

## **Appendix - C**

# **GUIDELINES FOR OPGW CABLE LIVE-LINE INSTALLATION**

### 1. General

Installation procedure for OPGW is basically similar to that for conventional overhead ground wires in overhead transmission line construction, however particular care required to be taken for protection of optical fibers in OPGW cable from damage by handling the same properly during transportation, unloading and installation at site. Live line installation to be carried out using traction machines and support rollers (hanging pulley blocks) using an experienced installation team comprising of minimum 30-35 persons. The installation team shall have one team leader/crew in-charge along with 15 skilled and 14 unskilled persons minimum in one installation crew.

List of Tools to be used are as per enclosed Annexure-1.

Following aspects are to be kept in mind before taking up live-line installation:

- a) Condition of existing ground wire for its suitability for live-line OPGW installation
- b) Tools and Plant suitability
- c) Working conditions, specially following:
  - Strong winds more than 7 m/sec
  - Rain or snow
  - Foggy
  - Lightening

### 2. Safety measures

All site workers must follow the Electricity Rules and Employer specified safety procedures. They must use safety belts, safety shoes, safety helmet and other safety items required.

Assign foremen/Crew In-charge for each erection crew for enforcing installation guidelines. It may be ensured that only authorized person is climbing the tower during live-line installation of OPGW. Fix the warning red flag on the tower, in order to keep the workers from encroaching into unsafe zones.

Frequent verification of healthiness of T&P and ropes shall be carried out before start of work.

#### 2.1 Permission to Work (PTW):

Permit to work to be obtained by the representative of installation agency from concerned sub-station staff in coordination with employer project manager prior to commencement of installation and the same is to be returned after completion of the work in all respects within the specified time duly following the PTW conditions.

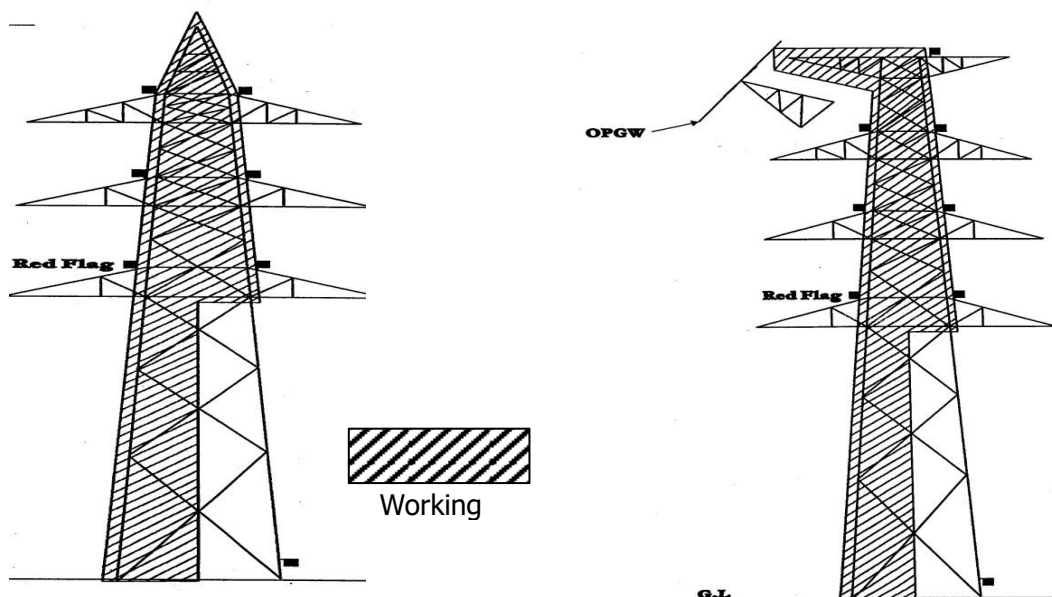
### 2.2 Preparedness to tackle untoward incidents:

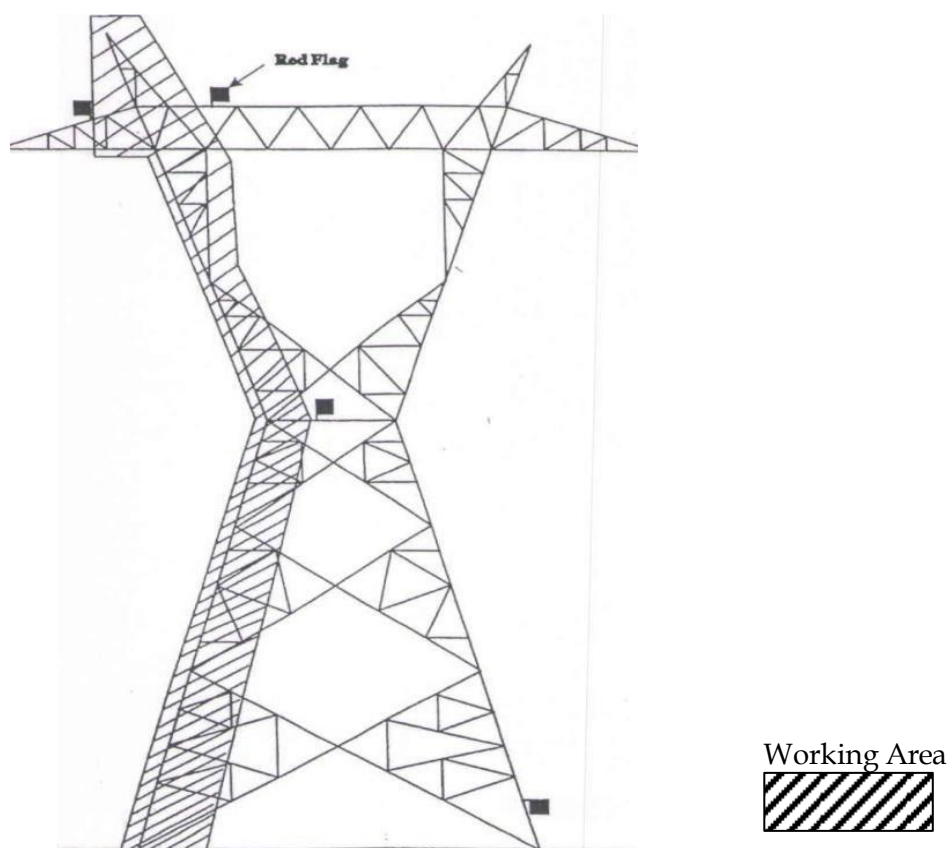
- a) Safety Engineer has to make sure the availability of First Aid Box with each team.
- b) Maintain a record of the details of list of all nearby hospitals/clinics in each area, with contact details and Emergency contact nos. of Ambulances.
- c) In case of any untoward situation, Safety engineer/crew in charge must act fast and provide the necessary first aid to the affected person(s). Ambulance to be arranged immediately from the nearby area and coordinate with hospital for immediate medical assistance as required.

### 2.3 Marking of Zones during OPGW Stringing:

It is essential for the installation agency to be aware of the safe zones of the Tower while carrying out live-line installation. Generally, crew members identified for preparation work on the ground will not work on the tower and will remain within hazard-free zone.

The pictorial view of the working zone and limitation of the restricted zone are shown below for your convenience.



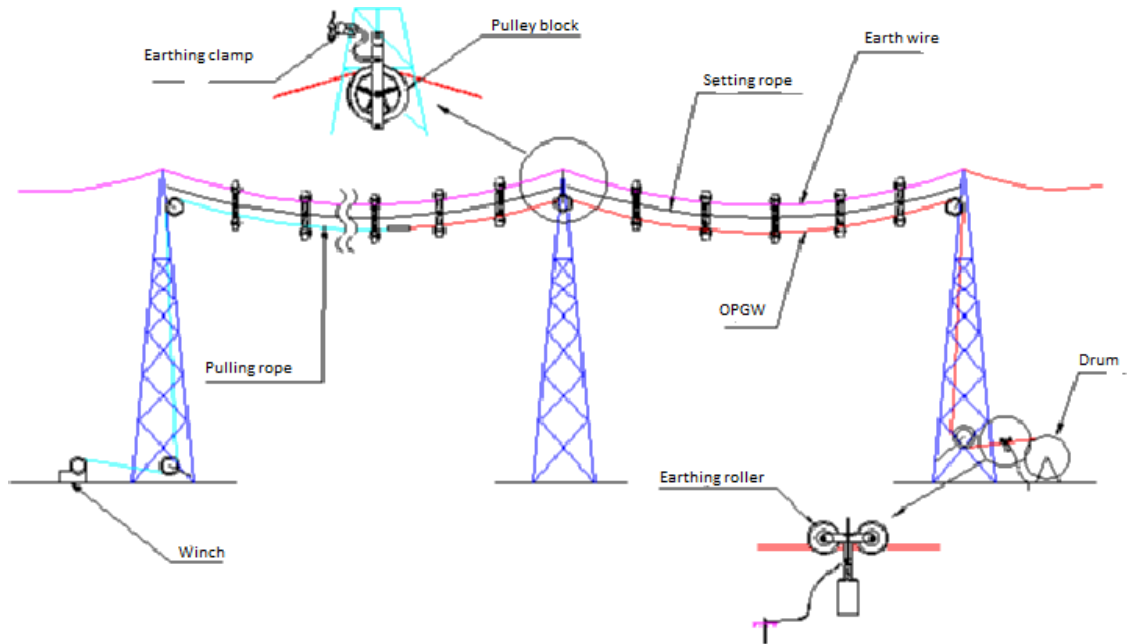


### 3. Grounding

Grounding of the following before starting work at site is required to be ensured. Grounding devices include the following:

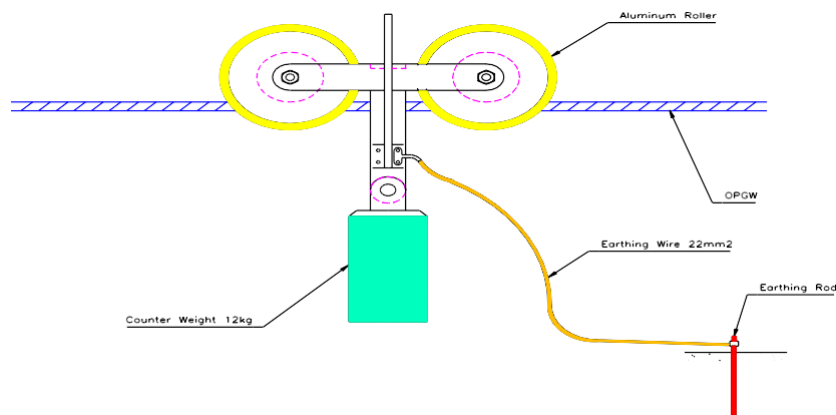
#### 3.1 Equipment Grounding:

Equipment like OPGW and Existing Ground wire (GW), aerial rollers (pulley blocks) are connected with individual copper cable attached to the tower (with copper rod installed on the ground) or to the main grid if grounding system exists. Grounding clamp should be cleaned well and ensure proper contact.



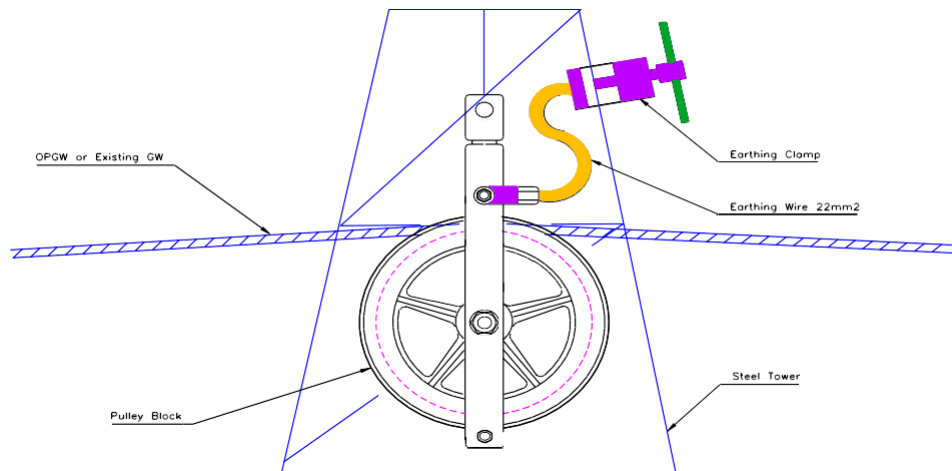
### 3.2 Running Ground:

Running ground shall be installed on the OPGW at drum side during OPGW stringing time and at the Winch side on the existing GW during dismantling time for the whole stringing operation to avoid any electrical charges of induction from the line.



### 3.3 Pulley Block Grounding:

For each tower grounding type pulley block must be used.



Grounding cable must be connected to the ground source first then to the object that needed to be grounded.

When removing grounds, the ground must be removed from the grounded objects first and then remove the grounding clamp from the ground source.

In case of any problems during the installation work, the person in charge of the section will immediately contact the sub-station in charge of the line and employer Project Manager immediately for required support.

Further, in order to have proper earthing, one aluminum roller (hanging pulley block) shall be used for additional safety after every ten rollers (neoprene) used in the span/section.

## 4. Live-line Installation Process

### 4.1 Installation plan:

The following measures are to be taken in advance for smooth completion of the installation.

PTW availability and coordination with employer project manager

- Erection crew mobilization along with T&Ps
- Safety aspects
- Field quality aspects
- Transportation arrangement

### 4.2 Materials handling:

Check the material with respect to the approved documentation. All materials shall be visually examined for any physical damage. Any material which is not as per documentation or is damaged, shall not be used.

OPGW Drums checks:

- Packing condition
- Packing list (Object, Type, Length, OPGW Weight, Drum No. etc)
- Attenuation results of OPGW

Hardware Fittings Checks:

- Bolts, Nuts Pitch
- Type & Quantity

Handling of OPGW:

OPGW contains optical fibers which are very delicate and to be handled with due care. For the safety of optical fibers, it is very important to avoid bending at a sharp angle. Manufacturer guidelines are to be followed strictly while handling the same.

In order to avoid undue tension on OPGW, it is not recommended to pay off OPGW together with phase conductors or other wires tied in parallel. The tension during stringing works should be well managed within permissible limits.

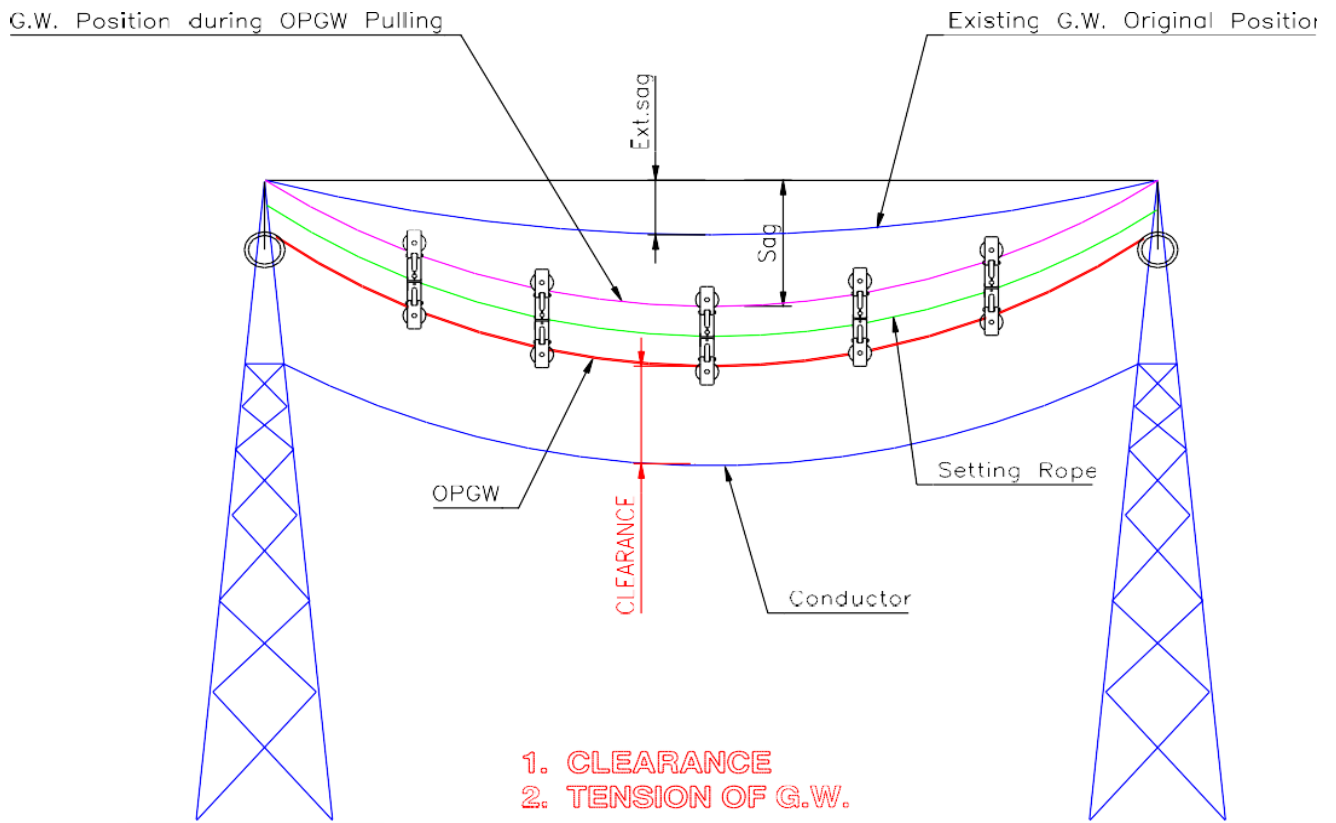
Adequate length of OPGW shall be ensured as loop at each joint location after stringing so that it is possible to bring OPGW up to the ground level for carrying out jointing work.

### 5. Clearance Checking

Check the clearance between existing ground-wire and live conductor before Stringing.

Check the clearance between OPGW and live conductor.

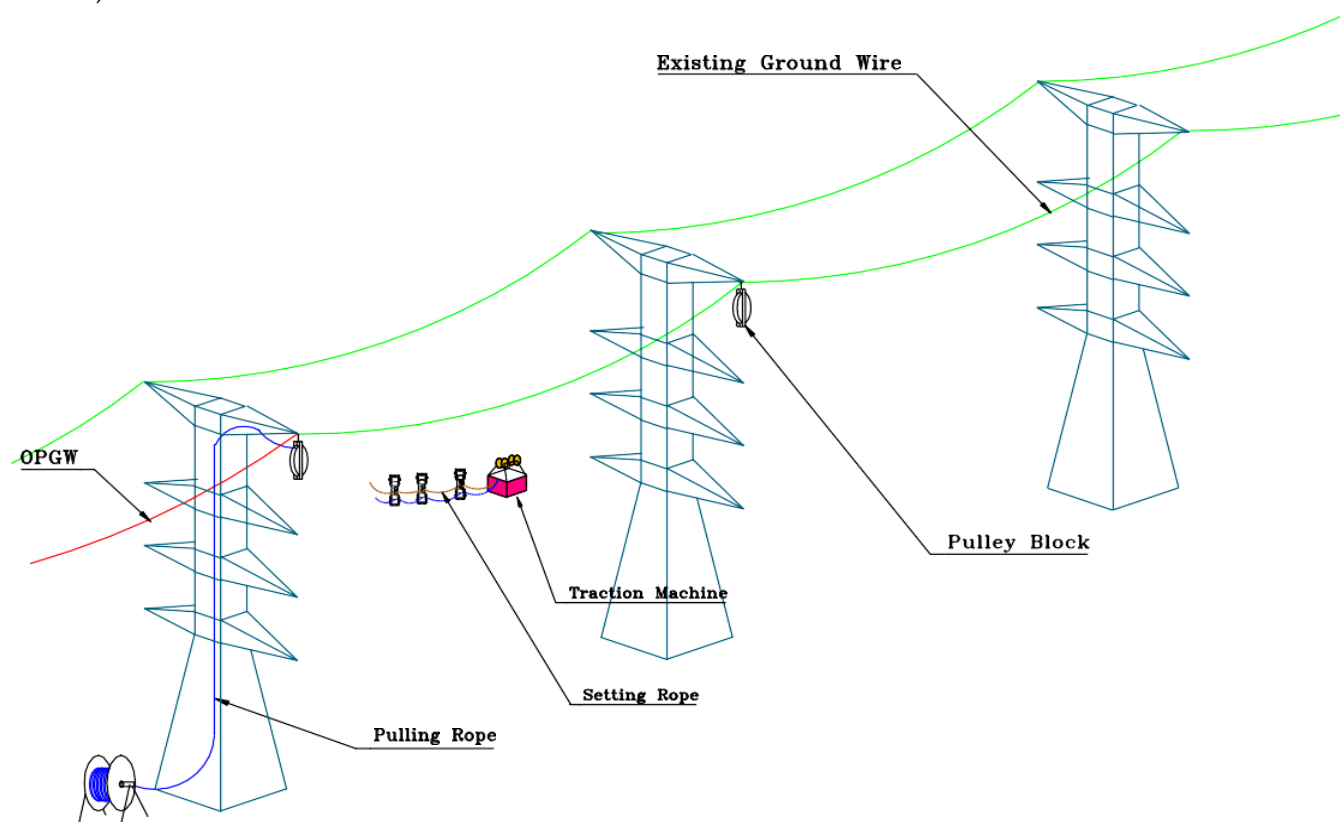
## Guidelines for Live Line Installation





### 6. OPGW Stringing

- Removal of Aviation globules in the spans (wherever applicable) by taking proper shutdown.
- Hang the pulley blocks on one of the earth wire peaks for the whole section (Section is a consecutive group of towers needed to support the installation of scheduled length of OPGW Drum)

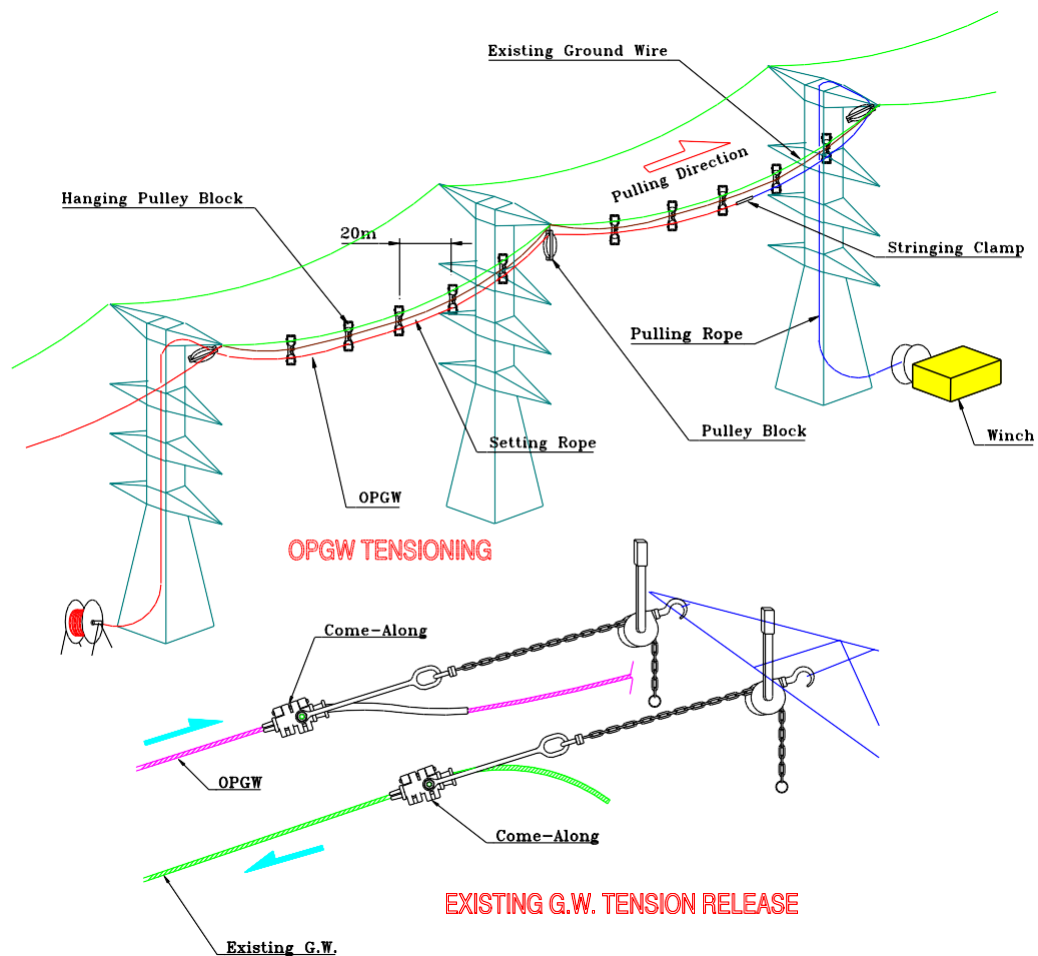


- Set the Traction machine on the existing ground wire.
- Set the support rollers (hanging pulley blocks) on the existing ground wire where the OPGW is to be installed.
- Connect the Setting Rope and Pulling Rope to the Traction Machine.
- Pull the support rollers (hanging pulley blocks), Setting Rope and Pulling Rope with the use of Traction Machine. Support rollers (Hanging Pulley blocks) should be hanged at an interval depending on voltage level, which is mentioned below. (A mark with these specified interval shall be marked on setting rope)

Sl.no	Voltage level	Spacing
1	220kV	18-22m
2	400kV	15-18m
3	765kV	10-12m

## Guidelines for Live Line Installation

- For every ten support rollers (hanging pulley blocks) of neoprene used in the span/section, one aluminum roller (hanging pulley block) shall be used.
- Securing the pulling & setting rope at end towers of the stringing section.
- Connect the OPGW to the Pulling Rope with Stringing Clamp.
- Pull the Pulling Rope with the use of winch machine to pay out the OPGW.
- Set the Come along and Lever Block to the existing ground wire.
- Release the tension of existing ground wire. At the same time, with a fixed come along and Lever Block, give more tension to the OPGW.

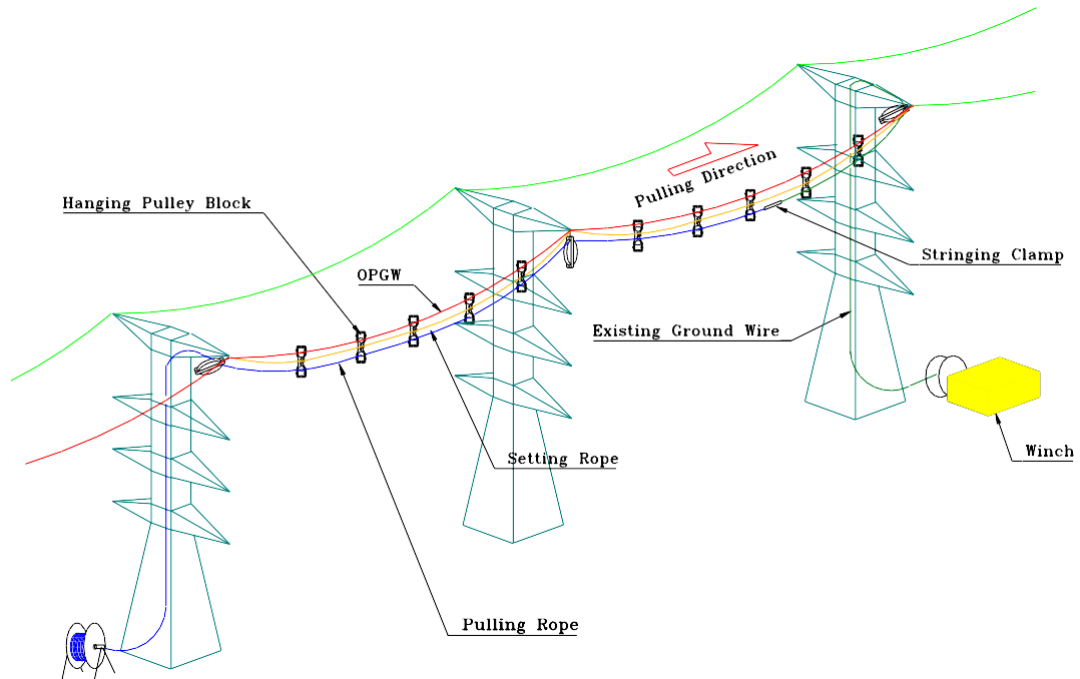


- Position of OPGW and existing ground wire will interchange with above action. The OPGW will be in upper position and existing ground wire in lower position in support rollers (hanging pulley blocks).
- With this OPGW paying for a section gets completed.
- Finally, after successful stringing of OPGW and dismantling of Earth wire along with all ropes, support rollers etc., proper shutdown may be taken to install aviation globules back in the respective spans. The installation agency to ensure healthiness of all ropes and T&Ps used for the stringing work.

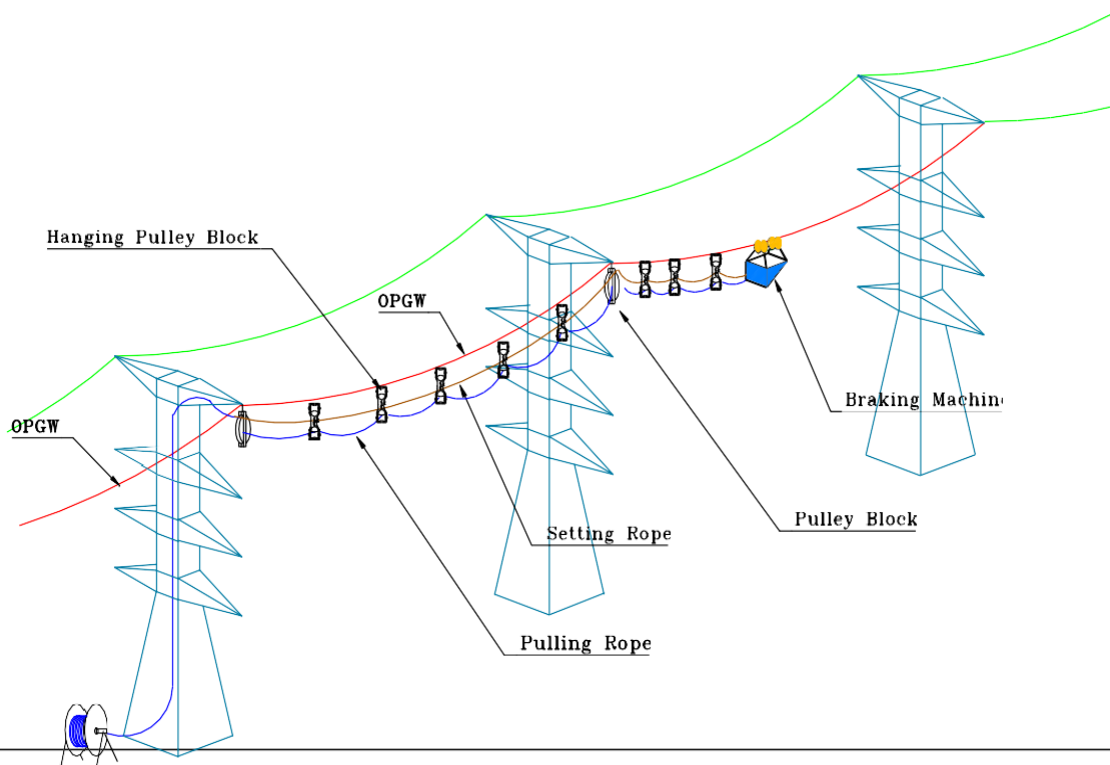
## 7. Dismantling process

### 7.1 Existing ground wire:

- Connect the existing ground wire with the Pulling Rope.
- Pull the Pulling Rope with winch to dismantle the ground wire.



### 7.2 Hanging Pulley Block, Setting Rope, and Pulling Rope:



- Set the Breaking Machine on the OPGW of the span required for dismantling.
- Connect the Pulling Rope and Setting Rope to the Braking Machine.
- Pull the Setting Rope and Pulling Rope to dismantle.

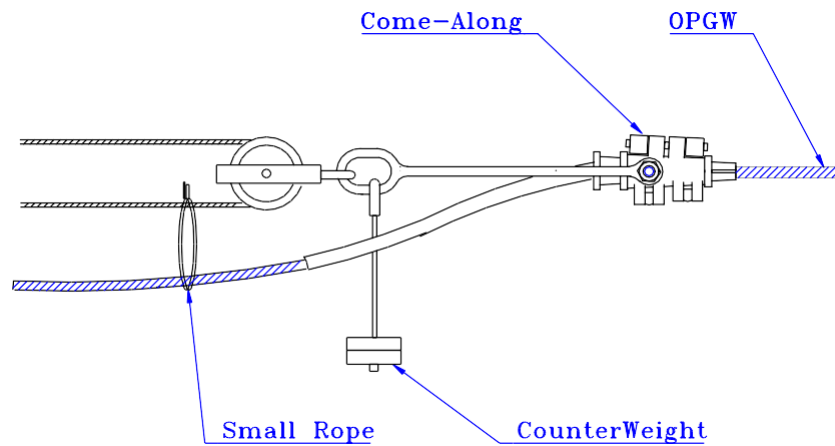
Collect and dismantle the support rollers (hanging pulley blocks) upon reaching the succeeding tower.

### 8 OPGW sagging.

- Use the pre-calculated Sag & Tension Table as sag reference.
- Avoid fixing the sag if the wind is strong.

#### 8.1 Sagging:

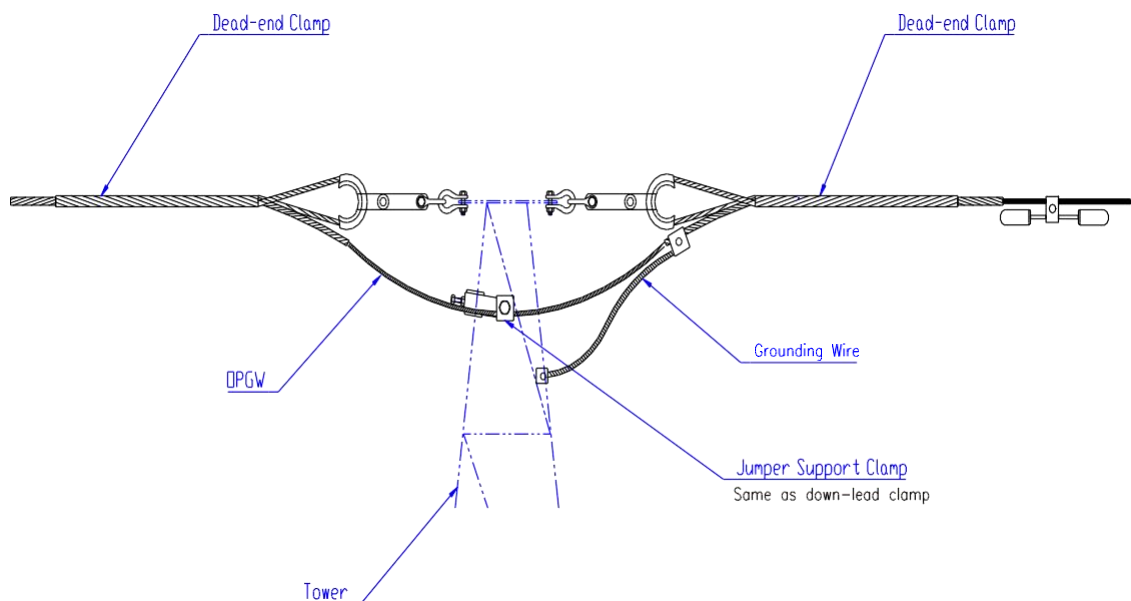
- (i) Methods and procedures for sagging of OPGW are the same as those of normal overhead ground wire.
- (ii) After stringing the OPGW shall be sagged using information furnished on the sag and tension chart. The sag of the OPGW should not exceed the existing ground-wire sag.
- (iii) Sagging thermometers shall be used to determine accurate temperature and OPGW sag of each sag section. Sagging thermometer shall be used sufficiently prior to the actual sagging operation to represent the temperature of the OPGW.
- (iv) At the time of sagging OPGW, the sag should be within 6 inches of the theoretical value for existing temperature condition.
- (v) OPGW tension between each sag section shall be equalized and this shall be determined by the vertical position of the suspension clamps on the last clipped structure of the preceding sag section.
- (vi) For pulling the OPGW with tension, the device of come along is to be recommended.
- (vii) Personnel should be specifically deployed for keeping watch on sag at a different section of the line during live line stringing.
- (viii) Waterproof caps shall be fixed at both ends of the OPGW cable after installation.



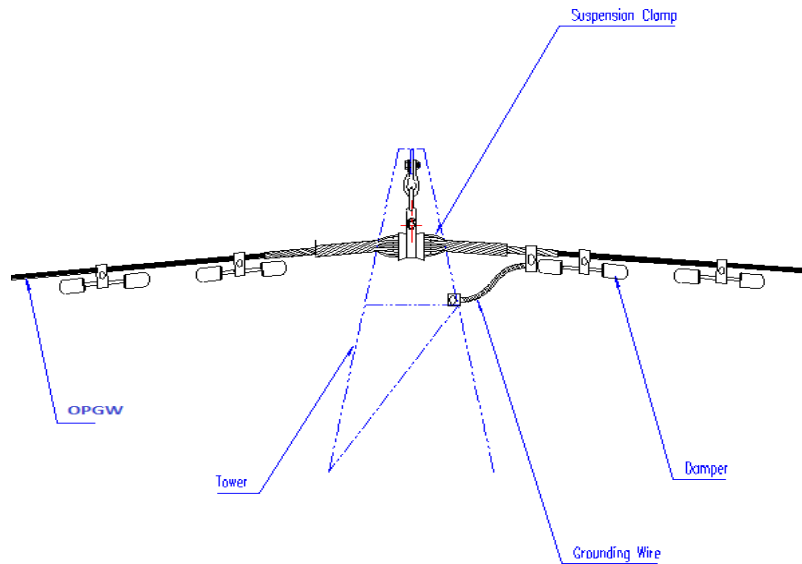
## 9 OPGW Clamping

- Make sure to install and tighten the bolt of clamp properly.
- Tightening must be made sequentially from the support point.

### TENSION TOWER



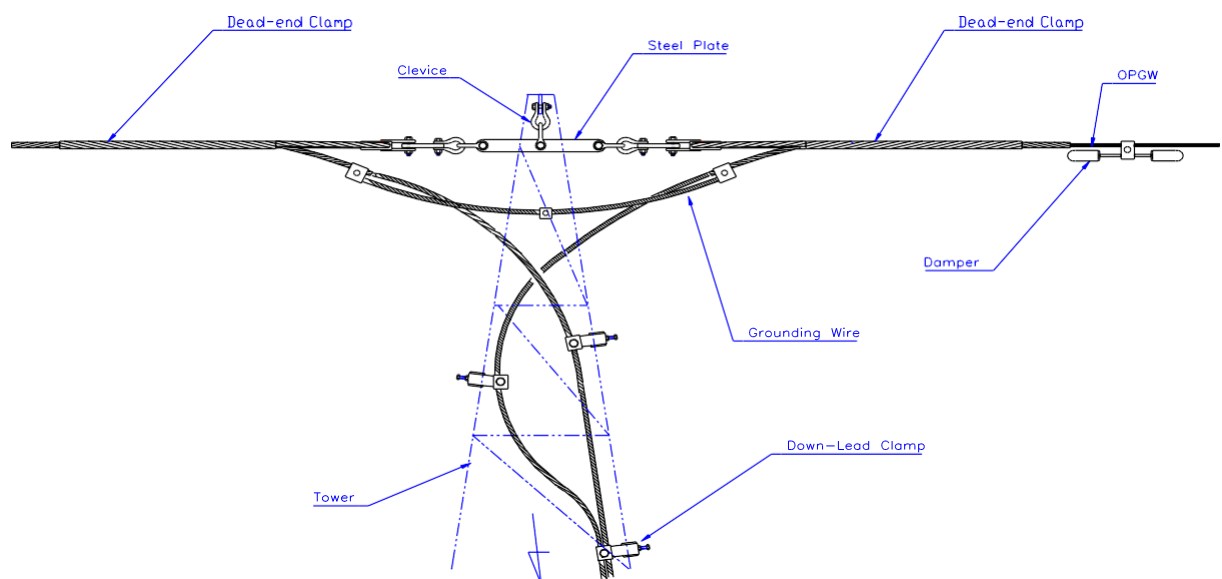
### SUSPENSION TOWER



### 10 OPGW down Leading

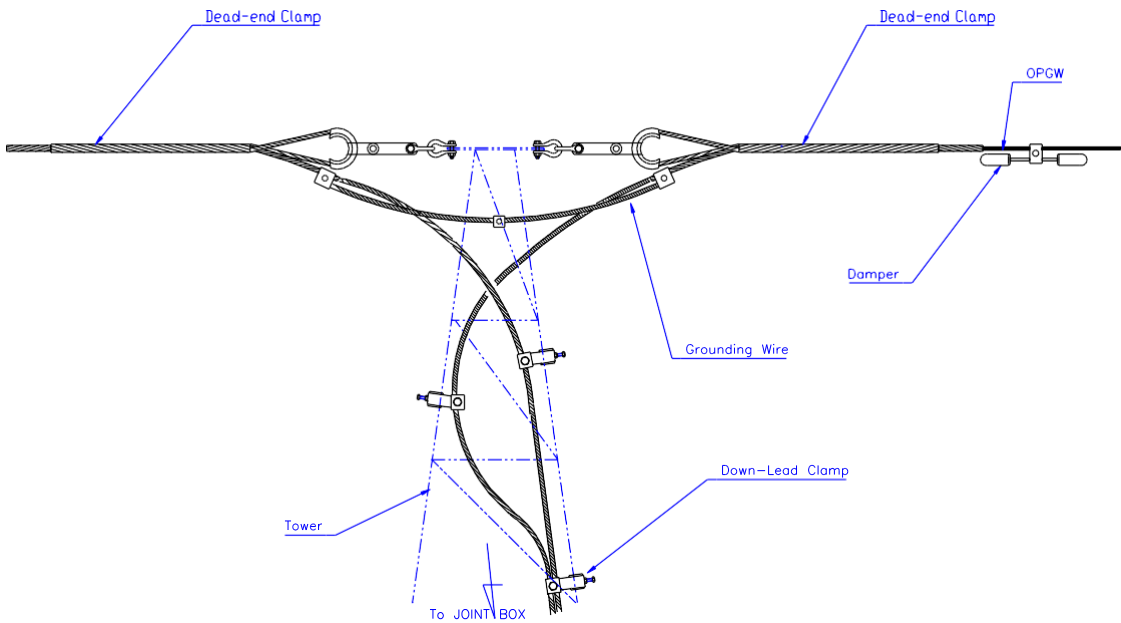
- Make sure to clip the OPGW with down lead clamp to the tower in a careful manner.
- Make sure to tighten the bolt of the down-lead clamp properly.
- Install the down-lead clamp at appropriate intervals.

### SUSPENSION TOWER FOR JOINTING TOWER



To JOINT BOX

TENSION TOWER FOR JOINTING TOWER



**Annexure-1**

## List of Tools

S. No	Description	Specifications
01	Aerial Roller/Pulley Block (Aluminum)	300 mm
02	Aerial Roller/Pulley Block (Aluminum)	450 mm
03	Aerial Roller/Pulley Block (Aluminum)	600 mm
04	Setting rope	12 mm PP Rope
05	Pulling Rope	(i) For Preparation: a) 12mm PP Rope (for 400kv and above); b) 12mm Nylon rope (for 220kV & below) (ii) For OPGW Pulling: 14mm Nylon rope
06	Lifting/Supporting Rope	12mm PP rope
07	Earthing roller	3-way roller
08	Traction machine	35 kgf
09	Winch machine	3 tons
10	Drum stand	
11	Wheel winder	
12	Come along clamp	
13	Kitto clamp	
14	D-shackle	
15	Sag-scope	
16	Support Rollers (Hanging Pulley block)	
17	Aluminum Roller (Aluminum Hanging Pulley Block)	
18	Earthing Lead	
19	Braking Machine	

In case of any additional tools, the contractor shall be responsible to arrange them for the completion of work.