The type test and short-circuit withstand test report of the transformers which are conducted or inspected by Thailand's national laboratories/institutes shall be valid within five (5) years count from the issued date in the test reports to the bid closing date.

For the type test and short-circuit withstand test report of the transformers which are conducted or inspected by laboratories/institutes, with in other countries shall be valid within ten (10) years count from the issued date in the test reports to the bid closing date.

PEA will also accept other documents instead of the type test and short-circuit withstand test reports in the following conditions:

(1) In case the proposed transformer has been supplied to PEA and get the order from PEA's Procurement Department or Substation Work Department or Transmission and Distribution System Work Department (from PEA's head office), the Purchase Order (PO) or Contact with List of suppliers or Proposal form can be submitted, or

(2) In case the proposed transformer has been registered for PEA Product Acceptance, the not-expired registration certificate counted to the bid closing date can be submitted, or

(3) In case the proposed transformer has been registered for Product lists for substation turnkey project, the not-expired registration certificate counted to the bid closing date can be submitted instead

However the document in case (1), (2) and (3) shall be proved that the transformer specified in the PO or Contract with List of suppliers or Proposal form or registration certificate shall be the same product, type/model and all ratings as the proposed transformer for this bid.

The cost of all tests and reports shall be borne by the bidders/manufacturers/contractor.

1e.3 Acknowledged independent testing laboratories

The type test and short-circuit withstand test shall be conducted or inspected by the acknowledged testing laboratories/institutes as follows:

(1) Laboratories/institutes which are members of the Short-circuit Testing Liaison (STL) or independent laboratories/institutes which are accredited according to TIS 17025 or ISO/IEC 17025 with the scope of accreditation covered the relevant test items, standards and equipment. The certification and scope of accreditation of the independent laboratories/institutes shall be submitted with the bid for consideration.

The bidders or manufacturers who are accredited according to TIS 17025 or ISO/IEC 17025 preferring to carry out the type tests and short-circuit withstand test of the transformers with the laboratories or by the manufacturers themselves, the tests shall be inspected by Thailand's

national laboratories, institutes, universities and electric utilities in (2) and other laboratories, institutes, universities or electric utilities approved by PEA.

(2) Thailand's national laboratories, institutes, universities and electric utilities, as follow:

- Electricity Generating Authority of Thailand (EGAT)

(3) Other laboratories, institutes, universities or electric utilities approved by PEA. In this case, the detail of the test facilities of the laboratories shall be submitted to PEA for approval before proceeding the tests and before the bid closing date. PEA reserves the right to send representatives to inspect and witness the tests with the cost of the bidders or manufacturers.

1e.4 The information in the Test report

The minimum information of the transformer in the type test and short-circuit withstand test report shall be the following items:

1. Transformer information

(1) Manufacturer's name
(2) Model
(3) Manufacturer's serial number
(4) Number of phase
(5) Rated voltage of the high-voltage winding
(6) Rated voltage of the low-voltage winding
(7) Rated voltage ratio
(8) Rated frequency
(9) Rated power
(10) Rated current of the high-voltage winding
(11) Rated current of the low-voltage winding
(12) Short-circuit impedance at 75°C
(13) Connection symbol
(14) Cooling method
(15) Total mass
(16) Mass of core and winding
(17) Oil quantity
(18) Highest voltage for equipment applicable the high-voltage winding
(19) Highest voltage for equipment applicable the low-voltage winding
(20) Rated insulation level
(21) Type of construction
(22) High-voltage winding type and material

(23) Low-voltage winding type and material

(24) Cross-section of the conductor in the high-voltage winding

(25) Cross-section of the conductor in the low-voltage winding

(26) Number of strands per turn of high voltage winding

(27) Number of strands per turn of low voltage winding

(28) Number of strands radially across the layer (for all turns) of high voltage winding

(29) Number of strands radially across the layer (for all turns) of low voltage winding

(30) Total number of turns per phase

(31) Number of turns each tap

2. Drawing

(1) Overall dimensions of transformer

(2) Tank dimension

(3) Drawing of cross section area of core

(4) Drawing of active part

(5) Drawing which show the core and coil information according to **Figure 7**

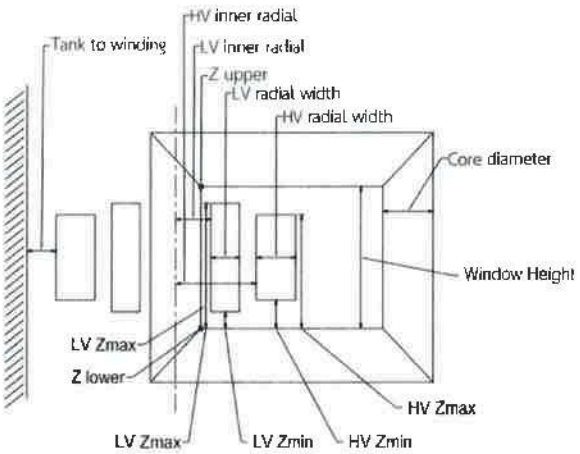

Figure 7: Core and coil constructions.

3. Photograph of transformers

The color photograph which reveal transformer construction for out-of-tank inspection before and after short-circuit withstand test shall be in the short-circuit withstand test report.

In case the information in the reports are not completed according to the above requirement, the bidders will be rejected.

1e.5 Acceptance test items and acceptance test procedures

1e.5.1 Acceptance test items

The sample of transformers shall pass the following tests in accordance with the IEC 60076 and IEC 60156 standards:

(1) Measurement of winding resistance (IEC 60076-1)

(2) Measurement of voltage ratio and check of phase displacement (IEC 60076-1)

(3) Measurement of short-circuit impedance and load loss (IEC 60076-1)

(4) Measurement of no-load loss and current (IEC 60076-1)

(5) Applied voltage test (IEC 60076-1 and IEC60076-3)

(6) Induced voltage withstand test (IEC 60076-1 and IEC60076-3)

(7) Oil Dielectric Breakdown voltage test (IEC 60156)

(8) Temperature-rise test (IEC 60076-2) [1]

(9) Full wave lightning impulse test (IEC 60076-3) [1]

(10) Short-circuit withstand test (IEC 60076-5)[2] (only for transformer rating of 50-250 kVA)

(11) Dry film thickness test, the dry film thickness test procedure shall be according to **1c.12.1 Painting system**

Note

[1] The Items (8) and (9) shall be tested on one (1) unit for each contract at the PEA laboratory or Acknowledged independent laboratories approved by PEA as specified in **1e.3 Acknowledged independent testing laboratories** or manufacturer laboratories depending on PEA's acceptance committee

[2] The Items (10) shall be tested on one (1) unit for each contract at Acknowledged Independent laboratories depend on PEA's acceptance committee approved by PEA as specified in **1e.3 Acknowledged independent testing laboratories.**

Any transformers which are out-of-tank for inspection in short-circuit withstand test, the insulating oil shall be dehydration at manufacture's factory and oil dielectric breakdown voltage shall be retested. The report of oil dielectric breakdown voltage test shall be submitted to PEA before shipment/delivery, for each ordered transformer.

1e.5.2 Acceptance test procedures

PEA's acceptance committee will select the sample of each lot, the number of transformer per lot according to **Table 10**. All sampling units shall be transported to PEA laboratory or Acknowledged independent laboratories for testing according to **1e.5.1 Acceptance test items**. The transportation shall be carried out by the contractor.

Table 10 The number of sample and criteria for consideration

Number of transformer per lot (Unit)	Sample size of transformers for acceptance test (Unit)	Maximum number of sample failing in the acceptance test (Unit)
2 to 15	2	0
16 to 25	3	0
26 to 90	5	0
91 to 150	8	0
151 to 500	13	1
More than 500	20	1

The number of failing units shall not more than the maximum number of failing sample in the acceptance test according to **Table 10.** Otherwise, the transformers in that lot shall be rejected.

In case the failing units are not more than the maximum number of failing sample in the acceptance test according to **Table 10**, the contractor has to take responsibility as following procedure.

(1) The contractor has to recheck all delivered transformers in that lot and repair or fix the defective transformers in that lot.

(2) The contractor shall analyze the problem and send the report to PEA's acceptance committee before the lot accepted.

(3) The transformers which are repaired or fixed in that lot shall be retested only in the relevant test items according to **1e.5.1 Acceptance test items**.

After the test, the transformers shall be rebuilt completely by the contractor with free of charge and send back to PEA with the same amount of the samples.

1f Inspection

To ensure about the quality of transformers, the inspection shall be carried out by the PEA's representative (PEA's witness committee) at following two stages:

- At anytime during receipt of raw material and manufacture/ assembly whenever the PEA desires.
- At finished stage i.e. transformers are fully assembled and are ready for dispatch.

C2 Material and packing data to be given by bidders

The bidders have to submit the following data and details of transformers and accessories with the bid:

2a Performance data and guarantee of three-phase transformers. (See pages 26 to 30 of 32)

2b Drawing of inside tank and overall transformer with dimensions in mm showing of particulars of normal construction details.

2c Drawings, with dimensions in mm, of the following accessories:

1. HV and LV bushings
2. Terminal connectors, on HV and LV bushings, with description of materials used for the component parts
3. Nameplate with connection diagram
4. Valve, showing the internal construction
5. Earthing terminal connector
6. Dehydrating breather, and details of coupling (if any)
7. Bracket for surge arrester
8. Earthing terminal for surge arrester
9. Lifting lug
10. Lifting eye
11. Pressure relief valve
12. Thermometer pocket
13. Oil level gauge
14. Oil filling plug
15. Supporting lugs
16. Compression type of cable lug
17. Sludge drain plug
18. Accessories according to manufacturer's design, if any

2d Catalogues and/or drawings with details of the following accessories:

1. Dial type thermometer
2. Double float Buchholz relay
3. Pressure-relief valve
4. Bird guard
5. Core
6. HV and LV Winding
7. Off load tap changer

8. Insulation paper
9. Gaskets
10. Oil drain vale
11. Accessories according to manufacturer's design, if any

2e **Dry film thickness test report**

2f **Type test and Short-circuit withstand test report**

2g **List of routine test**

2h **Drawing of core and coil construction**

2i **Specifications of transformer oil and test report**

2j **HV and LV Bushing test report**

2k **Others necessary information in order to show that the special test report can prove the performance of the proposed transformers.**

2l **Bidders shall propose and quote for recommended spare part list with separate price for each offered item (e.g., bushings)**

2m **Packing details**

Packing method (shown by drawing(s), and describe packing materials)
Number of transformers in one (1) crate or wooden case (one)
Overall dimensions (L x W x H) of each crate or wooden case in cm
Volume of each crate or wooden case in m^3
Gross weight of each crate or wooden case in kg
Number of crates or wooden cases

2n **Critical documents of the transformers (See page 25 of 32)**

The lists of documents shall be fulfilled and submitted with the bid.

The Critical documents of the transformers

No.	Required documents	Proposed technical document	Reference document (Page/Item)
1	HV and LV Bushing test report	☐ Yes ☐ No	
2	Dry film thickness test report	☐ Yes ☐ No	
3	List of routine test report	☐ Yes ☐ No	
4	<u>For 50-250 kVA and the reference transformer</u> Type test and Short-circuit withstand test report <u>For transformer more than 250 kVA and is not the reference transformer</u> Type test report and calculation report and accessories information, or	☐ Yes ☐ No	
	The copy of previous Purchase Order (PO) or Contract with List of suppliers or Proposal form, or	☐ Yes ☐ No	
	PEA Product Acceptance registration certificate, or	☐ Yes ☐ No	
	Product lists registration certificate	☐ Yes ☐ No	
5	The TIS 17025 or ISO/IEC 17025 certification and scope of accreditation of the independent laboratories/institutes (in case the independent laboratories/institutes are accredited according to TIS 17025 or ISO/IEC 17025)	☐ Yes ☐ No	
6	Performance data and guarantee of the three-phase transformers. (pages 26 to 30 of 32)	☐ Yes ☐ No	
7	Drawing of inside tank and overall transformer with dimensions in mm showing of particulars of normal construction details.	☐ Yes ☐ No	
8	Drawings, with dimensions in mm according to 2c	☐ Yes ☐ No	
9	Catalogues and/or drawings with details according to 2d	☐ Yes ☐ No	
10	Drawing of core and coil construction according to 2h	☐ Yes ☐ No	
11	Specifications of transformer oil and test report according to 2i	☐ Yes ☐ No	
12	Packing detail(s) according to 2m	☐ Yes ☐ No	

I **The items offered without submitting the critical documents shall be rejected**

Invitation to Bid No.:

2a Performance data and guarantee of three-phase transformers

Item .....

Manufacturer's name and country of origin		
Type or model		
Applied standard		
Rated power	kVA	
Rated frequency	Hz	
Rated primary voltage Rated secondary voltage	V V	
Connection symbol	Dyn11	
Type of oil preservation system	-	
Operation duty: continuous operation (Type DB)	Yes/No	
Max. temperature rise of winding (at full load) Max. temperature rise of top oil (at full load)	K K	
Primary tapping: off-circuit condition Number of steps of primary tapping Per cent of rated voltage of each tapping	Yes/No Steps %	
No-load current & Tolerance	% & %	&
Short-circuit impedance at 75°C & Tolerance	% & %	&
Losses, for each transformer unit No-load loss plus positive tolerance Load loss, plus positive tolerance, at 75°C	 W W	
Efficiency in %, at 75°C and at load: - 1/2 of rated power and P.F. = 1.0 - 1 of rated power and P.F. = 1.0	 % %	
Voltage regulation at P.F. = 1.0	%	

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

PROVINCIAL ELECTRICITY AUTHORITY

TECHNICAL SPECIFICATION DIVISION

THREE-PHASE TRANSFORMERS FOR 22 kV AND 33 kV 50 Hz DISTRIBUTION SYSTEMS WITH ABILITY TO WITHSTAND SHORT CIRCUIT

Item .....

Bushings		HV	LV
- Manufacturer's name	-		
- Country of origin	-		
- Applied standard	-		
- Rated current	A		
- Full-wave impulse withstand voltage, or BIL	kV, peak		
- Low-frequency dry 1-minute test voltage	kV, r.m.s.		
- Low-frequency wet 10-second test voltage	kV, r.m.s.		
- Protection class	-		
- Colour of glazing	-		
- Stud thread size, Metric	-		
Secondary neutral point is loaded with rated current	Yes/No		
Terminal connectors on HV and LV bushings			
- Manufacturer's name	-		
- For copper conductor diameter range (HV side)	mm		
- For aluminium conductor diameter range (HV side)	mm		
- For copper conductor diameter range (LV side)	mm		
- For aluminium conductor diameter range (LV side)	mm		
- Number of circuits, take-off (LV side)	Circuits		
- Terminal pads are according to PEA's Drawing No. SA4-015/47002	Yes/No		
Winding		HV	LV
- Manufacturer's name (the bidders have to quote not more than three (3) manufacturers)	-		
- Country of origin	-		
- Material: copper	Yes/No		
- Type of enamel or insulating material of wire	-		
- Size of wire			
- for HV side (diameter)	mm		
- for LV side (dimension)	mm x mm		
- Resistance per phase at 75°C	Ohm		

I