

# TECHNICAL DESCRIPTION FOR FITTINGS OF OPGW FOR 150kV & 400kV T.L.

## 1. SCOPE

This technical description covers the requirements for design, construction and testing of fittings for OPGW on T.L. of 150 kV and 400kV

The assembly of the fittings can be seen at the drawings OPGW-01 up to OPGW-03.

## 2. GENERAL REQUIREMENTS

**2.1** The fittings shall be in accordance with the basic requirements of the drawings OPGW-04 up to OPGW-15 of present specification. The fittings shall also be in accordance with the requirements of corresponding paragraphs of International Standard IEC 61284 and IEC 61897, when applied and don't conflict with the requirements of this specification. The quality of the fittings during the manufacturing process will be verified by standard EN ISO 9001.

Also the fittings must be designed so as to:

- be free from appearance defects such as cracks, burrs, notches, distortions, defective machining of the surfaces, bubbles and castings defects in general.
- be inherently resistant to atmospheric corrosion or be suitably protected against corrosion, such as can occur in transport, storage and in service.
- have breaking load not smaller than those referred to in the corresponding drawings.

**2.2** All iron and steel parts of the fittings must be hot dip galvanized, in accordance with the International Standards EN ISO 1461/99 and ASTM 143/A 143M – 03.

**2.3** All supplied material and equipment must be of the latest technology and a relative declaration-certificate must be provided by the manufacturers. List of purchasers to Power Companies of the offered or similar equipment, shall also be submitted for a period of at least five (5) years. The List of Purchasers shall be accompanied by corresponding certificates that certify that the materials have been used on Transmission Lines of above Power Companies, with excellent operation.

The manufacturer must guarantee the quality of the fittings and their installation for at least three (3) years.

**2.4** Dimensions of the fittings that constitute the assemblies shall conform to the requirements of the basic dimensions and tolerances indicated in the corresponding drawings. When no tolerances are specified they should be limited to avoid excessive play between assembled items. These dimensions are final (after galvanization).

Generally tolerances of the fittings shall be limited, especially between assembled items. When tolerances are not specified in the drawings, they shall meet the following requirements:

Dimensions	Tolerance
Up to and 35mm	±0,7mm
Over 35mm	±2%

**2.5** It shall be the responsibility of the manufacturer to furnish fittings that can be properly assembled to each other. The interchangeability of all fittings must be secured. The bolts that referred to the fittings and corresponding drawings shall be of the metric system.

**2.6** Each fitting shall be marked in relief with the identification number of the fitting shown in the P.P.C.'s corresponding drawing, the characteristic mark of the manufacturer and specified minimum failing load.

**2.7** Fittings must be packed in strong wooden cases and generally their packing and handling must be in such a manner that protects them from damage in transit (by sea, plane, rail way, on road), handling and outdoor storage. Each case shall contain only one

type of fitting and the maximum gross weight shall be 50kg. Also each case shall have maximum total quantity 100 items and shall be plainly and indelibly marked with distinctive markings of the following data:

- Manufacturer's name or trademark,
- Contract number,
- Fitting code name or corresponding PPC's drawing,
- Gross weight,
- Quantity.

### **3. TECHNICAL REQUIREMENTS**

Fittings are installed on T.L.150kV and 400kV by PPC S.A. having the following design. In case that bidder has different design of fittings, Corporation reserves the right to accept or not the new design.

#### **3.1 Suspension Assembly**

For suspension towers (type tower S, G and R), OPGW shall be suspended through an assembly that is described at dwg.OPGW – 01.

In each assembly shall be included a suspension clamp that will be free to swing in any direction. Inside of suspension clamp, at suspension point, shall be included proper material – neoprene – for the protection of OPGW and also at each clamp shall be included proper set of preformed armor rods made from aluminum alloy. Armor rods are required to protect the conductor at suspension point. Assembly has to secure the direct electrical connection between OPGW and tower, as well as, the safe operation of fibers.

In each assembly shall be included all necessary fittings to attach the OPGW to the existing tower fitting. The breaking strength (U.T.S) of the assembly shall be 70 kN.

#### **3.2 Tension Assembly for suspension tower**

For suspension towers (type tower S, G and R), when an optical joint is required, OPGW shall be attached with an assembly that is described at dwg.OPGW – 02.

In each assembly shall be included, among other, two bodies and corresponding reinforcing rods, with proper dimensions for OPGW. The material of these parts will be aluminum clad steel (A.C.S.). In each assembly shall be included turnbuckles that allow the sag of OPGW to be adjusted with full sagging tensile load on the conductor. Assembly has to secure the direct electrical connection between OPGW and tower, as well as, the safe operation of fibers.

In each assembly shall be included all necessary fittings to attach the OPGW to the existing tower fitting. The breaking strength (U.T.S) of the assembly shall be 120 KN.

#### **3.3 Tension Assembly**

For tension towers (type T and Z), OPGW shall be anchored through an assembly that is described at dwg.OPGW – 03.

In each assembly shall be included, among other, one body and corresponding reinforcing rods, with proper dimensions for OPGW. The material of these parts will be aluminum clad steel (A.C.S.). In each assembly shall be included turnbuckles that allow the sag of OPGW to be adjusted with full sagging tensile load on the conductor. Assembly has to secure the direct electrical connection between OPGW and tower, as well as, the safe operation of fibers.

In each assembly shall be included all necessary fittings to attach the OPGW to the existing tower fitting. The breaking strength (U.T.S) of the assembly shall be 120 KN.

### **3.4 Vibration Dampers**

Vibration dampers shall be of the “Stockbridge type” and proper to protect OPGW from aeolian vibrations. Generally dampers should comply with the requirements of Specification TR-18 and dwg.OPGW – 05. Dampers shall be installed according to Annex C of present specification. Inside of damper’s clamp shall be included proper elastomer in order to avoid stress of conductor at the suspension point during the installation of damper to OPGW.

Vibration dampers for OPGW shall be installed at the whole length of the T.L.

### **3.5 Counterweight suspension**

Counterweight shall be suspended on OPGW in special occasions and only if it is required by T.L. study. Counterweights shall be suspended under suspension clamp in suspension towers or under the attachment point in tension towers, with special assemblies that will be recommended by Manufacturer and will be approved by PPC S.A.

### **3.6 Requirements – Tests**

The fittings shall be tested with the same OPGW that are intended. Generally all fittings should conform to the requirements of IEC Standard 61284 and IEC 61897, where applicable, and shall be tested according to same Standard, as well as, the testing procedure published in Electra N<sup>o</sup> 188/Febr. 200 p. 43 "Guide to fittings for optical cables on transmission lines – part 2A: Testing procedures, Task Force 22.11.03.

The manufacturer has to submit with his offer detailed drawing of the offering fittings, dampers, as well as, necessary type and routine tests.

## **4. ADDITIONAL DATA**

### **4.1. OPGW**

The OPGW composed of aluminum clad steel concentric – lay stranded wires with proper internal tubes which content the fiber optics. The technical characteristics of OPGW are given in Annex A of the present specification.

### **4.2 Fiber Optics**

The fiber optics shall conform to the International Standard ITU-T and shall be G-652 and G-655 type. The technical characteristics of the fiber optics are given in attached specification “TECHNICAL DESCRIPTION OF OPTICAL FIBRES”.

## **5. TECHNICAL DATA OF THE OFFER**

The manufacturer must submit to the Corporation the following data with his offer:

**5.1** Detailed drawings in full scale with all dimensions and tolerances, for every offered assembly and fittings that constitute them, as well as for every single fitting that referred in present specification.

**5.2** Each drawing shall be accompanied with relevant data about:

- the breaking strength of each assembly and fitting, as well as the values of SMDL, SMFL, minimum slip load, permanent deformation of the fitting at SMDL, when it is required for the performance of all the specified type and sample tests,
- the material and the quality for every part of the fitting,
- the method of manufacture / fabrication (malleable or cast, etc.) of every fitting,
- the weight of the fitting,
- the specified tightening torque of the bolts (when it is required),

**5.3** Description of the manufacturing process shall be given. A quality assurance program (EN ISO 9001) for the factory, to verify the quality of the fittings during the manufacturing process shall also be given. Also manufacturer/supplier must submit the place that each fitting will be manufactured.

**5.4** Test reports concerning the type tests specified in par.3.6 of present specification, for the offered or similar, assemblies and fittings with full data in order to enable the Corporation to evaluate their offers in accordance with the requirements of present specification. All the specified tests must be referred to each type of fitting. Corporation has the right to accept or to reject any fitting after checking its suitability.

**5.5** Description (drawing) of the package according to par.2.7 of present specification.

**5.6** Technical brochures for offered items.

**5.7** Sales – Reference lists according to par.2.3 of present specification

## **6. INSPECTION**

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

**6.2** In every case of acceptance of the type test reports submitted by the manufacturer with his offer the Corporation reserves the right to request the performance of any or all type tests specified in par.3.6 of present specification. All tests at the factory as determined necessary by the Purchaser, to verify adequacy of material to meet specifications, shall be made by and at the expense of Seller and Seller shall furnish all test specimens, apparatus and instruments required for this purpose. Purchaser reserves the right to witness any or all tests.

**6.3** Manufacturer shall provide to the Corporation's representative all reasonable facilities for the testing and inspection of the material and for the control of the manufacture and packing of the fittings.

**6.4** Manufacturer shall keep Corporation informed on the progress of the work in his Plant and shall give advance notice of the expected completion dates, so that the progress of the work shall be clearly shown and the inspection of the material and the witnessing of the tests may be scheduled without delay.

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

**6.6** In each delivery quantity, sample tests shall be performed in accordance with the requirements of corresponding paragraphs of present specification.

## **ANNEX A**

### **TECHNICAL DATA O P G W for 400 kV T.L.**

Overall diameter	(mm)	13
Arc Current / Duration	(kA/sec)	9/0.5
Maximum Temperature after short time current according to IEC 865 (Initial temperature 20 °C)	(° C)	200
Temperature during operation	(° C)	−40÷80
Minimum Breaking Load	(kN)	110
Modulus of Elasticity	(kN/mm <sup>2</sup> )	160
Approx.weight of wire (max.)	(Kgr/m)	~0.75
Number/type of fibers	36/G–652.B and 12/G–655.B	
Type of fiber according to	ITU–T G–652.B/G–655.B	

### **ANNEX C**

#### **INSTALLATION GUIDANCE FOR VIBRATION DAMPERS OF OPGW AT T.L. OF 150kV & 400kV**

P.P.C. S.A. has standardized the number of vibration dampers according to the span length of the towers as follows:

<b>OPGW</b>	
<b>Span Length (m)</b>	<b>Number of Stockbridge Vibration dampers per span</b>
0 – 370	2
371 – 550	4
551 –	6

The position where the damper will be installed has also been standardized for OPGW at the following distances. The distance is measured from the center of the suspension clamp or from the end of the body clamp.

<b>Distance</b>			
	<b>1<sup>st</sup> Damper (m)</b>	<b>2<sup>nd</sup> Damper (m)</b>	<b>3<sup>rd</sup> Damper (m)</b>
OPGW for T.L.	0.80	1.60	2.40

The above standardization has been made in order to have installation guidance independently of the manufacturer.