




सत्यमेव जयते

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**


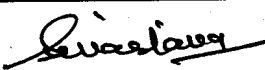
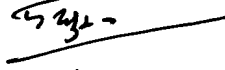
**FUNCTIONAL REQUIREMENT SPECIFICATION (FRS)
FOR REPAIR OF GATE UNIT OF GTO BASED TRACTION
CONVERTERS OF 3-PHASE ELECTRIC LOCOMOTIVES Type
WAP5, WAP7&WAG9**

SEPTEMBER' 2015

Approved by	 23.9.15
EDSE(Co-Ord)	Signature

Issued by

**Electrical Directorate
Research, Designs and Standards Organisation
Manak Nagar, Lucknow-226011**

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FUNCTIONAL REQUIREMENT SPECIFICATION (FRS) FOR REPAIR OF GATE UNIT OF GTO BASED TRACTION CONVERTERS OF 3-PHASE ELECTRIC LOCOMOTIVES TYPE WAP5, WAP7&WAG9

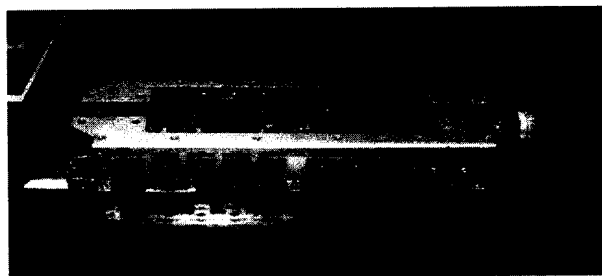
1.0. General:

- 1.1** Indian Railways imported 22 WAG9 locomotives and 11 WAP5 locomotives in 1997-98 from M/s. ABB, Switzerland. Later on, CLW started the manufacturing of these locomotives by procuring Power Converter, Auxiliary Converter & Control Electronics from ABB, Switzerland. These equipments were indigenized later on by M/s. BT, Vadodara, M/s. NELCO, M/s. BHEL and M/s. CGL through transfer of technology. This Functional Requirement Specification (FRS) is issued to serve as an essential guideline to repair of valve sets of traction converter for 3-phase electric locomotives. The firm should satisfy themselves about having complied with the technical requirements and other infrastructure.

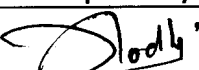
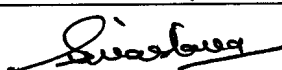
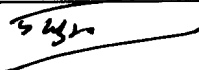
2.0 Background

The Gate Units (GUs), type GVA 587 A01 are designed for triggering Gate Turn-Off (GTO) thyristors fitted in traction converters of three phase electric locomotives. The GU supplies the turn on pulse and controlled continuous gate current to keep the thyristors in conductive state; and the turn off pulse and negative continuous gate voltage for keeping the GTO in permanently blocked condition. The GU supply is electrically isolated by a transformer while the signaling circuits are isolated using Optical fibre cables. The GU essentially consists of a clocked current source and a switching transistor that switches the gate of GTO during ON period. During turn OFF period, the circuit generates the powerful, fast rise current pulse required for a reliable GTO turn off, using the capacitor turn-off principle. Electrolytic capacitors charged to -15 volt (w.r.t cathode voltage) are abruptly switched to the gate of GTO.

To ensure the blocking ability of the GTO, the field effect transistors remain turned on till the next turn ON command. Typical photograph of Gate unit used in traction converter is shown in below for better appreciation.



Gate Unit

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There have been several failure cases of Gate units. The failure of gate unit sometimes results in failure of GTO and isolation of traction converter.

3.0. Scope:

This specification covers the repair of Gate unit for traction converters (Identification of failed components in gate unit, repairing /replacement of defective components) and testing of gate unit.

4.0. Compliance of RDSO's STR:

The potential bidder must give clause wise compliance of RDSO's STR for repairing of gate unit of traction converters of three phase locomotives.

5.0. Testing:

The testing on repaired Gate unit shall be carried out as per ABB document no HUCD 604130 & HUCD 685035.

6.1 Test protocol for repaired Gate Unit:

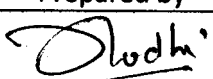
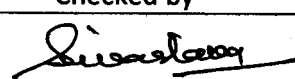
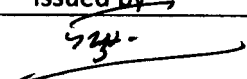
Firm shall submit the test protocol for testing the repaired Gate Unit to RDSO for approval. The testing shall be carried out by inspection official as per approved test protocol.

6.0. QAP and Test Schedules :

Before offering prototype repaired unit for testing, final QAP and test schedules shall be submitted by the successful bidder to RDSO for approval

7.0. Methodology of development:

- 7.1. Repaired gate unit shall be tested as per approved test protocol;
- 7.2. After successful tests on prototype units of gate unit, one loco set quantity, shall be cleared for fitment trial in locomotive;
- 7.3. Successful fitment trial shall be followed by field trial on 1 loco set quantity for 6 months in actual service;
- 7.4. After Successful field trial for 6 months, firm shall be approved for repair of gate unit for traction converters fitted in WAG9/WAP7/WAP5 locomotives;
- 7.5. Test protocol for prototype tests, field trials, shall be jointly decided in consultation with RDSO.

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