

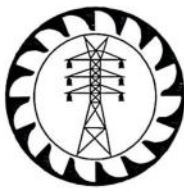
064: 2023

CEB  
SPECIFICATION

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**STEEL BOLTS AND NUTS/ WASHERS**



**CEYLON ELECTRICITY BOARD  
SRI LANKA**



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## SPECIFICATION FOR STEEL NUTS AND BOLTS/WASHERS

### 1.0 SCOPE

This specification covers the general requirements of manufacture and testing of following categories of Steel Bolts, Nuts and Washers for use in the overhead power distribution lines.

1. Galvanized Steel Bolts, Nuts and Washers
2. Ungalvanized Steel Bolts, Nuts and Washers

**Required category, bolt diameter and length will be prescribed in the schedule of prices by the procurement entity.**

The Ungalvanized Steel Bolts, Nuts and Washers shall be suitable for hot dip galvanizing by the CEB.

### 2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	400V	11kV	33kV
(b)	System highest voltage	440V	12kV	36kV
(c)	System frequency	50Hz	50 Hz	50 Hz
(d)	Number of phases	03	03	03
(e)	Method of earthing	Solid earthed	Resistively/ Non-effectively earthed	Solidly via earthing transformer/ Non-effectively earthed
(f)	System fault current	25kA	12.5 kA	14.2 kA

### 3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(e)	Operational altitude	0 – 1000m MASL (as per IEC 60076-1).
(f)	Isokeraunic (Thunder days) level	100 days

### 4.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	ISO 898-1:2013	Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread
(b)	ISO 898-2:2022	Fasteners — Mechanical properties of fasteners made of



		carbon steel and alloy steel — Part 2: Nuts with specified property classes
(c)	ISO 261:1998	ISO general purpose metric screw threads — General plan
(d)	ISO 965-2:1998	ISO general purpose metric screw threads — Tolerances — Part 2: Limits of sizes for general purpose external and internal screw threads — Medium quality
(e)	ISO 887:2000	Plain washers for metric bolts, screws and nuts for general purposes — General plan
(f)	ISO 4759-1:2000	Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C
(g)	ISO 4014:2022	Hexagon head bolts — Product grades A and B
(h)	ISO 4032:2023	Fasteners — Hexagon regular nuts (style 1)
(i)	BS EN ISO 1461:2022	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods
(j)	BS 4464:1969	Specification for spring washers for general engineering and automobile purposes. Metric series

## 5.0 BASIC FEATURES

### 5.1 General

The steel bolts and nuts shall be of the hexagonal heads type as per ISO 898 Part 1&2 and the screwed threads shall comply with ISO 261. The mechanical properties of the bolts and nuts shall comply with ISO 898. The hot dip galvanizing (if applicable) shall conform to BS EN ISO 1461.

### 5.2 Material

The steel used for the manufacture of the bolts and nuts shall be such that the mechanical properties of the finished products shall not be less than that of Property Class 5.6 as stipulated in Table 3 of ISO 898-1.

### 5.3 Hexagonal Head

The hexagonal head of the bolt shall be formed by cold forging and the required marking shall also be formed (embossed) during the formed (embossed) during the forging operation.

### 5.4 Screw Threads

The bolts shall be provided with rolled threads and the form of thread, diameters and associated pitches shall be in accordance with ISO 262.

### 5.5 Nuts

The height and width across flats of the hexagonal nuts shall be as stipulated for Style 1 in Table B.1 of ISO 898-2. The property class shall be marked as per ISO 898-2

### 5.6 Chamfering and Facing

#### 5.6.1 Head of Bolts

The hexagon bolt heads shall be chamfered at an angle of approximately 30 degrees on the





upper faces. The diameter of the ring formed by the chamfer on the upper face of the bolt shall not be smaller than 90% of the minimum across flat dimension.

### 5.6.2 Ends of Bolts

The thread rolling operation shall provide the necessary chamfer to the end of the bolt, and the end shall be reasonably square with the centre line of the shank.

### 5.6.3 Nuts

The nuts shall be chamfered at an angle of approximately 30°C on one face and they shall be machined on both faces.

## 5.7 Diameter of Shank of Bolts

The diameter of the unthreaded portion of the shank of Bolts shall be in accordance with the standard specified and it shall be round and uniform.

## 5.8 Length of Bolts and thread length

The nominal length and the thread length of various sizes of bolts shall be as given below.

	Bolt Diameter (mm)	Bolt Length (mm)	Thread Length (mm)
(a)	16	40	25 / full thread
(b)	16	50	25
(c)	16	120	25
(d)	16	180	75
(e)	16	200	75
(f)	16	230	75
(g)	16	250	75
(h)	16	280	75
(i)	16	300	75
(j)	16	350	75
(k)	16	400	75
(l)	16	450	75

## 5.9 Plain Washers

The washers shall be of the flat round type and shall be in accordance with ISO 887. The thickness shall not be less than 3.0mm and the diameter shall not be less than 45mm with a centre hole to allow M16 Bolt (as per schedule of prices) to pass through. Hot dipped galvanizing (if applicable) shall be as per BS EN ISO 1461.



### 5.10 Spring Washers

The spring washers shall be of single coil, rectangular cross section conforming to BS 4464. Hot dipped galvanizing (if applicable) shall be as per BS EN ISO 1461. The Thickness shall not be less than 3.3mm and the diameter shall be 30mm with a centre hole to allow M16 Bolt (as per schedule of prices) to pass through.

### 5.11 Dimensions and Tolerances

Dimensions (nominal, maximum and minimum values) for hexagonal head bolts and nuts are indicated in Table 1 of ISO 4014 and ISO 4032. The dimensional tolerances of the bolts, nuts, screw threads and washers shall be in accordance with ISO 965, ISO 262 and ISO 4759-1.

### 5.12 Galvanizing (if applicable)

The bolts, nuts and washers shall be hot dip galvanized to comply with BS EN ISO 1461 after all machining operations are completed.

Threads of bolts shall be galvanized under centrifugal system, and the threads of the nuts shall be oiled. In case of articles with thickness greater than 6mm, the Mean Galvanized Coating mass and thickness shall not be less than 610g/m<sup>2</sup> and 0.085mm respectively. In case of articles with thickness less than or equal to 3mm, the Mean Galvanized Coating mass and thickness shall not be less than 395g/m<sup>2</sup> and 0.055mm respectively. The threaded portion shall have Mean Galvanized Coating mass and thickness of 360g/m<sup>2</sup> and 0.050mm respectively (minimum).

Preparation of galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material.

To prevent the formation of white rust, all items shall be treated with sodium dichromate after galvanizing and stored under well ventilated conditions. Sherardising or other process shall not be used.

### 5.13 Finish

The bolts & nuts and washers shall be free from blister, scale, rust and other defects before galvanizing. The bolts, nuts and washers shall be smooth, clean, uniform throughout without any burs / sharp edges and free from defects after galvanizing. Washers shall be free from spelter after galvanizing.

The nuts shall be finger tight on bolts and will be rejected if they are excessively loose or tight fit. Bolts with threads re-died after galvanizing will also be rejected.

## 6.0 REQUIREMENTS FOR SELECTION

### 6.1 Quality Assurance

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification for the manufacture of galvanized / ungalvanized steel bolts and nuts/washers for the plant where the manufacturing is done. Bidders shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.



## 6.2 Manufacturing Experience

The manufacturer shall have minimum of ten (10) years experience in manufacturing galvanized / ungalvanized steel bolts and nuts/washers.

However, the manufacturers who have supplied galvanized / ungalvanized steel bolts and nuts/washers satisfactorily over the last five years, whose cumulative quantities either equal or exceeding the quantity in current bid, will be considered to have complied this clause.

## 6.3 Type Tests

Type Test Certificates conforming to the above referred ISO standards or any other international standard which is not less stringent, issued by:

Either

- (a) an accredited independent testing laboratory acceptable to the CEB or
- (b) an accredited or independent testing laboratory acceptable to the CEB where the type tests have been witnessed by CEB or a reputed independent body acceptable to CEB

shall be furnished with the offer. Type Test Certificates shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters. In case if the submitted type tests are according to any other international standard which is not less stringent than the specified, then the copy of the used standard in English shall be submitted with offer.

Proof of accreditation and accredited scope by a national/ international authority shall be forwarded with the offer. Test certificates shall be complete including all the pages as issued by the testing authority. Type test certificates shall be in English language. Parts of test certificates shall not be acceptable.

Following type tests conforming to the relevant ISO specified shall be submitted for each size;

- |       |                            |                                   |
|-------|----------------------------|-----------------------------------|
| i)    | Tensile Strength           |                                   |
| ii)   | Vickers hardness           |                                   |
| iii)  | Brinell hardness           |                                   |
| iv)   | Rockwell hardness          |                                   |
| v)    | Lower yield stress         |                                   |
| vi)   | Stress under proofing load | $S_p/R_{el}$<br>N/mm <sup>2</sup> |
| vii)  | Elongation after fracture  |                                   |
| viii) | Impact strength            |                                   |
| ix)   | Head soundness             |                                   |



## 7.0 ADDITIONAL REQUIREMENTS

### 7.1 Marking

The following marking shall be embossed on the bolt head (top) during head forging operation and galvanizing shall not obliterate the marking.

- a) Manufacturer's identification marks
- b) The letters CEB



- c) Property Class as per Table 3 of ISO 898 – 1

The diameter of the bolt as per ISO 261.

The property class of the nuts shall be marked as per ISO 898 – 2.

## 7.2 Packing

Each size of bolts with nuts / washers shall be packed separately in a polythene lined wooden boxes. Minimum number of bolts with nuts in a box shall be 100 and that of washers shall be 500. Each box shall be clearly marked with the following information.

- a) Name of Manufacturer and Country of manufacture  
 b) Size of Bolt with Nut / Washer  
 c) Quantity  
 d) Gross Weight

## 8.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

- (a) Constructional features such as:
- (i) Grade of steel used for bolts, nuts and washers.
  - (ii) Method of forming the hexagonal head, threads and markings.
  - (iii) Method of galvanizing bolts, nuts and washers (as applicable).
- (b) Particulars of Plants and Equipment available such as:
- (i) Name of the equipment
  - (ii) Type of operation to be performed by the equipment
  - (iii) Production rate (Number of components per hour)
  - (iv) Number of equipment available
- (c) Dimensional drawings of Bolts, Nuts and Washers
- (d) ISO 9001:2015 or latest Quality Assurance Certificate in accordance with clause 6.1.
- (e) Type Test Certificates in accordance with the clause 6.3.
- (f) Duly filled and signed 'Annex - B: Schedule of Technical Requirements and Guaranteed Technical Particulars'.

**Not furnishing above documents and details may result in the offer being rejected.**



## 9.0 SAMPLES

Two samples of each size of bolts & nuts, flat washers and spring washers offered shall accompany the Bid to facilitate analysis and evaluation. While analyzing samples, the purchaser reserves the right to check dimensions, inspect workmanship, and perform tests as prescribed in relevant standards specified.



## 10.0 INSPECTION AND TESTING

### 10.1 Inspection

The selected Bidder shall make necessary arrangements for inspection of the equipment by an Engineer appointed by the CEB and also to carry out in his presence necessary Acceptance / sample tests of the materials and equipment, offered.

### 10.2 Acceptance Tests

The following Sample / Acceptance test as per ISO 898 shall be witnessed by the Engineer for bolts, nuts and washers.

- i) Dimensional Check
- ii) Ultimate Tensile Strength
- iii) Elongation after fracture
- iv) Galvanizing Test

### 10.3 Sampling

The bolts & nuts/ washers packed as per Clause 7.2 shall be stored in such a manner to carry out sampling.

One bolt out of every 500 bolts of each size shall be selected randomly to carry out the acceptance tests as per Clause 10.2.

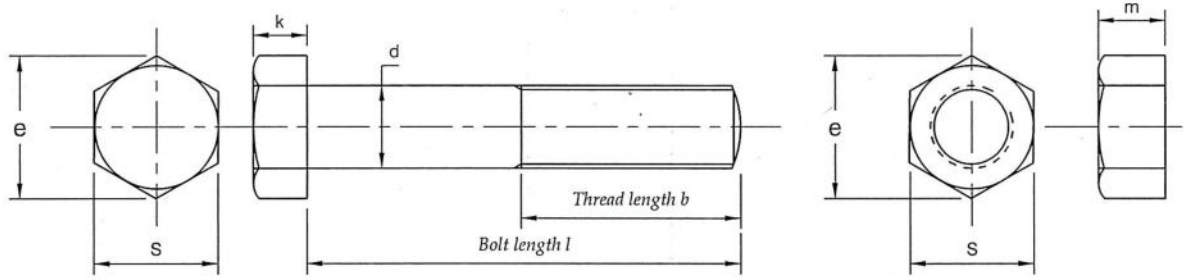
## 11.0 ANNEX

Annex - A : Drawing of Bolts and Nuts/Washers applicable with tolerances

Annex - B : Schedule of Guaranteed Technical Particulars

Annex - C : Non- Compliance Schedule



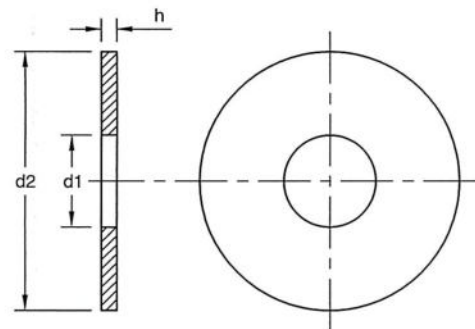


**M16 BOLT**

**M16 NUT**

Detail of Bolt & Nut					
	d	e	s	k	m
Min.	15.73	26.75	23.67	9.82	14.10
Nom.	16.00	-	24.00	10.00	-
Max.	16.00	-	24.00	10.18	14.80

Thread Lengths for M16 Bolt	
Bolt Length (l)	Thread Length (b)
40mm	25mm
50mm	25mm
120mm	25mm
180mm	75mm
200mm	75mm
230mm	75mm
250mm	75mm
280mm	75mm
300mm	75mm
350mm	75mm
400mm	75mm
450mm	75mm




**WASHER FOR M16 BOLT & NUT**

Detail of Washer			
	h	d1	d2
Min.	2.70	17.80*	49.46
Nom.	3.00	17.80	50.20
Max.	3.30	18.07	50.20*

Min.- Minimum Value  
Nom.- Nominal Value  
Max.-Maximum Value  
\* Same as the nominal value



ALL DIMENSIONS ARE IN MILLIMETERS

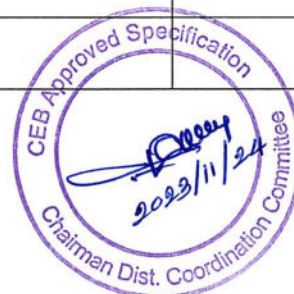
 <b>CEYLON ELECTRICITY BOARD</b>  DISTRIBUTION COORDINATION BRANCH	DISTRIBUTION STANDARDS & SPECIFICATION		SCALE : NOT TO SCALE	
	GALVANIZED STEEL BOLTS, NUTS & WASHERS		DRAWN : LALANI	EDITED : HARSHA
	DESIGNED BY	APPROVED BY	DATE : Oct. 2023	
			DRG. NO : DS&S/2023/064	
	E.E. (DS & S)	CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :	

## Annex- B

**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS**

(Following Information shall be furnished with the offer for each size)

		CEB Requirement	Offered	
1.	a) Name of manufacturer			
	b) Country of origin			
2.	Applicable Standards	As per clause 4.0		
3.	Bolts			
	i. Property Class	5.6		
	ii. Tensile Strength (Nominal and Minimum)	As per ISO 891-1		
	iii. Vickers hardness (Minimum and Maximum)			
	iv. Brinell hardness (Minimum and Maximum)			
	v. Rockwell hardness (Minimum and Maximum)			
	vi. Lower yield stress (Nominal)			
	vii. Stress under proofing load ( $S_p/R_{el}$ , N/mm <sup>2</sup> )			
	viii. Elongation after fracture (Minimum)			
	ix. Impact strength (Minimum)			
	x. Head soundness			
4.	Nut			
	i. Height of nut	As per ISO 898-2		
	ii. Width across flats			
	iii. Property Class			
	iv. Vickers hardness (Minimum and Maximum)			
	v. Brinell hardness (Minimum and Maximum)			
	vi. Rockwell hardness (Minimum and Maximum)			
	vii. Lower yield stress (Nominal)			
	viii. Stress under proofing load ( $S_p/R_{el}$ , N/mm <sup>2</sup> )			
	ix. Impact strength (Minimum)			
5.	Constructional features			
	i. Method of forming the hexagonal head			
	ii. Method of forming the threads			



	iii. Method of galvanizing (if applicable)		
	a. Galvanizing coating thickness on plain surface		
	Bolt	As per BS EN ISO 1461/ clause 5.12	
	Nut		
	Plain Washer		
	Spring washer		
	b. Galvanizing coating weight on plain surface		
	Bolt	As per BS EN ISO 1461/ clause 5.12	
	Nut		
	Plain Washer		
	Spring washer		
	iv. Method of marking		
7.	Particulars of Plants and Equipment available at the place of Manufacture (attach separate sheet)		
	i. Name of the equipment		
	ii. Type of operation to be performed by the equipment		
	iii. Production rate (Number of components per hour)		
	iv. Number of equipment available		
8.	Particulars of testing equipment available at the place of manufacture (attach separate sheet)		
9.	Whether markings and packing provided as per clause 7.0	Yes	
10.	Whether information provided as per clause 8.0	Yes	
11.	Whether the specified samples (Ref Clause 9.0) furnished	Yes	
12.	Whether the manufacturer will carry out Acceptance /Sample test as per clause 10.3 at the place of manufacture during inspection	Yes	

.....  
Signature of the Manufacturer and seal

.....  
Date

I/We certify that the above data are true and correct.

.....  
Signature of the Bidder and seal

.....  
Date





**NON-COMPLIANCE SCHEDULE**

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

.....  
Signature and seal of the Manufacturer

.....  
Date

I/We certify that the above data are true and correct

.....  
Signature and seal of the Bidder

.....  
Date

