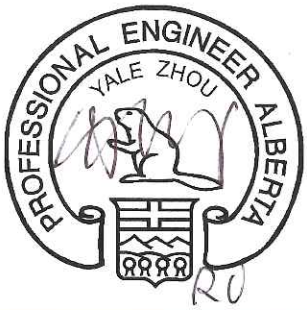
Functional Specification

Fortis Jenner 275S Upgrade



(Project Number 1692)

Issued to:

AltaLink Management Ltd., (the **legal owner** of the **transmission facility**), and to

FortisAlberta Inc. (the **market participant**)

February 12, 2016

R0

	Name and Title	Signature	Date
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Functional Specification Revision History

Revision	Description of Revision	Author	Date
R0B0	For comments	Yale Zhou	January 26, 2016
R0B1	Updated as per comments	Yale Zhou	February 1, 2016
R0	Final issuance	Yale Zhou	February 12, 2016

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1 PURPOSE

(1) The purpose of this document (the "Functional Specification") is to set out the technical specifications and requirements and approved variances issued by the AESO to the **legal owner** of the **transmission facility**, **AltaLink Management Ltd.**, and the **market participant**, **FortisAlberta Inc**., related to the design, construction, development and commissioning of certain new or modified facilities (the "**Project**") that have been proposed for or are related to a physical facilities connection with the **interconnected electric system** (the "Purpose").

(2) This Functional Specification is issued for the Purpose only, and the **legal owner** of the **transmission facility** and the **market participant** must comply with the Functional Specification provisions.

(3) The AESO is not responsible for any facilities designed by or for any third party, or installed on a third parties behalf, to accomplish the connection of the **Project** facilities.

(4) This Functional Specification includes:

(i) certain specific engineering, technical and functional requirements for the **Project**;

(ii) the requirements to comply with **ISO rules**, including OPPs, **reliability standards**, technical standards, and **ISO tariff** provisions, (the "Authoritative Documents");

(iii) the electrical system environment in which the connecting facilities must be designed and operated; and

(iv) any approved variances from requirements set out in any applicable AESO Authoritative Documents.

2 INTERPRETATION AND VARIANCES

(1) Subject to subsection (2), any revision or variance to any of the Functional Specification provisions by the **legal owner** of the **transmission facility** or the **market participant** is prohibited.

(2) The **legal owner** of the **transmission facility** or the **market participant** may make application, jointly or individually, in writing to the AESO requesting a variance to this Functional Specification, and the AESO may in writing approve of the variance after the AESO has completed an analysis of the implications to the **interconnected electric system** with respect to the requested variance.

(3) Words or phrases appearing in bold have the meanings set out in the *Consolidated Authoritative Document Glossary*.

3 PROJECT OVERVIEW

On August 18, 2015, the **market participant** requested to AESO to install one (1) new 25 kV feeder breaker at the Jenner 275S, located in the Empress Planning Area (Area 48), to address the distribution service deficiencies in the area. Two (2) additional 25 kV breakers are also proposed at Jenner 275S to meet reliability requirement.

The Demand Transmission Service (DTS) capacity contract will remain same as before (65.5 MW)

The requested in-service date (ISD) for the project is August 1, 2017.

4 FORECAST OF FUTURE DEVELOPMENT IN THE PROJECT AREA

Refer to AESO's website (www.aeso.ca) for the details of future development in the project area.

5 SCOPE OF WORK

5.1 General

(1) The **legal owner** of the **transmission facility** and the **market participant** must complete all engineering, design, land or land-use acquisition, siting, public consultation, applicable regulatory approvals and permits, material procurement, construction, commissioning, and associated permitting requirements for the **Project** facilities.

(2) The **legal owner** of the **transmission facility** and the **market participant** must coordinate with each other as required on all project facility design details, including protection and control, grounding, insulation, **point of connection**, and site layout with proper consideration of maintenance coordination.

(3) The **legal owner** of the **transmission facility** and the **market participant** must develop joint operating procedures and any connection agreements as required such that all connecting **transmission facilities** will operate safely and reliably.

(4) The **legal owner** of the **transmission facility** and the **market participant** must deliver to the AESO all final design and as-built **Project** facility information and records in the format and content required by the AESO, to enable the AESO to update and maintain its transmission technical records and system models.

(5) The **legal owner** of the **transmission facility** and the **market participant** must submit the **Project** information and records referred to in subsection (4) above, under the professional stamp and signature of a registered professional engineer in Alberta who assumes responsibility for the preparation and accuracy of the content of the information and records.

(6) The **legal owner** of the **transmission facility** and the **market participant** must mutually agree on each party's roles and responsibilities regarding inspection of all facilities of the **Project** prior to energization of the facilities.

(7) The **legal owner** of the **transmission facility** and the **market participant** must ensure, prior to energization of any or all **Project** facilities, that the facilities to be energized have been inspected by qualified personnel in accordance with industry standards and practices, so that the facilities are declared to be:

(a) Safe for operation; and

(b) In compliance with this Functional Specification, Alberta Reliability Standard and any Authoritative Documents for which the **Project** must comply

(8) No **Project** facilities are to be energized until an energization authorization has been issued by the AESO in accordance with the **ISO rules**.

5.2 Compliance with AESO Authoritative Documents

The **legal owner** of the **transmission facility** and the **market participant** must comply with the Authoritative Documents provisions which are applicable to the **Project** and which must be incorporated in to the design, construction, commissioning and operation of the connecting facilities and other connection **Project** work, including but not limited to, these provisions contained herein:

- AESO Operating Policies and Procedures

- AESO Alberta Reliability Standards
- AESO Measurement System Standard Rev. 1 (dated September 18, 2007).[1]
- AESO Generation and Load Interconnection Standard (dated September 19, 2006).[1];
- **ISO Rules**, including but not limited to:
  - Section 502.3, Interconnected Electric System Protection Requirements (effective March 27, 2015)
  - Section 502.4, Automated Dispatch and Messaging System and Voice Communication Systems Requirements (effective March 27, 2015)
  - Section 502.8, SCADA Technical and Operating Requirements (effective March 27, 2015)
  - Section 9.1, Transmission Facility Projects (effective September 24, 2013)

5.3 Modeling Data Requirements

All modeling data shall be provided per the Information Transmission Modeling Data Requirements (dated February 6, 2014).

5.4 Substation Equipment Specifications

All new substation equipment must meet the following minimum specifications:

- Temperature rating of -50ºC for all outdoor equipment.
- Equipment maximum and minimum continuous voltage ratings as indicated in Table 4.
- Minimum continuous equipment current ratings as indicated in Table 1.
- Equipment maximum fault level: 31.5 kA for 138 kV and 40kA for 240kV.

Table 1

Minimum Continuous Equipment Current Ratings (A)

Component	25 kV	138 kV	240 kV
Main Bus[1)]	1200	1200	2000
Cross Bus[2)]	600	600	2000
Feeder[3)] or line terminal[4)]	600	600	2000

1) Main bus includes all sections of ring bus scheme and single bus of simple bus scheme.
2) Cross bus includes diameter sections of breaker and a half or breaker and third schemes.
3) Feeder includes all equipment from the connection at the low voltage bus to the riser pole.
4) Line terminal includes all equipment and conductor from the transmission line to the line breakers.

5.5 Scope of Work for the Legal Owner of the Transmission Facility

(1) General Requirements

[1] The AESO considers this standard to remain in effect notwithstanding the statement in clause 1.5 in the standard. Efforts to revise the standard are currently underway through an industry work group.

- Coordinate with the **market participant** to develop necessary connection agreements and joint operating procedures.
- Ensure project safety is appropriately managed through all stages of the project.
- Undertake all required grounding studies, testing and mitigation as required for electrical safety and any mitigation for electrical effects on communication systems.
- Complete insulation coordination studies and coordinate with **market participant** as required to establish appropriate insulation levels.
- Complete all site preparation, foundations, grounding, bus-work, support structures, termination structures, duct work and cabling as required for the proposed additions.
- Coordinate all alignments with the **market participant** for the 25 kV feeder connections.

(2) Substation Jenner 275S – Appendices 7.2 - 7.3

Substation Equipment and major construction

- Install one (1) new 25 kV feeder with associated breaker and switches.
- Install two (2) 25 kV isolating circuit breakers with associated switch.

Protection and Control

- Complete system protection coordination studies and coordinate with adjacent substations and the **market participant** as required to establish settings appropriate for the facility additions and ATS operations.
- Install appropriate protection for the 25 kV facility additions.
- Install UFLS relays to meet load shedding requirement as per AESO OPP804.
- Install all other required protection equipment for the safe and reliable operation at Jenner 275S substation.
- Any frequency relays installed to protect equipment for off-nominal frequency operation must not be disabled for transmission system voltages that are below eighty percent (80%) of the rated voltage.

Telecommunication

- Review or upgrade if required the communication system and interfaces for tele-protection, SCADA, operational voice and data to ensure **ISO Rule** 502.4 requirements are met at Jenner 275S.

SCADA

- Update communication interface points if required such that SCADA data can be transmitted back to the AESO's System Coordination Centre (SCC) and Backup Coordination Centre (BUCC).

Revenue metering

- Install demand/energy meters as detailed in the AESO Measurement System Standard to measure power flow through the Measurement Point.

5.6 Scope of Work for the Market Participant

(1) General Requirements

- Coordinate with the **legal owner** of the **transmission facility** as required to perform insulation coordination, grounding studies, protection coordination, supervisory control and data acquisition
- The **market participant** is required to participate in the ATS under-frequency load shedding program as per AESO OPP-804. The **market participant** shall ensure that sufficient load is equipped with under-frequency load shedding relays that are capable of being armed in each frequency band to meet the program specifications, and have the scheme installed, tested, and commissioned appropriately as required
- Co-ordinate all alignments with the **legal owner** of the **transmission facility** as required to connect the **market participant**'s facility to the ATS
- Ensure connection project safety is appropriately managed throughout the project.

(2) Jenner 275S Substation – Appendices 7.2 - 7.3

Protection and control

- Complete protection coordination studies and coordinate with the **legal owner** of the **transmission facility** as required to establish settings appropriate for the **market participant** facility additions and ATS operations.

Revenue metering

- Provide the description of the measurement point location for the point of delivery/point of supply, and the acceptable installation options for revenue metering in order to report on the measurement point.

6 TRANSMISSION SYSTEM OPERATING CHARACTERISTICS

The **legal owner** of the **transmission facility** and the **market participant** must ensure all facilities are capable of operating in the following electrical environment.

6.1 Short Circuit Current Levels

(1) The short circuit current levels set out in Table 2 and 3 have been developed by the AESO based on information provided by the **legal owners** of the **transmission facility,** any connecting **generating units,** and adjacent operating areas. Available fault current levels will continue to increase as generation, transmission, and system inter-ties are added to the **interconnected electric system**. The **legal owner** of the **transmission facility** and **market participant** must continue to review the fault levels and their equipment ratings for adequacy.

(2) Any future equipment upgrades or protection system setting changes required due to increasing fault levels are the responsibility of the **legal owner** of the **transmission facility** or the **market participant**, as applicable.

(3) The following assumptions were incorporated into the AESO short circuit current models:

(i) All expected Alberta generation is dispatched.

(ii) All transmission elements are in service.

(iii) The proposed project facility is connected as per this document.

(iv) $V_{base} = V_{bus}$, $MVA_{base} = 100$

Table 2: Summary of Short-Circuit Current Levels – Post-Connection (2017 WP)

Substation	Base Voltage (kV)	Pre- Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Impedance (R1 + j X1) (p.u.)	1- Φ Fault (kA)	Zero Sequence Impedance (R0 + j X0) (p.u.)
Cypress 562S	240	263.27	6.0	0.007553+j0.04345	6.4	0.003927+j0.036218
	138	141.37	8.9	0.008168+j0.047249	8.8	0.0044+j0.051652
Amoco Empress 163S	240	263.24	6.0	0.007398+j0.043168	6.0	0.006079+j0.044548
	138	141.33	8.8	0.008305+j0.047551	8.4	0.006882+j0.058304
Jenner 275S	240	262.14	7.7	0.006024+j0.033488	4.8	0.02267+j0.09299
	138	140.68	0.5	0.075281+j0.823503	0.4	0.045912+j1.392546
Ware Junction 132S	240	260.71	14.4	0.002908+j0.017823	12.7	0.004067+j0.024325
Wardlow 230S	138	140.59	0.5	0.107315+j0.886222	0.4	0.110819+j1.622477

Table 3: Summary of Short-Circuit Current Levels – Post-Connection (2025WP)

Substation	Base Voltage (kV)	Pre- Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Impedance (R1 + j X1) (p.u.)	1- Φ Fault (kA)	Zero Sequence Impedance (R0 + j X0) (p.u.)
Cypress 562S	240	253.07	6.3	0.006957+j0.039351	6.6	0.003901+j0.035658
	138	143.06	9.0	0.008539+j0.046835	8.7	0.004825+j0.054663
Amoco Empress 163S	240	253.07	6.3	0.006805+j0.039105	6.2	0.005993+j0.043786
	138	142.89	9.0	0.008634+j0.047006	8.3	0.007285+j0.061026
Jenner 275S	240	255.05	8.3	0.005481+j0.030271	4.9	0.022427+j0.091233
	138	137.82	0.5	0.075998+j0.78135	0.4	0.044956+j1.330603
Ware Junction 132S	240	257.02	17.1	0.002268+j0.014778	15.3	0.003295+j0.019642
Wardlow 230S	138	137.73	0.5	0.108034+j0.844127	0.4	0.109824+j1.560402

6.2 Voltage Levels

Table 4 provides the normal planned operating voltage range in the area of the proposed facility.

Table 4: Planned Operating Range

Substation Name and Number	Nominal (kV)	Minimum Limit (kV)	Normal Operating Minimum (kV)	Normal Operating Maximum (kV)	Maximum Limit (kV)
Jenner 275S	138	124	135	145	150
Jenner 275S	240	216	234	252	264

Notes:

1. The Normal Operating Minimum and Normal Operating Maximum are generally associated with Category A events and system normal.
2. The Minimum Limit and Maximum Limit are generally associated with Category B, C, and D events and system abnormal.
3. The new facilities must be capable of continuous operation at voltages up to and including the Maximum Limit.

6.3 Insulation Levels

(1) Table 5 provides the minimum required basic insulation levels for the **transmission system**. Station equipment with lower insulation levels may be used provided that protection and coordination can be maintained with judicious insulation design and use of appropriate surge arresting equipment.

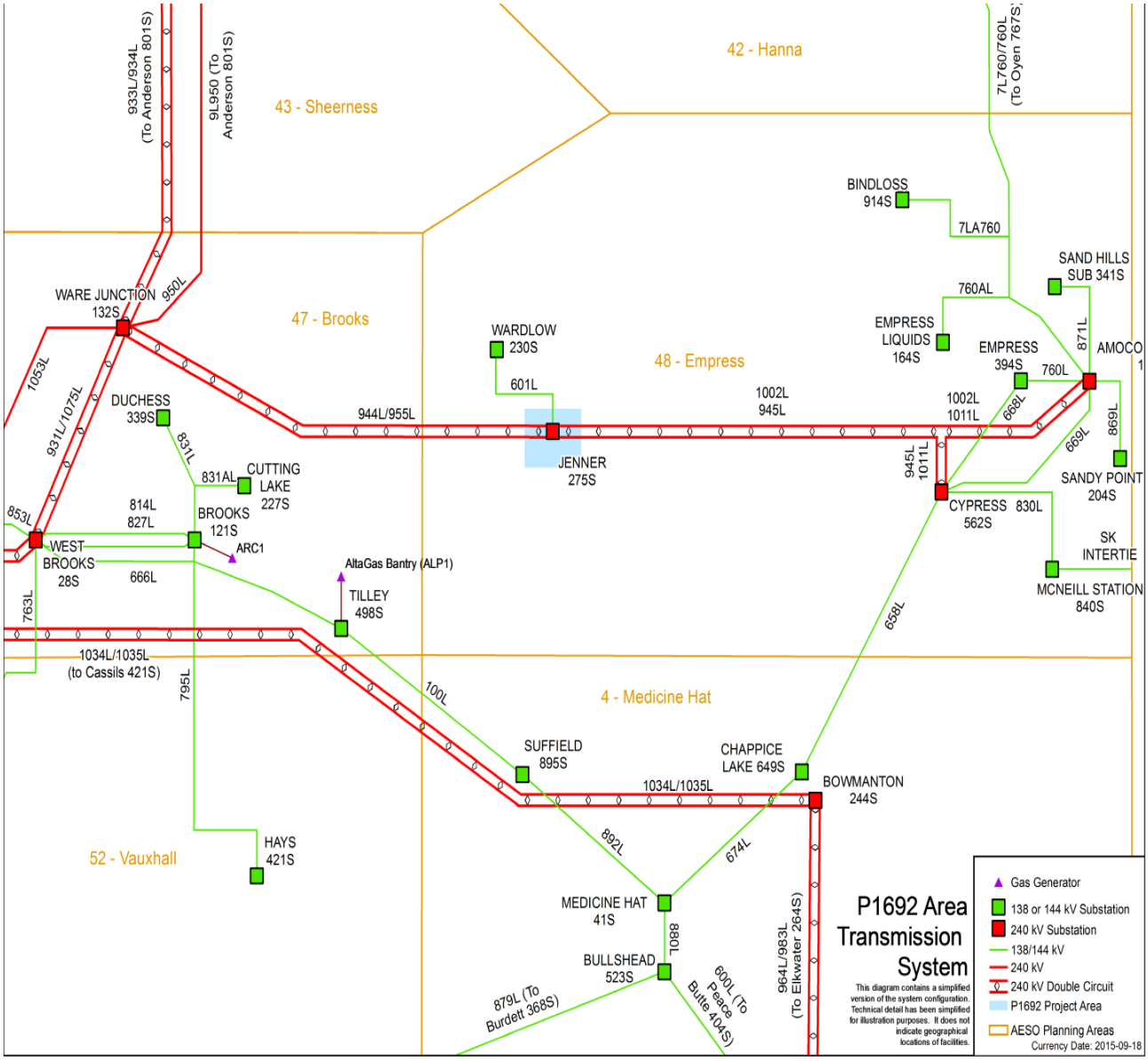
(2) For 25 kV circuit breakers where there is a grounded wye transformer and surge arrestors are installed a basic insulation level of 125 kV is acceptable.

Table 5: Basic Insulation Levels (kV)

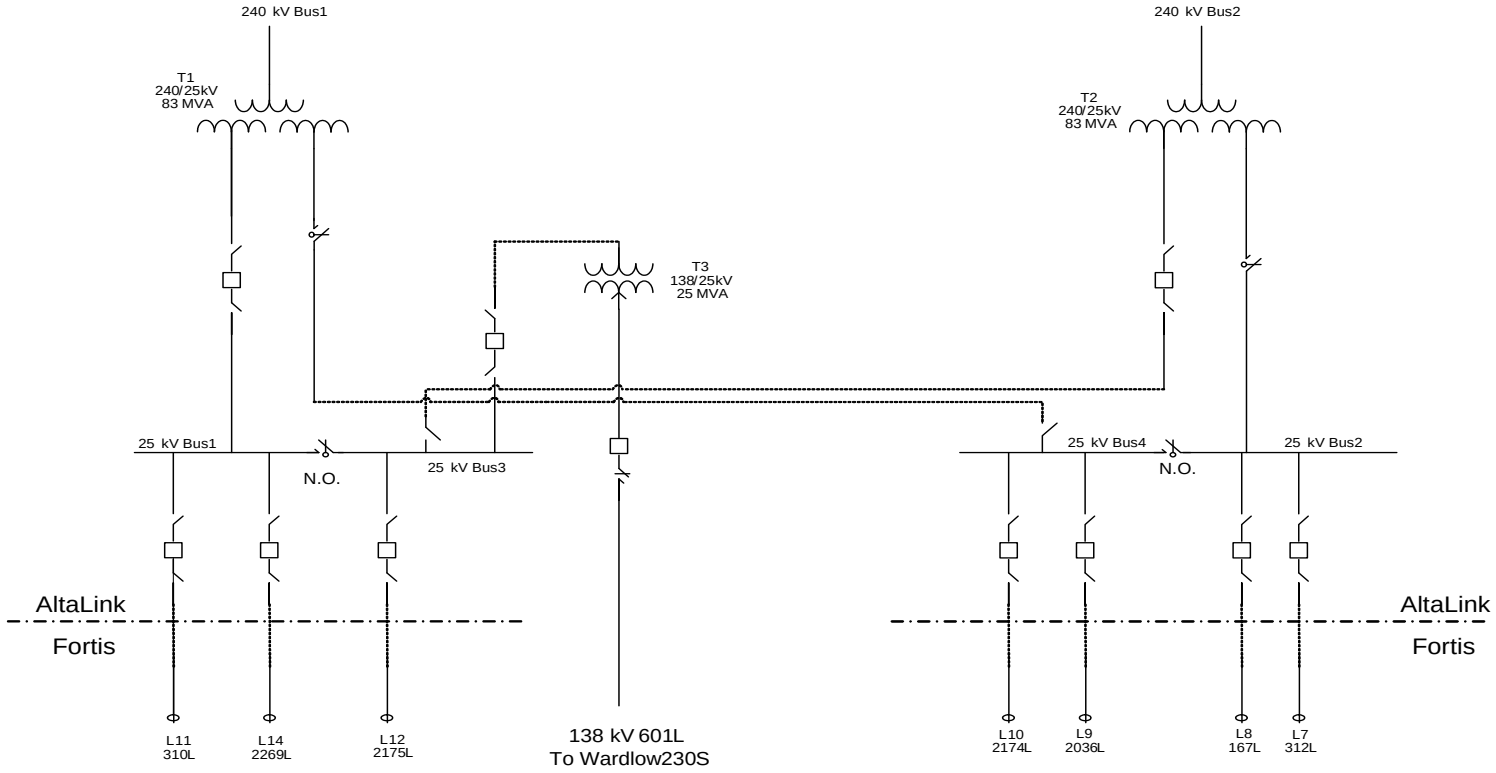
Nominal Voltage Classification (kV rms)	240	138	25
Station Post Insulators and Airbreaks	900	550	150
Circuit Breakers	1050	650	150
Current and Potential Transformers	1050	650	150
Transformer Windings (Protected by Surge Arresters)	850	550	125

7 APPENDICES

7.1 System Interconnection in the project area



7.2 Single Line Drawing – Jenner 275S Substation – Existing



Legend

- Circuit Breaker
- LTC Transformer
- Motorized Disconnect Switch
- Manual Ganged Disconnect Switch

Note

This single line diagram provides an illustration of a functional arrangement that would meet the need of the proposed project. The exact routing and configuration of the project may vary slightly from this configuration based on more detailed engineering, routing and siting information obtained from the legal owner of transmission facility and the market participant.

Jenner 275S Substation
Existing SLD (Partial)

1692-275S-SLD-01

7.3 Single Line Drawing – Jenner 275S Substation – Proposed