

4.11 INTERFERENCE AND AUDIBLE NOISE LEVELS

4.11.1 GENERAL

The Contractor shall take all the necessary precautions to ensure that there shall be no mal-operation, damage or danger to any equipment, system or personnel due to electromagnetic or electrostatic interference effects. The converter terminal(s) shall neither damage or cause mal-operation of the dc control and protection system. The Contractor shall take all the necessary precautions to prevent harmful interference which maybe generated by the converter operation to the following systems over the specified frequency ranges:

- a) Power line carrier (PLC) - 40 kHz to 500 KHz
- b) Radio communication systems - 0.15 MHz to 300 MHz
- c) Television systems - 30 MHz to 1000 MHz
- d) VHF, UHF & microwave radio systems.

The contractor shall carry out RI and PLC interference study based on the available site data furnished by employer. This data shall be furnished to contractor within one month from award. In case, the new study shows specified PLC and RI limits are exceeded, the contractor shall show in the study report that the noise from equipment under contractor scope, are not exceeding the pre-refurbishment limits mentioned in original study. If contractor is unable to show the same, contractor shall carry out required modification in equipment under his scope to meet the pre-refurbishment limits mentioned in original study.

The Performance of the existing equipment / measures to suppress RI and PLC noise is outside contractor scope.

Further measurements for PLC and RI levels shall be carried out for pre-refurbishment and post-refurbishment for same active power conditions with atleast one block in operation.

4.11.2 RADIO INTERFERENCE (RI)

a) This RIL criteria shall be achieved at all frequencies within the range of 0.15 MHz-to-300 MHz, and with the complete two ~~500~~ 250MW 12-pulse bridges operating at any dc power transfer level up to and including rated value.

b) Measurements of actual RIL at each station shall be made by the Contractor, at points along the above defined contour and at other critical points. For transmission lines, measurement shall be made at a distance of about 1 Km from each station at the mid- point of a span.

Measurements shall be made with the ac switchyard and ac transmission lines energized and the HVDC system in operation.

Measuring instruments shall comply with the American National Standard Institute Specifications for Electromagnetic Noise and Field Strength Instrumentation 10 kHz to 1 GHz, ANSI C63.2 (1 by 160 ms charge & discharge times, 9 kHz bandwidth).

The method of measurement shall comply with IEC Standards 61000-4-6 and 61000- 4-3 in the frequency range 150 kHz to 1000 MHz.

Measurements shall be made at a quasi-peak setting and shall include at least three complete frequency scans at each selected location. The RIL at a particular frequency and location shall be considered to be the average value of all measurements taken at that frequency and location.

The measuring procedure shall be submitted to the Employer for approval prior to measurements being made and a final report shall be submitted after completion of all measurements.

4.11.3 400 KV AC EQUIPMENT

Maximum radio interference voltage for frequency between 0.5 MHz to 2 MHz at 1.1 times of maximum DC voltage for DC system, 320 kV RMS for 400 kV system and 156 kV RMS for 220 kV system and 92 kV RMS for 132 kV system shall be 2500, 1000, 1000 and 500 micro Volt respectively.

The Contractor shall provide information on the noise spectrum at the termination of the HVDC converter station in the frequency range 40 kHz to 500 kHz.

Information on existing and planned power-line carrier systems shall be given to the Contractor by the Employer.

4.11.4.1 INTERFERENCE STUDY

During the detailed design stage, the Contractor shall perform a detailed interference study, based on final data to be submitted at that time by the Employer, to determine the extent and severity of possible PLC and open-wire carrier interference from the HVDC system and provide details of necessary carrier frequency and/or other mitigating measures necessary to avoid harmful interference. The interference study calculations shall be submitted to the Employer and shall include, but shall not be limited to, the following:

- a) Probable normal carrier frequency noise levels, plus prediction of the frequency of occurrence and duration of guaranteed maximum carrier frequency noise levels on the ac and dc side of the converter valves.
- b) Sensitivity to interference from the HVDC facility to each PLC and open-wire carrier system. Predicted dB decrease in normal and worst case signal-to-noise ratios for each PLC and open-wire carrier system due to interference from the HVDC system, and associated dynamic compensation, if any.
- c) Limit values for carrier frequency noise on the HVAC busses that are necessary to avoid harmful interference to the carrier systems studied.
- d) Detailed designs and noise reduction performance calculations for additional carrier frequency filtering required to meet the limits derived in (c) above.
- e) Carrier-frequency mutual coupling loss characteristics between the various transmission lines.

4.11.4.2 TESTS

A test programme describing the method to make measurements of actual carrier noise levels produced by the converter terminals shall be submitted by the Contractor for the approval of Employer. These measurements shall be used to

demonstrate compliance with the above requirements.

The measurements of actual noise levels in the carrier-frequency spectrum due to operation of the converter station and at other locations in accordance the test programme shall be performed by the Contractor.

4.11. 5 INTERFERENCE WITH CONTROL SYSTEM AND OTHER COMMUNICATION SYSTEMS

4.11.5.1 DESIGN CRITERIA

In order to meet the above requirements in the converter building, the Contractor shall submit calculations to the Employer including, but not limited to, the following:

- a) The predicted radiated and conducted noise levels from the converter valves in the frequency spectra of concern inside the valve halls.
- b) The allowable noise levels in the various areas of the converter building, including control room and other identifiable communications rooms in the HVDC station, which shall meet the station interference criteria for communication and control systems.
- c) The type of noise interference mitigation measures and their performance details which the Contractor shall provide as part of the scope of supply to reduce the sensitivity to interference of Contractor-supplied control and other equipment in his scope.

4.11.5.2 TESTS

The Contractor shall perform measurements of actual noise levels, in the frequency spectra of concern, produced due to operation of the converter station and of actual interference to communications and control equipment at site in accordance with a test program prepared by the Contractor and approved by the Employer.

4.11.6 AUDIBLE NOISE:

The Contractor shall limit the audible noise for various areas of the converter station and buildings in his scope of work to the following values and demonstrate by calculation and site measurement that the specified levels shall not be exceeded
Mechanical Equipment Indoor areas having long term access (measured at 2 meter distance) : 80dBA

Equipment in outdoor areas (measured at 15 meter distance) : 75dBA