

**PROFORMA FOR STAGE INSPECTION OF DISTRIBUTION TRANSFORMERS**

**(A) GENERAL INFORMATION:**

1. Name of firm : M/s.
2. Order No. and Date :
3. Rating-wise quantity offered :
4. Details of offer
  - a) Rating
  - b) Quantity
  - c) Serial Numbers
5. Details of last stage inspected lot:
  - a) Total quantity inspected
  - b) Serial Numbers
  - c) Date of stage inspection
  - d) Quantity offered for final inspection of  
(a) above with date

**(B) Availability of material for offered quantity :**

Details to be filled in

**(C) Position of manufacturing stage of the offered quantity :**

- a) Complete tanked assembly
- b) Core and coil assembly ready
- c) Core assembled
- d) Coils ready for assembly
  - (i) HV Coils
  - (ii) LV Coils

**Note:** (i) A quantity of less than 100 Nos. shall not be entertained for stage inspection.

If awarded quantity is less than 100 nos. than whole lot shall be offered in single lot.

- (ii) The stage inspection shall be carried out in case :-
  - (a) At least 25% quantity offered has been tanked and
  - (b) core coil assembly of further at least 30% of the quantity offered has been completed.
- (iii) Quantity offered for stage inspection should be offered for final Inspection within 15 days from the date of issuance of clearance for stage inspection, otherwise stage inspection already cleared shall be liable for cancellation.

Sl. No	Particulars	As offered	As observed	Deviation and Remarks									
(D)	<b><u>Inspection of Core:</u></b>												
	<b>(I) Core Material</b>												
	(1) Manufacturer's Characteristic Certificate in respect of grade of lamination used. (Please furnish test certificate)												
	(2) Remarks regarding Rusting and smoothness of core.												
	(3) Whether laminations used for top and bottom yoke are in one piece.												
	<b>(II) Core Construction :</b>												
	(1) No. of Steps												
	(2) Dimension of Steps												
	Step No.	1	2	3	4	5	6	7	8	9	10	11	12
	<b>As offered:</b>												
	W mm												
	T mm												
	<b>As found:</b>												
	W mm												
	T mm												
	(3) Core Dia (mm)												
	(4) Total cross Section area of core												
	(5) Effective cross Sectional area of core												
	(6) Clamping arrangement												
	(i) Channel Size												
	(ii) Bolt size and No.												
	(iii) Tie Rods size and No.												
	(iv) <b>Painting</b>												
	(a) Channels												
	(b) Tie Rods												
	(c) Bolts												

	(7) Whether top yoke is cut for LV connection.		
	(8) If yes, at 7 above, whether Reinforcement is done.		
	(9) Size of Support Channels provided for Core base and bottom yoke (Single piece of channels are only acceptable) this will not be applicable for Amorphous core. For Amorphous core, core clap with locking arrangement with tank base cover will be provided.		
	(10) Thickness of insulation provided between core base and support channel.		
	(11) core length (leg center to leg center)		
	(12) Window height		
	(13) Core height		
	(14) Core weight only (without channels etc.)		
<b>(E)</b>	<b>INSPECTION OF WINDING</b>		
	<b>(I) Winding material</b>		
	(1) Material used for		
	(a) HV winding		
	(b) LV winding		
	(2) Grade of material for		
	(a) HV winding		
	(b) LV winding		
	3) Test certificate of manufacturer (enclose copy) for winding material of:		
	(a) HV		
	(b) LV		
	<b>(II) CONSTRUCTIONAL DETAILS</b>		
	(1) Size of Cross Sectional area of conductor for :		
	(a) HV winding		

	(b) LV winding			
	(2) Type of insulation for conductor of :			
	a) HV winding			
	(b) LV winding			
	(3) Diameter of wire used for delta formation (mm)			
	(4) Diameter of coils in:			
	a) LV winding			
	i) Internal dia (mm)			
	ii) Outer dia (mm)			
	b) HV winding			
	i) Internal dia (mm)			
	ii) Outer dia (mm)			
	(5) Current Density of winding material used for :			
	(a) HV			
	(b) LV			
	(6) Whether neutral formation on top.			
	(7) HV Coils/ Phase			
	a) Number			
	b) Turns / coil			
	c) Total turns			
	(8) LV Coils/ Phase			
	a) Number			
	b) Turns / coil			
	c) Total turns			
	(9) Method of HV Coil Joints			
	(10) Total weight of coils of			

	a)	LV winding (kg)			
	b)	HV winding (kg)			
<b>(F)</b>	<b>INSULATION MATERIALS :</b>				
	<b>(I)</b>	<b>MATERIAL :</b>			
	1)	Craft paper			
	a)	Make			
	b)	Thickness (mm)			
	c)	Test Certificate of manufacturer (enclose copy).			
	2)	Press Board			
	a)	Make			
	b)	Thickness (mm)			
	c)	Test Certificate of manufacturer (enclose copy).			
	3)	Material used for top and bottom yoke and insulation			
	<b>(II)</b>	<b>Type and thickness of material used : (mm)</b>			
	a)	Between core and LV			
	b)	Spacers			
	c)	Inter layer			
	d)	Between HV and LV winding			
	e)	Between phases			
	f)	End insulation			
<b>(G)</b>	<b>CLEARANCES : (mm)</b>				
	<b>(I)</b>	<b>Related to core and windings</b>			
	1)	LV to Core (Radial)			
	2)	Between HV and LV  (Radial)			
	3)	(i) Phase to phase between HV Conductor			

	(ii) Whether two Nos. Press Board each of minimum 1 mm thick provided to cover the tie rods.			
	4) Thickness of locking spacers between LV coils (mm)			
	5) Axial wedges between HV and LV coils / phase (Nos.)			
	6) No. of radial spacers per phase between HV coils			
	7) Size of duct between LV and HV winding (mm)			
	(II) <b>Between core - coil assembly and tank : (mm)</b>			
	1) Between winding and body:			
	a) Tank lengthwise			
	b) Tank Breadth wise			
	2) Clearance between top cover and top yoke upto 100 kVA and between top cover and top most live part of tap changing switch for 200 kVA and above.			
(H)	<b>TANK :</b> (I) <b>Constructional details :</b> 1) Rectangular shape 2) Thickness of side wall (mm) 3) Thickness of top and bottom plate (mm) 4) Provision of slopping top cover towards HV bushing.			

Sl. No	Particulars	As offered	As observed	Deviation	Remarks
	5) Tank internal dimensions (mm)				
	a) Length				
	b) Breadth				
	c) Height				
	(i) On LV side				
	(ii) On LV side				
	(II) General details :				
	1) Inside painted by varnish/ oil corrosion resistant paint (please specify which type of coating done).				
	2) Gasket between top cover and tank				
	i) Material				
	ii) Thickness (mm)				
	iii) Jointing over laps (mm)				
	3). Reinforcement of welded angle (specify size and No. of angle provided ) on side walls of tank.				
	4) Provision of lifting lugs:				
	a) Numbers				
	b) Whether lugs of 8 mm thick MS Plate provided				
	c) Whether reinforced by welded plates edge wise below the lug upto re- enforcing angle of the tank done.				
	5) Pulling lug of MS Plate				
	a) Nos.				
	b) Thickness (mm)				
	c) Whether provided on breadth side or length side				
	6) Provision of air release plug				
	7) Provision of galvanized GI Nuts Bolts with 1 No. Plain and 1 No. spring washer.				
	8) Deformation of length wise side wall of tank when subject to:				
	a) Vacuum of (-) 0.7 kg/sq cm for 30 minutes.				

Sl. No	Particulars	As offered	As observed	Deviation and Remarks
	b) Pressure of 0.8 kg/sqcm for 30 minutes.			
<b>(I)</b>	<b>RAIDATORS :</b>			
	1. Fin Radiators of 1.25 mm thick sheet			
	a) Dimension of each fin (LxBxT)			
	b) Fins per radiator			
	c) Total No. of radiators			
	2. Verification of manufacturer's test certificate regarding Heat dissipation (excluding Top and Bottom) in w/sq m			
	3. Verification of position of radiator with respect to bushing.			
<b>(J)</b>	<b>CONSERVATOR :</b>			
	1. Dimensions ( L x D ) (in mm)			
	2. Volume (m <sup>3</sup> )			
	3. Inside dia of Conservator tank pipe (mm)			
	4. Whether conservator outlet pipe is projected approx. 20 mm inside the conservator tank.			
	5. Whether arrangement made so that oil does not fall on the active parts.			
	6. Whether die cast metal oil level gauge indicator having three positions at ( - 5° C, 30 ° C and 98 °C) is provided .			
	7. Whether drain plug and filling hole with cover is provided.			
	8. Inner side of the conservator Tank painted with-			
<b>(K)</b>	<b>BREATHER :</b>			
	1. Whether Die cast Aluminium body breather for silica gel provided.			
	2. Make			
	3. Capacity			



Sl. No (L)	Particulars <b>TERMINA : LS</b>	As offered	As observed	Deviation and Remarks
	1. Material whether of Brass Rods/ Tinned Copper.			
	a) HV			
	b) LV			
	2. Size (dia in mm)			
	a) HV			
	b) LV			
	3. Method of Star connection formed on LV side of 6mm thick(Should use Al./Cu. Flat bolted/ brazed with crimped lugs on winding alternatively for 63 and 100 kVA ratings brazing is done covered with tubular sleeve duly crimped). - Please state dimensions of Al/ Cu flat or tubular sleeve used.(mm)			
	4. Method of Connection of LV winding to LV Bushing (end of winding should be crimped with lugs (Al/Cu) and bolted with bushing stud).			
	5. Method of Connection of HV winding to HV bushing (Copper joint should be done by using silver brazing alloy and for Aluminium, brazing rod or with tubular connector crimped at three spots).			
	6. Whether SRB Ptube/insulated paper used for formation of Delta on HV.			
	7. Whether Empire sleeves used on the portion of HV winding joining to HV bushing.			
	8. Whether neutral formation is covered with cotton tape			
(M)	<b>BUSHINGS :</b>			
	1. Whether HV bushings mounted on side walls. Whether sheet metal 2. pocket used for mounting bushing			

	(pipe are not acceptable)			
	a) H V			
	b) L V			
	Whether arrangement for studs for fitting of HV Bushing are in diamond shape (so that Arcing Horns are placed vertically).			
3.				
4.	Position of mounting of LV bushings.			
5.	Bushing Clearance: (mm)			
	a) LV to Earth			
	b) HV to Earth			
	c) Between LV Bushings			
	d) Between HV Bushings			
(N)	<b>E CHANNEL /</b>			
	<b>ROLLERS :</b>			
	1. Size of channel (mm)			
	2. Whether channels welded across the length of the tank			
	3. Size and type of roller (mm)			
(O)	<b>OIL :</b>			
	1. Name of supplier			
	2. Break down voltage of oil: (kV)			
	i) Filled in tanked transformer			
	ii) In storage tank (to be tested by Inspecting Officer).			
	3. Supplier's test certificate(enclose copy)			
(P)	<b>ENGRAVING :</b>			
	1. Engraving of Sl. No. and name of firm.			
	i) On bottom of clamping channel of core-coil assembly.			
	ii) On side wall and top cover of tank along with date of despatch.			
(Q)	i) MS plate of size 125x125 mm welded on width side of stiffner			
	ii) Following details engraved (as per approved GTP):			
	(a) Serial Number			
	(b) Name of firm			
	(c) Order No. and Date			
	(d) Rating			
	(e) Name of Inspecting Officer			
	(f) Designation			
	(g) Date of dispatch			
(R)	<b>NAME PLATE DETAILS :</b>			
	Whether Name Plate is as per approved drawing			
(S)	<b>Colour of Transformer</b>			
	1. Tank body colourshell beas per annexure -paint which is attach here with			
	2. Conservator colour shell be as per annexure - paint which is attach here with			
(T)	<b>CHECKING OF TESTING FACILITIES:</b>			
	<b>TESTS :</b>			

	1. No Load Current			
	2. No Load Loss			
	3. % Impedance			
	4. Load Losses			
	5. Insulation Resistance Test			
	6. Vector Group Test (phase relationship)			
	7. Ratio and Polarity test relationship			
	8. Transformer Oil Test (Break Down Voltage)			
	9. Magnetic Balance			
	10. Measurement of winding resistance (HV and LV both)			
	11. Induced over voltage withstand test (Double voltage and Double frequency)			
	12. Separate source power frequency withstand test at 28 kV for HV and 3 kV for LV (one minute).			
	13. Air pressure/ Oil leakage Test			
	14. Vacuum test			
	15. Unbalanced current test			
	16. Temperature rise (Heat Run) test.			
(U)	We have specifically checked the following and found the same as per G.T.P./deviations observed as mentioned against each:			
	i) Rustlessness of CRGO laminations used			
	ii) Core steps			
	iii) Core area			
	iv) Core weight			
	v) Winding cross sectional area			
	a) LV			
	b) HV			
	vi) Weight of windings			
	vii) Clearance between winding and wall of tank (mm)			
	a) Length-wise			
	b) Breadth-wise			
	viii) Clearance between top of yoke/ top most live part of tap changer to tank cover.			
	ix) Details of Neutral formation			
	x) Connections to bushings:			
	a) LV			
	b) HV			
	xi) Slope of tank top			
	xii) Position of mounting of bushings			

### **Annexure-A**

#### **Check-list for Inspection of prime quality CRGO for Transformers**

During inspection of PRIME CRGO, the following points needs to be checked by the Transformer manufacturer. Utility's inspection shall verify all these points during inspection:-

#### **A) In case PRIME cutting is at works of Transformer Manufacturer:**

##### **1 Review of documents:**

- Purchase Order (unpriced) to PRIME CRGO supplier/ Authorized Agency
- Manufacturer's test certificate
- Invoice of the Supplier
- Packing list
- Bill of Lading
- Bill of Entry Certificate by Customs Deptt.
- Reconciliation Statement as per format below
- Certificate of Origin
- BIS Certificate

#### **Format for Reconciliation/Traceability records**

Packing List No. / Date /Quantity of PRIME CRGO received

Name of Manufacturer

Manufacturer test certificate No. / date

Serial No.	Details of Package/Job	Drawing Reference	Quantity involved	Cumulative Quantity Consumed	Balance in Stock

#### **2.1 Inspection of PRIME CRGO Coils:**

- a) PRIME CRGO-Manufacturer's identification Slip on PRIME CRGO Coils
- b) Visual Inspection of PRIME CRGO Coils offered as per packing list (for verification of coil details as per Test certificate & healthiness of packaging).
- c) Unique numbering inside of each sample of PRIME CRGO coil and verification of records to be maintained in the register for consumption of CRGO coil.
- d) ISI logo Sticker on packed mother coil and ISI logo in Material TC.

2.2 During inspection of PRIME CRGO, surveillance testing of sample shall be carried out for Stacking Factor, Permeability, Specific watt loss at 1.5 Tesla and/or 1.7 Tesla depending on

the grade of PRIME CRGO and aging test etc. applicable as per relevant IS/ IEC standard, Tech. Spec., MQP and Transformer manufacturer plant standard.

#### **Inspection Clearance Report Would Be issued after this inspection**

3 Inspection of PRIME CRGO laminations: Transformer manufacturer will maintain records for traceability of lamination to PRIME CRGO coils and burr/bow on lamination shall be measured.

#### 4. Inspection at the time of core building:

Visual Inspection of PRIME CRGO lamination. In case of suspected mix-up/ rusting/ decoloration, Samples may be taken for testing on surveillance basis mentioned in A.2.2 above.

Above tests shall be witnessed by utility. In case testing facilities are not available at Manufacturer's work, the sample(s) sealed by utility to be sent to approved labs for testing.

#### **Inspection Clearance Report would be issued after this inspection**

#### **B) In case PRIME CRGO cutting is at Sub-vendor of Transformer Manufacturer:**

- Review of documents:
  - Purchase Order (unpriced) to PRIME CRGO supplier/ Authorized Agency
  - Purchase Order (unpriced) to Core Cutter
  - Manufacturer test certificate
  - Invoice of the Supplier
  - Packing List
  - Bill of Lading
  - Bill Of Entry Certificate by Customs Deptt.
  - Reconciliation Statement as per format below
  - Certificate of Origin
  - BIS Certificate

#### **Format for Traceability records as below:-**

Packing List No./date/quantity of PRIME CRGO

receivedName of Manufacturer

Manufacturer test certificate No. / date

Serial No.	Name Of Customer	Details of Package/Job	Drawing Reference	Quantity involved	Cumulative Quantity Consumed	Balance in Stock	Dispatch Details

## 2.1 Inspection of PRIME CRGO Coils:

- PRIME CRGO-Manufacturer's identification Slip on PRIME CRGO Coils
  - Visual Inspection of PRIME CRGO Coils offered as per packing list (for verification of coil details as per Test certificate & healthiness of packaging).
  - Unique numbering inside of each sample of PRIME CRGO coil and verification of records to be maintained in the register for consumption of CRGO coil.
  - ISI logo Sticker on packed mother coil and ISI logo in Material TC.
- 2.2 During inspection of PRIME CRGO, surveillance testing of sample shall be carried out for Stacking Factor, Permeability, Specific watt loss at 1.5 Tesla, Thickness depending on the grade of PRIME CRGO and aging test etc. applicable as per relevant IS/IEC standard, Tech.Spec., MQP and Transformer manufacturer plant standard.

## Inspection Clearance Report would be issued after this inspection

### 3 Inspection of PRIME CRGO laminations:

Transformer manufacturer representative will inspect laminations and issue their internal Inspection Clearance Report. Inspection will comprise of review of traceability to prime CRGO coils, visual Inspection of PRIME CRGO laminations and record of burr/bow. After clearance given by the transformer manufacturer, utility will issue an Inspection Clearance Report after record review. If so desired by Utility, their representative may also join transformer manufacturer representative during this inspection.

## Inspection Clearance Report would be issued after this inspection

- 4 Inspection at the time of core building Visual inspection of PRIME CRGO laminations. In case of suspected mix-up/rusting/decoloration, samples may be taken for testing on surveillance basis for tests mentioned in B.2.2.

## Inspection Clearance Report would be issued after this inspection

NOTE:-

- Transformer Manufacturer to ensure that PRIME CRGO is procured from POWERGRID approved vendors and CRGO manufacturer should have valid BIS Certificate for respective offered Grade.
- Transformer Manufacturer should also involve themselves for ensuring the quality of CRGO laminations at their Core Cutter's works. They should visit the works of their Core cutter and carry out necessary checks.

## C) General

If a surveillance sample is drawn and sent to TPL ( if testing facility not available with the manufacturer), the transformer manufacturer can continue manufacturing

at their own risk and cost pending TPL test report on PRIME CRGO sample drawn. Decision for acceptance of PRIME CRGO shall be based upon report of sample drawn.

**These checks shall be read in –conjunction with approved quality plan, specification as a whole and conditions of contract.**

### **Sampling Plan (PRIME CRGO)**

33/11 kV	-1st transformer and subsequently at random 10% of Transformers (min.1) offered for inspection.
DTs and other ratings	-1st transformer and subsequently at random 10% of Transformers (min.1) offered for inspection. NOTE:- One sample for each lot of CRGO shall be drawn on surveillance basis.

CRGO has to be procured only from POWERGRID approved vendors. List of such vendors is available at the following website. Since the list is dynamic in nature, the site may be checked from time to time to see the list of approved vendors.

<http://apps.powergridindia.com/ims/ComponentList/Power-former%20upto%20420%20kV-CM%20List.pdf>

SL. NO	ITEM	VENDOR NAME
1	CRGO STEEL	M/S NIPPON STEEL & SUMITOMO METAL CORP, JAPAN
	CRGO STEEL	M/S KAWASAKI CORPORATION/JFE, JAPAN
	CRGO STEEL	M/S A.K. STEEL, USA
	CRGO STEEL	M/S POSCO KOREA
	CRGO STEEL	M/S AST ITALY
	CRGO STEEL	M/S TKES GERMANY
	CRGO STEEL	M/S UGINE DIVISION DUSINOR SACLAR, S.A., FRANCE
	CRGO STEEL	M/S ORB ELECTRICALS STEELS, UK
	CRGO STEEL	M/S PREUSSAG HANDEL, GERMANY
	CRGO STEEL	M/S ACESITA, BRAZIL
	CRGO STEEL	M/S VIZ STEEL, RUSSIA valid upto 05.02.2018
	CRGO STEEL WITH FINAL PROCESS OF COATING & ANNEALING	M/S TKES INDIA PVT. LTD. NASIK, (approval valid upto 20.08.2016) and subject to condition
	OF OF SEMIPROCESSED	
	CRGO MOTHER COIL	
	(SOURCED FROM TKES, GERMANY	