Amendment – II dated 01.06.2020 on the Request for Proposal and Transmission Service Agreement issued for selection of bidder as Transmission Service Provider to establish "Transmission System for evacuation of power from RE projects in Rajgarh (2500MW) SEZ in Madhya Pradesh" through tariff based competitive bidding process

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr><td colspan="3"><u>SPECIFIC TECHNICAL REQUIREMENTS FOR TRANSMISSION LINE</u></td></tr>
<tr><td>1.</td><td>2.0 a)

Steel section of grade E 250 and/or grade E 350 as per IS 2062, <u>are only</u> permitted for use in towers, extensions, gantry structures and stub setting templates. For towers in snowbound areas, steel sections shall conform to Grade-C of IS-2062.</td><td>2.0 a)

Steel section of grade E 250 and/or grade E 350 as per IS 2062, <u>only are</u> permitted for use in towers, extensions, gantry structures and stub setting templates. For towers in snowbound areas, steel sections shall conform to Grade-C of IS-2062.</td></tr>
<tr><td>2.</td><td>6.0

The relevant conductor configuration shall be as follows:-

i) Type of <u>HTLS</u> conductor: <u>INVAR/ GAP/ Composite core/ ACSS</u>
ii) Basic parameters:
<table>
<tr><th>Transmission Line</th><th>Ampacity of HTLS conductor (for an ambient temperature of 45 °C)</th><th>Minimum Conductor diameter (mm)</th><th>Maximum DC Resistance at 20°C (Ω/km)</th><th>Sub-conductor Spacing (mm)</th></tr>
<tr><td><u>400kV (Twin HTLS) transmission line</u></td><td>1596 A</td><td>28.62</td><td>0.05552</td><td><u>450 mm</u></td></tr>
</table></td><td>6.0

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<tr><td><u>400 kV Transmission line with Twin HTLS conductor</u></td><td>1596 A</td><td>28.62</td><td>0.05552</td><td><u>450</u></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr><td>3.</td><td>8.0

All electrical clearances including minimum live metal clearance, ground clearance and minimum mid span separation between earth wire and conductor shall be as per Central Electricity Authority (Measures Relating to Safety & Electric Supply) Regulations as amended from time to time and IS:5613.</td><td>8.0

All electrical clearances including minimum live metal clearance, ground clearance and minimum mid span separation between earth wire and conductor shall be as per Central Electricity Authority (Measures Relating to Safety & Electric Supply) Regulations as amended from time to time and IS:5613.

<u>The minimum live metal clearances for 400 kV D/c transmission lines shall be considered as follows:</u>
(i) <u>Under stationary conditions</u>
<u>From tower body: 3.05m</u>

(ii) <u>Under Swing conditions</u>
<table><tr><th><u>Wind Pressure Condition</u></th><th><u>Minimum Electrical Clearance</u></th></tr><tr><td><u>a) Swing angle (22º)</u></td><td><u>3.05 mtrs</u></td></tr><tr><td><u>b) Swing angle (44º)</u></td><td><u>1.86 mtrs</u></td></tr></table></td></tr>
<tr><td>4.</td><td>12.0

Each tower shall be earthed such that tower footing impedance does not exceed 10 ohms. Pipe type or Counterpoise type earthing shall be provided in accordance with relevant IS. Additional earthing shall be provided on every 7 to 8 kms distance at tension tower for direct earthing of both shield wires.</td><td>12.0

Each tower shall be earthed such that tower footing impedance does not exceed 10 ohms. Pipe type or Counterpoise type earthing shall be provided in accordance with relevant IS. Additional earthing shall be provided on every 7 to 8 kms distance at tension tower for direct earthing of both shield wires. <u>If site condition demands, multiple earthing or use of earthing enhancement compound shall be used.</u></td></tr>
</table>

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr><td>5.</td><td>New Point to be inserted</td><td><u>13.0</u>
<u>Pile foundation shall be used for towers located in the river bed, or on river banks or in areas where river flow or river course is anticipated to change based on previous years' hydrology data.</u></td></tr>
<tr><td>6.</td><td>New Point to be inserted</td><td><u>14.0</u>
<u>Transmission line route shall be finalized, in consultation with appropriate authorities so as to avoid the habitant zones of Great Indian Bustard and other protected species. Bird diverters, wherever required, shall be provided on the line.</u></td></tr>
<tr><td colspan="3"><u>SPECIFIC TECHNICAL REQUIREMENTS FOR SUBSTATION</u></td></tr>
<tr><td>7.</td><td>General

The proposed new substation shall be conventional AIS type generally confirming to the requirement of <u>CEA regulation for construction of substation.</u></td><td>General

The proposed new substation <u>and proposed augmentation at Bhopal (Sterlite) and Shujalpur substations</u> shall be conventional AIS type generally confirming to the requirement of <u>CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2010, as amended from time to time.</u></td></tr>
<tr><td>8.</td><td>1.1 Insulation Coordination

The system design parameters for substations/switchyards shall be as given below:

<table>
<tr><th>Sl No</th><th>Description of parameters</th><th colspan="2">400/220kV Rajgarh SEZ PP</th><th>400kV Bhopal (Sterlite) Extn.</th><th>400kV Shujalpur S/S Extn.</th></tr>
<tr><th></th><th></th><th>400 kV System</th><th>220 kV System</th><th>400 kV System</th><th>400 kV System</th></tr>
</table></td><td>1.1 Insulation Coordination

The system design parameters for substations/switchyards shall be as given below:

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<tr><th>Sl No</th><th>Description of parameters</th><th colspan="2">400/220kV Rajgarh SEZ PP</th><th>400kV Bhopal (Sterlite) Extn.</th><th>400kV Shujalpur S/S Extn.</th></tr>
<tr><th></th><th></th><th>400 kV System</th><th>220 kV System</th><th>400 kV System</th><th>400 kV System</th></tr>
</table></td></tr>
</table>

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr><td></td><td>
<table>
<tr><td>……..</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10.</td><td>Max. fault current</td><td>63kA</td><td>50kA</td><td><u>50kA</u></td><td><u>40kA</u></td></tr>
<tr><td>……</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>
<table>
<tr><td>……..</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10.</td><td>Max. fault current</td><td>63kA</td><td>50kA</td><td><u>63kA</u></td><td><u>63kA</u></td></tr>
<tr><td>……</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>9.</td><td>1.2 Switching Scheme

……..
i) At 400kV voltage level, each circuit of a double circuit transmission line shall be terminated in different diameters.

ii) Transformers of same HV rating shall be placed in different diameters.</td><td>1.2 Switching Scheme

……
i) At 400kV voltage level, each circuit of a double circuit transmission line shall be terminated in different diameters.

ii) Transformers <u>and Bus Reactor</u> of same HV rating shall be placed in different diameters.

iii) <u>At 220 kV switchyard, two numbers bus sectionalisers (one number for each bus) shall be used. One bus section shall accommodate 4 ICT bays (present + future); 8 line bays (present + future); 1 bus reactor bay (present); 1 bus coupler bay (present); 1 bus transfer bay (present) while other bus section shall accommodate 4 ICT bays (present + future); 7 line bays (present + future); 1 bus reactor bay (future); 1 bus coupler bay (future); 1 bus transfer bay (future).</u></td></tr>
<tr><td>10.</td><td>2.0 Substation Equipment and facilities:
…….
<table>
<tr><td rowspan="2">Sl.</td><td rowspan="2">Description of bay</td><td colspan="2">400/220kV Rajgarh SEZ PP</td><td rowspan="2">400kV Bhopal (Sterlite) Extn.</td><td rowspan="2">400kV Shujalpur S/S Extn.</td></tr>
<tr><td>400kV</td><td>220kV</td></tr>
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</table>
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<table>
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</table>
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</table>

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr><td></td><td>
<table>
<tr><td>1.</td><td>Bus Bar</td><td>4000A</td><td>4000A</td><td><u>4000A</u></td><td><u>3000A</u></td></tr>
<tr><td></td><td>……..</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>Bus Coupler Bay</td><td>-</td><td><u>4000A</u></td><td>-</td><td>-</td></tr>
<tr><td></td><td>……..</td><td></td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>Bus Sectionalizer Bay</td><td>-</td><td><u>4000A</u></td><td>-</td><td>-</td></tr>
</table>
<u>Further, current rating of all equipment in one diameter shall be the highest current rating required for connected line/ICT/Reactor so that the system could operate without any constraint in case of outage of any bus bar.</u>
</td><td>
<table>
<tr><td>1.</td><td>Bus Bar</td><td>4000A</td><td>4000A</td><td><u>Same as existing</u></td><td><u>Same as existing</u></td></tr>
<tr><td></td><td>……..</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>Bus Coupler Bay</td><td>-</td><td><u>3150A</u></td><td>-</td><td>-</td></tr>
<tr><td></td><td>……..</td><td></td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>Bus Sectionalizer Bay</td><td>-</td><td><u>3150A</u></td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>11.</td><td>2.1 400/220kV, 3-Phase Transformer

Transformer shall conform to IEC 60076 in general. The 500 MVA transformers shall be designed based on design of dynamic short circuit tested 315 MVA or 500 MVA transformers. The transformer and all its accessories including bushing/ built in CTs etc shall be designed to withstand thermal and mechanical stresses caused by symmetrical or asymmetrical faults on any terminals. Mechanical strength of the transformer shall be such that it can withstand 3-phase and 1- phase through fault for transformer rated voltage applied to HV and / or IV terminals of transformer. The short circuit shall alternatively be considered to be applied to each of the HV, IV and tertiary (LV) transformer terminals. Tertiary <u>is</u> <u>not</u> considered <u>to be</u> connected to source.

Core shall be constructed ……. temperature of 50 Deg. C.

The transformer shall be complete with all required accessories,</td><td>2.1 400/220kV, 3-Phase Transformer

Transformer shall conform to IEC 60076 in general. The 500 MVA transformers shall be designed based on design of dynamic short circuit tested 315 MVA or 500 MVA transformers. The transformer and all its accessories including bushing/ built in CTs etc shall be designed to withstand thermal and mechanical stresses caused by symmetrical or asymmetrical faults on any terminals. Mechanical strength of the transformer shall be such that it can withstand 3-phase and 1- phase through fault for transformer rated voltage applied to HV and / or IV terminals of transformer. The short circuit shall alternatively be considered to be applied to each of the HV, IV and tertiary (LV) transformer terminals. Tertiary <u>shall be</u> considered <u>not</u> connected to source <u>The maximum short circuit output current at the tertiary terminals shall be limited to a safe value to make the transformer short circuit proof. The Tertiary winding shall be designed to withstand mechanical and thermal stresses due to dead short circuit on its terminals. However, the cooling for continuous thermal rating of the tertiary winding shall be for at least</u></td></tr>
</table>

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr>
<td></td>
<td>
Bushing CTs, cooler control cabinet, individual and common marshalling box, <u>RTCC</u> etc as required for satisfactory operations of transformer. <u>The transformer shall be provided with IEC 61850 compliant digital RTCC relay having automatic voltage regulating features using Bay control and protection unit used for SAS, to operate OLTC including parallel operation of transformers.</u>

Neutral of the transformer shall be solidly grounded.

<u>HV, IV and LV bushing shall be RIP (resin impregnated paper condenser) with composite insulator type. 36kV Neutral bushing shall be solid porcelain or oil communicating type.</u>

The major technical particulars / parameters of transformer are given below:

<table>
<tr><th colspan="4">Technical Particulars / Parameters of 500MVA, 400/220/33kV, 3-Phase Autotransformer</th></tr>
<tr><th>Sl. No.</th><th>Description</th><th>Unit</th><th>Technical Parameters</th></tr>
<tr><td>1.</td><td>Rated Capacity : HV/IV/ LV (Tertiary)</td><td>MVA</td><td>500/500/166.67</td></tr>
<tr><td>2.</td><td>Voltage ratio (Line to Line)</td><td></td><td>400/220/33</td></tr>
<tr><td>3.</td><td>Vector Group</td><td></td><td>YNaOd11</td></tr>
<tr><td>4.</td><td>Cooling</td><td></td><td>ONAN/ONAF/(OFAF or ODAF) or ONAN/ONAF1/ONAF2</td></tr>
<tr><td>5.</td><td>Rating at different cooling above</td><td>%</td><td>60/80/100</td></tr>
<tr><td>6.</td><td>Type of Transformer</td><td></td><td>Constant Ohmic</td></tr>
</table>
</td>
<td>
<u>5 MVA capacity.</u>

Core shall be constructed ……. temperature of 50 Deg. C.

The transformer shall be complete with all required accessories, Bushing CTs, cooler control cabinet, individual and common marshalling box, etc as required for satisfactory operations of transformer. <u>Remote tap changer control and monitoring system including parallel operation of transformers shall be carried out using Bay control unit or digital RTCC relay through Substation Automation System.</u>

Neutral of the transformer shall be solidly grounded.

<u>HV, and IV bushing shall be RIP (Resin Impregnated Paper) / RIS (Resin Impregnated Synthetic) with composite insulator type. LV bushing shall be OIP/RIP/RIS. 36kV Neutral bushing shall be solid porcelain or oil communicating type.</u>

The major technical particulars / parameters of transformer are given below:

<table>
<tr><th colspan="4">Technical Particulars / Parameters of 500MVA, 400/220/33kV, 3-Phase Autotransformer</th></tr>
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<tr><td>1.</td><td>Rated Capacity : HV/IV/ LV (Tertiary)</td><td>MVA</td><td>500/500/166.67 <u>(Tertiary active loading: 5 MVA)</u></td></tr>
<tr><td>2.</td><td>Voltage ratio (Line to Line)</td><td></td><td>400/220/33</td></tr>
<tr><td>3.</td><td>Vector Group</td><td></td><td>YNaOd11</td></tr>
</table>
</td>
</tr>
</table>

Sl. No.	Existing Provisions				New / Revised Provisions			
				impedance type	4.	Cooling		ONAN/ONAF/(OFAF or ODAF) or ONAN/ONAF1/ONAF2
	7.	Impedance at 75 Deg C			5.	Rating at different cooling above	%	60/80/100
	a)	HV – IV (with tolerance as per IEC)	%	At Max./ Principal/ Min. Voltage Tap: 10.3/12.5/15.4	6.	Type of Transformer		Constant Ohmic impedance type
	b)	HV - LV	%	At Principal tap(minimum) : 60	7.	Impedance at 75 Deg C		
	c)	IV - LV	%	At Principal tap (minimum): 45	a)	HV – IV (with tolerance as per IEC)	%	At Max./ Principal/ Min. Voltage Tap: 10.3/12.5/15.4
	8.	**Losses**			b)	HV - LV	%	At Principal tap(minimum) : 60
	a)	Maximum No-Load Loss at rated voltage and frequency	kW	90	c)	IV - LV	%	At Principal tap (minimum): 45
	b)	Maximum Load Loss at rated current and 75^0C	kW	500	8.	**Losses**		
	c)	Max I^2R loss at rated current and frequency and at 75^0 C for HV and IV windings	kW	375	a)	Maximum No-Load Loss at rated voltage and frequency	kW	90
	d)	Maximum Auxiliary Loss at rated voltage and frequency	kW	15	b)	Maximum Load Loss at rated current and 75^0C	kW	500
	9.	Max. Temperature rise over 50 deg C ambient Temp	Deg. C	Top oil: 45 & Winding: 50	c)	Max I^2R loss at rated current and frequency and at 75^0 C for HV and IV windings	kW	375
	10.	Windings			d)	Maximum Auxiliary Loss at rated voltage and frequency	kW	15
	iii)	Insulation Level (LI/SI/PF)		kVp/kVp/kVrms				

Sl. No.	Existing Provisions				New / Revised Provisions			
	a)	HV		1300/1050/570	9.	Max. Temperature rise over 50 deg C ambient Temp	Deg. C	Top oil: 45 & Winding: 50
	b)	IV		950/-/395	10.	Windings		
	c)	LV		250/-/95	iii)	Insulation Level (LI/SI/PF)		kVp/kVp/kVrms
	d)	Neutral		95/-/38	a)	HV		1300/1050/570
	iv)	Tan delta of winding	%	< 0.5	b)	IV		950/-/395
	11.	Tap Changer & Tappings		OLTC with range **10%** for HV variation in the step of 1.25%, on common end of series winding	c)	LV		250/-/95
	12.	Maximum Partial discharge (PD) level at 1.58*Ur/√3	pC	100	d)	Neutral		95/-/38
	13.	Noise level at rated voltage and at principal tap at no load and all cooling active	dB	< 80	iv)	Tan delta of winding	%	< 0.5
	14.	Bushing			11.	Tap Changer & Tappings		OLTC with range **± 10%** for HV variation in the step of 1.25%, on common end of series winding
	i)	Rated voltage (HV/IV/LV/Neutral)	kV	420/245/52/36	12.	Maximum Partial discharge (PD) level at 1.58*Ur/√3	pC	100
	ii)	Rated current (Min.) HV/IV/LV/Neutral	A	1250/2000/3150/2000	13.	Noise level at rated voltage and at principal tap at no load and all cooling active	dB	< 80
	iii)	Insulation Level (LI/SI/PF)		kVp/ kVp/ kVrms	14.	Bushing		
	a)	HV		1425/ 1050/ 695	i)	Rated voltage (HV/IV/LV/Neutral)	kV	420/245/52/36
	b)	IV		1050/ 850/ 505	ii)	Rated current (Min.) HV/IV/LV/Neutral	A	1250/2000/3150/2000
	c)	LV		250/ -/ 105	iii)	Insulation Level (LI/SI/PF)		kVp/ kVp/ kVrms
	d)	Neutral		170/ -/ 77				
	iv)	Tan delta of bushings HV/IV/LV	%	< 0.5				
	v)	Max. PD of bushings at	pC	10				

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>level Um</td><td></td><td></td></tr>
<tr><td>15.</td><td>Insulating Oil</td><td></td><td><u>virgin high grade</u> inhibited, conforming to IEC-60296</td></tr>
</table>
</td><td>
<table>
<tr><td>a)</td><td>HV</td><td></td><td>1425/ 1050/ 695</td></tr>
<tr><td>b)</td><td>IV</td><td></td><td>1050/ 850/ 505</td></tr>
<tr><td>c)</td><td>LV</td><td></td><td>250/ -/ 105</td></tr>
<tr><td>d)</td><td>Neutral</td><td></td><td>170/ -/ 77</td></tr>
<tr><td>iv)</td><td>Tan delta of bushings HV/IV/LV</td><td>%</td><td>< 0.5</td></tr>
<tr><td>v)</td><td>Max. PD of bushings at level Um</td><td>pC</td><td>10</td></tr>
<tr><td>15.</td><td>Insulating Oil</td><td></td><td><u>Unused</u> inhibited <u>or uninhibited transformer oil</u>, conforming to IEC-60296-<u>2012</u></td></tr>
</table>
</td></tr>
<tr><td>12.</td><td>2.2 420kV, 3-Phase, Shunt Reactor

Reactor shall conform …….. beyond 1.5 p.u. voltage.

The reactor shall be of <u>either</u> gapped core type <u>or magnetically shielded air core type (shell type)</u> construction. The impedance ratio (X0/X1) specified shall be achieved by adopting either single phase construction in separate tanks or three phase with 3 limb or 5 limb core construction. <u>In case of coreless construction, a magnetic shield shall be provided around the coreless coils and non-magnetic material sheet shall form the central core to minimize the vibrations.</u> Core shall be constructed from non-ageing, cold rolled grain oriented silicon steel laminations with requisite BIS certification.</td><td>2.2 420kV, 3-Phase, Shunt Reactor

Reactor shall conform …….. beyond 1.5 p.u. voltage.

The reactor shall be of gapped core type construction. The impedance ratio (X0/X1) specified shall be achieved by adopting either single phase construction in separate tanks or three phase with 3 limb or 5 limb core construction. Core shall be constructed from non-ageing, cold rolled grain oriented silicon steel laminations with requisite BIS certification.

Shunt Reactors shall …….. temperature as 50 Deg C.</td></tr>
</table>

<table>
<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
<tr>
<td></td>
<td>
Shunt Reactors shall …….. temperature as 50 Deg C.

The reactor shall be complete with all required accessories, Bushing CTs, marshalling box etc as required for satisfactory operations of reactor. HV and Neutral bushings shall be RIP (resin impregnated paper <u>condenser</u>) with composite insulator type.

The Technical Particulars / Parameters of Shunt Reactor are given below:

<table>
<tr><th>Sl. No.</th><th>Description</th><th>Unit</th><th>Parameters</th></tr>
<tr><td><u>1.</u></td><td><u>Rated Voltage, Ur (1p.u)</u></td><td><u>kV</u></td><td><u>420</u></td></tr>
<tr><td><u>2.</u></td><td><u>Rated Capacity at 420 kV</u></td><td><u>MVAR</u></td><td><u>125</u></td></tr>
<tr><td><u>3.</u></td><td><u>Cooling System</u></td><td></td><td><u>ONAN</u></td></tr>
<tr><td><u>4.</u></td><td><u>Permissible current unbalance among different phases</u></td><td><u>%</u></td><td><u>± 2</u></td></tr>
<tr><td><u>5.</u></td><td><u>Crest value of Third Harmonic content in phase current at rated voltage with sinusoidal wave form</u></td><td><u>%</u></td><td><u>≤ 3% of the crest value of fundamental</u></td></tr>
<tr><td><u>6.</u></td><td><u>Range of constant Impedance</u></td><td></td><td><u>Up to 1.5 p.u. voltage</u></td></tr>
<tr><td><u>7.</u></td><td><u>Tolerance on current</u></td><td><u>%</u></td><td><u>0 to +5%</u></td></tr>
<tr><td><u>8.</u></td><td><u>Ratio of zero sequence reactance to positive reactance (X0/X1)</u></td><td><u>Range</u></td><td><u>0.9 - 1.0</u></td></tr>
</table>
</td>
<td>
The reactor shall be complete with all required accessories, Bushing CTs, marshalling box etc as required for satisfactory operations of reactor. HV and Neutral bushings shall be RIP (<u>R</u>esin <u>I</u>mpregnated <u>P</u>aper)/ <u>RIS (Resin Impregnated Synthetic)</u> with composite insulator type.

The Technical Particulars / Parameters of <u>3-phase, 125 MVAr, 420 kV</u> Shunt Reactor are given below:

<table>
<tr><th>S. No</th><th>Description</th><th>Unit</th><th>Technical Parameters</th></tr>
<tr><td>1.</td><td><u>Rated Capacity at 420kV</u></td><td><u>MVAr</u></td><td><u>125</u></td></tr>
<tr><td>2.</td><td><u>Rated Voltage (Ur) (1.0 pu)</u></td><td><u>kV</u></td><td><u>420</u></td></tr>
<tr><td>3.</td><td><u>Number of phases</u></td><td></td><td><u>3 (three)</u></td></tr>
<tr><td>4.</td><td><u>Connection</u></td><td></td><td><u>Star</u></td></tr>
<tr><td>5.</td><td><u>Cooling type</u></td><td></td><td><u>ONAN</u></td></tr>
<tr><td>6.</td><td><u>Frequency</u></td><td><u>Hz</u></td><td><u>50</u></td></tr>
<tr><td>7.</td><td><u>Reference standard</u></td><td></td><td><u>IEC 60076-6</u></td></tr>
<tr><td>8.</td><td><u>Service</u></td><td></td><td><u>Outdoor</u></td></tr>
<tr><td>9.</td><td><u>Permissible unbalance current among phases</u></td><td><u>%</u></td><td><u>±2%</u></td></tr>
<tr><td>10.</td><td><u>Crest value of third harmonic content in phase current at rated voltage with</u></td><td><u>%</u></td><td><u>≤ 3% of the crest value of fundamental</u></td></tr>
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Sl. No.	Existing Provisions				New / Revised Provisions			
	9.	Max. Temperature rise over 50 deg C Ambient Temp at rated voltage	Deg. C	Top oil: 40 & Winding: 45		sinusoidal wave form		
	10.	(a) Maximum Permissible load Losses at rated Voltage, Frequency and at 75°C (kW) for 420kV, 125 MVAR, 3-Phase Reactor	kW	160	11.	Range of constant impedance		Up to 1.5 p.u voltage (However, complete saturation characteristics of the Reactors upto 2.5 p.u. Voltage shall be furnished)
		(b) Maximum Permissible I2R Losses for 420kV, 125 MVAR, 3-Phase Reactor at rated Voltage, Frequency and at 75°C	kW	90	12.	Tolerance on current	%	0 to +5%
					13.	Ratio of zero sequence reactance to positive reactance (X0/X1)		Between 0.9 & 1.0.
					14.	Temperature rise over 50 °C Ambient Temp. at 420 kV		
					i)	Top oil measured by thermometer	°C	40
					ii)	Average winding measured by resistance method	°C	45
	11.	Windings			15.	Winding hot spot temperature rise over yearly weighted average temperature of 32 °C	°C	61
	a)	Insulation level (LI/SI/PF)		kVp/ kVp/kVrms	16.	Max. tank surface temperature	°C	110
		HV		1300/1050/-	17.	Max design ambient temperature	°C	50
		Neutral		550/-/230	18.	Windings		
	b)	Tan delta of windings	%	< 0.5				
	12.	Partial discharge (PD) level at 1.58 Ur / √3	pC	< 100				
	13.	Vibration & Tank stress		≤ 200 microns peak				

Sl. No.	Existing Provisions				New / Revised Provisions			
		level at rated voltage and frequency		to peak; Average: ≤60 microns peak to peak. Stress: ≤ 2.0kg/sq.mm at any point on tank.	i)	Lightning Impulse withstand Voltage		
						Line end	kV_p	1300
						Neutral	kV_p	550
					ii)	Chopped Wave Lightning Impulse Withstand Voltage		
						Line end	kV_p	1430
	14.	Noise level at rated voltage and frequency	dB	< 80	iii)	Switching Impulse withstand Voltage at Line end	kV_p	1050
	15.	Bushing			iv)	One Minute Power Frequency withstand Voltage		
	a)	Rated voltage : HV / Neutral	kV	420/145		Neutral	kVrms	230
	b)	Rated current (Min.) HV / Neutral	A	800/800	19.	Tan-delta of windings		≤ 0.005
	c)	Insulation level (LI/SI/PF)		kVp/ kVp / kVrms	20.	Neutral earthing		Solidly Earthed
		HV		1425/1050/695	21.	Whether neutral brought out		Yes (through 145kV class bushing)
		Neutral		650/-/305	22.	Bushing		
	d)	Tan delta of bushings : HV / Neutral	%	≤ 0.5	i)	Rated voltage		
	e)	PD of bushings at level Um	pC	<10		Line bushing	kV	420
	16.	Insulating Oil		virgin high grade inhibited, conforming to IEC-60296		Neutral bushing	kV	145
					ii)	Rated current		
						Line bushing	A	800
						Neutral bushing	A	800
					iii)	Lightning Impulse withstand Voltage		

Sl. No.	Existing Provisions	New / Revised Provisions			
			Line bushing	**kV_p**	**1425**
			Neutral bushing	**kV_p**	**650**
		iv)	**Switching Impulse withstand Voltage of Line bushing**	**kV_p**	**1050**
		v)	**1minute power frequency withstand of bushings (dry)**		
			Line bushing	**kV rms**	**695**
			Neutral bushing	**kV rms**	**305**
		vi)	**Minimum creepage distance**		**(Specific Creepage Distance: of 25mm/kV corresponding to highest line to line voltage)**
			Line bushing	**mm**	**10500**
			Neutral bushing	**mm**	**3625**
		vii)	**Partial discharge of bushings at Ur (line end and neutral)**	**pC**	**< 10**
		23.	**Maximum partial discharge level at $1.58Ur/\sqrt{3}$**	**pC**	**100**
		24.	**Vibration and tank stress at rated voltage**		**Max ≤200microns peak to peak** **Average ≤ 60microns peak to peak** **Tank stress:** **≤2.0kg/sq.mm at any point of tank**

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<tr><th>Sl. No.</th><th>Existing Provisions</th><th>New / Revised Provisions</th></tr>
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<table>
<tr><td><u>25.</u></td><td><u>Maximum noise pressure level at rated voltage & frequency</u></td><td><u>dB</u></td><td colspan="2"><u>80</u></td></tr>
<tr><td>26.</td><td><u>Maximum Permissible Losses of Reactor at rated current and frequency and at 75°C</u></td><td></td><td><u>Total loss</u></td><td><u>I²R Loss</u></td></tr>
<tr><td><u>i)</u></td><td><u>125MVAr 420kV</u></td><td><u>kW</u></td><td><u>160</u></td><td><u>90</u></td></tr>
<tr><td><u>27.</u></td><td><u>Insulating oil</u></td><td></td><td colspan="2"><u>Unused inhibited or uninhibited transformer oil conforming to IEC-60296:2012</u></td></tr>
</table>
<u>The neutral of shunt reactor shall be insulated to 550 kVp for lightning impulse. The neutral of the line reactors (wherever provided) shall be grounded through adequately rated Neutral Grounding Reactors (NGR) to facilitate single phase auto-reclosure, provided that the NGR shall be provided with bypass arrangement through a breaker so that the line reactor can be used as Bus reactor as and when required. The neutral of bus reactor shall be solidly grounded.</u>
</td></tr>
<tr><td>13.</td><td>2.3 Circuit Breakers(AIS)

The circuit breakers and accessories shall conform to IEC: 62271-100, IEC: 62271-1 and shall be of SF6 Type. The rated break time shall not exceed 40 ms for 400kV circuit breakers and 60 ms for</td><td>2.3 Circuit Breakers(AIS)

The circuit breakers and accessories shall conform to IEC: 62271-100, IEC: 62271-1 and shall be of SF6 Type. <u>The circuit breakers shall be of class C2-M2 (as per IEC) with regard to restrike</u></td></tr>
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Sl. No.	Existing Provisions	New / Revised Provisions
	220kV circuit breakers. 400kV, 220kV Circuit breakers shall be provided with single phase and three phase auto reclosing. The Circuit breakers controlling 400kV lines of more than 200km length shall be provided with pre insertion closing resistor of about 400 ohms maximum with 8 ms minimum insertion time or Controlled Switching Device. The short line fault capacity shall be same as the rated capacity and this is proposed to be achieved without use of opening resistors. The controlled switching device shall be provided in 400kV Circuit breaker of switchable line reactor and in Main & Tie circuit breakers of line with non-switchable line reactors and Bus reactors.	**probability during capacitive current breaking and mechanical endurance.** The rated break time shall not exceed 40 ms for 400kV circuit breakers and 60 ms for 220kV circuit breakers. 400kV, 220kV Circuit breakers shall be provided with single phase and three phase auto reclosing. The Circuit breakers controlling 400kV lines of more than 200km length shall be provided with pre insertion closing resistor of about 400 ohms maximum with 8 ms minimum insertion time or Controlled Switching Device. The short line fault capacity shall be same as the rated capacity and this is proposed to be achieved without use of opening resistors. The controlled switching device shall be provided in 400kV Circuit breaker of switchable line reactor and in Main & Tie **bay 400 kV** circuit breakers of line with non-switchable line reactors and Bus reactors.
14.	**2.4 Isolators (AIS)** The isolators shall comply to IEC 62271-102 in general. 400 kV and 220kV Isolators shall be double break type. All Isolators and earth switches shall be motor operated. Earth switches shall be provided at various locations to facilitate maintenance. Isolator rated for 400kV and 220kV shall be of extended mechanical endurance class - M2 **and all earth switches shall be class M0** as per IEC-62271-102. Main blades and earth blades shall be interlocked and interlock shall be fail safe type. 400kV and 220kV earth switch for line isolator shall be suitable for induced current switching duty as defined for Class-B.	**2.4 Isolators (AIS)** The isolators shall comply to IEC 62271-102 in general. 400 kV and 220kV Isolators shall be double break type. All Isolators and earth switches shall be motor operated. Earth switches shall be provided at various locations to facilitate maintenance. Isolator rated for 400kV and 220kV shall be of extended mechanical endurance class - M2 **and suitable for bus transfer current switching duty** as per IEC-62271-102. Main blades and earth blades shall be interlocked and interlock shall be fail safe type. 400kV and 220kV earth switch for line isolator shall be suitable for induced current switching duty as defined for Class-B.
15.	**2.5 Current Transformers (AIS)** Current Transformers shall comply with IEC 61869-1 & 61869- 2 in	**2.5 Current Transformers (AIS)** Current Transformers shall comply with IEC 61869-1 & 61869- 2 in

Sl. No.	Existing Provisions	New / Revised Provisions
	general. All ratios shall be obtained by secondary taps. Generally, Current Transformers (CT) for 400kV shall have six cores (four for protection and two for metering). 220kV Current Transformers shall have five cores (four for protection and one for metering). The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry. Accuracy class for protection core shall be PX and for metering core it shall be 0.2S. The rated burden of cores shall be closer to the maximum burden requirement of metering & protection system for better sensitivity and accuracy.	general. All ratios shall be obtained by secondary taps. Generally, Current Transformers (CT) for 400kV shall have six cores (four for protection and two for metering). 220kV Current Transformers shall have five cores (four for protection and one for metering). The burden and knee point voltage shall be in accordance with the requirements of the system including possible feeds for telemetry. Accuracy class for protection core shall be PX and for metering core it shall be 0.2S. The rated burden of cores shall be closer to the maximum burden requirement of metering & protection system **(not more than 20VA for metering core)** for better sensitivity and accuracy. **The Instrument security factor shall be less than 5.**
16.	**2.6 Capacitor Voltage Transformer (AIS)** Capacitive Voltage transformers shall comply to IEC 61869-1 & 61869-5 in general. These shall have three secondaries out of which two shall be used for protection and one for metering. Accuracy class for protection cores shall be 3P and for metering core shall be 0.2. The Capacitive voltage transformers on lines shall be suitable for Carrier Coupling. The Capacitance of CVT for 400kV and 220kV shall be of 4400/8800 pF depending on PLCC requirements. The rated burden of cores shall be closer to the maximum burden requirement of metering & protection system for better sensitivity and accuracy.	**2.3 Capacitor Voltage Transformer (AIS)** Capacitive Voltage transformers shall comply to IEC 61869-1 & 61869-5 in general. These shall have three secondaries out of which two shall be used for protection and one for metering. Accuracy class for protection cores shall be 3P and for metering core shall be 0.2. The Capacitive voltage transformers on lines shall be suitable for Carrier Coupling. The Capacitance of CVT for 400kV and 220kV shall be of 4400/8800 pF depending on PLCC requirements. The rated burden of cores shall be closer to the maximum burden requirement of metering & protection system for **(not more than 50VA for metering core)** better sensitivity and accuracy.

Sl. No.	Existing Provisions	New / Revised Provisions
17.	**2.7 Surge Arresters (AIS)** 336kV & 216kV Station class, **current limiting,** heavy duty gapless type Surge arresters conforming to IEC 60099-4 in general shall be provided for 420kV & 245kV systems respectively. The rated voltage of Surge arrester and other characteristics are chosen in accordance with system requirements. Surge arresters shall be provided near line entrances, transformers & Reactor so as to achieve proper insulation coordination. Surge Arresters shall be provided with porcelain/ polymer housing fitted with pressure relief devices. A leakage current monitor with surge counter shall be provided with each surge arrester.	**2.7 Surge Arresters (AIS)** 336kV & 216kV Station class, heavy duty gapless type Surge arresters conforming to IEC 60099-4 in general shall be provided for 420kV & 245kV systems respectively. The rated voltage of Surge arrester and other characteristics are chosen in accordance with system requirements. Surge arresters shall be provided near line entrances, transformers & Reactor so as to achieve proper insulation coordination. Surge Arresters shall be provided with porcelain/ polymer housing fitted with pressure relief devices. A leakage current monitor with surge counter shall be provided with each surge arrester.
18.	**2.8 Protection Relaying & Control System** The protective relaying system proposed to be provided for transmission lines, auto- transformers, reactors and bus bars to minimize the damage to the equipment in the events of faults and abnormal conditions, is dealt in this section. All main protective relays shall be numerical type with IEC 61850 communication interface. All numerical relays shall have built in disturbance recording feature.	**2.8 Protection Relaying & Control System** The protective relaying system proposed to be provided for transmission lines, auto- transformers, reactors and bus bars to minimize the damage to the equipment in the events of faults and abnormal conditions, is dealt in this section. All main protective relays shall be numerical type with IEC 61850 communication interface. All numerical relays shall have built in disturbance recording feature. **The protection circuits and relays of transformer and reactor shall be electrically and physically segregated into two groups each being independent and capable of providing uninterrupted protection even in the event of one of the protection groups failing, to obtain redundancy, and to take protection systems out for maintenance while the equipment remains in service.**
19.	**2.8 a) Transmission Lines Protection**	**2.8 a) Transmission Lines Protection**

Sl. No.	Existing Provisions	New / Revised Provisions
	400kV and 220kV lines shall have Main-I numerical three zone distance protection scheme with carrier aided inter-tripping feature. 400kV and 220kV lines shall also have Main-II numerical distance protection scheme like Main-I but from different make that of Main-I. The Main-I and Main-II protection relays of same make may be provided only if they are of different hardware **&** manufacturing platform. Line Current Differential relay (with back up distance protection feature) as Main–I and Main-II shall be considered at both ends for short lines (line length below 30kM) having Fibre Optic communication link. Differential relay at remote end shall be provided by the TSP. Associated power & control cabling and integration with SAS at remote end shall be provided by respective bay owner. ……	400kV and 220kV lines shall have Main-I numerical three zone distance protection scheme with carrier aided inter-tripping feature. 400kV and 220kV lines shall also have Main-II numerical distance protection scheme like Main-I but from different make that of Main-I. The Main-I and Main-II protection relays of same make may be provided only if they are of **different hardware, manufacturing platform or different principle of operation.** **However,** Line Current Differential relay (with back up distance protection feature) as Main–I and Main-II shall be considered at both ends for short lines (line length below 30kM) having Fibre Optic communication link. Differential relay at remote end shall be provided by the TSP. Associated power & control cabling and integration with SAS at remote end shall be provided by respective bay owner. ……..
20.	**2.8 b) Auto Transformer Protection** …… Suitable monitoring, control (operation of associated circuit breaker & isolator) and protection for LT auxiliary transformer connected to tertiary winding of auto-transformer for the purpose of auxiliary supply shall be provided. The Over current and **open delta protection is required to** be provided for the auxiliary transformer. These protection and control may be provided as built in feature either in the bay controller to be provided for the auxiliary system or in the control & protection IEDs to be provided for autotransformer.	**2.8 b) Auto Transformer Protection** …….. Suitable monitoring, control (operation of associated circuit breaker & isolator) and protection for LT auxiliary transformer connected to tertiary winding of auto-transformer for the purpose of auxiliary supply shall be provided. The Over current and **other necessary protection shall** be provided for the auxiliary transformer. These protection and control may be provided as built in feature either in the bay controller to be provided for the auxiliary system or in the control & protection IEDs to be provided for autotransformer.
21.	**2.9 a) Substation Automation System**	**2.9 a) Substation Automation System**

Sl. No.	Existing Provisions	New / Revised Provisions
	a) …….. The functions of control, annunciation, disturbance recording, event logging and measurement of electrical parameters shall be integrated in Substation Automation System. **The Automation System shall be provided with the facility of communication and control for remote end operation so that by providing remote HMI and suitable communication link, the substation can be controlled from a remote location. Mode of communication shall be considered as optical fibre or leased line based on IEC-60870-5-104 communication protocol.** At new substations, the Substation Automation System (SAS) shall be suitable for operation and monitoring of the complete substation including proposed future bays/elements. **……..**	a) …… The functions of control, annunciation, disturbance recording, event logging and measurement of electrical parameters shall be integrated in Substation Automation System. At new substations, the Substation Automation System (SAS) shall be suitable for operation and monitoring of the complete substation including proposed future bays/elements. **……..**
22.	3.1 i) …….. Additionally, Active Energy Meters may be provided at the same point in the 33kV tertiary of Transformer by local SEB/DISCOM for energy.	3.1 i) …… Additionally, Active Energy Meters may be provided at the same point in the 33kV tertiary of Transformer by local SEB/DISCOM for energy **accounting**.

Sl. No.	Existing Provisions	New / Revised Provisions
23.	3.1 iii) Suitable AC & DC distribution boards and associated LT Switchgear shall be provided at new substation. **For new substation, following switch boards with minimum rating as specified here under shall be considered with duplicate supply:** **(a)** 415V Main Switch board – **2 nos. (two sections separated by one bus coupler)** **(b)** AC distribution board – **2 nos. (two sections separated by one bus coupler)** (c) Main lighting distribution board – 1 no. (d) Emergency lighting distribution board – 1 no. (e) 220 Volt DC distribution board – 2 nos. (f) 48 Volt DC distribution board – 2 nos. **Sizing of LT Switchgear shall be suitable to cater the requirement for all present and future bays. AC & DC distribution boards shall have modules for all the feeders (including future as specified).**	**3.1** iii) Suitable AC & DC distribution boards and associated LT Switchgear shall be provided at new substation. **Sizing of LT Switchgear shall be suitable to cater the requirement for all present and future bays. AC & DC distribution boards shall have modules for all the present and future feeders as specified.** **For new substation, following switch boards shall be considered with duplicate supply with bus coupler/ sectionalizer and duplicate outgoing feeders except for Emergency lighting distribution board which shall have only one incoming feeder:** (a) 415V Main Switch board – **1** no. (b) AC distribution board – **1** no. (c) Main lighting distribution board – 1 no. (d) Emergency lighting distribution board – 1 no. (e) 220 Volt DC distribution board – 2 nos. **(f)** 48 Volt DC distribution board – 2 nos.
24.	3.7 Visual monitoring system for watch and ward of substation premises: **Visual monitoring system for effective watch and ward of substation premises covering the areas of entire switchyard, Control room building, other buildings/stores and main gate, shall be provided. The Visual Monitoring System shall have provision of WAN connectivity for remote monitoring.** **The number of cameras and their locations shall be decided in such a way that any location covered in the substation area can**	3.7 Visual monitoring system **(VMS)** for watch and ward of substation premises: **Visual monitoring system for effective watch and ward of substation premises shall cover all the transformers and reactors, all other major AIS Equipment (such as CB, isolators, CT, CVT, SA etc. as applicable), panel room, all the gates of switchyard and all entry and exit points of control room building and accordingly the location of cameras shall be decided. The camera shall be high definition color CCD camera with night vision feature. The VMS data partly/completely shall be recorded (minimum for 15 days) at least @25fps (or better) and**

Sl. No.	Existing Provisions	New / Revised Provisions
	be scanned. The cameras shall be located in such a way to monitor at least: **1. The operation of each and every isolator pole of the complete yard in case of AIS Sub-station.** **2. The Operation of each bay bays of GIS Hall as applicable.** **3. All the Transformer and Reactors, all the Entrance doors of Control Room Building, GIS hall and any other building as applicable.** **4. All the gates of switchyard.** **5. Main entrance Gate** **6. All other major AIS Equipment (such as CB, CT, CVT, SA etc. as applicable)** **At existing substations, the visual monitoring system as available shall be augmented as required.**	**stored on network video recorder. The system shall use video signals from various cameras installed at different locations, process them for viewing on workstations/monitors in the control room and simultaneously record all the cameras. Mouse/keyboard controllers shall be used for pan, tilt, zoom and other functions of the desired camera. The Visual Monitoring System shall have provision of WAN connectivity for remote monitoring.** **All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. The equipment should generally conform to Electromagnetic compatibility requirement for outdoor equipment in EHV substation.** **At existing substations, the visual monitoring system if available shall be augmented as per existing or better specification as required.**
25.	4.0 e) General Facilities In 400kV switchyard, if spare bay of half diameter is identified as future, all the equipment for Tie & Future bay shall be designed considering the current rating of line bay i.e. **3000A.**	4.0 e) General Facilities In 400kV switchyard, if spare bay of half diameter is identified as future, all the equipment for Tie & Future bay shall be designed considering the current rating of line bay i.e. **3150A.**
26.	At the end **PLCC** **PLCC & PBAX: Power line carrier communication (PLCC)**	**Deleted.**

Sl. No.	Existing Provisions	New / Revised Provisions
	equipment complete for speech, teleprotection commands and data channels shall be provided on each transmission line. The protections for transmission line and the line compensating equipment shall have hundred percent back up communication channels i.e. two channels for tele- protection in addition to one channel for speech plus data for each direction. The PLCC equipment shall in brief include the following:- **Coupling device, line traps, carrier terminals, protection couplers, HF cables, PABX (if applicable) and maintenance and testing instruments.** **A telephone exchange (PABX) of 24 lines shall be provided at new substations as means of effective communication among various buildings of the substation, remote end substations and with control centers (RLDC/SLDC) etc.** **Coupling devices shall be suitable for phase to phase coupling for 400kV Transmission lines. The pass band of coupling devices shall have sufficient margin for adding communication channel in future if required. Necessary protection devices for safety of personnel and low voltage part against power frequency voltages and transient over voltage shall also be provided.** **The line traps shall be broad band tuned suitable for blocking the complete range of carrier frequencies. Line Trap shall have necessary protective devices such as lightning arresters for the protection of tuning device. Decoupling network consisting of**	

Sl. No.	Existing Provisions	New / Revised Provisions
	line traps and coupling capacitors may also be required at certain substation in case of extreme frequency congestion. **The carrier terminals shall be of single side-band (SSB) amplitude modulation (AM) type and shall have 4 kHz band width. PLCC Carrier terminals and Protection couplers shall be considered for both ends of the line.** **PLCC equipment for all the transmission lines covered under the scheme (consisting of one set of analog PLCC channel along with circuit protection coupler and one set of Digital protection coupler for both ends) shall be provided by TSP. Further, PLCC equipment for both ends of transmission lines not covered under present scope shall be provided by developer of lines. However, CVT & Wave trap for all the line bays under present scope shall be provided by TSP.** **TSP shall provide/undertake necessary addition/modification/shifting/re-commissioning etc. of PLCC equipment due to LILO of transmission lines (wherever applicable).** **All other associated equipment like cabling, coupling device and HF cable shall also be provided by the TSP. The wave trap and CVT required for PLCC at remote end shall be provided by respective bayowner.**	
SPECIFIC TECHNICAL REQUIREMENTS Of COMMUNICATION SYSTEM		
27.	In order to meet the requirement for grid management and operation of	In order to meet the requirement for grid management and operation of

Sl. No.	Existing Provisions	New / Revised Provisions
	substations, Transmission Service Provider (TSP) shall conform to the following requirements. **<u>Transmission system for evacuation of power from RE projects in Rajgarh (2500 MW) SEZ in Madhya Pradesh</u>** **Rajgarh SEZ PP -Bhopal (Sterlite) 400kV D/c line (HTLS) (with minimum capacity of 2100 MVA/ckt at nominal voltage)** On Rajgarh SEZ PP - Bhopal (Sterlite) 400kV D/c line (HTLS) one OPGW containing 24 Fibres is to be installed by the TSP in place of conventional earth wire during the construction of line. The installation of OPGW shall be done from gantry of Rajgarh SEZ PP up to gantry of Bhopal (Sterlite) 400kV and shall be terminated in a Joint Box to be provided by TSP at both the ends. In case of requirement of repeater to establish link between Rajgarh SEZ PP -Bhopal (Sterlite), the OPGW (48F) connectivity from power line crossing point upto repeater station shall also be in the scope of TSP. **Rajgarh SEZ PP – Shujalpur 400 kV D/c line (HTLS) (with minimum capacity of 2100 MVA/ckt at nominal voltage)**	substations, Transmission Service Provider (TSP) shall conform to the following requirements. **Rajgarh SEZ PP -Bhopal (Sterlite) 400kV D/c line (HTLS) (with minimum capacity of 2100 MVA/ckt at nominal voltage)** **<u>OPGW:</u>** On Rajgarh SEZ PP - Bhopal (Sterlite) 400kV D/c line (HTLS) **<u>under present scope</u>** one OPGW containing 24 Fibres is to be installed by the TSP in place of conventional earth wire during the construction of line. The installation of OPGW shall be done from gantry of Rajgarh SEZ PP up to gantry of Bhopal (Sterlite) 400kV and shall be terminated in a Joint Box to be provided by TSP at both the ends. In case of requirement of repeater to establish link between Rajgarh SEZ PP -Bhopal (Sterlite), the OPGW (48F) connectivity from power line crossing point upto repeater station shall also be in the scope of TSP. **<u>The protection system for 400kV and higher voltage transmission line and the line compensating equipment shall have one hundred percent back up communication channels i.e. two channels for tele-protection in addition to one channel for speech plus data for each direction.</u>** **Rajgarh SEZ PP – Shujalpur 400 kV D/c line (HTLS) (with minimum**

Sl. No.	Existing Provisions	New / Revised Provisions
		capacity of 2100 MVA/ckt at nominal voltage)
	On Rajgarh SEZ PP - Shujalpur (Sterlite) 400kV D/c line (HTLS) one OPGW containing 24 Fibres is to be installed by the TSP in place of conventional earth wire during the construction of line. The installation of OPGW shall be done from gantry of Rajgarh SEZ PP up to gantry of Shujalpur 400kV and shall be terminated in a Joint Box to be provided by TSP at both the ends. In case of requirement of repeater to establish link between Rajgarh SEZ PP - Shujalpur, the OPGW (48F) connectivity from power line crossing point upto repeater station shall also be in the scope of TSP.	**OPGW:** On Rajgarh SEZ PP - Shujalpur (Sterlite) 400kV D/c line (HTLS) **under present scope** one OPGW containing 24 Fibres is to be installed by the TSP in place of conventional earth wire during the construction of line. The installation of OPGW shall be done from gantry of Rajgarh SEZ PP up to gantry of Shujalpur 400kV and shall be terminated in a Joint Box to be provided by TSP at both the ends. In case of requirement of repeater to establish link between Rajgarh SEZ PP - Shujalpur, the OPGW (48F) connectivity from power line crossing point upto repeater station shall also be in the scope of TSP. **The protection system for 400kV and higher voltage transmission line and the line compensating equipment shall have one hundred percent back up communication channels i.e. two channels for tele- protection in addition to one channel for speech plus data for each direction.**
	Establishment of 400/220 kV, 5X500 MVA at Rajgarh SEZ PP with 420kV (125 MVAR) bus reactor ……..	**Establishment of 400/220 kV, 5X500 MVA at Rajgarh SEZ PP with 420kV (125 MVAR) bus reactor** ……
28.	New Point to be inserted	**PLCC & PBAX:** **Power line carrier communication (PLCC) equipment complete for speech, tele-protection commands and data channels shall be provided on each transmission line. The protections for transmission line and the line compensating equipment shall have hundred percent**

Sl. No.	Existing Provisions	New / Revised Provisions
		back up communication channels i.e. two channels for tele- protection in addition to one channel for speech plus data for each direction.. The PLCC equipment shall in brief include the following:- • **Coupling device, line traps, carrier terminals, protection couplers, HF cables, PABX (if applicable) and maintenance and testing instruments.** • **At new substation, a telephone exchange (PABX) of 24 lines shall be provided at as means of effective communication among various buildings of the substation, remote end substations and with control centres (RLDC/SLDC) etc.** • **Coupling devices shall be suitable for phase to phase coupling for 765kV & 400kV Transmission lines. The pass band of coupling devices shall have sufficient margin for adding communication channel in future if required. Necessary protection devices for safety of personnel and low voltage part against power frequency voltages and transient over voltage shall also be provided.** • **The line traps shall be broad band tuned suitable for blocking the complete range of carrier frequencies. Line Trap shall have necessary protective devices such as lightning arresters for the protection of tuning device. Decoupling network consisting of line traps and coupling capacitors may also be required at certain substation in case of extreme frequency congestion.** • **The carrier terminals shall be of single side-band (SSB)**

Sl. No.	Existing Provisions	New / Revised Provisions
		amplitude modulation (AM) type and shall have 4 kHz band width. PLCC Carrier terminals and Protection couplers shall be considered for both ends of the line. • **PLCC equipment for all the transmission lines covered under the scheme (consisting of one set of analog PLCC channel along with circuit protection coupler and one set of Digital protection coupler for both ends) shall be provided by TSP. CVT & Wave trap for all line bays, under present scope shall be provided by TSP.** • **TSP shall provide/undertake necessary addition/modification/shifting/re-commissioning etc. of PLCC equipment due to LILO of transmission lines (wherever applicable).** • **All other associated equipment like cabling, coupling device and HF cable shall also be provided by the TSP.**