5 METERING AND TELECOMMUNICATIONS

Voice Communication Circuit – Generator

The connecting entity will be required to establish a dedicated voice communication circuit to the SRP Control Center to permit coordination of the synchronization and operation of the generation.

Voice Communications – General

Normal – At SRP's request, the connecting entity shall provide a dedicated voice communication circuit to the SRP Control Center. Such a dedicated voice communication circuit would originate from the connecting entity's office staffed 24 hours a day and would be typically required for generation facility synchronization and operation within the SRP balancing area.

All other normal voice communication concerning facility operations shall be conducted through the public telephone network to the Control Center phone number(s) issued by SRP.

Emergency – Voice communication in the event of a transmission system or energy emergency shall use the dedicated voice circuits, or public telephone network and phone number(s) designated for emergency use.

In the event of a transmission system or energy emergency, the connecting entity may be notified by the SRP Control Center. Specific instructions may also be given regarding the operation of the connecting entity's unit(s) depending on the nature of the emergency. These instructions may consist of voltage schedule changes, real and/or reactive dispatch changes, or instructions to shut down or start-up the Owner's unit(s). It is the Owner's responsibility to ensure that the unit operators follow all instructions given by the SRP Control Center during system emergencies.

At the discretion of SRP, generation control facilities and SCADA of specific electrical devices from the SRP Control Center may be necessary to integrate the generation into the SRP balancing area. Such additional facilities, including required communication channels, shall, if required, be furnished and installed by the connecting entity. Services such as cellular modem connectivity or public internet access, if required, shall be furnished, and installed by connecting entity.

The requirement for data acquisition and control will depend on the generation capacity or load size, system location, and voltage of connection, and the net generation input into the SRP system. In all cases, the equipment shall allow SRP to meet all industry standards that apply to SRP as a balancing authority, planning authority, transmission owner and operator and any other applicable classification. Data acquisition and control information will typically include, but not be limited to:

a) Desired generation MW & MVAR set point, with echo

b) Automatic generation control status (on,off)

c) Generator availability

d) Generation MW, MVAr output

e) Generator minimum and base MW capability

f) Generator MW AGC high limit and low limit

g) Connection facilities' breaker status/control/alarms

h) Connection facilities' MW and MVAR line values and bus voltage, and generator and substation metering (Mega Watt hour [MWh] & Mega VAR hour [MVARh]) data

i) Voltage

<u>Revenue Metering</u>

SRP approved revenue class metering equipment shall be installed to meter the aggregated load of the connected facility consisting of instantaneous bi-directional real and reactive power and integrated hourly real and reactive energy metering.

The revenue metering equipment will include exclusive-SRP use, revenue grade, potential and current transformers, meters and test switches. The revenue metering equipment will be tested periodically as defined in the service agreement and the test results will be available to all involved parties. The revenue meters, test switches and wiring termination equipment will be sealed and the seal may be broken only when the revenue meters are to be tested, adjusted or repaired. Proper authorities from both parties will be notified when seals are broken.

Three metering elements will be used to measure all real and reactive power crossing the metering point. Bi-directional energy flows including watt-hour and var-hour will be separately measured on an hourly or 5-minute basis. Appropriate demand quantities will be metered in terms of megawatts and megavars.

The instrument transformers used for revenue metering shall be installed on the transmission provider's side of the Connecting entity's transformer. Under special circumstances and with written approval granted by SRP, revenue metering may be performed on the customer side of the transformer.

Written approval shall only be given if the Connecting entity can provide accurate transformer loss compensation data from the manufacturer to be programmed into the revenue metering when instrument transformers are installed on the customer side of the transformer.

Synchrophasor Metering

The connecting entity will install SEL735 meters with Phasor Measurement Unit (PMU) capabilities for all traditional generation, solar generation, hybrid solar plus storage, or stand-alone storage interconnections. The PMU will be installed on the high side of the step-up transformer for each individual generator. If that step-up transformer services a single unit, the PMU shall be placed on the SRP side of the intertie line. In the case of a step-up transformer serving multiple generators, the PMU will be installed to capture synchrophasor data from each individual generator's net output.

The connecting entity will make available, upon request of SRP, a communication path for a network connection to the PMU or SRP will extend its Telecom network to connect to the PMU.

Synchrophasors will be programmed in accordance with the following standards:

- PMU ID Code shall be assigned by SRP
- Type of transport protocol will be TCP
- Sampling rate will be set to 30 samples per second
- Floating point format shall be used for phasor and frequency signals
- Data format shall be C37.118
- Phasor Data Concentrator IP address shall be assigned by SRP (or designated/masked for PMUs installed inside a foreign network connection other than SRPs).

The synchrophasor metering devices shall also be configured to capture continuous load profile data. SRP will provide standard parameters and intervals for recording. Stored data shall be made available to SRP upon request.

Telemetry

Connecting entity will install suitable telemetry equipment, acceptable to SRP, at the metering point to provide real-time telemetry data to SRP and to all other participating parties.

SCADA equipment shall adhere to the following standards:
IEEE C37.1-2007 “IEEE Standard for SCADA and Automation Systems”
IEEE 1613.1-2013 “IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Transmission and Distribution Facilities”
It is recommended that SCADA equipment also follow IEEE 1815-2015 “Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3)”

If Distributed Energy Resources are involved, the connecting entity shall follow IEEE 1547.3-2007 “IEEE Guide for Monitoring, Information Exchange, and Control of Distributed Resources Interconnected with Electric Power Systems”

Telemetry equipment will include transducers, RTU’s, modems, telecommunication lines, and any other equipment of the same or better function. The RTU, or equivalent device, must have multiple communication ports to allow simultaneous communications with all participants. That device will accommodate data communication requirements specified by each host system, including communication protocol, rate and mode (e.g. synchronous or asynchronous). If Ethernet connectivity is used, SRP will require Network Security devices such as, but not limited to, firewalls, DMZ, and IP traffic monitoring equipment installed at the point of connection and at the connecting entity’s expense. All metered values provided to the telemetry equipment will originate from common metering equipment. All transducers used for telemetry will have at least 0.1 percent accuracy. Telemetry methods shall have resolution of 0.5MW or 0.5MVAR or better. As part of real-time data to be provided, SRP has the right to require the status and remote control of switching devices at the Receipt and/or Delivery Points. SRP may require position status of any and all switching devices between the connecting entity’s generator(s) and the point(s) of interconnection. Typical generator values to be telemetered include but are not limited to:

a) Gross real power

b) Gross reactive power

c) Gross accumulated real power

d) Gross accumulated reactive power

e) Net real power

f) Net reactive power

g) Net accumulated real power

h) Net accumulated reactive power

i) Aux real power

j) Aux reactive power

k) Aux accumulated real power

l) Aux accumulated reactive power

The connecting entity will provide a continuous, accumulating record of megawatt-hours and megavar-hours by means of the registers on the meter. Freezing accumulation data transmission will be taken (at minimum) every clock hour. Values involved in EIM will be a 5-minute interval. The freezing signals must be provided by only one party, as agreed upon by the connecting entity and SRP.

The metering and telemetry equipment will be powered from a reliable power source, such as a station control battery, to allow the equipment to be operational for at least 8 hours after a power interruption. Proper surge protection will be provided for each communication link to protect communication hardware from ground-potential-rise due to any fault conditions. When real-time telemetry is required, a back-up data link must be provided in case of the outage of the primary telemetry line. The back-up link can be a data communication link between involved control centers; the party requesting service is responsible for furnishing the back-up link. Back up revenue meters, communications channels and RTU equipment may be required at the Interconnection's facility.

The connecting entity shall provide SRP personnel physical access to any SRP-owned SCADA equipment located on their site with reasonable advance notice (typically 72 hours or more).

The connecting entity shall provide resources necessary to test, re-test and commission any SCADA interface at the request of SRP. This will occur upon initial commissioning and could occur after initial commissioning when deemed necessary. Any system changes which might affect SRP's SCADA interface, or any of the transmitted data within, shall be provided to SRP in advance (six months or more for significant system changes).

Additional Metering and SCADA Information

SRP will determine the requirements for data protocol, the mode of data transmission (e.g., fiber optic, microwave, private wireless etc.), control functionality, and maintaining continuity (dual DC sources, dual port RTU, etc.) pertaining to metering and SCADA on a case-by-case basis. Any requirements imposed by SRP will not exceed those imposed for internal SRP projects unless special reliability or regulatory requirements necessitate more stringent requirements. Additional meter information and requirements for generator connecting to the SRP transmission system is contained in the SRP GIA.

Any data collection process used by the connecting entity that could impact SRP's telemetered data, shall meet the data collection refresh rates defined by SRP or IEEE C37.1 and be monitored for failure. The data refresh rate used at SRP is 2 seconds.

Telemetry of facility fire alarm and fire alarm system trouble may be required.

Solar/ Energy Storage Systems

Solar/ energy storage systems may have unique telemetry requirements.

Solar/ energy storage systems shall install inverters capable of frequency support functionality to respond to low frequency events and to provide voltage support to the local interconnected system. Such ancillary services shall have a means of control enabled with SRPs EMS system.

Solar/ energy storage systems shall allow for schedule interruptibility controllable from SRP Automatic Generation Control (AGC) Operators in response to system emergency needs. The generator owner shall provide an interface compatible with SRP's AGC control mechanism.

SRP shall have full access to solar/energy storage system sequence of events recorder.

Telemetry received and sent to the solar/energy storage system controller shall have the following features:

- Flexibility in scaling (i.e. ability to allow for W or MW scaling).
- Control for real or reactive power commands shall be designed to allow for following the last received command in case of solar/storage site controller loss of SRP system communications (i.e. no real or reactive power command shall be required to be repeated/refreshed by the SRP EMS system and no ancillary analog point for real or reactive power timeout shall be enabled for the same repeated/refresh command function).
- All analog setpoints shall have direct feedback(echo) signals.
- All control points shall be of a digital nature (i.e. changing battery mode from Real Power Mode to Reactive Power mode shall **not** be made by sending an integer 1,2,3, etc. but rather shall be enabled with a digital 1 or disabled with a digital 0).

SRP required solar/storage SCADA battery system level control points with feedback status:

Batt System CONTINUOUS DISPATCH (i.e. DIRECT REAL POWER COMMAND)
Batt System DISCHARGE INTERUPPTION
Batt System CHARGE INTERUPPTION
Batt System MODE CONTROL (i.e. REAL POWER DISPATCH, REACTIVE POWER DISPATCH)
Batt System FREQUENCY CONTROL (i.e. FREQUENCY ADD ON ENABLE)
Batt System VOLTAGE CONTROL (i.e. VOLT/VAR ADD ON ENABLE)

SRP required solar/storage SCADA battery system level analog status points:

Global Horizontal Irradiance
Plane Of Array Irradiance
Ambient Air Temperature
Barometric Pressure
AGC Batt SystemTarget Setpoint (i.e. setpoint the battery control system is instructing battery output)
Batt System State of Charge
Batt System State of Energy

Real Power Ramp Rate Change Control
Batt System Charge Power Available Capacity
Batt System Discharge Power Available Capacity
Batt System Power Factor
Batt System GEN WATTS
Batt System GEN VARS
Batt System GEN Energy Available Capacity

SRP required solar/storage SCADA battery system level digital status points:

Batt System Inverter Alarm (i.e. controller to inverter or inverter to battery loss of comms, or other inverter alarms)
Batt System Fault Alarm (i.e. fault on one or more battery modules)
Batt System Meter Loss of Communications (i.e. controller to site meter loss of comms, in case of closed loop battery feedback control)
Batt System Fire Alarm
Batt System Fire System Trouble Alarm

Strongly recommended solar/storage SCADA battery system unit level analog status points:

Batt System Unit Level Battery Fault Alarm
Batt System Unit Level Inverter Alarm (i.e. loss of inverter comms, other inverter alarms)
Batt System Unit Level Module Temperature
Batt System Unit Level Real Power Target
Batt System Unit Level Real Power Output
Batt System Unit Level Reactive Power Target
Batt System Unit Level Reactive Power Output
Batt System Unit Level State of Energy
Batt System Unit Level AC Current
Batt System Unit Level Frequency
Batt System Unit Level AC Voltage
Batt System Unit Level Coolant Flow

Strongly recommended solar/storage SCADA battery system unit level digital status points:

Batt System Unit Level Module Loss of Communications
Batt System Unit Level Inverter Fault
Batt System Unit Level AC breaker open
Batt System Unit Level Coolant Low
Batt System Unit Level Battery Temperature Warning

6 GROUNDING AND SAFETY ISSUES

General

All work to be performed by a connecting entity must conform with Good Utility Practice as required by the SRP GIP. For purposes of this FCR, Good Utility Practice shall mean any of the practices, methods and acts engaged in or approved by a significant portion of the electric industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in the region. Good Utility Practice also includes compliance with Applicable Reliability Standards, Applicable Laws and Regulations, Balancing Authority Area requirements, and orders issued by a Governmental Authority. A third party performing work within the boundaries of the connecting entity's facilities must abide by the safety rules applicable to the site.

System Grounding

The specific grounding of the connecting entity's system at the transmission voltage level will be considered on a case-by-case basis. Grounding studies will be necessary and shall be provided to SRP. This is intended to ensure compatibility with the SRP system and connection of the grounding systems. In general, the grounding system should be designed in accordance with IEEE Standard 80 – latest revision, "IEEE Guide for Safety in AC Substation Grounding." In evaluating the step and touch potential the target body weight value should be set to 50 kg.

As a minimum, a protective grounding loop shall be provided by the connecting entity for switches. Under certain conditions, a detailed engineering assessment study may be necessary. This will be determined on a case-by-case basis.

Specifics regarding maintenance/testing, construction techniques and inspections, transmission shielding, cathodic protection, and other items will be considered on a case-by case basis.

Temporary Protective Grounding

Temporary protective grounding as appropriate for construction, repairs, or maintenance in substations and switchyards shall be performed utilizing procedures which comply with OSHA 1910.269.

Facility Fence Safety Clearances

The fence safety clearances in the Connecting entity's facility shall comply with Section 11 of IEEE C2, "National Electrical Safety Code."

Switching

All personnel who are using the operating handles on disconnect switches on energized lines and equipment shall use the appropriate personal protection equipment as required by all applicable regulatory bodies and safety procedures. Before operating, the switch and ground arrangement shall be visually checked.

Electrical Safety Clearances

Clearance from live parts in the substation or switchyard shall comply with NESC (IEEE C2), Rules 110, 124, 232, 233, and 234. Safe approach distances shall be maintained by persons in the substation or switchyard according to the provisions of OSHA 1910.269.

If the incoming high voltage lines will cross road ways or railroad tracks, such as a siding or main line, to reach the connecting entity's facility, it may be necessary to increase the tensions or provide additional height on the structure to meet appropriate crossing requirements. Structural strength and clearance requirements are identified in the NESC and in the SRP Electrical Clearance Standards.

The point of attachment of the line entrance conductors shall be of sufficient height to meet all applicable clearance requirements for the proposed line configuration, including crossings over public streets, alleys, or roads in urban or rural districts, as outlined in the NESC.

In addition, the minimum vertical clearance of the conductors above ground and the vertical and horizontal clearance of conductors passing by but not attached to a structure (building, wall, pole, sign, grain bin, etc) shall be in accordance with the NESC, applicable state and local codes, and SRP Electrical Clearance Standards.

Fire Mitigation

All substations and switchyards shall incorporate appropriate fire mitigation measures per the guidelines of IEEE 979. Work in the substation and switchyard areas shall meet the cleanliness standards of IEEE 979 in order to mitigate any fire hazards as much as possible. Telemetry of the fire alarm and fire system trouble alarms may also be required.

Environmental Hazards

The connecting entity shall notify SRP, first orally and then in writing, of the release of any Hazardous Substances, any asbestos or lead abatement activities, or any type of remediation activities, each of which may reasonably be expected to affect SRP, as soon as possible but not later than twenty-four (24) hours after the entity becomes aware of the occurrence, and shall promptly furnish to SRP copies of any reports filed with any governmental agencies addressing such events.

All substations and switchyards shall incorporate appropriate mitigation of environmental hazards, in particular:

a) Oil containment and control of oil spills shall be incorporated per IEEE 980.

b) SF6 gas control and handling shall be implemented per EPA SF6 Emission Reduction

Partnership Guidelines documents found at <http://www.epa.gov/f-gas-partnership-programs/electric-power-systems-partnership>

Operating Clearances and Hold Tags

All work on equipment shall be performed using appropriate operating clearance and hold tag (lockout-tagout) procedures in compliance with OSHA 1910.269.

Non-Qualified Personnel

All non-qualified personnel shall be escorted and supervised by qualified persons at all times in substations, switchyards, and control buildings per the requirements of OSHA 1910.269.

Enclosed Spaces

All entries into enclosed spaces in substations and switchyards shall be performed by qualified persons and in conformance with the provisions of OSHA 1910.269.

7 INSULATION AND INSULATION COORDINATION

Power system equipment is designed to withstand voltage stresses associated with expected operation. Adding or connecting new facilities may change equipment duty, and may require that equipment be replaced or switchgear, telecommunications, shielding, grounding, or surge protection added to control voltage stress to acceptable levels. Voltage stresses, such as lightning or switching surges, and temporary over-voltages may affect equipment duty. Remedies will depend upon the equipment capability and the type and magnitude of the stress. The connecting entity shall make available to SRP all drawings, specifications, test plans, application documents, and equipment settings.

8 VOLTAGE, REACTIVE POWER, AND POWER FACTOR CONTROL

Voltage Range – Generator

In general, a generation facility that is a connecting entity must be capable of continuous non-interrupted operation within a steady-state voltage range during system normal and single facility outage conditions. This range is from 91.7% to 105.8% range. All reasonable measures should be taken to avoid tripping of the generation facility due to high or low voltage. Specification of the generator voltage schedule will be determined under the direction of the SRP Control Center. A steady-state deviation from this schedule between +0.5% to –0.5% of the nominal voltage will be permissible.

Voltage Range – Transmission and End-User

All connected facilities on SRP transmission system should expect voltage levels which generally range between 91.7% and 105.8% of nominal under system normal conditions and single transmission element outage conditions. If the connecting entity's supply voltage requirements are more restrictive than the 91.7% to 105.8% range, SRP recommends that the connecting entity consider the addition of voltage regulation equipment in their facility.

Nominal transmission system voltages presently on the SRP system are: 500 kV, 230 kV, and 115 kV. For nominal 500 kV, the factors should be multiplied times the normal operating voltage of 525 kV.

Under certain emergency conditions, the SRP transmission system may operate for a period of time outside of the 92% to 105% range. The connecting entity is responsible for providing any voltage sensing equipment required to protect their equipment during abnormal voltage operation.

Transmission interconnected equipment shall have the tap ranges and self-regulation necessary to accommodate the transmission system's reactive power flow requirements.

Net Demonstrated Real and Reactive Capabilities

The connecting entity must provide to SRP annually, the net demonstrated real capability in accordance with the NERC standards and the WECC supplements or guidelines. SRP reserves the right to witness these tests.

In addition, individual generators in the generation facility must make available the full steady-state over- and under-excited reactive capability given by the manufacturer's generator capability curve at any MW dispatch level. This requirement should be considered in all internal generator designs (including transformers, tap settings, motor and other loads, generator/exciter, voltage regulator). Tests which demonstrate this capability must be conducted in a manner and frequency that is in accordance with the NERC standards and the WECC supplements or guidelines. Such documentation shall be provided to SRP. SRP reserves the right to witness these tests.

Reactive Compensation

A circuit should be provided in the automatic voltage regulator (AVR) to permit the control of voltage beyond the generator terminals. This is known as reactive line drop compensation. The point of control is to be adjustable over a range covering 0 to 15% reactance (on the generator base) beyond the generator terminals. The specific requirements for reactive compensation, voltage regulator droop compensation for generators whose terminals are directly connected, and voltage regulators will be considered on a case-by-case basis. In general, any reactive compensation devices will be evaluated to ensure proper coordination with the SRP system.

Power Factor

The NERC Planning Standards state that distribution entities and customers connected directly to the transmission systems should plan and design their systems to operate at close to unity power factor to minimize the reactive power burden on the transmission systems. The SRP interpretation of "close to unity power factor" is that the power factor of the connected load should be within the range of approximately 0.90 lagging to 0.90 leading. The generating facility power factor design limitation minimum requirement shall be a reactive power capability sufficient to maintain a composite power delivery at the Points of Interconnection at a power factor between 0.95 leading and 0.95 lagging.

An End-User will be assessed a penalty for power factors below 90% (leading or lagging) at the time of the End-User peak demand.

Capacitors generally provide an effective means of controlling the power factor of a Connecting entity's facility. However, there are several factors that should be addressed in applying capacitors. These factors can include, but are not limited to, transient voltages due to capacitor switching and voltage amplification due to resonance conditions. The services of a qualified consultant should be obtained to review the specific application and provide recommendations in regard to control of these phenomena.

Mode of Frequency/Voltage Control

The connecting entity's generating facility shall operate with its speed governor and voltage regulators in automatic operation. If the connecting entity's speed governor and voltage regulators are not capable of such operation, the connecting entity shall immediately notify SRP.

9 POWER QUALITY IMPACTS

In general, the connection of any connecting entity - generator, transmission facility, or End-User - may not unacceptably compromise or degrade the power quality of any existing customer or connecting entity. The installation of power quality monitoring equipment by SRP at the connecting entity's expense may be necessary to verify compliance with power quality performance requirements. This may include both trending and event capture power quality monitoring based on SRP templates and also include communications of trend and event information back to a central server through SRP's current protocol and connections. SRP specifies 735 resolution monitor for this application. Prior to connection of any facilities, SRP may require, at the connecting entity's expense, a power quality study. A power quality study may include studies/evaluations of: voltage unbalance, voltage flicker, voltage fluctuation, harmonic distortion, transient overvoltage, temporary overvoltage, temporary undervoltage, insulation coordination, operating frequency, power factor range, and interruption/outage frequency. The studies may identify the need for additional equipment necessary to meet power quality standards. Additional specifics follow:

Harmonics/Voltage Flicker

Generators: A generator connecting entity shall take responsibility for limiting harmonic voltage and current distortion caused by their generation equipment. Limits for harmonic distortion (including inductive telephone influence factors) are consistent with those published in the latest issues of ANSI/IEEE 519, "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems." SRP may require the installation of a monitoring system to permit ongoing assessment of compliance with these criteria.

The generator's facilities and equipment shall not cause excessive voltage deviations nor introduce excessive distortion to the sinusoidal voltage waves as defined by IEC 61000-2-2 and EN 50160, or any applicable superseding electric industry standard. Voltage flicker levels are unacceptable if 85% of the long term flicker (Plt) exceeds a value of 1.0 in a one week measurement.

End-Users: If an End-User connecting entity's electrical equipment located at the End-User's facility (arc furnaces, cycloconverters, etc.) generates voltage flicker and harmonic distortion

that can negatively impact other End-Users, the End-User shall take responsibility, initially or in the future, for limiting interfering levels of harmonic voltage and current distortion and/or voltage flicker. Limits for harmonic distortion (including inductive telephone influence factors) are as published in the latest issues of ANSI/IEEE 519, “Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.” Limits for voltage flicker are defined by IEC 61000-2-2 as a short term flicker (Pst) level of 1.0 and a long term flicker (Plt) level of 0.8.

SRP may, initially or in the future, require the installation of a monitoring system to permit ongoing assessment of compliance with these criteria. The monitoring system, if required, will be installed at the End-User’s expense.

Subsynchronous Torsional Interaction

Certain equipment installations may present a condition that could result in a subsynchronous resonance (SSR) situation that could damage other generation equipment on the electric system. These situations will be analyzed by SRP, or an SRP consultant, and any appropriate corrective or preventive measures will be identified. Corrective and preventive measures may consist of torsional current monitoring at a defined point of compliance, special protective relaying on the turbine-generator shafts(s), or constrained operation of the End-User equipment under certain system configurations. Costs of studies and the design and installation of protective and/or monitoring equipment shall be the responsibility of the connecting entity.

Situations where high harmonic voltages and/or currents originate from the transmission system are to be addressed in the Connection Agreement.

Sensitive Electrical Equipment

Certain electrical equipment in the connecting entity’s facility may be sensitive to normally occurring electric interference from nearby connected loads in the connecting entity’s facility from other End-Users connected to the power system, natural causes, and system switching, etc. If sensitive electrical equipment is to be supplied directly from the electric power system, the connecting entity should examine the equipment grounding requirements and power supply requirements prior to installation. Attention should be given to the equipment’s tolerance to various forms of electric interference, including voltage sags and surges, momentary outages, transients, current and voltage harmonic distortion, or other electrical and electromechanical noise.

When electrical disturbances to sensitive electrical equipment such as computers, electronics, controls and communication equipment cannot be tolerated, the End-User shall install additional equipment as may be necessary to prevent equipment malfunctions and protect against equipment failure. The End-User should consult the supplier of such sensitive electrical equipment regarding the power supply requirements or the remedial measures to be taken to alleviate potential operational error or failure of the equipment. The End-User may need to hire a power quality consultant to also perform a site survey of the electric power supply environment and furnish recommendations to provide the acceptable levels of reliability and quality of service.

10 EQUIPMENT RATINGS

As with all design elements that have the potential to impact the transmission system, SRP reserves the right to review the facility design and specifications prior to the connection to the SRP transmission system.

In most cases, the cost of any changes to the existing transmission system that are necessary due to the connecting entity's project will be the responsibility of the connecting entity.

Size and Take-Off Tension of Line Conductors and Overhead Ground Wires

The connecting entity's structure shall be designed in accordance with Rule 250 of the NESC.

The line terminal connectors furnished by the connecting entity should be aluminum conductor with a bolted connector compatible with SRP's terminal pad. The overhead ground wire shall be connected to the Line Dead End Structure and the Line Dead End Structure shall be grounded using copper conductor connected to the ground grid.

Ratings of Current Carrying Equipment

For tap and looped connections, the connecting entity's high voltage bus and associated equipment, such as switches, connectors, and other conductors shall have a minimum continuous current and momentary asymmetrical current ratings which: (1) do not limit the SRP transmission system network capability and (2) have adequate capability for the initial and future system conditions identified by SRP.

Disconnect Switch(es)

Connecting entity shall install a group operated switch on each transmission line supply entrance to the connecting entity's facility that is accessible to SRP personnel at all times. The switch shall be mechanically lockable in the open position with an SRP padlock in order to provide for a visible electric isolation of the connecting entity's facility and shall be identified with an SRP designated equipment number.

Disconnect switches shall be three pole, single throw, group operated. Characteristics for all disconnect switches including voltage and Basic Insulation Level (BIL) ratings, clearances and pole spacing shall meet the applicable requirements. There shall be no braids in the current carrying parts of the switch. Group operated switches shall be complete with a horizontal, rotating-type operating handle. A gear operated or motor operator may be installed instead of a horizontal operating handle. A grounding device is to be furnished for the operating shaft and shall consist of a tin coated, flexible copper braid, located as close as possible to the operating handle. The braid shall have a cross-sectional area equivalent to 4/0 copper cable, or greater. The braid shall be secured to the shaft by means a galvanized steel U-bolt clamp and associated cradle-type galvanized steel hardware. The opposite end of the braid shall have one (1) 9/16 inch hole. Both ends of the braid shall be stiffened and protected by a ferrule or additional tinning. For multi-revolution operating pipe a suitable braidless grounding device shall be supplied.

All switches are to be manufactured and tested in accordance with the latest revision of ANSI C37.30.1-5, ANSI C37.32, and ANSI C37.34.

Surge Protection

SRP has specific standards for surge protection. The connecting entity will be required to meet these standards. See Appendix 1 for SRP's Apparatus Design Requirements for Surge Arrestors (Extracted from SRP Substation Design and Construction Standards - Chapter 20, Standard 20-1.20)

Lightning arresters protecting transformers shall be station class and may be either polymer or porcelain design and mounted on the transformer, except for 525 kV arresters which are pedestal mounted. However, since lightning arresters can adequately protect equipment some distance from the arresters, the overall number of lightning arresters required in each design can be reduced. Lightning arrester allowable separation distance from the equipment being protected is based on the most recent approved revision of IEEE Std. C62.22.

Consult manufacturer's catalog for details concerning arrester protective characteristics, ratings, and application.

Interrupting Device – Generation

A three phase circuit breaker with SRP approved relaying systems shall be installed to isolate the generation facilities from the SRP supply for all faults, loss of SRP supply, or abnormal operating conditions regardless of whether or not the connecting entity's generation is in operation. This device shall be capable of interrupting the maximum existing and future available fault current at that location. The three phase device shall interrupt all three phases simultaneously. The tripping control of the circuit interrupting device shall be powered independently of the utility Alternating Current (AC) source in order to permit operation upon loss of the SRP transmission system connection.

The specific reclosing times for the connecting entity's circuit interrupting device will be provided by SRP. It is the connecting entity's responsibility to design and maintain their interrupting device(s) to properly isolate generation upon loss of the SRP connection until the appropriate SRP facilities are returned to service. Synchronizing of generation to the SRP transmission system may be, at SRP's discretion, performed under the direction of the SRP Control Center. All manual or automatic synchronization must be supervised by a generator sync check relay. In addition, sync scopes are required at all transmission substations and generation switchyard to allow reconnection of islanded areas.

Other Considerations

Special considerations for specific atmospheric, geological, seismic, or environmental conditions will be evaluated on a case-by-case basis.

11 SYNCHRONIZING OF FACILITIES

Synchronization

The connecting entity shall assume all responsibility for properly synchronizing their generation for operation with the SRP transmission system. Upon loss of the SRP supply, the connecting entity shall immediately and positively cause the generation to be separated from the SRP system. Synchronizing of generation to the SRP transmission system may be, at the discretion of SRP, performed under the direction of the SRP Control Center though normal voice communication consistent with procedures described in Section 15. All manual or automatic synchronization must be supervised by a generator sync check relay. In addition, sync scopes are required at all transmission substations and generation switchyard to allow reconnection of islanded areas.

Automatic transmission line reclosing must be coordinated with and approved by SRP. Specific prohibitions for reclosing will be determined on a case-by-case basis. Test plans must be consistent with the NERC and other regulatory standards and provided to SRP for review and approval.

12 MAINTENANCE COORDINATION

All connecting entity owned equipment up to and including the first protective fault interrupting device shall be maintained and calibrated to the NERC and SRP standards. The connecting entity shall perform maintenance practices at a level that ensures the reliability and continuity of service to the interconnected transmission system. Relevant maintenance records must be maintained. This may include transmission facilities, generation equipment, transformers, circuit breakers, circuit switchers, power fuses, instrument transformers, switches, surge arresters, bushings, metering, communication equipment, trip circuits, interrupters, grounding systems, relays, and associated equipment (including battery and battery charger). Details of SRP maintenance procedures will be provided on request.

The connecting entity shall have an organization that is approved by SRP test and maintain all devices and control schemes provided by the connecting entity for the protection of the SRP system. Included in the testing and maintenance will be any initial set up, calibration, and check out of the required protective devices, periodic routine testing and maintenance, and testing and maintenance caused by a connecting entity or SRP change to the protective devices.

If the connecting entity's testing and maintenance program is not performed in accordance with SRP Standards, SRP reserves the right to inspect, test, or maintain the protective devices required for the protection of its system.

All costs associated with the testing and maintenance of devices provided by the connecting entity for the protection of the SRP system, including costs incurred by SRP in performing any necessary tests or inspections, shall be the responsibility of the connecting entity.

SRP reserves the right to approve the testing and maintenance practices of a connecting entity when the End-User's system is operated as a network with the SRP transmission system.

Necessary outages for transmission or generation equipment maintenance must be approved by SRP and should consider unit commitment obligations, other maintenance

schedules, and the overall reliability of the transmission system. It may be necessary to coordinate the requested outage with the Reliability Coordinator or neighboring utilities. The connected entity is responsible to ensure all approvals and clearances are obtained and that proper notifications are made in the appropriate time-frame.

13 OPERATIONAL ISSUES

Frequency Variations

Frequency protection must include both an underfrequency function and an overfrequency function. Protection settings must in no instance interfere with the means implemented by SRP to restore system frequency following a disturbance. Frequency protection settings in power plants connected to the transmission system must comply with the steady state frequency range provided by SRP. Specific acceptable ranges will be determined on a case-by-case basis using accepted industry standards intended to maintain the reliability of the bulk transmission system. However, in general the following ranges apply:

Generator Frequency Range: The connecting entity's generating facility will provide a balanced, symmetrical, three phase interchange of electrical power with the SRP transmission system at a nominal frequency of 60 Hz. The generation facility must be capable of continuous, non-interrupted operation in the frequency range of 59.5 to 60.5 Hz. Limited time, non-interrupted operation is also expected outside this frequency range in accordance with the generator manufacturer's recommendation.

Transmission System Frequency Range: The SRP transmission system typically operates at a nominal 60 Hz with a variation of +0.05 Hz to –0.05 Hz. Under certain emergency conditions, the transmission system may operate for a period of time outside of this range. The connecting entity is responsible for providing any frequency sensing equipment required to protect their facility during abnormal frequency operation.

Unbalanced Electric Conditions – Transmission/End-User

Voltage unbalance attributable to the connected facilities shall not exceed 1.0% measured at the point-of-service. Voltage unbalance is defined as the maximum phase deviation from average as specified in ANSI C84.1, "American National Standard for Electric Power Systems and Equipment – Voltage Ratings, 60 Hz." This voltage standard shall be considered during the facility design (prior to connection).

Phase current unbalance attributable to the connected facilities combined generation and load shall not exceed 5% measured at the point-of-interconnection.

Situations where high unbalance in voltage and/or current originate from the transmission system are to be addressed in the Connection Agreement.

Voltage Variations – Generator Connections

Acceptable voltage ranges for use in the design and operation of all facilities connected to the SRP transmission systems are provided in Section 8.0 of this report.

Load Shedding – Operational and Implementation Considerations

Load shedding considerations for the design and operation of all facilities connected to the SRP transmission systems are provided in Section 3.0 of this report.

Relay Coordination to Maintain Stability

Proper relay coordination is necessary to ensure stability. Relay coordination should be considered in both the design and operation of all transmission connected facilities. Specific protection system requirements can be found in Section 4.0.

Generator Connected Through a Looped-Service Connection

Any connection to the SRP transmission system that provides two line extensions to supply the End-User is considered a looped-service connection. In general, the two line extensions are installed to End-Users' Facilities obtaining looped service, not to enable SRP to provide adequate electrical service to any location other than the End-User.

A looped-service connection is the preferred connection type (versus tapped-service) when interconnection to an existing SRP facility is not feasible.

Generator Connected Through a Tapped Transmission Line

A tapped transmission line is not allowed unless SRP identifies a reliability issue that would require this type of installation. Any connection to the SRP transmission system that requires only the End-User load to pass through the connecting facilities under any condition is considered a tapped-service connection.

For circumstances where a tapped transmission line is allowed by SRP, the tapped transmission line shall be designed so it can be upgradable to a looped transmission line. The switchyard bus configuration will be determined by SRP but will be at a minimum, a single bus-single breaker bus configuration. Additional equipment to ensure the overall stability and reliability of the transmission system will be required for a tapped transmission line. The cost to add or modify facilities at remote locations to integrate the End-User's transmission connection will also be at the End-User's expense to the extent allowed by the SRP OATT.

Inverter Based Generation Resources Configuration

A connecting entity with an inverter based generation resource(s) shall provide SRP with all protection related settings, inverter manufacturing and software/firmware specifications, and inverter control settings before commissioning. The connecting entity shall also notify SRP of any changes to any of these configurations. SRP reserves the right to periodically request this information to verify compliance to this requirement.

The connecting entity may remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the requirements below. Remaining on-line shall be defined as continuous connection between the Point of Interconnection and the Inverter Based Generation. All voltage references are at the terminal of the inverter.

Momentary cessation is prohibited unless transient high and low voltage conditions exceed the limits listed in the table below. These values and time durations are directly from NERC Reliability Standard for Generator Frequency and Voltage Protective Relay Settings, PRC-024 (reference the latest standard).

High Voltage Ride Through Duration		Low Voltage Ride Through Duration	
Voltage (per unit)	**Time (Seconds)**	**Voltage (per unit)**	**Time (Seconds)**
≥ 1.2	Trip	< 0.45	0.15
≥ 1.175	0.2	< 0.65	0.30
≥ 1.15	0.5	< 0.75	2.00
≥ 1.10	1	< 0.90	3.00

For voltage sags down to 0.50 per unit the inverters are required to inject reactive current, directly proportional to the decrease in per unit voltage, during the duration of the fault.

For voltage transients between 1.10 and 1.20 per unit as measured at the terminal of the inverter, the inverters are required to absorb reactive current.

Upon cessation of transient voltage and voltage sag conditions and the return of the grid to normal operating voltage (0.90 < V < 1.10 per unit), inverters must automatically transition to normal active current injection (real power) and resynchronize with the grid in one second or less at 100% output.

Disconnecting Devices – Transmission or End-User

A three phase air break switch or a three-pole single-throw disconnect switch shall be installed on each transmission line supply entrance to the connecting entity's facility and be accessible at all times. This device shall be capable of withstanding momentary fault current. The disconnecting device shall be mechanically lockable in the open position with an SRP padlock in order to provide for a visible electric isolation of the connecting entity's facility and shall be identified with an SRP designated equipment number.

Other Applicable Operating Requirements

In order to assure the continued reliability of the SRP transmission system, the connecting entity may be requested to adhere to other operating requirements and/or encouraged to adopt common operating practices. These include the coordination of maintenance scheduling, performance not to exceed a specified forced outage rate, operations procedures during system emergencies, participation in balancing area operating reserves, provisions for backup fuel supply or storage, and provisions for emergency availability identified by the NERC. SRP, as the Transmission Provider, may require the connecting entity to provide generation based ancillary services per the SRP OATT.

Conformance with applicable requirements in the NERC Standards and WECC Supplements or guidelines is required. All data reportable to the NERC and/or the WECC shall also be made available to SRP.

14 INSPECTION REQUIREMENTS

Before a connecting entity owned facility may be energized, an energization procedure must be submitted to Transmission System Operations and System Protection for review and approval prior to placing any new facilities in service. This procedure must be submitted 90 days in advance for operational preparation and to mitigate changes to switching on SRP's system.

The connecting entity owned facility must also pass a final inspection by SRP personnel. SRP will inspect all substation equipment from the point of interconnection to the first protective fault interrupting device and the ground system. This may include circuit breakers, circuit switchers, power fuses, instrument transformers, switches, surge arresters, bushings, and relays and associated equipment (including battery and battery chargers). The inspection will consist of a visual inspection of all major equipment as well as review of required test results. In addition, SRP maintains the right to inspect all generator plant facilities prior to synchronizing. The inspections will focus on ensuring all technical, regulatory, and safety requirements have been met. Access to the facility must be provided to SRP to allow the described inspections. The facility owner may be required to modify operations to reasonably comply with the necessary training. However, SRP will coordinate such tests in a manner that minimizes the impact on actual operations.

The connecting entity is responsible for operating its facilities with full regard for the safe practices of, and with full cooperation under the supervision of the SRP Control Center. Under no circumstances shall a connecting entity energize SRP transmission facilities which have been de-energized. Circuits which are electrically disconnected from the SRP transmission system and are energized by a connecting entity constitute a potential safety hazard for both SRP transmission personnel and the general public. Also, the energizing of such circuits at abnormal voltage or frequency could cause damage to electrical equipment of both the SRP transmission system and the generation.

Specific minimum requirements for operation of generation on the SRP transmission system follow:

The ground system must be checked by using the resistance measurement procedures in accordance with IEEE Standard 81 "Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth."

15 NORMAL AND EMERGENCY OPERATING CONDITIONS

The operators of all facilities (generation, transmission, and End-Users) connected to the SRP transmission system shall provide a contact person for communications. This contact must have the authority to operate the facilities according to the instructions of the appropriate operating entity (typically SRP).

<u>Voice Communications</u>

Normal – At request of SRP, the connecting entity shall provide a dedicated voice

communication circuit to the SRP Control Center.

Such a dedicated voice communication circuit would originate from the connecting entity's office staffed 24 hours a day and would be typically required for generation facility synchronization and operation within the SRP balancing area.

All other normal voice communication concerning facility operations shall be conducted through the public telephone network to the control center phone number(s) issued by SRP.

Emergency – Voice communication in the event of a transmission system or energy emergency shall use the dedicated voice circuits, or public telephone network and phone number(s) designated for emergency use.

In the event of a transmission system emergency, energy emergency, or transmission facility restoration effort, the connecting entity may be notified by the SRP Control Center. Specific instructions may also be given regarding the operation of the connecting entity's unit(s) depending on the nature of the emergency. These instructions may consist of switching changes, voltage schedule changes, real and/or reactive dispatch changes or other VAR support issues, instructions to shut down or start-up the connecting entity's generating unit(s), and the need to implement emergency communication procedures. It is the connecting entity's responsibility to ensure that the unit operators follow all instructions given by the SRP Control Center during system emergencies. Connected facilities may be subject to the emergency operating plan of SRP that can require interruption of load to deal with generation deficiencies and/or transmission system emergencies. It is noted that interrupting of load will only be done in extreme conditions that would result in a more serious degradation of system performance than if the load were not shed.

It is the connecting entity's responsibility to take prudent steps when an area or system wide capacity emergency is declared. Load reductions shall be implemented by reducing nonessential loads. This type of reduction is usually conveyed through the local media.

In addition the End-User is responsible for providing the SRP Control Center a "customer contact list."

SRP will provide End-Users an unlisted phone number to be used for emergency or routine operations to the SRP Control Center. Operational emergencies (equipment) warrant a direct call either way.

Disturbance Monitoring

The connecting entity's facility must have disturbance monitoring equipment per applicable the NERC standards and the WECC supplements or guidelines.

16 BALANCING AREA AUTHORITY NOTIFICATION

The process for notification to the Transmission or Applicable Generation Owner of the Balancing Area Authority that a new project will be located in shall adhere to the project's respective GIA Balancing Authority Area Notification section.

17 MISCELLANEOUS REQUIREMENTS

Network Connection Definition and Requirements

Any connection to the SRP transmission system that allows bi-directional energy and/or fault current flow between otherwise independent transmission systems is an interconnection. This is considered a special circumstance, which requires a detailed system impact study to determine the acceptability of the proposed transmission interconnection and the specific interconnection requirements. Transmission interconnection requests on the SRP system will be considered on a case-by-case basis. The connecting entity will be responsible for reimbursement of the cost for these studies. In addition, the cost of facilities to establish and reliably integrate the new network connection will be at the expense of the connecting entity to the extent allowed by OATT of SRP.

Remote Relay Access

Remote relay access is not required unless specifically requested.

Connecting entity to provide relay logs, settings, disturbance data, fault records, etc. as requested by SRP.

18 INDEMNIFICATION

The use and reliance upon the information contained in this document shall in no way relieve the connecting entity from the responsibility to meet National Electric Code (NEC) and NESC requirements governing their design, construction, operation, and materials.

The connecting entity, for itself, its successors, assigns and subcontractors agrees to pay, indemnify and save SRP, its successors and assigns, harmless from and against any and all court cost and litigation expenses, including legal fees, incurred or related to the defense of any action asserted by any person or persons for bodily injuries, death or property damage arising or in any manner growing out of the use and reliance upon the information provided by SRP. Reliance upon this information shall not relieve the connecting entity from responsibility for the protection and safety of the general public.

Version History

Version	Date	Action	Change Tracking	Revised By
1	03/1/10	Created	N/A	Luke O'Dwyer
2	10/31/11	Updated	New version	Luke O'Dwyer
3	11/09/12	Updated	New version	David Crowell
4	12/17/12	Updated	New version	David Crowell
5	11/20/13	Updated	New version	David Crowell
6	12/18/14	Updated	New version	David Crowell
7	09/08/15	Updated	New version	David Crowell
8	08/25/16	Updated	New version	David Crowell, Nicco Magnotto
9	07/01/18	Reviewed	Same as Previous	Angel Omar Sandoval, PE
10	01/01/19	Updated	Grammar, Punctuation, added section 16	Angel Omar Sandoval, PE
11	11/01/19	Updated	New version	Angel Omar Sandoval, PE
12	3/31/22	Updated	New version	Anthony Sivesind, Dan Hollowell, Matt Rhodes, Snehal Dalal, Philip Augustin, Jeff Sams, Kevin Woolfolk
13	11/07/2023	Updated	Changed LGIP / LGIA references to GIP / GIA references	Ted Bright, P.E.

Appendix 1 - SRP's Apparatus Design Requirements for Surge Arrestors

(begins on next page)