INDEX

I. Suspension Assembly

1. Visual Material Verification and Dimensional Check as per approved DRS & Drawings
2. Clamp Slip Test
3. Mechanical Strength Test of the Assembly
4. Mechanical Strength Test on Each Component
5. Galvanizing Test

II. Tension Assembly- for Dead End; for Pass Through; for Splicing location and Tension Assembly for Suspension Tower(Yoke Plate type)

1. Visual Material verification and dimensional checks as per approved DRS/Drawings
2. Clamp Slip Strength Test
3. Mechanical strength Test on Each Component
4. Galvanizing Test

III. Structure Mounting Clamp (Down Lead Clamp) & (Earth Lead Assembly)

1. Clamp Fit Test
2. Clamp Strength Test
3. Visual Material verification and dimensional checks as per approved DRS & Drawings
4. Galvanizing Test

VI. In Line Splice Enclosures (Joint Box) & FODP

1. Visual Material verification and Specific component number & dimensional checks

Reference Documents:

1) Approved DRS & Drawings in Category-I
2) Applicable Standards - IEC 61284, 1997

SAMPLE SIZE AND CRITERIA FOR CONFORMITY as per IS:2486

1. SAMPLING

1.1 LOT

All fittings of same type and design manufactured under similar conditions of production, offered for acceptance. A Lot may consist of the whole or part of the quantity offered for FAT.

1.2

The number of fittings to be selected at random from the lot shall be in accordance with column I and col II of Table 1. If required {Point no. 2 Conformity) additional fittings as given in col III of Table 1 shall also be selected at random. In order to ensure the randomness of selection, random number tables shall be used (see IS 4905 : 1968).

2. CONFORMITY

Each of the fittings selected in the first stage in accordance with column I and column II of Table 1 shall be subjected to all acceptance tests. A fitting shall be declared defective if it fails in any of these tests. The lot shall be, considered as conforming to the requirements of acceptance tests if the number of defectives, in the sample is less than or equal to corresponding acceptance number (see column IV). The lot shall be rejected if the number of defectives is equal to or greater than first rejection, 'R1' (see column V). If the number of defective fittings are in between 'A' and 'R1', a second sample of same size (see column III) shall be selected from the lot at random and subjected to the tests. If the number of defectives in the two samples combined is less than 'R2' (see column VI), the lot shall be considered as conforming to the requirements of acceptance tests, otherwise the lot shall be rejected.

Table 1: Sampling Procedure (IS 2486)

S.No.	Lot Size	Sample Size		A	R1	R2
		I – Stage	II - Stage			
	(I)	(II)	(III)	(IV)	(V)	(VI)
1.	101 to 500	5	5	0	2	2
2.	501 to 1000	8	8	0	2	2
3.	1001 to 3000	13	13	0	2	2
4.	3001 to 10000	20	20	0	3	4
5.	10001 to 35000	32	32	1	4	5
6.	35001 and above	50	50	2	5	7

VISUAL MATERIAL VERIFICATION AND DIMENSIONAL CHECKS FOR HARDWARE FITTINGS OF OPGW CABLE (Suspension Assembly, All types of Tension Assemblies & Downlead Assembly)

Document : **IEC** 61284:1997, Approved DRS & Drawings

Manufacturer :

Test Location :

Test Sample : 100% of Quantity

- Suspension Assembly
- All types of Tension Assemblies- Dead End; Pass through; Splicing Location & Tension Assembly for Suspension Tower
- Parallel Groove clamp & Earth Lead Assembly/Grounding wire
- Vibration Dampers
- Downlead clamp Assembly

Objective : This test determines the factory acceptance of the batch quantity of fittings that they confirm to the relevant drawings and where appropriate/ have a sufficient galvanized coating.

Test Procedure:

1. Physical/Visual Verification for the part no. of all the materials as per approved DRS& drawings.

2. It shall be verified that the sample are in accordance with their relevant drawings, particularly as regards any dimensions to which special tolerance apply and indicated in the corresponding approved DRS/Drawings.

3. 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 ±1.5mm.

ii) Dimensions greater than 30 mm……±5% upto max. of ±5 mm.

(B) Helical Fittings:

i) Dimensions up to and including 30mm ±1.5mm.

ii) Dimensions greater than 30 mm……±5% upto max. of ±5 mm.

Galvanizing: 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 85µm.

Acceptance Criteria:

Fittings shall be accordance with their relevant drawings within the tolerance Specified.
Galvanized coatings on general articles shall be minimum thickness of 85µm.

Observation, if any;

Test Results: The Hardware fittings, as tested met / did not meet the requirement as per approved DRS & Drawings.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

CLAMP SLIP STRENGTH TEST FOR SUSPENSION ASSEMBLY

Test location :

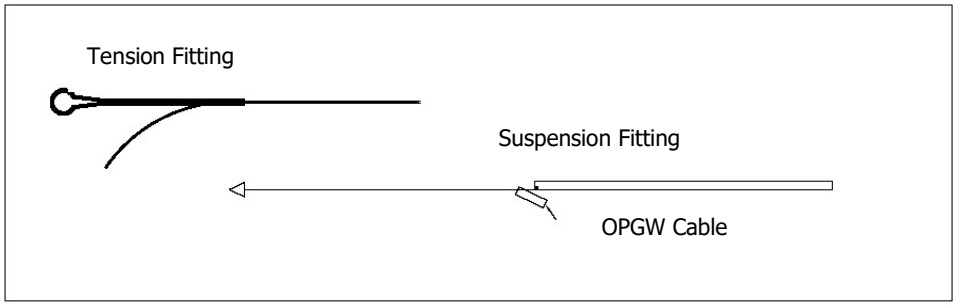
Manufacturer :

Test Standard : Overhead lines. Requirements and Test for fittings, IEC 61284 11.4.2 (method A) Slip Test on standard damps with a specified minimum and maximum slip load and Manufacturer's Technical Specification.

Test Sample : OPGW Cable, Suspension Assembly — As per approved DRS/Drawings

Objective: To simulate a differential load on the Suspension clamp assembly and prove that the load at which the cable slips through, is within the specified minimum and maximum slip load.

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.



Paint/Red marking should be applied to the assembly to assist in the visual inspection of relative movement.

The OPGW is assembled between the extremities of the hydraulic ram and subject to a tension load of 20% of the Ultimate Tensile Strength.

All Suspension Clamp and their associated components shall be identified against the relevant drawing and be uniquely marked for any future identification.

All results shall be automatically recorded on a plotter using 200mm horizontal Position scale and a 20kN vertical Load scale.

The following dimensions shall be recorded before the start of each test using a diameter tape or other suitable means:

a. Cable diameter at the center position of initial Clamp placement.

b. Protection Splice diameter at the center position of initial Clamp placement.

Assemble the Suspension Clamp on the OPGW using the Installation Instructions as a strict guide to ensure that the assembly is correctly fitted and is the same that will be carried out during actual installation.

Reduce the load applied to the OPGW to zero and detach the OPGW from the fixed end of the tension machine. Attach the Clamp to the fixed extremity mounting and secure with the approved bolt and nut, which must run down finger tight only to clear the split pin hole.

Test procedure:

1. A graph of Load (kN) and position(mm) shall be plotted.

2. The OPGW is loaded 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 Reinforcement rods, Armour rods and Suspension clamp were marked. The relative positions of the helical armour rods and associated reinforcing rods at each end were marked and also 2mm relative position between clamp body and armour rods was marked on one side.

3. The load is increased to the minimum slip window of 12 KN(Check for Minimum Slip Strength value for fitting in DRS) at a rate of 3 KN per minute and held constant for 60 seconds. 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 the position of the clamp body and 2mm relative position between clamp body and armour rods are marked on the other side.

4. After 1 minute, pause, the load is further increased at a rate of 3 KN per minute until either the relative position between clamp body and armour rods reaches more than 2mm or the load reaches the maximum slip load of 17 KN(Check for Maximum Slip Strength value for fitting in DRS). Visual examination of all paint marks is recorded, and a measurement of any displacement recorded in the table of results.

On completion of the test, a graph of 'Load' (KN) against 'Position' (mm) shall be produced. This graph shall forms the test record and will be examined to ascertain the point that slip has occurred.

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 slip load of 12 KN(check Minimum Slip Strength value for fitting in DRS).
2. Slippage shall occur between the specified min. and maximum slip load of 12-17 KN (or as per Minimum & Maximum Slip strength value in DRS).
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 slip strength (as per DRS),12 KN and maximum slip strength (as per DRS), 17 KN shall be considered as slip.
5. The armour rods shall not be displaced from their original lay or damaged ** .

*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 Identification List of all components against relevant drawings Measurement of OPGW diameter.

Observation, if any;

Test Results: The Suspension Assembly, as tested, met / did not meet the requirement specified in technical specification.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

Mechanical Strength Test for Suspension Assembly

Manufacturer :

Test Location :

Test Standard : MFR's Technical Specification, IEC61284:1997

Test Sample : OPGW Cable
Suspension Assembly
} As per approved DRS/Drawings

Objective: To determine the mechanical strength performance of the suspension assembly fitting for the OPGW.

Test Set-up:
The Items to be tested are installed into the hydraulic test machine and secured. The components being tested will be labeled to be exactly the same as the corresponding drawing in order to make identification clear.

The general arrangement for the Test Set-up is shown in Figure 1.

The Amour Rods and Protection Splice are assembled on to the approved OPGW using the Installation instructions as a strict guide to ensure that the assembly is correctly fitted and is the same that will be carried out during actual installation. The assembly shall be mounted in the hydraulic tensile test machine, with the Suspension Assembly suspended by the associated Clevis Eye in their normal working position. Suitable facilities to avoid bird-caging (twist) of the OPGW when tensioned shall also be provided.

Note: Care shall be taken to ensure that during the installation of the test fitting that the OPGW strands remain tight.

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 as per DRS (MFL) 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 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 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.

3. The applied load shall then be increased until the failing load is reached and value shall be documented.

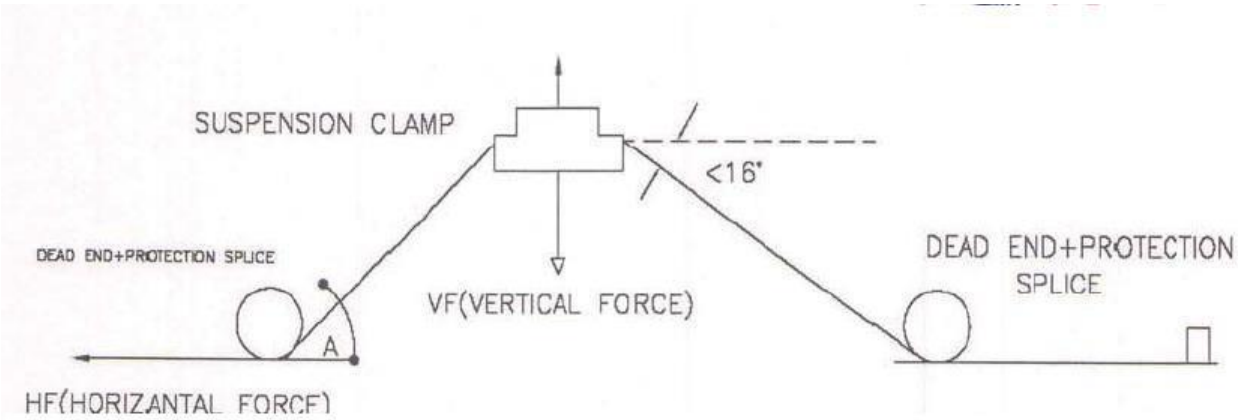


Figure 1: Test set up for mechanical strength test for suspension assembly

Acceptance Criteria:

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

i) No evidence of Binding of the Nuts or Deformation of components at the end of Part 1 of test.

ii) No evidence of Fracture up to 1 minute at Minimum Faliure Load during Part 2 of the Test.

iii) Any result outside these parameters shall constitute a failure.

Suspension clamp Shackle: Ultimate Strength (minimum) of fitting: as per approved DRS.

For each sample tested there shall be:-

Part 1:

Identification list of all components against relevant drawings and confirmation that the components meet the declared dimensions. Record of physical examination, specifically commenting on evidence of Binding of the Nuts, and deformation of the Suspension assembly components.

Part 2:

Confirmation record that the Clamp sustained a MFL load for one minute without fracture.
Recorded value of breaking load.

Identification of components against relevant drawing numbers:

Drawing Number	Issue	Description

Table of Suspension Assembly examination:

Sample Number	**Part 1**		**Part 2**	
	Possible to disassemble Assbly (Yes/No)	Comment on condition of components	Ass. sustained MFL for 1 minute (Yes/No)	Breaking Load (KN)
1				
2				
3				
4				
5				

Observations, if any:

Test Results: The Suspension Assembly, as tested, met/did not meet the requirement specified in the technical specification.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

MECHANICAL STRENGTH TEST ON EACH COMPONENT OF SUSPENSION ASSEMBLY
&
MECHANICAL STRENGTH TEST ON ALL TYPES OF TENSION ASSEMBLIES i.e. Dead End or Pass through or Splcing Location or Tension fitting for Suspension Tower (Yoke plate)

Manufacturer :

Test Location :

Test Standard : IEC 61284: 1997

Test Sample : OPGW
Tension Assembly
or each component of Suspension Assembly
} As per approved DRS & Drawings

Objective: To assess the Mechanical strength (Failing Load) test on each component of All types of Tension Assemblies.

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

TEST PROCEDURE
Each component of the Tension/Suspension assembly shall be fixed with suitable fixing arrangement with-the test machine. The load shall be increased steadily up to their specified tensile strength and held for one minute. The load shall then be increased up to the breaking of the component.

Acceptance Criteria:

1. No evidence of the fracture after one minute at nominated rated load.

2. The Mechanical strength (failing load) shall not be less than the specified rated requirement of load for all components.

3. Any result outside these parameters shall constitute a failure.

In case of Tension fitting on Suspension Tower(Yoke Plate Type) , the mechanical strength test is performed upto Failure Load/ breaking strength of Yoke Plate (as per value mentioned in DRS for Yoke Plate) during this Test. Additionally, the breaking strength of Yoke Plate should be more than the UTS of OPGW. Any evidence of fracture or deformation at the end of one minute at the minimum failure load/ breaking strength of

Yoke Plate shall be considered as failure. Any result outside these parameters shall also constitute a failure.

Observation, if any;

Test Results: Each component of tension assembly, as tested, met/did not meet the requirement specified in technical specification.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

CLAMP SLIP STRENGTH TEST ON ALL TYPES OF TENSION ASSEMBLIES

i.e. Dead End or Pass through or Splicing Location or

Tension fitting for Suspension Tower (Yoke plate)

Manufacturer :

Test location :

Test Standard : IEC 61284-1997

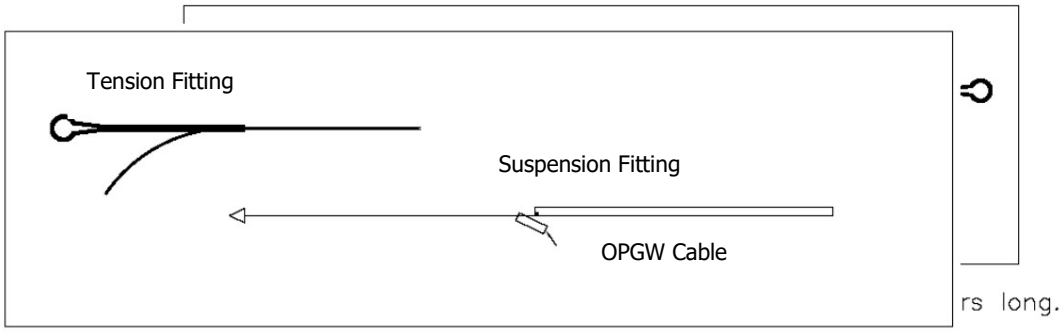
Test Sample OPGW Cable

Tension Assembly

} As per approved DRS/Drawings

Objective : To determine the clamp slip strength for the various types of tension assemblies proposed for the OPGW cable.

Test Set-up: The general arrangement for the Slip Strength Test of the Tension Assemblies is shown below



The Tension Assembly and associated components shall be identified against the relevant drawing and be uniquely marked for any future identification

The set-up for the slip strength for tension clamp is shown in Figure-2.

The tension assembly shall be fitted on a more than 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.

The Reinforcing Rods and Tension Assembly fitting is assembled on the OPGW using the Installation Instruction as a strict guide to ensure that the assembly is correctly fitted and is the same that will be carried out during actual installation. The assembly shall be mounted in the hydraulic tensile test machine, with suitable facilities to avoid bird caging (twist) of the OPGW when tensioned.

Note: Care shall be taken to ensure that during the installation of the test fittings the OPGW strands remain tight.

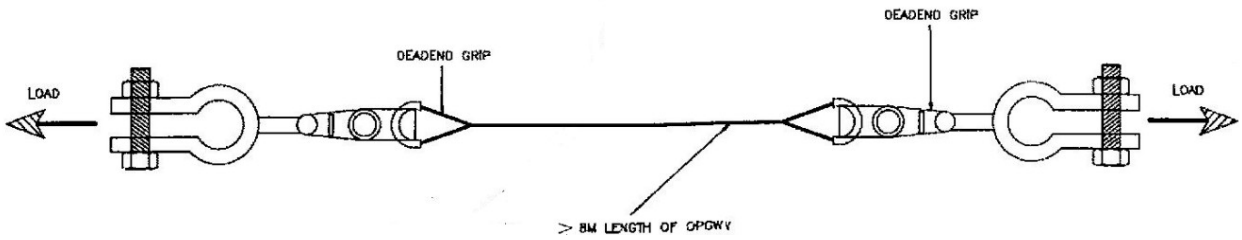


Figure 2: Schematic of slip strength test for tension assembly

Test Procedure:

A tension load shall gradually be applied up to 20% of the Ultimate Tensile Strength of the OPGW Cable.

1. Displacement transducers shall be installed to measure the relative movement between the OPGW relative to the reinforcing rods and the tension Dead-End relative to the reinforcing rods. In addition, suitable marking shall be made on the OPGW and Dead-End to confirm grip.

2. The load shall gradually be increased at a rate of 6 KN per minute until it reaches 50% of the specified UTS and the Position scale of the recorder is 'zeroed'.

3. The load shall gradually be increased at a rate of 6 KN per minute until it reaches 95% of the specified UTS and maintained for one minute.

4. After 1 minute pause, the load shall slowly be released to zero and the makings examined and measured for any relative movement.

5. On completion of the test a graph of Load (KN) against Position' (mm) shall be produced for each of the two measurements. This graph shall forms the test record and will be examined to ascertain the degree of any movement.

Acceptance Criteria:

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

No movement* shall, occur between the OPGW and the Reinforcing Rods, or between the Reinforcing Rods and the Tension assembly.

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

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

Any result outside these parameters shall constitute a failure.

Test Results:

The Tension Assembly, as-tested, met / did not meet the requirement specified in technical specification.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

STRUCTURE MOUNTING CLAMP STRENGTH TEST

(For Downlead Assembly)

Lab Location :

Manufacturer :

Test Standard : Technical Specification

Test Sample : OPGW Cable, Down lead clamp } As per approved DRS & Drawings

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 3.

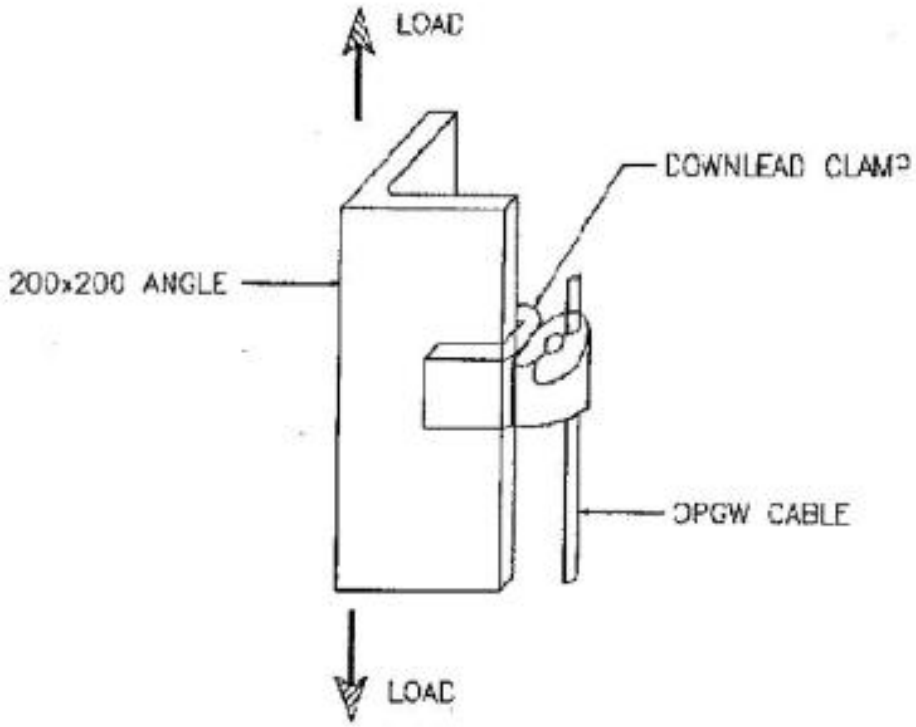


Figure 3: Schematic of structure mounting clamp strength test

Test Procedure:

1. A vertical load of 200 kg shall be 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 shall be 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:
The down lead clamp has passed the test if the following conditions are met.
No visible evidence of distortion / slipping or breaking of any components.
Any result outside these parameters shall constitute a failure.

Observation, if any:

Test Results:

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

The Structure mounting Clamps for OPGW tested, met / did not meet the requirement specified in technical specification.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

STRUCTURE MOUNTING CLAMP FIT TEST

Lab Location :

Manufacturer :

Test Standard : Technical Specification

Test Sample : OPGW, Down lead clamp } As per approved DRS & Drawings

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

Test Set-up:
For structure mounting clamp, fit test shall be conducted with two OPGW cables installed.

Test Procedure:
Structure mounting clamp shall be installed including clamping compound as required on the OPGW cable. The nut shall be tightened on to the bolt by using torque wrench with a torque of 40Nm or supplier's recommended torque and the tightened clamp shall be held for 10 minutes. After the test remove the OPGW cable and examine all its components for distortion, crushing or breaking. Also the OPGW cable shall be checked to ensure free movement within the core to measure the diameter of the core tube.

Acceptance Criteria:

1. If any visible distortion, crushing, cracking or breaking of the core tube is observed, the test will be defined as a failed.
2. When the diameter of the core tube as measured at any location in the clamped area is more than 0.5 mm larger or smaller of the core diameter as measured outside the clamped area, the test will be defined as a failed.

Observations, if any

Test Results: The Structure mounting Clamps Fit tested, met/did not meet the requirement specified in technical specification.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)

VISUAL/PHYSICAL VERIFICATION OF QUANTITIES AND SPECIFIC COMPONENT NUMBER FOR EACH COMPONENT OF SPLICE ENCLOSURES (JOINT BOX) & FODP AND DIMENSIONAL CHECKS AGAINST THE APPROVED DRAWINGS

Test location:

Manufacturer:

Test Sample: SPLICE ENCLOSURES (Joint Box)
FODP
} (As per approved DRS & Drawings)

Objective: This test confirms the appearance, Quantity and Dimension for Splice Enclosures & FODP for conformance to the relevant DRS/Drawings.

Test set-up:

It shall be verified that the sample are in accordance with their relevant drawings.
The following tolerance shall be allowed on all dimensions to which special tolerance do not apply.

SAMPLING: 100% of Items in the Lot

Dimensions:

The following tolerance shall be allowed on all dimensions to which special tolerances do not apply (i.e.) where tolerances are not indicated in the approved DRS/Drawings. Dimensions greater than 30 mm±5% up to a max. of ± 5 mm.

Visual & Quantity: To check the items in Lot & all found to be ok as per approved DRS & Drawings and the following.

No. of splice Trays

No. of holes for cable entry/ diameter of holes

IP Protection Class

Color shade

Specific Component Number

Acceptance Criteria:

Appearance should have no defect. All quantities should be correct.
Specific component number of each component shall be as per approved DRS/Drawings.
Dimensions shall be in accordance with their drawings with the tolerances specified.

Observations, if any:

Test Results : The Splice enclosure/FODP as tested met / did not meet the requirement specified.

Tested by:
(Sign with date)

Witnessed by:
(Sign with date)