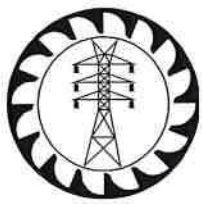
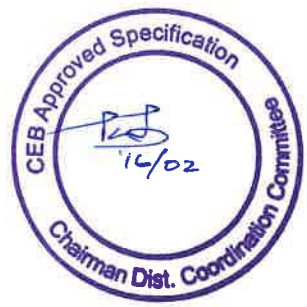
044-4: 2017

CEB
SPECIFICATION

PRE-STRESSED SPUN CONCRETE POLES FOR NON-COASTAL AREAS



CEYLON ELECTRICITY BOARD
SRI LANKA



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CONTENTS

SPECIFICATION FOR PRE-STRESSED SPUN CONCRETE POLES FOR NON-COASTAL AREAS

1.0 SCOPE

This specification covers the design, materials, manufacture, inspection, testing, drawings, and delivery of pre-stressed, spun concrete poles to be used in the low voltage distribution system of Ceylon Electricity Board.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	230V/400V
(b)	System highest voltage	240V/440V
(c)	System frequency	50 Hz
(d)	Number of phases	3
(e)	Method of earthing	Effectively earthed
(f)	System faults level	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 heavily polluted atmosphere
(e)	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(f)	Isokeruanic (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 or any other relevant international standards equal or superior to below standards, and amendments thereof.

(a)	BS EN 1992-1-1:2004	Design of concrete structures. General rules and rules for buildings.
(b)	BS 197-1:2011	Cement- Composition, specifications and conformity criteria for common cements.
(c)	BS EN 934-2:2009	Admixtures for concrete, mortar and grout. Concrete admixtures. Definitions, requirements, conformity, marking and labeling.
(d)	BS 4449:1997	Specification for carbon steel bars for the reinforcement of concrete.
(e)	BS 5896:2012	Specification for High tensile steel wire and strand for pre-stressing of concrete.
(f)	BS EN 12620:2002	Aggregates for concrete.
(g)	BS EN 12350-1:2009	Testing fresh concrete – Sampling.
(h)	BS EN 12350-2:2009	Testing fresh concrete - Slump-test.
(i)	BS EN 12390-1:2012	Testing hardened concrete. Shape, dimensions and other requirements for specimens and moulds.

(j)	BS EN 12390-2:2009	Testing hardened concrete. Making and curing specimens for strength tests.
(k)	BS EN 12390-3:2009	Testing hardened concrete. Compressive strength of test specimens.
(l)	BS EN 1008:2002	Mixing water for concrete. Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete.
(m)	BS EN 206:2013	Concrete - Specification, performance, production and conformity.

However in the event of discrepancy, details given in this CEB specification supersede above standards.

5.0 DESIGN LOADINGS

Each pole shall be able to withstand 2.5 times the design working load in all directions.

The ultimate design load used for designing each class of pole shall be calculated by applying a point load of 2.5 (factor of safety) times the appropriate standard design working load when the pole is held in the test frame specified in the Clause 12 of this specification.

6.0 STANDARDIZED TYPES/SIZES OF PRE-STRESSED SPUN CONCRETE POLES

Pole Height (m)	Buried Length (m)	Working Load (kg)	Pole Top Diameter (mm)	Pole Bottom Diameter (mm)	Minimum Thickness (mm)	Drawings
6	1	50	100	160	30	See Annex-A1
8.3	1.4	100	100	183	40	See Annex-A2

Taper of the poles shall be 1/100.

7.0 CONCRETE MATERIALS

7.1. General

All materials shall conform to the relevant standards referred in this specification. However, CEB reserves the right to inspect, and if deem to be necessary, to test samples from raw materials stockpiled for use, in any of the contractor's work sites. In the event of such samples not conforming to the standards given herein, CEB may inform same, to the contractor, in writing. On the receipt of such complaint, the contractor shall make immediate arrangements to remove those unsuitable materials completely from the work site, and replace them with materials conforming to the standards, at the contractors own expense.

7.2. Reinforcing Steel

Steel reinforcement shall be as follows:

(a) Hot rolled mild steel round bars complying with BS 4449.
(b) High tensile steel wires for pre-stressing complying with BS 5896

Test certificates for steel shall be submitted to the CEB in accordance with BS 4449 and BS 5896 and shall be issued by an accredited independent testing laboratory acceptable to the CEB.

Steel reinforcing bars shall be free from pitting, loose rust, mill scale, oil, grease, mortar, earth, paint or any harmful material.

7.3. Cement

Portland cement conforming to BS 197-1 shall only be used for casting of poles under this contract and shall pass the following tests;

(a) Fineness
(b) Chemical composition
(c) Compression strength
(d) Setting time
(e) Soundness

These tests shall be conducted at the expense of the contractor. Once approved, the quality of the cement used shall not be changed without approval of the CEB.

7.4. Aggregates

The aggregate shall be clean, hard and durable and shall not include any harmful extent such as dust, mud, organic substances, clay lumps, stone mica particles, and salt.

The Contractor shall furnish the following data of aggregate source for approval.

(a) Shape
(b) Surface texture
(c) Silt content
(d) Salt content
(e) Grading curves
(f) Flakiness Index
(g) Impact value
(h) Water absorption
(i) Soundness

The fine and coarse aggregates shall comply with BS EN 12620.

7.5. Water

The water used for the making concrete, mortar, and grout shall be clean, fresh and free from injurious amounts of oil, vegetable or organic matter or any other deleterious substance in suspension or in solution. The mix water shall be continuously monitored for salt content and the concrete mix so designed to limit total salt content.

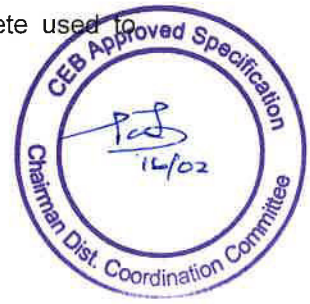
The water should comply with the requirements of BS EN 1008.

7.6. Admixtures

All admixtures shall comply with BS EN 934-2.

Any admixtures containing calcium chloride shall not be permitted in the concrete used to manufacture pre-stressed concrete poles.

No admixtures shall be added to the concrete mix without prior approval of the CEB.



8.0 STORAGE AND PROTECTION OF MATERIALS

8.1. Cement

Cement shall be stored in a suitable weather-tight enclosure on a broad platform raised off the ground. The enclosure should be such that free circulation of air around the bags of cement is kept to a minimum.

Any cement that has become damp, caked or lumpy shall not be used. Concrete batching operations shall be organized so that cement that has been longest at the place of manufacture of the poles is used first.

8.2. Aggregates

Both fine and coarse aggregates shall be separately stored so that they are kept clean and free from contamination and are not subjected to intermingling. Where a clean hard surface is not available for the stockpiles the bottom 150 mm of the aggregate piles which are in contact with the ground shall not be used.

Heaps of fine aggregate shall be capable of draining freely. Wet fine aggregate shall not be used until it has drained sufficiently to ensure proper control of the water/cement ratio.

8.3. Reinforcing Steel

All reinforcement shall be stored clear off the ground on sufficient supports to prevent distortion of bars and in clean dry place. Grease, oil, paint or any other substance that affects the bonding of reinforcement shall not be allowed to come in contact with them. If it does, then all such substances shall be cleaned off from the reinforcement before use.

8.4. Pre-Stressing Steel

All pre-stressing tendons shall be stored in a clean dry place off the ground and must be kept dry at all times. All loose surface, rust, protective oil, or other contaminants that will affect the bond of the tendons shall be thoroughly removed before use. Any part of the tendons that have become pitted, have any tears or nicks, or/permanently deformed or otherwise damaged shall not be used and shall be removed from the site.

9.0 MANUFACTURE

9.1. Reinforcement and pre-stressing steel installation

Reinforcement and pre-stressing steel shall be arranged as uniformly as possible. Six (6) number of High Tensile Steel bars of 6mm diameter shall be used for both 6m/50kg pole 8.3m/100kg pole construction.

Non pre-stressed reinforcements of at least four (4) numbers 6mm diameter mild steel bars and a continuous spiral link of 2.7mm diameter mild steel wires for the length of Non-prestressed bars shall be provided for all types of poles as indicated in the drawings in Annex A-1 and Annex A-2.

9.2. Covers

The **minimum cover** from the outermost reinforcement or pre-stressing steel to the nearest permanent surface of the concrete member shall be 9mm. All steel shall be accurately placed and shall be held in position during manufacture.

Pre-stressing tendons shall pass through rigidly held guide plates at the ends of members to maintain the minimum covers.

9.3. Pole Moulds

Moulds shall be designed, constructed and finished to ensure that they can be removed without damaging the hardened concrete, and shall be securely braced and supported to prevent sagging and bulging during the deposition of the concrete. Joints in the materials used to manufacture the moulds shall be tight and shall not permit any leakage of cement paste from the concrete mix. Retaining pins which form bolt holes in the finished pole shall be provided with flexible seals or some similar means to prevent the loss of any cement paste from the concrete mix.

9.4. Pre-stressing Tendon Stressing

All stressing operations shall be carried out under the direct supervision of a person who is thoroughly experienced with all aspects of pre-stressed concrete construction.

The stressing procedure adopted shall ensure that the force in a tendon increases at a reasonably constant rate. After stressing and anchoring, the force in a tendon shall be the initial force specified in the manufacturing drawings. During stressing the maximum force applied to a tendon shall not exceed 0.8 times of its ultimate tensile strength.

The required amount of pre-stressing force shall be measured by both tendon elongation and jack force or pressure. If the two measurements differ by more than 5 percent, then appropriate corrections shall be made.

Tendon elongation shall be calculated from the actual load/elongation graphs supplied by the steel manufacturer. Appropriate anchorage-draw-in shall be accurately assessed and allowed for. A correction shall be applied to the total elongation observed to compensate for any initial tensioning of the tendon applied to take up irregularities and slackness. Jack and anchorage friction shall be assessed and an appropriate correction made to the jacking pressure.

Records shall be kept for the following stressing operations:

(a) Amount of tendon elongation up to the stage of anchoring the tendon

(b) Allowance for anchorage-draw-in

(c) Jack force at anchorage

(d) Allowance for jack friction

(e) Manufacturer's identification mark for pre-stressing tendons used.

(f) Date and time of stressing

(g) Date and time of de-stressing

(h) Curing sequence and concrete strength at time of de-stressing

(i) Identification mark placed on each particular pole

The jacking force shall be measured to an accuracy of one-in-forty Pre-stressing force and the tendon elongation to an accuracy of 2 mm.

If the tendons are stressed then left for more than 2 weeks before being fully surrounded with concrete they shall be removed from the moulds and discarded.

Pre-stressing equipment shall be maintained in a serviceable condition and its calibration and accuracy checked every 3 months.

9.5. De-stressing

The transfer of pre-stress into the hardened concrete shall take place **gradually** and in such a determined order that tensile stresses sufficient to cause cracking are not induced in the concrete. At the time of de-stressing concrete should have achieved at least 2/3 of strength at the age of 28 days. Immediately after de-stressing the maximum stress in the tendons shall not exceed 0.75 of the ultimate tensile stress of those tendons.

If all the tendons are not to be released simultaneously then prior approval for releasing sequence shall be obtained from the CEB.

Any releasing device shall be so designed that during the period between stressing and de-stressing the tension in the pre-stressing tendons does not alter. It shall also be designed so that there is no increase in the stress in the tendons above the stress level in the tendons just prior to de-stressing.

9.6. De-bonding of tendons

Where a tendon or a number of tendons has to be de-bonded at a certain length and the particular tendon(s) shall be fully covered for the total de-bonded length only, using a plastic sheath. Application of grease onto the tendons for de-bonding is not allowed.

9.7. Mixing, placing and curing concrete

9.7.1. Mix design

Concrete used for casting of poles shall possess the following minimum qualities as per BS EN 206-2013.

(a) Minimum cement content - 450 kg/m^3

Minimum cement content for 6m Pole - 26 kg
Minimum cement content for 8.3m Pole - 48 kg

(b) Maximum free water-cement ratio - 0.45

(c) Minimum concrete strength at an age of 28 days - 50N/mm^2

(d) Nominal maximum aggregate size - 15mm

The concrete mix proposed by the Contractor shall be a standard tested design, and the details of the mix design shall be submitted to the CEB with following information.

(a) Source, nature and grading of both the fine and coarse aggregates.

(b) Type and supplier of the cement to be used

(c) Proportions by weight of fine and coarse aggregates

(d) Weight of cement per cubic meter of concrete.

(e) Water-cement ratio by weight

(f) Estimated slump of the mix

(g) Arithmetic mean compression strength of the mix at 7 days and 28 days using either cylinder compression test or cube compression samples plus the standard deviation of the test strengths of the number of cylinders and cubes tested.

(h) Any admixtures used

The ratio of the weight of the fine aggregates (sand) to the total weight of aggregates shall be between 0.35 and 0.50. All testing costs shall be borne by the contractor.

9.7.2. Ready-mixed concrete

Ready-mixed concrete as defined in BS 2426, batch off the site, may be used and comply with all requirements of this standard.

The ready mix concrete shall be carried in agitators, operating continuously or truck mixers made for this purpose. The concrete shall be compact in its final position within 1 hour of the introduction of cement to the aggregates. The time of such introduction shall be recorded on the delivery note together with the weight of the constituents of each mix.

When truck-mixed concrete is used, water may be added under supervision, either at the site or at the central batching plant, but no water be added in transit.

9.7.3. Concrete mixing

All concrete shall be mixed in weigh batch mixing machines. The machine shall have a large water storage tank with a gauge so that a predetermined quantity of water can be injected direct into the mixer drum.

The dry concrete shall be mixed until a uniform colour is obtained. After the addition of the water the concrete shall be mixed until a uniform colour is achieved. The total water in the mix shall not exceed the amount used in the trial mix.

Water contents of the aggregates should be considered in determining the quantity of water to be added. The amount of water shall be sufficient to ensure thorough hydration, good workability and high strength.

9.7.4. Workability

The consistency of the concrete shall be such that it can be readily worked into the corners and angles of the form work and around reinforcement without segregation of the materials or bleeding of free water at the surface. On striking the form work it shall present a face which is uniform, free from honeycombing, surface crazing or excessive dusting. The workability of the proposed mix in the various grades is adequate for the requirements of the specification. The contractor shall carry out workability tests on the preliminary trial mixes required elsewhere. These tests shall be carried out in accordance with BS 12350/12390, or any other applicable standards.

The samples to be tested shall be obtained from the batches used for the preliminary test cubes. The mould shall be filled in the presence of the CEB representative with concrete from which the preliminary test cubes are made and shall be compacted in the same manner with the same equipment as proposed for the works. This procedure shall if necessary, be repeated with modified mixes until the appearance of the concrete after striking the mould is acceptable to the CEB, after which it shall be used as the standard for that grade.

When a specific workability is called for a check shall be maintained by measuring slump at the rate of one test for each 10 cubic meters of concrete or three tests for each day of concreting.

9.7.5. Transport of concrete mix

The concrete shall be discharged from the mixer and transported to the works in such a way to as to prevent adulteration, segregation or loss of ingredients, and ensure that the concrete is of the required workability at the point and time of placing.

9.7.6. Placement and compaction

Placement rate of concrete shall be such that concrete is at all times plastic and flows readily into the space between reinforcements. No concrete that has partially hardened or been contaminated by foreign materials shall be deposited in the moulds, nor shall re-tempered concrete or concrete that has been re-used after initial set be used.

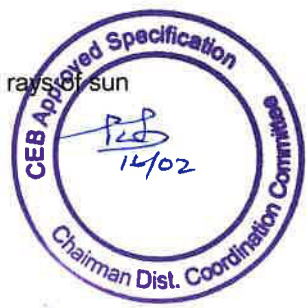
The placement of concrete in the moulds shall be completed within half an hour after the introduction of water to the cement and aggregate in the concrete mixer. Each mould shall be filled with concrete in continuous operation. Construction joints will not be permitted in the poles. If there is an interruption during the placement of concrete into the mould such pole shall be discarded.

9.7.7. Spinning

Spinning process shall be done immediately after concreting. The speed and timing of spinning process shall be sufficient to form even distribution of concrete compactness through the whole length of the pole.

9.7.8. Protection and curing of concrete

During the initial stages of hardening the concrete shall be protected from the direct rays of sun



light and from drying winds. The moulds containing the hardened concrete shall not be disturbed or shifted unless it is made sure that such movements will not damage the cast.

9.7.8.1. Moist curing at ambient temperature

All surfaces of the pole exposed to the atmosphere shall be kept constantly wet or damp for at least 7 days after casting. Concrete manufactured from type iii cement (high early strength) shall be moist cured at least for 4 days.

9.7.8.2. Curing at elevated temperature

Curing at elevated temperatures is permitted subject to the following precautions.

i) Adequate means shall be provided to prevent moisture loss from the concrete from the time of initial set to the end of the elevated temperature curing cycle.

ii) An initial maturing period shall be allowed before any increase of ambient temperature. This maturing period shall be measured from the time of completion of casting and shall be such that the product of time and ambient temperature at the place of casting the concrete is not less than 40°C hours (eg. 2 hours at 20°C = 40°C hours). During this maturity period the surface of the concrete shall not exceed 30°C.

iii) All pins and other fitments which pass through the mould and concrete shall be withdrawn after initial maturing to prevent damage to the concrete caused by differential expansion between the mould and the concrete.

iv) After initial maturity heat may be introduced to the concrete at a rate that limits the temperature rise to a maximum of 24°C per hour. Under no circumstances shall the temperature rise during any 15 minute exceed 6°C.

v) The temperature during the curing cycle shall not exceed 75°C.

vi) The rate of cooling of the concrete and the removal of any steam covers, blankets etc., shall be controlled prevent any damage due to thermal shock or differential cooling.

vii) The heat source shall be well distributed to ensure that a uniform temperature distribution exists in the concrete and no local overheating occurs to the concrete, the precasting moulds or to any test specimens.

viii) Concrete test specimens shall be cured exactly in the same manner as the concrete poles.

Temperature records shall be as follows, during curing at elevated temperature.

(a) The temperature during the initial maturing period

(b) Temperature at ½ hourly intervals during the temperature rise period.

(c) Temperature at 2 hourly intervals during the maximum constant temperature period and at the end of this period after shutting off the heat source.

Elevated temperature cured concrete poles shall be moist cured for further 4 days at ambient temperatures. During this period all surfaces of the pole exposed to the atmosphere shall be kept constantly wet or damp.

9.8. Surface finishes

Poles shall be free from surface defects including hair cracks. The surfaces of the poles in contact with the steel moulds shall be smooth and regular in shape and shall be free from pores. Water retaining pockets or honeycombing formation shall not be admissible.

All fins and other projections shall be rubbed down or ground flush with the general surface of the pole.

Repairs to defective casting will **not be permitted** and any pole of such nature will be **rejected**.

9.9. Dimensional tolerances

Recommended dimensional tolerance shall be as follows:

Length	±15mm	(Allowance shall be made during design for length reduction to pre-stress).
Bottom Diameter	+4mm -2mm	
Straightness	1.5mm/1000mm	Deviation from a straight line joining the top and the widest dimensions at the butt
Distance between holes	±5mm	
Center to center distance between holes	±3mm	

Any poles with dimensional deviations falling short, of the aforesaid will be rejected.

9.10. Marking of poles

Following data of the pole should be clearly and indelibly marked at a position approximately 1.5m above the ground level:

(a) Letters "CEB", Date of manufacture, Identification Mark of Manufacturer, Batch No. of the Pole (Given by the CEB), **Length of pole** in meters and its **design working load**, during the production. Subsequent marking on cement motor/grout applied **later** into the pole is **not** allowed.

(b) The Serial No. of the pole (Given by the CEB). No two poles belonging to same manufacturer could bear the same Serial Number.

9.11. Lifting, handling and shifting

Poles shall not be lifted or handled until the concrete has attained sufficient strength. Pole shall be held from at least two points while lifting.

Pole shall be transported on vehicles that provide full length support without any overhang. Any pole that shows signs of any damage shall be rejected. While lifting and shifting, major axis of the pole shall be kept vertical as much as possible.

9.12. Pole capping

To avoid intrusion of unwanted creatures, the top and bottom hollow ends of the pole should be sealed with cement plaster as per the drawings DS&S/2016/044-4A and DS&S/2016/044-4B.

9.13. Holes

The poles shall be fabricated with hole sizes and locations as specified in drawings in Annex A-1 and A-2. (Drawing nos. DS&S/2016/044-4A and DS&S/2016/044-4B).

10.0 CONCRETE SAMPLING AND TESTING

10.1. General

A random sampling procedure, to obtain the samples for compression strength tests of concrete has to be adopted the minimum frequency of sampling of the concrete shall be (01) one sample per (50) fifty poles, but not less than one sample per day, whichever is higher. "Casting of Samples" is described in clause 10.2. Contractor shall make arrangements to carry out the compression strength test as per BS EN 12390-3, for each of above samples, at an accredited independent testing laboratory acceptable to CEB.

The concrete shall be considered acceptable when the test results are in accordance with BS EN 206-2013.The cost of these tests shall be borne by the contractor.

In the event the above tests results are not in accordance with the relevant standards the poles so manufactured shall be rejected.

10.2. Casting of samples

Samples for compression strength tests shall be moulded in 150mm cubes, 100mm diameter x 200mm high cylinders or 150mm diameter x 300mm high cylinders. The date of casting of the sample shall be clearly and indelibly marked on the fresh concrete. Subsequent marking on freshly applied motor/grout layer is not allowed. For the purposes of this specification, to convert from cylinder strength to cube strength, table 12 of BS EN 206-2013 shall be used.

A sample shall consist of 4 cubes or cylinders made concurrently from the same batch of concrete. Two of the cubes or cylinders shall be used to establish the 28 day compression strength and the other two of the cubes or cylinders shall be used to establish the rate of gain in strength approx. 7 days of the concrete before de-stressing the tendons.

10.3. Acceptance criteria for compression strength

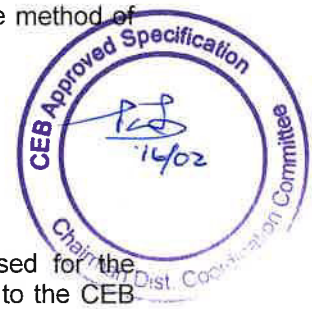
The concrete shall be considered acceptable when tested and found satisfactory according to stipulations in BS EN 206-2013.

10.4. Cost of testing

All testing shall be carried out in an accredited independent testing laboratory acceptable to CEB at the expense of the contractor in accordance with standards specified.

11.0 POLE LENGTH AND SHAPE

The pole shape shall be conforming to details stipulated in clause 6 and shall have a tapering section from bottom to top. The manufacturer shall submit a detailed description of the method of pole fabrication including the details of moulds.



12.0 INSPECTION & TESTING OF POLES

12.1. General

The CEB reserves the right to inspect plant & machinery and raw materials used for the manufacture of poles. At any time the contractor shall provide access to the plant to the CEB representative. Facilities as necessary labor, gauges, tools, materials testing equipment etc. for testing and inspection of poles shall be provided free of charge by the Contractor.

The CEB reserves the right to reject any pole which does not conform to the CEB specification.

12.2. Testing of poles

One-in-hundreds of each type of poles selected at random will be tested in the following manner. (One additional pole has to be manufactured for each batch of hundred poles or part thereof for testing purpose)

A pole shall be tested in the horizontal position only. The pole is to be held rigidly at the butt end in accordance with the supported length, 1/6th of the total length of each pole.

For horizontal testing, provision may be made by suitable supports to neutralize the bending moment induced by the weight of the pole.

"Apply the test load at a point 0.60m from the top of the pole and raise it in increments of 10% of the ultimate load. Take measurements of deflection after each increment of 10% of the ultimate load. At 40% and at 60% of ultimate load reduce the load to zero and measure the permanent set. Then increase the load in steps of 10% of the ultimate load until failure occurs, maintaining each load above 60% of the ultimate load for at least two minutes (failure load is the load at which the dynamometer indicates no further increase in load)".

The whole batch of 100 would be acceptable to the CEB, if the tested pole passes the criteria given in (a), (b), (c), (d) and (e).

(a) During the application of load upto 40% of the ultimate load, the pole shall not have developed any hair cracks.

(b) The permanent set recorded, after removal of a test load of 60% of ultimate load shall not exceed 10% of the deflection recorded for same test load.

(c) The hair cracks produced while loading upto 60% of the ultimate load, shall clearly close up on removal of the test load.

(d) The test load at failure shall exceed the ultimate load.

(e) On breaking the concrete after failure it shall be established that the following requirements are in accordance with the corresponding specification of Pole.

i) Type, diameter, length, number of bars and positioning of the main reinforcement.

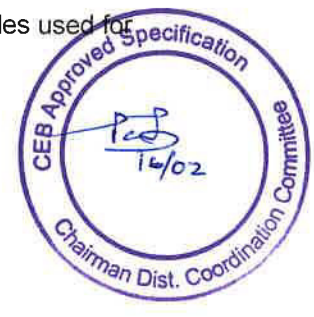
ii) Type, diameter, shape and pitch of the spiral link.

12.3. Failure to satisfy acceptance criteria

In the event that a pole does not satisfy any of the above acceptance criteria for the type tests, then one more pole shall be tested for all the five acceptance criteria. If additional pole tested fails to satisfy the acceptance criteria then the entire batch shall be rejected. All the poles rejected shall be marked with a permanent ink, of at a distance of 2.5 m from the bottom of the pole and removed from the site immediately.

12.4. Cost of testing

The cost of testing shall be borne by the contractor. This also includes the cost of poles used for testing.



13.0 TRANSPORTATION

13.1. Transport to site

The poles shall be transported on vehicles that provide full length support without any overhang. Any poles that show sign of damage shall be rejected and shall be removed by the Contractor.

13.2. Lifting and storage

Poles shall only be lifted by the points designated on the manufacturing drawings and when stacked at the manufacturing plant or at the point of delivery shall be separated by timber bearers placed between each unit at the designated lifting points. Timber bearers shall be placed only on lines vertically above each other.

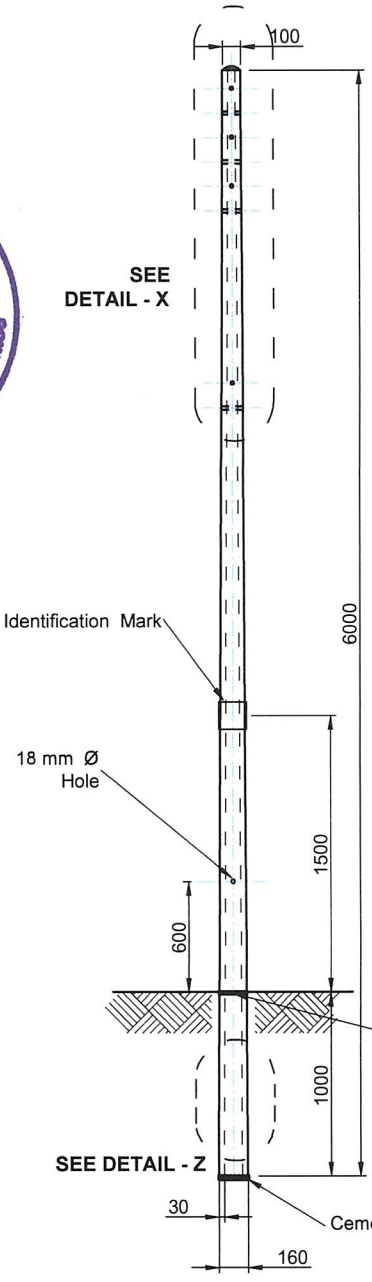
14.0 ANNEX

Annex –A1: Design of 6m, 50kg Pre-Stressed Spun Concrete Pole

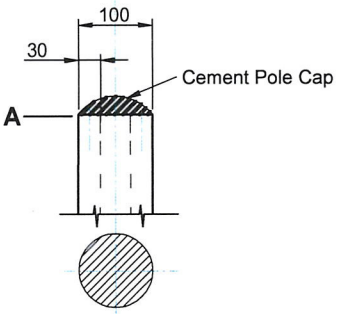
Annex –A2: Design of 8.3m, 100kg Pre-Stressed Spun Concrete Pole

Annex –B : Schedule of Guaranteed Technical Particulars

Annex –C : Non-Compliance Schedule

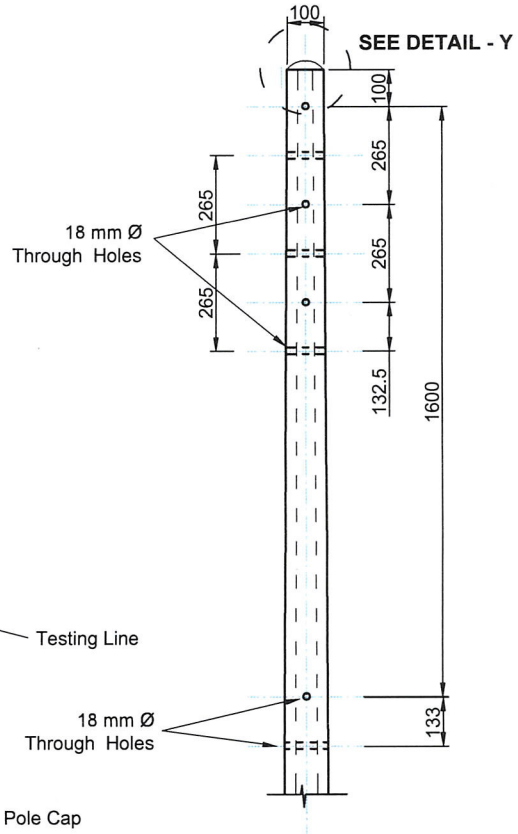


ELEVATION

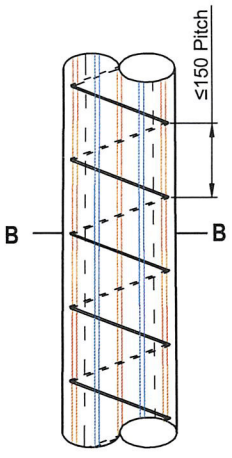


CROSS SECTION AT "A"

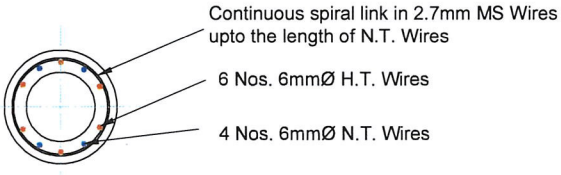
DETAIL Y



DETAIL X



DETAIL Z



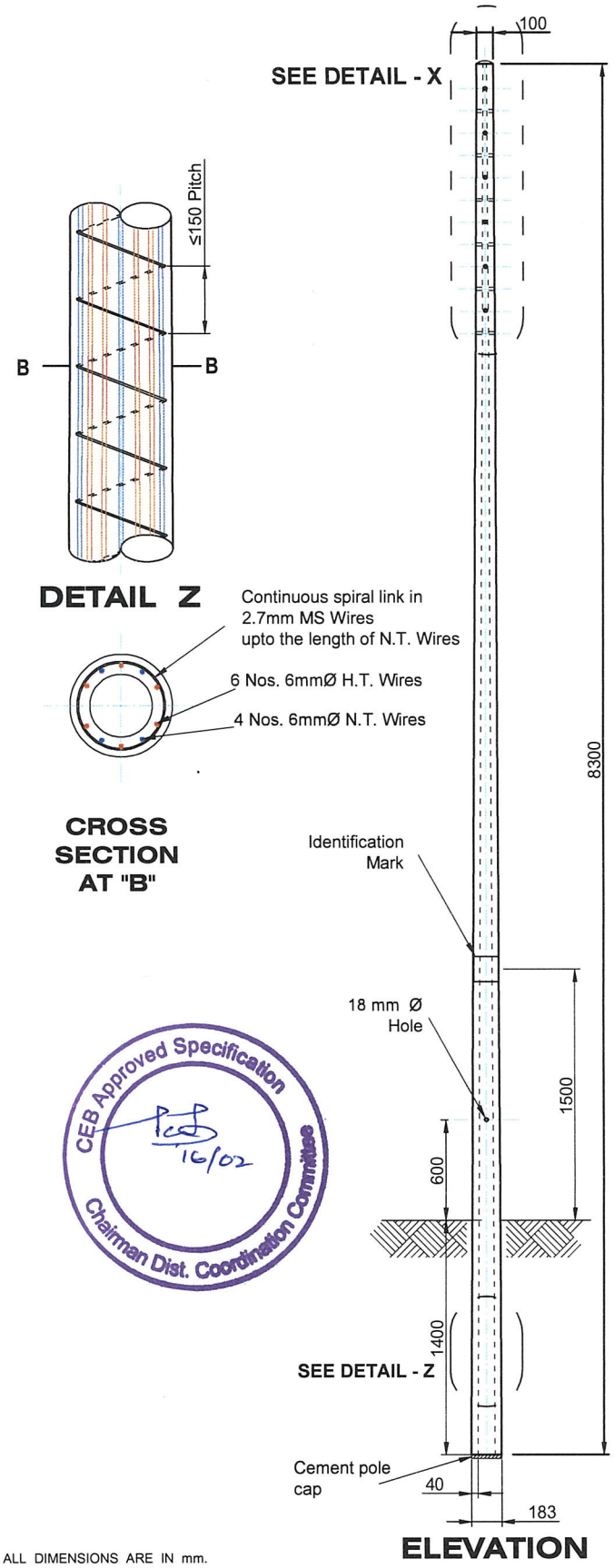
CROSS SECTION AT "B"

NOTE :

* All Holes 18 mm. Ø
* Minimum cylindrical strength of concrete shall be 50 N/mm² at an age of 28 days
* Maximum working load = 50 kg
* Overall height of pole = 6.0m
* Buried length =1.0m
* Factor of safety = 2.5
* Minimum covering = 9mm
* Nominal tensile strength of 6mmØ H.Twires shall be1670 N/mm²
* Yield strength of Mild Steel (MS) wires shall be 250N/mm²
* Length of the N.T. wires shall be at least 2.5 m from bottom of the pole. A continuous spiral link shall be provided upto the length of N.T. wires.
* H.T. wires shall be continuous through out the pole height.
* Approx. weight of the pole shall be less than 160 kg

ALL DIMENSIONS ARE IN mm.

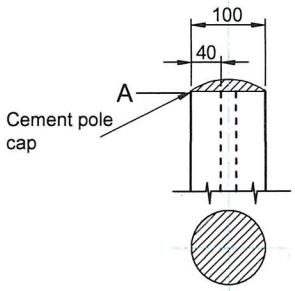
CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATION	SCALE : NOT TO SCALE
	6 METER 50 kg PRE-STRESSED SPUN CONC. POLE	DRAWN : LALANI
	DESIGNED BY / APPROVED BY	DATE : 23-12- 2016
		DRG. NO : DS&S/2016/044-4A
DISTRIBUTION COORDINATION BRANCH	EE (DC) / CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :



ELEVATION

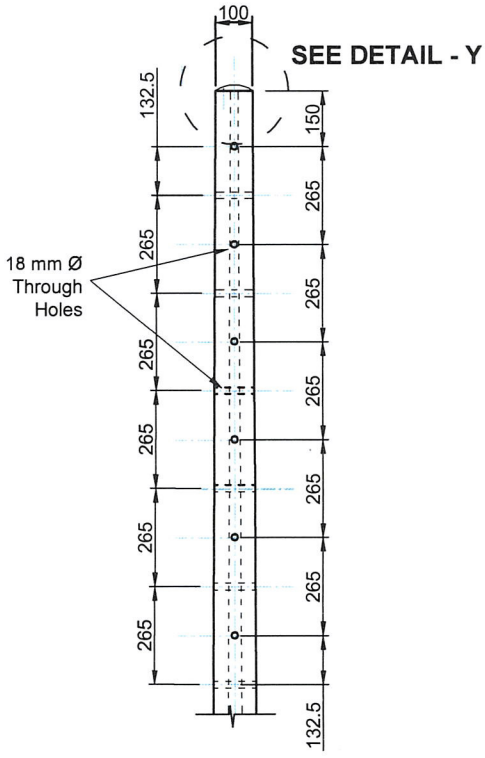
DETAIL Z

CROSS SECTION AT "B"



CROSS SECTION AT "A"

DETAIL Y



DETAIL X

NOTE :

* All Holes 18 mm. Ø
* Minimum cylindrical strength of concrete shall be 50 N/mm² at an age of 28 days
* Maximum working load = 100 kg
* Overall height of pole = 8.3m
* Buried length =1.4m
* Factor of safety = 2.5
* Minimum covering = 9mm
* Nominal tensile strength of 6mmØ H.Twires shall be1670 N/mm²
* Yield strength of Mild Steel (MS) wires shall be 250N/mm²
* Length of the N.T. wires shall be at least 5.5m from bottom of the pole. A continuous spiral link shall be provided upto the length of N.T. wires.
* H.T. wires shall be continuous through out the pole height.
* Approx. weight of the pole shall be less than 260 kg.

CEB Approved Specification 16/02 Chairman Dist. Coordination Committee

ALL DIMENSIONS ARE IN mm.

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATION	SCALE : NOT TO SCALE
	8.3 METER 100 kg PRE-STRESSED SPUN CONC. POLE	DRAWN : LALANI
		DATE : 23-12- 2016
	DESIGNED BY / APPROVED BY	DRG. NO : DS&S/2016/044-4B
DISTRIBUTION COORDINATION BRANCH	EE (DC) / CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :

Annex- B

SCHEDULE OF GURANTEED TECHNICAL PARTICULARS

(To be filled by the bidder for each sizes of poles)

1.	Name of the Manufacturer		
2.	Country of Origin		
3.	Length of the pole	m	
4.	Bottom Diameter	mm	
5.	Ground line Diameter	mm	
6.	Top Diameter	mm	
7.	Wall Thickness	mm	
8.	Pole Ultimate Load	kg	
9.	Nominal weight of the pole	kg	
10.	Taper		
11.	Whether test certificates for steel as per clause 7.2 are provided with the offer?		
12.	Whether the concrete mix design details as per clause 9.7.1 are provided with the offer?		
13.	Whether all documents related to Pole Length and Shape as per clause 11.0 are provided with the offer?		

....

Signature of the Manufacturer and seal **Date**

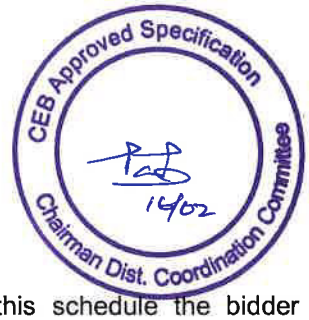
I/We certify that the above data are true and correct

....

Signature of the Bidder and seal **Date**

CEB Approved Specification
16/02
Chairman Dist. Coordination Committee

Annex – C



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 of the Manufacturer **Date**

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

....

Signature of the Bidder and seal **Date**