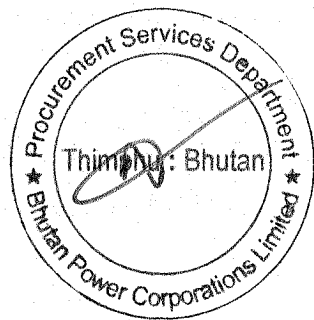


TECHNICAL SPECIFICATIONS

Lot 1: POLES



1. SCOPE

This specification covers the design, manufacture, testing, supply, delivery and performance requirements of the following galvanised steel poles:

- a. Steel swaged poles,
- b. Telescopic poles.

2. STANDARDS

The equipment shall comply with the latest editions of and amendments to Indian Standards listed below. Where any provision of this specification differs from those of the standards listed hereafter, the provision of this specification shall govern:

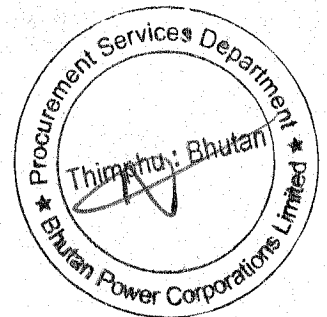
IS – Indian Standards

- IS 2713: Specification for tubular steel poles for overhead power lines
- IS 2062: Steel for general structural purposes

Note:

In case of conflict, the order of precedence shall be:

- This Specification
- IS Standards
- Other Standards



Alternative Standards may be approved, provided the Supplier demonstrates that they give a degree of quality and performance equivalent to that of the referenced Standards. Acceptability of any alternative Standard is at the discretion of the Purchaser.

The manufacturer must operate a quality assurance system that complies with ISO 9000. The Supplier shall provide current certification showing the manufacturers' compliance with ISO 9000 or equivalent national standard. The certificate must be issued by an independent, accredited issuing authority.

3. GALVANISING

Galvanizing of the steel poles shall be in accordance with ISO 1459 and ISO 1461. The zinc coating shall not be less than 600 g/m² of steel surface area.

The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be no impurities in the zinc or additives to the smelter bath, which could have a deleterious effect on the durability of the zinc coating.

Before pickling, all welding, drilling, cutting, grinding must be completed and all grease, paint, varnish, oil and welding slag completely removed. All protuberances, which would affect the life of galvanising should be removed.

To avoid the danger of white rust, galvanised material shall be stacked during transport and stored in such a manner as to permit adequate ventilation.

Galvanized steel items shall be thoroughly checked for damage before transport to the work site.

Any material found to be damaged shall be returned to its source. Cracked, flaked or scratched surfaces shall not be acceptable.

Galvanized steel shall be handled carefully during loading, transporting and unloading, and shall not be dropped on the ground, or dragged or scraped along the ground or any surface.

4. STEEL SWAGED POLES

Steel poles shall be swaged, mild steel poles manufactured in accordance with the requirements of IS 2713 and fabricated in three parts for assembly at site. The poles shall be hot dip galvanized internally and externally up to the level, which goes inside the earth. Data on standard poles used by BPC is mentioned in table below and drawing no. BPC-DDCS-2022-15.

Height	Strength	Size as per (2713)	Normal Service
7.5 m	1.81 kN	410-SP-9	LV ABC
10 m	2.02 kN	410-SP-45	11 kV & 33 kV
12 m	2.27 kN	410-SP-62	Special Case

The poles shall be supplied complete with taper plug and base plate.

The 7.5m poles shall be provided with 18 mm dia. through holes at 150mm, 350 mm, 550 mm and 750mm from the pole top at 90° cross angles for fixing the LV cable. Earthing of LV pole is not required as the overhead conductor is insulated.

4.1 SHAPE, ASSEMBLY OF POLES

Poles are to be manufactured in swaged form.

Swaged poles shall be manufactured from tubes worked while hot. Swaged poles shall consist of two tube sections with tapering diameters, the bottom section having the largest diameter. The length of the overlap shall be at least three times the diameter of the smaller tube, in each case. The Supplier shall state the length of overlap. The upper edge of the tube at each joint shall be chamfered at an angle of 45°.

The poles shall be supplied in two sections for assembly at site by bolting. Galvanised bolts of adequate strength, required for joining the poles at site, shall also be supplied, with manufacturer's instructions for the pole assembly.

Transportation of full-length poles is avoided in Bhutan, due to hand cartage in the mountainous terrain.

Cost of bolts, nuts and washers for joining pole sections shall be deemed included in the schedule rates for pole supply.

4.2 BOLTS, NUTS AND WASHERS

All bolts, nuts and washers, supplied under this Specification shall comply with the following:

The bolts and nuts shall comply with ISO 4016. Mechanical properties shall be in accordance with ISO 898.

The dimensions and characteristics in this Specification are intended to describe typical ISO metric bolts, nuts, and washers, such as are commonly used in the construction of electrical distribution lines, plant and equipment.

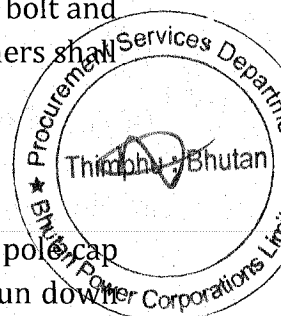
The safe working shear stress of bolts is taken as 120 MPa, with the area of the bolt measured at the root of the thread. The table below shows the ultimate tensile strength, the tensile stress areas, the safe working tensile loads and the safe working shear loads for the bolts covered by this Specification. The ultimate shear strength has been assumed to be 75% of the ultimate tensile load and a factor of safety of 2.5 has been applied:

Bolt Size	Ultimate Tensile Stress (N/mm²)	Tensile Stress Area (mm²)	Ultimate Tensile Strength (kN)	Working Tensile Load (kN)	Safe Working Shear Load (kN)
M16	400	157.0	62	25	18
M18	400	204.0	81	32	24
M20	400	245.0	98	39	29

Screw threads shall be parallel throughout their length. They shall be so formed that, after galvanising, the nut can be easily screwed by hand over the whole length of thread, without excessive play. Before despatch from the works, one washer shall be fitted to each bolt and a nut shall be screwed on the whole threaded length and left in that position. Washers shall be round, flat, of mild steel, unless where otherwise specified.

4.3 BASE PLATE, POLE CAP AND POLE EARTHING

Steel swaged poles shall be supplied complete with pole cap and base plate. The pole cap shall be welded to the pole top and shall be curved at the top to allow water to run down.

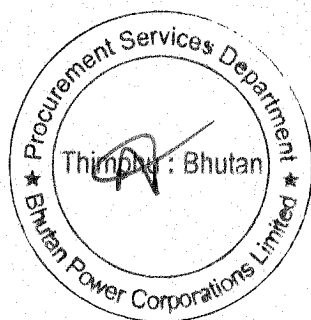


whereas the base plate shall be as per the dimensions indicated in the relevant drawings. All HT steel poles shall have provision for earth points above the ground line after installation. This shall be through bolt of 12 mm diameter located at a height of 350 mm above the ground line. The ground line position shall be approximately 1/6 of the total pole length.

5. GALVANISED TELESCOPIC POLES

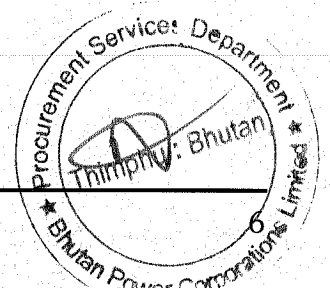
The standard overall length of telescopic poles used in BPC shall be of 11.2 m and 12 m which comes in 5 and 6 sections respectively. All 5 sections of 11.2 m and 12 m pole shall be same in design from the bottom, except the top section of the 12 m pole. This has been designed to offer inter-changeability during construction phase as the top section of 12 m pole can be easily capped on 11.2 m pole. The side taper for the pole is recommended between 10-25 mm per meter length which shall be uniform for all the sections. Length of pole sections shall be at a minimum lap of 1.5 times with the largest inside diameter of the female section with allowances for fabrication tolerance. The 12 m poles shall be equipped with 18 mm diameter through holes (for through bolt size M16) at 100 mm from pole top for fixing suspension clamp for shielding wire. The holes shall be at right angles to the run of the direction of the conductors. The distance of footing bar shall be 300 mm.

Total Length	Design Working Load	No. of Sections	Remarks
12.0 m	2.8 kN	6	33 & 11 kV with shield wire
11.2 m	2.8 kN	5	33 & 11 kV without shield wire



Details of the telescopic pole are given in the table below and drawing no. BPC-DDCS-2022-19

SL#	Description of Parameters	UoM	Telescopic Pole	
1	Overall length of poles	m	12	11.2
2	Embedded Length	m	2.0	1.87
3	Number of Sections	nos	6	5
4	Length of Sections (of whole section)			
	Section-I	m	1.08	2.65
	Section-II	m	2.65	2.65
	Section-III	m	2.65	2.65
	Section-IV	m	2.65	2.65
	Section-V	m	2.65	2.65
	Section-VI	m	2.65	-
5	Outside Diameter (Top & Bottom)			
	Section-I (Top)/(Bottom)	mm	100/132	119/197
	Section-II (Top)/(Bottom)	mm	119/197	180/258
	Section-III (Top)/(Bottom)	mm	180/258	240/318
	Section-IV (Top)/(Bottom)	mm	240/318	298/375
	Section-V (Top)/(Bottom)	mm	298/375	352/430
	Section-VI (Top)/(Bottom)	mm	352/430	-
6	Thickness of Steel			
	Section-I	mm	2.1	2.1
	Section-II	mm	2.1	2.1
	Section-III	mm	2.1	2.1
	Section-IV	mm	2.1	2.1
	Section-V	mm	2.1	2.1
	Section-VI	mm	2.1	-
7	Design Working Load (Horizontal)	kgf	286	286
8	Design Working Load (Vertical)	kgf	500	435
9	Weight of Pole (of all sections including wt. of zinc coating)	kg	207.333	200.495
	Section-I	kg	6.477	21.678
	Section-II	kg	21.678	30.054
	Section-III	kg	30.054	38.309
	Section-IV	kg	38.309	46.162
	Section-V	kg	46.162	53.695
	Section-VI	kg	53.695	-
10	Size of base plate (L x B x Thickness)	mm	500x500x3	500x500x3
11	Weight of Baseplate	kg	9.782	9.782



5.1 BASE PLATE, POLE CAP AND POLE EARTHING

Telescopic pole shall be provided with galvanized pole cap and base plate. The pole cap for 11.2 m pole or 12 m pole shall not be welded on poles. The pole caps shall be designed and manufactured to fit on the pole top respectively. Base plates shall be galvanized steel with minimum thickness of 3 mm. The base plate shall be made circular and provided with proper fixing arrangements for easy installation at site.

Each telescopic pole shall be provided with an earthing lug welded on the pole for pole earthing. This shall be with 14 mm dia hole with bolt and nut arrangement at 350 mm above ground level to connect to spike earthing.

5.2 FOOT BARS AND INSTALLATION LUGS

Telescopic poles shall be designed to enable installing removable foot-bars. Installation lugs for mounting the foot-bars shall be welded on the pole surface. Four (4) galvanized removable foot-bars shall be supplied for each pole which shall be kept permanently on the pole above the anti-climbing device. Details are given on drawing no. BPC-DDCS-2022-16/3-5

6. IDENTIFICATION MARKS

The following identification marks shall be legibly engraved/ punched/ embossed on each pole at a height of 3m from bottom end of the pole, before painting:

- (a) Manufacturer's name/Trade mark
- (b) Year of manufacture
- (c) Batch Number

The size of the letters shall be at least 5mm and the depth of engraving/height of embossing shall be such that the text remains legible after painting.

7. QUALITY CONTROL

All poles shall be inspected by an inspector appointed by the Purchaser. The Supplier shall assist the work of the Purchaser's inspector by providing copies of all relevant Standards, and allowing the inspector full use of the necessary tapes, measures and laboratory equipment, together with ample space and assistance in the handling of poles for inspection. Any costs incurred by the Supplier in aiding the inspector shall be deemed to be included in the contract.

Poles as delivered to the designated stores shall be free of all damage to protective paint coating, and shall not be out of straight by more than one thousandth of the length of the pole.

The inspector shall examine the poles for, among other things, the following characteristics:

- General appearance;

- Finish
- Dimensions; and
- Straightness

At least the following dimensional checks shall be made by the inspector:

- Length;
- Butt diameter and circumference;
- Top diameter and circumference;
- Non-circularity;
- Accuracy of drillings;
- Suitability of pole sections to overlap and bolt together;
- Straightness, where appropriate;
- Internal dimensions.

The group of poles or fittings offered at any one time shall constitute a batch. Within a batch, poles and fittings presented for inspection shall be segregated on a size basis. If 5% of the inspected items show damage or serious deviations from the design criteria, the entire batch shall be unconditionally rejected without further sorting.

Dimensions, such as length and top diameter, shall be measured with a standard steel tape.

8. LIST OF TESTS

The following tests shall be carried out on samples drawn from each consignment of the poles:

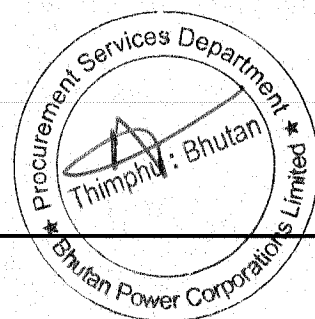
- i) Deflection Test
- ii) Permanent Set Test
- iii) Drop Test.

9. NUMBER OF SAMPLES TO BE TESTED

- No. of poles selected for conducting tensile and chemical analysis shall be as per Clause 10.1.1 of IS 2713.
- No. of poles selected for conducting deflection, permanent set and drop test shall be as per Clause 10.1.2 of IS 2713.

10. REJECTION

All the samples subjected to above tests shall pass the tests. Should one or more number of poles fail in any of the test, a second set of samples, double in number shall be drawn and subjected to above tests. Should one or more number of poles from second set of poles fail in any of the tests, the entire consignment shall be rejected.



11. TOLERANCES

The poles shall meet the requirements of relevant standards IS 2713 in all respects. In case of weight of the pole, though the standard allows negative tolerance on the weight of the pole (for individual pole as well as for the LOT), while the acceptance of the poles will be based on their conformity to the standards (in case of weight within the specified tolerance limits), the payment will, however, be prorated for any reduction in weight from the standard weight based on to the actual weight of the LOT (within the specified limits) compared to the calculated weight for the LOT based on standard weight indicated in the standard.

For example

IS 2713 allows 10% below the standard weight for individual poles, subject to 7.5% below the calculated standard weight for the LOT. If the pole and LOT weights are within the specified limits, the LOT will be considered as having met the requirement for acceptance, as far as weight is concerned, and will be accepted subject to its having met all other tests / requirements. However, the actual payment will be based on the following:

Payment as per contract rates = $R \times N$

Less reduction for lower weight = $R \times N \times \left\{ \frac{W_s - W_a}{W_s} \right\}$

i.e Actual Eligible Payment = $R \times N \times \left(\frac{W_a}{W_s} \right)$

where,

R is the rate per pole in the contract

N is the no. of poles in the LOT

$W_s = N \times W$, where W is the standard weight per pole

W_a = Actual weight of the LOT

