

**MADHYA PRADESH POWER TRANSMISSION CO. LTD.,  
JABALPUR**

**BID IDENTIFICATION NO. JICA-II/MPPTCL/TR-203**

**FOR PROCUREMENT OF**

**ACSR ZEBRA AND ACSR PANTHER CONDUCTOR**

**VOLUME-II**

**TECHNICAL SPECIFICATION**

This Volume describes all technical requirements for ACSR Panther Conductor which is covered under Bid Identification No. JICA-II/MPPTCL/TR-203 in the following one lot:

<b>Package No.</b>	<b>Particulars</b>	<b>Total Quantity covered</b>
<b>3</b>	<b>A. ACSR ZEBRA CONDUCTOR</b>	<b>1200 Kms</b>
	<b>B. ACSR PANTHER CONDUCTOR</b>	<b>2000Kms</b>

**NOTE: While submitting bid for the above it should be ensured that the bid is complete in all respects i.e. all Schedules from II to XII duly filled in and signed with supporting documents must be furnished.**

## **VOLUME-II**

### **A. TECHNICAL SPECIFICATION OF ACSR ZEBRA CONDUCTOR**

#### **1.0 SCOPE :**

**1.1** This specification provides for standard design, manufacture, stage testing, inspection and testing before despatch, packing and delivery of Steel Cored Aluminium Conductor specified hereunder for their satisfactory operation in various lines and sub-stations of the State. The Conductor is to be used as power conductor on single circuit and double circuit transmission lines and sub-stations.

**1.2** Bidders are required to quote for supply of all materials as detailed in the specification. The bidder shall furnish full particulars as called for in various clauses, in addition to filling and completing the schedules annexed to this specification.

**1.3** The unit rate quoted shall be inclusive of deployment of all plant, equipment, men, material, skilled & unskilled labors etc. essential for satisfactory supply of ACSR Zebra.

**1.4** All the raw materials for supply of ACSR Zebra shall be included in the Bidder's scope of supply. Bidder shall clearly indicate in Schedule-VIII, the sources from where he proposes to procure the raw materials.

#### **2.0 STANDARDS:**

The power conductor shall conform to the following Indian Standards, which shall mean latest revisions, amendments/changes adopted and published, unless otherwise specified hereinbefore.

<b>S. No.</b>	<b>Indian Standards or any Equivalent International Standard</b>	<b>Title</b>
1	IS:209	Specification for Zinc
2	IS:398 Part I to Part V (as relevant)	Specification for Aluminium Conductors for overhead Transmission purpose.
3	IS:1778	Reels and drums for Bare wires
4	IS:1521	Method of Tensile Testing of Steel wire
5	IS:2629	Recommended practice for Hot Dip Galvanising Iron and Steel
6	IS:2633	Method of Testing Uniformity of Zinc coating of Zinc coated Articles.
7	IS:4826	Galvanised coating on Round Steel wire
8	IS:6745	Method of Determination of weight of Zinc coating of zinc coated Iron and Steel Articles

S. No.	Indian Standards or any Equivalent International Standard	Title
9	IS:8263	Method of Radio Interference Tests
10	IS:1841	EC Grade Aluminium Rod produced by rolling
11	IS:5484	EC grade Aluminium Rod produced by continuous casting and rolling
12	IS: 2141	Method of Elongation test of steel wire

### 2.1 Acceptance of Other Authoritative Standards :

In the paragraph above, relevant Indian standards have been mentioned. However, the ACSR Zebra meeting any other authoritative international standard, which ensures equal or better quality than the standards, mentioned above shall also be acceptable. Please attach photocopy of all such standards according to which the, ACSR Zebra have been offered.

In this bid, the Bidders will have to furnish confirmation in regard to compliance of our entire technical requirement. The bid should clearly describe various technical particulars of the, ACSR Zebra as per details given in this specification.

### 3.0 CLIMATIC CONDITIONS :

3.1 The ACSR conductor shall be suitable for being installed directly in air supported with suspension insulator strings or anchored through tension insulator strings supported with hanger/suspension clamp or tension clamp at the cross arms of single circuit and double circuit transmission line towers. The conductor shall be therefore suitable for satisfactory continuous operation under the following climatic conditions:

1	Location in the state of	MADHYA PRADESH
2	Maximum ambient air temperature ( $^{\circ}\text{C}$ )	50.
3	Minimum temperature in shade ( $^{\circ}\text{C}$ )	1.
4	Maximum relative humidity (%)	95 (sometimes approaches saturation)
5	Average daily ambient air temperature ( $^{\circ}\text{C}$ )	40 $^{\circ}$ Centigrade
6	ISOCERANIC Level (days/year) (Average number of thunder storm days)	50
7	Average rainfall(mm)	1250
8	Maximum wind pressure (kg/ square metre)	150
9	Max. Altitudes above mean sea level (metres)	1000
10	Seismic level (Horizontal acceleration) (g)	0.3

**NOTE: Moderately hot and humid tropical climate conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Stroke is also present in the atmosphere. Heavy lightning also occurs during June to October.**

#### 4.0 PARAMETERS :

#### 4.1 Principal Parameters of Stranded Conductor:

S. No.	Details of Stranded Conductor	ACSR Zebra
a)	No. of Strands	Aluminium-54 Steel –7
i.	Steel Centre	1
ii.	1 <sup>st</sup> Steel Layer	6
iii.	1 <sup>st</sup> Aluminium Layer	12
iv.	2 <sup>nd</sup> Aluminium Layer	18
v.	3 <sup>rd</sup> Aluminium Layer	24
b)	Sectional Area of Aluminium (Sq.mm)	428.9
c)	Total Sectional Area (Sq.mm)	484.50
d)	Overall diameter(mm)	28.62
e)	Approximate weight (Kg/Km )	1621
f)	Calculated D.C. Resistance at 20 Deg.C (Ohm/Km)	0.06915
g)	Minimum UTS (kN)	130.32
h)	Modulus of Elasticity GN/SqMtr	69

#### 4.1.1 The details of Aluminium strand are as follows :

S. No.	Details of Aluminium Strands	ACSR Zebra
i)	Minimum breaking load of strand Before stranding (kN)	1.29
j)	Minimum breaking load of strand after stranding (kN)	1.23
k)	Maximum D.C. resistance of strand at 20 deg.C (Ohm/Km)	3.651
l)	Nominal Strand Dia	3.18
m)	Max. Strand Dia	3.21
n)	Min. Strand Dia	3.18
o)	Mass (Kg/Km) of Strand at Nominal dia	21.47

#### 4.1.2. The details of steel strand are as follows:

S. No	Details of Steel Strands	ACSR Zebra
p)	Minimum breaking load of strand Before stranding (kN)	10.43
q)	Minimum breaking load of strand after stranding (kN)	9.91
r)	Nominal Strand Dia	3.18

<b>S. No</b>	<b>Details of Steel Strands</b>	<b>ACSR Zebra</b>
s)	Maximum Strand Dia	3.24
t)	Minimum Strand Dia	3.18
u)	Mass (Kg/Km) of Strand at Nom. dia	61.95
v)	Zinc coating testing	3 dips of 1 min. each
w)	Wt. Of Zinc Coating (gms/sq. metre)	260

## **5.0 GENERAL TECHNICAL REQUIREMENTS : MATERIAL AND WORKMANSHIP (FOR ACSR ZEBRA):**

### **5.1 Materials:**

**5.1.1** The conductors shall be manufactured from EC grade aluminium rods suitably hard-drawn on wire drawing machines. The aluminium rods used shall comply with IS: 1841 and IS: 5484 or any equivalent International Standard. The mechanical and electrical properties of aluminium wire shall comply with the requirements given in relevant standard.

### **5.1.2 Physical constants for Hard-drawn Aluminium:**

#### **5.1.2.1 Resistivity:**

The resistivity of aluminium depends upon its purity and its physical condition. For the purpose of this specification the maximum value permitted is 0.28264 Ohm sq.mm/mt. at 20° C and this value has been used for calculation of the maximum permissible value of resistance.

**NOTE :** It is not intended to check the resistivity from the measured values of resistance.

#### **5.1.2.2 Density:**

At a temperature of 20° C the density of hard drawn aluminium has been taken as 2.703 g/cm.<sup>3</sup>

#### **5.1.2.3 Constant-Mass Temperature Co-efficient of Resistance:**

At a temperature of 20°C, the constant-mass temperature co-efficient of resistance of hard drawn aluminium measured between two potential points rigidly fixed to the wire, the metal being allowed to expand freely, has been taken as 0.004 per degree Celsius.

#### **5.1.2.4 Co-efficient of Linear Expansion:**

The co-efficient of linear expansion of hard-drawn aluminium at 0° C has been taken as  $23.0 \times 10^{-6}$  per ° C. This value holds good for all practical purposes over the range of temperature from 0 ° C to highest safe operating temperature.

**5.1.3** Galvanised steel wire shall be drawn from high carbon steel rods produced by either acidic or basic open hearth process, electric furnace process or basic oxygen

process. The mechanical and electrical properties of wire shall comply with the requirements given in relevant standard. The chemical composition of high carbon steel wires is given below for guidance only.

<b>Element</b>	<b>Percentage Composition</b>
Carbon	0.5 to 0.85
Maganese	0.50 to 1.10
Phosphorous	Not more than 0.035
Sulphur	Not more than 0.045
Silicon	0.10 to 0.35

### **5.1.3.1 Physical constants for Galvanised steel wires:**

#### **5.1.3.1.1 Density :**

At a temperature of 20° C, the density of galvanized steel wire is to be taken as 7.80 g/Cm<sup>3</sup>.

#### **5.1.3.1.2 Coefficient of Linear Expansion :**

In order to obtain uniformity in calculation a value of  $11.5 \times 10^{-6} \text{ }^\circ \text{C}$  may be taken as the value for the co-efficient of Linear Expansion of galvanized steel wires used for the cores of steel-reinforced aluminium conductors.

**5.1.3.1.3** The zinc used for galvanizing shall be electrolytic high-grade Zinc not less than 99.95 percent purity. It shall conform to and satisfy all the requirements of IS: 209. Galvanising may be done either by hot process or electrolytic process. Minimum weight of Zinc coating shall be 260 g/sq. metre. Neutral grease may be applied between the layers of wire.

#### **5.1.3.1.4 Freedom From Defects:**

The wires shall be smooth and free from all imperfections such as spills, slag inclusion, die marks, scratches, fittings, blow-holes, projections, looseness, overlapping of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding.

## **5.2 Wire Sizes**

### **5.2.1 Nominal Size:**

The aluminium and galvanized steel wires for the stranded conductor covered by this standard shall have diameters specified in clause 4.1.1 & 4.1.2. The diameter of the steel wires shall be measured over the zinc coating.

### **5.2.2 Tolerances on Nominal Size :**

Tolerance of + 1% is permitted on the nominal diameter of Aluminium Wires of Zebra Conductor and a tolerance of + 2 % is permitted on the nominal diameter of Galvanised Steel Core Wire.

### 5.3 Joints in Wires:

#### 5.3.1 Aluminium Wires:

No joints shall be permitted in the aluminium wires in the outermost layer of the ACSR Conductor. Joints in the inner layers are permitted, in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 mtr. apart in the complete stranded conductor such joints shall be made only by cold pressure butt-welding. It may please be noted that Joints are not permitted in the outermost layer of the conductor in order to ensure a smooth conductor finish and reduce radio interference levels and corona losses on extra high voltage lines.

#### 5.3.2 Galvanised Steel Wires:

There shall be no joints except those the base rods or wires before final drawing, in steel wires forming the core of the steel-reinforced aluminium conductor. Joints are not permitted in the steel wires after final drawing also in order to avoid reduction in the breaking strength of the conductor that may occur as a result of failure of the joints.

### 5.4 Stranding :

5.4.1 The wires used in the construction of galvanized steel reinforced aluminium conductor, before stranding, shall satisfy all the relevant requirements of this specification.

5.4.2 The lay ratio of the different layers shall be within the limits given in the Table below:-

#### LAY RATIO OF ALUMINIUM CONDUCTORS GALVANISED STEEL-REINFORCED

Type of Conductor	Ratio of Alu. wire diameter to steel wire diameter	Lay Ratios of Steel core 6 wire layer		Lay Ratios for Aluminium wires (3 Alu. Wire Layer Conductors)					
				Outermost layer		Layer immediately beneath outer most layer		Innermost Layer	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
ACSR Zebra Aluminium-54 Wire Steel - 7 Wire	1	13	28	10	14	10	16	10	17

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

**5.4.3** In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.

**5.4.4** In conductors having multiple layers of aluminium wires, the lay ratio of any aluminium layer shall not be greater than the lay ratio of the aluminium layer immediately beneath it.

**5.4.5** The finished Conductor shall have a smooth surface without any surface cut, abrasion, scuff marks and shall be free from dirt, grit, etc. even if the damage to conductor is acceptable from mechanical considerations. It will not be acceptable from electrical considerations, and full care should be taken not to supply damaged conductor. Projections of more than 2 mils shall not be acceptable. Any such damage shall be properly rectified or new conductor supplied.

**5.4.6** Failure of any sample to meet the above requirements shall be sufficient cause for rejection of the lengths of conductor represented by the sample. Particular care shall, therefore, be taken during manufacture, handling, packing and transportation of the conductor, to see that the surface is not dented, cut or damaged in any way.

## **5.5 Standard Length :**

**5.5.1** The standard length of conductor shall be 1500 metres. A tolerance of +/-5% on the standard length offered by the supplier shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

**5.5.2** Random lengths will be accepted provided no length is less than 70% of the standard length specified and the total quantity of such random lengths shall not be more than 5% of the total quantity ordered.

**5.5.3** Supplier shall also indicate the maximum single length, above the standard length, they can manufacture in the guaranteed technical particulars. This is required for special stretches like river crossing etc. The purchaser reserves the right to place orders for the above length to the 5% of the total ordered quantity on the same terms and conditions applicable for the standard lengths during the pendency of the contract.

## **5.6 Galvanising:**

**5.6.1** All the wires of Iron & steel strand shall be galvanized in accordance with IS-2629-1966. 'Recommended practice for hot dip galvanizing of Iron and Steel' or some other authoritative equivalent standard.

**5.6.2.** Specific technical requirements for galvanizing and relevant tests quoted in clause-6 of this specification for guidance shall be complied.

## **6.0 TESTS :**

**6.1** The conductor offered shall be type tested as per the relevant standards. Further the acceptance, routine tests and tests during manufacture shall be carried out on the conductor.



**6.1.1** Type tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this specification.

**6.1.2** All the materials offered shall be fully type tested as per the relevant standards and the supplier shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years, prior to the date of opening of bid. For any change in the design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of tests without any extra cost.

**6.1.3** Acceptance tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-despatch inspection, for the purpose of acceptance of that lot.

**6.1.4** Routine tests shall mean those tests which are to be carried out on each strand/spool/length of the conductor to check requirements which are likely to vary during production.

**6.1.5** Tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the supplier to ensure the desired quality of the end product to be supplied by him.

**6.1.6** The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Supplier and the Purchaser as per relevant clause of General Conditions of Contract.

**6.1.7** The standards and norms to which these tests will be carried out are listed in para 2.0. Where a particular test is a specific requirement of this specification, the norms and procedures of the test shall be as mutually agreed to between the Supplier and the Purchaser in the Quality Assurance Programme.

**6.1.8** For all type and acceptance tests, the acceptance values shall be the values guaranteed by the Supplier in the 'Guaranteed Technical Particulars' of his proposal or the acceptance value specified in this specification, whichever is more stringent for that particular test.

**6.1.9 Type Tests :**

The Conductor offered shall be fully type tested as per the relevant International/Indian Standard and the bidder shall furnish the report along with the offer. These tests must not have been conducted earlier than 5 years prior to the date of opening of bid. For any change in the design/type, already type tested and the design/type offered against this bid, the purchaser reserves the right to demand repetition of some or all type tests without any extra cost.

The above said test reports submitted with the offer shall not be older than five years, prior to the date of opening of bid.

- a) UTS test on stranded conductor
- b) DC resistance test on stranded conductor
- c) Stress-strain test on composite conductor

**Acceptance Tests :**

- a) Visual and dimensional check
- b) Visual check for joints, scratches etc. and lengths of conductor
- d) Dimensional check on steel and aluminium strands
- d) Check for lay ratios of various layers
- e) Galvanising test on steel strands
- f) Torsion and Elongation test on steel wire
- g) Breaking load test on steel and aluminium strands
- h) Wrap test on steel and aluminium strands
- i) DC resistance test on aluminium strands
- j) UTS test on welded joint of aluminium strand

**NOTE:** All the above tests except test mentioned at (j) shall be carried out on aluminium and steel strands after stranding only.

**6.1.10 Routine Test :**

- a) Check to ensure that the joints are as per specification.
- b) Check that there are no cuts, fins etc. on the strands.
- c) Check that drums are as per specifications.
- d) All acceptance tests as mentioned in Clause 6.1.10 above shall be carried out on each coil.

**6.1.11 Tests During Manufacture :**

- a) Chemical analysis of zinc used for galvanizing
- b) Chemical analysis of aluminium for making aluminium strands
- c) Chemical analysis of steel used for making steel strands

**6.1.13 Testing Expenses:**

The entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor, except for the expenses of the inspection/Purchaser's representative.

**6.1.14 Additional Tests:**

The Purchaser reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specification.

**6.1.15 Sample Batch for Type Testing**

- (a) The bidder shall offer at least three (3) drums for selection of samples required for conducting all the type tests, in case of change in design/type

already tested and the design type offered against this specification, which the purchaser reserves the right to demand carrying out type test without any extra cost.

- (b) The bidder is required to carry out all the acceptance tests successfully in the presence of Purchaser's representative before despatch of conductor.

#### **6.1.16 Test Reports**

- (a) Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Purchaser's representative.
- (b) Test Certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Purchaser.

#### **6.1.17 Test Facilities**

The following additional test facilities shall be available at Bidder's Works.

- (a) Calibration of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
- (b) Standard resistance for calibration of resistance bridges.
- (c) Finished conductor shall be checked for length verification and surface finish on separate rewinding machine at reduced speed (variable from 8 to 16 metres per minute). The rewinding facilities shall have appropriate clutch system and free of vibrations, jerks etc. with transverse layering facilities.

### **7. INSPECTION :**

**7.1** The purchaser's representative shall at all times be entitled to have access to the works and all places of manufacture where conductor/earth wire shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Supplier's works, raw materials and process of manufacture for conducting necessary tests as detailed herein.

**7.2** The Supplier shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of conductor/earth wire in its various stages so that arrangements can be made for inspection.

**7.3** No material shall be despatched from its point of manufacture before it has been satisfactorily inspected and tested, unless the inspection is waived off by the purchaser in writing. In the later case also, the conductor shall be despatched only after satisfactory testing for all tests specified herein has been completed.

**7.4** The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.

**7.5** At least 5% of the total number of drums subject to minimum of two in any lot put up for inspection, shall be selected at random to ascertain the length of conductor by following method:

“At the works of the manufacturer the conductor shall be transferred from one drum to another at the same time measuring its length with the help of graduated pulley and Cyclometer. The difference in the average length thus obtained and as declared by the supplier in the packing list shall be applied to all the drums if the conductor is found short during checking”

## **8.0 QUALITY ASSURANCE PLAN :**

**8.1** The Supplier shall invariably furnish following information along with his offer, failing which his offer may be liable for rejection. Information shall be separately given for individual type of equipment offered.

- (i) Statement giving list of important raw materials names of sub supplies for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of Supplier’s representative, copies of test certificates.
- (ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.
- (iii) List of manufacturing facilities available.
- (iv) Level of automation achieved and list of areas where manual process exists.
- (v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- (vi) Special features provided in the equipment to make it maintenance free.
- (vii) List of testing equipments available with the Supplier for final testing of material specified and test plant limitation. If any, vis-a-vis the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviation from specified test requirements.

**8.2** The successful Supplier shall within 30 days of placement of order, submit following information to the purchaser.

- (i) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
- (ii) Type test certificates of the raw material and bought out accessories.

- (iii) Quality assurance plan (QAP) with hold points for Purchaser's inspection. The quality assurance of plan and Purchaser's hold points shall be discussed between the Purchaser and Supplier, before QAP is finalized.

**8.3** The successful Supplier shall submit the routine test certificates of bought out accessories and central excise passes for raw material viz. oil, copper, aluminium, conductor's insulating materials, core material at the time of routine testing of the Conductor.

## **9. DOCUMENTATION :**

**9.1** Six sets of type test reports, duly approved by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply. Adequate copies of acceptance and routine test certificates, duly approved by the Purchaser shall accompany with despatched consignments.

**9.2** The manufacturing of the material shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the material prior to the approval of the drawing shall be at Supplier's risk.

**9.3** Approval of drawing/work by Purchaser shall not relieve the Supplier of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The material shall conform in all respect to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering. Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

## **10 PACKING AND FORWARDING :**

**10.1** The conductor shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength, to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS: 1778 except otherwise specified hereinafter.

**10.2** The drums shall be suitable for wheel mounting and for jetting off the conductor under a minimum controlled tension of the order of 5kN.

**10.3** The standard drum drawings are enclosed however, supplier should submit the proposed drum drawings along with the bid. The same shall be in line with the requirements of standard drawings and as stated herein. After placement of the letter of Award, the supplier shall submit four copies of fully dimensioned drawing of the drum he wishes to supply, for Purchaser's approval, before taking up manufacturing of conductor. After getting approval from the Purchaser, Supplier shall submit 30 more copies of the approved drawing to Purchaser for further distribution and field use at Purchaser's end.

**10.4** All wooden components shall be manufactured out of seasoned soft wood free from such defects that may materially weaken the component part of the drums. Preservative treatment for anti-termite /anti-fungus (Aldrine/Aldruse) shall be applied to the entire drum with preservatives of a quality which is not chemically harmful to the conductor.

**10.5** The flanges shall be of two/three ply construction with each ply at right angles to the other and nailed together. Further the outer face of the flange shall be reinforced with the circumferential battens, fixing in octagonal shape. The nails shall be driven from the inside face of flange, punched and then clenched on the outer face. The tolerance in thickness of each ply shall be +/- 3 mm only. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75 mm. Where a slot is cut in the flange to receive the inner end of the conductor, the entrance shall be in line with the periphery of the barrel. Spindle hole shall be provided at the centers of the planks of the plies and spindle plates with 102 mm dia. Holes shall be fitted on either side of both the flanges.

**10.6** The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.

**10.7** Barrel studs shall be used for construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing. Barrel studs should be tack welded with the nuts after tightening.

**10.8** Normally, the nuts on the studs shall stand protrude of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be counter sunk. The ends of barrel shall generally be flushed with the top of the nuts.

**10.9** The inner cheek of the flanges and drum barrel surface shall be painted with a bitumen based paint.

**10.10** Before reeling, cardboard or double corrugated or thick bituminised waterproof bamboo paper shall be secured to the drum barrel and inside of flanges or the drum by means of a suitable commercial adhesive material. The paper should be dried before use. Medium grade craft paper shall be used in between the layer of the conductor/earth wire. After reeling the conductor the exposed surface of the outer layer of conductor shall be wrapped with thin polythene sheet across the flanges to preserve the conductor from dirt, grit and damage during transportation and handling and also to prevent ingress of rain water during storage/transport.

**10.11** Minimum space of 125 mm shall be provided between the inner surface of the external protective layer and outer layer of the conductor.

**10.12.** Each batten shall be securely nailed across grains as far as possible to the flange edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nail shall not protrude above the general surface and shall not have exposed sharp edges or allow the battens to be released due to corrosion.

**10.13.** Outside the protective layer, there shall be minimum of two binder consisting of hoop iron/galvanized steel wire. Each protective layer shall have two recess to accommodate the binders.

**10.14.** The conductor ends shall be properly sealed and secured with the help of U-nails on one side of the flanges. The end securing shall be done by taking out at least 500 mm of steel core on either ends by U-nails. The composite conductor shall be binded by use of galvanized steel wire/aluminum wire at three locations at least 75 mm apart or more covered with PVC adhesive tape so as to avoid loosening of conductor layers in transit and handling.

**10.15.** Only one length of conductor shall be wound on each drum.

## **11. MARKING :**

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- i. Contract/Award letter number
- ii. Name and address of consignee
- iii. Manufacturer's name and address
- iv. Drum number
- v. Size of conductor
- vi. Length of conductor in metres
- vii. Gross weight of drum with conductor
- viii. Weight of empty drum with protective lagging
- ix. Arrow marking for unwinding

## **12 END SEALING :**

Both the ends of each length of conductor should be provided with non-destructive type metal crimped or epoxy capped seals with punching embossing/ engraving of manufacturer's monogram and drum number.

### **13 CHECK MEASUREMENT**

- 13.1.** At least 5% of the total number of drums in any lot put up for inspection shall be selected at random to ascertain the length of conductor by rewinding method. The % shortage if any in the length thus obtained and as declared by the supplier in the packing list, shall be applied to all the drums if the conductor is found short during checking.
- 13.2 The length of conductor shall also be verified at the consignees end. Where length measurement machines are not available the length will be verified by the weight basis. The determining factor will be length weight ratio of the sample drums verified at the firm's premises of the lot of which the drum under measurement at the consignees end forms a part. Tolerance in ordered quantity

### **14 TOLERANCE IN ORDERED QUANTITY**

A tolerance in the ordered quantity will be allowed to the extent of  $\pm 500$  Metres.



## **B. TECHNICAL SPECIFICATION OF** **ACSR PANTHER CONDUCTOR**

### **2.0 SCOPE :**

**1.1** This specification provides for standard design, manufacture, stage testing, inspection and testing before despatch, packing and delivery of Steel Cored Aluminium Conductor specified hereunder for their satisfactory operation in various lines and sub-stations of the State. The Conductor is to be used as power conductor on single circuit and double circuit transmission lines and sub-stations.

**1.2** Bidders are required to quote for supply of all materials as detailed in the specification. The bidder shall furnish full particulars as called for in various clauses, in addition to filling and completing the schedules annexed to this specification.

**1.5** The unit rate quoted shall be inclusive of deployment of all plant, equipment, men, material, skilled & unskilled labors etc. essential for satisfactory supply of ACSR Panther.

**1.6** All the raw materials for supply of ACSR Panther shall be included in the Bidder's scope of supply. Bidder shall clearly indicate in Schedule-VIII, the sources from where he proposes to procure the raw materials.

### **3.0 STANDARDS:**

The power conductor shall conform to the following Indian Standards, which shall mean latest revisions, amendments/changes adopted and published, unless otherwise specified hereinbefore.

<b>S. No.</b>	<b>Indian Standards or any Equivalent International Standard</b>	<b>Title</b>
1	IS:209	Specification for Zinc
2	IS:398 Part I to Part V (as relevant)	Specification for Aluminium Conductors for overhead Transmission purpose.
3	IS:1778	Reels and drums for Bare wires
4	IS:1521	Method of Tensile Testing of Steel wire
5	IS:2629	Recommended practice for Hot Dip Galvanising Iron and Steel
6	IS:2633	Method of Testing Uniformity of Zinc coating of Zinc coated Articles.
7	IS:4826	Galvanised coating on Round Steel wire
8	IS:6745	Method of Determination of weight of Zinc

S. No.	Indian Standards or any Equivalent International Standard	Title
		coating of zinc coated Iron and Steel Articles
9	IS:8263	Method of Radio Interference Tests
10	IS:1841	EC Grade Aluminium Rod produced by rolling
11	IS:5484	EC grade Aluminium Rod produced by continuous casting and rolling
12	IS: 2141	Method of Elongation test of steel wire

## 2.1 Acceptance of Other Authoritative Standards :

In the paragraph above, relevant Indian standards have been mentioned. However, the ACSR Panther meeting any other authoritative international standard, which ensures equal or better quality than the standards, mentioned above shall also be acceptable. Please attach photocopy of all such standards according to which the, ACSR Panther have been offered.

In this bid, the Bidders will have to furnish confirmation in regard to compliance of our entire technical requirement. The bid should clearly describe various technical particulars of the, ACSR Panther as per details given in this specification.

## 5.0 CLIMATIC CONDITIONS :

5.1 The ACSR conductor shall be suitable for being installed directly in air supported with suspension insulator strings or anchored through tension insulator strings supported with hanger/suspension clamp or tension clamp at the cross arms of single circuit and double circuit transmission line towers. The conductor shall be therefore suitable for satisfactory continuous operation under the following climatic conditions:

1	Location in the state of	MADHYA PRADESH
2	Maximum ambient air temperature ( $^{\circ}\text{C}$ )	50.
3	Minimum temperature in shade ( $^{\circ}\text{C}$ )	1.
4	Maximum relative humidity (%)	95(sometimes approaches saturation)
5	Average daily ambient air temperature ( $^{\circ}\text{C}$ )	40 $^{\circ}$ Centigrade
6	ISOCERANIC Level (days/year) (Average number of thunder storm days).	50
7	Average rainfall(mm)	1250
8	Maximum wind pressure (kg/ square metre)	150
9	Max. Altitudes above mean sea level (metres)	1000
10	Seismic level (Horizontal acceleration) (g)	0.3

**NOTE: Moderately hot and humid tropical climate conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Stroke is also present in the atmosphere. Heavy lightening also occurs during June to October.**

## 6.0 PARAMETERS :

### 6.1 Principal Parameters of Stranded Conductor:

S. No.	Details of Stranded Conductor	ACSR Panther
a)	No. of Strands	Aluminium-30 Steel-7
i.	Steel Centre	1
ii.	1 <sup>st</sup> Steel Layer	6
iii.	1 <sup>st</sup> Aluminium Layer	12
iv.	2 <sup>nd</sup> Aluminium Layer	18
v.	3 <sup>rd</sup> Aluminium Layer	-
b)	Sectional Area of Aluminium (Sq.mm)	212.10
c)	Total Sectional Area (Sq.mm)	261.60
d)	Overall diameter(mm)	21.00
e)	Approximate weight (Kg/Km )	976
f)	Calculated d.c. Resistance at 20 Deg.C (Ohm/Km)	0.139
g)	Minimum UTS (kN)	89.67
h)	Modulus of Elasticity GN/SqMtr	80

#### 6.1.1 The details of aluminium strand are as follows :

S. No.	Details of Aluminium Strands	ACSR Panther
i)	Minimum breaking load of strand Before stranding (kN)	1.17
j)	Minimum breaking load of strand after stranding (kN)	1.11
k)	Maximum D.C. resistance of strand at 20 deg.C (Ohm/Km)	4.107
l)	Nominal Strand Dia	3.00
m)	Max. Strand Dia	3.06
n)	Min. Strand Dia	3.00
o)	Mass (Kg/Km) of Strand at Nominal dia	19.11

#### 4.1.3. The details of steel strand are as follows:

S. No.	Details of Steel Strands	ACSR Panther
p)	Minimum breaking load of strand Before stranding (kN)	9.29
q)	Minimum breaking load of strand after stranding (kN)	8.83
r)	Nominal Strand Dia	3.00
s)	Maximum Strand Dia	3.06
t)	Minimum Strand Dia	3.00
u)	Mass (Kg/Km) of Strand at Nom. dia	55.18
v)	Zinc coating testing	3 dips of 1 min.each
w)	Wt. Of Zinc Coating	260gms/sq. metre

### 6.0 GENERAL TECHNICAL REQUIREMENTS : MATERIAL AND WORKMANSHIP (FOR ACSR PANTHER):

#### 6.1 Materials:

**6.1.1** The conductors shall be manufactured from EC grade aluminium rods suitably hard-drawn on wire drawing machines. The aluminium rods used shall comply with IS: 1841 and IS: 5484 or any equivalent International Standard. The mechanical and electrical properties of aluminium wire shall comply with the requirements given in relevant standard.

#### 6.1.2 Physical constants for Hard-drawn Aluminium:

##### 6.1.2.1 Resistivity:

The resistivity of aluminium depends upon its purity and its physical condition. For the purpose of this specification the maximum value permitted is 0.28264 Ohm sq.mm/mt. at 20° C and this value has been used for calculation of the maximum permissible value of resistance.

**NOTE :** It is not intended to check the resistivity from the measured values of resistance.

##### 6.1.2.2 Density:

At a temperature of 20° C the density of hard drawn aluminium has been taken as 2.703 g/cm.<sup>3</sup>

### 6.1.2.3 Constant-Mass Temperature Co-efficient of Resistance:

At a temperature of 20°C, the constant-mass temperature co-efficient of resistance of hard drawn aluminium measured between two potential points rigidly fixed to the wire, the metal being allowed to expand freely, has been taken as 0.004 per degree Celsius.

### 6.1.2.4 Co-efficient of Linear Expansion:

The co-efficient of linear expansion of hard-drawn aluminium at 0° C has been taken as  $23.0 \times 10^{-6}$  per ° C. This value holds good for all practical purposes over the range of temperature from 0 ° C to highest safe operating temperature.

**6.1.3 Galvanised steel wire** shall be drawn from high carbon steel rods produced by either acidic or basic open hearth process, electric furnace process or basic oxygen process. The mechanical and electrical properties of wire shall comply with the requirements given in relevant standard. The chemical composition of high carbon steel wires is given below for guidance only.

Element	Percentage Composition
Carbon	0.5 to 0.85
Maganese	0.50 to 1.10
Phosphorous	Not more than 0.035
Sulphur	Not more than 0.045
Silicon	0.10 to 0.35

### 6.1.3.1 Physical constants for Galvanised steel wires:

#### 6.1.3.1.1 Density :

At a temperature of 20° C, the density of galvanized steel wire is to be taken as  $7.80 \text{ g/Cm}^3$ .

#### 6.1.3.1.2 Coefficient of Linear Expansion :

In order to obtain uniformity in calculation a value of  $11.5 \times 10^{-6} \text{ }^\circ\text{C}$  may be taken as the value for the co-efficient of Linear Expansion of galvanized steel wires used for the cores of steel-reinforced aluminium conductors.

**6.1.3.1.3** The zinc used for galvanizing shall be electrolytic high-grade Zinc not less than 99.95 percent purity. It shall conform to and satisfy all the requirements of IS: 209. Galvanising may be done either by hot process or electrolytic process. Minimum weight of Zinc coating shall be 260 g/sq. metre. Neutral grease may be applied between the layers of wire.

#### 6.1.3.1.4 Freedom From Defects:

The wires shall be smooth and free from all imperfections such as spills, slag inclusion, die marks, scratches, fittings, blow-holes, projections, looseness, overlapping

of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding.

## **5.6 Wire Sizes**

### **5.6.1 Nominal Size:**

The aluminium and galvanized steel wires for the stranded conductor covered by this standard shall have diameters specified in clause 4.1.1 & 4.1.2. The diameter of the steel wires shall be measured over the zinc coating.

### **5.6.2 Tolerances on Nominal Size :**

Tolerance of + 1% is permitted on the nominal diameter of Aluminium Wires of Panther Conductor and a tolerance of + 2 % is permitted on the nominal diameter of Galvanised Steel Core Wire.

## **5.7 Joints in Wires:**

### **5.7.1 Aluminium Wires:**

No joints shall be permitted in the aluminium wires in the outermost layer of the ACSR Conductor. Joints in the inner layers are permitted, in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 mtr. apart in the complete stranded conductor such joints shall be made only by cold pressure butt-welding. It may please be noted that Joints are not permitted in the outermost layer of the conductor in order to ensure a smooth conductor finish and reduce radio interference levels and corona losses on extra high voltage lines.

### **5.7.2 Galvanised Steel Wires:**

There shall be no joints except those the base rods or wires before final drawing, in steel wires forming the core of the steel-reinforced aluminium conductor. Joints are not permitted in the steel wires after final drawing also in order to avoid reduction in the breaking strength of the conductor that may occur as a result of failure of the joints.

## **5.8 Stranding :**

**5.8.1** The wires used in the construction of galvanized steel reinforced aluminium conductor, before stranding, shall satisfy all the relevant requirements of this specification.

**5.8.2** The lay ratio of the different layers shall be within the limits given in the Table below:-

### **LAY RATIO OF ACSR PANTHER (Aluminium -30 Wire Steel.- 7 Wire)**

Ratio of Alu. wire diameter to steel wire diameter	Lay Ratios of Steel core 6 wire layer		Lay Ratios for Aluminium wires (3 Alu. Wire Layer Conductors)					
			Outermost layer		Layer immediately beneath outer most layer		Innermost Layer	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	13	28	10	14	10	16	-	-

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

**5.8.3** In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The wires in each layer shall be evenly and closely stranded.

**5.8.4** In conductors having multiple layers of aluminium wires, the lay ratio of any aluminium layer shall not be greater than the lay ratio of the aluminium layer immediately beneath it.

**5.8.5** The finished Conductor shall have a smooth surface without any surface cut, abrasion, scuff marks and shall be free from dirt, grit, etc. even if the damage to conductor is acceptable from mechanical considerations. It will not be acceptable from electrical considerations, and full care should be taken not to supply damaged conductor. Projections of more than 2 mils shall not be acceptable. Any such damage shall be properly rectified or new conductor supplied.

**5.8.6** Failure of any sample to meet the above requirements shall be sufficient cause for rejection of the lengths of conductor represented by the sample. Particular care shall, therefore, be taken during manufacture, handling, packing and transportation of the conductor, to see that the surface is not dented, cut or damaged in any way.

## **5.9 Standard Length :**

**5.9.1** The standard length of conductor shall be 1500 metres. A tolerance of +/-5% on the standard length offered by the supplier shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

**5.9.2** Random lengths will be accepted provided no length is less than 70% of the standard length specified and the total quantity of such random lengths shall not be more than 5% of the total quantity ordered.

**5.9.3** Supplier shall also indicate the maximum single length, above the standard length, they can manufacture in the guaranteed technical particulars. This is required for special stretches like river crossing etc. The purchaser reserves the right to place orders

for the above length to the 5% of the total ordered quantity on the same terms and conditions applicable for the standard lengths during the pendency of the contract.

## **5.6 Galvanising:**

**5.6.1** All the wires of Iron & steel strand shall be galvanized in accordance with IS-2629-1966. 'Recommended practice for hot dip galvanizing of Iron and Steel' or some other authoritative equivalent standard.

**5.6.2.** Specific technical requirements for galvanizing and relevant tests quoted in clause-6 of this specification for guidance shall be complied.

## **6.0 TESTS :**

**6.1** The conductor offered shall be type tested as per the relevant standards. Further the acceptance, routine tests and tests during manufacture shall be carried out on the conductor.

**6.1.12** Type tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this specification.

**6.1.13** All the materials offered shall be fully type tested as per the relevant standards and the supplier shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years, prior to the date of opening of bid. For any change in the design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of tests without any extra cost.

**6.1.14** Acceptance tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-despatch inspection, for the purpose of acceptance of that lot.

**6.1.15** Routine tests shall mean those tests which are to be carried out on each strand/spool/length of the conductor to check requirements which are likely to vary during production.

**6.1.16** Tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the supplier to ensure the desired quality of the end product to be supplied by him.

**6.1.17** The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Supplier and the Purchaser as per relevant clause of General Conditions of Contract.

**6.1.18** The standards and norms to which these tests will be carried out are listed in para 2.0. Where a particular test is a specific requirement of this specification, the norms and procedures of the test shall be as mutually agreed to between the Supplier and the Purchaser in the Quality Assurance Programme.

**6.1.19** For all type and acceptance tests, the acceptance values shall be the values guaranteed by the Supplier in the 'Guaranteed Technical Particulars' of his proposal or



the acceptance value specified in this specification, whichever is more stringent for that particular test.

#### **6.1.20 Type Tests :**

The Conductor offered shall be fully type tested as per the relevant International/Indian Standard and the bidder shall furnish the report along with the offer. These tests must not have been conducted earlier than 5 years prior to the date of opening of bid. For any change in the design/type, already type tested and the design/type offered against this bid, the purchaser reserves the right to demand repetition of some or all type tests without any extra cost.

The above said test reports submitted with the offer shall not be older than five years, prior to the date of opening of bid.

- e) UTS test on stranded conductor
- f) DC resistance test on stranded conductor
- g) Stress-strain test on composite conductor

#### **6.1.21 Acceptance Tests :**

- a) Visual and dimensional check
- b) Visual check for joints, scratches etc. and lengths of conductor
- h) Dimensional check on steel and aluminium strands
- d) Check for lay ratios of various layers
- e) Galvanising test on steel strands
- h) Torsion and Elongation test on steel wire
- i) Breaking load test on steel and aluminium strands
- h) Wrap test on steel and aluminium strands
- i) DC resistance test on aluminium strands
- j) UTS test on welded joint of aluminium strand

**NOTE:** All the above tests except test mentioned at (j) shall be carried out on aluminium and steel strands after stranding only.

#### **6.1.22 Routine Test :**

- e) Check to ensure that the joints are as per specification.
- f) Check that there are no cuts, fins etc. on the strands.
- g) Check that drums are as per specifications.
- h) All acceptance tests as mentioned in Clause 6.1.10 above shall be carried out on each coil.

#### **6.1.23 Tests During Manufacture :**

- a) Chemical analysis of zinc used for galvanizing

- b) Chemical analysis of aluminium for making aluminium strands
- c) Chemical analysis of steel used for making steel strands

#### **6.1.13 Testing Expenses:**

The entire cost of testing for the acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor, except for the expenses of the inspection/Purchaser's representative.

#### **6.1.15 Additional Tests:**

The Purchaser reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specification.

#### **6.1.15 Sample Batch for Type Testing**

- (a) The bidder shall offer at least three (3) drums for selection of samples required for conducting all the type tests, in case of change in design/type already tested and the design type offered against this specification, which the purchaser reserves the right to demand carrying out type test without any extra cost.
- (b) The bidder is required to carry out all the acceptance tests successfully in the presence of Purchaser's representative before despatch of conductor.

#### **6.1.16 Test Reports**

- (a) Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Purchaser's representative.
- (b) Test Certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Purchaser.

#### **6.1.17 Test Facilities**

The following additional test facilities shall be available at Bidder's Works.

- (a) Calibration of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
- (b) Standard resistance for calibration of resistance bridges.
- (c) Finished conductor shall be checked for length verification and surface finish on separate rewinding machine at reduced speed (variable from 8 to 16 metres per minute). The rewinding facilities shall have appropriate clutch system and free of vibrations, jerks etc. with transverse layering facilities.

### **7. INSPECTION :**

**7.6** The purchaser's representative shall at all times be entitled to have access to the works and all places of manufacture where conductor/earth wire shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Supplier's works, raw materials and process of manufacture for conducting necessary tests as detailed herein.

**7.7** The Supplier shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of conductor/earth wire in its various stages so that arrangements can be made for inspection.

**7.8** No material shall be despatched from its point of manufacture before it has been satisfactorily inspected and tested, unless the inspection is waived off by the purchaser in writing. In the later case also, the conductor shall be despatched only after satisfactory testing for all tests specified herein has been completed.

**7.9** The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.

**7.10** At least 5% of the total number of drums subject to minimum of two in any lot put up for inspection, shall be selected at random to ascertain the length of conductor by following method:

“At the works of the manufacturer the conductor shall be transferred from one drum to another at the same time measuring its length with the help of graduated pulley and Cyclometer. The difference in the average length thus obtained and as declared by the supplier in the packing list shall be applied to all the drums if the conductor is found short during checking”

## **8.0 QUALITY ASSURANCE PLAN :**

**8.2** The Supplier shall invariably furnish following information along with his offer, failing which his offer may be liable for rejection. Information shall be separately given for individual type of equipment offered.

- (viii) Statement giving list of important raw materials names of sub supplies for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of Supplier's representative, copies of test certificates.
- (ix) Information and copies of test certificates as in (i) above in respect of bought out accessories.
- (x) List of manufacturing facilities available.
- (xi) Level of automation achieved and list of areas where manual process exists.
- (xii) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

- (xiii) Special features provided in the equipment to make it maintenance free.
- (xiv) List of testing equipments available with the Supplier for final testing of material specified and test plant limitation. If any, vis-a-vis the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviation from specified test requirements.

**8.2** The successful Supplier shall within 30 days of placement of order, submit following information to the purchaser.

- (iv) List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
- (v) Type test certificates of the raw material and bought out accessories.
- (vi) Quality assurance plan (QAP) with hold points for Purchaser's inspection. The quality assurance of plan and Purchaser's hold points shall be discussed between the Purchaser and Supplier, before QAP is finalized.

**8.3** The successful Supplier shall submit the routine test certificates of bought out accessories and central excise passes for raw material viz. oil, copper, aluminium, conductor's insulating materials, core material at the time of routine testing of the Conductor.

## **9. DOCUMENTATION :**

**9.1** Six sets of type test reports, duly approved by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply. Adequate copies of acceptance and routine test certificates, duly approved by the Purchaser shall accompany with despatched consignments.

**9.2** The manufacturing of the material shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the material prior to the approval of the drawing shall be at Supplier's risk.

**9.3** Approval of drawing/work by Purchaser shall not relieve the Supplier of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The material shall conform in all respect to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering. Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

## **10 PACKING AND FORWARDING :**

**10.1** The conductor shall be supplied in non-returnable strong wooden drums provided with lagging of adequate strength, to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS: 1778 except otherwise specified hereinafter.

**10.2** The drums shall be suitable for wheel mounting and for jetting off the conductor under a minimum controlled tension of the order of 5kN.

**10.3** The standard drum drawings are enclosed however, supplier should submit the proposed drum drawings along with the bid. The same shall be in line with the requirements of standard drawings and as stated herein. After placement of the letter of Award, the supplier shall submit four copies of fully dimensioned drawing of the drum he wishes to supply, for Purchaser's approval, before taking up manufacturing of conductor. After getting approval from the Purchaser, Supplier shall submit 30 more copies of the approved drawing to Purchaser for further distribution and field use at Purchaser's end.

**10.4** All wooden components shall be manufactured out of seasoned soft wood free from such defects that may materially weaken the component part of the drums. Preservative treatment for anti-termite /anti-fungus (Aldrine/Aldruse) shall be applied to the entire drum with preservatives of a quality which is not chemically harmful to the conductor.

**10.5** The flanges shall be of two/three ply construction with each ply at right angles to the other and nailed together. Further the outer face of the flange shall be reinforced with the circumferential battens, fixing in octagonal shape. The nails shall be driven from the inside face of flange, punched and then clenched on the outer face. The tolerance in thickness of each ply shall be +/- 3 mm only. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75 mm. Where a slot is cut in the flange to receive the inner end of the conductor, the entrance shall be in line with the periphery of the barrel. Spindle hole shall be provided at the centers of the planks of the plies and spindle plates with 102 mm dia. Holes shall be fitted on either side of both the flanges.

**10.6** The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.

**10.7** Barrel studs shall be used for construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing. Barrel studs should be tack welded with the nuts after tightening.

**10.8** Normally, the nuts on the studs shall stand protrude of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be counter sunk. The ends of barrel shall generally be flushed with the top of the nuts.

**10.10** The inner cheek of the flanges and drum barrel surface shall be painted with a bitumen based paint.

**10.10** Before reeling, cardboard or double corrugated or thick bituminised waterproof bamboo paper shall be secured to the drum barrel and inside of flanges or the drum by means of a suitable commercial adhesive material. The paper should be dried before use. Medium grade craft paper shall be used in between the layer of the conductor/earth wire. After reeling the conductor the exposed surface of the outer layer of conductor shall be wrapped with thin polythene sheet across the flanges to preserve the conductor from dirt, grit and damage during transportation and handling and also to prevent ingress of rain water during storage/transport.

**10.11** Minimum space of 125 mm shall be provided between the inner surface of the external protective layer and outer layer of the conductor.

**10.12.** Each batten shall be securely nailed across grains as far as possible to the flange edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nail shall not protrude above the general surface and shall not have exposed sharp edges or allow the battens to be released due to corrosion.

**10.16.** Outside the protective layer, there shall be minimum of two binder consisting of hoop iron/galvanized steel wire. Each protective layer shall have two recess to accommodate the binders.

**10.17.** The conductor ends shall be properly sealed and secured with the help of U-nails on one side of the flanges. The end securing shall be done by taking out at least 500 mm of steel core on either ends by U-nails. The composite conductor shall be binded by use of galvanized steel wire/aluminum wire at three locations at least 75 mm apart or more covered with PVC adhesive tape so as to avoid loosening of conductor layers in transit and handling.

**10.18.** Only one length of conductor shall be wound on each drum.

## **11. MARKING :**

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- x. Contract/Award letter number
- xi. Name and address of consignee
- xii. Manufacturer's name and address
- xiii. Drum number
- xiv. Size of conductor
- xv. Length of conductor in metres
- xvi. Gross weight of drum with conductor
- xvii. Weight of empty drum with protective lagging
- xviii. Arrow marking for unwinding

## **12 END SEALING :**

Both the ends of each length of conductor should be provided with non-destructive type metal crimped or epoxy capped seals with punching embossing/ engraving of manufacturer's monogram and drum number.

## **13 CHECK MEASUREMENT**

**13.1.** At least 5% of the total number of drums in any lot put up for inspection shall be selected at random to ascertain the length of conductor by rewinding method. The % shortage if any in the length thus obtained and as declared by the supplier in the packing list, shall be applied to all the drums if the conductor is found short during checking.

**13.2** The length of conductor shall also be verified at the consignees end. Where length measurement machines are not available the length will be verified by the weight basis. The determining factor will be length weight ratio of the sample drums verified at the firm's premises of the lot of which the drum under measurement at the consignees end forms a part. Tolerance in ordered quantity

## **14 TOLERANCE IN ORDERED QUANTITY**

A tolerance in the ordered quantity will be allowed to the extent of  $\pm 500$  Metres.

## SCHEDULE -I

### DETAILS OF MATERIAL & QUANTITY FOR ACSR ZEBRA AND PANTHER

**Bidders may please note that the prices are to be offered exactly as per the forms given under section IV (Volume I) -“Bidding form”, page: 4-4, 4-5 & 4-6. Description of materials and quantity covered indicated hereunder should exactly be used for the purpose of offering their prices in the above forms.**

PACKAGE NO.	DESCRIPTION	QTY. (KMS)
3	A. 54/7/3.18 mm ACSR ZEBRA Conductor	1200
	B. 30/7/3.00 mm ACSR PANTHER Conductor	2000



**MADHYA PRADESH POWER TRANSMISSION CO. LTD.,  
JABALPUR**

**BID IDENTIFICATION NO. JICA-II /MPPTCL/TR-203**

**VOLUME II**

**FORMATS FOR  
SCHEDULE-II TO SCHEDULE-XII  
WHICH ARE TO BE FILLED UP,  
SIGNED AND SUBMITTED BY THE BIDDERS  
FOR SUPPLY OF ACSR ZEBRA AND PANTHER CONDUCTOR**

## SCHEDULE –II (A)

### TECHNICAL QUESTIONNAIRE FOR ACSR ZEBRA CONDUCTOR

**ALL POINTS MENTIONED BELOW SHOULD BE REPLIED IN THESE SHEETS ONLY WITHOUT MAKING ANY REFERENCE TO ANY CLAUSE IN THE BID. IF REPLIES ARE INCOMPLETE OR REPLY TO ANY CLAUSE IS NOT FURNISHED, BID MAY BE TREATED AS INCOMPLETE AND NON RESPONSIVE FROM TECHNICAL ANGLE.**

1	Name of bidder.	
2	Name of manufacturer.	
3	Country of origin	
4	Address of manufacturing works. Date & year of establishment of factory for manufacture of Zebra or higher size.	
5	Indian Standard Specification to which ACSR Conductor to be used on transmission lines will conform.	
6	Have the bidder got his own manufacturing units for manufacture of ACSR Zebra conductor. If so give full address.	
7	In case the bidder do not have their own manufacturing unit, please indicate the address of manufacturing unit where the bidder proposes to manufacture the ACSR Zebra Conductor.	
8	Please indicate the installed yearly manufacturing capacity of the manufacturing unit.	
9	Please indicate average monthly manufacturing rate of ACSR Conductor during the last five years.	
10	Please indicate the Kilometres of Zebra or higher size conductor manufactured and supplied during the last five financial years.	
(i)	Year 2016-17	
(ii)	Year 2015-16	
(iii)	Year 2014-15	
(iv)	Year 2013-14	
(v)	Year 2012-13	

11	Total quantity in kilometres of order under execution for conductor.	
12	Monthly rate at which pending orders to be executed.	
13	Is spare capacity enough to supply ACSR conductor at the proposed rate against present specification? Give details, if spare capacity is not enough how bidder proposes to meet the supply against the present bid.	
14	Please confirm whether document relating to supply of ACSR conductor furnished as per format prescribed in Schedule-V.	
15	Please indicate the details of Zebra or higher size conductor supplied by the bidder to various utilities enclosed.	
16	Please refer clause No. 4.1.1, 4.1.2 & 5.2.2 and confirm that there will be no negative variation in diameter of Aluminium and steel strand.	
17	Please refer clause no.5.3.1 confirm that there shall be no joints in Aluminium strand within 15 Meter in inner layer and there shall be no joint on outer layer of conductor.	
18	Please refer clause no.5.3.1 and confirm that you have got cold pressure but welding machine for making joints in aluminium wire. If yes, please indicate number of machines available in your works.	
19	Please refer clause no.5.3.2. and confirm that there shall be no joints in steel strands except those in the base rod or wire before final drawing.	

20	Please refer Clause-5.5 and confirm that conductor shall be supplied in the standard length .	
21	Please confirm that all testing facilities for acceptance test are available in manufacturer's works. If not, then where those tests will be got conducted.	
22	Please refer clause 6.1.2 and confirm that the bidder will conduct type test before commencement of supply at their own cost in case type tests not conducted during past 5 years period.	
23	Are you having separate rewinding machine for visual checking surface of conductor and measurement of its length.	
24	Please refer Clause-7 (Inspection) and confirm that the same is acceptable to you.	
25	Please refer clause no. 8 and confirm that you have furnished the quality assurance programme for manufacture of Conductor.	
26	Please confirm that our Clause-10 (packing & forwarding) is acceptable to you in toto.	
27	Please refer Clause-13 (Check measurement) and confirm that the same is acceptable to you.	
28	Please confirm that you have furnished photocopies of price circulars for raw materials on which prices of conductor is based.	
29	Please confirm that conductor offered by you shall conform to all technical requirements indicated in the bid. Please also confirm that in case of any deviations, the same are clearly indicated in Schedule-IX	
30	Please confirm that your bid conforms strictly to the requirements of the specifications. There is no deviation from commercial & technical terms & conditions of the bid document. Please also confirm that you furnished the Schedule-IX, duly signed in this regard.	

**SIGNATURE OF BIDDER**

**SCHEDULE –II (B)**  
**TECHNICAL QUESTIONNAIRE FOR ACSR PANTHER  
CONDUCTOR**

**ALL POINTS MENTIONED BELOW SHOULD BE REPLIED IN THESE SHEETS ONLY WITHOUT MAKING ANY REFERENCE TO ANY CLAUSE IN THE BID. IF REPLIES ARE INCOMPLETE OR REPLY TO ANY CLAUSE IS NOT FURNISHED, BID MAY BE TREATED AS INCOMPLETE AND NON RESPONSIVE FROM TECHNICAL ANGLE.**

1	Name of bidder.	
2	Name of manufacturer.	
3	Country of origin	
4	Address of manufacturing works. Date & year of establishment of factory for manufacture of Panther or higher size.	
5	Indian Standard Specification to which ACSR Conductor to be used on transmission lines will conform.	
6	Have the bidder got his own manufacturing units for manufacture of ACSR Panther conductor. If so give full address.	
7	In case the bidder do not have their own manufacturing unit, please indicate the address of manufacturing unit where the bidder proposes to manufacture the ACSR Panther Conductor.	
8	Please indicate the installed yearly manufacturing capacity of the manufacturing unit.	
9	Please indicate average monthly manufacturing rate of ACSR Conductor during the last five years.	
10	Please indicate the Kilometres of Panther or higher size conductor manufactured and supplied during the last five financial years.	
(i)	Year 2016-17	
(ii)	Year 2015-16	
(iii)	Year 2014-15	
(iv)	Year 2013-14	
(v)	Year 2012-13	

11	Total quantity in kilometres of order under execution for conductor.	
12	Monthly rate at which pending orders to be executed.	
13	Is spare capacity enough to supply ACSR conductor at the proposed rate against present specification? Give details, if spare capacity is not enough how bidder proposes to meet the supply against the present bid.	
14	Please confirm whether document relating to supply of ACSR conductor furnished as per format prescribed in Schedule-V.	
15	Please indicate the details of Panther or higher size conductor supplied by the bidder to various utilities enclosed.	
16	Please refer clause No. 4.1.1, 4.1.2 & 5.2.2 and confirm that there will be no negative variation in diameter of Aluminium and steel strand.	
17	Please refer clause no.5.3.1confirm that there shall be no joints in Aluminium strand within 15 Meter in inner layer and there shall be no joint on outer layer of conductor.	
18	Please refer clause no.5.3.1 and confirm that you have got cold pressure but welding machine for making joints in aluminium wire. If yes, please indicate number of machines available in your works.	
19	Please refer clause no.5.3.2. and confirm that there shall be no joints in steel strands except those in the base rod or wire before final drawing.	

20	Please refer Clause-5.5 and confirm that conductor shall be supplied in the standard length.	
21	Please confirm that all testing facilities for acceptance test are available in manufacturer's works. If not, then where those tests will be got conducted.	
22	Please refer clause 6.1.2 and confirm that the bidder will conduct type test before commencement of supply at their own cost in case type tests not conducted during past 5 years period.	
23	Are you having separate rewinding machine for visual checking surface of conductor and measurement of its length.	
24	Please refer Clause-7 (Inspection) and confirm that the same is acceptable to you.	
25	Please refer clause no. 8 and confirm that you have furnished the quality assurance programme for manufacture of Conductor.	
26	Please confirm that our Clause-10 (packing & forwarding) is acceptable to you in toto.	
27	Please refer Clause-13 (Check measurement) and confirm that the same is acceptable to you.	
28	Please confirm that you have furnished photocopies of price circulars for raw materials on which prices of conductor is based.	
29	Please confirm that conductor offered by you shall conform to all technical requirements indicated in the bid.	
30	Please confirm that your bid conforms strictly to the requirements of the specifications. There is no deviation from commercial & technical terms & conditions of the bid document. Please also confirm that you furnished the Schedule-IX, duly signed in this regard.	

**SIGNATURE OF BIDDER**

## **SCHEDULE-III**

### **DETAILS OF WOODEN DRUM DRAWINGS SUBMITTED WITH BID**

<b>S. NO</b>	<b>DRAWING NO</b>	<b>PARTICULARS OF DRAWING</b>
A	ACSR Zebra conductor	
B	ACSR Panther conductor	

**SIGNATURE OF BIDDER**



## **SCHEDULE- IV**

### **LIST OF PLANT & MACHINERY AND TESTING FACILITIES**

**The Bidder shall submit here complete and detailed list of plant and machinery, testing facilities, designing facilities available at their works.**

**SIGNATURE OF BIDDER**

## SCHEDULE-V (A)

### LIST OF PAST SUPPLIES

Tenderer shall also enclose details of past supplies indicating order no. & date, name of utility, date of commissioning and officials who could be contacted for offered items.

S. No.	Year	Total Quantity ACSR Zebra Conductor or Higher Size conductor
1	2012-13	
2	2013-14	
3	2014-15	
4	2015-16	
5	2016-17	
6	2017-18 Current Financial Year	

**Note:**

- i. For the above purpose, "year" means Financial year from April to March.
- ii. May please note information desired in this format is mandatory requirement.
- iii. A list of orders executed alongwith name of customers may please be furnished with this schedule for verification of quantity of ACSR Zebra Conductor or Higher Size conductor mentioned in this schedule.

Seal and Sign of Statutory Auditor

Date :

or

Chartered Accountant

Name of Audit Firm

Firm's Registration No

SIGNATURE OF BIDDER

## **SCHEDULE-V (B)**

### **LIST OF PAST SUPPLIES**

Tenderer shall also enclose details of past supplies indicating order no. & date, name of utility, date of commissioning and officials who could be contacted for offered items.

<b>S. No.</b>	<b>Year</b>	<b>Total Quantity ACSR Panther Conductor or Higher Size conductor</b>
1	2012-13	
2	2013-14	
3	2014-15	
4	2015-16	
5	2016-17	
6	2017-18 Current Financial Year	

**Note:**

- i. For the above purpose, "year" means Financial year from April to March.**
- ii. May please note information desired in this format is mandatory requirement.**
- iii. A list of orders executed alongwith name of customers may please be furnished with this schedule for verification of quantity of ACSR Panther Conductor or Higher Size conductor mentioned in this schedule.**

**Seal and Sign of Statutory Auditor**

**Date :**

**or**

**Chartered Accountant**

**Name of Audit Firm**

**Firm's Registration No**

**SIGNATURE OF BIDDER**

## **SCHEDULE – VI**

### **BASE INDICES TO BE CONSIDERED FOR PRICE VARIATION**

**Please indicate below the base indices to be considered for calculation of price variation.(If the indices are not available at the time of submitting the bid, please mention that the price as published in respective price circular shall be acceptable to the bidder).**

<b>S. No.</b>	<b>Particulars</b>	<b>Amount</b>
<b>1</b>	<p>For bidders material indices published by the following sources shall apply. The bidder shall indicate the base date indices in his bid.</p> <p>(i) EC Grade Aluminium Rods - Average price of M/s BALCO, NALCO &amp; HINDALCO published by Cable and Conductor Manufacturers Association of India.</p> <p>(ii) High Tensile Galvanised steel wire - As per price circular published by Cable and Conductor Manufacturers Association of India (CACMAI).</p>	

**SIGNATURE OF BIDDER**

**SCHEDULE -VII**  
**QUALITY ASSURANCE PROGRAMME AND**  
**PROGRAMME CHART**

**SIGNATURE OF BIDDER**

## **SCHEDULE -VIII**

### **SOURCES OF MATERIALS TO BE ARRANGED BY THE BIDDER FOR SUPPLY OF ACSR CONDUCTOR**

<b>S. No</b>	<b>Particulars</b>	<b>Name and address of the firm from where the bidder proposes to procure the material</b>
1.	EC grade Aluminium Rods	
2.	High Tensile Galvanised steel wire	

**SIGNATURE OF BIDDER**

## **SCHEDULE -IX**

### **SCHEDULE OF NO DEVIATION FROM COMMERCIAL AND TECHNICAL TERMS AND CONDITIONS**

**We have carefully gone through the Commercial and Technical specification (Volume-I & Volume II). We have satisfied ourselves and hereby confirm that our bid conforms strictly to the requirements of the specifications. There is no deviation from commercial & technical terms & conditions of the bid document.**

**SIGNATURE OF BIDDER**

## SCHEDULE-X (A)

### GUARANTEED TECHNICAL PARTICULARS OF ACSR ZEBRA CONDUCTOR

S. No.	Description	ZEBRA
1.	Maker's name	
	i. Aluminium rod	
	ii. Steel wire/rods	
	iii. Complete conductor	
2.	Specification to which	
	i. Raw materials pertain	
	ii. Conductor to be manufactured	
3.	Particulars of raw materials	
	i. Purity of aluminium rods (%)	
	ii. Carbon in HTGS wire	
	iii. Size of HTGS wire	
4.	Particulars of ACSR Conductor	
	i. Copper equivalent area (sq. mm)	
	ii. Stranding, lay and wire dia (mm)	
	iii. Nominal over all dia (mm)	
	iv. Approx. total weight (kg/km)	
	a. Steel Section (kg)	
	b. Aluminium Section (kg)	
	c. ACSR Conductor (kg)	
5.	Guaranteed ultimate tensile strength	
6.	Calculated D.C. resistance/km of conductor when corrected to standard weight at 20°C	
7.	Section Area of	
	i. Aluminium strand in sq. mm	
	ii. Steel strand in sq. mm	
	iii. Total sectional area of conductor in sq. mm.	
8.	Equivalent modulus of elasticity (average values from actual stress strand curves)	
	a. Aluminium (kg/cm <sup>2</sup> )	
	b. Steel (kg/cm <sup>2</sup> )	
	c. ACSR Conductor	
9.	Co-efficient of liner expansion	
	a. Aluminium per °C	
	b. Steel per °C	
	c. ACSR Conductor per °C	
10.	Mean Lay-ratio	
	i. First layer	
	ii. Second layer	
	iii. Third layer	
	iv. Fourth layer	



<b>S. No.</b>	<b>Description</b>	<b>ZEBRA</b>
11. i.	Continuous maximum current rating of conductor in still air at 40 °C ambient temperature (amp)	
ii.	Temperature rise for the above current ( °C)	
12. i.	Standard length of conductor (km.)	
ii.	Tolerance in length (in percent)	
iii.a.	Random length in percent of ordered quantity	
b.	Minimum length of Random length (Meters)	
c.	Net weight of conductor in one drum (as per standard length)	
d.	Weight of an empty drum in kg.	
13.	Particulars of strands	<b>Aluminium/steel</b>
i.	Diameter	
a.	Standard (mm)	
b.	Maximum (mm)	
c.	Minimum (mm)	
ii.	Standard sectional area (sq.mm)	
iii.	Weight per km.	
a.	Standard (kg)	
b.	Maximum (kg)	
c.	Minimum (kg)	
iv.	Minimum ultimate tensile strength (kg)	
v.	Minimum breaking load for wire of	
a.	Standard dia (kg)	
b.	Minimum dia (kg)	
vi.	Calculated resistance per km at 20 °C when corrected to standard weight	
a.	Standard (Ohm)	
b.	Maximum (Ohm)	
vii.	Final stress (kg/sq.mm)	
viii.	Zinc coating	
a.	Uniformity of coating, number and duration of dips(according to Preece test)	
b.	Minimum weight of coating (gms/sq.mm)	
c.	Purity of zinc and the standard to which it will conform	
14.	Minimum number of twists in 150 mm length (withstanding capacity)	
15	Dimensions of wooden drum	
a.	Diameter of flange without outer most lagging	
b.	Diameter of flange with outermost lagging	
c.	Outer diameter of barrel with circumferential battens	
d.	Inner Diameter of bush of the hub plate	
e.	Outermost transverse width (end to end of flange)	
f.	Inner Transverse width (between two inner cheeks of the flanges)	
g.	Width of each ply of the flange	

<b>S. No.</b>	<b>Description</b>	<b>ZEBRA</b>
h.	Number of ply in each flange	
i.	Diameter of mild steel tie rod in mm.	
j.	Number of tie rods	
k.	Size of packing washer of tie rods	
l.	Size of hub plates	
m.	Size of bolts of Hub plate	
n.	Thickness and height of outermost octagonal reinforcement ply	
o.	Barrel batten size	
p.	Flange lagging size	
q.	Size of barrel supports - width of each ply	
r.	Gap to be maintained between and inside surface of external lagging in mm	
s.	Size of nails	
t.	Depth of counter sulking of nails inside the wood	
16.	Type of paper and water proof material to be used for packing the conductor in drums	
17.	Whether manufacturing facility for 61 strand ACSR is available with you	
18.	Any other particulars which the tenderer may wish to give	

**SIGNATURE OF BIDDER**

## SCHEDULE-X (B)

### GUARANTEED TECHNICAL PARTICULARS OF PANTHER ACSR PANTHER CONDUCTOR

S. No.	Description	PANTHER
1.	Maker's name	
	i. Aluminium rod	
	ii. Steel wire/rods	
	iii. Complete conductor	
2.	Specification to which	
	i. Raw materials pertain	
	ii. Conductor to be manufactured	
3.	Particulars of raw materials	
	i. Purity of aluminium rods (%)	
	ii. Carbon in HTGS wire	
	iii. Size of HTGS wire	
4.	Particulars of ACSR Conductor	
	i. Copper equivalent area (sq. mm)	
	ii. Stranding, lay and wire dia (mm)	
	iii. Nominal over all dia (mm)	
	iv. Approx. total weight (kg/km)	
	a. Steel Section (kg)	
	b. Aluminium Section (kg)	
	c. ACSR Conductor (kg)	
5.	Guaranteed ultimate tensile strength	
6.	Calculated D.C. resistance/km of conductor when corrected to standard weight at 20°C	
7.	Section Area of	
	i. Aluminium strand in sq. mm	
	ii. Steel strand in sq. mm	
	iii. Total sectional area of conductor in sq. mm.	
8.	Equivalent modulus of elasticity (average values from actual stress strand curves)	
	a. Aluminium (kg/cm <sup>2</sup> )	
	b. Steel (kg/cm <sup>2</sup> )	
	c. ACSR Conductor	
9.	Co-efficient of liner expansion	
	a. Aluminium per °C	
	b. Steel per °C	
	c. ACSR Conductor per °C	
10.	Mean Lay-ratio	
	i. First layer	
	ii. Second layer	
	iii. Third layer	
	iv. Fourth layer	

<b>S. No.</b>	<b>Description</b>	<b>PANTHER</b>
11. i.	Continuous maximum current rating of conductor in still air at 40 °C ambient temperature (amp)	
ii.	Temperature rise for the above current ( °C)	
12. i.	Standard length of conductor (km.)	
ii.	Tolerance in length (in percent)	
iii.a.	Random length in percent of ordered quantity	
b.	Minimum length of Random length (Meters)	
c.	Net weight of conductor in one drum (as per standard length)	
d.	Weight of an empty drum in kg.	
13.	Particulars of strands	<b>Aluminium/steel</b>
i.	Diameter	
a.	Standard (mm)	
b.	Maximum (mm)	
c.	Minimum (mm)	
ii.	Standard sectional area (sq.mm)	
iii.	Weight per km.	
a.	Standard (kg)	
b.	Maximum (kg)	
c.	Minimum (kg)	
iv.	Minimum ultimate tensile strength (kg)	
v.	Minimum breaking load for wire of	
a.	Standard dia (kg)	
b.	Minimum dia (kg)	
vi.	Calculated resistance per km at 20 °C when corrected to standard weight	
a.	Standard (Ohm)	
b.	Maximum (Ohm)	
vii.	Final stress (kg/sq.mm)	
viii.	Zinc coating	
a.	Uniformity of coating, number and duration of dips(according to Preece test)	
b.	Minimum weight of coating (gms/sq.mm)	
c.	Purity of zinc and the standard to which it will conform	
14.	Minimum number of twists in 150 mm length (withstanding capacity)	
15	Dimensions of wooden drum	
a.	Diameter of flange without outer most lagging	
b.	Diameter of flange with outermost lagging	
c.	Outer diameter of barrel with circumferential battens	
d.	Inner Diameter of bush of the hub plate	
e.	Outermost transverse width (end to end of flange)	
f.	Inner Transverse width (between two inner cheeks of the flanges)	
g.	Width of each ply of the flange	

<b>S. No.</b>	<b>Description</b>	<b>PANTHER</b>
h.	Number of ply in each flange	
i.	Diameter of mild steel tie rod in mm.	
j.	Number of tie rods	
k.	Size of packing washer of tie rods	
l.	Size of hub plates	
m.	Size of bolts of Hub plate	
n.	Thickness and height of outermost octagonal reinforcement ply	
o.	Barrel batten size	
p.	Flange lagging size	
q.	Size of barrel supports - width of each ply	
r.	Gap to be maintained between and inside surface of external lagging in mm	
s.	Size of nails	
t.	Depth of counter sulking of nails inside the wood	
16.	Type of paper and water proof material to be used for packing the conductor in drums	
17.	Whether manufacturing facility for 61 strand ACSR is available with you	
18.	Any other particulars which the tenderer may wish to give	

**SIGNATURE OF BIDDER**

## SCHEDULE- XI

### LIST OF TYPE TEST REPORTS FOR ACSR CONDUCTOR

S. No.	Item	Reference No. & date of test report with no. of sheets of report	Description of type test including IS/other Standards Clause	Date of Test	Name of testing Laboratory	Test Result	Remarks if any
1	2	3	4	5	6	7	8
a	ACSR Zebra Conductor						
b	ACSR Panther Conductor						

**SIGNATURE OF BIDDER**

## **SCHEDULE- XII**

### **COMMERCIAL QUESTIONNAIRE**

**Bidders may please note the following: -**

- a. All points mentioned below should be confirmed/replied here only to avoid the risk of non-conformity of the bid as per the bid document requirement.**
- b. It may be noted by the bidders that all replies should be clear and affirmative without any confusion and without mentioning that the cross reference may be made to the bid document submitted by the bidder. To clarify, the details furnished in this Schedule should be clear and complete in itself.**
- c. Bidders have to be careful in furnishing all details clearly in this Schedule. It may be noted that no column should be left blank.**
- d. In case of conflict between this Schedule and the Instructions to Bidders or the Conditions of Contract, the clauses in the Instructions to Bidders and the Conditions of Contract shall prevail; and in case of conflict between the bidders answers in this Schedule and the Bidding Forms, the ones in the Bidding Forms shall prevail.**

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#### **Points to be confirmed in respect of Clauses under Section-II (Volume-I) Bid Data Sheet (BDS)**

- 1** Please confirm that the quantum of bid security to be furnished as given in Section II the Bid Data Sheet Clause ITB 21.2 has been noted and bid security for correct amount has been furnished. Please confirm that BG, if submitted towards bid security has been issued by a reputable Bank as per Clause 21.3 of Section I, Instructions to Bidders.
- 2** (a) Please refer Section II Bid Data Sheet Clause ITB 4.1 and confirm whether the bidder has participated as individual or in joint venture.  
  
(b) Please confirm that in case of joint venture/consortium, all parties shall be jointly and severally liable.

- (c) Please confirm that in case of joint venture, supporting legal documents and power of attorney have been enclosed and forms enclosed with the Bid as per prescribed formats.
- 3** Has the bidder included goods manufactured by some other agency and then in that case please confirm that authorization from the manufacturer as per ITB 19.1, Section-II, Bid Data Sheet has been enclosed.
- 4** Have you noted that the bids to be submitted will also include additional documents as per ITB 11.1 (i) as per Section II bid data sheet and it may be confirmed that all documents have been furnished.
- 5** Please confirm that in compliance to ITB 13.1, Section I, Bid Data Sheet no alternative bid has been submitted.
- 6** Please refer Section II, Bid Data Sheet, ITB 14.8 (c) and confirm that the condition mentioned therein regarding transportation of material is acceptable to you and your bid is based on this requirement.
- 7** Please refer Clause ITB 14.7 Section II Bid Data Sheet and confirm that the offered prices are variable (adjustable) as per price variation formula brought out in Clause 14.1, Section VIII, SCC. In this connection:
- 7.1** Please confirm that the price variation formula as furnished is acceptable to you without any deviation.



- 7.2** Please confirm that base indices for price variation shall be as prevailing on first day of the month one month prior to date of bid opening.
- 7.3** Please confirm you have furnished the details of base indices, its sources and other details as asked for in the price variation formula.
- 8** Please indicate currency of bid for supply.
- 9** Please confirm that for related services, the prices have been offered and indicate currency of prices.
- 10** Please confirm that bid in three copies (1+ 2) have been submitted
- 11** Please confirm that you have noted that variation in quantity while placing order could be made to the extent of (+)20% or (-) 10% and this condition is acceptable to you.

**Points to be confirmed in respect of Clauses under  
Section III(Volume-I)  
Evaluation and Qualification Criteria**

- 12** Please confirm that you have noted the condition that bid received for part quantity will be treated as non-responsive and will be rejected.
- 13** (a) Please refer Clause 1.2 of Section-III & confirm that the conditions mentioned therein have been noted in regard to loading for inland freight charges and inland transit insurance charges.

- (b) Please confirm you have noted that the technical criteria shall be evaluated on pass – fail system as per Clause 3 of Section III .

**14** Please confirm that following conditions for non - responsiveness of bids stipulated in Vol. I & II of bidding document have been noted, otherwise your bid would be treated as non-responsive.

**14.1** Whether bid security furnished is for adequate amount and in proper form. Please indicate here Bid No., bid security amount and mode of security. Please confirm that all conditions regarding Bid security stipulated in clause 21.2, Section-II, Volume-I have been noted by you.

**14.2** Please confirm bid submission sheet has been submitted.

**14.3** Please confirm you are an eligible bidder under Clause 4 Section I and necessary documentation to this effect has been submitted.

**14.4** Please confirm you have noted that late bids will be returned.

**14.5** Please confirm that validity of your bids is 120 days from the date of bid opening otherwise your offer will be rejected.

**14.6** Please confirm that validity of bid security is 120+28 days from the date of bid opening. In case validity is found to be short, bid will be rejected.

- 14.7** Please confirm you have carefully noted experience criteria and supply capacity criteria as brought out in Section III and sufficient certificates/supporting documents have been annexed with your bid in support of your claim for meeting these criteria.
- 14.8** Please confirm you have noted that conditional bid of any nature is not acceptable and incase any condition has been mentioned by you, the same may be specified here.
- 14.9** Please confirm that you have noted that bid for part quantity will be treated as non-responsive.
- 14.10** Please confirm that you have noted that deemed export benefit are not available as brought out under ITB 14.9 of Section-II; Bid Data Sheet.
- 14.11** Delivery shall be the essence of the contract. It may be noted that prompt deliveries would be preferred by the purchaser. Please confirm you have noted that delivery schedule in excess of more than three months beyond specified delivery schedule will make your offer non-responsive. Please indicate here whether you have complied with this requirement or not.  
Please confirm you have noted that in respect of bids wherein offered delivery schedule does not exceed more than three months specified delivery schedule, loading for the purpose of evaluation shall be done @ 0.1% for each day of delay.

- 14.12** Please confirm you have noted that no deviation from terms of payment shall be permitted.
- 14.13** Please confirm you have furnished required notarized power of attorney for authorized signatory or similar legal instrument in line with Clause ITB 22.2 of Section II Bid Data Sheet.
- 14.14** Please confirm you have noted that incase of violation of condition regarding “Corrupt Practice”, the bid will be treated as non-responsive.
- 14.15** Please confirm that offered performance warranty for all equipments shall be 12 months from the date of commissioning or 18 months from the date of delivery whichever is earlier and this condition is acceptable to you.
- 14.16** Please confirm liquidated damages Clause @ 0.5% of the contract price per week upto a maximum of 10% of the contract price is acceptable to you.
- 14.17** Please confirm that in the event of a contract on you performance security for 10% contract price as per Section VIII shall be furnished.
- 14.18** Please confirm that all technical details, test report etc. as per Volume II to make your offer complete in all respect has been submitted.
- 14.19** Please confirm that the required technical questionnaire enclosed with technical bid has been submitted duly filled-in.

- 14.20** Please confirm you have carefully noted experience criteria and supply capacity criteria as brought out in Section III and sufficient certificates/supporting documents have been annexed with your bid in support of your claim for meeting these criteria.
- 14.21** Please refer Clause 5.0 of Section III and confirm that you have a minimum experience of 5 years of supply of ACSR Panther/ or higher size conductor and necessary proof to this effect has been enclosed.
- 14.22** Please also confirm that the conductor supplied by you are in successful operation for a minimum period of three years and necessary performance report from user organisation has been enclosed with your bid.
- 14.23** In case you are not a manufacturer, but only a duly authorized representative of the manufacturer, please confirm that necessary “Manufacturer’s Authorization” issued by the manufacturer, as per Section-III, Volume-I has been enclosed with your Bid.
- 14.24** Please confirm that in case of a bid on joint venture basis lead member and other members of the consortium meets the experience criteria and supply capacity criteria as per Clause 5.0 Section III.
- 14.25** Please confirm you have carefully noted our requirement of Financial criteria as per Clause 5.1 of Section III and furnished

the sales details for 3 years as per prescribed format.

- 14.26** Please confirm the supply capacity criteria under Clause 2.4.3 of Section III has been carefully noted by you and you have furnished all required documents to substantiate that the supply capacity criteria for the offered quantity are met with. Please confirm necessary details in tabular form have been furnished alongwith certificates of procurement authorities.
- 15** Please confirm condition of litigation as per Clause 2.4.2 of Section III has been noted by you and necessary certificate has been given.
- 16** Please confirm for the purpose of offering prices, you have followed the formats furnished under Section IV without any deviation. Please confirm you have noted that no modification in the proforma is to be done.(except for requisite modification in the Bidding Forms).

**Points to be replied in respect of Clauses under  
Section VIII (Volume-I)  
Special Conditions of Contract.**

- 17** Please confirm you have noted that the Governing law shall be Indian law applicable in the jurisdiction of competent court in Jabalpur.
- 18** Please confirm that the place for arbitration proceedings shall be as per clause 9.2 GCC.
- 19** Please note that you will be eligible to participate against purchaser's bid invitation only, if bid document is procured by you from the purchaser. In support of proof of purchase of bid

document from us photocopy of money receipt or covering letter vide which Bid document was forwarded by us should be enclosed with the bid security furnished by you.

- 20** Please refer Clause 5 “Eligible Goods and related Services” of Section I, ‘Instructions to Bidders’, and confirm that you qualify to participate for goods and related services as per conditions mentioned therein. Please confirm that necessary undertaking/ document to this effect has been furnished with the bid.
- 21** Please confirm that your bid price is subject to price variation, in which case you must confirm that you accept all the provisions and conditions for Price Variation specified in the Special Conditions of Contract, Clause GCC 13.1
- 22** Please confirm terms of payment as per Clause GCC 15.1 without any deviation is acceptable to you. Please note in case of any deviation, your offer will be treated as non-responsive.
- 23** Please confirm you have noted all conditions mentioned under Clause GCC 15.1. Please also confirm that you will claim only GST and indicate the rate here.
- 24** Please confirm that performance security shall be furnished as per bid condition.
- 25** Please confirm whether you have offered any discount on offered bid price and if so-
- (a) Whether discount is conditional or unconditional. If discount is conditional, please state the condition here.

- 26** Please refer Clause 14 of Volume-II and confirm that the stipulation regarding tolerance in the ordered quantity to the extent of  $\pm 500$  Meter is acceptable to you.

**SIGNATURE OF BIDDER**



## SCHEDULE –XII

### CHECK LIST OF SCHEDULES

The Bidders should specifically declare that they have enclosed various schedules, drawings, calculations and other details as per bid.

Reference	Particulars	Strike out Declaration whichever is not applicable
<b>TECHNICAL BID</b>		
SCHEDULE –I	DETAILS OF MATERIAL & QUANTITY	YES/NO
SCHEDULE –II	TECHNICAL QUESTIONNAIRE	YES/NO
SCHEDULE-III	DETAILS OF WOODEN DRUM DRAWINGS SUBMITTED WITH BID	YES/NO
SCHEDULE-IV	LIST OF PLANT & MACHINERY AND TESTING EQUIPMENTS	YES/NO
SCHEDULE-V	BASE INDICES TO BE CONSIDERED FOR PRICE VARIATION	YES/NO
SCHEDULE-VI	QUALITY ASSURANCE ROGRAMME AND PROGRAMME CHART	YES/NO
SCHEDULE-VII	SOURCES OF MATERIALS TOBE ARRANGED BY THE BIDDER FOR SUPPLY OF ACSR CONDCTOR	YES/NO
SCHEDULE-VIII	SCHEDULE OF NO DEVIATION FROM COMMERCIAL AND TECHNICAL TERMS AND CONDITIONS	YES/NO
SCHEDULE-IX	SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS	YES/NO
SCHEDULE-X	LIST OF TYPE TEST REPORT	YES/NO
SCHEDULE-XI	COMMERCIAL QUESTIONNAIRE	YES/NO
SCHEDULE-XII	CHECK LIST OF SCHEDULES	YES/NO

**SIGNATURE OF BIDDER**

## TENDER FORM

The undersigned hereby bids and offers (subject to **Company's** conditions of bidding) the **M.P. POWER TRANSMISSION COMPANY LIMITED, (hereinafter referred to as 'Company')** to test and supply the plant, machinery and materials, deliver and execute and do the several works and things which are described or referred to in the enclosures and schedules to the Bid Identification No. **TR-203** copies of which are annexed hereto and which under the terms thereof are to be supplied, executed and done by the contractor in a thoroughly good and workman like manner, and to perform and observe the provisions and agreements or the part of the contract contained in or reasonably to be inferred from the said tender documents for the sums and at the rates set out in schedules annexed hereto.

It is confirmed that all (i) Questionnaire for Commercial terms and conditions (ii) Questionnaire for technical specification of equipments/ materials and (iii) All other conditions-where ever described in the bid document have been replied in full giving clear details. It has been noted that in case any reply is not given or any reply is incomplete/ ambiguous the Company will have the right to take the same in such a way that may be advantageous for the Company. Company's decision in this regard will be final. The bidder will have no right to furnish any technical or commercial clarifications after opening of the bid which may in any way alter the offered prices.

Further cost of Bid Identification No ₹\_\_\_\_\_remitted through Demand Draft/ Banker's cheque No. \_\_\_\_\_ dt.\_\_\_\_\_ drawn on \_\_\_\_\_ (Name of Bank) is enclosed alongwith Documents submitted in Hardcopy.

Dated this \_\_\_\_\_ day of \_\_\_\_\_ 2018.

(Bidder's Signature)

Name \_\_\_\_\_

Address \_\_\_\_\_

Seal :