

**Addendum & Corrigendum Slip No. 01  
to the Technical Specification No. TI/SPC/PSI/TRNPWR/3200**

**1.0** This A&C slip is issued to add the following ratings for the Traction Power Transformers

- (i) 40/56MVA Traction Power Transformer for Mumbai Sub Urban area only.
- (ii) 21.6/30.24MVA, 100/27kV Traction Power Transformer

**2.0** The clauses in which changes are to be made:

SN	Clause No.	Description	As amended																																										
1.	Cover Page	-----	Add the Traction Power Transformer Rating, 40/56MVA																																										
2.	1.2	Scope	(i) Add the transformer rating 21.6/30.24MVA - 100/27kV. Add New Para (iv) as 40/56MVA - 220/27kV or 132/kV or 110/27kV or 100/27kV or 66/27kV (For Mumbai sub urban Area only). (Transformer with on load tap changer)																																										
3.	3.1	Dimensions	21.6/30.24MVA & 30/42MVA mentioned in the table to be replaced by "21.6/30.24MVA, 30/42MVA & 40/56MVA"																																										
4.	3.5.5	Windings	30 MVA Mentioned in the third line to be replaced by 30/42MVA & 40/56MVA																																										
5.	3.7.2:	Bushings	Add the following row in the table: <table border="1" style="width:100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width:20%;">Transformer MVA</th> <th style="width:50%;">Primary Side Bushing current</th> <th style="width:30%;">Secondary Side Bushing current</th> </tr> </thead> <tbody> <tr> <td>40/56MVA</td> <td>For 220kV, 132kV - 800A For 110kV, 100kV - 1000A For 66kV - 1600A</td> <td>4000A</td> </tr> </tbody> </table>	Transformer MVA	Primary Side Bushing current	Secondary Side Bushing current	40/56MVA	For 220kV, 132kV - 800A For 110kV, 100kV - 1000A For 66kV - 1600A	4000A																																				
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6.	3.10.3	OLTC	Replace the 30/42MVA mentioned in the line with the 30/42MVA & 40/56MVA																																										
7.	3.10.3.5	OLTC	Add the par c as below: <b>c. (For 40/56MVA- For Mumbai sub urban area only)</b> <table border="1" style="width:100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width:10%;">Nominal Voltage</th> <th style="width:10%;">Max Voltage</th> <th style="width:10%;">Min Voltage</th> <th style="width:10%;">Per Tap Voltage</th> <th style="width:15%;">Voltage at max Tap</th> <th style="width:15%;">Voltage at min tap</th> </tr> <tr> <th>kV</th> <th>kV</th> <th>kV</th> <th>kV</th> <th>kV</th> <th>kV</th> </tr> </thead> <tbody> <tr> <td>220</td> <td>242</td> <td>187</td> <td>3</td> <td>241</td> <td>193</td> </tr> <tr> <td>132</td> <td>145.2</td> <td>112.2</td> <td>2</td> <td>146</td> <td>114</td> </tr> <tr> <td>110</td> <td>121</td> <td>93.5</td> <td>1.25</td> <td>118.75</td> <td>98.75</td> </tr> <tr> <td>100</td> <td>110</td> <td>85</td> <td>1.25</td> <td>108.75</td> <td>88.75</td> </tr> <tr> <td>66</td> <td>72.6</td> <td>56.1</td> <td>1.25</td> <td>74.75</td> <td>54.75</td> </tr> </tbody> </table>	Nominal Voltage	Max Voltage	Min Voltage	Per Tap Voltage	Voltage at max Tap	Voltage at min tap	kV	kV	kV	kV	kV	kV	220	242	187	3	241	193	132	145.2	112.2	2	146	114	110	121	93.5	1.25	118.75	98.75	100	110	85	1.25	108.75	88.75	66	72.6	56.1	1.25	74.75	54.75
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8.	3.10.3.6	OLTC	The existing table in the clause should be numbered as; (a) Ratings of the tap changer for 30/42MVA  Add the new clause (b) as; (b) Ratings of the tap changer for 40/56MVA <table border="1" style="width:100%; border-collapse: collapse; margin-top: 5px;"> <tbody> <tr> <td style="width:30%;">Primary Voltage, kV</td> <td>220</td> <td>132</td> <td>110</td> <td>100</td> <td>66</td> </tr> <tr> <td>Voltage Class, kV</td> <td>245</td> <td>145</td> <td>123</td> <td>110</td> <td>72.5</td> </tr> <tr> <td>Rated Current</td> <td>400</td> <td>800</td> <td>800</td> <td>1250</td> <td>1600</td> </tr> <tr> <td>Short Circuit Current for 2 seconds</td> <td>6kA</td> <td>8kA</td> <td>8kA</td> <td>12.5kA</td> <td>16kA</td> </tr> </tbody> </table>	Primary Voltage, kV	220	132	110	100	66	Voltage Class, kV	245	145	123	110	72.5	Rated Current	400	800	800	1250	1600	Short Circuit Current for 2 seconds	6kA	8kA	8kA	12.5kA	16kA																		
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9.	5.1.1	Rating Particulars	Add particulars for the for the 21.6/30.24MVA, 100/27kV, as described in Para 4.0 of this A&C slip
10.	5.1.5 (New Clause)	Rating Particulars	Add New Clause to include the particulars for the 40/56MVA Traction Power transformer (for Mumbai Sub Urban area only), as Described in Para 3.0 of this A&C slip
11.	6.3.1.7	Temperature rise Test	in the third line add 5.1.5(14)
12.	Annexure 6	Dimensions	21./30.24MVA & 30/42MVA mentioned in the table to be replaced by "21./30.24MVA,30/42MVA & 40/56MVA"

**3.0 Details of Clause no. 5.1.5 are as below:**

Particulars of the System for 40/56MVA Traction Power transformer (for Mumbai Sub Urban area only). The rating and general data of the transformer shall be as follows:

SN	Rated primary voltage Un, kV	220	132	110	100	66	
1.	Highest Primary system voltage Um, kV	245	145	123	110	72.5	
2.	Short - circuit apparent power at the Transformer Location (MVA)	20,000	10,000	10,000	6,000	3,500	
3.	Rated current at the principal tapping, A, (for 40MVA base )	Primary	182	303	363	400	606
		Secondary	1481				
4.	Maximum permissible losses at rated frequency, voltage, current and at the principal tapping (40MVA Base), kW	No Load	24	21	21	21	21
		Load	155	155	155	155	155
		Total loss	179	176	176	176	176
5.	Type	ONAN/ONAF cooled, single phase, step-down, Traction Power Transformer, double limb wound, core -type for outdoor installation.					
6.	Windings	Uniformly insulated concentric disc duly interleaved / intershielded.					
7.	Rated frequency, Hz	50 +/-3%					
8.	Rated secondary voltage (at no - load), kV	27					
9.	Rated power, MVA	40/56					
10.	Maximum value of Percentage Impedance (40MVA Base)	(16 +/- 0.5)% at principal tap & between 15 to 17% at extreme tap position (Absolute value of the Transformer impedance at all the taps shall be within 15 to 17% of the base vale at the principal tap)					
11.	Non - cumulative over load capacity after the transformer has reached steady temperature on continuous operation at rated load( i.e. at rated power)	1. 150% rated load for 15 min (For ONAN & ONAF Mode) 2. 200% rated load for 5 min (for ONAN Mode only)					
12.	Polarity	Subtractive					
13.	Tappings (On Load Tap Changer)	A separate tapped winding on the primary winding to give rated secondary voltage for variation in primary voltage as detailed in 3.10					
14.	Temperature rise	The temperature rise over an ambient temperature of 50°C both at rated and overload conditions shall not exceed the value indicated below:					

		1. Winding: 50 °C at rated load, and 60 °C for overloads as specified in Clause 5.1.2(11) (temperature measured by resistance method). 2. Top oil: 40 °C (temperature rise measured by thermometer). 3. Current carrying parts in air: 40 °C (temperature rise measured by thermometer)	
15.	Ability to withstand short circuit	Thermal ability	5 s
		Dynamic ability	0.25 s
16.	Flux density at rated voltage and frequency at principal tapping	Shall not exceed 1.55 tesla(Flux density has not to exceed 1.90 tesla at any of the taps at extreme voltage condition)	
17.	Current density in the windings at rated current	Shall not exceed 2.5 A/mm <sup>2</sup>	
18.	Acoustic sound level when energized at rated voltage and at no-load	Not more than 75 dB at a distance of one meter.	

**Note:** Non-cumulative power load means overload which occur at sufficient interval of time apart such that the temperature rise limits, both of oil and winding do not exceed the values specified in clause 5.1.5 (14) of this specification .The interval of time between two successive non-cumulative overloads shall not be less than 3 hours.

19. Bushings: (more than rated current 2.5 times of the transformer )

SN	Item	Secondary	Primary				
1.	Type	OIP condenser	OIP condenser				
2.	Highest voltage for equipment Um, kV	52	245	145	123	110	72.5
3.	Rated current, A	4000	800	800	1000	1000	1600
4.	Minimum creepage distance in air , mm	1600	6125	3625			1813

20. Bushing Type current Transformers for differential protection of transformer

SN	Item	Secondary	Primary				
1.	Highest voltage for equipment Um, kV	52	245	145	123	110	72.5
2.	CT Ratio	4000/5	400/5	800/5	800/5	900/5	1300/5
3.	Frequency, Hz	50+/-3%					
4.	Class of accuracy as per IS:2705 (Part IV)	PS					
5.	Minimum knee -point emf , V	360	175				
6.	Maximum excitation current at knee - point voltage , A	0.100	0.75				
7.	Maximum resistance of the secondary winding , ohm	0.9	0.5				

#### 4.0 Particulars for the 21.6/30.24MVA, 100/27kV Traction Power Transformer

SN	Rated primary voltage Un, kV	100	
1.	Highest Primary system voltage Um, kV	110	
2.	Short - circuit apparent power at the Transformer Location (MVA)	6,000	
3.	Rated current at principal tapping and 21.6MVA base (A)	Primary	216.0
		Secondary	800
4.	Maximum permissible losses at rated voltage, current and at the principal tapping, kW (21.6MVA Base)	No Load	9.0
		Load	85.0
5.	Type	ONAN/ONAF cooled, single phase, step-down Power Transformer, double limb wound, core -type for outdoor installation.	
6.	Windings	Uniformly insulated concentric disc duly interleaved / intershielded.	
7.	Rated secondary voltage (at no - load), kV	27	
8.	Rated power, MVA	21.6/30.24	
9.	Rated frequency, Hz	50 +/-3%	
10.	Maximum value of Percentage Impedance	(12 +/- 0.5)% at principal and extreme tap positions. (21.6MVA Base )	
11.	Non - cumulative over load capacity after the transformer has reached steady temperature on continuous operation at rated load( i.e. at rated power)	<ol style="list-style-type: none"> <li>1. 150% rated load for 15 min. (ONAN &amp; ONAF)</li> <li>2. 200% rated load for 5 min. (ONAN only)</li> </ol>	
12.	Polarity	Subtractive	
13.	Tappings (Off – Circuit)	A separate tapped winding on the secondary winding to give rated secondary voltage for variation in primary voltage of + 10% to -15% , in steps of 5% each.	
14.	Temperature rise	<p>The temperature rise over an ambient temperature of 50°C both at rated and overload conditions shall not exceed the value indicated below:</p> <ol style="list-style-type: none"> <li>1. Winding: 50 °C at rated load, and 60 °C for overloads as specified in Clause 5.1.1(11) (temperature measured by resistance method).</li> <li>2. Top oil: 40 °C (temperature rise measured by thermometer).</li> <li>3. Current carrying parts in air: 40 °C (temperature rise measured by thermometer).</li> </ol>	
15.	Ability to withstand short circuit , sec.	<p>Thermal ability : 5 s</p> <p>Dynamic ability : 0.25 s</p>	

16.	Flux density at rated voltage and frequency at principal tapping	Shall not exceed 1.55 tesla (Flux density has not to exceed 1.90 tesla at any of the taps at extreme voltage condition)
17.	Current density in the windings at rated current	Shall not exceed 2.5 A/mm <sup>2</sup>
18.	Acoustic sound level when energized at rated voltage and at no-load	Not more than 75 dB at a distance of one meter.

Note: Non-cumulative power load means overload which occur at sufficient interval of time apart such that the temperature rise limits, both of Oil and Winding do not exceed the values specified in clause 5.1.1(14) of this specification .The interval of time between two successive non-cumulative overloads shall not be less than 3 hours.

19. Bushings:

SN	Item	Secondary	Primary
1.	Type	OIP condenser	OIP condenser
2.	Highest voltage for equipment Um, kV	52	110
3.	Rated current, A	2000	800
4.	Minimum creepage distance in air , mm	1300	2800

20. Bushing Type current Transformers for differential protection of transformer

SN	Item	Secondary	Primary
1.	Highest voltage for equipment Um, kV	52	110
2.	CT Ratio	1600/5	500/5
3.	Frequency, Hz	50+/-3%	
4.	Class of accuracy as per IS:2705 (Part IV)	PS	
5.	Minimum knee -point emf , V	175	150
6.	Maximum excitation current at knee - point voltage , A	0.25	0.75
7.	Maximum resistance of the secondary winding , ohm	0.5	0.25

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