

**The type test procedures on the OPGW Cable fittings and accessories are listed in below table:**

No.	TEST NAME	APPLICABLE STANDARD	TEST RESULT PASS/FAIL
1	Visual examination, dimensional & material verification test	ISO 1461-2009/IEC:61284-1997	
2	Mechanical Strength Test for Suspension assembly	IS 2486/IEC:61284-1997	
3	Mechanical Strength Test for Tension assembly	IS 2486/IEC:61284-1997	
4	Clamp Slip Strength Test for Suspension assembly	IS 2486/IEC:61284-1997	
5	Slip Strength Test for Tension Clamp	IS 2486/IEC:61284-1997	
6	Grounding clamp and structure mounting clamp fit test	IS 2486/IEC:61284-1997	
7	Structure mounting clamp strength test	As per Vol. B Technical specification	

**Reference Document:**

- 1) Approved DRS & Drawings of OPGW Hardware & Fittings.
- 2) Applicable for OPGW installation hardware & fittings.
- 3) Applicable standard.( ISO 1461 IS 2486/IEC:61284)
- 4) Contract-Technical Specifications

**Sampling Procedure:** For OPGW installation hardware and fittings, at least ten (10) samples shall be offered for selection.

(Tested by)  
Sign & date

(Witnessed by)  
Sign & date

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**1. TYPE TEST PROCEDURE OF  
VISUAL EXAMINATION, DIMENSIONAL & MATERIAL VERIFICATION TEST**

Test Name: Visual Examination, Dimensional & Material Verification Test

Manufacturer:

Standard: ISO 1461-2009 / IEC 61284-1997

Objective: It shall be verified that the samples are in accordance with the relevant drawings, particularly as regards any dimensions to which special tolerance apply and have a sufficient galvanized coating.

**Test Procedure:**

The following tolerance shall be allowed/on all dimensions to which special tolerance do not apply.

**Appearance:** To check all and ascertain to be appropriate as per DRS & Drawings.

**Dimensions:**

(A) Forgings:

- i) Dimensions up to and including 30mm  $\pm 1.5$ mm.
- ii) Dimensions greater than 30 mm..... $\pm 5\%$  upto max. of  $\pm 5$  mm.

(B) Helical Fittings:

- i) Dimensions up to and including 30mm  $\pm 1.5$ mm.
- ii) Dimensions greater than 30 mm..... $\pm 5\%$  upto max. of  $\pm 5$  mm.

**Galvanizing (Tension assembly fittings, Suspension assembly fittings, Earth lead Assembly Down-lead/fastening Clamps, all nuts & bolts components as per approved DRS & Drawings):**

- i) Galvanized coatings shall be tested in accordance with as appropriate.
- ii) All measurements shall be made after galvanizing where galvanizing is the normal finish. Galvanized coatings shall be tested and galvanized coating shall be minimum 85 $\mu$ m, except 43 $\mu$ m of bolts & nuts.

**Acceptance Criteria:**

Fittings shall be accordance with their relevant drawings within the tolerance Specified. Galvanized coatings on general articles shall be minimum thickness of 85 $\mu$ m, except 43 $\mu$ m of bolts & nuts.

**OBSERVATIONS, IF ANY:**

**TEST RESULT:** The Hardware Fittings as tested met/did not meet the requirements as preapproved DRS & Drawings.

(Tested by)  
Sign & date

(Witnessed by)  
Sign & date

## 2. TYPE TEST PROCEDURE OF MECHANICAL STRENGTH TEST FOR SUSPENSION ASSEMBLY

Test Name: Mechanical Strength Test for Suspension Assembly

Manufacturer:

Standard: IS 2486 / IEC 61284-1997

Objective: To verify the mechanical strength test for suspension Assembly.

### TEST SET-UP

The amour rods /reinforcement rods are assembled onto the approved OPGW by the installation instructions to check the assembly is correctly fitted and is the same that will be carried out during installation.

### TEST PROCEDURE

#### Part 1:

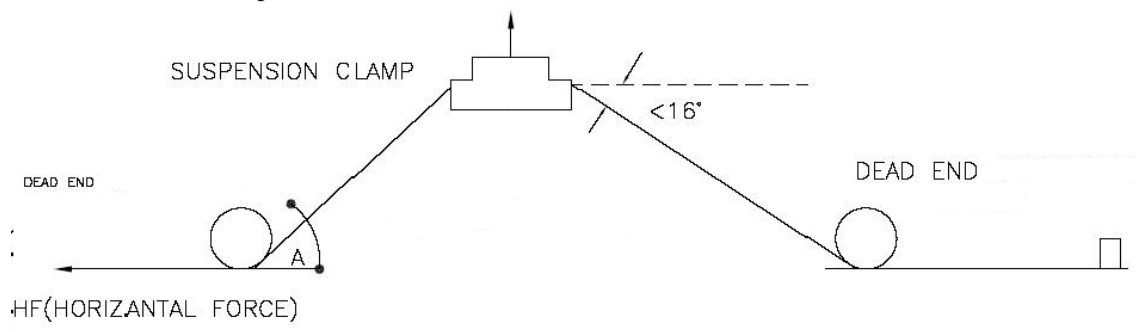
1. The suspension assembly shall be increased at a constant rate up to a load equal to 50% of the specified minimum failure load increased and held for one minute for the test rig to stabilize.
2. The load shall then be increased at a steady rate 67% of minimum failure load and held for five (5) minutes. The angle between the cable, the suspension assembly and the horizontal shall not exceed 16°.
3. This load shall then be removed in a controlled manner and the protection splice shall be disassembled.
4. Examination of all the components shall be made and any evidence of visual deformation shall be documented.

#### Part 2:

1. The suspension clamp shall then be placed in the testing machine. The tensile load shall gradually be increased up to 50% of the specified minimum failure load of the suspension assembly and held for one minute for the Test Rig to stabilize.
2. The load shall be further increased at a steady rate until the specified minimum failure load is reached and held for one minute. No fracture shall occur during this period.
3. The applied load shall then be increased until the failing load is reached and value shall be documented.

### ACCEPTANCE CRITERIA

1. No evidence of binding of the nuts or deformation of components at end of Part 1 of test.
2. No evidence of fracture at the end of one minute at the minimum failure load during Part 2 of the test.
3. Any results outside the above parameters shall constitute a failure.



**Figure 1: Test set up for mechanical strength test for suspension assembly**

**OBSERVATIONS, IF ANY:**

**TEST RESULT:** The Hardware Fittings of OPGW cable met/not met the acceptance criteria for the Mechanical Strength Test for suspension assembly.

**(Tested by)**

Sign & date

**(Witnessed by)**

Sign & date

### 3. TYPE TEST PROCEDURE OF MECHANICAL STRENGTH TEST FOR TENSION ASSEMBLY

Test Name: Mechanical strength for Tension assembly

Manufacturer:

Standard: IS 2486 / IEC 61284-1997

Objective: To verify the mechanical strength test for the tension assembly.

#### TEST SET-UP

The Tension assembly is correctly fitted and is the same that will be carried out during installation.

#### TEST PROCEDURE

##### Part 1:

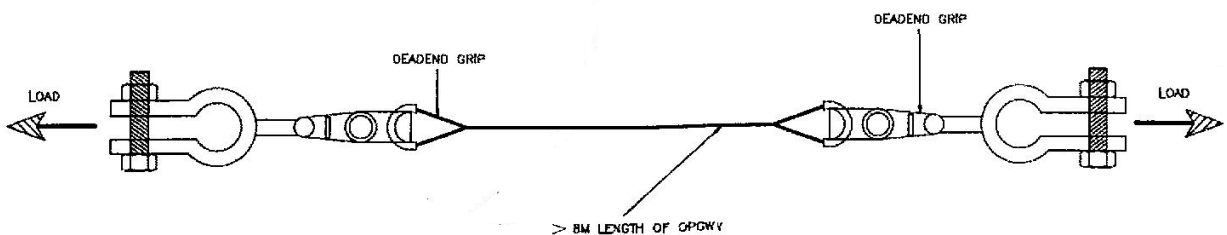
1. The tension assembly (excluding tension clamp) of cable section shall be increased at a constant rate up to a load equal to 50% of the specified minimum failure load increased at a constant rate and held for one (1) minute for the test rig to stabilize.
2. The load shall then be increased at a steady rate to 67% of the minimum failure load and held for five minutes.
3. This load shall then be removed in a controlled manner and the tension assembly shall be disassembled, Examination of the Tension Dead—End and associated components shall be made and any evidence of visual deformation shall be documented.

##### Part 2:

1. The Tension Dead-End and associated components shall then be reassembled and bolts tightened as before.
2. The tensile load shall gradually be increased up to 50% of the specified minimum failure load of the tension assembly and held for one minute for the test rig to stabilize and the load shall be further increased at a steady rate until the specified minimum failure load is reached and held for one minute.
3. The applied load shall then be increased until the failing load is reached and the value shall be documented.

#### ACCEPTANCE CRITERIA

1. No evidence of binding of the nuts or deformation of components at end of part 1 of test.
2. No evidence of fracture at the end of one minute at the minimum failure load during part 2 of the test.
3. Any results outside the parameters shall constitute a failure.
4. Failure load shall meet or exceed value as per approved DRS.



**OBSERVATIONS, IF ANY:**

**TEST RESULT:** The Hardware Fittings of OPGW cable met/not met the acceptance criteria for the Mechanical Strength Test for Tension assembly.

**(Tested by)**  
Sign & date

**(Witnessed by)**  
Sign & date

#### 4. TYPE TEST PROCEDURE OF SLIP STRENGTH TEST FOR SUSPENSION ASSEMBLY

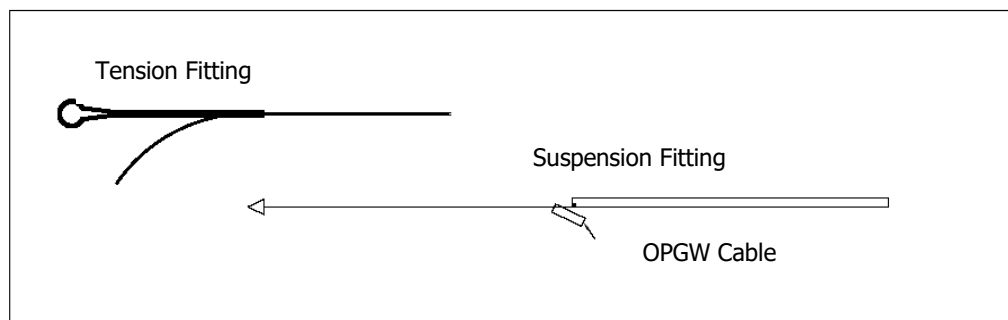
Test Name: Clamp slip strength test of suspension assembly

Manufacturer:

Standard: IS 2486 / IEC 61284-1997

Objective: To verify the clamp slip strength test for suspension assembly proposed for the OPGW cable.

**Test Set-up:** The below figure shows the schematic of the test configuration. The OPGW used for this test shall be type approved by Power Grid.



**Figure 3: Test set up for slip strength test for suspension assembly**

The suspension assembly shall be vertically suspended by means of a flexible attachment. A suitable length fibre optical cable shall be fixed in the clamps.

#### **Test procedure:**

1. After the suspension clamp has been assembled, the test rig is tensioned to 1 KN and the position scale on the recorder 'Zeroed'. The test rig is then tensioned to 2.5 KN and the relative positions of the Reinforcing rods, Armour rods and Suspension clamp were marked by suitable means to confirm any slippage after the test has been completed. The relative positions of the helical armour rods and associated reinforcing rods at each end shall be marked and also 2mm relative position between clamp body and the armour rods shall be marked on one side.
2. The load shall be increased to 12 KN at a loading rate of 3 KN/min and held for one minute. At the end of this one minute, the relative displacement between clamp body and the armour rods will be observed. If the slippage is 2mm or above, the test shall be terminated. Otherwise at the end of one minute the position of the clamp body and 2mm relative position between clamp body and armour rods shall be marked on the other side.
3. After the one minute pause, the load shall be further increased at a loading rate of 3 KN/min, and recording of load and displacement shall continue until either the relative position displacement between clamp body and armour rods reaches more than 2mm or the load reaches the maximum slip

load of 17 KN. On reaching either of the above values the test is terminated. Visual examination of all paint marks shall be recorded, and a measurement of any displacement recorded in the table of results.

### Acceptance Criteria:

The Suspension Clamp has passed the Slip Test if the following conditions are met:

1. No slippage\* shall occur at or below the specified minimum slip load of 12 KN.
2. Slippage shall occur between the specified minimum and maximum slip load of 12-17 KN.
3. There shall be no slippage of the reinforcing rods over the cable, and no slippage of the armour rods over the reinforcing rods.
4. The relative movement (i.e. more than 2 mm between armour rods and clamp body) between minimum 12 KN and maximum slip 17 KN shall be considered as slip.
5. The armour rods shall not be displaced from their original lay or damaged \*\*.
6. Any result outside the above parameters is a failure.

\*Definition of no slippage as defined in IEC 61284: 1997. Any relative movement less than 2mm is accepted. The possible couplings or elongations produced by the cable as the result of the test itself are not regarded as slippage.

\*\* Definition of no damage in accordance with convention expressed in IEC 61284: 1997 no damage, other than surface flattening of the strands shall occur; any result outside these parameters shall constitute a failure.

For each sample tested there shall be Graphical records of Slip Load against Position Displacement

### OBSERVATIONS, IF ANY:

**Test Results:** The hardware fittings, as tested, met/ not met the acceptance criteria for the Clamp Slip strength Test for suspension assembly.

**(Tested by)**  
Sign & date

**(Witnessed by)**  
Sign & date

## 5. TYPE TEST PROCEDURE OF SLIP STRENGTH TEST FOR TENSION CLAMP

Test Name: Slip strength test of tension clamp

Manufacturer:

Standard: IS 2486 / IEC 61284-1997

Objective: To verify the slip strength test for tension clamp proposed for the OPGW cable.

### TEST SET-UP

The set-up for the slip strength for tension clamp is shown in Figure-4.

The tension clamps shall be fitted on both ends of a 8 m length of fibre optic cable on both ends.

The assembly shall be mounted on a tensile machine and anchored in a manner similar to the arrangement to be used in service.

### TEST PROCEDURE

1. A tensile load shall gradually be applied up to 20% of the Rated Tensile Strength of the OPGW.
2. Displacement transducers shall be installed to measure the relative movement between the OPGW relative to the reinforcing rods and Tension Dead-End relative to the reinforcing rods. In addition, suitable marking shall be made on the OPGW and Dead-End to confirm grip.
3. The load shall be gradually increased at a constant rate until it reaches 50% of the specified UTS and the Position scale of the recorder is 'zeroed'.
4. The load shall then gradually be increased at a constant rate until it reaches 95% of the specified UTS and maintained for one minute.
5. After 1 minute pause, the load is slowly released to zero and the markings examined and measured for any relative movement.
6. On completion of the test a graph of load against position is produces for each of the two measurements.

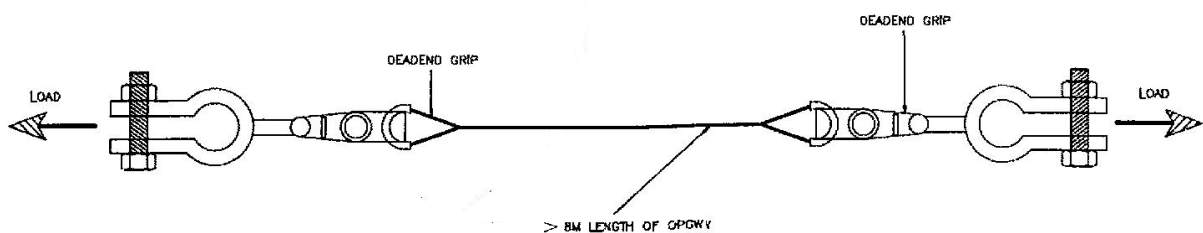
### ACCEPTANCE CRITERIA:

No movement\* shall, occur between the OPGW and the Reinforcing Rods, or between the Reinforcing Rods and the Dead-End assembly.

No failure or damage or disturbance to the lay of the Tension Dead-end Clamp, Reinforcing Rods or OPGW.

\*Definition of no movement as defined in IEC 61284: Any relative movement not more than 2mm is accepted. The possible couplings or elongations produced by the conductor as a result of the test itself are not regarded as slippage.

Any results outside these parameters shall constitute a failure.



**Figure 4: Test set up for slip strength test of tension clamp**

**OBSERVATIONS, IF ANY:**

**TEST RESULT:** The Hardware Fittings of OPGW cable met/not met the acceptance criteria for the Slip strength Test for Tension clamp.

**(Tested by)**  
Sign & date

**(Witnessed by)**  
Sign & date

## 6. TYPE TEST PROCEDURE FOR GROUNDING AND STRUCTURE MOUNTING CLAMP FIT TEST FOR SUSPENSION SET AND TENSION SET

Test Item: Fit Test of Grounding Clamp

Manufacturer:

Standard: IEC 61284-1997

Objective: To determine the Fit test for Grounding clamp and structure mounting (downlead clamp) clamp fit test proposed for the OPGW cable.

### TEST PROCEDURE

For structural mounting clamp, one series of tests shall be conducted with two fibre optic cables installed, one series of tests with one fibre optic cable installed in one groove, and one series of tests with one fibre optic cable in the other groove.

For grounding clamp, one series of tests shall be conducted with one fibre optic cable with structural reinforcing rods installed in one side, the grounding wire into other side, for both Suspension and Tension assemblies, separately.

The clamp shall be installed including clamping compound as required on the fibre optic cable and the grounding wire. The nut shall be tightened on to the bolt by using torque wrench with supplier's recommended torque and the tightened clamp shall be held for 10 minutes. After the completion of the test, the fibre optic cable and the grounding wire components shall be examined for distortion, crushing or breaking. Also the fibre optic cable shall be checked to ensure free movement within the core using dial calipers to measure the diameter of the core tube.

### ACCEPTANCE CRITERIA

There shall be no visible distortion, crushing, cracking or breaking of the core tube and the fibre optic cable within the core tube shall be free to move. The diameter of the core tube as measured at any location in the clamped area shall be not more than 0.5 mm larger or smaller of the core diameter of the core tube as measured outside the clamped area.

There shall be no visible distortion crushing or cracking of the grounding wire. Any result outside these parameters is a failure.

### OBSERVATIONS, IF ANY:

### TEST RESULTS:

Fitting No.	Torque applied for 10 mins (Nm)	Free Movement of core (Yes/No)	Visual distortion, crushing, cracking or breaking	Average core diameter in clamped area (mm)	Average core diameter in unclamped area (mm)	Difference (mm)
1						
2						
3						

The Hardware Fittings of OPGW cable met/not met the acceptance criteria for the Fit Test for Grounding clamp.

**(Tested by)**  
Sign & date

**(Witnessed by)**  
Sign & date

## 7. TYPE TEST PROCEDURE OF STRUCTURE MOUNTING CLAMP STRENGTH TEST

Test Name: Structure Mounting Clamp Strength Test

Manufacturer:

Standard: Technical Specification

Objective: To demonstrate the ability of the down lead bracket assembly to withstand a specified load.

### Test Set-up:

The clamp and mounting assembly shall be assembled on a vertical 200mm x 200mm angle and a short length of fiber optic cable installed as shown in Figure 2

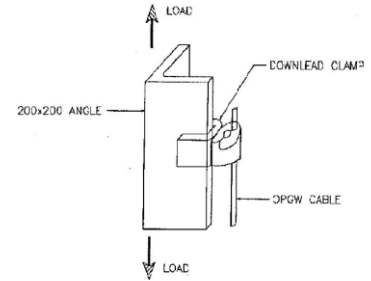


Figure 2: Schematic of structure mounting clamp strength test

### Test Procedure:

1. A vertical load of 200 kg is applied at the end of the mounting clamp and held for 5 minutes.
2. The markings on the structure Down Lead Clamp and OPGW are examined for any signs of visible distortion, slipping or breaking of any components.
3. The load is increased to 400 kg and held for 30 seconds.
4. The load is then removed and the markings on the structure, Down Lead Clamp and OPGW are examined for any signs of visible distortion, slipping or breaking of any components.

Acceptance Criteria:

Any visible distortion, slipping or breaking of any component of the mounting clamp shall constitute failure.

### Test Results:

The Structure mounting Clamps tested, met the requirement specified in technical specification, and results are shown as follows.

S/N	Load (kg)	Description	Comment
1	400		
2	400		
3	400		
4	400		
5	400		

The Hardware Fittings of OPGW cable met/not met the acceptance criteria for the Structure Mounting Clamp Strength Test.

(Tested by)  
Sign & date

(Witnessed by)  
Sign & date