Phone No. 080-22243926
Fax No. 080-22110134
Website : www.kptcl.com

Email ID: dgmtkptcl@rediffmail.com

KARNATAKA POWER TRANSMISSION CORPORATION LTD.,

Corporate Identity Number (CIN): U40109KA1999SGC025521

No. KPTCL/B25/4809/05-06
Encl:

Corporate Office,
Kaveri Bhavan,
Bengaluru - 560 009.
Dated:
30 JUN 2016

CIRCULAR

Sub: Strategy to be adopted for taking up repairs of power transformers of different voltage class.

Ref: CEE RT & R&D note no. CEE/RT & R&D/EEE(O)/97 dt: 18/12/2015 approved by Managing Director, KPTCL.

Preamble:

The estimate for carrying out repairs on the failed transformers is typically prepared based on the inference drawn from the various tests conducted immediately after its failure. The reason being that no facilities would be available at the site for assessing the extent of its failure in terms of requirement of heavy duty crane and human resources etc., to open out the active parts of the transformer for its inspection and to assess the actual damages that might have been caused to its active parts. As a result, the active part of the transformer is opened out at the works of the contract agency who has been awarded with the repair works, before carrying out any repairs. The active part of the transformer is opened out in the presence of the officers of the KPTCL in order to finalise and freeze up the actual repairs that needs to be carried out which in most of the cases differs to a large extent from the estimated one which is resulting in variation in terms of the actual repairs to be carried out vis-à-vis the awarded one. Also, there is no uniformity in recommending the quantum and type of repairs to be carried, by the inspecting officers which has a larger ramification on the financial front and also on the guaranty to be insisted for the repairs carried out. All this has led to huge variation in the initial contracted amount before opening and after opening the transformer. Also, non-uniformity in deciding or recommending the nature, type and quantum of repairs to be carried

out, coils to be replaced, guarantee period to be insisted, type of tests to be carried out, to be decided before inviting tender also needs to be reviewed.

The life expectancy of a power transformer is considered to be 25 years. Also, it is fact that the power transformers which deliver power at distribution level voltage i.e. either at 33 or 11 KV are subjected to more stress compared to the transformers which deliver power at the transmission level of voltage of 66 KV and above. And as such, a strategy on the repair to be carried out on the failed transformer has to be decided based on its ageing in terms of the no. of years already served by it. For this purpose, 08 years has been considered to be the critical service life rendered by a power transformers of voltage class 220/66 KV, 220/110 KV so as to decide on the scope of repair work to be carried out upon its failure. Similarly, for power transformers of voltage class 66/33/11 KV, 110/33/11 KV, a critical service life of 07 years has been considered for deciding the scope of repair to be carried out upon its failure.

Hence, the following guidelines are hereby appended below for preparation of the estimate and also to take note of certain points/action which needs to be initiated during tendering, joint inspection of the active part of the transformer at the works of the contract agency etc.,:

Sl no.	Particulars	Remarks
1	Three phase Transformers of 220 kV Class.	1. If the transformer has served for 08 years or more continuously after its last major repair (replacement of all the phases of the winding) or otherwise from the date of commissioning, all the three phase windings of HT, LT and tertiary shall be got replaced together with oil. 2. If the transformer, irrespective of no. of years served after its last major repair (replacement of all the phases of the winding) or otherwise from the date of commissioning and if the percentage impedance between its windings are less than the desired values, then also, all the three phase windings of HT, LT and tertiary shall be got replaced together with oil with necessary modification to the earlier design so as to achieve the desired percentage impedance.

		3. If the transformer has served less than 08 years of continuous service after its last major repair (replacement of all the phases of the winding) or otherwise from the date of commissioning and if percentage impedance between all the windings are sufficient, then in such cases the estimate shall be prepared as per the inference drawn in the transformer failure report with or without replacement of oil which shall be decided before preparation of estimate. 4. The estimate shall also include credit for the released windings and the oil as the case may be. 5. If all the windings of the transformer are proposed for replacement together with oil, the transformer shall be subjected to temperature rise test* and impulse withstand test* for which provision for conducting these tests together with rates shall be made in the estimate. This shall be either at the transformer repairer's works with KPTCL staff witnessing the same OR at any other NABL Accredited Lab which is nearest to the Repairer's works. 6. Also, a guarantee period of **continuous service of 42 months** from the date of **receipt of transformer at site** OR **36 months** from the date of commissioning whichever is earlier shall be stipulated in the tender for such **cases of para 5.** In all other cases, guarantee for the works to be carried out as estimated shall only be insisted for **30 months from the date of receipt of transformer at site** OR **24 months** from the date of commissioning whichever is earlier.
2	Three phase Transformers 110 KV Class and below.	1. If the transformer has served for 07 years or more continuously after its last major repair (replacement of all the phases of the winding) or otherwise from the date of commissioning, all the three phase windings of HT and LT shall be got replaced

		together with oil. 2. If the transformer has served less than 07 years of continuous service after its last major repair (replacement of all the phases of the winding) or otherwise from the date of commissioning and if percentage impedance between all the windings are sufficient, then in such cases the estimate shall be prepared as per the inference drawn in the transformer failure report with or without replacement of oil which shall be decided before preparation of estimate. 3. The estimate shall also include credit for the released windings and the oil as the case may be. 4. If all the windings of the transformer are proposed for replacement together with oil, the transformer shall be subjected to temperature rise test* and impulse withstand test* for which provision for conducting these tests together with rates shall be made in the estimate. This shall be either at the transformer repairer's works with KPTCL staff witnessing the same OR at any other NABL Accredited Lab which is nearest to the Repairer's works. 5. Also, a guarantee period of **continuous service of 42 months** from the date of **receipt of transformer at site** OR **36 months** from the date of commissioning whichever is earlier shall be stipulated in the tender for such cases of para 5. In all other cases, guarantee for the works to be carried out as estimated shall only be insisted for **30 months from the date of receipt of transformer at site** OR **24 months** from the date of commissioning whichever is earlier.

*NOTE

1) If all the three phase windings of the failed transformer are proposed for replacement then in such cases the following shall be ensured;

   a) Complete overhauling of other parts associated with it like, OLTC, Fans, Radiators, MOG, PRV, Bucholtz relay, painting etc., shall also be taken up. Also the original 'NO LOAD' and 'LOAD' loss levels of the transformer shall be maintained and in case if there is a possibility of further improving the 'LOAD' loss on the lower side, the same shall be explored without change in the core size.

   b) 'Temperature rise' test has to be conducted and a tolerance of ±5% shall be considered for the capacity.

   c) 'Impulse tests' shall be carried out on the transformer under test after repairs at 90% of the voltages specified for that voltage class of the transformer as per IS 2026.

   d) The testing facility shall be equipped with testing equipments calibrated by 'NABL' accredited laboratory to carry out the tests at the repairer premises and the same shall be incorporated in the tender document. The temperature rise and Impulse test shall be either at the transformer repairer's works with KPTCL staff witnessing the same OR at any other NABL Accredited Lab which is nearest to the Repairer's works.

2) In cases which requires replacement of all windings of the phases for the transformer which does not fit within ambit of these guidelines then such cases shall specifically be recommended by the inspecting officers with due justification for taking appropriate decision by the Central purchase committee.

After finalising the scope of work to be carried out after joint inspection, the repairer shall take note of the design parameters and also take sufficient photos/video if required and then all the released windings shall be crushed in the presence of the KPTCL officers and a certificate to that effect shall be incorporated in the Minutes of the joint inspection report

Further, the Chief Engineers, Transmission Zone are authorised to accept variation in the contracted amount up to 25% only. Any variation beyond this shall be

referred to Central purchase Committee for approval. The above guidelines shall be followed scrupulously by all the Transmission Zones in respect of transformers to be taken up for repairs right from the stage of preparation of estimate, finalising the terms and conditions of the tender etc., with immediate effect. To speed up the process of repair of power transformers, the **jurisdictional R.T division shall send the tentative estimate for the repairs to be carried out on the failed transformer along with the failure report.**

Also, a format for conducting joint inspection and the list of parameters/ details to be noted during joint inspection of power transformers by Officers of KPTCL is also attached which shall be followed in all Transmission Zones/TAQC.

It will be the responsibility of the **Zonal Chief Engineers** to get the transformer duly repaired/scrapped as per norms. The tender in case the transformer need to be repaired shall be finalised within 2 months of the failure duly following KTPP Act and transformer to be got repaired within 4 to 6 months depending on voltage class. It will be the responsibility of Zonal Chief Engineers to review the status of repair every month and report to SEE (P&M). The transformer not getting repaired even **after 7 months** shall be reported to **SEE P&M separately**.

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Deputy General Manager (Technical)
KPTCL, Kaveri Bhavan, Bengaluru-9.

Copy to:

1. The Chief Engineer Electy., Transmission Zone, KPTCL, Bengaluru/ Tumkur/ Mysuru / Hassan/Bagalkot and Gulbarga.
2. The Chief Engineer Electy., TA&QC/ RT and R&D/ T&P/P&C/SLDC, KPTCL, Bengaluru.
3. FA (I/A)/ FA (A&R)/FA (RA), KPTCL, Kaveri Bhavan, Bengaluru-09.
4. All Superintending Engineers (Elec), KPTCL.
5. The Superintending Engineer (El), (IT&MIS), KPTCL, Kaveri Bhavan, Bengaluru - with a request to upload this circular on the website of KPTCL.
6. All Executive Engineers (Elec), KPTCL.
7. PS to Managing Director/ Director (Transmission) / Director (Finance)/ Director (A&HR) and Director & Company Secretary, KPTCL, Kaveri Bhavan, Bengaluru.

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Name of the station (where the transformer failed):
Capacity:
Voltage class:
Make:
Sl no:
Percentage Impedence of the transformer:

Name of repairer:
Date of joint inspection:
Place:

ANNEXURE-A

Sl.NO	Description	Quantity	Measured
	Weight (per Phase)		
1	Weights of HV Coil	kg	
2	Weights of HV Tapping Coil	kg	
3	Weights of IV Coil	kg	
4	Weights of LV Coil	kg	
5	Weight of Connecting copper lead & Busbar	kg	
6	Total	kg	
7	Weight of Solid insulation (inculding Permalli wood)	kg	
	Dimensions		
8	Inner Dia. / Outer Dia. Of HV Coil	mm	
9	Inner Dia. / Outer Dia. Of HV Tapping Coil	mm	
10	Inner Dia. / Outer Dia. Of IV Coil	mm	
11	Inner Dia. / Outer Dia. Of LV Coil	mm	
12	Axial Height of HV winding (Copper to Copper)	mm	
13	Axial Height of HV Tapping winding (Copper to Copper+ Insulation+Copper to Copper)	mm	
14	Axial Height of IV winding (Copper to Copper)	mm	
15	Axial Height of LV winding (Copper to Copper)	mm	
16	Radial Height of HV winding (Copper to Copper)	mm	
17	Radial Height of HV Tapping winding (Copper to Copper+ Insulation+Copper to Copper)	mm	
18	Radial Height of IV winding (Copper to Copper)	mm	
19	Radial Height of LV winding (Copper to Copper)	mm	
	Conductor Size		
20	HV Coil PICC (Paper Insulated Copper Conductor)		
	Bare	mm	
	Covered	mm	
	No. of Conductors in parallel	No.	
	No. of turns	No.	
21	HV Tapping Coil PICC (Paper Insulated Copper Conductor)		
	Bare	mm	
	Covered	mm	
	No. of Conductors in parallel	No.	
	No. of turns	No.	
22	IV Coil PICC (Paper Insulated Copper Conductor)		
	Bare	mm	
	Covered	mm	
	No. of Conductors in parallel	No.	
	No. of turns	No.	

ANNEXURE-A			
Sl.NO	**Description**	**Quantity**	**Measured**
23	LV Coil PICC (Paper Insulated Copper Conductor)		
	Bare	mm	
	Covered	mm	
	No. of Conductors in parallel	No.	
	No. of turns	No.	
	Winding Details		
24	Type of Winding		
	HV Coil		
	HV Tapping Coil		
	IV Coil		
	LV Coil		
25	Point of Tapping(Line end/Netural End/Centre of winding)		
26	No. of Discs in HV Coil		
27	No. of Discs in HV Tapping Coil		
28	No. of Discs in IV Coil		
29	No. of Discs in LV Coil		
	Winding Resistance Per phase @ °C		
30	HV Coil	Ω (Ohms)	
31	HV Tapping Coil	Ω (Ohms)	
	Total tap winding		
	Tap1	Ω (Ohms)	
	Tap2	Ω (Ohms)	
	Tap3	Ω (Ohms)	
	Tap4	Ω (Ohms)	
	Tap5	Ω (Ohms)	
	Tap6	Ω (Ohms)	
	Tap7	Ω (Ohms)	
	Tap8	Ω (Ohms)	
	Tap9	Ω (Ohms)	
	Tap10	Ω (Ohms)	
	Tap11	Ω (Ohms)	
	Tap12	Ω (Ohms)	
	Tap13	Ω (Ohms)	
	Tap14	Ω (Ohms)	
	Tap15	Ω (Ohms)	
	Tap16	Ω (Ohms)	
	Tap17	Ω (Ohms)	
32	IV Coil	Ω (Ohms)	
33	LV Coil	Ω (Ohms)	
34	Weight of all the three phases	kg	
35	Weight of insulation of all three phases(insulding Solid Permalli wood)	kg	
36	Weight of Connecting copper lead & Busbar of all three phases	kg	

ANNEXURE-A			
Sl.NO	**Description**	**Quantity**	**Measured**
	CRGO Core Lamination(Damaged if any)		
	No fo steps damaged		
37	Dimension for each step		
37.1	Height	Cms	
	Width	Cms	
	Thickness	mm	
	Weight	kg	
37.2	Height	Cms	
	Width	Cms	
	Thickness	mm	
	Weight	kg	
37.3	Height	Cms	
	Width	Cms	
	Thickness	mm	
	Weight	kg	
37.4	Height	Cms	
	Width	Cms	
	Thickness	mm	
	Weight	kg	
	Total weight of damaged laminations	kg	

NOTE: During joint inspection , it may be noted that the tap leads from the tap windings shall not be cut until the scope of work is finalised.The windings not suspected faulty shall be dismantled with due care so that they can be reused if decided later .

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ANNEXURE- B

Sl. No	Name of the Accessory		Qty	Condition (Good/Bad)	Remarks
1	Bushings	400kV			
		220kv			
		110kv			
		66kv			
		33kv			
		11kv*			
2	Buchholz relay				
3	OSR				
4	MOG				
5	Breather				
6	WTI				
7	OTI				
8	PRV				
9	RTCC Panel				
10	FCC				
11	MB				
12	WTI CT				
13	Any Other Accessories such as Valves etc.,				
*	if other than condensor type bushings,condtion of metal parts shall be remarked.				

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ANNEXURE-C

Sl.NO	Description	Quantity	Measured	Remarks
	OLTC			
1	Make			
2	Type			
3	Inspection of the Mechanical parts			
4	Inspection of insulation distances of diverter switch and the oil compartments.			
5	Condition of contacts			
	i. Selector Switch			
	ii. Diverter Switch			
6	Determination of the contact wear			
7	Measurement of the transistion resistors			
8	**Inspection of the motor drive shaft and protection relay**			
9	Function test			
10	Measurement of contact reisitance of each tap.			
	Tap1			
	Tap2			
	Tap3			
	Tap4			
	Tap5			
	Tap6			
	Tap7			
	Tap8			
	Tap9			
	Tap10			
	Tap11			
	Tap12			
	Tap13			
	Tap14			
	Tap15			
	Tap16			
	Tap17			
11	Visual inspection of DOVA			