ODISHA POWER TRANSMISSION CORPORATION LIMITED

VOL-II
(PART-II)

Package CPC-73/2014-15:

Construction of 220kV Double Circuit Transmission line on DC tower from 220/132/33KV Grid S/S Aatri(Karadagadia) to Pandiabil 400/220 KV Grid S/S (Benapanjari) of PGCIL (Appx. Line Length: 24.0 Kms) on Turnkey basis" in e- tendering mode only

GUARANTEED TECHNICAL PARTICULARS

NOTICE INVITING TENDER-NIT NO. "73 / 2014-15"

TENDER SPECIFICATION NO Sr.G.M- CPC-TENDER- PACKAGE- 73/2014-15.

GUARANTEED TECHNICAL PARTICULARS

(TO BE FILLED AND SUBMITTED BY BIDDERS WITH THE TECHNICAL BID)

GUARANTEED TECHNICAL PARTICULARS

FOR

CONDUCTOR, EARTH WIRE, INSULATORS

GUARANTEED TECHNICAL PARTICULARS OF CONDUCTOR

ACSR CONDUCTOR: **MOOSE** **ZEBRA** **PANTHOR**

Sl. No.	**Description**
1.	Code Word

2. Maker's name address and Country.
   a) Aluminum rods
   b) Steel Wire/rods
   c) Complete conductor
3. Stranding and wire diameter
   a) Aluminum.
   b) Steel.
4. Standard nominal copper area in sq. mm
5. Calculated equivalent aluminum area in sq. mm
6. Actual aluminum area in sq. mm.
7. Standard area of cross section in sq. mm.
   a) Aluminum strand
   b) Steel strand
   c) Conductor
8. Diameter of complete conductor in mm.
9. Minimum ultimate tensile stress of strand, in Kg/sq. mm. Before stranding and after stranding for
   a) Aluminum strand.
   b) Steel strand
10. Guaranteed ultimate tensile strength of conductor in Kg.
11. Minimum breaking load in Kg. Before stranding and after stranding for
   a) Aluminum strand.
   b) Steel strand.

12. Purity of aluminum rods.
13. Zinc coating of steel strand.
    a) Uniformity of coating
       number and/duration of dips.
    b) Minimum weight of coating gm/sq. mm.
14. Weight in Kg. per K.M.
    a) Aluminum.
    b) Steel.
    c) Conductor.
15. Resistance in ohms per Km. at 20° c.
16. Continuous maximum current
    rating of conductor in still
    air at 45° C ambient temperature,
    considering temp. rise of 50°C.
17. Modulus of elasticity of :
    Conductor.
18. Co-efficient of linear expansion
       per degree centigrade of.
    a) Aluminum strand.
    b) Steel Strand.
    c) Conductor.
19. Percentage of carbon in
    steel wire.
20. Standard length of each
    peace in Km.
21. Initial and final sags and
    tension and stringing charts,
    whether furnished.
22. Tolerance, if any on standard length.
23. Number of standard length
    in one reel.

24. Dimensions of the reel in cms.

25. Weight of the Conductor
in one reel in Kg.

26. Weight of the reel in Kg.

27. Gross weight of the reel
including weight of the conductor.

28. Wheather the conductor will be manufactured
as per the relevant Indian Standard Specification
& as per Section-IV 'Technical specification' of this specification.

29. Wheather the conductor will be Tested
as per the relevant Indian Standard Specification
& as per Section-IV 'Technical specification' of this specification.
(Cause-12 of Section –IV of Technical Specification)

29. Other particulars, if any.

GUARANTEED TECHNICAL PARTICULARS OF THE GALVANIZED STEEL G.I. EARTH WIRE

SL No.	DESCRIPTION		**'7/3.15 mm**	**'7/3.66 mm**
1.	Maker's name, address and country			
2.	Percentage of carbon content of the steel wire.			
3.	Particular of steel strands			
	a) Number of strands.			
	b) Diameter	Mm		
	c) Standard sectional area	Sq.mm		
	d) Minimum ultimate tensile strength.	N/mm2		
	e) Minimum breaking land			
	f) Final stress in steel wires	N/mm2 KN/mm2		
4.	(a) Uniformity of coating of number and duration of dips.	Minutes Number of dips.		
	1.			
	2.			
	b) Minimum weight of coating	GM/m2		
5.	Standard overall diameter of ground wire.	Sq.mm		
6.	Area of cross section of ground wire.	Mm		
7.	Guaranteed ultimate tensile strength of ground wire.	N/mm2		
8.	Maximum working tension	N/mm2		
9.	Resistance in ohms per KM at 20^0C.			
10.	Standard length of ground wire.	Km.		
11.	Modulus of elasticity of ground wire.	Kg / cm2 Final Initial		
12.	Co-efficient of linear expansion.			
13.	Zinc coating :-			
	a) Number of one minute dip			
	b) Number of half minute dip.			
	c) Quality of zinc			
14.	Weight of coating on wire			
15.	Process of galvanising			

GUARANTEED TECHNICAL PARTICULARS FOR INSULATORS

(SEPARATE SHEETS MAY BE FILLED IN FOR EACH VOLTAGE RATING & DIFFERENT KN RATING)

Sl. No.	Description.	Single Suspension	Double suspension	Single Tension	Double Tension.
1.	2.	3.	4.	5.	6.
1.	Makers name and address and country.				
2.	Size and designation of Ball and socket and standard to which if will conform mm.				
3.	No. of insulator discs per string.				
4.	Outside dia of the disc. Mm				
5.	Spacing – mm				
6.	Creepage distance of the single disc –mm				
7.	Electro-mechanical strength of single disc. Kg.				
8.	Withstand voltage of single disc.				
8.1	Power frequency: a) Dry-kV (rms) b) Wet-kV (rms				
8.2	Impulse voltage 1.2/50 micro second. a) Positive-kV (peak) b) Negative-kV (peak)				
9.	Withstand				

Sl. No.	Description.	Single Suspension	Double suspension	Single Tension	Double Tension.
	voltage for the complete string.				
9.1	Power frequency:				
	a) Dry-kV (rms)	With and without corona			
	b) Wet kV (rms)	ang.			
9.2	Lighting impulse voltage 1.2/50 micro second.				
	a) Positive kV(peak)	-do-			
	b) Negative Kv(Peak)				
9.3	Switching surge voltage 250/2500 micro second (for 400KV only)	-do-			
	a) Dry-kV (rms)				
	b) Wet kV (rms)				
10.	Flashover voltage for the disc.				
10.1	Power frequency:				
	a) Dry-kV (rms)				
	b) Wet kV (rms)				
10.2	Lighting impulse voltage 1.2/50 micro second.				
	a) Positive kV(peak)				
	b) Negative Kv(Peak)				
11.	Flashover				

Sl. No.	Description.	Single Suspension	Double suspension	Single Tension	Double Tension.
	voltage for the complete string.				
11.1	Power frequency:				
	a) Dry-kV (rms)	With and without corona ring.			
	b) Wet kV (rms)				
11.2	Lighting impulse voltage 1.2/50 micro second.				
	a) Positive kV(peak)				
	b) Negative Kv(Peak)				

GUARANTEED TECHNICAL PARTICULARS

FOR

TRANSMISSION LINE : 400/220/132 KV

GUARANTED TECHNICAL PARTICULARS TO BE FIILED BY THE BIDDERS
SCHEDULE : B
Manufacturers And Place Of Manufacture,
Testing And Inspection
(To be filled up by Bidder)

Item	Manufacturer	Place of manufacture	Place of testing and inspection
Line conductors (ACSR) :	SUPPLIED	BY THE	EMPLOYER
Earthwire (galvanised steel) :			
Steel billets			
Drawing steel wires			
Stranding complete conductors			
Insulator units			
HV testing laboratory	-	-	
Insulator set fittings			
Earthwire fittings			

Conductor joints			
Conductor spacers/spacer dampers			
Vibration dampers (for earthwires and conductors)			
Steel towers :			
Design			
Steel billets, etc.			
Steel sections			
Fabrication			
Galvanising			
Check assembly			
Tower tests	-	-	
Bolts and nuts			
Tower fittings			
Earthing materials			

SCHEDULE : C
General Technical Particulars And Guarantees
(Parameters considered and guaranteed by the Bidder for the purpose of this Contract. The data filled in shall form the part of the Contract, in case of Award and shall be binding on the Contractor)

C. 1 - Span Lengths
(To be filled up by the Bidder)

	Unit	132kV	220kV	400kV
Normal span	m			
Tower design spans:				
Wind spans:				
Suspension towers	m			
Tension towers	m			
Maximum weight spans:				
Suspension towers	m			
Tension towers	m			

Minimum weight spans:				
Suspension towers	m			
Tension towers (uplift net)	m			

C . 2 - Line Conductor : 132 kV Construction
(To be filled up by the Bidder)

	Unit	
Complete line conductor:		
Actual area (total) per single conductor	mm^2	
Number of conductors per phase		
Horizontal distance between conductor centres of one phase	mm	
Each single conductor:		
ACSR conductor of code name		
IEC STANDARD No		
INDIAN STANDARD No		
Material of conductor		
Number and diameter of wires:		
Aluminium	No./mm	
Total area of conductor	mm^2	
Overall diameter of stranded conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Maximum tension of conductor at 5°C and 36% full wind pressure	Newton	
Maximum tension of conductor at 32°C with full wind pressure	Newton	

Maximum tension of conductor in still air at minimum temperature of 5°C	Newton	
Assumed equivalent modulus of elasticity of conductor	N/mm^2	
Assumed equivalent coefficient of linear expansion of conductor	per °C	

C . 2 - Line Conductor : 132 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	
Vibration damping system:		
*Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment:		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

* Delete as appropriate and fill in details for selected damping system

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 2.3.14, for the approval of the Project Manager.)

C . 3 - Line Conductor : 220 kV Construction
(To be filled up by the Bidder)

	Unit	
Complete line conductor:		
Actual area (total) per single conductor	mm^2	
Number of conductors per phase		
Horizontal distance between conductor centres of one phase	mm	
Each single conductor:		
ACSR conductor of code name		
IEC STANDARD No		
INDIAN STANDARD No		
Material of conductor		
Number and diameter of wires:		
Aluminium	No./mm	
Total area of conductor	mm^2	
Overall diameter of stranded conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Maximum tension of conductor at 5°C and 36% full wind	Newton	
Maximum tension of conductor at 32°C with full wind	Newton	
Maximum tension of conductor in still air at minimum temperature of 5°C	Newton	
Assumed equivalent modulus of elasticity of conductor	N/mm^2	
Assumed equivalent coefficient of linear expansion of conductor	per °C	

C . 3 - Line Conductor : 220 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	
Vibration damping system:		
*Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment:		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

* Delete as appropriate and fill in details for selected damping system

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 2.3.14, for the approval of the Project Manager.)

C . 4 - Line Conductor : 400 kV Construction
(To be filled up by the Bidder)

	Unit	
Complete line conductor:		
Actual area (total) per single conductor	mm^2	
Number of conductors per phase		
Horizontal distance between conductor centres of one phase	mm	
Each single conductor:		
ACSR conductor of code name		
IEC STANDARD No		
INDIAN STANDARD No		
Material of conductor		

Number and diameter of wires: Aluminium.	No./mm	
Total area of conductor	mm^2	
Overall diameter of stranded conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Maximum tension of conductor at 5°C and 36% full wind	Newton	
Maximum tension of conductor at 32°C with full wind	Newton	
Maximum tension of conductor in still air at minimum temperature of 5°C	Newton	
Assumed equivalent modulus of elasticity of conductor	N/mm^2	
Assumed equivalent coefficient of linear expansion of conductor	per °C	

C . 4 - Line Conductor : 400 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	
Vibration damping system and Spacing system:		
*Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment:		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

Mean sub span for spacers	m	
If spacer dampers are to be offered:		
Mean sub span for spacer dampers	m	

* Delete as appropriate and fill in details for selected damping system

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 2.3.14, for the approval of the Project Manager. Also ,for spacer and spacer damper the Contractor shall furnish placement chart, for the approval of the Project Manger, as per the Clause No. 2.4.3.2 and 2.5.20 respectively.)

C . 5 - Earth Wire : 132 kV and 220 kV Constructions
(To be filled up by the Bidder)

	Unit	**GSW**
Complete earth conductor:		
Appropriate Indian Standard No		
Appropriate IEC Standard No		
Material of conductor		
Number and diameter of wires	No./mm	
Overall diameter of conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Lay length	mm	
Direction of the lay of the outer layer		
Chemical composition of the steel wire		
Carbon	%	
Manganese		
Phosphorous		
Sulphur		
Silicon		
Purity of Zinc for galvanising		

Steel strands after galvanising Diameter Minimum breaking load of one strand Galvanising a) Minimum weight of Zinc coating per sq.m. of the uncoated wire surface after galvanising	% mm kN gms	

C . 5 - Earth Wire : 132 kV and 220 kV Constructions (Continued)
(To be filled up by the Bidder)

	Unit	**GSW**
b) Minimum no. of one minute dips that the galvanised strand can withstand after stranding in Standard Preece Test	Nos.	
Maximum tension at 5°C and 36% full wind	Newton	
Maximum tension at 32°C with full wind	Newton	
Maximum tension of conductor in still air at 5°C	Newton	
Assumed equivalent modulus of elasticity of Conductor	hbar	
Assumed equivalent coefficient of linear expansion of conductor	per °C	
Maximum length of conductor on drum #	km	
D.C. resistance at 20 ^{o}C	ohms/km	
Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment		
First damper	mm	
Second damper when required	mm	

Third damper when required	mm	

It is permitted to supply two lengths of 2 kms each, in a single drum.

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 3.3 , for the approval of the Project Manager.)

C . 6 - Earth Wire : 400 kV Construction (To be filled up by the Bidder)

	Unit	**GSW**
Complete earth conductor:		
Appropriate Indian Standard No		
Appropriate IEC Standard No		
Material of conductor		
Number and diameter of wires	No./mm	
Overall diameter of conductor	mm	
Mass of conductor per kilometre	kg	
Ultimate strength of conductor	Newton	
Lay length	mm	
Chemical composition of the steel wire	%	
Carbon		
Manganese		
Phosphorous		
Sulphur		
Silicon		
Purity of Zinc for galvanising	%	
Steel strands after galvanising		
Diameter	mm	
Minimum breaking load of one strand	kN	
Galvanising		

a) Minimum weight of Zinc coating per sq.m. of the uncoated wire surface after galvanising	gms	
b) Minimum no. of one minute dips that the galvanised strand can withstand, after stranding in Standard Preece Test.		

C . 6 - Earth Wire : 400 kV Construction (Continued)
(To be filled up by the Bidder)

	Unit	GSW
Maximum tension at 5°C and 36% full wind pressure	Newton	
Maximum tension at 32°C with full wind pressure	Newton	
Maximum tension of conductor in still air at 5°C	Newton	
Assumed equivalent modulus of elasticity of Conductor	hbar	
Assumed equivalent coefficient of linear expansion of conductor	°C	
Maximum length of conductor on drum #	km	
D.C. resistance of the complete earthwire at $20^{O}C$	ohms/km.	
Direction of lay of the outer layer		
Maximum span for:		
One vibration damper at each end of span	m	
Two vibration dampers at each end of span	m	
Three vibration dampers at each end of span	m	
Dimensions from clamp mouth to vibration damper attachment		
First damper	mm	
Second damper when required	mm	
Third damper when required	mm	

It is permitted to supply two lengths of 2kms each, in a single drum.

(After placement of order, the Contractor has to carry-out vibration analysis and furnish a detailed vibration damper placement chart, as has been specified at Clause No. 3.3 , for the approval of the Project Manager.)

C . 7 - Earthwire Fittings and Accessories
(To be filled up by the Bidder)

	Unit	GSW:7/3.15	GSW:7/3.66
Suspension Clamps			
Total drop	mm		
Weight of the assembly	kg		
Breaking load	kN		
Slipping strength	kN		
Tightening torque	kN		
Galvanising			
a) Minimum weight of Zinc coating per Sq.m. of uncoated surface	gms. /sq. m		
b) No. of one minute dips all the galvanised parts can withstand in Standard Preece test			
c) Purity of Zinc used for galvanising	%		
Tension Clamps			
Total weight of the assembly	kg		
Weight of the steel parts	kg		
Weight of the Aluminium encasing	kg		
Slipping strength of the clamp	kN		
Minimum breaking load of the assembly	kN		
Compression pressure	Tonne		
a) Steel sleeve			
b) Aluminium encasing			
Inside diameter (Before compression)	mm		
a) Steel sleeve			
b) Aluminium encasing			

C . 7 - Earthwire Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	GSW:7/3.15	GSW:7/3.66
Outside dimension of the steel sleeve	mm		
a) Before compression			
b) After compression			
i) Corner to corner			
ii) Surface to surface			
Outside diameter of the Aluminium encasing (Before compression)	mm		
Outside dimension of the clamp after compression of the Aluminium encasing	mm		
Length of the steel sleeve	mm		
a) Before compression			
b) After compression			
Final dimension of the clamp after compression with Aluminium encasing	mm		
Brinnel hardness no. of the steel sleeve (range)			
Resistance of the completed tension clamp	ohms		
Galvanising :			
a) Minimum weight of Zinc coating per Sq.m. of uncoated surface	gms./sq.m		
b) No. of one minute dips all the galvanised parts can withstand in Standard Preece test			
c) purity of Zinc used for galvanising	%		
Mid-span compression joints for earthwire			
Total weight of the joints	kg		
Weight of the steel sleeve	kg		
Weight of the aluminium sleeve	kg		

C . 7 - Earthwire Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	GSW:7/3.15	GSW:7/3.66
Inside diameter before compression	mm		
a) Steel sleeve			
b) Aluminium encasing			
Outside diameter before compression	mm		
a) Steel sleeve			
b) Aluminium encasing			
Outside dimensions of the joint after compression	mm		
a) Steel sleeve			
i) Corner to corner			
ii) Surface to surface			
b) With aluminium encasing			
Length of the steel sleeve	mm		
a) Before compression			
b) After compression			
Final length of the joint after compression with aluminium encasing	mm		
Compression pressure	Tonne		
Slipping strength	kN		
Resistance of the completed joint	ohms		
Galvanising :			
a) Minimum weight of Zinc coating per Sq.m. of uncoated surface	gms./sq.m		
b) No. of one minute dips all the galvanised parts can withstand in Standard Preece test			
c) Purity of Zinc for galvanizing	%		
Flexible copper bonds			
Resistance of the Cu-bond	ohms		
Total weight of the Cu-bonds	kg		
Slipping strength	kN		

C . 8 - Conductor(ACSR) Fittings and Accessories
(To be filled up by the Bidder)

	Unit	PANTHER	ZEBRA	MOOSE
Mid-span compression joints for Conductors				
Weight of the joints	kgs			
Slipping strength	kN			
Resistance of the completed joints	ohms			
Material of the joints (specify alloy type and its aluminium contents)				
Before compression dia. of sleeve	mm			
a) Inner diameter				
b) Outer diameter				
Dimensions after compression	mm			
a) Corner to corner				
b) Surface to surface				
Length of the sleeve	mm			
a) Before compression				
b) After compression				
Compression pressure	Tonne			
Whether designed for intermittent or continuous compression				
Minimum corona extinction voltage under dry conditions	kV			
Radio interference voltage under conditions	Micro Volts			

C . 8 - Conductor(ACSR) Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	PANTHER	ZEBRA	MOOSE
Repair sleeve for conductors				
Weight of the sleeve	kgs			
Before compression dia. of sleeve	mm			
a) Inner diameter				
b) Outer diameter				
Dimensions after compression	mm			
a) Corner to corner				
b) Surface to surface				
Length of the sleeve	mm			
a) Before compression				
b) After compression				
Compression pressure	Tonne			
Minimum corona extinction voltage under dry conditions	kV			
Radio interference voltage under conditions	Micro Volts			
T-connector (only for ACSR MOOSE)				
Weight of the T-connector	kgs			
Axial tensile strength of the welded portion of the T-connector	kN			
Breaking strength of the T-connector	kN			
Resistance of the completed T-connection	ohms			

C . 8 - Conductor(ACSR) Fittings and Accessories (continued)
(To be filled up by the Bidder)

	Unit	PANTHER	ZEBRA	MOOSE
Before compression dia. of the T-connector	mm			

a) Inner diameter				
b) Outer diameter				
Dimensions after compression	mm			
a) Corner to corner				
b) Surface to surface				
Length of the T-connector	mm			
a) Before compression				
b) After compression				
Compression pressure	Tonne			
Minimum corona extinction voltage under dry conditions	kV			
Radio interference voltage under conditions	Micro Volts			

C . 9 - Vibration Damper For Conductor and Earthwire
(To be completed by the Bidder)

Vibration Dampers for ACSR PANTHER	Unit	
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		
Magnetic power loss per vibration damper	Watts	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions at 1MHz , at 105 kV	Micro Volts	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for ACSR PANTHER	Unit	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	
Vibration Dampers for ACSR ZEBRA		
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for ACSR ZEBRA	Unit	
Magnetic power loss per vibration damper	Watts	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions at 1MHz, at 154 kV	Micro Volts	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	
Vibration Dampers for ACSR MOOSE		
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of : 1) Damper mass		
2) Messenger cable		

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for ACSR MOOSE	Unit	
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		
Magnetic power loss per vibration damper	Watts	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions at 1MHz , at 305 kV	Micro Volts	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for 7/3.15mm Earthwire	Unit		
Total weight of the damper	kgs		
		Left	Right

Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the fatigue test	%	

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for 7/3.15mm Earthwire	Unit	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	

3) Purity of Zinc used for galvanizing	%	
Vibration Dampers for 7/3.66mm Earthwire		
Total weight of the damper	kgs	
		Left Right
Weight of each damper mass	kgs	
Resonance frequencies		
1) First frequency	Hz	
2) Second frequency	Hz	
Dimension of each damper mass	mm	
Material of :		
1) Damper mass		
2) Messenger cable		
No. of strands in messenger cable		
Lay ratio of the messenger cable strands		
Min. tensile strength of messenger cable	kg/sq.mm.	
Mass pull-off strength	kN	
Clamping torque	kg.-m	
Slipping strength of the damper clamp	kN	
1) Before fatigue test		
2) After fatigue test		

C . 9 - Vibration Damper For Conductor and Earthwire (Continued)
(To be completed by the Bidder)

Vibration Dampers for 7/3.66mm Earthwire	Unit	
Percentage variation in reactance after fatigue test in comparision with that before the fatigue test	%	
Percentage variation in power dissipation after fatigue test in comparision with that before the	%	

fatigue test		
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanizing	%	

C . 10 - Bundle Spacers For 400kV Line Conductors
(To be filled up by the Bidder)

	Unit	
Material of component parts(indicate type of alloy)		
1) Insert		
2) Main body		
3) Retaining rods (if any)		
Manufacturing process for		
1) Insert		
2) Main body		
3) Retaining rods (if any)		
Retaining rods (if used)		
1) Type of alloy used		
2) No. of retaining rods used for each spacer		
3) Diameter of the rod	mm	
4) Length of the rod	mm	
5) Total weight of one set of the rods	kgs	
Elatomer		
1) Supplier		
2) Type		
3) Moulded on the insert or not		
4) Shore hardness		
5) Thickness on the insert	mm	
6) Temperature for which designed	^{o}C	
Minimum strength of the spacer		
1) Compressive load	kN	

2) Tensile load	kN	
Weight of the spacer	kgs	
Designed clamping torque (if applicable)	kg-m	
Slipping strength of spacer clamp 1) Before vibration test	kN	
2) After vibration test	kN	

C . 10 - Bundle Spacers For 400kV Line Conductors (Continued)
(To be filled up by the Bidder)

	Unit	
Magnetic power loss per spacer	Watts	
Galvanising of ferrous parts (if any)		
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanising	%	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions	Micro Volts	
Electrical resistance of the elastomer cushioned spacer (specify the range)	ohms	

C.11 - Bundle Spacers For Jumpers Of 400kV Lines
(To be filled up by the Bidder)

	Unit	
Material of component parts (indicate type of alloy) 1) Insert		
2) Main body		
Manufacturing process for 1) Insert		
2) Main body		

Elatomer 1) Supplier		
2) Type		
3) Moulded on the insert or not		
4) Shore hardness		
5) Thickness on the insert	mm	
6) Temperature for which designed	^{o}C	
Minimum strength of the spacer for jumpers 1) Compressive load	kN	
2) Tensile load	kN	
Weight of the spacer for jumpers	kgs	
Designed clamping torque for spacer for jumpers	kg-m	
Slipping strength of spacer clamp for jumpers	kN	
Magnetic power loss per spacer for jumpers	Watts	
Galvanising of ferrous parts (if any) 1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m	
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.	
3) Purity of Zinc used for galvanising	%	
Min. corona extinction voltage under dry conditions	kV	
Radio interference voltage under dry conditions	MicroVolt	
Electrical resistance of the elastomer cushioned spacer for jumpers (specify the range)	ohms	

C.12 - Spacer Dampers For 400kV Line Conductors
(To be filled up by the Bidder)

	Unit	
Material of component parts (indicate type of alloy / rubber component) 1) Insert		
2) Main body		
3) Retaining rods (if any)		
4) Damping ball		
Manufacturing process for		

1) Insert		
2) Main body		
3) Retaining rods (if any)		
4) Damping ball		
Retaining rods (if used)		
1) Type of alloy used		
2) No. of retaining rods used for each unit		
3) Diameter of the rod	mm	
4) Length of the rod	mm	
5) Total weight of one set of the rods	kgs	
Elatomer		
1) Supplier		
2) Type		
3) Moulded on the insert or not		
4) Shore hardness		
5) Thickness on the insert	mm	
6) Temperature for which designed	^{o}C	
Minimum strength of the spacer damper		
1) Compressive load	kN	
2) Tensile load	kN	

C.12 - Spacer Dampers For 400kV Line Conductors (Continued)
(To be filled up by the Bidder)

	Unit	
Weight of the spacer damper	kgs	
Designed clamping torque (if applicable)	kg-m	
Slipping strength of spacer damper clamp		
1) Before vibration test	kN	
2) After vibration test	kN	

Galvanising of ferrous parts (if any)			
1) Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m		
2) Minimum No. of one minute dips the ferrous parts can withstand in the Standard Preece Test	Nos.		
3) Purity of Zinc used for galvanising	%		
Min. corona extinction voltage under dry conditions	kV		
Radio interference voltage under dry conditions	Micro Volts		
Magnetic power loss per spacer damper	Watts		
Electrical resistance of the elastomer cushioned spacer damper (specify the range)	ohms		

C.13 - Disc Insulator Units (Standard Type)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single disc unit	kg				
Size and designation of the ball pin shank	mm				
Diameter of the disc	mm				
Tolerance on the diameter	+/-mm				
Ball to ball spacing between disc	mm				
Tolerance on ball to ball spacing	+/-mm				
Minimum creepage distance of a single disc	mm				
Positive tolerance on the minimum creepage distance	+mm				
Shell material (Glass/Porcelain)					
Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				

2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency puncture voltage (rms) of single disc unit	kV				

C.13 - Disc Insulator Units (Standard Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Impulse withstand voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
No. of dips in Standard Preece Test					
1) Cap socket					
2) Ball pin					
Axial and radial run-out (According to IEC)					
1) As per pointer A	mm				
2) As per pointer B	mm				

C.13A - Composite Insulator Units (Standard Type)

(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single insulatort unit	kg				
Size and designation of the ball pin shank / clevis and tongue	mm				
Diameter of (along with tolerance)	mm				
1) central core without housing sleeve cover					
2) central core with housing sleeve cover					
3) weather shed					
Length of single insulator unit	mm				
Tolerance on unit insulator length	+/-mm				
Minimum creepage distance of a single insulator unit	mm				
Positive tolerance on the minimum creepage distance	+mm				
Core material					
Shed material					
Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				

C.13A - Composite Insulator Units (Standard Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					

Impulse withstand voltage (peak) of single disc unit (dry) 1) Positive 2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
No. of dips in Standard Preece Test 1) Cap socket 2) Ball pin					

Note : Any other parameters which Bidder feels are necessary to define the offered composite insulator unit, shall be indicated and guaranteed in the above format.

C.14 - Disc Insulator Units (Anti-fog Type)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single disc unit	kg				
Size and designation of the ball pin shank	mm				
Diameter of the disc	mm				
Tolerance on the diameter	+/-mm				
Ball to ball spacing between disc	mm				
Tolerance on ball to ball spacing	+/-mm				
Minimum creepage distance of a single disc	mm				
Positive tolerance on the minimum creepage distance	+mm				
Shell material (Glass/Porcelain)					

Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency puncture voltage (rms) of single disc unit	kV				

C.14 - Disc Insulator Units (Anti-fog Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Impulse withstand voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
Purity of Zinc used for sleeve	%				
No. of dips in Standard Preece Test 1) Cap socket					

2) Ball pin					
Axial and radial run-out (According to IEC)					
1) As per pointer A	mm				
2) As per pointer B	mm				

C.14A - Composite Insulator Units (Anti-fog Type)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Weight of the single insulatort unit	kg				
Size and designation of the ball pin shank / clevis and tongue	mm				
Diameter of (along with tolerance)	mm				
1) central core without housing sleeve cover					
2) central core with housing sleeve cover					
3) weather shed					
Length of single insulator unit	mm				
Tolerance on unit insulator length	+/-mm				
Minimum creepage distance of a single insulator unit	mm				
Positive tolerance on the minimum creepage distance	+mm				
Core material					
Shed material					
Power frequency flashover voltage (rms) of single disc unit					
1) Dry	kV				
2) Wet	kV				
Power frequency withstand voltage (rms) of single disc unit					
1) Dry	kV				

2) Wet	kV				

C.14A - Composite Insulator Units (Anti-fog Type) (Continued)
(To be filled up by the Bidder)

	Unit	70kN	90kN	120kN	160kN
Impulse flashover voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Impulse withstand voltage (peak) of single disc unit (dry)					
1) Positive					
2) Negative					
Steepness of the impulse voltage which the disc unit can withstand in Steep Wave Front Test	kV per micro sec.				
Corona extinction voltage (rms) under dry condition, for single unit					
Maximum RIV at 1 MHz and at 10 kV (rms) for single unit	Micro Volts.				
Purity of Zinc used for galvanising	%				
No. of dips in Standard Preece Test					
1) Cap socket					
2) Ball pin					

Note : Any other parameters which Bidder feels are necessary to define the offered composite insulator unit, shall be indicated and guaranteed in the above format.

C . 15 - Insulator Strings (Suspension Sets For 132 kV Lines)
(To be filled up by the Bidder)

	Unit	Single "I" Suspension Strings	Double "I" Suspension Strings	Pilot Suspension Strings
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)			

Impulse flashover voltage (peak) under dry conditions				
1) Positive	kV			
2) Negative	kV			
Impulse withstand voltage (peak) under dry conditions				
1) Positive	kV			
2) Negative	kV			
Salt-fog pollution withstand voltage (only for strings with anti-fog disc units)	kV(rms)			
Minimum corona extinction voltage under dry conditions	kV(rms)			
Radio interference voltage under dry conditions at 1MHz, at 105kV	Micro Volts			
Mechanical strength of the complete insulator string along with all hardware fittings	kN			
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%			
Number of insulator units in each string				

C . 15 - Insulator Strings (Suspension Sets For 132 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm			
Weight of the set, complete with all fittings and arcing horns	kg			
Weight of the counter-weights	kg			

Minimum arcing gap distance	mm			
Maximum magnetic power loss of the suspension assembly	Watts			
Slipping strength of the suspension assembly (clamp torque Vs. slip curve shall be enclosed)	kN			
Particulars of Standard/AGS pre-formed armour rod set for suspension assembly		Standard Or, AGS	Standard Or, AGS	Standard Or, AGS
1) No. of rods per set	No.			
2) Direction of the lay				
3) Overall length after fitting on the conductor	mm			
4) Actual length of each rod along its helix	mm			
5) Diameter of each rod	mm			
6) Tolerance in				
a) Diameter of each rod	+/- mm			
b) Length of each rod	+/- mm			
c) Difference of length between the longest and shortest rod in a set	+/- mm			
7) Type of Aluminium alloy used for manufacture of PA rods				
8) UTS of each rod	kg/mm ^{2}			

C . 15 - Insulator Strings (Suspension Sets For 132 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Particular of Elastomer (for AGS clamps only)				
1) Supplier of elastomer				
2) Type of elastomer				

3) Shore hardness of elastomer				
4) Temperature range for which elastomer is designed	^{o}C			
5) Moulded on insert	yes/no			
Purity of Zinc used for galvanising	%			
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.			
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m			

C . 16 - Insulator Strings (Tension Sets For 132 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Impulse withstand voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 105kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		

Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		

C . 16 - Insulator Strings (Tension Sets For 132 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Weight of the set, complete with all fittings and arcing horns	kg		
Minimum arcing gap distance	mm		
Electrical resistance of the complete tension assembly along with jumper connection	ohms		
Slipping strength of the tension assembly	kN		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m		

C . 17 - Insulator Strings (Suspension Sets For 220 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)			
Impulse flashover voltage (peak) under dry conditions				
1) Positive	kV			

2) Negative	kV			
Impulse withstand voltage (peak) under dry conditions				
1) Positive	kV			
2) Negative	kV			
Salt-fog pollution withstand voltage (only for strings with anti-fog disc units)	kV(rms)			
Minimum corona extinction voltage under dry conditions	kV(rms)			
Radio interference voltage under dry conditions at 1MHz, at 154kV	Micro Volts			
Mechanical strength of the complete insulator string along with all hardware fittings	kN			
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%			
Number of insulator units in each string				

C . 17 - Insulator Strings (Suspension Sets For 220 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm			
Weight of the set, complete with all fittings and arcing horns	kg			
Weight of the counter-weights	kg			
Minimum arcing gap distance	mm			
Maximum magnetic power loss of the suspension assembly	Watts			
Slipping strength of the suspension assembly (clamp torque Vs. slip curve shall be enclosed)	kN			
Particulars of Standard/AGS pre-formed armour rod set for suspension assembly		Standard Or, AGS	Standard Or, AGS	Standard Or, AGS
1) No. of rods per set	No.			
2) Direction of the lay				
3) Overall length after fitting on the conductor	mm			
4) Actual length of each rod along its helix	mm			
5) Diameter of each rod	mm			
6) Tolerance in				
a) Diameter of each rod	+/- mm			
b) Length of each rod	+/- mm			
c) Difference of length between the longest and shortest rod in a set	+/- mm			
7) Type of Aluminium alloy used for manufacture of PA rods				
8) UTS of each rod	kg/mm ^{2}			

C . 17 - Insulator Strings (Suspension Sets For 220 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Double "I" Suspension Strings**	**Pilot Suspension Strings**
Particular of Elastomer (for AGS clamps only)				
1) Supplier of elastomer				
2) Type of elastomer				
3) Shore hardness of elastomer				
4) Temperature range for which elastomer is designed	^{o}C			
5) Moulded on insert	yes/no			
Purity of Zinc used for galvanising	%			
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.			
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq. m			

C . 18 - Insulator Strings (Tension Sets For 220 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		

Impulse withstand voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 105kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		

C . 18 - Insulator Strings (Tension Sets For 220 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single Tension Strings**	**Double Tension Strings**
Weight of the set, complete with all fittings and arcing horns	kg		
Minimum arcing gap distance	mm		
Electrical resistance of the complete tension assembly along with jumper connection	ohms		
Slipping strength of the tension assembly	kN		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq. m		

C . 19 - Insulator Strings (Suspension Sets For 400 kV Lines)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Pilot Suspension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Switching surge withstand voltage (peak) under wet conditions			
1) Positive	kV		
2) Negative	kV		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Impulse withstand voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 305kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			

C . 19 - Insulator Strings (Suspension Sets For 400 kV Lines) (Continued)

(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Pilot Suspension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		
Weight of the set, complete with all fittings and arcing horns	kg		
Weight of the counter-weights	kg		
Minimum arcing gap distance	mm		
Maximum magnetic power loss of the suspension assembly	Watts		
Slipping strength of the suspension assembly (clamp torque Vs. slip curve shall be enclosed)	kN		
Particulars of Standard/AGS pre-formed armour rod set for suspension assembly		Standard Or, AGS	Standard Or, AGS
1) No. of rods per set	No.		
2) Direction of the lay			
3) Overall length after fitting on the conductor	mm		
4) Actual length of each rod along its helix	mm		
5) Diameter of each rod	mm		
6) Tolerance in			
a) Diameter of each rod	+/- mm		
b) Length of each rod	+/- mm		
c) Difference of length between the longest and shortest rod in a set	+/- mm		
7) Type of Aluminium alloy used for manufacture of PA rods			
8) UTS of each rod	kg/mm^2		

C . 19 - Insulator Strings (Suspension Sets For 400 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**Single "I" Suspension Strings**	**Pilot Suspension Strings**
Particular of Elastomer (for AGS clamps only)			
1) Supplier of elastomer			
2) Type of elastomer			
3) Shore hardness of elastomer			
4) Temperature range for which elastomer is designed	^{o}C		
5) Moulded on insert	yes/no		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq. m		

C . 20 - Insulator Strings (Tension Sets For 400 kV Lines)
(To be filled up by the Bidder)

	Unit	**SingleTension Strings (Low Duty)**	**Double Tension Strings**
Power frequency withstand voltage of the string with arcing horns and corona control rings / grading rings under wet conditions	kV(rms)		
Switching surge withstand voltage (peak) under wet conditions			
1) Positive	kV		
2) Negative	kV		
Impulse flashover voltage (peak) under dry conditions			
1) Positive	kV		
2) Negative	kV		
Impulse withstand voltage (peak) under dry conditions			

1) Positive	kV		
2) Negative	kV		
Salt-fog pollution withstand voltage (only for strings with anti-fog units)	kV (rms)		
Minimum corona extinction voltage under dry conditions	kV(rms)		
Radio interference voltage under dry conditions at 1MHz, at 305kV	Micro Volts		
Mechanical strength of the complete insulator string along with all hardware fittings	kN		
Maximum voltage (in percentage) across any disc in the complete insulator string under phase to earth voltage *(not applicable for string with composite insulator units)*	%		
Number of insulator units in each string			

C . 20 - Insulator Strings (Tension Sets For 400 kV Lines) (Continued)
(To be filled up by the Bidder)

	Unit	**SingleTension Strings (Low Duty)**	**Double Tension Strings**
Overall length of the set including clamp and all fittings (specify the tolerance also)	mm		
Weight of the set, complete with all fittings and arcing horns	kg		
Minimum arcing gap distance	mm		
Electrical resistance of the complete tension assembly along with jumper connection	ohms		
Slipping strength of the tension assembly	kN		
Purity of Zinc used for galvanising	%		
Minimum No. of one minute dips the ferrous parts can withstand in Standard Preece Test	No.		
Minimum weight of Zinc coating per Sq.m. of the uncoated surface	gm/sq.m		

C . 21 - Tower Design Particulars : 132 kV Construction
(To be filled up by the Bidder)

	Unit	
Maximum tension per phase, for purposes of tower design and application		
Suspension towers	Newton	
Tension towers	Newton	
Slack span side downleads, `per individual conductor'	Newton	
Maximum uplift per phase on each crossarm for purpose of tension tower design	Newton	
Maximum tension of earth conductor for purpose of tower design and application:		
Suspension towers	Newton	
Tension towers	Newton	
Earthwire slack span side downleads	Newton	
Maximum uplift of each earth conductor on the tower for purpose of tower design	Newton	
Minimum clearance between live metal and tower steelwork:		
i. with suspension insulator set swing 0°	mm	
with suspension insulator set swing 15°	mm	
with suspension insulator set swing 30°	mm	
with suspension insulator set swing 45°	mm	
with suspension insulator set swing 60°	mm	
ii. with jumper loop swing 0°	mm	
with jumper loop swing 10°	mm	
with jumper loop swing 20°	mm	
with jumper loop swing 30°	mm	
with jumper loop swing 40°	mm	
Insulator suspension set, unobstructed transverse swing angle from vertical	degrees	
Earth conductor suspension clamps, unobstructed transverse swing angle from vertical	degrees	

Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	

C . 22 - Tower Design Particulars : 220 kV Construction
(To be filled up by the Bidder)

	Unit	
Maximum tension per phase, for purposes of tower design and application		
Suspension towers	Newton	
Tension towers	Newton	
Slack span side downleads, `per individual conductor'	Newton	
Maximum uplift per phase on each crossarm for purpose of tension tower design	Newton	
Maximum tension of earth conductor for purpose of tower design and application:		
Suspension towers	Newton	
Tension towers	Newton	
Earthwire slack span side downleads	Newton	
Maximum uplift of each earth conductor on the tower for purpose of tower design	Newton	
Minimum clearance between live metal and tower steelwork:		
i. with suspension insulator set swing 0°	mm	
with suspension insulator set swing 15°	mm	
with suspension insulator set swing 30°	mm	
with suspension insulator set swing 45°	mm	
with suspension insulator set swing 60°	mm	
ii. with jumper loop swing 0°	mm	
with jumper loop swing 10°	mm	
with jumper loop swing 20°	mm	
with jumper loop swing 30°	mm	
with jumper loop swing 40°	mm	

Insulator suspension set, unobstructed transverse swing angle from vertical	degrees	
Earth conductor suspension clamps, unobstructed transverse swing angle from vertical	degrees	
Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	

C . 23 - Tower Design Particulars : 400 kV Construction
(To be filled up by the Bidder)

	Unit	
Maximum tension per phase, for purposes of tower design and application		
Suspension towers	Newton	
Tension towers	Newton	
Slack span side downleads, `per individual conductor'	Newton	
Maximum uplift per phase on each crossarm for purpose of tension tower design	Newton	
Maximum tension of earth conductor for purpose of tower design and application:		
Suspension towers	Newton	
Tension towers	Newton	
Earthwire slack span side downleads	Newton	
Maximum uplift of each earth conductor on the tower for purpose of tower design	Newton	
Minimum clearance between live metal and tower steelwork:		
i. with suspension insulator set swing 0°	mm	
with suspension insulator set swing 15°	mm	
with suspension insulator set swing 30°	mm	
with suspension insulator set swing 45°	mm	
with suspension insulator set swing 60°	mm	
ii. with jumper loop swing 0°	mm	
with jumper loop swing 10°	mm	
with jumper loop swing 20°	mm	
with jumper loop swing 30°	mm	

with jumper loop swing 40°	mm	
Insulator suspension set, unobstructed transverse swing angle from vertical	degrees	
Earth conductor suspension clamps, unobstructed transverse swing angle from vertical	degrees	
Earth conductor maximum shielding angle from vertical at tower attachment point over outer line conductors	degrees	

C . 24 - Tower Design Particulars (Common for all Towers)
(To be filled up by the Bidder)

	Unit		
Maximum ratio of unsupported length of steel compression member to their least radius of gyration:			
Leg members, ground wire peak members and lower members of the crossarms in compression			
Other members carrying computed stresses			
Redundant members			
Tension only members			
		Mild steel	High yield steel
Maximum ultimate stresses, for checking tower designs not subjected to test (unless otherwise approved) :			
Compression members, Bidder to indicate his design Assumptions	N/mm^2		
Tension members (elastic limit)	N/mm^2		
Shear on bolts	N/mm^2		
Bearing on bolts	N/mm^2		

C . 25 - Particulars Of Double Circuit Towers : 132 kV Construction
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Type of insulator sets		Suspension	Tension	Tension	Tension
Maximum angle of deviation	degree				
Normal span length	m				
Minimum ground clearance of line conductor at 85°C, normal ground	m				
Sag of line conductor in normal span length at 85°C	m				
Maximum distance of line conductor below crossarm	m				
Height above ground of bottom conductor Crossarm	m				
Minimum height of earth conductors above upper line conductor : at tower	m				
: at mid-span	m				
Vertical spacing between line conductors at tower : Minimum	m				
Actual	m				
Overall tower height	m				
Maximum differential foundation movement permitted under ultimate loads	mm				
Clearance between conductors of one circuit and tower climbing leg of the other circuit : Minimum	m				

Actual	m				
Horizontal distance, from tower centre line of insulator attachments	m				
Horizontal distance, from tower centre line of earth conductors	m				

C . 25 - Particulars Of Double Circuit Towers : 132 kV Construction (Continued)
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m				
Overall tower base dimensions at ground line (transverse x longitudinal) : Maximum for standard height towers	m				
Actual for standard height towers	m				
Total transverse overturning moment at ground line of standard height tower.	kN-m.				
Mass of complete standard height tower above ground line (including bolts/nuts; bolts/nuts to be indicated separately)	kg				
Mass of tower body extension above ground line : 3 metre body extension only	kg				
6 metre body extension only	kg				
9 metre body extension only	kg				
12 metre body extension only	kg		-	-	-
18 metre body extension only	kg		-	-	-

C . 26 - Particulars Of Double Circuit Towers : 220 kV Construction
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD

Type of insulator sets		Suspension	Tension	Tension	Tension
Maximum angle of deviation	degree				
Normal span length	m				
Minimum ground clearance of line conductor at 85 °C, normal ground	m				
Sag of line conductor in normal span length at 85 °C	m				
Maximum distance of line conductor below crossarm	m				
Height above ground of bottom conductor crossarm	m				
Minimum height of earth conductors above upper line conductor : at tower	m				
: at mid-span	m				
Vertical spacing between line conductors at tower : Minimum	m				
Actual	m				
Overall tower height	m				
Maximum differential foundation movement permitted under ultimate loads	mm				
Clearance between conductors of one circuit and tower climbing leg of the other circuit : Minimum	m				
Actual	m				
Horizontal distance, from tower centre line of insulator attachments	m				
Horizontal distance, from tower centre line of earth conductors	m				

C . 26 - Particulars Of Double Circuit Towers : 220 kV Construction (Continued)
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m				
Overall tower base dimensions at ground line (transverse x longitudinal)					
Maximum for standard height towers	m				
Actual for standard height towers	m				
Total transverse overturning moment at ground line of standard height tower	kg-m.				
Mass of complete standard height tower above ground line (including bolts/nuts; bolts/nuts to be indicated separately)	kg				
Mass of tower body extensions above ground line					
3 metre body extension only	kg				
6 metre body extension only	kg				
9 metre body extension only	kg				
12 metre body extension only	kg		-	-	-
18 metre body extension only	kg		-	-	-
25 metre body extension only	kg		-	-	-

C . 27 - Particulars Of Double Circuit Towers : 400 kV Construction
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	DA	DB	DC	DD
Type of insulator sets		Suspension	Tension	Tension	Tension
Maximum angle of deviation	degree				
Normal span length	m				
Minimum ground clearance of line conductor at 85 °C, normal ground	m				
Sag of line conductor in normal span length at 85 °C	m				

Maximum distance of line conductor below crossarm	m				
Height above ground of bottom conductor crossarm	m				
Minimum height of earth conductors above upper line conductor : at tower	m				
: at mid-span	m				
Vertical spacing between line conductors at tower : Minimum	m				
Actual	m				
Overall tower height	m				
Maximum differential foundation movement permitted under ultimate loads	mm				
Clearance between conductors of one circuit and tower climbing leg of the other circuit : Minimum	m				
Actual	m				
Horizontal distance, from tower centre line of insulator attachments	m				
Horizontal distance, from tower centre line of earth conductors	m				

C . 27 - Particulars Of Double Circuit Towers : 400 kV Construction (Continued)
(To be filled up by the Bidder)

TYPE OF TOWER	Unit	**DA**	**DB**	**DC**	**DD**
Tower body dimensions at bottom crossarm level (transverse x longitudinal)	m				
Overall tower base dimensions at ground line (transversex longitudinal) Maximum for standard height towers	m				
Actual for standard height towers	m				

Total transverse overturning moment at ground line of standard height tower	kg-m.				
Mass of complete standard height tower above ground line (including bolts/nuts; bolts/nuts to be indicated separately)	kg				
Mass of tower body extensions above ground line					
3metre body extension only	kg				
6metre body extension only	kg				
9metre body extension only	kg				
12metre body extension only	kg		-	-	-
18metre body extension only	kg		-	-	-
25metre body extension only	kg		-	-	-

C . 28 - Foundation Design Particulars
(To be filled up by the Bidder)

	Unit	
Assumed density of Plain Cement Concrete (PCC) for foundation in dry soil	kg/m^3	
Assumed density of Plain Cement Concrete (PCC) for foundation in presence of sub-soil water	kg/m^3	
Assumed density of Re-inforced Cement Concrete (RCC) for foundation in dry soil	kg/m^3	
Assumed density of Re-inforced Cement Concrete (RCC) for foundation in presence of sub-soil water	kg/m^3	
28 day concrete cube strength (characteristic strength for M-20 concrete)	N/mm^2	
28 day concrete cube strength (characteristic strength for M-15 concrete)	N/mm^2	
Minimum proportion of stub load to be allowed for in the design of stub cleats	%	
Density of all type of soils :		
1) under dry conditions	kg/m^3	
2) in presence of surface water	kg/m^3	
3) in presence of sub-soil water	kg/m^3	

Ultimate bearing capacity of the soil :		
1) normal soil under dry condition	kN/m^2	
2) normal soil in presence of surface as well as sub-soil water	kN/m^2	
3) wet black cotton soil	kN/m^2	
4) fissured rock (both for dry and wet)	kN/m^2	
5) hard rock	kN/m^2	
Angle of repose for :		
1) dry soil	Degree	
2) wet soil due to presence of surface/ sub-soil water	Degree	
3) wet black cotton soil	Degree	
4) dry fissured rock	Degree	
5) wet fissured rock	Degree	
Ultimate bond between steel and concrete	kN/m^2	

C . 29 - Quality Of Materials
(To be filled up by the Bidder)

Particulars	Unit						
Towers:		**Mild steel**		**High tensile steel**			
		Steel members	**Steel nuts and bolts**	**Steel members**	**Steel nuts and bolts**		
Grade/standard							
Tensile breaking stress	2 N/mm						
Elongation on breaking	%						
Gauge length of specimen	mm						
Diameter of specimen	mm						
Yield point as percentage of breaking stress							
Insulators and fittings:		**Insulator unit metalwork**			**Phase and earth conductor metal fittings**		
		Steel	**Malleable cast iron**	**Insulator caps**	**Steel**	**Malleable cast**	

						iron
Grade/standard						
Tensile breaking stress	N/mm^2					
Elongation on breaking	%					
Gauge length of specimen	mm					
Diameter of specimen	mm					
Yield point as percentage of breaking stress	%					