



**INDEPENDENT POWER TRANSMISSION OPERATOR S.A.**  
**TRANSMISSION NEW PROJECTS DEPARTMENT**  
**TRANSMISSION LINES EQUIPMENT ELECTRICAL DESIGN**  
**AND CABLES ENGINEERING SECTION**

**SPECIFICATION No TR-17**

**COMPOSITE INSULATORS WITH BALL AND SOCKET COUPLING**

**Revision July 2012**

**ATHENS - GREECE**

**COMPOSITE INSULATORS WITH BALL AND SOCKET COUPLING**

This specification covers the manufacturing and testing of composite insulators, with ball/socket coupling.

The composite insulators have to pass successfully the tests mentioned in paragraph 3 and shall meet all the requirements mentioned herebelow.

**1. DESIGN AND FABRICATION**

**1.1** The insulators shall be designed and fabricated to provide mechanical ruggedness and long-service life, without thereby sacrificing requirements to meet electrical and operating characteristics herein specified.

**1.2** The insulator shall be made from two insulating parts equipped with metal fittings. The internal insulating part namely "core" will be designed to ensure specified mechanical load and will be manufactured from rod in low-stress ECR fiberglass (corrosion resistant) impregnated with epoxy resin.

The specified creepage distance is provided of an external insulating part, namely "housing" with sheds, and will be manufactured from High Temperature Vulcanized (HTV) silicon rubber.

**1.3** Every insulator must be equipped, at the live end with a guard ring device for field grading, corona protection and an arcing horn at the tower side. Every guard device shall be properly designed to give sufficient protection in case of long duration power arcs. Guard device must have proper dimensions in order to be used also in double tension string (indicative dwg. TR-17/1).

These devices have to prevent as much as possible any damage of the insulator and any disfigurement or burns of metal fittings and conductor strands.

**1.4** Insulators shall be designed to avoid excessive concentration of electrical stresses, in any section or across leakage surfaces. Design features tending to adversely affect radio reception shall be avoided as far as practicable.

**1.5** All the interfaces of the insulators will be made in such a manner as to achieve the specified mechanical load without any slip, for example between metal parts and the core.

**1.6** The metal parts shall be made of a good commercial grade of malleable iron or open hearth or electric furnace steel, hot-dip galvanized.

**1.7** Insulators should have been subjected to the "design tests", in accordance with IEC 1109/92 (paragraph 5) and its Amendment 1/95.

**1.8** Dimensions of ball and socket couplings of composite insulators will be in accordance with IEC Publication 60120/1984 (standard coupling / split – pin).



**AΔMHE**

## **2. MARKING**

Each insulator shall bear legible and indelible symbols identifying the manufacturer, the year of manufacture and the specified mechanical load identified by the word "SML" as well as, the material of the housing.

## **3. TESTS**

Composite insulators shall be subjected to the following tests, in accordance with IEC Publications, 1109/92 and its Amendment 1/95, 61467/97 and the values given in ANNEXES A and B. All required tests should be performed in proper independent laboratories accredited according to International Standard ISO/IEC 17025, except sample and routine tests which can be performed to manufacturer's laboratory, if it is certified by ISO 9001. Test reports have to be written in Greek or English language and shall be certified by laboratory where the tests have taken place.

### **3.1 TYPE TESTS:**

Tests have to be performed according to Standard IEC 1109/92 (paragraph 6) and its Amendment 1/95, except Power Arc test.

**3.1.1** Dry lightning impulse withstand voltage test as per paragraph 6.1.

**3.1.2** Wet power-frequency test as per paragraph 6.2.

**3.1.3** Wet switching impulse withstand voltage test as per paragraph 6.3.

**3.1.4** Mechanical load-time test and test of the tightness of the interface between end fittings and insulator housing, as per paragraph 6.4.

**3.1.5** Radio interference test as per paragraph 6.5.

**3.1.6** Power Arc test according to IEC 61467/97.

Test shall be performed with test circuit B (Unbalanced supply circuit/Balanced return circuit) of Table 1 and Test series X of Table 2 of above International Standard.

### **3.2 SAMPLE TESTS:**

Tests shall be performed according to Standard IEC 1109/92 (paragraph 7) and its Amendment 1/95.

**3.2.1** Selection and number of samples as per paragraph 7.1.

**3.2.2** Verification of dimensions as per paragraph 7.2.

**3.2.3** Verification of the locking system as per paragraph 7.3.

**3.2.4** Verification of tightness of the interface between end fittings and insulator housing (E2) and of the specified mechanical load, SML (E1) as per paragraph 7.4.



**AAMHE**

**3.2.5** Galvanizing test as per paragraph 7.5.

**3.2.6** Re-testing procedure as per paragraph 7.6.

**3.3 ROUTINE TESTS:**

Tests shall be performed according to Standard IEC 1109/92 (paragraph 8) and its Amendment 1/95.

**3.3.1** Identification of the composite insulators as per paragraph 8.1

**3.3.2** Visual examination as per paragraph 8.2

**3.3.3** Mechanical routine test as per paragraph 8.3

**4. INSPECTION AND TESTING**

**4.1** The insulators shall be subjected to inspection and shall not be released for shipping without the approval of Company's representative. The approval for shipping shall neither relieve the Manufacturer from responsibility of furnishing material conforming to all requirements of the Company nor invalidate any claim which the Company may make because of defective or unsatisfactory material.

**4.2** Manufacturer shall submit to the Company copies of the control and test reports of the material. The Company reserves the right to demand all the routine test reports from the manufacturer.

**4.3** In each delivery quantity, sample tests shall be performed in accordance with the requirements of paragraph 3.2 of present specification.

**4.4** For type test reports that haven't been submitted or that aren't adequate according to the requirements of paragraph 3 of present specification, IPTO reserves the right to request the performance of any or all type tests specified in paragraph 3.1 of present specification on samples which shall be taken from the production of the offered items. The Company reserves the right to select test laboratory and witness any or all tests.

**4.5** All Bidders shall have to state the manufacturers of the material, as well as all related sub-contractors, if any.

They shall also have to submit along with their offer a Quality Assurance Plan (Q.A.P.), for the manufacturing procedure of the stated manufacturer and all potential sub-contractors, by which it shall be evident in a detailed way the entire manufacturing procedure, the quality control equipment as well as all quality control stages, including all of the related printed material and referring to the specific international standards and regulations applied.

During the Technical Evaluation procedure, IPTO shall reserve itself the right to monitor the production procedure so as to ascertain the application of the Q.A.P. and, in general, to conclude on the production procedure, in a way that shall deem the offer technically acceptable or not.

**5. PACKING AND SHIPPING**

**5.1** Packing and shipping of the insulators must be in such a manner that protects them from damage in transit (by sea, plane, rail way, on road) and handling.



**AΔMHE**

**5.2** Containers shall conform the all standard requirements, for the class of material being packed and shall be suitable for outdoor storing.

**5.3** Each container shall be legibly and durable marked with the gross weight, the number of insulators, the purchase order number, the manufacturer's serial number (if any) and all shipping marks.

**5.4** All insulators, together with crates and methods of packing, shall be subject to final inspection and test at Seller's works. The number of insulators in each package is specified in ANNEXES A and B.

## **6. DATA TO BE SUBMITTED WITH OFFER**

In the offers must be included the following data in a clear and unique way.

**6.1** Bidder shall submit for the offered insulator a scale drawing showing in cross-section all essential components, dimensions and tolerances, type of material of the components and method of casting (malleable or cast, etc.) of metal parts.

**6.2** A reference list of at least three (3) Electrical Companies, who have buy enough quantities of the same or similar type insulators with those that are offered which have been used with excellent operation on overhead Transmission Lines, for a period of at least five (5) years followed by the corresponding certificates.

Reference list and corresponding certificate shall include the exact type of insulator, operation voltage, exact quantity and the date of selling or installation. Certificates shall be original or validated copies and distinct regarding the Electrical Company that edit and guarantee the excellent operation of corresponding insulators.

Bidders that have supplied in the last decade, IPTO or PPC with the requested material, have no obligation of submitting the prerequisites of this paragraph, provided that it does not change the factory of manufacture.

**6.3** Bidders must provide design tests reports, proving satisfactory performance, for the offered type of insulator according to the terms of IEC Standard 1109/92 paragraph 4.1, performed, according to chapter 5 of the IEC Standard 1109/1992 and its Amendment 1/95, by an independent laboratory accredited according to International Standard ISO/IEC 17025.

Test reports for an accelerated ageing test 5000 hours, such as that described in Appendix C of IEC 1109/1992, if available (for informative reasons).

**6.4** Bidder has to submit with his offer, test reports concerning the type tests specified in paragraph 3.1 of present specification, if available.

**6.7** Bidder has to confirm the insulator data specified in ANNEXES A or B and to complete them in corresponding column.

**TECHNICAL DATA**

**(Composite insulators equipped with guard device for application on 150 kV T.L.)**

<b>DESIGNATION</b>		<b>IPTO data</b>	<b>Manufacturer data</b>
Nominal System Voltage	kV	150	
Maximum System Voltage	kV	170	
Short Circuit Current	kA	25	
Arc Current Duration	sec	0.5	
Ball and Socket Size	mm	16A	
Min. Leakage Distance	mm	5600	
Section Length L *	mm	—	
Lightning Impulse withstand voltage, dry 1.2/50 pos.	kV	750	
One minute power frequency withstand voltage, dry	kV	360	
Maximum RIV at 1000 kHz	μV	50	
Specified Mechanical Load, SML	kN	100	
Number of insulators per package		50	

\* As per tender terms