

SUPPLEMENTAL NOTICE NO. 1

INVITATION TO BID NO. TS12-MJ1-10

SUPPLY OF 500 kV CURRENT TRANSFORMER
AND COUPLING CAPACITOR VOLTAGE TRANSFORMER
TRANSMISSION SYSTEM EXPANSION PROJECT NO. 12

The attached Supplemental Notice No. 1 shall be considered as part of Bidding Documents No. TS12-MJ1-10

As acknowledgement of receipt that all additions, deletions and revisions contained in this Supplemental Notice are incorporated into the above Bidding Documents, Bidder is requested to sign and return this acknowledgement via facsimile No. 0 2436 0294 or email address : procurement.tse@egat.co.th within three (3) days from the date of the announcement of this Supplemental Notice on <http://www4.egat.co.th/fprocurement/biddingeng/>.

The original acknowledgement which is manually signed in ink by a person or persons duly authorized shall be included in the proposal to be submitted on the bid opening date.

ELECTRICITY GENERATING AUTHORITY OF THAILAND

June 15, 2018
(Date of Authorization)

ACKNOWLEDGEMENT

This undersigned Bidder hereby certifies that the additions, deletions and revisions set forth in this Supplemental Notice No. 1 to Invitation to Bid No. TS12-MJ1-10 are incorporated as part of the above Bidding Documents and will be fully included in any bid which he may submit.

Signed _____
Title _____
Company _____
Date _____

ELECTRICITY GENERATING AUTHORITY OF THAILAND
 Nonthaburi
 Thailand
 Telex : 72348 EGAT TH
 Fax : (662) 4336317

SUPPLEMENTAL NOTICE NO. 1
 INVITATION TO BID NO. TS12-MJ1-10
 SUPPLY OF 500 kV CURRENT TRANSFORMER
 AND COUPLING CAPACITOR VOLTAGE TRANSFORMER
 TRANSMISSION SYSTEM EXPANSION PROJECT NO.12

The following supplemental information is hereby given for the above described Invitation :

Section I : Specifications

1. Delete Specification No. 301 : Instrument Transformer (Jul.96)
2. Add the attached Specification Nos. 305 : 500 kV Coupling Capacitor Voltage Transformer (08/95) and 306 : 500 kV Current Transformers (01/96) to the end of this section.

Bid submitted must be in accordance with this Notice. Receipt of this Notice shall be acknowledged by the Bidder on the proposal included in the Bidding Documents in the space provided on page C3, Article C-7 Supplemental Notices.

ELECTRICITY GENERATING
 AUTHORITY OF THAILAND

..... June 15, 2018

SPECIFICATION NO. 305

500 kV COUPLING CAPACITOR VOLTAGE TRANSFORMER

- 305-1 **General.** This specification covers the general technical requirement for design, manufacture, test and supply of 500 kV coupling capacitor voltage transformers.

The specific ratings, characteristics and the special requirements and features of the equipment not cover herein are giving in the accompanying Ratings and Features sheet.

- 305-2 **Materials and Workmanship.** All materials shall be new and shall be the best available for the purposes used, considering strength, ductility, durability and suitability for the intended services and best engineering practice. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

- 305-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 meters or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity without corrosion, deterioration or degradation of performance characteristics.

- 305-4 **Codes and Standards.** All equipment, materials and fabrication and testing under this specification shall conform to the latest standard, specifications and codes contained below and all applicable codes, standards and specifications referenced therein.

ANSI	American National Standards Institute Incorporated
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electric Manufactures Association

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All threaded parts requiring external connection shall have UNC screw and pipe threads. All internal parts may have threads in accordance with the established specification in the country of manufacturer.

It is the intent that all equipment, materials and fabrication shall conform to applicable ANSI, ASME, ASTM, AWS, IEEE, NEMA and NEC codes, standards and specifications even though the same may not be specifically noted herein. The Bidder or Contractor may obtain from EGAT the sources for obtaining copies of codes, specification and standards.

Equivalent codes, specifications and standards established and approved in the country of equipment or material manufacture may be used subject to EGAT approval. If this selection is made, the Bidder shall so state and include in his bid the governing codes, specifications and standards proposed.

The latest issue of all codes, specifications and standard shall govern.

The most stringent requirement, in the event of code, specification or standard conflict, shall govern. This specification shall govern in the event of discrepancies between it and applicable codes, specifications and standards.

305-5 Design and Construction.

- 5.1 Type and Ratings. The coupling capacitor voltage transformers shall be supplied with the rating as specified on the Ratings and Features sheet.
- 5.2 Ferroresonance. A meaningful ferroresonance circuit shall be provided for effective suppression of ferroresonance conditions. Ferroresonance suppression device used of electronic circuit is not accepted.
- 5.3 Corona Rings. Corona rings shall be supplied with all 500 kV coupling capacitor voltage transformers if required to meet specified RIV levels.

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- 5.4 Terminals. Each coupling capacitor voltage transformer shall be equipped with suitable terminal pads. The terminal pads shall be provided with four 14.3 mm (9/16 inch) diameter holes with 45 mm (1-3/4 inch) spacing between the centers of each hole in accordance with the standard NEMA 4 holes arrangements.

The terminal pads shall be of high conductivity bronze or copper and shall be plated with hot flowed electro-tin to a thickness of not less than 0.0127 mm (0.0005 inch).

- 5.5 Porcelain and Housings. Porcelain housings shall have adequate mechanical and electrical strength. The color of porcelain shall be of chocolate brown. Porcelain housings shall be wet process, homogeneous and free from cavities or other flaws. The glazing shall be uniform in color and free from blisters, burns and other defects.

The porcelain housing shall be capable of rated low frequency wet withstand voltage under hot line washing conditions.

- 5.6 Ground Terminal Connectors. Ground terminal connectors shall be of the clamp type suitable for No.4/0 AWG copper stranded conductor. Terminal connector shall be made of high conductivity material and shall be completed with corrosion resistance bolts, nuts and lock washers.

- 5.7 Cable and Conduit Entrance. A knock-out type hole for 2 (two) of inches (62 mm diameter hole) shall be provided at the bottom of secondary terminal box. A cable hole with cable gland suitable for 18 mm outside diameter cable shall be provided for bringing in the RF cable when carrier accessories are specified.

- 5.8 Secondary Terminals Blocks. Terminal blocks shall be provided in the coupling capacitor voltage transformer secondary terminal box for terminating the secondary winding terminals and external cables.

The terminal blocks shall be rated for 600 VAC, 30 A and be capable of handling a maximum of two 6 mm² conductors per terminal. The terminal blocks shall be provided with white marking strip without covers. The white marking strips shall be

marked with a circuit designation which will identify the circuit. The designation shall be related to the wiring schematic and connection diagrams. All internal wiring shall be supplied with wire designation sleeves marked to agree with the terminal blocks and equipment drawings. This sleeve shall be of a type that is not easily removed. All markings shall be of a permanent type (machine stamped or engraved). All wire terminated on the terminal blocks shall be finished with crimped on ring type connectors. Extra terminals shall be provided for grounding cable shields and future modifications.

Terminal connectors suitable for 16 mm² copper cable shall also be provided for the RF carrier leads when the coupling capacitor voltage transformers are specified with carrier accessories.

- 5.10 Supporting Structures. Supporting structures, if specified in the Price Schedule and/or Ratings and Features, shall be hot-dip galvanized after fabrication in accordance with ASTM designation: A123 and A153. All necessary galvanized bolts, nuts and washers to complete the erection shall be furnished including embedded anchor bolts for securing the supporting structures to the concrete foundation.

The galvanizing coating shall meet the values as shown in the following table :

Galvanizing Coating Weight

Description	Thickness	Coating Weight (g/m ²)	
		Average Value	Minimum Value
Shaped steel and steel plate	6 mm and over	more than 702	more than 610
Shaped steel and steel plate	Under 6 mm	more than 610	more than 550
Steel pipe	-	more than 550	more than 490
Bolts, nuts	-	more than 381	more than 305
Washers, fillers	5 mm and over	more than 381	more than 305
	under 5 mm	more than 305	more than 259

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Finished materials shall be dipped into the solution of dichromate after galvanizing for white rust protection.

Marking. All individual pieces shall be marked with the correct designations shown on the approved shop drawings. Marking shall be done by die stamping the marks into the metal before galvanizing and shall be clearly legible after galvanizing. The number and letter shall be a minimum of 12 mm in height and 8 mm wide.

Each supporting structure shall be provided with mounting holes for fixing of junction box and shall be equipped with clamp-type ground terminal connector suitable for 4/0 AWG copper stranded conductor.

305-6 Type. Test for coupling capacitor voltage transformer shall be performed according to the requirement specified in the test items listed below. The costs of all tests and reports shall be borne by the Contractor.

6.1 Design Test. One unit of each type and model of coupling capacitor voltage transformer shall be subject to the tests specified below. The past design test records for an identical unit witnessed or inspected by a third party, may be furnished instead of performing the actual design test, unless otherwise specify in the test item below.

6.2 Routine Test. Each coupling capacitor voltage transformer shall be completely assembled at the factory and subject to the tests specified below.

6.3 Test Report. The report of all tests, curves and standard application data shall be furnished to EGAT immediately after completion of the tests.

6.4 Test Procedure. The Contractor shall submit the test procedure of routine tests and actual design tests to EGAT for approval. The test procedure shall consist of procedures, applied voltage, current and criteria to justify the result of the tests.

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6.5 Test Items for Coupling Capacitor Voltage Transformer. The tests shall be performed in accordance with the latest ANSI C93.2, unless otherwise specified.

6.5.1 Design Tests.

- (a) Power frequency withstand voltage (wet) test
- (b) Impulse test
- (c) Switching impulse test
- (d) Radio-influence voltage test
- (e) Accuracy test
- (f) Short-time over voltage test
- (g) Thermal burden test
- (h) Short circuit test
- (i) Ferroresonance test. The actual test shall be performed on CCVT being supplied. The oscillographic records of test performed shall be submitted.
- (j) Transient response test. The actual test shall be performed on CCVT being supplied. The peak value of any transient oscillation of the secondary output voltage shall decay, within one cycle of rated frequency, to a value of less than 10% of the peak value before short circuit. The oscillographic records of the test performed shall be submitted.
- (k) Carrier frequency insertion loss
- (l) Carrier drain coil rated frequency voltage drop and insulation level tests
- (m) Low voltage terminal stray capacitance and stray conductance tests
- (n) Carrier frequency capacitance and dissipation factor test
- (o) Mechanical test (Cantilever test)
- (p) Low voltage terminal insulation level test
- (q) Creepage distance measurement. The actual test shall be performed on CCVT being supplied.

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6.5.2 Routine Tests.

- a. On the capacitor divider
 - (a) Capacitance and dissipation factor measurement before and after power frequency withstand voltage (dry) test
 - (b) Power frequency withstand voltage (dry) test
 - (c) Partial discharge measurement
- b. On the electromagnetic unit
 - (a) Induced potential test on the primary circuit
 - (b) Applied potential test on the secondary circuit
 - (c) Insulation factor measurement. The result corrected to 20°C shall not be greater than 1.0%.
- c. On the completed CCVT
 - (a) Accuracy tests
 - (b) Polarity check
 - (c) Protective-gap setting

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Drawing and Documents for 500 kV Coupling Capacitor Voltage Transformer

Drawings and documents shall at least comprise the followings :

A. Drawings for Approval

<u>Item</u>	<u>Drawing Title</u>	<u>Approval and Final Dwgs.</u>	<u>Reproducible Dwgs.</u>	<u>Microfilm</u>
1	Outline drawing	x	x	x
2	Schematic diagram	x	x	x
3	Nameplate including ratings, connection diagram and EGAT's Contract No., Item No. and EGAT serial No.	x	x	x
4	Line terminal pad	x	-	-
5	Ground terminal connector	x	-	-
6	Detail of secondary terminal box	x	-	-
7	Steel supporting structure including bill of material	x	x	-
8	Detail of carrier terminal and accessories	x	-	-

B. Drawing and Documents for Reference

- 1 Internal cross-section view
- 2 Characteristics of insulating oil

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Instruction Manual for 500 kV Coupling Capacitor Voltage Transformer

Instruction manual shall consist of all necessary information and shall comprise at least the following parts :

Part A Coupling capacitor voltage transformer instruction including transportation, receiving, inspecting, storage, handling, installation, testing, operation and maintenance.

- a. Coupling capacitor voltage transformer general technical information
- b. Installation instructions including but not limited to
 - Transportation
 - Receiving and handling
 - Inspection
 - Storage
 - Installation
 - Method of oil filling
 - Characteristics of insulating oil
 - Oil temperature-oil level curve (if any)
- c. Operation and maintenance
 - Method of adjustment of transformer ratio and phase angle
 - Method of reactor tuning
 - Routine inspection
 - Maintenance
 - List of test equipment required
 - List of spare parts
- d. Catalogs
 - Bill of material
 - Equipment model numbers
 - Detailed description of the equipment
 - Specifications of the equipment

Part B Complete set of all final drawings and/or documents arranged in order of each complete item.

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SPECIFICATION NO. 306
500 kV CURRENT TRANSFORMERS

- 306-1. General.** This Specification covers the general requirement for design, manufacture, test and supply of 500 kV current transformer.

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are giving in the accompanying Ratings and Features sheet.

- 306-2. Materials and Workmanship.** All materials shall be new and shall be the best available for the purposes used, considering strength, ductility, durability and suitability for the intended services and best engineering practice. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

- 306-3. Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 meters or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity without corrosion, deterioration or degradation of performance characteristics.

- 306-4. Codes and Standards.** All equipment, materials, devices, fabrication and testing shall conform to the codes, specifications and standards listed below and all applicable codes, specifications and standard referenced therein.

ANSI American National Standard Institute Incorporated

ASME American Society of Mechanical Engineers

ASTM American Society for Testing and Materials

AWS American Welding Society

IEEE The Institute of Electrical and Electronic Engineers

NEMA National Electric Manufacturers Association

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All threaded parts requiring external connection shall have UNC screw and pipe threads. All internal parts may have threads in accordance with the established specification in the country of manufacturer.

It is the intent that all equipment, materials, devices, fabrication and testing shall conform to the application codes, specifications and standards even though they are, not specifically noted herein. Equivalent codes, specifications and standards established and approved in the country of equipment or material manufacturer may be used subject to EGAT's approval. If this election is made, the Bidder shall so state and include in his bid the governing codes, specifications, and standards proposed together with an itemized list of specific deviations from the requirements of codes, specifications and standards referenced herein.

The latest issue of all codes, specifications and standards shall govern.

The most stringent requirement, in the event of code, specification standard conflict, shall govern. This specification shall govern in the event of discrepancies between it and applicable codes, specifications and standards.

306-5. Design and Construction.

5.1 Type and Construction. The current transformer shall be oil filled and hermetically sealed in accordance with the accompanying Ratings and Features sheet.

The expansion system for changing of oil volume to variation in oil transformer, if compensate by expansion bellow, the bellow shall be made of metal. For inverted (top core) type current transformer, the metallic bellow shall be used only, other oil expansion systems are not acceptable.

The current transformer with core molded or encapsulated in epoxy resin or located in porcelain housing is not acceptable.

The secondary circuit connection to ground shall be made in such a way as to permit convenient temporary removal for isolation or testing.

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5.2 **Accuracy Classification.** The current transformer shall have an accuracy classification in accordance with the Ratings and Features sheets and shall have uniformly distributed secondary windings for all taps.

5.3 **Transient Performance.** The design of secondary cores for using with transmission line protective relay systems shall be satisfactory for the conditions specified on the Ratings and Features sheet including the specified circuit breaker reclosing operation. They shall permit one cycle of accurate, undistorted output prior to any saturation for a full asymmetrical short circuit condition.

The cores used for transmission line protection shall be furnished with gaps to reduce the remanence, and designed with a low enough secondary time constant such that the maximum instantaneous error during current flow after circuit breaker reclosing is less than the value specified on the Ratings and Features sheet.

5.4 **Terminals.** Each current transformer shall be equipped with suitable terminal pads. The terminal pads shall be provided with four 14.3 mm (9/16 inch) diameter holes with 45 mm (1-3/4 inch) spacing between the centers of each hole in accordance with the standard NEMA 4 holes arrangements.

The terminal pads shall be of high conductivity bronze or copper and shall be plated with hot flowed electro-tin to a thickness of not less than 0.0127 mm (0.0005 inch). Whenever larger terminal pads are required for higher current rating, the mounting holes shall conform to NEMA Standards, and details of the mounting holes shall be submitted for approval.

5.5 **Porcelain Housings.** Porcelain housings shall have adequate mechanical and electrical strength. The color of porcelain shall be chocolate brown. Porcelain housings shall be wet process, homogeneous and free from cavities or other flaws. The glazing shall be uniform in color and free from blisters, burns and other defects.

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- 5.6 Ground Terminal Connectors.** Ground terminal connectors shall be of the clamp type suitable for No.4/0 AWG copper stranded conductor. Terminal connector shall be made of high conductivity material and shall be completed with corrosion resistance bolts, nuts and lock washers.
- 5.7 Secondary Terminal Boxes.** A removable blank cover plate, suitable for two (2) 62 mm diameter holes, shall be provided at the bottom of the secondary terminal box.
- 5.8 Terminations.** Current transformer polarity shall be subtractive and the terminal markings shall be in accordance with IEEE Std. C57.13. Terminal blocks furnished for terminating current transformer secondary winding wiring shall be of short-circuit type. Each terminal block terminal shall be capable of accomodating 6 mm² cable minimum.
- 5.9 Protective Devices.** The current transformers shall be equipped with a primary bypass protective device or surge arrester for protection of the winding from high voltage surges unless the calculation data can be furnished for EGAT approval which demonstrates that primary protective devices are not required.
- 5.10 Supporting Structures.** Supporting structures, if specified in the Price Schedule shall be hot-dip galvanized after fabrication in accordance with ASTM designation: A123 and A153. All necessary galvanized bolts, nuts and washers to complete the erection shall be furnished including embedded anchor bolts for securing the supporting structures to the concrete foundation.

The galvanizing coating shall meet the values as shown in the following table.

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Galvanizing – Coating Weight

Description	Thickness	Coating Weight (g/m ²)	
		Average Value	Minimum Value
Shaped steel land steel plate	6 mm and over	more than 702	more than 610
Shaped steel and steel plate	Under 6 mm	more than 610	more than 550
Steel pipe	-	more than 550	more than 490
Bolts, nuts	-	more than 381	more than 305
Washers, fillers	5 mm and over	more than 381	more than 305
Washers, fillers	Under 5 mm	more than 305	more than 259

Finished materials shall be dipped into the solution of dichromate after galvanizing for white rust protection.

Marking. All individual pieces shall be marked with the correct designations shown on the approved shop drawings. Marking shall be done by die stamping the marks into the metal before galvanizing and shall be clearly legible after galvanizing. The number and letter shall be a minimum of 12 mm in height and 8 mm wide.

Each supporting structure shall be provided with mounting holes for fixing of junction box and shall be equipped with clamp-type ground terminal connector suitable for 4/0 AWG copper standard conductor.

306-6. Special Requirement. In case inverted type (top core) is proposed, type test record of multiple chopped wave test shall be submitted together with tender documents during the bidding. This type test record shall be submitted as required evidence for consideration of evaluation.

306-7. Test. Tests for current transformer shall be performed according the requirement specified in the test item listed below. The costs of all tests and reports shall be borne by the Contractor.

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- 7.1 **Design Test Record.** The part design test record of the same type and same rating as EGAT called for, certified or witnessed by third party, shall be submitted with the tender document. The design test shall be subject to the tests specified in each equipment test item.
- 7.2 **Routine Test.** Each current transformer shall be completely assembled at the factory and subject to the tests specified below.
- 7.3 **Test Report.** The report of all tests, curves and standard application data shall- be furnished to EGAT immediately after completion of the tests.
- 7.4 **Test Procedure.** The Contractor shall submit the test procedure of routine tests and actual design tests to EGAT for approval. The test procedure shall consist of procedures, applied voltage current and criteria to justify the result of the tests.
- 7.5 **Test Items for Current Transformer.** The tests shall be performed in accordance with the latest IEEE Std C57.13.

7.5.1 Design Tests.

- (a) Short time mechanical current rating test
- (b) Short time thermal current rating tests
- (c) Temperature rise test at maximum rated current (of continuous thermal current rating factor)
- (d) Power frequency withstand voltage test
- (e) Impulse test
- (f) Wet and dry switching impulse voltage withstand test, 1175 kV crest minimum, 250 x 2500 us positive and negative waves per IEEE C37.09.
- (g) Transient performance test.
- (h) Open-circuit secondary voltage magnitude and withstand capability.

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- (i) Multiple chopped impulse test, only for inverted type (top core) current transformer. Twelve (12) sets of 50 negative chopped wave impulse at the rate of, about 1 impulse per minute (total of 600 chopped wave impulse) shall be performed. Oil sampling for dissolved gas analysis before the test and three days after the test shall be carried out.

7.5.2 Routine Tests.

- (a) Applied voltage test
- (b) Induced voltage test
- (c) Accuracy test for each ratio of all winding (including excitation curve of one unit of each item)
- (d) Polarity check
- (e) Winding resistance measurement for maximum ratio of all winding but one unit of each item shall be performed for each ratio of all winding.
- (f) Insulation resistance measurement.
- (g) Insulation power factor measurement. The result corrected to 20°C shall not be more than 1.0%.
- (h) Partial discharge measurement. The permissible partial discharge level shall not be more than 10 pC at U_m and pC at $1.2 U_m/\sqrt{3}$ (U_m : Maximum Service Voltage)
- (i) Creepage distance measurement. One unit of each type and rating shall be subject to this test.

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Drawings and Documents for 500 kV Current Transformer

Drawings and documents shall at least comprise the followings :

A. Drawings for Approval

<u>Item</u>	<u>Drawing Title</u>	<u>Approval and Final Dwgs.</u>	<u>Reproducible Dwgs.</u>	<u>Microfilm</u>
1	Outline drawing	x	x	x
2	Nameplate including ratings, connection diagram and EGAT's Contract No., Item No. and EGAT Serial No.	x	x	x
3	Line terminal pad	x	-	-
4	Ground terminal connector	x	-	-
5	Detail of secondary terminal box	x	-	-
6	Steel supporting structure including bill of material	x	x	-
7	Detail of primary protective device (if any)	x	-	-

B. Drawings and Documents for Reference

- 1 Internal cross-section view
- 2 Characteristics of insulating oil

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Instruction Manual for 500 kV Current Transformer

Instruction manual shall consist of all necessary information and shall comprise at least the following parts :

Part A Current transformer instruction including installation, operation and maintenance.

a. Current transformer general technical information.

b. Installation instruction including but not limited to

- Transportation
- Inspection
- Installation instruction
- Method of oil filling
- Characteristics of insulating oil
- Oil temperature – oil level curve (if any)

c. Operation and maintenance

- Routine inspection
- Maintenance

Part B Complete set of all final drawings and/or documents arranged in order of each complete item.

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