

**TECHNICAL SPECIFICATIONS**  
**AND SCHEDULES**

## **TECHNICAL SPECIFICATION**

### **POLYMERIC INSULATORS**

#### **1. GENERAL**

TENSION SILICONE RUBBER INSULATORS shall be suitable to replace the existing porcelain cap and pin type, a minimum total creepage distance of (1320) mm. Silicone rubber tension insulators are to be offered in a complete one module set (e.g string), separate set is rejected.

NON TENSION LINE POST SILICONE RUBBER INSULATORS shall be post type suitable for the highest voltage system (36) KV and having a minimum total creepage distance of 1320 mm. Post insulators are to be supplied complete with mounting studs, nuts and washers suitable for mounting on steel angle crossarms. The stud should suit the existing hole in the crossarm which is around (22) mm and must have a length of around (70) mm.

Insulators should be fitted with proper end and base fittings to allow direct and ease replacement of the existing porcelain 33 KV post, and 33 KV disc (Tension) insulators.

Main particulars and features of the required polymeric insulators and the existing porcelain insulators are to be the same, e.g creepage distance and mechanical strength.

**Polymeric silicone rubber insulators should have an excellent weather resistance, UV resistance and suitable to use in desert areas (high level of sun radiation and dust storms)**

#### **2. POST INSULATOR WITH TOP CLAMP**

Post silicon rubber shall be complete with horizontal trunnion clamps suitable with conductor size (50-200) mm<sup>2</sup> end and base fittings with zinc sleeve.

The clamp shall be made of aluminum alloy (wrought Alloy) to fix the ACSR and AAAC size (50-200) mm<sup>2</sup> conductor with the post insulator and it shall be completed with all required accessories to fix it.

### **3. SILICONE COMPOSITE INSULATORS**

#### **3.1 Standards Referred To**

The insulator as well as the complete string shall meet the requirements of the latest issue of the following standards:

IEC 60060-1	High Voltage Test Techniques Part 1: General definitions and test requirements
IEC 60437	Radio interference tests on high voltage Insulators
IEC 60471	Dimensions of clevis and tongue couplings of string insulator units
IEC TS 60815	Guide for the selection of insulators in respect of polluted conditions
IEC 61109	Composite insulators for A. C. overhead lines with a nominal voltage greater than 1000 V.
IEC 62217	Polymeric insulators for indoor and outdoor use with a nominal voltage >1 000 V –General definitions, test methods and acceptance criteria

## **3.2 Design of Insulators**

The composite insulator consists of three parts: load bearing glass fibre reinforced rod (core), polymeric housing and metallic end fittings.

### **2.2.1 Core**

The mechanical functions are taken over by the insulator core which shall be a glass-fibre reinforced epoxy resin rod of high strength (FRP rod). Glass fibres and resin shall be optimized regarding mechanical strength and moisture absorption.

The interface formed by rod and housing shall be of a quality to prevent brittle fracture phenomena. E-CR-glass fibres can be also provided that have a high electrical strength (in comparison to ECR-glass) and equivalent acid resistance.

### **2.2.2 Housing**

The housing can consists of a silicone rubber directly moulded onto the rod. The flash of the seam shall be removed in case of unexceptional appearance.

The silicone rubber shall have excellent UV resistant performance.

The thickness of the silicone rubber covering the rod shall be at least 3mm. The concentricity of the rod within embedded in the silicone rubber housing has to been proven. This housing protects the core against the environmental influences, to fulfil this duty over an expected live time of more than 30 years, the interface between housing and core shall be chemically bonded.

To achieve an excellent pollution performance and tracking performance of the housing the application of HTV (high temperature vulcanizing) silicone rubber filled with an appropriate amount of ATH (aluminium tri hydrate) shall be preferred.

The shed design shall be specified in accordance with IEC60815. A flat, aerodynamic profile is required since the requested insulators under this specification will be installed in desert areas. The shed design shall take into account the better self-cleaning performance of silicone rubber sheds, which is caused by their flexibility.

The protected creepage distance refers to that part of the insulator which is protected against rain at right angles to the axis of the bushing.

The mechanical functions are taken over by the insulator core which shall be a glass-fibre reinforced epoxy resin rod of high strength (FRP rod). Glass fibres and resin shall be optimized regarding mechanical strength and moisture absorption.

### **2.2.3 End Fittings**

End fittings bear the mechanical load to the core. Considering mechanical values exceeding 80 KN (SML) they should be made of forged steel preferably (high tensile strength quality) of tension insulators. The gap between fitting and sheath shall be sealed by an elastomere with permanent elasticity. The sealing shall stick to the surface of the metal fittings as well as to the housing.

The fittings shall be attached onto the rod by a compression method process (coaxial or hexagonal compression method) which does not damage the individual fibres of the rod in any way. The required end fittings configuration is shown in the attached drawings. Dimensions of clevis and tongue connection shall be in accordance with IEC60471.

## **3.3 Electrical Design**

The total creepage distance and the protected creepage distance over the external surface of bushings and insulators shall not be less than the minimum specified values. The protected creepage distance refers to that part of the insulator which is protected against rain at right angles to the axis of the bushing. And the total length for insulators shall be around specified value shown in attached drawings.

## **3.4 Mechanical Design**

The strength of insulators shall be such that, when supporting the maximum working load as in service, the factor of safety shall be not less than 2.5. They shall be secured in an approved manner with metal but shall be mounted with suitable interposing materials.

The design shall be such that stresses due to expansion and contraction in any part of the insulator and fittings shall not lead to the development of defects.

The design of all insulators shall be such as to achieve an excellent contamination resistant performance.

### **3.5 Sample Silicone Composite Insulators**

Non-returnable silicone composite tension and non tension insulator Samples, one for each of the main items listed in Schedule 'A' and identical to the designs offered, shall be hand-carried and submitted with the Tender on the specified date for opening Tenders. These representative samples will be closely examined and will undergo mechanical and electrical tests. Failure of the samples to meet the mechanical and electrical Specifications set out in this Document will entitle the Purchaser to reject the Tender.

### **3.6 Tolerances on Dimensions**

In accordance with IEC61109 the following tolerances are permitted for all dimensions without special request:

- $\pm (0.04 \times d + 1.5)$  mm when  $d \leq 300$ mm
- $\pm (0.025 \times d + 6)$  mm when  $d > 300$ mm

Where d being the dimensions in millimeters.

### **3.7 Warranty**

The manufacturer shall provide a guarantee for the good performance of the composite insulator. The warranty period shall be 5 years after delivery.

### **3.8 Identification**

The composite Insulator shall be marked in accordance to IEC61466.

## **4. INSPECTION AND TESTS**

### **3.1 General**

All equipment is subject to inspection by the Engineer at the Manufacturer's Works and on your account. Not less than (21) days notice of all tests shall be given to the Engineer in order that he may present if he so desires. The Supplier shall make the tests specified and any others required by the Engineer to show that the Goods comply with the Specification and with the appropriate Schedules. The tests shall be made at the Supplier's expense.

No passing of the plant or materials by the Engineer shall relieve the Supplier of his responsibility. The Supplier shall also be responsible for proper carrying out of all tests of work and of plant and material carried out or supplied by a Sub-contractor to the same extent as if the work, plant or material were carried out or supplied by the Supplier himself.

If, due to the Goods and/or component materials not complying with this Specification; further tests are necessary, the Supplier shall pay all additional costs which may be incurred in re-testing.

During the execution of the Contract, test specimens, if required by the Engineers, shall be taken from the materials for the purpose of check tests or analyses for testing and forwarded at the expense of the supplier to the Testing Authorities selected by the Engineer.

Six copies of the Supplier's records of all tests shall be given to the Engineer.

All material which is specified for tests at the Manufacturer's Works shall satisfactorily pass such test before being painted.

All instruments used for the purpose of testing shall be approved and, if required, shall be calibrated at the expense of the Supplier by such body as may be approved.

Where type tests are specified below they shall be carried out in the presence of the Engineer. Alternatively the Supplier shall provide certificates showing that such tests have been carried out satisfactorily on apparatus similar to that being supplied.

## **3.2 Silicone Composite Insulators**

### **3.2.1 Design Test**

The design tests shall prove the suitability of design, materials and method of manufacturing. These tests are prescribed in IEC 61109. It has to be shown that the design of the composite insulator, which is subject of this specification, has passed all of the required tests:

3.2.1.1 Test on interfaces and connections of end fittings

3.2.1.2 Assembled core load-time test

3.2.1.3 Test of housing and shed materials

3.2.1.4 Test of core material

### **3.2.2 Type Tests**

The tests are intended to verify the main characteristic (electrical and mechanical) of a composite insulator which is defined by creepage distance, shed inclination, shed diameter, shed spacing, arcing distance, core diameter and the method of attachment of the metal fittings.

**The test procedure shall be performed by IEC standard from one of STL group laboratory**

The electrical and mechanical tests shall be applied to those insulators which have passed the design tests. The electrical tests shall be performed with arcing devices, if they are an Integral part of the insulator type.

Tests are classified as follows:

3.2.2.1 Dry lightning impulse withstand voltage test, according to IEC 60383

3.2.2.2 Wet power frequency test, according to IEC 60383

3.2.2.3 Wet switching impulse withstand voltage according to IEC60383 for voltage level exceeding 245 kV

3.2.2.4 Mechanical load-line test, according to IEC61109

3.2.2.5 Radio interference voltage test according to IEC60437



### **3.2.3 Sample Tests**

The sample tests serve for verification of typical characteristics of the composite insulator, especially those properties, which can be influenced by deviation or tolerances of manufacturing process and material. The following tests have to be performed on insulators taken at random from the lot and performed at a number, which corresponds to the total volume:

3.2.3.1 Verification of dimensions according to IEC61109

3.2.3.2 Verification of locking system, in case of ball and socket according to IEC60120, In line with requirements of IEC60383. For Insulators with clevis and tongue the IEC60471 is to apply

3.2.3.3 Verification of the mechanical strength SML

3.2.3.4 Galvanizing Test in accordance with IEC60383

If one insulator of the tested specimen fails to comply with the sample test requirements, re-testing has to be realized according to IEC61109.

### **3.2.4 Routine Tests**

Each composite Insulator has to be evaluated in the following tests:

3.2.4.1 Visual Examination

This includes the following steps:

- Alignment of fittings according to drawing
- Uniformity of housing surface
- Flash in case of moulded parts
- Sealing system

3.2.4.2 Mechanical Routine Test

Each insulator has to withstand at ambient temperature a tensile load corresponding to at least 50% of the specified mechanical load (SML). The procedure is in accordance to IEC61109.

### **3.2.5 Tracking and erosion test**

**The manufacturer has to submit a test certificate to indicate the performance of a 5000- hour multi-stress test according to IEC61109 and IEC62217 Also; documentations have to be provided to indicate that the test has been passed successfully. The test procedures must be performed by one of STL group laboratory as an evidence of his capability to manufacture such materials.**

## **5. REFERENCE:**

Bidder must include with his offer a detailed list reference indicating types, quantities, and years of service of insulators he supplied as well as detailed address of buyers, particularly these buyers having same climatic conditions in the region.

## **6. OFFER CATALOGUES AND SAMPLES:**

Each offer should be attached with catalogues with a clear drawing with dimensions and other technical specifications for each type of the offers items.

**A Non-returnable sample of each type should be submitted with the offer, and any offer received without drawings and samples will be rejected during evaluation without any prior notice.**

## 7. DRAWINGS

Drawing for approval shall be submitted in triplicates as paper print, and after having been approved, the contractor shall submit six further copies, one copy at least being a reproduction on tracing as specified in these specifications.

The following drawings shall be submitted with the offer:

- a) General arrangement of insulators.
- b) Detail drawings of all fittings.

The following is a list of drawing to be submitted by the contractor for approval within one month from the commencement date or such other period as may be agreed with the purchaser:

- a) Drawings corresponding to all drawings submitted by the supplier with tender.
- b) Detailed drawing of insulators, fittings.
- c) Arrangements drawing with details of all accessories.

## 8. PACKING and TRANSPORT, STORAGE, INSTALLATION AND MAINTENANCE INSTRUCTIONS

The composite Insulators shall be packed to avoid, damages by transportation. The type of addressing is mostly defined by the client's request.

Manufacturer's insulator shall provide appropriate instructions and information covering general conditions during transport, storage, installation and maintenance of the insulators **and the name of the manufacturer company shall be written on the name plate of the insulator.**

These instructions can include recommendation for cleaning the insulators.

Before the specified completion date of the contract works, the supplier shall submit maintenance or cleaning instruction, diagrams and record drawings for approval by the engineers, and shall supply six further copies of the final approved form.

**TENDER DRAWINGS ARE AS FOLLOWS:-**

<b><u>DRAWING NO.</u></b>	<b><u>TITLE</u></b>
<b>Fig. (1)</b>	<b>33KV Tension Polymeric Insulators</b>
<b>Fig. (2)</b>	<b>33KV Non-tension Post Polymeric Insulators</b>

## **SCHEDULES AND GUARANTEES**

<b><u>SCHEDULE NO.</u></b>	<b><u>DESCRIPTION</u></b>
<b>A</b>	<b>Schedule of Requirements</b>
<b>B</b>	<b>Price schedules</b>
<b>C</b>	<b>Guaranteed delivery period schedules</b>
<b>D</b>	<b>Manufacturers, places of manufacture and testing place</b>
<b>E</b>	<b>Technical Particulars and Guarantees Schedules</b>
<b>F</b>	<b>List of type test certificates</b>
<b>G</b>	<b>Reference list</b>
<b>H</b>	<b>Deviation from specifications Schedules if any</b>

**SCHEDULE (A)**  
**SCHEDULE OF REQUIREMENTS**

<b>Item No.</b>	<b>Description</b>	<b>Stock Code</b>	<b>Unit Item</b>	<b>Quantity Required</b>
1.	36kV Tension polymeric silicon rubber insulators suitable for (100-200) mm <sup>2</sup> conductors as specified and shown in Fig. No. (1).		No.	200
2.	36kV non-tension polymeric silicon rubber insulators suitable for (100-200) mm <sup>2</sup> conductors complete with horizontal trunnion clamps suitable with conductor size (50-200) mm <sup>2</sup> end and base fittings with zinc sleeve and shown in Fig. No. (2).		SET	200
3.	Cost of one engineer from EDCO to attend the factory routine test at the manufacture for a week.			

**SCHEDULE (B)**  
**PRICES SCHEDULES**

ITEM NO.	DESCRIPTION	QTY AND UNIT	UNIT PRICE & CURRENCY .....		TOTAL PRICE C &F AQABA JORDAN
			FOB	C &F AQABA	
1.	36kV Tension polymeric silicon rubber insulators suitable for (100-200) mm <sup>2</sup> conductors as specified and shown in Fig. No. (1).	200 No.			
2.	36kV non-tension polymeric silicon rubber insulators suitable for (100-200) mm <sup>2</sup> conductors complete with horizontal trunnion clamps suitable with conductor size (50-200) mm <sup>2</sup> end and base fittings with zinc sleeve and shown in Fig. No. (2).	200 set.			
3.	Cost of one engineer from EDCO to attend the factory routine test at the manufacture for a week.				
TOTAL PRICE (C & F) AQABA					

**IMPORTANT NOTES:**

**1-EDCO HAS THE RIGHT TO ACCEPT PARTIAL OFFERS AND TO AWARD PART OF THE ITEMS OR QUANTITIES WITHOUT ANY LIMIT REGARDLESS CLAUSE (2.3) FROM SECTION III (GENERAL CONDITIONS OF CONTRACT).**

**2- EDCO HAS THE RIGHT TO REJECT ANY OFFER BASED ON EDCO EVALUATION TO THE QUALITY, RELIABILITY AND WELL-KNOWN MANUFACTURERS.**

**SCHEDULE (C)**  
**GUARANTEED DELIVERY PERIODS IN WEEKS**

DESCRIPTION	DELIVERY PERIOD FOB-SPECIFY PORT	DELIVERY PERIOD AQABA PORT JORDAN
<p>36KV POLYMERIC TENSION INSULATORS.</p> <p>36KV NON-TENSION POLYMERIC SILICON RUBBER INSULATORS SUITABLE FOR (100-200) MM<sup>2</sup> CONDUCTORS COMPLETE WITH HORIZONTAL TRUNNION CLAMPS SUITABLE WITH CONDUCTOR SIZE (50-200) MM<sup>2</sup> END AND BASE FITTINGS WITH ZINC SLEEVE</p>		

**Delivery period shall be as short as possible, and it will be considered during evaluation, at any way the delivery time shall not exceed (12) weeks, C&F Aqaba port from the date of receipt EDCO purchasing order.**



**SCHEDULE (D)**  
**MANUFACTURERS, PLACES OF**  
**MANUFACTURE AND TESTING PLACE**

DESCRIPTION	MANUFACTURER	PLACE OF MANUFACTURE	PLACE OF TESTING
<p>36KV POLYMERIC TENSION INSULATORS.</p> <p>36KV NON-TENSION POLYMERIC SILICON RUBBER INSULATORS SUITABLE FOR (100-200) MM<sup>2</sup> CONDUCTORS COMPLETE WITH HORIZONTAL TRUNNION CLAMPS SUITABLE WITH CONDUCTOR SIZE (50-200) MM<sup>2</sup> END AND BASE FITTINGS WITH ZINC SLEEVE</p>			

**SCHEDULE (E)**  
**TECHNICAL PARTICULARS AND GUARANTEES**  
**FOR POLYMERIC INSULATORS**

**This Schedule shall be completed by the Tenderer, and particulars and guarantees will be binding on the contractor.**

NO.	DESCRIPTION		ITEM NO. 1	ITEM NO. 2
1	1.1 Manufacturer		-----	-----
	1.2 Type number or identification		-----	-----
2	Manufacturing method		-----	-----
3	Material			
	3.1 Core		-----	-----
	3.2 Housing including sheds		-----	-----
	3.3 Sealing		-----	-----
	3.4 End fittings		-----	-----
	3.5 Thickness of zinc coating		-----	-----
4	Tests			
	4.1 Comply with standard (IEC 61109 or ANSI C29.11)		-----	-----
	4.2 Tests reports are attached	(Y/N)	-----	-----
5	Packing and shipping			
	5.1 Net weight	(kg)	-----	-----
	5.2 Standard package	(kg)	-----	-----
	5.3 Weight of crate	(kg)	-----	-----
	5.4 Package volume	(m <sup>3</sup> )	-----	-----

6	Insulator marking comply with		-----	-----
7	ISO certificate is attached	(Y/N)	-----	-----
8	Experience in silicone composite insulator manufacturing	(Year)	-----	-----
9	Dimensions and drawings			
	9.1 Drawing number attached		-----	-----
	9.2 Section length without hardware	(mm)	-----	-----
	9.3 Number of sheds		-----	-----
	9.4 Creepage distance	(mm)	-----	-----
	9.5 Protected creepage distance over silicone of complete insulator (90 deg. shadow)	(mm)	-----	-----
	9.6 Dry Arcing distance	(mm)	-----	-----
	9.6 Outside overall diameter of unit	(mm)	-----	-----
	9.7 Total length	(mm)	-----	-----
	9.8 Mass of complete set with fittings	(Kg)	-----	-----

10	Electrical data			
	10.1 System voltage, Um	(kV)	-----	-----
	10.2 Impulse withstand voltage, 1.2/50, positive.	(kV)	-----	-----
	, negative.	(kV)	-----	-----
	10.3 One minute power frequency withstand voltage, 50Hz, wet.	(kV)	-----	-----
	10.4 One minute power frequency withstand voltage, 50Hz, dry.	(kV)	-----	-----
	10.5 Minimum voltage at which corona shall be visible	(kV)	-----	-----
	10.6 Minimum 50HZ puncture voltage of unit	(kV)	-----	-----
11	Mechanical data			
	11.1 Specified mechanical load SML, tension	(kN)	-----80-----	-----
	11.2 Routine test load	(kN)	-----	-----
	11.3 Maximum working load	(kg)	-----	-----
	11.4 Breaking cantilever strength	(kN)	-----	----10----
	11.5 Torsional Load	N.m	-----	-----
12	<b>Has an Ageing Test been performed in accordance with applicable IEC standards?</b>		-----	-----
	<b>Duration of ageing test?</b>		-----	-----
	<b>Name and Location Testing Laboratories?</b>		-----	-----
13	End Fitting		-----	-----

14	Raw material manufacturer of silicone rubber	-----	-----
15	Method of moulding silicone rubber onto rod	-----	-----
16	Is silicone composite insulator moulded (y/n)	-----	-----
	If not determine the method used for assembling sheds	-----	-----
17	No. of years the specified silicone composite tension insulator has been in production?	-----	-----
18	Reference list	-----	-----
19	<b>Has a 5000- hour multi-stress test according to IEC 61109 test been performed successfully?</b>	-----	-----

## **SCHEDULE (F)**

### **LIST OF TYPE TEST CERTIFICATES FOR OFFERED MATERIALS**

Tenderers shall provide the information required below for the type test certificates from a recognized testing station covering the equipment offered to IEC recommendations & shall be submitted with the tender.

Failure to provide copies of type test certificates/reports will result in rejection of the tender.

<b>Type test made on identical designs of equipment to those offered</b>	<b>Certificate No.</b>	<b>Certificate Authority</b>

## **SCHEDULE (G)**

### **SERVICE EXPERIENCE OF FOR OFFERED MATERIALS**

Tenderers shall provide the information required below for the service experience of the same offered materials.

<b>Customer</b>	<b>Total QTY. (Pc.)</b>	<b>No. of years in service</b>

**SCHEDULE (H)**

**DEVIATIONS FROM SPECIFICATIONS (IF ANY)**  
**TO BE COMPLETED BY THE TENDERER**

ITEM NO.	BREIF DESCRIPTION	DEVIATIONS