JEA Facility Interconnection Requirements

Developed in response to NERC FAC-001-2 and associated recommendations

Revision 3.0 – Dec 7, 2015

Table of Contents

Introduction:

In February, 2005, The North American Electric Reliability Corporation (NERC) adopted Standard FAC-001, thereby requiring that all Transmitting Electric Utilities "*shall document, maintain, and publish facility connection requirements to ensure compliance with NERC Reliability Standards and applicable Regional Reliability Organization, sub-regional, Power Pool, and individual Transmission Owner planning criteria and facility connection requirements*". The standard then prescribes the specific actions that each Transmitting Utility must take in order to implement interconnections to the Bulk Electric System Facilities when interconnecting Generation Facilities, Transmission Facilities, or End-user (retail load) facilities to the Bulk Electric System. This document describes JEA's program for accomplishing the specific actions of that NERC Standard.

This document is also intended to serve as a single point of beginning for entities, inside or outside JEA, who desire to interconnect to JEA Transmission Assets. As such, this document includes, by way of reference (refer to the bibliographic references in the text or the end of the document) a variety of sources and references to help clarify the requirements of JEA. Non-copyright sources are available by contacting JEA.

FAC-001 also purports that "To avoid adverse impacts on the reliability of the Bulk Electric System, Transmission Owners and applicable Generator Owners must document and make Facility interconnection requirements available so that entities seeking to interconnect will have the necessary information.". Accordingly, this purpose defines the general approach of this document.

Application for Interconnection:

JEA, as a transmitting utility, observes the related FERC Orders 888 and 889 including the publishing of an "Open Access Transmission Tariff" or OATT. That document describes JEA's approach to acceptance and processing of all interconnections to the JEA Transmission System, which is a superset of the Bulk Electric System (BES) facilities addressed in FAC-001. Also, JEA participates in the on-line Florida Open Access Same Time Information System, or FLOASIS (http://floasis.siemens-asp.com), which provides for on-line posting of applications for interconnections to the JEA Transmission System. Qualified wholesale entities desiring to apply for interconnections (Generation or Transmission) are referred to that internet site for further instructions, while retail entities desiring Transmission Interconnection may contact the JEA Customer Service Center, at 42 West Church Street, Jacksonville, Florida, 32202, 904.665.6000.

JEA Interconnection Requirements:

Interconnecting to the JEA Transmission System require the execution of a set of commercial and technical tasks, to assure that the resulting interconnection is safe, reliable, operable and economical. While these tasks vary, depending upon the type and size of interconnection, all JEA Interconnection Requirements can be summarized briefly as follows;

> "All Generation, Transmission, an End-User Facilities interconnecting to the JEA Transmission System shall be designed, constructed, and operated in a manner that meets the requirements of all Federal, State and Local laws and Codes, and that also meets all of the requirements of Industry-Accepted National Standards, the requirements of NERC

> and it's appropriate sub region (FRCC), and generally does not conflict with or impede JEA's use of its own Transmission System."

This document provides that information necessary to meet the requirements of NERC FAC-001-2, and to assist those who wish to interconnect to the JEA Electric System in the execution for these tasks.

JEA Interconnection Requirements:

The party that desires to make an interconnection to the JEA Transmission System should refer to the paragraphs above, regarding the execution of the commercial agreements to begin the interconnection process. These agreements vary depending on the size of the interconnection, whether the interconnection is at wholesale or retail, whether or not there is Generation involved, and possibly other specifics of the interconnection. However, in every case, the requestor's initial obligation is limited to the performance of a request for interconnection, via the contact information provided earlier in the section of this report titled "Application for Interconnection". Upon making such application, the obligation to continue the processing of the commercial aspects of a new interconnection will transfer to JEA, until such time that JEA requests additional data or other commitments from the interconnecting party. The continued processing will then require a stepwise dialog between JEA and the interconnecting party, and this dialog follows the stepwise procedures as specified in FERC Orders 888, 889, 2000 (LGIP and LGIA) and 2006 (SGIP and SGIA). The interested reader may refer to those documents for more information at http://www.ferc.gov.

Interconnection Requirements – Engineering and Technical:

JEA strives to meet the Engineering and Technical requirements of NERC Standard FAC-001, which states that ;

> Each Transmission Owner shall document Facility interconnection requirements, update them as needed, and make them available upon request. Each Transmission Owner's Facility interconnection requirements shall address interconnection requirements for:
>
> 1.1. generation Facilities;
>
> 1.2. transmission Facilities; and
>
> 1.3. end-user Facilities.

These Engineering and Technical Requirements are delineated in the NERC standard, and are listed in the following sections. Where the requirements differ between the three categories of interconnection, the individual requirements of each category are addressed within the pertinent sections. JEA has additional standards that either stem from or compliment the Engineering and Technical Requirements as delineated in the NERC Standards, and these are either listed or referenced in the appendix of this report.

System Performance Assessment (NERC FAC-001 R3.1 - 3.2 and R4.1 – 4.2)

For each of the possible interconnection scenarios deemed acceptable to the interconnecting customer, JEA will assess the system performance for the entire planning horizon against JEA's planning criteria using NERC and FRCC standard assessment practices. Where system performance is not maintained to

planning criteria levels, JEA will develop plans to remedy the performance impact. JEA will provide a written summary of these plans to all affected and interested parties. The written summary shall include:

1. Procedures for coordinated joint studies of the interconnected facility and its associated impacts on the interconnected transmission system. Where the impacts affect other systems, those affected systems will be notified as soon as feasible.

2. The Interconnected voltage levels

3. The real and reactive capability or demand at the point of interconnection

4. The required breaker duty and surge protection

5. The required system protection and coordination

In general, JEA will assess the performance of the system during faulted conditions from the interconnected facility and its associated impacts on JEA's existing facilities including additional thermal loadings, voltage suppressions, incremental fault duty on existing protection equipment (breakers), and associated critical clearing times for JEA's protection systems.

The expense to perform these assessments shall be the responsibility of the interconnecting customer.

Breaker/Equipment duty and surge protection

Upon completion of the studies mentioned earlier, the JEA System Planning Section shall develop a scope instrument that defines, in basic terms, the needs for Transmission Interconnection and System Improvements. The JEA System Planning Section shall develop this scope document in collaboration with JEA's Engineering, Operations, and Maintenance Sections, as well as the Interconnection Applicant. The nature and timeline of this process shall be consistent with the existing FERC Orders mentioned elsewhere in this document, and are consistent with JEA's Transmission Tariff.

On JEA-owned facilities, JEA T&S Engineering shall then select Circuit Breakers, buswork, transmission structures, insulators, surge protectors, instrument transformers, telecommunication components, protection and control components and all other components that are both consistent with the needs of the Applicant and are standard for the JEA Transmission System. While JEA shall strive to keep the interconnection costs as economical as possible, recognizing that many JEA-standard and industry-standard components are only practically available in fixed, granular capacities, and JEA shall choose from those JEA-standard components, to allow JEA to safely operate and maintain the systems. This particularly applies to Circuit Breakers and Surge Protection, which is applied to JEA Substations for incoming Transmission Lines and applied at the Substation Bus.

Appendices II and III provide further information about the available Voltages, Ampacities, Surge Protection, and related information of standard JEA substation components. The Interconnection Applicant is encouraged to peruse this information prior to approaching JEA for Interconnection Service.

This subsection shall not apply to systems owned and operated by the Applicant, except that, the applicant will be responsible for demonstrating and assuring that the Applicant's system shall not perform in a way that can be injurious to the safety or reliability of the JEA Transmission System.

In the case of Transmission Interconnection of End-User Facilities, JEA's Customer Order Management Department shall be the party responsible for all technical and engineering functions outlined in this subsection. JEA will perform all of these technical and engineering functions on behalf of the End-User, in a manner consistent with and equivalent to the procedures that it conducts with wholesale entities.

System Protection and Coordination

Based upon successful completion of studies, JEA T&S Engineering shall develop an initial design document, which defines the scope of work, the single line diagram, and a preliminary AC Single Line Diagram for the Interconnecting Facilities (including protective elements and basic trip logic). Upon doing so, JEA T&S Engineering shall initiate discussions with the Interconnection Applicant to assure consistency of the overall protection system (including on any zones that overlap ownership/operation boundaries) with applicable NERC standards. The System Protection and Coordination subsection of the Appendix covers specific relaying requirements in more detail for Generator, Transmission, and End-User Facilities.

Upon completion of the AC Single Line Diagram, Licensed Electrical Engineers from JEA and the Interconnection Applicant shall commence the development of a list of protection and control specifics (relaying philosophy), which will become the basis of future relay selection, relay settings, panel design, and telecommunications interfacing for the two protection and control systems. This document shall be subject to the basic requirements of the System Protection and Coordination subsection of the Appendix, as well as all applicable NERC and FRCC Standards.

In the case of Transmission Interconnection of End-User Facilities, JEA's Customer Order Management Department shall be the party responsible for all technical and engineering functions outlined in this subsection. JEA will perform all of these technical and engineering functions on behalf of the End-User, in a manner consistent with and equivalent to the procedures that it conducts with wholesale entities.

Metering and Telecommunications

JEA shall install a Revenue Metering System in the nearest available JEA Substation to permit JEA to accurately telemeter all power and energy delivered to and taken from the JEA Transmission System. This Metering shall be owned, installed, and maintained exclusively by JEA, and includes the following;

- All JEA Metering shall be revenue-class, electronic meters, with revenue class instrument transformers. These devices shall be specified, installed, and serviced exclusively by JEA. While the Interconnection Applicant is free to install his own metering system, the actual use of revenue metering shall be as determined by Commercial Contracts executed prior to constructing the Interconnection.

- The Interconnection Applicant will be copied on all metering system test reports (manufacturers test reports, etc.) and will be invited to witness on-site installation and testing of all metering system components, but will not be allowed to participate in the installation.

- For Transmission Interconnections to the systems of others, JEA Metering shall be revenue-class, electronic meters, with revenue class instrument transformers, for purposes of Tie Line Information (AGC and ACE Data Sources), in addition to the relay-class instrument transformers deployed for SCADA and Protection. JEA does not co-mingle these sources of data. JEA can provide metering data from these sources to the Interconnection Applicant, via telemetry, upon reasonable request and subject to commercial terms.

- JEA shall select all Metering System Components based on the capacity requirements specified in the Interconnection Application, and from JEA's metering standards. The JEA Commercial Meter Services Section maintains these standards and will work with the Interconnection Applicant in the final selection of meters.

- Meters for Generation output and Startup Energy shall be metered separately for the life of the interconnection.

JEA shall also develop a list of necessary telecommunication channels that become necessary between the facilities of JEA and the Interconnection Applicant. Typically, when zones of protection overlap (such as the case between a generation plant and a JEA Substation) JEA will require the installation of overhead fiber optic cable for the establishment of the various telecommunication channels. All JEA Substations are designed to accommodate physically redundant fiber optic channels, but radially-interconnected systems may allow a single multi-fiber-cable approach.

Grounding and Safety Issues

JEA practices substation grounding according to the requirements of IEEE-80 and the National Electric Safety Code, each of which is available from the publisher (copyrighted materials). All JEA facilities constructed for the purposes of Transmission Interconnection will be constructed using these standards. JEA encourages the Interconnection Applicant to do the same.

When the Interconnection Customer conducts transmission switching operations, the Transmission operations must be cleared through the JEA Bulk Power Operations Section. Any such operations require a minimum of two days notice and must be served to JEA, with the proposed switching sequence, via electronic mail request. The JEA Bulk Power Group shall then respond with a permission/denial of such activities, in writing, with the permission/denial based upon then-existing electric system conditions. All necessary contact information shall be provided to the Interconnection Customer (from the JEA Bulk Power Operations Section) upon execution of an Interconnection Agreement..

JEA also has an extensive safety program, to include specific procedures for locking, tagging, and maintaining communications during Transmission System Operations. At least one month prior to commencing any Transmission System Switching, JEA shall require the staff of the Interconnection Applicant to attend two (2) four-hour classes, provided at nominal cost by JEA, where the specifics of JEA safety requirements will be provided.

In the case of Transmission Interconnection of End-User Facilities, JEA's Customer Order Management Department shall be the party responsible for all technical and engineering functions outlined in this

subsection. JEA will perform all of these technical and engineering functions on behalf of the End-User, in a manner consistent with and equivalent to the procedures that it conducts with wholesale entities.

Insulation and Insulation Coordination

JEA has established standards regarding the insulation and insulation coordination of its substations and transmission circuits (surge arrestors, BIL coordination between Substations and Transmission Circuits, etc.). Copies of these standards are available upon request. All JEA facilities constructed for the purposes of Transmission Interconnection will be constructed using these standards. JEA encourages the Interconnection Applicant to do the same.

Depending on the nature of the interconnection and location within the JEA Service Territory, it may be necessary to establish a means of protecting and maintaining Transmission Facilities from contamination (typically salt spray). Upon request of the interconnection customer, JEA will review its insulation maintenance practices in similar locales.

In the case of Transmission Interconnection of End-User Facilities, JEA's Customer Order Management Department shall be the party responsible for all technical and engineering functions outlined in this subsection. JEA will perform all of these technical and engineering functions on behalf of the End-User, in a manner consistent with and equivalent to the procedures that it conducts with wholesale entities.

Voltage, Reactive Power, and Power Factor Control

For purposes of economy and community impact, JEA normally interconnects all Transmission Services at the nearest available transmission line voltage. In the case of End-User Interconnections, JEA will determine the interconnection voltage based solely on economics, depending on the location. Voltage Regulation and Reactive Power for End-User Interconnections (retail Transmission-Level Loads) may be required, and if so, will be provided entirely by JEA. (JEA's retail Tariff has specific charges to offset these costs).

For interconnections to Transmission Lines, the Power Flow studies mentioned earlier will determine the need for reactive compensation and/or other devices to control and maintain voltage. Normally, for Transmission Line Interconnections, the effective interconnection power factor should not fall below 0.98 leading or lagging (maximum ratio of reactive to real power = 20%). If an Interconnection Applicant has specified performance factors in his application that are outside of this range, JEA Electric System Planning Engineers will meet with the applicant to discuss and arrange for mitigation options. In addition, in those special cases where power flow studies indicate that this amount of reactive power flow results in failure to adhere to NERC Standards for Voltage Control, then mitigation will be necessary, and JEA Electric System Planning Engineers will notify the applicants of the study results and meet with the applicant to discuss and arrange for mitigation options

- For Transmission Interconnections to Generating Facilities, JEA will require that the generator meet all applicable NERC Standards for Generation Plants, including NERC Standards VAR-001 and VAR-002. In particular;

- Unless agreed otherwise, every generating resource shall be designed and constructed with an AVR (Automatic Voltage Regulation) excitation system, or its equivalent. Power Flow studies will help in the selection of specifications for such a system.

- Every Generating Resource shall provide an AVR status indication (via SCADA) and shall be subject to AVR set-point control by JEA.

- Unless agreed otherwise, the Generator shall be capable of delivering/receiving net reactive power at a Power Factor of 0.98 leading or lagging as measured at the high side of the Geenrator Step Up Transformer, and shall be capable of doing so when the Transmission Interconnection Voltage is at nominal voltage +/- 5% of nominal. Such Reactive support is necessary for voltage stability of the JEA Transmission System, and requires specific design assumptions be made regarding the generator, excitation system, and generator step-up transformer. Designing, constructing, operating, and testing the excitation system is the responsibility of the Interconnection Customer and subject to JEA approval for continued interconnectivity.

- For further information regarding reactive power and voltage control, refer to the NERC website section: “Reliability Standards”.

Power Quality Impacts

Power Quality addresses the reliability of electric service and the ability of the electric service to deliver an undistorted, fundamental frequency power signal to a customer interconnection during any reasonable power consumption circumstance. JEA Power Quality requirements for the Transmission System are the same as those required for distribution systems, addressing voltage range, harmonic distortion, and other qualities that might otherwise interfere with the quality of electric service provided to the customer.

For detailed discussion of JEA’s Power Quality Standards, refer to Chapter 8 of the JEA’s Rules and Regulations for Electric Service at http://www.jea.com/business/services/devandbuild/rulesregs.asp.

Equipment Ratings

All JEA Equipment ratings are developed in a manner that is consistent with NERC Ratings Documents FAC-008 and FAC-009. All Interconnection Applicants are encouraged to review these documents for guidance. JEA uses standard nameplate ratings on all equipment that bears a nameplate, and models and tests the equipment according to Manufacturers Test Reports and Recommendations. For Transmission Line Ratings, the JEA Bulk Power Operations Section has a Transmission Line Ratings Methodology Document that is available upon request.

JEA facilities built for any of the three interconnection categories will accept the nameplate ratings as being the equipment ultimate loading rating. Exceptions will include the case when a series component limits the ratings of other series components, in which case the operating limit shall be the smallest rated component in the series circuit.

In addition to the above, JEA may require certain generators to submit testing reports on a frequent schedule that indicate the maximum real and reactive power outputs. Such testing, if required by JEA, will be similar to that testing which JEA does to meet the requirements of FRCC, and shall include such things as installed generator curves and frequency-domain governor and excitation models (to replace the data supplied with the Interconnection Application). Such Data shall be supplied to JEA not later than 30 days prior to first synchronism with the JEA Transmission System.

Synchronizing of Facilities

JEA Facilities that are constructed for end user facilities (without cogeneration) do not need any synchronization and therefore are exempt from this requirement. As a separate but related issue, phase rotation will be accomplished using standard test devices, and shall be performed by JEA. Phase Rotation testing is not normally checked b JEA Relays that serve End Users, but if local generation sources are known to be in use, JEA will install standard synchronizing relaying to check phase rotation, angular difference, and angular acceleration, prior to permitting a close.

For the Category of a Transmission Interconnection to the Systems of Others, first Synchronizing of Facilities shall take place by both manual and automatic testing of potentials across an open circuit breaker controlled by JEA. JEA shall allow the Interconnection Customer to Synchronize via methods and devices that are approved by JEA, provided also that JEA has a reasonable opportunity to witness testing of these methods and devices. After first successful testing and synchronism, future closing of circuit breakers would be accomplished via automatic synchronism checking relays, provided no topographical changes in the Transmission Interconnection has occurred.

For the Category of a Generator Interconnections, Synchronizing of Facilities shall first take place by both manual and automatic testing of potentials across an open circuit breaker while under review of JEA. JEA shall allow the Interconnection Customer to synchronize via methods and devices that are approved by JEA, with JEA staff present to witness the testing of these methods and devices. After first successful testing and synchronism, future synchronism would be accomplished via automatic synchronism checking relays, provided no break in the Interconnection Circuit Path (other than a circuit breaker contact opening) has occurred. Should any other break in the Interconnection Circuit Path (i.e., changing of a switch, removal and replacement of step-up transformer or jumpers, removal of iso-phase bus links, etc.) then JEA will require repeating the synchronism procedures as though the generator were being newly installed.

Maintenance Coordination

JEA Facilities that are constructed solely for End-Users shall be maintained in a manner that assures safety and reliability of service. JEA shall coordinate the maintenance of these facilities with the JEA customer through JEA's Customer Service Department. All responsibility for such coordination belongs to JEA.

JEA realizes that Generation and Transmission Interconnection Customers shall occasionally need to coordinate generation and transmission clearances for purposes of safe maintenance. JEA and the

Interconnection Customer shall agree on a means, method, and procedure for coordinating maintenance-related clearances of facilities via the associated Interconnection and Operating Agreements.

Subject to the constraints of the Interconnection and Operating Agreements, requests for clearances of facilities will not be withheld. However, the active procedure shall be a specific outage request, sent at least 24 hours in advance, to the Bulk power Operations Group, who shall normally respond within 24 hours. Final execution of the scheduled clearance will be subject to Electric System Conditions.

Operational issues (abnormal frequency and voltages)

JEA Facilities that are constructed solely for End-Users shall be designed and operated in a manner that assures safety and reliability of service. JEA participates with the FRCC Load Shedding schemes, and as such shall coordinate with its End-Users for the possibility of being subject to UFLS and UVLS load shedding systems. All responsibility for such coordination belongs to JEA.

For all Generation and Transmission Interconnection Entities, JEA shall review, during the study process, all of the following requirements for abnormal frequency and voltage operating conditions, and shall plan and agree upon responses to such events should they occur.

For all Transmission Interconnections, JEA shall require Out-of-Step Relaying and Protection, in addition to the other protection system requirements outlined in the Appendix.

For all Generator Interconnections, JEA shall require the coordination of all of the following to assure adequate system performance of the JEA Transmission System;

Each Generating Entity shall assure that a Generation Resource shall remain reasonably available to contribute continued real power generation in the event of disturbance. To assure this, the Generating Entity shall provide time-domain models and specifications of the net results of all generator tripping mechanisms that might trip in the event of a disturbance, such as (but not limited too) reverse power and PLU relays, relays that trip for oscillatory power flows, over-speed, Under Frequency and Under Voltage devices, any machine-specific protection devices (i.e., Lean Fuel Blowout of gas turbines). Upon receipt of such data, JEA will perform studies, if necessary, to confirm the ability of the resulting generation system to provide reasonable continued real power generation in the event of disturbance. For the purposes of this paragraph, JEA shall submit the results of such studies with the FRCC Stability Working Group for review. JEA and the Interconnection entity shall then pursue any necessary mitigation.

Each Generation Entity that takes energy from a JEA Distribution Source for generator startup shall be approached regarding JEA's participation in the FRCC UFLS program, to assure that the generation availability, or lack thereof, is accounted for during UFLS events. If such availability failure is an issue for the reliability of the JEA Transmission System, mitigation may be required.

Inspection Requirements for Existing or New Facilities

JEA Facilities that are constructed solely for End-Users shall be JEA Owned and shall therefore have perpetual access for inspection. All responsibility for such inspection belongs to JEA.

For Transmission and Generation Interconnection Entities, JEA shall require the following;

- Whenever JEA has on-site devices, such as Protective Relays, JEA shall be provided a perpetual and unobstructed easement or access of personnel and necessary tools and instruments to allow JEA to inspect, adjust, repair, replace and upgrade such systems and facilities. Except in Electric System Emergencies, JEA shall perform such only after providing reasonable notice to the Transmission and Generation Interconnection Entity, which notice shall include such information as needed to provide for safety and coordination with the Entity.

- JEA has an interest in occasionally inspecting other components, not owned by JEA. These might include the inspection of protective relays (i.e., download or front panel review of settings) to investigate coordination accuracies or suitability of trip logic. These kinds of inspections shall normally be done with the assistance of staff from the Transmission or Generation Interconnection Entity.

Communications and Procedures during Normal and Emergency Operating Conditions

JEA Facilities that are constructed solely for End-Users shall be JEA Owned, Operated and Maintained by JEA and shall therefore be Subject to the Communication Procedures of JEA's Bulk Power Operations Groups. All responsibility for such inspection belongs to JEA.

During Normal Operating Conditions, JEA and the Interconnecting Entity will adhere to the following;

- All Normal Operations shall be prescheduled with the JEA System Operations Control Center. The specific information required in order to pre-schedule operations shall be delineated in the Interconnection Operations Agreement.

- All personnel entering into or leaving a live JEA facility shall require JEA Safety Training. This training will include information regarding the possession of a communication device, and with whom and how to communicate to the JEA System Operations Control Center.

- All personnel that are to be involved in the entry of the other party's facilities shall approach the other party in advance for security clearance. Reasonable amounts of personnel identification shall be accepted and displayed at all times when on the facilities of others, and contacts to the staff of others will include the mention of or display (as the situation allows) of such identification.

- All personnel who normally will or normally could become involved in the operations of the Transmission System will communicate their contact information on a regular basis. Each Party shall develop a means for the timely notification of each other when new employees join their entity or when formerly authorized personnel leave.

During Emergency Operating Conditions, JEA and the Interconnecting Entity will adhere to the above to the extent that the circumstances will allow. JEA's System Operations and Control Center is a perpetually-manned facility. Also, JEA Participates with the FRCC State Security Coordination process, which coordinator has the right to take operator action up to and including electrical severance of interconnections; JEA and the Interconnecting Entity are subject to such order at all times.

Resources for Further Information

JEA has various standards, policies and procedures that will or may apply to any specific case of a Transmission Interconnection. The burden of providing this information to the Interconnection Applicant transfers to JEA upon receipt of a valid application for interconnection. The attached Appendix is provided as a summary of the technical (non-commercial) requirements that JEA will require of an interconnecting entity.

A list of contact information of staff within JEA that can provide more specific information is included in Appendix I. This document will be maintained per JEA and NERC Policies to assure that the information is timely and accurate, however, any questions or recommendations regarding this document may be referred to the Director of Compliance.

Version	Date	Reviewers	Revision Description
0	April 2008	Russell Simmons	Initial Document to state all facility connection requirements in one document.
1	April 2009	Leslie Roberts	Format was changed to better show requirements of FAC-001-0.
1.1	July 2012	Michael Short	Updated contact list.
2.0	Dec 2014	Michael Short	Updated to FAC-001-1
3.0	Dec 2015	Michael Short	Updated to FAC-001-2

(End)

Appendix I - JEA Contact List

Name & Title	Responsibility	Addresss	Phone	E-Mail
Ventresca, Thomas	Manager, Electric System Support Services	21 West Church Street, 10th Floor Jacksonville, FL 32202	(904) 665-5822	VENTTV@JEA.COM
Durham, Russell	Manager, Electric T&D Planning	21 West Church Street, 10th Floor Jacksonville, FL 32202	(904) 665-7108	DURHRJ@JEA.COM
White, Neil D	Manager, Bulk Power Operations	6610 Ramona Blvd. Jacksonville, FL 32202	(904) 665-8814	WHITND@JEA.COM
Burbure, Vijay A	Director, Grid Projects	21 West Church Street, 9th Floor Jacksonville, FL 32202	(904) 665-6782	BURBVA@JEA.COM
Babik, Jalal John	Director, Electric Compliance	21 West Church Street, 7th Floor Jacksonville, FL 32202	(904) 665-8736	BABIJJ@JEA.COM
Short, Michael L	Author of Revision 3.0 Manager, Project Design	21 West Church Street, 9th Floor Jacksonville, FL 32202	(904) 665-7048	SHORML@JEA.COM

Appendix II
Summary of Topographical Standards applied to Transmission Interconnections

JEA has General and Specific Engineering and Technical Requirements for all interconnections. JEA's General Engineering and Technical Requirements apply to ALL transmission interconnections of all categories, and apply equally to both JEA-Owned and non JEA-Owned facilities. These mostly address basic design and topography standards, and are summarized below;

1. JEA owns, operates, and maintains a large, highly interconnected Transmission System. Additions to the system must be designed to be consistent with the existing system designs, and accordingly, JEA will provide the following information to the Interconnection Applicant upon receipt of a valid request for interconnection, as well as execution of certain non-disclosure agreement(s) as JEA sees fit;

    a. JEA publishes a "System One-Line Diagram" and a "Transmission System Map". These two instruments will be provided to the Interconnection Applicant shortly after a valid request for interconnection is tendered to JEA.

    b. JEA Staff from Transmission Planning, Transmission and Substation Engineering, and Transmission Bulk Power Operations shall be available to meet with the Interconnection Applicant shortly after a valid request for interconnection is tendered to JEA. This meeting will be for the purpose of explaining the existing nearby facilities and to determine a list of possible electrical interconnection schemes.

    c. Standard JEA Substation Topographies include such industry standards as Ring Bus, Radial Bus (IEEE Loop Service), Breaker and Half, and Double bus schemes. Normally, when an existing transmission line is to be intercepted by an interconnection, a small Ring Bus Switching Station will be used to avoid interference with power flowing through the existing circuit. Separate Transmission circuits would then be installed to interconnect the applicant to the JEA Transmission System via the switching station.

2. All interconnections shall be effected at a JEA-controlled substation. The reasons for this policy are many, and include;

    a. Avoidance of Tapped Transmission Lines (connecting to a transmission line without substation circuit breakers) .

    b. Security of Critical Electric Infrastructure

    c. Permanent Accessibility for staff and equipment

    d. Safety and Security of Electric System Operations

    e. Inspections and Operational Awareness

    f. Ownership, Operation, and Maintenance of Metering Equipment.

3. JEA will, working with the Interconnection Applicant, select the most economical option for interconnection via a new or existing JEA substation. When any existing nearby substation has termination capacity that is unused and not yet committed in the existing JEA Planning documents, JEA will make the termination available, subject to agreement on commercial terms. This will often be the most economical solution. When an existing Transmission line(s) passes near to the interconnection point that is specified by the Interconnection Applicant, JEA shall examine the possibility of constructing an interconnection substation to interconnect the facility into the JEA Transmission System. This shall require a minimum of three terminals, (two for JEA's Transmission Line loop service terminations, and at least one for the line to the facilities of the Interconnection Applicant).

4. In the case of a Generating Interconnection Applicant, the Interconnection Applicant may choose between the construction of an overhead transmission line (or lines) to an existing JEA substation, or, as an alternative, the construction of a plant switchyard with a (JEA-Owned and Operated) Collector Bus. In the latter event, certain real property rights will need to be delineated in the commercial documents.

5. In the case of constructing a new Substation, the design and engineering shall meet JEA Substation Standard Practices. A contact name is provided elsewhere for Interconnection Applicants who wish to review these standards, but typical JEA Substations are designed to meet all applicable Industry Standards and will provide for beaker redundancy, Protection and Control sensitivity and security, Telecommunications Redundancy, Maintenance of Equipment, and Safety.

6. In many cases, interconnection will be effected through one or more Transmission Lines. JEA immediately recognizes two cases;

    a. For Transmission Lines that are JEA -Owned, the construction shall follow the Transmission Line Construction Standards of JEA, which are visible on line at www.jea.com. In addition, JEA requires that it's lines be constructed to endure wind loads up to 120 mph, and JEA has standards for allowable connectors, insulators, conductor sizes, ratings, and pull-off strengths. Normally, JEA shall Engineer, Procure and Construct all components of the construction of a JEA-Owned line, and terminate line tensions onto a Interconnection-Customer supplied structure, and line currents onto the Interconnection Customer's NEMA 4-hole pad.

    b. For Transmission Lines that are not JEA -Owned, the former requirements shall not be in place, however, all of the requirements of the National Electric Safety Code, along with sound engineering practice, shall be in place. JEA shall require certain additional functions and components in order to preserve the operational integrity of the JEA Electric System, as described later.

7. JEA shall not own nor operate any Transmission Line that does not terminate into a JEA Transmitting Substation (on at least one end). JEA also will not own nor operate any Substation

Facilities that does not terminate at least one wholly owned transmission line, which line must terminate into the JEA Electric System.

Appendix III
Substation Engineering Standards Summary

1. Substation (Physical) Engineering

   The following paragraphs provide a brief summary of JEA's Standard Practices for Substation Design. Further information will be provided to the Interconnection Applicant upon request, after receipt of a valid request for interconnection. JEA recommends, but does not require, the interconnection customer to consider these standards when developing designs for its substation, if any.

   1.1. Substation Topography: Substation Topography is developed by the JEA System Planning Section, based upon all of the following;

      1.1.1. NERC and FRCC planning requirements for such things as breaker failure, bus fault, etc.

      1.1.2. JEA System Operations switching requirements.

      1.1.3. Compatibility with surrounding substations.

   1.2. Substation Site Civil Engineering: JEA performs all of the following in the construction of it's Transmitting Substations:

      1.2.1. Clearing, Grubbing and Grading to produce a compacted site that can be drained to on-site storm water storage in a manner consistent with the regulations of the Florida Department of Environmental Protection.

      1.2.2. Landscaping, buffers, and Irrigation consistent with the City of Jacksonville (COJ) Landscape Ordinance.

      1.2.3. Fencing consistent with the COJ and NESC Codes.

      1.2.4. Plumbing, water, and sewer consistent with COJ codes – every substation contains a basic water closet with toilet and sink for staff use.

      1.2.5. Control buildings to contain all Protection, Control and Communications equipment, standard JEA construction of Concrete Masonry Construction with built up hollow core roof. Separate battery room and water closet.

      1.2.6. Rocked Structure Yard with Asphalt paved circumferential asphalt drive. Standard drainage includes elevated grade rocked structure area surrounded by inverted-crown asphalt road with catch basins and drainage facilities to a suitable retention facility.

      1.2.7. Foundations are chosen as the more economical of spread footer or drilled pier design, with non-hooked anchor rods, to meet the load requirements of supporting structures. Foundations for transformers and breakers containing less than 12,000 gallons of oil are slab on grade. SPCC Oil handling is performed by pond skimmers and, in special cases other instruments for containment.

   1.3. Substation Structure Engineering

1.3.1. JEA procures all substation structures from a bulk-bid package that is bit out approximately every three years. All Steel is hot-dipped galvanized, either square tube or folded plate, custom designed, fabricated, and assembled on site (shipped knocked down) to support all design loads.

1.3.2. All JEA design wind loads are for 120 mph winds, due to JEA's initiative to storm-harden it's electric system critical assets.

1.3.3. Structure engineering is designed to withstand available fault currents, and due to JEA's highly interconnected system, JEA has high fault currents. Whenever practical, JEA designs structure to support bus under fault currents that equal the breaker fault currents.

1.4. Switches, Insulators, and Buswork

1.4.1. JEA procures all substation Switches, Insulators, and Buswork from a bulk-bid package that is bid out approximately every three years. The packager is responsible for final designs of these components, which designs are subject to the review of a JEA Professional Engineers.

1.4.2. JEA uses 3", 4", or 5" circular bus as a standard for Transmission Voltages in Substations, depending on loads. All JEA design wind loads are for 120 mph winds, due to JEA's initiative to storm-harden its electric system critical assets. JEA Design Fault Currents are for maximum available fault currents, or, where practical, the limit of the circuit breakers.

1.4.3. JEA also procures standard switches as 3PST G.O.A.B. Switches, two per piece of equipment, as maintenance disconnects. Incoming Transmission Lines have switches for safety grounding.

1.4.4. Transmission Bus Insulation levels and clearances are consistent with IEEE C57, NESC and RUS Substation design standards, for the following voltages 69 kV (350 kV BIL), 138 kV (650 kV BIL), and 230 kV (900 kV BIL)

1.5. Circuit Breakers:

1.5.1. JEA procures all Transmission Circuit Breakers from a bulk-bid package that is bid out approximately every three years. This means allows for economies of scale over time as JEA takes advantages of reduced efforts for design, maintenance and maintenance training, and stocking of spares. JEA stores minimal (emergency service) spares and orders all major materials as needed.

1.5.2. JEA uses Gas Circuit Breakers, dead-tank, spring-spring, dual trip coil, with integral relay-class multi-ratio current transformers.

1.5.3. Typical Ratings are 2000A steady state, 40, 50, or 63 kA symmetrical interrupting duty, and having withstand potential equivalent to the bus insulation levels.

1.5.4. Circuit Breaker interruption time is determined by System Planning, and is subject to available industry-standard ratings.

1.6. Transformers

1.6.1. JEA procures all Transmission Autotransformers from a bulk-bid package that is bid out approximately every three years. This means allows for economies of scale over time as JEA takes advantages of reduced efforts for design, maintenance and maintenance training, and stocking of spares. JEA does not store spare autotransformers and such transformers have long lead times.

1.6.2. JEA uses oil-filled core-type non-blanket (conservator) construction transformers, with integral relay-class multi-ratio current transformers.

1.6.3. Typical Ratings are 120/160/200 MVA and 240/320/400 MVA.. JEA may elect single-phase autotransformers for very large transformation applications.

1.6.4. JEA specifies all autotransformer tap changers and manufacturers in the current bid documents..

2. Protection and Control Standards Summary

JEA uses standardized protection (relaying) and control (Supervisory Control and Data Acquisition or SCADA) systems in all substation. These systems consist of components which are largely typical of electric utilities, and include the following sub-systems;

2.1. Transmission Line Protection, Data Acquisition, and Control:

2.1.1. JEA uses line differential relays (primary relaying) and step-distance relays (backup) for protection of Transmission lines. These two relays use separate, redundant cabling and trip coils for breaker signaling.

2.1.2. The presence of line differential relays (primary relaying) requires high speed telecommunications channels. This requirement is addressed in a subsequent subsection of this Appendix.

2.1.3. JEA uses either of the relays to telemeter data acquisition for SCADA purposes, to include the status of the breaker, current measures, gas pressures, and other signals as needed.

2.1.4. JEA uses either of the relays to telemeter data non-protection control signals for SCADA purposes, to include the tripping and closing. Tripping and closing can also be accomplished at the Substation Control Panel and at the breaker itself.

2.1.5. Transmission Interconnections also include Synchronism Check (blocking close for invalid phase, phase difference, or phase acceleration) and Out of Step protection. JEA does not reclose tie lines automatically.

2.2. Substation Bus Protection and Data Acquisition

2.2.1. JEA uses redundant bus differential relays for protection of Transmission-Level Buses. These two relays use separate, redundant cabling and trip coils for breaker tripping of those breakers connected to the bus.

2.2.2. Depending on Substation topography, JEA may use any combination of low impedance or high-impedance relays to detect bus faults. The more common applications use double high-impedance relays for bus protection.

2.2.3. JEA uses independent relays and lockouts, one each per breaker on each bus (For example, at time of original writing, JEA is using the SEL-352 for breaker control during breaker failure).

2.3. Substation Breaker Control and Failure Protection

JEA uses industry-standard breaker failure and control schemes as follows;

2.3.1. Breaker Control: Breaker Control is accomplished via a Breaker Control Relay for SCADA control. Breaker Control relays are also used to detect a breaker failure.

2.3.2. Breaker statuses and insufficient gas pressure is communicated through a Breaker Control Relay.

2.3.3. Breaker Failure operates a panel-mounted lockout relay that signals the tripping of appropriate other breakers as well as directing a transfer trip via communications path.

2.4. Autotransformer Control and Protection

2.4.1. JEA uses bus differential relays for protection of Transmission-Level Autotransformers. JEA uses high-side and low-side over current relays as a backup to the differential relays. These two relays use separate, redundant cabling and trip coils for breaker tripping of those breakers connected to the Autotransformer. Autotransformers are always protected by separate high and low side gas circuit breakers.

2.4.2. Auto Transformer tap changers are controlled via Relays installed for that specific purpose.

(End of Appendix III)