

**Procedures for Interconnection of
Generation, Transmission, and End User Facilities**

**To the Grand River Dam Authority
Transmission System**



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GRDA/SPP Interaction

GRDA is an active, participating member of the Southwestern Power Pool (SPP) and is represented on the SPP Transmission Working Group. GRDA shares its planning, design, and approval authority with applicable working groups within SPP for the purpose of providing an integrated, reliable transmission system both for GRDA and for the SPP operating region. Studies and assessments provided to these SPP groups will include definition of study assumptions, system performance results, any alternatives which were considered, and jointly coordinated recommendations for analysis and consideration by the applicable working group(s).

SPP is responsible for the completion and approval of overall system plans throughout the planning horizon. GRDA abides by SPP policies, practices, and planning criteria concerning all system extensions, additions, and interconnections. Final review and approval authority for new and/or additional Generation and Transmission Facilities connected to the GRDA transmission system rests with SPP.

Standards

All new or modified generation, transmission, or end-use facilities shall comply with all applicable codes, standards, government regulations, environmental regulations, siting requirements, contracts, operating agreements, and tariff requirements related to the facilities identified above. These include, but are not limited to, all NERC Reliability Standards and SPP Supplements to those standards that are applicable to the particular Functional Entity, as defined by NERC.

Generation Facilities:

The owner of the proposed Generating Facility shall notify the GRDA Chief Engineer of its intent to construct a generating facility attached to the GRDA transmission system as soon as the owner begins considering a location that involves the GRDA transmission system. The Generator owner shall provide the general location, generation capacity, type of generation, interconnect voltage, and projected in-service date to GRDA.

Notification point at GRDA:

GRDA Chief Engineer
 P. O. Box 1128
 Pryor, Oklahoma 74362-1128

Phone: 918-824-7837
 Email: jtullis@grda.com

GRDA will inform SPP of the proposed generation addition. The owner will then be responsible for completing Appendix 1 of the Generator Interconnection Procedures (GIP) contained in Attachment V of the SPP Open Access Transmission Tariff (OATT) and submitting it to SPP. This submittal will begin the process required for evaluation of the possible generator interconnection and is required regardless of the size of the generation unit. This OATT document is available to the public at the SPP internet site: www.spp.org.

All studies done by SPP in response to this request shall be done at the expense of the Generation

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Facility Owner as defined in Attachment V of the OATT. The final approval and acceptance of the proposed connection to the interconnected transmission system rests with SPP. Note that nothing in the GIP process shall constitute a request for transmission service or confer upon an Interconnection Customer any right to receive transmission service.

Transmission Facilities:

The owner of the proposed Transmission Facility shall notify the GRDA Chief Engineer of its intent to construct a transmission facility attached to the GRDA transmission system as soon as the owner begins considering such a project. The Transmission Facility owner shall provide the general location of the proposed interconnection, the interconnect voltage, the reason for the interconnection, the requested capacity of the interconnection, and projected in-service date to GRDA.

Notification point at GRDA:

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P. O. Box 1128
Pryor, Oklahoma 74362-1128

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Email: jtullis@grda.com

GRDA will inform SPP of the proposed transmission addition and requested interconnection. As a member of the Southwest Power Pool (SPP), GRDA’s transmission facilities make up a part of the SPP Transmission System and SPP is the Transmission Provider for services on that system. As such, SPP is responsible for the conditions under which transmission service is provided upon the system.

GRDA engineers will meet with the Transmission Facility owner to obtain details and data concerning the connection for the purpose of performing system studies of the effect of the connection on the transmission system. Applicable charges will be assessed by GRDA for its engineering work preparing these studies.

Transmission planning studies must be performed as necessary to determine the impact on the interconnected transmission system when connecting new and/or modified end-use facilities. The results of these studies will be presented to the SPP Transmission Working Group for review.

Load Flow Analysis

A load flow (steady state) analysis is conducted by establishing a mathematical model of the power system and simulating certain specified operating conditions. The results predict power flow magnitudes and voltage levels under the loss of any individual system element. The load flow analysis enables the prediction of equipment overloads and the determination of excessive voltage drops, which may be encountered.

Short Circuit Analysis/Breaker Rating Analysis

A short circuit (i.e., fault current) analysis will be performed as necessary to determine the effect that the new generation will have on the system fault currents. This data will be used to evaluate

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the impact of the generation on the fault duty (i.e., interrupting capability or rating) of the previously installed equipment such as circuit breakers and switches.

Transient Stability Analysis

A transient stability (dynamic) analysis will be performed as necessary to determine the transmission system’s response to a sudden change in the state of the system due to faults on the system and unit outages. Specifically, the analysis will evaluate the transmission system in the area of the added generation as well as the generator’s response following faults in the system.

The Customer requesting transmission service shall then contact SPP and make application for Point to Point Transmission Service, as defined in Section II of the OPEN ACCESS TRANSMISSION TARIFF FOR SERVICE OFFERED BY SOUTHWEST POWER POOL (OATT) or Network Integration Transmission Service, as defined in Section III of the same document. This OATT document is available to the public at the SPP internet site: www.spp.org under “Engineering and Planning / Tariff Studies”.

SPP will be responsible for any additional studies, contracts, and other documentation required of the Customer to secure the service(s) requested. The final approval and acceptance of any proposed transmission connection and transmission service to that connection from the SPP interconnected transmission system rests with SPP.

End-User Facilities:

Distribution Voltage End-Users

GRDA provides retail electric service at distribution voltages only to customers located in the Mid America Industrial Park south of Pryor, Oklahoma. For retail service requests and information, the End-User should contact the following:

Grant Burget
P. O. Box 409
Vinita, Oklahoma 74301

Phone: 918-256-5545
gburget@grda.com

Connection requirements, costs, and standards for retail customers are included in the ***GRDA Terms and Conditions of Service***, available from Ms. Weatherford.

Transmission Level Voltage End-Users

End-User Facilities requiring transmission level service voltage which will be supplied by GRDA wholesale or retail power contracts fall under the responsibility of the GRDA Chief Engineer. GRDA provides transmission level service at 69 kV, 138 kV, and 161 kV depending upon the location of the service request. The End-User customer shall provide the general location of the proposed connection, the required voltage, the requested capacity of the interconnection, the expected load factor or an indication of the load profile of the customer, and projected in-service date to GRDA.

		
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Notification point at GRDA:

GRDA Chief Engineer
 P. O. Box 1128
 Pryor, Oklahoma 74362-1128

Phone: 918-824-7837
 Email: jtullis@grda.com

Customer contracts are required for such services and the costs associated with the required GRDA infrastructure and system improvements are paid by the customer. The GRDA Engineering Department shall review and approve connection, metering, and protection designs for all interconnection facilities.

Transmission Level Voltage End-Users with Service from Third Parties

End-User Facilities requiring transmission level service voltage which will be supplied by Third Parties fall under the responsibility of the GRDA Chief Engineer and SPP. Such service would be considered as a Transmission Interconnection under the SPP OATT and SPP approval would be required.

GRDA provides transmission level service at 69 kV, 138 kV, 161 kV, and 345 kV depending upon the location of the service request. The End-User customer shall provide the general location of the proposed End User Connection, the required voltage, the requested capacity, the expected load factor or an indication of the load profile of the connection, and the projected in-service date to GRDA. GRDA will then notify SPP of the proposed interconnection and the Customer will then be required to provide information and comply with SPP requirements as listed in R1.2 above.

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Customer contracts are required for such services and the costs associated with the required GRDA infrastructure and system improvements are paid by the customer. The GRDA Engineering Department shall review and approve connection, metering, and protection designs for all interconnection facilities.

Procedures for coordinated joint studies of new facilities and their impacts on the interconnected transmission systems

The coordinated joint studies of new facilities and their impacts on the interconnected transmission system are done by GRDA and the facility owner. GRDA engineers will meet with the new facility owner to obtain details and data concerning the connection for the purpose of performing system studies of the effect of the new facility on the transmission system. Such

		
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studies shall include load flow and short circuit for the system with the additional transmission facility. If the facility is a generator, the studies include a stability study. The results of these studies will be presented to the SPP for review.

Once the customer submits a Generation Interconnection Request or an Application for Transmission Service, that customer facility plan's impact on the SPP system is included in the process of current and future studies as determined by SPP and the particular conditions of the OATT under which the application falls.

Procedures for notification of new or modified facilities to SPP as soon as feasible

The owner of the proposed Generating, Transmission, or End-User Facility shall notify the Chief Engineer of GRDA of its intent to construct a generating, transmission, or end-user facility attached to the GRDA transmission system as soon as the owner begins considering a location that involves the GRDA transmission system. GRDA will submit the information to the appropriate working groups within the Southwestern Power Pool (SPP) organization for record pending analysis of the studies.

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

The owner of the proposed Generation, Transmission, or End-User Facility shall notify GRDA of the planned voltage capacity level and the capacity (MW and MVAR) with his original proposal for the generation facility. That information will be passed to SPP in GRDA's initial contact with SPP. That information will also be provided by the owner to SPP in the various forms required for the Large Generator Interconnection studies, the Point-to-Point Interconnection studies, or the Network Integration Transmission Service studies. If the project is approved by SPP, its data is included within the SPP data bank and that information remains in the data base for future studies until removed by SPP as a result of customer choice. The voltage, MW, and MVAR capacity or demand requirements are included in future studies and evaluated according to SPP parameters. If changes to the SPP transmission system are required to maintain the values within specified limits, the system changes will be made and the charges reimbursed according to SPP rules.

GRDA standards for interconnect to its system limit voltage fluctuations from 95% to 105% under normal conditions. During contingencies, system voltages can exist between 90% and 105%.

GRDA power factor standards allow a minimum 96% lagging power factor before penalty is imposed.

Breaker duty and surge protection

Breaker duty and surge protection levels are determined based on system studies that consider the impact of the Generation, Transmission, or End User Facility at the time the facility is proposed. Once constructed, the facilities are included in future studies. If later system improvements modify the breaker duty or surge protection requirements, those changes will be indicated in the studies concerning the improvements. If changes in breaker duty or surge protection are necessary due to later system improvements, then those changes will be directed by SPP and the costs covered under the SPP policies.



System protection and coordination

Once the Generation, Transmission Interconnect, or End-User Facility has been approved by the necessary levels in the SPP acceptance process, the owner’s engineers shall work with GRDA to coordinate system protection devices and plans between the GRDA transmission system and the new facility source. If questions arise, GRDA and/or SPP decisions shall determine the final system requirements. GRDA relay engineers will review system protection and coordination settings on the time periods stated by NERC criteria.

Metering and telecommunications

GRDA required real-time communications for operation of the SCADA system and for telemetered load data. Once the Generation, Transmission Interconnection, or End User Facility has been approved by the necessary levels in the SPP acceptance process, the owner’s engineers shall work with GRDA to coordinate metering and telecommunications systems requirements between the GRDA transmission system and the facility so that these systems can be incorporated into the construction process for the facility. GRDA will install, own, and maintain all metering and telecommunications equipment required for GRDA monitoring of the facility. Testing of the metering equipment will be done by GRDA as defined in the terms of the customer contract with GRDA.

Grounding and safety issues

Once the Generation, Transmission Interconnection, or End User Facility has been approved by the necessary levels in the SPP acceptance process, the owner’s engineers shall work with GRDA to identify and mitigate any grounding and/or safety concerns. Current issues of industry safety manuals and safety codes shall be used as the basis for solving problems in these areas of concern. GRDA shall provide the owner with calculated fault currents from the GRDA system at the proposed facility location for use in design of the grounding system by the owner’s engineers. GRDA will review the owner’s designs as they affect any mutual interconnections of grounding systems.

Insulation and insulation coordination

Once the Generation, Transmission Interconnection, or End User Facility has been approved by the necessary levels in the SPP acceptance process, the owner’s engineers shall work with GRDA to determine insulation level requirements for the facility. In general, GRDA uses the following insulation design levels on its transmission system:

Voltage Class (kV)	Insulation Level (BIL)
69	350
138	650
161	750
345	1300

Voltage, Reactive Power, and power factor control

Once the Generation, Transmission Interconnection, or End User Facility has been approved by

		
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the necessary levels in the SPP acceptance process, the owner’s engineers shall design their systems such that they meet SPP contract requirements for these variables. Voltage, reactive control, and power factor control are all covered within the service agreements which will be established between the owner and SPP.

Power quality impacts

It shall be the responsibility of the Generation, Transmission Interconnection, or End User Facility Owner to solve and correct at the Owner’s costs any power quality issues caused on the GRDA and/or SPP transmission systems by the facility.

Equipment Ratings

Once the Generation, Transmission Interconnection, or End User Facility has been approved by the necessary levels in the SPP acceptance process, the owner’s engineers shall design and specify the equipment in the facility using the equipment ratings provided to SPP for the various studies used to accept the facility. Any use of ratings that result in installed equipment having a rating not consistent with that provided for the SPP studies will result in denial of final connection of the facility to the GRDA and SPP transmission system.

Synchronizing of facilities

It shall be the requirement of the Generating, Transmission Interconnection, or End User Facility to synchronize its operating equipment to the 60-Hertz system in dynamic operation on the GRDA and SPP transmission system(s). The facility shall include such relaying and protective equipment as may be necessary to insure that the facility equipment cannot be inadvertently closed onto the transmission system in an out-of-phase operating condition.

The facility shall also provide with underfrequency protective equipment that shall be set per SPP Criteria to disconnect the facility from the SPP transmission system and to “island” the generation equipment or de-energize the transmission interconnection or end-user connection under certain decreasing frequency conditions on the transmission system. Maintenance and testing of the necessary underfrequency relaying systems shall be the responsibility of the facility owner.

Maintenance coordination

As part of the interconnection or service agreements between the Generating, Transmission Interconnection, or End User Facility and SPP, the facility owner shall agree to coordinate the scheduling of maintenance outages at the facility through SPP for the benefit of all concerned.

Operational issues (abnormal frequency and voltages)

As part of the interconnection or service agreement between the Generating, Transmission Interconnection, or End User Facility and SPP, the facility owner shall agree to pursue solutions aggressively if operational issues such as abnormally frequency or voltages occur at the facility. The facility owner shall work with SPP to resolve the problem(s) for the benefit of all concerned.

If abnormal voltage and frequency problems cannot be resolved within a time frame determined by SPP, SPP retain the right to disconnect the facility from the GRDA and SPP transmission system, if necessary, to maintain electrical system stability, acceptable power quality, and continuity of service to the other customers and loads supplied by the transmission system.

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Inspection requirements for existing or new facilities

The Generation, Transmission Interconnection, or End User Facility owner shall agree to allow representatives from GRDA and SPP to inspect the facility prior to its connection to the GRDA transmission system to verify the existence, operational capability, and functional condition of the required system protective equipment. GRDA and SPP representatives shall be present to witness the testing and commissioning of the protective relay systems and the synchronizing system. The Owner shall provide GRDA and SPP with copies of the relay test results for record purposes.

GRDA personnel shall install, inspect, test, activate, and maintain the metering and telecommunications equipment necessary to monitor the Generation, Transmission Interconnection, or End User Facility generation, load, voltage, frequency, and/or other variables as determined by GRDA. The facility owner shall allow access to the facility by GRDA personnel any time during normal working hours or emergency conditions for the purpose of inspecting and maintaining the GRDA equipment.

Communications and procedures during normal and emergency operating conditions

The Generation, Transmission Interconnection, or End User Facility shall communicate with SPP directly during normal and emergency operating conditions.

Customer charges for GRDA expenses

The costs of all studies and engineering review performed for customer interconnections by GRDA shall be paid to GRDA by the customer. The customer shall provide GRDA with a payment of \$10,000 prior to the beginning of any studies. GRDA will charge costs against this pre-payment as they are accrued. If study costs exceed the initial payment, then an additional deposit will be required for the GRDA work to continue. If at the completion or termination of the study phase there are funds remaining from the deposit, the remainder will be returned to the customer. Applicable GRDA costs will include but not be limited to, employee time at hourly rates including benefits, consultant expenses (as billed), expendable materials expense, technology costs (computers and software), travel expenses, copying, postage, and other costs directly attributable to the requested study project.



Initial Interconnection Request Notification Form

*To be completed by the Owner of a Proposed Facility
Interconnecting with the Grand River Dam Authority*

Company Name & Address: _____

Primary Contact: _____
Phone Number: _____ **Email Address:** _____

Signature: _____ **Date:** _____

Check box and complete area(s) that apply

Generation Interconnect:
Location: _____
Generation capacity: _____ mVA
Type of generation: _____
Interconnect Voltage: _____ kV
Projected In-Service Date: _____

Transmission Interconnect:
Location: _____
Interconnect Voltage: _____ kV
Reason for Interconnection: _____

Capacity of Interconnection: _____ mVA
Projected In-Service Date: _____

End-User Facility Interconnect
 Distribution Voltage Level
 Transmission Voltage Level
 Transmission Voltage Level with Service from Third Party

Service Location: _____
Service Voltage Level: _____ kV
Capacity of Interconnection: _____ mVA or _____ kW
Load Factor: _____ % or Include indication of Expected Load Profile
Projected In-Service Date: _____

Return Form to: GRDA Chief Engineer Phone: 918-824-7837
P. O. Box 1128
Pryor, Oklahoma 74362-1128 Email: jtullis@grda.com

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Document Control

Change History:

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V 01.01	Updated Chief Engineer	11/16/10	M. Herron
V 01.02	Updated GRDA/SPP Interaction section and Generation Facilities section, page 3-4	3/19/11	M. Herron
	Added Header and document control tables	3/22/2011	K. Ehrhard
V 01.03	Replaced J. Weatherford with Grant Burget as contact person; Clarifications in load flow, short circuit, and transient analysis paragraphs	11/1/11	M. Herron

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Reviewed By	Title	Date
M. Herron	AGM- Engineering, SO and Reliability	2/03/10
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