

CHECK LIST for FACTORY ASSESSMENT			
VENDOR NAME AND ADDRESS			Date of Visit
Visiting person name: Note: The visit is only to understand the manufacture process of UG HT and LT cables/AB cables manufactured by different manufacturers for production of quality and reliable cables. Keeping in view the needs of BESCO, for UG HT/UT LT/AB cables of different rating, visiting personnel may make keen observations on the ongoing manufacturing process control like: required infrastructure, process methods, technology adopted, quality and source of raw materials, test facility, storage, cleanliness, Quality plan for manufacture and testing etc. Make sure that during visit, their production is not disturbed.			
Contact Person at vendor premises:			
Inspection Check List			Comments
Check for PRODUCT MANUFACTURING CAPABILITY -BESCO REQUIREMENT			
1	HT UG Cables (6.35 kV/11kV) CROSS LINKED POLYETHYLENE (XLPE) INSULATED 3 CORE 11KV CABLES		
	11 KV XLPE UG cables of Typical cross sections 3Cx 95 Sqmm, 3Cx 120 Sqmm, 3Cx 150 Sqmm, 3Cx 185 Sqmm, 3Cx 240 Sqmm, 3Cx 300 Sqmm, 3Cx 400 Sqmm,	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Other cross sections		
2	LT UG Cables (1.1 kV) CROSS-LINKED POLYETHYLENE INSULATED (HEAVY DUTY) ARMoured PVC SHEATHED UG CABLE.		
	Three & Half Core Aluminium XLPE Insulated as per IS:7098 (Part-1) = typical cross sections		
	1.1 kV, 3.5 core x 400 sq,mm 1.1 kV, 3.5 core x 240 sq,mm 1.1 kV, 3.5 core x 120 sq,mm 1.1 kV, 3.5 core x 120 sq,mm 1.1 kV, 3.5 core x 25 sq,mm	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No	

	1.1 kV, 4 core x 16 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Other cross section range		
3	HT Aerial Bunched cable (11 kV)		
	CROSS LINKED POLYETHYLENE INSULATED AND PVC SHEATHED H.T.(11KV) AERIAL BUNCHED CABLES		
	Power Core	Messenger Wire	<input type="checkbox"/> Yes <input type="checkbox"/> No
	3x35 mm. +	1x105 mm.	<input type="checkbox"/> Yes <input type="checkbox"/> No
	3x50 mm. +	1x105 mm.	<input type="checkbox"/> Yes <input type="checkbox"/> No
	3x70 mm. +	1x180 mm.	<input type="checkbox"/> Yes <input type="checkbox"/> No
	3x95 mm. +	1x180 mm.	<input type="checkbox"/> Yes <input type="checkbox"/> No
	3x120 mm. +	1x180 mm.	<input type="checkbox"/> Yes <input type="checkbox"/> No
4	L.T AERIAL BUNCHED CABLES Cross linked polyethylene (XLPE) insulated Aluminium Cables twisted over a central aluminium alloy insulated messenger wire		
	3x16+1x16+1x25	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	3x25+1x16+1x25	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	3x35+1x16+1x25	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	3x50+1x16+1x35	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	3x70+1x16+1x50	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	3x95+1x16+1x70	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	3x95+1x25+1x70	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	L.T. PVC Insulated Single -Core Aluminium Lead Wire (Multi Strand).		
	10 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	16 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	25 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	50 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	70 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	95 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	120 sq.mm	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	CHECK WHAT INFRASTRUCTURE IS AVAILABLE		
	Aluminum Wire drawing machines , Aluminum intermediate multi wire drawing line, Annealing furnace, Copper wire drawing machine, Fine wire drawing machine Bunching machine, Twisting line machines, Extruder machines, Grinder machine Laying machines, Armouring machines of different sizes, XLPE curing tank, Spooling machines Rewinding machines etc.	<input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A <input type="checkbox"/> A <input type="checkbox"/> Not A	

	PROCESS CONTROL METHODS		
	Wire Drawing machine		
	Inspect the wire drawing process.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how they make sure that wire drawing steel dies are not excessively worn out.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	How they check for proper diameter and no imperfections in the strand and for consistency of the conductors.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	How they check for any defects in the drawn wires. Find out whether it is by checking tensile and elongation properties.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Stranding /bunching		
	Examine the stranding or bunching process which ensures that conductors are properly twisted together.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how they verify the lay length and pitch (lay factors)	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Insulation extrusion		
	Check for Insulation extrusion and curing methods CCV (Continuous catenary vulcanisation) Heat transfer from steam High temperature compatible fluid Thermal radiation in a nitrogen atmosphere Vertical catenary vulcanisation (VCV) Silane chemical cross linking process (Sioplas) Irradiation by high energy electron beam	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Is it Single extrusion method	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Is it Tripple extrusion method	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	If CCV, VCV, EBR, methods, Check how thermal decomposition of per oxides is done	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Is per oxides done pre-compounded into the polymer or	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	directly added at the extruder	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	If CCV line is used- check how dry curing is carried out	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Is it by thermal radiation from the tube in a pressurised atmosphere of inert gas, usually nitrogen.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check what is the pressure of Nitrogen gas set	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	If steam curing is done what is the steam temperature	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Inspect the insulation extrusion process and examine the cleanliness of the raw materials used/storage/material handling/ cleanliness of extruder.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	

	Check whether provision is be made to exclude any entrapment of dust or contaminants during handling.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check if proper feeding arrangements is made from storage containers into the extruders without exposure to the atmosphere.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Curing or vulcanisation		
	Inspect the process curing or vulcanization of insulation to ensure proper curing times and temperatures.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check what is the extrusion temperature	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check what is the curing temperature	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how the cross linking (vulcanization) process does not expose the material to water or steam.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how proper operating temperatures during extrusion is ensured	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check the process of degassing extruded cable core	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	If Sioplas (Silane chemical cross linking method which involves two steps : grafting and extrusion) technology is used Check how material compounding operation, of a grafted Polyethylene (co-polymer) is done Check the storage conditions of grafted co-polymer (it has a self life of one year)	<input type="checkbox"/> OK <input type="checkbox"/> Not OK <input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how the grafted polyethylene is fed to the insulating line extruder along with a catalyst masterbatch. Check whether the catalyst is dibutyl-tin-dilaurate	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Crosslinking is achieved by the action of heat and moisture off-line in a curing tank containing water Find out what is the water temperature. Is it 80°C Crosslinking reaction speed is governed by the diffusion rate of water in the polyethylene Find out whether polyethylene absorbs water If not, check if it is converted to methonal		
	Find out whether silane crosslinked polyethylene is comparable to the water content of dry cured CCV produced materials	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how carbon loaded semiconducting version of the grafted polymer to form the conductor screen and the core screen is done from additional hoppers	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	

	Check what methods are adopted for uniformity and thickness of the insulation layer. How do they check for any voids, bubbles, or other defects by tests	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Find out what material is used for outer sheath. Is it PVC, LDPE, HDPE.... Find out what additives are added to get heat resistant property of outer sheath cable sheath	<input type="checkbox"/> OK <input type="checkbox"/> Not OK <input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Find out what additives are added to get flame retarding properties	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Cabling		
	Check how they verify the cabling process to ensure the correct lay-up of insulated conductors.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check how they Inspect the concentricity and symmetry of the cable structure.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Metallic Shielding		
	Inspect the application of metallic shielding layers to ensure proper coverage and continuity to perform its function like electrostatic protection, electromagnetic protection, and protection from transients such as lightning, surges and fault currents.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Make sure that the Non-magnetic metallic materials: copper wire/tape of aluminum wire /strip are used for shielding	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Find out how they check for any defects in the shielding	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Jacketing		
	Check how the jacket material made of PVC or black linear low density polyethylene or liner medium density polyethylene or high density polyethylene is tested	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Examine the jacketing process, how they ensure proper thickness and uniformity of the outer protective layer.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	Check for visual defects, such as cuts or abrasions on the jacket.	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	RAW MATERAILS Check the SOURCE OF RAW MATERIALS and their storage conditions(Indoor or Outdoor)	<input type="checkbox"/> OK <input type="checkbox"/> Not OK	
	EC grade Aluminium Hindalco Industries Ltd Bharat Aluminium company ltd National aluminium co ltd Vedanta Aluminium company ltd	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No	

[illegible]

	Testing and control room review	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Calibration of testing equipment:	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Your observations and overall summary in about 500 words