



GOVERNMENT OF INDIA
MINISTRY OF LABOUR & EMPLOYMENT
DIRECTORATE GENERAL OF MINES SAFETY

DHANBAD – 826001, JHARKHAND

No. DGMS/ S&T/Tech. Cir. (Approval) No. 3

Dhanbad, the 3rd June 2010

To:

The Owner, Agent, Manager of All Mines & The Manufacturers

Subject: Standard Components and Properties of Steel Roof Bolts to be used in Mines

Steel Roof Bolts with Nuts, Dome Washer, Bearing Plates and W-Straps are being widely used in the mines. In making of such steel supports, various types of steel rods, TMT bars are generally used. In order to ensure the desired strength and durability of such supports, a study was carried out during the year 2008 and the steel supports including roof bolts were brought under the purview of approval vide Gazette Notification No. GSR 160 dated 14th August, 2008, and a circular in this regard was also issued vide this Directorate's issue No. DGMS (Tech) (S&T)/Circular No. 3/703 dated 14.08.2008.

The Roof Bolts, Nuts, Bearing Plates & W-straps manufactured by various companies have also been approved from this Directorate. The Data collected during the testing of such supports were analysed. After detailed discussions and meetings held with scientists from Central Institute of Mining & Fuel Research (CIMFR) and Professors from Indian School of Mines, Dhanbad, a Technical Circular No. DGMS/S&T/Tech. Cir. (Approval) No. 11 dated 17th July 2009 was issued on the standard components and properties of roof bolts to be used in mines. Based on the standards and parameters specified in the circular, testing of the steel roof bolts are being conducted at the test house and on the basis of such test reports approvals are being granted.

During the period of testing, approval and field trials of such roof bolts and bearing plates including w-straps, various suggestions, recommendations and advices were received from the scientists from Research & Development Centre for Iron & Steel (RDCIS), Ranchi & CIMFR, Dhanbad, CMPDIL, Ranchi, ISM, Dhanbad, and CIL, Kolkata. The feedbacks received

from such organisations have since been considered and the standard and parameters of the roof bolts and its assembly to be used in mines are prescribed as under:

1.0 Physical Properties:

(a) Shape & Size:

The Roof bolt shall be of MS Steel or TMT Rebar having circular cross-section with ribs on circumferential region. The manufacturer of the roof bolt shall specify the design, calculations, Yield Strength and Ultimate Tensile Strength along with elongation at Yield and the factor of safety of the roof bolt manufactured by them. The Roof bolt shall be as per the drawing and dimensions given by the manufacturer.

(b) Length:

Length of the Roof Bolt shall not be more the designed length ± 5 mm.

(c) Diameter:

Diameter of the Roof Bolt shall not be more than the designed diameter $\pm 4\%$ by mass as specified under IS 1786 – 2008 or as per the standard given in BS 7861 (Part-1) 2008.

(d) Straightness:

The roof Bolt shall be straight without any joint, welding, deviation or deflection. However if the deflection or deviation cannot avoided due to practical reasons, it shall not be more than $\pm 0.1\%$ per meter length of the bolt.

(e) Rib:

The Rib of the Roof Bolt shall be as per the design of the rib with an objective to maximize the surface area without reducing the core diameter of the roof bolt and having maximum grip with the grout. However the height of the rib shall be kept within the standard prescribed in IS 1786 – 2008 or BS 7861 (Part 1) 1996 or latest revision thereof.

2.0 Physico-mechanical Properties:

Steel for the Roof Bolt:

The roof bolt shall be of thermo-mechanically treated (TMT) rebar manufactured from MS Grade Fe-500, Fe-600 or above. The Yield Stress, Tensile Strength and % elongation steel Grade shall be maintained as per the IS 1786 and IS 13920.

However the minimum load bearing capacity (Anchorage Load) of the roof bolt shall be 160 kN.

3.0 Chemical Composition:

Chemical composition of the steel for manufacturing of the roof bolts varies according to the requirement of strength characteristics and specific applications given by the roof bolt manufacturer and the end user. However certain chemical constituents of the steel which influence the required properties of steel are prescribed below:

Sl No.	Constituent	Percentage by weight
1	Carbon ©	0.25 (Max)
2	Sulfur (S)	0.05 (Max)
3	Phosphorous(P)	0.05 (Max)
4	Manganese	1.5 (Max)
5	Other Alloying/micro alloying elements	0.50 (Max)

In this regard, reference may be made of IS 1786: 2008 for considerations and testing.

Thread on the Roof Bolt:

(a) The **thread** on the roof bolt shall be M20 cold rolled thread conforming to IS 4218 (part- 2 & 3) and no cut thread shall be used. The minimum length of the thread shall be 150 ± 5 mm and the tolerance class designation of 8g. The thread shall conform to tolerance class of 7H.

As a routine test, one thread in every 50 produced shall be checked using a go/no-go gauge.

(b) Non-threaded end

The non threaded end of the rock bolt shall be formed by cropping or sawing and shall be free from burrs and edges which protrude beyond the profile of the rock bolt.

As a routine, one rock bolt in every 200 produced shall be checked for straightness.

(c) The **Nut** shall be of hexagonal shape of thickness not less than 30mm conforming to IS 1363 (Part-3) and the thread shall conform to tolerance class of 7H.

(d) Pull Test: Thread and the Nut on the roof bolt shall be subjected to pull test which should not slip at the yield strength/load of the roof bolt.

Bearing Plate

(a) The Bearing Plate of the roof bolt shall be Dome Washer Plate of dimension 150 x 150 x 8 (minimum) mm with compatible central hole of required size and angled side to accommodate the conical seat and nut.

(b) The minimum load at which the Domed Washer Plate will become flat should be at least 14 Tonnes.

Conical Seat

(a) Conical Seat shall be of forged steel of required dimension

(b) The Conical Seat shall not deform at 1.20 times the Yield stress of the roof bolt.

The roof bolt, thread, nut, conical seat, domes washer plate as well as domed bearing plate shall be subjected to tensile test and type as specified in BS 7861 (Part-1) 1996 or revised edition.

4.0 Tensile Test of the Roof Bolt Assembly

(a) The Roof Bolt Assembly shall be subjected to Tensile Test and should not fail up to 16 Tonnes load.

Subject to the condition that System Stiffness of the Roof Bolt assembly shall be within 20 KN/mm -System stiffness between 50 to 150 KN.

5.0 Other Properties & Parameters

(a) Weatherability:

The Roof Bolts and its components or parts shall be subjected to **Accelerated Weathering Test** in mine water condition for 20 days. No deterioration should occur on the Assembly.

(b) Accelerated Weathering Test shall also be conducted in acidic water condition for 20 days during which no deterioration should occur on the Assembly.

[Note: The AWT under mine water condition generally is at pH > 4 and that under acidic water condition is considered at pH-2 (5 % HCL aqueous solution) during testing. The test limit is that the loss of weight shall not be more than 5%]

(c) Corrosion Resistance Test:

The Roof Bolt Assembly shall also be subjected to Field Exposure and Corrosion Resistivity Test as per IS- 5555: 1970 to test the resistance to corrosion of the steel of the roof bolt and its parts. The Roof Bolt should pass the required test.

6.0 SAMPLING & TESTING

In order to check the composition and required parameters during manufacture, it shall be required that the random sampling be done @ of 2 roof bolts per 1000 pieces of roof bolts and its accessories manufactured in a batch which shall be subjected to the required set of tests as prescribed in the previous paragraphs above and the data shall be kept recorded in a bound paged book kept for the purpose which shall be signed by the persons carrying out the test and shall be countersigned by the quality control officer posted at the manufacturing unit(s).

6.1 The user shall carry out Physical examination tests as far as possible but shall conduct Tensile Test of the Assembly for every batch of Roof Bolts & its Accessories received at their end before use and keep the records in a bound paged book kept for the purpose.

In case the Roof Bolts or any of its accessories fail to pass the required tests at the user's end, that batch or lot of the manufacture shall not be used in the mine and intimation thereof shall be sent to the manufacturer. A record in this regard shall be maintained at the mine/company.

6.2 The Chief Inspector of Mines or an Inspector of Mines may inspect, check and examine the manufacturing facilities at any time and get samples tested during the course of inspection or send such samples for testing at any national test houses/laboratories at the cost of the manufacturer.

6.3 The Chief Inspector of Mines or an Inspector of Mines may inspect, check and examine the roof bolts and its accessories at any time in the mine or the area of the mines

and get samples tested during the course of inspection or send such samples for testing at any national test houses/laboratories at the cost of manufacturer or user.

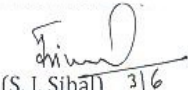
7.0 General Requirement

All the Owner, Agent and Manager including the manufacturers and suppliers shall be required to comply with this standard and any deviation or defects found in the product supplied or used in the mine, shall be brought to the notice of this Directorate.

Manufacturers and the Users including the Test Houses, who are engaged for testing of such material, are therefore requested to ensure the above mentioned Standard and Parameters before supplying and using at the mine.

The Standard, Parameters and Testing of Steel Roof Bolt assembly as mentioned above, in this circular shall be considered as approved by the Chief Inspector of Mines by a general order as provided under regulation 181(3) of the Coal Mines Regulations, 1957. This is being issued in continuation of the gazette notification No. GSR 160 dated 14th August, 2008,

Yours Faithfully,



(S. J. Sibāl) 3/6

Director General of Mines Safety