1. General

1.1 Scope Overview

This document covers the design, manufacture, supply, installation, commissioning, trial operation and operational support of the 350 MW Back-to-Back HVDC (VSC) Converter in voltage source converter configuration.

The Back-to-Back HVDC (VSC) Converter (located at Ayrum Substation) is to be connected to the electrical power system of Georgia via a 500 kV transmission line and the electrical system of Armenia on the 400 kV side.

The Back-to-Back HVDC (VSC) Converter shall be designed to provide amongst others the following functions:

- to control power in either direction (by remote or local control)
- to maintain continuous control of the 50 Hz AC voltage at each side of the converter at the AC busbars to which it is connected
- to make provision for electromechanical damping to the AC power systems on each side
- to provide reactive power at the points of connection.

1.2 Work included in the Scope

The Contractor shall design, manufacture, install, test and commission all the equipment of their supply for the 350 MW Back-to-Back HVDC (VSC) Converter. The work shall include all equipment and accessories to ensure a fully functional and complete installation and shall include but not be limited to the following (based on the design and topology of the converter):

- solid state valve equipment complete with all solid state devices, heat sinks and auxiliary equipment for gating, monitoring, voltage grading and protection
- HVDC Transformers, including appropriate phase shift requirements for harmonic elimination, air core reactors, or other equipment required for the Contractor’s design
- a 500 kV point of connection to the 500 kV AC switchyard. 500 kV filters, switched reactor, capacitor banks etc., if required, shall be connected to the tie between the HVDC Transformers and the 500 kV point of connection.
- a 400 kV point of connection to the 400 kV AC switchyard. 400 kV filters, switched reactor, capacitor banks etc., if required, shall be connected to the tie between the HVDC Transformers and the 400 kV point of connection.
- pre-insertion circuits between the HVDC Transformers and the converters for 400 kV and 500 kV side connections based on Contractor’s design and converter topology

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- cooling system for converters comprising of a re-circulating closed cycle, de-ionized, water system (primary circuit) and a re-circulating closed cycle (glycol water mixture), water system (secondary circuit) complete with all pumps, water purification system and control and protection system
- converter hall air conditioning system
- local and remote operator control and monitoring equipment
- control and protection for all converter equipment in Contractor's supply
- harmonic filters and reactive power banks as needed to meet performance requirements of the specification.
- DC capacitors for converters as required for performance and rating requirements of the specification
- metering equipment
- alarm sequence of events recorder and digital transient fault recorder
- circuit breakers and other switchgear for connecting the converter equipment and associated HVDC Transformers to the AC busbars
- circuit breakers and other switchgear if required for AC filter banks and shunt reactive power banks
- DC isolating and grounding switches
- potential transformers for control and protection of converters
- current transformers for control and protection of converters
- current transformers for protection of AC filter banks and shunt reactive power banks
- surge arresters for protection of converter equipment and HVDC Transformers connected to the converters
- surge arresters for protection of AC filter banks and shunt reactive power banks
- dual batteries, battery chargers and uninterruptible power supplies required for the control and protection of converters
- all station power transformers, load centers and motor control centers required for complete redundant operation
- on-site emergency back-up auxiliary electrical supply with automatic switchover
- factory tests as required by this specification and standards
- dynamic performance studies, protection studies, harmonic performance studies and transient performance studies
- commissioning and acceptance tests:
  - provide all testing services for factory tests on all major equipment
  - provide all testing services for on-site commissioning tests
- spare parts
- documentation and manuals
- training program
- models of the Back-to-Back HVDC (VSC) Converter for PSS/E and PSCAD/EMTDC simulation software programs
- station ground mat and grounding of all equipment supplied by the Contractor
- power and control cables and connections between individual pieces of equipment supplied by the Contractor.