



RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LIMIED

[Corporate Identity Number CIN: U40109RJ2000SGC016485]

(AN ISO 9001:2015 CERTIFIED COMPANY)

REGD. OFFICE VIDYUT BHAWAN JANPATH, JYOTI NAGAR, JAIPUR-302005

OFFICE OF SUPERINTENDING ENGINEER (Automation, N/M & SP)

Telephone No.2740752 – Fax No.2740794

Email: se.spl@rvpn.co.in

NO. RVPN/SE (AUTOMATION)/TN-111/ XEN-I/

JAIPUR, DT:

M/s APAR Industries Limited
301, Panorama Complex
R.C. Dutt Road, Alkapuri
Vadodara, Gujarat - 390007

Sub: - Uprating of existing (A) 220 kV S/C Bap - Barsingsar LTPS (B) 220 kV S/C Barsingsar - Bikaner (C) 220 kV S/C Tinwari - Jodhpur Ckt I (400 kV) (D) 220 kV S/C Tinwari - Jodhpur Ckt II (400 kV) (E) 132 kV S/C Pugal Road - Bikaner (220 kV) (F) 132 kV S/C Pokran - Dechu (220 kV) Transmission lines including strengthening and augmentation of existing Busbars & Bays at terminal substations against Specification No. **RVPN/EHV/A&SP/TN-111**.

- Ref: 1. This office Contract No. RVPN/ SE (Automation)/ XEN-1/ TN-111/ Contract/ P.O.132/ D. 59 dated 03.10.2023
2. Your letter No. AIL/BRD/MKT/RVPN/LTC-SEL/HTLS-TN-111/B-16 dated 16.02.2024.
3. Your letter No. AIL/BRD/MKT/RVPN/LTC-SEL/HTLS-TN-111/C-12 dated 12.03.2024.
4. Your letter No. AIL/BRD/MKT/RVPN/LTC-SEL/HTLS-TN-111/E-14 dated 14.05.2024 (submission of revised Technical documents and required Type test reports)

In reference to aforesaid subject and reference, following drawings/ documents submitted by you vide your letter under reference have been checked/ examined & are hereby generally approved as per contract's General Technical Requirements & specification:

Sr. No.	Drawing/ Document Title	Drawing/ Document No.	Rev. No.
1	1.1 kV PVC Type Copper Cables Make: M/s Suyog Electricals Limited, Vadodara, Gujarat		
1.a	Guaranteed Technical Particular	SEPL/KP/APAR/GTP/23-24/11071	00
	3C x 2.5 sqmm		
	4C x 2.5 sqmm		
	6C x 2.5 sqmm		
	12C x 2.5 sqmm		
	18C x 2.5 sqmm		
1.b	Manufacturing Quality Plan	SEPL/KP/APAR/QAP/23-24/11071	00

The approved drawings/ documents are enclosed herewith for needful. Please note that approval of aforesaid drawing/ document does not relieve you from your responsibility towards correctness of design of the system. The approval shall not be considered as limiting any of responsibilities and liabilities by the contractor for mistakes and deviations from the requirements specified under the specification and documents.

This is issued without prejudice to other terms and conditions of the LOA.

Encl: As above

Copy to the following for information:

- The Assistant Engineer (T&C), RVPN, Bhadla/ Jodhpur
- The Assistant Engineer – I (T&C), RVPN, Bikaner/ Jaipur

RajKaj Ref
7259939



(Narottam Vyas)
Superintending Engineer
(Automation & SP)

Validity unknown

Digitally signed by Narottam Vyas
Designation : Superintending
Engineer
Date: 2024.05.17 19:14:21 IST
Reason: Approved

GAURANTEED TECHNICAL PARTICULARS

CLIENT : RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LTD
 CONTRACTOR : APAR INDUSTRIES LIMITED
 LOA NO.: RVPN/SE(AUTOMATION)/XEN-I/TN-111/Contract/P.O.132/D.59/Jaipur DATED: 03.10.2023
 Manufacturer : Suyog Electricals Ltd.
 Ref: SEPL/KP/APAR/GTP/23-24/11071
 Rev : 00 Dt.29.04.2024

PROJECT: Uprating of (A) 220kV S/C Bap-Barsingsar LTPS (B) 220kV S/C Barsingsar -Bikaner (C) 220kV S/C Tinwari - Jodhpur CKT I (400KV) (D) 220kV S/C Tinwari -Jodhpur CKT II (400KV) (E) 132kV Pugal Road -Bikaner (220KV) (F) 132kV S/C Pokran -Dechu (220kV) Transmission Lines including strengthening and augmentation of existing busbars & bays at terminal substations against specification No. RVPN/EHV/A&SP/TN-111.

SR No	DESCRIPTION	Unit	3C X 2.5mm2	4C X 2.5mm2	6C X 2.5mm2	12C X 2.5mm2	18C X 2.5mm2
1	Make		SEPL				
2	Standard Applicable		IS :1554 Part1				
3	Rated Voltage	V	1100V				
4	Suitable for earthed or unearthed system		both				
5	Conductor		Annealed Stranded Bare Copper as per IS : 8130				
	a) Number of wires (minimum)	Nos	7				
	b) Shape		Stranded Circular				
6	INSULATION		Extruded PVC Type A as per IS:5831				
	a) Material of insulation		Extruded PVC Type A as per IS:5831				
	b) Nominal Thickness	mm	0.9				
	c) Min. Volume resistivity at 27° C	Ω-cm	1 x 10 ¹³ at 27° C				
	d) Min. Volume resistivity at 70° C	Ω-cm	1 x 10 ¹⁰ at 70° C				
7	Core identification		Red,Yellow,Blue	Red,Yellow,Blue, Black	Grey Core Numbering		
8	INNER SHEATH		PVC TYPE ST-1 as per IS:5831				
	a) Material		PVC TYPE ST-1 as per IS:5831				
	b) Extruded or Wrapped		Extruded				
	c) Thickness (min)	mm	0.3				
	d) Dia over inner sheath (+/- 2mm)	mm	9.4	10.4	12.6	17	20.2
	e) Colour		Black				
9	ARMOUR		G.S. Round Wire as per IS: 3975				
	a) Type of armour		G.S. Round Wire as per IS: 3975				
	b) Nominal dimension of strips/Wire	mm	1.4				
	c) Dia. Over Armour (+/- 2mm)	mm	12.1	13.1	15.3	20.1	23.4
10	OUTER SHEATH		Extruded FRLS PVC TYPE ST-1 as per IS:5831				
	a) Material		Extruded FRLS PVC TYPE ST-1 as per IS:5831				
	b) Thickness (min.)	mm	1.24		1.4		
	c) Colour		Grey				
	d) Overall diameter of cable (+/-2mm)	mm	14.9	15.9	18.1	23.2	26.5
11	Approximate weight of cable	kg/km	420	470	610	1035	1370
12	ELECTRICAL CHARACTERISTICS						
	a) Max. D.C. resistance at 20 Deg. C.-	Ω/km	7.41				
13	Max. permissible conductor temperature						
	a) Under continuous full load	Deg. C.	70° C				
	b) Under transient condition	Deg. C.	160° C				
14	Current carrying capacity						
	a) In Ground (continuous)	Amps	28	28	20	17	14
	b) In duct (continuous)	Amps	24	24	18	14	12
	c) In air (continuous)	Amps	23	23	18	14	12
15	Reactance per km at 50Hz	Ω/km	0.11				
16	Star Capacitance	µF/km	0.4				
17	Short time Over Capacity & Duration						
	a) S.C. rating of conductor for 1 Sec.	K.A.	0.288				
18	FRLS PROPERTIES						
	a) Oxygen Index(test as per ASTM-D2863)	%	29% (min)				
	b) Temperature Index Test (ASTM-D2863)	Deg. C.	250 Deg.C (min)				
	c) Smoke Density(test as per ASTM-D2843)	%	60% (max) (SDAR)				
	d) Acid gas emission(test as per IEC-754(I))	%	20% (max)				
19	CABLE DRUM						
	a) Safe pulling force when pulled by pulling edge on the conductor	N/mm2	50N/mm2				
	b) Recommended min. installation radius		12 X O.D				
	c) Standard drum length of cable (subject to a manufacture of ±5%)	mtr	1100 mtr x 1 Drum	1000 mtr x 4 Drums & 950 mtr x 1Drum	1000 mtr x 3 Drums & 850 mtr x 1Drum	1000 mtr x 5 Drums & 500 mtr x 1 Drum	1000 mtr x 1 Drum & 1200 mtr x 1 Drum
20	Marking on cable (Printing)		SEPL 1100V Electric Cable FRLS , _C x 2.5 SQ.MM, RRVPNL, 2024 , Seq Marking.				

GENERALLY APPROVED
 S.E./XEN-I/II (Auto/AEN)
 Auto. N/M & sp Circle
 R.R.V.P.N.L., Jaipur

NOTE :-
 1 The Data specified above are based on IS specification and in case of any dispute or typographical error, interpretation of IS specification shall prevail.
 2 The conductor diameter are indicative and shall confirm to meet the IS requirements of conductor resistance
 3 The packing drum dimension and weight are approximate and may vary.
 4 Non standard length shall be limited to 10% of the ordered quantity.



GAURANTEED TECHNICAL PARTICULARS

CLIENT : RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LTD
 CONTRACTOR : APAR INDUSTRIES LIMITED
 LOA NO.: RVPN/SE(AUTOMATION)/XEN-I/TN-111/Contract/P.O.132/D.59/Jaipur DATED: 03.10.2023
 Manufacturer : Suyog Electricals Ltd.
 Ref: SEPL/KP/APAR/GTP/23-24/11071
 Rev : 00 Dt.29.04.2024

PROJECT: Uprating of (A) 220kV S/C Bap-Barsingsar LTPS (B) 220kV S/C Barsingsar -Bikaner (C) 220kV S/C Tinwari -Jodhpur
 CKT I (400KV) (D) 220kV S/C Tinwari -Jodhpur CKT II (400KV) (E) 132kV Pugal Road -Bikaner (220kV) (F) 132kV S/C Pokran -
 Dechu (220kV) Transmission Lines including strengthening and augmentation of existing busbars & bays at terminal
 substations against specification No. RVPN/EHV/A&SP/TN-111.

SR NO	DESCRIPTION	Unit	4C X 4mm2	4C X 6mm2
1	Make		SEPL	
2	Standard Applicable		IS :1554 Part1	
3	Rated Voltage	V	1100V	
4	Suitable for earthed or unearthed system		both	
5	Conductor		Annealed Stranded Bare Copper as per IS : 8130	
	a) Number of wires (minimum)	Nos	7	
	b) Shape		Stranded Circular	
6	INSULATION		Extruded PVC Type A as per IS:5831	
	a) Material of insulation			
	b) Nominal Thickness	mm	1	
	c) Min. Volume resistivity at 27° C	Ω-cm	1×10^{13} at 27° C	
	d) Min. Volume resistivity at 70 °C	Ω-cm	1×10^{10} at 70° C	
7	Core identification		Red, Yellow, Blue, Black	
8	INNER SHEATH		PVC TYPE ST-1 as per IS:5831	
	a) Material		Extruded	
	b) Extruded or Wrapped			
	c) Thickness (min)	mm	0.3	
	d) Dia over inner sheath (+/- 2mm)	mm	12.1	13.4
	e) Colour		Black	
9	ARMOUR		G.S. Round Wire as per IS: 3975	
	a) Type of armour			
	b) Nominal dimension of strips/Wire	mm	1.4	
	c) Dia. Over Armour (+/- 2mm)	mm	14.9	16.2
10	OUTER SHEATH		Extruded FRLS PVC TYPE ST-1 as per IS:5831	
	a) Material		Grey	
	b) Thickness (min.)	mm	1.24	1.4
	c) Colour			
	d) Overall diameter of cable (+/-2mm)	mm	17.7	19
11	Approximate weight of cable	kg/km	610	710
12	ELECTRICAL CHARACTERISTICS			
	a) Max. D.C. resistance at 20 Deg. C.-	Ω/km	4.61	3.08
13	Max. permissible conductor temperature			
	a) Under continuous full load	Deg. C.	70° C	
	b) Under transient condition	Deg. C.	160° C	
14	Current carrying capacity			
	a) In Ground (continuous)	Amps	37	46
	b) In duct (continuous)	Amps	31	39
	c) In air (continuous)	Amps	30	39
15	Reactance per km at 50Hz	Ω/km	0.106	0.1
16	Star Capacitance	μF/km	0.44	0.51
17	Short time Over Capacity & Duration			
	a) S.C. rating of conductor for 1 Sec.	K.A.	0.46	0.69
18	FRLS PROPERTIES			
	a) Oxygen Index(test as per ASTM-D2863)	%	29% (min)	
	b) Temperature Index Test (ASTM-D2863)	Deg. C.	250 Deg.C (min)	
	c) Smoke Density(test as per ASTM-D2843)	%	60% (max) (SDAR)	
	d) Acid gas emission(test as per IEC-754(I))	%	20% (max)	
19	CABLE DRUM			
	a) Safe pulling force when pulled by pulling edge on the conductor	N/mm2	50N/mm2	
	b) Recommended min. installation radius		12 X O.D	
	c) Standard drum length of cable (subject to a manufacture of ±5%)	mtr	1000 mtr x 3 Drums & 850 mtr x 1Drum	1000 mtr x 1 Drums & 650 mtr x 1Drum
20	Marking on cable (Printing)		SEPL 1100V Electric Cable FRLS , 4C x SQ.MM, RRVPNL, 2024 , Seq Marking.	

NOTE :-

- The Data specified above are based on IS specification and in case of any dispute or typographical error, interpretation of IS specification shall prevail.
- The conductor diameter are indicative and shall confirm to meet the IS requirements of conductor resistance
- The packing drum dimension and weight are approximate and may vary.
- Non standard length shall be limited to 10% of the ordered quantity.



GENERALLY APPROVED
 S.E./XEN-I/II (Auto/AEN)
 Auto. N/M & SP Circle
 R.R.V.P.N.L., Jaipur
for 4C X 4 mm² cable only as above.

QUALITY ASSURANCE PLAN FOR 1.1 KV CONTROL CABLES AS PER IS :1554 (PART - 1)

CLIENT : RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LTD
 CONTRACTOR : APAR INDUSTRIES LIMITED
 LOA NO.: RVPN/SE(AUTOMATION)/XEN-I/TK-111/Contract/P.O.132/D.59/Jaipur DATED: 03.10.2023
 Manufacturer : Suyog Electricals Ltd.
 Ref: SEPL/KP/APAR/QAP/23-24/11071
 Rev : 00 Dt.02.02.2024

PROJECT: Upgrading of (A) 220KV S/C Bap-Barsingar LTFS (B) 220KV S/C Barsingar-Bikaner (C) 220KV S/C Tinwari -Jodhpur CKT I (400KV) (D) 220KV S/C Tinwari -Jodhpur CKT II (400KV) (E) 132KV Pugal Road-Bikaner (220KV) (F) 132KV S/C Pokran -Dechu (220KV) Transmission Lines including strengthening and augmentation of existing busbars & bays at terminal substations against specification No. RVPN/EHV/A&SP/TN-111.

Sr No	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	TYPE/METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMET OF RECORD			Remarks
							V	P	W	
1 FINAL TESTING										
A ROUTINE TEST										
	a)	High Voltage test at room temp	Electrical	100%	IS:1554(P-1)	IS:1554(P-1)	T.R	2	3	-
	b)	Conductor Resistance	Electrical		IS:8130	IS:8130	T.R	2	3	-
B ACCEPTANCE TEST										
	a)	Annealing test (for copper)*	Mech		IS:8130	IS:8130	I.R	-	3	2
	b)	Conductor Resistance test.	Electrical		-DO-	-DO-	I.R	-	3	2
	c)	Thickness of Insulation & Sheath	Physical	10%	IS:1554(P-1)	IS:1554(P-1)	I.R	-	3	2
	d)	T.S & Elongation at break of Insulation & Outer Sheath.	Physical		IS:5831	IS:5831	I.R	-	3	2
	e)	Insulation Resistance / V.R	Electrical		-DO-	-DO-	I.R	-	3	2
	f)	High Voltage test at room temp	Electrical		IS:1554(P-1)	IS:1554(P-1)	I.R	-	3	2
FRLS										
	a)	Oxygen Index	Physical		ASTM-D-2863	G.T.P	I.R	-	3	2
	b)	Temp. Index	Physical		ASTM-D-2863	G.T.P	I.R	-	3	2
	c)	Smoke density	Physical	1 sample / Inspection Lot	ASTM-D-2843	G.T.P	I.R	-	3	2
	d)	HCL Gas Generation	Chemical		IEC-754	G.T.P	I.R	-	3	2
	e)	Flammability test	Physical		IS:10810(P-53)	IS:10810(P-53)	I.R	-	3	2
C TYPE TEST										
A) Test on Conductor										
	a)	Annealing test (for copper) *	Mech		IS:8130	IS:8130	T.R	2	3	-
	b)	Conductor Resistance test.	Electrical		-DO-	-DO-	T.R	2	3	-
	B)	Test for Armour wire/Strip	Chemical		IS:3975	IS:3975	T.R	2	3	-
	C)	Test for Thickness of Insulation, Inner Sheath & Outer Sheath.	Physical		IS:1554(P-1)	IS:1554(P-1)	T.R	2	3	-
	D)	Physical tests for Insulation and Outer Sheath								
	1)	T.S & Elongation at break	Physical	1 sample / Inspection Lot	IS:5831	IS:5831	T.R	2	3	-
	2)	Ageing in air oven	Physical		-DO-	-DO-	T.R	2	3	-
	3)	Shrinkage test	Physical		-DO-	-DO-	T.R	2	3	-
	4)	Hot Deformation test	Physical		-DO-	-DO-	T.R	2	3	-
	5)	Loss of mass in air oven	Physical		-DO-	-DO-	T.R	2	3	-
	6)	Heat shock test	Physical		-DO-	-DO-	T.R	2	3	-
	7)	Thermal stability test	Physical		-DO-	-DO-	T.R	2	3	-
	E)	Insulation Resistance / V.R	Electrical		-DO-	-DO-	T.R	2	3	-
	F)	High Voltage test (Water immersion)	Electrical		IS:1554(P-1)	IS:1554(P-1)	T.R	2	3	-
	G)	High Voltage test at room temp	Electrical		-DO-	-DO-	T.R	2	3	-
FRLS										
	a)	Oxygen Index	Physical		ASTM-D-2863	G.T.P	T.R	2	3	-
	b)	Temp. Index	Physical		ASTM-D-2863	G.T.P	T.R	2	3	-
	c)	Smoke density	Physical		ASTM-D-2843	G.T.P	T.R	2	3	-
	d)	HCL Gas Generation	Chemical		IEC-754	G.T.P	T.R	2	3	-
	e)	Flammability test	Physical		IS:10810(P-53)	IS:10810(P-53)	T.R	2	3	-

T.R.= Test Report
 I.R.= Inspection Report
 Note : " * " Applicable For Solid Conductor
 P = Performed by
 W = Witnessed by
 V = Verified by
 Prepared By: _____
 Approved By: _____
 Suyog Industries Limited

GENERALLY APPROVED
 S. K. MENON (Auto/AEN)
 R.V.P.N.L., Jaipur

