

# Section 6: Employer's Requirements

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## • SPECIFICATIONS

This section describes the scope of works and technical requirements for the design, procurement, quality management, fabrication, supply, and delivery of all material to the worksite, installation, testing and commissioning of the new ADSS and new OPGW.

In the event of conflict between the requirements stated in relevant documents, precedence for technical issues shall be given in the order below:

- This document, then
- Australian Standards, then
- International Standards, then
- Other documents at the discretion of SP.

## • BACKGROUND

### 2.1 OPGW Along The 33kV

The existing Lungga-Honiara 33kV line is composed of Cherry ACSR/GZ phase conductor, 7/2.0 SC/GZ OHEW, ceramic/glass insulators, lattice steel towers, and a steel monopole.

The existing OHEW shall be replaced with continuous optical fibre ground wire (OPGW) to provide the line with communication capability and at the same time shield the phase conductor against direct lightning strokes.

The general arrangement and approximate spacing of the attachment points for the typical suspension and strain towers are shown in Figure 1.1. The vertical spacing between the OHEW and top phase conductor in lattice towers is generally about 3m. From these dimensions, the shielding angle at the suspension towers is about 31°. The strain steel monopole at T23 has its conductor attachments point in vertical configuration and the spacing between the OHEW and top phase conductor is 1.5m.

The existing arrangement of the earthpeak OHEW attachment points is shown in Figure 1.2. The existing OHEW will be retired and replaced with a suitable OPGW. The suspension earthpeak will need to be assessed and modified (refer to sample drawing SP-LH-AS-005 shts 1 to 3) to suit the arrangement of the proposed suspension OPGW assembly (see SP-LH-AS-003 sht 001)

Refer to list of drawings section for other available design drawings/schedules for Contractor's consideration.

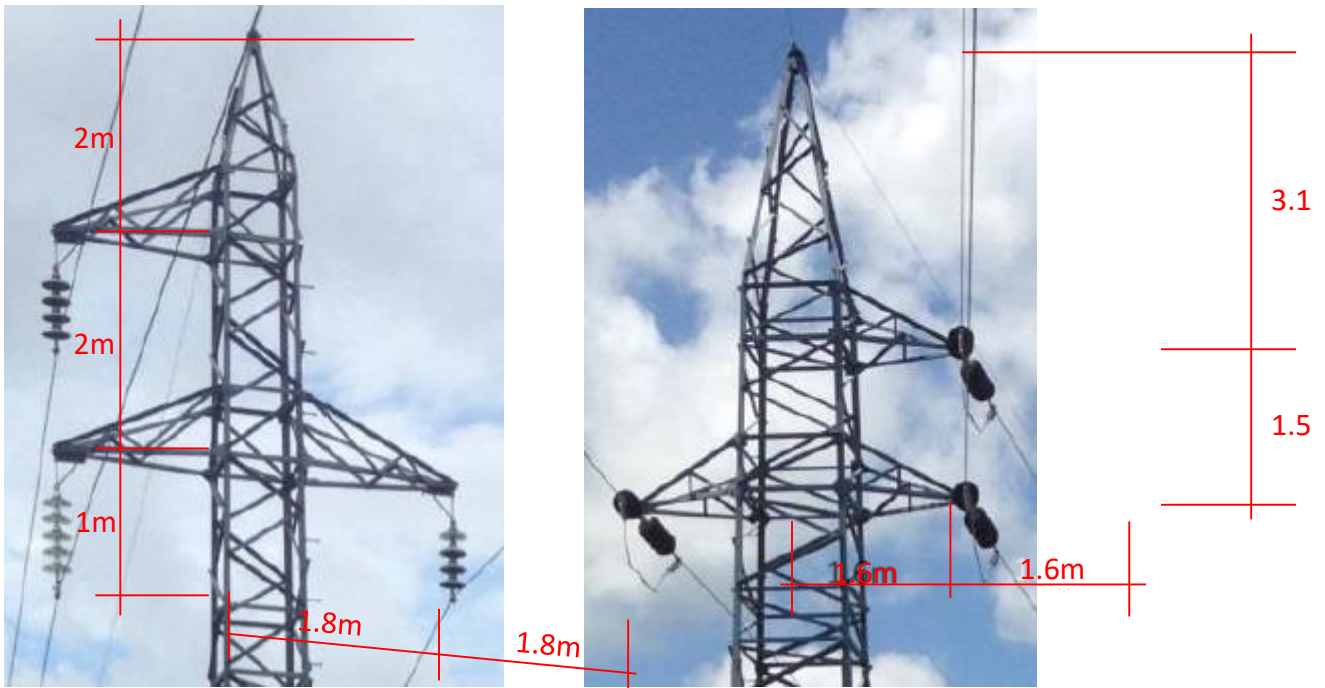


Figure 1.1: Typical tower arrangement (Left: Suspension, Right: Strain)

Figure 1.2: Existing OHEW assemblies – (Left: Suspension, Right: Strain)



## 2.2 ADSS Along 11kV

Solomon Power wishes to establish an ADSS communication network on the Eastern network between Lungga Power Station, Henderson Solar Farm and East Honiara Substation.

It is proposed that the ADSS fibre optic cable system shall be predominantly supported by the existing overhead 11kV feeder lines with several sections requiring underground installation.

On 19<sup>th</sup> August 2019, Iqbal Kalsi travelled to Solomon Power's Ranadi office for a site visit . The objective of the visit was to determine the scope of detail design work required to add the ADSS on the existing lines. In addition to assessing the sites, discussions were held with various personnel within Solomon Power to gather as-built information of the existing lines drawings of the affected existing 11kV feeder lines.

### 2.2.1 Proposed ADSS Route

#### Eastern Network

As shown in Figure 1 below, the ADSS is proposed to follow the existing 11kV express feeder line from Lungga Power Station traversing south eastward generally over farmland and small settlement before coming onto the only two lattice towers on the line to cross over a river which spans just over 770m.

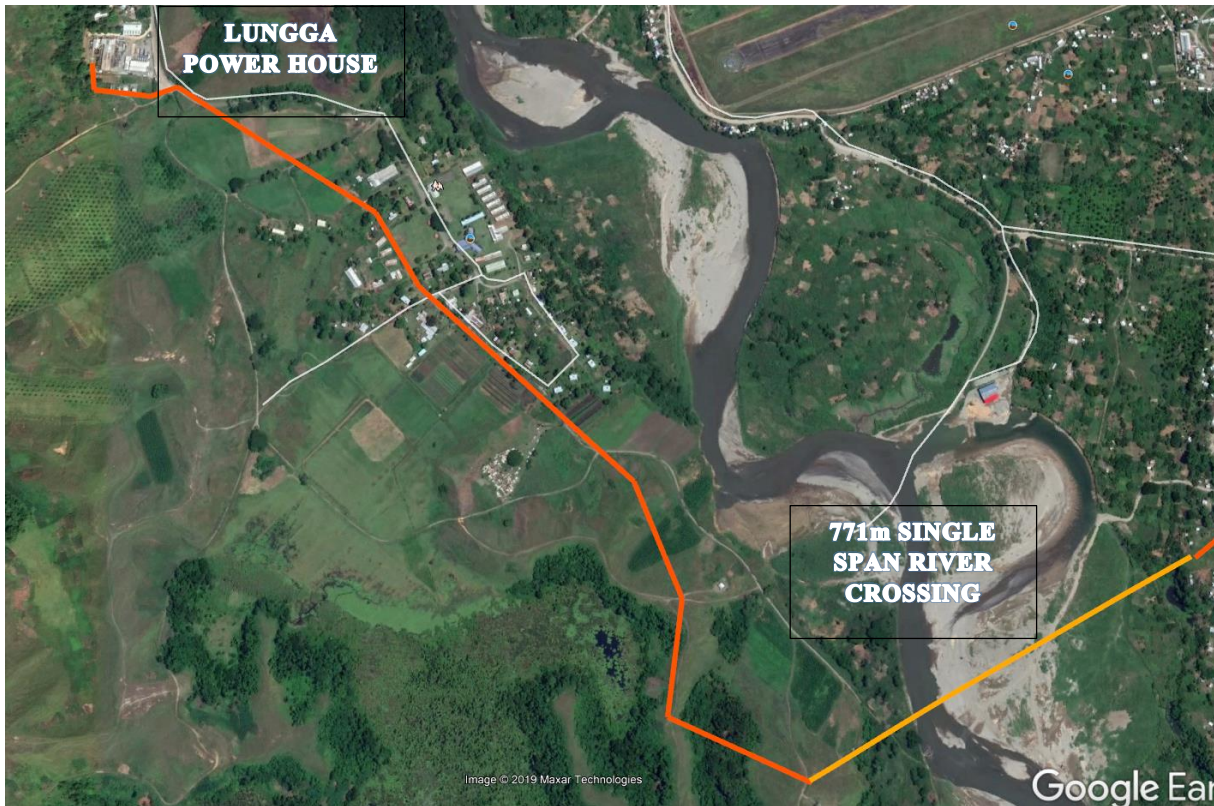


Figure 1: Lungga Power House to River Crossing Span Route

Figure 2 below shows the express feeder line continuing onto another small settlement, crossing over several houses along the way. It then continues running alongside the Access Road and crossing over the

road at several locations before coming onto the Feeder 12 termination point i.e. pole PL5479. It then continues south eastward over farmland towards the Henderson Solar Farm.



**Figure 2: River Crossing Span to Henderson Solar Farm**

Figure 3 below shows Feeder 12 from PL5479 running alongside the Access road towards the airport runway while staying on the west side of the road. It then crosses over the road before continuing parallel to the airport runway on the southern side of the road towards Kukum highway. Upon or prior to reaching Kukum highway, the ADSS will need to be undergrounded due to aviation height restrictions which is indicated by the blue lines in Figure 3.



**Figure 3: PL5479 to East Honiara (i.e. Feeder 12)**

### 2.2.2 Existing Pole Types

The Express Feeder line comprises of a mixture of the legacy rectangular concrete poles, round steel and Oclyte poles and 2 double circuit lattice towers. Apart from the recently built Feeder 12 line which is supported by new 9m tall steel poles supplied by Gateway Energy and the two double circuit lattice

towers, the rest of the pole structures are a mixture of the legacy rectangular concrete poles, round steel poles and Oclyte steel poles.

AECOM design has identified some of the poles will need to be replaced to accommodate the new ADSS wire. SP is currently undertaking the replacement and installation of the new poles as per AECOM design which is stipulated in ADSS Construction Schedule drawings which is included in the package of this tender.

### **2.2.3 ADSS Type**

Solomon Power requires the ADSS to be Single Mode 24-Fibre Optic cable. Two types of ADSS wire constructions is required for this project:

Type 1 – Aerial Short Span i.e. < 200m e.g. Prysmian SM@RTSPAN ADSS (Spec included in Appendix A) or something similar

Type 2 – Aerial Long Span i.e. 775m span e.g. Prysmian ADSS48F G652S (Spec included in Appendix A) or something similar

Type 3 – Underground Cable e.g. Prysmian DW SM@RTCORE FTL4/EP1 (Spec included in Appendix A) or something similar

Fibre optics shall be designed, tested and manufactured to IEEE 1222/IEC/EN 60794-3-20 (Aerial)/60794-3-11 (underground).

## **3.0 Loose Tube (Underground Fiber) Cable**

Solomon Power requires underground fiber optic cable for sections where ADSS installation is not feasible due to aviation restrictions, road crossings, site-specification limitations, or other environmental constraints. The underground fiber shall be Single Mode 24-core, design for direct burial or installation in conduit system as per the route design.

The underground fiber shall be designed,, tested, and manufactured in accordance with IEC/EN 60793-3-11 or equivalent standard for underground telecommunication cables, and shall include appropriate protection against moisture crushing, impact, and rodent damage. The transition between ADSS and underground sections shall be carefully designed and installed to ensure mechanical protection, environmental sealing, and maintain fiber intergrity.

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## • BASIC REQUIREMENTS AND GUIDELINES

Basic requirements and guidelines for this Project are as follows:

1. All documents (e.g. designs, drawings, reports, schedules, etc) to be submitted by the Contractor shall be written in the English language and prepared using the Systeme Internationale (SI or Standard International) system of units. They shall be easily readable, in good quality, and submitted to SP for review and approval before they are used for construction and / or fabrication.
2. All requirements in this Specification are to be considered as minimum requirements. The Contractor is to undertake its own design.
3. Unless specifically stated in this Specification, all drawings, reports, and other reference documents provided to the Contractor are "For Information" only. All associated risks involved with the use of any the information therein, either direct or derived, shall be borne by the Contractor.
4. As a minimum requirement, the Contractor shall submit the following documents as part of its bid submission:
  - a. Program Schedule
  - b. Curriculum vitae of Key Personnel
  - c. Work method statement
  - d. Design methodology
  - e. Details of Project Quality Management System
  - f. Details of Work Health and Safety System Proposal
  - g. Outline Project Safety in Design Management Plan
  - h. Schedule of equipment suppliers and manufacturing locations
  - i. The Contractor's engineering design under this Project shall be in accordance with the requirements of this Specification and the equipment/materials supplied from approved suppliers. In case of conflict in the requirements, the Contractor shall bring this to the attention of SP and seek written confirmation of the requirements from SP. Under no circumstances is the Contractor to decide on

his own what the applicable requirements are in case of such conflict. SP reserves the right to reject any or the complete part of the Work arising out of the Contractor's own decisions.

5. The construction works should ideally be during the dry season. Allowances in the schedule should be made to accommodate review and approval period of the Contractor's submission.
6. The Contractor shall design, supply, install, test, and commission all materials required to complete the Works as a fully functional system whether described in detail or not in this Specification.
7. The Contractor shall repair any and all damage to existing installations incurred during the performance of the Works including, but not limited to, damage to existing transmission lines, underground services, roads, railways, drainage structures, fencing and gates.
8. The Contractor shall supply all the design and drawings in electronic form to SP upon completion of the Project. "As installed" documents must be supplied to SP no later than 15 days after the Commissioning of the new ADSS, new OPGW and new Loose Tube Fiber (Underground fiber).
9. The Contractor shall design, supply, install, test, and commission the Works required to install the new ADSS, new OPGW, new underground fiber, and associated fittings. All Works shall be delivered using the best available engineering practice and procedures. The Contractor is responsible for the successful completion of the Project.

## SCOPE OF WORK

The scope of work for this Project includes but is not limited to:

ADSS Scope	OPGW SCOPE
<ol style="list-style-type: none"> <li>1. mobilisation to site;</li> <li>2. route survey to confirm data shown in the tower schedule;</li> <li>3. design, procure, supply, install, test and commission all individual components necessary to install the new ADSS, including but not limited to:                             <ol style="list-style-type: none"> <li>a. ADSS including splice boxes and coiling frames;</li> <li>b. ADSS fitting assemblies and line hardware (e.g. dampers, joints, warning spheres, aerial warning lights, etc.);</li> <li>c. Attachment hardware fittings for the two lattice towers</li> </ol> </li> <li>4. quality control of serial production at manufacturers shop facilities;</li> <li>5. Dismantling of old equipment as required</li> <li>6. inspection prior to delivery to site;</li> <li>7. packaging and organizing safe transport and delivery to project site;</li> <li>8. storage and handling of all required material for installation and construction at project site;</li> <li>9. site establishment includes, but not be limited to, the following:</li> </ol>	<ol style="list-style-type: none"> <li>1) mobilisation to site;</li> <li>2) route survey to confirm data shown in the tower schedule;</li> <li>3) design, procure, supply, install, test and commission all individual components necessary to retire the existing OHEW and install the new OPGW, including but not limited to:                             <ol style="list-style-type: none"> <li>a. OPGW including splice boxes and coiling frames;</li> <li>b. OPGW fitting assemblies and line hardware (e.g. dampers, joints, warning spheres, aerial warning lights, etc.);</li> <li>c. Suspension tower earthpeak;</li> </ol> </li> <li>4) dismantling and disposal of existing OHEW including all associated line hardware and fitting assemblies;</li> <li>5) prototype assembly of the suspension tower earthpeak;</li> <li>6) quality control of serial production at manufacturers shop facilities;</li> <li>7) inspection prior to delivery to site;</li> <li>8) packaging and organizing safe transport and delivery to project site;</li> </ol>

- a. installation and upkeep of site offices, first aid stations and crib rooms in location(s) determined by the Contractor to optimise the execution of the Works;
- b. responsibility for the supply of service facilities, secure storage, laydown and service areas that the Contractor deems necessary;
- c. provision of all temporary power required for the construction and commissioning of the Works and all associated facilities;
- d. provision of mobile telephones and/or satellite telephones, radios, computers and other equipment and communications cabling for voice and fax/data communications required by the Contractor;
- e. provision of desks and chairs for 2 SP personnel or nominated representatives;
- f. installation and maintenance of portable ablution facilities, compliant with all relevant Legislative Requirements, for use by Contractor's Personnel;
- g. construction and maintenance of any access roads required to complete the Works;
- h. development of traffic management plans to comply with the relevant road Authority's requirements and the Contractor's construction traffic for all aspects of the Works that must be subject to SP's review. The Contractor must take all necessary measures to ensure plant

- 9) storage and handling of all required material for installation and construction at project site;
- 10) site establishment includes, but not be limited to, the following:
  - a. installation and upkeep of site offices, first aid stations and crib rooms in location(s) determined by the Contractor to optimise the execution of the Works;
  - b. responsibility for the supply of service facilities, secure storage, laydown and service areas that the Contractor deems necessary;
  - c. provision of all temporary power required for the construction and commissioning of the Works and all associated facilities;
  - d. provision of mobile telephones and/or satellite telephones, radios, computers and other equipment and communications cabling for voice and fax/data communications required by the Contractor;
  - e. provision of desks and chairs for 2 SP personnel or nominated representatives;
  - f. installation and maintenance of portable ablution facilities, compliant with all relevant Legislative Requirements, for use by Contractor's Personnel;
  - g. construction and maintenance of any access roads required to complete the Works;
  - h. development of traffic management plans to comply with the relevant road Authority's

size is suitable to gain access to any restricted areas;

- i. provision of all temporary Works and barricading required to protect existing infrastructure from construction vehicle movements, including barriers, protective barricades, fences, windrows, bunds, diversions, signs, markers, warning lights, spotters and flag men, including maintenance of the foregoing. This must include the protection of edges of excavations and embankments along access and haul roads;
- j. transportation to site of all items necessary to complete the Works including crange to unload equipment and materials, safe storage in the nominated lay down areas, security and provision of all temporary timber packing, bearers and structures;
- k. Reloading, transport and handling of equipment and materials from lay down areas to the point of use; and
- l. removal of all temporary facilities following completion of the Works.

10. preparation and submission of the complete documentation of the work for SP review.

11. restore maintenance track(s) if damaged;

12. supply, install, and dismantle temporary scaffolds for road and rail crossing, as required;

13. produce all documentation including installation, operation and maintenance (IOM) manuals and

requirements and the Contractor's construction traffic for all aspects of the Works that must be subject to SP's review. The Contractor must take all necessary measures to ensure plant size is suitable to gain access to any restricted areas;

- i. provision of all temporary Works and barricading required to protect existing infrastructure from construction vehicle movements, including barriers, protective barricades, fences, windrows, bunds, diversions, signs, markers, warning lights, spotters and flag men, including maintenance of the foregoing. This must include the protection of edges of excavations and embankments along access and haul roads;
- j. transportation to site of all items necessary to complete the Works including crange to unload equipment and materials, safe storage in the nominated lay down areas, security and provision of all temporary timber packing, bearers and structures;
- k. Reloading, transport and handling of equipment and materials from lay down areas to the point of use; and
- l. removal of all temporary facilities following completion of the Works.

11) preparation and submission of the complete documentation of the work for SP review.

12) restore maintenance track(s) if damaged;

Manufacturer Data Requirements (MDR) for SP records; and

14. site clean-up and demobilisation from site.

13) supply, install, and dismantle temporary scaffolds for road and rail crossing, as required;

14) produce all documentation including installation, operation and maintenance (IOM) manuals and Manufacturer Data Requirements (MDR) for SP records; and

15) site clean-up and demobilisation from site.

#### Loose Tube (Underground) Fiber Optic Scope

1. mobilisation to site;
2. route survey and geotechnical assessment for underground sections;
3. design, procure, supply, install, test and commission all individual components necessary for underground fiber installation, including but not limited to:
  - a. Underground fiber cable (Single mode, 24-core);
  - b. Conduit, ducts, and protective casing;
  - c. Splice enclosures, joint boxes, and termination panels;
  - d. Warning tape, markers, and protective covers;
4. Excavation, trenching, and reinstatement of ground surfaces;
5. Installation of underground cable via direct burial or in conduit systems;
6. Road and pavement crossings with appropriate permitting and reinstatement;
7. Splicing, termination, and testing of underground fiber sections;
8. Provision of "as-installed" drawings and cable route records;
9. site establishment includes, but not be limited to, the following:

- a. installation and upkeep of site offices, first aid stations and crib rooms in location(s) determined by the Contractor to optimise the execution of the Works;
- b. responsibility for the supply of service facilities, secure storage, laydown and service areas that the Contractor deems necessary;
- c. provision of all temporary power required for the construction and commissioning of the Works and all associated facilities;
- d. provision of mobile telephones and/or satellite telephones, radios, computers and other equipment and communications cabling for voice and fax/data communications required by the Contractor;
- e. provision of desks and chairs for 2 SP personnel or nominated representatives;
- f. installation and maintenance of portable ablution facilities, compliant with all relevant Legislative Requirements, for use by Contractor's Personnel;
- g. construction and maintenance of any access roads required to complete the Works;
- h. development of traffic management plans to comply with the relevant road Authority's requirements and the Contractor's construction traffic for all aspects of the Works that must be subject to SP's review. The Contractor must take all necessary measures to ensure plant size is suitable to gain access to any restricted areas;
- i. provision of all temporary Works and barricading required to protect existing infrastructure from construction vehicle movements, including barriers, protective barricades, fences, windrows, bunds, diversions, signs, markers, warning lights, spotters and flag men, including maintenance of the foregoing. This must include the protection of edges of excavations and embankments along access and haul roads;
- j. transportation to site of all items necessary to complete the Works including craneage to unload equipment and materials, safe storage in the nominated lay down areas, security and provision of all temporary timber packing, bearers and structures;
- k. Reloading, transport and handling of equipment and materials from lay down areas to the point of use; and
- l. removal of all temporary facilities following completion of the Works.

10. preparation and submission of the complete documentation of the work for SP review.

11. Restoration of disturbed areas and environmental compliance;
12. supply, install, and dismantle temporary shielding and barriers for excavation sites;
13. produce all documentation including installation, operation and maintenance (IOM) manuals and Manufacturer Data Requirements (MDR) for SP records; and
14. site clean-up and demobilisation from site.

## **ADSS, OPGW AND UNDERGROUDN FIBER CABLE REQUIREMENT**

### **5.1 Aerial Dielectric Sheld Support Cable Requirement**

The design documentation provided with the tender document is based on the ADSS parameters shown below. The optical fibres (minimum of 24 cores) shall be appropriate for the communication system designed by SP. Under no circumstance, the ADSS shall be installed to the specification stipulated in the supplied drawings and shall not exceed the permitted structural capacity of the existing structures. A Contractor nominated ADSS shall suit the requirements of this Project and shall be installed such that it maintains acceptable lightning performance as well as safe clearances to phase conductors.

Suitable coiling frame and joint boxes for the ADSS shall be provided by the Contractor. Joint boxes shall be sized to accommodate all splicing plus 10% spare splicing capacity and all required cables including a minimum of one additional cable entry. A 20m loop of ADSS shall be coiled on the coiling frame adjacent to the joint box at each joint. To assist maintenance and possible future branch-splicing, the joint boxes and attached fibres shall be readily removable to an environmentally controlled van at ground level. The joint boxes shall be suitable for mounting above the anti-climbing device without modification to the line structure. Details of Contractor's proposed arrangements shall be submitted to SP as part of the review process.

Table 1 : ADSS Parameters

<b>Parameter</b>	<b>Unit</b>	<b>Aerial Short Span i.e. &lt; 200m</b>	<b>Aerial Long Span i.e. 775m span</b>	<b>Underground Fibre</b>
<b>Min no of Fibres</b>	<b>no</b>	<b>24</b>	<b>24</b>	<b>24</b>
Diameter, Dout	mm	10.5	7.6	10

Nominal Weight, w	N/m	7.84	1.608	0.73
Cross sectional Area, A	mm <sup>2</sup>	62.8	29.00	
Breaking Load, CBL	kN	10.9	26.00	
Modulus of Elasticity, E @20°C	kN/mm <sup>2</sup>	8.9	119	
Coefficient of Linear Expansion, α @ 20°C	x10 <sup>-6</sup> /°C	10.0	15.2	
Short time current capacity, I <sup>2</sup> t	kA (2s)		5.5	
Max. everyday tension	kN	1.0		

## 5.2 Optical Fibre Ground Wire (OPGW) Requirement

The design documentation provided with the tender document is based on the OPGW parameters shown below. The optical fibres (minimum of 24 cores) shall be appropriate for the communication system designed by SP. Under no circumstance, shall the OPGW is permitted the exceed the existing loads imposed on the structures by the existing OHEW. A Contractor nominated OPGW shall suit the requirements of this Project and shall be installed such that it maintains acceptable lightning performance as well as safe clearances to phase conductors.

Suitable coiling frame and joint boxes for the OPGW shall be provided by the Contractor. Joint boxes shall be sized to accommodate all splicing plus 10% spare splicing capacity and all required cables including a minimum of one additional cable entry. A 20m loop of OPGW shall be coiled on the coiling frame adjacent to the joint box at each joint. To assist maintenance and possible future branch-splicing, the joint boxes and attached fibres shall be readily removable to an environmentally controlled van at ground level. The joint boxes shall be suitable for mounting above the anti-climbing device without modification to the line structure. Details of Contractor's proposed arrangements shall be submitted to SP as part of the review process.

Table 2: OPGW Parameters

Parameter	Unit	7/2.0 SC/GZ OHEW	OPGW
Diameter, D <sub>out</sub>	mm	6.0	7.6
Weight, w	N/m	1.697	1.608
Cross sectional Area, A	mm <sup>2</sup>	21.99	29.00
Breaking Load, CBL	kN	26.00	26.00
Modulus of Elasticity, E	GPa	170	119
Coefficient of Linear Expansion, α	x10 <sup>-6</sup> /°C	11.5	15.2
Short time current capacity, I <sup>2</sup> t	kA (2s)		5.5

### 5.3 Loose Tube Fiber (Underground Fiber Optic) Requirement

Solomon Power requires underground fiber optic cable for sections where ADSS installation is not feasible due to aviation restrictions, road crossings, or other environmental constraints. The underground fiber shall be Single Mode 24-core, suitable for direct burial or installation in conduit system as per the route design.

The underground fiber shall be designed, tested, and manufactured in accordance with IEC/EN 60793-3-11 or equivalent standard for underground telecommunication cables.

Table 3: Underground Fiber Parameters

Parameter	Unit	Underground Fiber
Min. No. of Fiber	Cores	48
Cable Diameter, D <sub>out</sub>	mm	13.0-15.0 (typically ~ 14mm)
Nominal Weight, w	N/m	1.2 – 1.8 (typically ~ 1.5mm)
Minimum Bending Radius	mm	Installation: 210 (15x D) Static: 140 (10 x D)
Crush Resistance	kN/m	≥ 3.0 -4.0
Impact Resistance	J	≥ 7 - 10
Operating Temperature Range	°C	-40 to +70 (enhanced for UG)
Tensile Load (Installation)	N	≥1500
Tensile Load (Operating)	N	≥600

## SUSPENSION EARTHPEAK PROTOTYPE ASSEMBLY AND TRIAL FIT

The Contractor shall design, supply, assemble a prototype the suspension tower earthpeaks and trial fit it prior to mass fabrication. SP's review of drawings for prototype assembly of a earthpeaks shall not be taken as approval for subsequent production purposes. The fabrication details required under this Specification shall be checked for compliance in the assembled prototype earthpeak.

All fasteners (nuts, bolts, etc) shall be tightened "snug tight" as defined in AS 4100 to ensure that the various members are in close contact and all movements between adjacent members and/or fixings have been eliminated. Fasteners used in trial assembly shall not be re-used.

Within 10 business days prior to the intended inspection date, the Contractor shall notify SP of the availability of the prototype structures for inspection and trial fit.

SP may direct changes to the details so that the design conforms to the Works and such changes shall be incorporated into the constructed towers. Subsequent to SP's inspection and approval, no alteration to the existing towers shall be made without SP's written approval.

## DETAIL DESIGN DRAWINGS

SP has previously engaged AECOM to undertake detail design and develop the construction drawings and specifications for the installation of the ADSS and OPGW.

**Table 1: ADSS Drawings**

Drawing Number	Drawing Title	Rev.
<b>LUNGA POWER STATION TO HENDERSON SOLAR FARM</b>		
SK-DP1-01	ADSS SUSPENSION CLAMP - BAND CLAMP OR BOLTED ASSEMBLY	A
SK-DP1-02	ADSS SHORT SPAN TENSION - BAND CLAMP OR BOLTED ASSEMBLY	A
SK-DP1-03	ADSS CABLE STORAGE BRACKET	A
SK-DP1-04	ADSS SPLICE ENCLOSURE	A
SK-DP1-05	ADSS TOWER TENSION ASSEMBLY	A
SK-DP1-06	ADSS CONSTRUCTION SCHEDULE	A
SK-DP1-07	ADSS ROUTE PLAN AND PROFILE	A
SK-DP1-08	UGOH TRANSITION POLES 5435 - ADSS TERMINATION DETAILS	A
SK-DP1-09	ADSS UNDERGROUNDING ROUTE - HENDERSON SOLAR FARM	A
SK-DP1-10	ADSS GRAPHICAL PLAN LINE ROUTE	A
SK-DP1-11	TELECOMMUNICATIONS PIT DETAILS	A
SK-DP1-12	ADSS PROJECT MATERIAL SCHEDULE	A

SK-DP1-13	ADSS STRINGING CHART	A
SK-DP1-14	ADSS UNDERGROUNDING ROUTE - ADSS UGOH TERMINATION POLE 4943	A
SK-DP1-15/1	ADSS LUNGGGA UNDERGROUNDING - ROUTE PLAN	A
SK-DP1-15/2	ADSS LUNGGGA UNDERGROUNDING - DATA CONTROL CENTRE	A
SK-DP1-16	ADSS LUNGGGA UNDERGROUNDING - ADSS CABLE TRENCH CROSS SECTIONS	A
SK-DP1-17	STAY POLE ASSEMBLY	A
SK-DP1-18	ADSS DAMPER SCHEDULE	A
<b>EAST HONIARA SUBSTATION TO POLE 5479 SECTION</b>		
SK-DP2-01/1-2	ADSS DESIGN CONSTRUCTION SCHEDULE	A
SK-DP2-02/1-9	ADSS ROUTE PLAN AND PROFILE	A
SK-DP2-03	ADSS GEOGRAPHICAL PLAN - OVERALL PLAN	A
SK-DP2-04/1-5	ADSS UNDERGROUNDING ROUTE - DETAIL PLAN (EAST HONIARA SS TO POLE 5479)	A
SK-DP2-05	ADSS UNDERGROUNDING - CROSS SECTIONS	A
SK-DP2-06/1-3	MATERIAL SCHEDULE	A
SK-DP2-07/1-2	ADSS STRINGING CHART	A
SK-DP2-08	ADSS UNDERGROUNDING ROUTE - ADSS UGOH TERMINATION POLE	A
SK-DP2-09	TELECOMMUNICATIONS PIT DETAILS	A
SK-DP2-10	TYPICAL STAY WIRE ASSEMBLY	A
SK-DP2-11	ADSS SUSPENSION CLAMP - BAND CLAMP OR BOLTED ASSEMBLY	A
SK-DP2-12	ADSS SHORT SPAN TENSION - BAND CLAMP OR BOLTED ASSEMBLY	A
SK-DP2-13	ADSS CABLE STORAGE BRACKET	A
SK-DP2-14	ADSS SPLICE ENCLOSURE	A

**Table 2: OPGW Drawings**

Drawing Number	Drawing Title	Rev.
SP-LH-TS-001-001	Tower Schedule	0
SP-LH-LS-002 sht 001	Line Equipment Schedule	0
SP-LH-AS-003 sht 001	OPGW Suspension (to suit Ø7.6mm OPGW) Assembly	0
SP-LH-AS-004 sht 001	OPGW Strain (to suit Ø7.6mm OPGW) Assembly	0
SP-LH-AS-004 sht 002	OPGW Strain (to suit Ø7.6mm OPGW) Assembly-Insulated	0
SP-LH-AS-005 sht 001	Suspension OPGW Attachment Arrangement	0
SP-LH-AS-005 sht 002	Suspension OPGW Attachment Arrangement-Details	0
SP-LH-AS-005 sht 003	Suspension OPGW Attachment Arrangement-Details	0
SP-LH-SS-006 sht 001 to 023	Stringing Schedule-SFPOC24 OPGW	0

**Table 3: Underground Fiber Drawings**

Drawing Number	Drawing Title	Rev.
SP-RL-US-010	Joint Bay Typical Detail	0

## PROGRAM SCHEDULE

As part of the requirements for submitting a bid for this project, the Contractor shall assess, prepare, and submit a project schedule for review and consideration of SP. Below are the anticipated target dates:

ADSS	OPGW	Underground Fiber Optic (Loose Tube)
Tender period	Tender period	Tender period
Request for Tender	Request for Tender	Request for Tender
Site visit	Site visit	Site visit
Queries and Clarifications	Queries and Clarification	Queries and Clarification

Bid submission	Bid submission	Bid submission
Contract negotiations	Contract negotiations	Contract negotiations
Contract award	Contract award	Contract award
Start-up meeting	Start-up meeting	Start-up meeting
Mobilisation	Mobilisation	Mobilisation
Procurement	Design Period	Route survey & geotechnical assessment
ADSS	Liaise with Suppliers	Design & procurement of underground components
ADSS fitting assemblies and apparatuses	Suspension earthpeak design, prototyping, and trial fit	Excavation, trenching & conduit installation
Suspension earthpeak mass fabrication	SP review and approvals	Testing and commissioning
Construction	Procurement	Restoration & reinstatement
Check pole coordinates, heights and types stipulated in the supplied ADSS construction schedules and ensure all new poles has been installed or existing poles replaced	OPGW	as-installed documentation
Install new attachment fittings	OPGW fitting assemblies and apparatuses	Site clean-up & demobilisation
String new ADSS	Suspension earthpeak mass fabrication	Project completion

Testing and commissioning	Construction	
Site clean-up	Retire existing OHEW	
Demobilisation	Install suspension earthpeak on suspension towers	
Project completion	String new OPGW	
	Testing and commissioning	
	Site clean-up	
	Demobilisation	
	Project completion	

## **CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLANS/REQUIREMENTS**

## **CONSTRUCTION METHODOLOGY**

The Contractor must not commence stringing the ADSS and OPGW on any structure until SP has approved that the structure is complete in all respects. SP requires all ADSS and OPGW activities to be carried out in an approved manner including the careful handling of ADSS and OPGW before and during operations such as (but not limited to) the running out, tensioning, sagging, jointing, clamping of ADSS and OPGW.

The Contractor shall consult with the ADSS manufacturer and follow its recommendations and requirements for proper inspection, handling, pre-installation testing, installation, and stringing, and testing of the ADSS and OPGW.

It is the Contractor's responsibility to ensure that the work methods it employs do not infringe on the integrity of the transmission line supports, do not damage the ADSS and OPGW in any way, are safe and are safe to all surrounding elements, personnel and the public.

As equipment weight and size very often interferes with both accurate stringing procedures and the physical size of pulling equipment can become prohibitive, the IEEE document generally recommends or requires a maximum strength factor of 50 percent for the stringing equipment capacity. This is in order to limit the pulling equipment's size weight. The Contractor is hence required to understand or be familiar with the generated loads of proposed stringing operations.

Definitions and terminology with respect to stringing in this Specification shall be referenced as defined in the above IEEE document.

## ADSS and OPGW INSTALLATION

The following conditions must be applied when stringing ADSS and OPGW:

- Square rigging must not be arranged at the tensioner end of the haul.
- The Contractor must consult with the manufacturer of tensioner machine to ensure that the proposed set up does not generate unnecessary or excessive torque and twist on the ADSS and OPGW.
- The Contractor must consult with the manufacturer to determine if an anti-twist device (head board) is required.
- Anti-twist devices (head boards) that require grips to be installed between the device and the ADSS and OPGW must not be used.
- The eye of any cable grip must be attached to a swivel shackle.

The Contractor shall provide constant surveillance of the connection point between the draw wire/rope and ADSS/OPGW throughout the duration of the haul (use of a visual marker on the ADSS and OPGW such as a plastic cable tie can assist with determining rotation).

### STRINGING METHODOLOGY

At least 30 days prior to commencing stringing operations, the Contractor shall provide a work method statement for SP's approval with pertinent details as listed below but not limited to:

- The timeline for each pull section, sag and clamping of each line section, ensuring these are within the required SP time limitations.
- The methodology must ensure sufficient notice to stakeholders, including, if necessary any timing/deadline required by them. It should outline all arrangements made in this regard.
- A clear outline as to the methods and procedures that will be deployed in the stringing and final sagging of the ADSS and OPGW (including creep methodology). These will include work instructions, procedures or method statements required for the specific transmission line to be strung.
- The proposed pulling tensions and methods for monitoring the applied loads.
- Show/compare that any applied loads will be within the allowable loads on the structures and the equipment.

- Equipment types (winches, brake, compressors and dies etc).
- The communication and control that will be deployed on any pull section, and any increases if necessary on particular sections. This must include names of key persons involved in the activity (eg: Stringing Supervisor, machines operators, safety observers, etc).
- Any pertinent aspect of a particular pull section, which is critical for the section or the Works contract, in particular if urban areas are involved.
- The precautions taken to ensure the safety of the operation – including induction control and temporary earthing plan.
- Quantities and allowance of spare/standby equipment.
- Indication of the procedures for all likely rework or temporary construction options that may arise.
- A drawing illustrating the site set up for the specific stringing run must be included with the methodology. As a minimum, the drawing must show the following:
  - All structures within the tension run/section including distances between structures;
  - selected locations for stringing equipment proposed;
  - the location of all ADSS and OPGW joint box proposed;
  - differences in elevation and general topography of the section; and
  - all major crossings involved in each pull section.
- If required, the Contractor shall provide additional information, which might not have been covered in the submitted work method statement, in order to clearly understand the proposed technique.
- Sagging details, including creep and any off-set clipping information and results shall be submitted for approval to SP at least 14 days prior to the planned date of stringing any tension section. Such notice shall include any intended helicopter stringing operations.
- Prior to any helicopter stringing operations, the Contractor shall place a Public Notice (in the local newspaper) and contact all directly affected occupiers/landowners at least seven days before any such operation.

- In rural farming areas, the final implementation of any such helicopter stringing will be dependent on the Contractor obtaining the necessary permission from both the civil aviation as well as all affected stakeholders (with sensitive farm stock) within a one kilometre area of the effected stringing section.

- **CROSSINGS, NOTICES AND PERMITS**

The Contractor shall make all arrangements and obtain any permits and approvals necessary from the service owner being crossed over. All material supply and construction costs associated with any such service crossing including the costs of any permit fees or fees charged for outages, services provided by the owners of such services, protection and the like associated with crossing of the service shall be borne by the Contractor.

In the case of power line crossings, the Contractor shall comply with the Electrical Safety Instructions issued by SP in all respects as well as with any other relevant Statutory requirements, standard and/or code as might apply.

Effective measures shall be taken (i.e. the use of substantial temporary conductor supports or hurdles) to prevent encroachment of statutory clearance or other clearance requirements of any issued permit, by the ADSS and OPGW being strung to these services being crossed (power or communication lines, roads or railways).

On request, the Contractor shall provide SP with design information for any temporary structures, including the maximum allowable loads, the method of calculation, clearances, assumptions made and structural details. The method employed to minimise/contain risk in the event of a ADSS and OPGW breaking at the puller and hitting the protected service shall be included in the work method statement.

- **HANDLING STRINGING EQUIPMENT**

The ADSS and OPGW shall be strung (or recovered) with tension methods, see IEEE 524 Section 4.2.

All handling/stringing equipment to be employed shall be as specified by the manufacturer. Unless SP approves otherwise, the tensioner bull wheel and the ADSS and OPGW sheaves configuration and dimensions, and all other stringing equipment shall comply with the requirements of IEEE 524. The equipment shall be positioned as is recommended by the IEEE standard. The Contractor shall provide details/specifications of stringing equipment, if requested by SP. The basic equipment outline details shall be listed in the work method statement and any deviations from this IEEE standard shall be highlighted.

# TYPICAL PROCEDURES FOR STRINGING OPERATIONS FOR ADSS AND OPGW, AND UNDERGROUND FIBER INSTALLATION GUIDE

## 12.1 ADSS Installation Equipment Sites

It is important to pick the proper location for the pay-off and take-up equipment. The reel of ADSS cable (pay-off) must be located directly in line with the first sheave and must be back from the structure four times the height of the sheave (4:1 distance to height ratio). It is recommended to have at least three structures before the first large angle change. The equipment and ADSS cable reel should be in a safe and secure location, worry-free from vandalism or theft since the equipment could sit overnight.

### Sheave Installation

Each structure in the pulling segment must have a sheave installed and a pulling rope threaded through it. Each sheave must be balanced so that the rope, and later the ADSS cable, rides at the bottom of the neoprene insert's groove. It is important to tie up the sheave at each angle so the pulling rope and ADSS cable enter and exit the sheave smoothly. If the cable enters at an angle, it has a very good chance of jumping from the sheave groove into the space between the sheave and the yoke holding the sheave to the pole. This would cause severe damage to the cable.

### Pulling Lines

Once the sheaves are installed, the pulling rope shall be threaded (reeved) through the system. It is extremely important that the pulling rope and the ADSS cable have the same diameter and approximate weight. This will allow the sheaves to float at the same level with the pulling rope as they will when the ADSS cable enters the sheaves. It is important that the cable and sheave are in the same plane, to avoid any cable damage caused by contact with the edges of the sheave. The pulling line should be all dielectric and not be susceptible to internal, electrical static charge buildup. The pulling rope should never be allowed to touch or drape over distribution lines or slump between pole attachments. It should have constant tension throughout the entire pulling operation.

### Pulling the ADSS Cable

The ADSS cable shall be attached to the pulling rope using a double swivel eye and woven wire grip. Special attention must be paid to the grip and swivel as they pass through the sheaves and near the towers. The double swivel eye insures the ADSS cable will not see an induced torsion as the pulling line enters and exits each sheave.

A 'flag' shall be attached just behind the swivel eye on the ADSS cable jacket. This flag should stay straight through each sheave. If the flag starts to flip over the cable, it shows the swivel eye is not working properly. If this is the case, the pulling operation should be stopped and the swivel should be oiled or fixed.

The woven wire grip shall be of a proper diameter and of sufficient length on the cable jacket to insure even loading of the cable strength members. The edges of the woven wire grip should be taped smooth so the grip does not damage the neoprene inserts of the travellers as it passes through.

The cable tension must not exceed the maximum installation tension recommended . Special attention must be paid to maintaining an even tension and speed. The wire mesh grips are designed to pull the cable, not to hold it under final tension. Do not use the wire mesh grips to apply the final tension to the cable.

### **Sagging**

The ADSS cable shall be sagged from the pay-off (cable reel) end towards the take-up equipment, starting with the tension grip at the first structure near the cable reel. The sag can be adjusted using several methods. The recommended method is the 'line of site' method. This requires the sag distance to be determined ahead of time for each particular span length. One or more spans between tension grip locations should be checked using this method. After placing the cable under tension, it may be necessary to wait for approximately 24 hours for the cable to creep before making the final sag measurements.

The 'Line of Site' sagging method requires climbing both structures on either side of a span to be checked.

The structure closest to the pay-off end of the system is tensioned. Then the next structure is marked using bright coloured tape with the appropriate mid-span sag distance from the attachment height. The lineman returns to the pay-off end structure and measures down the mid-span sag distance and places his line of site at that same height. This person should have radio contact with the take-up operator and give instructions of how much to tighten the cable in the system so that the belly of the sag of this particular span rises to match the bright coloured tape mark on the opposite structure. Once the sag matches the requirement, the take-up side tension structure can be climbed and clipped in. The cable sag just after pulling should be looser than the required, clipped in sag. The belly of the sag shall always be brought up the proper sag, not loosened or brought down to the correct sag.

There are two methods of pulling the cable back to the structure to tension it. A temporary tension grip can be partially installed to supply a pulling loop, or an aramid yarn braiding pulling eye may be used. It is not acceptable to use a hoist, clamp, or other device not designed for fibre optic cables at mid-segment to temporarily pull the cable.

### **Clipping-in and Tensioning**

The system segment shall first be sagged and tensioned at the appropriate structures. The tension grips shall have a sufficient drip loop between two tension grips on a structure to allow free movement. The tension grips shall be attached to the structure using an extension link (It is recommended using at least a 30 cm (12 inch) extension link) in order to get proper distance from the structure to allow the drip loop. The drip loop should be positioned downward and at least 30 cm (12 inches) deep.

Next the AGS Suspensions and/or Tangents can be installed. The installing of the ADSS hardware (Tensions, Tangents and AGS Suspensions) shall be prompt. The ADSS cable shall not be allowed to sit in the sheaves more than one week (or less in bad weather).

### **Damper Installation**

If the system requires Aeolian vibration dampers, they can be installed after the ADSS hardware is in place at each individual structure. However, it is normally necessary for some type of vibration control. Please refer to your hardware supplier if there is concern about a potential vibration situation.

### **Splicing**

Splicing should be performed on the ground. The splice can then be stored aurally (recommend at least 6 meters off the ground), at ground level in a pedestal or cabinet, or underground in a hand hole or manhole. Sufficient length of cable ends should allow the cable to descend the structure and enter a splicing vehicle or splicing area. Each splice should have at least a small storage loop to allow the splice to be removed from the base of the pole to the splicing equipment if it can not be located close by. Six meters of cable shall be discarded from each pulling grip end to remove damaged or stressed cable. Then typically, each cable end should have at least 30 meters or more from the tension attachment, depending on the tower or pole size. Be sure to account for at least 3 meters of cable for the splicing operation. Cable Down Guides should be used to attach the ADSS cable to the structure along the entire height. The number of clamps, type of clamps, and distance between clamps should be sufficient to prevent any cable.

## 12.2 OPGW STRINGING

The Contractor shall consider minimising the risk of OPGW damage as well as maintaining the structure loadings to within allowable limits in selecting sites for pulling, tensioning, snub structures, and OPGW jointing.

The Contractor shall make all required temporary staying of both the structures as will be necessary. The OPGW may not be anchored to any portion of any tower, except on strain structures, and then only at points designed for such OPGW attachment. Temporary anchoring to structure footings and guy anchors will generally not be permitted.

Sufficient observers with communication radios or other means, whether for single or multiple drum pulls, shall be provided by the Contractor to ensure damage or over stressing of either the OPGW or the support structures does not occur. The Contractor shall maintain efficient continuous communication between all personnel involved in the pulling out or sagging operations.

The sheaves shall be hung at approximately the final elevation and position of the OPGW. For the security of both structure and OPGW, SP requires the sheaves to be hung off strops of lengths approximately that of the suspension assembly when the OPGW are strung through a strain or tension structure position.

In both the work method statement and on site, the Contractor shall ensure to the satisfaction of SP that scuffing or other damage to the OPGW will not occur in the OPGW installation process, and also following the implementation of any remedial action.

### RUNNING OUT

The Contractor shall not commence stringing until SP has approved all of the supports and foundations in the relevant pull-section of the line and received and approved the Contractor's work method statement and stringing program.

The foregoing equipment section requirements as well as those in IEEE 524, shall be adhered to. The driving principal required is, that equipment and operation shall keep the OPGW clear of the ground and obstacles at all times, while stressing the OPGW as little as possible.

The maximum tension imposed on an OPGW during stringing operations (refer to OPGW manufacturer's guide) shall be just sufficient to clear obstacles on the ground. It may be necessary under certain circumstances to string the OPGW near sag tension to clear crossing structures such as poles of the highways, roads or distribution lines. Observers shall confirm the clearance is being achieved. However, where stringing tensions are greater than 10 per cent of the OPGW's UTS, consideration must be given to the degree of stressing of the OPGW based on the time involved. The stringing-planning shall also take into consideration, that over long pull-

sections the tension close to the puller will be higher than at the tensioner-end. Another important consideration, with large elevation differences between supports in a tension section, considerable differences in the tension values can occur to the OPGW while it sits in sheaves.

In general, stringing tensions shall be approximately 50 per cent of the required 'ambient' sag tension. Unless a pre-tensioning procedure is being proposed, the Contractor shall not exceed the sag tension during the stringing operation, in both cases compliance with SP requires the puller and the tensioner to be equipped with approved tension indicating devices.

When OPGW are held under tension, additional safety clamps shall supplement auxiliary clamps prior to making the permanent attachments to the support attachment point. This is to be done by securing the OPGW to the strain earthpeak in the case of tension/strain make-offs. The earthing shall be outside of these safety clamp application points.

The Contractor is responsible for providing and maintaining earth-grounding precautions at all stringing locations, approved by SP.

The Contractor is warned of the danger of working on the line when any portion of the line under construction runs close to energised lines, this warning shall also be noted for during thunderstorms. If a thunderstorm is imminent, the Contractor shall remove its employees and/or sub-contractors from the line at no cost to SP except where covered under the Contract.

### **SAGGING PROCEDURES**

The Contractor shall pull up the OPGW to the appropriate sag and tension determined from the approved stringing schedule. The Contractor shall submit the completed stringing schedule to SP for approval at least 14 days before sagging of any particular tension section. A complete set of the approved stringing schedule and criteria shall be available at all times on site.

The Contractor shall notify SP at least 24 hours prior to any planned sagging operations and unless otherwise approved no sagging shall be undertaken except in the presence of SP. The Contractor shall keep accurate installation records, which shall include all OPGW data like weather conditions, OPGW and ambient temperature at the time of sagging, final sag and/or tension, location of joints and dampers for submission to SP on completion of the stringing. These records shall also be submitted in electronic format. During the course of the fieldwork, the Contractor shall satisfy SP that the sags in the OPGW agree with the stringing schedules.

Sagging shall be conducted during daylight hours only under 'still air' conditions. The sagging work shall be suspended at any time, when in the opinion of SP or the Contractor that wind or other adverse weather conditions would prevent satisfactory sagging.

### **CONDUCTOR TEMPERATURE**

Unless SP accepts an alternative suggested method, the temperature indicated on a thermometer, inserted in to a 2000 mm length OPGW (being sagged) from which a 150 mm core has been removed to accommodate the thermometer, shall determine the appropriate ambient temperature of the conductor. Any conductor creep correction shall be assessed from this ambient temperature. Such apparatus shall be freely suspended, free of structure shading, and where possible, shall be hung at the average elevation of the span or from the crossarm for at least two hours prior to taking the 'conductor' temperature reading.

Where, for whatever reason an intermediate snubbing position (and which will have been separately calculated) is created in a tension section, three adjacent suspension structure's assemblies (to the new sagging section) shall have the conductor moved into clamps (including whatever off-set may be required) prior to removing the temporary anchors and continuing the sagging of the new sag-section. These OPGW suspension assemblies shall remain in the plumb position once the new section is sagged and during plumb marking.

### **SAGGING OPGW PERIODS**

When stringing OPGW the maximum period between running out and clamping-in shall not exceed 48 hours unless the OPGW is restrained from moving in the sheaves, which will require SP approval, or unless the Supplier indicates a different period.

### **SUSPENSION CLIPPING**

Once a strain section's sagging is accepted, unless the sag section is over flat terrain, the conductor plumb point marking while in sheaves shall follow immediately thereafter. All offset adjustments of the conductors are undertaken from this plumb point when clamping-in takes place.

When transferring the conductors into the suspension units the Contractor shall employ a method approved by SP. The method shall avoid damage to the conductor being transferred.

Where conductors are supported in Armour Grip Suspension Units (AGSU) at suspension supports, due care should be taken to ensure that any new or existing fittings are designed and suitable for their intended use/purpose at the particular line position. Additionally, care should be taken to ensure the AGSU 'insert's joint' lies in approximately a horizontal plane.

OPGW clamps incorporating armour rods (e.g. AGSU) shall be employed/installed in strict accordance to the manufacturer's recommendations, which are to be supplied to SP. Unless otherwise specified the suspension clamp shall be within 50 mm of the rods centre point and the individual rod ends shall not exceed a variance of 12 mm between individual rods.

The OPGW clamping shall be carried out such that all OPGW suspension assemblies shall hang in a vertical plane at the sagging temperature. The cost of correcting conditions that fail to comply with this requirement shall be at the Contractor's expense including, if necessary, replacement material.

#### **VIBRATION DAMPERS**

Unless particular requirements exist, all spans shall have vibration dampers fitted, which shall be placed in accordance with the manufacturer's recommendation following offset clipping and clamping operations, once the OPGW is securely fastened in the clamp.

The number of dampers per span length shall be in accordance with manufacturer's recommendations, and spaced accordingly from the suspension clamp or mouth of the tension clamp. If the use of armour rods makes it impossible to meet these spacings, the first damper shall be positioned 25 mm from the end of the rods, thereafter spaced as specified normally from this first damper.

#### **PACKAGING, HANDLING, AND TRANSPORT**

The Contractor shall exercise appropriate care during storage, handling and transport of all components. The prime considerations at all times for these activities shall be safety and avoiding damage or stress to the components.

#### **PACKING**

All materials shall be carefully packed and secured for transport in such a manner that they are protected from all dust and climatic conditions during loading, transport, unloading and subsequent storage in the open. Materials shall be suitably packed and protected against vibration, movement and shock which may occur during loading and transport.

#### **HANDLING**

Methods of handling shall ensure that the component is not damaged or marked by lifting gear or by impact with the ground or other items. Components shall not be dragged, dropped, or unnecessarily rolled, but shall be lifted cleanly by a crane of suitable capacity operating with a spreader beam if necessary. Care shall be taken to ensure that the components are not unduly strained.

Heavy and bulky materials shall be provided with adequate lifting fixtures to facilitate ready handling during transit and on arrival at site.

#### **TRANSPORT**

The Contractor shall submit to SP its proposal for protection of equipment during transit. The responsibility for safe delivery remains with the Contractor.

All equipment supplied under this Contract shall be clearly identified on the outside of any case with the type and number of items contained therein and the gross weight. Large crates are to be marked on 3 sides, and smaller crates which can be easily manhandled are to be marked on two (2) sides at least.

A consolidated list of all consignments of components shall be maintained by the Contractor and shall be available for inspection by SP on request.

## **12.3 UNDERGROUND FIBER INSTALLATION**

### **Route Survey and Preparation:**

The Contractor shall conduct a thorough route survey to identify underground utilities, soil conditions, and any obstacles, and any obstacles. All necessary permits and approvals for excavation and road crossings shall be obtained by the Contractor.

### **Trenching Installation**

- Trenches shall be excavated to a minimum depth of 600mm in open ground and 800mm under roads or paved areas.
- Conduit (if used) shall be PVC or HDPE, with a minimum inner diameter of 40mm.
- Conduit Joints Shall be sealed to prevent moisture ingress.

### **Cable Laying:**

- The cable shall be laid with a minimum bending radius of 20 times the cable diameter.
- In rocky or unstable soil, sand bedding and protective covers shall be used.
- Cable shall be laid without tension; pulling tension shall not exceed 50% of the cable's maximum tensile strength.

### **Splice and Jointing**

- Splice enclosures shall be airtight and suitable for underground installation.
- Sufficient slack (Minimum 10m per splice location) shall be provided for future maintenance.
- All splices shall be tested for continuity and optical loss before backfilling.

### **Testing and Documentation;**

- Optical Time Domain Reflectometer (OTDR) testing shall be performed upon installation.
- 'As-installed' drawing, including cable depth and route coordinates, shall be provided to SP within 15 days of commissioning.
- 

### **Safety and Environmental Compliance;**

- All excavation works shall comply with local safety regulations.
- Sould erosion and sediment control easures shall be implemented as per environmental management plans.

# RISK MANAGEMENT

## **STAKEHOLDER CONSULTATION REQUIREMENTS**

## **OWNER'S ENGINEER'S ROLES/SCOPE**

1. Respond to Request For Clarifications (RFC) from the bidders
2. Assist and advice during bid evaluation
3. Attend start-up meeting
4. Review Contractor's design and advice acceptability
5. Construction supervision
6. Witness testing and commissioning and final handover

## **SUPPLEMENTARY INFORMATION REGARDING WORKS TO BE PROCURED**

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## PERSONNEL REQUIREMENTS

Using Form PER - 1 and PER - 2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements:

No.	Position	Total Work Experience [years]	Experience In Similar Work [years]
1			
2			
3			
4			
5			

## • EQUIPMENT REQUIREMENTS

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

No.	Equipment Type and Characteristics	Minimum Number Required
1		
2		
3		
4		
5		