Valley Electric Association, Inc.

A Touchstone Energy® Cooperative

GRIDLIANCE

Blackstone Portfolio Company

Transmission Interconnection Handbook

Applicable to Transmission Facilities Interconnecting with VEA & GridLiance Transmission Facilities

Notice: Document Subject to Change

The information and requirements in this manual are subject to change over time. The most current version of this Transmission Interconnection Handbook is available by emailing your request to VEAengineering@vea.coop.

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Version History

Version	Date	Action	Change Tracking
1.0	12-29-17	New Transmission Interconnection Handbook	New
1.1	12-21-18	Review and update	Updated VEA's contact email; Added section 3.3; Removed section 4.5, section 5.5, section 5.7, section 5.11, and section 6.4; Edited section 6.1.1 and section 6.1.5; Errata

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1 TRANSMISSION INTERCONNECTION OVERVIEW

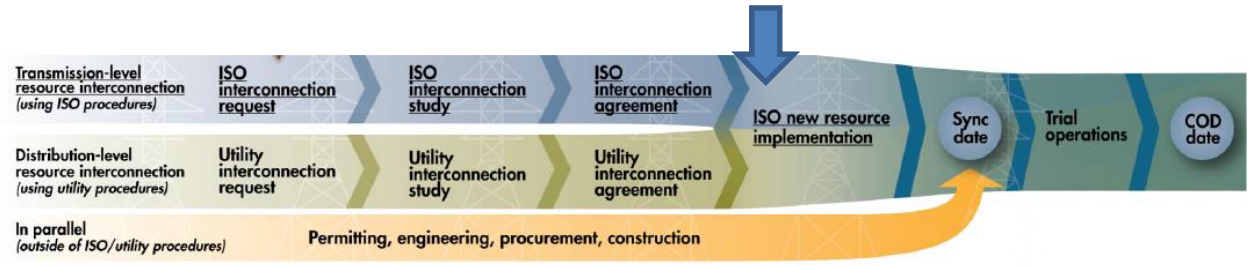
The purpose of this Transmission Interconnection Handbook (Handbook) is to provide Customers general requirements to interconnect their non-VEA owned transmission facilities to VEA's electric system. The Handbook describes general requirements. Not all requirements can be specified in a Handbook because some requirements are case specific. Therefore, this Handbook provides Customers an overview of the requirements to address their transmission facility interconnection requests. VEA will determine all interconnection requirements with specificity, thru VEA's interconnection studies requested and paid for by the Customer.

2 INTRODUCTION

This Interconnection Handbook has been prepared by Valley Electric Association, Inc. to identify the typical minimum technical requirements (the "Requirements") for connecting transmission facilities to the transmission system operated by Valley Electric Association, Inc. (the "System or Utility"). "VEA" will refer to both Valley Electric Transmission Association, Inc (VETA) and Gridliance West, LLC (GridLiance), as the owners of transmission facilities operated and maintained by Valley Electric Association, Inc. "Valley Electric" will mean only Valley Electric Association, Inc. The interconnections include facility additions and modifications to accommodate Customer facilities being connected or planned to be connected to VEA. These Requirements are necessary to ensure the safe and reliable operation of the electric Utility. Documentation of these Requirements also fulfills compliance obligations associated with North American Electric Reliability Corporation (NERC) standard FAC-001.

An Interconnection Handbook is a handbook, developed by the Participating Transmission Owner (PTO). This handbook describes technical and operational requirements for wholesale Customers connected to the PTO's portion of the CAISO Controlled Grid. PTO standards contained in the Interconnection Handbook shall be deemed consistent with Good Utility Practice and Applicable Reliability Criteria.

Normally, Customers are interested in PTO's Interconnection Handbooks when they have reached the "ISO new resource implementation" stage as shown in the graphic below. However, VEA's Interconnection Handbook is available at any stage of the interconnection process by emailing the Engineering Department at VEAengineering@vea.coop. This handbook is written for those knowledgeable in the electric industry. Definitions of abbreviated terms are not always defined when used, but rather provided at the end of this document for those unfamiliar with industry terms and abbreviations.



2.1 Exclusions

These Requirements do not address procedural information related to facility interconnections nor cover all possible technical details. The Requirements are not intended to function as a design specification. The final design of facility connections to the System will be subject to VEA review and approval on a case-by-case basis.

2.2 Other Requirements

In addition to compliance with these Requirements, any entity seeking to connect transmission to VEA is responsible for complying with all other interconnection obligations established by contract and applicable rules, tariffs, regulations, standards, and criteria. Such requirements may include the following:

- NERC reliability standards, recommendations and alerts.
- Western Electric Coordinating Council (WECC) reliability standards
- California Independent System Operator (CAISO) criteria
- Federal Energy Regulatory Commission (FERC) regulations
- State and Local jurisdictional requirements

2.3 Requirements Are Subject to Change

These Requirements are subject to change. VEA maintains and updates these Requirements as necessary. The Customer shall ensure that they comply with the most recent version of these Requirements. The current version is available upon request at VEAengineering@vea.coop.

2.4 Costs

All arrangements for system studies, engineering design, construction, ownership, operations, maintenance, replacement equipment, metering, facility controls, and telecommunications must be set forth in a written contract between VEA, the Customer, and if necessary, the CAISO. If additional equipment or replacement equipment is required on the System to accommodate the facility interconnection, VEA will install or modify the equipment at the cost of the Customer. VEA may maintain transmission capacity and operational control of such equipment. Further, as permitted by applicable laws and regulations, VEA reserves the right to participate in the costs of proposed facility expansion plans that may be accommodated through mutually advantageous alternatives that may also provide substantial benefits to regional reliability or transmission transfer capability. Advance funds or deposits are required by VEA and/or the CAISO prior to any studies, system modifications, upgrades, or additions be performed.

2.5 Transmission Capacity is Not Guaranteed

A direct interconnection into VEA's System does not guarantee transmission capacity on portions of the VEA transmission system or neighboring systems. Customer's capacity rights are determined through the CAISO GIDAP process as described on the CAISO website (www.caiso.com).

3 STUDY AND NOTIFICATION PROCEDURES (FAC-001, R3)

3.1 Procedures for Coordinated Studies of New or Materially Modified Interconnections and Their Impacts on Affected Systems (FAC-001, R3.1)

- VEA is a PTO in the CAISO. VEA has placed all of its transmission system facilities under the administration and operation of the CAISO. Generation, transmission, and end-user facilities that are connecting at the transmission-level are required to follow the CAISO procedures for interconnection.
- The CAISO procedures for interconnection are available on the CAISO website (www.caiso.com). These procedures include steps to request a new Facility interconnection or material modification to an existing interconnection, as well as the data required to be submitted to properly study the interconnection.
- VEA participates in the CAISO study process for transmission-level interconnections in the VEA area. The CAISO manages the coordinated study process for new or materially modified existing transmission-level interconnections and their impacts on affected system(s).

3.2 Procedures for Notifying Those Responsible for the Reliability of Affected System(s) of New or Materially Modified Existing Interconnections (FAC-001, R3.2)

- VEA participates in the CAISO study process for transmission-level interconnections in the VEA area. The CAISO manages the process for notifying those responsible for the reliability of affected system(s) of new or materially modified existing interconnections.
- Additionally, the CAISO or VEA will notify affected system(s) of new or materially modified existing interconnections through the CAISO interconnection process or directly by VEA.

3.3 Procedures for Confirming with Those Responsible for the Reliability of Affected Systems of New or Materially Modified Transmission Facilities Are Within a Balancing Authority Area's Metered Boundaries (FAC-001, R3.3)

- Responsibility for Identifying Functional Entities
    - The Customer shall identify the entity responsible for the reliability of the new or materially modified Transmission Facilities (i.e., the Customer is responsible for being or identifying a Transmission Owner and a Transmission Operator for its Transmission Facilities).
    - The Customer is also responsible for identifying the Balancing Authority Area in which its Transmission Facilities will reside. VEA is not responsible for finding a Balancing Authority for the Customer's Transmission Facilities.
- Documentation Required
    - The Customer shall make arrangements for its Transmission Facilities to be within the metered boundaries of a Balancing Authority and shall obtain documentation from the Balancing Authority that its Transmission Facilities are located within the boundaries.
        - This documentation may be a letter from a representative of the Balancing Authority or some other document showing completion of processes to place the Transmission Facilities within the Balancing Authority Area.
        - The documentation must be dated and must confirm that the Transmission Facilities are within the boundaries. (I.e., it cannot be acknowledgement of an application or documentation of an incomplete process.)
        - The Customer shall provide (within the documentation or in a separate document) contact information for the Balancing Authority, specifically a representative that can confirm the Customer's Transmission Facilities are within the Balancing Authority Area.
- Submittal & Review
    - The Customer shall provide the documentation to VEA at least 180 days prior to the desired In-Service Date.
    - VEA will review the documentation to ensure that it meets the requirements listed above. VEA will also contact the Balancing Authority representative for confirmation.
    - If the documentation provided is insufficient or confirmation cannot be obtained, VEA will not provide Approval of the In-Service Date until sufficient documentation has been submitted.

- **Failure to submit sufficient documentation may cause delays for which the Customer is solely responsible.** The Customer is encouraged to submit documentation early and follow up on the approval process to ensure timely completion of the Interconnection process.

4 PROTECTION REQUIREMENTS

Protective devices (relays, circuit breakers, synchronizing equipment, etc.) must be installed for the protection of VEA's electric system as required by VEA. While some protection requirements can be standardized, the detailed protection design highly depends on the type and characteristics of the interconnecting Transmission Facilities, (i.e., voltage, impedance, and ampacity), and the existing protection equipment and configuration of VEA's electric system in the vicinity of the point of interconnection. Fault duty, existing relay schemes, stability requirements, and other considerations, such as the effects of the interconnection on neighboring utilities, may impact the selection of protection systems. The final decision as to the specific protection and other requirements for each installation will be made by VEA.

4.1 Voltage Criteria

The operating voltages of the VEA transmission system are 230 kV and 138 kV. The transmission system is a mix of two-terminal and radial transmission line configurations. VEA's operating practice is to maintain voltage within +8/-5% of nominal system voltage for their transmission system. For emergency or contingency operation system voltage is maintained within +/-10%. Steady State voltages are provided below.

		Steady State Pre-Contingency		**Steady State Post-Contingency**	
System	Facility	**High (kV/p.u.)**	**Low (kV/p.u.)**	**High (kV/p.u.)**	**Low (kV/p.u.)**
All Busses	230 kV	248.4/1.080	218.5/0.950	253/1.100	207/0.900
	138 kV	149.0/1.080	131.1/0.950	151.8/1.100	124.2/0.900

4.2 General Clearing Time and Relay Replacement

For voltage classes 138 kV and above, primary relay protection for network transmission circuits will be designed to clear transmission line faults within a maximum of 6 cycles. Future project stability studies may indicate faster clearing times are necessary. If so, then VEA will inform the Customer at that time.

4.3 Protection Criteria

VEA documents its protection requirements in a separate document entitled "System Wide Protection Criteria". This document will be provided to the Customer as part of the interconnection process.

4.4 Protective Device Numbers and Description

21P Phase Distance

21G Ground Distance

25 Synchronism Check

50G Residual Ground Instantaneous Overcurrent

50GDT Residual Ground Definite Time

50P Phase Instantaneous Overcurrent

50PDT Phase Definite Time

51G Residual Ground Time Overcurrent

51P Phase Time Overcurrent

79 Automatic Reclosing

87B Bus Differential 87L Line Differential

87T Transformer Differential

BFI Breaker Failure Initiate

CCVT Capacitively Coupled Voltage Transformer

CT Current Transformer

CTI Coordination Time Interval

DTT Direct Transfer Trip

LOP Loss of Potential

MTA Maximum Torque Angle

PT Potential Transformer

SIR Source-to-Line Impedance Ratio

SOTF Switch-onto-Fault

NOTE: For additional information on device numbers, refer to ANSI C37.2.

5 BREAKER DUTY AND SURGE PROTECTION

5.1 VEA Duty Analysis

The recognized standards to evaluate circuit breakers are: IEEE Standard C37.010-1999 (R2005), "IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis," and ANSI/IEEE Standard C37.5 for circuit breakers rated on a total current basis. VEA reviews breaker duty and surge protection of all new facility additions based upon these standards. As part of this review, VEA determines whether the new facilities over-load the interrupting capability of existing and planned electrical facilities. Similarly, neighboring utilities may require upgrades to their equipment when they determine new facilities over-load their equipment.

When studies of future facilities indicate the short-circuit duty will reach the capability of existing breakers, consideration is given to the following factors:

1) Magnitude of short circuit duty.
2) The effect of future projects on the duty.
3) Increasing the interrupting capability of equipment.
4) The ability of a particular breaker to interrupt short circuits considering applicable operating experience and prior test data.

Methods of limiting duty to the circuit breaker capability include, but not limited to:

1) De-looping or rearranging transmission lines at substations;
2) Split bus arrangements.

Please note that VEA normally performs annual short circuit duty analysis, which may include reevaluation of the Customer's facility breakers and whether these breakers need to be upgraded or replaced.

5.2 Customer Owned Duty/Surge Protection Equipment

The Customer's system protection facilities shall be designed, operated, and maintained to isolate any fault or abnormality that would adversely affect the VEA System or the systems of other entities connected to the VEA System. The Customer shall, at its own expense, install, operate, and maintain system protection facilities in accordance with applicable CAISO,

WECC, NESC and NERC requirements and in accordance with design and application requirements of this Interconnection Handbook.

Such protective equipment shall include, but not limited to, a disconnecting device and a fault current-interrupting device located between the Customer's transmission facilities and VEA electric system at a site selected upon mutual agreement of the Parties. The owner of Customer facilities shall be responsible for protection of their equipment and other equipment from such conditions as negative sequence currents, over- or under-frequency, sudden load rejection, over- or under-voltage, and generator loss-of-field. The Customer shall be solely responsible to disconnect their facility if conditions on VEA's electric system impact their facilities.

5.3 Protection and Control System Information to Accommodate Customer Interconnection

At the Customer's expense, VEA will perform a detailed interconnection study to identify the cost of any required modifications to VEA's protection and control systems that are required to interconnect new transmission.

The Customer shall provide VEA with electrical drawings for review and approval prior to equipment procurement. The drawings provided should consist of Single Line Meter and Relay Diagrams, schematic drawings detailing connectivity (3-Line AC) and tripping schemes (DC) for all VEA required relays. The Single Line Meter and Relay Diagrams listing the major protective equipment should be provided prior to ordering relays. The 3-Line AC and the DC schematics should be provided before fabricating relay panels. The following documents must be submitted for VEA review and approval before any agreements are executed: Single Line Diagram, Single Line Meter and Relay Diagrams.

The Customer must also provide VEA with test reports for the particular types of protection devices, including verification of all protective functionality, before VEA will allow the facility to operate in parallel. Where tele-protection is utilized, the communication circuits must be tested and the scheme functionally verified prior to release for commercial operation. The Customer must submit written test reports for qualified testing to VEA, or at any time upon request by VEA, that demonstrate that the relays are operable and within calibration.

VEA will not test the Customer's equipment, but may witness the testing performed by a qualified testing firm retained by the Customer. On-site power (typically 120 volts) is required for the test equipment. Circuit breakers must be tested at least every eight years after initial inspection. It is also in the Customer's best interest to make sure all of its protective equipment is operating properly, since significant equipment damage and liability can result from failures of the entity's protective equipment.

5.4 Reliability and Redundancy

The Customer shall design the protection system with sufficient redundancy that the failure of any one component will still permit the Facility to be isolated in the required clearing time from the VEA power system under a fault condition. Multi-function three-phase protective relays used for line protection must have redundant relay(s) for backup. The required breakers must be trip tested by the Customer at least once a year.

5.4.1 Settings Guidelines

Please refer to VEA's "System Wide Protection Criteria" provided in a separate document during the interconnection process.

6 MISCELLANEOUS REQUIREMENTS:

6.1 Required Equipment for Disturbance Monitoring and Reporting – DDR and PMU

As part of good utility practice, VEA plans to benchmark Bulk Electric System (BES) computer models against real-world events such as Remedial Action Schemes (RAS) operations and BES outages. In support of this goal, VEA requires installation of Dynamic Disturbance Recording (DDR) and Phasor Monitoring Unit (PMU) facilities for all Customers interconnecting into VEA's service area.

VEA's standard requirement is for Customers to use SEL DDR & PMU devices. VEA will coordinate with the Customer during the interconnection process to identify appropriate SEL devices, the infrastructure needed to support such devices and Customer reporting requirements. DDR, PMU devices and associated infrastructure shall be purchased and installed at the Customer's expense.

6.1.1 Transmission Facilities Standards

The Customer shall adhere to all national, state, and local design standards where applicable. Where facilities are intended to be owned by VEA, designs must be consistent with VEA's requirements.

6.1.2 Transmission Taps

Generally, VEA does not tap its transmission lines. Transmission taps will be approved by VEA on a case-by-case basis. Typically, transmission lines are interconnected by a new 3-ring bus substation or a breaker-and-a-half position at an existing substation.

6.1.3 Sub-Synchronous Resonance and Control Interaction Studies

Customer owned transmission lines that have a series capacitor attached to the line and wish to interconnect to VEA, must demonstrate to VEA that Sub-Synchronous Resonance studies have been performed on their line. VEA will analyze the SSR study results as part of the interconnection process.

6.1.4 Automatic Voltage Regulators (AVR)

Automatic voltage control equipment, synchronous condensers, and Flexible Alternating Current Transmission System (FACTS) shall be kept in service to the maximum extent possible with outages coordinated to minimize the number out of service at any one time. Such voltage control equipment shall operate at voltages specified by the CAISO.

6.1.5 Underfrequency Relays

Under frequency protection will be evaluated as part of interconnection study requirements.

6.2 Ratings

6.2.1 Facility Ratings

The ratings of facilities are the responsibility of the owner of those facilities. For facilities owned by VEA, ratings will comply with VEA's Facility Rating Methodology. Ratings of non-VEA facilities must conform to the current NERC Reliability Standard governing facility ratings. VEA may provide its Facility Rating Methodology document as part of the interconnection process.

6.2.2 Path Ratings

As stated in WECC path rating requirements, new facilities and facility modifications should not adversely impact accepted or existing path ratings. New or modified facilities can include transmission lines, generating plants, substations, series capacitor stations, remedial action schemes or any other facilities affecting the capacity or use of the interconnected electric system.

6.3 Synchronizing of Facilities

Testing and synchronizing of a Customer's Facilities shall be required.

Synchronizing locations shall be determined ahead of time. Synchronizing procedures shall be developed by the Customer and coordinated with VEA and if applicable the CAISO. VEA and the Customer shall mutually agree and select the initial synchronization date; the date upon which a facility is initially synchronized to VEA's electric system and upon which trial operation begins.

Note: VEA's transmission lines utilize ACB phase rotation. The owner of the Transmission Facilities is responsible to know and follow all applicable regulations, industry guidelines, safety requirements, and accepted practice for the design, operation and maintenance of their facility.

6.4 Maintenance Coordination and Inspection

The security and reliability of the interconnected power system depends upon periodic inspection and adequate maintenance of the Customer's Transmission Facilities and associated equipment, including but not limited to control equipment, communication equipment, relaying equipment and other system facilities.

The Customer shall follow FERC, NERC, WECC, PeakRC and CAISO procedures and are responsible for disseminating information on scheduled and forced outages and for coordinating scheduled outages of transmission facilities which affect the security and reliability of the interconnected power system.

6.4.1 Abnormal Frequency and Voltages

6.4.1.1 Joint Reliability Procedures

Where specific transmission issues have been identified, those entities affected by and those entities contributing to the problem shall develop joint procedures for correcting issues and maintaining grid reliability.

6.4.1.2 Voltage and Reactive Flows

The local TOP and the CAISO shall coordinate the control of voltage levels and reactive flows during Normal and Emergency Conditions. All Customer operating entities shall assist with the the local TOP and the CAISO's coordination efforts.

6.4.1.3 Transfer Limits Under Outage and Abnormal System Conditions

In addition to establishing total transfer capability limits under normal system conditions, transmission providers and balancing authority shall establish total transfer capability limits for facility outages and any other conditions such as unusual loads and resource patterns or power flows that affect the transfer capability limits.

6.4.2 Communications and Procedures

6.4.2.1 Use of Communication System

It is essential the Customer establish and maintain communications with Valley Electric Dispatch at all times for reliable grid operation. If the Customer's communication services are dual-use with Valley Electric Dispatch and others, it is important such communication services be kept clear of nonessential use during system emergency operations.

6.4.2.2 Remedial Action Schemes - Communication Equipment Requirements

As stated in the NERC and WECC Planning Standards, the function of a Remedial Action Scheme (RAS), is to "detect abnormal system conditions and take pre-planned, corrective action (other than the isolation of faulted elements) to provide acceptable system performance." In the context of new generation projects, the primary action of a RAS would be to detect a transmission facility outage or an overloaded transmission facility and then trip or run back (reduce) generation output to prevent damage to the overloaded facilities, protect against potential overloads, and/or avoid other criteria violations.

The need for RAS is determined through the CAISO Generation Interconnection Process studies. The Customer is informed of their RAS participation, if any, as part of these studies. Whether RAS shall be required on a specific generating station will depend on various factors including total generation exports from VEA's area, location and size of the generator, the nature, consequences and expected frequency of grid disturbances and future transmission projects.

Any RAS proposals must be approved by both VEA and CAISO and must comply with the applicable CAISO Planning Standards and Good Utility Practice. VEA also expects all RAS operating on its System to be taken to WECC RASR Committee for approval prior to final design and construction.

Valley Electric, the CAISO and PeakRC will monitor the status and operation of RAS.

If required to participate in a RAS, the Customer Facilities shall have the necessary communication equipment. This equipment provides line monitoring and high-speed communications between the Customer's breaker and the central control facility, utilizing applicable protocols. RAS may also be applied to individual transmission lines in order to relieve congestion on much larger portion of VEA's electric system.

RASs are fully redundant systems. The following paragraph is an excerpt from the "WECC Remedial Action Scheme Design Guide that specifies the Philosophy and General Design Criteria" for RAS redundancy. "Redundancy is intended to allow removing one scheme following a failure or for maintenance while keeping full scheme capability in service with a separate scheme. Redundancy requirements cover all aspects of the scheme design including detection, arming, power, supplies, telecommunications facilities and equipment, logic controllers (when applicable), and RAS trip/close circuits."

Excerpt from: WECC Remedial Action Scheme Design Guide (11/28/2006)

7 GENERAL OPERATING REQUIREMENTS:

a) Transmission Grid Operator: On January 1, 2013, the CAISO assumed operational control over VEA's transmission grid.
b) System Operating Bulletins: The Transmission Facilities connecting into VEA's electric system may be subject to operating requirements established by VEA, the CAISO or both. VEA's general operating Requirements are discussed in the sections below. VEA may also require additional operating Requirements specific to a specific set of Transmission Facilities. If so, these Requirements will be documented in VEA's System Operating Bulletins (SOB) and/or interconnection and power purchase agreements.
c) Owner Responsibilities: The owner of the Transmission Facilities is responsible for complying with all applicable operating requirements. Operating procedures are subject to change as system conditions and system needs change. Therefore, it is advisable for the owner to regularly monitor operating procedures that apply to its Transmission Facilities. The CAISO publishes its operating procedures on its internet site, but it is prudent for the owner to contact the CAISO and VEA for specific Requirements.
d) Quality of Service: The interconnection of the Customer's Transmission Facilities with VEA's electric system shall not cause any reduction in the quality of service being provided to VEA's Customers. If complaints result from operation of the Customer's Transmission Facilities, such equipment shall be disconnected until the problem is resolved.
e) VEA Circuits: Only VEA's authorized personnel are permitted to energize or de-energize VEA circuits or equipment..
f) Operate Prudently: The owner of the Transmission Facilities will be required to operate its equipment in accordance with prudent electrical practices.
g) Protection in Service: The Transmission Facilities shall be operated with all required protective apparatus. Redundant protective devices may be provided at the Customer's expense. Any agreement by VEA for deviation from normal operations shall not to be interpreted as permission for subsequent similar incidents.
h) Added Facilities Documentation: The customer may not commence parallel operation of its end user Facility until final written approval has been given by VEA. As part of the approval process, the customer shall provide, prior to the commencement of parallel operation, all documents required by VEA to establish the value of any facilities installed by the customer and deeded to VEA for use as added facilities. VEA reserves the right to inspect the customer's end user Facility and witness testing of any equipment or devices associated with the interconnection.

7.1 VAR Correction

VAR correction may be required to correct for Customer VAR deficit, such as transmission line VAR deficit or transformer VAR losses. Adequate VAR correction shall be provided by the Customer under the conditions of maximum coincident Customer loads (one-in-five-year heat storm conditions), after adjusting for dependable local generation and loss of the largest local bypass generator.

VAR correction may also be planned for light load, heavy load and for system normal and contingency conditions to maintain allowable voltage levels. VAR correction may require the installation of shunt capacitors, shunt reactors, tertiary shunt reactors, synchronous condensers, FACTS or transformer tap changers.

7.1.1 Interconnection with Other Utilities

Interconnection with other utilities will normally be designed with the capability of maintaining near-zero VAR exchange between systems. Entities interconnecting their transmission system with VEA's system shall endeavor to supply the

reactive power required on their own system, except as otherwise mutually agreed upon. VEA shall not be obligated to supply or absorb reactive power for the Customer's Transmission Facilities when it interferes with operation of VEA's electric system, limits the use of VEA interconnections, or requires the use of generating equipment that would not otherwise be required.

7.2 Voltage Regulation/Reactive Power Supply Reserves

To ensure secure and reliable operation of the interconnected power system, reactive supply and reactive generation shall be properly controlled and have adequate reactive reserves. Customers shall ensure their reactive reserves are adequate to maintain CAISO or VEA voltage limits under facility outage conditions. Reactive reserves required for acceptable response to contingencies and shall be automatically applied when contingencies occur. Customer operation of static and dynamic reactive devices shall be coordinated with VEA such that static devices are switched in or out of service so the maximum reactive reserves are maintained on other facilities such as generators, synchronous condensers and other dynamic reactive devices.

If power factor correction equipment is necessary, it may be installed by the Customer on its Transmission Facilities, or if approved by VEA, by VEA on VEA's facilities at the Customer's expense.

7.2.1 Reactive Power Equipment

The owner of the interconnecting Transmission Facilities shall provide for the supply of its reactive requirements, including appropriate reactive reserves, and its share of the reactive requirements to support power transfers on interconnecting transmission circuits.

7.2.1.1 Facility Reactive Power Equipment Utilization

The reactive power equipment utilized by the interconnecting Customer to meet VEA's Requirements must be designed to minimize the exposure of VEA's Members, VEA's electric system, and the electric facilities of others (i.e., other facilities and utilities in the vicinity) to:

a) Severe overvoltages that could result from self-excitation of induction generators,
b) Transients that result from switching of shunt capacitors,
c) Voltage regulation problems associated with switching of inductive and capacitive devices.
d) Unacceptable harmonics or voltage waveforms, which may include the effect of power electronic switching, and
e) Voltage flicker degrading power quality.

7.2.1.2 Facility Reactive Power Equipment Design

The reactive power equipment utilized by Customer's Transmission Facilities connecting to VEA's system to meet VEA's Requirements must be designed to provide a variable source of reactive power (either continuously variable or switched in discrete steps). For discrete step changes, the size of any discrete step change in reactive output shall be limited by the following criteria:

a) the maximum allowable voltage rise or drop (measured at the point of interconnection with VEA's electric system) associated with a step change in the output of the Transmission Facilities' reactive power equipment must be less than or equal to 1%; and
b) the maximum allowable deviation from a Customer's reactive power schedule (measured at the point of interconnection with the VEA system) must be less than or equal to 10% of the Customer's maximum (boost) reactive capability.

7.2.2 Voltage and Reactive Control

7.2.2.1 Coordination

Customers shall coordinate the use of voltage control equipment to maintain transmission voltages and reactive flows at optimum levels for system stability within the operating range of electrical equipment. Operating strategies for distribution capacitors and other reactive control equipment shall be coordinated with transmission system requirements.

7.2.2.2 Transmission Lines

Although transmission lines should be kept in service as much as possible, during overvoltage system conditions, a Customer's transmission line(s) may be opened as a means to mitigate voltage problems in the local area. VEA will notify CAISO when removing such facilities from and returning them back to service.

7.2.2.3 Switchable Devices

Devices frequently switched to regulate transmission voltage and reactive flow shall be switchable without de-energizing other facilities.

7.3 Voltage Imbalance and Abnormal Voltage or Current Waveforms (harmonics)

Power quality problems are caused when voltage imbalances and harmonic currents result in abnormal voltage and/or current waveforms. Generally, if a Customer's Transmission Facilities connecting to VEA's system degrades power quality to VEA's facilities, or other VEA Customer facilities, VEA may require the installation of equipment to eliminate the power quality problem.

7.3.1 Voltage Imbalance

The unbalanced voltage level (magnitude and phase), due to a Customer's Transmission Facilities connecting to VEA's system, may not exceed 1% at the Point of Interconnection under steady state system conditions. Under certain conditions (contingency conditions), VEA may allow higher levels of voltage imbalance if justified after a study conducted by VEA. In any event, the unbalanced voltage level created by facilities interconnecting to VEA's system shall not exceed 1.5%.

It is the responsibility of Customers connected to VEA's electric system to install adequate mitigation devices to protect their own equipment from damage that maybe caused by voltage imbalance condition.

The Point of Common Coupling (PCC) will generally be at the location of the revenue meter or the point of ownership change in the electrical system between VEA and the Customer. For Customers served by dedicated facilities, the location of the PCC will be determined by mutual agreement between the Customer and VEA.

7.3.2 Harmonics

Facilities interconnecting to VEA's system are required to limit harmonic voltage and current distortion produced by static power converters or similar equipment in accordance to good engineering practice used at their facility to comply with the limits set by the current IEEE Standards.

7.3.2.1 Disconnection

VEA may disconnect any Facility connected to its system until the above Requirements are met.

7.4 Non-VEA Steel Pole Grounding

A Customer connecting Transmission facilities to VEA's system shall follow VEA Construction, Operation, and Maintenance requirements. The last Customer-owned structure, such as the dead-end transmission tower, before interconnecting to VEA's facilities shall be designed and constructed to meet VEA grounding requirements.

Customer facilities where VEA's crews are required to climb for construction, operation, or maintenance shall be constructed so as to meet VEA's grounding requirements. Customer constructing to VEA specifications will also ensure that VEA crews can safely perform and complete the jobs at hand in accordance with VEA's safety practices. Examples of safety related areas include:

- Climbing Steps
- Belt-Off Locations
- Grounding Locations
- Required PPE
- Jumper Cable Ownership

Steel pole grounding bolts and bases shall be the same as step bolts and bases. If there is the potential need to have VEA personnel work on non-VEA owned steel poles connecting the Customer's Transmission Facilities directly to VEA's electric system a dead-end structure adhering to VEA's Construction, Operation, and Maintenance standards, is required.

Please note that these requirements are for steel poles only. Non-steel or ungrounded poles will have project- specific grounding requirements as determined by VEA.

8 TELEMETERING

For a high degree of service reliability under normal and emergency operation, it is essential that the Customer's Transmission Facilities connecting to VEA's system have adequate and reliable telecommunication facilities to transmit information to VEA.

At a minimum, VEA requires the Customer to telemeter to VEA's Dispatch Center the following technical data at the point of connection: The Customer's voltage level, MW/MVAR capacity, and/or demand.

8.1 Telecommunications Requirements

8.1.1 General Description

The following description are for typical Telecommunications equipment installation on a Customer's Facilities connecting to VEA's system. Specific design and installation details are addressed during final engineering for facilities at each specific Point of Interconnection.

The telecommunications facilities needed to support line protection on a Customer's Facilities connecting to VEA's system depend on its specific protection needs and the existing telecommunications infrastructure in the area. Fiber Optic (FO) communications matched with protective relays are normally used on transmission power lines for fast clearing. For voltage classes 138 kV and above, primary relay protection for network transmission circuits will be designed to clear transmission line faults within a maximum of 6 cycles. Future project stability studies may indicate faster clearing times are necessary. If so, then VEA will inform the Customer at that time.

The selection of protection devices is dependent on the power line characteristics (i.e., voltage, impedance, and ampacity) of the Customer's Facilities and the surrounding area. Therefore, identical non-VEA owned Facilities connected at different locations in VEA's electric system can have widely varying protection requirements and attendant telecommunication costs.

In cases where a second FO telecommunication is required, for protection relay coordination or to support a RAS, the second FO path must comply with WECC guidelines governing diverse routing. The Customer will construct the communications path(s) between their Facilities and the point of interconnection. Primary path can be provided with a FO cable on the Customer's Facilities or as OPGW (fiber Optical Ground Wire). Diverse routing will be required for the secondary path. Telemetering data (SCADA) and line protection control signals will also be transported on these paths.

If FO is not required for line protection or RAS, a leased T1 circuit may be used for telemetering (SCADA).

8.1.2 Fiber Optic Communications Paths:

The Customer will build the FO paths from the communication room on its Facilities to the point of interconnection with VEA. The Customer's OPGW or FO cable on its Facilities may serve as one path. If a diverse route is required, the Customer may elect to install FO cable in an underground conduit in the right-of-way to serve as the diverse route.

VEA shall design, operate, and maintain certain telecommunications terminal equipment at the point of interconnection to support line protection, telemetering (SCADA), equipment protection, and RAS communications applicable to the project.

8.1.3 Space Requirements

The Customer shall provide sufficient floor space within a secure building for VEA to install and operate up to two 8' x 19" wide communication equipment (EIA-310-D) racks. These racks shall contain telecommunication equipment to

support SCADA, equipment protection, and RAS communications applicable to the project. VEA recommends separating the communications equipment into two racks when diverse protection and/or RAS circuits are required.

The Customer shall provide sufficient wall space adjacent to the VEA communication equipment rack(s) for a 36" x 36" x ¾" plywood backboard for leased or other related circuit termination. The plywood shall be clear of obstructions from adjacent equipment and painted with fire resistant gray semi-gloss enamel (Dunn- Edwards DE-1073, New Hope Gray or equivalent).

The Customer shall provide a working clearance of 49.5" (measured from the center of the rack) in front and behind the equipment rack(s) for the safety of installation and maintenance personnel. The working clearance specified provides a 36" unobstructed space for ladders and/or test equipment carts. Additionally, VEA considers telecommunications equipment racks to contain "live electrical equipment," which is consistent with the 36" working clearance specified in the National Electric Code.

VEA shall secure the equipment rack using the floor angles using only with ½"-13 stainless steel hardware. If the floor of the equipment room is concrete, Hilti HDI 1/2 "drop-in" anchors shall be used.

8.1.4 HVAC Requirements

The Customer shall provide and maintain suitable environmental controls in the equipment room, including an HVAC system to minimize dust, maintain a temperature of 30° C or less, and 5-95% non-condensing relative humidity.

The HVAC requirements for fiber optic terminal equipment are more stringent than what is required for RTU equipment. Therefore, whenever line protection or RAS specifies the use of fiber optic communications and its terminal equipment, the telecommunication requirements will match fiber optic terminal equipment requirements.

NOTE: Environmental controls for microwave terminal equipment (when applicable) are generally more stringent than fiber optic terminal equipment.

8.2 VEA Access Requirements

After the communication equipment is installed and in operation, the Customer shall provide 24 hours a day, 7 days a week accesses to Valley Electric employees and approved contractors for planned maintenance and service restoration.

8.2.1 Power and Grounding Requirements

The Customer shall provide a connection point to station ground within ten (10) feet of the VEA communication equipment rack(s). VEA will provide and install cabling from the equipment rack(s) to the designated station ground termination to protect the communications equipment and service personnel.

The Customer shall provide two 10 Amp dedicated branch circuits from the 125 VDC station power to support the telecommunications equipment rack(s). The dedicated source breakers shall be labeled "VEA- Telecom A" and "VEA-Telecom B." If DC power is not available, two 15 amp 120 VAC circuits may be used as long as the circuits are sourced from an Uninterruptible Power System with a minimum of 4 hour backup. The power source shall not be shared with other equipment.

The Customer shall provide a 120 VAC 15 Amp convenience power source adjacent to the telecommunications equipment rack(s). As this source will be utilized for tools and test equipment by installation and maintenance personnel, UPS is not required. The Customer shall provide ample lighting for the safety of installation and maintenance personnel.

8.2.2 Telemetry and Leased T1 Line:

For projects requiring only a leased T1 circuit for RTU communications, the Customer shall:

a) Arrange with the local carrier to provide a T1 circuit from the Customer's Facilities to the nearest VEA service center or similar facility;
b) Provide conduit, raceway, copper cable, fiber optic cable as necessary for VEA to extend the leased circuit from the Local Exchange Carrier MPOE (Minimum Point of Entry or "demark") to the VEA communications equipment rack(s). The VEA equipment rack(s) shall be no more than 100' from the MPOE;

c) Incur the monthly cost of the leased T1; Provide conduit, raceway, copper cable, fiber optic cable to extend the RTU circuit from the communications equipment to the RTU or from a leased T1 communications circuit in the event the VEA RTU is not located within the same facility;

The VEA RTU and communications equipment rack(s) shall be no further apart than 100'.

8.2.3 Miscellaneous:

a) While VEA may discuss telecommunication connection preferences of the Customer's Facilities connecting to VEA's system, ultimately, VEA has final discretion regarding the selection of telecommunication connection equipment. The telecommunication connection must fit within the operating requirements, design parameters, and communications network architecture of the entire VEA telecommunications network.
b) Because the use of microwave requires detailed engineering evaluation not performed within Interconnection Studies, the use of microwave as an option for the second diverse communications route to support protection of the Customer owned Facilities connecting to VEA's system will only be considered as part of final engineering and design.
c) The use of other telecommunications such as satellite communication requires detailed engineering evaluation not performed within Interconnection Studies. As such, use of other telecommunications will only be considered as part of final engineering and design.

9 PROPERTY REQUIREMENTS

9.1 Right of Way Requirements

The Customer must acquire the necessary Rights of Way requirements for their transmission line, along with the Access requirements to the point of interconnection with VEA's facilities. The use of VEA Rights of Ways and/or property shall not be included in any interconnection proposals.

9.2 Transmission Line Crossing Policy

Customers must request in writing for permission to cross VEA facilities or property. For reference, below are generally VEA's Transmission Crossing Policy guidelines:

- A new non-VEA owned transmission line of equal or lower voltage shall not be allowed the superior position and will cross under the existing VEA Facilities and/or the new facilities proposed prior to the new line, including facilities needed for queued-or-clustered-ahead generation or transmission.
- A new non-VEA owned transmission line, triggered by a Customer facility, with higher voltage may be allowed the superior position than a VEA line if it has a self-supporting Dead-end construction, and has a minimum of double insulator strings on both sides. VEA will regain the superior position if its lower voltage facilities are upgraded and are of equal or higher voltage than the non-VEA owned transmission line.
- A new non-VEA owned transmission line of higher voltage may be allowed the superior position if it crosses a multiple VEA circuit corridor (two circuits or more). However, this type of crossing needs to be reviewed, and approved by VEA on a case-by-case basis.

9.3 Signage for Facilities Accessed by VEA Personnel

Some Customer facilities may need to be accessed by VEA personnel. The Customer shall coordinate with VEA on appropriate signage and component identification numbers if applicable. Generally, VEA signage meets NESC and ANSI Z535 Safety Sign Standards for Electric Utility Power Plants and Substations.

10 VEA CONTACT INFORMATION

Typically, VEA will assign a single point to coordinate information between VEA and Customers during an initial meeting with the Customer. The single point of contact should be part of all communication, but as a project develops sometimes other employees may interface directly with the Customer. VEA will provide the Customer direct VEA contacts during an initial meeting and later when needed.

11 DEFINITIONS

- Terms used in this document are defined in the CAISO master definition supplement list located at the CAISO website.
- The CAISO internet home page at http://www.caiso.com or such other internet address as the CAISO shall publish from time to time.
- CAISO - The California Independent System Operator Corporation, a state chartered, California non-profit public benefit corporation that operates the transmission facilities of all Participating TOs and dispatches certain Generating Units and Loads.
- CAISO Operations Date - March 31, 1998.

12 REFERENCES

Following is a list of the technical standards and criteria referenced within VEA's Interconnection Technical Requirements.

1) NERC/WECC Planning Standards
2) WECC Coordinated Off-Nominal Frequency Load Shedding Plan
3) IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems IEEE 80 Guide for Safety in AC Substation Grounding
4) IEEE 929 Recommended Practice for Utility Interface of Residential and Intermediate Photovoltaic (PV) Systems IEEE 519 IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
5) IEEE C37.010-1999 IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
6) UL 1741 Inverters, Converters, and Controllers for Use in Independent Power Systems
7) ANSI C84.1 Voltage Ratings for Electric Power Systems and Equipment VEA Transmission Planning Criteria and Guidelines
8) WECC Minimum Operating Reliability Criteria
9) Overview of Policies and Procedures for Regional Planning Project Review, Project Rating Review, and Progress Reports