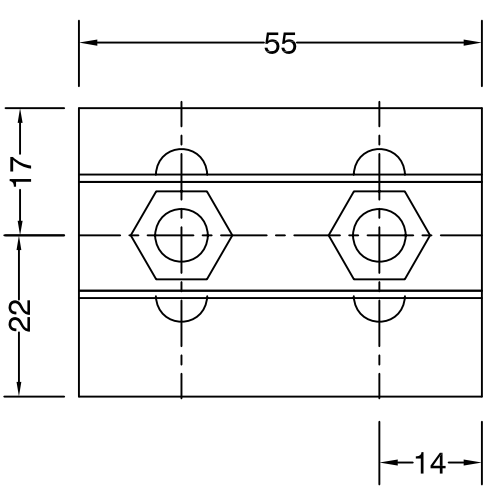
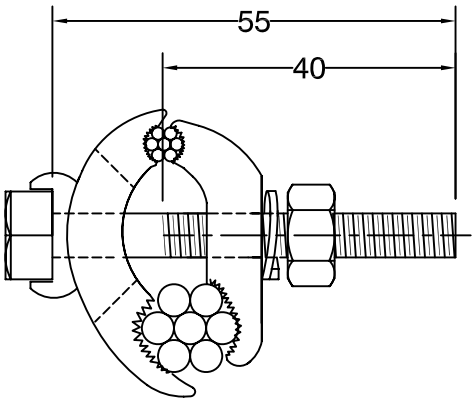
026 - 1 : 1998

CEB
STANDARD

BOLTED CLAMPS AND CONNECTORS FOR OVERHEAD LINE CONDUCTORS

CEYLON ELECTRICITY BOARD
SRI LANKA

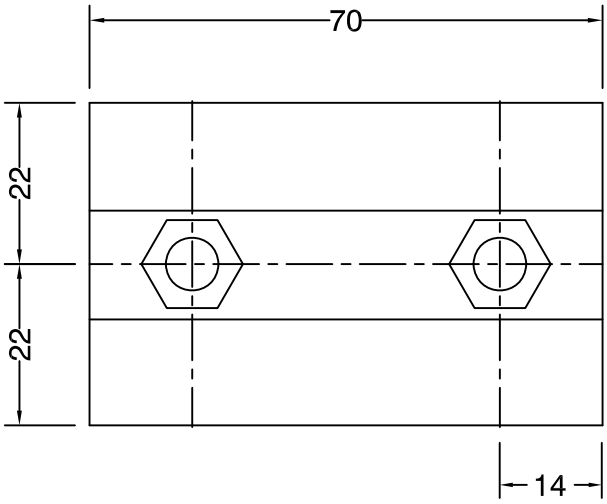


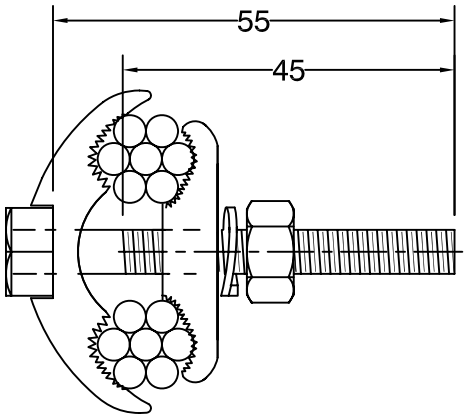


TYPE B

Main 7/3.40 to 7/4.39
Tap 7/1.35 to 7/1.70

SERVICE CLAMP





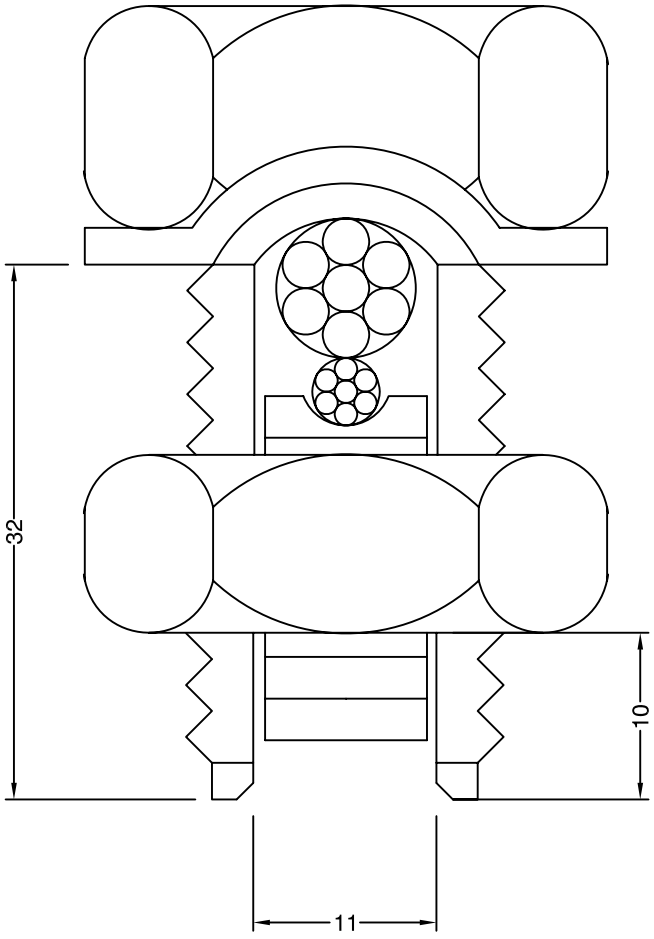
TYPE A

7/3.40 to 7/4.39 - 7/3.40 to 7/4.39

PARALLEL GROVE CLAMP

ALL DIMENSIONS ARE IN mm
& TOLARANCE ±2 MM

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATION	SCALE : NOT TO SCALE
	PARALLEL GROVE CLAMP & SERVICE CLAMP	DRAWN : LALANI
	DESIGNED BY / APPROVED BY	DATE : APR 1998
		DRG. NO : CEB/DS&S 026-1A:98
DIST. PLANNING BRANCH	CHIEF ENGINEER (DS & S) / CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :



ALL DIMENSIONS ARE IN mm.

NOTE :
TOLARANCE ON ALLUMINIUM COMPOMENT = ±2 mm.

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATION	SCALE : NOT TO SCALE
	SERVICE LINE TAP	DRAWN : LALANI
	DESIGNED BY / APPROVED BY	DATE : APR ,1998
		DRG. NO : CEB/DS&S 026-1B:98
DIST. PLANNING BRANCH	CHIEF ENGINEER (DS & S) / CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :

Specification

for

BOLTED CLAMPS AND CONNECTORS FOR OVERHEAD LINE CONDUCTORS

CEB Standard 026 - 1 : 1998

CEYLON ELECTRICITY BOARD

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SPECIFICATION FOR BOLTED CLAMPS AND CONNECTORS FOR OVERHEAD LINE CONDUCTORS

1.0 SCOPE

This specification covers the design, manufacture and testing of Bolted Clamps and Connectors for overhead line Bare Conductors and Insulated Cables.

2.0 SYSTEM PARAMETERS

a.	Nominal Voltage	33 kV	11 kV	400/230V
b.	System highest Voltage	36 kV	12 kV	400 V
c.	System frequency	50 Hz	50 Hz	50 Hz
d.	Method of Earthing	Non Effective Earthing	Effective Earthing	Effective Earthing
e.	System fault levels	13.1 kA	13.1 kA	25 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 polluted atmosphere.
e.	Operational altitude	From M.S.L. to 1900 meters above M.S.L.

4.0 APPLICABLE STANDARDS

4.1 Clamps & Connectors

The Clamps and Connectors shall be in accordance with the latest editions of the standards specified below and amendments thereof.

a)	BS	3288	(1973)	-	Insulators and conductor fittings for O/H power lines.
b)	BS	1474	(1987)	-	Wrought Al and Al alloys, bars,

					extruded round tubes and sections
c)	BS	729	(1971)	-	Hot dip galvanized coatings on Iron & Steel articles.
d)	BSEN	20273	(1992)	-	Fasteners. Clearance holes for bolts and screws.
e)	ISO	898-1	(1988)	-	Mechanical properties of fasteners, bolts, screws and studs.

4.2 Conductors & Cables

The Clamps and Connectors specified shall be compatible with overhead Conductor and Insulated Cables manufactured to the following standards.

a)	BS	215	(1970)	-	All Aluminium Conductors and ACSR.
b)	BS	3242	(1970)	-	Aluminium alloy stranded conductors for overhead power transmission.
c)	IEC	104	(1987)	-	Aluminium-Magnesium-Silicon Alloy wire for overhead line conductors.
d)	BS	6346	(1989)	-	PVC Insulated cables for electricity supply.
e)	IEC	502	(1994)	-	Extruded solid dielectric insulated power cables.

5.0 MATERIAL REQUIREMENT & WORKMANSHIP

5.1 Material

The aluminium / copper components of the Bolted Clamps shall be made of high quality aluminium or aluminium alloy / copper.

All two piece Clamps shall have an interlocking design to prevent mismatch.

In the case of Bi-metallic Connectors;

i) All copper components or parts shall be high copper content alloy.

or

ii) The copper and aluminium components shall be effectively fused to prevent deterioration by galvanic action.

5.2 Steel Hardware

The hexagon Bolts and screws shall have a tensile strength not less than 600 N/mm^2 as specified in the ISO 989-1 Part 1 for bolts, screws and studs.

All Bolts shall be of sufficient length to allow installation without disassembling the connectors.

The bolts shall be marked with the designation symbol of the property class as stipulated in ISO 989-1.

Spring washers shall be provided where necessary to compensate for expansion of steel and aluminium

The Bolts, Nuts and Washers shall be hot dip galvanized as per BS 729.

5.3 Oxide Inhibiting Grease/Compound

The internal faces of aluminium fittings shall be coated with Oxide Inhibiting Grease/Compound to improve electrical contact and ensure maximum electrical performance of fittings.

The quantity of Oxide inhibiting grease/compound shall be sufficient to ensure the integrity of the fitting when used on smallest conductor for which it is designed.

The Oxide inhibiting grease/compound shall contain suspended particles to penetrate the oxide film present on aluminium surfaces. Full details of the type of Oxide inhibiting grease / compound used in the aluminium components, and document in proof of tests carried out for compatibility shall be furnished.

5.4 Workmanship

High quality Workmanship shall be maintained in the manufacture of Bolted Clamps and Connectors and shall be free from sharp edges burrs and swarf.

6.0 TECHNICAL REQUIREMENTS

6.1 General

The Bolted Clamps and Connectors shall be suitable for use with the type and sizes of conductors indicated in the schedule of prices.

The Clamps shall have sufficient contact surface with the conductors to provide maximum conductor contact and holding strength throughout the service life.

The contact making surfaces of aluminium Clamps shall be coated with Oxide inhibiting grease/compound to ensure low contact resistance between surfaces as stipulated in Clause 5.3.

The Clamp shall be suitable for one wrench installation and shall prevent slip while tightening the bolts.

6.2 Parallel Grove (PG) Aluminium Clamps.

6.2.1 Main Line PG Clamps (Al/Al)

The Al/Al Bolted Parallel Grove Clamps for main line connections shall be as indicated in the Drawing No. CEB/DS&S 026-1A:98. The Clamps shall be able to accommodate conductors equal sizes as indicated below and in the schedule of prices.

The clamps shall be of the two bolt type and the across flat dimension of the bolts shall not be less than 12mm.

The current carrying capacity of the Clamp shall not be less than that of the main conductor

The temperature rise of the Clamp shall not be more than that of the main conductor.

Type A) 7/3.40mm to 7/4.39mm Both Main and the tap

6.2.2. Service Clamps (Al/Al)

The Al/Al Bolted Service Clamps shall be as indicated in the Drawing No.CEB/ DS&S 026-1A:98. The clamps shall be used to connect aluminium stranded service conductor to AAC. (Main line conductor) and shall be able to accommodate unequal combinations.

The Clamps shall be of the two bolt type and the across flat dimension of the bolts shall not be less than 10mm.

The Clamp shall accommodate conductors of unequal sizes as given below and in the schedule of prices.

The current carrying capacity of the Clamp shall not be less than that of the service conductor.

The temperature rise of the Clamp shall not be more than that of the main conductor.

		Main Conductor (AAC)	Service Conductor
Type	**B)**	**7/3.40mm to 7/4.39**	**7/1.35mm - 7/1.70mm**

6.3 Service Line Taps for Aluminium Conductors

The Service Line Taps shall be made of aluminium alloy and as indicated in the Drawing No. CEB/DS&S 026-1B : 98. It shall consist of a slotted bolt to accommodate the aluminium conductors with a nut carrying an aluminium tongue for clamping the conductors. The nut shall tighten the tongue over the conductors as the nut is screwed to the threaded slotted bolt.

The width of the slot and length of the bolt shall be adequate enough to accommodate the conductors to be clamped one over the other. The sizes of conductors are indicated below and in the schedule of prices. The threaded end of the slotted bolt from the nut shall not be less than 10mm once the clamping is done.

Main 7/3.40mm - 7/4.39mmTap 7/1.04mm

6.4 Bi-metallic Clamps (Al/Cu)

The Bi-metallic Clamps shall be manufactured with bi-metallic alloy or manufactured with copper and aluminium where the contact surfaces shall be effectively fused.

The aluminium to copper surface contact shall be so arranged as to prevent electrolytic corrosion. Technical literature shall be supplied with regard to the type of Bi-metallic connection to be supplied.

The design of Bimetallic fittings shall be such as to eliminate any effect arising from galvanic corrosion which should impair the performance of the fittings.

Quality Assurance

The Bidder shall furnish documentary proof that the manufacturer possesses ISO 9002 Quality Assurance certification for the manufacture of Bi-metallic Clamps. Copies of the proof document/certificates shall be certified by the Bidder as true copies of the originals".

6.4.1 Main Line PG Bi-metallic Clamps

The Aluminium/Copper Bi-metallic Parallel Grove Bolted Clamp, with two bolts, shall be able to accommodate copper and stranded aluminium conductors of any of the combinations possible from the conductor sizes indicated below and in the schedule of prices.

The Clamps shall be of the two bolt type and the across flat dimension of the bolts shall not be less than 12mm.

The current carrying capacity of the Clamp shall not be less than that of the main conductor.

The temperature rise of the Clamp shall not be more than that of the main conductor.

Conductor cross sectional area - Aluminium 50mm² - 100mm²
Copper 70mm² - 95mm²

6.4.2 Service Bi-metallic Clamps (Al/Cu)

The Al/Cu Bi-metallic Service Clamp shall be suitable to connect Aluminium stranded service conductor to solid Copper Main Conductor.

The Clamp shall be of the two piece type and be able to accommodate the conductors of sizes as indicated below.

The Clamp shall be of the two bolt type and the across flat dimension of the bolts shall not be less than 10mm.

The current carrying capacity of the Clamp shall not be less than that of the service conductor.

The temperature rise of the Clamp shall not be more than that of the main conductor.

Conductor cross sectional area ;

Main	**Copper**	**25mm² - 50mm²**
Tap	**Aluminium**	**6mm² - 16mm²**

6.5 Copper Clamps

6.5.1 Main Line PG Clamps (Cu/Cu)

The Clamp shall be of bolted parallel grove type for Copper Conductors. It shall accommodate unequal conductor sizes of combinations as indicated below.

The Clamp shall be of the two bolt type and the across flat dimension of the bolts shall not be less than 10mm.

The current carrying capacity of the clamp shall not be less than that of the main conductor.

The temperature rise of the clamp shall not be more than that of the main conductor.

Conductor cross sectional area - **Copper 35mm² - 70mm²**

6.5.2 Service Clamps (Cu/Cu)

The Clamp shall be suitable for effectively clamping stranded Copper Service Conductor to solid Copper Main Conductor as indicated below.

The Clamp shall be of the single or two bolt type and the across flat dimension of the bolts shall not be less than 8mm.

The current carrying capacity of the Clamp shall not be less than that of the service conductor.

The temperature rise of the Clamp shall not be more than that of the main conductor.

Conductor cross sectional area -	**Main**	**25mm² - 50mm² Copper**
	Service	**6mm² - 10mm² Copper**

6.5.3 Line Taps for Copper Conductors

The Line Taps shall be of the tin plated brass slotted bolt and nut type. It shall consist of a slotted bolt to accommodate the stranded copper conductors with a nut carrying a copper tongue for clamping the conductors. The nut shall tighten the tongue over the conductors as the nut is screwed to the threaded bolt.

The width of the slot and length of the bolt shall be adequate enough to accommodate the conductors to be clamped (as indicated in the schedule of prices) one over the other and the threaded end of the bolt from the nut shall not be less than 10mm once the clamping is done.

Conductor cross sectional area -	**Main**	**25mm² - 50mm² Copper**
	Service	**2.5mm² - 6mm² Copper**

6.5.4 Bulldog Clip (Copper)

The Clamp shall be the Bulldog clip type suitable for effectively clamping copper conductors of equal/unequal sizes on any combination ie. 25mm² to 95mm².

The current carrying capacity of the Clamp shall not be less than that of the main conductor.

The temperature rise of the Clamp shall not be more than that of the main conductor.

7.0 ADDITIONAL REQUIREMENTS

7.1 Identification

Conductor Fitting shall be identified with the manufacturer's identification marks and fitting references.

This marking shall also be applied to any component of the fitting where the component is separate from the fitting when despatched by the manufacturer.

7.2 Markings

The following information shall be engraved or embossed out side of all fittings.

The conductor type (AAC, ACSR or Copper) size or size range of the conductor for which the fittings are suitable.

7.3 Packing

Each item shall be suitably sealed in polythene bag to provide mechanical and corrosion protection to contact surfaces in transit and storage. Fifty numbers of same item shall be packed in cardboard box and the box shall be marked with the following information;

a) Name of item & Batch No.

b) Code No. as per manufacturers catalogue

c) Applicable conductor size

d) Quantity

e) Name of manufacturer/Country of manufacture

f) Year of manufacture

g) Standard applicable

Packaging shall be such as to permit easy identification of fittings without their removal.

Components of fittings which are not subject to factory assembly shall be secured and packed together as complete fittings, before despatched.

8.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be supplied with the offer.

a) Constructional features, material used for components and relevant technical literature in English.

b) All the dimensions of the fitting (inside & outside), and drawings shall be furnished.

c) The current carrying capacity, Temperature rise and other relevant technical details shall also be furnished.

d) The standard to which the fittings are manufactured shall also be mentioned.

e) Full details of the type of Oxide inhibiting grease/compound used and documents in proof of tests carried out for compatibility with the conductor material.

f) Documentary evidence to prove ISO 9002 Certification for Bi-metallic Clamps and connectors.

g) **Type Test Reports**

The following type test reports from a **Recognized Independent Testing Authority acceptable to Purchaser** pertaining to a recent manufacture of same Model/Type of clamps and fitting shall be furnished.

1. Resistance Measurement
2. Heating-cycle Test
3. Mechanical Strength Test
4. Galvanizing Test of the Bolts

Failure to furnish the above details will result in the offer being rejected.

9.0 SAMPLE STUDY

Three Samples of each item offered shall accompany the bid to facilitate analysis and evaluation.

10.0 INSPECTION & TESTING

10.1 Inspection

The selected Bidder shall make necessary arrangements for inspection by an Engineer appointed by the Purchaser and also to carry out in his presence Acceptance / Sample tests on the materials offered.

10.2 Testing (Sample/Acceptance Test)

The following Sample /Acceptance tests as per BS 3288 Part 1 shall be witnessed by the Purchaser.

1. Verification of Dimensions
2. Galvanizing Tests
3. Mechanical Test
4. Electrical Tests

11.0 TECHNICAL LITERATURE AND DRAWINGS

The Catalogues (English version) describing the items and indicating the Model/Reference number, Code Name, Conductor Sizes & other relevant details shall be furnished with the items. Routine Test Certificates shall also be furnished with the items.

12.0 APPENDIX

A - Drawing No. CEB/DS&S 26-1A:98 - Parallel Grove Clamp and Service Clamp

B - Drawing No. CEB/DS&S 26-1B:98 - Service Line Tap (Al)

C - Schedule of Particulars - to be filled by the Bidders

APPENDIX - C

SCHEDULE OF PARTICULARS
(To be filled by the Bidder for each Item/type)

1)	Name of Item			
2)	Name of Manufacturer and Country of Manufacture			-
3)	Applicable Standards			-
4)	Code No./ Catalogue No.			-
5)	Whether the following Certificates/Reports furnished (as applicable).			
	i)	Type Test (as per Clause 8.0 (g))	Yes/No	-
	ii)	Quality Assurance Certification conforming to ISO 9002 for Bi-metallic Clamps	Yes/No.	-
	iii)	Oxide inhibiting grease/compound	Yes/No.	-
6)	Following details for each items offered (as applicable).			
	i)	Type		-
	ii)	Applicable main conductor Size		-
	iii)	Applicable tap conductor size	-	
	iv)	Length of the Clamp		-
	v)	Type of oxide inhibitive compound used		-
	vi)	Temperature rise	°C	-
	vii)	Whether the applicable conductor sizes are marked on the clamp	Yes/No	-
	viii)	Bolt		
		a) Size & Length of the bolt	mm / mm	-
		b) Thread length	mm	-
		c) Tensile strength of the bolt	N/mm^2	-
		d) Minimum elongation after fracture	mm	-
		e) Property Class as per ISO 989-1		-
	viii)	Thickness of galvanized coating	mm	-

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Seal and Signature of the Manufacturer **Date**

BLT_CLM