FACILITY CONNECTION REQUIREMENTS
Lines, Loads and Generation Interconnections
(NERC Standard FAC-001)

Version History

Version	Date	Action	Change Tracking	Reviewed by
0	June 14, 2007	Documentation Development	Developed new document	Warren Clark
1	Dec. 12, 2008	Reviewed Document	No changes to document	Warren Clark
2	Dec. 15, 2009	Reviewed Document	Update regional coordination section and grammatical corrections Added Washington interconnection process, system protection language	Warren Clark
3	Sept. 13, 2010	Complete Rewrite of Document	Revised sections to cover 16 points in Standard Added additional detail and specifics to each section Updated 12/15/09 Version History	Warren Clark/ Kenny Dillon
4	Aug. 9, 2011	Clarification	Revision Part III, Section 3	Kenny Dillon
5	Jan. 21, 2013	Document Review and minor Revisions	Revision Part I, Interconnection Studies; Revision Part III, Section 6.1,D,i,a	Warren Clark
6	Feb. 2 2015	Document Review and minor Revisions	Revisions to multiple sections. Added language on WUTC interconnection process and changed tariff from 64 to 65; Updated metering requirements, changed name of UFLS program; corrected references to RC.	Warren Clark

Facility Connection Requirements

Preface: All connections to the Avista Corporation (Avista) electric system must be in compliance with all applicable Avista Transmission Standards, Electric Service Standards, and Planning Standards of the North American Electric Reliability Council (NERC) or its successor, as administered by the Western Electricity Coordinating Council (WECC) or its successor.

The Introduction to Section I.C of the NERC Planning Standards states that:

> "All facilities involved in the generation, transmission, and use of electricity must be properly connected to the interconnected transmission systems to avoid degrading the reliability of the transmission systems to which they are connected. To avoid adverse impacts on reliability, generation and transmission owners and electricity end-users must meet facility connection and performance requirements as specified by those responsible for the reliability of the interconnected transmission systems."

These documents and all attachments are subject to change, and serve as a template for interconnecting new generation, lines or loads. Not all interconnections may require all of the items in this document, and engineering judgment will be made on a case by case basis. The current version of this document will be posted on the Avista OASIS page.

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I. INTRODUCTION AND SUMMARY

These Facility Connection Requirements address North American Electric Reliability Corporation (NERC), Western Electric Coordinating Council (WECC) and Avista requirements for interconnection of generation facilities ("Generation Interconnection"), transmission facilities ("Line Interconnection") and end-user facilities ("Load Interconnection"). Specifically, the Facility Connection Requirements identify technical requirements and other applicable regulatory requirements for connecting transmission lines, large loads and generation resources to the Avista electric system. Where requirements are specific to a certain type of interconnection, those requirements will be identified as such.

Purpose. The primary purpose of these connection requirements is to ensure the safe operation, integrity and reliability of the Avista electric system. These Facility Connection Requirements do not specifically address contractual matters, such as costs, ownership, scheduling, and billing. Also, Transmission Service is not addressed by these Facility Connection Requirements and should be requested from Avista through the Avista Open Access Same-Time Information System (OASIS) independently of any interconnection requests. Please refer to Avista's OASIS, http://www.oatioasis.com/avat/index.html, or contact:

Avista Transmission Operations
Manager, Transmission Services
1411 E. Mission, MSC-16
Spokane, Washington 99202-1902
1-800-727-9170
transmission.services@avistacorp.com

for more information on the interconnection process, business practices, contractual matters or transmission service.

Scope. This document is intended to cover the Facility Connection Requirements for interconnection of facilities at 100 kV and above.

Defined Terms. In these Facility Connection Requirements, the terms Avista, Balancing Authority Area, Avista electric system, and Company all refer only to Avista Transmission Operations and Planning Department. The term "Avista electric system" includes facilities operating at 100 kV or above. Interconnection proposals from Avista Marketing and Energy Affiliates, or from other non-Transmission departments within Avista, are handled in the same manner as those originating from third parties. The term 'Requester' refers to a utility, developer or other entity that requests a new or modified connection for a line, load or generation resource. The term "Project" refers to a request to interconnect a generating resource, transmission line or a load that may impact the Avista electric system.

Submission of Interconnection Projects. Projects are to be submitted by a Requester (as defined above). Avista evaluates and studies each Project individually, as it was described in the request and determines impacts to the Avista electric system facilities. For generation interconnections, the Requester must follow the Generator Interconnection Process for large or small generator interconnections (LGIP or SGIP, respectively), as applicable. Those processes are included as

attachments in Avista's Open Access Transmission Tariff ("Tariff") or Avista's Washington State Electric Tariff. Specific interconnection requirements for a Project resulting from the study process will be provided to the Requester when the study process is finalized. Generally, the majority of costs for integrating the Project are borne by the Requester.

Interconnection Studies. Interconnection studies may include a preliminary plan of service for physical and communications interconnections in the form of the Interconnection Feasibility Study. Physical laws that govern the behavior of electric systems do not recognize the boundaries of electric facility ownership. Therefore, the electric power systems must be studied without regard to ownership to develop a properly designed interconnection that can assure safe operation, integrity and reliability of the Avista electric system. The Interconnection System Impact Study may include analysis of short-circuit fault duties, transient voltages, reactive power requirements, stability requirements, harmonics, safety, operations (including communications), maintenance and prudent electric utility practices. Estimated cost of facilities and a plan for construction will be provided in the Interconnection Facilities Study.

Other Applicable Standards. These Facility Connection Requirements are not intended to be design specifications or an instruction manual, and the information presented may change periodically based on industry events, regulatory requirements, evolving standards and practices or for other reasons. The technical requirements stated herein are consistent with Avista's current internal practices for system additions and modifications. These requirements are generally consistent with principles and practices of the NERC, WECC, Institute of Electrical and Electronics Engineers (IEEE) and American National Standards Institute (ANSI). The standards of the above-listed organizations are also subject to change and when applicable, the most recent version of such standards shall apply to each interconnection request. Applicability of the above standards that affect the Avista electric system will also be consistent with Avista engineering practices and subject to final interpretation by Avista engineering staff.

Additionally, much of the information in these Facilities Connection Requirements coordinates with or is dictated by Avista's Large and Small Generator Interconnection Procedures (LGIP and SGIP, respectively) as provided in Avista's Tariff or Avista's Washington State Electric Tariff, Service Schedule 65 – Interconnection Standards (normally not applicable to interconnections at 100 kV or above).

II. REQUESTING AN INTERCONNECTION OF NEW FACILITIES

Parties may request interconnection of a generation facility, transmission line, or load to the Avista electric system. For any of these requests, Avista should be contacted as early as possible in the planning process. An interconnection study must be performed to determine the required additions and modifications to Avista's substations, transmission lines, and control and communications circuits to accommodate the proposed interconnection.

Requests for transmission service are addressed by Avista's current Tariff and are not included in this document.

The transmission planning process is an important first step in the determination of interconnection feasibility. The transmission planning studies will identify impacts, deficiencies, available capacity, operational problems or interconnection facility concerns and evaluate potential solutions. A proposed interconnection must not degrade the reliability or operating flexibility of the existing power system. The proposed interconnection must comply with all NERC and WECC Reliability Standards.

1. Requesting an Interconnection

A. Generation Interconnection Request

Requests for new generation interconnections will be consistent with the process for interconnection outlined in the Avista's Tariff or Avista's Washington State Electric Tariff, Service Schedule 65 – Interconnection Standards. Where applicable for generation interconnection requests, the specific timeline, queuing, and submission requirements in the Tariff or Service Schedule 65 will be followed. Requests for generation interconnection require significant information regarding the Project. Specifics of required information as well as more information about the generation interconnection process and necessary forms are available on Avista's OASIS at:
http://www.oatioasis.com/avat/index.html

and Avista's website at:
http://www.avistautilities.com/services/electricity/interconnection/Pages/default.aspx

B. Line Interconnection Request

Requests for new transmission or line interconnections are initiated by completion of the request form which can be found on Avista's OASIS. No application fee is required. A scoping meeting will be held to fully discuss the request and all aspects of the proposed line interconnection. A study agreement will follow which will require a deposit.

C. Load (End-user) Interconnection Request

Information regarding Avista's electric service requirements for new load (End-user) connections, applicable tariffs, project initiation information requirements and contact numbers may be found on the Avista Utilities web site (www.avistautilities.com) or calling 800-227-9187. Submittal of project information to Avista's customer service representative will start the communication and evaluation process. Avista provides retail electric service to customer in north Idaho and eastern Washington. Presently the neither state allows for retail wheeling and customer connections are managed through the applicable state retail electric tariff.

2. Notification of Interconnection

The process of providing notification of an interconnection request is dependent upon the type of interconnection request being made. The process for each type of request, and the general requirements, are detailed below:

A. Generator Interconnection Request

After an application for a generator interconnection has been submitted and a study agreement is signed, the general information regarding the project is posted as part of the generation interconnection queue on Avista's OASIS site. Information included in this posting includes, but may not be limited to, the location of the requested interconnection point, size of the project, and fuel source. Also, the project may be reported to the ColumbiaGrid subregional planning group.

B. Line Interconnection Request

After an interconnection request involving transmission facilities has been accepted by Avista, it shall be reported to ColumbiaGrid and/or WECC at the first opportunity by the Requester or Avista. This may include, but is not limited to, providing a project summary at a ColumbiaGrid meeting or inclusion of the project in the WECC Significant Additions report. If the Project is requesting interconnection to facilities that are jointly owned, but operated by Avista, notification of the request shall be sent to each owner.

C. Load (End-user) Interconnection Request

Notification for a load interconnection request will be evaluated on a case by case basis, specific to that load interconnection request. Some customers request that an end-user load interconnection request initially remain confidential. However, an end-user Project requesting interconnection with regional or subregional transmission facilities may require some notification at ColumbiaGrid and/or WECC before a final plan-of-service is completed.

3. Coordination of Interconnection Studies

The transmission planning process for the proposed new facility must also accommodate coordinated joint studies with other affected interconnected electric system owners. Once a new Project is considered feasible for interconnection, and Avista has determined it affects other interconnected electric system owners, Avista shall notify the ColumbiaGrid subregional planning group and/or WECC, as applicable to the specific interconnection request. Avista has designated ColumbiaGrid as the appropriate forum to carry out the task of coordinating transmission plans among the transmission providers in the Northwest.

The ColumbiaGrid subregional planning group provides an appropriate technical forum of regional transmission providers who can review proposed facility plans and readily identify concerns, issues and impacts. The regional transmission providers and Requesters can work together to develop the most efficient transmission plan that will accommodate the proposed project and meet the regional reliability standards. Dependent upon the type and scope of the interconnection request, a transmission planning study performed by either Avista or others will need to be reviewed and endorsed by the appropriate ColumbiaGrid subcommittee. Depending on the location of the proposed project, there may need to be review by multiple subcommittees on a coordinated basis.

4. Interconnection Studies

Avista will conduct or review system impact studies as required to evaluate the system impact of a proposed Project interconnection on the reliability and capability of the electric system. These studies can require considerable time and effort, depending on the size of the Project and its potential system impacts. Any costs to conduct or review interconnection studies are the responsibility of the requesting party. The Interconnection System Impact Study will include, but are not limited to powerflow, dynamic stability, short circuit studies, Sub-Synchronous Resonance (SSR) (if deemed necessary), and electro-magnetic transient studies (if deemed necessary). Evaluation of alternatives to the proposed interconnection, such as lower voltage construction, alternative interconnection points, reactive support facilities, or upgraded facilities, may be requested. Powerflow analysis will require 10-year load and resource growth projections and the planned facilities needed to satisfy all long term requirements. If the studies indicate that additions or upgrades to the existing electric system are necessary, Avista will conduct or review an Interconnection Facilities Study, at the expense of the requesting entity, to determine the cost of additions or upgrades and the time frame for implementing system additions or upgrades. Technical issues associated with the Project, such as voltage regulation, machine dynamics, metering requirements, protective relaying, any special protection or remedial action schemes (RAS) including automatic tripping or damping of generation or load, and substation grounding will also be addressed as required in development of the preferred plan of service.

III. GENERAL FACILITY CONNECTION REQUIREMENTS

Avista's facility connection requirements will address, but are not limited to, the following:

1. Coordination of joint studies of new facilities and their impacts on the interconnected electric systems.
2. Notification of new or modified facilities to others (those responsible for the reliability of the interconnected electric systems) as soon as feasible.
3. Voltage level and MW and MVAR capacity or demand at point of connection.
4. Breaker duty and surge protection.
5. System protection and coordination.
6. Metering and telecommunications.
7. Grounding and safety issues.
8. Insulation and insulation coordination.
9. Voltage, Reactive Power, and power factor control.
10. Power quality impacts.
11. Equipment Ratings.
12. Synchronizing of facilities.
13. Maintenance coordination.
14. Operational issues (abnormal frequency and voltages).
15. Inspection requirements for existing or new facilities.
16. Communications and procedures during normal and emergency operating conditions.

Each of the items listed above will be addressed in Avista's study(ies), as applicable to the specific interconnection request.

1. Coordination of joint studies of new facilities and their impacts on the interconnected electric systems

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

Coordination of joint studies for the interconnection of new Projects will be handled with ColumbiaGrid as outlined in Section II (3).

2. Notification of new or modified facilities to others (those responsible for the reliability of the interconnected electric systems) as soon as feasible

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

Notification to other interconnected electric systems owners and operators of new or modified Projects will be handled through ColumbiaGrid as outlined in Section II (3).

3. Voltage level and MW and MVAR capacity or demand at point of connection.

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

i. Key Reliability and Availability Considerations

The new interconnection shall meet all applicable requirements of the WECC and NERC standards. In addition, the following requirements apply to all Projects:

- Tools and spare equipment must be readily available at the Requester's disposal to accomplish foreseeable operations and maintenance tasks.
- Standardized design, planning and operating practices and procedures should be used so that the new connection may be readily incorporated into the existing transmission network.
- For reliable operation, certain telecommunications, control, and protection equipment may need to be provided with redundancy.
- The equipment for the new connection shall have sufficient capabilities for both the initial operation and for the long range operation.
- Operations and maintenance personnel must be properly trained for both normal and emergency conditions.
- Because of increased risks and potential hazards inherent with operating Requester's facilities connected with Avista's facilities, overall safety for life, quality of service and property is paramount. Avista shall disconnect Requester's facilities anytime Requester's facilities pose a dangerous condition, and such disconnection is appropriate to protect safety of Avista's employees, customers, general public, or to maintain integrity of the Avista's facilities.

ii. General Provisions

Interconnections to Avista's Electric system may require that one or more of Avista's transmission lines be looped through a Point Of Interconnection ("POI") switching station (with circuit breakers) or a tapped interconnection to be sectionalized with the addition of switching equipment. The design and ratings of these facilities shall not restrict the capability of the lines and Avista's contractual transmission path rights.

4. Breaker Duty and Surge Protection

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

Circuit breakers, disconnect switches, and similar equipment connected to Avista's electric system shall be capable of carrying both normal and emergency rating load currents, and must also withstand available fault currents without

damage. This equipment shall not become a limiting factor, or bottleneck, in the ability to transfer power on the Avista electric system. During prolonged steady-state operation, all such equipment shall be capable of carrying the maximum continuous current that the interconnected facility can reasonably deliver.

5. System Protection and Coordination

A. Applicable to Generation, Line and Load (End-user) Interconnection Requests

System protection and control schemes are coordinated to provide for safety and equipment protection and to minimize disruption of services during system disturbances. Interconnections will generally require an analysis, and an addition or modification of the existing protection and control schemes to maintain security and dependability of operation. The new protection must be compatible with Avista's latest system protection design standard as to relay capability, protection scheme and communication requirements. The protection scheme will also ensure there are no problems with being out of synchronization when closing breakers and where applicable recognize out of step conditions with the Avista electrical system for either tripping or blocking.

Interconnected generation facilities will be required to participate in the Avista and WECC Off-Nominal Frequency Load Shedding Plan. There are several acceptable settings in the program from which to choose. Interconnected End-Users are required to participate in the Avista under frequency load shedding program and WECC Off-Nominal Frequency Load Shedding Plan.

6. Metering and Telecommunications

6.1 Metering

A. Applicable to Generation, Line and Load (End-user) Interconnection Requests

i. Data Requirements for System Operation and Scheduling

All transmission arrangements for power schedules within, across, into or out of the Avista Balancing Authority Area require metering and telemetering. Some generators or loads that are in another balancing authority area, referred to as a ‘host’ balancing authority area, also require metering and telemetering to the Avista Balancing Authority Area. Transmission arrangements with loads, generators, or new transmission facilities may include voltage control, and automatic generation control (AGC). The Reliability Coordinator (RC) for the region requires data to ensure the reliable operation of the entire grid. The technical plan of service for interconnecting a load, generator, or new transmission facility includes the metering and telemetering equipment consistent with the transmission contract, or balancing authority area services agreement.

Such metering and telemetering equipment may be owned, operated, and maintained by Avista or by other parties approved by Avista. Telecommunications requirements for data collection are included in Section 6.2.

Revenue billing, system dispatching, operation, control, transmission scheduling and power scheduling each have slightly different needs and requirements concerning metering, telemetering, data acquisition, and control. Specific requirements also vary depending upon whether the new connection is physically connected to the Avista electric system or electronically connected via telemetering, placing the Project within the Avista Balancing Authority Area.

ii. Telemetering Data Requirements for Avista Control Centers

Avista requires telemetering data for the integration of new interconnections at adjacent balancing authority area boundaries, as well as new generation and load within the Avista Balancing Authority Area. This typically consists of the continuous telemetering of active and reactive power quantities (in MW and Mvar) and hourly transmission of the previous hour's energy (in MWh) from the POI to the Avista control center and backup control center. Table 6-1 summarizes the general metering and telemetering requirements and Table 6-2 identifies requirements based on connection location.

iii. Facilities Tied to the Avista Balancing Authority Area Boundary

Telemetering is required for all normally closed interconnections at an Avista Balancing Authority Area boundary. For this case, telemetering of active power and energy (MW, MWh) is required. There may also be a need for reactive power (Mvar, Mvarh) information for purposes of billing based on power factor. High capacity interconnections may require redundant metering and telemetering. All facilities that are interchange points should be redundant.

For connections that are to be normally open, or closed only for emergencies, Avista determines telemetering needs on a case-by-case basis.

iv. Calibration and Accuracy of Revenue and Interchange Metering

Revenue and interchange metering must be calibrated at least every two years. More frequent calibration intervals may be negotiated. All parties to the transmission interconnection agreement may witness the calibration.

Each meter shall be calibrated against a standard or reference instrument or meter that has been calibrated and certified during the preceding twelve months. Calibration of standard meters and instruments must meet

accuracy requirements of the National Institute of Standards and Technology.

v. SCADA Metering Data

SCADA generation and/or interchange metering data shall be calibrated every two years at a minimum or more often if significant errors occur affecting the state estimator results. All parties to the transmission interconnection agreement may witness the calibration.

Table 6-1 General Metering and Telemetering Data Requirements

System or Quantity	Avista System Operator	Transmission Scheduling	Revenue Billing
MW	Yes	No	No[1]
MWh	Yes[4]	Yes[4]	Yes[4]
MWh IN	Yes[4,6]	No	No
MWh OUT	Yes[4,6]	No	No
kvar	Yes	No	No
kvarh	Yes	No	Yes
kV	Yes[5]	No	No
Load Size	≥ 1 MVA	≥ 1 MVA	≥ 1 MW
Data Sample Rate	MW: 1 second or other approved rate compatible with NERC policy	Last hour MWh sent each hour	Hourly MWh data retrieved daily (MV-90[2] type system)
Tie Capacity	All normally closed ties	All normally closed ties	All ties
AGC	Yes[3]	Yes[3]	No
Generation Reserves	Operating, spinning, regulating, & MW capability	Actuals as delivered	Actuals as delivered

Notes:

1. A MW reading for revenue billing may be required where special transmission arrangements are necessary.
2. Direct Incoming Dial Public Switched Telephone Line or its equivalent required for MV-90™.
3. All balancing authority area boundaries & customer connections providing ancillary services.
4. Electric Industry Data Exchange (EIDE) data link is required for MWh data
5. kV system quantity not required for generation connected to a host utility distribution system at or below 34.5 kV. See Table G-2, "No direct Electrical Connection".
6. Avista also requires frozen top-of-hour accumulated meter reads from which to verify hourly net MWh values.

Table 6-2 Metering, Telemetering and SCADA Data Requirements vs. Connection Location

Connection to Avista electric system	Connection Located Inside Avista BAA	Connection Located Outside Avista BAA
Direct Electrical Connection[1]	MW, MWh, MV-90[2], Mvar, Mvarh, kV circuit breaker status & control	MW, MWh, MV-90[2], Mvar, Mvarh, kV circuit breaker status & control
No Direct Electrical Connection[1]	MW, MWh, Mvar, MV-90[2]	MW[3]

Notes:

1. Dedicated circuit is required for MW, MWh, Mvar, Mvarh, and kV.
2. Direct Incoming Dial Public Switched Telephone Line or its equivalent required for MV-90™.
3. MW is required if the capacity of a WECC path that Avista manages is impacted.

Table 6-3 Metering, Telemetering and SCADA Data Requirements for Loads, (L), Including Station Service, At the Meter Point and inside Avista Balancing Authority Area

Quantity	L < 1 MVA	1 ≤ L < 25 MVA	L ≥ 25 MVA
Billing Information [MV-90[3]]; Hourly MWh NET, IN, OUT & Mvarh[2]	Yes If L ≥ 1 MW	Yes	Yes
Hourly Estimate of Load[1] **(by web, FAX, or phone)**	No	Yes[4]	Yes[4]
MW Continuous Data	No	Yes	Yes
Loss of Meter Potential Alarm	No	Yes	Yes
Telemetering Equipment Failure Alarm	No	Yes	Yes
Uni-Directional MW & Bi-Directional Mvar Meter	Yes	Yes	No
kV	No	Yes	Yes
kvar	No	Yes	Yes
Redundant Meters	No	No	Yes

Notes:

1. Hourly estimate of load must equal the sum of transmission schedules for delivered power.
2. Hourly integration of Mvar may be used for reactive billing if Mvarh not available from meters.
3. Direct Incoming Dial Public Switched Telephone Line or its equivalent required for MV-90™.
4. Required from the scheduling agent to Avista.

Table 6-4 Metering, Telemetering and SCADA Data Requirements for Generation

System or Quantity	G < 3 MVA	3 ≤ G < 50MVA Local[2] Load Only	3 ≤ G < 50MVA Exporting Output	G ≥ 50 MVA
Billing Information (MV-90™)	Yes If G ≥ 1 MVA[4]	Yes	Yes	Yes
Hourly Estimate of Generation[1] (by web, FAX, or phone)	Conditional[2]	Yes	Yes	Yes
Hourly MWh IN (telemetered)	No	Yes	Yes	Yes
Hourly MWh OUT (telemetered)	No	Yes	Yes	Yes
Hourly MWh (telemetered)	No	Yes	Yes	Yes
MW Continuous Data	No	Yes	Yes	Yes
Limit Wind Generation	No	Yes	Yes	Yes
Loss of Meter Potential	No	Yes	Yes	Yes
MW & Mvar on Each Unit[3]	No	Yes	Yes	Yes
Uni-directional MW & Bi-directional Mvar meter	Yes[4]	Yes	No	No
Bi-directional MW & Mvar Meter	No	Yes	Yes	Yes
Redundant Meters	No	Yes	Yes	Yes

Notes:

1. Hourly estimate of generation must equal the sum of transmission schedules for marketed power. It is required from the scheduling agent to Avista.
2. Hourly estimate is not required if generation is serving local load only. It is required if generation is being used as a marketing resource. Local load is defined as load that is on the generator side of the meter.
3. Separate meters for each unit are required when generators per line are not identical.
4. For generating resources connected to a Host Utility (i.e. not directly connected to the Avista electrical system), Avista owned metering is not required. The generation developer or Host Utility must furnish and install revenue quality instrument transformers and a revenue meter that provides Avista with MV-90™ access via the Public Switched Telephone Network, or via cellular telephone. However, any generating resource (regardless of size) connected directly to the Avista electrical system requires Avista owned metering.

B. Applicable to Generation Interconnection Requests

i. Generation within Avista Balancing Authority Area

For generation connected internal to the Avista Balancing Authority Area, telemetering is required for generation facilities of aggregate output equaling or exceeding 3 MVA. For this case, telemetering of real power and energy (MW, MWh), and reactive power (Mvar, Mvarh) is normally required. Avista will determine telemetering needs on a case by case basis for generation sites that remain below 3 MVA. Station service load may require separate telemetering if it comes from a different balancing authority area. Table 6-4 summarizes metering, telemetering and SCADA requirements for generation within the Avista Balancing Authority Area.

Metering and telemetering for temporary generation installations (planned for less than one year of service) will be determined on a case-by-case basis. Generation sites with an aggregate output equaling or exceeding 50 MVA may require redundant communication paths to both Avista control centers via Distributed Network Protocol 3.0 in order to reliably send and receive data directly from the Avista AGC System.

WECC requires any generation plant over 200 MVA to have data sent to the Extra High Voltage (EHV) Data Pool. Avista will provide the required data to the EHV Data Pool for any plant over 200 MVA in the Avista Balancing Authority Area unless the generator is a WECC member. In that case, the generator is responsible for reporting to the EHV Data Pool directly or via an agent.

ii. Generation in the Avista Balancing Authority Area Not Controlled by Avista

Telemetering is required for generation located internal to the Avista Balancing Authority Area to account for the scheduling that is required to deliver that energy to the appropriate host balancing authority area. The requirements are similar to interchange telemetering requirements.

iii. Jointly-owned Generation

Telemetering for interconnection of shared or jointly owned generation commonly use dynamic signals. These signals are usually a calculated portion of an actual metered value. The calculation may include adjustments for losses, changing ratios of customer obligations or shares, or thresholds and limits. Two-way dynamic signals are used when a customer request for MW change can only be met by an actual change in generation. In this case, a return signal is the official response to the request and its integrated value is designated the official meter reading. Previous integration intervals were typically one hour. Some types of dynamic signals may require shorter integration intervals. The integration interval is determined by the type of service provided consistent with

Avista tariffs to properly account for transmission usage. Avista uses the NERC recommended 'accumulator method' for accounting, not the 'rounding method' for integrated values.

iv. Data Requirements for Balancing Authority Area Services

Data requirements for balancing authority area services, such as regulation or operating reserves, apply only to generation resources inside the Avista Balancing Authority Area. For resources that are not part of Avista's Balancing Authority Area, the operator of the Host balancing authority area determines the data requirements.

For generation resources inside the Avista Balancing Authority Area, Ancillary Services, (e.g. reserves) must be acquired. Provisions for all Ancillary Services are specified in the agreement for service under the Tariff. Avista must specifically approve all arrangements for generators intending to provide Ancillary Services to Avista. If the generator is capable of providing Ancillary Services in excess of its obligation, then Avista may choose to contract with the generator operator to provide additional Ancillary Services.

Technical discussions between Avista and generator developers are necessary before the specific implementation requirements can be determined. For generation facilities with a total capacity of 50 MVA or above, redundant Distributed Network Protocol 3.0 data connections to Avista control centers will generally be required to transmit unit status and MW, Mvar and kV from the project. The AGC data to be passed over the data link may include some or all of the data quantities listed in Table 6-5. For each project a detailed data requirements list with definitions will be provided during the design phase of the interconnection of the project. Actual generator specific data requirements are developed and documented in the Interconnection Agreement.

All interconnected generation projects are required to implement and maintain automatic voltage control on a voltage schedule provided by the Avista System Operator. The status and availability of each auxiliary reactive support device is also required. Individual generators with internal automatic var compensation (e.g. double fed wound rotor) may be required to receive a voltage set point signal. This will be determined on a case-by case basis.

v. Ancillary Services

If Avista is purchasing ancillary services from the generation facility, AGC control of the generator capability is required on a long-term basis. Prior to purchasing AGC services, a capabilities, cost, and benefit investigation as to the AGC control capabilities of the generation facility is required to determine the specific AGC requirements.

Requirements for Ancillary Services are also driven by how the generator operator or the purchaser chooses to meet the reserve obligations of the generation facility, as described below. Either the generation operator or the entity making the transmission arrangements is liable for the reserve obligations associated with the operation of the generation facility consistent with the Avista Tariff. Generation marketed as interruptible power is treated separately under special provisions and guidelines by the WECC and Avista. The responsible party may fulfill these obligations in any of the following ways:

- Make these reserves available to Avista from the generating facility
- Make these reserves available to Avista from another one of their generation resources
- Contract with another generator operator to make these reserves available to Avista on their behalf
- Contract with Avista to cover this reserve obligation

vi. Supervisory Control and Data Acquisition (SCADA) Requirements

New substations may require Avista SCADA control and status indication of the power circuit breakers and associated isolating switches used to connect with Avista. SCADA indication of real and reactive power flows and voltage levels are also required. If the connection is made directly to another utility's electric system, SCADA control and status indication requirements shall be jointly determined with the Requester, and Avista. SCADA control of breakers and isolating switches that are located at other than the generating facility are not normally required, although status and indication may be necessary for system security purposes. Section 6.2 discusses telecommunications requirements for SCADA systems.

vii. AGC Installation

Redundant SCADA communications may be required for generation facilities greater than 50 MVA and is required for generation facilities over 200 MVA to bring additional data from the generator(s) to the Avista control centers. Tables 6-5a and 6-5b show the typical AGC data required.

C. <u>Applicable to Load (End-user) Interconnection Requests</u>

i. Loads within Avista Balancing Authority Area

For loads with direct electrical connections to the Avista Balancing Authority Area, AGC telemetering is not normally required. For interruptible loads, Avista determines telemetering needs on a case-by-case basis. Significantly large and intermittent loads (e.g. arc furnaces, irrigation pumps, electric draglines) may require an interface to the Avista AGC system. Existing practices throughout North America usually require a warning signal of pre-loading in order to assure that adequate generation

reserves are spinning before any sudden load change occurs. Table 6-3 summarizes metering, telemetering, and SCADA requirements for loads based upon size.

ii. Data Requirements for Balancing Authority Area Services

Non-traditional sources are sometimes used for supplying ancillary services. If a load provides regulating or contingency reserve services, data requirements for deployment of the reserves will be similar to those applied to generating resources. To the extent that a third party may externally supply regulating or contingency reserve services at the Avista Balancing Authority Area interconnecting boundary, data requirements for their deployment may be similar to those applied to generating resources. Technical discussions are necessary before the specific data requirements can be determined. The following provides a brief overview of these requirements:

a. Supplemental AGC Services

If Avista is purchasing supplemental AGC services, AGC interface is required on a long-term basis. Prior to Avista purchasing supplemental services, an investigation into the capabilities, cost, and benefits of AGC control is required to determine the specific AGC requirements. Most supplemental services are scheduled and delivered using real-time dynamic signals, thus requiring telemetering.

b. Ancillary Services

Ancillary Services requirements are also driven by how the interconnected customer chooses to meet these obligations. Either the Requester or the entity making the transmission arrangements is responsible for meeting obligations for necessary ancillary services associated with the interconnection through a service agreement under the Tariff. Most self-provided ancillary services are scheduled and delivered using real-time dynamic signals, which require telemetering. The responsible party may fulfill these obligations in any of the following ways:

- Directly provide ancillary services by making resources available to Avista to deploy
- Contract with a third party to make resources available to Avista to deploy
- Contract with Avista to cover this ancillary services obligation

The Requester must demonstrate that the selected options are technically sound and meet all relevant reliability standards, policies and criteria of NERC, WECC and Northwest Power Pool (NWPP) or their successors.

Where a third party is providing ancillary services, the following data is required with a sampling rate as follows – typically four seconds between samples for regulation and ten seconds for operating reserves:

- Net instantaneous active power transferred (in MW)
- Instantaneous reactive power (in Mvar) and total reactive power (Mvarh) transferred
- Operating reserve capability during the upcoming ten minutes
- MWh NET for most-recent hour
- MWh IN accumulated meter read for most-recent hour (frozen top-of-hour read – truncated integer)
- MWh OUT accumulated meter read for most-recent hour (frozen top-of-hour read – truncated integer)
- Area Control Error (Station Control Error for Generating unit)
- Actual Scheduled Interchange

c. Supervisory Control and Data Acquisition System (SCADA)

Additional data may be required from loads such as steel rolling mills and wind tunnels, in order to make generation control performance more predictable. Such additional data may include, but not be limited to, precursor signals of expected load changes. SCADA control may also be required. Specific requirements and needs are determined for each load. This may require a separate SCADA remote terminal unit or it may require data be added into an existing SCADA as determined by Avista.

Table 6-5a Automatic Generation Control (AGC) Quantities

Generation Plant to Avista Control Center(s):	
1.	**Plant in Avista AGC mode / local mode[1]**
2.	**Net instantaneous power output (MW), unit MW output**
3.	**Plant output attributed to natural governor response**
4.	**Plant ramp rate capability – maximum raise and lower**
5.	**Plant jerk rate capability (rate of change of ramp rate) – maximum raise and lower**
6.	**Regulating reserve capability – during next 10 min**
7.	**Spinning reserve capability – during the next 10 minutes**
8.	**Operating reserve capability**
9.	**Maximum capability – normal conditions**
10.	**Maximum capability – power system emergency conditions**
11.	**Minimum generation capability**
12.	**Unit power system stabilizer and automatic voltage regulation status**
13.	**Unit status – defined below for each generator unit in numerical order** - **Out of service – unit not available for use in 10 minutes notice** - **Standby mode – unit available for use in 10 minutes notice** - **Standby mode – on –line / not an AGC** - **On-line – not on AGC** - **On-line – on AGC** - **On-line – condensing**
14.	**Total Mvar output, unit Mvar output**
15.	**Total instantaneous maximum Mvar capacity boost or each POI voltage level**
16.	**Total maximum Mvar capacity boost or each POI voltage level**
17.	**Total instantaneous maximum Mvar capacity buck or each POI voltage level**
18.	**Total maximum Mvar capacity buck**
19.	**Plant in Avista kV mode / local kV mode[2]**
20.	**Acknowledge Limit Wind Generation**

Notes:

1. When plant is in Avista AGC mode, the Avista AGC system is enabled at the plant. The plant is controlling power output to meet the generation request and generation rate of response (MW/minute) originating from Avista. When the plant is in local mode the Avista AGC system is disabled. The plant is not controlling its power output to meet generation request and generation rate of response originating from Avista.
2. When plant is in Avista kV mode, the coordinated var control system is enabled at the plant. The plant is controlling reactive power output to meet the voltage schedule originating from Avista. When the plant is in local kV mode, the Avista coordinated var control system is disabled at the plant but automatic voltage regulators must remain in service. The plant is controlling its reactive power output to meet the nominal voltage schedule originating from Avista

Table 6-5b Automatic Generation Control (AGC) Quantities

Avista Control Center(s) to Generation Plant:	
1.	**Generation request at rated frequency set point – AGC-requested power output level in MW for the following look-ahead time horizons: 0, 5, 10, 15, 20, and 30 minutes**
2.	**Generation requested rate of response**
3.	**Amount of regulating reserve to carry**
4.	**Generation base point – the generation level in MW sat which Avista experts to be operation the plant at the end of the ramp**
5.	**Plant MW control mode – regulating, base load, standby or off control**
6.	**Avista operating mode indication to the plant – normal, assist, emergency**
7.	**Bus voltage schedule(s) in kV and actual measurement(s)**
8.	**Avista AGC control center identifier**
9.	**Avista Mvar Control Mode – coordinated voltage schedule, nominal voltage schedule**
10.	**Low Reserves Notification**
11.	**Limit Wind Generation – command**
12.	**Limit Wind Generation – MW amount**

D. Applicable to Generation and Line Interconnection Requests

i. Generation and Network Interchange Scheduling Requirements

Any new load or generation being integrated into the Avista electric system must adhere to the scheduling requirements of the prevailing tariff under which it is taking transmission or balancing authority area service from Avista. Customers may be required to provide Avista Transmission Scheduling with an estimate of their hourly load, hourly generation schedules, and/or net hourly interchange transactions. These estimates will be used for both pre-scheduling and planning purposes. Avista will require customers to provide these estimates as necessary in order for Avista to manage the load or resource balance within the Avista Balancing Authority Area and to determine usage of the Avista electric system.

In the case of new transmission facilities, scheduling and accounting procedures are needed if the facility is part of an interface between the Avista Balancing Authority Area and another balancing authority area. This scheduling and accounting of interchange between two balancing authority areas normally requires telemetered data from the POI to the control centers of the balancing authority area operators. This data is termed interchange metering and telemetering by Avista and includes MW and MWh quantities. Avista requires that all balancing authority area transactions be pre-scheduled for each scheduling interval using the normal scheduling procedures. The end-of-hour actual interchange must be conveyed each hour to the Avista control center(s). This can be accomplished through the use of telemetering or data link.

When the new interconnection represents a shared or jointly owned interface to Avista, or a split resource between the balancing authority area and any other, then a calculated allocation is usually required to divide up the total metered interchange. This nonphysical interface is accomplished by dynamic signal. A two-way dynamic signal is required when a combined request and response interface is used. An example is supplemental AGC services. A one-way dynamic signal is required when a response (or following) interface is used. Moving a balancing authority area boundary is an example of this requirement.

a. Generation Metering Requirements

Generation metering usually consists of bi-directional meters and related communications systems providing active power (in MW) and energy (in MWh) from the POI. Active power is telemetered on a continuous basis for AGC and hourly energy is sent each hour to the balancing authority area accounting for Avista. All generation projects of aggregate size equaling or exceeding one MVA making wholesale transactions and interconnected at 100 kV and above require hourly prescheduling. Avista may also require

indication of available spinning reserve and controlled reserves, both in MW.

b. Interchange Metering Requirements

Interchange telemetering generally consists of bi-directional meters and related telecommunications systems providing MW and MWh at or near the POI. The MW measurement is telemetered on a continuous basis for AGC and hourly MWh is sent each hour to the control center. (Tables 6-1, 6-2 and 6-4 summarize the requirements). Interchange telemetering accuracy and calibration requirements are stated in Section 6.1(A)(vi).

Effective telemetering requires real-time knowledge of the quality of measurement. Associated with the telemetering signal are various indications of this quality. Analog telemetering is commonly accompanied with squelch and telemetering carrier fail alarms. A loss of meter potential or meter potential phase unbalance should trigger a telemetering carrier failure alarm. Digital telemetering has equivalent signal failure alarms. The metering equipment must also be monitored and alarmed in the telemetering signal. Typical alarms include but are not limited to:

- Loss of meter potential
- Loss of telemetering signal
- Loss of meter potential signal

c. Generation Parasitic Load, Station Service and Start-Up Metering

Avista requires generation projects to self-supply parasitic loads when generating. When not generating, the generation plant station service load may be served by backfeed over the transmission line that interconnects Avista and the generation plant. Generation plant station service and start-up loads must be properly and accurately metered. At a minimum, bi-directional revenue metering and extended range current transformers are required. In addition, separate dedicated instrument transformers and revenue meters may be required to measure station service and start-up loads. It is preferred to meter generation by locating bi-directional revenue meters and revenue accuracy current transformers such that accurate station service can also be metered. Then metering of net generation, start-up power and station service can be accomplished from a single location. However, if this is not possible, then metering with demand interval data recording (MV90™ compatible) revenue meters and communications is required at the station service transformer(s).

ii. Revenue and Interchange Metering System

All facilities capable of exchanging at least 1 MW of active power and directly connected to the Avista electric system require Avista qualified metering for revenue and/or interchange energy data recording is required for Avista's billing and scheduling functions. Revenue metering includes energy (MWh) and reactive power (Mvarh) produced by revenue meters and recorded on a demand interval basis. Interchange metering includes bi-directional energy and reactive data as well as special telemetering requirements for scheduling purposes. The metering shall be located to measure the net power at the POI to and from the Avista electric system.

The revenue metering system (MV-90™) includes a remote metering system to record the hourly MWh data. The hourly MWh data is downloaded from the metering recorder on a daily basis over voice-grade telephone lines. All recorders must be fully compatible with the MV-90™ protocol. Upon request, MV-90™ data is available to the customer or its agent.

iii. Requirements for Revenue and Interchange Metering

Three-element, three-phase, four-wire meters shall be used on grounded power systems. Two-element, three-phase, three-wire meters can be used on balanced, ungrounded power systems. Both revenue metering and interchange metering shall be bi-directional to record both active and reactive power flows to or from the POI. Metering packages include a MWh recording device compatible with the Avista MV-90™ or Avista scheduling system, as applicable.

Tables 6-1 through 6-4 identify revenue metering requirements. Section 6.2(A)(vi) discusses telecommunications requirements for the MV-90™ system.

6.2 Telecommunications

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

Telecommunications facilities shall be installed to fulfill the control, protection, operation, dispatching, scheduling, and revenue metering requirements. They may be owned by Avista, another utility or a third party. At a minimum, telecommunications facilities must be compatible with, and have similar reliability and performance characteristics to, that currently used for operation of the power system to which the new generation or loads will be connected. Telecommunications facilities will employ redundant equipment and geographically diverse paths when required by WECC or NERC Reliability Standards and/or criteria. Depending on the performance and reliability requirements of the control and metering systems to be supported, the facilities may consist of any or all of the following:

- WECC Guidelines for the Design of Critical Communications Circuits (Telecommunications Work Group)
- WECC Communications Systems Performance Guide for Protective Relaying Applications (Telecommunications and Relay Work Groups)

Depending on the performance and reliability requirements of the control and metering systems to be supported, the facilities may consist of any or all of the following:

i. Radio Systems

A radio system requires transmitters, receivers, telecommunication fault alarm equipment, antennas, batteries, chargers, and multiplex equipment. It may also include buildings, towers, emergency power systems, mountaintop repeater stations and their associated land access rights, as needed to provide an unobstructed and reliable telecommunications path. In order to meet power system reliability requirements, radio path diversity, equipment redundancy or route redundancy may be required. These measures protect against telecommunications outages caused by equipment failure or atmospheric conditions. In the vicinity of wind turbines the use of radio systems may be limited because of interference from the turbine blades.

ii. Fiber Optic Systems

A fiber optic system requires light wave transmitters, receivers, telecommunication fault alarm equipment, multiplex equipment, batteries, chargers, emergency power systems, fiber optic cable (underground or overhead) and rights-of-way. Cable route redundancy may be required in order to prevent telecommunications outages caused by cable breaks.

iii. Leased Facilities

A leased facility requires telecommunications facilities, high-voltage isolation equipment, and rights-of-way. It may also include multiplex equipment, emergency power systems, and batteries, depending on the commercial technology employed. Redundancy may be required in order to prevent telecommunications outage.

iv. Wireline Facilities

A wireline facility (e.g., leased line) requires telecommunications cable (underground or overhead), high-voltage isolation equipment, and rights-of-way. It may also include multiplex equipment, emergency power systems, and batteries, depending on the wireline technology employed. Cable route redundancy may be required in order to prevent telecommunications outage.

v. Voice Communications

a. Basic Requirements

If the generation or load facility is within the Avista Balancing Authority Area and any type of telemetering is required, then voice communications to the operator are also required. Voice communications may be accomplished by the Public Switched Telephone Network or a private Automatic Ringdown Trunk. Either option is sufficient for facilities 50 MW or less. If the facility is not staffed with operators, alternative arrangements with a scheduling or control agent may be made, subject to Avista approval.

b. Automatic Ringdown Trunks

Dedicated, direct automatic ringdown trunk (or equivalent) voice circuits between each appropriate Avista control center and the operator of the generators or loads may be required.

c. Independent Communications

Independent voice communications for coordination of system protection, control and telecommunication maintenance activities between Avista and the generation facility or POI should also be provided.

vi. Data Communications

Telecommunications for SCADA, MV-90™, and telemetering must function at the full performance level before and after any power system fault condition. Repair personnel must restore service continuity immediately after the fault without the need for intervention. The following requirements for telemetering of data are specified:

a. SCADA

For communication of SCADA information, one or more dedicated circuits are typically required between a new facility and the appropriate Avista control center(s).

b. Automatic Generator Control (AGC) Interchange & Control Telemetering

One or more dedicated circuits are typically required between the new generation facility and the appropriate Avista control center(s) for telemetering of AGC Interchange and control information for operations and scheduling applications.

c. General Telemetering

General telemetering of power and energy data (in MW, Mvar, MWh) and data acquisition systems typically require one or more

dedicated communication circuits. These circuits link the new facility to the Avista SCADA masters receiving the data.

d. Revenue Metering System (MV-90™)

Commercial dial-up telephone exchange line facilities or functional equivalent are required for support of the MV-90™ compatible remote MV-90™ equipment. The exchange line facilities communicate with the MV-90™ compatible master computer at the Avista control center. The circuit used for this purpose may also be shared with voice communications and other dial-up data communications.

vii. Telecommunications for Control and Protection

Telecommunications for control and protection must function at the full performance level before, during and after any power system fault condition. The delivery of a false trip or control signal, or the failure to deliver a valid trip signal is unacceptable. Active telecommunication circuits for control and protection must not be tested, switched, shorted, grounded or changed in any manner by any worker, unless prior arrangements have been made through the Avista dispatcher.

a. Application on Avista electric system (100 kV and above)

The highest telecommunications performance level as specified by the WECC is 99.95% availability. This level of performance is required on all protection circuits for lines connected to the Avista Main Grid. This performance level is also required for RAS circuits that must meet WECC and NERC Reliability Standards and compliance criteria. These circuits require totally redundant schemes.

Availability is determined for the total path of the protective relaying circuit, from one end of the transmission line to the other. Options for achieving these availability requirements by utilizing two or more separate telecommunication methods, routes or systems may be considered. When alternately routed telecommunications for protective relaying schemes are required, a combination of two of these telecommunications methods may be used to meet availability requirements.

b. Speed of Operation

Throughput operating times of the telecommunications system must not add unnecessary delay to the clearing or operating times of protection or RAS. System studies and WECC trip time requirements determine maximum permissible throughput operating times of control schemes.

c. Equipment Compatibility

Protection systems and supporting telecommunications equipment installed at the interconnecting facility must be functionally compatible or identical to the corresponding equipment employed at the Avista facility. This functionality need not extend to peripherals, such as signal counters and test switches that might be present on Avista's equipment. Teleprotection equipment employed by the Requester must be approved by Avista prior to installation. At the time of the request for interconnection Avista will supply the Requester with a list of acceptable, pre-qualified equipment. Should the Requester choose to employ equipment not on this list, Avista reserves the right to test the equipment for acceptable performance in the required control application. Equipment that passes this testing can be approved by Avista for subsequent installations.

Teleprotection systems, including transfer trip, must be properly designed and tested to demonstrate that they perform their intended functions. When applying digital telecommunications systems to protection schemes, care must be taken to ensure equipment compatibility.

viii. Telecommunications during Emergency Conditions

a. Emergency Conditions

Emergency telecommunications conditions may develop that affect telecommunications equipment with or without directly affecting power electric system facilities.

Examples of telecommunications emergencies include the following:

- Interruption of power to telecommunications repeater and relay stations
- Telecommunications equipment failure, whether minor or catastrophic
- Interruption or failure of commercial, public switched telephone network facilities or services
- Damage to telecommunications facilities resulting from accident, acts of vandalism, or natural causes. Equipment redundancy and telecommunications route redundancy can protect against certain kinds of failure and telecommunications path interruption. A repair team dedicated to the telecommunications of the interconnecting facility should be retained along with an adequate supply of spare components.

b. Backup Equipment

Where commercial, public telephone network facilities or services support important power system telecommunications, a backup strategy should always be developed by the Requester to protect against interruption of such services. Backup methods could include redundant services, self-healing services, multiple independent routes, carriers and combinations of independent facilities such as wireline and cellular, fiber and radio, etc. Backup telecommunications system equipment such as emergency standby power generators with ample on-site fuel storage and reserve storage battery capacity must be incorporated in critical telecommunications facilities. Backup equipment should also be considered for certain non-critical telecommunications to provide continued operation of telecommunications during interruption of transmission services.

c. Disaster Recovery

The Requester should have a disaster recovery plan in place for telecommunications restoration that should be exercised periodically. The disaster recovery plan should include the ability to provide equipment capable of bypassing or replacing entire telecommunication stations or major apparatus until permanent repairs can be made.

d. Telecommunications Security

The operation of power system telecommunications facilities should be continuously monitored at a central alarm point so that problems can be immediately reported, diagnosed and repaired. Telecommunication sites and facilities should be secured against unauthorized access.

7. Grounding and Safety Issues

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

Each substation must have a ground grid that is solidly connected to all metallic structures and other non-energized metallic equipment. This grid shall limit the ground potential gradients to such voltage and current levels that will not endanger the safety of people or damage equipment in, or immediately adjacent to, the station under both normal and fault conditions. The ground grid size and type are in part based on local soil conditions and available electrical fault current magnitudes. In areas where ground grid voltage rises beyond acceptable and safe limits (for example due to high soil resistivity or limited substation space), grounding rods and grounding wells may be required to reduce the ground grid resistance to acceptable levels.

If a new ground grid is close to another substation, the two ground grids may be isolated or connected. If the ground grids are isolated, then no metallic ground connections are allowed between the two substation ground grids. Cable shields, cable sheaths, station service ground sheaths and overhead transmission shield wires can all inadvertently connect ground grids. All-dielectric type fiber optic cables are highly preferable for providing telecommunications and control between two substations while maintaining isolated ground grids. If the ground grids are to be interconnected, the interconnecting cables must have sufficient capacity to handle fault currents and control ground grid voltage rises. Avista must approve any connection to an Avista substation ground grid.

The ground grid will be designed to applicable ANSI and IEEE Standards relating to safety in substation grounding or the most recent guidelines found in the IEEE Guide in AC Substation Grounding. Design review and testing may be required to ensure these guidelines are met.

B. <u>Applicable to Generation Interconnection Requests</u>

New interconnections of transmission lines and/or generation may substantially increase fault current levels at nearby substations. Modifications to the ground grids of existing substations may be necessary to keep grid voltage rises within safe levels. The facilities study will determine if modifications are required and the estimated cost.

C. <u>Applicable to Line Interconnection Requests</u>

New interconnections of transmission lines and/or generation may substantially increase fault current levels at nearby substations. Modifications to the ground grids of existing substations may be necessary to keep grid voltage rises within safe levels. The interconnection study will determine if modifications are required and the estimated cost.

8. Insulation and Insulation Coordination

A. <u>Applicable to Line and Load (End-user) Interconnection Requests</u>

i. All Transmission Lines

The insulation levels of any newly added or connected transmission facility shall be coordinated with the adjoining substation insulation levels in such a way as to prevent the conveyance of temporary overvoltage events (e.g. lightning, switching surges, etc.) originating on the transmission facility from violating the insulation critical flashover, insulation clearances, and short circuit withstand requirements within the adjoining substation(s).

ii. Shielded Transmission Lines

Newly added transmission facilities constructed with Overhead Ground Wire (OHGW) or Optic Ground Wire (OPGW) located in the shield

position shall be connected in such a way as to mitigate (send to ground) transmission line temporary over-voltage events (i.e. lightning) and isolate them from adjoining substation(s) facility equipment.

iii. Substation Facilities

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

9. Voltage, Reactive Power and Power Factor Control

System voltage schedules are instituted to maintain system voltage within equipment ratings and to provide adequate reactive margin during all operating conditions and system events. Avista publishes System Operating Procedure (SOP) 05 – Voltage Schedule 230 kV and 115 kV, which defines normal operating voltages on the Avista 230 kV and 115 kV electric system (SOP 05 may be provided on an as needed basis determined by Avista). All interconnected entities are required to accommodate Avista's voltage schedule. If necessary, and if adequate reactive margins can be maintained, deviations from the voltage schedule may be accommodated on a case by case basis. All voltages must be held within applicable equipment ratings. All line interconnections shall be operated so that reactive requirements are not a burden to either entity's system.

Transformer tap settings, voltage ratings and the set points, sizes of shunt-connected capacitor and/or reactor equipment as well as other voltage control devices shall be coordinated with Avista to optimize reactive flows and voltage profiles. Automatic controls may be necessary to maintain these profiles on the interconnected system.

A. <u>Applicable to Generation Interconnection Requests</u>

- Avista's voltage schedule (SOP 05) shall be implemented at the POI
    - If necessary, and if adequate reactive margins can be maintained, deviations from the voltage schedule may be accommodated on a case by case basis. All voltages must be held within applicable equipment ratings.
- Post contingency voltage deviations at the interconnection shall be less than 5% for N-1 (Category B) contingencies and less than 10% for N-2 (Category C) contingencies.
- Requester shall design the generating facility to maintain a composite power delivery at continuous rated power output at the POI at a power factor within the range of 0.95 leading to 0.95 lagging.

- A wind generating plant shall maintain a power factor within the range of 0.95 leading to 0.95 lagging, measured at the POI as defined in the LGIA, if the System Impact Study shows that such a requirement is necessary to ensure safety or reliability. The power factor range standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors if agreed to by Avista, or a combination of the two. The Requester shall not disable power factor equipment while the wind plant is in operation. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the System Impact Study shows this to be required for system safety or reliability.
- All synchronous generators shall be equipped with automatic voltage regulators (AVR).
    - AVR's shall be operated in "Voltage Control" mode
    - AVR's shall support system voltage during voltage excursions.
    - AVR's shall be equipped with Power System Stabilizers (PSS).
- All asynchronous generators shall
    - Operate in "Voltage Control" mode.
    - Operate to support system voltage during voltage excursions.
    - Operate to limit voltage changes to 2.5% at the POI for sudden changes in generator output due to loss of fuel (wind, sun, etc).

B. <u>Applicable to Line Interconnection Requests</u>

- All line interconnections shall be operated such that reactive requirements are not a burden on either entity's system.
- Avista's voltage schedule (SOP 05) shall be implemented at the POI
    - If necessary, and if adequate reactive margins can be maintained, deviations from the voltage schedule may be accommodated on a case by case basis. All voltages must be held within applicable equipment ratings.
- Any voltage control devices, such as shunt capacitors or reactors, shall limit voltage changes to 2.5% under normal operating conditions. Voltage changes up to 5% due to capacitor or reactor switching are permissible under contingency conditions.
- Post contingency voltage deviations at the interconnection shall be less than 5% for N-1 (Category B) contingencies and less than 10% for N-2 (Category C) contingencies.

C. <u>Applicable to Load (End-user) Interconnection Requests</u>

- All load interconnections shall be operated such that:
    - Lagging power factor shall not exceed 0.95 at the POI
    - Leading power factors will be evaluated on case by case basis
- Loads that are equipped with active reactive support, such as synchronous motors equipped with voltage regulators and switched capacitors, shall:
    - Adhere to Avista's voltage schedule (SOP 05) at the POI

- Support voltage at the POI during system voltage excursions
- Limit voltage changes at the POI to 2.5% under normal operating conditions. Voltage changes up to 5% due to capacitor or reactor switching are permissible under contingency conditions.

10. Power Quality Impacts

Power quality is the responsibility of both the end users (loads and generation) connected to a utility system and the utilities providing distribution and transmission. Since this document focuses on the interconnection of lines and loads, and generation to the Avista electric system, this section will deal primarily with power quality problems typically introduced by the end user or Requester as termed in this document. The Requester is expected to address, in the design of their facilities, potential sources and mitigation of power quality degradation prior to interconnection. Design considerations should include applicable standards including, but not limited to IEEE Standards 142, 519, 1100 1159, 1547, and ANSI C84.1.

In general, the Requester has the responsibility not to degrade the voltage of the Avista electric system, serving other users by requiring nonlinear currents from the system. The Requester also has certain responsibilities to account for electric system events such as switching transients and fault-induced voltage sags. Standards exist for manufacturers and system designers to take into account short duration system events in order to design equipment or systems with sensitivities capable of riding through events that are within utility system operating standards. If it is determined that the new connection facility is causing a power quality problem, then the Requester will be held responsible for installation of the necessary equipment or operational measures to mitigate the problem. Typical forms of power quality degradation include, but are not limited to voltage regulation/unbalance, harmonic distortion, flicker, voltage sags/interruptions, and transients. Some of the more common forms of degradation are discussed below.

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

i. Voltage Fluctuations and Flicker

Voltage fluctuations may be noticeable as visual lighting variations (flicker) and can damage or disrupt the operation of electronic equipment. IEEE Standard 519 and IEC 61000-3 provide definitions and limits on acceptable levels of voltage fluctuation. Loads or system connections to the Avista electric system shall comply with the limits in these standards.

ii. Harmonic Distortion

Nonlinear devices such as adjustable or variable speed drives (ASD/VSD), power converters, arc furnaces, and saturated transformers can generate harmonic voltages and currents on the electric system. These harmonics can cause telecommunication interference, increase thermal heating in transformers and reactors, disable or cause misoperations of solid-state equipment and create resonant overvoltages. In order to protect power system equipment from damage

or misoperations, harmonics must be managed and mitigated. The new connection shall not introduce harmonics into the Avista electric system in excess of the limits specified in IEEE Standard 519.

In addition to loads with nonlinear devices, new generation resources or distributed resources should be evaluated not only for possible injected harmonics, but also for potential resonant conditions. For example, some generation resources, whether due to power factor correction capacitors or cable capacitances, may be capacitive during certain operating configurations. These types of configurations may result in resonant conditions within the project or in combination with the utility system. The short circuit ratio (SCR) tests as listed in IEEE 1547 and IEEE 519 can be good indicators of this potential problem. If the evaluation of the new connection indicates potential harmonic resonance the Requester may be required to filter, detune, or mitigate in some way the potential resonant conditions associated with connection of the new resource. For individual end users, the IEEE 519 Standard limits the level of harmonic currents injected at the POI (listed in IEEE literature as the Point of Common Coupling (PCC)) between the end user and the utility. Recommended limits are provided for individual harmonic components and for the total demand distortion. These limits are expressed as a percentage of the customer's demand current level, rather than as a percentage of the fundamental, in order to provide a basis for evaluation over time. There are also limits for voltage distortion for both individual frequency and total harmonic distortion.

iii. Phase Unbalance

Unbalanced phase voltages and currents can affect coordination of protective relaying, create higher flows of current in neutral conductors, and cause thermal overloading of transformers and motors. The measurement of voltage unbalance, Negative Sequence Unbalance Factor (NSUF) is the ratio of the negative sequence voltage divided by the positive sequence voltage, expressed as a percentage. The NSUF limits listed herein applies to normal system operations. For connections at 230 kV and above, the voltage unbalance should not exceed 1%. For connections below 230 kV, the contribution at the POI from a single interconnection should not be allowed to cause a voltage unbalance greater than 1.3%. The voltage unbalance limit is 2% at Points of Common Coupling for the aggregate effect of multiple loads. System problems such as a blown transformer fuse or open conductor on a electric system can result in extended periods of phase unbalance. It is the Requester's responsibility to protect all of its connected equipment from damage that could result from such an unbalanced condition.

11. Equipment Ratings

A. <u>Applicable to Generation, Line and Load (End-user) Interconnection Requests</u>

i. Transmission Line Ratings

For transmission lines interconnecting into Avista's electric system transmission line ratings and design criteria shall meet the requirements of Avista's general practices of transmission line design, including MVA, operating voltage, ampacity, insulation critical flashover, insulation clearances, shielding, structure grounding, and short circuit withstand requirements. In all cases, NESC and OSHA requirements shall be satisfied. Requester shall make available to Avista all drawings and specifications, terminations plans, and line ratings.

ii. Substation Facility Ratings

Substation facility ratings shall meet the applicable requirements of NESC, ANSI, and IEEE Standards. Avista will design the POI station such that all electrical equipment in the substation will be sized to carry the full continuous and short circuit current ratings of the intercepted transmission path over the range of ambient temperatures from -30°C to 50°C. All interrupting devices, such as circuit breakers, shall have interrupting capability sufficient to satisfactorily interrupt the maximum short circuit currents that may occur at the location of the interconnection, including margin for circuit breaker duty and DC offset.

iii. General Requirements

Circuit breakers, disconnect switches, and similar equipment connected to Avista's transmission facilities shall be capable of carrying both normal and emergency rating load currents, and must also withstand available fault currents without damage. This equipment shall not become a limiting factor, or bottleneck, in the ability to transfer power on the Avista electric system. During prolonged steady-state operation, all such equipment shall be capable of carrying the maximum continuous current that the interconnected facility can reasonably deliver.

All circuit breakers and other fault-interrupting devices shall be capable of safely interrupting fault currents for any fault that they may be required to interrupt. Application shall be in accordance with ANSI/IEEE C37 Standards. These requirements apply to the equipment at the POI as well as other locations on the Avista electric system where Avista supplies the fault-interrupting requirements.

Transformer tap settings (including those available for under load and no load tap changers), reactive control set points of shunt reactive equipment, and phase shift angles for phase shifters must be coordinated with Avista to optimize both reactive flows and voltage profiles. Automatic controls may be necessary to maintain these profiles on the interconnected system. Timed changes should be coordinated with time schedules established by the NWPP.

The Requester is responsible for determining the facility ratings for the interconnection equipment associated with the Collector Station. These facilities will be designed, constructed, owned, and maintained by the Requester, assigned agent, or future owner.

12. Synchronization of Facilities

A. Applicable to Line Interconnection Requests

Avista utilizes hot bus/dead line (HBDL) reclosing, hot bus/hot line (HBHL) reclosing, synch checking, and unsupervised reclosing schemes throughout its system. In general:

i. 230 kV Lines

One terminal tests the line and closes on HBDL at approximately 1.0 second. The remote terminal closes on synch check at 2.0 seconds. If the initial reclose tests bad, the second terminal will not close. 230 kV terminals will automatically reclose for single line to ground faults. 230 kV terminals will lockout without a reclose attempt for a multiphase fault.

230 kV interconnections should include provisions for synch checking at one terminal and HBDL reclosing at the other terminal. Reclosing for multiphase faults should be blocked. For a three terminal application, one terminal shall reclose and test the line on HBDL, and the other two terminals may reclose via synch checking.

ii. 115 kV Lines

Generally, there is no supervision on 115 kV reclosing, which is typically set for 1.0 second. However, if there is a generating source on the line, the initial reclose is HBDL to ensure the generating source is off. The remote terminal may reclose on HBHL or synch check, depending on the installed relay equipment. 115 kV lines can be equipped with auto sectionalizing schemes, and multiple shot reclosing to accommodate the isolation times.

115 kV interconnections should include provisions for synch checking at one terminal and HBDL reclosing at the other terminal.

B. Applicable to Generation Interconnection Requests

Generators shall be equipped with circuit breakers for synchronizing. Circuit Breakers attached to the 115 kV or 230 kV system shall be under control of the Avista System Operator and shall not be used to synchronize the generator.

The generator interconnection terminal shall be equipped with HBDL closing (Avista hot bus). The generator breaker shall be equipped with synch checking.

No generator shall be synchronized to the Avista system without the permission of the Avista System Operator.

13. Maintenance Coordination

Each Avista and Requester (each may be referred to as a "Party," or collectively as the "Parties") shall provide the other with reasonable notification for routine maintenance, operational tests, inspection activities and meter testing. For such activities that do not require major equipment or system outages, the Party performing the same shall provide the other Party notice at least twenty-four hours before scheduled outage. For such activities that will require major equipment or system outages, the Party performing the same activities shall provide the other Party notice consistent with the reporting requirements for the Reliability Coordinator (RC) Coordinated Outage System (COS).

14. Operational Issues (abnormal frequency and voltages)

A. Applicable to Load (End-user) Interconnection Requests

All loads shall be required to participate in Underfrequency Load Shedding (UFLS) at Avista's discretion. UFLS is coordinated throughout the Western Interconnection through the WECC Off-Nominal Frequency Load Shedding Plan. UFLS requirements will be determined from the WECC Off-Nominal Frequency Load Shedding Plan or its successor.

All loads shall be required to participate in Undervoltage Load Shedding (UVLS) at Avista's discretion. UVLS schemes may be applied over wide geographic areas or in local areas.

Avista shall have the ability to interrupt load if necessary to preserve the integrity of the Bulk Electric System (BES). This is not to be confused with "interruptible" load. This type of action is available to the Avista System Operator to address abnormal and extreme events.

B. Applicable to Line Interconnection Requests

All transmission interconnections at the BES level shall remain in service under abnormal frequency and voltage conditions unless the interconnection is part of a planned separation scheme.

C. Applicable to Generator Interconnection Requests

All generators shall remain online during abnormal frequency conditions as described in the WECC Off-Nominal Frequency Load Shedding Plan or its successor.

All generators shall remain online for system faults which occur outside of the generator's zone of protection.

15. Inspection Requirements for Existing or New Facilities

All transmission and generation elements (i.e. lines, line rights-of-way, circuit breakers, control and protection equipment, metering, telecommunications, and generators) shall be inspected, tested, maintained and documented in conformance with all local, regional, and federal standards. The Requester has full responsibility for the inspection, testing, calibration, maintenance, and documentation of their equipment up to the location of change of ownership. Avista may request an annual certification that the Requester has documented and implemented an adequate transmission or generation maintenance and inspection plan for its interconnecting facilities.

A. Applicable to Generation, Line and Load (End-user) Interconnection Requests

i. Pre-Energization Testing and Inspection

Pre-energization testing, inspection and operation verification, of the interconnecting facility, is the responsibility of the Requester in accordance with a documented Inspection and Test Plan. Avista may request specific tests for the POI. Requester shall make available to Avista all drawings, specifications, equipment settings, and test records of the interconnecting facilities for approval prior to energization.

ii. Ongoing Maintenance and Inspection Planning

Ongoing maintenance and inspection planning of Requester's facilities shall be the sole responsibility of the Requester. The Requester may be required by local, regional, or federal standards to develop a maintenance and inspection plan. It is the Requester's responsibility to identify all applicable standards and comply and document as required with those applicable standards.

iii. Maintenance Coordination

Each Party shall provide the other with reasonable notification for routine maintenance, operational tests, inspection activities and meter testing. For such activities that do not require major equipment or system outages, the Party performing the same shall provide the other Party notice at least twenty-four hours before scheduled outage. For such activities that will require major equipment or system outages, the Party performing the same activities shall provide the other Party notice consistent with the reporting requirements for the Reliability Coordinator (RC) Coordinated Outage System (COS).

16. Communication procedures

Complete, precise, and timely communication is required for maintaining the reliability and security of a power system. Under normal operating conditions, the major link of communication with various interconnectors shall be by telephone lines. Avista and its customers shall maintain communication which shall include, but not be limited to, 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, and other routine communication. In case of emergency or abnormal operating conditions, various communication channels may be used. Emergency telephone numbers should be agreed upon by both Parties prior to the actual interconnection date.