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SPECIFICATIONS FOR FIBERGLASS LV POLES

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Revision History

#	Date	Revision No.	Revised By	Major Revision Description
1	**08/2025**	**00**	Engr. Mohamed M. Saad Engr. Benrazer T. Dahum	

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1. SCOPE

This SEC Distribution Material Specification (SDMS) specifies the minimum technical requirements for design, materials, manufacturing, testing, inspection and performance for Composite fiberglass LV poles intended to be used in the distribution system of Saudi electricity company (SEC) used for low voltage network.

2. CROSS REFERENCES

This material standard specification shall be read in conjunction with SEC specification No.01-SDMS-01(latest revision), titled "General Requirements for All Equipment/Materials" which shall be considered as an integral part of this SDMS, also be read in conjunction with SEC purchase order requirements or contract schedules.

3. APPLICABLE CODES AND STANDARDS:

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacturer may propose equipment/material conforming to an alternate code or standard without jeopardizing the requirements of this SDMS. However, the provision of SEC standards should supersede the provision of these standards in case of any differences.

3.1	ASTM D635	Standard Test Methods for Rate Burning and/or Extent and Time of Burning of Plastic in a Horizon Position
3.2	ASTM E84	Standard Test for Flame Spread
3.3	ASTM D1036	Standards Test Method of Static Test of Wood Pole
3.4	ASTM D G154	Standard Practice for Operating Fluorescent Ultraviolet Lamp Apparatus for Exposure of Non-Metallic Materials.

4. DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 General

4.1.1 The Composite fiber glass poles shall be manufactured from a single piece of the required length. The cross-sectional shape shall be tapered and conform to dimensions given in the tables & drawings in these specifications.

4.1.2 The Composite fiberglass poles shall satisfy the dimensional length and pole top loading requirements as per the design parameters. The dimensions across the flats for the top and bottom for the fiber glass poles is listed in Table-2 are a preferred design to utilize one dimension for the pole.

4.1.3 The poles shall be factory drilled for holes then outfitted with UV resistant plastic plugs

4.2 DESIGN:

4.2.1 Types, dimensions & characteristics of fiber glass poles included in these specifications are given in Table-2.

4.2.2 Applications of the fiber glass poles are given in Table-3.

4.2.3 The standard poles shall be suitable for the specified applications based on the design parameters in Table-4.

4.2.4 Poles are designed to withstand the worst possible combination of simultaneous loading of:

- Lateral loads consisting of wind forces on conductors corresponding to wind span, wind force on insulators, wind force on pole and maximum conductor tension.
- Vertical loads consisting of pole self-weight, weights of conductors, insulators, pole mounted equipment, lineman & compression force due to reaction of stays wherever applicable.

Table -1: Type, Dimensions and Characteristics of Standard Conical Fiberglass Poles

Pole Type	Brief Description	Top Across Flat Dia. (mm)	Bottom Across Flat Dia. (mm)	Average Pole Thickness (mm)	Ultimate Load (Kg.)
FC10	10m Fiber glass pole, Low Voltage	148	332	11	803

Table -2: Applications of Standard Conical Fiberglass Pole for Single Circuit Lines.

Pole Type	Pole Structure	Angle of Deviation (degree)	No. of Stays/Location from Top (mm)	Buried Depth (mm)	Cross Arm Location from Top (mm)
FC10	Intermediate, LV	0-15	N/A	1500	N/A
	Medium angle, LV	16-60	1@250	1500	N/A
	Heavy angle, LV	61-90	1@250	1500	N/A
	Terminal, LV	-	1@250	1500	N/A

Table -3: Design parameters for single circuit LV.

Description		**10.2 m**
Span (m)	**Basic**	**50**
	Wind	**55**
	Weight	**75**
Wind Pressure (N/m^2)	**On Pole**	**1200**
	On conductors at 10°C	**600**
Factor of Safety	**Vertical Loads**	**1.5**
	Transvers Loads	**1.5**
	Longitudinal Loads	**1.5**
	Ultimate Loads	**-**
	Conductor minimum breaking strength	**3.0**
Planting Depth (m)		**1.5**
Types of structure	**Unstayed**	**Intermediate (0-15°)**
	Stayed	**Med. Angle (16-60°)**
	Stayed	**Heavy Angle (60-90°)**
	Stayed	**Terminal**
	Unstayed	**Self-support (90°)**

Conductors	**Phase**	**120 mm^2 Quadruplex Cable (3- Insulated AAC for Phase & 1- Bare ACSR/AW Messenger-Neutral)**
	Earth Wire	**N/A**
Stay Wires	**Minimum Breaking Load**	**65 KN**
	Max. Tension	**90 % of min. breaking load**
	Min. angle to the pole	**37°**
Temperature	**Minimum**	**-2 °C**
	Maximum	**+80 °C**

4.3 MATERIALS

4.3.1 Nonmetallic Pole Construction

The nonmetallic shaft is manufactured by the filament winding process using continuous fiberglass roving combined with a thermosetting epoxy resin. The shaft includes an integral sand-hardened coating with two (2) layers of axial reinforced FRP layers on either side of the core. The structural wall is made of a sand-filled epoxy polymer mortar to provide additional durability and stiffness. A highly weather resistant sand covered pigmented epoxy coating is applied over the outer structural layer to provide UV protection.

4.3.1.1 **Top Cap**

A top cap shall be supplied by manufacturer of nonmetallic pole products secured to pole top with fasteners for ease of removal for accessing interior of pole top for ground wire access, etc. The top cap shall have a 3-in. (8-cm) high peaked cone to minimize raptor nesting.

4.3.1.2 **Bottom Plate**

A bottom plate shall be supplied by manufacturer of the Pole secured to pole top with fasteners for ease of removal for accessing interior of pole base for ground wire access, etc.. In addition, the bottom plate shall have a 5-in. (13-cm) diameter opening to afford access to the inside of the Pole for

running wires and cables, as well as to permit any water collecting in the base to drain.

4.3.1.3 **Basic Level Impulse**

Non-metallic poles should adhere to tests by National Electric Energy Testing Research and Applications Center (NEETRAC) to ensure durability to high voltage impulses. Typical testing includes a composite pole subjected to 75 impulses simulating lightning strikes during adverse weather conditions and should have no visible damage to the pole. The result should demonstrate that nonmetallic pole sustains impulses of 600,000 volts dry and 400,000 volts wet.

4.3.1.4 **Fire-Resistance**

The standard nonmetallic Pole shall have a Flame Spread Rating of "A" in accordance with ASTM E84 test criteria.

4.3.1.5 **Hardware Attachment**

Non-metallic pole can be drilled per the customer's specification at the factory for hardware attachments. The minimum recommended separation between holes is 3-1/2" in. (8.9 cm). Field drilling should be easily accommodated with carbide tipped drill bits . It is recommended that hardware be attached with curved washers on both sides of the pole.

4.3.1.6 **Step Attachments**

When specified, step attachments shall be provided by manufacturer. If no specification exists, the manufacturer of the Pole Products will recommend step attachment models and spacing. Step attachments holes may be drilled at the factory or in the field.

4.3.2 Fiberglass Poles Consist

4.3.2.1 Glass Fabric grade E according to (ASSHTO 6 edition) and percentage, in poles materials is 45% by weight.

4.3.2.2 Unsaturated polyester resin for general purposes.

4.3.2.3 Other additives for polyester Hardness and UV stabilizer for color stability, The Color should be as distribution company requirement.

4.3.2.4 Polyester Veil for Smooth Surface

4.3.2.3 Top pole cover made from Hot Dip Galvanized Steel (Steel 37) rust resistant, prepare to fix wires as distribution company requirements.

4.4 FABRICATION

- The pole is manufactured by the centrifugal casting method, which ensures a good distribution of the materials of the pole along its length.
- The fiber glass percentage is not less than 45% from the pole weight.
- The color shall be overlaped with the material of the pole, which ensures stability of the color.
- To use a fiberglass of grade "E" that is intended for use in engineering and electrical works.
- To use a layer of polystyrene" veil" on the surface of the column to obtain a smooth surface and to protect the material of the pole from Ultraviolet rays from the sun.
- Fabrication tolerance for all dimensions is ±2%.

Additional Technical Requirements.

a) Apply reflective paint for safety purposes, to prevent collisions or accidents caused by vehicles. Alternatively, light reflectors may be added to the poles.

b) Apply black paint to clearly mark the concrete boundary, ensuring structural works are carried out according to specifications. This includes placing a visual marker to indicate the correct depth of the pole during excavation.

c) Create openings at the lower section of the pole to allow concrete to flow inside, ensuring the pole's stability during installation.

d) Add a visible warning sign on the pole.

e) Designate a clear area on the pole for attaching the lifting belt to ensure secure handling and prevent belt slippage during lifting operations.

4.5 MARKING

4.5.1 Each pole shall be provided with 80 mm x 80 mm nameplate riveted to the fiber glass pole shaft at the location specified in applicable drawing, as shown below. All markings shall be legible and so applied to remain legible under normal handling and installation practices.

4.5.2 Each pole shall be provided with color coding consisting of 50 mm wide band with the following color painted to the pole at the location specified in applicable drawing:

- 10.2 m single circuit – white.

5. INSPECTION AND TESTING

To verify conformance with the requirements of this specifications and quality assurance of the tapered fiber glass pole, SEC designated representative will conduct acceptance inspection and witness testing at the manufacturer's plant.

5.1 INSPECTION/ROUTINE TEST REQUIREMENTS

5.1.1. Sample conforming in SEC approved drawings shall be subject for inspection and testing.

5.1.2. Visual inspection shall include but not limited to dimensional verification, checks for satisfactory workmanship, material quality, freedom from surface defects.

5.1.3. SEC designated representatives always have free access while work is being carried out, to all areas of the manufacturing plant which concerns the work.

5.1.4. Inspection/routine tests may be made during all stages of manufacturing, testing, and shipping. Inspection may be at the point of shipment or delivery site at SEC option. However, inspection and acceptance shall not relieve the supplier of his conformance with the requirements of these specifications.

5.1.5. The Fiberglass pole products should not require inspections outside of normal field inspection practices for the utility's pole hardware and equipment inspections.

5.1.6. Proof load Test (Horizontal Testing)

The conical fiber glass pole shall be proof tested in accordance with applicable standards. one pole of each design shall be tested as per the manufacturing's testing procedure approved by SEC before starting mass production. Manual application of load during testing shall not be allowed. Digital dynamometers shall be used to obtain accurate readings.

The proof test will verify the adequacy of conical fiber glass poles to withstand the static design loads specified for that structure as an individual entity under controlled conditions.

In the event of any pole not fulfilling the test requirements, further two should be tested. Should either of this fail, the whole order of the pole shall be deemed to have failed to comply with these specifications.

5.2 TYPE TESTING REQUIREMENTS

5.2.1. All material shall be tested in accordance with the latest applicable standards specified in these specifications. Type testing shall be witnessed by SEC delegates and/or SEC approved third-party auditors/experts contracted by the manufacturer.

5.2.2. Following the completion of all the tests, certified copies of the type test reports shall be submitted to SEC for review & approval.

5.2.3. Type tests shall include the followings tests from a sample of poles to be done and approved their results before starting mass production:

Mechanical Properties: should be according to standard specifications as follows:

- Tensile strength (N/mm²) according to BSEN ISO 527-4α 5
- Impact Strength (KJ/m²) according to ASTM-D-256
- Bending Strength (N/mm²) according to BS EN ISO 14125
- Elongation % according to BSEN ISO 527-4α 5
- Modules of elasticity (N/mm²) according to BS EN ISO 14125

Electrical Properties: should be according to standard specifications as follows:

- Surface resistivity according to ASTM 257.
- Volume resistivity according to ASTM 257.
- Dielectric Strength (N/mm²) according to ASTM 257.

Physical Properties: should be according to standard specifications as follows:

- Rate of Burning according to ASTM-D 635.

As for the above tests, it should be done at an approved from SEC laboratories and their results shall be submitted to SEC for approval before starting mass production.

5.2.4 Pole Deflection Test (Wind Speed Test):

- The test will be operating According to ASTM D4923-92.
- Test conditions:
  - Properly fixing a pole to prevent rotation during a test is critical for safety and accurate results.
  -The load line of the dynamometer should be at least 12 inches away from pole top.
  -Load shall be perpendicular to unloaded loaded pole axis (±5◦).
  -The pole deflection shall be measured to the nearest 0.5 in (1.27 cm) from pole top using the unloaded pole-top position as base.

- Pole deflections under loads shall be measured and recorded. Deflection readings shall be recorded for the "before-load", "load-on" and "load-off" conditions as well as at all intermediate holds during loads. All deflections shall be performed to common base readings, such as the initial position, taken before and test loads applied.

- The ultimate load where the test shall be done on is (803 kg.)

- A no load deflection reading shall be taken five minutes after removal of the maximum test load. The reading shall not exceed the allowable deflection (2% of the exposed length).

- Test report, the supplier shall furnish a full and comprehensive report of the deflection test on the pole and shall include detailed diagrams and tabulation showing values and methods of load application and deflection records of the load test, photographs of test set up and description (with photographs) of all failures, if any.

- Test acceptance, the supplier upon receipt of written acceptance from SEC for the satisfactory performance of the pole loading tests, may start fabrication of mass production of fiber glass poles.

5.3 ROUTINE TESTING REQUIREMENTS

Visual inspection shall include but not limited to: Dimensional verification, checks for satisfactory workmanship, material quality, free from surface defects for a few poles as mentioned below:

INSPECTION TESTING PLAN REPORT
Routine Test

Description of Goods:
Customer:
Date: Order: TDS No.:

Process	Test	Unit	Required	Actual
Injection Process	Length	cm		
	Color	RAL		
	The External examination	-		
Cutting & Door Opening & Accessories	Distance Between Arm And G.S Base	m		
	The External examination	-		
Arm & G. Steel Base	Arm Length	cm		
	The External examination of Arm	-		
	G. Steel Base Diameter	cm		
	Tolerance:	± 2%		

6. PACKING AND SHIPMENT

6.1 Packing

Each fiber glass pole shall be covered with stretch film then a carton film then two layers of stretch film for preventing the poles from any scratches may occur during the shipment of poles.

Each nonmetallic Pole shall be individually wrapped with 12-in. (30-cm) wide protecting foam sheet near each end and in the middle to prevent pole surface marring during shipping.

6.2 Handling

It is recommended that Nonmetallic Pole Products will be handled with standard cloth slings and Straps and to avoid chains for lifting.

7. GUARANTEE

The vendor shall guarantee the fiber glass poles against all defects arising out of faulty design, poor workmanship or sub-standard material for a period ten (10) years from the date of delivery.

If no exceptions to these specifications are taken and no listed of deviations is submitted, it shall be deemed that, in every respect, the conical fiber glass pole offered conforms in the requirements of these specifications.

8. SUBMITTALS

8.1- In addition to documentations specified in 01-SDMS-01, the following shall be submitted by the vendor/manufacturer:

a) Detailed drawings of concrete pole showing the complete dimensions, identification marks, number and location of pre-drilled bolt holes, details of pole top cap, earthing nut and marking plate.

b) Detailed drawing/procedure for bundling of poles.

8.2- Submittals required following award of contract:

a) Drawings for final SEC approval shall be submitted prior to starting of manufacturing. Suppliers shall furnish all final drawings in original or Mylar tracings as well as on digital format.

b) Manufacturing schedule, progress report and test schedules.

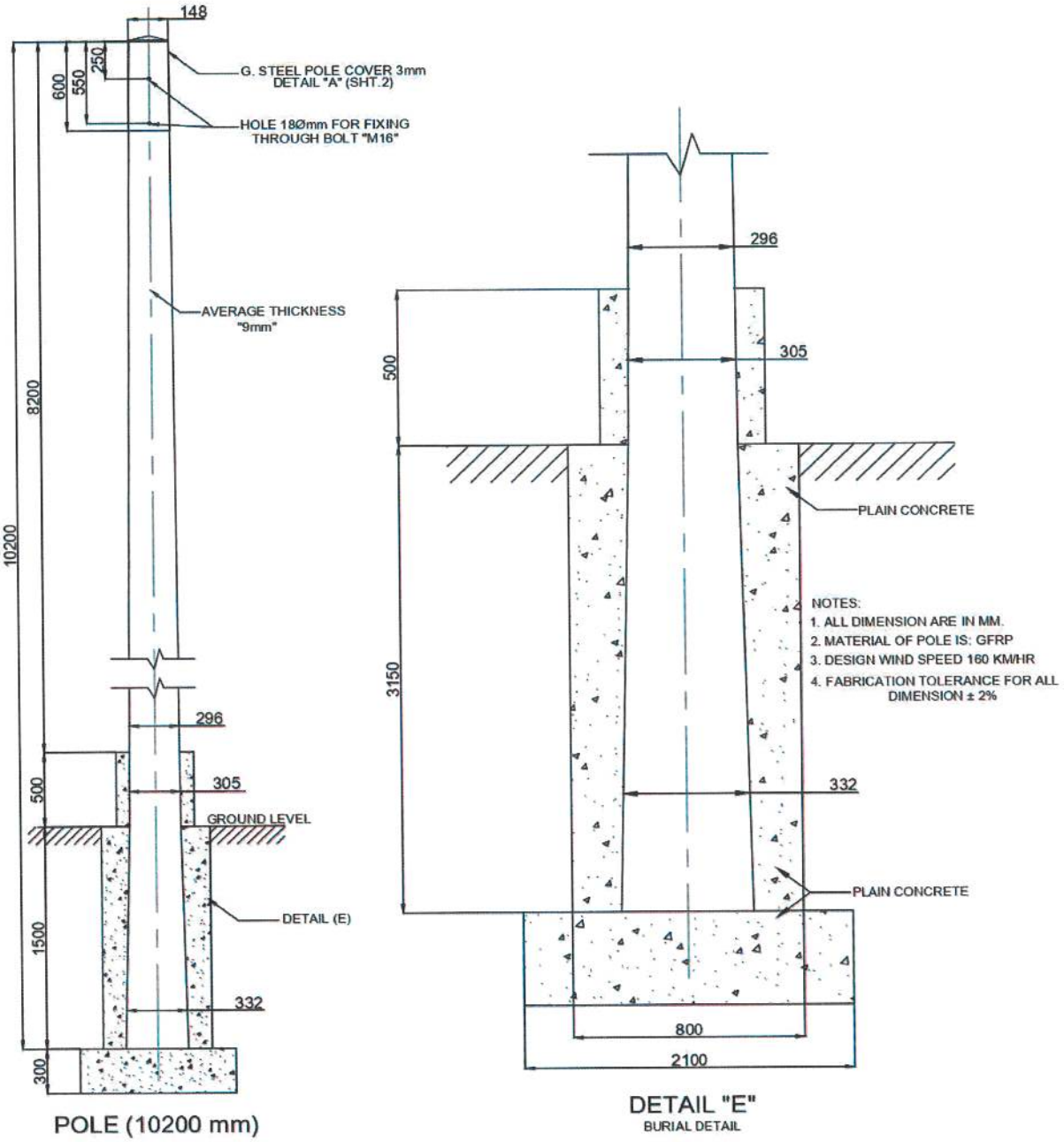
c) Test reports including, but not limited to, the following:

- Certified mills test reports for all material.
- Test reports on dimensional checks.
- Report of all structure testing, when required, including photos, diagrams, loading trees, etc.

9. TECHNICAL DATA SCHEDULE

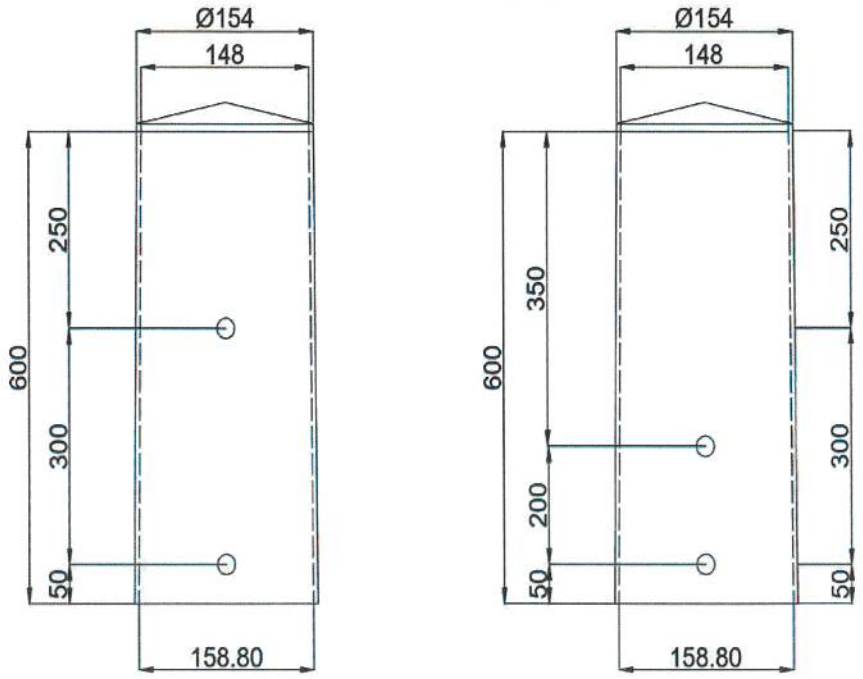
DESCRIPTION	SEC Specified Values*	Vendor Proposed Values**
Pole Type	As specified	
Length, m	As specified	
Top A/F diameter, mm	As specified	
Bottom A/F diameter, mm	As specified	
Shaft Thickness, mm	As specified	
Pole Ultimate Load, kg	As specified	
Total Weight After, kg	As specified	
Standard Designation/Grade of Fiberglass for Pole Shaft	As specified	
Minimum Yield Stress of Fiberglass Materials for Pole Shaft, N/mm^2	As specified	
Weather-proof, High-Temp Grade, Silicone U-Type Edge Sealing Gasket on Top End of Pole Shaft	As specified	
Grade 4.6, HDG Fasteners (Bolts, Nuts, Lock - Nuts)	As specified	
Pre-drilled Holes are Capped with UV-Resistant Plastic Plugs	As specified	
M12 x 30mm Mounting Bolts with Washers for Earthing	As specified	
M12 x 30mm Mounting Bolts with Washers for Top Cap & Bearing Plate	As specified	
Tolerances	As specified	
Straightness of the Pole	As specified	
Nameplate with Complete Information	As specified	
Nameplate Affixed on the Pole Shaft Using Fiberglass Screws	As specified	
Fiberglass Pole Color Code (Number of Bands)	RAL 7035	

10. DRAWINGS



POLE (10200 mm)

DETAIL "E"
BURIAL DETAIL



DETAIL "A"

NOTES:

1. ALL DIMENSION ARE IN MM.
2. MATERIAL OF POLE IS: GFRP
3. DESIGN WIND SPEED 160 KM/HR
4. FABRICATION TOLERANCE FOR ALL DIMENSION ± 2%