

MAKE IN INDIA

EXTRA HIGH VOLTAGE CABLE TECHNICAL CATALOGUE



Dynamic Cables Ltd.

(A Govt. Recognised Star Export House) An ISO 9001:2015,14001:2007 & OHSAS 18001:2007 Company www.dynamiccables.co.in







PREFACE-66KV XLPE CABLES

Established in 1986, Dynamic Cables is a leading supplier of cables and conductors to meet the requirement of the transmission & distribution industry globally. We have over three decades of experience as a cable manufacturer. Complemented with state of the manufacturing and testing facilities we are able to design, manufacture and test our products in house.

Dynamic Cables is committed to the production of the best product quality and service, utilizing cutting edge European Technology in manufacturing. The core technologies in production processes, Material applications and logistic procedures are all done through modern techniques.

Dynamic Cables has now gained entry into an elite group of manufacturers who can boast of a manufacturing range upto 66KV cables. Our CCV (Continuous Catenary Vulcanizing) Extrusion line which is from Supermac Industries, India utilizes a Single-point-triple-extrusion method which can take care of long continuous production schedules, frictional heat and pressure to deliver a uniform production cycle. The CV tube for this extrusion line has been procured from Scholz Autoclaves, Germany which uses high quality parts, sophisticated constructive designs and the exclusive use of precision steel tubes with uniform wall thickness

INFRASTRUCTURE & MACHINERY

Construction and fabrication of the plant has been according to European and international standards and regulations.All production machines are top of the line of the cables machinery suppliers. From start up with wire drawing lines to extrusion lines, to assembly machines up to the laboratories and the final test fields, all technical equipment have been procured to ensure compliance with International standards ensuring world class product quality standards are met.

QUALITY CONTROL SYSTEM

Application of the most modern production facilities in connection with a proven system for the approval of the equipment through the ISO model of Quality control. We guarantee high quality, proven product characteristics at the highest level of safety.

With the systematic conversion of innovative ideas into reliable and economic solutions to meet demands, we gear ourselves to the individual specifications of our customers. In our comprehensive range you will find vertical lines, catenary lines, horizontal lines, pressure reversing vessels as well as conversions and special designs of all kinds. The wide variety of cable variations requires optimum design of the CV line and its components. We are in a position to satisfy these demands thanks to the use of the latest programs and incorporation of ISO Quality standards.







SALIENT FEATURES OF HYBRID CCV LINE MANUFACTURING PROCESS

Optimum Production capacity of upto 1800 Kms per annum for MV & HV Cables.

German CV Tube by MaschinenbauScholz, Germany ensures manufacture of high-quality products using the latest technology.

To control the manufacturing process, the line has been provided with computer-monitored instruments and servo controls. Some of the important systems are:

Equipped with driven Pay off & Accumulator to ensure continuous working without jerks. Online X-Ray device checks and displays the concentricity & thickness of all three layers to operator on the screen during the running of the line.

CCV tube has a Touch Less Sag control system. This system ensures no marks / lines on core unlike the older lines. Facilities like conductor pre-heater, core twister (to control eccentricity / ovality) and Degasification have also been provided for EHV Cables.

Computerized control system ensures optimum efficiency, fast start-up, synchronized operations of compound feeds, and three extruders, CCV line heating temperature zones / gas supply and pressure, payoff and take up.

An amalgamation of INDO-GERMAN Technology ensures an end product which meets national and international quality standards.

HV Cables are manufactured and supplied in accordance to the applicable standards like: IEC-62067: IEC 60840: IS 7098 (Part (III).







MANUFACTURING PROCESS

CONDUCTOR	Compacted Circular Conductors				
	Aluminum	Upto 1000 Sqmm			
	Copper	Upto 800 Sqmm			
Compound handling & Clean Room	The material handling system at Dynamic Cables ensures ultimate cleanliness and state of the art feeding system. The semi –conducting feeding area is maintained at clean class 10000, whereas the XLPE insulation compound feeding area is maintained at clean class 1000.				
Triple Extrusion	The extrusion of semi-conducting conductor screen, XLPE insulation and semi- conducting insulation screen in one operation by triple extrusion through single cross head ensures perfect bonding of all the layers and results in optically smooth interface which removes all possibilities of irregularities and micro voids formation.				
Curing under inert gas (Nitrogen gas) Atmosphere	The cross linking process under inert atmosphere keeps the insulation absolutely dry which eliminates all chances of electromechanical treeing during whole life of the cable				
TESTING					
High Voltage Test System	The series resonance test system 700 KV/28000 KVA at dynamic cables testing lab is capable of testing long lengths of cables upto 66 KV rating at a small input power. This helps in saving time and money by avoiding extra joints in the cable system.				
Impulse voltage test	The impulse voltage test equipment at Dynamic Cables is rated at 2400 KV- 240 KJ. The high energy rating of the test equipment can test extra high voltage cable samples upto 500 KV rating having very low capacitances				
Partial Discharge Test	The shielded room in our testing lab is capable of detecting partial discharges of less than 2 pc.				
Other electrical & physical tests	Dynamic Cables lab is fully equipped to perform all routine, acceptance and type tests for cables upto 66KV rating as per the requirements of IEC 60840,IS 7098 part -3 and other relevant international standards.				







ADVANTAGES OF XLPE

XLPE is an abbreviation of cross -linked polyethylene. This has been recognized world-wide as excellent dielectric material for wires and cables. It first went into commercial production in the 1960. Polyethylene, which is a thermoplastic material converted into a thermosetting material by a process of crosslinking. The linear chain structure of polyethylene is changing into three-dimensional network structure. By this change, polyethylene, which has outstanding dielectric properties, is made resistant to extreme temperatures. Following are the special advantages of the XLPE Cable:

HIGH CONTINUOUS CURRENT RATINGS

Higher continuous operating temperature 90-C for conductor permits XLPE Cables to carry higher current than PVC or paper insulated cables

HIGH SHORT CIRCUIT RATINGS

Maximum allowable continuous temperature during short circuit for XLPE insulated cables is 250°C, which increases the short circuit rating of XLPE cables drastically compared to PVC & paper Insulated cables.

LOW DEFORMATION AT HIGH TEMPERATURE

Under combined heat and mechanical pressure XLPE suffers less deformation compared to other solid dielectrics.

HIGH EMERGENCY OVER LOAD CAPACITY

XLPE Cables can be operated at 130-C during emergency. This should not exceed 100 Hours in any 12 Consecutive months and 500 hours during the lifetime of the cable.

LOW DIELECTRIC LOSS

The dielectric losses of XLPE is much below the conventional solid dielectrics like PVC & EPR.This results in considerable saving in costs when power transmission at higher voltages is done through XLPE Cables.

LOW CHARGING CURRENTS

The charging currents are considerably lower than other dielectrics. This permits close setting of protection relays. The high resistance to heat deformation and ageing in hot air provide an important advantage in cable rating and is of special significance at locations where the ambient temperature is high. These along with better resistance to environment stress cracking and a low dielectric constant, make XLPE cables particularly suitable for high voltage and extra high voltage applications.

GENERAL PROOPERITES OF XLPE COMPOUND FOR EHV CABLES		
Specific Gravity	0.93	
Tan at Rated voltage		
1. At Ambient temperature (20°C)	10 x 10 ⁻⁴	
2. At operating temperature (90°C)	10 x 10 ^{-₄}	
Volume resistivity at 20°C	1 x 10 ^{1₄}	
Max Permissible operating conductor Temp °C	90°C	
Max Permissible Temp during Short Circuit °C	250°C	
Short Time overloads Temp °C	130°C	
Dielectric constant at 20°C	2.35	





CONSTRUCTION DETAILS OF HV XLPE CABLES

The XLPE Cable has the construction of a conductor (copper or aluminum), conductor screen of semiconducting compound insulated with cross-linked polyethylene and then shielded with semiconducting compound followed by metallic screen to be covered by PVC or polyethylene for anticorrosion followed by a semiconducting layer.

CONDUCTOR

The most important layer in cables is the current carrying component and it may be Annealed Copper or hard drawn Aluminum stranded wires. Conductor consists of stranded soft drawn wires wounded together and is compacted circular in shape.

WATER TIGHT CONDUCTORS

Upon request, the conductor may be water tight by using swelling tapes inside it (Between conductor layers).

CONDUCTOR SCREEN

The conductor screen consists of an extruded semi-conducting polyethylene to minimize electrical stresses due to the stranded configuration of the conductor. The semi conducting material used for conductor screen has no deleterious effect on the conductor. An optional semi – conducting tape is generally applied over the conductor before the extruded semiconducting layer.

INSULATION

The insulation material is an extruded and dry cured cross-linked polyethylene (XLPE), and it is the cable electrical protection. The conductor screen, insulation and insulation screen are extruded simultaneously in one process (TRIPLE EXTRUSION) to ensure that the screen and insulation are intimately bonded together and free from all possibilities of voids between layers. The extrusion process is carried out under strictly controlled atmospheric conditions. The Dry cured & dry cooled process under the inert atmosphere (N, Gas) enables to enhance the electro mechanical and thermal characteristics of XLPE insulation. The insulation should withstand the rated voltage, lightning over voltages and switching over voltage during its lifetime. The insulation material is capable to withstand 90°C during normal operation and 250°C during short circuit conditions.

INSULATION SCREEN

The insulation screen is provided over the insulation by extruded semi - conducting compound, this minimizes the possibility of ionization on the outer surface of insulation to make the dielectric stresses radial.

METALLIC SCREEN / SHEATH

This layer is the short circuit current carrying component and it may be one of the following type:

A. Poly-Al laminated tape in combination with copper wire & open helix copper tape:

1) Poly-Al laminated tape works as radial moisture barrier and copper wire screen takes care of each fault current.

B. Corrugated Aluminium sheath:

1) Corrugated AI sheath works as radial moisture barrier and additionally it takes care of the earth fault current.

OUTER SHEATH

This is the final protection layer for all inside layers, and it may be one of the following types:

- 1. PE material (HDPE, LDPE, MDPE)
- 2. PVC material





CROSS SECTIONAL DRAWING FOR 38/66 Kv cable



- 1 Aluminium/Copper Compacted Conductor
- 2 Semi-conducting Tape
- 3 **Conductor Screen**
- 4 **XLPE** Insulation
- 5 **Insulation Screen**
- 6 Semicon Water swellable Tape
- 7 Corrugated Aluminium sheath

8 Anticorrosive paint 9

- HDPE/PVC Outer sheath
- **Graphite Coating**

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SCHEMATIC DIAGRAM OF CONTINOUS CATENARY VULCANISATION (CCV









ELECTRICAL TEST PARAMETERS

Rated System Voltage	High System Voltage	High Voltage Test		Partial Discharge test	Impulse Voltage Test	Voltage T Impuls	est After Se Test
Uo/U (KV)	Um (KV)	Voltage KV	Duration Min	1.5 Uo (KV)	KV	KV	Duration Min
38/66	72.5	95	30	57	325	95	15

RESISTIVITY TEST FOR SEMI- CONDUCTING LAYER

The resistivity test for extruded semi-conducting layers applied over the conductor and over the insulation shall be determined by measurements on test pieces taken from core

The procedure for measurement shall be in accordance with annex C of IS 7098 (Part-3)

The measurement shall be made at a temperature within $+2^{\circ}C$ of the rated maximum normal operating conductor temperature

The resistivity shall not exceed the following

Conductor Screen 1000 Ohm-meter Core Screen

500 Ohm-meter



ELECTRICAL & PHYSICAL DIMENSIONS

66KV(E) Corrugated Aluminum Sheathed cables

Nom. Cross Section of Conduction (Samm)	Nom Thickness of Insulation (mm)	Nom Aluminum sheath thickness (mm)	Nom Outer Sheath thickness (mm)	Approx. Overall Cable Diameter (mm)	Approx. wt of cable (Cu Conductor) (kg/m)	Approx. wt of cable (Al Conductor) (kg/m)	Maximum Capacitance (µF/km)	Maximum Charging Current (A/km)
	11.0	1.0	2.0	()	5, ,	2.0	0.20	2.1
240	11.0	1.6	2.8	69.0	5.3	3.9	0.20	2.4
300	11.0	1.6	2.8	71.0	5.9	4.2	0.22	2.6
400	11.0	1.6	3.0	74.0	6.9	4.7	0.24	2.9
500	11.0	1.6	3.0	78.0	8.0	5.2	0.26	3.1
630	11.0	1.7	3.2	81.0	9.5	5.8	0.28	3.3
800	11.0	1.7	3.4	87.0	11.4	6.8	0.32	3
1000	11.0	1.8	3.4	91.0	13.5	7.7	0.35	4.2

Note:

1) Above dimensions are for standard construction. In case of any specific fault current requirement, thickness for AI sheath will be decided accordingly.

2) Constructional data given in above table are for guidance only. Cable as per national (IS 7098- Part 3)/International specifications IEC 60502, IEC 60840 shall be offered on request.

OUR GLOBAL FOOTPRINTS



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