

transmission line and the same should have been in satisfactory operation for a minimum period of two (2) years as on as on date of NOA; and

(b) The qualified manufacturer should also have successfully completed at least the following type tests on tension & suspension strings for 345kV or above application as on date of NOA:

- Power Frequency Voltage withstand test (Wet)
- Switching Surge Voltage Withstand test (Wet)
- Lightning Impulse Voltage Withstand test (Dry)
- Corona & Radio Interference Voltage Test (Dry)

- (iii) In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at (i) & (ii) (a) above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10% CPG corresponding to cost of the item(s).

- 2.34.2** The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.34.1 (i) or (ii) and also meeting the conditions stipulated at 2.43.

2.35 Hardware Fittings for 220 kV voltage level transmission line

- 2.35.1** The qualified manufacturer shall be a manufacturer of hardware fittings of similar nature. The qualified manufacturer's experience should include the following:

- (i) The qualified manufacturer should have designed, manufactured, tested and supplied hardware fittings for at least 600 sets of tension strings and 1200 sets of suspension strings for 220kV or above voltage transmission line and the same should have been in satisfactory operation⁵ for a minimum period of two (2) years as on date of NOA;

OR

- (ii) (a) Alternatively, the qualified manufacturer should have designed, manufactured, tested and supplied hardware fittings for at least 600 sets of tension strings and 1200 sets of suspension strings for 110kV or above voltage transmission line and the same should have been in satisfactory operation for a minimum period of two (2) years as on as on date of NOA; and

(b) The qualified manufacturer should also have successfully completed at least the following type tests on tension & suspension strings for 220kV or above application as on date of NOA:

- Power Frequency Voltage withstand test (Wet)
- Lightning Impulse Voltage Withstand test (Dry)

(iii) In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at (i) & (ii) (a) above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10% CPG corresponding to cost of the item(s).

2.35.2 The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.35.1 (i) or (ii) and also meeting the conditions stipulated at 2.43.

2.36 Hardware Fittings for 132 kV voltage level transmission line

2.36.1 The qualified manufacturer shall be a manufacturer of hardware fittings of similar nature. The qualified manufacturer's experience should include the following:

- (i) The qualified manufacturer should have designed, manufactured, tested and supplied hardware fittings for at least 600 sets of tension strings and 1200 sets of suspension strings for 110kV or above voltage transmission line and the same should have been in satisfactory operation[§] for a minimum period of two (2) years as on date of NOA;
- (ii) In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at (i) above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10 % CPG corresponding to cost of the item(s).

2.36.2 The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.36.1 (i) and also meeting the conditions stipulated at 2.43.

2.37 Accessories for Conductor and Earth wire for 765kV voltage level transmission line

2.37.1 The qualified manufacturer shall be a manufacturer of accessories for conductor & earthwire of similar nature. The qualified manufacturer experience should include the following:

The qualified manufacturer should have designed, manufactured, tested and supplied the item(s) of accessories for conductor & earth wire covered under the package or item(s) of similar/ comparable nature. For spacer dampers for Hexa/ Quad bundle conductor and vibration dampers for earth wire, the experience should include at least the supply of 6900 nos. of quad spacer dampers and 2300 nos. of vibration dampers for earth wire for 345kV or above transmission line and the same should have been in satisfactory operation⁵ for a minimum period of two (2) years as on date of NOA. (For accessories for galvanized steel Earthwire, the requirement of voltage level shall not be applicable).

2.37.2 In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at 2.37.1 above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10 % CPG corresponding to cost of the item(s).

2.37.3 The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.37.1 and also meeting the conditions stipulated at 2.43.

2.37.4 The manufacturer(s) meeting the above requirement for any individual item or items shall be considered qualified for the respective item or items only.

2.38 Accessories for Conductor and Earth wire for 400 kV transmission line with Quad/ Triple bundle conductor

2.38.1 The qualified manufacturer shall be a manufacturer of accessories for conductor & earthwire of similar nature. The qualified manufacturer experience should include the following:

The qualified manufacturer should have designed, manufactured, tested and supplied the item(s) of accessories for conductor & earth wire covered under the package or item(s) of similar/ comparable nature. For spacer dampers for Quad/ Triple bundle conductor and vibration dampers for earth wire, the experience should include at least the supply of 6900 nos. of quad spacer dampers and 1950 nos. of vibration dampers for earth wire for 345kV or above transmission line and

the same should have been in satisfactory operation[§] for a minimum period of two (2) years as on date of NOA. (For accessories for galvanized steel Earthwire, the requirement of voltage level shall not be applicable).

- 2.38.2** In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at 2.38.1 above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10% CPG corresponding to cost of the item(s).

- 2.38.3** The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.38.1 and also meeting the conditions stipulated at 2.43.

- 2.38.4** The manufacturer(s) meeting the above requirement for any individual item or items shall be considered qualified for the respective item or items only.

2.39 Accessories for Conductor and Earth wire for 400 kV transmission line with twin bundle conductor

- 2.39.1** The qualified manufacturer shall be a manufacturer of accessories for conductor & earthwire of similar nature. The qualified manufacturer experience should include the following:

The qualified manufacturer should have designed, manufactured, tested and supplied the item(s) of accessories for conductor & earth wire covered under the package or item(s) of similar/ comparable nature. For Bundle Spacer and Vibration dampers, the experience should include at least the supply of 7,875 nos. of twin bundle spacers and 5,850 nos. of vibration dampers for conductor and 1,950 nos. of vibration dampers for earthwire for 220kV or above voltage transmission line and the same should have been in satisfactory operation[§] for a minimum period of two (2) years as on date of NOA. (For accessories for galvanized steel Earthwire, the requirement of voltage level shall not be applicable).

- 2.39.2** In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at 2.39.1 above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10 % CPG corresponding to cost of the item(s).

- 2.39.3** The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.39.1 and also meeting the conditions stipulated at 2.43.

- 2.39.4** The manufacturer(s) meeting the above requirement for any individual item or items shall be considered qualified for the respective item or items only.

2.40 Accessories for Conductor and Earth wire for 220kV transmission line

- 2.40.1** The qualified manufacturer shall be a manufacturer of accessories for conductor & earthwire of similar nature. The qualified manufacturer experience should include the following:

The qualified manufacturer should have designed, manufactured, tested and supplied the item(s) of accessories for conductor & earth wire covered under the package or item(s) of similar/comparable nature. For Bundle Spacer and Vibration dampers, the experience should include at least the supply of 7,875 nos. of twin bundle spacers and 5,850 nos. of vibration dampers for conductor and 1,950 nos. of vibration dampers for earthwire for 220kV or above voltage transmission line and the same should have been in satisfactory operation\$ for a minimum period of two (2) years as on date of NOA. (For accessories for galvanized steel Earthwire, the requirement of voltage level shall not be applicable).

- 2.40.2** In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at 2.40.1 above, the contractor shall furnish extended warranty^^ of additional two years over and above the warranty period specified under the package.

^^ Additional extended warranty in terms of 10 % CPG corresponding to cost of the item(s).

- 2.40.3** The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.40.1 and also meeting the conditions stipulated at 2.43.

- 2.40.4** The manufacturer(s) meeting the above requirement for any individual item or items shall be considered qualified for the respective item or items only.

2.41 Accessories for Conductor and Earth wire for 132 kV transmission line

- 2.41.1** The qualified manufacturer shall be a manufacturer of accessories for conductor & earthwire of similar nature. The qualified manufacturer experience should include the following:

The qualified manufacturer should have designed, manufactured, tested and supplied the item(s) of accessories for conductor & earth wire covered under the package or item(s) of similar/ comparable nature. For Vibration dampers, the experience should include at least the supply of 5,850 nos. of vibration dampers for conductor and 1,950 nos. of vibration dampers for earthwire for 132kV or

above voltage transmission line and the same should have been in satisfactory operation[§] for a minimum period of two (2) years as on date of NOA. (For accessories for galvanized steel Earthwire, the requirement of voltage level shall not be applicable).

- 2.41.2** In case of indigenous manufacturers, if the Qualified manufacturer is not meeting the stipulated two years operational experience requirements specified at 2.41.1 above, the contractor shall furnish extended warranty^{^^} of additional two years over and above the warranty period specified under the package.

^{^^} Additional extended warranty in terms of 10 % CPG corresponding to cost of the item(s).

- 2.41.3** The proposed manufacturer can also be a qualified licensee of a qualified manufacturer meeting the above specified requirements at 2.41.1 and also meeting the conditions stipulated at 2.43.

- 2.41.4** The manufacturer(s) meeting the above requirement for any individual item or items shall be considered qualified for the respective item or items only.

2.42 Mono Pole Structures

(Applicable in packages where QR provisions for Pole structure manufacturers is not covered under Main QR)

The bidder/ Contractor should have its own manufacturing facilities & experience as stipulated below or should have assured access to supply the pole structures from Qualified Manufacturer(s) meeting individually the following minimum requirements and must demonstrate that based on known commitments they will be available for use in the proposed contract: -

The qualified manufacturer should have its own manufacturing facilities for transmission line pole structures. Further, the qualified manufacturer should have designed, manufactured and either type tested or supplied transmission line pole structures for *220 kV or above voltage / **110 kV or above voltage/ ***66 kV or above voltage transmission line as on date of NOA.

(* Applicable for 400kV voltage level)

(**Applicable for 220kV voltage level)

(*** Applicable for 132kV or below voltage level)

In case the Contractor is proposing supply of pole structures from his sub-vendors(s), the Contractor will be required to furnish a performance guarantee of 2% of the cost of such transmission line pole structures from the manufacturer(s)

at the time of finalizing the manufacturer(s), during execution of the Contract (Format enclosed at **Annexure-E**)

2.43 Licensor-Licensee conditions (Applicable for items other than HTLS Conductor)

- (i) Manufacturer/licensees shall have adequate design infrastructure and manufacturing facility and capacity and procedures including quality control.
- (ii) A qualified Licensee of a qualified manufacturer shall comply with all of the following requirements and furnish a joint undertaking by the licensor along with the bid.
 - a) Any design undertaken by the licensee shall be approved by the licensor.
 - b) Manufacture by the licensee shall be done with the approval of the licensor and Employer under a quality assurance programme approved and monitored by the licensor.
 - c) Licensee must furnish back-up guarantee from the licensor for individual and overall performance of all materials supplied under the contract.
 - d) Licensor must guarantee sequential and timely supply of materials and submission of technical information and data as desired by the Employer so as to meet the overall construction schedule and
 - e) The agreement between licensee and licensor (copy to be submitted along with the undertaking as per, Proforma enclosed as **Annexure-F** to this section) shall be valid for a period of at least five (5) years after the guarantee period of equipment and materials under supply is over.

2.44 Licensor-Licensee conditions (Applicable for HTLS Conductor)

- (i) Manufacturer/ Licensee shall furnish a legally enforceable joint undertaking by the Licensor along with the Licensee in the bid to guarantee following requirement:-
 - a) Any design undertaken by the Licensee shall be approved by the Licensor.
 - b) Manufacturing by the Licensee shall be done with the approval of the Licensor under a quality assurance programme approved and monitored by the licensor.
 - c) In addition to the Contract Performance Security to be furnished by the Contractor, the Licensor shall furnish back-up performance security in the form of bank guarantee for 5% of the Ex-works cost of the HTLS conductor as per the format provided for successful performance of HTLS conductor to be manufactured and supplied by the Licensee under the contract.

- d) Licensor must guarantee sequential and timely supply of materials and submission of technical information and data as desired by the Employer so as to meet the overall construction schedule and
- e) The agreement between licensee and licensor (copy to be submitted along with the undertaking as per Proforma enclosed as **Annexure-G** to this section) shall be valid for a period of at least two (2) years after the guarantee period of equipment and materials under supply is over.

2.45 In case manufacturer is a holding company, the technical experience referred to in above clauses shall be of that holding company only (i.e. excluding its subsidiary/ group companies). In case manufacturer is a subsidiary of a holding company, the technical experience referred to in above clauses shall be of that subsidiary company only (i.e. excluding its holding companies)

Note: \$ Satisfactory operation under above clauses means certificate issued by the Employer certifying the operation without adverse remark.

2.46 Technical requirement of Sub-Contractors

2.46.1 The subcontractor must have either of the following experience of having successfully completed similar works during last 7 years as on the last day of month previous to the one in which the sub-contractor is proposed to be engaged:

- a) Three similar works costing not less than the amount equal to 40% of the cost of the work to be sub-contracted
OR
- b) Two similar works costing not less than the amount equal to 50% of the cost of the work to be sub-contracted
OR
- c) One similar work costing not less than the amount equal to 80% of the cost of the work to be sub-contracted

2.46.2 Minimum Average Annual Turnover* (MAAT) for best three years i.e. 36 months out of last five financial years of the sub-contractor should be

*Annual Gross Revenue from operations/ Gross operating income as incorporated in the profit & loss account excluding other operating income/Other Income.

Note:

1. Similar work shall mean the work which are of similar in nature to the work to be sub-contracted e.g. for the scope of civil work to be sub contracted, the experience should be of civil work.
2. The aforesaid qualifying requirement shall however, not be applicable for engaging labour as per extant policy.
3. The cost of the work to be sub-contracted shall be considered as available in the Contract Agreement. However, if the value is not available in the Contract Agreement, the same shall be the estimated value for such work.
4. The above criteria is in addition to extant policy on selection of sub-contractor as per WPPP, Vol-II.
5. The MAAT requirement shall be worked out basis the following formula:
Minimum Average Annual Turnover (MAAT)= Cost of the work to be sub-contracted x1.5/Completion period in years**

**The completion period shall be considered as 1 year even if the same is less than 1 year

3.0 General aspects of Employer design Towers

3.1 Tower Extensions

3.1.1 Provisions for tower extensions shall be as per clause 1.2 of Section IV A of technical specification

3.1.2 All above extension provisions to towers and foundations shall be treated as part of normal towers and foundations only.

3.2 Span and clearances

Span and clearances given in following clauses are indicative. Span & Clearances to be adopted for the specific package shall be as per Tower Spotting Data to be given to the contractor during execution stage.

3.2.1 Normal Span

The normal ruling span of the line of different voltage level is given in the table below:

Sl. No.	Voltage Level of Transmission Line	Design Span or Normal Ruling Span
A)	400 kV, 765 kV, ± 500 kV HVDC and ± 800 kV HVDC	400 meters

B)	220 kV	350 meters
C)	132 kV	320 meters

3.2.2 Wind Span

The wind span is the sum of the two half spans adjacent to the support under consideration. For normal horizontal spans this equals to normal ruling span.

3.2.3 Weight span

The weight span is the horizontal distance between the null points of the conductors on the two spans adjacent to the tower.

3.2.4 In case at certain locations, actual spans are found to be exceeding the design spans and cross-arms/ other members of towers are required to be modified/ reinforced, the tower shall be modified/ reinforced by the contractor based on drawings supplied to the Contractor.

4.0 Details of Line Materials

4.1 AC Lines

4.1.1 765 kV Voltage level

A) 765 kV Single Circuit Transmission Line with Horizontal / DELTA/ Vertical Delta Configuration

1	Conductor	Four ACSR BERSIMIS conductor per phase with sub-conductor spacing of 457 mm in Horizontal/ Delta configuration.
2	Earthwire/ OPGW	Two Earthwires (7/3.66mm) or One Earthwire (7/3.66mm) and one OPGW or Two OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' suspension Pilot	120
b)	Double 'I' suspension	240

c)	Single 'V' suspension Pilot	120 (Along one arm)
d)	Single Tension	120
e)	Single 'V' suspension	210 (Along one arm)
f)	Double 'V' suspension	420 (Along one arm)
g)	Quadruple Tension	840

B) 765 kV Double Circuit Transmission Line

1	Conductor	Six ACSR ZEBRA conductor per phase with sub-conductor spacing of 457 mm in vertical configuration.
2	Earthwire / OPGW	Two Earthwires (7/3.66mm) or One Earthwire (7/3.66mm) and one OPGW or Two OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
Insulator String details		
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Double 'I' suspension	320
b)	Single 'I' suspension Pilot	160
c)	Single Tension	160
d)	Quadruple Tension	840

4.1.2 400 kV Voltage Level

A) 400kV Double Circuit (QUAD ACSR MOOSE) Transmission Line

1	Conductor	Four ACSR MOOSE conductor per phase with sub-conductor spacing of 457 mm in vertical configuration.
2	Earthwire / OPGW	Two Earthwires (7/3.66mm) or One Earthwire (7/3.66mm) and one OPGW or Two OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.

3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Double 'I' suspension	240
b)	Single 'I' suspension Pilot	120
c)	Single Tension	120
d)	Quadruple Tension	640

B) 400 kV Single/Double Circuit (TWIN ACSR MOOSE) Transmission Line

1	Conductor	Two ACSR MOOSE conductor per phase with sub-conductor spacing of 450 mm.
2	Earthwire / OPGW	Two Earthwires (7/3.66mm) or One Earthwire (7/3.66mm) and one OPGW or Two OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' Suspension	120
b)	Single 'I' suspension Pilot	120
c)	Single Tension	120
d)	Double Tension	320

C) 400 kV Double Circuit (triple ACSR SNOWBIRD) Transmission Line

1	Conductor	Triple ACSR Snowbird conductor per phase with sub-conductor spacing of 457 mm.
2	Earthwire / OPGW	Two Earthwires (7/3.66mm) or One Earthwire (7/3.66mm) and one OPGW or Two OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)

a)	Double 'I' Suspension	240
b)	Single 'I' suspension Pilot	120
c)	Single Tension	120
d)	Double Tension	420

D) 400 kV Double Circuit (twin ACSR LAPWING) Transmission Line

1	Conductor	Twin ACSR Lapwing conductor per phase with sub-conductor spacing of 450 mm.
2	Earthwire / OPGW	Two Earthwires (7/3.66mm) or One Earthwire (7/3.66mm) and one OPGW or Two OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' Suspension	160
b)	Single 'I' suspension Pilot	160
c)	Single Tension	160
d)	Double Tension	420

4.1.3 220 kV Voltage Level

A) 220kV Single/Double Circuit (Single ACSR Zebra) Transmission Line

1	Conductor	ACSR Zebra conductor
2	Earthwire / OPGW	One Earthwire (7/3.15mm) or OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' Suspension	70

b)	Single 'I' suspension Pilot	70
c)	Single Tension	120
d)	Double Tension	240

B) 220kV Single/Double Circuit (TWIN ACSR MOOSE) Transmission Line

1	Conductor	Two ACSR MOOSE conductor per phase with sub-conductor spacing of 450 mm.
2	Earthwire / OPGW	One Earthwires (7/3.66mm) or One OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' Suspension	120
b)	Single 'I' suspension Pilot	120
c)	Single Tension	120
d)	Double Tension	320

4.1.4 132 kV Voltage Level

A) 132kV Single/ Double Circuit Transmission Line with Single ACSR PANTHER Conductor

1	Conductor	ACSR Panther conductor
2	Earthwire / OPGW	One Earthwire (7/3.15mm) or OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' Suspension	90
b)	Single Tension	90
c)	Double Tension	180

B) **132kV Single/ Double Circuit Transmission Line with Single ACSR ZEBRA Conductor**

1	Conductor	ACSR ZEBRA conductor
2	Earthwire / OPGW	One Earthwire (7/3.15mm) or OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in Section-IA.
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'I' Suspension	90
b)	Single Tension	120
c)	Double Tension	240

4.2 HVDC Lines

4.2.1.1 $\pm 800\text{kV}$ HVDC Transmission line

1	Conductor	Four ACSR Lapwing conductor per phase with sub-conductor spacing of 457 mm in Horizontal configuration.
2	Earthwire/ OPGW	Two Earthwires (7/4.50mm) or One Earthwire and one OPGW with mechanical & electrical properties equivalent to the used earthwire may be used as indicated in section-1 A
3	Insulator String details	
	Type of String	Mechanical Strength of Insulator String (kN)
a)	Single 'Y' suspension	420 along each arm of V portion & 840 along I portion
b)	Triple Tension String	1260
c)	Single I Pilot	160
Details of DMR		
1	Conductor	Twin ACSR Lapwing conductor per phase with sub-conductor spacing of 450 mm in Horizontal configuration.
2	Insulator String Details	