

**Annexure 14: Documents related to
installed OPGW/FOTE DTPC**



APAR INDUSTRIES LTD.

REGD. OFFICE : 301/306, ⁷⁸²PARVATI MA COMPLEX,
R. C. DUTT ROAD, VADODARA - 390007.
INDIA
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F : (+91) (265) 2330309
E : apar.baroda@apar.com
url : www.apar.com

AIL/ALK/BRD/D-009/C-W/BP/OPGW/20/A09
April 7, 2020

Jaigad Power Transco Ltd
1st Floor Jeevan Jyothi Complex
Off Mumbai-Goa NH-66 | Shivaji Nagar | Chiplun-415605 |
Maharashtra | India | M +91 9552577122 | D 2355 253460
Kind Attn: Mr. Vaibhav Sansare | Assistant Manager-Transmission |

Dear Sir,

Sub: Your requirements of 48F OPGW & its HW fitting for budgetary inquiry for preparing DPR
to lay OPGW by replacing existing ground wire
Ref: Your enquiry mail 27th March 2020

We are in receipt of your captioned enquiry and are pleased to submit our **offer** for supply of OPGW as
under:

Description, Quantity & Prices:
As per Attached Annexure `A` for SILVASSA works

Price basis: The above prices have been worked out purely on **Domestic sale basis**

OPGW: The Prices quoted at annexure `A` are on **FIRM price basis for supply of OPGW & its
HW fitting, placement of order within the validity of our offer.**

OTHER TERMS & CONDITIONS:

GST on OPGW:

@18%, which is applicable at present on ex works price and F&I charges or actual at the time of
supply shall be charged extra for the supplies to be made from our works at Silvassa.

GST on HW & fittings:

@18%, which is applicable at present on ex-works price and F&I charges or actual at the time of
supply shall be charged extra for the supplies to be made from our works at Silvassa.

Statutory Variation:

Statutory variation shall be applicable for change in structure of present taxes & duties on actual basis,
as applicable at the time of execution and shall be to the account of Jaigad Power Transco Ltd.

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CORPORATE OFFICE : APAR HOUSE, CORPORATE PARK, SION TROMBAY ROAD, CHEMBUR, MUMBAI - 400 071. INDIA
T : (+91) (22) 2526 3400 / 6780 0400 • F : (+91) (22) 2524 6326 • E : corporate@apar.com • url : www.apar.com

WORKS 1 : SURVEY 148/1, 148/3/1, VILLAGE KUDACHA, SILVASSA - RAKHOLI ROAD, SILVASSA (U.T. OF D & NH) PIN : 396230. INDIA
T : (+91) (260) 3013400 • F : (+91) (260) 3013401 / 02 • E : masaf.conductor@apar.com • url : www.apar.com

WORKS 2 : CONDUCTOR DIVN. UNIT - III, SURVEY NO. 127/1/2, VILLAGE - ATHOLA, SILVASSA-UMARKUL ROAD,
SILVASSA (U.T. OF D & NH) PIN : 396230. INDIA.
T : (+91) (260) 3013400 • F : (+91) (260) 3013401 / 02 • E : masaf.conductor@apar.com • url : www.apar.com

CIN : L91110GJ1989PLC012802



ISO 9001 : 2008 CERTIFICATE REGISTRATION NO. : 20090164QM08
ISO 14001 : 2004 CERTIFICATE REGISTRATION NO. : 20090164UM
OHSAS : 18001 : 2007 CERTIFICATE REGISTRATION NO. : 20090164BS0H

Payment:

100% of Ex-works prices along with full taxes, duties, Freight & Insurance and Price variation if any shall be paid to us through irrevocable, confirmed and acceptable letter of credit, which shall be established with a nationalized Bank/first class schedule Bank, on **90 days interest free credit** which shall be counted from the date of Lorry receipt. (LC to be issue other than "PNB" AND "IDBI BANK"), LC to be opened along with manufacturing clearance. Commercial production will begin only after the letter of credit is advised to us by our Bank.

IN CASE OF CANCELLATION OF CONTRACT BY YOU, MARKED TO MARKET FINANCIAL IMPLICATION WILL BE TO YOUR ACCOUNT.

Delivery:

Delivery schedule of quoted **OPGW & it's HW fitting** will be discussed and decided mutually at the time of finalization of order. **Delivery is subject to force majeure conditions.**

Validity:

Our offer shall be valid for your acceptance and release of order up to and including **15th April 2020** and thereafter subject to our confirmation.

Technical Specifications:

The offered design manufactured & supplied strictly as per attached GTP.

Type Test on OPGW:

The Offered design is approved and accepted by PGCIL (Approval Letter attached).

Standard length, Packing & Marking:

The OPGW shall be supplied in standard lengths as mentioned in the GTP with a tolerance of +/-5% on the standard lengths. **The OPGW will be packed in Returnable Steel drums with returnable PP sheet at the time of supplies. M/s Jaigad Power Transco Ltd will keep the empty drums with all component and PP sheet at the stores & Apar will dismantle & collect the empty drums with all components and PP sheet from M/S Jaigad Power Transco Ltd store at our cost. Jaigad Power Transco Ltd will provide the required documents viz. waybills/road permit if any for lifting of the empty steel drums with all components and PP Sheet. In case of non-receipt of Steel drums with all component and PP sheet etc., extra charge @Rs 20000/- Per Drum and @2500 Per PP sheet will be paid by Jaigad Power Transco Ltd to Apar & this clause must be appear in you PO in case you place the order against this offer.** Marking on the drums shall be done strictly as per the customer specifications.

We do hope, you will find our offer quite competitive and exactly in line with your requirement. However, if you require any further information/details, please do inform, which will be provided immediately.

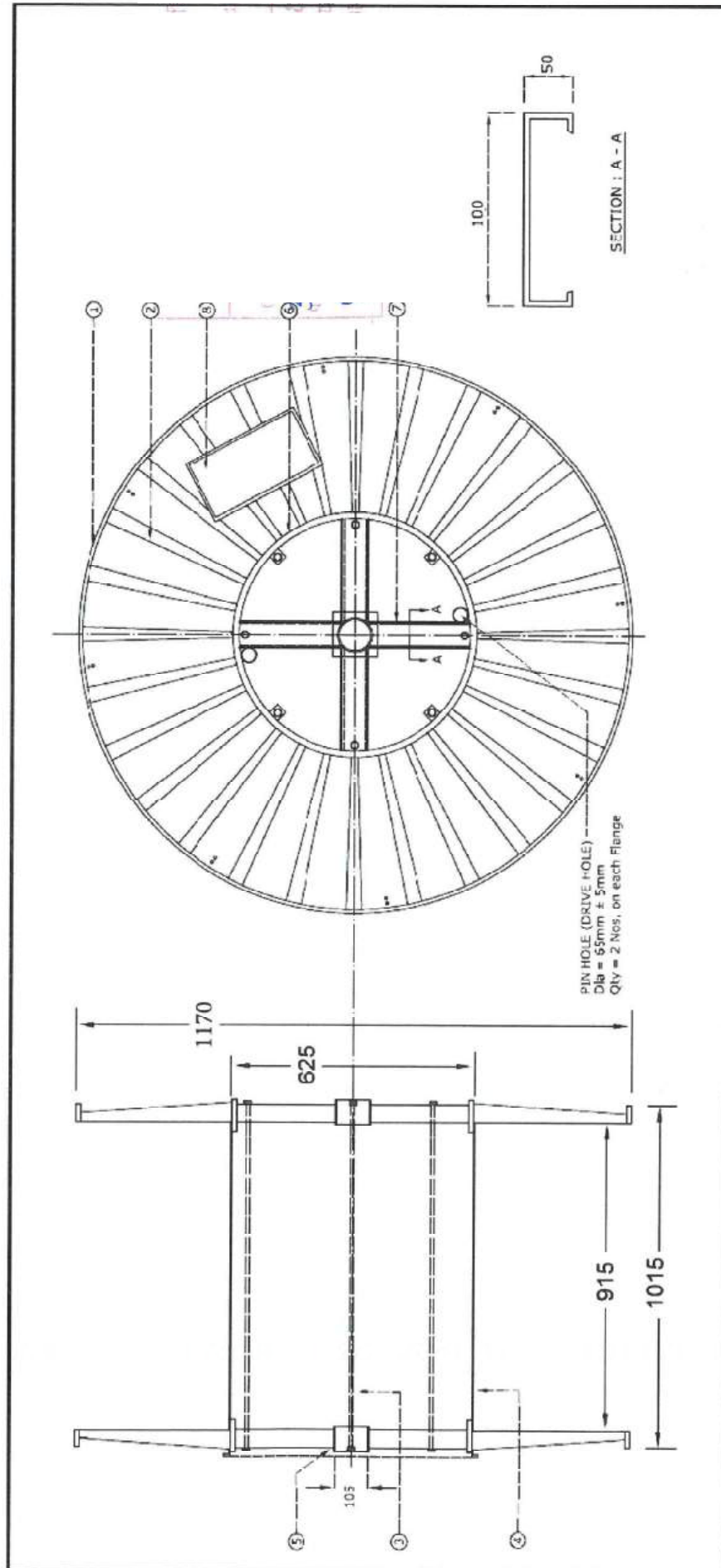
Thanking you and assuring you of our best attention at all times,
Yours faithfully,

For APAR Industries Limited

S K Agarwal

Vice President (Marketing)

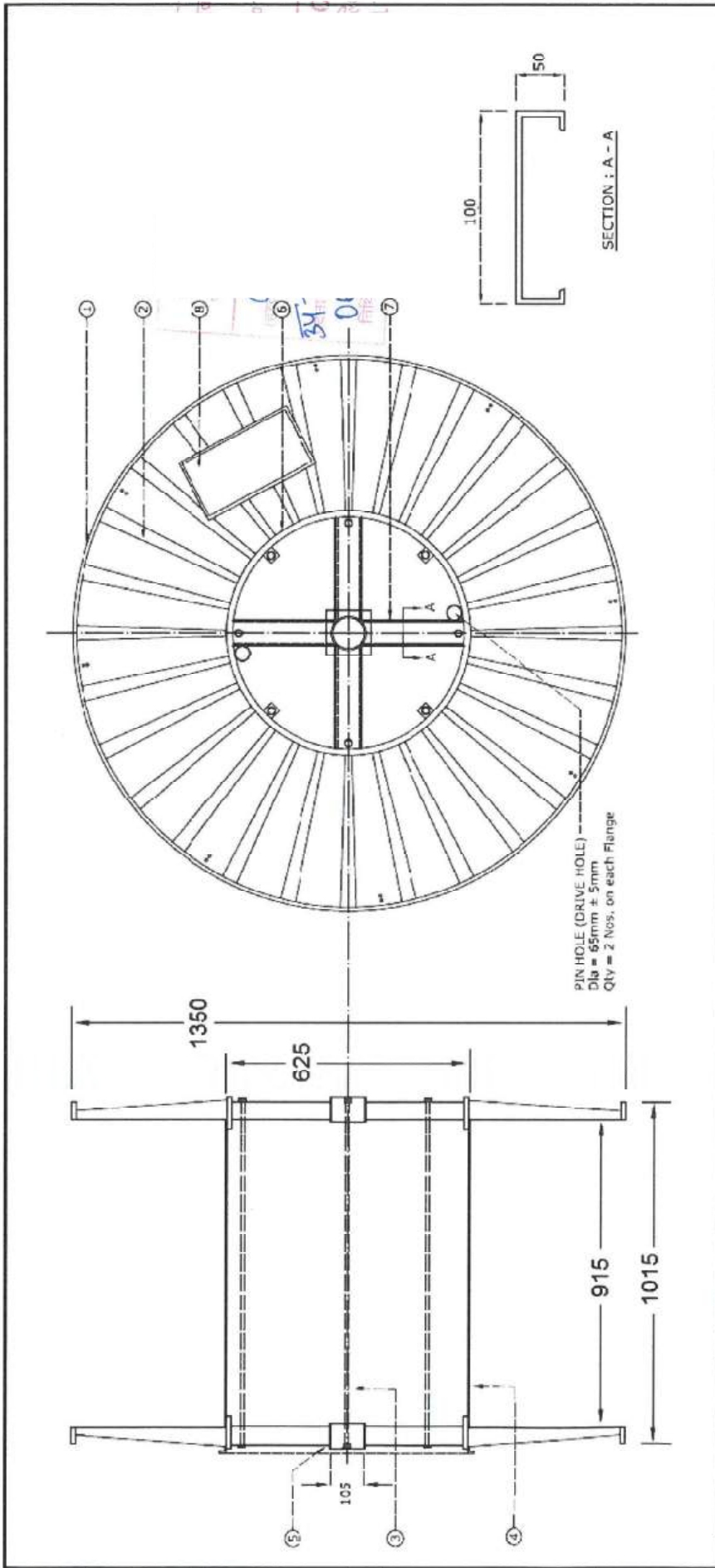
Encl: 1) Price Schedule – Annexure `A' 2) General terms & conditions



1 OUTER RING		50 X 6 mm	
2	CORRUGATION SHEET	1.20 mm (THICK)	
3	TIE ROD	12mm & 8 Nos.	
4	BARREL SHEET	1.60 mm (THICK)	
5	CENTRE HOLE	105 mm ID x 115 mm OD.	
6	INNER RING	100mm (W) X 4.00 mm (THICK)	
7	CROSS ARM	100mm x 50mm, 4.00mm (THICK)	
8	FRAME SIZE (FOR MARKING)	200mm x 300mm (APPROX)	
9	PAINT	GREEN COLOR ENAMEL PAINT	
10	Barrel and inner surface of flange shall have water proof protective HDPE sheet.		
11	The drums are Returnable with Polypropylene sheet Covering.		
12	Flanges shall have non corrosive primer coat and enamel paint of Green colour.		
13	The outer layer of the OPGW Cable shall be covered with Min. 5mm Thick Polypropylene sheet to protect the cable from damages during transit.		

RETURNABLE STEEL DRUM		POWERGRID CORPORATION OF INDIA LIMITED	
CUSTOMER	NOA NO.		
ITEM / CODE NAME	OPGW CABLE - 12.00mm / 48F11ASA(92.940)		
OPGW DETAILS	Specification	IEC 61232, IEEE 1138 & ITU G652	
	Standard length	3000 mbs ± 5%	
	Net Weight	1335 Kg (APPROX)	
	Gross weight	1505 Kgs (Approx)	
APAR INDUSTRIES LTD. INDIA		Issue No. : 01	
		Issue Date : 06.09.2019	
		Rev. No. 00	
		Rev. Date : 00	
SCALE : N.T.S	DRG. NO. :- AILS.LCS.14GE.48OPGW/02		

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1 OUTER RING		50 X 6 mm	<p align="center">RETURNABLE STEEL DRUM</p> <p>Note -</p> <p>a) All dimensions are in mm</p> <p>b) All mild steel shall conform to IS-2062</p> <p>c) Washers are required on all bolts</p> <p>d) Tolerance on dimension of drum parts other than the thickness of sheets shall be ± 3%.</p>	CUSTOMER	POWERGRID CORPORATION OF INDIA LIMITED		
2 CORRUGATION SHEET		1.20 mm (THICK) 12mm & 8 Nos.		NOA NO.			
3 TIE ROD		1.60 mm (THICK)		ITEM / CODE NAME	OPGW CABLE - 12.00mm / 48F11AS[92,9,40]		
4 BARREL SHEET		105 mm ID x 115 mm OD.		CPGW DETAILS	Specification	IEC 61232, IEEE 1138 & ITU G652	
5 CENTRE HOLE		100mm (W) X 4.00 mm (THICK)			Standard length	5000 mtrs ± 5%	
6 INNER RING		100mm x 50mm, 4.00mm (THICK)			Net Weight	2225 Kg (APPROX)	
7 CROSS ARM		200mm x 300mm (APPROX)			Gross weight	2450 Kgs (Approx)	
8 FRAME SIZE (FOR MARKING)		GREEN COLOR ENAMEL PAINT					
9 PAINT		Barrel and inner surface of flange shall have water proof protective HDPE sheet.		Issue No. : 01	APAR INDUSTRIES LTD.		
10 Barrel and inner surface of flange shall have water proof protective HDPE sheet.		The drums are Returnable with Polypropylene sheet Covering.		Issue Date : 06.09.2019	INDIA		
11 The drums are Returnable with Polypropylene sheet Covering.		Flanges shall have non corrosive primer coat and enamel paint of Green colour.		Rev. No. 00			
12 Flanges shall have non corrosive primer coat and enamel paint of Green colour.		The outer layer of the OPGW Cable shall be covered with Min. 5mm Thick Polypropylene sheet to protect the cable from damages during transit.		Rev. Date : 00			
13 The outer layer of the OPGW Cable shall be covered with Min. 5mm Thick Polypropylene sheet to protect the cable from damages during transit.				SCALE : N.T.S	DRG. NO. : AILS : LCS:14GE:48CPGW01		
			Page No. 01 of 01				

GENERAL TERMS & CONDITIONS OF APAR IN CONNECTION TO OUR QUOTED OFFER

Applicability of GST:

We have quoted our prices on the basis of present rate of Taxes & Duties applicable. The Central Government is proposing to revise Tax Structure. The GST may be implemented & other taxes/duties may get revised or restructured during the tenure of execution of the contract. In such event, our quoted Taxes & Duties shall be revised in line with changes made by Govt. The revision or restructuring of Taxes/Duties shall be considered as statutory variation. The changes in taxes & Duties under statutory variation will be charged at actual during the execution of Contract or any extended delivery schedule

Special Note: It is the essence of the contract (which must be mutually signed) under the Indian Contract Act 1933 and its legally valid modifications / amendments particularly under Section 4, 58 etc. that our this offer be accepted in toto without any modification or change, such that we receive in our office which made this offer or accepted by our authorized representative your signed order on valid letterhead on or before 5 pm of the last valid date of our offer.

If for any reason, you, as the buyer, wish to make any change which amounts to a counter offer, kindly note that we as the seller are at complete liberty to accept, reject or make such safety clause, for our protection, reasonably written, mutually acceptable request which should be accepted by the buyer, before expiry of original offer.

All mutually accepted offer and acceptance must be clearly typed in English language only, before expiry of date of validity, under Indian Contract Law with jurisdiction of the Bombay High Court, Bombay, as final.

Bank Guarantee:

Looking to our very long business association in the event of order, we request you to please exempt us from submission of contract Performance Bank Guarantee.

Guarantee:

Guarantee will be 18 months from the date of supply or 12 months from the date of commissioning whichever is earlier.

Quality Assurance System:

We have developed our quality assurance system strictly in line with the ISO 9001-2008 requirements & shall strictly adhere to the same.

Qualification Requirement Data:

We are pleased to furnish herewith our Qualification requirement data towards our eligibility to perform the above contract as detailed hereunder:

We, APAR Industries Limited is Asia's largest manufacturers of over head transmission and distribution power line bare conductors viz. ACSR, AAC, AAC, AACSR, ACAR, ACSR/AS and are in this line for more than 5 decades. We are having two well equipped manufacturing units situated at Silvassa (U.T.) christened as Rakholi & Athola. Our cumulative production capacity is more than 1,25,000 MT per annum.

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APAR INDUSTRIES LIMITED, BARODA.

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We are supplying to Power Grid Corporation of India, NTPC, All state Electricity Boards and turnkey contractors. We are also exporting our conductors to all over the world directly and through world renowned turnkey contractors, all over the world.

We confirm that we have sound design infrastructure and manufacturing facilities, capacity and procedures including quality control.

We are an ISO 9001-2008, ISO 14001:2004 & OHSAS: 18001: 2007 Company, issued by Underwriters Laboratories Inc., USA. We are also having Export House Registration under 3 Star Category issued by Ministry of Commerce, Government of India.

Financial capabilities:

We are financially a sound company and enjoying very high credibility all over the world with suppliers of Aluminium and steel wire and have large banking facilities of L/C for procurement of raw material.

**IN THE EVENT OF PLACEMENT OF ORDER ON US AGAINST THIS OFFER/PROJECT
FOLLOWING POINTS MUST BE INCLUDED IN THE PURCHASE ORDER****Force Majeure:**

If performance of any obligation under the P.O (other than an obligation of the Purchaser to make payment) is prevented, restricted or delayed by any act of God, act or omission of government, war, hostilities, industrial dispute (including go-slow and work to rule actions) at either party's premises or elsewhere, failure or delay in source of supply of materials or equipment, fire, explosion, accident or breakdown of essential machinery or equipment or caused by the delay of a sub supplier (such delay not being the fault of the supplier) or by any cause (whether similar or not to any of the above events) beyond the reasonable control of the party whose performance is affected, then that party shall be excused from and shall not be liable for failure in performance to the extent of that prevention, restriction or delay. The party wishing to claim relief by reason of any of the said circumstances shall notify the other party in writing without delay on the intervention and on the cessation thereof.

Change In the facilities:

In case of any changes in the place of delivery on account of purchaser's action, Duties & Taxes shall be charged as per the prevailing in the state /territory and the same should be payable by purchaser along with differential freight & other expenses.

Limited Liability:

1. Notwithstanding anything contained in this Agreement and/or any of its parts, portions, allied Purchase Orders and Agreements it is agreed between the parties hereto that the aggregate cumulative liability of the Supplier under this Purchase Order (regardless of if the claim is based upon tort, negligence or strict liability) resulting in any way from the performance or non performance, at any and all times, for on any and all indemnities, liabilities, loss, damages, expenses, claims, direct damages, risk purchase etc., shall at any time not in aggregate exceed

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APAR INDUSTRIES LIMITED, BARODA.**3**

the 100% of the of the total value of the payment / price actually received by the Supplier under this Purchaser Order.

2. The limitations of liability set forth in this Contract shall also apply for the benefit of Supplier's subcontractors, sub-suppliers, agents, advisors, directors and employees.

Consequential Damages:

Neither the Supplier nor the Purchaser shall be liable to the other by way of indemnity or by reason of any breach of contract or of statute, tort (including negligence in whatever form) or any other legal theory for any loss of profit, loss of use, loss of production (including loss of hydrocarbons), loss of contracts, loss of revenue or of anticipated savings, any increase in operating costs, loss of information and data or for any financial or economic loss or for any indirect or consequential damage whatsoever that may be suffered by the other.

Deemed Acceptance:

Supplier is ready with the delivery and If the Purchaser does not take delivery of the Equipment / Goods or denies dispatch upon notification from Supplier, the Supplier shall be entitled on behalf of the Purchaser to put such Equipment / Goods into storage at the Purchaser's expense.

The Supplier shall be deemed to have delivered such Equipment / Goods to the Purchaser on storage and shall be entitled to payment on presentation of the warehouse receipt in place of lorry receipt or similar document otherwise required under this Purchase Order. Risk shall pass to the Purchaser on storage.

Termination Clause:

If termination will take place due to reasons not attributable to the Supplier then the purchase will be liable to pay to the supplier for the quantity dispatched within the agreed time limit.

- Delivery schedule finalized at the time of placement of order will be binding on both the Customer and Apar. Any change in the delivery schedule requested by the customer, Apar will revert on whether it is agreeable and what would the cost be on account of the change in delivery schedule. If the customer is agreeable to paying the extra cost, then only the delivery schedule would change, otherwise the original delivery schedule would be binding.
- In the event of order and once delivery schedule is finalized, apar will manufacture material strictly to meet the agreed delivery schedule. If due to any reason, whatsoever the nature, purchaser fails to lift the material within 15 days from the date of readiness of the materials, the Customer will be liable to pay interest @SBI Base Rate + 2% and this has to be paid by the Customer to Apar on a monthly basis against the invoice submitted by Apar.
- In the event of order, all the payment shall be made strictly on due date. Any delay in releasing payment on due date, an interest rate @SBI Based Rate + 2% will be charged extra.

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APAR INDUSTRIES LIMITED, BARODA.

- Once the FOB/Ex-works prices are fixed up with mutual consent and if the contract is terminated due to breach of meeting contractual obligation by the Customer, the marked to market value on account of the difference in Aluminium prices between the date of fixing the price and the date of termination of contract is to the customer's account - e.g. if the prices are fixed up on 15th Jan 12 with LME \$2220 per MT for supply of conductor during the month of May, and if there is a breach by customer to meet contractual obligation, APAR will terminate the contract on 15th March 12, the Aluminium price at LME at that time @2100 per MT, customer has to pay to APAR USD100 per MT on Aluminium content of total quantity of aluminium involved.
- In case of a contract with a Price Variation formula which is linked to a base index and the price relevant as per the agreed delivery schedule, the finished product FOB / EX-works prices would get firmed up as per the PV formula. If the contract is terminated due to breach of meeting contractual obligation by the Customer, the marked to market value on account of the difference in aluminium prices between the date of fixing the price and the date of termination of contract is to the Customer's account – e.g. if the contract is placed on 15th January 12 with aluminium base price \$2100 per MT, the prices are variable with average price of Aluminium prevailing during 3rd month from the date of B/L i.e. if shipment during April the average price of Aluminium for the month January will be taken into consideration for PV. If the delivery schedule of conductor is during April 2012, for working out the price of shipment, average price of Aluminium at LME prevailing in January –say \$2100 – has to be taken into consideration. If the contract is cancelled due to breach by customer to meet contractual obligation and the contract is terminated by Apar during March 2012 then the price difference of average price of January 12 and price prevailing on date of termination (say \$2000) will be \$100 and shall be to customer's account, which customer has to compensate to APAR within 7 days of such termination of contract.
- Please note that the CIF / Delivered prices offered by us are on variable basis and applicable cost for shipment will be worked out based on rates prevailing as on 30 days prior to the date on which material is offered for inspection.

In the event of order against our this quote, in order to avoid any kind of discrepancies which will be resulting into amendment to PO at later date, we would like you to provide us draft of the PO first for our checking. Order may release after the draft is approved by us.

We do hope, you will find our offer quite competitive and exactly in line with your requirement. However, if you require any further information/details, please do inform, which will be provided immediately.

Thanking you and assuring you of our best attention at all times,

Yours faithfully,
For APAR Industries Limited

Ashwin Shah
Sr. Vice President (Marketing)



APAR INDUSTRIES LIMITED

02

18.07.2019



TECHNICAL SPECIFICATION

Rev	Date	Description

DIVERSIFIED GLOBAL PRESENCE IN
OVER 100 COUNTRIES



Prepared By : Dnyaneshwar
Checked By : P.Agnihotri
Issued By : S.K.Jana

DRS Form 1(a)

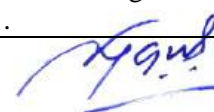
**DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE**

OPTICAL GROUND WIRE (OPGW) – 48 Fibre:

Manufacturer : APAR INDUSTRIES LIMITED

Part # : 48F11AS[92.9,40]

CABLE CONSTRUCTION			
Seq	Parameter:	As per Technical Specification	As per Bidder Offering
1.	No. of Fibres Dual Window Single-Mode:	24 / 48	48
2.	Buffer Type:	Loose Tube	Loose Tube
3.	Buffer Tube material	As applicable	PBT (Polybutylene Terephthalate)
4.	No. of Buffer Tubes	As applicable	4
5.	No. of Fibers per buffer Tube	As applicable	12
6.	Expected Cable Life	25 Year	25 Years
7. Parameters of OPGW			
(i)	UTS	Kgf	9470 Kgf (92.90 KN)
(ii)	Effective area	mm ²	58.40
(iii)	Weight	Kg/m	445
(iv)	Diameter	mm	12.00
(v)	Modulus of elasticity	Kg/mm ²	14275
(vi)	Coeff. Of linear expansion	/°C	13.8 x 10 ⁻⁶
(vii)	Central tube design	Al. or Steel	Central Optical unit consists of an Aluminium tube housing the multiple buffered optical fiber units containing the fibers .



DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Manufacturer: APAR INDUSTRIES LIMITED

CABLE CONSTRUCTION			
Seq	Parameter:	Unit:	Particulars:
1	Fibre Manufacturer Dual Window Single-Mode:		Sterlite Technologies Ltd. Fibre Type : DWSM G.652D
2	No. of Fibres Dual Window Single-Mode:	each	48
3	Buffer Type:		Loose tube
4	Buffer Tube Diameter:	mm	1.95 ± 0.10
5	Buffer Tube material		PBT (PolyButylene Terephthalate)
6	No. of Buffer Tubes:	each	04
7	No. of Fibers per Tube:	each	12
8	Identification/numbering of individual tubes:		Different Color / 4 Tube (Blue, Orange, Green, Brown)
9	No. of empty tubes (If any):	each	N/A
10	Filling material:		Fibre Jelly (Non-hygroscopic, Non-conductive)
11	Filling material compliant with technical specifications?	Yes/No	Yes
12	Strength member(s):		FRP and ACS Wires
13	Binding yarn/ tape:		Thermal Barrier
14	<u>Describe Central Core Design:</u>		Central optical unit consists of an aluminium tube housing the multiple buffered optical fibre units containing the fibres. The central optical unit and the outer stranded metallic conductor protect the fibres from Mechanical, Electrical and Environmental effects.



DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Seq	Parameter:	Unit:	Particulars:
15.	Aluminium Clad steel wire Diameter: Number:	mm each	2.60 11
14.	Aluminium alloy wires Diameter: Number:	mm each	N/A N/A
15.	Aluminium tube inner diameter:	mm	5.20 ± 0.10
16.	Aluminium tube outside diameter:	mm	6.80 ± 0.10
17.	Cable Diameter: (nominal ± deviation)	mm	12.00 ± 0.20
20.	Cable cross-section area (Nominal):	mm ²	73.48
21.	Cable cross-section area (Effective):	mm ²	58.40
22.	Fully Compliant with IEEE 1138:	Yes/No	Yes

Mechanical Properties of Cable

23.	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	92.9 (Minimum)
24.	Fibre strain margin:	%	47 % of Cable UTS
25.	Zero fibre strain up to load	kN	43.66
26.	Weight:	kg/km	445 ± 3%
18.	Crush strength:	kg/mm	231.4 Kg/100mm ²
19.	Equivalent Modulus of elasticity:	KN/mm ²	140
29.	Minimum Bending Radius without microbending:	mm	360
30.	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm mm	360 480



DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Seq	Parameter:	Unit:	Particulars:
31.	Tensile proof test (Screening) level:	KN/mm ²	1.113
32.	Maximum permissible tensile stress:	KN/mm ²	0.636
33.	Permissible CTS. tensile stress:	KN/mm ²	0.318
34.	Maximum sag at maximum temperature and design span with no wind:	mm	As per the Final Sag and Tension chart
35.	Everyday tension at 32°C, no wind:	% of UTS	As per the Final Sag and Tension chart (Max 20% of UTS)
36.	Maximum tension at Every day condition with full wind pressure	Kg	As per the Final Sag and Tension chart

Thermal Properties of Cable

37.	Coefficient of linear expansion:	per °C	13.8 X 10 ⁻⁶
38.	Coefficient of expansion Cladding: Core:	per °C per °C	23 X 10 ⁻⁶ 11.5 X 10 ⁻⁶
39.	Nominal operating temperature range:	°C	-40°C to +80°C
40.	SC current transient peak temperature:	°C	200
41.	Maximum allowable temperature for lightning strike:	°C	210
42.	DC Resistance of OPGW cable at 20°C	Ω/Km	0.824
43.	Short Circuit Current	KA	≥ 6.32 KA for 1 Second (40 KA ² s)

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DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

CABLE SPOOL and DRUM			
Seq	Parameter:	Unit:	Particulars:
44.	Available length per spool Maximum: Nominal:	m m	5250, 3150 5000, 3000 (Standard length and tolerance of cable per reel shall be : 1) 5000m \pm 5% 2) 3000m \pm 5% However Customized lengths as per the requirement can also be provided)
45.	Size of drum:	m	(Flange * Barrel * Traverse) 5000m drum : 1.550*0.850*0.915 1.350*0.625*0.915 3000m drum : 1.170*0.625*0.915
46.	Weight of empty drum:	kg	5000m drum : 200 Kg (Approx) 3000m drum : 150 Kg (approx.)
47.	Weight of drum with cable: spooled	kg	5000m drum : 2450 (Approx) 3000m drum : 1505 (Approx)
48.	Will drum length scheduling be practiced to match transmission line span lengths?	Yes/No	N.A

49. Describe Drum materials:

Returnable Steel Drum covered with Polypropylene Sheet for main & Spare quantity supply.

50. Describe cable end capping and protection against abrasion etc.:

Both ends of OPGW cable shall be securely fastened to drum and sealed with a shrinkable End Cap.



DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

INSTALLATION			
Seq	Parameter:	Unit:	Particulars:
51.	Splice Loss:		
	Maximum:	dB	0.10
	Average:	dB	0.05
52.	Operating Temperature Range:	°C	-40°C to +80°C
53.	Rated Isoceraunic No.		50
54.	Expected Cable Life:	Years	25
55.	Installation rate per team:	km/day	Matching with the line and stringing Schedule.
56.	No. of persons per team:	no.	
57.	Max. possible span for specified operating conditions:	M	As per Sag Tension Chart
58.	Midspan sag at 0°C with no wind loading:	Mm	
59.	Midspan sag at max temp. with no wind loading:	Mm	
60.	Midspan sag at max temp. and wind loading:	Mm	
61.	Cable swing angles: Worst Case: Everyday:		<u>N/A</u>
62.	<u>Describe Installation method(s):</u>		OPGW is suitable for live line installation or normal installation



DRS Form 2

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE
DUAL-WINDOW SINGLE MODE (DW-SM)

OPTICAL PARAMETERS			
Seq	Parameter:	Unit:	Particulars:
1.	Fibre manufacturer(s)/Type:		Sterlite Technologies Ltd. Fibre Type : DWSM G.652D
2.	Fibre production method:		Activated Chemical Vapour Deposition (ACVD)
3.	Attenuation Coefficient@ 1310 nm: @ 1550 nm:	dB/km dB/km	≤ 0.35 ≤ 0.21
4.	Attenuation Variation with Wavelength (± 25 nm):	dB/km	≤ 0.05
5.	Attenuation at water peak @ 1383 nm	dB/km	≤ 0.34
6.	Point discontinuity @ 1310nm: @ 1550nm:	dB dB	≤ 0.10 ≤ 0.10
7.	Temperature dependence (induced attenuation):	dB	≤ 0.05 (-60°C to +85°C)
8.	Nominal Mode Field Diameter @ 1310 nm: @ 1550 nm:	μm	9.1 10.3
9.	Mode Field Diameter Deviation @ 1310 nm: @ 1550 nm:	μm	± 0.4 ± 0.5
10.	Mode field non-circularity:	%	≤ 6.0
11.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	Ps/nm.km	≤ 3.5 ≤ 5.3 ≤ 18
12.	Zero dispersion wavelength:	nm	1300 ~ 1324
13.	Zero dispersion Slope:	ps/nm ² .km	≤ 0.090
14.	Cutoff wavelength:	nm	≤ 1260
15.	Refractive Index :		1.4670 @1310 nm & 1.4675 @1550 nm
16.	Refractive Index profile:		Step Index
17.	Cladding Design:		Matched
18.	Numerical aperture:		0.13 typical



DRS Form 2 (Continued)

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE
DUAL-WINDOW SINGLE MODE (DW-SM)

PHYSICAL and MECHANICAL PROPERTIES			
Seq	Parameter:	Unit:	Particulars:
19.	Bend Performance: (37.5 mm radius, 100 turns) @ 1310 nm (37.5 mm radius, 100 turn) @ 1550 nm (16mm radius, 1 turn) @ 1550nm	dB dB dB	Attenuation Rise \leq 0.05 per Km Attenuation Rise \leq 0.05 per Km Attenuation Rise \leq 0.50 per km
20.	Core Diameter (nominal \pm deviation) :	μm	8.50 ± 1.0
20.	Core non-circularity:	%	≤ 6.0
21.	Cladding Diameter (nominal \pm deviation):	μm	125 ± 0.7
22.	Core- Clad / Mode field concentricity Error	μm	≤ 0.5
23.	Cladding non circularity:	%	≤ 0.8
24.	Fibre cut-off wavelength	nm	≤ 1320
25.	Protective Coating type & material Primary: Secondary:		UV-cured Acrylate. UV-cured Acrylate.
26.	Protective Coating Diameter (nominal \pm deviation):	μm	245 ± 10
27.	Protective Coating removal method:		Stripping method
29.	Coating Concentricity	μm	Coating cladding error < 12
30.	Polarisation mode dispersion coefficient	ps/km ^{1/2}	≤ 0.2
31.	Proof test level	GPa	≥ 0.69
28.	Colour coding scheme compliant with EIA/TIA 598 or IEC 60304 or Bellcore GR-20.	Yes/No	Bellcore GR-20
29.	Colouring material compliant with technical specs?	Yes/No	Yes
34.	Minimum Guaranteed design life span of optical fibres	Year	25

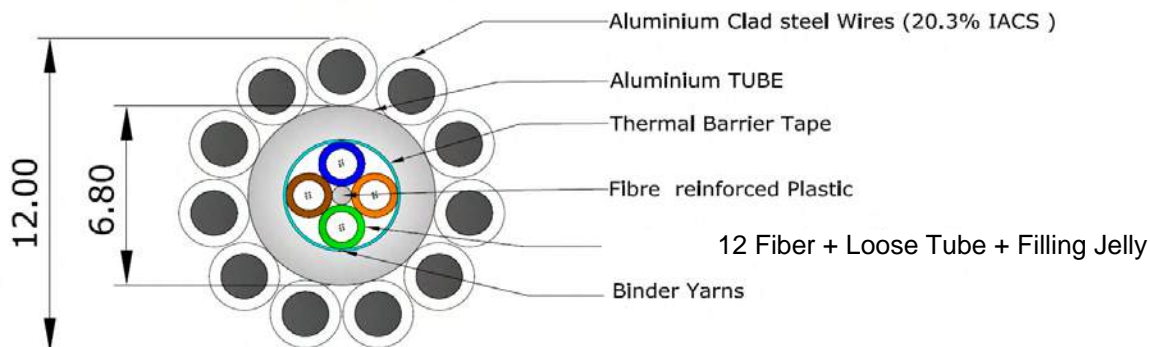




APAR INDUSTRIES LIMITED

A) Additional Details of OPGW Cable

Cross Sectional Drawing:



48F11AS[92.9,40]		Named	No.	Diameter
Structure Details	Center	Aluminum Tube	1	6.8 mm \pm 0.10 mm
		Inner Diameter	1	5.2 mm \pm 0.10 mm
	Layer 1	20%AS wire	11	2.60 mm \pm 0.04mm
Technical Data	According to IEEE std 1138, IEC 60794-4 standards			
	Stranding direction of outer layer is "Left-hand"			
	Fiber No. & Type		48 G.652D	
	Standard Diameter		12.00 mm	
	Supporting Cross Section			
	Section of AS wire		58.40 mm ²	
	Section of Aluminium Tube		15.08 mm ²	
	Approximate mass		445 Kg/Km	
	Rated Tensile Strength		\geq 92.90 KN	
	Modulus of Elasticity		140 KN/mm ²	
	Thermal Coefficient of Linear Expansion		13.8 $\times 10^{-6}/^{\circ}\text{C}$	
	Calculated D.C. Resistance at 20°C		\leq 0.824 Ω/km	
	Short-Circuit Current (1 sec, 20~200°C)		\geq 6.32 KA	
Short-Circuit Current Capacity (20~200°C)		\geq 40 kA ² ·s		
Minimum Bending Radius		360 mm		
Individual Al.Clad Steel Strands of Cable (After Stranding)	Wire Diameter		2.60 mm	
	Tensile Strength (min)		1590 N/mm ²	
	Elongation At fracture in 250 G.L. (min)		1.50 %	
	Torsion (100xd) (min)		20 Twists	
	Thickness of Aluminum Cladding (min)		0.130 mm	
	Conductivity at 20°C (min)		20.3 % (IACS)	
	Temperature coefficient of resistance		0.0036 /°C	
Temperature Range :	Installation		-15°C ~ +50 °C	
	Transportation and Operation		-40°C ~ +80 °C	

Remarks : 1) All Sizes and Values are Nominal Values
2) Tolerance on diameter, area and weight is $\pm 1.5\%*D$, $\pm 3\%*A$ and $\pm 3\%*W$



APAR INDUSTRIES LIMITED

B) Reference Standards

The standard specifications according to which the OPGW cable shall be manufactured and tested are:

- ❖ IEC 60793-1 : Optical fiber Part 1: Generic specifications
- ❖ IEC 60793-2 : Optical fiber Part 2: Product specifications
- ❖ ITU-T G.652 : Characteristics of a single-mode optical fiber cable
- ❖ ITU-T G.655 : Characteristics of a non-zero dispersion-shifted single-mode optical fiber and cable
- ❖ EIA/TIA 598 B : Color code of fiber optic cable.
- ❖ IEC 60794-4 : Sectional specification – Aerial optical cables along electrical power lines
- ❖ IEC 60794-4-10 : Aerial optical cables along electrical power lines –Family specification for OPGW
- ❖ IEC 60794-1-2 : Optical fiber cables-Part 1-2: Generic specification-Basic optical cable test Procedure.
- ❖ IEEE 1138-2009 : IEEE Standard for testing and performance for optical ground wire(OPGW) for use on electric utility power lines
- ❖ IEC 61395 : Overhead Electrical Conductors – Creep test procedures for stranded conductors.
- ❖ IEC 61232 : Aluminum –clad steel wire for electrical purposes
- ❖ IEC 61089 : Round wire concentric lay overhead electrical stranded conductors

For Apar Industries Ltd, India

(S.K.Jana)
Sr.GM-QA & Tech



400 KV NEW KOYNA Substation, MSETCL, TPPA Protection Audit (MP-D) 28.08.2024 to 01.09.2024

The protection audit is carried out at 400 KV New Koyna Substation, MSETCL on dated 28.08.2024 to 01.09.2024 by Madhya Pradesh team, MP-D. The following members were present during protection audit.

From Audit team MP-D

1. Mr. Archit Srivastava
Executive Engineer, MPPTCL,

2. Mr. Manish Thakur
Assistant Manager, NHDC

3. Mr. Romin Shukla
Assistant Engineer, MPPGCL

From Auditee Team

1. Mr. Sandeep Sopan Patil
Addl. Executive Engineer, MSETCL

2. Mr. Om Shankar Choudhary
Dy. Executive Engineer, MSETCL

3. Mr. Manoranjan Kumar
Dy. Executive Engineer, MSETCL

During visit following points observed:

1. Total 08 No. 400 KV Feeders namely ; 400 KV New Koyna – Stage 4 I and II, 400 KV New Koyna – Karad I and II, 400 KV New Koyna – Dabhol I and II and 400 KV Jaigad I and II.
2. Total 03 No. ICT namely, 105 X 3 MVA ICT-1, 105 X 3 MVA ICT-2, and 105 X 3 MVA ICT-3 of 400 KV/220 KV/ 33 KV along with spare 01 No. ICT of 105 MVA are installed.
3. Total 04 No. of 220 KV Feeders namely 220 KV New Koyna – Pophli, 220 KV New Koyna – Pedambhe, 220 KV New Koyna – Niwali and 220 KV New Koyna – Lote are present.
4. 02 No. Transformers of 25 MVA 220 KV / 33 KV are installed.
5. Manufacturer recommendation is to be ascertained regarding the values of the resistive reach (Arc resistance and Tower footing resistance) for detecting high resistive fault as to avoid over reaching in all the feeders.
6. Only PLCC is used as a carrier protection in 400 KV New Koyna – Dabhol I and II and 400 KV Jaigad I and II feeders. For enhanced protection OPGW/ FOTE DTPC may be installed.
7. Changeover selector switch from Line CVT to Bus CVT -1 to Bus CVT -2 selection may be provided in every feeder panel for reliable system.
8. C&R Panel of all the feeders and ICT –I & II are old and all the auxiliary relays including LBB relay are static type. They may be replaced by new C&R Panel along with numerical relays for getting DR.

Archit Srivastava
01/09/2024

Manish Thakur
01/09/24

Romin Shukla
01/09/2024

Sandeep Sopan Patil
1/9

Om Shankar Choudhary
01/09/24
Manoranjan Kumar
1/9/24

9. As per Ram Krishna committee, Zone 4 timings delay for all the feeders can be set according to the Zone 2 time setting guidelines.
10. LBB retrip feature is not provided in all the 400 KV feeders, 220 KV feeders and ICT 1 and 2.
11. Except 400 KV New Koyna – Jaigad II feeder, Main 2 relay of all the 400 KV feeders, 400 KV Bus Bar Panel and 220 KV Bus Bar Panel are not GPS synchronized.
12. In the entire 400 KV feeders CT core for LBB relay is used in series with Main 1 relay. Separate CT core may be used for Main 1 protection.
13. Auto reclose is not enabled in 400 KV New Koyna – Stage 4 I and II feeder.
14. In all the feeders, for static overvoltage relays DR facility is not available.
15. DR initiation from Master trip relay must be provided in all the Relay Panels.
16. Slope setting and Over flux setting for all the ICTs and Transformers must be reviewed.
17. In 400 KV Jaigad I and II feeder bay earth pit resistance is found on higher side. It must be attended.
18. Most of LA surge counter is not found working. It may be rectified.
19. All the 400 KV Circuit Breakers except 400 KV Jaigad I and II feeders & ICT III are very old and hydraulic type. It may be replaced.
20. Line Differential Relay may be installed in 400 KV New Koyna Stage 4 I and II feeders.
21. Oil level is observed low in Spare ICT. Oil Topping may be done.
22. Leakage from inspection window is observed in spare ICT.
23. Silica Gel in all the ICTs must be replaced.
24. Online DGA of ICT III is not working.
25. In all the 220 Feeders except only Main 1 is provided. Main 2 DPR relay may be installed.
26. Most of 220 KV feeders and transformers C&R Panel is 1998 manufactured with old conventional wiring scheme including static LBB relays with no DR and re-trip feature. It may be replaced.
27. Repeated trippings on Backup protection of 220 KV New Koyna - Pedambhe is observed. It must be reviewed for Main Protection operation.
28. Line Differential Relay may be installed in all the 220 KV feeders except 220 KV New Koyna – Niwali feeders.

AM
01/05/2024

AM
01/04/24

AM
01/09/2024

AM
1/9

AM
01/05/24
Manoj Kumar
11/9/24

29. Load trimming scheme is not provided in 25 MVA Transformer I and II.
30. DR is not configured with Master trip relay in all the most of feeders.
31. 220 KV Bus – Bar is static type and very old. DR is not available. It may be replaced.
32. Pickup setting for Bus – Bar protection needs to be reviewed.
33. All the Battery Chargers are very old 1996-97 mfg. It may be replaced.
34. Fire fighting equipments are out of date and needs to be refilled.
35. DC Leakage monitoring system in control room may be installed.
36. Synchronizing trolley is very old. It may be replaced.

From Audit team MP-D

- 01/09/2024
1. Mr. Archit Srivastava
Executive Engineer, MPPTCL,

01/09/24

 2. Mr. Manish Thakur
Assistant Manager, NHDC

01/09/2024

 - 3 Mr Romin Shukla
Assistant Engineer, MPPGCL

From Auditee Team

- 01/09/24
1. Mr. Sandeep Sopan Patil
Addl. Executive Engineer, MSETCL

Om Shankar

 2. Mr. Om Shankar Choudhary
Dy. Executive Engineer, MSETCL

Manoranjan K

 3. Mr. Manoranjan Kumar
Dy. Executive Engineer, MSETCL

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उपक्रम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)



कार्यालय: सौदमिनी प्लॉट नं.2 सेक्टर 29 गुडगाँव 122001 हरियाणा

टेलीफोन: 0124-2571700,2274 फैक्स : 0124.2571981

Office: "SAUDAMINI", Plot No.2, Sector-29, Gurgaon -122001 Haryana
Tel.:0124-2571700, (Extn)2274, Fax 0124-2571981

CIN - L40101DL1989GOI038121, Web site :- www.powergridindia.com

संदर्भ: सी-एल.डी.सी-उ.क्षे.-पैकेज(बी)-रिलायबल-अपार-टेक- 42

दिनांक: 06.09.2019

To

M/s. APAR Industries Ltd. (APAR),
301, Panorama Complex, R.C. Dutt Road,
Alkapuri, Vadodara-390007, Gujarat, India.

ध्यानार्थ: Mr. S. K. Agarwal, Asst. Vice President (Marketing)

विषय: Package-B: Communication System for Central Sector under Northern Region- II (Reliable Scheme) Under Reliable Communication Scheme under Central Sector for Northern Region.

NOA Supply: CC-CS/827-NR2/OPGW-3737/3/G5NOA-I/8806 dated 03.01.2019

NOA Service: CC-CS/827-NR2/OPGW-3738/3/G5/NOA-II/8807 dated 03.01.2019

Effective date of Completion: 22 Months from NOA i.e. 02.11.2020

पत्र संदर्भ: AIL/PGCIL/NR2/2018-19/Sep/109 dated 06.09.2019

निम्नलिखित दस्तावेजों की स्वीकृति हेतु:

- DRS & Technical Brochure of 48F APAR make 12mm OPGW (UTS:92.9kN)

महोदय,

कृपया अपने पत्र का अवलोकन करें जिसके द्वारा आपने डिजाइन/दस्तावेज एवं ड्राइंग अनुमोदन हेतु प्रस्तुत किया है। संलग्न पत्रक में सूचीबद्ध डिजाइनों/दस्तावेज एवं ड्राइंग पर हमारी टिप्पणियाँ / अनुमोदन को सूचित किया गया है। प्रत्येक डिजाइन/दस्तावेज एवं ड्राइंग के अनुमोदन/ टिप्पणी कोड हेतु कृपया अभ्युक्ति / टिप्पणी (Remark) एवं अनुमोदन श्रेणी कॉलम में दर्शाई गयी श्रेणी का अवलोकन करें।

Please refer to your letter vide which you had submitted Design/DRS documents and drawings for review and approval. We are here in conveying comments/approval / Comment code of each drawing/document/design. Please refer the category indicated in remarks/category column of the annexure sheet.

कृपया ध्यान रखें कि डिजाइन/दस्तावेज एवं ड्राइंगमें हमारे द्वारा इंगित संशोधन के अलावा किये गये किसी अन्य संशोधन के मामले में उसका पूर्ण औचित्य के साथ विशेष उल्लेख किया जाये और डिजाइन/दस्तावेज एवं ड्राइंग को अनुमोदन हेतु पुनः प्रस्तुत किया जाये।

In case of any modification other than those desired by us are carried out, the same shall be highlighted with full justification thereof and resubmitted for approval.

उपरोक्त संदर्भ मे यह स्पष्ट किया जाता है कि यहाँ सूचित अनुमोदन/ टिप्पणी आपके संविदात्मक दायित्वों और नियमों के आयामों, निर्माण की सामग्रियों, भार, मात्रायों, डिजाइनों के ब्यौरों, एसेम्बली फिटस, कार्यनिष्पादन विवरण की सत्यता और भारतीय सांविधिक कानूनों से आपूर्तियों की अनुरूपता के लिये न तो आपके उत्तरदायित्व से मुक्त करती है और न ही संविदा के अधीन हमारे अधिकार को सीमित करती है ।

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उपक्रम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)



कार्यालय: सौदमिनी प्लॉट नं.2 सेक्टर 29 गुडगाँव 122001 हरियाणा

टेलीफोन: 0124-2571700,2274 फैक्स : 0124.2571981

Office: "SAUDAMINI", Plot No.2, Sector-29, Gurgaon -122001 Haryana

Tel.:0124-2571700, (Extn)2274, Fax 0124-2571981

CIN - L40101DL1989GOI038121, Web site :- www.powergridindia.com

संदर्भ: सी-एल.डी.सी-उ.क्षे.-पैकेज(बी)-रिलायबल-अपार-टेक-42

दिनांक: 06.09.2019

Approval/comments conveyed herein neither relieves the Contractor of his contractual obligations and his responsibilities towards weights, qualities, design details, assembly fits, performance particulars and Conformity of the supplies with the Indian Statutory Laws as may be applicable nor does it limit the purchaser's right under the contract.

सधन्यवाद,

भवदीय,

(एच एस कौशल)

वरिष्ठ महाप्रबंधक (भार प्रेषण एवं संचार)

संलग्नक : अनुलग्न पन्नों के अनुसार ।

प्रति/Copy: मुख्य महाप्रबंधक, एसेट प्रबंधन, उ.क्षे.-2, जम्मू ।

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड

(भारत सरकार का उपक्रम)
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कार्यालय: सौदमिनी प्लॉट नं.2 सेक्टर 29 गुडगाँव 122001 हरियाणा

टेलीफोन: 0124-2571700,2274 फैक्स : 0124.2571981

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Tel.:0124-2571700, (Extn)2274, Fax 0124-2571981

CIN - L40101DL1989GOI038121, Web site :- www.powergridindia.com

Annexure-1 /अनुलग्न -1

संदर्भ: सी-एल.डी.सी-उ.क्षे.-पैकेज(बी)-रिलायबल-अपार-टेक-42

दिनांक: 06.09.2019

क्रमांक	शीर्षक / दस्तावेज संख्या Document Title Reference Number	अनुमोदन श्रेणी Category	टिप्पणी Remarks
1.	DRS of 48F APAR make 12mm OPGW (UTS:92.9kN)	I	अनुमोदित दस्तावेज संलग्नित हैं / Approved documents are enclosed herewith.
2.	Technical Brochure for 48F APAR make 12mm OPGW (UTS:92.9kN)	IV	

श्रेणियां /Categories:

- I. फेब्रिकेशन/निर्माण/टाईप टेस्टिंग हेतु अनुमोदित/जारी।
Approved/released for fabrication/construction.
- II. फेब्रिकेशन/निर्माण/टाईप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिये गये टिप्पणियों एवं संशोधनों को सम्मिलित किया जाए। कृपया रिवाइज्ड दस्तावेज अनुमोदनार्थ हेतु प्रस्तुत करें।
Approved/released for fabrication/construction subject to incorporation of comments and modification as noted. Revised drawing required.
- III. टिप्पणियों को सम्मिलित करने के उपरांत दस्तावेज अनुमोदनार्थ हेतु प्रस्तुत करें।
To be resubmitted for approval after incorporating the comments.
- IV. सूचनार्थ एवं रिकार्ड हेतु।
For information and record.

नोट :इस पत्र के अनुसार दस्तावेज में दिये गये अनुमोदन द्वारा किसी भी मद सब-वेंडर या उसके द्वारा विनिर्मित सामग्री का अनुमोदन सम्मिलित नहीं है। यह अनुमोदन गुणवत्ता आश्वासन एवं निरीक्षण समूह द्वारा प्राप्त करें।

Note: The approval of the drawing conveyed vide this letter does not cover the approval of sub-vendor for make of the items. The approval in this respect is to be obtained from Quality Assurance Group.

संजीत कुमार सिंह

उप प्रबंधक (भार प्रेषण एवं संचार)



APAR INDUSTRIES LTD.

REGD. OFFICE : 301/306, PANORAMA COMPLEX,
R. C. DUTT ROAD, VADODARA - 390007,
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T : (+91) (265) 2323175 / 2323176
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E : apar.baroda@apar.com
url : www.apar.com

REF: AIL/PGCIL/NR2/2018-19/Sep/109

DATE: 06/09/2019

To,
Sr. General Manager (LD&C)
Power Grid Corporation of India Ltd,
Saudamini, Plot No.2, Sector-29,
Gurgaon – 122001, Haryana.

SK Sanjiv
06/09/2019

Kind Attn.: Mr. H.S. Kaushal, Sr. GM (LD&C)

Project: Package – B Communication System for Central Sector under Northern Region – II (Reliable Scheme) Under Reliable Communication Scheme under Central Sector for Northern Region.

Sub: Submission of DRS & Drum Drawing 12.00mm 48F APAR make OGPW for NR II Package B

Ref: Your NOA No. CC-CS/827-NR2/OPGW-3737/3/G5/NOA-I/8806 & NOA II/8807 DT: 03.01.2019

Dear Sir,

With reference to the above subject, NOA No. CC-CS/827-NR2/OPGW-3737/3/G5/NOA-I/8806 & NOA II/8807 DT: 03.01.2019, we hereby submitting DRS & Drum Drawing of 12.00mm 48F APAR make OGPW as attached here with for Package – B Communication System for Central Sector under Northern Region – II (Reliable Scheme) Under Reliable Communication Scheme under Central Sector Northern for your review and approval please.

Thanking you and assuring our best service all time.

Yours Faithfully,

For Apar Industries Limited,



S.K AGARWAL

ASST.VICE PRESIDENT (MKTG.)

Encl.: As above.

CORPORATE OFFICE : APAR HOUSE, CORPORATE PARK, SION TROMBAY ROAD, CHEMBUR, MUMBAI - 400 071 INDIA
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OHSAS : 18001 : 2007 CERTIFICATE REGISTRATION NO. 20000164850H



APAR INDUSTRIES LIMITED

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Revision date : 00

PACKAGE : Package- A, B and C : Communication system for Central Sector under Northern Region-I(Reliable Scheme, Northern Region-II (Reliable Scheme) and Northern Region- III (Reliable Scheme).



TECHNICAL SPECIFICATION (48F OPGW)

Rev	Date	Description



Prepared By : Dnyaneshwar
Checked By : P.Agnihotri
Issued By : S.K.Jana

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DRS Form 1(a)

**DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE**

OPTICAL GROUND WIRE (OPGW) – 48 Fibre:

Manufacturer : APAR INDUSTRIES LIMITED

Part # : 48F11AS[92.9,40]

CABLE CONSTRUCTION

Seq	Parameter:	As per Technical Specification	As per Bidder Offering
1.	No. of Fibres Dual Window Single-Mode:	24 / 48	48 ✓
2.	Buffer Type:	Loose Tube	Loose Tube ✓
3.	Buffer Tube material	As applicable	PBT (Polybutylene Terephthalate) ✓
4.	No. of Buffer Tubes	As applicable	4 ✓
5.	No. of Fibers per buffer Tube	As applicable	12 ✓
6.	Expected Cable Life	25 Year	25 Years ✓
7. Parameters of OPGW			
(i)	UTS	Kgf	9470 Kgf ✓ (92.90 KN) ✓
(ii)	Effective area	mm ²	58.40 ✓
(iii)	Weight	Kg/m	445 ✓
(iv)	Diameter	mm	12.00 ✓
(v)	Modulus of elasticity	Kg/mm ²	14275 ✓
(vi)	Coeff. Of linear expansion	/°C	13.8 x 10 ⁻⁶ ✓
(vii)	Central tube design	Al. or Steel	Central Optical unit consists of an Aluminium tube housing the multiple buffered optical fiber units containing the fibers. ✓





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DATA REQUIREMENTS SHEETS for OVERHEAD FIBRE OPTIC CABLE

OPTICAL GROUND WIRE (OPGW):

Manufacturer: APAR INDUSTRIES LIMITED

Part #: 48F11AS[92.9,40]

CABLE CONSTRUCTION			
Seq	Parameter:	Unit:	Particulars:
1	Fibre Manufacturer Dual Window Single-Mode:		Sterlite Technologies Ltd. ✓ Fibre Type : DWSM G.652D ✓
2	No. of Fibres Dual Window Single-Mode:	each	48 ✓
3	Buffer Type:		Loose tube ✓
4	Buffer Tube Diameter:	mm	1.95 ± 0.10 ✓
5	Buffer Tube material		PBT (PolyButylene Terephthalate) ✓
6	No. of Buffer Tubes:	each	04 ✓
7	No. of Fibers per Tube:	each	12 ✓
8	Identification/numbering of individual tubes:		Different Color / 4 Tube ✓ (Blue, Orange, Green, Brown)
9	No. of empty tubes (If any):	each	N/A ✓
10	Filling material:		Fibre Jelly ✓ (Non-hygroscopic, Non-conductive)
11	Filling material compliant with technical specifications?	Yes/No	Yes ✓
12	Strength member(s):		FRP and ACS Wires ✓
13	Binding yarn/ tape:		Thermal Barrier ✓
14	<u>Describe Central Core Design:</u>		Central optical unit consists of an aluminium tube housing the multiple buffered optical fibre units containing the fibres. The central optical unit and the outer stranded metallic conductor protect the fibres from Mechanical, Electrical and Environmental effects.





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DRS Form 1 (Continued)

**DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE**

OPTICAL GROUND WIRE (OPGW):

Seq	Parameter:	Unit:	Particulars:
15.	Aluminium Clad steel wire Diameter: Number:	mm each	2.60 ✓ 11 ✓
14.	Aluminium alloy wires Diameter: Number:	mm each	N/A N/A
15.	Aluminium tube inner diameter:	mm	5.20 ± 0.10 ✓
16.	Aluminium tube outside diameter:	mm	6.80 ± 0.10 ✓
17.	Cable Diameter: (nominal ± deviation)	mm	12.00 ± 0.20 ✓
20.	Cable cross-section area (Nominal):	mm ²	73.48 ✓
21.	Cable cross-section area (Effective):	mm ²	58.40 ✓
22.	Fully Compliant with IEEE 1138:	Yes/No	Yes ✓

Mechanical Properties of Cable

23.	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	92.9 (Minimum) ✓
24.	Fibre strain margin:	%	47 % of Cable UTS ✓
25.	Zero fibre strain up to load	kN	43.66 ✓
26.	Weight:	kg/km	445 ± 3% ✓
18.	Crush strength:	kg/mm	231.4 Kg/100mm ² ✓
19.	Equivalent Modulus of elasticity:	KN/mm ²	140 ✓
29.	Minimum Bending Radius without microbending:	mm	360 ✓
30.	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	360 ✓
		mm	480 ✓

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(हस्ताक्षर/Sign.)
06/9/19
Date

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DRS Form 1 (Continued)

**DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE**

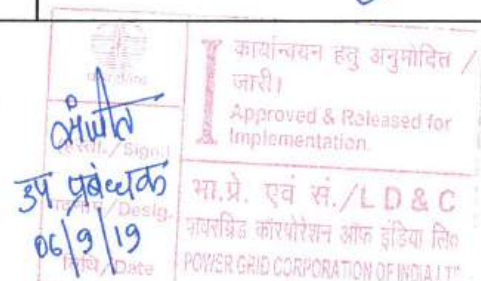
OPTICAL GROUND WIRE (OPGW):

Seq	Parameter:	Unit:	Particulars:
31.	Tensile proof test (Screening) level:	KN/mm ²	1.113 ✓
32.	Maximum permissible tensile stress:	KN/mm ²	0.636 ✓
33.	Permissible CTS. tensile stress:	KN/mm ²	0.318 ✓
34.	Maximum sag at maximum temperature and design span with no wind:	mm	As per the Final Sag and Tension chart ✓
35.	Everyday tension at 32°C, no wind:	% of UTS	As per the Final Sag and Tension chart (Max 20% of UTS) ✓
36.	Maximum tension at Every day condition with full wind pressure	Kg	As per the Final Sag and Tension chart ✓

Thermal Properties of Cable

37.	Coefficient of linear expansion:	per °C	13.8 X 10 ⁻⁶ ✓
38.	Coefficient of expansion	Cladding:	per °C 23 X 10 ⁻⁶ ✓
		Core:	per °C 11.5 X 10 ⁻⁶ ✓
39.	Nominal operating temperature range:	°C	-40°C to +80°C ✓
40.	SC current transient peak temperature:	°C	200 ✓
41.	Maximum allowable temperature for lightning strike:	°C	210 ✓
42.	DC Resistance of OPGW cable at 20°C	Ω/Km	0.824 ✓
43.	Short Circuit Current	KA	≥ 6.32 KA for 1 Second (40 KA ² s) ✓

- Continued -





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DRS Form I (Continued)

**DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE**

OPTICAL GROUND WIRE (OPGW):

CABLE SPOOL and DRUM			
Seq	Parameter:	Unit:	Particulars:
44.	Available length per spool Maximum: Nominal:	m m	5250, 3150 ✓ 5000, 3000 ✓ (Standard length and tolerance of cable per reel shall be : ✓ 1) 5000m ± 5% ✓ 2) 3000m ± 5% ✓ However Customized lengths as per the requirement can also be provided) ✓
45.	Size of drum:	m	(Flange * Barrel * Traverse) 5000m drum : 1.550*0.850*0.915 1.350*0.625*0.915 3000m drum : 1.170*0.625*0.915
46.	Weight of empty drum:	kg	5000m drum : 200 Kg (Approx) ✓ 3000m drum : 150 Kg (approx.) ✓
47.	Weight of drum with cable: spooled	kg	5000m drum : 2450 (Approx) ✓ 3000m drum : 1505 (Approx) ✓
48.	Will drum length scheduling be practiced to match transmission line span lengths?	Yes/No	N.A

49. Describe Drum materials:

Returnable Steel Drum covered with Polypropylene Sheet for main & Spare quantity supply.

50. Describe cable end capping and protection against abrasion etc.:

Both ends of OPGW cable shall be securely fastened to drum and sealed with a shrinkable End Cap.





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DRS Form 1 (Continued)

**DATA REQUIREMENTS SHEETS for
OVERHEAD FIBRE OPTIC CABLE**

OPTICAL GROUND WIRE (OPGW):

INSTALLATION			
Seq	Parameter:	Unit:	Particulars:
51.	Splice Loss:		
	Maximum:	dB	0.10 ✓
	Average:	dB	0.05 ✓
52.	Operating Temperature Range:	°C	-40°C to +80°C ✓
53.	Rated Isoceraunic No.		50 ✓
54.	Expected Cable Life:	Years	25 ✓
55.	Installation rate per team:	km/day	Matching with the line and stringing Schedule. ✓
56.	No. of persons per team:	no.	
57.	Max. possible span for specified operating conditions:	M	As per Sag Tension Chart ✓
58.	Midspan sag at 0°C with no wind loading:	Mm	
59.	Midspan sag at max temp. with no wind loading:	Mm	
60.	Midspan sag at max temp. and wind loading:	Mm	
61.	Cable swing angles:		N/A ✓
	Worst Case: Everyday:		
62.	Describe Installation method(s):		OPGW is suitable for live line installation or normal installation ✓





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DRS Form 2

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE
DUAL-WINDOW SINGLE MODE (DW-SM)

OPTICAL PARAMETERS			
Seq	Parameter:	Unit:	Particulars:
1.	Fibre manufacturer(s)/Type:		Sterlite Technologies Ltd. ✓ Fibre Type : DWSM G.652D ✓
2.	Fibre production method:		Activated Chemical Vapour Deposition (ACVD) ✓
3.	Attenuation Coefficient@ 1310 nm: @ 1550 nm:	dB/km dB/km	≤ 0.35 ✓ ≤ 0.21 ✓
4.	Attenuation Variation with Wavelength (±25 nm):	dB/km	≤ 0.05 ✓
5.	Attenuation at water peak @ 1383 nm	dB/km	≤ 0.34 ✓
6.	Point discontinuity @ 1310nm: @ 1550nm:	dB dB	≤ 0.10 ✓ ≤ 0.10 ✓
7.	Temperature dependence (induced attenuation):	dB	≤ 0.05 (-60°C to +85°C) ✓
8.	Nominal Mode Field Diameter @ 1310 nm: @ 1550 nm:	µm	9.1 ✓ 10.3 ✓
9.	Mode Field Diameter Deviation @ 1310 nm: @ 1550 nm:	µm	±0.4 ✓ ±0.5 ✓
10.	Mode field non-circularity:	%	≤ 6.0
11.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	Ps/nm.km	≤ 3.5 ✓ ≤ 5.3 ✓ ≤ 18 ✓
12.	Zero dispersion wavelength:	nm	1300 ~ 1324 ✓
13.	Zero dispersion Slope:	ps/nm ² .km	≤ 0.090 ✓
14.	Cutoff wavelength:	nm	≤ 1260 ✓
15.	Refractive Index :		1.4670 @1310 nm & ✓ 1.4675 @1550 nm ✓
16.	Refractive Index profile:		Step Index ✓
17.	Cladding Design:		Matched ✓
18.	Numerical aperture:		0.13 typical

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DRS Form 2 (Continued)

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE
DUAL-WINDOW SINGLE MODE (DW-SM)

PHYSICAL and MECHANICAL PROPERTIES			
Seq	Parameter:	Unit:	Particulars:
19.	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm (37.5 mm radius, 100 turn) @1550 nm (16mm radius, 1 turn) @ 1550nm	dB dB dB	Attenuation Rise ≤ 0.05 per Km ✓ Attenuation Rise ≤ 0.05 per Km ✓ Attenuation Rise ≤ 0.50 per km ✓
20.	Core Diameter (nominal \pm deviation) :	μm	8.50 ± 1.0 ✓
20.	Core non-circularity:	%	≤ 6.0 ✓
21.	Cladding Diameter (nominal \pm deviation):	μm	125 ± 0.7 ✓
22.	Core- Clad / Mode field concentricity Error	μm	≤ 0.5 ✓
23.	Cladding non circularity:	%	≤ 0.8 ✓
24.	Fibre cut-off wavelength	nm	≤ 1320 ✓
25.	Protective Coating type & material Primary: Secondary:		UV-cured Acrylate. ✓ UV-cured Acrylate. ✓
26.	Protective Coating Diameter (nominal \pm deviation):	μm	245 ± 10 ✓
27.	Protective Coating removal method:		Stripping method ✓
29.	Coating Concentricity	μm	Coating cladding error < 12 ✓
30.	Polarisation mode dispersion coefficient	ps/km ^{1/2}	≤ 0.2 ✓
31.	Proof test level	GPa	≥ 0.69 ✓
28.	Colour coding scheme compliant with EIA/TIA 598 or IEC 60304 or Bellore GR-20.	Yes/No	Bellcore GR-20 ✓
29.	Colouring material compliant with technical specs?	Yes/No	Yes ✓
34.	Minimum Guaranteed design life span of optical fibres	Year	25 ✓

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APAR INDUSTRIES LIMITED

B) Reference Standards

The standard specifications according to which the OPGW cable shall be manufactured and tested are:

- ❖ IEC 60793-1 : Optical fiber Part 1: Generic specifications
- ❖ IEC 60793-2 : Optical fiber Part 2: Product specifications
- ❖ ITU-T G.652 : Characteristics of a single-mode optical fiber cable
- ❖ ITU-T G.655 : Characteristics of a non-zero dispersion-shifted single-mode optical fiber and cable
- ❖ EIA/TIA 598 B : Color code of fiber optic cable.
- ❖ IEC 60794-4 : Sectional specification – Aerial optical cables along electrical power lines
- ❖ IEC 60794-4-10 : Aerial optical cables along electrical power lines –Family specification for OPGW
- ❖ IEC 60794-1-2 : Optical fiber cables-Part 1-2: Generic specification-Basic optical cable test Procedure.
- ❖ IEEE 1138-2009 : IEEE Standard for testing and performance for optical ground wire(OPGW) for use on electric utility power lines
- ❖ IEC 61395 : Overhead Electrical Conductors – Creep test procedures for stranded conductors.
- ❖ IEC 61232 : Aluminum –clad steel wire for electrical purposes
- ❖ IEC 61089 : Round wire concentric lay overhead electrical stranded conductors

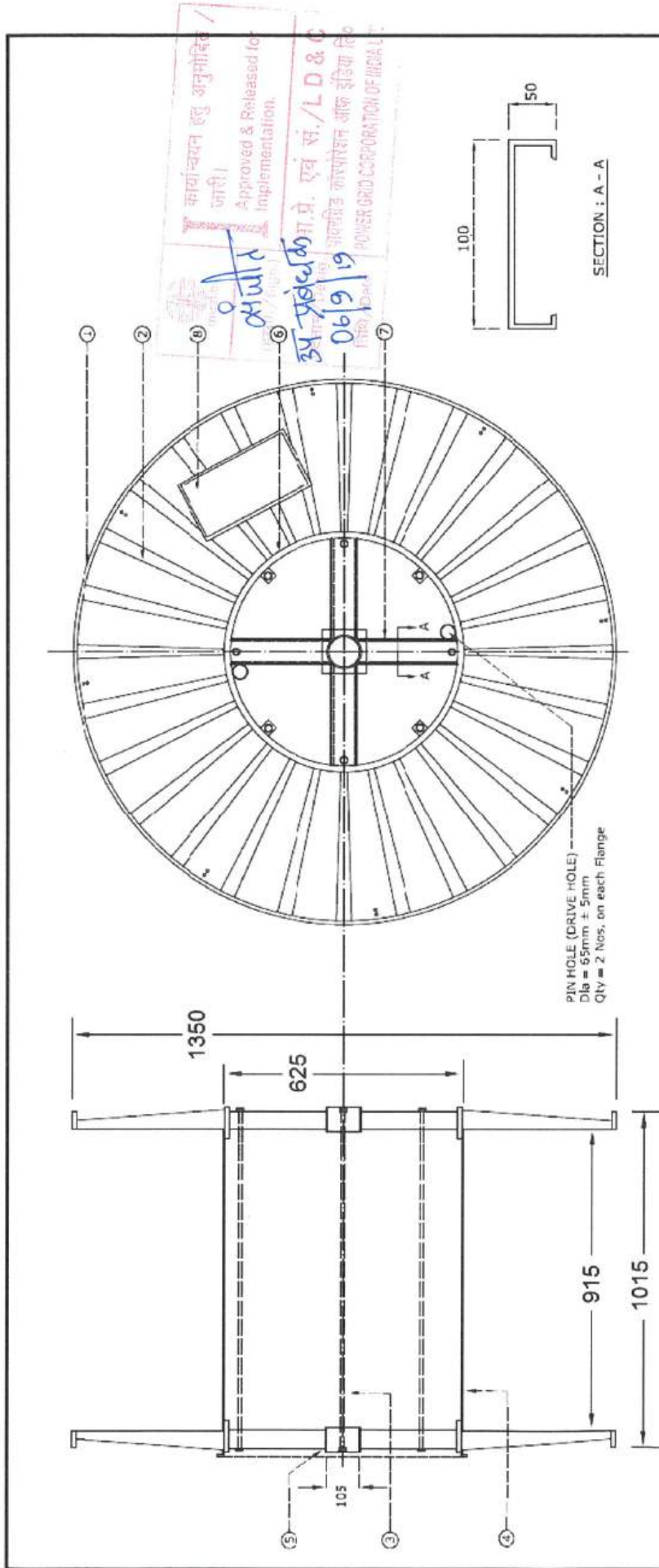
C) Optical Fiber Identification

Individual optical fibers within a fiber unit and fiber units shall be identifiable in accordance with EIA/TIA 598 color-coding scheme as specified below.

Coloring utilized for color coding optical fibers shall be integrated into the fiber coating and shall be homogenous. The color shall not bleed from one fiber to another and shall not fade during fibre preparation for termination or splicing.

Fiber Units	Fiber No. and Fiber Color					
Blue Tube	1	2	3	4	5	6
	Blue	Orange	Green	Brown	Slate	White
	7	8	9	10	11	12
	Red	Black	Yellow	Violet	Rose	Aqua/Nat
Orange Tube	1	2	3	4	5	6
	Blue	Orange	Green	Brown	Slate	White
	7	8	9	10	11	12
	Red	Black	Yellow	Violet	Rose	Aqua/Nat
Green Tube	1	2	3	4	5	6
	Blue	Orange	Green	Brown	Slate	White
	7	8	9	10	11	12
	Red	Black	Yellow	Violet	Rose	Aqua/Nat
Brown Tube	1	2	3	4	5	6
	Blue	Orange	Green	Brown	Slate	White
	7	8	9	10	11	12
	Red	Black	Yellow	Violet	Rose	Aqua/Nat

END



1 OUTER RING		50 X 6 mm	<p>RETURNABLE STEEL DRUM</p> <p>Note -</p> <p>a) All dimensions are in mm</p> <p>b) All mild steel shall conform to IS-2062</p> <p>c) Washers are required on all bolts</p> <p>d) Tolerance on dimension of drum parts other than the thickness of sheets shall be ± 3%.</p> <p>10 Barrel and inner surface of flange shall have water proof protective HDPE sheet.</p> <p>11 The drums are Returnable with Polypropylene sheet Covering.</p> <p>12 Flanges shall have non corrosive primer coat and enamel paint of Green colour.</p> <p>13 The outer layer of the OPGW Cable shall be covered with Min. 5mm Thick Polypropylene sheet to protect the cable from damages during transit.</p>
2 CORRUGATION SHEET		1.20 mm (THICK) 12mm & 8 Nos.	
3 TIE ROD		1.60 mm (THICK)	
4 BARREL SHEET		105 mm ID x 115 mm OD.	
5 CENTRE HOLE		100mm (W) X 4.00 mm (THICK)	
6 INNER RING		100mm x 50mm, 4.00mm (THICK)	
7 CROSS ARM		200mm x 300mm (APPROX)	
8 FRAME SIZE (FOR MARKING)		GREEN COLOR ENAMEL PAINT	
9 PAINT			
10			
11			
12			
13			

CUSTOMER	POWERGRID CORPORATION OF INDIA LIMITED	
NOA NO.		
ITEM / CODE NAME	OPGW CABLE - 12.00mm / 48F11AS[92,9,40]	
OPGW DETAILS	Specification	IEC 61232, IEEE 1138 & ITU G652
	Standard length	5000 mtrs ± 5%
	Net Weight	2225 Kg (APPROX)
	Gross weight	2450 Kgs (Approx)
Issue No. :	01	
Issue Date :	06.09.2019	
Rev. No. :	00	
Rev. Date :	00	
SCALE : N.T.S	DRG. NO. :- AILS-14GE:48OPGW/01	

Signature

