

भारत सरकार / Government of India

श्रम एवं रोजगार मंत्रालय / Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय/Directorate General of Mines Safety



No. DGMS (Tech) Circular No. 06 of 2020 Dhanbad dated 27 .02.2020

To

The Owner/Agent/Manager of Coal and Metalliferous Mines & OEM

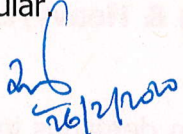
Subject: Minimum Design requirements for various Safety Features to be incorporated for use in Heavy Earth Moving Machinery (HEMM) & Heavy/Light vehicles in Open Cast Mines.

1. With increasing dependence on opencast mines for all the production demands in the Coal and Metalliferous sector, there has been a steep rise in the population of HEMMs and heavy/light vehicles in mines, distributed between both departmental and contractual components. The recent statistics on alarming rise in cases of incidences/accidents in opencast mines singularly point to the basic cause as intricately connected to such deployment in mines. Though, several statutory provisions have already been made under the Coal Mines Regulations, 2017 and the Metalliferous Mines Regulations, 1961, and various statutory permissions issued thereunder apart from DGMS Circulars having been issued from time to time, the issue of their safe operations with particular reference to provisioning and satisfactory operation of various safety features, continues to be a major cause of concern to all.
2. Inspections by officers of this Directorate in the recent past have revealed highly unacceptable levels of compliance in mines, with mere provisioning of such safety features gaining the upper hand rather than effective and sustained functionality. Even on provisioning, it has been observed that there are wide variations on design aspects, with availability of multiple but unverified types/models, mostly without adherence to any acceptable Indian/International standards wherever are available already. In nut shell, the very purpose of provisioning and effective functioning of such safety features with HEMMs deployed in opencast mines, appears to be largely defeated as could be appreciated by the alarming rising trends of connected incidences/accidents.
3. Therefore, with a view to harmonizing the entire gamut of safety features to be provided with any HEMM and heavy/light vehicles for deployment in an opencast mine, in respect of the minimum required design/functionality, a one day technical workshop was organized at DGMS(HQ) on the occasion of the 119th Foundation Day Celebrations on the 7th of January, 2020 in which, a total of 260 senior level representatives from coal mines,

metalliferous mines, manufacturers and educational/other institutions respectively, participated, including officers from this Directorate.

4. Arising out of wide, extensive and successful deliberations, a broad consensus was arrived at amongst all stake holders into maintaining the minimum design requirements of such safety features as per the Guidelines enclosed with this Circular. It may please be borne in mind that the enclosed guidelines are only the minimum recommended levels and may be altered from time to time as per evolving needs and that there is no bar on adherence to any higher/superior levels of design and functionality in the interest of safety. It also further be appreciated that adherence to this circular will go a long way in drastically minimizing hazards due to operation of both HEMM and light/heavy vehicles in opencast mines, thus commensurately enhancing safety in mines.

5. Accordingly, the owner/agent/manager of every opencast mine in operation and the Original Equipment Manufacturers (OEM) are requested to ensure compliance with this circular



(R. Subramanian)
Director General of Mines Safety (Off.)

Encl: As above.

**GUIDELINES IN RESPECT OF PROVISIONING OF SAFETY FEATURES OF HEMMs &
HEAVY/LIGHT VEHICLES FOR SAFE DEPLOYMENT IN OPENCAST MINES.**

1.0. Rear Vision Camera:

A system that consists of a Monitor (component that provides visual image of Blind Area), Camera (component that transmits the images detected by it to the monitor) and other components capable of detecting objects including people within the Blind area unambiguously with an uninterrupted sequence of signal or information appropriate to detection Zone / Field of View (Blind Area).

Applicability: All Heavy Earth Moving Machinery

1.1. The Rear vision camera shall meet the following minimum requirements and standards:

1.1.1. The system shall boot automatically along with starting of Engine / Power source of Machine, shall perform an initial system check and shall give readiness indication. The system shall shutdown along with shutting down of Engine / Power source. The system shall have system readiness, standby and system malfunction indication to indicate its status.

1.1.2. The system shall remain in stand-by mode (operation mode whereby the system is active, but no information is transmitted by the camera or monitor) and shall wake up automatically upon selection/engagement of appropriate control(s) (such as reverse gear, etc) by Machine Operator for negotiating Blind Area (Killing Zone) to provide uninterrupted vision of Blind Area(s) to the operator. The system shall return to Stand-by mode upon release the appropriate controls by the operator.

1.1.2. The monitor shall be so positioned that it can easily be seen by the Operator sitting in his/her seat in either Day light or Darkness without strain. Appropriate shielding shall be used to reduce the effect of direct sunlight onto the Monitor.

1.1.3. The system shall be provided with auto mode tail light with adequate illumination for better visibility during darkness. The system shall be capable of operating in dark and shall automatically switch to infrared / any other suitable technique /mode when the brightness of field of view is too low or in case of failure of the tail light.

1.1.4. Components of the system shall in no way restrict any function or operation of the machine. The components shall be so designed and mounted to the machine in such a way to limit exposure to, or amplification of, dynamic loads, temperature, shock or vibration and dust that could prematurely damage the device and to deter unauthorized disablement or their removal. Components of system shall be adequately protected from external damage.

1.1.5. The system shall have field of vision in accordance with ISO 16001 (Earth-moving machinery-Object detection systems and visibility aids-Performance requirements and tests) (or equivalent Indian standard when formed), shall satisfy test requirements of ISO 16001 and shall have Ingress Protection of IP 69K in accordance with IEC 60529 (Degrees of Protection Provided by Enclosures (IP Code)) and test Certificates to these effects shall be obtained from any Government / NABL Accredited institutions/Test Houses having adequate test facilities.

26
26/2/2020

1.1.6. The System may be provided with provisions for recording the images captured with time stamp to enable easy retrieval and analysis of the immediate past 24 deployment operating hours.

2.0. Warning System for Operator Fatigue:

A system capable of analyzing various symptoms associated with Operator fatigue to detect drowsiness of Operator from regular driving / operating behaviour and sound loud audio and visual warnings immediately upon detection of drowsiness to alert the Operator and others in the vicinity by incorporating one or more technique(s).

Applicability: All Heavy Earth Moving Machinery

2.1. The Warning System for Operator Fatigue shall meet the following minimum requirements and standards:

2.2.1. The system shall boot automatically along with starting of Engine / Power source of Machine, shall perform an initial system check and shall give readiness indication. The system shall shutdown along with shutting down of Engine / Power source. The system shall be provided with system "ON", initialization, tracking and system malfunction indication to indicate its status.

2.2. 2.The system shall detect state of drowsiness of Operator from regular driving behavior and shall provide loud verbal warnings to him / her and simultaneously flash externally mounted warning light easily visible to others for alerting the Operator and others in the vicinity to pay attention. It shall also be capable of detecting the drowsiness even when spectacle is worn by the Operator.

2.2.3. The system shall have following four stages:

- (a) **Initialization** - Every time the system is started, it needs to be set up and optimized for current user (Operator) and conditions. The initialization process shall be a quick one,
- (b) **Tracking** - continuous monitoring of the Operator within a dynamically specified tracking area in real-time,
- (c) **Drowsiness Detection** and
- (d) **Warning** - Once it has been determined that the driver/operator appears to be in an abnormal driving state, the system shall alert the driver of potential dangers that can arise. Combination of audio and visual alerts is used to attract the Operator's attention and raise their alertness level. Alerting has to be implemented in such a way as not to cause the opposite effect of intended and startle the driver / operator into causing an accident.

2.2.4. Components of the system shall in no way obstruct Operator's line of sight hindering his / her visibility and restrict any function or operation of the machine. The components shall be so designed and mounted to the machine in such a way to limit exposure to, or amplification of, dynamic loads, temperature, shock or vibration and dust that could prematurely damage the device and to deter unauthorized disablement or their removal.

2.2.5. The System may be provided with provisions for recording the warning generated with time stamp to enable easy retrieval and analysis of the immediate past 96 deployment operating hours.

2.2.6. For determining type, duration and sound level of audio warning and intensity of external Visual warning, DGMS Circulars, Indian and International standards issued in this regard may be referred to.

3.0. Auto Dipping System:

Applicability: Dumpers /Tippers / Light and Heavy Vehicles plying in the Mine.

A System comprising sensor(s) and a Control Unit capable of automatically switching high beam lamp to low beam as soon as it senses a vehicle approaching from the opposite direction at a distance of about 150 meters and switches it back to high beam when the vehicles pass each other to avoid glare and blinding of Operator so as to relieve the operator from frequent switching between high and low beam of head light.

3.1. The Auto Dipping System shall meet the following minimum requirements and standards:

3.1.1. The system shall boot automatically along with switching "ON" of head light of the vehicle/machine, shall perform an initial system check and shall give readiness indication. The system shall shutdown along with switching "OFF" of the head light. The system shall be provided with system "ON" and system malfunction indication to indicate its status.

3.1.2. System sensor shall be capable of detecting high beam light of incoming vehicle approaching from opposite direction at a distance of about 150 meters or at much closer proximity in case of vehicles approaching from branch roads and send signal to Control unit. Suitable filters shall be incorporated in the system to avoid nuisance/false reaction to Pole lights, spot lights and haul road general lightings. The sensor shall send appropriate signal immediately to control unit upon cessation of high beam light falling on it.

3.1.3. System control unit shall automatically activate Low beam or high beam upon receipt of appropriate signal from the sensor without the intervention of the Operator.

3.1.4. Components of the system shall in no way obstruct Operator's line of sight hindering his / her visibility. The system shall be equipped with Operator Override to comply with authorized override to meet eventualities.

3.1.5. Test Certificates to these effects shall be obtained from any Government / NABL Accredited institutions/Test Houses having adequate test facilities.

4.0. Mechanical Device to avoid Head to Tail Collision of Dumpers:

A mechanical system / device(s) adequately designed to protect operator of Dumper in the event of Head to Tail collision even in mixed capacity dumpers operating environment. The device(s) / system shall be of standalone mechanical structure or combination of mechanical structures wherein maximum impact energy generated by collision is absorbed by the device / system or diverted away from the operator to protect the operator when the operator is adequately constrained in his / her seat by seat belt.

Applicability: Dumpers

26
26/2/2000

4.1. The Mechanical Device to avoid Head to Tail Collision of Dumpers shall meet the following minimum requirements and standards:

The system / device(s) shall be of standalone Mechanical structure or combination of Mechanical structures, viz, combination of Operator cabin protective structure and protection arrangement at Tail end of the Dumper or bumper extension or any other suitable arrangements. Hydraulic system or any other suitable system may be included as add-on. As far as possible, in new Dumpers, the Device(s) / System shall be part of original design of the Dumpers to avoid retro fitting difficulties.

4.1.1. The system / device(s) shall protect the Dumper Operator during head to tail collision when the operator is constrained by operator seat belt even in mixed capacity dumper operating environment.

4.1.2. Components of the system / device(s) shall not affect visibility of Operator, stability of the Dumper and intended use for which the Dumper is designed.

4.1.3. The system / device(s) shall absorb most of impact energy generated by collision or divert most of the impact energy away from the Operator so as to ensure protection from direct hit or crushing of Operator.

4.1.4. Components of the system / device(s) shall not hinder with loading operation or foul with components of Loader / Shovel / Excavators.

5.0. Automatic Fire Detection and Suppression System (AFDSS) for HEMM:

An automatic system to detect and suppress fire in hot zones of machine and is capable of sensing, activating and delivering the fire suppression agent(s) without human intervention in the event of fire with additional provision for manual actuation and appropriate indication and warning to Operator by incorporating one or more kinds of heat sensing system and suitable fire suppressant agents.

Applicability: All Heavy Earth Moving Machinery

5.1. The Automatic Fire Detection and Suppression System (AFDSS) shall meet the following minimum requirements and standards:

5.1.1 The system shall meet requirements of DGMS (Approval) Circular No. 2 dated 08.07.2013. In addition, it shall meet following additional requirements:

5.1.2. The system shall have system healthy and system malfunction indication to indicate its status. The system shall be provided with Manual actuation control(s) inside Operator cabin and t outside of operator cabin preferably away from hot zones. Components of the system shall in no way obstruct Operator's line of sight hindering his / her visibility.

5.1.3. The system shall cover all fire susceptible areas including engine, diesel tank, battery box, transmission, exhaust pipe and other hot zones having potential to cause fire.

5.1.4. The system shall be fully automatic, robust and shall not be damaged / made inoperative during routine maintenance activities. Components of system, in particular, sensing elements, shall be adequately protected from external damage. Nuisance heat sensing shall be avoided by the system.

5.1.5. The system, as far as practical, shall be designed in such a way to supply adequate quantity of fire suppressing agent to the zone where the fire is detected and to be suppressed on need basis for effective fire fighting and to avoid re-ignition of fire instead of blind discharge through all discharge nozzles.

6. 0. Dump Body raised position indicator with warning:

A system or a device capable of sensing non-return of dump body to completely retracted & transportation mode, restricting transmission of Dumpers / Tipper trucks, when engaged, up to first gear while the dump body is not completely lowered and simultaneously triggering an audible and/or visual warning till such time the dump body is completely lowered.

Applicability: Dumpers / Tipper trucks

6.1. The Dump Body raised position indicator with warning shall meet the following minimum requirements and standards:

6.1.1. The system shall trigger visual warning sooner Dump body is raised from its retracted cum transport mode. The warning shall remain "ON" till such the time the Dump body is not completely retracted/lowered. The system may have additional mechanical indicator to show that the dump body is not in fully retracted position. The visual warning shall be so located as to be readily visible and recognizable in the daylight and distinguishable from other alerts at night time by the Operator when seated in Operator Seat. As far as possible, the warning indicator shall be integral part of Operator console / Display Panel.

6.1.2. The system shall sound Audio warning in addition to Visual Warning when Dumper / Truck is attempted to move from its stationary position with dump body not in completely retracted position. The system shall not allow engagement of transmission system beyond first gear when the dump body is in raised position.

6.1.3. Sensors of the system shall have Ingress Protection of IP 68 in accordance with IEC 60529 and test Certificates to this effect shall be obtained from any Government / NABL Accredited institutions/Test Houses having adequate test facilities.

7. 0. Exhaust Brake:

Applicability: Dumpers / Tipper trucks / Heavy Vehicles.

7.1. The Exhaust Brake shall meet the following minimum requirements and standards:

7.1.2. The brake shall be an Auxiliary Braking System and shall be compliment but not a replacement to service Brake.

7.1.3. Control forces of the braking system controls and other brake testing requirement shall be in accordance with IS 16479 (*Performance requirements and test procedures of braking systems for wheeled high-speed rubber-tracked Earth Moving Machines and construction equipment vehicles*) stipulated for Retarder. For Heavy vehicles, it shall be in accordance with relevant Automotive Industry Standards (AIS).

26/2/2020

7.1.4. The Brake control shall be provided in the Operator's cabin within the Zone of Reach and distinctly marked.

8. 0. Load Indicators:

An automatic Load sensing, measuring and data logging system to monitor load, to sound warning when loaded beyond its designed safe carrying load and to record the payload during machine operation. The system shall have signaling provision on both sides of the Dumpers / Tipper trucks to indicate the loading status along with indication to the Operator.

Applicability: Dumpers / Tipper trucks

8.1. The Load Indicators for Dumpers and Tippers shall meet the following minimum requirements and standards:

8.1.1. The system shall comprise of onboard automatically load sensing/measuring device, indicating arrangement and warning system.

8.1.2. The system shall have exterior load indicating device(s) (in the form of different light indicators) so that the loader Operator is aware of under load, safe load and Over Loading of the Dumpers / Tippers. The indication shall also be extended to Dumper / Tipper Operator and the indication shall be suitably placed in Operator cabin as easily seen by the Operator without strain and without affecting his outside visibility. The Exterior load indicator shall be provided on both sides of Dumper / Tipper.

8.1.3. The system shall sound Audio warning when safe carrying capacity of Dumper / Tipper is reached. The Warning shall be continuous when the Dumper/truck is overloaded. The system shall not have manual override.

8.1.4. The system shall have Ingress Protection of IP 68 in accordance with IEC 60529 and test Certificates to this effect shall be obtained any Government / NABL Accredited institutions/Test Houses having adequate test facilities.

8.1.5. Light intensity of the Indicator shall be as per the requirements of AVA stipulated by DGMS. Intensity of Audio Warning shall be as per the requirements of AVA stipulated by DGMS.

8.1.6. The System may be provided with provisions for recording the warning generated with time stamp to enable easy retrieval and analysis of the immediate past 96 deployment operating hours.

9.0. Dump Body Stabilizers for Tippers:

The Dump Body Stabilizers for Tippers shall meet the following minimum requirements and standards:

Adequate and suitable mechanical arrangement(s) in the form of stabiliser to prevent toppling of Tipper / separation of dump body of the Tipper from lift cylinder(s) during dumping operation of the Tipper shall be provided in all Tippers. As far as possible, the dump body shall be designed during design phase of Tippers.

10.0. Seat belt and Seat Belt Reminder:

Applicability: Dumpers / Tipper trucks / Light and Heavy Vehicles.

10.1. The Seat belt and Seat Belt Reminder shall meet the following minimum requirements and standards:

10.1.1. Seat Belt

(a) Seat Belt shall be an arrangement of strap(s), 3 point contact type with a securing buckle with quick release, adjusting devices and attachments which are capable of being anchored in Operator's cabin of HEMM.

(b) Seat Belt shall be designed to minimize the risk of injury to its wearer (Operator), in the event of collision or of abrupt deceleration of the vehicle, by limiting the mobility of the wearer's body. It shall be capable of returning to normal operating position sooner the condition(s) causing the risk is/are diminished and shall not hinder normal operations of the Operator.

(c) A cutting arrangement shall be provided in Operator cabin at a place which is easily approachable by the operator/person for cutting the strap in case of jamming of securing buckle during escape / rescue operations in case of any eventualities.

10.1.2. Seat Belt Reminder system

(a) The system shall detect an unfastened safety-belt and initiate two stages of both Visual and Audible alerts, namely, First Level Warning and Second Level Warning.

(b) The visual warning shall be so located as to be readily visible and recognizable in the daylight and distinguishable from other alerts at night time by the Operator when seated in Operator Seat. As far as possible, the warning indicator shall be integral part of Operator console / Display Panel. The Visual Warning shall be flashing tell-tale.

Note 1: "First Level Warning" means a visual warning activated when the ignition switch is engaged (engine running or not) and the Operator's safety-belt is not fastened. An audible warning can be added as an option.

Note 2: "Second Level Warning" means a visual and audible warning activated when a Operator operates a vehicle without fastening of Operator safety-belt.

Note 3: Reference for Test requirements: AIS 145 (for appropriate N type vehicle) or any other acceptable international automotive standards

11. 0. No Bump Circuit for Drills:

The No Bump Circuit shall meet the following minimum requirements and standards:

A system capable of automatically bringing down and maintaining speed of vertical travel and rotary motion of rotary mechanism automatically to predetermined safe level(s) during drill rod connection between rotary and drill rod and between drill rods irrespective of speed selection by Operator of Drill machine. The No Bump Circuit shall provide for such speed(s) during the above mentioned connections so as to avoid damage to threads of pipe(s) and rotary heads.

26/2/2020

12. 0. Breakout Wrench for Drills:

The Breakout Wrench shall meet the following minimum requirements and standards:

12.1. The wrench shall be of adequate design and construction and shall be capable of breaking out tightly threaded Drill Rod Connections safely and operated from Operator cabin of the Drill. Break out wrench shall be mounted in the machine and is in addition to normal arrangement provided to break out threaded drill rod connections. For smaller diameter Drill pipes and machines intended for drilling holes for secondary blasting, a portable Break out wrench arrangement may be used.

12.2. The wrench shall have provision to automatically adjust its jaws to diameter of Drill rod to compensate for any drill pipe wear and shall be provided with mechanical locking arrangement to secure the wrench at its resting position. The wrench shall be so installed as not to affect Operator's visibility to Drill Rods / Drill Platform.

12.3. Adequate safeguard shall be provided to prevent accidental / inadvertent actuation of controls in Operator's Cabin.

13. Propel joystick-spring loaded type to return to neutral (Dead-man safety) for Drills:

The Propel joystick-spring loaded type to return to neutral (Dead man safety) shall meet the following minimum requirements and standards:

It shall be capable of returning to deactivated (Neutral) position automatically upon release of lever by Operator and shall immediately bring propel / tramming operation of the Machine to Halt and safe state.

14.0. Proximity Warning Device:

A system designed for early detection of static and moving objects, vehicles, human beings encountered within virtual target area during movement of Dumper / Tipper and for triggering warning the operator to prevent collision or run over. The system shall comprise sensors which may employ one or more or combination of technology / methodology (for detection of objects, vehicles, and human beings), control unit(s) (for receiving input from sensor(s), processing it and forwarding necessary input to Warning Unit) and warning unit to trigger Audio visual warning to the operator. The system shall have variable target area during forward movement depending upon speed of the Dumper / Tipper and predetermined target area during rearward movement.

Applicability: Dumpers / Tipper trucks

14.1. The Proximity Warning Device shall meet the following minimum requirements and standards:

14.1.1. Proximity warning device / system shall be provided for detecting static and moving objects including human beings on its own during the vehicle movement for a specified range, and warn the operator in the operator's station.

14.1.2. At least one object detection sensor, accessible and not interfering with the Dumper's / Truck's operation shall be provided both in the front and at rear of the Dumper / Truck at suitable

locations. The system shall be ergonomically designed and mounted for operator and maintenance personnel.

14.1.3. The system shall be reliable and be able to provide an adjustable audio visual warning when it detects static and moving objects including human beings, least height light motor vehicle used in the mine, etc., within the virtual target area of respective Dumper/Truck.

14.1.4. The sensor shall detect static and moving objects in a virtual target area as defined below. The manufacturer shall ensure maximum possible detection coverage in the virtual target area depending on the available fitment area and proximity detection technology defined as below:

14.1.5. Virtual Target Area in Front of Dumper/Truck:

(a) Width of the virtual target area shall be equal to the width of the Dumper/Truck plus 0.5m on both sides.

(b) The inner edges (base line) that represent the width of the virtual target area shall pass through the inner edge of bumper of Dumper/Truck. The centerline of the virtual target area and the Dumper/Truck centerline shall coincide.

(c) Length of the virtual target area shall conform to maximum stopping distance as mentioned in the IS: 16479 (*Performance requirements and test procedures of braking systems for wheeled high-speed rubber-tracked Earth Moving Machines and construction equipment vehicles*) and the length of virtual target area shall be calculated by the Control Unit of the system dynamically and automatically with relation to vehicle's speed at any given point of time while covering the blind spot distance observed within the width of virtual target area when the Dumper / Tipper was in static pre-start (ignition – on) condition. While calculating stopping distance in accordance with IS 16479, the test slope percentage may be taken as 6.25 % (i.e. 1 in 16, which is maximum permissible slope of haul road under normal operating conditions). Further, Brake response time and operator response time shall also be considered while calculating the stopping distance.

14.1.6. Virtual Target Area in Rear of Dumper/Truck:

(a) Width of the virtual target area shall be equal to the width of the Dumper/Truck plus 0.5 m on both sides.

(b) Length of the virtual target area shall be more than or equal to the length of the Dumper/Truck.

(c) The inner edges (base line) that represent the width of the virtual target area shall pass through the centerline of the rear axle of the Dumper/Truck.

(d) The centerline of the virtual target area and the Dumper's/Truck's centerline shall coincide.

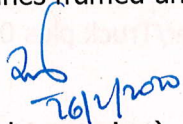
14.1.7. The system shall not detect any obstacles beyond the width of the virtual target area and its detection area shall be restricted along the vehicle's pathway for minimizing false alarm. The system shall have intelligent alert generating mechanisms like indication of obstacle in the vehicle's pathway, whether left, right or center and triggering audio alerts after detection of obstacles of auto-cut off type, to avoid operator inconvenience/distraction. The System shall be provided with provisions for recording of details of warning generated with time stamp with

location details (if feasible) to enable easy retrieval and analysis of the immediate past 96 deployment operating hours.

14.1.8. The system shall be tested at any Government approved laboratories or Test houses accredited by NABL subject to confirmation of its ability to conduct such tests conforming to following Standards (or its revised versions) and the test house shall not be part of Manufacturer's testing facility.

- (a) IEC 61000-4-5:2014 - Electromagnetic compatibility (EMC): Testing and measurement techniques - Surge immunity test.
- (b) IEC 61000-4-6: 2013 - Electromagnetic compatibility (EMC): Testing and measurement techniques - Immunity to conducted disturbances, induced by radio frequency fields.
- (c) JSS 5555:2000(Rev-2) - Sinusoidal Vibration Test, Frequency: 8 to 500 Hz, Acceleration: 40m/s^2 , Duration 2 hrs in each axis.
- (d) IS-9000: Part-V/Sec 1 - 1981 Reaffirmed 2007 - Damp Heat Test (at 40°C & 95% RH for 16 Hrs).
- (e) IS-9000: Part-II/Sec 3 - 1977 reaffirmed 2004 - Cold Test (-10°C).
- (f) IS-9000: Part-III/Sec 3 - 1977 reaffirmed 2004 - Dry Heat Test ($+70^\circ\text{C}$).
- (g) IS-9000: Part-XIV/Sec 2 - 1998- Rapid Temperature Cycle Test.
- (h) Ingress Protection Test, IP-66 required;

14.1.9. Rules/guide lines framed by Ministry of Communications and Information Technology (Wireless Planning and Co-ordination Wing), wherever applicable, shall be complied. The technology / technologies of the system shall also comply with other applicable statutory guidelines framed under various Rules /Regulations / Acts by Government of India.


(R. Subramanian)
Director General of Mines Safety (Off.)