



BIHAR STATE POWER TRANSMISSION COMPANY LIMITED

MANUFACTURING QUALITY PLAN – ACSR Zebra Conductor

Manufacturers Details (Name, Works, Address etc.)		Customer	Vendor's Code	Item : ACSR Zebra Conductor	M.Q.P.No. - 040	Valid From : 15.01.2016
		BSPTCL			Rev. No. 00	Valid upto : Till Revision
					Date : 07.01.2016	
Code 1	Indicates place where testing is planned to be performed i.e. Inspection location.			Code 2	Indicates who has to perform the tests i.e. Testing Agency	
A	At conductor manufacturer's works			J	The Conductor Manufacturer	
B	At Component manufacturer's works			K	The Component Manufacturer	
C	At authorized distributors place			L	The Third Party	
D	At independent Lab.			M	The Turn key Contractor	
E	At turn key contractor's location					
F	Not Specified					
Code 3	Indicates who shall witness the tests i.e. Witnessing Agency			Code 4	Review of Test Reports/Certificates	
P	Component Manufacturer itself			W	By conductor Manufacturer	
Q	Component Manufacturer and conductor Manufacturer			X	By Contractor during product/process inspection	
R	Component Manufacturer, Conductor Manufacturer and Contractor			Y	By BSPTCL during product/process inspection.	
S	Conductor Manufacturer itself			Z	By Contractor and /or BSPTCL during product/process inspection.	
T	Conductor Manufacturer and Contractor					
U	Conductor Manufacturer, Contractor and BSPTCL					
V	Third Party itself					
Code 5	Whether specific approval of sub-vendor / component make envisaged?			Code 6	Whether test records required to be submitted after final inspection for issuance of Dispatch Clearances /Instructions ?	
E	Envisaged			Y	Yes	
N	Not Envisaged			N	No	



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NOTES :

1. Proper co-relation of materials with test certificates from Raw Material stage to finished conductor shall be maintained.
2. Galvanized Steel Wire to be procured from BSPTCL approved sources and the conductor manufacturer shall furnish the following test certificates from steel wire manufacturer for review by BSPTCL.
 - Chemical test certificate of Steel Wire Rod manufacturer
 - Test certificate of Zinc manufacturer
 - Test certificates of the tests carried out by steel wire manufacturer on finished steel wire.

The conductor manufacture shall obtain steel wire manufacturers test certificates for galvanized steel wire atleast 20% of the coils & conductor manufacturer shall carry out tests on 10% of coils on receipt of steel wire.
3. The conductor manufacturer will carry out the acceptance test on aluminium and steel strands on 10% of the drums offered for inspection and will submit the records at the time of BSPTCL inspection.
4. Adequate care shall be taken to avoid damages to galvanising during preforming and post forming operations.
5. Valid calibration certificates of various testing and measuring equipments by NABL accredited agencies and standard resistance for verification of Resistance bridges shall be available at conductor manufacturer works.
6. The area where conductor is to be manufactured (stranding m/c & rewinding m/c) shall be covered with rubber mat/ coir mat/ Wooden floor, etc.
7. All guides, rollers, pulleys etc. used for manufacturing conductor shall be of Nylon/ Hylum/ Teflon or other soft material instead of steel.
8. Finished conductor shall be checked for length verification and surface finish on separate rewinding machine at variable speed from 8 to 16 mtr/ minute.

The rewinding facilities shall have appropriate clutch system and shall be free from vibration and jerks etc. with traverse laying facilities.

If length is found less than declared length during rewinding, then two drums from the same lot shall be verified for declared length. In case any of these drums is found have less length, the lot will be rejected otherwise lot shall be accepted with the actual length.

In case of defects in surface finish, additional two drums shall be taken for rewinding & if same problem is observed the entire lot shall be rejected.



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- 9 The conductor manufacturer shall maintain records of the joints in inner layer of the conductor for all the drums and shall submit the records to BSPTCL for review at the time of inspection.
- 10 The conductor ends are required to be sealed with heat shrinkable sleeves and shall be properly secured with the drum by "U" clamps (nail) after covering the conductor with PVC adhesive tape to avoid loosening of conductor layers during transit and handling.
- 11 The drums shall be suitable for wheel mounting and letting off the conductor under an minimum controlled tension of the order of 5 KN.
- 12 The inner cheek of the flanges & drum barrels surface shall be painted with Bitumen based paint. Before reeling, thick bituminized water proof bamboo paper shall be secured on the drum barrel and inside of the flanges of drum. After reeling the conductor, the exposed surface of the outer layer of the conductor shall be wrapped with water proof thick bituminised bamboo paper & then transparent plastic sheet.
- 13 The wood used in the drum shall preferably be neutral(non corrosive)with pH (aqueous extract) 5.5 to 7.5 and the wood preservative Copper used compound shall be avoided.
- 14 The manufacturer may supply the conductor in non-returnable painted steel drums. After preparation of steel surface according to IS 9954, synthetic enamel paint shall be applied after one coat of primer.
- 15 Conductor manufacturer has to ensure marking of Dispatch Clearances /Instructions no on all drums before dispatch and a copy of Dispatch Clearances /Instructions along with the test reports should be sent to the site along with the dispatches.
- 16 The Lay ratio of any Aluminium layer shall not be greater than the lay ratio of Aluminium layer immediately beneath it.
- 17 The MQP should be read in conjunction with the applicable technical specification against which the conductor is being manufactured.and in case any contradiction between technical specification / Approved drawing and MQP, detailed mentioned in Technical Specification and Approved drawing shall be final.
- 18 Standard length & random length of conductor shall be governed as specified in BSPTCL technical specification.
- 19 Rejection & retests shall be as per IS 398.
- 20 During conductor inspection, inspection engineer shall have to check tensile strength and conductivity of received aluminium wire rod at conductor manufacturer works and shall review the records

A. Section: RAW MATERIAL INSPECTION

1.2	Aluminium Wire Rod Chemical Composition	Spectro	Suppliers TC	Suppliers TC	Al 99.5 % min & Cu 0.04 % max	Suppliers TC	B	K	P	W	E	N	
1.2.2	Diameter	Dimensional	1 sample from each coil.	IS 5484 and BSPTCL Spec.	Min. 9.00 mm, Nom. 9.50mm Max. 10.00 mm	Supplier TC & BSPTCL Report	A/B	J/K	S/P	Y	-	N	
1.2.3	Tensile Strength	Mechanical	1 sample from each coil.	IS 5484 and BSPTCL Spec.	Min. 10.50 Kg/mm ²	Supplier TC & BSPTCL Report	A/B	J/K	S/P	Y	-	N	
1.2.5	Conductivity	Electrical	1 sample from each coil.	IS 5484, IEC 8898 and BSPTCL Spec.	Min. Conductivity 61.0 % of IACS.	Supplier TC & BSPTCL Report	A/B	J/K	S/P	Y	-	N	



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Sr. No.	Components/ Operations & Description of Test	Type of Check	Quantum of Check/ Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
2.0	High Tensile Galvanized Steel Wire Chemical Analysis	Chemical	One sample/lot of 100 MT or part thereof per supplier to be tested on receipt by conductor manufacturer	BSPTCL Spec.	C 0.50 to 0.85 % Mn 0.50 to 1.10 % Si 0.10 to 0.35 % P 0.035 % (max) S 0.045 % (max)	Supplier TC	B	K	P	W	E	N	
2.1.0						TPL report	D	L	V	Z		N	
2.1.2	Diameter	Dimensional	20 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	As per Approved Technical specification	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.3	Tensile Strength/ Breaking Load	Mechanical	20 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	As per Approved Technical specification	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.4	Elongation at break	Mechanical	20 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	Min.4.0 %at 250 mm gauge length.	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.5	Torsion Test	Mechanical	20 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	Min.18 twist on a gauge length of 100xdiameter of wire	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.6	Wrapping Test	Mechanical	20 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	Wrap-8,unwrap-6 & wrap-6 On a mendrel having diameter equal to 4 x diameter of wire. The wire shall not break.	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL Report	A	J	S	Z		N	



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2.1.7	Adhesion Test	Mechanical	20 % Coils per lot	IS 4826 and BSPTCL Spec.	The Zinc coating shall remain adherent to the steel wire when wound 10 turns on a mandrel having diameter equal to 4 x The diameter of wire	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.8	Preece Test (Dip Test)	Chemical	20 % Coils per lot	IS 4826 and BSPTCL Spec.	As per Approved Technical specification	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL	A	J	S	Z		N	
2.1.9	Mass of Zinc coating	Chemical	20 % Coils per lot	IS 4826, IS 6745 and BSPTCL Spec.	As per Approved Technical specification	Suppliers TC	B	K	P	Z	-	N	
			10% Coils per lot			BSPTCL	A	J	S	Z		N	
2.1.10	Surface finish of GS Wire coils	Visual	100 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	The Wires shall be smooth, uniform and free from imperfections such as spills, splits, scale inclusion, die marks, scratches, abrasion, blow holes etc.	Suppliers TC	B	K	P	Z	-	N	
			100 % Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.11	Check for Joints	Visual	100 % Coils per lot	IS 398 Pt.-2,Pt- 5 , IEC 888 & BSPTCL Spec.	There shall be NO JOINT	Suppliers TC	B	K	P	Z	-	N	
			100 % Coils per lot			BSPTCL Report	A	J	S	Z		N	
2.1.12	Purity of Zinc	Chemical	1 sample for every lot of 100 MT or part thereof	IS 209,IEC 888/1987 and BSPTCL Spec.	Min. Purity of Zinc 99.95 %	Suppliers TC	D	L	V	Z	-	N	



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							1	2	3	4	5	6	
B.	SECTION:IN PROCESS INSPECTION												
3.0	Aluminium Drawn Wire												
3.0.1	Diameter of Drawn Aluminium Wire	Dimensional	one sample from first, middle & last drawn wire coil from each wire rod	IS 398-P-2 & 5 and BSPTCL Spec.	As per Approved Technical specification	BSPTCL Report	A	J	S	W	-	N	
3.0.2	Breaking Load/ Tensile strength	Mechanical	one sample from first, middle & last drawn wire coil from each wire rod	IS 398-P-2 & 5 and BSPTCL Spec.	As per Approved Technical specification	BSPTCL Report	A	J	S	W	-	N	
3.0.3	Resistance	Electrical	one sample from first, middle & last drawn wire coil from each wire rod	IS 398-P-2 & 5 and BSPTCL Spec.	As per Approved Technical specification	BSPTCL Report	A	J	S	W	-	N	
3.0.4	Wrapping Test	Mechanical	one sample from first, middle & last drawn wire coil from each wire rod	IS 398-P-2 & 5 and BSPTCL Spec.	Wrap-8,unwrap-6 & wrap-6 turns on the wire itself. The wire shall not break.	BSPTCL Report	A	J	S	W	-	N	



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							1	2	3	4	5	6	
4.0	Steel Stranding Process												
4.1	Lay Ratio/ Direction & Compactness	Measurement and Visual	At the beginning of Each set up	IS 398-P-2 & 5 and BSPTCL Spec..	As per Approved Technical specification	BSPTCL Report	A	J	S	W	-	N	
4.2	Pre-forming and post forming of Steel core	Visual	One sample from each length	IS 398-P-2 & 5 and BSPTCL Spec..	No Spreading of strands when composite core wire is cut	BSPTCL Report	A	J	S	W	-	N	
4.3	Check for Joints	Visual	100 % on each drum	IS 398-P-2 & 5 and BSPTCL Spec..	There shall be NO JOINT	BSPTCL Report	A	J	S	W	-	N	
4.4	surface smoothness	Visual	100 % on each drum	IS 398-P-2 & 5 and BSPTCL Spec..	The wire shall be free from defects	BSPTCL Report	A	J	S	W	-	N	
5.0	Final Conductor Stranding Process												
5.1	Lay Ratio/ Direction & Compactness	Physical	At the beginning of Each set up	IS 398-P-2 & 5 and BSPTCL Spec..	As per Approved Technical specification	BSPTCL Report	A	J	S	W	-	Y	
5.20	Check for Joints	Visual	100 % on each drum	IS 398-P-2 & 5 and BSPTCL Spec..	There shall be NO JOINT in on the outermost layer. Joints are allowed in inner layers but no two such joints shall be less than 15 meters apart in completed conductor.	BSPTCL Report	A	J	S	W	-	N	



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							1	2	3	4	5	6	
5.30	Surface smoothness of Strands and stranded conductor	Visual	100%	IS 398-P-2 & 5 and BSPTCL Spec..	The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protrusion of wires), wires cross over, over riding, looseness (wire being dislocated by finger/hand pressure and or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot, dirt, grit, etc.	BSPTCL Report	A	J	S	W	-	N	
5.40	Conductor Packing (in process)	Visual	100%	IS 398-P-2 & 5 and BSPTCL Spec..	Medium grade Kraft/crepe paper shall be used in between the layers of conductor. After reeling the conductor, the exposed surface of the outermost layer of conductor shall be wrapped with water proof thick bituminized paper.	BSPTCL Report	A	J	S	W	-	N	



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C. Section: FINAL TESTING

6.0	Routine Test on Finished Conductor																
6.1.	All acceptance tests	-	10 % of the drums	IS 398-P-2 & 5 and BSPTCL Spec..	Shall pass all the requirements.	BSPTCL Report	A	J	S	Z	-	N					
6.2	Check for Joints, Surface condition of strands and stranded conductor.	-	100 % on each drum	IS 398-P-2 & 5 and BSPTCL Spec...	Shall pass all the requirements.	BSPTCL Report	A	J	S	Z	-	N					
Sr. No.	Components/ Operations & Description of Test	Type of Check	Quantum of Check/ Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks				
							1	2	3	4	5	6					
7.0	Acceptance Tests on Finished Conductor.																
7.1	Lay Ratio / Direction & Compactness	Physical	15% of offered drums	BSPTCL Spec..	Steel layer- 13 to 18 Inner Al. layer- 10 to 17 Middle Al layer-10 to 16 Outer Al layer-10 to 14	Inspection test report	A	J	U	Y	-	Y					
7.2	Acceptance Tests on Aluminum Strands of Finished Conductor.																
7.2.1	Diameter of Aluminium strands	Dimensional	10% of offered drums	IS 398-P-2 & 5 and BSPTCL Spec.	3.18 ±0.03 mm	Inspection test report	A	J	U	Y	-	Y					
7.2.2	Breaking Load/ Tensile strength	Mechanical	10% of offered drums	IS 398-P-2 & 5 and BSPTCL Spec.	1.23 kN min	Inspection test report	A	J	U	Y	-	Y					
7.2.3	Resistance	Electrical	10% of offered drums	IS 398-P-2 & 5 and BSPTCL Spec.	0.003626 ohm/mtr maximum at 20 °C	Inspection test report	A	J	U	Y	-	Y					
7.2.4	Wrapping Test	Mechanical	10% of offered drums	IS 398-P-2 & 5 and BSPTCL Spec.	As per IS	Inspection test report	A	J	U	Y	-	Y					
7.2.5	UTS test on welded joints of Aluminium/ Al alloy strands by cold pressure butt welding machine	Mechanical	5 specimen against each lot	IS 398-P-2 & 5 and BSPTCL Spec.	1.23 kN min	Inspection test report	A	J	U	Y	-	Y					



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7.3	Acceptance Tests on Galvanised Steel strands of Finished Conductor.												
7.3.1	Diameter	Dimensional	10% of offered drums	IS 398-P-2.5, IEC-888 and BSPTCL Spec..	3.18 ±0.06 mm	Inspection test report	A	J	U	Y	-	Y	
7.3.2	Tensile Strength/ Breaking Load	Mechanical	10% of offered drums	IS 398-P-2.5, IEC-888 and BSPTCL Spec..	9.91 kN min	Inspection test report	A	J	U	Y	-	Y	
7.3.3	Elongation at break	Mechanical	10% of offered drums	IS 398-P-2.5, IEC-888 and BSPTCL Spec..	min 4% on gauge length of 250 mm	Inspection test report	A	J	U	Y	-	Y	
7.3.4	Torsion Test	Mechanical	10% of offered drums	IS 398-P-2.5, IEC-888 and BSPTCL Spec..	min 16 twists in gauge length equal to 100 times the dia of wire	Inspection test report	A	J	U	Y	-	Y	
7.3.5	Wrapping Test	Mechanical	10% of offered drums	IS 398-P-2.5, IEC-888 and BSPTCL Spec..	Wrap-8,unwrap-6 & wrap-6 On a mandrel having diameter equal to 4 x diameter of wire. The wire shall not break.	Inspection test report	A	J	U	Y	-	Y	
7.3.6	Adhesion Test	Mechanical	10% of offered drums	IS 398-P-2.5, IEC-888 and BSPTCL Spec..	The Zinc coating shall remain adherent to the steel wire when wound 10 turns on a mandrel having dia. 4x dia. of wire	Inspection test report	A	J	U	Y	-	Y	
7.3.7	Preece Test (Dip Test)	Chemical	10% of offered drums	IS 398-P-2.5, IS 4826, IEC-888 and BSPTCL Spec..	2 dips of 1 min & 1 dip of 0.5 minute	Inspection test report	A	J	U	Y	-	Y	
7.3.8	Mass of Zinc coating	Chemical	15% of offered drums	IS 398-P-2.5, IS 4826, IEC-888 and BSPTCL Spec..	240 gms/sq mtr	Inspection test report	A	J	U	Y	-	Y	



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7.4	Length measurement of Finished Conductor												
7.4.1	Check for joints, surface finish and length measurement by rewinding	Visual & Measurement	2 drums per offered lot	IS 398-P-2 & 5 and BSPTCL Spec..	No scale on the surface and the surface shall be free from any imperfections. No joint on the outermost layer. The conductor length should be as per the offered packing list & drums as per approved drawing.	Inspection test report	A	J	U	Y	-	Y	
8.0	Wooden Drums and packing materials												
8.1	Dimensional check of wooden drums	Dimensional	One sample from every 10 Drums or part thereof	IS : 1778 & BSPTCL approved Drum drawing	BSPTCL approved drum drawing	Inspection test report	A	J	U	Y	-	Y	
8.2	Barrel Batten Test	Mechanical	One sample from every 10 Drums or part thereof	IS 1778	Barrel Baten strength Min. 300 Kgf.	Inspection test report	A	J	U	Y	-	Y	
8.3	Chemical Test on water proof bituminised bamboo paper	Chemical	One sample per batch of paper	-	Chloride - 0.05 % max., Sulphate- 0.25 % max., Copper - 0.01 % Max., pH- 5.5 to 7.5	TPL report	D	L	V	Y	-	N	
8.4	Visual check of wooden drums	Visual	100% drums	IS : 1778 & BSPTCL approved Drum drawing	The inner cheek of the flanges & drum barrels surface shall be painted with Bitumen based paint. Before reeling, card board or double corrugated or Thick bituminized water proof bamboo paper shall be secured to the drum barrel and inside of the flanges of drum	Inspn. Report	A	J	U	Y	-	Y	



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9.0	Packing, Marking and Dispatch												
9.1	Application of water proof bituminised bamboo paper	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Joint Inspn. Report	A	J	S/U*	Y	-	N	*100 % by Conductor manufacturer & 10 % by BSPTCL
9.2	Distance between outermost layer and inner surface of protective	Visual	100%	BSPTCL Spec..	BSPTCL Spec... (Min - 75mm)	Packing List	A	J	S/U*	Y	-	N	
9.3	No. of turns in outer most layer	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.4	Contract/ Award Letter no.	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.5	Manufacturer's Name and Address	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.6	Drum No.	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.7	Size and Code Name of Conductor	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.8	Length of Conductor	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.9	Gross weight of drum after Lagging	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.10	Tare weight with lagging	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.11	Net weight of conductor in the Drum without Lagging	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	
9.12	Arrow Marking for rolling the conductor drum	Visual	100%	BSPTCL Spec..	BSPTCL Spec..	Packing List	A	J	S/U*	Y	-	N	



BIHAR STATE POWER TRANSMISSION COMPANY LIMITED

MANUFACTURING QUALITY PLAN – ACSR Zebra Conductor

Manufacturers Details (Name, Works, Address etc.)		Customer	Vendor's Code	Item : ACSR Zebra Conductor	M.Q.P.No. - 040	Valid From : 15.01.2016							
		BSPTCL			Rev. No. 00	Valid upto : Till Revision							
					Date : 07.01.2016								
Sr. No.	Components/ Operations & Description of Test	Type of Check	Quantum of Check/ Sampling with basis	Reference document for Testing	Acceptance Norms	Format of Record	Applicable Codes						Remarks
							1	2	3	4	5	6	
9.13	A) Top End of the conductor in each drum are sealed with adhesive Tamper proof sticker duly signed by Inspection Engineer. B) Lead sealing with plier and identification no. at both ends. (C) The conductor ends are required to be sealed with heat shrinkable sleeves and shall be properly secured with the drum with the help of "U" clamps (nail) after covering the conductor below clamp with PVC adhesive tape to avoid loosening of conductor layers during transport and handling.	Visual	100%	BSPTCL Spec..	BSPTCL Spec..		A	J	U	Y	-	Y	100% by BSPTCL
9.14	Position of conductor ends	Visual	100%	BSPTCL Spec..	BSPTCL Spec..		A	J	S/U*	W	-	N	*100% by conductor manuf. & 10% by BSPTCL
9.15	Tack welding on Nuts on the barrel and Hub Plates.	Visual	100%	BSPTCL Spec..	BSPTCL Spec..		A	J	S/U*	W	-	N	
9.16	Name and address of consignee	Visual	100%	BSPTCL Spec..	BSPTCL Spec..		A	J	S/U*	Y	-	N	