

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**



सत्यमेव जयते

**SPECIFICATION  
FOR  
VIGILANCE CONTROL DEVICE  
TO BE USED IN  
25 kV AC TAP CHANGER LOCOMOTIVE**

**SPECIFICATION No. RDSO/2008/EL/SPEC/0025/Rev.6 (Sep-2012)**

<b>Approved by</b>	
<b>Sr. EDSE/ RDSO</b>	

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S.N.	Date of Revision	Page Nos.	Revision	Reasons for Revision
1.	23.06.03	All	1	Based on CR suggestions
2.	28.05.04	2,9,11 & 13	2	Inclusion of data logging and interfacing
3.	02.12.08	4,6,7,8,10,11,12 & 13	3	Inclusion of LCD display and amendment 1 & 2
4.	11.01.09	3,5 to 15,17,18 & 21 to 26	4	Standardisation as per VCD of three phase loco and to ensure interchangeability between different makes
5.	22.03.10	7,10,11,12,13, 14, 15, 16, 19, 22, 23, 24, 27, 28	5	Inclusion of Rly Bd comments.
6.	.09.12	3, 4, 5, 6,11-17, 22, 29	6	Specification revised to delete chapter-4 related with scope of supply, and clauses related name of suppliers, technical para modified to make timing cycle similar to 3 phase locomotives, clause related with amendment 1 deleted and other minor technical changes.

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## CHAPTER 1- GENERAL

### 1.0 SCOPE & OBJECT:

A vigilance feature to monitor the alertness of the driver exists in three phase drive locomotive. AC tap changer locomotives have been provided with Vigilance Control device (VCD). The VCD is for monitoring alertness of the engine crew through a multi-resetting system which gets reset by specified normal operational activities of the crew, in addition to acknowledgement of the vigilance check by pressing a pedal switch or push button provided for driver and assistant driver respectively for this purpose. Absence of the normal driving functions or the acknowledgement at specified intervals shall activate vigilance control system to flash an indication which if still not acknowledged shall cause audio warning. If audio warning is also not acknowledged, it shall result in emergency brake application. This shall also take care of problem of operation of locos by unauthorised persons getting into unattended loco cab. This shall be designed as a fail safe system.

1.01 This specification is intended to define the technical requirements of Vigilance Control Device (VCD) to be used in existing and new tap changer locomotives and the interface requirements. The commercial conditions such as eligibility criteria, vendor specific conditions, vendor approval, warranty clause, AMC clause and scope of supply covering Supplier's responsibility and Railway's responsibility shall be separately prescribed by Zonal Railways/purchaser as a part of special conditions of purchase order/works contract.

1.02 This revised specification supersedes the earlier technical specification No. RDSO/2008/EL/SPEC/0025/Rev.5 (March' 2010) with amendment 1 dated 24-01-11.

### 1.1 DEFINITIONS:

RDSO	- Research Designs & Standards Organisation
Tenderer	- Firm/companies participating in the tender
Supplier	- The qualified tenderer for supply of the equipment
Railways	- Indian Railways Administration
CLW	- Chittaranjan Locomotive Works
AMC	- Annual Maintenance Contract

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**1.2. SUBMISSION OF DESIGN AND DESIGN APPROVAL:**

1.2.1 The design shall be developed as per requirement given in the specification. The detailed design as per following details, shall be submitted by the Supplier to RDSO for scrutiny and approval of the design features before commencing of the manufacturing.

- Quality Assurance Plan (QAP)
- Bill of Material (BoM)
- Schematic Circuit
- Functional Description
- System design concept
- Data sheets for components/devices and other equipment proposed
- Mechanical interface diagram (Outline General Arrangement)
- Modifications needed in the present locomotive to accommodate the offered system
- Salient features and advantages of the offered system
- Recommended list of spares for 3 year maintenance after warranty
- List of special tools, jigs and fixtures needed for assembly, testing, commissioning, maintenance and repair.
- QAM (Quality Assurance Manual)
- Test protocol with procedure of testing.
- ISO 9000 certification.
- Detailed operation and maintenance manual, installation drawings shall also be supplied with the designs.
- Vendor list for subsystems
- Procedure for parameter alteration, software downloading, diagnostic uploading, analysis etc.

1.2.2 The suppliers shall, however, be responsible for performance of complete system.

1.2.3 The supplier shall be responsible for carrying out all the modifications at his cost on any part of the equipment during the period of warranty required for satisfactory operation of the equipment as per technical specification. For any technical decision the final authority from the purchaser's side is RDSO.

**1.3 REFERENCE TO VARIOUS SPECIFICATIONS:**

1.3.1 IEC-60571(1998-02) General requirements and tests for electronic equipment used on Rail vehicles. (Second Edition)

1.3.2 IEC-60077 :Railway applications – electric equipment for rolling stock

1.3.3 IEC-61000 : Electromagnetic Compatibility (EMC)

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- 1.3.4 IEC-60529 : Degrees of protection provided by enclosures (Code IP)
- 1.3.5 RDSO spec no ELRS/SPEC/SI/0015 for “ Reliability of Electronics used in Rolling stock application”

**1.4 INFRINGEMENT OF PATENT RIGHTS:**

Indian Railway shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, components used in design, development and manufacturing of VCD and any other factor which may cause such dispute. The responsibility to settle any issue lies with the manufacturer.

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## CHAPTER 2- TECHNICAL REQUIREMENT

### 2.1 Input Voltage:

VCD equipment shall be supplied power from locomotive battery at a nominal voltage of 110 volts DC. However, the battery voltage may vary from 78 V dc to 136 V dc.

### 2.2 Requirement:

2.2.1 Vigilance Control Unit shall be a microprocessor based multi-resettable and fail safe system. It shall reset by operation of the frequently operated control functions by the driver as defined in para 2.2.2 of this specification.

The system shall be based upon a number of time cycles, the periods of which are preset for any particular application. The system shall be designed to work on the normally energised principle and it is only active in the loco cab that is active.

#### 2.2.2 Vigilance cycle/Delay cycle:

The cycle has a preset period normally set at 60 seconds. This cycle is automatically restarted whenever the vigilance unit detects one of a number of external inputs derived from other vehicle control functions under the driver's control from the active cab, the presence of which automatically infers that the driver has taken some positive action and is therefore vigilant.

- The control functions include Notch-up / Notch-down by the master controller (MP) or EEC;
- Operation of the sander, horn, Train Brake (A-9), Loco Brake (SA9), MPS-1;
- Operation of the vigilance pedal (foot) switch available for driver or vigilance push button available for assistant drive.

In normal circumstances, provided that the driver is periodically performing some positive action, the cycle shall be continually reset and shall never run to completion. Only if the driver fails to perform such an action within the cycle period, the cycle period shall be completed.

When such an event occurs, a second time cycle, i.e. action cycle shall be initiated and audible and visual warnings shall be given to the driver.

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2.2.3 Action cycle/Warning cycle:

This cycle is initiated whenever the delay cycle runs to completion indicating that no positive driver action has been detected for the length of the delay cycle period. During this cycle, VCD shall begin flashing a yellow warning light for a time period  $8\pm 2$  seconds. If by end of this period, an acknowledgement by crew has not been actuated, an audible alarm for a time period  $8\pm 2$  seconds shall begin in addition to yellow flashing light.

In order to maintain normal vehicle operation, the driver shall operate the Vigilance foot switch or push button or any other equipment, specified in clause 2.2.2, before the action cycle expires to prove positively that he has not become incapacitated.

Once reset in this manner, system operation reverts to the delay cycle and normal vehicle operation is maintained.

If for any reason, the action cycle expires without being reset, the brake cycle is initiated to make an automatic brake application.

2.2.4 Penalty brake Cycle:

The brake cycle is initiated if the driver fails to respond to the audible and visual warnings before the expiry of the action cycle. A brake application is immediately initiated. This ensures that the vehicle is brought to a complete standstill. Vigilance unit initiates penalty brake, which remain applied for a period  $32\pm 2$  seconds and cannot be reset once applied during this period.

Only after the expiry of the brake cycle period and then only after the master controller has been set to the off position can the vigilance unit be reset using the reset push button provided at driver desk. The brake application then get released, the audible and visual warnings are cancelled and normal vehicle operation can be re-established.

2.2.5 Main functions of the vigilance system include:

- (a) Activating the system
- (b) Vigilance/delay cycle
- (c) Action cycle/warning
- (d) Audio-visual warning

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- (e) Penalty brake cycle
- (f) Penalty brake release
- (g) Vigilance reset
- (h) Vigilance suppression
- (i) Data storage

**2.2.6 Fault Cycle**

The operation of the vigilance unit is continuously monitored by its own test routines. If at any time, a condition is detected which could lead to unsafe system operation, a brake application shall be immediately initiated and a fault indication shall be displayed by flashing red LED. The fault cycle has a preset period normally set at 32 seconds during which period the brake application cannot be cancelled. Only after the expiry of the fault cycle can an attempt be made by the driver to reset the fault condition using the vigilance reset push button and resume normal locomotive operation.

**2.3 System Operation - Normal:**

- 2.3.1 Cycle time (T0) of 60 seconds.
- 2.3.2 The crew has to acknowledge the device within T0 time by pressing vigilance foot switch available for driver or vigilance push button available for assistant driver or by operating any other equipment, specified in clause 2.2.2.
- 2.3.3 The vigilance cycle time (T0) starts again.
- 2.3.4 If the above acknowledgement is not received within T0 time, the VCD shall begin flashing a yellow warning light for a time period (T1) Sec.
- 2.3.5 If by the end of period T1, an acknowledgement by the crew has not been actuated, the VCD shall actuate an audible alarm for a time period (T2) sec. The warning light shall also continue to flash during this period.
- 2.3.6 If, by the end of period T2, an acknowledgement is not received, the VCD system shall initiate penalty brake application, which shall continue for a period T3 seconds, even if a reset acknowledgement is received during this (T3) time period.

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- 2.3.7 The audible warning shall continue during the T3 time period along with flashing warning light as in period T2.
- 2.3.8 After time period T3, audible warning as well as warning flashing light shall continue in T4 until the VCD is reset by setting master controller to off position and pressing reset push button provided at the driver desk.
- 2.3.9 At any time during the periods T0, T1 or T2 the device may be reset to the beginning by any acknowledgement by the crew.
- 2.3.10 The time sequence of system operation mentioned above are summarised in the table below:

Operating cycles	Time periods (seconds)	Indications	Possibility to Reset
Vigilance cycle (T0)	60±2	None	Yes
Warning cycle (T1) Level 1	8±2	Yellow flashing light	Yes
Warning cycle (T2) Level II	8±2	Yellow flashing light and alarm sound	Yes
Penalty brake (T3) Level I	32±2	Yellow flashing light and alarm sound	No
Penalty brake (T4) Level II	Until reset	Yellow flashing light and alarm sound	Yes

## 2.4 System Operation – Other Conditions :

### 2.4.1 Vigilance Suppression:

There shall be a provision to suppress the operation of VCD when continuous proof of driver's vigilance is not required. Such suppression shall be initiated by an external input to the system, derived from a vehicle speed sensor and from brake application. Brake application shall be sensed through operation of A9 or SA9 pressure. Vigilance suppression shall not function during the Fault cycles. The suppression of operation of the vigilance system shall be done in the following conditions:

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- Vehicle is stationary / speed is very low
- Vehicle is used in slave mode
- Brake application
- Manual control of GR

A “speed low” signal shall be provided to the VCD system from an external source such as speedometer (not a part of the scope of supply of this specification). A potential free “speed low signal” is available from the speedometer which remain high (110 V) when speed remains less than 2 (two) Kmph. In case such external signal is not available, then vigilance suppression shall be done on the basis of logical deduction of low vehicle speed based on the state of brake application i.e. initially when battery is “ON” VCD shall check low speed signal if same is not available VCD shall go in vigilance cycle when brakes (A-9 &SA-9) are released and MP is operated. In subsequent operation, thereafter, VCD shall be in vigilance cycle when brakes are released.

2.4.2 Multiple Unit Operation:

The VCD system shall be disabled on a slave locomotive in multiple operations.

**2.5 Fault mode operations and Diagnostics**

2.5.1 Internal system Fault in VCD Unit and fail safe feature:

The operation of the vigilance unit is continuously monitored by its own in-built test routines. If at any time, a faulty condition is detected, a brake application is immediately initiated and a fault indication shall be given to driver by flashing red LED suggesting driver to bypass VCD through bypass arrangement. The test routine period shall normally be set at 32 seconds during which period the brake application cannot be cancelled. Only after the expiry of fault cycle, and provided the master controller handle has been set to off position, can an attempt be made by the driver to reset the fault condition using the vigilance reset push button and resume normal locomotive operation. Such internal faults shall be recorded in inbuilt memory with date and time.

2.5.2 Bypassing Arrangement:

A two position rotary program switch (HVCD) shall be provided through which VCD can be bypassed in case the device becomes defective/malfunxions. Red LED shall glow at cab unit indicating VCD bypass to the driver. Arrangement shall be made so that in case VCD is

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bypassed, feed from main unit to pick up QVCD relay is not extended in any case. For ensuring this, feed to QVCD relay coil shall be extended through normally closed contact of HVCD switch.

2.5.3 Mismanagement by Crew:

VCD shall have built in logic based on trailing edge counter principle so that such inputs are not used for acknowledgement of control functions., In case vigilance push button or vigilance foot switch remains in pressed position for more than 60+/-2 seconds continuously either by driver or due to defect in push button/foot switch, warning cycle and brake cycle shall be initiated as per para 2.3.4 to 2.3.9 . All such events shall be recorded in fault data.

2.6 **General Construction:**

2.6.1 The VCD shall consist of one main unit and two cab units. The construction and wiring of VCD shall be so as to ensure complete inter changeability of the VCD set consisting of one main unit, two cab units of different makes without change in wiring. Apart from main unit and cab units, accessories mentioned in Annexure-3 and any other accessories not mentioned in this specification but required to make the Vigilance Control Device functional shall be part of VCD system in accordance with this specification. The supplier shall procure the items from the CLW/RDSO approved sources and as per CLW specification as mentioned in **Annexure-3**.

2.6.2 **Main Unit:** The main unit shall consist of all the control cards housed in a metal box as per the drawings given in Annexure-1/1 of this specification. The main unit shall be protected against dust in accordance with IP50. A LCD display shall be provided on the front of main unit as per specification clause No.2.6.3 of this specification. The main unit shall be provided with two USB ports (Type A Jack-4 position for pen drive and Type B jack-4 position for Laptop) for down loading stored data for connecting commercially available pen drive and laptop. The USB ports shall be suitably covered and protected.

2.6.2.1 LCD display:

There shall be LCD display (2x16 dot matrix) on the main unit to show the current status of VCD i.e. VCD bypassed, VCD in service and internal fault and other events which are to be recorded as an event with scroll buttons (up and down) for viewing messages stored in the memory. Backlit arrangement

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shall be provided for all time visibility. Following are typical display messages which shall appear on LCD display exactly the same:

- (a) "POWER ON"/"POWER OFF"
- (b) "VIGILANCE CYCLE/WARNING CYCLE"
- (c) "FOOTSWITCH/PUSHBUTTON/A9/SA9/HORN/SANDER/MP OPERATED".
- (d) "IP PROBLEM"
- (e) "QVCD RELAYDEFECTIVE"
- (f) "VCD BYPASS BUT HEALTHY dd/mm/yy"
- (g) "VCD BYPASS AND FAULTY dd/mm/yy"
- (h) "VCD FAULTY"
- (i) "VCD REACTIVATED" #
- (j) "PB APPLIED"
- (k) "VCD SUPPRESSED"
- (l) "MPS-1 OPERATED"
- (m) "MCGR OPERATED"
- (n) "DATA DOWNLOADING"
- (o) "DOWNLOADING COMPL"

\*Power off shall be for recording purpose only in internal memory.

# After bypass of VCD, VCD is again becomes active

### 2.6.3 Cab Unit:

The cab units shall consists of all the required indication lamps, Buzzer and control card if any housed in a metal box as per the drawings given in Annexure-1/2. One cab unit shall be provided in each driver's cab. The cab unit shall be protected against dust and water in accordance with IP52. There shall be a provision to avoid on line theft of LED lamps from the cab unit. This arrangement shall be got approved by RDSO as part of design approval.

Following indications, buzzer and push button shall be provided in a cab unit:

- A green LED indication shall be provided to indicate that the device is in working order.
- A red LED indication (flashing) shall be provided to indicate faulty condition of VCD (ref. para 2.5.1 of this specification).
- A yellow LED indication (flashing) shall be provided to indicate warning cycle (ref. para 2.3.5 and 2.3.10 of this specification).
- A red LED indicating VCD bypass shall be provided to indicate that VCD is bypassed (refer para 2.5.2 of this specification).

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- Buzzer with intermittent sound of 1170 Hz, to indicate warning cycle (refer clause 2.3.5 of this specification) in accordance to the CLW specification indicated in **Annexure-3** with minimum sound level of 100 dB at 1(one) meter distance; and
- Vigilance acknowledgement push button for assistant driver.

**2.6.4 Other details:**

- 2.6.4.1 A push button to reset VCD in case of penalty brake application shall be provided for driver on driver desk.
- 2.6.4.2 A Bypass switch (HVCD) to bypass VCD in case of fault in the VCD shall be provided in Cab-2 switch board panel.
- 2.6.4.3 An external relay QVCD (PC-8 type) shall be provided to interface with regression circuit and with brake circuit as per clause 2.11.1.
- 2.6.4.4 Cables: All the single core and multi core cables used for wiring related with VCD in the locomotive and from main unit to cab unit shall be fire retardant and shall be procured from RDSO approved sources only.

**2.7 Sensing Arrangement:** Suitable sensors shall be provided for sensing of the control functions by the driver as defined in para 2.2.2 of this specification. However, any malfunction of sensors shall not hamper normal locomotive operation.

2.7.1 Brake position sensing: Existing pressure switches P1 & P2 in locomotive shall be used for sensing train brake (A-9) and BP pressure dropping and a Independent pressure switch shall be provided for sensing of independent loco brake (SA-9). The setting of pressure switche shall be:

SA9 pressure switch : Cut in 1.5 Kg/cm<sup>2</sup> Cut out 1.0 kg/cm<sup>2</sup>  
Horn pressure switch : Cut in 4.0 Kg/cm<sup>2</sup> Cut out 3.5 kg/cm<sup>2</sup>

2.7.2 In case of Penalty brake not coming through IP valve due to IP valve cock isolated, the system shall indicate "IP Problem".

**2.8 Connectors:**

The cab units and main unit shall employ circular connectors of threaded type of Allied or Amphenol make only to ensure modularity and easy replacement. These connectors shall be complete with all required accessories. The connector types and pin allocation details are shown in **Annexure-4**. The connector types and pin allocation should be exactly same so as to ensure interchange ability of VCD units of different makes. A 40 pin terminal strip of two way M5 type shall be

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provided near main unit to terminate inputs from 22 pin connector and 9 pin connector. The signal wires from this terminal strip shall be taken to respective devices. The connections at terminal strip shall be made from left to right first for 22 pin connector (A to X) and then for 9 pin connector (A to I).

**2.9 Electronics:**

- 2.9.1 The electronics shall be suitable for rolling stock application in heavily EMI polluted environment.
- 2.9.2 The PCB cards used in main VCD unit and Cab units shall have locking and removing arrangement.
- 2.9.3 VCD main unit shall have proper filters and signal conditioning at all the sensing ports to prevent any mal functioning due to noise/distortion in DC control circuit of locomotive.
- 2.9.4 Electrical Isolation: For sensing of electrical signal from the loco circuit, optical isolation (6 kV opto-couplers) shall be provided.

**2.10 Data logging and Interfacing:**

2.10.1 VCD shall have its own data logging facility in its in-built memory. All messages listed in clause 2.5.5 and internal faults of VCD shall be stored with date (in dd/mm/yy format) and time stamp (in 24 hour format). Such occurrences shall be kept stored for at least 60 days. VCD shall also record all displayed messages as per para 2.5.5 if it is bypassed but healthy. There shall be provision for downloading of data through any standard PC/Laptop and commercially available pen drive. The data recorded in the VCD or any other software of VCD shall not be affected by virus/malware of any kind available in the data downloading PC/Laptop or pen drive. The format for downloaded data shall be as shown in **Annexure-2**. The downloaded data shall be of standard format for offline analysis and shall be compatible to Windows MS office (MS Excel, MS Word etc.). Suitable downloading and analysis software shall be provided for this purpose. The analysis software shall be able to give the tabular and graphical report of various parameters required. The details of such software shall be submitted during design approval stage. Provision shall be made in the analysis software for generating exception statements which shall be used for managerial decision making. The software shall also be made available on the official website of the Supplier in the downloadable format. Also, suitable Single user

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license for the software tool for change of parameters in the VCD shall be provided.

- 2.10.2 VCD shall also have provision for interfacing with microprocessor based control and fault diagnostic system wherever fitted in the locomotive. Two (02) Nos. of 110 V volts potential free contact shall be provided: out of which one shall communicate activation of VCD while the other shall communicate healthiness of VCD. It shall be possible to log the VCD activation and failures in the Microprocessor based control and fault diagnostic system and generate suitable diagnostic messages.
- 2.10.3 The interface with brake system shall be provided on VCD through potential free contacts of normally energized relay (this relay shall be inside VCD main unit) for driving external relay (QVCD) provided in locomotive external to VCD main unit. QVCD relay shall be normally de-energised. During penalty brake application or in fault condition,, the internal relay shall get de-energized so as to energise QVCD relay.
- 2.10.4 In order to test VCD in locomotive in Electric loco sheds, VCD suppression due to low speed signal shall be required to be disabled by providing a "Test switch". For this purpose a toggle switch of 6 Amp capacity shall be provided near main unit.

## 2.11 Location of various equipments in locomotive:

2.11.1 The location of various equipments in locomotive is as follows:

S.No.	Equipment Name	Locomotive		
		WAM-4/WAG-5	WAP1/4	WAG7
1.	VCD main Unit	Machine room on the wall behind Cab-1	Machine room on the wall behind Cab-1	Machine room on the wall behind Cab-1
2.	Cab units	Both cab near assistant driver desk	Both cab near assistant driver desk	Both cab near assistant driver desk
3.	Vigilance foot switch	On right hand side of PVEF below master controller in both cabs	On right hand side of PVEF below master controller in both cabs	On right hand side of PVEF below master controller in both cabs
4.	Vigilance Ack push button switch	On cab unit	On cab unit	On cab unit
5.	VCD reset push button switch	Both cab on driver desk	Both cab on driver desk.	Both cab on driver desk
6.	QVCD Relay	Cab-1 TPN Panel	Pneumatic Panel	Cab1 TPN Panel

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		above baby compressor or Cab-2 Relay panel	near CPs or Cab-2 Relay panel	above baby compressor or Cab-2 Relay panel
7.	SA-9 pressure switch	Cab-1 TPN Panel	Pneumatic panel near compressors	Pneumatic panel near compressors
8.	Horn Pressure switches	Both cab, driver side behind marker light or below gauges, on the outgoing pipe line of horns	Both cab, driver side behind marker light or below gauges, on the outgoing pipe line of horns	Both cab, driver side behind marker light or below gauges, on the outgoing pipe line of horns
9.	Bypass switch(HVCD)	Cab-2 switch board	Cab-2 switch board	Cab-2 switch board

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### CHAPTER 3- CLIMATIC AND ENVIRONMENTAL CONDITION

- 3.1 The Vigilance Control Device shall be fitted in locomotive where the temperature shall be
- a) Maximum temperature
    - } Stabled Locomotive under sun : 75 deg. C
    - } On board Working loco under sun : 60 deg. C
  - b) Minimum temperature : - 5 deg. C
  - c) Average temperature : 50 deg. C
- 3.2 Humidity: Upto 100% during rainy season.
- 3.3 Altitude: Upto 1776 m above mean sea level.
- 3.4 Rainfall: Very heavy in certain areas. The loco equipment shall be designed suitably.
- 3.5 Environment: Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/cub. In many iron ore and coalmine areas, the dust concentration is very high affecting the filter and air ventilation system of locomotive where the equipment shall be mounted.
- 3.6. Coastal area: The equipment shall be designed to work in coastal area in humidity and salt laden and corrosive atmosphere. The maximum values of the condition shall be as follows:
- a) Maximum pH value : 8.5.
  - b) Sulphate : 7 mg per litre.
  - c) Max. concentration of chlorine : 6 mg per litre.
  - d) Maximum conductivity :130 micro siemens /CM
- 3.7 Vibration: The equipment shall be designed to withstand the vibrations and shock encountered in service satisfactorily as specified in IEC60077 and 60571.1 (1998 - 02) (second edition) publication for the VCD and electronic equipments respectively and relevant IECs as applicable to other equipment.
- 3.8 Electromagnetic Pollution – High degree of electromagnetic pollution is anticipated in locomotive machine room, where the equipment shall be mounted. Necessary precaution shall be taken in this regard.

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### CHAPTER 4-TESTS

4.1 VCD shall be tested for functional and reliability performance as per details given below. Following tests shall be carried out on the prototype unit as per relevant IEC specification and mutually agreed test program which shall be submitted during design approval stage. Manufacturer shall bear the expenses of the tests.

4.2 Following tests shall be done.

S. No.	TEST	CLAUSE	TYPE	ROUT-INE
1.	Visual inspection	IEC 60571.1 clause 10.2.1	✓	✓
2.	Tolerance & Dimension		✓	✓
3.	Cooling	IEC 60571 clause 10.2.3	✓	
4.	Insulation Resistance	IEC 60571 clause 10.2.9	✓	✓
5.	Di Electric		✓	✓
6.	Vibration and shock	IEC 60571 clause 10.2.11	✓	
7.	Performance test by fault simulation	IEC 60571 clause 10.2.2	✓	✓
8.	Voltage Surge	IEC 60571.1 clause 10.2.6.2	✓	
9.	Electrostatic Discharge test	IEC 60571.1 clause 10.2.6.4	✓	
10.	Transient burst susceptibility test	IEC 60571.1 clause 10.2.7	✓	
11.	Radio interference test	IEC 60571.1 clause 10.2.8	✓	
12.	Salt mist test	IEC 60571.1 clause 10.2.10	✓	
13.	Damp heat	IEC 60571.1 clause 10.2.5	✓	
14.	Dry heat up to 80 degree C	IEC 60571.1 clause 10.2.4	✓	
15.	Burn – in	As per Burn-in cycle attached as Annexure-5	✓	*
16.	Functional Test	As per test program to be finalised during design approval stage	✓	✓
17.	Test for protection against dust and water	IEC 60529 clause 13 and 14	✓	
18.	Endurance Test	As per clause 4.3 (d) of this spec.	✓	

\*Note: Burn-in test shall be done on every 50<sup>th</sup> unit produced during routine test.

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4.3 The following clarifications are issued on the tests above.

- (a) Visual inspection and Tolerance & Dimension –The object of visual inspection is to check that the equipment is free from defects and the equipment are as per approved drawing. Bill of materials shall be submitted. The make, rating of equipments, subassemblies shall be checked with the details as per approved design. If a change is needed in make or rating of important equipments, sub-assemblies, it shall be intimated and shall have approval of RDSO. VCD equipment with modified subassemblies shall be given separate revision number. All the important dimensions shall be measured and shall be in permissible tolerance.
- (b) Insulation resistance and Dielectric test -- The insulation resistance with 1000 V megger shall not be less than 100 M ohms at 70 % RH for all the circuits. The dielectric test shall be carried out after earthing special cards if necessary before applying Dielectric voltage. The dielectric test to be carried out at a test voltage of 1500 kV<sub>rms</sub>. for 60 secs. The leakage current to be less than 1 mA.
- (c) Burn in test -- The cards used on the equipment shall be subjected to burn- in as per the temperature cycle in **annexure-5**. The cards shall be kept energized during the test. Functional test of each card shall be carried out after the burn in test. This shall be part of internal test by manufacturer, whose results shall be submitted during routine test.
- (d) Endurance test -- The mechanical parts which need frequent operations like foot pedal switch, acknowledgement push button for driver and assistant driver and vigilance reset button are to be subjected to endurance test for 1,00,000 cycles of operation. At the end of the above cycles, these mechanical parts shall be inspected for physical wear and tear. The contact resistance shall not increase more tahn 10% of the initial value. The springs used, if any, shall regain atleast 50% of the operational height when released at the end of the endurance test cycles of 1,00,000 operations. Finally the device shall be checked for its satisfactory performance.

4.4 The prototype unit shall be inspected by the engineers of RDSO at the factory premises or at mutually agreed venue, where all the facilities shall be

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made available for carrying out the prototype test. The equipments shall be kept in field trials for a period of six months. The RDSO engineers shall associate and witness the tests in the locomotive also till they are successfully completed.

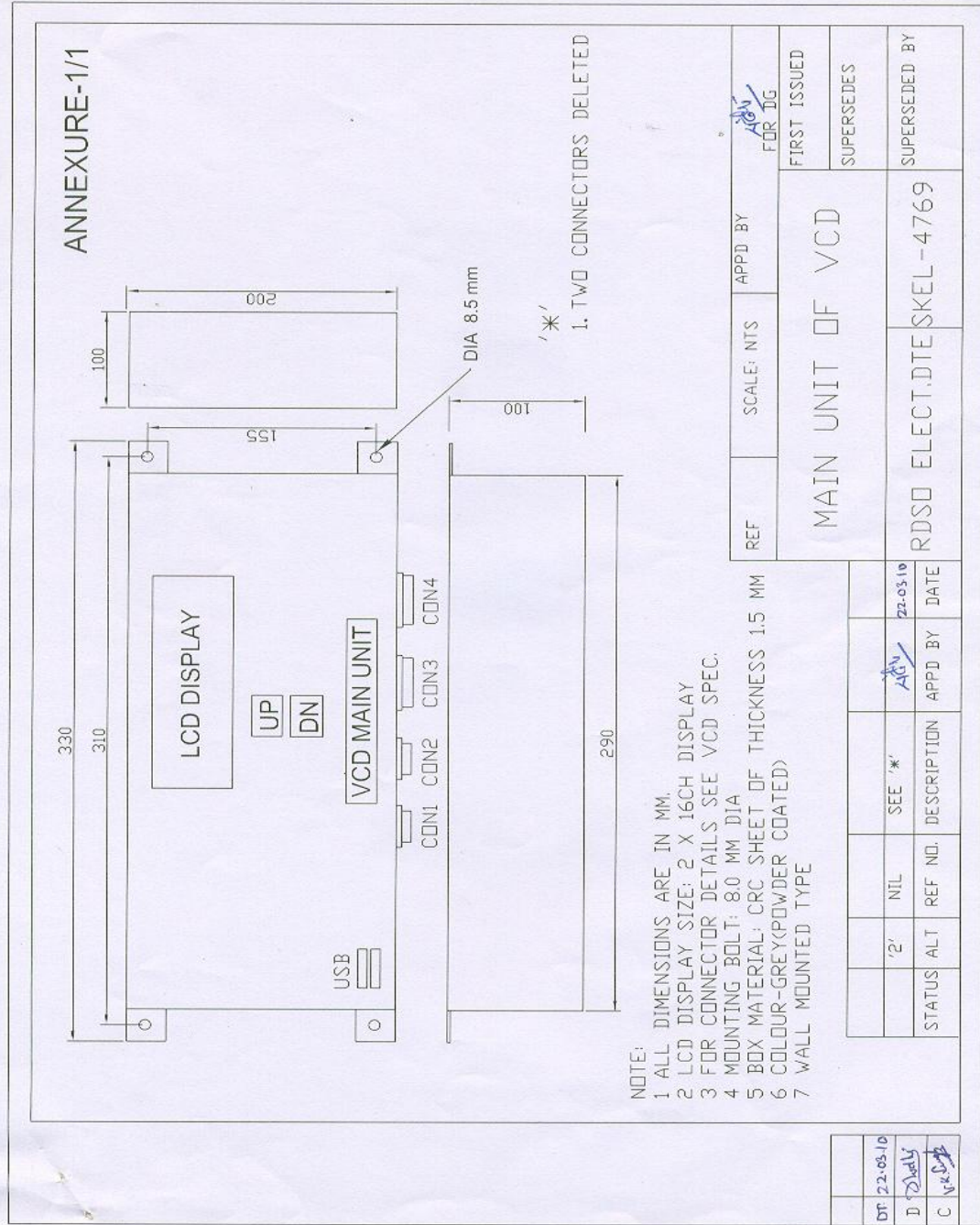
- 4.5 The individual equipments and sub-systems as may be necessary shall be type tested and routine tested in accordance with relevant IECs.
- 4.6 Type tests shall be performed to verify that product meets the requirements specified and agreed upon between users & manufacturer. Subject to agreement between user and manufacturer, some or all the type tests shall be repeated once in two years by RDSO and purchaser on sample basis so as to confirm the quality of the product. Type test shall be repeated in following cases.
- Modification of equipment, which is likely to affect its function.
  - Failure or variations established during type or routine test.
  - Resumption of production after an interruption of more than two years.
  - At the time of indigenisation, if the firm has supplied the product with foreign collaboration.

The type test shall be carried out for the equipment/sub-assembly indigenised. The type test on the full unit in the case of indigenisation shall be considered only if there is major design change.”

- 4.7 Routine tests are to be carried out to verify that properties of the product corresponding to those measured during type tests. Routine test are to be done by the manufacturer on each equipment.

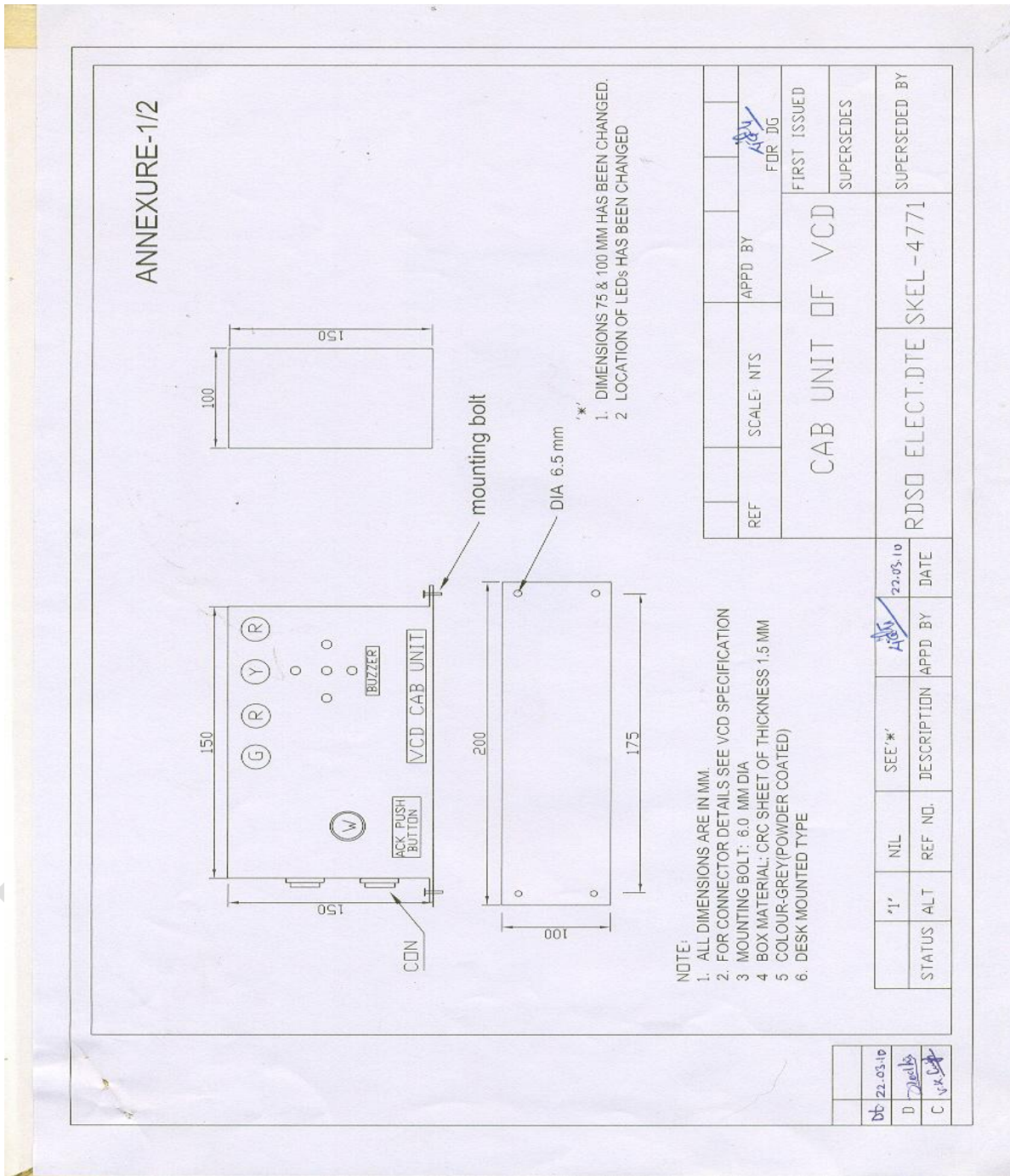
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Annexure-1/1



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**Annexure 1/2**



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**Annexure – 2**

Sl No.	Date	Time	Message	Remarks

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### Annexure – 3

The following accessories to be supplied with Vigilance Control Device shall be as per following specifications as indicated in table below or latest and shall be procured from CLW/RDSO approved sources only.

S.No.	Equipment Name	CLW specification
1.	Vigilance foot switch	CLW/ES/3/0032/A
2.	Vigilance acknowledgement push button type switch	CLW/ES/3/0072/C
3.	QVCD Relay	CLW/ES/R/27
4.	SA-9 pressure switches	CLW/ES/S-24/I
5.	Horn Pressure switches	CLW/ES/S-24/I
6.	Two position, Bypass switch(HVCD) Type No. 250 2YW00 6W	CLW/ES/S-1/W
7.	LED indication lamp	CLW/ES/3/0072
8.	Buzzer for Vigilance alarm	CLW/ES/3/0078/A
9.	Toggle switch, 6 Amp	CLW/ES/S-27
10.	VCD reset push button type switch (30.5 diameter)	CLW/ES/S-8/L
11.	Cables	As per relevant RDSO specification depending upon size

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**Annexure – 4**

**Connectors at Cab Unit:**

S. No.	Connector Type	Connector code	Pin No.	Signal name	Qty & use
1.	9- Pin Circular, threaded type- female and male	(MS 3106F-20-16S for female for cable) and (MS 3102R-20-16P male for cab unit)	A	Signal for buzzer from main unit	1 No. male connectors in cab at each cab unit and 1 No. female connectors at cable connecting main unit and cab unit at cab unit end
			B	COM for buzzer from main unit	
			C	Vigilance push button signal to main unit	
			D	COM for Vigilance push button to main unit	
			E	Indication signal from cab unit to main unit for green LED	
			F	Indication signal from cab unit to main unit for red LED	
			G	Indication signal from cab unit to main unit for yellow LED (flashing)	
			H	Indication signal from cab unit to main unit for red LED (flashing)	
			I	Common	
2.	2-Pin Circular, threaded type- female and male	(MS 3106F-12S-3S female for cable) and (MS 3102 R-12S-3P male for Cab unit)	A	+110 VDC from SB	one No. male connector at each cab unit and 1 No. female connectors each at cable connecting battery supply to cab unit (for buzzer & PSU) and M5 lug on other end
			B	-110 VDC from SB	

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**Connectors at main unit:**

S.No.	Connector Type	Connector code	Pin No.	Signal name	Qty & use
1.	22- Pin Circular, threaded type female and male	(MS 3106F-28-11S female for Cable) and (MS 3102R-28-11P male for main unit)	A	Foot Switch -Cab1	1 No. male at Main unit and 1 No. female at cable connecting inputs to main unit
			B	Foot Switch -Cab2	
			C	Bypass switch	
			D	P2	
			E	MP 0	
			F	Sander	
			G	P1	
			H	SA9	
			I	Manual control of GR (input)	
			J	Horn Cab-1	
			K	Horn Cab-2	
			L	+110 VDC	
			M	-110 VDC	
			N	Notch UP by MP/EEC	
			P	Notch DN by MP/EEC	
			R	Low Speed	
			S	QVCD O/P(IP)	
			T	QVCD O/P(Regression)	
			U	BL Key Cab-1	
			V	BL Key Cab-2	
W	MPS-1				
X	SPARE				
2.	9- Pin Circular, threaded type- female and male	(MS 3106F-20-18S for female for cable) and (MS 3102R-20-18P male for Main unit)	A	QVCD COM	1 No. male at Main unit and 1 No. female at cable connecting outputs to main unit
			B	QVCD +ve COIL	
			C	FDCS COM	
			D	FDCS NO active	
			E	FDCS NO healthy	
			F	Reset push button signal from Reset push button to main unit Cab1	
			G	Reset push button signal from Reset push button to main unit Cab2	
			H	COM for Reset push button	
			I	SPARE	
3.	9- Pin Circular,	(MS 3106F-20-16S for female	A	Signal for buzzer from main unit	2 No. female connectors each

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	threaded type-female and male	for cable) and (MS 3102R-20-16P male for Main unit)	B	COM for buzzer from main unit	at main unit and 2 No. male connectors at cable connecting main unit and cab unit at main unit end
			C	Vigilance push button signal to main unit	
			D	COM for Vigilance push button to main unit.	
			E	Indication signal from cab unit to main unit for green LED	
			F	Indication signal from cab unit to main unit for red LED	
			G	Indication signal from cab unit to main unit for yellow LED (flashing)	
			H	Indication signal from cab unit to main unit for red LED (flashing)	
			I	Common	

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### Annexure-5

S. No.	Pin No.	Signal name	Explanation of signal available at main unit
22 Pin Input Connector of main unit			
1.	A	Foot Switch -Cab1	Normally supply shall not be available. Whenever foot switch is pressed & released from Cab1, 110 V shall be available
2.	B	Foot Switch -Cab2	Normally supply shall not be available. Whenever foot switch is pressed & released from Cab2, 110 V shall be available
3.	C	Bypass switch	Normally 110 V supply shall be available. Whenever VCD is bypassed, 110 VDC shall not be available.
4.	D	P2	<b>Cut in 4.5 Kg/cm<sup>2</sup> Cut out 4.8 kg/cm<sup>2</sup></b> 110 VDC supply is available whenever pressure is 4.5 Kg/ cm <sup>2</sup> or below. Supply is not available whenever pressure is 4.8 Kg/ cm <sup>2</sup> or above.
5.	E	MP 0	When MP is at 0, supply shall not be available.
6.	F	Sander	Normally supply shall not be available. Whenever sander is pressed & released supply shall be available.
7.	G	P1	<b>Cut in 4.5 Kg/cm<sup>2</sup> Cut out 4.8 kg/cm<sup>2</sup></b> 110 V supply is available whenever pressure is 4.5 Kg/ cm <sup>2</sup> or below. Supply is not available whenever pressure is 4.8 Kg/ cm <sup>2</sup> or above.
8.	H	SA9	<b>Cut in 1.5 Kg/cm<sup>2</sup> Cut out 1.0 kg/cm<sup>2</sup></b> 110 V supply is available whenever pressure is 1.5 Kg/ cm <sup>2</sup> or above. Supply is not available whenever pressure is 1.0 Kg/ cm <sup>2</sup> or below.
9.	I	Manual control of GR (input)	Normally supply shall not be available, Whenever MCGR is operated, 110 V shall be available
10.	J	Horn Cab-1	<b>Cut in 4.0 Kg/cm<sup>2</sup> Cut out 3.5 kg/cm<sup>2</sup></b> 110 V supply is available whenever pressure is 4.0 Kg/ cm <sup>2</sup> or above. Supply is not available whenever pressure is 3.5 Kg/ cm <sup>2</sup> or below.
11.	K	Horn Cab-2	<b>Cut in 4.0 Kg/cm<sup>2</sup> Cut out 3.5 kg/cm<sup>2</sup></b> 110 V supply is available whenever pressure is 4.0 Kg/ cm <sup>2</sup> or above. Supply is not available whenever pressure is 3.5 Kg/ cm <sup>2</sup> or below.
12.	L	+110 VDC	+110 VDC available when battery is ON

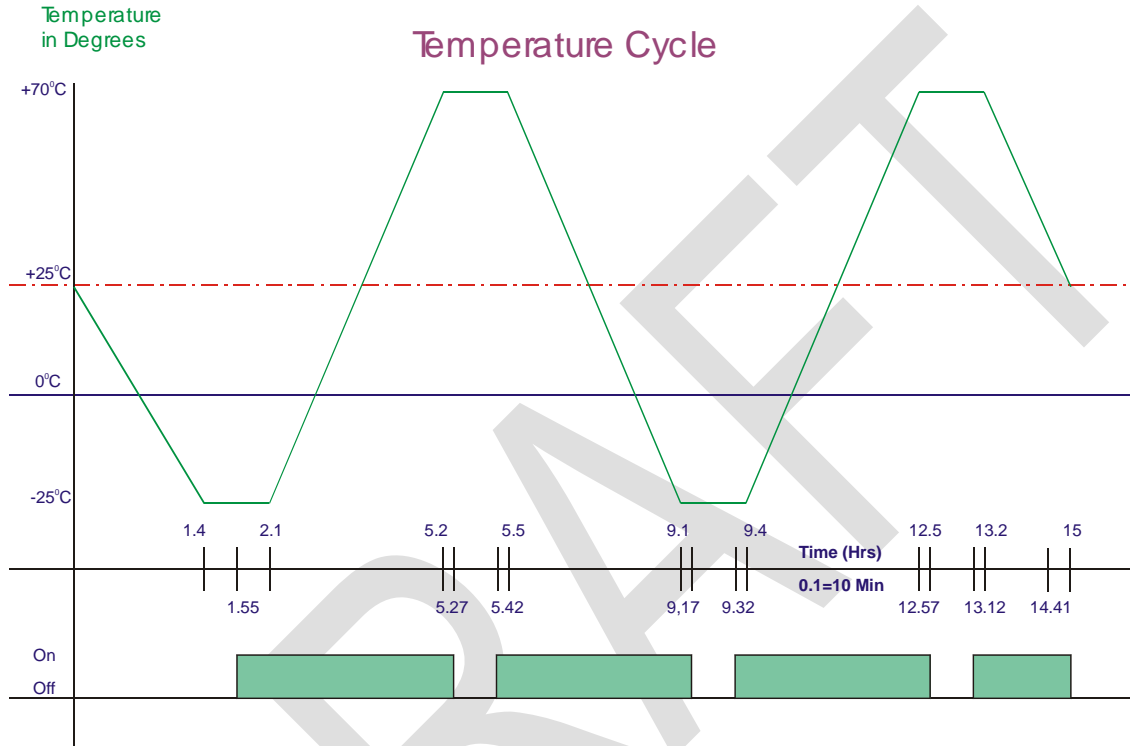
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13.	M	-110 VDC	-110 VDC available when battery is ON
14.	N	Notch UP by MP/EEC	+110 VDC available when notched up
15.	P	Notch DN by MP/EEC	+110 VDC available when notched down
16.	R	Low Speed	+110 V is available when speed is less than 2 kmph.
17.	S	QVCD O/P(IP)	Normally +110 V supply shall be available. Whenever QVCD picks up supply shall not be available at this signal.
18.	T	QVCD O/P(Regression)	Normally +110 V supply shall not be available. Whenever QVCD picks up supply shall be available at this signal.
19.	U	BL Key Cab-1	+110 V supply shall be available When BL key is ON from Cab-1 side.
20.	V	BL Key Cab-2	+110 V supply shall be available When BL key is ON from Cab-2 side.
21.	W	MPS-1	+110 V supply shall be available when MPS-1 is operated.
22.	X	SPARE	SPARE
<b>9 Pin Input/Output Connector of main unit</b>			
1.	A	QVCD COM	-110 VDC supply to QVCD coil from main unit
2.	B	QVCD NO	+110 VDC supply from main unit to QVCD relay coil when QVCD is to be picked up.
3.	C	FDCS COM	Common wire from main unit to FDCS equipment (Normally not required by FDCS equipment)
4.	D	FDCS NO active	+110 VDC supply is extended to FDCS whenever VCD is active i.e. VCD is not bypassed.
5.	E	FDCS NO healthy	+110 VDC supply is extended to FDCS whenever VCD is healthy i.e. not faulty.
6.	F	Reset push button signal from Reset push button to main unit Cab1	Normally +110 VDC supply shall be available at Reset push button incoming. Whenever CAB 1 Reset push button is pressed + 110 VDC supply shall be extended to the main unit as signal
7.	G	Reset push button signal from Reset push button to main unit Cab2	Normally +110 VDC supply shall be available at Reset push button incoming. Whenever CAB 2 Reset push button is pressed + 110 VDC supply shall be extended to the main unit as signal
8.	H	COM for Reset push button	This may not be used
9.	I	SPARE	SPARE

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**Annexure-6**

**BURN-IN TEST**



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