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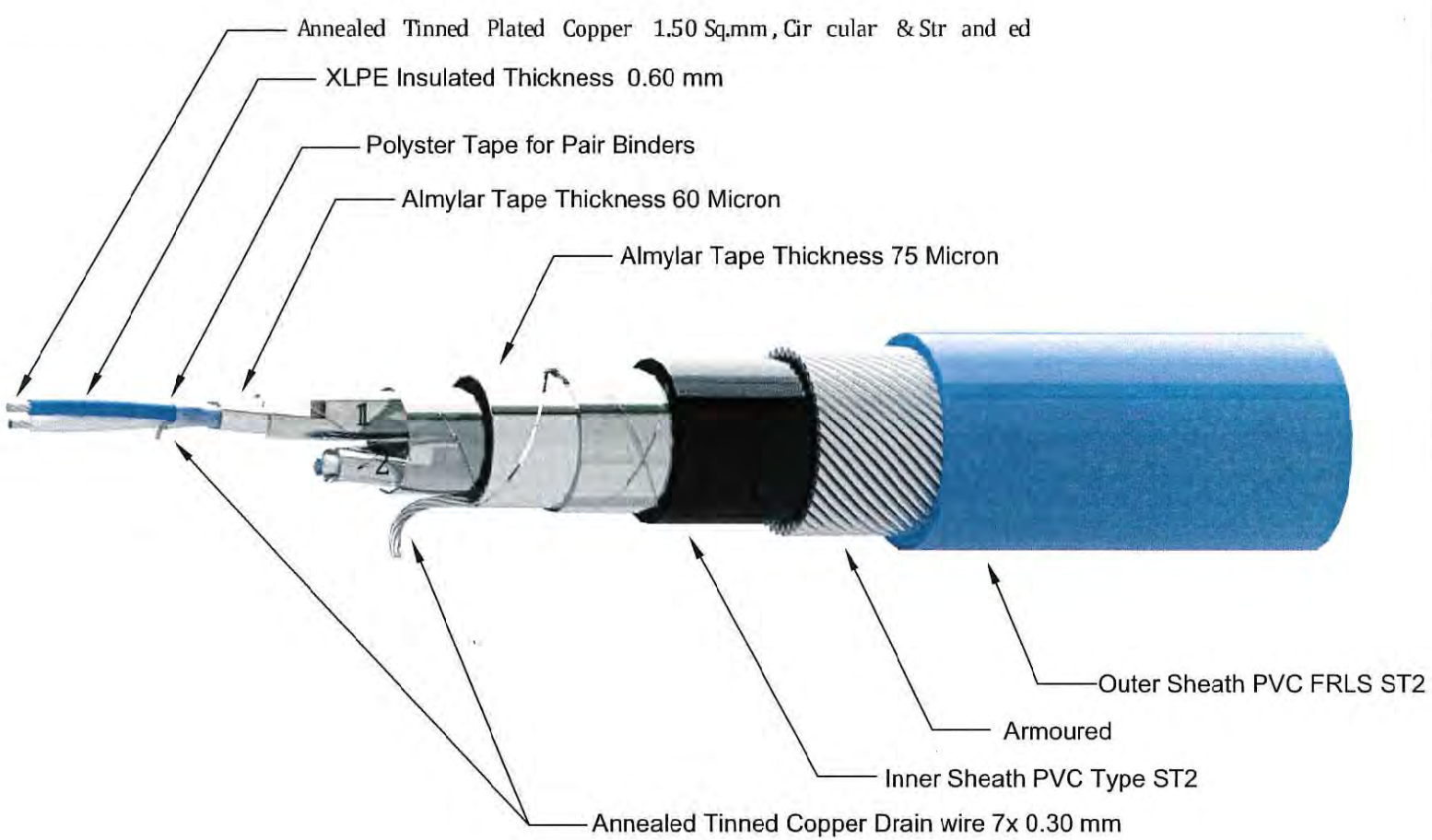

SIGNAL CABLE 2 PAIR x 1.50 SQ.MM

ITEM DESCRIPTION: SIGNAL CABLE , 4 PAIR X 1.50 SQ.MM			
Sr.	PARAMETER DESCRIPTION	UNIT	SIZE OF CABLE
1	Manufacturer & Place of Manufacturing		
2	**Reference Standards**		Generally conforming to IS 7098 Part 1&2, BS 5308 Part II,BS EN 50288 Part-7, BS EN 50290-2-29,IS 8130, IS 5831, IS:3975, IS:2633, IS 1554(I), IEC754-1, ASTMD 2863, 2843, SS424475 Cl. F3 IEC-60332-III, VDE-207(P-6)
3	**Voltage Grade**	V	650/1100V
4	**Electrical Characteristics**		
•	Power frequency test voltage (Spark Test)		As per BS 5099
•	Max. A.C. Resistance of conductor at Temp. 90°C	Ohm/Km	17.3
•	Max. D.C. Resistance at Temp. 20°C	Ohm/km	12.5
•	Highest voltage for equipment (Um)	KV	2Kv
•	Test voltage at site after laying	KV	1.5 KV for 1 Minute for core to core / 1.0 KV for 1 minute for core screen
5	**Conductor**		
•	Material		Stranded Annealed Tinned high conductivity copper class-2 of IS -8130
•	Grade & purity	%	Electrolytic &99.9
•	No. of strands /Dia. (mm) of each strand Nom.	mm	7/ 0.53
•	Area of Cross Section	Sq.mm	1.50
•	Shape of Conductor		Stranded - Circular
6	**Insulation**		
•	Material Type & Grade		XLPE
•	Thickness Of Insulation (Min)	mm	As per IS 7098 (0.40 MM)
•	Thickness Of Insulation (Nom.)	mm	As per IS 7098 (0.55 MM)
•	Method Of Application		Extruded
•	Diameter Over Insulation Approx.	mm	2.80 MM
•	Pair Twisting Lay (If Application)		100mm max , 10 Twist / Meter min,
•	Pair Colour		White & Blue
7	**Individual Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.06 (Nom.)
•	Coverage & Overlap	%	100%&25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No of Stands / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
8	**Overall Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.075 (min)
•	Coverage & Overlap	%	100% & 25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No. of Stand / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
9	**Inner Sheath**		
•	Material		HR PVC Type ST-2 Of IS-5831
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Dia. Over Outer Sheath Approx	mm	15MM
•	Colour		Black
10	**Outer Sheath**		
•	Material		HR PVC Type ST-2 of IS -5831 with FRLS Properties
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Colour		Blue
11	**Armouring**		Galvanized Flat Steel Strip
•	Thickness Of Armour (Dia.)		As per IS 7098-1-Table -6
12	**Nom Overall Outer Dia. Of Cable App. (± 2mm)**	Mm	20 mm (±) 2 mm
13	**Net Weight Approx.**	Kg/Km	720 kg
14	**Recommended Min. Bending Radius**		12XOD of cable
15	**Classification Of Cables For Improved Fire Performance (Category No. /Name)**		Category C2
16	**FRLS Properties (For Outer Sheath)**		
•	Smoke Density Rating		Max 60 % as per ASTM D2843
•	Oxygen Index At Room Temp.		Min 29% as per ASTMD2863
•	Temperature Index		Min 250°C as per ASTM D2863
•	HCL Emission (Acid Gas Generation)		Max 20% (by weight) as per IEC 754(I)
•	Fire Resistance Test		As per IEEE-383,IEC-60332-PART-III CAT-A, SS-424-1475
17	**High Voltage Test At Factor With Duration**	KV_{rms}	CORE to Core -1.5 KV for 1 minute / Core to shield -1KV for 1 minute
18	**Cable Drum**		
•	Approx Gross Weight Of Drum	Kg/Km	70 Kg
•	Net Weight Of Drums Approx	Kg/ km	1000 kg
•	Standard Length Of Cable (Subject To A Manufacture Of (+/-5%)	Meter	1000 ± 5%
19	Suitability With Regard To Moisture, Ozone, Acid ,Oil & Alkaline Surroundings		Confirmed
20	**Printing On The Outer Sheath Of Cable**		REVTI® MAKE SIGNAL CABLE PAIR X SIZE , 1.1KV , MONTH YEAR , 000 M , BHEL BHOPAL , UJVNL
21	**Additional Information**		
•	Min. Cross Talk At 0.8khz	dB	60
•	Mutual Capacitance At 1khz Core To Core (Max)	nF/km	115
•	Mutual Capacitance At 1khz Core To Screen (Max)	nF/km	400
•	Mutual Inductance @ 1khz	mH/Km	1mH/km
•	L/R Ratio (Max) Micro Henry /Ohm	µH/Ω	40(for 1.5sq.mm)
•	Max Attenuation At 1 Khz (dB/Km)	(dB/Km)	80 dB
•	Min Insulation Resistance At 20 Deg° C	Mohm/Km	100 Mohm/Km

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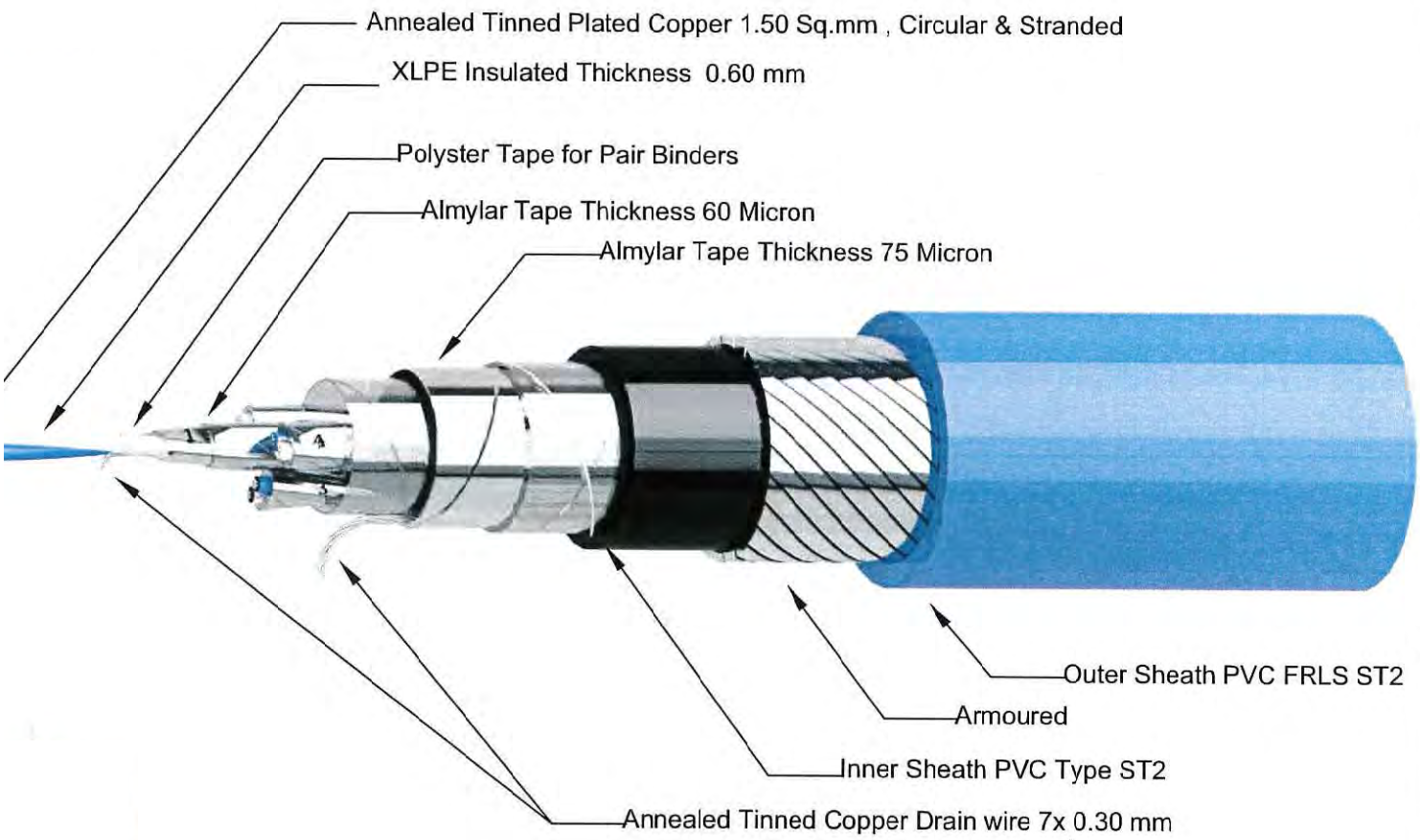

SIGNAL CABLE 4 PAIR x 1.50 SQ.MM

ITEM DESCRIPTION: SIGNAL CABLE , 8 PAIR X 1.50 SQ.MM			
Sr.	PARAMETER DESCRIPTION	UNIT	SIZE OF CABLE
1	Manufacturer & Place of Manufacturing		
2	**Reference Standards**		Generally conforming to IS 7098 Part 1&2, BS 5308 Part II,BS EN 50288 Part-7, BS EN 50290-2-29,IS 8130, IS 5831, IS:3975, IS:2633, IS 1554(I), IEC754-1, ASTMD 2863, 2843, SS4241475 Cl. F3 IEC-60332-III, VDE-207(P-6)
3	**Voltage Grade**	V	650/1100V
4	**Electrical Characteristics**		
•	Power frequency test voltage (Spark Test)		As per BS 5099
•	Max. A.C. Resistance of conductor at Temp. 90°C	Ohm/Km	17.3
•	Max. D.C. Resistance at Temp. 20°C	Ohm/km	12.5
•	Highest voltage for equipment (Um)	KV	2Kv
•	Test voltage at site after laying	KV	1.5 KV for 1 Minute for core to core / 1.0 KV for 1 minute for core screen
5	**Conductor**		
•	Material		Stranded Annealed Tinned high conductivity copper class-2 of IS -8130
•	Grade & purity	%	Electrolytic &99.9
•	No. of strands /Dia. (mm) of each strand Nom.	mm	7/ 0.53
•	Area of Cross Section	Sq.mm	1.50
•	Shape of Conductor		Stranded - Circular
6	**Insulation**		
•	Material Type & Grade		XLPE
•	Thickness Of Insulation (Min)	mm	As per IS 7098 (0.40 MM)
•	Thickness Of Insulation (Nom.)	mm	As per IS 7098 (0.55 MM)
•	Method Of Application		Extruded
•	Diameter Over Insulation Approx.	mm	2.80 MM
•	Pair Twisting Lay (If Application)		100mm max , 10 Twist / Meter min,
•	Pair Colour		White & Blue
7	**Individual Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.06 (Nom.)
•	Coverage & Overlap	%	100%&25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No of Stands / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
8	**Overall Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.075 (min)
•	Coverage & Overlap	%	100% & 25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No. of Stand / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
9	**Inner Sheath**		
•	Material		HR PVC Type ST-2 Of IS-5831
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Dia. Over Outer Sheath Approx	mm	19 MM
•	Colour		Black
10	**Outer Sheath**		
•	Material		HR PVC Type ST-2 of IS -5831 with FRLS Properties
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Colour		Blue
11	**Armouring**		Galvanized Flat Steel Strip
•	Thickness Of Armour (Dia.)		As per IS 7098-1-Table -6
12	**Nom Overall Outer Dia. Of Cable App. (± 2mm)**	Mm	24 mm (±) 2 mm
13	**Net Weight Approx.**	Kg/Km	720 kg
14	**Recommended Min. Bending Radius**		12XOD of cable
15	**Classification Of Cables For Improved Fire Performance (Category No. /Name).**		Category C2
16	**FRLS Properties (For Outer Sheath)**		
•	Smoke Density Rating		Max 60 % as per ASTM D2843
•	Oxygen Index At Room Temp.		Min 29% as per ASTMD2863
•	Temperature Index		Min 250°C as per ASTM D2863
•	HCL Emission (Acid Gas Generation)		Max 20% (by weight) as per IEC 754(I)
•	Fire Resistance Test		As per IEEE-383,IEC-60332-PART-III CAT-A, SS-424-1475
17	**High Voltage Test At Factor With Duration**	KV_{rms}	CORE to Core -1.5 KV for 1 minute / Core to shield -1KV for 1 minute
18	**Cable Drum**		
•	Approx Gross Weight Of Drum	Kg/Km	70 Kg
•	Net Weight Of Drums Approx	Kg/ km	1620 kg
•	Standard Length Of Cable (Subject To A Manufacture Of (+/-5%)	Meter	1000 ± 5%
19	Suitability With Regard To Moisture, Ozone, Acid ,Oil & Alkaline Surroundings		Confirmed
20	**Printing On The Outer Sheath Of Cable**		REVTI® MAKE SIGNAL CABLE PAIR X SIZE , 1.1KV , MONTH YEAR , 000 M , BHEL BHOPAL , UJVNL
21	**Additional Information**		
•	Min. Cross Talk At 0.8khz	dB	60
•	Mutual Capacitance At 1khz Core To Core (Max)	nF/km	115
•	Mutual Capacitance At 1khz Core To Screen (Max)	nF/km	400
•	Mutual Inductance @ 1khz	mH/Km	1mH/km
•	L/R Ratio (Max) Micro Henry /Ohm	µH/Ω	40(for 1.5sq.mm)
•	Max Attenuation At 1 Khz (dB/Km)	(dB/Km)	80 dB
•	Min Insulation Resistance At 20 Deg° C	Mohm/Km	100 Mohm/Km

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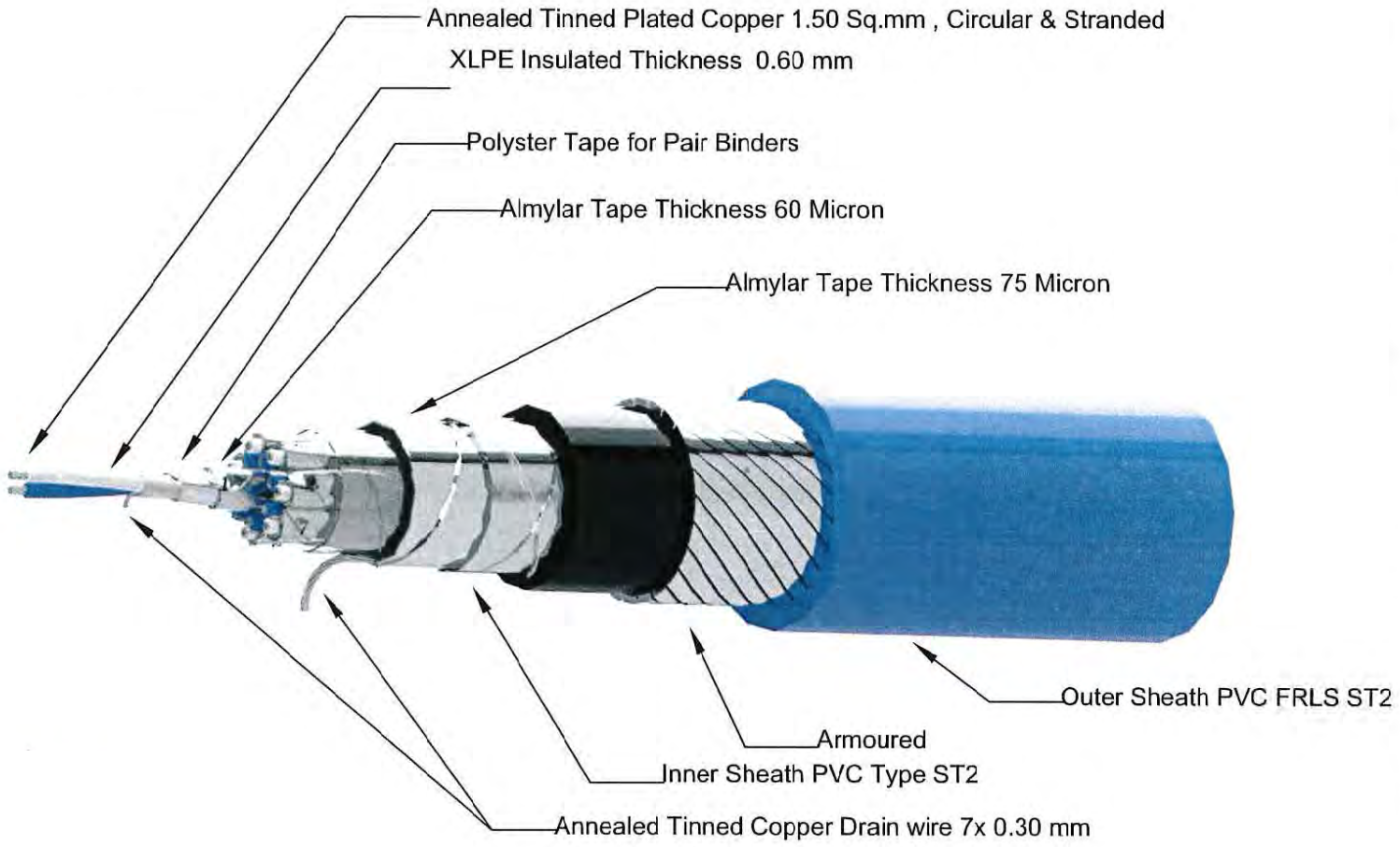

SIGNAL CABLE 8 PAIR x 1.50 SQ.MM

ITEM DESCRIPTION: SIGNAL CABLE , 12 PAIR X 1.50 SQ.MM			
Sr.	PARAMETER DESCRIPTION	UNIT	SIZE OF CABLE
1	Manufacturer & Place of Manufacturing		
2	**Reference Standards**		Generally conforming to IS 7098 Part 1&2, BS 5308 Part II,BS EN 50288 Part-7, BS EN 50290-2-29,IS 8130, IS 5831, IS:3975, IS:2633, IS 1554(I), IEC754-1, ASTMD 2863, 2843, SS4241475 Cl. F3 IEC-60332-III, VDE-207(P-6)
3	**Voltage Grade**	V	650/1100V
4	**Electrical Characteristics**		
•	Power frequency test voltage (Spark Test)		As per BS 5099
•	Max. A.C. Resistance of conductor at Temp. 90°C	Ohm/Km	17.3
•	Max. D.C. Resistance at Temp. 20°C	Ohm/km	12.5
•	Highest voltage for equipment (Um)	KV	2Kv
•	Test voltage at site after laying	KV	1.5 KV for 1 Minute for core to core / 1.0 KV for 1 minute for core screen
5	**Conductor**		
•	Material		Stranded Annealed Tinned high conductivity copper class-2 of IS -8130
•	Grade & purity	%	Electrolytic &99.9
•	No. of strands /Dia. (mm) of each strand Nom.	mm	7/ 0.53
•	Area of Cross Section	Sq.mm	1.50
•	Shape of Conductor		Stranded - Circular
6	**Insulation**		
•	Material Type & Grade		XLPE
•	Thickness Of Insulation (Min)	mm	As per IS 7098 (0.40 MM)
•	Thickness Of Insulation (Nom.)	mm	As per IS 7098 (0.55 MM)
•	Method Of Application		Extruded
•	Diameter Over Insulation Approx.	mm	2.80 MM
•	Pair Twisting Lay (If Application)		100mm max , 10 Twist / Meter min,
•	Pair Colour		White & Blue
7	**Individual Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.06 (Nom.)
•	Coverage & Overlap	%	100%&25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No of Stands / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
8	**Overall Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.075 (min)
•	Coverage & Overlap	%	100% & 25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No. of Stand / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
9	**Inner Sheath**		
•	Material		HR PVC Type ST-2 Of IS-5831
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Dia. Over Outer Sheath Approx	mm	23 MM
•	Colour		Black
10	**Outer Sheath**		
•	Material		HR PVC Type ST-2 of IS -5831 with FRLS Properties
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Colour		Blue
11	**Armouring**		Galvanized Flat Steel Strip
•	Thickness Of Armour (Dia.)		As per IS 7098-1-Table -6
12	**Nom Overall Outer Dia. Of Cable App. (± 2mm)**	Mm	34 mm (±) 2 mm
13	**Net Weight Approx.**	Kg/Km	720 kg
14	**Recommended Min. Bending Radius**		12XOD of cable
15	**Classification Of Cables For Improved Fire Performance (Category No. /Name)**		Category C2
16	**FRLS Properties (For Outer Sheath)**		
•	Smoke Density Rating		Max 60 % as per ASTM D2843
•	Oxygen Index At Room Temp.		Min 29% as per ASTMD2863
•	Temperature Index		Min 250°C as per ASTM D2863
•	HCL Emission (Acid Gas Generation)		Max 20% (by weight) as per IEC 754(I)
•	Fire Resistance Test		As per IEEE-383,IEC-60332-PART-III CAT-A, SS-424-1475
17	**High Voltage Test At Factor With Duration**	KV_{rms}	CORE to Core -1.5 KV for 1 minute / Core to shield -1KV for 1 minute
18	**Cable Drum**		
•	Approx Gross Weight Of Drum	Kg/Km	70 Kg
•	Net Weight Of Drums Approx	Kg/ km	800 kg
•	Standard Length Of Cable (Subject To A Manufacture Of (+/-5%)	Meter	1000 ± 5%
19	Suitability With Regard To Moisture, Ozone, Acid ,Oil & Alkaline Surroundings		Confirmed
20	**Printing On The Outer Sheath Of Cable**		REVTI® MAKE SIGNAL CABLE PAIR X SIZE , 1.1KV , MONTH YEAR , 000 M , BHEL BHOPAL , UJVNL
21	**Additional Information**		
•	Min. Cross Talk At 0.8khz	dB	60
•	Mutual Capacitance At 1khz Core To Core (Max)	nF/km	115
•	Mutual Capacitance At 1khz Core To Screen (Max)	nF/km	400
•	Mutual Inductance @ 1khz	mH/Km	1mH/km
•	L/R Ratio (Max) Micro Henry /Ohm	µH/Ω	40(for 1.5sq.mm)
•	Max Attenuation At 1 Khz (dB/Km)	(dB/Km)	80 dB
•	Min Insulation Resistance At 20 Deg° C	Mohm/Km	100 Mohm/Km

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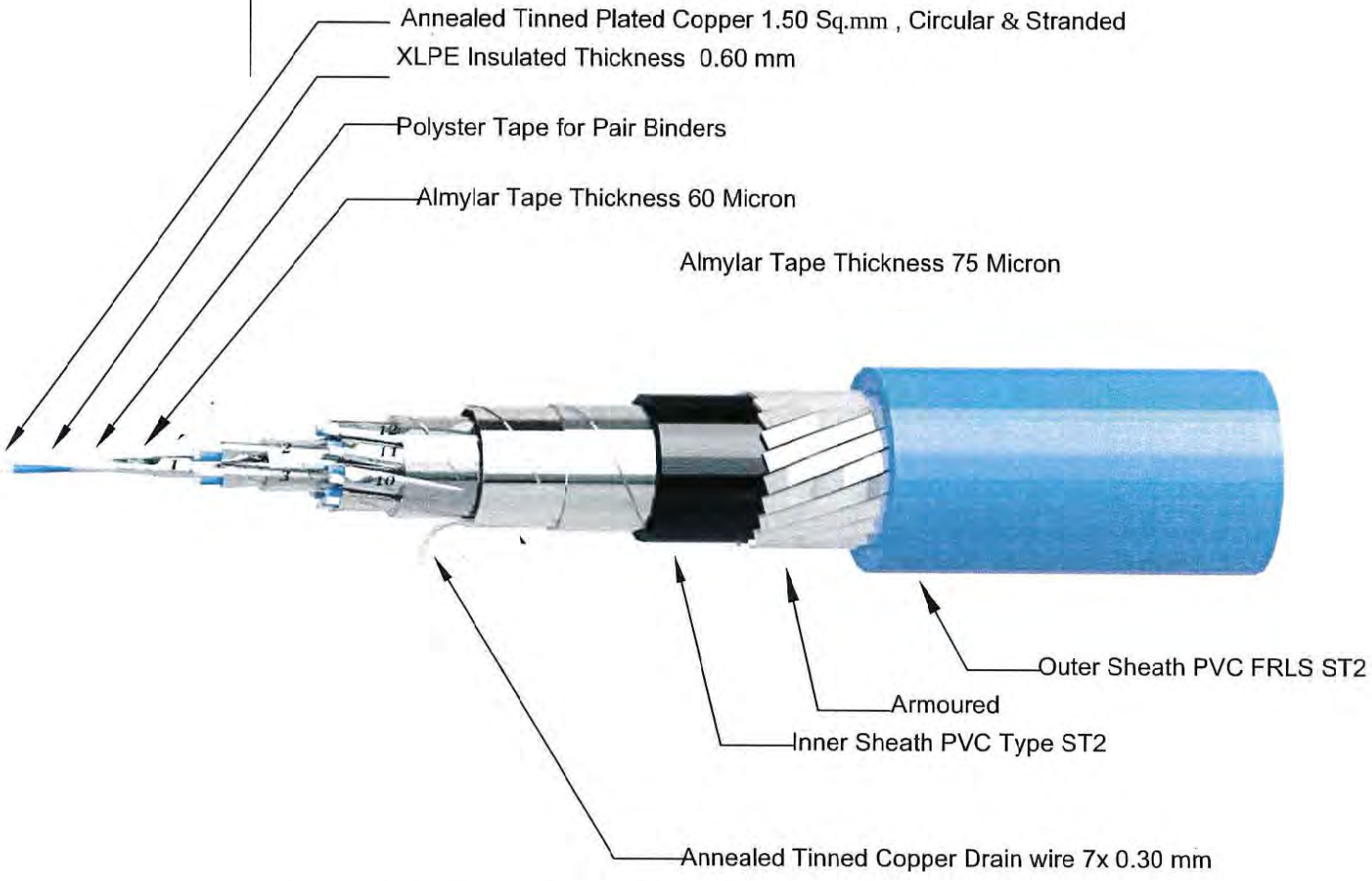

SIGNAL CABLE 12 PAIR x 1.50 SQ.MM

ITEM DESCRIPTION: SIGNAL CABLE , 2 TRIAD X 1.50 SQ.MM			
Sr.	PARAMETER DESCRIPTION	UNIT	SIZE OF CABLE
1	Manufacturer & Place of Manufacturing		
2	**Reference Standards**		Generally conforming to IS 7098 Part 1&2, BS 5308 Part II,BS EN 50288 Part-7, BS EN 50290-2-29,IS 8130, IS 5831, IS:3975, IS:2633, IS 1554(I), IEC754-1, ASTMD 2863, 2843, SS4241475 Cl. F3 IEC-60332-III, VDE-207(P-6)
3	**Voltage Grade**	V	650/1100V
4	**Electrical Characteristics**		
•	Power frequency test voltage (Spark Test)		As per BS 5099
•	Max. A.C. Resistance of conductor at Temp. 90°C	Ohm/Km	17.3
•	Max. D.C. Resistance at Temp. 20°C	Ohm/km	12.5
•	Highest voltage for equipment (Um)	KV	2Kv
•	Test voltage at site after laying	KV	1.5 KV for 1 Minute for core to core / 1.0 KV for 1 minute for core screen
5	**Conductor**		
•	Material		Stranded Annealed Tinned high conductivity copper class-2 of IS -8130
•	Grade & purity	%	Electrolytic &99.9
•	No. of strands /Dia. (mm) of each strand Nom.	mm	7/ 0.53
•	Area of Cross Section	Sq.mm	1.50
•	Shape of Conductor		Stranded - Circular
6	**Insulation**		
•	Material Type & Grade		XLPE
•	Thickness Of Insulation (Min)	mm	As per IS 7098 (0.40 MM)
•	Thickness Of Insulation (Nom.)	mm	As per IS 7098 (0.55 MM)
•	Method Of Application		Extruded
•	Diameter Over Insulation Approx.	mm	2.80 MM
•	Pair Twisting Lay (If Application)		100mm max , 10 Twist / Meter min,
•	Pair Colour		White ,Blue , Black
7	**Individual Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.06 (Nom.)
•	Coverage & Overlap	%	100%&25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No of Stands / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
8	**Overall Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.075 (min)
•	Coverage & Overlap	%	100% & 25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No. of Stand / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
9	**Inner Sheath**		
•	Material		HR PVC Type ST-2 Of IS-5831
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Dia. Over Outer Sheath Approx	mm	13 MM
•	Colour		Black
10	**Outer Sheath**		
•	Material		HR PVC Type ST-2 of IS -5831 with FRLS Properties
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Colour		Blue
11	**Armouring**		Galvanized Flat Steel Strip
•	Thickness Of Armour (Dia.)		As per IS 7098-1-Table -6
12	**Nom Overall Outer Dia. Of Cable App. (± 2mm)**	Mm	22 mm (±) 2 mm
13	**Net Weight Approx.**	Kg/Km	720 kg
14	**Recommended Min. Bending Radius**		12XOD of cable
15	**Classification Of Cables For Improved Fire Performance (Category No. /Name)**		Category C2
16	**FRLS Properties (For Outer Sheath)**		
•	Smoke Density Rating		Max 60 % as per ASTM D2843
•	Oxygen Index At Room Temp.		Min 29% as per ASTMD2863
•	Temperature Index		Min 250°C as per ASTM D2863
•	HCL Emission (Acid Gas Generation)		Max 20% (by weight) as per IEC 754(I)
•	Fire Resistance Test		As per IEEE-383,IEC-60332-PART-III CAT-A, SS-424-1475
17	**High Voltage Test At Factor With Duration**	KV_{rms}	CORE to Core -1.5 KV for 1 minute / Core to shield -1KV for 1 minute
18	**Cable Drum**		
•	Approx Gross Weight Of Drum	Kg/Km	70 Kg
•	Net Weight Of Drums Approx	Kg/ km	800 kg
•	Standard Length Of Cable (Subject To A Manufacture Of (+/-5%)	Meter	1000 ± 5%
19	Suitability With Regard To Moisture, Ozone, Acid ,Oil & Alkaline Surroundings		Confirmed
20	**Printing On The Outer Sheath Of Cable**		REVTI® MAKE SIGNAL CABLE PAIR X SIZE , 1.1KV , MONTH YEAR , 000 M , BHEL BHOPAL , UJVNL
21	**Additional Information**		
•	Min. Cross Talk At 0.8khz	dB	60
•	Mutual Capacitance At 1khz Core To Core (Max)	nF/km	115
•	Mutual Capacitance At 1khz Core To Screen (Max)	nF/km	400
•	Mutual Inductance @ 1khz	mH/Km	1mH/km
•	L/R Ratio (Max) Micro Henry /Ohm	µH/Ω	40(for 1.5sq.mm)
•	Max Attenuation At 1 Khz (dB/Km)	(dB/Km)	80 dB
•	Min Insulation Resistance At 20 Deg° C	Mohm/Km	100 Mohm/Km

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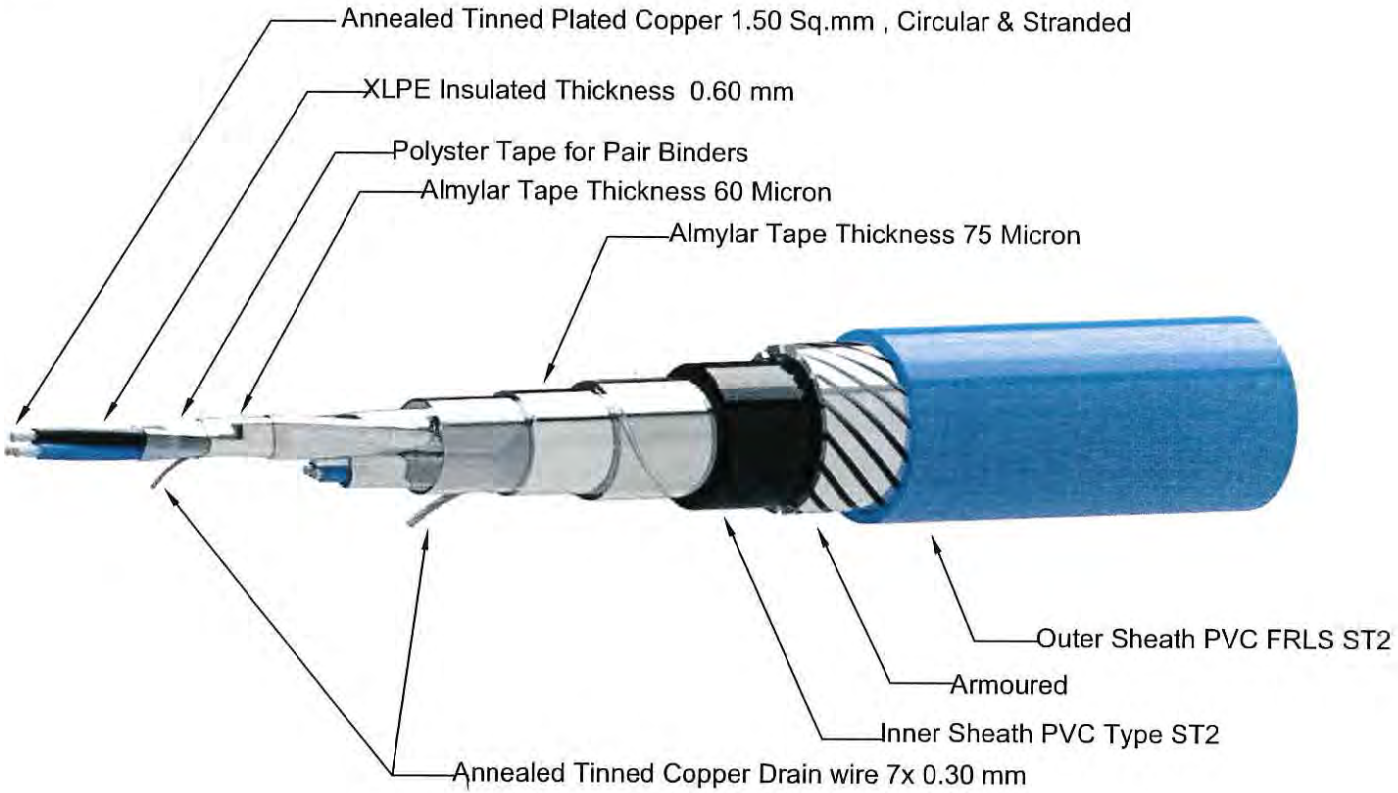
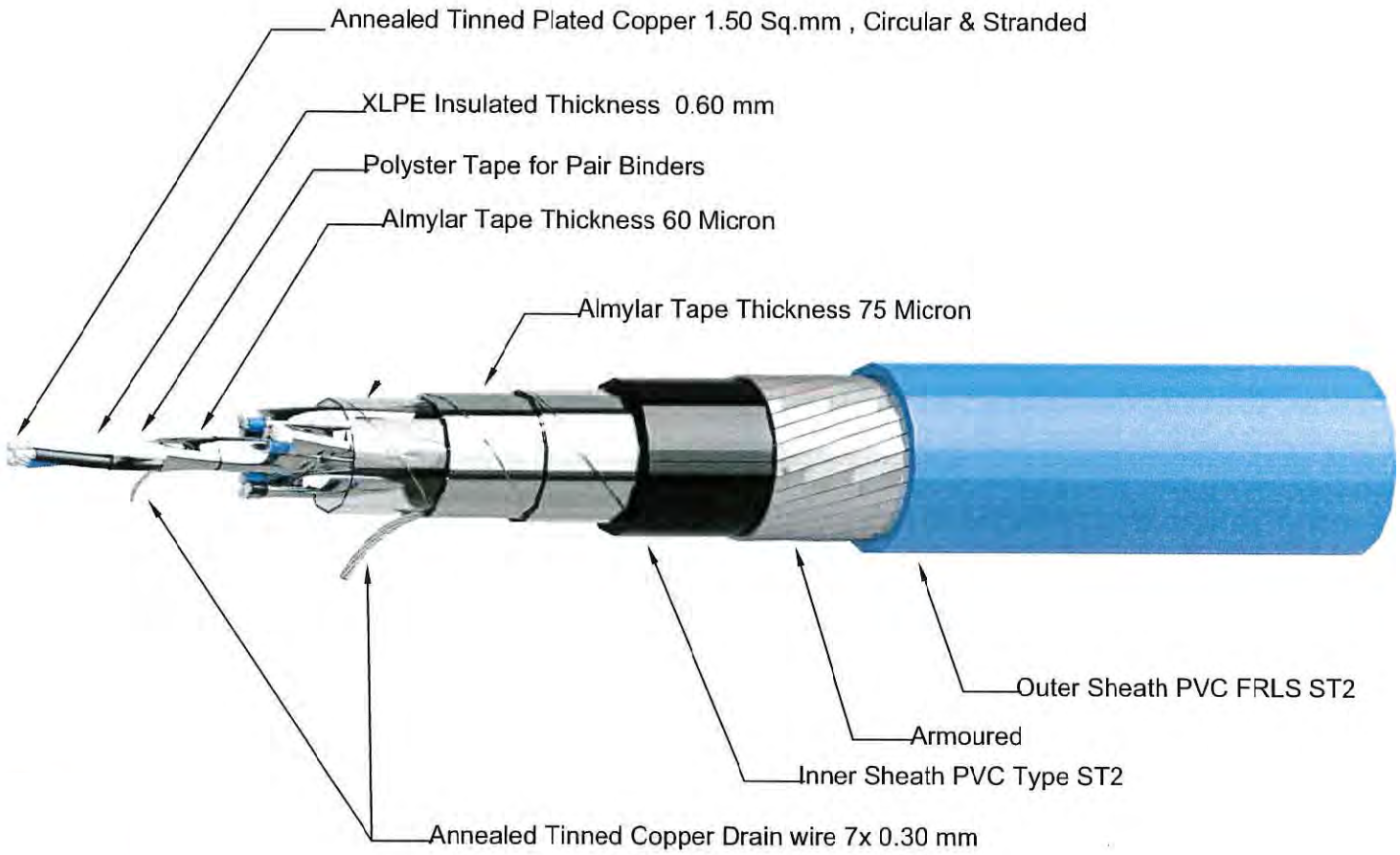


SIGNAL CABLE 2 TRIAD x 1.50 SQ.MM

ITEM DESCRIPTION: SIGNAL CABLE , 4 TRIAD X 1.50 SQ.MM			
Sr.	PARAMETER DESCRIPTION	UNIT	SIZE OF CABLE
1	Manufacturer & Place of Manufacturing		
2	**Reference Standards**		Generally conforming to IS 7098 Part 1&2, BS 5308 Part II,BS EN 50288 Part-7, BS EN 50290-2-29,IS 8130, IS 5831, IS:3975, IS:2633, IS 1554(I), IEC754-1, ASTMD 2863, 2843, SS4241475 Cl. F3 IEC-60332-III, VDE-207(P-6)
3	**Voltage Grade**	V	650/1100V
4	**Electrical Characteristics**		
•	Power frequency test voltage (Spark Test)		As per BS 5099
•	Max. A.C. Resistance of conductor at Temp. 90°C	Ohm/Km	17.3
•	Max. D.C. Resistance at Temp. 20°C	Ohm/km	12.5
•	Highest voltage for equipment (Um)	KV	2Kv
•	Test voltage at site after laying	KV	1.5 KV for 1 Minute for core to core / 1.0 KV for 1 minute for core screen
5	**Conductor**		
•	Material		Stranded Annealed Tinned high conductivity copper class-2 of IS -8130
•	Grade & purity	%	Electrolytic &99.9
•	No. of strands /Dia. (mm) of each strand Nom.	mm	7/ 0.53
•	Area of Cross Section	Sq.mm	1.50
•	Shape of Conductor		Stranded - Circular
6	**Insulation**		
•	Material Type & Grade		XLPE
•	Thickness Of Insulation (Min)	mm	As per IS 7098 (0.40 MM)
•	Thickness Of Insulation (Nom.)	mm	As per IS 7098 (0.55 MM)
•	Method Of Application		Extruded
•	Diameter Over Insulation Approx.	mm	2.80 MM
•	Pair Twisting Lay (If Application)		100mm max , 10 Twist / Meter min,
•	Pair Colour		White ,Blue , Black
7	**Individual Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.06 (Nom.)
•	Coverage & Overlap	%	100%&25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No of Stands / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
8	**Overall Screening**		
•	Material		Aluminium Mylar Tape
•	Type		Helical
•	Thickness	mm	0.075 (min)
•	Coverage & Overlap	%	100% & 25%
•	Drain Wire (If Applicable)		
•	Material		Annealed Tinned Copper
•	Cross Section	sq.mm	0.5
•	No. of Stand / Dia. (Mm) Of Each Strand Nom.	mm	7/0.3
9	**Inner Sheath**		
•	Material		HR PVC Type ST-2 Of IS-5831
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Dia. Over Outer Sheath Approx	mm	15 MM
•	Colour		Black
10	**Outer Sheath**		
•	Material		HR PVC Type ST-2 of IS -5831 with FRLS Properties
•	Type		Extruded
•	Thickness	mm	Thickness as per IS 7098
•	Colour		Blue
11	**Armouring**		Galvanized Flat Steel Strip
•	Thickness Of Armour (Dia.)		As per IS 7098-1-Table -6
12	**Nom Overall Outer Dia. Of Cable App. (± 2mm)**	Mm	23 mm (±) 2 mm
13	**Net Weight Approx.**	Kg/Km	720 kg
14	**Recommended Min. Bending Radius**		12XOD of cable
15	**Classification Of Cables For Improved Fire Performance (Category No. /Name)**		Category C2
16	**FRLS Properties (For Outer Sheath)**		
•	Smoke Density Rating		Max 60 % as per ASTM D2843
•	Oxygen Index At Room Temp.		Min 29% as per ASTMD2863
•	Temperature Index		Min 250°C as per ASTM D2863
•	HCL Emission (Acid Gas Generation)		Max 20% (by weight) as per IEC 754(I)
•	Fire Resistance Test		As per IEEE-383, IEC-60332-PART-III CAT-A, SS-424-1475
17	**High Voltage Test At Factor With Duration**	KV_{rms}	CORE to Core -1.5 kV for 1 minute / Core to shield -1KV for 1 minute
18	**Cable Drum**		
•	Approx Gross Weight Of Drum	Kg/Km	70 Kg
•	Net Weight Of Drums Approx	Kg/ km	800 kg
•	Standard Length Of Cable (Subject To A Manufacture Of (+/-5%)	Meter	1000 ± 5%
19	Suitability With Regard To Moisture, Ozone, Acid ,Oil & Alkaline Surroundings		Confirmed
20	**Printing On The Outer Sheath Of Cable**		REVTI® MAKE SIGNAL CABLE PAIR X SIZE , 1.1KV , MONTH YEAR , 000 M , BHEL BHOPAL , UJVNL
21	**Additional Information**		
•	Min. Cross Talk At 0.8khz	dB	60
•	Mutual Capacitance At 1khz Core To Core (Max)	nF/km	115
•	Mutual Capacitance At 1khz Core To Screen (Max)	nF/km	400
•	Mutual Inductance @ 1khz	mH/Km	1mH/km
•	L/R Ratio (Max) Micro Henry /Ohm	µH/Ω	40(for 1.5sq.mm)
•	Max Attenuation At 1 Khz (dB/Km)	(dB/Km)	80 dB
•	Min Insulation Resistance At 20 Deg° C	Mohm/Km	100 Mohm/Km

ID NO. - REI



SIGNAL CABLE 4 TRIAD x 1.50 SQ.MM

TECHNICAL SPECIFICATION/DATASHEET

S.No.	Parameters	Requirement
1	Applicable Standards	1) Three phase induction motors : IS:325, IEC:60034, IS: 12615 2) Single phase AC motors : IS:996, IEC:60034 3) Energy Efficient motors : IS 12615, IEC:60034-30 4) Designation of Methods of Cooling of Rotating Electrical Machines : IS 6362. 5) Designation for types of construction and mounting arrangement of rotating electrical machines : IS 2253
2	Rated voltage	415V, 3 Phase
3	Frequency (Hz)	50Hz
4	Permissible variations for	
	a) Voltage	+/-10%
	b) Frequency	(+)3 to (-)5%
	c) Combined	10 % (absolute sum)
	System fault level at rated voltage	50KA for 1 sec
	Short time rating for terminal boxes	50KA for 0.25 sec
	LV system gounding	solidly
5 (a)	Type of motors	General purpose, Constant speed, Three/Single phase. Continous duty (S1) squirrel cage induction motor suitable for direct-on-line starting.
(b)	Service conditions	Hot, Humid and Tropical Atmosphere highly polluted.
(c)	Maximum acceptable kW rating of LV motor	160kW
(d)	Rating up to which Single phase motor	Acceptable below 0.20 kW
6 (a)	Energy efficient motors	Continuous duty LT motors up to 160 KW Output rating (at 50 deg.C ambient temperature), shall be premium efficiency (IE3) as per IEC: 60034-30/ IS:12615.
(b)	Efficiency class	IE3
7	Design margin over continous max. demand of the driven equipment (min)	Motor name-plate rating at 50°C shall have at least 15% margin
8	Starting requirement	
	a) Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed	85% below 110kw 80% from 110kw to 160kw
	b) Maximum locked rotor current	as per IS 12615
	c) Starting duty	a) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. b) Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. c) Two hot starts in succession, with motor initially at normal running temperature. d) The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.
	e) the locked rotor withstand time under hot condition at highest voltage limit	a) Under hot condition at 110% rated voltage shall be more than motor starting time by at least 3 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time at minimum permissible voltage. B) Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.
9	Runing requirement	a) The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. b) The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.
10	Noise level (max.)	as per IS:12065
11	Vibration shall be limited within the limits	as per IS:12075
12	Construction Features	
(i)	Enclosure Details	
	a) Degree of protection	i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 with canopy
	b) Method of ventilation	Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type.
(ii)	Insulation	Class 'F' with temperature rise limited to class 'B'. Windings shall be impregnated to make them non-hygroscopic,oil resistant and flame resistant.

(iii)	Bearings	(a) Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs. (b) Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. (c) Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. (d) Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement. (e) Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.
13	Main terminal box	
	Type	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
	DOP	same as motor
	Position when veiwed from the non driving end	- Left hand side
	Rotation	90 Deg.
	Space heater	Supply- 240VAC, 50Hz, Motors rated 30KW and above shall have sapce heater to maintain the motor internal air temperature above the dew point. Separate terminal box for space heaters & RTDs shall be provided.
	Cable glands and lugs	-Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. Gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
	Minimum clearances to be provided between phase to phase and phase to earth	25MM
14	Earthing points 2 nos. suitable for conenction	Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
15	Paint shade	Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions subject to Customer's approval during detailed engineering.
16	Testing	1. All type & Routine tests shall be as per IS 12615. 2. The Contractor shall submit the type tests reports for the tests conducted on the equipment similar to those to be supplied under this contract and the test(s) should have been conducted at an independent laboratory not earlier than five (5) years prior to supply under this contract. 3. In case the contractor is not able to submit valid report of the type test(s) or in case type test report(s) are not found to be meeting the specification requirements, or not including all specified tests the contractor shall conduct all such tests under this contract. The cost of such test shall be deemed to be included in the price. The owner shall have right to witness the type tests. 4. All routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
17	RATING PLATE	In addition to the minimum information required by IS, the following information shall be shown on motor rating plate : (a) Temperature rise in Deg.C under rated condition and method of measurement. (b) Degree of protection. (c) Bearing identification no. and recommended lubricant.
18	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

19	additional requirement	1. All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion. 2. All fittings and hardwares shall be corrosion resistant. 3. Temperature Rise: Air cooled motors: 70°C by resistance method. 4. Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing. 5.Motor weighing 20 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.
DATA TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER ORDERING		
1. GENERAL		
i)	Manufacturer & Country of origin.	
ii)	Equipment driven by motor)	
iii)	Motor type	
iv)	Country of origin	
v)	Quantity	
2. DESIGN AND PERFORMANCE DATA		
i)	Frame size	
ii)	Type of duty	
iii)	Type of enclosure and method of cooling	
vi)	Type of mounting	
vii)	Direction of rotation as viewed from DE END	
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
	(B) Rating as specified in load list	
xi)	Rated speed at rated voltage and frequency	
xii)	At rated Voltage and frequency	
	a) Full load current (Amps)	
	b) No load current (Amps)	
xiii)	Power Factor at	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
	e) NO load	
	f) Starting.	
xiv)	Efficiency at rated voltage and frequrecy	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
xv)	Starting current (amps) at	
	a. 100 % voltage	
	b. Minimum starting voltage	
xvi)	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
xvii)	Safe stall time with 110% of rated voltage	
	a. From hot condition	
	b. From cold condition	
xviii)	**Torques :**	
	a. Starting torque at min. permissible voltage(kg-mtr.)	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e. Rated torque (kg.m)	
xix)	Stator winding resistance per phase (ohms at 20 Deg.C.)	
xx)	GD^2 value of motors	
xxi)	Locked rotor KVA input (at rated voltage)	
xxii)	Locked rotor KVA/KW.	
xxiii)	**Bearings**	
	a. Type	
	b. Manufacturer	
	c. Self Lubricated or forced Lubricated	
	d. Recommended Lubricants	
	e. Guaranteed Life in Hours	
	f. Whether Dial Type thermometer provided	
	g. Oil pressure Gauge/switch	
	i. Range	
	ii. Contact Nos. & ratings	
	iii. Accuracy	
xxiv)	**Vibration**	
	a) Velocity (mm/s)	
	b) Displacement (microns)	

xxv)	Noise level (DB)	
3. CONSTRUCTIONAL FEATURES		
i	Stator winding insulation	
	a. Class & Type	
	b. Tropicalised (Yes/No)	
	c. Temperature rise over specified max.	
	i. Cold water temperature of 38 DEG. C.	
	ii. Ambient Air 50 DEG. C.	
	d. Method of temperature measurement	
	e. Stator winding connection	
	f. Number of terminals brought out	
ii	Type of terminal box for	
	a. stator leads	
	b. space heater	
	c. Temperature detectors	
	d. Instrument switch etc.	
iii)	For main terminal box	
	a. Location	
	b. Entry of cables	
	c. Recommended cable size	
	d. Fault level (MVA)	
iv)	Temperature detector for stator winding	
	a Type	
	b. Nos. provided	
	c . Location	
	d. Make	
	e. Resistance value at 0 deg. C. (ohms)	
vi)	Paint shade	
vii).	Weight of(approx)	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	

INSTRUCTION TO BIDDER
1. This data sheet shall be filled up on the basis of finally agreed points, bid clarifications and MOM with the bidder.
2. This Data Sheet shall be submitted by successful bidder after award of contract.

1.0 **SYSTEM DESIGN DATA**

1.1	Design Ambient	:		°C
1.2	Relative Humidity			
	a) Average	:		
	b) Maximum	:		
1.3	Max. System voltage for continuous operations	:		V
1.4	Rated frequency	:		Hz
1.5	One minute power frequency withstand voltage :			
	a) Main circuit	:		kV.
	b) Aux. circuit	:		kV.
1.6	DC System fault level (220 V)	:		kA

2.0 **APPLICABLE STANDARDS**

Compliance to the standards indicated in Annexure I of Data Sheet A confirmed unless specifically mentioned otherwise in "Schedule of Deviations"	:	[ ] YES	[ ] NO

3.0 **CONSTRUCTIONAL FEATURES**

3.1 **GENERAL**

3.1.1	Switchgear type designation of manufacturer	:	
3.1.2	Operational Fronts	:	[ ] Double Front [ ] Single Front [ ] Both as per BOM

3.1.3 Sheet metal type — ROLLING — THICKNESS

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a)	Non-load bearing covers	:	[ ] Hot [ ] Cold		mm
b)	Non-load bearing partitions	:	[ ] Hot [ ] Cold		mm
c)	Load bearing members	:	[ ] Hot [ ] Cold		mm
d)	Frames	:	[ ] Hot [ ] Cold		mm
e)	Doors	:	[ ] Hot [ ] Cold		mm
f)	Withdrawable units	:	[ ] Hot [ ] Cold		mm

3.1.4 Rating above which louvers are provided : A

3.1.5 Degree of Protection of switchboards with modules in service and all doors closed.

a) Without louvers :

b) With louvers :

3.1.6 Method of power connection from busbars to module : [ ] Rigid busbars
[ ] Insulated conductor

3.1.7 Minimum size of primary power conductors

a) Copper : mm^2

b) Aluminium : mm^2

3.1.8 Spare modules considered as per Data Sheet A / BOM : [ ] YES [ ] NO

3.2 **DRAWOUT MODULES**

3.2.1 Type of execution of modules (functional unit)

a) Circuit breaker unit (Incoming & outgoing) : [ ] Withdrawable [ ] Fixed

b) MCCB unit (Incoming) : [ ] Withdrawable [ ] Fixed

c) Switch-Fuse & Contactor (Incoming) : [ ] Withdrawable [ ] Fixed

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d)	Switch or Switch-Fuse (Incoming)	:	[ ] Withdrawable [ ] Fixed	
e)	MCCB unit (Outgoing)	:	[ ] Withdrawable [ ] Fixed	
f)	Contactor starter unit (Outgoing)	:	[ ] Withdrawable [ ] Fixed	
g)	Switch-Fuse unit (Outgoing)	:	[ ] Withdrawable [ ] Fixed	
h)	Incoming Voltage Transformer (VT)	:	[ ] Withdrawable [ ] Fixed	
i)	BUS VT	:	[ ] Withdrawable [ ] Fixed	
j)	Control Transformer	:	[ ] Withdrawable [ ] Fixed	
k)	Space Heater	:	[ ] Withdrawable [ ] Fixed	
l)	Alarm	:	[ ] Withdrawable [ ] Fixed	
m)	DC Supply	:	[ ] Withdrawable [ ] Fixed	

3.2.2 Rating upto which withdrawable units applicable, if specified in 3.2.1 b), d), e) and g) above. : A

3.2.3 Facility for functional testing of withdrawable modules provided for:

a)	Incomer Circuit Breaker	:	[ ] YES	[ ] NO
b)	Outgoing Circuit Breaker	:	[ ] YES	[ ] NO
c)	Contactor controlled units	:	[ ] YES	[ ] NO
d)	Bus - Couplers Circuit Bkr. Controlled	:	[ ] YES	[ ] NO

3.3 **BUSBARS & CONNECTIONS**

3.3.1 Busbar material

a) Phase & Neutral

i.	Material	:	[ ] Copper	[ ] Aluminium
ii.	Grade	:		

b) Earth

i.	Material	:	[ ] Copper	[ ] Aluminium

[ ] Galvanised MS

ii. Grade :

3.3.2 Support material :

3.3.3 Fault Level : kA

3.3.4 Max. temperature for short time rating : °C

3.3.5 Short time current

a) For switchboards fed thru ACB / MCCB : kA, sec.

b) For switchboards fed thru HRC Fuses : kA, sec.

3.3.6 Momentary rating : kA (peak)

3.3.7 Type of joints : [ ] Silver plated
[ ] Non-silver plated
[ ] Both

3.3.8 Temperature Rise

a) Design ambient : °C

b) Temp. rise (max.) for
i. Silver plated joints : °C

ii. Non-silver plated joints : °C

3.3.9 Whether HRPVC sleeving provided : [ ] YES [ ] NO

3.3.10 Whether shrouds on busbar tap offs provided : [ ] YES [ ] NO

3.3.11 Applicable method of colour coding for black PVC sleeving :

3.3.12 Busbar clearances in air (minimum)
a) Phase-Phase : mm
b) Phase-Earth : mm

3.3.13 Spacing between supports : mm

3.3.14 Spacing between busbars : mm

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3.4 SECONDARY WIRING AND TERMINALS

3.4.1	Voltage grade of wires		:		V
3.4.2	Conductor material of wire				
	a)	Power wiring	:		
	b)	Control wiring	:		
3.4.3	Sizes of wires				
	a)	Power wiring (min.)	:		mm^2
	b)	CT leads	:		mm^2
	c)	Other control wires	:		mm^2
3.4.4	Insulation material of wires		:		
3.4.5	Colour code of wires conforms to Section D		:	[ ] YES	[ ] NO
3.4.6	Type of lugs used for internal wiring		:		
3.4.7	Minimum current rating of terminal block		:		A
3.4.8	Is shrouding inherent feature for live parts of terminal block for -				
	a)	Secondary isolating contacts	:	[ ] YES	[ ] NO
	b)		:	[ ] YES	[ ] NO
	c)		:	[ ] YES	[ ] NO
3.4.9	Number of ways per block of terminals		:		
3.4.10	Standard mounting of terminal blocks		:		
3.4.11	Whether terminals for CTs provided with shorting facility		:	[ ] YES	[ ] NO
3.4.12	Whether disconnectable link type short circuiting terminals provided for secondary injection		:	[ ] YES	[ ] NO
3.4.13	Spare terminals as percentage of total terminals		:		%

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3.5 **AUXILIARY BUSES**

3.5.1 Provision of following as applicable to various switchboards

a)	AC Control Bus	:	[ ] 240 V	[ ] 110 V
b)	DC Control Bus	:	[ ] 220 V	[ ] 110 V
c)	24V AC Wdg. htg. Bus	:	[ ] YES	[ ] NO
d)	240V AC Space htg. Bus	:	[ ] YES	[ ] NO
e)	Alarm Bus	:	[ ] YES	[ ] NO

3.6 **CONTROLS, INDICATIONS & ALARMS**

3.6.1 Means for simulation testing provided : [ ] YES [ ] NO

3.6.2 Scope considered for interposing relays for remote command interface : [ ] Mounting & wiring only
[ ] Supply, mounting & wiring

3.6.3 No. of contacts and rating at 230 V AC (make & carry) and 220 V DC (breaking)

			NO + NC	RATING (A) (AC)	(DC)
a)	Air Circuit Breaker				
	i. Internal use	:			
	ii. Purchaser's use	:			
	iii. Releases				
	A. Overload	:			
	B. Short Circuit	:			
	C. Under Voltage	:			
	D. Earth Fault	:			
b)	MCCB	:			

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c)	Switches	:	
d)	Power Contactors	:	
e)	Thermal Overload Relay	:	
f)	Single Phasing Preventer	:	
g)	Push Button	:	
h)	Miniature Circuit Bkr.	:	
i)	Control switches	:	
j)	Selector switch	:	
k)	Timer		
	i. ON delay	:	
	ii. OFF delay	:	
	iii. Instantaneous	:	

3.7 CABLING AND TERMINATIONS

a)	Cable Entry	:	[ ] BOTTOM [ ] TOP [ ] REAR
b)	Cable Sizes as per enclosed annexure II (Data Sheet A) considered	:	[ ] YES [ ] NO
c)	Type of incoming connections from transformer to PCC	:	[ ] Bus Trunking [ ] Cable [ ] Bus Duct

3.8 EARTHING

3.8.1	Size of earth bus (min.)	:	mm^2

3.9 **LABELING**

3.9.1	Inscriptions, material and locations as per specification confirmed, specifically mentioned otherwise in "Schedule of Deviations"	:	[ ] YES [ ] NO

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3.9.2	Thickness of anodised aluminium sheet	:		mm

4.0 **SWITCHGEAR MAIN ASSEMBLIES**

4.1 **AIR CIRCUIT BREAKERS**

4.1.1	Rated voltage	:		V
4.1.2	Maximum voltage at which circuit-breaker can operate continuously	:		V
4.1.3	Number of Poles	:	[ ] Three	[ ] Four
4.1.4	No. of breaks per pole	:		
4.1.5	Clearances in air			
	a) Between phases	:		mm
	b) Live parts to earth	:		mm
4.1.6	Symmetrical (RMS) interrupting capacity at rated voltage.	:		kA
4.1.7	Rated breaking capacity at service voltage	:		MVA
4.1.8	Momentary making current	:		kA (peak)
4.1.9	Short time rating	:		kA, sec.
4.1.10	Short circuit performance category	:		
4.1.11	Derating factor for operation under site conditions	:		
4.1.12	Operating mechanism			
	a) Closing	:	[ ] Motor wound spring	
		:	[ ] Manual	
	b) Tripping	:	[ ] Direct acting	
			[ ] Shunt trip	
			[ ] Both of above	
4.1.13	Operation counter provided	:	[ ] YES	[ ] NO

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4.1.14	Auxiliary voltage for			
	a)	Spring charging motor	:	V DC
	b)	Closing release coil	:	V DC
	c)	Shunt trip coil	:	V DC
4.1.15	Limits of voltage for satisfactory operation of the following devices as %age of normal voltage			
	a)	Spring charging motor	:	%
	b)	Closing release coil	:	%
	c)	Shunt trip coil	:	%
4.1.16	Spring charging motor details			
	a)	Rating	:	kW
	b)	Rated voltage	:	V
	c)	Rated current	:	A
	d)	Speed	:	r.p.m.
	e)	Insulation class	:	
	f)	Spring charging time	:	sec.
	g)	Max. temperature rise over specified ambient	:	^{o}C
4.1.17	Maximum temp. of the main contacts with rated continuous current (After considering derating for site conditions)		:	^{o}C
4.1.18	Type of main contacts		:	
4.1.19	Material of main contacts		:	
4.1.20	Type of arcing contacts		:	
4.1.21	Material of arcing contacts		:	
4.1.22	Whether contacts are silver plated		:	[ ] YES [ ] NO

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If yes,

4.1.23	Thickness of silver plating		:		
4.1.24	Contact pressure		:		
4.1.25	Maximum number of auxiliary contacts that can be fitted		:		
4.1.26	Whether NO & NC contacts interchangeable at site		:	[ ] YES	[ ] NO
4.1.27	Maximum number of secondary isolating contacts that can be fitted		:		
4.1.28	Power required for closing at				
	a)	Normal voltage	:		Watts/VA
	b)	80% normal voltage	:		Watts/VA
4.1.29	Power required for tripping				
	a)	Normal voltage	:		Watts/VA
	b)	50% normal voltage	:		Watts/VA
	c)	Trip circuit consumption (With supervision lamp)	:		Watts/VA
4.1.30	Are the circuit breakers trip free		:	[ ] YES	[ ] NO
4.1.31	Type of release (where applicable)		:	[ ] Static	[ ] Electromagnetic
4.1.32	Provision of releases for specified function				
	a)	PCC incomer			
		i. Overload	:	[ ] YES	[ ] NO
		ii. Short Circuit	:	[ ] YES	[ ] NO
		If Yes, With timer	:	[ ] YES	[ ] NO

	iii.	Under Voltage	:	[ ] YES	[ ] NO
		If yes,			
		With timer	:	[ ] YES	[ ] NO
	iv.	Earth Fault	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO
b)	MCC incomer				
	i.	Overload	:	[ ] YES	[ ] NO
	ii.	Short Circuit	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO
	iii.	Under Voltage	:	[ ] YES	[ ] NO
		If yes,			
		With timer	:	[ ] YES	[ ] NO
	iv.	Earth Fault	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO
c)	Outgoing Feeder				
	i.	Overload	:	[ ] YES	[ ] NO
	ii.	Short Circuit	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO
	iii.	Under Voltage	:	[ ] YES	[ ] NO
		If yes,			
		With timer	:	[ ] YES	[ ] NO
	iv.	Earth Fault	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO
d)	Bus - Coupler				
	i.	Overload	:	[ ] YES	[ ] NO

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	ii.	Short Circuit	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO
	iii.	Under Voltage	:	[ ] YES	[ ] NO
		If yes,			
		With timer	:	[ ] YES	[ ] NO
	iv.	Earth Fault	:	[ ] YES	[ ] NO
		If Yes,			
		With timer	:	[ ] YES	[ ] NO

4.1.33 Release setting range

a)	Overload	:		%
b)	Short circuit	:		%
c)	Under Voltage	:		%
d)	Earth Fault	:		%

4.1.34 Release time delay

a)	Short circuit	:		sec.
b)	Under Voltage	:		sec.
c)	Earth Fault	:		sec.

4.1.35 Min. recommended grading time between consecutive circuit breakers fitted with

a)	Electromagnetic relays	:		msec.
b)	Solid state releases	:		msec.

4.1.36 Means provided for remote indication of individual function for above releases : [ ] YES [ ] NO

4.1.37 Whether following anti-pumping features provided

a)	Mechanical	:	[ ] YES	[ ] NO
b)	Electrical	:	[ ] YES	[ ] NO

4.1.38 Whether programmable secondary isolating contact provided : [ ] YES [ ] NO

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4.2 **CONTACTOR STARTER UNITS (DIRECT-ON-LINE)**

4.2.1	Max. Motor rating upto which contactor starter considered	:		kW
4.2.2	Type of short circuit device	:	[ ] HRC Fuse	[ ] MCCB
4.2.3	Locked rotor protection provided	:	[ ] YES	[ ] NO
4.2.4	Type of co-ordination between SCPD & other starter components as per IS: 8544.	:	[ ] a [ ] b	[ ] c
4.2.5	Whether secondary isolating contacts are self-isolating self-aligning type	:	[ ] YES	[ ] NO

4.3 **SWITCH-FUSE UNITS**

4.3.1	Breaking capacity at 110 % rated voltage and 0.3 power factor	:		
4.3.2	Short time rating	:		kA, sec.

4.4 **MOULDED CASE CIRCUIT BREAKERS (MCCB)**

4.4.1	Application			
	a) Contactor Starter	:	[ ] YES	[ ] NO
	b) Other circuits	:	[ ] YES	[ ] NO
	c) If Yes for b) Provided for rating upto	:		A
4.4.2	Rated voltage	:		V
4.4.3	Number of poles	:		
4.4.4	Derating factor for site ambient conditions	:		
4.4.5	Minimum clearances in air			
	a) Between poles	:		mm

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	b)	Live parts to frame	:		mm
4.4.6	Construction materials of				
	a)	Frame	:		
	b)	Main contacts	:		
	c)	Arcing contacts	:		
4.4.7	Whether contacts are plated		:	[ ] YES	[ ] NO
	If yes,				
4.4.8	Material of plating		:		
4.4.9	Main contact pressure		:		
4.4.10	Maximum temperature rise over ambient for				
	a)	Main contacts	:		^{o}C
	b)	Other moulded parts	:		^{o}C
4.4.11	Short time rating		:		kA, sec.
4.4.12	Rated short circuit duty		:		
4.4.13	Rated breaking capacity (rms) at 415 V		:		kA
4.4.14	Rated making current		:		kA (peak)
4.4.15	On/Off operation				
	a)	Manual	:	[ ] YES	[ ] NO
	b)	Remote power operated	:	[ ] YES	[ ] NO
4.4.16	Releases provided				
	a)	Overload	:	[ ] YES	[ ] NO
	b)	Under voltage	:	[ ] YES	[ ] NO
	c)	Short circuit	:	[ ] YES	[ ] NO

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4.4.17	Whether MCCBs are suitable for use without Short Circuit and/or Overload release without impairing its function in any way	:	[ ] YES [ ] NO
4.4.18	Whether comparison of I Vs T plot of MCCB and fuse will automatically ensure discrimination between the two in S/C and O/L region	:	[ ] YES [ ] NO
	If no,		
4.4.19	State the other consideration for achieving discrimination	:	
4.4.20	Type of coordination with the characteristics of other devices as per IS: 8544, when used as SCPD with contactor	:	[ ] a [ ] b [ ] c
4.4.21	Whether coordination indicated above verified by the test	:	[ ] YES [ ] NO
4.4.22	Whether MCCB is suitable for direct switching on to motor	:	[ ] YES [ ] NO
	If yes,		
4.4.23	Utilization category as per IS: 2959	:	
4.4.24	Whether shunt trip provided	:	[ ] YES [ ] NO
	If yes,		
	a) Nominal voltage	:	V [ ] AC [ ] DC
	b) Voltage variation range	:	%
	c) Energisation power	:	VA
4.4.25	Whether solenoid closing operation provided	:	[ ] YES [ ] NO
	If Yes,		
	a) Nominal voltage	:	V [ ] AC [ ] DC
	b) Voltage variation range	:	%
	c) Energisation power	:	VA

5.0 **SWITCHGEAR COMPONENTS**

5.1 **ISOLATING SWITCH**

5.1.1	Rated voltage	:	V

5.1.2	No. of poles	:		
5.1.3	Minimum thermal rating	:		A
5.1.4	Are switches suitable for breaking locked rotor current of the motor of maximum rating controlled by the switches	:	[ ] YES	[ ] NO
5.1.5	Derating factor for site ambient conditions	:		
5.1.6	Utilization category for main contacts	:		
5.1.7	Temperature rise over ambient for main contacts when carrying rated current for site condition	:		^{o}C

5.2 **POWER CONTACTORS**

5.2.1	Short time rating	:		kA, sec.
5.2.2	Rated voltage of main contacts	:		V
5.2.3	Rated voltage of auxiliary			
	a) AC	:		V
	b) DC	:		V
5.2.4	Coil voltage (nominal)	:	[ ] 110 V AC 50 Hz [ ] 220/240 V AC 50 Hz [ ] 110 V DC [ ] 220 V DC	
5.2.5	Permissible supply voltage variation w.r.t. nominal coil voltage	:		%
5.2.6	Drop out voltage for coil	:		V
5.2.7	No. of poles for main contactor	:		
5.2.8	Insulation class for winding of electromagnet	:		
5.2.9	Temperature rise over ambient	:		^{o}C

for coil winding

5.2.10 Minimum thermal rating when used in power circuit : A

5.2.11 Utilization category

a) Reversible motor :

b) Non-reversible motor :

5.2.12 Type of hold-in mechanism : [ ] Electrically held
[ ] Mechanical latch-in

5.3 HIGH RUPTURING CAPACITY (HRC) FUSES

5.3.1 Whether fuse mounted in the insulated carrier : [ ] YES [ ] NO

5.3.2 Rupturing capacity

a) AC : kA

b) Dc : kA

5.3.3 Temperature rise over ambient at rated current : °C

5.4 THERMAL OVERLOAD RELAY

5.4.1 Range : %

5.4.2 Resetting : [ ] Hand [ ] Self
[ ] Both with changeover facility

5.4.3 Whether ambient compensated : [ ] YES [ ] NO

If yes,
Compensated upto ambient of : °C

5.4.4 Single phasing prevention feature provided : [ ] YES [ ] NO

5.5 SINGLE PHASING PREVENTER (SPP)

(To be filled up where separate SPP is considered)

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5.5.1	Applicable above motor rating	:		kW
5.5.2	Delay time	:		sec.
5.5.3	Setting (%age of FLC)	:		%
5.5.4	Resetting	:	[ ] Hand	[ ] Self

5.6 **INSTRUMENTS AND METERS**

5.6.1	Provision of ammeter for motor rating above	:		kW
5.6.2	Voltmeter			
	a) Shape	:		
	b) size	:		mm x mm
	c) Accuracy class	:		
	d) Voltage coil rating	:		V
	e) Angle of deflection	:		deg.
	f) Scale length	:		mm
5.6.3	Ammeter			
	a) Shape	:		
	b) size	:		mm x mm
	c) Accuracy class	:		
	d) Current coil rating	:		A
	e) Angle of deflection	:		deg.
	f) Scale length	:		mm
5.6.4	Energy Meters			
	a) Shape	:		

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b)	size	:		mm x mm
c)	Accuracy class	:		
d)	Current coil rating	:		A
e)	Voltage coil rating	:		V
f)	Angle of deflection	:		deg.
g)	Scale length	:		mm
h)	Hours of operation	:		hours

5.7 **RELAYS**

5.7.1	Type	:	[ ] Static [ ] Electromagnetic
5.7.2	Coil Rating		
a)	Current coil	:	[ ] 1 A [ ] 5 A
b)	Voltage	:	V
5.7.3	Means for in-built testing provided	:	[ ] YES [ ] NO
5.7.4	Minimum grading time recommended between consecutive breakers fitted with the relays	:	msec.

5.8 **CURRENT TRANSFORMERS**

5.8.1	Secondary Rating	:	[ ] 1 A [ ] 5 A
5.8.2	Output	:	VA
5.8.3	Accuracy class (metering)	:	
5.8.4	Accuracy class (protection)	:	
5.8.5	Accuracy limit factor (ALF)	:	
5.8.6	Type of Primary winding	:	[ ] Bar [ ] Wound

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5.8.7	Primary current rating		:		A
5.8.8	Instrument security factor		:		
5.8.9	Specific data for CTs required for differential Protection				
	a)	Knee point voltage (Vk)	:		V
	b)	Exciting current at Vk/2	:		A
	c)	Secondary resistance	:		ohms
5.8.10	Short time rating		:		kA, sec.
5.8.11	Momentary current		:		kA
5.8.12	Insulation material		:		
5.8.13	Class of insulation		:		
5.8.14	Max. temperature rise over ambient for the winding		:		^{o}C
5.8.15	Whether capable of carrying rated primary current for 1 minute with the secondary winding open circuited		:	[ ] YES	[ ] NO

5.9 VOLTAGE, CONTROL & WINDING HEATING TRANSFORMERS

5.9.1 Voltage Transformers

	a)	System Earthing considered	:	[ ] Effective	[ ] Non-effective
	b)	Secondary terminal voltage (phase-phase)	:		V
	c)	Insulation material	:		
	d)	Class of insulation	:		
	e)	Accuracy class	:		
	f)	Output	:		VA

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g)	Winding configuration	:		[ ] 3, 1ϕ [ ] 3ϕ [ ]	V
h)	Over voltage factor				
	i. continuous	:			
	ii. 30 seconds	:			
i)	Max. temperature rise of winding over ambient	:			°C

5.9.2 Control Transformers (for contactor operation)

a)	Rated Primary voltage(Phase-Phase)	:		V
b)	Taps	:		%
c)	Minimum secondary terminal voltage (when primary voltage is minimum & transient current is maximum)	:		V
d)	Secondary terminal voltage	:	[ ] 110 V	[ ] 240 V
e)	Whether separate control transformer considered for individual circuit	:	[ ] YES	[ ] NO

5.9.3 24 V Winding Heating Transformer
(If applicable as per Data Sheet A)

a)	Secondary terminal voltage	:		V
b)	Primary voltage	:		V

5.10 **MINIATURE CIRCUIT BREAKER**

(Data to be filled up if applicable)

5.10.1	Breaking capacity	:		kA
5.10.2	Thermal overload and magnetic short circuit protection provided	:	[ ] YES	[ ] NO

5.11 **CONTROL AND SELECTOR SWITCH**

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5.11.1 Control Switch

a)	Type	:	[ ] Stay put [ ] Spring return [ ] Wing knob [ ] Pistol grip
b)	Voltage grade	:	V
c)	No. of positions	:	
d)	Lockability	:	[ ] In each position [ ] with integral barrel lock & key in neutral position
e)	No. of poles / ways	:	
f)	Angular movement	:	deg.

5.11.2 Selector Switch

a)	Type	:	[ ] Stay put [ ] Wing knob
b)	Voltage grade	:	V
c)	No. of positions	:	
d)	Lockability	:	[ ] in each position [ ] with integral barrel lock & key
e)	No. of poles/ ways	:	
f)	Angular movement	:	deg.

5.12 **INDICATION LAMPS**

5.12.1	Voltage grade	:	V
5.12.2	Series resistor value used as economy ohms resistor or dropping resistor for supervision	:	
5.12.3	Circuit voltage	:	[ ] 220/240 V AC [ ] 110 V DC [ ] 220 V DC

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5.12.4	Lens colour as per Data Sheet A.		:	[ ] YES	[ ] NO
5.12.5	Diameter of lamp		:		mm
5.12.6	Wattage consumption of lamp				
	a)	With resistor	:		Watts
	b)	Without resistor	:		Watts
5.13	PUSH BUTTONS				
5.13.1	Voltage Grade		:		V
5.13.2	No. of Contacts		:		(NO + NC)
5.13.3	Function		:	START	STOP RESET
	a)	Colour of actuator	:		
	b)	Type of actuator head (S=Shrouded, M=Mushroom)	:	S/M	S/M S/M
	c)	Lockability (Y=Yes, N=No)	:	Y/N	Y/N Y/N

5.14 **ANTI-CONDENSATION HEATERS**

5.14.1	24 V motor winding heating			
	a)	Applicable Rating(including & below)	:	kW
	b)	Maximum space htg. current (%age of FLC) considered for the sizing of transformer	:	%
5.14.2	Panel space heating			
	a)	Voltage	:	V AC
	b)	Thermostat provided	:	[ ] YES [ ] NO
	c)	If b) is yes, limit of adjustability of temp. within panel	:	°C

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d) If b) is no, the min temp. to be maintained : °C

e) Separate provision for front and rear panels considered : [ ] YES [ ] NO

5.15 **GENERAL PURPOSE TIMERS**
(Other than electromechanical & Electronic timers used in protection)

5.15.1 Coil voltage rating (AC) : [ ] 220 V [ ] 110 V

5.15.2 Limits of voltage variation : %

5.15.3 Time delay range : sec.

5.15.4 Type of delay mechanism : [ ] Pneumatic
[ ] Electronic
[ ] Electromechanical

5.15.5 Repeat accuracy :

6.0 **PAINTING**

6.1 Shade

a) Interior : as per IS:5

b) Exterior : as per IS:5

6.2 Paint Finish

a) Interior : [ ] Matt [ ] Semi-glossy

b) Exterior : [ ] Semi-glossy [ ] Full-glossy

6.3 Paint thickness (min.) : microns

7.0 MAKE AND TYPE OF COMPONENTS

	EQUIPMENT	MAKE	TYPE DESIGNATION OF MANUFACTURER	No. OF YEARS IN SERVICE
1.	Air Circuit Breaker			

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2.	MCCB (AC)					
3.	MCCB (DC)					
4.	Isolating Switch					
5.	AC Contactor					
6.	DC Contactor					
7.	HRC Fuse (base & link)					
8.	Single Phasing Preventer					
9.	Voltmeter					
10.	Ammeter					
11.	Energy meter					
12.	Relays					
	i. Thermal O/L					
	ii. Inverse Time Over Current					
	iii. Definite Time Over Current					

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		iv.	Motor Protection			
---		v.	Inverse Time Earth Fault			
---		vi.	Definite Time Earth Fault			
---		vii.	Interposing Relay			
---		viii.				

---	13.	CT				
---	14.	VT				
---	15.	Control Transformer				
---	16.	Winding Heating Transformer				
---	17.	MCB				
---	18.	Control Switch				
---	19.	Selector Switch				
---	20.	Indicating Lamps				
---	21.	Panel space Heater				
---	22.	Gen. Purpose Timer				

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	23.	Push Buttons				
---	24.	Breaker operation counter				
---	25.	Breaker switch				
---	26.	Neutral link				
---	27.	Cable gland				
---	28.	Cable lugs				
---	29.	DC switch				
---	30.	Fixed terminals				
---	31.	Lighting switch				
---	32.	Limit switch				
---	33.	Sockets				
---	34.	Terminal drawouts				
---	35.	Thermostat				

8.0 SPARES

8.1 **O&M Spares**

a) Period for which O&M spares offered : years

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b)	Whether additional O&M offered (other than those indicated)	:	[ ] YES	[ ] NO

8.2 Start-up spares

a)	Whether E & C spares offered	:	[ ] YES	[ ] NO
b)	Whether any additional start-up spares offered for purchaser's consideration	:	[ ] YES	[ ] NO

9.0 **DOCUMENTATION**

Whether following furnished as per clause 12.3 Section D.

a)	Typical sectional drawing	:	[ ] YES	[ ] NO
b)	Schematic drawings for each functional unit	:	[ ] YES	[ ] NO
c)	Wire routing, termination and numbering details	:	[ ] YES	[ ] NO
d)	Type test Certificates of switchboard, circuit-breakers and components	:	[ ] YES	[ ] NO
e)	Final Quality Plans with signatures and seal on each sheet	:	[ ] YES	[ ] NO
f)	Catalogues / Technical leaflets of switchboard and components	:	[ ] YES	[ ] NO
g)	Bar chart of activities and their schedules	:	[ ] YES	[ ] NO

The above documents shall be submitted in the form of Annexures - A to Annexure - G in the exact order listed above along with Data Sheet C.

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DATASHEET C

GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

S.No.		Unit	Description
1.0	**General**	-	
1.1	Name of manufacturer	-	
1.2	Place of Manufacture	-	
2.0	**Standards Applicable**		
2.1	**IS: 7098 Part-I** For general specification of XLPE Cables	-	YES
2.2	**IS: 8130** For conductor material	-	YES
2.3	**IS: 5831** For material of inner sheath & outer sheath.	-	YES
2.4	**IS: 3975 / IS: 8130** For armour of 3 core/ single core cables	-	YES
2.5	**IS: 10810** For method of tests	-	YES
2.6	**IS:10418** For cable drums	-	YES
2.7	**ASTMD-2863** For oxygen index test	-	YES
2.8	**ASTMD-2843** For smoke density test	-	YES
2.9	**SS:424-14-75 & IEC-332-III-Cat-B & CAT-A, IEC-332-I/ IEEE: 383** For flammability test	-	YES
2.10	**IEC-754-1** For Acid gas generation	-	YES
2.11	Current rating of cables conforms to	-	
2.12	Short circuit rating conforms to	-	
2.13	Formula for calculating short circuit current for Different duration	-	
3.0	(a) Installation Conditions at site	deg. C	
	i) Ambient air temperature	deg. C	
	ii) Ground temperature	cm	
	iii) Depth of laying of cables buried in ground	deg. C cm/W	
	(b) Installation conditions for current rating specified at clause 6.3		
4.0	CHARACTERISTICS OF FRLS SHEATH		
	(a) Oxygen index		

	(b) Temperature index		
	(c) Acid gas generation		
	(d) Smoke density rating		
5.0	CABLE DRUMS		
	(a) Type & construction		
	(b) Standard drum length		
	(c) Tolerance on drum length		
6.0	INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE		
6.1	No. of cores x size		
6.2	Voltage grade (Uo/U)	kV	
6.3	Base current ratings (*) based on Cl. 3.0		
	(a) In air	Amp	
	(b) In ground	Amp	
	(c) ducts	Amp	
6.4	Short circuit rating	kA,Sec	
6.5	(a) D.C. resistance of conductor at 20 deg C	ohm/km	
	(b) A.C. resistance of conductor at 90 deg. C	ohm/km	
	(c) Reactance of cable at Normal frequency	ohm/km	
	(d) Electrostatic capacitance of cable at normal frequency	mF/km	
6.6	CONDUCTOR		
	(a) Material type & grade	-	
	(b) No & dia of wires in each core before stranding	no x mm	
	(c) Shape	-	
6.7	XLPE INSULATION		
	(a) Nominal thickness of insulation	mm	
	(b) Method of Curing	-	
6.8	PVC ST2 INNERSHEATH		
	(a) Material	-	
	(b) Thickness (min.)	mm	
	(c) Method of application	-	
	1. Multi-core cables		
	(i) With fillers		
	(ii) With out fillers	Pressure Extruded	
	2. Single core cables		
	d) Type and shape of fillers (if used)		

	e) Colour		
6.9	ARMOUR		
	(a) Material		
	(i) Single core cables		
	(ii) Multi-core cables		
	(b) Size/ dimensions		
	(c) Minimum no. of wires /formed wires		
	(d) Tolerance on formed wire dimension		
	(e) Maximum resistivity of GS formed wire		
	(f) Maximum resistivity of Aluminium round wire		
6.10	PVC ST2 FRLS OUTERSHEATH		
	(a) Nominal thickness of outer sheath	mm	
6.11	DIAMETERS		
	(a) Diameter of insulated conductor	mm	
	(b) Cable diameter under armour	mm	
	(c) Cable diameter over armour	mm	
	(d) Overall diameter of cable	mm	
6.12	Tolerance on overall diameter	(±) mm	
6.13	Minimum bending radius	x O.D	
6.14	Safe Pulling Force	kG	
6.15	Weight of cable	kg./km	
	(a) Weight of conductor	MT/km	
	(b) Weight of XLPE insulation	MT/km	
	(c) Weight of PVC (Inner Sheath, Outer Sheath & Fillers)	kg./km	
	(d) Weight of Armour (As applicable)	kg./km	
6.16	Dimension of drum	mm	
6.17	Shipping weight	kg	
6.18	Cable marking on outer sheath		

(*) For single core cables, the continuous current rating shall be furnished separately for armour earthed at one end and at both ends.

NAME OF VENDOR				REV.	
			SEAL		
NAME	SIGNATURE	DATE			

DATASHEET C

GUARANTEED TECHNICAL PARTICULARS (TO BE SUBMITTED BY SUCCESSFUL BIDDER)

1.0	**GENERAL**		
1.1	Name of manufacturer	:	
1.2	Place of manufacture	:	
2.0	**STANDARDS APPLICABLE**		
2.1	**IS-1554 (Part-I)** For general specification of PVC cables	:	YES
2.2	**IS:8130** For conductor material	:	YES
2.3	**IS-5831** For material of insulation, innersheath & outersheath.	:	YES
2.4	**IS:3975/ IS:8130** For armour multi core/ single core cables)	:	YES/NO/NA
2.5	**IS:10810** For method of tests	:	YES
2.6	**IS:10418** For cable drums	:	YES
2.7	**ASTMD-2863** For oxygen index test	:	YES
2.8	**SS:424-14-75,** **IEC-332-Part-III (Category-B),** **IEEE 383/74** For flammability test	:	YES

2.9	**IEC-754-1** For acid gas generation test	:	YES
2.10	**ASTMD-2843** For smoke generation test	:	YES
2.11	**IS:5831** For heat shock test, loss of mass test and thermal heat stability test	:	YES
2.12	Current rating of cables conforms to	:	
2.13	Short circuit rating conforms to	:	

3.0 **CABLE CONSTRUCTION**

3.1 **Conductor :**

Conductor material to IS:8130 (Class/Grade)

a) Control cables :

3.2 **Insulation**

a) Material :

b) Dielectric constant at normal frequency : KV/mm

c) Insulation resistance constant (min.)

i) at 27 deg. C : Mega-ohm km
ii) at 70/85 deg.C : Mega-ohm km

d) Minimum volume resistivity

i) at 27 deg. C : Mega-ohm km
ii) at 70/ 85 deg.C : Mega-ohm km

e) Minimum tensile strength : N/mm2

f) Minimum % Elongation at rupture :

g) Tolerance on thickness :

3.3 **Inner Sheath**

a)	PVC Type ST1 to IS: 5831	:	YES
b)	Whether FRLS	:	YES/NO
c)	Method of application		
i)	with filllers		
ii)	without fillers	:	Pressure extruded
d)	Type & shape of fillers (if used)	:	
e)	Colour		

3.4 **Armour**

a)	Galvanised steel wire/ formed wire conforming to IS:3975 for multi-core cables.	:	YES
b)	Hard drawn aluminium wire H4 grade conforming to IS:8130	:	YES/NA
c)	Method of joining	:	
d)	Breaking load of joint	:	

3.5 **Outer Sheath**

a)	PVC Type ST1 to IS: 5831	:	YES
b)	Whether FRLS	:	YES
c)	Method of application	:	
d)	Minimum Tensile strength	:	N/mm2
e)	Minimum % elongation at rupture	:	
f)	Colour		
g)	Tolerance on thickness	:	
h)	Whether progressive sequential length marking provided.	:	

4.0 **PERMISSIBLE VOLTAGE AND FREQUENCY VARIATION**

a)	Voltage	:	(±)	%
b)	Frequency	:	(±)	%
c)	Voltage-frequency combined combined	:	|ABS|	%

5.0 Permissible Conductor Temp. for

a)	Maximum Continuous Rating	:	^{o}C
b)	Short Circuit	:	^{o}C

6.0 Installation Conditions for specified current rating

a)	ambient air temperature in deg. C	:	^{o}C
b)	ground temperature	:	^{o}C
c)	depth of laying of cables buried in ground :	:	cm
d)	thermal resistivity of soil	:	^{o}C cm/W
e)	thermal resistivity of insulation	:	^{o}C cm/w

7.0 Formula for calculating short circuit current for different durations

8.0 **CHARACTERISTICS OF FRLS SHEATH**

a)	Oxygen index	:
b)	Temperature index	:
c)	Acid gas generation	:
d)	Smoke density rating	:

9.0 **CABLE DRUMS**

a)	Type & construction	:
b)	Standard drum length	:
c)	Tolerance on drum length	:

10.0 **DOCUMENTATION**

Whether following enclosed

a)	X-sectional drawing with construction details	:	YES
b)	BHEL's Quality Plan with seal of acceptance	:	YES
c)	Derating factors as stipulated in Section-D	:	YES
d)	Packing drawing	:	YES/NO

(TO BE FILLED IN FOR EACH SIZE OF CABLE IN THE FORM OF TABLE)

11.0	No. of cores x size	:	
12.0	Voltage grade	:	kV
13.0	Base current ratings (*) based on cl.5.0, cl.6.0		
	a) In air	:	Amp
	b) In ground	:	Amp
	c) In ducts	:	Amp
14.0	Short circuit rating	:	kA, sec.
15.0	a) D.C. resistance of conductor at 20 °C	:	ohm/km
	b) A.C. resistance of conductor at 70 °C/ 85 °C	:	ohm/km
	c) Reactance of cable at normal frequency	:	ohm/km
16.0	CONDUCTOR		
	a) Material, type & grade	:	
	b) No & dia of wires in each core before stranding	:	no x mm

c) Shape :

17.0 Nominal thickness of insulation : mm

18.0 Inner sheath thickness (min.) : mm

19.0 Sizes of armour : no x mm

20.0 Nominal thickness of outersheath : mm

21.0 DIAMETERS

a) i) Fictitious diameter of insulated conductor : mm

ii) Approximate cable diameter of insulated conductor : mm

b) i) Fictitious cable diameter of under armour/ over innersheath : mm

ii) Approximate cable diameter under armour/ over innersheath : mm

c) i) Fictitious cable diameter of under armour/ over innersheath : mm

ii) Approximate cable diameter over armour : mm

d) i) Fictitious overall diameter of cable : mm

ii) Approximate overall diameter of cable : mm

22.0 Tolerance on overall diameter : (±) mm.

23.0 Minimum bending radius : x O.D.

24.0 Safe pulling force : kg.

25.0 Weight of cable : kg./km

26.0 Dimension of drum : mm

27.0 Shipping weight : kg.

28.0 Identification mark on outersheath :

29.0 Identification marks on drum :

S.No.	Particulars	Unit	Description
1	Manufacturer's name	-	
2	Reference design standards	-	
3	Conductor size	sq. mm	
4	Rated Voltage	V	
5	Number of pairs	No.	
6	Cable suitable for both earthed & unearthed system	-	
7	Conductor		
	a) Material	-	
	b) Reference Standard	-	
	c) Grade	-	
	d) No. of strands	No.	
	e) Diameter of strands (nom.)	mm	
	f) Approx. dia of conductor	mm/	
	Cross Section area	sq. mm	
	g) Maximum conductor resistance per Km at 20°C	ohm	
8	Insulation		
	a) Reference Standard	-	
	b) Material composition	-	
	c) Minimum thickness	mm	
	d) Nom.Thickness	mm	
	e) Max. thickness	mm	
	f) Minimum volume resistivity as pre VDE-0207 Part-4	Ohm cm	
	g) Dielectric constant	-	
	h) The insulation will withstand conductor operating temp. of 70°C	-	
	i) Core diameter including insulation	mm	

S.No.	Particulars	Unit	Description
9	Core laying		
	a)Whether cores are twisted.	-	
	b) Maximum lay of twist	mm	
10	Individual Shield		
	a) Material	-	
	b) Thickness of tape	mm	
	c) Coverage/ Overlap	%	
	d) Noise interference better than	dB	
11	Drain wire for individual shield		
	a) Reference standard	-	
	b) Size/ No. of strands	sq. mm/ no.	
	c) Material	-	
	d) Resistance of drain wire per km at 20 deg.C	ohm	
12	Overall shield		
	a) Material	-	
	b) Thickness of tape	mm	
	c) Coverage/Overlap	%	
	d) Noise interference better than	dB	
13	Drain wire for overall shield		
	a) Reference standard	-	
	b) Size/ No.of strands	sq. mm/ no.	
	c) Material	-	
	d) Resistance per Km at 20°C	Ohm/ km	
14	Fillers if applicable		
15	Inner sheath		
	a) Material, type and standard	-	
	b) Whether FRLS	-	
	c) Colour	-	
	d) Method of application	-	
	e) Thickness (min)	mm	
16	Armour		
	a) Material,	-	
	b) Minimum Coverage	%	
	c) Method of jointing	-	
	d) Breaking load of joint	-	
	e) Size (approx.)	mm	
	f) Dia of armour	mm	
	g) No. of wires	mm	

S.No.	Particulars	Unit	Description
17	Outer sheath		
	a) Reference standard	-	
	b) Material	-	
	c) Minimum thickness of sheath	mm	
	d) Calculated dia under outersheath	mm	
	e) Oxygen index (as per ASTMD 2863)	-	
	f) Temperature index (in deg. C as per ASTMD 2863)	-	
	g) Maximum acid gas generation as per IEC754-1	%	
	h) Maximum smoke density rating as per ASTMD 2843	%	
	i) Colour of outer sheath	-	
18	Dia under armour	mm	
19	Overall diameter of cable	mm	
20	Tolerance on overall diameter	mm	
21	Weight of		
	conductor	Kgs. / km	
	PVC (insulation, sheath & fillers)	Kgs. / km	
	Armour	Kgs. / km	
	Cable (approx.)	Kgs. / km	
22	Cable parameters at 20°C(+/-3 deg. C)		
	a) Conductor resistance (max)	Ohm/ km	
	b) Insulation resistance (min)	M-Ohm	
	c) Mutual capacitance at 0.8KHz (max)	nF/ km	
	d) Cross talk at 0.8KHz (min)	dB	
	e) Attenuation at 1 KHz (max)	dB/ km	
	f) Characteristic impedence max.	Ohm	
23	Continuous operating temp. (deg.C)	deg. C	
24	Whether complete cable Flame retardant as per IEEE-383	-	
25	Whether complete cable passes Swedish Chimney test as per SEN 4241475 (F3)	-	
26	Identification		
	a) Length of cable marked at every mtr.	-	
	b) FRLS marked at every 5 mtrs	-	
	c) Each core of the pair numbered	-	
	d) Conductor identification details for pairs	-	
	e) Details of cable markings	-	

S.No.	Particulars	Unit	Description
27	Test voltage		
	a) High voltage test/ Dielectric Strength		
	i) Voltage (KV)	kV	
	ii) Duration	min	
	b) High Voltage test		
	i) Voltage (KV)	V	
	ii) Duration	min	
	c) Resistance to direct current test	-	
	as per VDE-0815		
	Voltage	V	
	Duration	hrs/days	
28	Min bending radius	mm	
29	Ovality at any cross section	mm	
30	Variation of dia through out cable length		
31	Cable cross-sectional drawings for each type of cable furnished		
32	i) Length of single coil in a drum	M	
	ii) Marking on drum	-	
	iii) Seasoned wood drum provided	-	
	iv) Both ends of cable to be sealed with PVC/ Rubber caps to prevent water/ moisture ingress		
	v) Gross weight (approx.)	kg.	
	vi) Net weight (approx.)	kg	
33	Type test procedures as per VDE 0472, IS 10810, VDE 0815, BHEL Technical Spec. and other relevant standards enclosed.		
34	Anti termite & rodent test		

Below sub vendor list comprises of BHEL approved sub vendors for cables, LT Switchgear, Cable Trays, Earthing material. The same shall be subjected to final approval by customer at contract stage without any technical / commercial implication to BHEL.

PACKAGE WISE BHEL PEM APPROVED SUPPLIER LIST

Sl No	Package Name	Supplier Name	Supplier Communication Address
1	LT SWITCHGEAR	ABB India Limited	Mr.Tommy Andreson/Mr.Naveen Maikhuri PLOT NO.79, STREET NO.17 VADODARA Phone- 9958188524 Pincode : 390013 Email : rizwan.siddiqui@in.abb.com
2	LT SWITCHGEAR	ALSTOM LTD.	Mr. Sanjeev Khetrapal Siège social: Immeuble Le Galilée - 51, esplanade du Général de Gaule,La Défense PARIS Phone- 2270500 Pincode : 92907 Email : parthsarathi.harichandan@alstom.com
3	LT SWITCHGEAR	C and S ELECTRIC LTD.	222, OKHLA INDUSTRIAL ESTATE, PHASE-II, NEW DELHI Phone- 9871799447 Pincode : 110020 Email : panel.marketing@cselectric.co.in
4	LT SWITCHGEAR	CONTROLS and SCHEMATICS LTD.	Mr. C.L. Narayana Street No.8, 3-6-584/G, Himayatngar HYDERABAD Phone- 9391006355 Pincode : 500029 Email : clnarayana@controlsandschematics.com
5	LT SWITCHGEAR	GE INDIA INDUSTRIAL PVT.LTD.	42/1 & 45/14, ELECTRONIC CITY, PHASE-II, HOSUR ROAD, BANGALORE Phone- 51113164/3115-7/3113 Pincode : 560008 Email : vijay.pal@ge.com
6	LT SWITCHGEAR	KMG ATOZ SYSTEMS PVT.LTD	Mr. Atter M Ram/Mr. S.P Goyal G-120, Sai Plaza,187-188, Sant Nagar,East of Kailash NEW DELHI Phone- 0120-4207920 Pincode : 110 065 Email : atoz@atoz.co.in
7	LT SWITCHGEAR	LARSEN and TOUBRO LTD.	Mr. Mohan Kumar L & T HOUSE, BALLARD ESTATE, P.O.BOX-278, MUMBAI Phone- 22618181/82 Pincode : 400001 Email : BAS@LNTECC.COM
8	LT SWITCHGEAR	SCHNEIDER ELECTRIC INDIA PVT. LTD.	A-29, MOHAN COOPERATIVE INDL ESTATE, MATHURA ROAD, NEW DELHI Phone- 51678010 Pincode : 110044 Email : aditya.bawa@schneider-electric.com
9	LT SWITCHGEAR	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
10	LT SWITCHGEAR	SPACEAGE SWITCHGEARS LTD.	68, INDUSTRIAL DEVELOPMENT COLONY, MEHRAULI ROAD, GURGAON Phone- 2302711,2310123/4 Pincode : 122001 Email : info@spaceagegroup.org; at.soundar@spaceagegroup.org
11	LT SWITCHGEAR	TRICOLITE ELECTRICAL INDUSTRIES LTD	Mr. Abhishek Nangia/Mr. SK Raghav V- 325 Rajouri Garden NEW DELHI Phone- 9560376219 Pincode : 110027 Email : abhishek@tricoliteenergy.in
1	CABLE TRAYS & ACC.	ADVANCE POWER PRODUCTS LLP	Mr. Manmohan Damani 24A, Rabindra Sarani, Kolkata Phone- 033-22252463 Pincode : 700073 Email : sales@advancepowerproducts.in
2	CABLE TRAYS & ACC.	EROS METAL WORKS (P) LTD.	Mr. Amit N. Pande G-5, MIDC Industrial area Hingna Road Nagpur Phone- 9371490163 Pincode : 440028 Email : eemwpl@erosgroup.co.in;sohumpande@erosgroup.co.in
3	CABLE TRAYS & ACC.	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA Phone- 9830241788 Pincode : 700028 Email : mail@ipipl.co.in
4	CABLE TRAYS & ACC.	PARMAR METALS PVT.LTD.	MR. KIRIT PARMAR 28-A, BHAKTINAGAR INDL ESTATE RAJKOT Phone- 9925019998 Pincode : 360 002 Email : info@parmarmetal.com
5	CABLE TRAYS & ACC.	PATNY SYSTEMS (P) LTD	PATNY PLAZA 160 , SARDAR PATEL ROAD SEUNDRABAD SECUNDRABAD Phone- 040-27902451 Pincode : 500003 Email : mr.mkt@patnysystems.com

6	CABLE TRAYS & ACC.	PENTAX FERRO INCORPORATE	Mr. Rajeev Kandhari 801, 8th Floor, Palm Springs, Link road, Malad (W) Mumbai Phone- 09820088400 Pincode : 400064 Email : rajeev@jencogalva.com
7	CABLE TRAYS & ACC.	Pinax Steel Industries Pvt. Ltd.	Village - Deokuli, PO - Musepur, Bihta, Patna Phone- 9264477062 Pincode : 801103 Email : p.singh@pinaxgroup.in, kumar@pinaxgroup.in
8	CABLE TRAYS & ACC.	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharlal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata, Phone- 9331008739 Pincode : 700071 Email : pppdaga4@gmail.com;info@thepremierpower.com
9	CABLE TRAYS & ACC.	R.K. Engineering Works	W/87,Addl Ambernath Anandnagar,MIDC,Ambernath-East Thane Phone- 9923009696 Pincode : 421506 Email : salespune@rkenggwork
10	CABLE TRAYS & ACC.	RABI ENGINEERING WORKS PVT. LTD.	MR. TAPAN KUMAR SEN/MR. SIDDHARTHA 327, R.N. GUHA ROAD, DUM DUM, KOLKATA Phone- 9748753002 Pincode : 700028 Email : rabiengineering@gmail.com
11	CABLE TRAYS & ACC.	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com
12	CABLE TRAYS & ACC.	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	11A , MAHARISHI DEBENDRA ROAD 1ST FL , ROOM NO.4 KOLKATA Phone- Pincode : 700007 Email : maruthikabra@gmail.com
13	CABLE TRAYS & ACC.	Saral Industries	Mr. Y.K. Gupta L-1, L-2, Industrial Area-1 Sultanpur Road Rae Bareli Phone- 0535-2702474 Pincode : 229010 Email : saralindustries@gmail.com
14	CABLE TRAYS & ACC.	UNITECH FABRICATORS and ENGINEERS PVT LTD	INDRAPRASHTHA APARTMENT 24 , M.B.RAOD , BIRATI KALABAGAN KOLKATA KOLKATA Phone- 9836381647 Pincode : 700051 Email : ufepl@rediffmail.com;ufepl@vsnl.net;
1	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	AM-TECH ENGG.SERVICES	Chinmay Patwardhan 305 ,UNIQUE CHAMBERS 925 B/1,FC ROAD PUNE Phone- 9822499078 Pincode : 410004 Email : amtech.aditya@amail.com
2	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA Phone- 9830241788 Pincode : 700028 Email : mail@ipipl.co.in
3	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	Maheshwari Electrical Mfrs. Pvt. Ltd.,	Mr. Abhishek Garg, 9999902481 A-59, Sector-5, Noida, Phone- 9811027324, Pincode : 201301, Email : memindia@gmail.com,
4	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharlal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata, Phone- 9331008739 Pincode : 700071 Email : pppdaga4@gmail.com;info@thepremierpower.com
5	CABLE TRAY SUPPORT SYSTEM - BOLTABLE	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com
1	LT PVC POWER CABLE	APAR INDUSTRIES LTD.	Mr. Vijay Kumar Bajaj 12/13,Jyoti Wire House,23-A,Shah Ind Est Off. Veera Desai Road, Andheri (West). Mumbai Phone- 022-26740001 Pincode : 400053 Email : info.cable@apar.com
2	LT PVC POWER CABLE	CHANDRESH CABLES LIMITED	Mr RK JAIN/MD, G-6 NEW MADHAVPURA MARKET, NEAR POLICE COMMI. OFFICE, SHAHIBAUG AHMEDABAD Phone- 9825136231 Pincode : 380004 Email : rkjain@avocab.com
3	LT PVC POWER CABLE	CMI LTD.	Mr.Munishvar Gaur, 501-503,New Delhi House, 27,Barakhamba Road New Delhi, Phone- 9599599244 Pincode : 110001 Email : mgaur@cmilimited.in

4	LT PVC POWER CABLE	CORDS CABLE INDUSTRIES LTD.	MR. NAVEEN SAWHNEY B-1/A-26, MOHAN CO-OPERATIVE INDUSTRIAL ESTATE, MATHURA ROAD, NEW DELHI Phone- 9818356799 Pincode : 110044 Email : sg@cordscable.com
5	LT PVC POWER CABLE	Dynamic Cables Limited	F-260 ,Road No. 13 V.K.I Area Jaipur Phone- 01412332388 Pincode : 302013 Email : info@dynamiccables.co.in
6	LT PVC POWER CABLE	GEMSCAB INDUSTRIES LTD.	Sh. A. N. Pathak, (GM/Business Develop.) 704-707, 7th Floor, Vikrant Tower 4, Rajendra Place NEW DELHI Phone- 09212560974 Pincode : 110008 Email : anpathak@gemscab.com
7	LT PVC POWER CABLE	Govind Cable Industries,	73/1, Cotton Street, Kolkata, Phone- 9331055614, Pincode : 700007, Email : govindcable2001@yahoo.com
8	LT PVC POWER CABLE	GUPTA POWER INFRASTRUCTURE LIMITED	Mr. NITISH KUMAR PARIDA ,502, 5th Floor, K M Trade Tower,Radisson Blu Complex, Sector-14, Kaushambi Ghaziabad Phone- 09861995978 Pincode : 201010 Email : info@guptapower.com
9	LT PVC POWER CABLE	Insucon Cables And Conductors Pvt. Ltd.	Mr. SUMIT NAHATA, 314-A, 3rd Floor, City Centre, Sansar Chand Road Jaipur Phone- 8290073333 Pincode : 302001 Email : info@insuconcables.com
10	LT PVC POWER CABLE	KEC INTERNATIONAL LIMITED	Mr. Radheshyam Singh CEAT MAHAL, 1ST FLOOR, 463, DR. ANNIE BESANT ROAD,WORLI, MUMBAI Phone- 9313244467 Pincode : 400 030 Email : powercables@kecrpg.com
11	LT PVC POWER CABLE	KEI INDUSTRIES LTD.	Mr. ANIL GUPTA D-90, OKHLA INDUSTRIAL AREA, PHASE-I, NEW DELHI Phone- 011-26818840 Pincode : 110020 Email : lalit.saxena@kei-ind.com
12	LT PVC POWER CABLE	LASER POWER & INFRA PVT. LTD.	Mr. Devesh Goel, Director 5A, Woodburn Central 5th Floor, Unit No. 502 & 503 Kolkata Phone- 9830623440 Pincode : 700020 Email : devesh@laserpowerinfra.com
13	LT PVC POWER CABLE	Lumino Industries Limited	Acropolis, 1858/1, 12th Floor, Rajdanga Main Road, KOLKATA Phone- 9711480487 Pincode : 700107 Email : northzone@luminoindustries.com
14	LT PVC POWER CABLE	Nangalwala Industries Pvt. Ltd.	F 151 to 154 M.I.A M.I.A Alwar Phone- 9928033029 Pincode : 301030 Email : registration@suncables.co
15	LT PVC POWER CABLE	PARAMOUNT COMMUNICATIONS LTD.	Mr. Sanjay Aggarwal C-125, Naraina Industrial Area, Phase-I, NEW DELHI Phone- 9650005915 Pincode : 110028 Email : jatan.singh@paramountcables.com
16	LT PVC POWER CABLE	POLYCAB INDIA LIMITED	HICO HOUSE, Ist FLOOR, 771, PANDIT SATWALEKAR MARG, MAHIM, MUMBAI Phone- 011-29841697 Pincode : 400016 Email : lnsingh@polycab.com
17	LT PVC POWER CABLE	Ravi Industries	Deepak Goyal, Proprietor Plot No. 451,EPIP,HSIIDC INDUSTRIAL AREA Sec-53, Phase 3, Kundli Sonipat Phone- 9810019276 Pincode : 131028 Email : deepakgoyal@deegeelitecables.com
18	LT PVC POWER CABLE	RAVIN CABLES LIMITED	MR.PRAKASH LAKHKAR 30,AKRUTI TRADE CENTRE, 3RD FL, ROAD NO.7 , MIDC ,MAROL,ANDHERI (E) MUMBAI Phone- 09324081733 Pincode : 400093 Email : surendra.rawat@ravingroup.com
19	LT PVC POWER CABLE	Sam Cables & Conductors (P) Ltd.,	6th Km. Rudrapur-kichha Road, Post-Lalpur, Rudrapur, Distt. Udham Singh Nagar , Uttrakhand, Phone- 9837766444, Pincode : 263148, Email : manpreet@samcables.com,
20	LT PVC POWER CABLE	SBEE CABLES (INDIA) LIMITED	Kishore Kumar .B, Director No.29, JCW Industrial Estate 11th Km Kanakapura Road Bangalore Phone- 08026662172 Pincode : 560062 Email : info@sbeecables.in

21	LT PVC POWER CABLE	SHIVPRIYA CABLES PVT. LTD.	Mr. AYUSH GUPTA,DIRECTOR B 15 / 23 GROUND FLOOR DLF CITY PHASE-I GURUGRAM Phone- 9810322001 Pincode : 122002 Email : info@shivpriyacables.com
22	LT PVC POWER CABLE	SPECIAL CABLES PVT. LTD.	MR.MUKUL KHANNA-VICE PRESIDENT B-II/12, Mohan Cooperative Industrial estate, Badarpur, Mathura Road NEW DELHI Phone- 9599186479 Pincode : 110044 Email : sales@specialcables.co.in
23	LT PVC POWER CABLE	SRIRAM CABLES PVT. LTD.	Anil Garg / Sunil Garg Flat No. 102, A 8A Rama Road, Adarsh Nagar Delhi Phone- 011-27670005 Pincode : 110033 Email : contact@sriramcables.com
24	LT PVC POWER CABLE	SUYOG ELECTRICALS LTD.	Mr.Bimal Y.Desai/Mr. Haresh Hansoti 1, Madhuvan Apartment,24 Arunoday Society,Alkapuri VADODARA Phone- 9227192737 Pincode : 390 007 Email : suyog@seplcables.com
25	LT PVC POWER CABLE	THERMO CABLES LTD.	Ms.UMA GHURKA/N.SRINIVASA RAO 28, NAGARJUNA HILLS, PUNJAGUTTA HYDERABAD Phone- 9397803596 Pincode : 500082 Email : isharma@thermocables.com
26	LT PVC POWER CABLE	TIRUPATI PLASTOMATICS PVT. LTD.	Mr. Ravi Gemini B-141 A, Road No. 9D V.K.I. Area Jaipur Phone- 0141-2330305 Pincode : 302013 Email : ravi.gemini@yahoo.com
27	LT PVC POWER CABLE	ULTRACAB INDIA LIMITED	SR NO 262 BH GALAXY BEARINGS LTD SHAPAR VERAVAL RAJKOT Phone- Pincode : 360024 Email : tenders@ultracab.in
28	LT PVC POWER CABLE	UNIVERSAL CABLES LTD.	MR. Y.S. LODHA/MR. AMITAVA ABOSE P.O. BIRLA VIKAS, SATNA SATNA Phone- +91 9584968066 Pincode : 485005 Email : amsingh@unistar.co.in
29	LT PVC POWER CABLE	V-MARC INDIA LIMITED	Mr. Vikas Garg, 203,Aditya Complex,Local Shopping Centre Sarita Vihar 110092 Phone- 8171169401 Pincode : New Delhi Email : sales@v-marc.in
30	LT PVC POWER CABLE	Zenium Cables Ltd.	H.O:102/103 Leena Heights,Opp.Thunga Hospital Mira Bhayander Road, Mira Road(E) Thane Phone- 02228114444 Pincode : 401107 Email : info@zeniumcables.com
1	LT PVC CONTROL CABLE	Advance Cable Technologies (P) Ltd.	Mr. Siddharth Jain G-1, Sunrise Serenity, No.1,40 Ft.Road, M.R. Garden,Geddalahhalli, Aswathnagar, Bangalore Phone- 9845326881 Pincode : 560094 Email : dbhat@advancecable.in
2	LT PVC CONTROL CABLE	CHANDRESH CABLES LIMITED	Mr RK JAIN/MD, G-6 NEW MADHAVPURA MARKET, NEAR POLICE COMMI. OFFICE, SHAHIBAUG AHMEDABAD Phone- 9825136231 Pincode : 380004 Email : rkjain@avocab.com
3	LT PVC CONTROL CABLE	CMI LTD.	Mr.Munishvar Gaur, 501-503,New Delhi House, 27,Barakhamba Road New Delhi, Phone- 9599599244 Pincode : 110001 Email : mgaur@cmilimited.in
4	LT PVC CONTROL CABLE	CORDS CABLE INDUSTRIES LTD.	MR. NAVEEN SAWHNEY B-1/A-26, MOHAN CO-OPERATIVE INDUSTRIAL ESTATE, MATHURA ROAD, NEW DELHI Phone- 9818356799 Pincode : 110044 Email : sg@cordscable.com
5	LT PVC CONTROL CABLE	DELTON CABLES LTD.	MR. V.K. GUPTA 4801, BHARAT RAM ROAD, 24, DARYA GANJ, NEW DELHI Phone- 9560866060 Pincode : 110002 Email : shashikumar@deltoncables.com
6	LT PVC CONTROL CABLE	Dynamic Cables Limited	F-260 ,Road No. 13 V.K.I Area Jaipur Phone- 01412332388 Pincode : 302013 Email : info@dynamiccables.co.in
7	LT PVC CONTROL CABLE	ELKAY TELELINKS LTD.	Mr. Vinod Dubey K.C.HOUSE,5/66, PADAM SINGH ROAD, KAROL BAGH, NEW DELHI Phone- 9899789830 Pincode : 110005 Email : projects@elkaygroup.net

8	LT PVC CONTROL CABLE	GEMSCAB INDUSTRIES LTD.	Sh. A. N. Pathak, (GM/Business Develop.) 704-707, 7th Floor, Vikrant Tower 4, Rajendra Place NEW DELHI Phone- 09212560974 Pincode : 110008 Email : anpathak@gemscab.com
9	LT PVC CONTROL CABLE	GUPTA POWER INFRASTRUCTURE LIMITED	Mr. NITISH KUMAR PARIDA ,502, 5th Floor, K M Trade Tower,Radisson Blu Complex, Sector-14, Kaushambi Ghaziabad Phone- 09861995978 Pincode : 201010 Email : info@guptapower.com
10	LT PVC CONTROL CABLE	Insucon Cables And Conductors Pvt. Ltd.	Mr. SUMIT NAHATA, 314-A, 3rd Floor, City Centre, Sansar Chand Road Jaipur Phone- 8290073333 Pincode : 302001 Email : info@insuconcables.com
11	LT PVC CONTROL CABLE	K C POWERTRACKS	Mr. SUDHAKAR GARG (CEO), S. NO. 185/1/1, PLOT NO. 7, DOKMARDI SILVASSA Phone- 9825264766 Pincode : 396230 Email : powertrackscable@gmail.com
12	LT PVC CONTROL CABLE	KEI INDUSTRIES LTD.	Mr. ANIL GUPTA D-90, OKHLA INDUSTRIAL AREA, PHASE-I, NEW DELHI Phone- 011-26818840 Pincode : 110020 Email : lalit.saxena@kei-ind.com
13	LT PVC CONTROL CABLE	Nangalwala Industries Pvt. Ltd.	F 151 to 154 M.I.A M.I.A Alwar Phone- 9928033029 Pincode : 301030 Email : registration@suncables.co
14	LT PVC CONTROL CABLE	PARAMOUNT COMMUNICATIONS LTD.	Mr. Sanjay Aggarwal C-125, Naraina Industrial Area, Phase-I, NEW DELHI Phone- 9650005915 Pincode : 110028 Email : jatan.singh@paramountcables.com
15	LT PVC CONTROL CABLE	POLYCAB INDIA LIMITED	HICO HOUSE, Ist FLOOR, 771, PANDIT SATWALEKAR MARG, MAHIM, MUMBAI Phone- 011-29841697 Pincode : 400016 Email : lnsingh@polycab.com
16	LT PVC CONTROL CABLE	PRESTIGE CABLE INDUSTRIES	Mr. ASHISH AGGARWAL, PARTNER M-15, BADLI INDUSTRIAL ESTATE, PHASE-1, DELHI Phone- 9350581279 Pincode : 110042 Email : prestigecable@gmail.com
17	LT PVC CONTROL CABLE	SBEE CABLES (INDIA) LIMITED	Kishore Kumar .B, Director No.29, JCW Industrial Estate 11th Km Kanakapura Road Bangalore Phone- 08026662172 Pincode : 560062 Email : info@sbeecables.in
18	LT PVC CONTROL CABLE	SPECIAL CABLES PVT. LTD.	MR.MUKUL KHANNA-VICE PRESIDENT B-II/12, Mohan Cooperative Industrial estate, Badarpur, Mathura Road NEW DELHI Phone- 9599186479 Pincode : 110044 Email : sales@specialcables.co.in
19	LT PVC CONTROL CABLE	SRIRAM CABLES PVT. LTD.	Anil Garg / Sunil Garg Flat No. 102, A 8A Rama Road, Adarsh Nagar Delhi Phone- 011-27670005 Pincode : 110033 Email : contact@sriramcables.com
20	LT PVC CONTROL CABLE	SUYOG ELECTRICALS LTD.	Mr.Bimal Y.Desai/Mr. Haresh Hansoti 1, Madhuvan Apartment,24 Arunoday Society,Alkapuri VADODARA Phone- 9227192737 Pincode : 390 007 Email : suyog@seplcables.com
21	LT PVC CONTROL CABLE	SVARN INFRATEL PVT. LTD.	Mr. Ajay Kumar Gupta/MD, Plot no.-1, Site no.1, 14/3, Mathura Road, Faridabad Phone- 9811142260 Pincode : 121003 Email : info@svarn.com
22	LT PVC CONTROL CABLE	THERMO CABLES LTD.	Ms.UMA GHURKA/N.SRINIVASA RAO 28, NAGARJUNA HILLS, PUNJAGUTTA HYDERABAD Phone- 9397803596 Pincode : 500082 Email : isharma@thermocables.com
23	LT PVC CONTROL CABLE	TIRUPATI PLASTOMATICS PVT. LTD.	Mr. Ravi Gemini B-141 A, Road No. 9D V.K.I. Area Jaipur Phone- 0141-2330305 Pincode : 302013 Email : ravi.gemini@yahoo.com
24	LT PVC CONTROL CABLE	UNIVERSAL CABLES LTD.	MR. Y.S. LODHA/MR. AMITAVA ABOSE P.O. BIRLA VIKAS, SATNA SATNA Phone- +91 9584968066 Pincode : 485005 Email : amsingh@unistar.co.in

25	LT PVC CONTROL CABLE	V-MARC INDIA LIMITED	Mr. Vikas Garg, 203,Aditya Complex,Local Shopping Centre Sarita Vihar 110092 Phone- 8171169401 Pincode : New Delhi Email : sales@v-marc.in
26	LT PVC CONTROL CABLE	Zenium Cables Ltd.	H.O:102/103 Leena Heights,Opp.Thunga Hospital Mira Bhayander Road, Mira Road(E) Thane Phone- 02228114444 Pincode : 401107 Email : info@zeniumcables.com
1	SCREENED CONTROL CABLES	Advance Cable Technologies (P) Ltd.	Mr. Siddharth Jain G-1, Sunrise Serenity, No.1,40 Ft.Road, M.R. Garden,Geddalahhalli, Aswathnagar, Bangalore Phone- 9845326881 Pincode : 560094 Email : dbhat@advancecable.in
2	SCREENED CONTROL CABLES	CMI LTD.	Mr.Munishvar Gaur, 501-503,New Delhi House, 27,Barakhamba Road New Delhi, Phone- 9599599244 Pincode : 110001 Email : mgaur@cmilimited.in
3	SCREENED CONTROL CABLES	CORDS CABLE INDUSTRIES LTD.	MR. NAVEEN SAWHNEY B-1/A-26, MOHAN CO-OPERATIVE INDUSTRIAL ESTATE, MATHURA ROAD, NEW DELHI Phone- 9818356799 Pincode : 110044 Email : sg@cordscable.com
4	SCREENED CONTROL CABLES	DELTON CABLES LTD.	MR. V.K. GUPTA 4801, BHARAT RAM ROAD, 24, DARYA GANJ, NEW DELHI Phone- 9560866060 Pincode : 110002 Email : shashikumar@deltoncables.com
5	SCREENED CONTROL CABLES	ELKAY TELELINKS LTD.	Mr. Vinod Dubey K.C.HOUSE,5/66, PADAM SINGH ROAD, KAROL BAGH, NEW DELHI Phone- 9899789830 Pincode : 110005 Email : projects@elkaygroup.net
6	SCREENED CONTROL CABLES	GUPTA POWER INFRASTRUCTURE LIMITED	Mr. NITISH KUMAR PARIDA ,502, 5th Floor, K M Trade Tower,Radisson Blu Complex, Sector-14, Kaushambi Ghaziabad Phone- 09861995978 Pincode : 201010 Email : info@guptapower.com
7	SCREENED CONTROL CABLES	KEI INDUSTRIES LTD.	Mr. ANIL GUPTA D-90, OKHLA INDUSTRIAL AREA, PHASE-I, NEW DELHI Phone- 011-26818840 Pincode : 110020 Email : lalit.saxena@kei-ind.com
8	SCREENED CONTROL CABLES	PARAMOUNT COMMUNICATIONS LTD.	Mr. Sanjay Aggarwal C-125, Naraina Industrial Area, Phase-I, NEW DELHI Phone- 9650005915 Pincode : 110028 Email : jatan.singh@paramountcables.com
9	SCREENED CONTROL CABLES	POLYCAB INDIA LIMITED	HICO HOUSE, Ist FLOOR, 771, PANDIT SATWALEKAR MARG, MAHIM, MUMBAI Phone- 011-29841697 Pincode : 400016 Email : lnsingh@polycab.com

10	SCREENED CONTROL CABLES	Shriram Telelink	46/4/1, Sahibabad Indl. Area, SITE IV SAHIBABAD, GHAZIABAD Phone- 9999909700 Pincode : 201010 Email : info@shriramtelelink.com
11	SCREENED CONTROL CABLES	SPECIAL CABLES PVT. LTD.	MR.MUKUL KHANNA-VICE PRESIDENT B-II/12, Mohan Cooperative Industrial estate, Badarpur, Mathura Road NEW DELHI Phone- 9599186479 Pincode : 110044 Email : sales@specialcables.co.in
12	SCREENED CONTROL CABLES	SUYOG ELECTRICALS LTD.	Mr.Bimal Y.Desai/Mr. Haresh Hansoti 1, Madhuvan Apartment,24 Arunoday Society,Alkapuri VADODARA Phone- 9227192737 Pincode : 390 007 Email : suyog@seplcables.com
13	SCREENED CONTROL CABLES	T C Communication Pvt. Ltd.	Mr. Ashok Bathwal 505, Vikas Deep, 18 Laxmi Nagar District Centre New Delhi Phone- 9810002411 Pincode : 110092 Email : ashok@technocab.in
14	SCREENED CONTROL CABLES	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com
15	SCREENED CONTROL CABLES	THERMO CABLES LTD.	Ms.UMA GHURKA/N.SRINIVASA RAO 28, NAGARJUNA HILLS, PUNJAGUTTA HYDERABAD Phone- 9397803596 Pincode : 500082 Email : isharma@thermocables.com
1	ABOVE GROUND EARTHING MATERIALS	EROS INFRASTRUCTURES PVT. LTD.	Mr. Amit Pande MIDC Industrial Area, Butibori, G-97, Nagpur Phone- 0712-3205305 Pincode : 441103 Email : amitp@erosgroup.co.in
2	ABOVE GROUND EARTHING MATERIALS	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA Phone- 9830241788 Pincode : 700028 Email : mail@ipipl.co.in
3	ABOVE GROUND EARTHING MATERIALS	NAMDHARI INDUSTRIAL TRADERS PVT. LTD	Mr. Gurdeep Singh 515/5, Industrial Area-B, Overlock Road, Ludhiana Phone- 0161-2531398 Pincode : 141003 Email : namdhari_ind_traders@yahoo.com
4	ABOVE GROUND EARTHING MATERIALS	PATNY SYSTEMS (P) LTD	PATNY PLAZA 160 , SARDAR PATEL ROAD SEUNDRABAD SECUNDRABAD Phone- 040-27902451 Pincode : 500003 Email : mr.mkt@patnysystems.com
5	ABOVE GROUND EARTHING MATERIALS	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharlal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata, Phone- 9331008739 Pincode : 700071 Email : pppdaga4@gmail.com;info@thepremierpower.com
6	ABOVE GROUND EARTHING MATERIALS	RABI ENGINEERING WORKS PVT. LTD.	MR. TAPAN KUMAR SEN/MR. SIDDHARTHA 327, R.N. GUHA ROAD, DUM DUM, KOLKATA Phone- 9748753002 Pincode : 700028 Email : rabiengineering@gmail.com
7	ABOVE GROUND EARTHING MATERIALS	RAJASTHAN METAL SMELTING CO.	D-80, Road No. 7, V.K.I.A., Jaipur Phone- 9928966443 Pincode : 302013 Email : info@rmscoindia.com
8	ABOVE GROUND EARTHING MATERIALS	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com
9	ABOVE GROUND EARTHING MATERIALS	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	11A , MAHARISHI DEBENDRA ROAD 1ST FL , ROOM NO.4 KOLKATA Phone- Pincode : 700007 Email : maruthikabra@gmail.com
10	ABOVE GROUND EARTHING MATERIALS	Saral Industries	Mr. Y.K. Gupta L-1, L-2, Industrial Area-1 Sultanpur Road Rae Bareli Phone- 0535-2702474 Pincode : 229010 Email : saralindustries@gmail.com
11	ABOVE GROUND EARTHING MATERIALS	UNITECH FABRICATORS and ENGINEERS PVT LTD	INDRAPRASHTHA APARTMENT 24 , M.B.RAOD , BIRATI KALABAGAN KOLKATA KOLKATA Phone- 9836381647 Pincode : 700051 Email : ufepl@rediffmail.com;ufepl@vsnl.net;

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

बी एच ई एल	LOAD DATA (ELECTRICAL)	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	4X36MW CHILLA HEP (RM&U)	NAME		DATA FILLED UP ON
		SYSTEM / S	HVAC	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	513	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
		CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
		PROJECT:		PO NO.:	DATE:
		ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 1 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)				REMARKS
										D *	M **	B	C	
(1)	(2)	(3)	(4)	(5)	M	B/C	(7)	(8)	(9)					(11)
1	**RAW MATERIAL**													
1.1	Angles, Channels & Sheet Steel for Fabrication (CR/HR)	Thickness	MA	Meas.	1 sample of each type & size per Lot	-	Approved Drawing/ IS-513, IS-1079, IS 2062	Approved Drawing/ IS-513, IS-1079, IS 2062	QC record		P	-	-	
		Surface finish & check for waviness / flatness	MA	Visual	-do-	-	IS-513, IS-1079, IS 2062	IS-513, IS-1079, IS 2062	QC record		P	-	-	
		Bending Test	MA	Mech.	Sample	-	Approved Drawing/ IS-513-1994	Approved Drawing/ IS-513-1994	MTC		V	-	-	
1.2	Bus Bar – Copper/ Aluminum	Dimension	MA	Meas.	1 sample of each type & size per Lot	-	IS- 5082 (Al.)/ IS-1897 (CU)/ Approved Drawing	IS- 5082 (Al.)/ IS-1897 (CU)/ Approved Drawing	QC record		P	-	-	
		Surface Finish	MA	Visual	-do-	-	IS- 5082 (Al.)/ IS-1897 (CU)	IS- 5082 (Al.)/ IS-1897 (CU)	QC record		P	-	-	
		Conductivity	MA	Elec.	10% SAMPLE	-	As per IS- 5082/ IS-1897	As per IS- 5082/ IS-1897	MTC		P	-	-	
2	**BOUGHT OUT ITEMS**													
2.1	Air Circuit Breaker	Type & Rating	MA	Visual	100%	-	Approved Drawing/ Data sheet/ IEC-60947-2	Approved Drawing/ Data sheet/ IEC-60947-2	QC RECORD		P	-	-	
		All Routine test	CR	Test	-do-	-	Approved Drawing/ Data sheet/ IEC-60947-2	Approved Drawing/ Data sheet/ IEC-60947-2	MTC	✓	V	V	V	
2.2	CT's	Overall dimensions & mounting arrangement	MA	Meas.	10% of each type & rating per lot	-	Manufacturing Drawing	Manufacturing Drawing	QC Record		P	-	-	
		Make, Type & Rating	MA	Visual	-do-	-	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	QC Record		P	-	-	
		All routine tests	CR	Elec.	100%	10%	IS-2705	IS-2705	MTC	✓	V	V	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	27/2/24	MEGHA/ NARENDRA NATH JAJWARE	Checked by:	28/2/24	KUNDAN PRASAD			Reviewed by:			
Reviewed by:		SANDEEP LODH	Reviewed by:	28/2/24	HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO	DATE:
		CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
		PROJECT:		PO NO.:	DATE:
		ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 2 of 10

S NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)			REMARKS
					M	B/C				D	M	B	C	
(1)	(2)	(3)	(4)	(5)			(7)	(8)	(9)					(11)
2.3	PT's	Overall dimensions & mounting arrangement	MA	Meas.	10% of each type & rating per lot	-	Manufacturing Drawing	Manufacturing Drawing	QC Record		P	-	-	
		Make, Type & Rating	MA	Visual	-do-	-	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	QC Record		P	-	-	
		All routine tests	CR	Elec.	100%	10%	IS-3156	IS-3156	MTC	✓	V	V	V	
2.4	Air Break Switch, Fuse, MCCB, MPCB, Push Button, MCB, Control & Selector Switches AC/DC, Power & aux. Contactor, Timers, OLR, Coupling Relays, Indicating Lamp	Make, Type & Rating	MA	Visual	1 sample of each type & rating per lot	-	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	QC RECORD		P	-	-	
2.5	Indicating Instruments	Make, Type & Rating	MA	Visual	10% of each make, type & rating per lot	-	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	MTC		P	-	-	
		All routine tests	MA	Elec.	100%	10%	IS-1248	IS-1248	MTC	✓	V	V	V	
2.6	Transducer	Make, Type & Rating	MA	Visual	10% of each make, type & rating per lot	-	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	QC RECORD		P	-	-	
		All routine tests including calibration & accuracy test reports	MA	Elec.	100%	10%	IEC 60688/ Approved Drawing/ Data sheet	IEC 60688/ Approved Drawing/ Data sheet	MTC	✓	V	V	V	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD		
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

BHEL	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
		CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
		PROJECT:		PO NO.:	DATE:
		ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 3 of 10

S. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)				REMARKS
										D *	M **	R	C	
(1)	(2)	(3)	(4)	(5)	M	B/C	(7)	(8)	(9)					(11)
2.7	MFM & IMC	Make, Type & Rating	MA	Visual	10% of each make, type & rating per lot	-	Approved Drawing/ Data sheet	Approved Drawing/ Data sheet	QC RECORD		P	-	-	
		All routine tests including accuracy test Reports	MA	Elec.	100%	10%	IEC 62052 & IEC 60947/ Approved Drawing/ Data sheet	IEC 62052 & IEC 60947/ Approved Drawing/ Data sheet	MTC	✓	V	V	V	
2.8	Control Transformer	Make, Type & Rating	MA	Visual	100%	-	Approved drawing	Approved drawing	QC RECORD		P	-	-	
		Voltage ratio	MA	Elec.	100%	-	Approved drawing	Approved drawing	QC RECORD		P	-	-	
		All routine tests	MA	Elec.	100%	10%	IS 12021	IS 12021	MTC		V	V	V	
2.9	Numerical Relay	Make, Type & Rating	MA	Visual	100%	-	Approved drawing	Approved drawing	QC RECORD		V	-	-	
		Routine test report	MA	Elec.	100%	100%	IEC-60255/IEC-61850	IEC-60255/IEC-61850	MTC	✓	V	V	V	
		Numerical Relay Testing	MA	Elec.	10% of each type & rating per lot	10% of each type & rating per lot	Approved FAT Test Procedure	Approved Test FAT Procedure		✓	P	W	W	Only for NTPC project
2.10	Synthetic rubber Gasket/ Neoprene rubber gasket	Visual & Dimension, Profile, shore hardness, Elongation at break & ageing & compression Test, Ozone Resistance Test	MA	Review of Document	10%	-	Approved Drawing/ Manufacturer's Standard	Approved Drawing/ Manufacturer's Standard	QC RECORD/ COC		P	V	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD			Reviewed by:			
Reviewed by		SANDEEP LODH	Reviewed by:		HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
		CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
		PROJECT:		PO NO.:	DATE:
		ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 4 of 10

S. NO	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)				REMARKS
										D *	M **	B	C	
(1)	(2)	(3)	(4)	(5)	M	B/C	(7)	(8)	(9)					(11)
2.11	PVC wire	Verify size, color & properties	MA	Visual	1 sample of each type & size per lot	-	IS-694	IS-694	QC RECORD/ MTC		P	-	-	
2.12	Space heater, Thermostat, 3-pin socket, hooter, terminal block	Make & Type	MA	Visual	1 sample of each type per lot	-	Manufacturer's Standard	Manufacturer's Standard	QC RECORD		P	-	-	
2.13	ACB Handling trolley	Functional Checks	MA	Test	1 sample of each type & rating of first lot	-	Manufacturer's Standard	Manufacturer's Standard	QC RECORD		P	V		Subsequent lots will be cleared based on CCC
3	IN PROCESS INSPECTION													
3.1	Panel Fabrication	Cutting, punching, shearing & bending	MA	Meas.	Mfr. Practice	-	Manufacturer's Standard	Manufacturer's Standard	QC RECORD		P	-	-	
		Panel front door cut-outs punching	MA	Meas.	-do-	-	Approved drawing	Approved drawing	QC RECORD		P	-	-	
3.2	Paint Check	Pre- Treatment of sheet	MA	Process	-do-	-	Manufacturer's Standard practice, IS-6005	Manufacturer's Standard practice, IS-6005	QC RECORD		P	-	-	
		Paint Shade	MA	Visual	1 sample per lot	-	Approved drawing	Approved drawing	QC RECORD		P	-	-	
		Paint Thickness & Adhesion	MA	Test	Mfr. Practice	-	Approved drawing	Approved drawing	QC RECORD		P	-	-	Cross hatch method using adhesive tape
3.3	Panel Assembly	Panel shell assembly, Top & back cover assembly, Panel door assembly, hinge fitting & door knob fitting etc.	MA	Process	100%	-	Manufacturer's Internal drawing made to meet Approved drawing	Manufacturer's Internal drawing made to meet Approved drawing	QC Records		P	-	-	

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Prepared by:		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD			Reviewed by:			
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
		CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
		PROJECT:		PO NO.:	DATE:
		ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 5 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)			REMARKS
										D *	M **	B	C	
(1)	(2)	(3)	(4)	(5)	M	B/C	(7)	(8)	(9)					(11)
		Size of busbar & busbar finish	MA	Process	100%	-	-do-	-do-	QC RECORD		P	-	-	
		Colour coding of busbar	MA	Visual	100%	-	-do-	-do-	QC RECORD		P	-	-	
		Insulator type & mounting	MA	Process	100%	-	Manufacturer's Internal drawing made to meet Approved drawing	Manufacturer's Internal drawing made to meet Approved drawing	QC RECORD		P	-	-	
		Busbar support distance & tightness of bolts for Main bus bars and bus bar joints	MA	Process	100%	-	Manufacturer's Standard	Manufacturer's Standard	QC RECORD		P	-	-	
		Main , Control & Auxiliary Busbar Clearances	MA	Process	100%	-	Manufacturer's Internal drawing made to meet Approved drawing	Manufacturer's Internal drawing made to meet Approved drawing	QC Records		P	-	-	
		CT / PT mounting arrangement & tightness	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Termination for power & control circuits	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Lug size & crimping quality	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Earthing busbar size & continuity; Earthing of panel & doors	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Breaker safety shutter operation	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Spring loaded power and control contact alignment	MA	Process	100%	-	-do-	-do-	QC Records		P			

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Prepared by:		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD			Reviewed by:			
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR			Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO	DATE:
	CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
	PROJECT:		PO NO.:	DATE:
	ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 5 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)			REMARKS
										D	M	B	C	
(1)	(2)	(3)	(4)	(5)	M	B/C	(7)	(8)	(9)					(11)
		Tin / silver plating/ bimetallic strip between Cu & Al joints	MA	Process	100%	–	-do-	-do-	QC Records		P			
3.4	Module assembly	Component identification	MA	Process	100%	-	Manufacturer's Internal drawing made to meet Approved drawing	Manufacturer's Internal drawing made to meet Approved drawing	QC Records		P	-	-	
		Component layout, mounting & dimensions	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Incoming & outgoing power & control contacts assembly & Alignment	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Power circuit wire / strip termination & clearances	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Busbar joints	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		Functional Checks	MA	Process	100%	-	-do-	-do-	QC Records		P	-	-	
3.5	Control Wiring	Wire Size & lug size & Color of wire	MI	Visual	100%	-	Approved Wiring drawing	Approved Wiring drawing	QC Records		P	-	-	
		Proper wire Clamping & Ferruling	MI	Visual	100%	-	Manufacturer's Standard	Manufacturer's Standard	QC Records		P	-	-	
		Continuity as per wiring drawing	CR	Test	Sample	-	Approved drawing	Approved drawing	QC Records		P	-	-	
		Tightness of termination & crimping check	MA	Test	100%	-	Manufacturer's Standard	Manufacturer's Standard	QC Records		P	-	-	

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Prepared by:		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
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	PROJECT:		PO NO.:	DATE:
	ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 7 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)				REMARKS
										D *	M **	B	C	
(1)	(2)	(3)	(4)	(5)	M	B/C	(7)	(8)	(9)					(11)
4	FINAL INSPECTION & TESTING													
		1. Overall visual check for aesthetics, verticality of panels and alignment between two transport sections	MA	Visual	100%	10%	Approved GA drawing	Approved GA drawing	QC Records	✓	P	W	W	
		2. Verification of overall dimensions including sheet steel thickness	MA	Meas.	100%	1 sample of each type of panel per lot	Approved GA drawing	Approved GA drawing	QC RECORD	✓	P	W	W	
		3. Busduct interface, phase sequence, flange dimensions & clearances	MA	Visual	100%	100%	Approved GA drawing	Approved GA drawing	QC RECORD	✓	P	W	W	
		4. Busbar (Main horizontal) - clearances, color coding, phase sequence, identification for each transport unit	CR	Meas. & Visual	100%	10%	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	
		5. Verification of tightness of busbar joints by torque wrench	CR	Mech.	100%	10%	Manufacturer's Standard	Manufacturer's Standard	QC RECORD	✓	P	W	W	
		6. CT /PT fixing & mounting arrangement	MA	Visual	100%	10%	Manufacturer's Standard	Manufacturer's Standard	QC RECORD	✓	P	W	W	
		7. Check shrouding of accessible live parts, Cable supports and tool falling shroud in cable alley and application of PVC sleeves on busbars	MA	Visual	100%	10%	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	

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Prepared by:		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD			Reviewed by:			
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.	DATE:
		CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
		PROJECT:		PO NO.:	DATE:
		ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 8 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)				REMARKS
					M	B/C				D *	M **	B	C	
(1)	(2)	(3)	(4)	(5)			(7)	(8)	(9)					(11)
		8. Verification of Components for make, type, rating & layout	MA	Visual	100%	10% of each type of module per lot	Approved drawing/ Make's List	Approved drawing/ Make's List	QC RECORD	✓	P	W	W	
		9. Check control wiring / terminal arrangement & ferruling	MA	Visual	100%	10% Same as above	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	
		10. Safety Shutters operation check	CR	Elec.	100%	10% Same as above	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		11. Check door interlock & defeat interlock feature	MA	Elec.	100%	10% Same as above	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		12. Mech. operation test for ACB	CR	Elec.	100%	10% Same as above	IEC 60947-2	IEC 60947-2	QC RECORD	✓	P	W	W	
		13. Breaker operation at service , test & isolate position	CR	Elec.	100%	100%	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		14. Power & control draw-out contacts alignment check	MA	Elec.	100%	10% of each type of module per lot	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		15. Check for Breaker Anti-pumping & trip free feature	MA	Elec.	100%	100%	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		16. Earthing of ACB Cradle	MA	Visual	100%	100%	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		17. Interlocks & operation check - Elect. / Mech. open, close: under test, service & isolation position	CR	Elec.	100%	10% of each type of module per lot	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	

BHEL						BIDDER/ SUPPLIER	
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	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		MEGHA/ NARENDRA NATH IAJWARE	Checked by:		KUNDAN PRASAD		
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN	SPEC. NO:	DATE:
	CUSTOMER:	QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
	PROJECT:	PO NO.:	DATE:
	ITEM: LT SWITCHGEAR / SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 9 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY (10)				REMARKS
					M	B/C				D	M	B	C	
(1)	(2)	(3)	(4)	(5)			(7)	(8)	(9)					(11)
		18. Interchangeability check for draw-out modules	MA	Mech.	100%	10%	Technical Specification	Technical Specification	QC RECORD	✓	P	W	W	
		19. Earth bus dimensions, Earthing of draw-out modules, door etc.	MA	Elec.	100%	10% of each type of module per lot	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	
		20. Check Paint shade, thickness, Adhesion & finish	MA	Visual/ Test	100% for shade & finish; 2-3 samples/lot for thickness & adhesion check	2 - 3 samples/ board	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	
		21. Bus bar support arrangement: centre to centre distance between supports	MA	Meas.	100%	10%	TTR	TTR	QC RECORD	✓	P	W	W	
		22. Overlapping of bus bar joints	MA	Meas.	100%	10%	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	
		23. Degree of protection check, check profile & fixing of gaskets	MA	Visual	2 - 5 samples at gasketted joints per board	2-5 samples at gasketted joints per board	Approved drawing/ Technical Specification	No insertion possible from openings & gasketted joints	QC RECORD	✓	P	W	W	Paper insertion method - IP5X Comp. & 1 mm wire insertion method - IP4X Comp.
		24. IR Test before & after the HV Test	MA	Elec.	100%	100%	IS/ IEC 61439	IS/ IEC 61439	QC RECORD	✓	P	W	W	
		25. HV test on Power circuit	CR	Elec.	100%	100%	IS/ IEC 61439	IS/ IEC 61439	QC RECORD	✓	P	W	W	

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Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR		

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
	CUSTOMER:		QP NO.: PE-QP-999-506-E002, REV. 0	DATE: 27.02.2024
	PROJECT:		PO NO.:	DATE:
	ITEM: LT SWITCHGEAR	SYSTEM: LT SWITCHGEAR	SECTION: II	SHEET 10 of 10

S. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK (6)		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY (10)			REMARKS
					M	B/C			(9)	D *	M **	B	C	(11)
(1)	(2)	(3)	(4)	(5)			(7)	(8)						
		26. Functional Test of each type of draw-out feeders	MA	Functional	100%	10%	Approved drawing	Approved drawing	QC RECORD	✓	P	W	W	
5	Packing	Soundness of packing, Loading etc.	MA	Verify	100%	100%	Manufacturer's Standard	Manufacturer's Standard			P	-	-	

LEGENDS:

*Records, identified with "Tick"(√) shall be essentially included by supplier in QA documentation.
** **M**: Supplier/ Manufacturer/ Sub-Supplier, **B**: Main Supplier/ BHEL/ Third Party Inspection Agency, **C**: Customer.
P: Perform, **W**: Witness, **V**: Verification, as appropriate.
MA: Major, **MI**: Minor, **CR**: Critical, **D**: Documentation

BHEL						BIDDER/ SUPPLIER	
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Prepared by:		MEGHA/ NARENDRA NATH JAJWARE	Checked by:		KUNDAN PRASAD		
Reviewed by:		SANDEEP LODH	Reviewed by:		HARISH KUMAR		

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 1 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B/C				D	M	B	C	
1	2	3	4	5	6		7	8	9	*	**			
1.0	**RAW MATERIALS**													
1.1	**Aluminium /Copper Rods (Conductor/ Armour Wire)**	a) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Cert.	✓	V	V	-	
		b) Grade	MA	-do-	-do-	-do-	IS:8130 (Al), IS:613 (Cu)	IS:8130 (Al), IS:613 (Cu)	-do-	✓	V	V	-	
		c) Resistivity	MA	Electrical Tests	Manufacturer std.	Manufacturer std.	IS:613 (Cu), IS:5082 (Al)	IS:613 (Cu), IS:5082 (Al)	-do-	✓	P	V	-	
1.2	**PVC Compound for insulation**													
		a) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Cert.	✔	V	V	-	

BHEL					
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	Sign & Date	Name		Sign & Date	Name
Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 2 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					6					*	**			
					M	B/C				D	M	B	C	
1	2	3	4	5			7	8	9					
		b) Type/ Grade	MA	-do-	-do-	-do-	Approved Datasheet	Approved Datasheet	-do-	✓	V	V	-	
		c) Shelf life/ Storage condition	MA	-do-	-do-	-do-	Compound mfg std	Compound mfg std	-do-	✓	V	V	-	
1.3	**Fillers (if applicable)**	1. Make/ Type/ Grade	MA	Verify	Manufacturer standard	Manufacturer standard	Manufacturer approved source & Approved datasheet	Manufacturer approved source & Approved datasheet	Test Cert.	✓	P	V	-	Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of cable)
		2. Flame retardant & moisture	CR	Chemical / Environ.	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	V	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
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		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 3 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B/C				D	M	B	C	
1	2	3	4	5	6		7	8	9	*	**			
		resistant. (As applicable)												
1.4	**Galvanised steel wire/strip for Armour (as applicable)**	**GENERAL:**												
		1. Make	MA	Verify	Manufacturer std.	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Inspection report / Test Cert.	✓	P	V	-	
		2. Dimension	MA	Measurement	1 sample each size	1 sample each size	Appd. Data Sheet	Appd. Data Sheet	-do-	✓	P/V	V	-	
		3. Phy. and Elec. Properties	MA	Physical & Electrical Tests	Sample*	Sample*	IS 3975	IS 3975	-do-	✓	P/V	V	-	* Sample from each armour size/Batch

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL			Reviewed by:			
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 4 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
		4.Galvanization Quality (Acceptance test as per IS 3975)	MA	Galv.Tests	-do-	-do-	IS 3975	IS 3975	-do-	✓	P/V	V	-	
1.5	**PVC Compound (for sheath)**													
		a) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	Inspection report / Test Cert.	✓	V	V	-	
		b) Type/ Grade	MA	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	V	V	-	
		c) Shelf life/ Storage condition	MA	-do-	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	✓	V	V	-	

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BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 5 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
1.6	**Wooden Drum if applicable as per approved data sheet**	1. Phy. & Constructional checks	MA	Visual	Mfr's Plant Std.	Mfr's Plant Std.	IS 10418	IS 10418	Inspection report / Test Cert.	✓	P	V	-	
		2. Anti termite treatment	MA	Chem.	-do-	-do-	Mfr's Plant Std.	Mfr's Plant Std.	-do-	✓	P	V	-	
1.7	**Steel Drum #**	1. Dimension	MA	Meas.	Mfr's Plant Std.	Mfr's Plant Std.	Approved drg **of steel drum**	Approved drg **of steel drum**	Inspection report / Test Cert.	✓	P	V	-	**# If required, as per spec./ mentioned in approved data sheet**
		2. Surface finish	MA	Visual	-do-	-do-	Surface shall be smooth	Surface shall be smooth	-do-	✓	P	V	-	
2.0	**IN PROCESS**													

BHEL					
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Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 6 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
2.1	**Wire Drawing**	1. Size	MA	Dimensional	Plant Mfg. Std.	Plant Mfg. Std.	Approved datasheet	Approved datasheet	Inspection Report/ Test report	✓	P	V	-	
		2. Surface finish	MA	Visual	-do-	-do-	Surface shall be smooth	Surface shall be smooth	-do-	✓	P	V	-	
		3. % of Elongation	MA	Mechanical	-do-	-do-	IS 8130	IS 8130	-do-	✓	P	V	-	
2.2	**Tinning**	1. Size	MA	Dimensional	Plant Mfg. Std.	Plant Mfg. Std.	Mfrs Std	Mfrs Std	-do-	✓	P	V	-	(Applicable only for tin-coated Copper conductor)
		2. Chemical test for tinning	CR	Chemical	-do-	-do-	IS 10810 Pt-4	Is-8130	-do-	✓	P	V	-	
2.3	**Stranding of wires**	1. No. of wires	MA	Counting	One Sample of each size	One Sample of each size	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	V	-	

BHEL					
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BIDDER/ SUPPLIER	
Sign & Date	
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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 7 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
		2. Resistance (DC)	CR	Electrical	-do-	-	-do-	-do-	-do-	-do-	P	-	-	
		3. Sequence, lay length & Direction	MA	Visual, Measurement	One Sample of each size	-	Mfrs Std. / Appd. Datasheet	Mfrs Std. / Appd. Datasheet	-do-		P	-	-	
		4. Surface Finish	MA	Visual	100%	-	Surface shall be smooth	Surface shall be smooth	-do-		P	-	-	
		5. Dimension	MA	Measurement	One Sample of each size	-	Appd. Datasheet	Appd. Datasheet	-do-		P	-	-	
2.4	**Core Insulation** (No repair permitted)													
		1. Surface finish	MA	Visual	100%	100%	Free from bulging, burnt particles, lumps, cuts	Free from bulging, burnt particles, lumps, cuts & scratches	Inspection Report/ Test report	✓	P	V	-	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL		
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR		

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		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 8 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B/C				D	M	B	C	
1	2	3	4	5	6		7	8	9	*	**			
							& scratches							
		2. Insulation Thickness	CR	Measurement	-do- One Sample of each size	-	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	-	-	
		3. Concentricity # Eccentricity & Ovality $	CR	Measurement	One Sample of each size	One Sample of each size	Mnfr's Std / Approved data sheet	Mnfr's Std / Approved data sheet	-do-	✓	P	V	-	# To be checked at starting & finish end of extruded length $ To be checked for PVC/HRPVC Power Cable
		4. Dia over insulation	MA	Measurement	-do-	-	-do-	-do-	-do-	✓	P	-	-	
		5. Core Identification	MA	Visual	100%	-	Approved Data Sheet	Approved Data Sheet	-do-	✓	P	-	-	

BHEL					
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Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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Doc No:			
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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 9 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
		6. TS & % Elongation	MA	Mechanical	100%	-	IS:1554-I, IS:5831	IS:1554-I, IS:5831	-do-	✓	P	-	-	
		7. Spark Test or Water immersion test	CR	Electrical	100%	-	Mnfr's Std	Mnfr's Std	-do-	✓	P	-	-	
2.5	**Core Laying**	1. Dia over laid up core	MA	Measurement	One Sample of each size	-	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	-	-	
		2. Sequence of lay & lay length & direction of laid up core	MA	Visual & Measurement	-do-	-	IS 1554-pt-1	IS 1554-pt-1	-do-	✓	P	-	-	
2.6	**Inner Sheath Extrusion (if applicable)**	1. Surface finish	MA	Visual	100%	-	Surface shall be smooth	Surface shall be smooth	Inspection Report/ Test report	✓	P	-	-	
		2. Thickness	CR	Measurement	One Sample of each size	-	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	-	-	

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Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR

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		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 10 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
		3. Dia over inner sheath	MA	-do-	-do-	-	-do-	-do-	-do-	✓	P	-	-	
		4. Colour	MA	Visual	-do-	-	-do-	-do-	-do-	✓	P	-	-	
2.7	**Armour (as applicable)**	1. No. of wires/Strips	MA	Counting	At the start of the process	-	Mnfr's Std	Mnfr's Std	Inspection Report/ Test report	✓	P	-	-	
		3. Lay length / Direction	MA	Visual & Meas.	-do-	-	IS 1554 P-1	IS 1554 P-1	-do-	✓	P	-	-	
		4. Coverage	MA	Measurement	-do-	-	-do-	-do-	-do-	✓	P	-	-	
		5. Dia over armouring	MA	Measurement	-do-	-	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	-	-	
2.8	**Outer Sheath Extrusion**	1. Surface finish	MA	Visual	100%	-	Surface shall be smooth	Surface shall be smooth	Inspection Repo	✓	P	-	-	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY					Doc No:			
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Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL	Seal		Reviewed by:			
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 11 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
	(No repair permitted)								rt/ Test report					
		2. Sheath Thickness	CR	Measurement	One Sample of each size	-	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	-	-	
		3. Dia over outer sheath	MA	-do-	-do-	-	-do-	-do-	-do-	✓	P	-	-	
		4. Colour Embossing/ Sequential Marking	MA	Visual	100%	-	Approved data sheet	Approved data sheet	-do-	✓	P	-	-	
3.0	**Final Inspection (INTERNAL)**	**1. Routine Test**	CR	Electrical Tests & Measurement	100%	100%	#	#	-do-	✓	P	V	V	#: Refer Annexure-A & Annexure-B to QP.

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
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Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL			Reviewed by:			
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:	Harish Kumar	HARISH KUMAR			Approved by:			

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 12 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
4.0	**Final Inspection (EXTERNAL)**	**1. Finish & Length (Cable & cable drum)**	MA	Visual	One drum	One drum	Appd. Datasheet	Free from Porosity, Bulging, Burnt particles, lumps, cuts & scratches	Inspection Report/ Test report	✓	P	W	W	
		2. Dimension	MA	-do-	IS 1554-I	IS 1554-1	Appd. Data sheet	Appd. Data sheet	-do-	✓	P	W	W	
		3. Armouring - Coverage & No.of Wires/Strips	MA	Visual & Meas.	-do-	-do-	-do-	-do-	-do-	✓	P	W	W	
		4. Marking & Colour Coding	MA	Visual	-do-	-do-	-do-	-do-	-do-	✓	P	W	W	
		5. Acceptance Tests	CR	Phy, Elect. Tests & FRLS Tests	Sample #	Sample #	#	#	-do-	✓	P	W	W	#: Refer Annexure-A & Annexure-B to QP.

BHEL					
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BIDDER/ SUPPLIER	
Sign & Date	
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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 13 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
		6. Type & FRLS Tests	CR	Measurement	Sample #	Sample #	#	#	-do-	✓	P	W / V	W / V	Witness required for conduction of Type test; else 'Verification' of type test(s) reports to be done. #: Refer Annexure-A & Annexure-B to QP. .
5.0	**Packing**	**End sealing / Polythene wrapping**	MA	Visual	100%	100%	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	V		

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ENGINEERING			QUALITY			Sign & Date		Doc No:			
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Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL			Reviewed by:			
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:		HARISH KUMAR			Approved by:			

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E003, R-02	
		PROJECT:		PO NO.:	
		ITEM: 1. LT PVC CONTROL CABLE 2. LT HRPVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	SYSTEM: CABLE	SECTION: II	SHEET 14 OF 14

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	

NOTES:

A. For lists of routine tests, acceptance tests & type tests refer Annexure-A to SQP.
B. For project specific tests (if any); refer Annexure-B to SQP.
C. Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch no. should be traceable to the final cable drum number or batch no.
D. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated above whether it is identified for BHEL verification or witness or not.
E. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER

P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

D: DOCUMENTATION

BHEL					
ENGINEERING			QUALITY		
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Prepared by:	Devendra Singh	Priyanka Gupta / Devendra Singh	Checked by:	Suman Nakwal	SUMAN NAKWAL
Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
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Approved by:			

	ANNEXURE-A TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER:
		BIDDER/VENDOR:	QUALITY PLAN NUMBER: PE-QP-999-507-E003, R02	SPECIFICATION TITLE:
	SHEET 1 OF 4	SYSTEM: CABLE	ITEM: 1. LT PVC CONTROL CABLE 2. LT PVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

1. Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.

2. Sampling:
   a) Type test to be conducted on one size for each type (Al/Cu conductor) of cable.
   b) FRLS & Flammability Test to be conducted only on one sample.

3. Repeat type test(s) are not required, in case the requirements of note no. 2, clause no. 2.2 of IS 1554-1 (as per amendment no. 5 of 2012) are met.

B. Acceptance Test Conduction:

1. Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.

2. Sampling:
   Sampling for acceptance tests shall be as per Appendix-B of IS: 1554 Part-I.

3. Flammability Test to be conducted only on one sample.

C. Routine Test Conduction:

1. Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.

D. Tests listed in S. No-7.0 & 8.0 shall be conducted only on one sample.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	**Tests for Conductor**				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	Internal in process Test Report to be furnished for to inspector at the time of inspection
II.	Tensile test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 2	

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Reviewed by:	Ayan Saha	AYAN SAHA	Reviewed by:		HARISH KUMAR

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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
III.	Wrapping test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T	IS 10810 Pt 38	
V.	Winding / Adhesion Test	For GS strip only	T	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T	IS 10810 Pt 41	
IX.	Wrapping Test	Applicable for Aluminium wire & GS wire	A	IS 10810 Pt 3	
3.0	Physical Tests for PVC Insulation & PVC sheath				
I.	Test for thickness	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation & PVC outer sheath			
(a)	Before ageing		T, A	IS 10810 Pt 7	
(b)	After ageing		T, A	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	T	IS 10810 Pt 10	
V.	Hot deformation test	For PVC outer sheath only	T	IS 10810 Pt 15	
VI.	Heat shock test	For PVC outer sheath only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For PVC insulation & PVC outer sheath only	T	IS 10810 Pt 12	

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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
VIII.	Thermal stability test	For PVC insulation & PVC outer sheath only	T	IS 10810 Pt 60	
4.0	Improved Fire performance (FR-LSH) Tests				
I.	Oxygen index test	*For outer sheath only*	T, A	IS 10810 Pt 58 / ASTMD 2863/	Applicable for Inner Sheath also, if the same is indicated in Datasheet-A
II.	Smoke density test	*For outer sheath only*	T	IS 10810 Pt 63 / ASTMD 2843	
III.	Acid gas generation test	*For outer sheath only*	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	*For outer sheath only*	T	IS 10810 Pt 64 / ASTMD 2863	
5.0	Flammability Tests				
I.	Flammability test for bunched cables	For complete cable	T	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B	Test & Category applicable as indicated in Technical Datasheet
II.	Flammability test for single cable	For complete cable	T, A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	
6.0	Electrical Tests				
I.	High Voltage Test (Water immersion test)	On cores	T, A, R	IS 10810 Pt 45	
II.	High Voltage Test at room temperature	For complete cable	T, A, R	IS 10810 Pt 45	
III.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A	IS 10810 Pt 43	
7.0	Anti-rodent and Termite Repulsion test	For PVC outer sheath only	A	Refer Note	Test applicable if indicated in Technical Datasheet-A
8.0	Anti-Fungal Test	For PVC outer sheath only	A	Self-certification by vendor for anti-fungal property.	
9.0	Special Tests				

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	ANNEXURE-A TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER:
		BIDDER/VENDOR:	QUALITY PLAN NUMBER: PE-QP-999-507-E003, R02	SPECIFICATION TITLE:
	SHEET 4 OF 4	SYSTEM: CABLE	ITEM: 1. LT PVC CONTROL CABLE 2. LT PVC CONTROL CABLE 3. LT PVC POWER CABLE 4. LT HRPVC POWER CABLE	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Hydrolytic Stability Test	For complete cable	**	ASTM D 3137:81	Test applicable if indicated in Technical Datasheet
II.	Ultraviolet Radiation Test	For complete cable	**	BS EN ISO 4892-2	

***** These tests shall be conducted on one sample for the entire contract and duration of these tests shall be 14 days.***

Note: A few chipping of the PVC compound is slowly ignited on a porcelain dish or cubicle in a muffle furnace at about 60-degree C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). Place a drop of aqueous sodium sulphide solution on a thick filter paper and allow soaking. Touch the spot with a drop of above extract. A black spot indicates the presence of lead, the anti-termite and rodent compound.

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Annexure “B” to Standard Quality Plan

PROJECT SPECIFIC REQUIREMENT

PROJECT:

PACKAGE: (1) LT PVC CONTROL CABLE, (2) LT HRPVC CONTROL CABLE, (3) LT PVC POWER CABLE, (4) LT HRPVC POWER CABLE

S. No.	TEST	APPLICABLE	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.	Accelerated water absorption test for insulation	as per NEMA-WE-3.11.			
2.	Dielectric retention Test: The dielectric strength of the cable insulation			tested in accordance with Cl. 6.7.4 of	
	NEMA WE-5 at 75 +/- 1 °C shall not be less than 60% of the original dielectric strength.				
3. Test for rodent and termite repulsion property					

PREPARED BY	CHECKED BY	REVIEWED BY	APPROVED BY
NAME: DESIGNATION:	NAME: DESIGNATION:	NAME: DESIGNATION:	NAME: DESIGNATION:

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 03.	
		PROJECT:			
		ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE		SHEET 1 OF 8

Sl No	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			REMARK
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
INSTRUCTIONS														
1	RAW MATERIALS & BOUGHT OUT ITEMS													
1.1	Copper Rods/ Wires (For Conductor & drain wire)	a) Make	MA	Physical verification	Sample/Batch	Sample/Batch	Manufacturer approved source	Manufacturer approved source	Test Cert.	✔	V	V	-	
		b) Type/ Grade	MA	-do-	100%	100%	IS 613	IS 613	-do-	✔	V	V	-	
		d) Resistivity	MA	Electrical Tests	Manufacturer std.	Manufacturer std.	IS 613	IS 613	-do-	✔	P	V	-	
1.2	PVC Compound (for insulation)	a) Make	MA	Physical verification	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Cert.	✔	V	V	-	
		b) Type/ Grade	MA	-do-	100%	100%	Approved datasheet	Approved datasheet	-do-	✔	V	V	-	
		c) Shelf life/ Storage condition	MA	-do-	100%	100%	Compound Manufacturer std.	Compound Manufacturer std.	-do-	✔	V	V	-	
1.3	Screen / Tapes/ Binders	1. Make	MA	Physical verification	100%	100%	Manufacturer approved source	Manufacturer approved source	Inspection Report/ Test Cert	✔	V	V	-	
		2. Dimension	MA	Measurement	Manufacturer std.	Manufacturer std.	Manufacturer datasheet/ Approved datasheet	Manufacturer datasheet/ Approved datasheet	Inspection Report/ Test Cert	✔	V	V	-	
		4. Chem. & Phys. Properties	MA	Chemical & Physical Tests	-do-	do-	Manufacturer std.	Manufacturer std.	-do-	✔	P	V	-	

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Reviewed by:	27/12/24	Hema kushwaha	Reviewed by:	27-12-24	Harish

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	CUSTOMER :	QP NO.: PE-QP-999-507-E004, REV 03.	
	PROJECT:		
	ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE	SHEET 2 OF 8

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	*	AGENCY			REMARK
1	2	3	4	5	6		7	8	9	D	** M	B	C	
					M	B/C								
1.4	Fillers (as applicable)	1. Make/ Type/ Grade	MA	Physical verification	Manufacturer standard	Manufacturer standard	Manufacturer approved source & Approved datasheet	Manufacturer approved source & Approved datasheet	Test certificate	✔	P/V	V		Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other comp. of cable)
1.5	Galvanised steel wire/strip for Armour (if applicable)	1. Make	MA	Physical verification	Manufacturer std	Manufacturer std	Manufacturer approved source	Manufacturer approved source	Inspection Report/ Test Cert	✔	P	V		
		2. Dimension	MA	Measurement	1 sample each size/ lot	1 sample each size/ lot	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P/V	V		
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	Sample*	IS 3975	IS 3975	-do-	✔	P/V	V		* SAMPLE FROM EACH ARMOUR SIZE/ BATCH /LOT
		4 Galvanization Quality (Acceptance test as per IS 3975)	MA	Test as per IS 3975	-do-	-do-	IS 3975	IS 3975	-do-	✔	P/V	V		
1.6	PVC compound for Sheath	a) Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	IS 5831	IS 5831	Test Cert.	✔	P/V	V		
		b) Elec. Properties	MA	Electrical Tests	-do-	-do-	-do-	-do-	-do-	✔	P/V	V		
		c) FRLS Properties (as applicable)	CR	Chemical/ Environ	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✔	P/V	V		
		d) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	Inspection Report/ Test Cert	✔	V	V		
		e) Type/ Grade	MA	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✔		V		
		f) Shelf life/ Storage condition	MA	-do-	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	✔	V	V		

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Reviewed by	27/2/24	Hema Kushwaha	Reviewed by	29.2.24	Harish

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN	SPEC. NO :	DATE:
	CUSTOMER :	QP NO.: PE-QP-999-507-E004, REV 03.	
	PROJECT:		
	ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE	SHEET 3 OF 8

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	*	** AGENCY			REMARK
					M	B/C				D	M	B	C	
1	2	3	4	5	6		7	8	9					
1.7	Wooden drum	1. Phy. & Constructional checks	MA	Measurement	Manufacturer std.	Manufacturer std.	IS 10418	IS 10418	Inspection Report	✔	P	V	-	
		2. Anti-termite treatment	MA	Chem.	-do-	-do-	Manufacturer std.	Manufacturer std.	Inspection Report	✔	P	V	-	
1.8	Steel drum (if applicable as per approved data sheet)	1. Dimension	MA	Measurement	Manufacturer std.	Manufacturer std.	Approved drg. of steel drum	Approved drg. of steel drum	Inspection Report	✔	P	V	-	
		2. Surface finish	MA	Visual	-do-	-do-	-	Surface shall be smooth	Inspection Report	✔	P	V	-	
2	**IN PROCESS**												-	
2.1	Wire Drawing	1. Size	MA	Dimensional	Manufacturer std.	Manufacturer std.	Approved datasheet	Approved datasheet	Inspection Report/ Test Report	✔	P	V	-	
		2. Surface finish	MA	Visual	-do-	-do-	Surface shall be smooth	Surface shall be smooth	-do-	✔	P	V	-	
		% of Elongation	MA	Mechnical	-do-	-do-	IS 8130	IS 8130	-do-	✔	P	V		
2.2	Tinning (Conductor or drain wire)	1. Size	MA	Dimensional	Manufacturer std.	Manufacturer std.	Manufacturer std.	Manufacturer std.	-do-	✔	P	V	-	
		2. Chemical test for tinning	CR	Chemical	-do-	-do-	IS 10810 - 4	IS 8130	-do-	✔	P	V	-	

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		CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 03.	
		PROJECT:			SHEET 4 OF 8
		ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE		

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			REMARK
					6					*	**			
1	2	3	4	5	M	B/C	7	8	9	D	M	B	C	
2.3	Stranding of wires	1. No. of wires	MA	Counting	one Sample each	one Sample each	Approved datasheet	Approved datasheet	-do-	✔	P	V	-	
		2. Resistance (DC)	CR	Electrical	-do-	-	-do-	-do-	-do-	✔	P	-	-	
		3. Sequence, lay length & Direction	MA	Visual, Measurement	one Sample each size/lot	-	Manufacturer std.	Manufacturer std.	-do-		P	-	-	
		4. Surface Finish	MA	Visual	100%	-	Surface shall be smooth	Surface shall be smooth	-do-		P	-	-	
		5. Dimension	MA	Measurement	one Sample each size/lot	-	Approved datasheet	Approved datasheet	-do-		P	-	-	
2.4	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	100%	Free from bulging burnt particles lumps, cuts & Scratches.	Free from bulging burnt particles lumps, cuts & Scratches.	Inspection Report / Test Report	✔	P	V	-	
		2. Insulation thickness (Min./ Max.)	CR	Measurement	one Sample of each size/lot		Appd. data sheet	Appd.data sheet	-do-	✔	P	-	-	
		3. Concentricity #	CR	Measurement	-do-	-do-	Mfr's Std. / Appd. Data sheet	Mfr's Std. / Appd. Data sheet	-do-	✔	P	V	-	# To be checked at starting & finish end of extruded length
		4. Dia over insulation	MA	Measurement	-do-	Manufacturer standard / Approved data sheet	Appd.data sheet	Appd.data sheet	-do-	✔	P	-	-	
		5. Core identification	MA	Visual	100%	-	Appd.data sheet	Appd.data sheet	-do-	✔	P	-	-	
		6. T S & % Elongation	MA	Mechanical	100%	-	IS-1554/IS-5831	IS-1554/IS-5831	-do-	✔	P	-	-	
		7. Spark Test	CR	Electrical	100%	-	Mfr's Std.	Mfr's Std.	-do-	✔	P	-	-	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 03.	
		PROJECT:			
		ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE		SHEET 5 OF 8

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			REMARK
					6					*	**			
1	2	3	4	5	M	B/C	7	8	9	D	M	B	C	
2.5	Core pairing, screening (provision of drain wire & laying)	1. Pair identification	MA	Visual	100%	100%	Appd. Data Sheet	Appd. Data Sheet	Inspection Report	✔	P	-	-	
		2.Wire size & tape size	MA	Measurement	100%	100%	-do-	-do-	-do-	✔	P	-	-	
		3.Test for capacitance	CR	Elect. Test	100%	100%	-do-	-do-	-do-	✔	P	-	-	
		4. Sequence of lay and lay length	MA	Visual & Measurement	one Sample of each size/lot	one Sample of each size/lot	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	-	-	
		5. Screen overlap & coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-	✔	P	-	-	
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	-do-	✔	P	-	-	
		7. Continuity of drain & drain wire with Screen	MA	Elect. Test	100%	100%	<--------No Discontinuity ---------->		-do-	✔	P		-	
2.6	Inner Sheath Extrusion (if applicable)	1. Surface finish	MA	Visual	100%	100%	Free from bulging, burnt particles, lumps, cuts & Scratch	Free from bulging, burnt particles, lumps, cuts & Scratch	-do-	✔	P	-	-	
		2. Sheath thickness	CR	Measurement	One sample of each size/lot	One sample of each size/lot	Approved Data sheet	Approved Data sheet	-do-	✔	P	-	-	
		3.Dia over inner sheath	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	-	-	
		4. Colour	MA	Visual	-do-		Appd. Data Sheet	Appd. Data Sheet	Appd. Data Sheet	✔	P	-	-	

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ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	27/2/24	khushbu agrawal	Checked by:	27.02.24	Suman			Reviewed by:			
Reviewed by:	27/2/24	Hema kushwaha	Reviewed by:	27/2/24	Harish			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 03.	
		PROJECT:			
		ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE		SHEET 6 OF 8

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			REMARK
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
2.7	Armouring (if applicable)	1. No of wires/Strips	MA	Counting	At the start of the process	At the start of the process	Mftr's Std	Mftr's Std	-do-	✔	P	-	-	
		2. Size of wire/ Strip	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	-	-	
		4. Lay Length/Lay Direction	MA	Visual, Meas.	At the start of the process	At the start of the process	IS-1554	IS-1554	-do-	✔	P	-	-	
		5. Coverage	MA	Measurement	-do-	-do-	IS-1554	IS-1554	-do-	✔	P	-	-	
		6. Dia over armour	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	-	-	
2.8	Outer Sheath Extrusion (No repair permitted)	1. Surface Finish	MA	Visual	100%	-	Surface shall be smooth	Surface shall be smooth	Inspection Report/ Test report	✔	P	-	-	
		2. Sheath thickness	CR	Measurement	One sample of ech size/lot	-	Appd. Data Sheet	Approved Data sheet	-do-	✔	P	-	-	
		3. Dia over outer sheath	MA	Measurement	-do-	-	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	-	-	
		4. Colour / Embossing / Sequential Marking	MA	Visual	100%	-	Appd. Data Sheet	Appd. Data Sheet	-do-	✔	P	-	-	Sequencing be done by printing/marking
		5. TS & % Elongation	MA	Mechanical	100%	100%	IS 5831/ IS 10810 part 7	IS 5831	-do-	✔	P	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by	27/2/24	khushbu agrawal	Checked by	27.02.24	Suman
Reviewed by	27/2/24	Hema kushwaha	Reviewed by	27/2/24	Harish

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by :			
Approved by :			

548

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 03.	
	PROJECT:			SHEET 7 OF 8
	ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE		

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			REMARK
1	2	3	4	5	6		7	8	9	*	**			
					M	B/C				D	M	B	C	
3	Final Inspection (Internal)	Routine Test	CR	Electrical test & Measurement	100%	100%	#	#	-do-	✔	P	V	V	# Refer Annexure-A to QP
4	Final Inspection (External)	1. Finish & Length (Cable & cable drum)	MA	Visual, Measurement	One drum in each lot	One drum in each lot	Appd. Data Sheet	Free from Bulging, Burnt particles, lumps, cuts & scratches/ Approved data sheet	Inspection Report / Test Report	✔	P	W	W	
		2. Dimensions	MA	Measurement	IS-1554-1	IS-1554-1	Appd. Data sheet	Appd. Data sheet	Inspection Report	✔	P	W	W	
		3. Armouring - Coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-	✔	P	W	W	
		4. Marking/Colour/ pair identification (Cable & cable drum)	MA	Visual	-do-	-do-	-do-	-do-	-do-	✔	P	W	W	
		5. Acceptance Tests	CR	Phy & Elect Tests	#	#	#	-do-	-do-	✔	P	W	W	# Refer Annexure-A to QP
		6. Type Tests	CR	Measurement	#	#	#	Appd. Data sheet	-do-	✔	P	W	W	Check for applicability of conduction of test(s) as per approved datasheet. #: Refer Annexure-A to QP
5	Packing	End sealing / Polythene wrapping	MA	Visual	100%	100%	Appd. Data sheet	Appd. Data sheet	-	✔	P	W		
		CABLE DRUMS	MA	Visual	100%	100%	Appd. Data sheet	Appd. Data sheet	-	✔	P	W		

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by	27/2/24	khushbu agrawal	Checked by:	27.2.24	SUMAN
Reviewed by	27/2/24	Hema kushwaha	Reviewed by:	27/2/24	Harish

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

549

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO:	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 03.	
	PROJECT:			SHEET 8 OF 8
	ITEM: SCREENED CONTROL CABLES	SYSTEM: CABLE		

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			REMARK
									*		**			
1	2	3	4	5	6		7	8	9	D	M	B	C	
					M	B/C								

NOTES:

A) For lists of routine tests, acceptance tests & type tests refer Annexure-A to SQP.
B) For project specific tests (if any) refer Annexure-B to SQP
C) Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no. witness or not
D) Cable manufacturer to maintain all quality records identified as per all QP stages enumerated above whether it is identified for BHEL verification or witness or not
F) Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred

LEGENDS:

*Records, identified with "Tick"(√) shall be essentially included by supplier in QA documentation
** M: Supplier/ Manufacturer/ Sub-Supplier, B: Main Supplier/ BHEL/ Third Party Inspection Agency, C: Customer
P: Perform, W: Witness, V: Verification, as appropriate
MA: Major, MI: Minor, CR: Critical, D: Documentation

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by	7/6/24			27.02.24	Suman
Reviewed by	27/2/24		Reviewed by	27/2/24	Harish

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Remarks	Seal
Reviewed by			
Approved by			

Annexure "A" to Standard Quality Plan

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

1. Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test
2. Sampling:
   a) Type test (except for Sl. no. b & c below) to be conducted on one size (preferably highest size.) of each type (F or G type)
   b) Electrical & C&I tests to be conducted on one size of each type of cables
   c) FRLS & Flammability Test to be conducted only on one sample

B. Acceptance Test Conduction:

1. Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
2. Sampling:
   a) Acceptance tests (except for Sl. no. b & c below) for every lot shall be as per Appendix-B (Clause 15.22) of IS: 1554
   b) Electrical & C&I tests to be conducted on each size of each type of cables
   c) FRI-S & Flammability tests to be conducted only on one sample irrespective of size/type.

C. Routine Test Conduction:

1. Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.
2. Sampling: Routine tests shall be conducted on 100% cable drums

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	**Tests for Conductor**				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	***Internal in process Test Report to be furnished for to inspector at the time of inspection***
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 10810 Pt 4	
III.	Resistance test	For Al/Cu	T, A,R	IS 10810 Pt 5	
2.0	**Tests for Armour Wires/Strips**				

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding / Adhesion Test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
IX.	Wrapping Test	Applicable for Aluminium wire & GS wire	A	IS 10810 Pt 3	
3.0	**Physical Tests for PVC Insulation & PVC sheath**				
I.	Test for thickness	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation & PVC outer sheath	T, A		
(a)	Before ageing		T, A	IS 10810 Pt 7	
(b)	After ageing		T, A	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	T	IS 10810 Pt 10	
V.	Hot deformation test	For PVC outer sheath only	T	IS 10810 Pt 15	
VI.	Heat shock test	For PVC outer sheath only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For PVC insulation & PVC outer sheath only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC insulation & PVC outer sheath only	T	IS 10810 Pt 60	
IX	Bleeding & Blooming test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 19	For testing color of core
X	Cold bend test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 20	In low temperature siff cable
XI	Cold impact test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 21	SAME ABOVE FOR DIA ABOVE 12.5 MM
XII	Colour fastness to water	For PVC insulation & PVC outer sheath	T	IS 10810 Pt 18, Appendix-A of IS: 5831	

22/12/24

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
4.0	**Tests for Al-Mylar Shield**				
I	Continuity test	For Al-Mylar shield		Plant Standad	
II	Shield thickness	For Al-Mylar shield		ADS	
III	Overlap test	For Al-Mylar shield		ADS	
IV	Constructional details, dimensions	For Al-Mylar shield		ADS	
V	Visual, surface finish+	For Al-Mylar shield		Plant Standard	
VI	Overall coverage	For Al-Mylar shield		Plant Standard	
VII	Noise interference test.	For Al-Mylar shield		ADS	
5.0	**Tests for Drain Wire**				
	Annealing test	For copper conductor only		IS 10810 Pt 1	In process records shall be furnished to inspector at the time of inspection.
	Tin coating test (for tinned copper)	For copper conductor only		IS 10810 Pt 4	
	Resistance test	For Cu Conductor		IS 10810 Pt 5	
	Diameter test	For conductor		ADS	
6.0	**Improved Fire performance (FR-LSH) Tests**				
I.	Oxygen index test	*For outer sheath only*	T, A	IS 10810 Pt 58 / ASTMD 2863/	**Test applicable as indicated in Project specific Annexure-B**
II.	Smoke density test	*For outer sheath only*	T	IS 10810 Pt 63 / ASTMD 2843	
III.	Acid gas generation test	*For outer sheath only*	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	*For outer sheath only*	T	IS 10810 Pt 64 / ASTMD 2863	
7.0	**Flammability Tests**				
I.	Flammability test for bunched cables	For complete cable	T	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B	**Test applicable as indicated in Project specific Annexure-B**
II.	Flammability test for single cable	For complete cable	T, A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	
8.0	**Electrical Tests**				
I.	High Voltage Test (Water immersion test)	On cores	T, A, R	IS 10810 Pt 45	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
II.	High Voltage Test at room temperature	For complete cable	T, A, R	IS 10810 Pt 45	
III.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A,R	IS 10810 Pt 43	
IV.	L/R Ratio	For complete cable	A,R	BS:5308 Part II	
V.	Spark Test	Online Process during Extrusion of Insulation	ONLINE	BS:5308 Part II	
VI.	Thermal ageing test	For complete cable	T	IS-1554 Pt-1	Not applicable for screen cable as per IS
VII	Bending Test		T	IS 10810 Pt 50	
9.0	**C&I Tests**				
	Cross talk	For complete cable	T,A		
	Attenuation	For complete cable	T,A		
	Characteristic Impedance	For complete cable	T,A		
	Mutual capacitance	For complete cable	T,A,R		
	Noise interference	For complete cable	T,A		
10.0	**Anti-rodent and Termite Repulsion test**	For PVC outer sheath only	A	Refer Note	**Test applicable as indicated in Project specific Annexure-B**
11.0	**Anti-Fungal Test**	For PVC outer sheath only	A	Self-certification by vendor for anti-fungal property.	
12.0	**Special Tests**				
I.	Hydrolytic Stability Test	For complete cable	**	ASTM D 3137:81	**Test applicable as indicated in Project specific Annexure-B**
II.	Ultraviolet Radiation Test	For complete cable	**	BS EN ISO 4892-2	

***** These tests shall be conducted on one sample for the entire contract and duration of these tests shall be 14 days.***

Note: A few chipping of the PVC compound is slowly ignited on a porcelain dish or cubicle in a muffle furnace at about 60-degree C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). Place a drop of aqueous sodium sulphide solution on a thick filter paper and allow soaking. Touch the spot with a drop of above extract. A black spot indicates the presence of lead, the anti-termite and rodent compound.

In addition to above, the following special tests shall also be performed on the cables.

Accelerated water absorption test for insulation as per NEMA-WE-3.11.

Dielectric retention Test: The dielectric strength of the cable insulation tested in accordance with Cl. 6.7.4 of NEMA WE-5 at 75 +/- 1 °C shall not be less than 60% of the original dielectric strength.

Test for rodent and termite repulsion property: B

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-E005, REV. 04	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.:	DATE:
	ITEM: CABLE TRAYS & ACCESSORIES	SYSTEM: CABLING		SHEET 1 of 3

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6		7	8	9	D	M	B	C	
					M	B								
1.0 RAW MATERIAL														
1.1	HOT ROLLED CARBON STEEL SHEET	1 CHEM & PHY PROPERTIES	MA	VERIFICATION OF TC'S	100%	100%	IS -1079	IS -1079	TC	√	P/V	V	-	
		2 DIMENSIONS	MA	MEASUREMENT	100%	-	IS-1730	IS-1730	QC RECORD		P	-	-	
		3 SURFACE FINISH	MA	VISUAL	100%	-	IS-1079	IS-1079	QC RECORD		P	-	-	
1.2	ZINC	CHEM COMP	MA	CHEM TEST	EACH HEAT	EACH HEAT	IS-209	IS-209	TC	√	P/V	V	-	
2.0 IN-PROCESS														
2.1	FABRICATION	1 DIMENSIONS	MA	MEASUREMENT	100%	100%	APPD DOCUMENT	APPD DOCUMENT	QC RECORD	√	P	V		
		2 WELDING QUALITY	MA	VISUAL	100%	100%	ASME SEC IX	ASME SEC IX	QC RECORD	√	P	V		Welding is to be done by qualified welders in accordance with ASME SEC IX article III WPS, POR & WPQ to be reviewed during inspection
		3 SURFACE FINISH	MA	VISUAL	100%	100%	FREE FROM DEFECTS & SLAG	FREE FROM DEFECTS & SLAG	QC RECORD	√	P	V	-	
2.2	SURFACE PREPARATION	1 CLEANING, PICKLING & RINSING & FLUXING	MA	VISUAL	100%	-	IS 2629	IS 2629	QC RECORD		P/V	-	-	
		2 SURFACE FINISH	MA	VISUAL	100%	-	IS 2629	IS 2629	QC RECORD		P/V	-	-	

BIDDER/SUPPLIER	
Sign & Date	
Seal	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Checked by:	Manj	MANJU MEGHA	Checked by:	Mintoo	Mintoo
Reviewed by:	Hem	HEMA KUMAWAT	Reviewed by:	22/2/24	Hemant

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-E005, REV. 04	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.:	DATE:
	ITEM: CABLE TRAYS & ACCESSORIES	SYSTEM: CABLING		SHEET 2 of 3

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	* D	**			
					M	B					M	B	C	
2.3	GALVANISING	1.TEMPERATURE OF ZINC BATH	MA	MEASUREMENT	CONTINUOUS	-	IS-2629	IS-2629	QC RECORD		P/V	-	-	Galvanization is to be done at galvanization plant listed in Annexure-I to quality plan.
		2.DROSS	MA	VISUAL	PERIODIC	-	IS-2629	IS-2629	QC RECORD		P/V	-	-	
		3.RATE OF IMMERSION	MA	VISUAL	100%	-	IS 2629	IS 2629	QC RECORD		P/V	-	-	
		4. SURFACE FINISH	MA	VISUAL	100%	-	IS 2629	FREE FROM BURRS, ROUGHNESS, SLAG FLUX, STAIN ETC.	QC RECORD		P/V	-	-	
3.0 FINISHED ITEMS														
3.1	(CABLE TRAY, ACCESSORIES &)	1. DIMENSIONS	MA	MEASUREMENT	IS-2500 (PART 1) LEVEL S-4	IS-2500 (PART 1) LEVEL S-4	APPD.DRG	APPD. DOCUMENT	INSP.REPORT	√	P	W	-	
		2. SURFACE FINISH	MA	VISUAL	IS-2500 (PART 1) LEVEL S-4	IS-2500 (PART 1) LEVEL S-4	APPD. DRG	FREE FROM BURRS, SLAG, ROUGHNESS,FLUX, STAIN ETC.	INSP.REPORT	√	P	W	-	
		3.RIGIDITY (FOR TRAYS)	MA	DEFLECTION TEST	05 No./ LOT/	05 No./ LOT/	APPD. DRG	APPD. DOCUMENT	INSP.REPORT	√	P	W	-	600MM wide Ladder & perforated cable tray to be tested. Maximum deflection shall not exceed 7MM on mid span on uniform loading of 100KG/M.

BIDDER/SUPPLIER	
Sign &Date	
Seal	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Checked by:		MANOJ MEENA	Checked by:		
Reviewed by:		HEMA KUSHWAHA	Reviewed by:	20/2/24	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-E005, REV. 04	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.:	DATE:
	ITEM: CABLE TRAYS & ACCESSORIES	SYSTEM: CABLING		SHEET 3 of 3

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	B					M	B	C	
3.0 FINISHED ITEMS														
		4 MASS OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-4759	IS-6745	APPD DOCUMENT	INSP REPORT	√	P	W	-	
		5 UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-4759	IS-2633	IS-2633	INSP REPORT	√	P	W	-	
		6 THICKNESS OF ZINC COATING	MA	PHYSICAL TEST	IS-4759	IS-4759	APPD DOCUMENT	APPD DOCUMENT	INSP REPORT	√	P	W	-	
		7 ADHESION	MA	MECH TEST	IS-4759	IS-4759	IS-2629	IS-2629	INSP REPORT	√	P	W	-	
		8 COUPLER PLATE	MA	VISUAL	100%	100%	APPD DOCUMENT	APPD DOCUMENT	INSP REPORT	√	P	W	-	Inspector to mention the total number of bags/bundles of coupler plates, nuts, bolts & washer in the inspection report.
		9 NUT & BOLT	MA	VISUAL	100%	100%	APPD DOCUMENT	APPD DOCUMENT	INSP REPORT	√	P	W	-	
		10 WASHER	MA	VISUAL	100%	100%	APPD DOCUMENT	APPD DOCUMENT	INSP REPORT	√	P	W	-	Further manufacturer shall attach the detail of total number of bags/bundles of the respective items with packing list.
		11 PACKING	MA	VISUAL	100%	100%	APPD DOCUMENT	APPD DOCUMENT	INSP REPORT	√	P	V	-	

NOTES:

1. LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ASME/IEC ETC) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. **D**: DOCUMENTATION.

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B**: BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER.

P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE **MA**: MAJOR, **MI**: MINOR, **CR**: CRITICAL.

BIDDER SUPPLIER	
Sign & Date	
Seal	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Checked by:			Checked by:		
Reviewed by:			Reviewed by:		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER / SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO : PE-TS-XXX-507-E013	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-013, REV. 03	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.: -NA-	DATE:
	ITEM: CABLE TRAY SUPPORT SYSTEM -BOLTABLE	SYSTEM: CABLING		SHEET 1 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6 M	6 B	7	8	9	D	M	B	C	
1.0 RAW MATERIAL														
1.1	ROLLED CARBON STEEL SHEET	1.CHEM & PHY PROPERTIES	MA	VERIFICATION OF TC'S	100%	-	IS1079 (for hot rolled) IS-513 (for cold rolled)	IS1079 (for hot rolled) IS-513 (for cold rolled)	TC		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	IS-1730/	IS-1730	QC RECORD		P	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	IS1079 (for hot rolled) IS-513 (for cold rolled)	IS1079 (for hot rolled) IS-513 (for cold rolled)	QC RECORD		P	-	-	
1.2	ZINC	CHEM.COMP	MA	CHEM. TEST	EACH HEAT	-	IS-209	IS-209	QC RECORD	√	P/V	V	-	
2.0 IN-PROCESS														
2.1	FABRICATION	1.DIMENSIONS	MA	MEASUREMENT	100%	-	APPD.DRG	APPD.DRG	QC RECORD	√	P	V	-	
		2.WELDING QUALITY	MA	VISUAL	100%	-	ASME SEC. IX	ASME SEC. IX	QC RECORD	√	P	V	-	Welding is to be done by qualified welders in accordance with ASME Sec IX article III. WPS, PQR and WPQ to be reviewed during inspection

558

BIDDER/SUPPLIER	
Sign & Date	
Seal	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Checked by:		MANOJ MEENA	Checked by:		MD Mintoo
Reviewed by:		HEMA KUSHWAHA	Reviewed by:	22/2/24	Harish

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER / SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO : PE-TS-XXX-507-E013	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-013, REV. 03	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.: -NA-	DATE:
	ITEM: CABLE TRAY SUPPORT SYSTEM -BOLTABLE	SYSTEM: CABLING		SHEET 2 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B				D	M	B	C	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM DEFECTS & SLAG	FREE FROM DEFECTS & SLAG	QC RECORD	√	P	V	-	
2.2	SURFACE PREPARATION	1.CLEANING, PICKLING & RINSING & FLUXING	MA	MEASUREMENT	PERIODIC IN EACH SHIFT	-	IS:2629	IS:2629	QC RECORD		P	-	-	
		2. SURFACE FINISH	MA	VISUAL	100%	-	IS:2629	IS:2629	QC RECORD		P	-	-	
2.3	GALVANISING	1.TEMPERATURE OF BATH	MA	MEASUREMENT	CONTINUOUS	-	IS-2629	IS-2629	QC RECORD		P/V	-	-	Galvanization is to be done at galvanization plant listed in Annexure-1 to quality plan.
		2.DROSS	MA	VISUAL	PERIODIC	-	IS-2629	IS-2629	QC RECORD		P/V	-	-	
		3.RATE OF IMMERSION	MA	VISUAL	100%	-	IS 2629	IS 2629	QC RECORD		P/V	-	-	
		4. SURFACE FINISH	MA	VISUAL	100%	-	IS 2629	FREE FROM BURRS, SLAG, ROUGHNESS, FLUX, STAIN ETC.	QC RECORD		P/V	-	-	

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BIDDER/SUPPLIER			BHEL					FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date			ENGINEERING			QUALITY		Doc No:			
Seal				Sign & Date	Name		Sign & Date	Name		Sign & Date	Name
			Checked by:		MANOJ MEENA	Checked by:		MINTOO	Reviewed by:		Seal
			Reviewed by:		HEMA KUSHWAHA	Reviewed by:	22/2/24		Approved by:		

MANUFACTURER/ BIDDER / SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO : PE-TS-XXX-507-E013	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-013, REV. 03	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.: -NA-	DATE:
	ITEM: CABLE TRAY SUPPORT SYSTEM -BOLTABLE	SYSTEM: CABLING		SHEET 3 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	* D	** M	B	C	
					M	B								
3.0 FINISHED ITEMS														
3.1	SINGLE / DOUBLE CHANNELS, CANTILEVER ARMS, CLAMPS	1 DIMENSIONS	MA	MEASUREMENT	IS-2500 (PART-1) LEVEL S-4	IS-2500 (PART-1) LEVEL S-4	APPD.DRG	APPD.DRG	INSP REPORT	√	P	W		
		2 SURFACE FINISH	MA	VISUAL	IS-2500 (PART-1) LEVEL S-4	IS-2500 (PART-1) LEVEL S-4	APPD.DRG	FREE FROM BURRS, SLAG, ROUGHNESS, FLUX, STAIN ETC	INSP REPORT	√	P	W		
		3 MASS OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-4759	IS-6745/ APPD.DRG	APPD.DRG	INSP REPORT	√	P	W		
		4 UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-4759	IS-2633	IS-2633	INSP REPORT	√	P	W		
		5 THICKNESS OF ZINC COATING	MA	MEASUREMENT	IS-4759	IS-4759	APPD.DRG	APPD.DRG	INSP REPORT	√	P	W		
		6 ADHESION	MA	MECH.TEST	IS-4759	IS-4759	IS-2629	IS-2629	INSP REPORT	√	P	W		
3.1.1	TYPE TESTING	PHYSICAL	CR	TEST	1 SAMPLE*	1 SAMPLE*	APPD. TYPE TEST PROCEDURE	APPD. TYPE TEST PROCEDURE	INSP REPORT	√	P	W		*1 sample per / offered quantity

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BIDDER/SUPPLIER

Sign & Date

Seal

BHEL

ENGINEERING

Checked by: Sign & Date Name MANOJ MEENA HEMA KUSHWAHA

Reviewed by:

QUALITY

Checked by: Sign & Date Name

Reviewed by:

22/2/24

FOR CUSTOMER REVIEW & APPROVAL

Doc No:

Reviewed by: Sign & Date Name Seal

Approved by:

MANUFACTURER/ BIDDER / SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO : PE-TS-XXX-507-E013	DATE:
	CUSTOMER : -NA-		QP NO.: PE-QP-999-507-013, REV. 03	DATE: 04.01.2024
	PROJECT: -NA-		PO NO.: -NA-	DATE:
	ITEM: CABLE TRAY SUPPORT SYSTEM -BOLTABLE	SYSTEM: CABLING		SHEET 4 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	B				D	M	B	C	
3.1.2	WELD INTEGRITY TEST	SOUNDNESS	CR	MAGNETIC PARTICLE INSPECTION (MPI) DIE-PENETRATION (DP)	SAMPLE TESTD DURING TYPE TESTING	SAMPLE TESTED DURING TYPE TESTING	APPD. TYPE TEST PROCEDURE	NO DEFECT	INSP.REPORT	√	P	W	-	AFTER CARRYING OUT TYPE TEST, WELD INTEGRITY TEST TO CHECK THE WELD SOUNDNESS/ ACCEPTANCE SHALL BE DONE BY MANUFACTURER
4.0	PACKING	SEALING IDENTIFICATION	MA	VISUAL	100%	100%	BHEL APPD. DOCUMENT	BHEL APPD. DOCUMENT	INSP.REPORT	√	P	W	-	

NOTES:

1. LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ASME/IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, **D**: DOCUMENTATION

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B**: BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,

P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

BIDDER/SUPPLIER	BHEL						FOR CUSTOMER REVIEW & APPROVAL		
Sign & Date	ENGINEERING			QUALITY			Doc No:		
Seal		Sign & Date	Name		Sign & Date	Name		Sign & Date	Name
	Checked by:		MANOJ MEENA	Checked by:			Reviewed by:		
	Reviewed by:		HEMA KUSHWAHA	Reviewed by:	22/2/24		Approved by:		

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
बीएचईएल BHEL		CUSTOMER:		QP NO.: PE-QP-999-509-E001, R3	DATE:
		PROJECT:		PO NO.:	DATE:
		ITEM: ABOVE GROUND EARTHING MATERIALS	SYSTEM: EARTHING		SHEET 1 OF 2

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					6		7	8	9	*	**		
1	2	3	4	5	M	B				D	M	B	C
1.0	**RAW MATERIAL:**												
1.1	MILD STEEL (FLATS & RODS) AS PER SPECIFICATION	1.CHEMICAL & PHYSICAL PROPERTIES	MA	VERIFICATION OF TC'S	100%	-	IS 2062	IS 2062	MILL TC	✓	P	V	-	REFER REMARKS AT SL. NO. 3.1
		2. DIMENSIONS	MA	MEASUREMENT	100%	-	IS 1730	IS 1730	QC RECORD	✓	P		-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	IS 1079	IS 1079	QC RECORD	✓	P		-	
1.2	ZINC	1.CHEMICAL COMP.	MA	CHEM. TEST	SAMPLE	-	IS 209	IS 209	QC RECORD	✓	P	V	-	
2.0	**IN PROCESS:**												
2.1	CUTTING, DRILLING	1.DIMENSIONS	MA	MEASUREMENT	100%	-	IS 1730	IS 1730	QC RECORD	✓	P	V	-	
2.2	SURFACE PREPARATION	1. CLEANING, PICKLING, RINSING & FLUXING	MA	VISUAL	100%	-	IS 2629	IS 2629	QC RECORD	✓	P	-	-	
		2. SURFACE FINISH	MA	VISUAL	100%	-	IS 2629	IS 2629	QC RECORD	✓	P	-	-	
2.3	GALVANISING	1.TEMPERATURE OF BATH	MA	MEASUREMENT	CONTINUOUS	-	IS 2629	IS 2629	QC RECORD	✓	P	-	-	GALVANIZATION IS TO BE DONE AT GALVANIZATION PLANT LISTED IN ANNEXURE-1 TO QUALITY PLAN.
		2. DROSS	MA	VISUAL	PERIODIC	-	IS 2629	IS 2629	QC RECORD	✓	P	-	-	
		3.RATE OF IMMERSION	MA	VISUAL/ MEASUREMENT	100%	-	IS 2629	IS 2629	QC RECORD	✓	P	-	-	
		4. SURFACE FINISH	MA	VISUAL	100%	-	IS 2629	FREE FROM BURRS, ROUGHNESS, SLAG, FLUX, STAIN	QC RECORD	✓	P	-	-	
3.0	**FINISHED ITEMS:**													.
3.1	MS FLATS	1. CHEMICAL COMP.	MA	CHEM. TEST	1 No./LOT/SIZE	-	IS 2026	IS 2026	LAB TC	✓	P	V	-	NOTE: SAMPLE FOR CHEMICAL TEST SHALL BE SELECTED BY BHEL& TESTING SHALL BE DONE AT NABL/ GOVT. APPD. LAB
		2. DIMENSIONS	MA	MEASUREMENT	IS 2500 (PART 1) LEVEL S-4	IS 2500 (PART 1) LEVEL S-4	IS 1730	IS 1730	INSPECTION REPORT	✓	P	W		

BIDDER/SUPPLIER	
Sign &Date	
Seal	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Checked by:		MANOJ MEENA	Checked by:		Suman
Reviewed by:		Sandeep Gupta	Reviewed by:	22.2.24	Hari

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

562

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6		7	8	9	D	M	C	N	
					M	C/ N								
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI		
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Reviewed by:			
Approved by:			

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:
1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR**, CR:** CRITICAL
D: DOCUMENTATION

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT		P/V	-		
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC.	TEST REPORT		P	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		P/V	-		
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-		HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P/V	-		

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✔	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 3 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-	
		2.DIMENSION(BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180º	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 4 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK		P/V	-	-	
									LOG BOOK					
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET			P/V	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG./ SPECS.	LOG BOOK		P	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 5 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		P/W	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	LOG BOOK	✔	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 6 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✔	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✔	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✔	P	V	-	THREE DIPS TO BE GIVEN

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 7 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		4.DURATION	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✔	P	V	-	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✔	P	V	-	
		3.HV	MA	ELECT. TEST	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✔	P	V	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	100%	-	MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S DWG.	LOG BOOK		P	-	-	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	TEST/INSPC. REPORT	✔	P	V	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		2.WORKMANSHIP	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		3.AXIAL PLAY	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✔	P	V	-	
		4.DIMENSIONS	MA	MEAS.	100%	-	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✔	P	V	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 8 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✔	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325//IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✔	P	V$	-	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✔	P	V$	-	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✔	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	✔	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1/IS: 12802	IS-325/IS-12615/IEC-60034 PART-1/IS: 12802	TC	✔	P	V$	-	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TC	✔	P	V$	-	$ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325/IS-12615& DATA SHEET	IS-325/IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✔	P	V$	-	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✔	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✔	P	W$	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 9 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✔	P	W	-	(#): REFER NOTE-8

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THE SAME IS VALID FOR 5 YEARS.

4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.

5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.

6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.

7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.

8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.

9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.

10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,

P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL

D: DOCUMENT

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO:	DATE:
	CUSTOMER:		QP NO.: PE-QP-999-509-E001, R3	DATE:
	PROJECT:		PO NO.:	DATE:
	ITEM: ABOVE GROUND EARTHING MATERIALS	SYSTEM: EARTHING		SHEET 2 OF 2

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					6		7	8	9	*	**			
1	2	3	4	5	M	B				D	M	B	C	
		3. SURFACE FINISH	MA	VISUAL	IS 2500 (PART 1) LEVEL S-4	IS 2500 (PART 1) LEVEL S-4	-	FREE FROM BURRS, ROUGHNESS, SLAG, FLUX, STAIN ETC.	QC RECORD	✓	P	W		
		4.MASS OF ZINC COATING	MA	CHEM. TEST	IS 4759	IS 4759	IS-6745	FLATS 5 MM THICK AND OVER 610 GM/SQ.M. FLATS UNDER 5 MM, BUT NOT LESS 2 MM 460 GM/SQ.M.	INSP. REPORT	✓	P	W	-	
		5.UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-4759	IS-2633	IS-2633	INSP. REPORT	✓	P	W	-	
		6. THICKNESS OF ZINC COATING	MA	MEASUREMENT	IS-4759	IS-4759	IS-4759	FLATS 5 MM THICK AND OVER=AVG 86 MICRON AND MINIMUM 75 MICRON. FLATS UNDER 5 MM THICK, BUT NOT LESS 2 MM =AVG 65 MICRON	INSP. REPORT	✓	P	W	-	
		7. ADHESION	MA	MECH. TEST	IS-4759	IS-4759	IS 2629	IS 2629	INSP. REPORT	✓	P	W	-	
	NOTE: ITEMS LIKE PIPES/ FLEXIBLE COPPER BRAID/ GI WIRE/ GS ROD/ SHIELDING MAST/ TEST LINK WILL BE CLEARED BASED ON COC (CERTIFICATE OF COMPLIANCE)													
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	BHEL APPROVED DOC	BHEL APPROVED DOC	INSPC. REPORT	✓	P	V	-	

NOTES:

1 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ASME/IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(V) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, D: DOCUMENTATION ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE MA: MAJOR, MI: MINOR, CR: CRITICAL

BIDDER/SUPPLIER	
Sign &Date	
Seal	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Checked by:		MANOJ MEENA	Checked by:		Suman
Reviewed by:		Sandeep Lodhi	Reviewed by:	22.2.24	Harish

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

SECTION: I

SUB-SECTION: C-4

TECHNCIAL SPECIFICATION

(C&I PORTION)

C&I TECHNICAL SPECIFICATION FOR HEATING, VENTILATION & AIR CONDITIONING (HVAC) SYSTEM

SPECIFIC TECHNICAL REQUIREMENT

1. **Complete** Control & Instrumentation for Heating, Ventilation and Air Conditioning (HVAC) System is in bidder scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder.

2. A central computerized PLC based control system cum Annunciation panel with solid state annunciation windows along with product integrated microprocessor panel for the chilling unit for HVAC system complete with all wiring, instrumentation & associated accessories shall be in bidder scope of supply. Vendor to ensure necessary provision and hardware requirement in its PLC panel for complete HVAC System.

3. Bidder to include Field instrumentation along with necessary fittings, accessories and valve manifold etc. and Field Junction Box (JB's), in his scope of supply. Each instrument/ equipment shall have a unique KKS Tag no. Field instrument specification and Data Sheet are given elsewhere in this specification.

4. Bidder to provide local control panels for AHUs, ACUs, exhaust fans, fresh air supply fans & cooling water pumps etc. and elsewhere as per requirement.

5. All fields cabling for instruments/motor/pump/blower to JB is in bidder's scope. The field I/O s should be grouped together in JBs suitably and a common trunk cable shall be taken to the panel.

6. Each PLC to have its engineering station (EWS) and any change in the PLC shall be done from its own EWS only. Processor selection shall be based upon number of IO's for each system. Soft-link shall be provided between SCADA and PLC for monitoring purpose. PLC system shall be sized based on application/ process requirement, and controller sizing shall be guided by CPU utilization.

7. Instrument installation drawings are to be provided by bidder. All instrument fitting and erection hardware/racks as per instrument installation diagram shall be in bidder's scope.

8. All manual valves at pump discharge shall be provided with Open and Close Limit Switches.

9. PLC control system as defined in the enclosed specification and Data Sheets shall be in bidder scope. The PLC system shall comprise of (i) PLC based local panel (ii) UPS Power supply (iii) Operator interface in the form of CRT, keyboard and OWS and EWS along with required furniture.

10. PLC shall have the facility to synchronize its time with Plant master clock system using IRIG-B signals. Necessary Hardware (IRIG-B port) for same at PLC end to be provided by bidder. The cable connecting PLC and plant master clock system shall be in bidder scope.

11. PLC shall be connected to Plant SCADA through redundant bidirectional serial link with OPC Compliant for monitoring/Control. For details, please refer PLC Configuration Diagram.

12. All furniture (tables, chairs etc.) required for PLC operator HMI shall be in bidder's scope. Chairs shall be capable of being adjusted for height and position of backrest. The chairs shall be mounted on five castors, shall swivel and shall have arm rests'. One table and chair shall be provided for each operator station and separate table for each printer.

13. The requirements given below are to be read in conjunction with detailed Technical specification enclosed.

14. For cable scope refer Electrical scope sheet between BHEL and vendor defined in electrical specification.

15. Bidder shall provide at least 20% or minimum two numbers, whichever are higher, spare channels as hot on rail spares in each configured I / O modules. In addition to this 10% or minimum one number, whichever is higher, extra assigned complete spare I / O modules mounted on rails in sub racks as hot on rail spare for each category of installed I / O modules shall also be provided. Spare modules shall be distributed over each controller group. Spare channel and modules shall be fully wired up to termination cabinets.

16. Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

17. Supplied system shall provide critical group alarms for HVAC system to be hardwired to plant SCADA.

18. Provision for input fire signal from fire alarm system to be ensured in the PLC panel for opening/ closing of the motor operated fire dampers to be supplied by bidder.

19. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.

20. Provision for earthing of the panel to be provided by vendor.

21. Vendor to submit GA drawing and datasheets of PLC and Local control panels indicating layout of instruments, construction details, wiring diagram, class of protection for enclosure, paint type, paint color, thickness and material of enclosure sheet, control scheme during detailed engineering.

22. Layout & space requirement of panel to be specified during detailed engineering.

23. Typical Hook Up diagram of all types of bidirectional drives (Motor Operated Valves, MOVs) is attached for use(subject to Customer approval).

24. Bidder shall provide Cable Schedule in BHEL excel format. Also, Cable Interconnections details and wiring diagram for Complete System shall be in Bidders' scope.

25. Bidder to provide all control panels, system cabinets, termination & relay cabinets complete with all accessories, wiring and all mounting and erection hardware including junction boxes, canopies, structural steel as required. All instruments/drives shall be terminated on Junction Boxes/Panel in Bidder scope of supply. 20% Spare terminals shall be provided on Junction Boxes.

26. Bidder to delegate/depute their person/experts as per owner/consultant requirements.

27. The make of all the items shall be from approved sub-vendor list.

28. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards.

29. Bidder shall provide the signal exchange, to Plant SCADA in BHEL prescribed format to be furnished during detailed engineering.

30. Salient features of the Unit Cabinet shall be:

a. Frame shall be of galvanized steel members.
b. Cabinet shall be galvanized steel casing with a pre-painted finish.
c. The assembly shall be installed outdoor and should, therefore, have adequate weather protection/ resistance.

31. Unit control Module

The unit shall be provided with Microprocessor Control System for air cooled centrifugal chiller. It shall have control logic with the Clear Language Display, which will have various functions that allow the operator to read unit information and adjust set points.

32. Chiller System Logging

The UCM will display data required to log the chiller system. The following information will be available as standard feature with the air cooled screw Chiller Microprocessor.

- Entering and leaving chilled water temperature
- Ambient air temperature
- Evaporator and condenser refrigerant temperature and pressures.
- Percent RLA for each compressor
- Percent line voltage
- Compressor starts and running hours
- Active set points:
  → Chilled water set point
  → Current limit set point
  → Low ambient lockout point
- Over 90 diagnostic and operating conditions
- Part failure diagnostics:
  → Water temperature sensors
  → Refrigerant temperature sensor
  → Compressor contractors

33. Remote Display Panel

- The system shall be provided with a twisted pair connection to an optional remote display panel. With this provision it will be possible to control chiller operation from the remote panel similar to the control interface on the chiller itself, and it will be possible to turn “On” and “Off”, change the chilled water set point, and display all operating and diagnostic conditions from this panel. The remote display panel shall be mounted indoors so that it can be accessed without the need to go to the chillers plant room/ item.
- Remote clear language display will have the ability to control multiple units. In the multiple unit configuration, the Remote Clear language Display Panel will have the capability to communicate with up to four units. Each unit will require a separate communication link with the Remote Display Panel.

34. Interface to the Station SCADA System

The system should have provisions and facility for interfacing the chiller with station SCADA system:

- Chiller inputs will include
  - → Chiller enable/ disable
  - → Circuit enable/ disable
  - → Chilled water set point
  - → Current limit set point
- Chiller outputs will include:
  - → Compressor running indication
  - → Alarm indication (for each circuit)
  - → Maximum capacity
- Cooling water pumps:
  - →Remote/local selector switch
  - → Start/Stop Push Buttons

NOTES:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.

2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.

3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.

18.5.12. Controls and Electrical Equipment

The HVAC system shall be equipped with operation on fully automatic mode and manual mode.

Automatic Control and Regulation:

The HVAC system shall be equipped with a fully independent computerized and automatic control system for efficient operation, which shall be included in the supply. It should automatically shutdown all fans immediately in case of fire detection.

All sensors and instruments (temperature, pressure, humidity, etc.), limit switches, etc. required for automatic regulation and monitoring of proper service of the systems shall be included in the supply.

Manual mode

Individual starting and stopping of equipments by push buttons.

All the necessary cabling between the control panels and the field HVAC components (as fans, sensors, pumps, valves, air dampers, etc.) shall be included in the supply and shall be in accordance with relevant standards/codes in recent practice.

Each of the control systems shall be equipped with the necessary control, interlocking and security devices. Any failure or breakdown in the control system shall be indicated by a signal on the respective control panel, as well as remotely in the main control room. Potential free contacts and terminals for remote indication of the alarms shall be provided in the panels. All necessary protection viz single phasing, IDMT and Instantaneous over current relays, Under voltage relays etc. shall be provided.

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xii. The centralized control system of the HVAC system shall be based on microprocessor and shall be programmable, meaning the direct digital control program code may be customized for the intended use. The program features shall include time schedules, set points, controllers, logic, timers, trend logs,and alarms. The unit controllers shall typically have analog and digital inputs that allow measurement of the variable (temperature, humidity, or pressure). Digital inputs shall be typically (dry) contacts from a control device, and analog inputs are typically a voltage or current measurement

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from a variable (temperature, humidity, velocity, or pressure) sensing device. Digital outputs shall be typically relay contacts used to start and stop equipment, and analog outputs are typically voltage or current signals to control the movement of the medium (air/water/steam)control .devices such as valves, dampers, and motors.

xiv. Local control panels for air handling units, water cooled chilling units, circulation/ cooling water pumps, strainer, exhaust fans etc.

xv. Necessary pressure, temperature, flow/ humidity, sensing devices/ instruments, meters etc.

xvi. Provision of necessary contacts and/ or ports for integration with plant SCADA system through local control board of common services.

18.5.1.10. Unit Cabinet

Salient features of the Cabinet will be:

i. Frame shall be of heavy-gage galvanized steel members.
ii. Cabinet shall be galvanized steel casing with a pre-painted finish.
iii. Cabinet shall be capable of withstanding 500-hour salt spray test in accordance with the ASTM B-117 standard.

18.5.1.11. Unit Control Module

The unit shall be provided with microprocessor control system for air-cooled Rotary chiller with latest chiller control technology.It shall have control logic with the Clear Language Display panel will have sufficient keys. The read-out screen shall be a two-line, 40 character liquid crystal with a backlight. The backlight shall allow the operator to read the display in low-light conditions.

18.5.1.12. Unit Control Module Features

a) Equal Compressor Sequencing

The control system shall maximize both compressor and motor life by equalizing the number of starts and the operating hours. The UCM will start the compressor with the least number of starts and

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turn off the compressor with the most operating hours, equalizing starts and running hours. This will provide equal compressor wear to various units.

b) Chiller Flow Protection
The in-built protection will automatically detect a no water flow condition.

18.5.1.13. Chiller System Logging

The UCM will display data required to log the chiller system. The following information will be available as standard feature with the Air-Cooled rotary Chiller Microprocessor.

- Entering and leaving chilled water temperatures.
- Ambient air temperature
- Evaporate and condenser refrigerant temperatures and pressures.
- Percent RLA for each compressor
- Percent line voltage
- Compressor starts and running hours.
- Active set points.
  - Chilled water set point
  - Current limit set point
  - Low ambient lockout set point
- Over 90 diagnostic and operating conditions
- Part failures diagnostics:
  - Water temperature sensors
  - Refrigerant temperature sensor
  - Compressor contactors

18.5.1.14. Remote Display Panel

The system shall be provided with a twisted pair connection to an optional remote display panel. With this provision it will be possible to control chiller operation from the remote panel similar to the control interface on the chiller itself, and it will be possible to turn "On" and "Off", change the chilled water set point, and display all operating and diagnostic conditions from this panel. The remote

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display panel shall be mounted indoors so that it can be accessed without the need to go to the chillers plant room/ item.
Remote clear language display will have the ability to control multiple units. In the multiple unit configuration, the Remote Clear language Display Panel will have the capability to communicate with up to four units. Each unit will require a separate communication link with the Remote Display Panel.

18.5.1.15. Interface to the Station DAC System

The system should have provisions and facility for interfacing the chiller with Station DAC System:

- Chiller inputs will include:
  - Chiller enable/ disable
  - Circuit enable/ disable
  - Chilled water set point
  - Current limit set point
- Chiller outputs will include:
  - Compressor running indication
  - Alarm indication (for each circuit)
  - Maximum capacity

7. INSTRUMENTATION AND CONTROL EQUIPMENT

7.1 GENERAL

All instrumentation and control equipment shall be of internationally reputed make having proven performance and acceptability in the field.

7.2 DESIGN CRITERIA

7.2.1 General

Chapter 6, "Electrical Works", shall be considered for I & C equipment as far as applicable. Special reference is made to cabling, wiring and labeling.

All components shall be of an approved and reliable design. The highest extent of uniformity and interchangeability shall be reached. The design shall facilitate maintenance and repair of the components.

The Works shall be pre-assembled to the highest extent in the Contractor's or Sub-Contractor's workshop, e.g., shop welding of thermometer wells and other connections, wiring of boards, desks, etc., including internal wiring and installation of devices shall be carried out. Fragile instruments shall be removed for transportation to site.

All components shall be suitable for continuous operation under site conditions.

Materials for instrumentation and control equipment, including piping material, which is exposed to the measured media, shall be selected accordingly.

All components shall be compatible with other electrical, electronic and mechanical Works.

All instrumentation and control functions shall be shown on the piping and instrumentation diagrams. The symbols to be used shall be in accordance with ISO standard. The identification system (tag numbers) shall be in accordance with the Works identification system and is subject to approval by the Engineer. All measurements and alarms shall be listed in a measuring list of a standard form subject to Approval by the Engineer. For remote controls, a schedule of interlocks shall be provided. The features of automatic controls shall be shown in block diagrams.

Shielded cables shall be provided for the control and supervisory equipment where required.

7.2.2 Standards

If the Contractor intends to apply Standards and Regulations other than those specified, he shall provide the Engineer-in-chargewith two (2) sets of such documents, which shall be complete, unabridged and written in the Contract Language.

7.2.3 Sizes of Indicating Instruments and Recorders

The meters, instruments and recorders shall be of standard size, to be selected to guarantee aesthetic appearance of switchgears, control panels, control desks, etc. The front glasses shall be of the anti-glare type. The scales shall be 90 degrees type for local control panels but must be 240 degrees type for control room instrumentation.

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The control switches, adjusters, etc., on the panels and desks shall harmonise with the utilised indicator sizes.

7.3 TESTS

The single components and pre-erected assemblies shall undergo functional and routine tests in the Contractor's or Sub-Contractor's workshop. The ready mounted control and supervisory system shall undergo functional tests on Site prior to commissioning of the power Works.

Calibration tests shall be made on all-important pressure gauges and other instruments as required by the Engineer in charge.

7.4 MEASURING SYSTEMS

Electric measuring signals of 4-20 mA shall be transmitted to the control room for emergency or regulating circuits. In this case the absence of live zero signal shall lead to a warning signal. Measuring signals for indicating purposes will be 4-20 mA.

The components shall quickly respond to any changes of the measured magnitudes. Measuring ranges of indicators, transducers, etc. shall be selected in such a way that the rated value of the measured magnitude covers approx. 75% of the range.

All local instruments shall, as far as practicable, be mounted vibration free to allow good reading. Wherever required, damping elements shall be used.

Corresponding systems shall be grouped together in local panels.

All local indicating instruments and test connections shall be included in the respective Works as integrated parts. The scope of local indicating instruments and test connections shall enable the operator to properly survey the Works, and shall also allow to adequately carrying out all acceptance and other tests.

The binary sensors shall be fused separately and supplied with 24 V D.C.

7.4.1 Flow Measurements

The primary elements of flow meters shall be standard Venturi tubes, pitot tubes, standard orifices, anubar inductive , Electro-Mangetic Type or ultrasonic type. Their design and performance shall be in accordance with applicable standards.

The design and arrangement of tapping points, piping and valves shall be in accordance with VDI/ VDE rules 3512.

Beginning at a rate of flow of at least 5% of the measuring range all flow transmitters shall measure correctly. The error limit shall be ±1% for a rate of flow higher than 10%. The error of the primary elements is not included in this accuracy. The root extraction of flow measurement shall be effected electrically within the transmitter.

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Arrangement:

The arrangement of the throttling devices, the straight lengths upstream and downstream from the throttling device shall be in accordance with the said standards. Bends shall be at a sufficient distance upstream from the throttling device, particularly when large orifice ratios are used.

7.4.2 Temperature Measurements

All wells for capillary type thermometers, resistance temperature sensors and thermocouples shall be of the weld-in type. Wells for thermometers and temperature sensors of the screw-in type shall be restricted to measuring points for lubrication oil, and to such measuring points where welding is not suitable, e.g., at cast-iron parts. Shop-welded thermometer wells shall be covered by screw caps for protection during transportation and erection.

Resistance thermometers and thermocouples shall be equipped with waterproof connection heads. Thermometer arrangements shall be such that the connection heads do not become warmer than 80 °C, and the measuring inserts are easily exchangeable.

The temperature sensors shall be selected in such a way to minimise the number of different spare inserts. Resistance thermometers shall be used as far as possible and shall generally be of type Pt 100. Double resistance thermometers (with two resistors in one insert) should be avoided.

The use of dial-type contact thermometers shall be restricted to bearing metal and oil temperature measuring. In all other cases, thermocouples or resistance thermometers and electric contact modules (monitors) shall be used. Glass thermometers and similar thermometers will not be accepted as contact thermometers.

7.4.3 Pressure Measurements

Pressure gauges shall be shock and vibration-proof (preferably by filling with glycerin) and shall be equipped with toothed wheels and toothed segments of the machined type. They shall completely be made of stainless steel.

Higher than rated pressure shall not deteriorate the pressure gauge or affect its calibration. The pressure gauges shall be equipped with a radial-connecting stud, to allow the mounting on a gauge holder.

Pressure gauges with potentiometers will not be accepted for use as a pressure transmitter.

The error for pressure transmitters shall be limited to ±0.5%.

Pressure gauges and transmitters for inflammable liquids shall have filled systems and the filling liquid shall be separated from the inflammable liquid by means of adequate isolating membranes.

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Each gauge, pressure switch and transmitter for absolute or differential pressure shall be equipped with a pressure gauge isolating valve including a test connection of the screwed type M20 x 1.5 mm so that such device can be removed without any disturbance of the plant operation.

Pressure gauges and transmitters for pressures of 10 bar and above shall not be directly mounted on the pressure tapping point. They shall be mounted apart from the tapping point on gauge holders or gauge boards. Whenever possible, pressure gauges and transmitters shall be group wise combined on racks or consoles.

Pressure gauges for high pressures shall be equipped with a relief valve for safety reasons in case of leaks (with a rubber reverse flow check).

In case of flowing substances, the measuring point shall be selected in locations of undisturbed flow.

If the pressure is pulsating, the devices concerned shall be connected via flexible tubes or other pulse-absorbing means.

In general, all pressure gauges, transmitters and pressure contacts shall easily be accessible for maintenance and supervision.

The design and arrangement of tapping points, piping and valves shall be in accordance with VDI/VDE rules 3512.

The scales shall have a diameter of 150 mm with black letters and figures on a white background. The calibration shall be in "bar".

The adjustment of the pointer shall be possible by means of an adjustment device without removing the pointer from its axle.

The high and low-pressure connections of differential pressure gauges shall be marked accordingly.

All casings shall be dust and watertight and be made of stainless steel.

7.4.4 Level Measurements

The liquid level measurements in reservoirs and tanks with atmospheric pressure shall be made by means of pressure transmitter of mercury less-type, by displacement-type transmitters or float-disc-transmitters. The errors shall not exceed ± 1.0% of the total measuring range. Level switches shall be of the externally mounted float or displacement operated type. The switch shall be of packing less construction; there shall be a minimum of moving parts.

7.4.5 Electrical Measurements

All Electrical instruments shall be of flush mounted design, dust and moisture-proof. A.C. ammeters and voltmeters shall have digital type system of not less than 1.5 accuracy class for connection to the secondary side of instrument transformers. D.C. measuring instruments shall have digital type systems of the same accuracy. Watt meters/energy meters shall have electro-dynamic measuring

mechanisms if fed by transmitters. Watt meters shall be suitable for unbalanced systems and accuracy of energy meters should be of 0.2 % accuracy class.

All indicating instruments shall generally withstand without damage a continuous overload of 20% referred to the rated output value of the corresponding instrument transformers. Ammeters shall not be damaged by fault-currents within the rating and fault duration time of the associated switchgear via the primaries of their corresponding instrument transformers.

All instruments and apparatus shall be capable of carrying their full load currents without undue heating. All instruments and apparatus shall be rear connected, and the enclosures shall be earthed. Means shall be provided for zero adjustment of instruments without dismantling.

All voltage circuits to instruments shall be protected by MCB's in the unearthed phases of the circuit, installed as close as practicable to the instrument transformer terminals, or, where instruments are direct-connected, as close as practicable to the main connection. All power factor indicators shall have the star point of their current coils brought out to a separate terminal which shall be connected to the star point of the current transformer secondary windings.

When more than one measured value is indicated on the same instrument, a measuring point selector switch shall be provided next to the instrument and shall be engraved with a legend specifying each selected measuring point.

All instruments shall be of the flush mounting type and shall be fitted with non-reflecting glass and shall comply in every respect with the requirements of IEC Publication 51. Except for instruments employed for Works performance tests all instruments shall have an accuracy class of 1.5.

Scales shall be arranged in such a way that the normal working indication is between 50-75% of full-scale reading permitting an accurate reading. CT connected Ammeters provided for indication of motor currents shall be provided with suppressed overload scales of twice full scale. The dials of such ammeters shall include a red mark to indicate the full load current of the motor.

Instrument scales shall need the approval by the Engineer-in-charge. All instruments mounted on the same panel shall be of same style and appearance.

Transmitter connected ammeters (for example those in mosaic-type control desks) shall have 90 degrees or 240 degrees circular scales calibrated 0-120 %. The rated motor current shall correspond to 100% scale indication.

All metering circuits shall be terminated in marked terminal blocks for remote metering purposes.

7.4.6 Position Measurements

Position transmitters of the potentiometer type will not be accepted. Inductive or capacitive type shall be provided.

Position transmitters for continuous position indication and measuring transducers shall have an output current of 4-20 mA and aux. supply voltage (if required) 220 or 48 V D.C. The "potentiometer-type" position measuring principle is not permitted.

7.4.7 LIMIT SWITCHES

Limit switches shall be provided for each electrically operated gate, valve or gantry to automatically stop the motor at both ends of travel. Additional switches shall be provided where necessary for control, interlocks and indication.

Limit switches shall be mounted suitable for easy adjustment and for rigidly locking in position after being adjusted. They shall be of heavy-duty rating and have two changeover contacts suitable for 220 V D.C. operations.

Switch fixings shall be positive and shall be unaffected by vibration. At the same time they should be capable of easy adjustment to suit changing parameters of the associated plant.

Particular attention shall be paid to potentially harmful environmental conditions, including water, oil, dust, dirt, temperature variations and differential expansions. Where switches operate through linkages, precautions shall be taken to eliminate variations of settings and incorrect operations resulting from wear or tolerances.

7.4.8 Contact Devices

Contacts of level switches, pressure switches, temperature switches, limit switches, and of all other devices shall be of the snap action type (SPDT). Contact devices for interlocking systems shall be separate, i.e., contact devices serving commonly for interlocking and other purposes will not be accepted.

7.5 PROTECTION SYSTEMS

Electrical/Mechanical Protection and Interlocking Systems shall be provided for all works components and individual systems to ensure a safe and reliable operation and to limit harm and damage to personnel and works to an utmost extent.

The primary functions of these facilities shall be to disconnect selectively faulty sections of the systems prior to influence or damage to other works and to maintain operative systems as far as possible.

Moreover these devices shall facilitate the duty of the operation staff and prevent mal-operation.

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7.6 TRANSMITTER RACKS AND PIPING

Wherever practicable, transmitters for flow, pressure, etc., shall be installed in readily accessible positions in the proximity of the measuring point, free from vibration and protected against damage, moisture, dust, corrosive air, and great temperature changes.

The transmitters shall be grouped and assembled as far as practicable on local transmitter racks or in cubicles with glass or plexi-front.

The connecting lines between the primary elements and the transmitters shall be installed to falls in order to ensure that no air pockets or water locks are created.

6. ELECTRICAL WORKS

6.1 GENERAL

The electrical items of Works of any electrical or mechanical installation to be provided under this Contract according to the Particular Technical Specifications shall - if not stated otherwise therein-fulfil the requirements of this Section.

All components shall be of an approved and reliable design. The highest extent of uniformity and interchangeability shall be reached. The design shall facilitate maintenance and repair of the components with ease and speed.

The Works shall be pre-assembled to the highest possible extent in the Contractor or Sub-Contractor's works, complete with all devices and wired up to common terminal blocks.

The power supply and control cables shall be laid up to these common terminal blocks. The required control and protection devices, instruments, etc., within the different scopes of work shall be supplied and connected by the relevant Contractor.

Unless otherwise agreed, ratings of main electrical Works (in feeds, bus-ties) as selected or proposed by the Contractor, whether originally specified or not, shall generally include a safety margin of 10% under consideration of the worst case to be met in service. Prior to approval of such basic characteristics, the Contractor shall submit all relevant information such as consumer lists, short circuit calculations, de-rating factors, etc.

Short-circuit calculations shall be evaluated giving full evidence that every electrical component can withstand the maximum stresses under fault conditions, for fault levels and durations obtained under the worst conditions, e.g., upon failure of the corresponding main protection device and time delayed fault clearing by the back-up protection device.

All Works shall be suitable for the prevailing climatic conditions.

Outdoor installations needing protections shall be protected against solar radiation by means of adequate covers, where required.

The Contractor shall ensure that all the equipments and devices are insensitive to any signals emitted by wireless communication equipment.

6.2 STANDARDS

The design, manufacture and testing of all Works and installations shall strictly comply with the latest edition of the relevant IEC standards or any other international standards.

6.3 COLOUR CODE

In general, the colour code for electrical Works shall be as described in the Particular Technical Specifications.

The manufacturer's painting systems shall be used to the maximum possible extent, but shall by all means be subject to the approval of the Engineer. Final coats of paint shall be matching adjacent installations, where required.

6.4 ELECTRIC MOTORS

6.4.1 General

All motors shall be of approved manufacture and shall comply with the requirements of this Chapter. Motors of the same type and size shall be fully interchangeable and shall comply - as far as applicable - to IEC standard motor dimensions.

The general construction shall be stiff and rigid; no light metal alloy casings will be accepted. All precautions shall be taken to avoid any type of corrosion.

All motors shall be fitted with approved types of lifting hooks or eyebolts as suitable.

AC motors shall have squirrel cage type rotors.

Motor Voltages and Power Ratings

The service voltages and corresponding power ratings for electric motors to be used in the Project shall be as follows:

- Motors up to 100 kW
- Service voltage : 3-phase a.c. 415/240 V,50 HZ
- Mode of starting : direct-on-line up to 50 kW

Above 50 kW with suitable starters

- Motors up to 0.75 kW
- Service voltage : single-phase a.c. 240 V, 50 HZ
- Mode of starting : condenser
- Motors intended to work on the d.c. System
- Service voltage : 220 V D.C.
- Mode of starting : resistor

6.4.2 Rating

The rating of the motors shall be adequate to meet the requirements of its associated equipment. The service factor, being the ratio of the installed motor output to the required power at the shaft of the driven machine at its expected maximum power demand, shall be applied as follows:

Power Demand of Driven Machine	Service Factor
Up to 5 kW	1.2
More than 5 kW	1.1

A.C. motors shall be capable of operating continuously under rated output conditions at any frequency between 95% and 105% of the rated frequency and/or with any voltage variation between 90% and 110% of the nominal voltage. A transient over voltage of 130% of the nominal voltage shall as well be sustained.

Further, the motors shall be capable of maintaining stable operation when running at 70% nominal voltage for a period of 10 seconds. The pullout torque for continuously loaded motors shall be at least 160% of the rated torque and for intermittently loaded motors 200% of the rated torque.

D.C. motors shall be capable of operating continuously under rated output conditions at any voltage between 90% and 110% of the nominal voltage with a fixed brush setting for all loads. Unless otherwise approved, the speed drop between no-load and full-load shall not exceed 10% of no-load speed.

6.4.3 Starting

A.C. motors shall be designed for direct on-line starting. They shall be capable of being switched on without damage to an infinite bus bar at 110% of the nominal voltage with an inherent residual voltage of 100% even in phase opposition. For starting the motors from the individual main and auxiliary bus bars, a momentary voltage drop of 20% referred to nominal voltage should be taken into consideration. With 85% of the nominal voltage applied to the motor terminals, each motor shall be capable of accelerating its associated load to full speed with a minimum accelerating torque of 5% of full load torque.

The maximum starting currents (without any tolerance) shall not exceed the following values: -

- 5 times of rated current for low voltage motors rated 100 kW or above
- 2 times of rated current for D.C. motors (by means of starting resistors)

Generally, all motors shall be able to withstand three cold starts per hour, equally spaced. In addition, each medium voltage motor shall be capable of enduring two successive starts with the motor initially at operating temperature. Each low voltage motor shall be capable of withstanding three successive starts under the same conditions or once every twenty minutes without detrimental heating.

Motors for frequent automatic starting shall have an adequate rating. In the motor list the Contractor shall state the frequency of starts permitted in compliance with the motor design.

6.4.4 Windings and Insulation Class

The insulation of all motors shall be of class F but will not exceed the temperature limits of class B materials in operation. It shall be suitable for operation in damp locations, for occasional contact with corrosive gases and vapours and for considerable fluctuations in temperature.

The stator winding shall be suitably braced to withstand the forces due to direct-on-line starting and transfer conditions as mentioned before. The winding envelopment and tails shall be non-hygroscopic. The stator winding shall withstand the maximum fault current for the period determined by the associated protective devices.

The rotor winding (if applicable) shall be designed to give trouble-free continuous service including repeated direct-on-line starting. The rotor shall be subjected to a 120% over speed test for 2 minutes without showing any winding dislocation.

6.4.5 Ventilation and Type of Enclosure

All motors shall be of the totally enclosed fan-cooled type, protection class IP 54 according to IEC Recommendation 144. Cable termination points shall be of class IP55.

They shall have a closed internal cooling air circuit re-cooled by an external cooling air circuit drawn from the opposite side of the driving end.

Where motors are installed outdoors, a weatherproof design shall be chosen. L.V. motors of IEC size 132 and above shall be equipped with automatically controlled heating elements for protection against internal condensation of moisture during standstill periods. Such A.C. heater shall be suitably fixed inside the motor casing; the leads shall be led to a separate L.V. terminal box.

Motors installed outdoors and directly subjected to solar radiation shall be rated such as not to exceed a maximum metal temperature of 85°C. Where necessary, such motors shall be provided with sun shields.

Vertical motors shall be provided with a top cover to prevent the ingress of dirt, etc.

6.4.6 Bearings

As far as possible, the motors shall have sealed ball or roller bearings. All motors with ratings of about 1 kW and above shall be equipped with lubricators permitting greasing while the motor is running and for preventing over-lubrication. Additionally, the bearings shall be fitted with grease nipples permitting the use of a universal grease gun.

Vertical motors shall have approved thrust bearings.

Where sleeve bearings are being used, they shall be of the self or forced lubricating type. If forced lubrication is required, it shall be arranged common to both the motor and the driven machine and provisions shall be made to ensure lubrication during start-up and

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