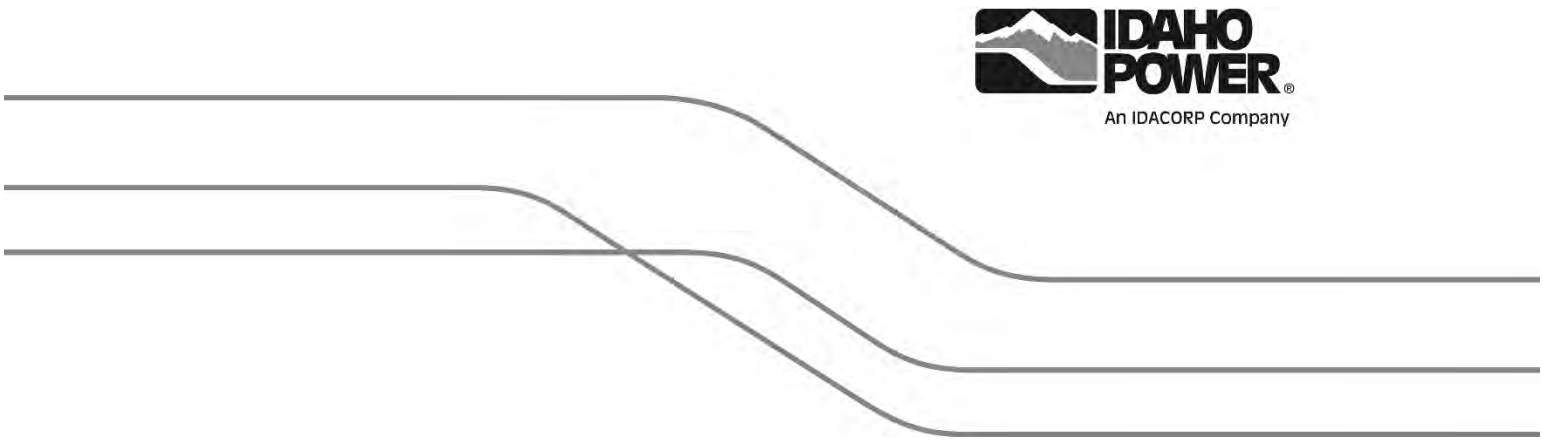

Facility Connection Requirements

December 2018

In compliance with NERC standard FAC-001-3

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FACILITY CONNECTION REQUIREMENTS

This document has been prepared to address the requirements of the North American Electric Reliability Corporation (NERC) Facilities Design, Connections, and Maintenance standard FAC-001-03, effective January 1, 2019. Facility connection and performance requirements are established to avoid adverse impacts on reliability. This document addresses requirements that apply to all the following facilities, unless otherwise noted: generation, transmission, and end-user.

These guidelines are general and may not cover all details in specific cases. Additional requirements not found in the document may be necessary as a result of the findings of a system-impact study for a specific project.

Interconnections to the Idaho Power Company (IPC) system may be made at the transmission or distribution level consistent with IPC's Open Access Transmission Tariff (OATT) filed with the Federal Energy Regulatory Commission (FERC). Generation facilities can initiate IPC's generator interconnection process by applying for interconnection under OATT. Transmission and end-user facilities may be required to use IPC's large load and transmission interconnection processes.

In general, interconnection equipment types include, but are not limited to, transformation, switching/disconnection, metering, system protection and control, communications/telemetry, and network upgrades.

All interconnection equipment shall meet applicable Underwriters Laboratories, Inc. (UL), American National Standards Institute (ANSI), and Institute of Electrical and Electronics Engineers (IEEE) standards, and shall be installed to meet all applicable local, state, and federal codes.

As part of the review, design, and construction of the interconnection, the facility owner is responsible for the following:

- Designing, installing, operating, and maintaining his/her own equipment in accordance with all applicable federal, state, electrical, and safety codes, as well as prudent electrical utility practices

- Obtaining necessary permits and inspections required by federal, state, and local authorities having jurisdiction over the project

- Submitting specifications for the equipment and control schematics for review

  Note: Written approval by IPC does not indicate or ensure acceptance by local code authorities and assumes no responsibility for the facility owner's design or operation.

- Obtaining written approval for parallel operation prior to operation

- Providing IPC access to owned facilities for switching, dispatching, inspection, and other operations requirements
- Complying with the requirements as specified herein
- Reimbursing IPC for all expenses (labor, mileage, equipment, overheads, etc.) incurred to review, design, construct, and commission facilities or any other function required to enable the installation and interconnection of the customer's facility

Details for net-metering projects can be found in the Idaho Public Utilities Commission (IPUC) Schedule 84.

Acknowledgment

IPC acknowledges that portions of this document were based on the Facility Connection Requirements documents prepared by Dominion Virginia/North Carolina Power[1] (Dominion) and Florida Light & Power–New England Division[2] (FPL–NED). IPC sincerely appreciates Dominion's and FPL–NED's permission to use and customize portions of their documents as the basis for IPC's *Facility Connection Requirements*. This type of intercompany cooperation provides a substantial benefit to IPC's customers.

Facility Ownership

All interconnection equipment electrically located on the facility owner's side of the interconnection point shall be owned and maintained by the facility owner. All interconnection equipment electrically located on the IPC side of the interconnection point shall be owned, operated, and maintained by IPC. However, exceptions may be allowed and certain facility, operations, and maintenance agreements will apply.

Interconnection Point

If IPC owns the dedicated transformer, the interconnection point shall be the facility owner's side of the utility revenue meter. If the facility owner owns the dedicated transformer, the interconnection point shall be the facility owner's side of the primary voltage disconnect device. Regardless of dedicated transformer ownership, the interconnection point shall be the facility owner's side of the disconnect device for large customers (greater than 1 Megavolt-Ampere [MVA]).

[1] https://www.dom.com/library/domcom/pdfs/electric-transmission/facility-connection-requirements.pdf

[2] http://www.oatioasis.com/FPLNED/FPLNEDdocs/FPL-NED_FCR_final.doc

Generation Facilities

For large projects (greater than 1 MVA), IPC will own, operate, and maintain the disconnect device and circuit interrupting device.

With the exception of the revenue metering equipment and the protective relaying and control equipment, the generator customers, at their option, may provide the circuit interrupting device for projects smaller than 1 MVA.

Requirements

R3.3.1. Procedures for Coordinated Joint Studies

Generation Facilities

Three types of studies are performed for proposed generation interconnections: feasibility, system impact, and facility. Each of these studies produces a written summary as dictated by the following standards or any subsequent standards as they may be updated:

- Large Generator Interconnection Procedures and Agreement, Attachment M—sections 6, 7, and 8 in OATT
- Small Generator Interconnection Procedures and Agreement, Attachment N—Section 3 in OATT
- Public Utility Commission of Oregon's (OPUC) Division 82, Small Generator Interconnection Rules
- Interconnections to Non-Utility Generation, IPC's Tariff Schedule 72

Synchronous generators or renewable energy resources, such as wind turbine generators and/or solar inverters, connected to the IPC system shall be able to withstand certain temporary excursions in voltage, frequency, and reactive and real-power output without tripping. A system impact study will determine if reactive devices are required to maintain the voltages within acceptable limits. Maintaining the generation is required to support the grid and avoid cascading events. Generation protection and control shall be set in accordance with all applicable NERC and Western Electricity Coordinating Council (WECC) requirements to coordinate with excitation limiters.

Certain circumstances may exist that necessitate the imposition of performance criteria that is considered more stringent than the default criteria specified herein. Such circumstances shall be identified during the feasibility, system impact, or facility studies for each particular generator.

Transmission Facilities

IPC is a member of WECC. One of the many functions of WECC is to coordinate studies of new and modified transmission facilities and their impacts on the interconnected transmission system. IPC actively participates in this process. The process is described in a WECC document entitled *Project Coordination, Path Rating and Progress Report Processes , October 15, 2015.* The document can be downloaded from WECC's website[3].

End-User Facilities

IPC's large-load request process governs the study process for connection of end-user loads of 1 megawatt (MW) and larger. This process results in a capacity analysis and, if necessary, a large-load engineering assessment. Both study reports are provided to the facility owner.

R3.3.2. Procedures for Notification

The facility owner is required to notify IPC's Grid Operations outage coordinator with a minimum of 45 days advance notice of any additions or modifications to existing facilities that have the potential to affect an interconnection. IPC's outage coordinator will assess the potential impact of the modifications and contact the appropriate affected parties. The significance of any impact has the potential to vary over a broad range. Changes that could affect the operating limits on the interconnected system may require engineering studies and the involvement of numerous WECC committees. The most significant impacts will trigger the processes described in the previous section R3.3.1. Less significant changes that still impact reliability will be forwarded to the reliability coordinator.

IPC may disconnect the facility in the event of any planned or unplanned maintenance or repair of the system connected to the facility. In the event of unplanned maintenance or repairs, no prior notice will be provided. In the event of planned repairs, IPC will attempt to notify the facility owner of the time and duration of the planned outage.

Generation Facilities

A facility owner shall provide a 24-hour telephone contact(s) to IPC. This contact will be used by IPC to arrange access for repairs, inspection, or emergencies. IPC will make such arrangements (except for emergencies) during normal business hours.

IPC will provide a name and telephone number so the generator facility owner can obtain information about any IPC activity impacting the generation facility (outages, disconnection, etc.).

[3] wecc.biz/Reliability/Project_Coordination_Path_Rating_and_Progress_Report_Processes_20170316.pdf

R3.3.3. Procedures for Confirming Facilities are within IPC's Metered Boundaries

IPC's procedures in its role as a NERC Transmission Owner (TO) for confirming with those responsible for the reliability of affected systems of new or materially modified Facilities are within a Balancing Authority Area's metered boundaries include the following activities:

- Load Serving Operations will use engineering studies and coordinate with System Planning to verify if new Facilities are within IPC's Balancing Authority Area's metered boundaries.

- Load Serving Operations will coordinate with Project Management to verify all requirements for interconnection within IPC's Balancing Authority Area's metered boundaries have been met.

- Idaho Power is registered as a NERC Balancing Authority. For instances where IPC is the TO and not the BA, Load Serving Operations will provide notification requesting confirmation from the party interconnecting that they have made appropriate provisions with the applicable BA to operate within those metered boundaries.

- Load Serving Operations will issue a construction complete letter specifying the interconnecting project has met all requirements and made appropriate arrangements to operate within IPC's Balancing Authority Area.

Considerations

IPC will consider the following items in the development of facility interconnections.

Voltage Level and MW and Mvar Capacity or Demand

After the facility owner supplies IPC with the approximate geographic location and the desired MW and Megavolt-Amperes reactive (Mvar) capacities at the point of interconnection, IPC will exercise engineering judgment and the results of engineering studies to determine appropriate voltage levels, interconnection points, and system capabilities, since the most practical voltage and interconnection points are site- and project-specific.

Breaker Duty—Surge Protection

All facilities and equipment must meet or exceed the fault duty capability necessary for system short-circuit requirements as determined through short-circuit analyses. Equipment should fully comply with the latest ANSI/IEEE C37 collection of standards for circuit breakers, switch gear, substations, and fuses.

To maintain transmission reliability, each fault-interrupting device must be rated for full fault-interrupting capability to satisfy the short-circuit level requirements at the interconnection

point. Full fault-interrupting capability is per the latest IEEE C37-2008 and C57 collections of standards or any subsequent standards as they may be updated. As a general rule, neither party should depend on the other for the protection of their respective equipment.

System Protection and Coordination

Entities connecting to the IPC transmission system shall be responsible for complying with all applicable requirements of NERC, WECC, and FERC, such as operation analysis and maintenance.

Protective relaying systems and associated communications systems for all facility interconnections shall be planned, designed, constructed, and maintained in accordance with applicable NERC and WECC standards. Utility-grade protective relays and fault-clearing systems are required on the interconnected power system.

All protective relays shall meet or exceed ANSI/IEEE Standard C37.90-2005 or any subsequent standards as they may be updated. Adjoining power systems may share a common zone of protection between parties. The design must provide coordination of speed and sensitivity to maintain power system security, stability, and reliability.

The facility owner is responsible for providing a protection system that will protect its equipment against, and minimize the effects of, overvoltage, under voltage, overload, short circuits (including ground fault conditions), open circuits, phase imbalance, phase reversal, surges from switching and lightning, off-nominal frequency conditions, and other injurious electrical conditions that may arise on IPC's interconnected system. IPC will not assume any responsibility for protection of the facility owner(s) or of any portion of their equipment. The facility owner is responsible to ensure the operation of the facility does not damage the IPC system or its customers. The protection system arrangement (relay, control, and communications equipment) selected by the facility owner must be compatible with the protection system used by IPC to protect the transmission grid. Compatible relaying equipment must be used for a given zone of protection. Compatibility includes protection application, redundancy, operating speed, communication type, and communication medium.

Multifunction protective relays and redundant relaying may be required.

A load-break disconnecting device shall be capable of isolating the facility owner's equipment from the IPC system. The disconnect device shall be rated to handle the voltage and current requirements of the installation. The basic insulation level (BIL) of the disconnect device shall be such that it will coordinate with IPC's system. The location of the disconnect device shall be as specified or as determined by mutual agreement and be readily accessible, operable, and lockable (where applicable) by IPC at all times. Fused disconnects are not permitted for any interconnection rated 25-Kilovolt-Ampere (KVA) or greater.

Mechanical and electrical logic and interlocking mechanisms are required between interconnected facilities to ensure safe and reliable operation. These include, but are not limited to, breaker and switch auxiliary contacts, relays, and physical locking devices.

The facility owner is responsible to provide for the orderly re-energization and synchronization of their high-voltage equipment to other parts of the electric system. Appropriate operating procedures and equipment designs are needed to guard against out-of-sync closure or uncontrolled energization. Facility owners are responsible to know and follow all applicable regulations, industry guidelines, safety requirements, and accepted practices for the design, operation, and maintenance of the facility.

IPC may require a facility to connect to the IPC system through a dedicated transformer. The dedicated transformer shall either be provided by IPC at the facility owner's expense or be provided by the facility owner conforming to the latest version of ANSI C57 and to the requirements in this document. If the customer chooses to provide the transformer, the transformer shall be multi-tap, where applicable, and the winding connections shall be discussed with IPC prior to purchasing the transformer.

Disconnect Device

Other than for net-metering projects, the disconnect device will be owned, installed, operated, and maintained by IPC.

Generation Interconnection Protection Requirements

When the generation customer provides the interrupting device, a power source for tripping and control consisting of a direct current (DC) power source and storage battery must be provided for the protection system by a DC system. The DC system is to be sized with enough capacity to operate all tripping devices after eight hours without a charger, per IEEE standards. In either case, the facility will be tripped for a loss of the DC system. An under-voltage alarm must be provided for remote monitoring by the facility owner, who shall take immediate action to restore power to the protective equipment.

Dedicated Transformer

In general, the generator facility shall be served through a dedicated transformer that serves no other customers.

Distribution Voltage Interconnections (Less than 40 kilovolt [kV])

A Wye-Grounded or Wye-Ungrounded to Wye-Grounded step-up transformer shall be used to interconnect to IPC distribution. The IPC side must have a Wye-Grounded connection. A suitable high-side, three-phase disconnect device shall be owned, installed, operated, and maintained by IPC. The interconnecting facility may also use the disconnect device to isolate its system.

The ground fault current shall be less than 20 amps, as measured on the IPC side at the point on interconnection.

IPC will install protection based on the MVA rating at the point of interconnection.

The interconnection package shall be equipped with a circuit-interrupting device with associated relaying that will prevent the generator from being connected to a de-energized or single-phased (if normally three-phase) source. The protective relay will be set in accordance with IEEE 1547-2008 or any subsequent standards as they may be updated.

After a generation facility disconnect (resulting from a voltage or frequency excursion), the generation facility shall remain disconnected until IPC's service voltage and frequency are within the operating voltage range of 106 volts (V) to 132 V (120-V base), and frequency range of 59.3 hertz (Hz) to 60.5 Hz for a minimum of five minutes.

The controls (typically consisting of control switches, lockout relays, and other discrete components) shall perform the following functions:

- The generator facility can allow the circuit-interrupting device to close or force it to trip. However, the generator facility cannot force the circuit-interrupting device to close or prevent it from tripping.

- If the circuit-interrupting device closes into a fault, it shall trip and lockout, requiring a manual reset.

IPC may require direct transfer trip (remote operation of a circuit breaker by means of a communications channel) in the following situations:

- The minimum load-to-generation ratio on a circuit is such that a ferroresonance condition could occur.

- It is determined that the interconnection protective relaying may not operate for certain conditions or faults.

Additional disconnect devices will be required for electrical isolation of interconnection facilities for maintenance. The additional disconnect devices will be considered as network upgrades.

Any protective equipment or setting specified by IPC shall not be changed or modified at any time by the facility owner without written consent from IPC.

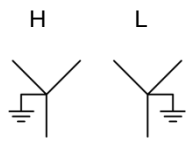
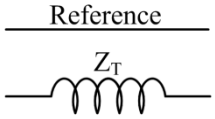
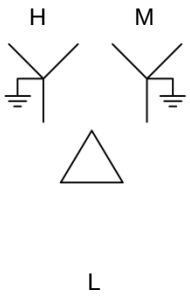
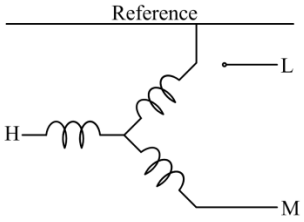
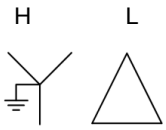
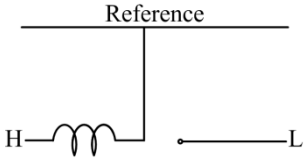
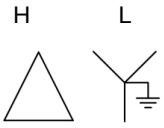
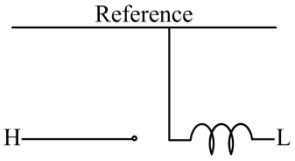
Transmission Voltage Interconnections (Greater than 40 kV)

All transmission voltage interconnections shall have a dual primary multifunction protective relaying scheme that provides backup coverage of the remote bus. Dial-up telecommunications capability for remote relay interrogation is required at the point of interconnection. Communications-aided tripping through the use of a dedicated communications channel may also be required based on IPC engineering studies. Redundancy in communications may be required depending on critical clearing time. A transfer trip may be required for protection or islanding schemes. The addition of the facility must not result in the unacceptable degradation of the performance of the protection on the transmission line.

Communication infrastructure to the interconnection protection package may be required.

The permissible winding configuration of the interconnect transformer is dependent on the application.

Table 1
Transformer configurations

Transformer Type	Zero-Sequence Connection	Comments
Wye-Grounded Wye-Grounded 		Not a ground source but passes ground current. Independent power producer must supply enough ground current for IPC transmission relaying.
Wye-Grounded Wye-Grounded with Delta Tertiary 		Ground source for transmission relaying.
Wye-Grounded Delta 		Ground source available to transmission relaying. Independent power producer is Delta connected—no ground source.
Delta Wye-Grounded 		No ground source available to transmission relaying. High-side grounding bank required to provide ground current.

Metering and Telecommunications

Energy Metering

At the facility owner's expense, IPC will specify, design, install, own, and maintain all metering devices (including instrument transformers) used to measure the delivery and receipt of energy for payment purposes. Metering shall be required for each point of delivery. Meter accuracy will be maintained within +/– 0.3 percent. IPC will test meters on an annual schedule for generation and transmission interconnections; the customer will receive notification of test scheduling and copies of test results upon request.

Requests for additional unscheduled testing will be honored at the expense of the requester unless the meters are found to be out of tolerance.

The facility owner's protection equipment shall not share electrical equipment and instrument transformers associated with IPC revenue metering.

The facility will provide and install all mounting structures, conduits, meter sockets, meter socket enclosures, metering transformer cabinets, and switchboard utility service sections of the size and type approved by IPC. Ownership and maintenance responsibilities will be determined on a case-by-case basis.

Energy Metering Communications

Typical metering requirements include the following (if applicable):

- 15-minute load profile data for the following:
  - Kilowatt hours (kWh) delivered to the customer
  - kWh received from the customer
  - KVA reactive (kvar) hours delivered and received
- Total accumulative registers for the following:
  - kWh delivered to the customer
  - kWh received from the customer
  - kvar hours delivered and received

Generation

The facility owner, at his/her expense, may be required to provide and maintain (from a public telecommunications provider) a voice-grade telephone circuit at each point of delivery dedicated for the purpose of accessing IPC's dial-up energy metering equipment and protective relaying.

Revenue Metering

Metering facilities will be determined by the requirements of the individual installation and contractual arrangements and applicable tariffs.

Supervisory Control and Data Acquisition

Typical Supervisory Control and Data Acquisition (SCADA) data requirements include the following:

- Status of interrupting devices
- MW flow

- Mvar flow
- Voltage at interconnection point

Generation and End User

IPC may require a remote terminal unit (RTU) for the purpose of gathering customer load and equipment status information needed at the appropriate IPC operations center. When required, IPC shall own and maintain the SCADA devices at the facility owner's expense. The facility owner shall provide (at its own expense and from a public telecommunications provider) a telecommunications data circuit to the operations center designated by IPC. IPC shall specify the communications protocol for the data circuit. Instantaneous bi-directional analog real-power and reactive-power flow information must be telemetered directly to the locations specified by IPC.

Phasor Measurement Unit (PMU) Synchrophasor Data is typically required and may include an additional telecommunications circuit.

Generating facilities connected to the transmission system at 60 kV or above with a single unit capacity of 10 MVA or larger, or facilities with an aggregate capacity of 20 MVA or larger shall be equipped with PMU equipment.

Interconnect relaying installed by IPC is capable of phasor measurement functions. Additional equipment required to perform phasor measurements include a high-accuracy satellite clock and a communication circuit capable of carrying the PMU data to a data concentrator. A determination must be made during the study phase to determine if the data storage or data concentrator have adequate capacity for the new interconnect.

Transmission Interconnection SCADA

For the purpose of gathering interconnection load and equipment status information needed at IPC's appropriate operations center, IPC shall own and maintain the SCADA devices. IPC shall provide a telecommunications data circuit to the operations center designated by IPC. IPC shall specify the communications protocol for this data circuit. Instantaneous bi-directional analog real-power and reactive-power flow information must be telemetered directly to the locations specified by IPC.

Telecommunications

Generation

The size of the project dictates the required communication circuits. Those requirements are outlined in Table 2.

Table 2
Telecommunication requirements

Project Size	Revenue Metering	SCADA	PMU
Less than 1 MVA (Less than 3 MVA for OR)	X		
1–20 MVA (3–20 MVA for OR)	X	X	
Greater than 20 MVA	X	X	X

Grounding and Safety Issues

A safe grounding design must accomplish the following two basic functions:

1. Ensure a person in the vicinity of grounded structures and facilities is not exposed to critical levels of step or touch potential.

2. Provide a path for electric currents into the earth under normal and fault conditions without exceeding any operating and equipment limits or adversely affecting the continuity of service.

Accordingly, each electrical facility must have a grounding system or grid that solidly grounds all metallic structures and equipment in accordance with the standards outlined in ANSI/IEEE 80-2000 (IEEE Guide for Safety in alternating current [AC] Substation Grounding), ANSI/IEEE C2-2007 (National Electrical Safety Code [NESC]), or any subsequent standards as they may be updated.

Testing must be performed to ensure safe step- and touch-potential parameters have been met in accordance with IEEE 80-2000 or any subsequent standards as they may be updated.

When various switching devices are opened on an energized circuit, the ground reference may be lost if all sources are not effectively grounded. This situation may cause over-voltages that can affect personnel safety and damage equipment. This is especially true when one phase faults to ground. Therefore, the interconnected transmission power system is to be effectively grounded from all sources. This is defined using symmetrical components: $\frac{X_0}{X_1} < 3$ and $\frac{R_0}{X_1} < 1$.
Interconnected generators should provide effective system grounding for the high-side transmission equipment by means of a grounded high-voltage generation step-up transformer.

Insulation and Insulation Coordination

Insulation coordination is the selection of insulation strength. Insulation coordination must be done properly to ensure electrical system reliability and personnel safety. Basic switching surge levels (BSL); surge-arrester application; conductor spacing and gap application; and substation and transmission line insulation strength, protection, and shielding shall be documented and submitted for evaluation as part of the interconnection plan.

Interconnection facilities to be constructed in areas with salt spray contamination or other types of contamination shall be properly designed to meet or exceed the performance of facilities not in a contamination area with regard to contamination-caused outages. Equipment shielding and surge protection for BIL shall be designed to meet the latest IEEE C62 standards, along with IPC standards.

Voltage, Reactive Power, and Power Factor Control

Generation Facilities

IPC's voltage, reactive power, and power factor control requirements for generators are described in its generator interconnection agreements.

Synchronous Generation Facilities

Generators larger than 30 MW are required to have a power system stabilizer (PSS). The PSS shall be installed and operated on generation units with a suitable exciter in accordance with the WECC policy statement on PSS.

Each synchronous interconnected unit shall have automatic voltage reduction (AVR) and shall be tuned in accordance with IEEE 421-1986 or any subsequent standards as they may be updated. Voltage regulator controls and limit functions (e.g., over/under excitation and volt-per-hertz [V/Hz] limiters) shall coordinate with the generator's short-term duration capabilities and protective relays. AVR systems must be continuously acting, and power-factor regulation may be required. Synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with IPC's distribution system; however, voltage control and system stabilization may be required for larger generators connected to the transmission system.

Induction Generation Facilities

Induction generation may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured at the point of interconnection is acceptable based on current inrush limits. The same requirements also apply to induction generation connected at or near synchronous speed because a voltage dip is present due to inrush magnetizing current. There are limitations to the number of machines that may be started simultaneously.

Voltage flicker must be in accordance with the latest edition of IEEE 141 and must not exceed the limits defined by the maximum permissible voltage fluctuations border line of visibility curve. Refer to Figure 10.3 in the latest version of IEEE 519.

The IPC system may provide the AVR capacity required by induction generators at the generator's expense.

Inverter-Based Facilities

Inverter-based facilities will be required to provide a plant controller that will operate the system in Volt/VAr control mode to regulate voltage according to a voltage schedule that will be

provided by IPC. The system must be capable of injecting reactive power (over-excited) and absorbing reactive power (under-excited) corresponding to a +/- 0.90 power factor for distribution and sub-transmission (up to 69 kV) connected facilities for all active power outputs between 20 percent and 100 percent of nameplate active (real) power rating as shown in Figure 1.

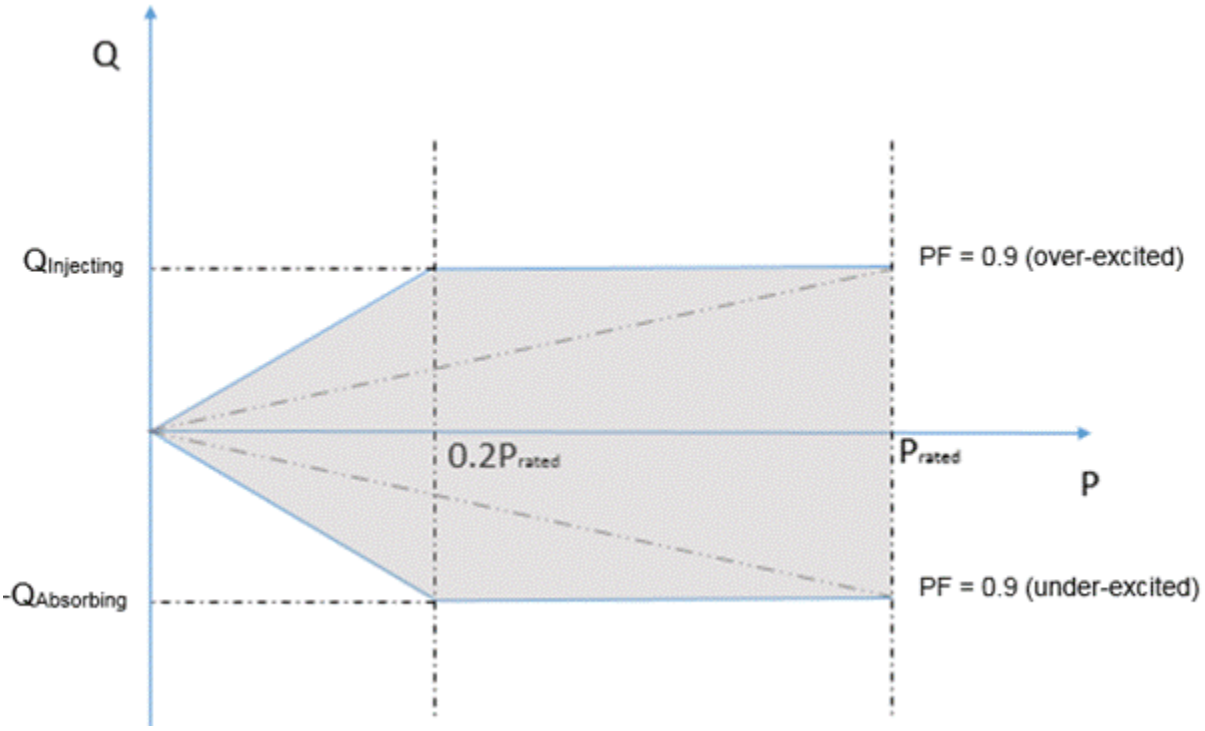


Figure 1
Operating requirements for distribution and sub-transmission connected inverter-based facitlities

Transmission Facilities

The transmission system must be capable of moving electric power from areas of generation to areas of load under a wide variety of expected system conditions. Adequate reactive power supplies are required to reliably support a wide variety of transfers. Transmission facilities must be designed to minimize excessively high voltages during light transmission loading conditions, yet have adequate reactive supplies to support system voltage during heavy transmission loading conditions.

End-User Facilities

IPC designs the system to serve end-user facilities within the latest version of ANSI C84.1. End-user facilities connected directly to the transmission system should plan and design their systems to operate near unity power factor to minimize the reactive power burden on the transmission system.

Power Quality Impacts

Interconnection Requirements for Harmonic Levels

Facilities shall not have harmonic current distortion levels exceeding the levels specified in the Current Distortion Limits tables of IEEE 519-1992, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems* (or any subsequent standards as they may be updated). Harmonic limits on voltage shall be three percent of the fundamental voltage for any single harmonic, or the voltage total harmonic distortion (THD) limited to five percent, whichever is more stringent.

Interconnection Requirements for Flicker

Facility owners are required to limit voltage fluctuations to those specified in IEEE 519-1992 or any subsequent standards as they may be updated.

Equipment Ratings

All circuit breakers and other fault-interrupting devices shall be capable of safely interrupting all possible fault currents. Application of circuit breakers shall be in accordance with the ANSI/IEEE C37-2008 collection of standards or any subsequent standards as they may be updated.

All current-carrying equipment and devices shall be designed to carry the maximum loads predicted and used in load-flow analyses. Loads exceeding nameplate or normal design capacities are not acceptable except when allowed by manufacturers' design documentation or standard industry practices.

Equipment BIL, shielding, and surge-protective device applications must meet requirements as determined by the latest IEEE C62 standards. IPC will provide the BIL for the system in the interconnection area.

Synchronizing of Facilities

Synchronizing equipment consisting of potential transformers and associated protective relaying/controls is required on facilities where energy can be sourced on both sides of an interconnection circuit breaker. This equipment serves the following purposes:

- Verifies the voltages on both sides of a circuit breaker fall within certain tolerances of magnitude and phase angle as established by system conditions
- Supervises the closing and automatic reclosing of the circuit breaker
- Prevents the closing of the circuit breaker when the two systems are out of sync

Voltage magnitudes, phase angles, and frequency constraints shall be determined on a case-by-case basis.

Generation Facilities

Live line, dead bus (LLDB) control is used in the interconnection circuit breaker reclosing scheme when generation facilities are connected to IPC. The circuit breaker cannot be closed unless the generation side has zero voltage. The interconnection circuit breaker shall not be used to synchronize a generator to the transmission system. Instead, the generation facilities shall have their own synchronizing facilities. If a generation facility becomes disconnected from IPC's system, the facility shall remain disconnected until system voltage and frequency are within an established range.

Interconnected and Separate Systems for Generators

The facility owner may elect to run its generator in parallel (interconnected) with IPC or as a separate system with the capability of nonparallel load transfer between the two independent systems. The two methods of operation are outlined as follows.

A parallel system is one in which the facility owner's generation equipment can be connected to IPC's system resulting in a transfer of power between the two systems. A consequence of such parallel operation is that the parallel generator becomes an electrical part of the IPC system, which must be considered in the operation and protection of IPC's facilities. The general and specific requirements for parallel generation installations are discussed in this document.

A separate system is one in which there is no possibility of delivering energy to the IPC system from the customer's equipment. For this operation to be practical, the facility owner may want to maintain the capability of transferring load between the two systems, but such transfer must be accomplished in an open-transition or nonparallel mode. This can be accomplished by either an electrically or mechanically interlocked switching arrangement that precludes operation of both switches in the closed position simultaneously. If the facility owner has a separate system, IPC will require verification that the transfer scheme meets the nonparallel requirements. This verification will be accomplished by review and approval of drawings and equipment specifications by IPC and, if IPC so elects, by field inspection of the transfer scheme. IPC will not be responsible for approving the facility owner's generation equipment and assumes no responsibility for its design or operation.

Maintenance Coordination

The maintenance of facilities is the responsibility of the owner of those facilities. Adjoining facilities on the interconnected power system are to be maintained in accordance with accepted industry practices and procedures. Each party is to have a documented maintenance program ensuring the proper operation of equipment. IPC will have the right to review maintenance reports and calibration records of equipment that could impact the IPC system if not properly maintained. IPC is to be notified as soon as practical about any out-of-service equipment that might affect the protection, monitoring, or operation of interconnected facilities. In accordance with NERC Reliability Standard TOP-003 or any subsequent standards as they may be updated, each generator operator shall provide outage information to IPC operations one day in advance for planned outages for any generator greater than 50 MW.

Maintenance of facilities interconnected to the IPC transmission system shall be done in a manner that does not place the reliability and capability of the IPC transmission system, or other portions of the WECC transmission system, at risk. Planned maintenance must be coordinated and scheduled with IPC.

Operational Issues (Abnormal Frequency and Voltages)

Operational procedures are to be established in accordance with all applicable United States (US) Nuclear Regulatory Commission (NRC), NESC, Occupational Safety and Health Administration (OSHA), WECC, and NERC requirements. Each party shall designate operating representatives to address the following:

- Lines of communications
- Maintenance coordination
- Actions to be taken after de-energization of interconnected facilities
- Other required operating policies

All parties are to be provided with current station operating diagrams. Common, agreed-on nomenclature is to be used for naming stations, lines, and switches. Updated diagrams are to be provided to IPC when changes occur to interconnected facilities.

Operators of facilities interconnecting to the IPC transmission system will notify IPC, or its designated operating representative, before performing any switching that would significantly affect voltage, power flow, or reliability in the system. During emergency conditions, the facility operator shall raise or lower generation, adjust reactive power, switch facilities, or reduce end-user load as directed by the IPC grid operator.

Inspection Requirements for Existing or New Facilities

Each party to the interconnection agreement shall perform routine inspection and testing of its facilities and equipment in accordance with good utility practice and regulatory requirements to ensure the continued interconnection of the facilities with IPC's system.

Each party, at its own expense, shall have the right to observe the testing of any other party's facilities and equipment whose performance may reasonably be expected to affect the reliability of the observing parties' facilities and equipment. Parties shall give notification in advance of facility and equipment testing. If a party observes any deficiencies or defects—or becomes aware of a lack of scheduled maintenance and testing—the observing party shall provide notice that is prompt under the circumstance, and the observed shall make any corrections required in accordance with good utility practices and as required by regulatory agencies.

Communications and Procedures during Normal and Emergency Operating Conditions

Complete, precise, and timely communication is an essential element for maintaining reliability and security in a power system. Under normal operating conditions, the major communication link with various interconnects shall be by telephone lines. IPC and the facility owner shall maintain communications that shall include, but not be limited to, the following:

- System paralleling or separation
- Scheduled or unscheduled shutdowns
- Equipment clearances
- Periodic load reports
- Maintenance schedules
- Tagging of interconnection interrupting devices
- Meter tests
- Relay tests
- Billing
- Other routine communication

In case of emergency or abnormal operating conditions, various communication channels may be used. Emergency telephone numbers should be agreed on by both parties prior to the actual interconnection date.

Review/Revision History

This document has been approved and revised according to the history recorded below.

Review Date	Revisions
01/04/06	Document was implemented.
03/25/08	Delivery management annual review.
04/30/09	Delivery management annual review. • Update Idaho Power website references. • Add reference to TOP-003 in section R2.1.13. • Remove references to PNSC. • Expand R2.1.1 to address all facility types.
12/01/10	Merged Generation Interconnection document into the *Facility Connection Requirements*.
09/09/11	Delivery management annual review • Updated OATT references • Updated external website references
04/10/13	Delivery management annual review. Updated external website references.
09/23/13	Change to Protection Requirement wording from “as measured on the IPC side of the interconnecting transformer” to “as measured at the point of interconnection” because many interconnection projects have multiple transformers. (Page 7 of document)
05/15/14	Delivery management annual review. Updated Tariff Schedule 72 approval date. (Page 3 of document)
04/30/15	Delivery management annual review. Updated external website references.
12/31/15	Delivery management annual review. Updated external website references.
04/30/16	Delivery management annual review: • Updated voltage, reactive power, and power factor control requirements. • Updated distribution voltage interconnection requirements.
06/02/2017	Updated to reflect requirements of revision of FAC-001-2.
12/01/2018	Updated to reflect new FAC-001-3 Requirement R3.3.3.

Glossary of Acronyms

AC	Alternating current
ANSI	American National Standards Institute
AVR	Automatic voltage reduction
BIL	Basic impulse surge level
BSL	Basic switching surge level
DC	Direct current
DLLB	Dead line, live bus
Dominion	Dominion Virginia/North Carolina Power
FAC	Facilities
FERC	Federal Energy Regulatory Commission
FPL–NED	Florida Light & Power–New England Division
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
IPC	Idaho Power Company
IPUC	Idaho Public Utilities Commission
kV	Kilovolt
KVA	Kilovolt-Ampere
kvar	Kilovolt-Ampere reactive
kWh	Kilowatt-hour
LGIA	Large Generator Interconnection Agreement
LLDB	Live line, dead bus
LLDB/DLLB	Live line, dead bus/dead line, live bus
MVA	Megavolt-Amperes
Mvar	Megavolt-Amperes reactive
MW	Megawatt
NEMA	National Electrical Manufacturers Association
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NRC	U.S. Nuclear Regulatory Commission
OATT	Open-Access Transmission Tariff
OPUC	Public Utility Commission of Oregon
OSHA	Occupational Safety and Health Administration
PMU	Phasor measurement unit
POTT	Permissive overreaching transfer trip
PSS	Power system stabilizer
RTU	Remote terminal unit
SCADA	Supervisory Control and Data Acquisition
SGIA	Small Generator Interconnection Agreement
THD	Total harmonic distortion
UL	Underwriters Laboratories
V	Volt
V/Hz	Volt-per-hertz
WECC	Western Electricity Coordinating Council

Definitions

Acceptance Test—A test performed or witnessed for a specific protection package or device to determine whether specified requirements are met.

Automatic Disconnect Device—An electronic or mechanical device used to isolate a circuit or piece of equipment from a source of power without human intervention.

Circuit—A conducting part through which an electric current is intended to flow.

Circuit Interrupting Device—A device designed to open and close a circuit by non-automatic means and to open the circuit automatically as a result of a system excursion without damage to itself when properly applied within its rating.

Cogeneration—The sequential production of electricity and heat, steam, or useful work from the same fuel source.

Coordinated Interconnection Review—Any studies performed by utilities to ensure the safety and reliability of the electric grid with respect to the interconnection of distributed generation as discussed in this document.

Dedicated Transformer—A transformer that provides electrical service to only one customer. The customer may or may not have a generation facility.
Note: "Dedicated" does not imply de facto ownership or exclusive use by the generator.

Direct Transfer Trip—Remote operation of a circuit interrupting device by means of a communication channel.

Disconnect (verb)—To isolate a circuit or equipment from a source of power. If isolation is accomplished with a solid-state device, disconnect shall mean to cease the transfer of power.

Disconnect Device—A mechanical device used for isolating a circuit or equipment from a source of power.

Dispatchability—The generating facility is operable and can be called on at any time to increase its deliveries of capacity to any level up to the contract capacity.

Disturbance—Trouble on the electrical system normally referring to fluctuation of frequency or voltage values.

Electric Generator—A machine or device that transforms energy (solar, mechanical, etc.) into electrical power.

Energize—To apply voltage to a circuit or piece of equipment.

Energy Conversion Device—A machine or solid-state circuit for changing direct current (DC) to alternating current (AC) or a machine that changes shaft horsepower to electrical power.

Equipment—A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as a part of, or in connection with, an electrical installation.

Facility—A set of electric equipment that operates as a single bulk electric system element (e.g., a line, a generator, a shunt compensator, transformer, etc.).

Facility Owner—Generator, transmission owner, or end user.

Fault—An electrical short circuit between elements of potential difference.

Feeder—All circuit conductors between the utility distribution substation or other power supply source and the final point of interconnection with a customer or generator.

Forced Outage—Any electrical outage resulting from a design defect, inadequate construction, operator error, or a breakdown of the mechanical or electrical equipment that fully or partially curtails the electrical output of the generating facility.

Frequency—The number of cycles occurring in a given interval of time (usually on second) in an electric current. Frequency is commonly expressed in hertz (Hz).

Generating Facility—The interconnection customer's device for the production of electricity identified in the interconnection request; it shall not include the interconnection customer's interconnection facilities.

Ground—A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth (zero potential), or to some conducting body that serves in place of the earth.

Hertz (Hz)—The term denoting cycles per second or frequency.

Interconnection—The physical electrical connection that allows the transfer of electrical energy between a generating facility and the utility.

Interconnection Customer—Any entity, including the transmission owner, or any of its affiliates or subsidiaries, that proposes to interconnect its generating facility with Idaho Power Company's (IPC) electrical system.

Interconnection Equipment—The equipment required by prudent electrical utility practice and applicable electrical and safety codes to interconnect, operate, and safely deliver energy from the generator to the utility system.

Interconnection Request—An interconnection customer's written application, under Idaho Power Company's (IPC) Open-Access Transmission Tariff (OATT), to interconnect a new generating facility or to increase the capacity of, or make a material

modification to, the operating characteristics of an existing generating facility interconnected with IPC's electrical system.

Islanding—A condition in which a portion of the Idaho Power Company (IPC) system that contains both load and distributed generation is isolated from the remainder of the IPC system.

Maintenance Test—A test performed upon initial installation and repeated periodically to determine that there is continued acceptable performance.

Material Modification—Modifications that have a material impact on the cost or timing of any interconnection request with a later queue priority date.

Nameplate Rating—Output rating information appearing on a generator nameplate in accordance with applicable industry standards.

Network Upgrades—Additions, modifications, and upgrades to Idaho Power Company's (IPC) electrical system required at or beyond the point at which the interconnection facilities connect to IPC's electrical system to accommodate the interconnection.

Open Access Transmission Tariff (OATT)—Idaho Power Company's (IPC) Federal Energy Regulatory Commission (FERC)-approved tariff through which open access transmission service and interconnection service are offered.

Outage—A condition existing when a circuit is de-energized.

Overload—A load in amperes greater than an electric device or circuit is designed to carry or operate.

Overvoltage—Voltage higher than that desired or for which equipment is designed.

Parallel—To electrically connect a generator or energized source, operating at an acceptable frequency and voltage, with an adjacent generator or energized system, after matching frequency, voltage, and phase angle.

Parallel Operation—The operation of a non-utility generator while connected to the utility's grid. Parallel operation may be solely for the generator's operating convenience or for the purpose of delivering power to the utilities grid.

Point of Interconnection—The point where the generator's facilities physically connect to Idaho Power Company (IPC) facilities (i.e., point of ownership change).

Power—The time rate at which electrical energy is emitted, transferred, or received; usually expressed in watts (W).

Power Factor—The ratio of actual power to apparent power.

Power System Stabilizer (PSS)—A control system applied to a generator that monitors generator variables, such as current, voltage, and shaft speed and sends the appropriate control signals to the voltage regulator to dampen system oscillations.

Primary—Normally considered as the high-voltage winding of a substation or distribution transformer.

Protection Equipment—Circuit-interrupting device, protective relaying, and associated instrument transformers (if applicable).

Prudent Electrical Practices—Practices, methods, and equipment commonly used in prudent electrical engineering and operations to design and operate electrical equipment lawfully and with safety, dependability, efficiency, and economy.

Radial Feeder—A distribution line that branches out from a substation and is normally not connected to another substation or another circuit sharing a common supply.

Relay—A device operative by a variation in the condition of one electric circuit to affect the operation of another device in the same or in another electric circuit.

Secondary—The winding of a transformer normally operated at a lower voltage than the primary winding.

Self-Excited—An electric machine in which the field current is secured from its own armature current.

Synchronism—Expresses the condition across an open circuit wherein the voltage sine wave on one side matches the voltage sine wave on the other side in frequency and without phase-angle differences.

System—The entire generating, transmitting, and distributing facilities of an electric company.

System Operator—A generic term used to describe the individuals responsible for the integrity or the operational control of the transmission owner's system and any successor thereto.

Transmission Owner's System—The integrated system of electrical generation, transmission, and distribution facilities—and all equipment and facilities ancillary thereto—owned and/or operated by the transmission owner.