OVERHEAD **CONDUCTORS**

LITMUS
INDUSTRIES LIMITED

INTRODUCTION

Founded in 1977, Litmus Industries Ltd. (formerly Lumbini Vidyut) had the vision to tap into Nepal's boundless hydropower potential

It was far ahead of its time to identify the enormous need for conductor based transmission lines that could be a catalyst for change by distributing electricity to all regions in Nepal. Upon acquiring Litmus Industries in 1977, Lucky Group (now Ramesh Comtrp.) underwent a 360-degree change in management and policies. Over the years, Litmus Industries gradually transformed into a profitable organization based on the consistent efforts of the new management and the group's commitment to quality and innovation. With a large area of land in Butwal Industrial Estate, near the border of Sunauli, the company has now established itself as one of the leading names in the Cables & Conductors Industry in Nepal, and has exported its products once to India for over 15 years. As a result of our diverse product portfolio, relentless dedication, expertise in the market, and the trust of our growing customer base has placed in us, we have been able to reap immense rewards. From the prestigious NS Quality Award in 2010 to the most coveted ISI certification for our Cables in 2015, Litmus Industries is the only cable company in Nepal that has an ISI (Indian Standard) mark.

OUR MISSION

- Innovate for a brighter future.
- To work towards safe, energy efficient products and solutions for our customers
- To create deep connections, value creation and growth for our people, partners and stakeholders.

OUR VISION

To maintain Leadership by being the largest and most diversified cables and electrical company in Nepal through commitment in quality, advance technology and best customer service.

AT A GLANCE

FOUNDED

1977

EMPLOYEE

500+ Personnel

Corporate office

Tripureshwor, Kathmandu

Factoy Office

BID, Butwal

Technology

Advance German Technology

Production Capacity

Annual Capacity of over 72000 KMPA

QUALITY POLICY/ QUALITY STANDARD

Implementation of a Total Quality Management System that is reviewed on a regular basis and communicated to every employee as a means of continuous improvement.

Providing quality service and products conforming to relevant specifications at a competitive price to meet or exceed customer expectations is Litmus Industries' motto, the best resources will be used in order to achieve continuous improvement in the quality of the work and to enhance employee involvements at all levels.

Quality Management Policy is regularly reviewed and communicated to all those who work for and on behalf of the Company along with the provision of Critical to Quality (CTQ) trainings to supervisors and operators. By doing so, the quality management policy will be transferred into an ongoing, ceaseless procedure. Prospective raw materials will be cautiously inspected from arriving companies for their performance parameters and conformance to the quality management policy. Throughout the entire production process, strict quality parameters are checked consistently at each stage of production. Regular internal quality checks are conducted in different section to monitor the effectiveness of Total Quality Management.

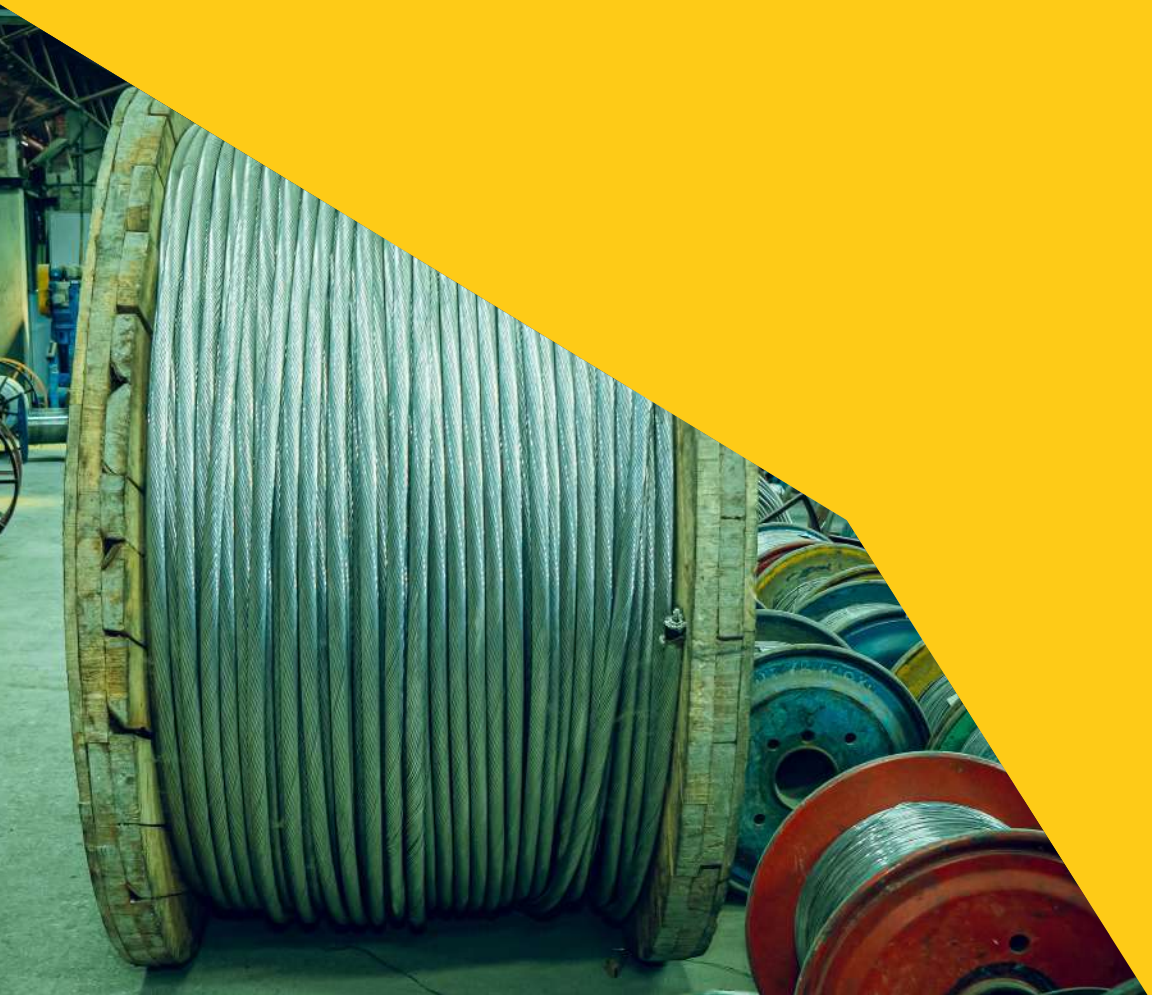
Some Salient Features of LITMUS Wires and Cables

- Made from imported quality raw materials
- ISO 9001: 2015 certified
- Awarded with NS mark by the department of Nepal Bureau of Standard & Metrology
- Well-equipped machinery to produce 1.5 sq mm to 1000 sq mm power cables
- In-house testing facility and opportunity to inspect at every stage of manufacturing
- Managed by highly experienced and trained engineers and professionals
- Well-established packaging and delivery system
- Quality products and services at a competitive price
- Clientele ranging from the giant private sector to the public sector

OVERHEAD CONCUDTORS

Conductor is a physical medium to carry electrical energy form one place to other. It is an important component of overhead and underground electrical transmission and distribution systems.

Litmus Overhead Conductors are used in overhead transmission and distribution network applications. They are also used for un-insulated hook ups, jumpers, grounding conductors and other applications. Litmus brand is the manifestation of 's constant endeavour for providing a comprehensive range of overhead conductors to satisfy its customers with products of the highest quality standard.



RANGE OF PRODUCTS

There are three common types of Standard Conductors and they have distinct advantages and disadvantages to using a certain conductor type under certain conditions. Litmus Conductors are capable of manufacturing all types of conductors as per the customer requirement.

All Aluminium Conductor (AAC)	All Aluminium Alloy Conductor (AAAC)	Aluminium Conductor Steel Reinforced (ACSR)
Made of 1350-H19 Aluminium	Made of 620 Al Alloy	Made of 1350-H19 Al & Galvanized Steel Core
Highest conductivity & moderate strength.	High conductivity & strength.	Highest strength & good conductivity.
Ideal installation in urban areas for short span with maximum current transfer.	Ideal installation on the seacoast & corrosion prominent areas.	Ideal installation for long spans & extensively used in transmission & rural distribution circuits.

ALUMINIUM CONDUCTOR STEEL REINFORCE (ACSR)

The utility industry has utilized ACSR as a common choice of conductor in transmission and rural distribution circuits for many years. ACSR is used extensively on long spans as both ground and phase conductors because of its high mechanical strength-to-weight ratio and good current carrying capacity. ACSR consists of a solid or stranded galvanized steel core surrounded by one or more layers of 1350-H19 aluminium. Because of the presence of 1350 aluminium in the construction, ACSR has equivalent, or higher thermal ratings in comparison with equivalent sizes of AAC. The circular mil area of ACSR is specified according to the cross-sectional area of aluminium to be contained in the construction. The steel content of ACSR typically ranges from 11% to 18% by weight for larger than SWG sizes available in 18/1, 45/7, 72/7 or 84/19 stranding. However, it can vary up-to 40% depending on the desired tensile strength. It is desirable for ground wires in extra-long spans crossing rivers, for examples, to have a stranding of 8/1, 12/7, or 16/19 giving them higher tensile strength.

WEASEL

Weasel Conductor has 6 wires of aluminum and one wire of steel of diameter 2.59mm, these types of conductors are called Weasel Conductor. Weasel Conductor has Current Carrying Capacity of 134 amp and breaking load of 11.44KN. Weasel conductor has a resistance of 0.9077Q/km. Weight of Weasel conductor is 128kg/km.

RABBIT

Rabbit c0nductors have 6 wires of aluminum and 1 wire of s eel of diameter 3.55mm–3.35mm, its current carrying capacity 185 amp. Rabbit conductors have a breaking load capacity of 18.30KN and Resistance of 0.5426 Q/km. Weight of Rabbit Conductor is 214kg/km.

OTTER

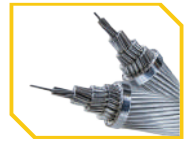
Otter Conductor has 6 wires of aluminum wire and 1 steel wires of diameter 4.22mm. Current Carrying Capacity of Lynx conductor is 240 Amp and the breaking load is 28.81 KN. Otter conductor has a resistance of 0.314 Q/km. Weight of otter conductor is 339kgs/km.

DOG

Dog Conductor has 6 wires of aluminum wire of diameter 1.57mm and 7 steel wires of diameter 4.72mm. Current Carrying Capacity of Dog conductor i 278 Amp and breaking oad is 32.7KN. Dog conductors have resistance of 0.2733 Q/km. Weight of Dog conductor is 394kgs/km.

WOLF

Wolf Conductor has 30 wires of aluminum wire and 7 steel wires of diameter 2.59mm. Current Carrying Capacity of Wolf conductor is 355 Amp and breaking load capacity is 69.24KN. Wolf conductor have a resistance of 0.1828 Q/km. Weight of Wolf conductor is 726kgs/km



PANTHER

Panther Conductor has 30 wires of aluminum and 7 wire of steel of diameter 3mm. Its Current Carrying Capacity is 421 Amp. Panther onductor has a breaking load of 92.25KN and resistance of O..1363 Q/km. Weight of Panther conductor is 974 kg/km.

BISON

Bison Conductor has 30 wires of aluminum wire and 7 steel wires of diameter 3.00mm. Current Carrying Capacity of Wolf conductor is 800 Amp and breaking load capacity of 121 KN Bison conductor have a resistance of 0.0758 Q/km. Weight of bison conductor is 1443 1443kgs/km.

BEAR

Bear Conductor has 30 wires of aluminum wire and 7 steel wires of diameter 3.35mm. Current Carrying Capacity of Wolf conductor is 650 Amp and breaking load capacity of 111.2KN. Bear conductor have a resistance of 0.1093 Q/km. Weight of bear conductor is 1214•1214 kgs/km

ZEBRA

Zebra Conductor has 54 wires of aluminum wire and 7 steel wires of diameter 3.18mm. Current Carrying Capacity of Zebra conductor is 860 Amp and breaking load capacity of 131.9KN. Zebra conductor has a resistance Of 0.06740 Q/km Weight Of zebra conductor is 1621 kgs/km.

CARDINAL

Cardinal Conductor has 54 wires of aluminum wire and 7 steel wires of diameter 3.38mm. Current Carrying Capacity of Wolf conductor is 990 Amp and breaking load capacity of 153KN. Cardinal conductor has a resistancefO 0.0598 Q/km. Weight Of cardinal conductor is 1837kgs/km.

MOOSE

Moose Conductor has 54 wires of aluminum wire and 7 steel wires of diameter 3.53mm. Current Carrying Capacity of Wolf conductor is 980 Amp and breaking load capacity of 161 KN. Moose conductor has a resistance of 0.05470 Q/km. Weight of moose conductor is 1999kgs/km.

STANDARDS:398, BS:215 NS:259

FEATURES TO HIGHLIGHT

- The advantage of ACSR consists of High Tensile Strength and Light Weight, which means, over longer span it requires less support.
- ACSR is available with varying percentages of Steel Core to achieve different strengths.
- Another advantage of this Conductor is that the desired strength can be achieved without the loss of Ampacity.
- Due to the Greater Diameter of ACSR Conductor, a much higher Corona Limit can be obtained, causing big advantages on high as well as extra-high voltage overhead Lines.

ALUMINIUM CONDUCTOR STEEL REINFORCE (ACSR)

AS PER BS 215

CODE	NOM. AL AREA	EQUIVT COPPER AREA	STRANDING AND WIRE DIAMETER		T	AREA			WEIGHT			NOMINAL BREAKING LOAD	MAX. DC RESISTANCE AT 200 C
			AL	STEEL		AL	STEEL	TOTAL	AL	STEEL	TOTAL		
	mm2	mm2	mm	mm	mm	mm2	mm2	mm2	Kg/Km	Kg/Km	Kg/Km	N	Ohm/Km
Mole	10	6.5	6/1.50	1/1.50	4.50	10.60	1.77	12.36	29	14	43	4130	2.706
Squirrel	20	12.9	6/2.11	1/2.11	6.33	20.98	3.49	24.48	58	27	85	7910	1.370
Gopher	25	16.1	6/0.36	1/2.36	7.08	26.25	4.37	30.62	72	34	106	9600	1.093
Weasel	30	19.4	6/2.59	1/2.59	7.77	31.61	5.27	36.88	87	41	128	11440	0.9077
Rabbit	50	32.3	6/3.35	1/3.35	10.05	52.88	8.81	61.70	145	69	214	18360	0.5426
Otter	80	51.6	6/4.22	1/4.22	12.66	83.92	13.99	97.91	230	109	339	28820	0.3419
Dog	100	64.5	6/4.72	7/1.57	14.15	105.0	13.55	118.60	288	106	394	32700	0.2733
Wolf	150	96.8	30/2.59	7/2.59	18.13	158.1	36.68	194.9	437	289	726	69240	0.1828
Panther	200	129	30/3.00	7/3.00	21.00	212.1	49.48	261.6	586	388	974	92250	0.1363
Jaguar	200	130	18/3.86	1/3.86	19.30	210.6	11.70	222.3	580	91	671	46600	0.13670
Bear	250	161	30/3.35	7/3.35	23.45	264.4	61.70	326.1	730	483	1213	111120	0.1093
Bison	350	226	54/3.00	7/3.00	27.00	381.17	49.48	431.2	1056	388	1444	120900	0.07573
Deer	400	258	30/4.27	7/4.27	29.89	429.6	100.2	529.8	1186	785	1971	178500	0.06726
Zebra	400	258	54/3.18	7/3.18	28.62	428.9	55.60	484.5	1186	435	1621	131900	0.06740
Camel	450	290	54/3.35	7/3.35	30.15	475.9	61.70	537.6	1314	483	1797	145900	0.06073
Moose	500	323	54/3.53	7/3.53	31.77	528.5	68.51	597.0	1462	537	1999	161000	0.05470

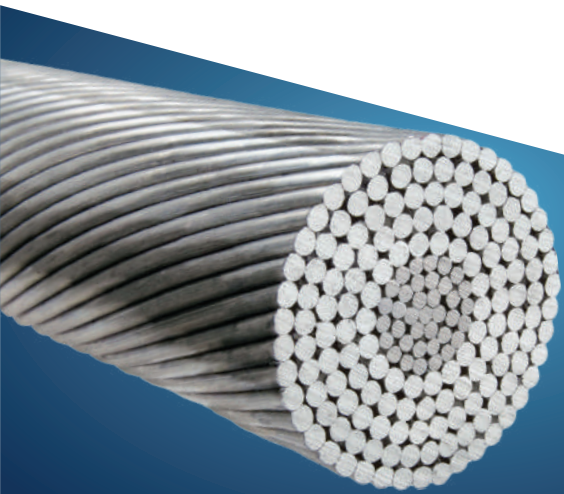
PACKAGING: In Wooden or M.S. Drum as required by client.

**All data set out in this catalogue is given for indication purpose only.

ALUMINIUM CONDUCTOR STEEL REINFORCE (ACSR)
AS PER IS 398: 1996 / NS 259: 2048

NOMINAL ALUMINIUM	STRANDING AND WIRE DIAMETER		SECTIONAL AREA OF ALUMINIUM	TOTAL SECTIONAL AREA	APPROXIMATE DIAMETER	APPROXIMATE (7)	CALCULATED RESISTANCE AT 20OC MAX (8)	APPROXIMATE CALCULATED BREAKING LOAD (9)
	ALUMINIUM	STEEL				Kg/Km	Ohm/Km	kN
(I)	(2)	(3)	(4)	(5)	(6)	43	2.780	3.97
mm2	mm2	mm	mm2	mm2	mm	73	1.618	6.74
10	6/1.50	1/1.50	10.60	12.37	4.50	85	1.394	7.61
18	6/1.96	1/1.96	18.10	21.12	5.88	128	0.9289	11.12
20	6/2.11	1/2.11	20.98	24.48	6.33	214	0.5524	18.25
30	6/2.59	1/2.59	31.61	36.88	7.77	319	0.3712	26.91
50	6/3.35	1/3.35	52.88	61.70	10.05	394	0.2792	32.41
80	6/4.09	1/4.09	78.83	91.97	12.27	726	0.1871	67.34
100	6/4.72	7/1.57	105.0	111.5	14.15	974	0.1390	89.67
150	30/2.59	7/2.59	158.1	194.9	18.13	1281	0.07311	88.79
200	30/3.00	7/3.00	212.1	261.5	21.00	1621	0.06868	130.32
400	30/4.27	7/1.96	404.1	425.2	26.88	1998	0.05595	159.60
400	54/3.18	7/3.18	428.9	484.5	28.62	1781	0.05231	120.16
520	54/3.53	7/3.53	528.5	597.0	31.77			
560	42/4.13	7/2.30	562.7	591.7	31.68			

**All data set out in this catalogue is given for indication purpose only.



LAY RATIO OF ALUMINUIM CONDUCTORS GALVANISED STEEL REINFORCED (CLASUES 10.2, 10.3 & 13.8)

NUMBER OF WIRES		RATIO OF ALUMINIUM WIRE	LAY RATIOS FOR STEEL CORE		LAY RATIOS FOR ALUMINIUM WIRE					
ALUMINIUM	STEEL	DIAMETER TO STEEL WIRE DIAMETER	(6 WIRE LAYER)		OUTER MOST LAYER		Layer immediately beneath Outermost layer		Innermost layer of conductors with 3 aluminum wire layers	
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1	2	3	4	5	6	7	8	9	10	11
6	1	1.0	----	----	10	14	----	----	----	----
6	7	3.0	13	28	10	14	----	----	----	----
30	7	1.0	13	28	10	14	10	16	----	----
42	7	1.8	13	28	10	14	10	16	10	17
54	7	1.0	13	28	10	14	10	16	10	17

STRANDING CONSTANTS FOR ACSR

NUMBER OF WIRES IN CONDUCTOR		MASS		STRANDING CONSTANT
ALUMINIUM 1	STEEL 2	ALUMINIUM 3	STEEL 4	ELECTRIC RESISTANCE 5
6	0	6.091	1.000	0.1692
6	7	6.091	7.032	0.1692
30	7	30.67	7.032	0.03408
42	7	42.90	7.032	0.02432
54	7	55.23	7032	0.01894

**Note- For the purpose of calculation, the mean lay ratio shall be taken as the arithmetic mean of the relevant minimum & maximum values given in this table.

QUALITY PLAN

Quality Assurance of ACSR Conductors

Sr.No.	COMPONENT AND OPERATION		CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	FORMAT OF RECORD
A.	RAW MATERIAL							INSPECTION
1.	ALUMINIUM	a)	Resistivity at 20°C	CRITICAL	ELECTRICAL	10% OF A LOT	IS : 5484/12444	Test report
		b)	Diameter	MAJOR	PHYSICAL	10% OF A LOT	IS : 5484/12444	Test report
		c)	Surface Appearance	MAJOR	PHYSICAL	10% OF A LOT	IS : 5484/12444	Test report
		d)	Tensile strength & Elongation at break	CRITICAL	PHYSICAL	10% OF A LOT	IS : 5484/12444	Test report
2.	G.I. WIRE	a)	Dimension	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		b)	Tensile Strength & Elongation at break	CRITICAL	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		c)	Mass of Zinc coating & Uniformity of Zinc coating	MAJOR	CHEMICAL	10% OF A LOT	IS : 4826-1979	Test report
		d)	Torsion Test for wire	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
3.	WOODEN / STEEL DRUMS	a)	Surface Appearance	MAJOR	VISUAL	EACH DRUM	IS : 1778-1980	Test report
		b)	Dimensions	MAJOR	PHYSICAL	EACH DRUM	As per LVU Standard	Test report
B.	IN PROCESS							
1.	WIRE DRAWING	a)	Diameter of Wire	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		b)	Tensile Strength for aluminium	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		c)	Wrapping Test for aluminium	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		e)	Resistivity at 20°C	CRITICAL	ELECTRICAL	10% OF A LOT	IS : 398-5-1992	Test report
		f)	Surface Appearance	MAJOR	VISUAL	10% OF A LOT	IS : 398-5-1992	Test report
2.	STRANDING	a)	No. of Wires	MAJOR	COUNTING	EVERY LENGTH	IS : 398-5-1992	Test report
		b)	Lay Length & Direction at Each Layer	MAJOR	PHYSICAL/VISUAL	EVERY LENGTH	IS : 398-5-1992	Test report
		c)	Diameter of Conductor	MAJOR	PHYSICAL	EVERY LENGTH	IS : 398-5-1992	Test report
		d)	Conductor resistance at 20 ^{0}C	CRITICAL	ELECTRICAL	1 SAMPLE/LOT	IS : 398-5-1992	Test report
		e)	Surface Appearance	MAJOR	VISUAL	EVERY LENGTH	IS : 398-5-1992	Test report
C.	FINAL CABLE TESTING							
1.	ROUTINE TEST	a)	Conductor Resistance at 20°C	CRITICAL	ELECTRICAL	10% OF A LOT	IS : 398-5-1992	Test report
		b)	Visual Examination	MAJOR	VISUAL	10% OF A LOT	IS : 398-5-1992	Test report
		C)	Measurement of Diameter of individual al. & steel wires	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		d)	Measurement of lay ratio	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		e)	Breaking load test on individual wires	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		f)	Ductility Test	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		g)	Wrapping test	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report
		h)	Galvanizing Test	MAJOR	PHYSICAL	10% OF A LOT	IS : 398-5-1992	Test report

2.	TYPE TEST	a)	Conductor Resistance at 20°C	CRITICAL	ELECTRICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		b)	Visual Examination	MAJOR	VISUAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		C)	Measurement of Diameter of individual al. & steel wires	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		d)	Measurement of lay ratio	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		e)	Breaking load test on individual wires	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		f)	Ductility Test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		g)	Wrapping test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		h)	Galvanizing Test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		i)	Surface Condition Test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		j)	Corona Test	CRITICAL	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
		k)	Radio Interferance Voltage Test	CRITICAL	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	TTC
3.	ACCEPTANCE TESTS (IF REQUIRED)	a)	Conductor Resistance at 20°C	CRITICAL	ELECTRICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		b)	Visual Examination	MAJOR	VISUAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		C)	Measurement of Diameter of individual al. & steel wires	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		d)	Measurement of lay ratio	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		e)	Breaking load test on individual wires	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		f)	Ductility Test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		g)	Wrapping test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC
		h)	Galvanizing Test	MAJOR	PHYSICAL	1 SAMPLE/LOT	IS : 398-5-1992	ITC

TTC = Type Test Certificate(Report) RTC = Routine Test Certificate(Report) ITC= Inspection Test Certificate

TEST TYPE CERTIFICATE

Type tests are predominately destructive tests, conducted to determine if the cable construction and materials are compliant with standard specifications.

Litmus has tested its ACSR Conductors from globally renowned testing laboratory like Ghaziabad Testing laboratories, CIMEC Infralabs and other NABL certified Laboratories.

GHAZIABAD TESTING LABORATORIES PVT. LTD.
BIS / GOVERNMENT APPROVED LABORATORY

TEST REPORT
ULR No.: TC617022200001505F

Page 1 of 2

Name & Address of the Customer	: M/s. Lumbini Vidyut Udyog Pvt. Ltd. Butwal Industrial Estate, Butwal, Nepal
Reference No./Date	: LVUPL/GTL/Type Test/2022-23 DATED : 01/07/2022
Sample Code No./ Report No.	: TC6170-220704-1505 (B)
Report Date	: 14/07/2022
Sample Received On	: 04/07/2022
Analysis Date	: 04/07/2022 To 14/07/2022
Report Prepared On	: 14/07/2022
Sampled By	: Customer
Sample Description	: 520 Sqmm, ACSR Moose Quad Conductor for over head Transmission Conductor. Aluminium wire 54/3.53 mm +Galvanized steel Reinforced wire 7/3.53 mm. **Separate Wire Provide Before Stranding:** Aluminium wire size 3.53 mm and Galvanized steel wire size 3.53 mm Along with sample for Testing Before Stranding
Test Specification	: [As per IS: 398 (Part-5) : 1992 with latest amendments & IEC : 60437]
Condition of the Sample on receipt	: Received in good condition
Test Conducted	: 1. Corona Test 2. RIV Test

AD-150, Amrit Steel Compound, South Side G.T. Road Industrial Area, Ghaziabad-201001
Ph.: 0120-2866108, E-mail : enquiry@gtllab.org, Website : www.gtllab.org
An ISO 9001-2015, ISO : 14001-2004 & OHSAS 18001-2007 Certified Laboratory

CIMEC Infralabs Private Limited
CIMEC

TYPE TEST REPORT

ACHIEVEMENTS

- Litmus is the first ACSR conductors manufacturing company in Nepal with a strong focus on quality and innovation. Litmus provides reliable solutions for the country's electrical infrastructure needs.

- Litmus, as the first domestic manufacturer in Nepal, has successfully secured a project to deliver 3600 km of 400 kVA ACSR Moose conductor, further solidifying their leadership in the industry. Litmus continues to pave the way for indigenous manufacturing and plays a crucial role in driving Nepal's electrical sector forward.

AERIAL BUNDLED CABLES (ABC)

AB Cables is also called Aerial Bundled Cable or is simply referred to as AB Cable. Aerial Bundled Cables (ABC) is a very novel concept for overhead Power Distribution System. When compared to the conventional bare Conductor Overhead Distribution System, ABC provides higher safety and reliability, lower power losses and ultimate system economy by reducing installation, maintenance and operative cost.

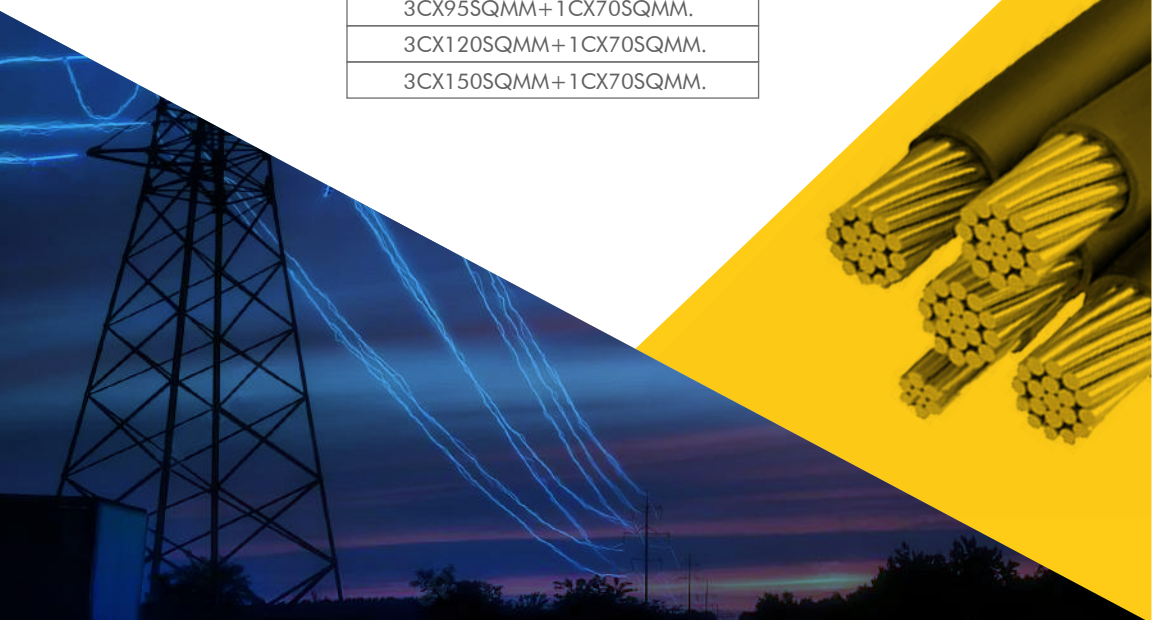
Aerial Bundled Cables, 1100 volt Grade, are used for distributing power to individual consumers by utility service providers like Electricity Distributing Authorities. The Cable is kept supported on poles. The line is tapped intermittently from any required position which enables to be used in urban as well as rural areas alike.

AERIAL BUNDLED CABLE FOR LT LINES

In the ABC system, the insulated conductors (3 or 4 numbers as required) are twisted around a high strength Aluminium or Aluminium Alloy Bare Wire or insulated core, which carries the main weight and also serves as the earth-cum-neutral wire. The phase conductors are not under tension. The system is very safe and LT faults are practically eliminated.

MANUFACTURING SIZES:

1CX25SQMM+1CX25SQMM.
3CX25SQMM+1CX25SQMM.
3CX50SQMM+1CX35SQMM.
3CX95SQMM+1CX70SQMM.
3CX120SQMM+1CX70SQMM.
3CX150SQMM+1CX70SQMM.



APPLICATION OF ABC CABLES

Aerial Bundled Cables can be used to replace bare conductor in overhead distribution systems. It is ideal for use in urban areas with congested power distribution and narrow lanes and by-lanes. The flexible system is much easier than conventional overhead power lines to re-route when demanded by changes in urban development plans.

ABC can be conveniently used:

- As replacement of bare lines in rural areas, in woods and in other localities where the spare is limited.
- As replacement of bare lines where reliability of supply is of prime importance.
- As replacement of bare lines where high degree of stability of supply voltage is of importance.
- In hilly terrains where cost of erection of overhead lines of underground cables becomes very high.
- For temporary supplies

FEATURES TO HIGHLIGHT

- Higher current rating and emergency overload rating
- Superior short circuit rating
- Low dielectric loss
- Much better insulation resistance
- Resistant to chemical and corrosive gases etc.
- Better resistance to surge currents
- Much longer life of the cables

ADVANTAGES OF ABC CABLES:

In comparison to Bare Overhead Power Distribution Lines, ABC has greater reliability in maintaining services because power and neutral conductors are insulated with the best di-electric medium, resulting in the following advantages:

- Safest system because phase conductors are insulated, no risk of danger of accidental touching live conductor.
- Less fault rage on account of good protection against line and ground fault by high winds or falling trees or bird especially in hilly areas & forests as encountered in rural distribution networks.
- High insulation resistance to earth in all seasons and polluted atmospheres.
- Negligible leakage currents and low losses.
- Multiple circuits of power and telephone cables could be strung in the same set of poles or any other supports like walls etc.
- Better adaptability to run concurrently with existing over-head bare conductor system without any interference.
- High capacitance and low inductance leading to low impedance of lines.
- Total lines costs are reduced and maintenance is very easy.
- Insulation of conductors also helps in preventing corrosion of the conductor.
- Cores being insulated, the chances of power thefts are eliminated.
- These are cheaper than underground power cables.
  Life of Transformers increased as the supply interruptions are minimized.

CONSTRUCTION OF ABC CABLES

XLPE/HDPE insulated power conductors of Aluminium (Neutral conductor and street lighting conductor if and when necessary) are laid together (twisted) around a high tensile strength (Aluminium Alloy may be used) instead or bare messenger wire to form the Aerial Bundled Cable.

Standard: IS: 14255
Conductor: Aluminium, Aluminium Alloy
Insulation Materials: XLPE
Working Temperature: 0o C - 90o C;
Minimum Bending Radius: Overall diameter < 25mm: 4×overall diameter
Overall diameter ≥ 25mm: 6×overall diameter

QUALITY PLAN FOR AERIAL BUNDLED CABLE

Litmus has always focused & paid attention to the technical requirements to maintain industry standard. Continuous research and development aids to our goal of bringing the best quality products for our customers to maintain and raise industry standards. We make sure to keep our technical aspect updated with the most innovative technology which is then reflected on our products and services. Rigorous cable testing is performed using advanced lab testing machines such as computerized UTS and profile projector. We have introduced Kaizen and 5S (Sorting, Sweeping, Standardizing & Sustaining) method in the shop floor for continuous improvement. We practive Total Quality Management System with the introduction os Critical to Quality (CTQ) Training to operators and supervisors to ensure that every individual behind our products are in line with our vision to empower the nation with nothing but the best wires and cables.

TEST TYPE CERTIFICATE

Type tests are predominately destructive tests, conducted to determine if the cable construction and materials are compliant with standard specifications.

Litmus has tested its Aerial bunched Cables (ABC) from globally renowned testing laboratory like KEMA and other NABL certified Laboratories.

DNV·GL

KEMA TEST REPORT

1370-18

Object	Self-supporting LV Aerial Bundled Conductor (ABC)
Type	0,6/1 kV – 4x50 mm² – Al / XLPE
Client	Lumbini Vidyut Udyog Pvt. Ltd, Lucky Tower, Tripureswar, 44600 Kathmandu, Nepal
Manufacturer	Lumbini Vidyut Udyog Pvt. Ltd, Butwal Industrial Estate, Butwal, Nepal
Tested by	DNV GL Netherlands B.V., Arnhem, the Netherlands
Date of tests	28 May to 14 June 2018
Test specification	The tests have been carried out in accordance with client's instructions (technical specifications, self-supporting LV Aerial Bundled Conductors (ABC) Nepal Electricity Authority Tender No: [illegible])
Summary and conclusion	The object complies with the relevant requirements of the standard.

This report applies only to the object tested. The responsibility for conformity of any object having the same type references as that tested rests with the Manufacturer.

* as declared by the manufacturer

This report consists of 20 pages in total.

DNV GL Netherlands B.V.

Executive Vice President
KEMA Laboratories

KEMA Laboratories

Arnhem, 8 November 2018

Litmus has flawlessly supplied and delivered over 7000 km of serial bunched cables in various sizes to the Nepal Electricity Authority within a span of just 2 years.

PROPERTIES OF CONDUCTORS OF VARIOUS SIZES

S.No	DESCRIPTION	UNIT	55 sq. mm CONDUCTOR	100 mm^2 CONDUCTOR
1	Actual Area	mm^2	55	100
2	Stranding & wire diameter	mm	7/3.15	7/4.26
3	Approximate overall diameter	mm	9.45	12.78
4	Approximate weight	Kg/mm	149.20	272.86
5	Maximum calculated DC resistance at 20°C	Ω/mm	0.6210	0.3390
6	Approximate calculated breaking load	kN	16.03	29.26
7	Current Rating	Amps	234	325

ALL ALUMINIUM ALLOY CONDUCTOR (AAAC)

Concentric Lay Stranded Aluminium Alloy Conductors (AAAC) are made out of high strength Aluminium-Magnesium-Silicon Alloy. These Conductors are designed to get better strength to weight ratio and offer improved electrical properties, excellent sag-tension characteristics and superior corrosion resistance when compared with ACSR.

FEATURES TO HIGHLIGHT

- High Strength to weight ratio
- Better Sag Characteristics.
- Improved electrical properties
- Excellent resistance to corrosion

ALUMINIUM CONDUCTOR STEEL REINFORCE (AAAC)

AS PER BS 3242: 1970/IS 398

CODE	NOMINAL ALUMINIUM AREA	EQUIVALENT COPPER AREA	STRANDING AND WIRE DIAMETER	APPROX. OVERALL DIAMETER	TOTAL	WEIGHT	NOMINAL BREAKING LOAD	MAXIMUM DC RESISTANCE AT200 C
	mm2	mm2	mm	mm	mm2	Kg/Km	Kgf	Ohm/Km
Box	15	9.68	7/1.85	5.55	18.81	51	536	1.750
Acacia	20	12.9	7/2.08	6.24	23.78	65	684	1.384
Almond	25	16.1	7/2.34	7.02	30.10	82	862	1.094
Cedar	30	19.4	7/2.54	7.62	35.47	97	1015	0.9281
-	35	22.6T	7/2.77	8.31	42.18	115	1206	0.7803
Fir	40	25.8	7/2.95	8.85	47.84	131	1366	0.6880
Hazel	50	32.3	7/3.30	9.90	59.87	164	1713	0.5498
Pine	60	38.7	7/3.61	10.83	71.65	196	2050	0.4593
-	70	45.2	7/3.91	11.73	84.05	230	2404	0.3916
Willow	80	48.4	7/4.04	12.12	89.73	246	2568	0.3668
-	90	51.6	7/4.19	12.57	96.51	264	2759	0.3410
-	100	58.1	7/4.45	13.35	108.8	298	3110	0.3026
Oak	100	64.5	7/4.65	13.95	118.9	325	3396	0.2769
-	100	64.5	19/2.82	14.31	118.8	326	3391	0.2787
Mulberry	125	80.6	19/3.18	15.9	151.1	415	4312	0.2190
Ash	150	96.8	19/3.48	17.4	180.7	497	5165	0.1830
Elm	175	113.0	19/3.76	18.8	211.0	580	6029	0.1568
Poplar	200	129.0	37/2.87	20.09	239.0	658	6840	0.1385
-	225	145.0	37/3.05	21.35	270.8	745	7725	0.1226
Sycamore	250	161.0	37/3.23	22.61	303.0	835	8664	0.1094
Upas	300	194.0	37/3.53	24.71	362.1	997	10350	0.09155
-	350	226.0	37/3.81	26.67	421.8	1162	12055	0.07860

ALL ALUMINIUM CONDUCTOR (AAC)

Concentric Lay Stranded Aluminium Conductor (AAC) is made up of one or more strands of hard drawn aluminium rod. These Conductors are used in low, medium and high voltage overhead lines. AAC has seen extensive use in urban areas where spans are usually short but high conductivity is required. Because of its relatively poor strength to weight ratio, AAC has limited use in transmission lines and rural distribution because of long spans utilized.

FEATURES TO HIGHLIGHT

- High Current Carrying Capacity.
- Excellent Resistance to Corrosion.
- Suitable for Low & Medium voltage lines in Urban Area

ALUMINIUM CONDUCTOR STEEL REINFORCE (AAC)

AS PER BS 215

CODE	NOMINAL ALUMINIUM AREA	EQUIVALENT COPPER AREA	STRANDING AND WIRE DIAMETER	APPROX. OVERALL DIAMETER	TOTAL	WEIGHT	NOMINAL BREAKING LOAD	MAXIMUM DC RESISTANCE AT200 C
	mm2	mm2	mm	mm	mm2	Kg/Km	Kgf	Ohm/Km
Weevil	30	19.4	3/3.66	7.9	31.6	86	496	0.9082
Ladybird	40	25.8	7/2.79	8.4	42.8	117	701	0.6687
Ant	50	32.3	7/3.10	9.3	52.8	145	846	0.5419
Fly	60	38.7	7/3.40	10.2	63.6	174	1010	0.4505
Bluebottle	70	45.2	7/3.66	11.0	73.7	202	1156	0.3884
Grasshopper	80	51.6	7/3.91	11.7	84.1	230	1303	0.3405
Clegg	90	58.1	7/4.17	12.5	95.6	262	1482	0.2994
Wasp	100	64.5	7/4.39	13.2	106.0	290	1632	0.2700
Bee	125	80.6	7/4.90	14.7	132.0	361	2033	0.2167
Cricket	150	96.8	7/5.36	16.1	157.9	432	2432	0.1812
Homet	150	96.8	19/3.25	16.3	157.6	434	2519	0.1825
Caterpillar	175	113.0	19/3.53	17.7	186.0	512	2920	0.1547
Chafer	200	129.0	19/3.78	18.9	213.2	587	3304	0.1349
Spider	225	145.0	19/3.99	20.0	237.6	652	3672	0.1211
Cockroach	250	161.0	19/4.22	21.1	265.7	731	4120	0.10830
Butterfly	300	194.0	19/4.65	23.3	322.7	888	4966	0.08912
Moth	350	226.0	19/5.00	25.0	373.2	1027	5748	0.07709
Centipede	400	258.0	37/3.78	26.5	415.2	1145	6434	0.06944

FINAL QUALITY PLAN

S.N	Material/ Equip./ Tools, Process Name	Characteristic to be checked	Category	Specific Value/ Ref. Standards	Sampling plan Frequency	Safety Required	Meas. Monitoring Devices required	Control Method	Rejection Plan	Resp.	Records
1	Aerial Bunched Conductors	Over all Dia	Major	IS: 14255	Each Size		Caliper	Inspection & testing	Reject	QCI	LVU/QC /R/05
		Insulation Thickness	Major	IS: 14255			Caliper				
		No of wires.	Major	IS: 8130			Manually				
		Conductor Resistance	Major	IS: 8130			Ohm meter				
		Elongation Test of XLPE Compound	Major	IS: 14255			Tensile Tester				
		Tensile Strength of PVC	Major	IS: 14255			Tensile Tester				
		Volume Resistivity	Major	IS: 14255			Million Mega ohm Meter				
		Hot Set Test	Major	IS 7098-I			Hot Set				
		Shrinkage Test	Major	IS 7098-I			Hot Air Oven				
		Ageing	Major	IS 7098-I			Ageing Oven Tensile Tester				

TECHNICAL CHARACTERISTICS OF AERIAL BUNDLED CABLE (ABC)

AB Cable Type (sq.mm.)	Minimum Number of Strands		Minimum thickness of insulation (mm)		Max. DC resistance at 20°C (Ω/km)		Minimum Tensile strength of messenger (kN)	Approx. Overall Diameter of Cable (mm)	Approx. weight of cable (kg/mm)
	Phase	Messenger	Phase	Messenger	Phase	Messenger			
3x150+1x70	19	7	1.8	1.5	0.206	0.492	19.7	50	1791
3x120+1x70	19	7	1.7	1.5	0.243	0.492	19.7	46	1482
3x95+1x70	19	7	1.6	1.5	0.320	0.492	19.7	42.7	1237
3x50+1x35	7	7	1.5	1.2	0.641	0.986	9.8	32.3	692
3x25+1x25	7	7	1.2	1.2	1.2	1.38	7.0	25	390
2x25	7	7	1.2	1.2	1.2	1.38	7.0	22.4	195

TECHNICAL DATA: SELF SUPPORTING LV ABC

Nominal cross sectional area, mm2	25	50	25
Number of Core	4	4	4
Form of conductor	Stranded	Compacted	Stranded
Number of wires in conductor	7	7	19
Min. diameter of conductor, mm	5.8	8.0	11.3
Max. dc resistance of conductor at 20 deg.C, Ohm/km	1.200	0.641	0.320
Min. breaking load of conductor, kN	3.5	7.0	13.3
Min. average thickness of inuslation excluding ribs, mm	1.3	1.5	1.7
Min. thickness of insulation at any point, mm	1.07	1.25	1.43
Min. breaking load of cable, kN	14.0	28.0	53.0

APPLICATION

Conductor (MVCC) is becoming as one of the best replacement of Over Head Bare Conductor (ACSR) and Aerial Bunched cable in power transmission and distribution system in some part of the world. The uses of Covered Conductor which is similar like SAC (Space Aerial Bunch Cables) are seen in South Korea, Japan, Iran, Myanmar and some parts of Australia. It has a very successful journey so far.

- Covered Conductor is extensively used in voltage up gradation projects ranging between 6.6KV to 66 KV.
- Covered Conductors can function smoothly with conductor temperature up to 80ºC and in corrosive and highly polluted area.
- The outer jackets of covered conductors being UV resistant, it can be used in high UV radiation areas.
- Covered Conductors fulfill the demands in extreme cold environment with heavy snow and ice load.

XLPE COVERED CONDUCTORS

INTRODUCTION

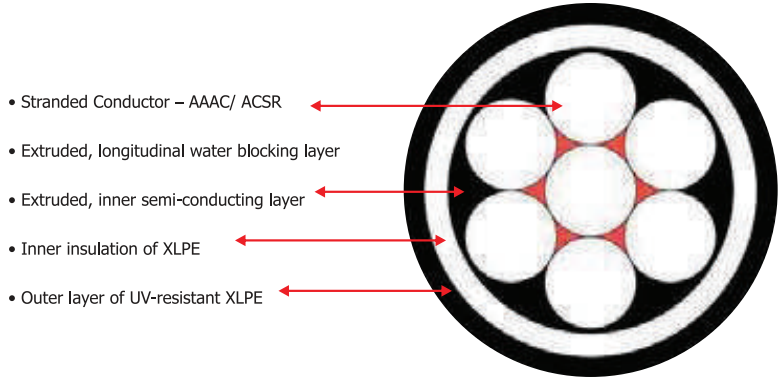
The XLPE covered aluminum cable- 11kV Voltage Class is constituted by a compact round conductor, composed by aluminum strands, blocked or not, and with a cross-linked polyethylene (XLPE) covered in black or gray color, with special characteristics to be resistant against electric tracking and UV-rays. As XLPE is a thermoses material, it enables operation up to 90°C continuously implying in higher capacity when compared to the thermoplastic materials.

BENEFITS

- Reduced Conductor Slashing.
- Reduced right of way.
- Reduce power interruptions and outage.
- No interruptions by contact of tree branches or creepers.
- Reduced operation and maintenance cost.
- No faults due to clashing of phase conductors during wind and stormy conditions.
- Better reliability under bad weather conditions like heavy snow fall, windy or stormy conditions.
- Protect big birds and animals: Peacocks, Flamingos, Elephants etc.
- Phase to Phase conductor distance can be reduced which can reduce the tower related costs.
- Negligible Leakage Current on surface of the Covered Conductors.
- Covered conductor is self- supporting and can have pole spans of 60 to 70 meters.
- Increasing the power distribution network reliability.
- Effectively used in difficult terrain and in densely populated areas.
- Lower total cost of ownership over the life cycle compared to underground cables or Aerial Bunched Cables.
- Same corridor of an old bare overhead line can be used for covered conductors.
- The pole man span of AB cables are short, as the full cable weight has to be carried by a single messenger conductor.
- Ideal for installation in forest areas and bird sanctuaries.
- Cheaper alternative to underground cables and AB cables.

CROSS SECTIONAL DRAWING OF COVERED CONDUCTOR

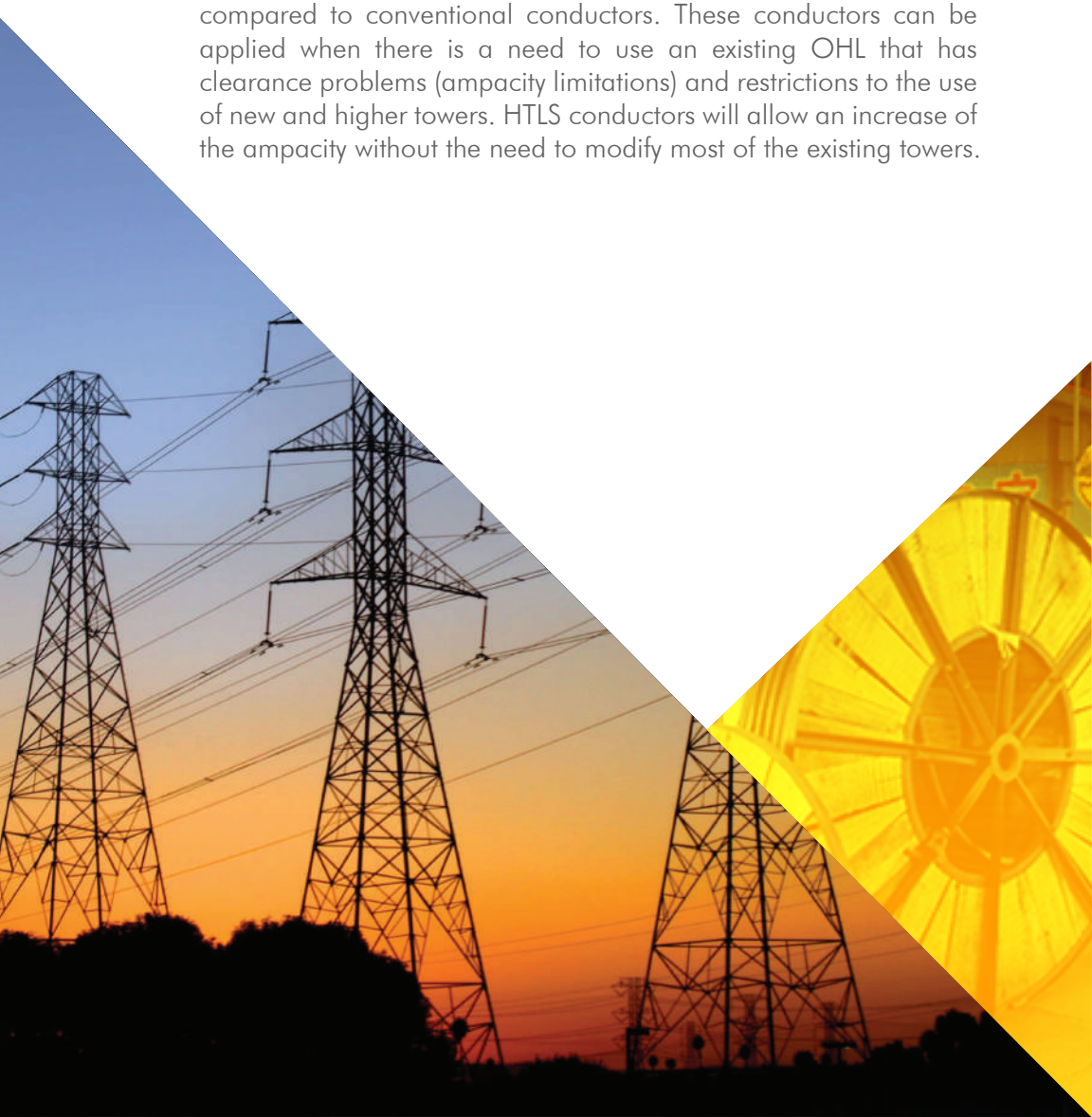
Covered Conductors are manufactured with longitudinally water tight construction with AAAC/ACSR conductor. These are XLPE insulated anti tracking with UV-resistant outer sheath.



HIGH TEMPERATURE LOW SAG CONDUCTORS (HTLS)

INTRODUCTION:

High Temperature Low Sag Conductors (HTLS) can withstand operating temperatures of up to 210°C, thus carrying higher power compared to conventional conductors. These conductors can be applied when there is a need to use an existing OHL that has clearance problems (ampacity limitations) and restrictions to the use of new and higher towers. HTLS conductors will allow an increase of the ampacity without the need to modify most of the existing towers.



TYPES:

- Aluminium conductor steel support (ACSS).
- Aluminum conductor composite reinforced (ACCR).
- Aluminum conductor composite core (ACCC).
- Gap type thermal resistant aluminum alloy conductor steel reinforced.
- Invar Core Conductor.

ADVANTAGES:

- Supporting the seasonal or occasional demand peaks as well as emergency
- Overloads required by the grid operation during line life.
- Continuous operation at higher temperatures thus, increasing the electrical load.
- Do not modify the structures (towers and foundations)
- Maintain adequate electrical clearances (maximum sags)
- Increase the current capacity 1.6-2.0 times of ACSR.

RANGE OF PRODUCTS

CATEGORY	PRODUCTS	STANDARD
Overhead Conductors	1.Aluminium Conductor Steel Reinforced (ACSR) upto 61 Strands for overhead electrical power transmission 2. All Aluminium Conductors (AAC) upto 61 strands for overhead transmission of power 3. All Aluminium Alloy Conductors (AAAC) upto 61 Strands for overhead transmission of power 4. High Temperature Low Sag Conductors (HTLS) (Launching Soon) 5. XLPE covered conductors	BS:215, NS:259, IS:398
	6. Aerial Bunched Cables (ABC)	IS: 14255, BS: 7870 IEC: 208, IEC: 502
Wires & Cables	**1. House Wiring Cables** i. Multi Strand Cable ii. Fire Retardant Low Smoke (FRLS) iii. Ecowire- ZH (Halogen free) iv. Concentric cables v. Flexible Twin Twisted Cables	IS:994, BS:6346
	2. LV Power Cables i. Copper Conductor- Armoured & Unarmoured - Single core up to 1000 mm2 - Multi-core up to 400 mm2 ii. Aluminium Conductor- Armoured & Unarmoured - Single core up to 1000 mm2 - Multi-core up to 400 mm2	BS:6346, IS:1554, IS:7098
	3. Control Cables Copper Conductor- Armoured and Unarmoured (Up to 61 core in size 1.5 mm2, 2.5 mm2)	BS:6346, IS:1554
Enamel wires & Copper strips	**Enamel copper winding wires**	IS:13730
	Paper insulated wires/ strips	IEC:60317

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