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**Informative Document – Year 2 013** 



"BIRD PROTECTION AND NATURAL PROTECTED AREAS CONSERVATION SYSTEM FOR M.V. ELECTRICAL OVERHEAD LINES BASED ON POLIMERIC ANCHORING AND SUSPENSION INSULATORS TYPES C3670EBAV & C3670 EBA"

This document is made up of thirteen pages.



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### 1. INTRODUCTION

**ENVERTEC**'s commitment to supply our customers **top quality products, services and solutions** has been always present in this company's mission.

For that we deeply trust in the knowledge, expertise and experience of our own staff but we also feel it is mandatory to establish a really close relationship with our customers, in order to know their real needs, and with our suppliers, in order to obtain the desired results. And those relationships must be based on trust, professionalism and search of a common objective: a quality and competitive product accord to the final customer's needs so that the result is profitable and fruitful for every involved party.

Considering that philosophy this document presents **ENVERTEC**'s feasible solution to improve natural protected areas conservation by **reducing** both, **bird electrocution and fire risks**, and enhancing continuity and **reliability** of **power supply**.

The proposed solution is part of the deep relationship between **ENVERTEC** and our main partner in the polymeric insulator industry, the manufacturer **CAON ELECTRIC INSTALLATION Co. Ltd.** 

### 2. OBJECT AND SCOPE OF THE SYSTEM

The proposed system fits in the general **ENVERTEC**'s objective to provide specific feasible solutions to concrete problems in the field of electrical power supply.

This system was developed in order to introduce a new tool to **prevent birds** from **electrocution** and better protect selected natural areas by **reducing fire risks** caused by discharges on medium voltage overhead electrical lines due to **bird collisions** or nearby **vegetation**. Additionally this system works in order to reduce the risk of outages and improving the continuity of the power supply service.

The introduced system complies with existing mandatory electrical and environmental regulations and it is suitable for medium voltage overhead lines up to 36 kV.





Figure 1. Polymeric Insulators Type C3670EBAV and C3670EBA.

### 3. DESCRIPTION OF ENVERTEC'S SYSTEM

The introduced system, shown in the figure 1 below, is based on the use of our specific in-house designed **polymeric insulators** type **C3670EBAV** (see element number 1 in figure 1 below). In addition the system can be reinforced by using our polymeric insulators type C3670EBA (see element number 2 in figure 1 below) in order to hold the loose connection when it is advisable, for instance in windy areas.

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Figure 2. Bird protection and Natural Protected Areas Conservation System.

The design, layout and characteristics of the elements and materials involved in this development made of it a really suitable and viable solution which features unique and significant improvements versus other currently used alternatives.

Figure 3.

Picture of installed Bird Protection System based on Insulator types C3670EBAV and C3670EBA and additional bird protection devices by ENVERTEC.



#### **Polimeric insulators type C3670EBAV:**

C3670EBAV insulators were design and developed to provide a unique and better alternative to the existing systems used to try to avoid electrocution of bulky protected birds in electrical overhead medium voltage lines.



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Figure 4. Polimeric Insulator Type C3670EBAV.

Rated characteristics:

Mechanical characteristics:

Density:	$\geq$ 1,1 ± 0.5 g/cm <sup>3</sup> .
Hardness:	≥ 43 ± 3 Shore A.
Breakdown tension:	$\geq 5 \pm 0,5 \text{ N/mm}^2.$
Break lengthening:	≥ 400 ± 50 %.
Tear resistance:	≥ 20 ± 3 N/mm.
Specified mechanical load:	70 kN.

**Dimensional characteristics:** 

Leakage distance:	1 300 +10/- 0 mm.
Dry arcing distance:	1 000 mm.
Insulator length, L:	1 104 +10/- 0 mm.
Max. Diameter of insulating zone:	D: 85 mm.
Core diameter:	18 mm.
Min. Thickness of silicone body:	4,5 mm.

**Electrical characteristics:** 

Rated voltage, U <sub>n</sub> :	30 kV			
Material highest voltage, U <sub>m</sub> :	36 kV			
LI withstand voltage, U <sub>l</sub> :	200 kV			
Wet power frequency withstand voltage, Uf: 80 kV				
Tracking resistance:	≥ Clase 1 A 4,5			
Voltaic arc resistance:	≥ 2,5 kAs			



Other characteristics:

LOI (Limitating Oxigen Index): Assigned pollution level:  $\geq$  25 % 4 (IV - Very high pollution).

Comparing **bird-protection system** based on **C3670EBAV** insulator (figure 5) with other existing solutions (figures 6a and 6b) it is easy to make out the advantages of the ENVERTEC's system because of the **longer totally insulated part** due to a **single body insulator** instead of several parts made up of metal to only increase distances but no insulation capability.

Advantages of the C3670EBAV insulator based-on system rely on the following key points:

- **Totally insulated length:** > 1 000 mm. The proposed solution provides a significant reduction of active zones (warning area) in favor of a much bigger insulated area. That significantly increases the protection when **bulky birds perch** on the line.
- Single-boby chain vs several elements joint together enables the system to:
  - **Reduce mechanical problems** and **breakdowns** in joints and links.
  - Quicker and simplier setup.
  - **50 % off weight**: insulator type C3670EBAV weighs **1.98 Kg vs 5.50 Kg** which is the weight of a 24 kV polymeric insulator + bird-protection extension.
  - **Signifficantly reduce labour cost** by setting up (setup of the insulator with the metallic extension for warning area is not required anymore) and maintenance.
- **Economical solution**. For instance the price of a C3670EBAV insulator is 20 % lower than the price of a 24 kV / 70 kN polymeric insulator and the required bird-protection extension.

All that leads to a really technically-adapted, convenient and feasible solution.





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**Bird Protection** Solution based on Short polymeric Insulator.



#### **Polimeric insulators type C3670EBA:**

C3670EBA insulators are the perfect partner of insulators type C3670EBAV to complete our bird protection system making it safer and more reliable in all type of situations.



Rated characteristics:

Mechanical characteristics:

Density:	$\geq 1.1 \pm 0.5  \text{g/cm}^3$ .
Hardness:	$\geq$ 43 ± 3 Shore A.
Breakdown tension:	$\geq 5 \pm 0,5 \text{ N/mm}^2.$
Break lengthening:	≥ 400 ± 50 %.
Tear resistance:	≥ 20 ± 3 N/mm.
Specified mechanical load:	70 kN.
Dimensional characteristics:	
Leakage distance:	980 mm.
Dry arcing distance:	415 mm.
Insulator length, L:	568 +10/- 10 mm.
Max. Diameter of insulating zone, D:	125 mm.
Core diameter:	18 mm.
Min. Thickness of silicone body:	3 mm.



Electrical characteristics:

Rated voltage, $U_n$ :	30 kV
Material highest voltage, Um:	36 kV
LI withstand voltage, U <sub>l</sub> :	200 kV
Wet power frequency withstand	d voltage, U <sub>f</sub> : 80 kV
Tracking resistance:	≥ Clase 1 A 4,5
Voltaic arc resistance:	≥ 2,5 kAs
Other characteristics:	
LOI (Limitating Oxigen Index):	≥ 25 %
Assigned pollution level:	3 (III - High pollution).

### Additional advantages: Quality in Product and Quality in Service

Additional advantages of our system came from our way of doing things. In **ENVERTEC** quality of product and service is an on-going concern.

### **Quality of the product:**

Our deep relationship with our main polymeric insulator supplier CAON enables us to define and monitor specific features and characteristics in our insulators.

The core of all our insulators and then types C3670EBAV and C3670EBA insulators are produced with dielectric epoxy resin strengthened with fiber glass which is acid penetration resistant. Furthermore joint between the insulator core and the metal fittings is carried out by means of an eight-point radial compression process. That way we get insulators with a mechanical resistance bigger than 70 kN (obtained mean values > 80 kN) and there are no problems concerning insulator breakdown (especially in core-metal fittings joints).

Insulator core is covered with a type **HTV polymeric silicone rubber sheath** which undergoes a 200 °C vulcanization process. This material is a dielectric layer with **Hc2 hydrophobic level** which supplies an outstanding behavior in hydrolysis and saline environments. The quality of the material is also reinforced by a mean sheath **thickness** of **4.5 mm**. This product has passed all the required design and type tests including the 5 000 hours ageing and artificial pollution tests in reputable independent laboratories. That enables us to guarantee our insulators for over a 20-year time.

Our type **C3670EBAV** insulators are designed with a long leakage distance which together with the quality of the material stops the dielectric capability loss of the insulators due to environmental ageing. That way **less maintenance** activities are required and they can be separated in time so that **they do not bother nesting and breeding periods of birds.** 

The whole set of rated characteristics of our insulators are properly put to the test. Every insulator has to undergo the specified set of **tests** according to our Quality System and the applicable Standard.



• DESIGN AND TYPE TESTING IN EXTERNAL LABORATORIES.

**CAON** performed successful design and type tests of all its insulators according to the required IEC Standards.

**ENVERTEC** sees to it that **CAON** performs type tests in independent accredited laboratories which are signatories of ILAC – Mutual Recognition Agreement among National Accreditation Bodies throughout the world (<u>http://www.ilac.org/index.php?id=321</u>).

Some CAON testing suppliers are the following:

- Testing and Certification Center of "XIHARI" (<u>http://www.xihari.com</u>) China -. Accredited by the China National Accreditation Service (CNAS, file L0223) to ISO 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories, for the competence of testing in the required tests. Besides, the laboratory is entitled to operate as a Testing Laboratory under the responsibility of TÜV Rheinland InterCert Kft., MEEI Division as National Certification Body and to carry out testing within the IECEE CB Scheme for all its scope (see www.iecee.org for further information).
- Laboratorio Central Oficial de Electrotecnia, "LCOE F2I2" (<u>http://www.f2i2.net</u>) Spain -. Accredited by the Spanish National Accreditation Body (ENAC, file LE-192) to ISO 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories, for the competence of testing in the required tests. Besides, LCOE is depositary of the Spanish national high voltage standards which assures tests are performed counting on top level metrological traceability.
- Laboratorio de Pruebas de Equipos y Materiales, "CFE LAPEM" (<u>http://www.cfe.gob.mx</u>)) México -. Mexican national laboratory Accredited by the Mexican National Accreditation Service (EMA, several files, e.g. EE-0132-012/11 –power testing-, EE-0159-005/12 metrology-) to ISO 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories, for the competence of testing in the required tests.
- STRI AB laboratory (Sweden) (<u>http://www.stri.se/index.pl?id=2189</u>) for 5 000 hour-long climatic ageing tests.
- ROUTINE AND SAMPLING TESTING IN OWN MANUFACTURER'S LABORATORIES.

In addition to internal quality control tests and measurements carried out during production process, **CAON** performs in their own laboratories the specified routine and sampling tests according to the corresponding Standard.

Internal testing activity is done by qualified technical staff of the manufacturer's Quality Control Department, and **CAON** has the required testing and measurement systems to do those tests. All quality control measurement devices are maintained and calibrated in accredited external laboratories according to a suitable maintenance and calibration schedule.



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Figure 8. Testing activity in CAON premises as part of Quality Control Assurance.

### **Quality in service:**

**ENVERTEC**'s philosophy has developed in our relationship with **CAON** by means of undertaking concrete actions to produce **ENVERTEC-CAON** polymeric insulators.

In **ENVERTEC** we closely work with the manufacturer in matters like materials, design, quality, reporting and traceability from raw materials to the customer through our Plan to Control and Quality of Supplies.

Our Plan is underpinned by two main ideas:

1) Close **collaboration** and **communication** with manufacturer, in favour of participatory and constructive decision making processes.

2) Surveillance and control of manufacturer's/supplier's activity on each production process stage.

Implementation of those principles is carried out by means of specific measures like the following:



- More detailed marking on each supplied insulator, indelible and including additional data not mandatory according to applicable regulation:
  - **Batch number** written on the surface of each insulator. This batch number is always related to **ENVERTEC**'s order reference in order to keep traceability under control during life of insulator.
  - Manufacturing month (only year is mandatory according to standards).



Caon LOT XXXX 36/70EBAV 36 kV 70 kN Month / Year

Figure 9. More comprehensive marking on insulators to ease traceability.

• Package optimization:

• Making it much **easier** to **identify** the material **from** the **outside** by defining the data that have to be included on external marking like brand, type, product description, batch number, year, **customer's reference**/ name, external packing volume, handling instructions and preservation.

• **Double packing system** so that each wooden crate or external package holds some cardboard boxes with insulators inside. Three or sets of three pieces are allocated in each box tightly held and separated by shaped polyurethane pieces which reinforce material integrity during transportation and subsequent delivery to final destination and storage / installation.



Figure 10. Insulator packaging.

### • Specific documentation for each order / delivery

Each order is delivered with a comprehensive report including the following information:

- Information related to production process of the provided product:
  - Control of certification, accreditation and/or recognition validity;



- Monitor changes in production center and verification of proper production conditions for the material to be delivered;
- Supply references of the same type of product;
- Traceability of suppliers of raw materials, components, and/or subcontracted services or products used to manufacture the insulator batch to be delivered.
- List of testing and measurement equipment used by the manufacturer to carry out internal quality control activities as well as routine and sampling tests in their premises.
- Calibration schedule of those measurement devices and systems. Suitability assessment.
- Information related the provided product:
  - List of raw material suppliers;
  - Batch number of each raw material;
  - Marking on each insulator;
  - Production procedure of the product including each step of the process;
  - Internal quality control activity;
  - Design and/or type test reports in accredited independent laboratories;
  - Routine and sampling test reports in manufacturer's laboratories.

Result and validity of tests is based on:

Applied Standard, specification and/or test procedure;

Testing equipment and their calibration state;

Measurement correction factors considering calibration results of the used measuring equipment;

Test uncertainty budget for tests performed in manufacturer's laboratories.

This Plan and its implementation enable **ENVERTEC** to supply unique and detailed information about the **traceability and quality** of both production process and product, and from order reception to delivery. Moreover, that traceability chain may be easily extended to the life-cycle of the product after delivery by implementing simple communication links with our customers.



Reliable Solutions & Trusted Products for MV - HV Electrical Networks.

Whole Development of Specific Solutions.

