EGAT's Privacy Notice on Procurement, Inventory Management and Contract Administration

Electricity Generating Authority of Thailand (EGAT) has performed the protection of the Personal Data regarding procurement, inventory management and contract administration to be in accordance with **the Personal Data Protection Act B.E. 2562** (the "2019 PDPA"), which comes into effect on June 1, 2022.

Details about EGAT's Privacy Notice on Procurement, Inventory Management and Contract Administration are available for you at https://www.egat.co.th/privacy-notice-procurement_en.html or the below QR Code.

The Redaction of Sensitive Personal Data

EGAT has announced the Privacy Notice on Procurement, Inventory Management and Contract Administration for the collection, use or disclosure of Personal Data, excluding the Sensitive Personal Data.

Should the documents you wish to submit to EGAT contain the Sensitive Personal Data as defined in Section 26 of the 2019 PDPA, pertaining to racial, ethnic origin, political opinions, cult, religious or philosophical beliefs, sexual behavior, criminal records, health data, disability, trade union information, genetic data, biometric data, or of any data which may affect you in the same manner, you shall redact or conceal such data before submitting to EGAT.

<u>ประกาศความเป็นส่วนตัว (Privacy Notice) สำหรับการจัดซื้อจัดจ้าง การบริหารพัสดุ และการบริหารสัญญาของ กฟผ.</u>

การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย (กฟผ.) ได้ดำเนินการคุ้มครองข้อมูลส่วนบุคคลสำหรับการจัดซื้อจัดจ้าง การบริหารพัสดุ และการบริหารสัญญา เพื่อให้เป็นไปตาม**พระราชบัญญัติคุ้มครองข้อมูลส่วนบุคคลของประเทศไทย พ.ศ. 2562** (PDPA) ซึ่งมีผลบังคับใช้อย่างครบถ้วน ตั้งแต่วันที่ 1 มิถุนายน 2565 ทั้งนี้ ท่านสามารถศึกษารายละเอียดประกาศความเป็นส่วนตัว (Privacy Notice) สำหรับการจัดซื้อจัดจ้าง การบริหารพัสดุ และการบริหารสัญญา ได้ที่ https://www.egat.co.th/privacy-notice-procurement.html หรือที่ QR Code ด้านล่าง

<u>การขีดฆ่าข้อมูลส่วนบุคคลอ่อนไหว</u>

กฟผ. มีประกาศความเป็นส่วนตัว (Privacy Notice) สำหรับการจัดซื้อจัดจ้าง การบริหารพัสดุ และการบริหารสัญญา เพื่อใช้ในการเก็บรวบรวม ใช้ หรือเปิดเผย ข้อมูลส่วนบุคคล แต่ไม่เก็บข้อมูลส่วนบุคคลอ่อนไหว หากเอกสารของท่านที่ต้องส่งมอบให้ กฟผ. มีข้อมูลส่วนบุคคลอ่อนไหวตามที่ถูกบัญญัติไว้ในมาตรา 26 ของ PDPA ดังนี้ เชื้อชาติ เผ่าพันธุ์ ความคิดเห็นทางการเมือง ความเชื่อในลัทธิ ศาสนาหรือปรัชญา พฤติกรรมทางเพศ ประวัติอาชญากรรม ข้อมูลสุขภาพ ความพิการ ข้อมูลสหภาพแรงงาน ข้อมูลพันธุกรรม ข้อมูลชีวภาพ หรือข้อมูลอื่นใด ซึ่งกระทบต่อเจ้าของข้อมูลส่วนบุคคลในทำนองเดียวกันรวมอยู่ด้วย ขอให้ท่านขีดฆ่า หรือปกปิดข้อมูลดังกล่าว ก่อนส่งมอบให้แก่ กฟผ.

1st Draft of Terms of Reference,

Announcement and Details of Medium Cost

for Invitation to Bid No. GBA3-SC-05 and TIWS-SC-05

Supply of Shunt Capacitor Bank

Bulk Power Supply for the Greater Bangkok and Vicinity Area Phase 3 Transmission System Improvement Project in Western and Southern Regions to Enhance System Security

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The Electricity Generating Authority of Thailand (EGAT) plans to call for proposals for the subject Invitation to Bid. Any person who has the authorization from the company, firm, joint venture or consortium who supplies or manufactures the equipment required under the subject invitation to Bid is allowed to submit a comment against the first draft of the Terms of Reference (TOR), the Announcement and the Details of Medium Cost attached herewith.

How to Comment

Those who would like to comment shall submit an official letter signed by the authorized person(s) together with the letter of authorization or the power of attorney, and addressed to "Chief, International Procurement Department - Transmission Segment, Procurement and Inventory Management Division".

Comments shall be submitted via email address: ***wirinya.cha@egat.co.th*** with all related documents attached (e.g. the letter of authorization and the power of attorney).

Comments shall be received by EGAT on or before ***September 19, 2025***, Bangkok Standard Time, **otherwise the comments will not be taken into consideration**.

EGAT reserves the right to change or not to change the terms and conditions contained in the Terms of Reference, the Announcement and the Details of Medium Cost subject to its consideration and such decision shall be final.

Kanchanok Phoousaha

Miss Kanchanok Phoousaha
Head, International Buy Section - Transmission System Segment
September 12, 2025

Notice to Bidder

Subject : Online Payment for Purchase of Bidding Documents

Please be informed of the online payment for purchase of bidding documents as follows:

1) Fill-out the Registration Form and the proof of payment in the link provided in https://www4.egat.co.th/fprocurement/biddingeng

   Payment shall be made by bank transfer or telegraphic transfer to EGAT's account no. 109-6-01958-2 (swift code : KRTHTHBK), Krung Thai Bank Public Company Limited, Bangkruai Branch, Nonthaburi.

   All bank charges and fees incurred by the payment of bidding documents shall be under the buyer's responsibility.

2) The registration will be deemed complete only upon successful processing of the payment and confirmation of funds received.

3) After the payment has been verified for approximately 3 working days, the in-charge officer will send the link for downloading the bidding documents together with the receipt to the purchaser's email address in the Registration Form.

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Invitation to Bid No. GBA3-SC-05 and TIWS-SC-05

Supply of Shunt Capacitor Bank

Bulk Power Supply for the Greater Bangkok and Vicinity Area Phase 3 Transmission System Improvement Project in Western and Southern Regions to Enhance System Security

The Electricity Generating Authority of Thailand (EGAT) is calling for the subject Invitation to Bid to be financed by EGAT's fund.

Place of Delivery : Bangkok Port / Ex-works

Medium Cost (including Value Added Tax and other expenses) : THB 124,000,000.-

Eligibility of Bidders

1. The Bidder shall be a juristic person who manufactures or provides such materials or services and shall not be named in the List of Work Abandoners published by the Permanent Secretary, Ministry of Finance, and/or in the Debarment List and/or in the List of Work Abandoners declared by EGAT.
2. The Bidder shall not be a Jointly Interested Bidder with other Bidders as from the date of EGAT's issuance of the Invitation, or shall not be a person who undertakes any action as an "Obstruction of Fair Price Competition" for this Invitation.
3. The Bidder shall not either be EGAT's consultant or involve in EGAT's consultancy company under this Invitation to Bid, or shall not have EGAT's personnel involved in his business as shareholder having voting right that can control his business, director, manager, officer, employee, agent, or consultant except those who are officially ordered by EGAT to act or participate therein.
4. The Bidder shall not be the person who is privileged or protected not to be taken any legal proceedings under Thai Court; Provided that such Bidder's government declares that such special privilege is waived.
5. The Bidder who is a joint venture or consortium shall carry out all the work under such formation from the time of bidding until the fulfillment of the Contract.

Availability of Bidding Documents

Bidding Documents are available for online purchase during 8:00 hrs. to 15:00 hrs., Bangkok Standard Time, as from_____to_____ at USD 100.- or THB 3,000.- per copy, non-refundable.

Please find more details for online purchasing process at http://www4.egat.co.th/fprocurement/biddingeng or contact for further information at telephone no. 66 2436 0341 or procurement.tse@egat.co.th.

Delivery of Bids

Bids shall be submitted at Bidding Room, 1st Floor, Tor 137 Building at EGAT's Head Office, Nonthaburi during 9:00 hrs. to 10:00 hrs., Bangkok Standard Time, _____and will be opened publicly at 10:00 hrs.

ELECTRICITY GENERATING AUTHORITY OF THAILAND

(Date of Announcement)

(Mrs. Kannika Dhachalupat)

Chief, International Procurement Department – Transmission Segment

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ประกาศการไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

เรื่อง ประกวดราคาซื้อ เลขที่ GBA3-SC-05 and TIWS-SC-05

การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย (กฟผ.) มีความประสงค์จะซื้อ Shunt Capacitor Bank สำหรับโครงการขยายระบบไฟฟ้าในเขตกรุงเทพและปริมณฑล ระยะที่ 3 โครงการปรับปรุงระบบส่งไฟฟ้าบริเวณภาคตะวันตก และภาคใต้เพื่อเสริมความมั่นคงระบบไฟฟ้า โดยใช้งบประมาณ กฟผ.

สถานที่ส่งมอบ : ท่าเรือกรุงเทพฯ / หน้าโรงงานผู้ผลิต

ราคากลาง (รวมภาษีมูลค่าเพิ่มและค่าใช้จ่ายอื่น ๆ) : 124,000,000.- บาท

คุณสมบัติของผู้เสนอราคา

1. ต้องเป็นนิติบุคคลผู้ผลิตหรือเป็นผู้มีอาชีพขายพัสดุตามประกาศและต้องไม่เป็นผู้ทิ้งงานซึ่งปลัดกระทรวงการคลังได้แจ้งเวียนชื่อไว้ หรือต้องไม่เป็นผู้ที่ กฟผ. ห้ามติดต่อหรือห้ามเข้าเสนอราคา หรือต้องไม่เป็นผู้ที่ได้รับผลของการสั่งให้นิติบุคคลหรือบุคคลอื่นเป็นผู้ทิ้งงานตามคำสั่ง กฟผ.
2. ต้องไม่เป็นผู้มีผลประโยชน์ร่วมกันกับผู้เสนอราคารายอื่น ณ วันประกาศประกวดราคาครั้งนี้เป็นต้นไป หรือต้องไม่เป็นผู้กระทำการอันเป็นการขัดขวางการแข่งขันราคาอย่างเป็นธรรมในการดำเนินการประกวดราคาครั้งนี้
3. ต้องไม่เป็นที่ปรึกษาของ กฟผ. หรือมีส่วนร่วมในบริษัทที่ปรึกษาของ กฟผ. ในงานนี้ หรือต้องไม่มีผู้ปฏิบัติงาน กฟผ. เข้าไปมีส่วนร่วมในกิจการของผู้เสนอราคา ไม่ว่าจะในฐานะผู้ถือหุ้นที่มีสิทธิควบคุมการจัดการ กรรมการ ผู้อำนวยการ ผู้จัดการ พนักงาน ลูกจ้าง ตัวแทน หรือที่ปรึกษา ยกเว้น ในกรณีที่ผู้ปฏิบัติงานได้รับคำสั่งอย่างเป็นทางการจาก กฟผ. ให้ไปปฏิบัติงานหรือเข้าร่วมในกิจการของผู้เสนอราคา
4. ต้องไม่เป็นผู้ได้รับเอกสิทธิ์หรือความคุ้มกัน ซึ่งอาจปฏิเสธไม่ยอมขึ้นศาลไทย เว้นแต่รัฐบาลของผู้เสนอราคาได้มีคำสั่งให้สละสิทธิ์และความคุ้มกันเช่นว่านั้น
5. ผู้ประสงค์เข้าประกวดราคาในนามของกิจการร่วมค้าหรือกิจการค้าร่วม (Joint Venture or Consortium) จะต้องดำเนินการทุกขั้นตอนของการประกวดราคาในนามของกิจการร่วมค้าหรือกิจการค้าร่วม ตั้งแต่การเสนอราคาจนสิ้นสุดข้อผูกพันกับ กฟผ.

การขายเอกสารประกวดราคา

ผู้สนใจติดต่อซื้อเอกสารประกวดราคา ในราคาชุดละ 3,000.- บาท ในวันทำการระหว่างเวลา 08:00 น. ถึง 15:00 น. ตั้งแต่วันที่_____ถึงวันที่_____ ทั้งนี้ สามารถดูรายละเอียดการซื้อเอกสารประกวดราคาได้ที่เว็บไซต์ http://www4.egat.co.th/fprocurement/biddingeng หรือสอบถามข้อมูลเพิ่มเติมได้ทางโทรศัพท์ หมายเลข 0 2436 0341 หรืออีเมล procurement.tse@egat.co.th

การยื่นซองประกวดราคา

กำหนดยื่นซองประกวดราคา ในวันที่ _____เวลา 09:00 น. ถึง 10:00 น. และเปิดซองประกวดราคาเวลา 10:00 น. ณ ห้องประกวดราคา ชั้น 1 อาคารฝ่ายจัดซื้อจัดจ้างและบริหารพัสดุ ท.137 การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย เชิงสะพานพระราม 7 จังหวัดนนทบุรี

ประกาศ ณ วันที่

(นางกรรณิกา ธชาลุภัฏ)

หัวหน้ากองจัดซื้อจัดจ้างต่างประเทศสายงานระบบส่ง

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ตารางแสดงวงเงินงบประมาณที่ได้รับจัดสรรและราคากลาง(ราคาอ้างอิง)

ในการจัดซื้อจัดจ้างที่มิใช่งานก่อสร้าง

1. **ชื่อโครงการ** Bid No. GBA3-SC-05 and TIWS-SC-05
   การจัดซื้อ Shunt Capacitor Bank
   โครงการขยายระบบไฟฟ้าในเขตกรุงเทพและปริมณฑล ระยะที่ 3
   โครงการปรับปรุงระบบส่งไฟฟ้าบริเวณภาคตะวันตกและภาคใต้เพื่อเสริมความมั่นคงระบบไฟฟ้า
   /หน่วยงานเจ้าของโครงการ ฝ่ายแผนงานและโครงการระบบส่ง การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

2. **วงเงินงบประมาณที่ได้รับจัดสรร**
   โครงการขยายระบบไฟฟ้าในเขตกรุงเทพและปริมณฑล ระยะที่ 3
   งบประมาณ 12,100 ล้านบาท
   โครงการปรับปรุงระบบส่งไฟฟ้าบริเวณภาคตะวันตกและภาคใต้เพื่อเสริมความมั่นคงระบบไฟฟ้า
   งบประมาณ 63,200 ล้านบาท

3. **วันที่กำหนดราคากลาง** 22 กรกฎาคม 2568 (วันที่ อวส. อนุมัติ)
   ราคารวมภาษีมูลค่าเพิ่มและค่าใช้จ่ายอื่นๆ เป็นเงิน 124,000,000.00 บาท **ราคา/หน่วย** ตามเอกสารแนบ

4. **แหล่งที่มาของราคากลาง**
   หลักเกณฑ์การกำหนดราคากลางการจัดซื้อและจัดจ้างงานก่อสร้างระบบส่งไฟฟ้าของสายงานพัฒนาระบบส่ง

5. **รายชื่อเจ้าหน้าที่ผู้กำหนดราคากลาง**
   5.1 นายภูภัทร พานทอง หสก-ร., กวอ-ร.
   5.2 นายชิตพล จินต์อัจฉริยกุล วศ.7, หสก-ร., กวอ-ร.

   <u>หมายเหตุ</u> ค่าใช้จ่ายอื่นๆ ได้แก่ ค่าใช้จ่ายที่ กฟผ. ต้องจ่ายตามวิธีการพิจารณาเปรียบเทียบราคาที่กำหนดไว้ในเอกสารประกวดราคา เช่น อากรขาเข้า เป็นต้น

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MEDIUM COST FOR BID NO. GBA3-SC-05 and TIWS-SC-05

SUMMARY OF BID PRICE

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3
TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

No.	Description	Currency	Supply of Equipment		Foreign Currency	Local Currency
			Foreign Supply	Local Supply		
			CFR Thai Port	Ex-works Price (excluding VAT) Baht	(excluding VAT)	(excluding VAT) Baht
			Amount	Amount	Amount	Amount
1	BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3	THB	67,944,495.06			
				16,599,712.05		52,098.84
2	TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY	THB	22,648,165.02			
				5,533,237.35		17,366.28
BID PRICE		THB	90,592,660.08	Baht 22,132,949.40		Baht 69,465.12
OTHER EXPENSES		THB	3,170,743.10			
VAT		THB	6,563,438.22	Baht 1,549,306.46		Baht 4,862.56
SUMMARY OF BID PRICE		THB	100,326,841.40	Baht 23,682,255.86		Baht 74,327.68
TOTAL MEDIUM COST		THB	124,083,424.94			
TOTAL MEDIUM COST (ROUNDED)		THB	124,000,000.00			

นายสรวิชญ์ หิมะมาน
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Jul 2025

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MEDIUM COST FOR BID NO. GBA3-SC-05 and TIWS-SC-05

Schedule A1 : 230 kV Shunt Capacitor Bank

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply CFR Thai Port		**Supply of Equipment** Local Supply Ex-works Price (excluding VAT) Baht		**Foreign Currency** (excluding VAT)		**Local Currency** (excluding VAT) Baht	
					Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
A1-1	230 kV 72 MVAR Shunt Capacitor Bank complete with switching devices as per Ratings and Features RF CK8705 and Dwg. No. SE-SC-8-04 and TP-E-10.7 (The given MVAR represents the total Reactive Power of Capacitor Units only)	3		THB	22,132,949.40	66,398,848.20	5,533,237.35	16,599,712.05	XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
A1-2	Spare Parts for Item No. A1-1	lot		THB	1,545,646.86	1,545,646.86			XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
A1-3	Service of Installation Supervisor of Circuit Breaker Item No. A1-1	6.00	man day	THB	XXXXX	XXXXX	XXXXX	XXXXX			8,683.14	52,098.84
Total Price for Schedule A1				**THB**		**67,944,495.06**	**Baht**	**16,599,712.05**			**Baht**	**52,098.84**

นายสรวิชญ์ หิมะมาน
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Jul 2025

DRAFT

MEDIUM COST FOR BID NO. GBA3-SC-05 and TIWS-SC-05

Schedule B1 : 230 kV Shunt Capacitor Bank

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply CFR Thai Port		**Supply of Equipment** Local Supply Ex-works Price (excluding VAT) Baht		**Foreign Currency** (excluding VAT)		**Local Currency** (excluding VAT) Baht	
					Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
B1-1	230 kV 72 MVAR Shunt Capacitor Bank complete with switching devices as per Ratings and Features RF CK8705 and Dwg. No. SE-SC-8-05 and TP-E-10.7 (The given MVAR represents the total Reactive Power of Capacitor Units only)	1		THB	22,132,949.40	22,132,949.40	5,533,237.35	5,533,237.35	XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
B1-2	Spare Parts for Item No. B1-1	lot		THB	515,215.62	515,215.62			XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
B1-3	Service of Installation Supervisor of Circuit Breaker Item No. B1-1	2.00	man day	THB	XXXXX	XXXXX	XXXXX	XXXXX			8,683.14	17,366.28
Total Price for Schedule B1				**THB**		**22,648,165.02**	**Baht**	**5,533,237.35**			**Baht**	**17,366.28**

นายสรวิชญ์ หิมะมาน
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Jul 2025

DRAFT

Contract No.

Invitation to Bid No.
GBA3-SC-05 and TIWS-SC-05

ELECTRICITY GENERATING AUTHORITY OF THAILAND

BIDDING DOCUMENTS

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

EGAT'S FUND

DRAFT

BIDDER : _____

(2025)

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

EGAT'S FUND

CONTENTS

CONFIRMATION FORM

DISCOUNT FORM

ADDITIONAL REGULATION

IMPORTANT INFORMATION

DATA SHEET

SECTION A INVITATION TO BID

SECTION B INSTRUCTIONS TO BIDDERS

SECTION C PROPOSAL

SECTION D CONTRACT

SECTION E GENERAL CONDITIONS

SECTION F SPECIAL CONDITIONS

SECTION G RATINGS AND FEATURES

SECTION H BILL OF MATERIALS (None)

SECTION I SPECIFICATIONS

SECTION J DRAWINGS

DRAFT

CONTENTS

Article No.	Description	Page
	Confirmation Form	-
	Discount Form	-
	Additional Regulation	1-11
	Important Information	i
	Data Sheet	i
	SECTION A : INVITATION TO BID	
A-1	Invitation	A1
A-2	Eligibility of Bidders: General Requirements	A1
A-3	Eligibility of Bidders: Technical Requirements	A2
A-4	Joint Venture or Consortium	A5
A-5	Preparation and Delivery of Bids	A5
A-6	Availability of Bidding Documents	A6
	SECTION B : INSTRUCTIONS TO BIDDERS	
	Overview of the Procurement Process	B1
B-1	Preparation of Bids	B2
B-2	Bid Prices	B3
B-3	Bid Security	B5
B-4	Validity of Bids	B6
B-5	Delivery of Bids	B6
B-6	Withdrawal of Bids	B6
B-7	Interpretation of Bidding Documents before Bid Opening	B6
B-8	Information to be Submitted with Bid	B7

DRAFT

Article No.	Description	Page
B-9	Deviations from Specifications	B9
B-10	Rejection of Bids	B9
B-11	Delivery Time	B9
B-12	Evaluation and Comparison of Bids	B10
B-13	Acceptance of Bids	B11
B-14	Appeal	B11
B-15	Award of Contract	B12
B-16	Bidder's Responsibility	B12
B-17	Supplemental Notices	B12
B-18	Cost of Bidding	B13
B-19	Cancellation of Bid	B13
	Specimen of Bid Security	B14

SECTION C : PROPOSAL

C-1	Price Schedule	C1
C-2	Penalty for Equipment Not Meeting Guaranteed Characteristics	C2
C-3	Guaranteed Delivery Time	C2
C-4	Drawing and Document Submission Schedule	C2
C-5	Estimate of Deliveries	C2
C-6	Bid Security	C3
C-7	Supplemental Notices	C3
	Part 1 : Price Proposal	Project 1-C1
	Part 2 : Proposal Data	Part 2-C1
	Part 3 : Delivery Schedule and Distribution List	Part 3-C1

DRAFT

Article No.	Description	Page
	SECTION D : CONTRACT	
D-1	Contract Documents	D1
D-2	Acceptance of Proposal	D2
D-3	Agreement	D2
D-4	Obligation of Contractor	D2
D-5	Obligation of EGAT	D2
D-6	Mutual Obligations	D3
D-7	Deposit of Performance Security	D3
D-8	Assignment	D3
D-9	Notices	D3
D-10	Integration	D4
D-11	Counterpart	D4
	SECTION E : GENERAL CONDITIONS	
E-1	Definitions	E1
E-2	Intent of Contract Documents	E2
E-3	Applicable Law and Legal Jurisdiction	E3
E-4	Statutory Requirements	E3
E-5	Patents and Copyrights	E3
E-6	Subcontracts	E4
E-7	Export Charges	E4
E-8	Import Duty and Taxes	E4
E-9	Value Added Tax	E5
E-10	Income and Other Taxes	E6

DRAFT

Article No.	Description	Page
E-11	Fees and Duties	E7
E-12	Performance Security	E8
E-13	Inspection and Tests	E9
E-14	Preparation for Shipment and/or Delivery	E11
E-15	Clearance and Weight Limitations	E13
E-16	Shipment	E13
E-17	Documents Required for Each Shipment	E15
E-18	Force Majeure	E18
E-19	Transportation Insurance	E19
E-20	Transfer of Title	E19
E-21	Changes and Extra or Omitted Work	E19
E-22	Termination and Suspension of Contract	E20
E-23	Default and Termination	E20
E-24	Indemnification by the Contractor	E21
E-25	Limitation of Liability	E22
E-26	Consequential Damages	E22
E-27	Vesting of Contract in Receiver	E22
E-28	Extension of Time	E23
E-29	Failure to Meet Requirements	E23
E-30	Operation or Use of Unsatisfactory Equipment	E26
E-31	Dispute Resolution	E26
E-32	Language and Numbers	E26
	Specimen of Guarantee	E27
	Instructions for Packaging	E28

DRAFT

Article No.	Description	Page
	SECTION F : SPECIAL CONDITIONS	
F-1	Scope of Work	F1
F-2	Responsibility of Contractor	F1
F-3	Cooperation with Other Contractors	F1
F-4	Supervision of Installation	F2
F-5	Acceptance Tests	F3
F-6	Failure to Meet Performance Guarantees	F3
F-7	Acceptance Certificate	F3
F-8	Payment	F4
F-9	Liquidated Damages for Late Delivery of Equipment	F8
F-10	Maintenance Guarantee	F9
F-11	Drawings and Documents to be Furnished by Contractor	F11
F-12	Maintenance Security	F14
	Specimen of Maintenance Guarantee	F16
	Drawings and Documents to be Furnished by the Contractor (For Control and Protection Equipment)	F17
	Drawings and Documents to be Furnished by the Contractor (For All Equipment except Control and Protection Equipment)	F18
	SECTION G : RATINGS AND FEATURES	
G-1	Ratings and Features	G1
	SECTION H : BILL OF MATERIALS (None)	
-	-	-

DRAFT

Article No.	Description	Page
	SECTION I : SPECIFICATIONS	
I-1	Specifications	I1
	SECTION J : DRAWINGS	
J-1	Drawings	J1

DRAFT

CONFIRMATION FORM

(INDIVIDUAL COMPANY / JOINT VENTURE)

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

By signing in the space provided below, we confirm that:-

- According to "Eligibility of Bidders" and in addition to the Documentary List attached to the bidding documents, we are not a Jointly Interested Bidder with the other bidders as from the date of EGAT's issuance of the subject Invitation and are not a person who undertakes any actions as an "Obstruction of Fair Price Competition".
- According to Article B-8 Information to be Submitted with Bid, we confirm
  - ☐ Registration with the Revenue Department as a value added tax registrant in Thailand as per certificate of value added tax registration (ภพ.20) attached.
  - ☐ Non-Registration as a value added tax registrant in Thailand, but will register later.
  - ☐ Non-Registration as a value added tax registrant in Thailand and will not register.

Confirmed :

……..…….

By : ……..……..

Title : ……..…….

Date : ……..……...

DRAFT

CONFIRMATION FORM

(CONSORTIUM)

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Member No. … of the consortium:
By signing in the space provided below, we confirm that:-

- According to "Eligibility of Bidders" and in addition to the Documentary List attached to the bidding documents, we are not a Jointly Interested Bidder with the other bidders as from the date of EGAT's issuance of the subject Invitation and are not a person who undertakes any actions as an "Obstruction of Fair Price Competition".
- According to Article B-8 Information to be Submitted with Bid, we confirm
  - ☐ Registration with the Revenue Department as a value added tax registrant in Thailand as per certificate of value added tax registration (ภพ.20) attached.
  - ☐ Non-Registration as a value added tax registrant in Thailand, but will register later.
  - ☐ Non-Registration as a value added tax registrant in Thailand and will not register.

Confirmed :

……..…….

By : ……..……..

Title : ……..…….

Date : ……..……...

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DISCOUNT FORM
(Excluding VAT)

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Bidder : _____

By signing in the space provided below, we confirm that:-

- ☐ we offer no discount.
- ☐ we offer discount(s) as follows:

Details of discount	Currency	Amount

Remarks :

- ***The Bidder shall apply discount(s) on any item(s), schedule(s), or the total price, excluding Value Added Tax (VAT).***
- The above discount(s) shall not be subject to any conditions. Discount with conditions shall not be considered.
- This Discount Form, together with Bidder's Summary of Bid Price, will be publicly presented on a screen to all Bidders in the bid opening room at the time of bid opening.

Confirmed by authorized person(s):

……..…….

By : ……..……..

Title : ……..……...

Date : ……..……...

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Additional Regulation

This Regulation shall apply to the Enquiry, Bid for Supply, Lease, Hire of Work, or Hire of Consultant by Way of Selection.

1. Attachments

   1.1 Definitions
   1.1.1 Jointly Interested Bidder
   1.1.2 Obstruction of Fair Price Competition

   1.2 Documentary List

2. Bidder's Qualifications

   2.1 The Bidder shall professionally be in the business of providing materials or services or leasing or consultancy services, as the case may be, and shall not be named in the list of work abandoners published by the Permanent Secretary, Ministry of Finance, and/or in the debarment list and/or the list of work abandoners declared by EGAT according to Article 5 of this Regulation.

   2.2 The Bidder shall not be a Jointly Interested Bidder with other bidders as from the date of EGAT's issuance of the Invitation for Bid/Enquiry or the Invitation Letter/ Terms of Reference for the consultancy services, as the case may be, or shall not be a person who undertakes any action as an "Obstruction of Fair Price Competition" described in Article 1.1 – Definitions.

   2.3 The Bidder shall not have EGAT's personnel involve in his business as shareholder having voting right that can control his business, director, manager, officer, employee, agent or consultant except for the ones who are officially ordered by EGAT to act or participate therein.

3. Information to be Submitted with Bid

   The Bidder shall submit with his bid the documents according to Article 1.2 - Documentary List, including but not limited to, the following documents :-

   3.1 Where the Bidder is a juristic person :

   (a) ordinary partnership or limited partnership

   a certified copy of affidavit of incorporation, name list of managing partners, list of persons entrusted with controlling power (if any), as well as a certified copy of registration for value added tax (if any).

   (b) limited company or public limited company

   a certified copy of affidavit of incorporation, memorandum of association, name list of managing directors, list of persons entrusted with controlling power (if any) and name list of major shareholders, as well as a certified copy of registration for value added tax (if any).

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Such certified copy of affidavit of incorporation with the validity of not more than six (6) months from the date of certification to the opening date of Bid/Enquiry or the date of Invitation Letter/Terms of Reference in case of consultancy services, as the case may be, shall certify at least the following information :

(i) Type of a juristic person : an ordinary partnership, a limited partnership, a limited company, a public limited company,

(ii) Name according to (i),

(iii) Number and names of managing partners or managing directors,

(iv) Number and names of managing partners or managing directors authorized to act on behalf of the company,

(v) Amount of shareholders' equity or registered capital,

(vi) Authority of managing partner in case of partnership,

(vii) Location of head office,

(viii) Registration purposes,

(ix) Scope of work indicated in business permit license of a foreign juristic person who registers in Thailand,

(x) Other documents e.g. changes or additions to the above documents, branches (if any).

3.2 Where the Bidder is a natural person or a group of persons other than a juristic person :

a certified copy of :
- identity card ***or passport (if non-Thai national)***
- partnership agreement or contract (if any)
- partners' identity cards ***or passport (if non-Thai national)***
- registration required by Ministry of Commerce of Thailand
- registration for value added tax (if any)

3.3 Where the Bidder is a joint venture / consortium :

a certified copy of :
- association agreement
- identity card or passport (if non Thai national)
  (The participant in the joint venture or consortium is <u>not</u> a juristic person.)
- all documents specified in *Item 3.1* of Additional Regulation
  (The participant in the joint venture or consortium is a juristic person.)

3.4 Other documentary evidence as required per *Item 3, 6 or 8* of <u>Documentary List</u> (if any).

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4. Preliminary Examination

4.1 EGAT shall examine the qualification of all bidders to determine whether any bidder is a Jointly Interested Bidder as from the date of EGAT's issuance of the Invitation for Bid/Enquiry or the Invitation Letter/Terms of Reference for the consultancy services, as the case may be, and/or undertakes any action as an "Obstruction of Fair Price Competition" before or during the bid opening. If there is evidence showing that any bidder is a Jointly Interested Bidder or undertakes any action as an "Obstruction of Fair Price Competition", EGAT shall delete his name from the list of bidders and inform such bidder by written notice hereof.

4.2 The Bidder whose name is deleted according to Article 4.1, may, within fifteen (15) calendar days from the date of receipt of EGAT's written notice, appeal to EGAT, explaining reasons together with relevant documents for EGAT's reconsideration.

In case EGAT agrees with the objection of the appellant but considers that the cancellation of enquiry/bidding will be beneficial to EGAT, EGAT may, at its sole discretion, cancel such bid. In the event that the Bidder who undertakes any action as an "Obstruction of Fair Price Competition" does not appeal or, after his appeal, EGAT does not agree with his objection, such Bidder shall be regarded as a work abandoner.

EGAT's decision shall be notified to the appellant in writing and such decision shall be final and conclusive.

5. Reservation of the Right for Proposal and Others

In case any juristic person is regarded as a work abandoner by EGAT and such abandonment is caused by the manager, the managing partner, the managing director, the executive or the person authorized to manage the business of that juristic person, EGAT shall also include his name as a work abandoner.

In case any juristic person is regarded as a work abandoner by EGAT, such decision shall also be applied to other juristic persons of the same business where its manager, managing partner, managing director, executive, or person authorized to manage the business is the same person who is the manager, managing partner, managing director, executive, or person authorized to manage the business of the juristic person who is regarded as a work abandoner by EGAT as aforesaid.

In case any natural person is regarded as a work abandoner by EGAT, such decision shall also be applied to other juristic persons who submit the proposal and have such natural person as the manager, managing partner, managing director, executive or person authorized to manage the business of such juristic persons

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1.1 Definitions

These definitions shall apply to the Enquiry, Bid for Supply, Lease, Hire or Work, or Hire of Consultant by Way of Selection.

1.1.1 ***"Jointly Interested Bidder"*** means a natural person or juristic person who submits bid to EGAT for the supply of goods, lease, hire of work, or hire of consultant by way of selection, as the case may be, and who has an interest, either directly or indirectly, in the business of another natural person or juristic person whose bid is also submitted to EGAT in this bidding.

The interest, either direct or indirect, in another natural person or juristic person as aforesaid includes the relationship in the following manners :

(1) Management relationship, whereby the manager, the managing partner, the managing director, the executive or the person authorized to manage the business of a natural person or a juristic person has the power, or is able to exercise the power, in managing the business of the other one or more natural persons or juristic persons whose bids are also submitted to EGAT in this bidding.

(2) Capital relationship, whereby a partner in an ordinary partnership or a partner with unlimited liability in a limited partnership or a major shareholder in a limited company or a public limited company is a partner in the other one or more ordinary partnerships or limited partnerships, or is a major shareholder in the other one or more limited companies or public limited companies whose bids are also submitted to EGAT in this bidding.

(3) Cross relationship between (1) and (2), whereby the manager, managing partner, managing director, executive or person authorized to manage the business of a natural person or juristic person is a partner in the other one or more ordinary partnerships or limited partnerships, or is a major shareholder in the other one or more limited companies or public limited companies whose bids are also submitted to EGAT in this bidding, or *vice versa*.

"*Major shareholder*" means a shareholder who holds more than twenty five (25) percent of stake in such an enterprise or at another percentage determined by the Governor as he deems expedient for some types or sizes of enterprises.

Holding of position, being a partner or shareholding as aforesaid by the spouse or minor of the person in (1), (2) or (3) shall be deemed the holding of position, being a partner or shareholding by such person.

If any bidder uses the name of another person as the manager, managing partner, managing director, executive, partner or shareholder, but in which case he himself in fact exercises the power in management or he himself is the real partner or shareholder of the partnership or limited company or public limited company, as the case may be, and the related partnership or limited company or public limited company whose bid is also submitted to EGAT in this bidding, that bidder shall be deemed to have a relationship under (1), (2) or (3), as the case may be.

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1.1.2 ***"Obstruction of Fair Price Competition"*** means any act committed by a bidder or bidders causing hindrance or obstruction or impeding the opportunity for fair price competition in the tendering of bid to EGAT, whether done by collusion, or by granting, requesting, or agreeing to grant, demand, accept or agreeing to accept money or property or other benefit or by committing an act of violence or by threatening to commit an act of violence or presenting a false document or doing any act in bad faith, with the objective of acquiring benefit among the other bidders or in order to give benefit to any specific bidder so that such person will be entitled to enter into a contract with EGAT or in order to avoid fair price competition, or in order to take advantage to EGAT which not being usual business practices.

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1.2 Documentary List

This documentary list shall apply to the Enquiry, Bid for Supply, Lease, Hire of Work, or Hire of Consultant by Way of Selection.

		No. of page(s)	For EGAT only	
	Thai National Bidder			
[ ]	1. Where the Bidder is a natural person or a group of persons other than a juristic person			
	( ) (a) Natural Person		Yes	No
	- Certified copy of identity card	……	☐	☐
	( ) (b) Group of persons			
	- Certified copy of partnership agreement or contract (if any)	……	☐	☐
	- Certified copy of identity card(s) of partners or related documents according to Item 2 (a) and (b) of each participant of the group	……	☐	☐
[ ]	2. Where the Bidder is a juristic person			
	( ) (a) Ordinary partnership or limited partnership			
	- Certified copy of affidavit of incorporation	……	☐	☐
	- Name list of managing partners and list of persons entrusted with controlling power (if any) (Please fill in the form on page 10.)	……	☐	☐
	( ) (b) Limited company or public limited company			
	- Certified copy of affidavit of incorporation	……	☐	☐
	- Memorandum of Association	……	☐	☐
	- Name list of managing directors and list of persons entrusted with controlling power (if any) (Please fill in the form on page 10.)	……	☐	☐
	- Name list of major shareholders (Please fill in the form on page 11.)	……	☐	☐
[ ]	3. Other documents (if any)			
	( ) Certified copy of any other registration required by Ministry of Commerce of Thailand	……	☐	☐
	( ) Certified copy of registration for value added tax	……	☐	☐
	( ) …….	……	☐	☐
	( ) ……..	……	☐	☐

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	No. of page(s)	For EGAT only	
Non-Thai National Bidder			
[ ] 4. Where the Bidder is a natural person or a group of persons other than a juristic person			
( ) (a) Natural Person		Yes	No
- Certified copy of passport	……	☐	☐
( ) (b) Group of persons			
- Certified copy of partnership agreement or contract (if any)	……	☐	☐
- Certified copy of passport of partners or related documents according to Item 5 of each participant of the group	……	☐	☐
[ ] 5. Where the Bidder is a juristic person			
- Certified copy of affidavit of incorporation	……	☐	☐
- Name list of managing partners, directors, etc., as the case may be, and list of persons entrusted with controlling power (if any)	……	☐	☐
- Memorandum of Association (if any) (Please fill in the form on page 10.)	……	☐	☐
- Name list of major shareholders (if any) (Please fill in the form on page 11.)	……	☐	☐
[ ] 6. Other documents (if any)			
( ) ……	……	☐	☐
( ) ……	……	☐	☐
( ) ……	……	☐	☐
( ) ……			
( ) ……			

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	No. of page(s)	For EGAT only	
Thai and Non-Thai National Bidder			
[ ] 7. Where the Bidder is a joint venture / consortium		Yes	No
- Certified copy of association agreement	……	☐	☐
( ) (a) If participant of a joint venture / consortium is not a juristic person			
(i) Thai national			
- Certified copy of identity card	……	☐	☐
(ii) Non-Thai national			
- Certified copy of passport	……	☐	☐
( ) (b) If participant of a joint venture / consortium is a Thai-national juristic person			
( ) (i) Ordinary partnership or limited partnership			
- Certified copy of affidavit of incorporation	……	☐	☐
- Name list of managing partners, and list of persons entrusted with controlling power (if any) (Please fill in the form on page 10.)	……	☐	☐
( ) (ii) Limited company or public limited company			
- Certified copy of affidavit of incorporation	……	☐	☐
- Memorandum of Association	……	☐	☐
- Name list of managing directors, and list of persons entrusted with controlling power (if any) (Please fill in the form on page 10.)	……	☐	☐
- Name list of major shareholders (Please fill in the form on page 11.)	……	☐	☐

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	No. of page(s)	For EGAT only	
( ) (c) If member of a joint venture / consortium is a Non-Thai national juristic person		Yes	No
- Certified copy of affidavit of incorporation	……	☐	☐
- Name list of managing partners, directors, etc., as the case may be, and list of persons entrusted with controlling power (if any) (Please fill in the form on page 10.)	……	☐	☐
- Memorandum of Association (if any)	……	☐	☐
- Name list of major shareholders (if any) (Please fill in the form on page 11.)	……	☐	☐
[ ] 8. Other documents (if any)			
( ) Certified copy of any other registration required by Ministry of Commerce of Thailand	……	☐	☐
( ) Certified copy of registration for value added tax in Thailand	……	☐	☐
( ) ……	……	☐	☐
( ) ……	……	☐	☐
( ) ……	……	☐	☐

We hereby confirm that all documents detailed above are true and correct.

Signed

_____

(Name of Bidder)

stamp company seal (if any)

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List of Names of Manager / Managing Partner / Managing Director / Executive /
Person Who Is Authorized to Manage the Business
(Relationship in Management)

Bidder shall fill in and submit this form with his bid

Enquiry / Bid No :……..…. Enquiry / Bid Opening Date : ……...

Name of Company / Partnership / Juristic Person :……

No.	Name – Surname	Position	Name – Surname of Spouse	Name – Surname of Minor

We hereby confirm that all documents submitted are true and correct.

Signed _____
(Name of Bidder)

Stamp company seal (if any)

Remarks
1. The unused wordings shall be struck out.
2. Duplicate this page as necessary.

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List of Partner in Ordinary Partnership / Partner with Unlimited Liability in Limited Partnership /
Major Shareholder in Limited Company or Public Limited Company
(Relationship in Capital)

Bidder shall fill in and submit this form with his bid

Enquiry / Bid No. : ..... Enquiry / Bid Opening Date : .....

Name of Company / Partnership / Juristic Person : .....

Registered Capital : (currency) ..... Number of Share : ..... Price per Share : (currency) .....

No.	Name - Surname	Position	Number of Share (%) or Amount of Shareholder's Equity	Name – Surname of Spouse	Number of Share (%) or Amount of Shareholder's Equity	Name – Surname of Minor	Number of Share (%) or Amount of Shareholder's Equity

We hereby confirm that all documents submitted are true and correct.

Signed_____

(Name of Bidder)

Stamp company seal (if any)

Remarks

1. The unused wordings shall be struck out.
2. "Major Shareholder" means a shareholder who holds more than twenty-five (25) per cent of stake in an enterprise. The shareholding of spouse or minor of a person shall be regarded as being the shareholding of such person. In case of no major shareholder, please specify "No major shareholder" in the tabulation above.
3. Duplicate this page as necessary.
4. The Bidder shall submit List of Names of Manager/ Managing Partner/ Managing Director/ Executive/ Person Who Is Authorized to Manage the Business (Relationship in Management)/ and List of Partner in Ordinary Partnership/ Partner with Unlimited Liability in Limited Partnership/ Major Shareholder in Limited Company or Public Limited Company (Relationship in Capital) of the Bidder as per page 10-11 of this Additional Regulation.

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Important Information

for

Invitation to Bid No. GBA3-SC-05 and TIWS-SC-05

The purpose of this section is to inform the Bidders to **carefully study** the details of the revised terms and conditions in the bidding documents. The following provisions have been **recently revised** as stated hereunder:

Article A-5. Preparation and Delivery of Bids and Article B-1. Preparation of Bids

Details on how to prepare the proposal have been revised. Bids shall be prepared in accordance with the Instructions to Bidders contained in the Bidding Documents in one (1) original hard copy and one (1) electronic copy contained in USB flash drive.

Article A-5. Preparation and Delivery of Bids

Details of bid opening time and place shall be specified in the Tentative Schedule.

Article A-6. Availability of Bidding Documents

Availability of Bidding Documents has been changed from CD-ROM to electronic files for download via link provided by EGAT.

Channel of Documents Submission

For channel of document submission in the hereunder Articles, facsimile and telex has been replaced with letters submitted electronically or electronic mails (E-mails).

- Article B-1. Preparation of Bids
- Article B-4. Validity of Bids
- Article D-9. Notices
- Article E-17. Documents Required for Each Shipment
- Article F-8. Payment

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Article B-2. Bid Prices

For Source of Supply and Service b., Prices for Equipment manufactured outside Thailand (imported Equipment) shall be firm, stated both on FOB Port of Shipment/Vessel and CFR Thai Port basis, and quoted in Thai baht, US dollar, euro, Japanese yen, renminbi (Chinese yuan), or in the Bidder's or Manufacturer's home currency only if his currency trading is prevailed at the time of bidding in any international market other than in Bidder's or Manufacturer's home country.

The following paragraph has also been added :-

"Prices for the following Equipment manufactured outside Thailand which was imported before the bid opening date shall be firm ex-works and quoted in Thai baht, provided that the Bidder shall submit any document(s) evidencing the importation date of such Equipment:

- Power Fuse
- Stationary Battery and Battery Charger
- Insulator for substation
- Cable Termination
- Compression Connector and Miscellaneous Hardware
- Bus Fittings
- Grounding Material
- Substation Miscellaneous"

Article E-16. Shipment

The Maritime Promotion Bureau has been updated to the Maritime Promotion Division and its contact information has also been updated.

Article F-8. Payment

After each payment is made, the Contractor or beneficiary shall issue and submit the receipt to EGAT as detailed in the paragraph added at the end of this article.

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DATA SHEET

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DATA SHEET

for

Invitation to Bid No. GBA3-SC-05 and TIWS-SC-05

This section consists of provisions that are specific to each procurement and supplement the information or requirements included in bidding documents.

Article B-3. Bid Security

The amount of bid security shall be USD 187,940.- or THB 6,150,000.-.

Article B-4. Validity of Bids

The validity of the bid shall be for one hundred and fifty (150) Days from the date specified for opening of bid.

Article B-8. Information to be Submitted with Bid

Item m. is not applicable.

Article B-12. Evaluation and Comparison of Bids

The evaluation of bid prices shall be on a combination of all schedules basis.

Article E-29. Failure to Meet Requirements and F-10. Maintenance Guarantee

Maintenance Guarantee Period

- For all Equipment except Shunt Reactor, 200 MVA 230 kV and above Power Transformer and 500 kV System Voltage Equipment

  The Contractor shall guarantee the proper functioning of Equipment for a period of one (1) Year except the following Equipment the guarantee period of which shall be as follows :

Equipment	Period of Guarantee (Year)
- Fault Recording System	2
- Control and Protection System	2

- For Shunt Reactor, 200 MVA 230 kV and above Power Transformer and 500 kV System Voltage Equipment

  The Contractor shall guarantee the proper functioning of Equipment for a period of five (5) Years.

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Defective Equipment to be replaced with the whole new set

For GIS, Power Transformer, Power Circuit Breaker, Shunt Reactor, in case EGAT, at its sole discretion, requires the Contractor to replace any defected Equipment, the Contractor shall replace the Equipment with the whole new set as specified in Failure to Meet Requirements in section E and Maintenance Guarantee in section F.

Article F-9. Liquidated Damages for Late Delivery of Equipment

The Liquidated Damages shall be at the rate of one-tenth of one (0.10) per cent of the price of each complete item of Equipment not timely delivered for each Day of delay. This sum is payable regardless of the actual loss and/or damages incurred.

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SECTION A

INVITATION TO BID

E L E C T R I C I T Y G E N E R A T I N G A U T H O R I T Y O F T H A I L A N D
Nonthaburi
Thailand

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

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A-1. Invitation

The Electricity Generating Authority of Thailand (EGAT) hereby invites sealed bids for furnishing and delivering of Shunt Capacitor Bank under Bulk Power Supply for The Greater Bangkok and Vicinity Area Phase 3 and Transmission System Improvement Project in Western and Southern Regions to Enhance System Security hereinafter called Equipment in accordance with the terms, conditions and Specifications described in these Bidding Documents.

A-2. Eligibility of Bidders: General Requirements

All Bidders shall meet the following requirements; failure to so comply shall constitute sufficient ground for rejection.

a. The Bidder shall be a partnership, firm or company, either alone or in joint venture or in consortium.

b. The Bidder must have purchased the bidding documents from EGAT. For a joint venture or a consortium, only one (1) member of the joint venture or consortium is required to purchase the bidding documents.

   In case the Bidder's name is not exactly the same as the purchaser's name, the purchaser shall notify EGAT of the name of the Bidder in writing prior to the bid opening time.

c. The Bidder shall be well-established and maintain a permanent place of business. For a joint venture or consortium, all members of the joint venture or consortium are required to meet this qualification.

d. The Bidder shall not be named in the List of Work Abandoners published by the Permanent Secretary, Ministry of Finance, and/or in the Debarment List and/or in the List of Work Abandoners declared by EGAT.

e. For the Bidder who changes name before submitting the bid, his experience records in previous name shall be considered as the experience records of the Bidder.

f. The Bidder shall not be a Jointly Interested Bidder with other Bidders as from the date of EGAT's issuance of this invitation to bid, or shall not be a person who undertakes any action as an "Obstruction of Fair Price Competition" as defined in Additional Regulation for this invitation.

g. The Bidder shall not either be EGAT's consultant or involve in EGAT's consultancy company under this invitation, or have EGAT's personnel involved in his business as shareholder having voting right that can control his business, director, manager, officer, employee, agent or consultant except the ones who are officially ordered by EGAT to act or participate therein.

h. The Bidder shall not be the person who is privileged or protected not to be taken any legal proceeding under Thai court; provided that such Bidder's government declares that such special privilege is waived.

i. In case of a joint venture or consortium, the Bidder shall carry out all the provision of the Equipment and all Work under such formation from the time of bidding until the fulfillment of the Contract and the parties to the joint venture or the consortium shall accept joint and several liability for performing all obligations under the bid and the Contract.

j. The Bidder shall not propose to supply the Equipment from the country under the state of war whether declared or not.

k. The Bidder shall have adequate fund to meet financial obligations incidental to this Contract.

l. The Bidder shall submit documentary evidence established in accordance with Article B-8. Information to be Submitted with Bid to demonstrate the Bidder's sufficient eligibility to bid and qualification to perform the Contract.

A-3. Eligibility of Bidders: Technical Requirements

I. All Bidders shall meet the following requirements; failure to so comply shall constitute sufficient ground for rejection.

a. The Bidder shall manufacture or supply the Equipment or Work as required under this invitation to bid.

b. If the Bidder is a new company formed by acquisition of or merger with other companies or business units before submitting the Bid, the experience records of any

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of such previous companies or business units that meet the requirements set forth herein are acceptable as the experience records of the Bidder.

c. The Bidder shall have no just or proper claims pending against the Bidder with respect to breach in the performance of contract on other similar works awarded by EGAT. If the Bidder is a new company formed by acquisition of or merger with other companies or business units, the pending claim of any of such previous companies or business units shall be considered pending claim of the Bidder.

d. The Bidder shall have sufficient capacity to carry out the Work.

e. The Bidder shall have designed and supplied at least 3 sets of capacitor bank having the similar or greater capacity and voltage rating which have been successfully in service for at least three (3) consecutive years.

f. The Bidder shall propose the Equipment manufactured by the qualified manufacturers who shall fulfill the following requirements:

1. Being well-established and maintaining a permanent place of business.

2. The manufacturer shall have the experience records that meet the requirements set forth herein.

   Reference records of either parent or affiliated companies shall not be considered as the records of such manufacturer.

3. If the Manufacturer is a new company formed by acquisition of or merger with other companies or business units, and any of such previous companies or business units has the experience records that meet the requirements set forth herein, such experience records are acceptable as the experience records of the new company, provided that each item of the equipment to be supplied under this bid shall be manufactured from the same source of supply as indicated in each of such relevant supply records as described in Item f.5 below. Otherwise, it shall not be acceptable and shall be sufficient grounds for rejection.

   For the avoidance of doubt, it is not allowed to combine the experience records of the previous companies or business units in order to meet the experience requirements.

4. Regularly manufacturing of Equipment of the type and ratings proposed.

5. For Power Circuit Breaker, Vacuum Switch, Disconnecting Switch, Instrument Transformer, Current Limiting Reactor, Surge Arrester and Capacitor Unit. These Equipment shall be manufactured by the qualified manufacturers who shall fulfill the following requirements:

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5.1. Having minimum three (3) consecutive years of successful operation/use in EGAT's system or in overseas country (not his own country) and

5.1.1 at least 3 three phase sets having the same or similar ratings and features as specified:

Power Circuit Breaker, Vacuum Switch, Disconnecting Switch, Instrument Transformer, Current Limiting Reactor and Surge Arrester.

5.1.2 Capacitor Unit, at least 1,000 units having the same or similar ratings and features as specified.

In case that supply of Equipment of the type and ratings proposed fulfills the requirement, the manufacturer may propose a newly developed / modified type of such equipment with successful operation/use record of minimum one (1) year in overseas country (not his own country) and at least 3 three phase sets for article 5.1.1 and 1,000 units for article 5.1.2. The detailed information of the development / modification shall be submitted with his proposal. EGAT, however, reserves the right and will make its own judgment whether or not to consider / accept the proposed developed / modified type.

Supply records of the higher rating Equipment shall not be accepted if the Bidder does not propose such higher rating Equipment in his bid.

6. Having a past design test record of the Equipment as proposed, if specified in EGAT's specification. The past design test record shall be performed according to the test specified in EGAT's specification.

7. Proposing the manufacturer who has no just or proper claims pending against Equipment on other similar works.

In case the manufacturer is a new company formed by acquisition or merger with other companies or business units, the pending claim of any of such previous companies or business units shall be considered pending claim of the manufacturer.

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II. All Bidders should preferably meet the following requirements; failure to so comply may constitute sufficient ground for rejection.

a. Proposing local manufacturer for the following Equipment:

Control Cabinet, Capacitor Rack, Central Terminal Box, Power and Control cable, Lighting Cable, Copper Ground Wire, Steel Supporting Structure and Skid Steel Base, Disconnecting Switch Operating Platform, Bus Pole Structure, Stainless Steel Casing, 115 kV and below XLPE Power Cable, Aluminum Tube, ***Aluminum Conductor***.

A-4. Joint Venture or Consortium

In the event that the successful Bidder is a joint venture or a consortium formed of two or more companies, EGAT requires that the parties to the joint venture or the consortium accept joint and several liability for all obligations under the Contract.

A-5. Preparation and Delivery of Bids

Bids shall be prepared in accordance with the Instructions to Bidders contained in the Bidding Documents in one (1) original ***hard copy and one (1) electronic copy contained in USB flash drive***, in English, on the bid forms included for this purpose and shall be accompanied with a bid security as required under Article B-3. Bid Security in a separate sealed envelope.

For preparation of original hard copy, each page of the original hard copy shall be marked with the volume number and the page number in the lower right-hand corner, for example, Volume 1 of 10 and Page 1 of 100.

For preparation of electronic copy, each volume of the signed original hard copy shall be scanned into one (1) PDF file and each PDF file shall be named according to the volume number.

The USB flash drive shall contain electronic files of the proposal in the following formats :-

- PDF files of all pages of each volume of the proposal, and

- Excel files of filled-in Proposal Data, and

- Excel files of filled-in Price Schedule

DRAFT

In the event of any discrepancy between the original hard copy and the electronic file(s), the original hard copy shall govern.

The envelope of the bids will be marked in capital letters in the lower left-hand corner as follows :

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

and shall be addressed and delivered to :

International Procurement Department - Transmission Segment
Procurement and Inventory Management Division
Electricity Generating Authority of Thailand
Bangkruai, Nonthaburi 11130
Thailand

on or before 10:00 a.m., Bangkok Standard Time, *see Tentative Schedule*

If the envelope(s) is not sealed, marked and addressed as required above, EGAT will assume no responsibility for the bid misplacement or premature opening.

Bids will be opened publicly at the ***place and*** time specified ***in Tentative Schedule.***

Bids received after the time stipulated herein shall be rejected and returned unopened.

A-6. Availability of Bidding Documents

The Bidding Documents are available for examination ***and online purchase at http://www4.egat.co.th/fprocurement/biddingeng/*** and can be obtained ***by downloading via link provided by EGAT*** upon payment to EGAT, non-refundable, in the amount of USD 100.- or Baht 3,000.- . These prices include the value added tax.

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SECTION B

INSTRUCTIONS TO BIDDERS

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INSTRUCTIONS TO BIDDERS

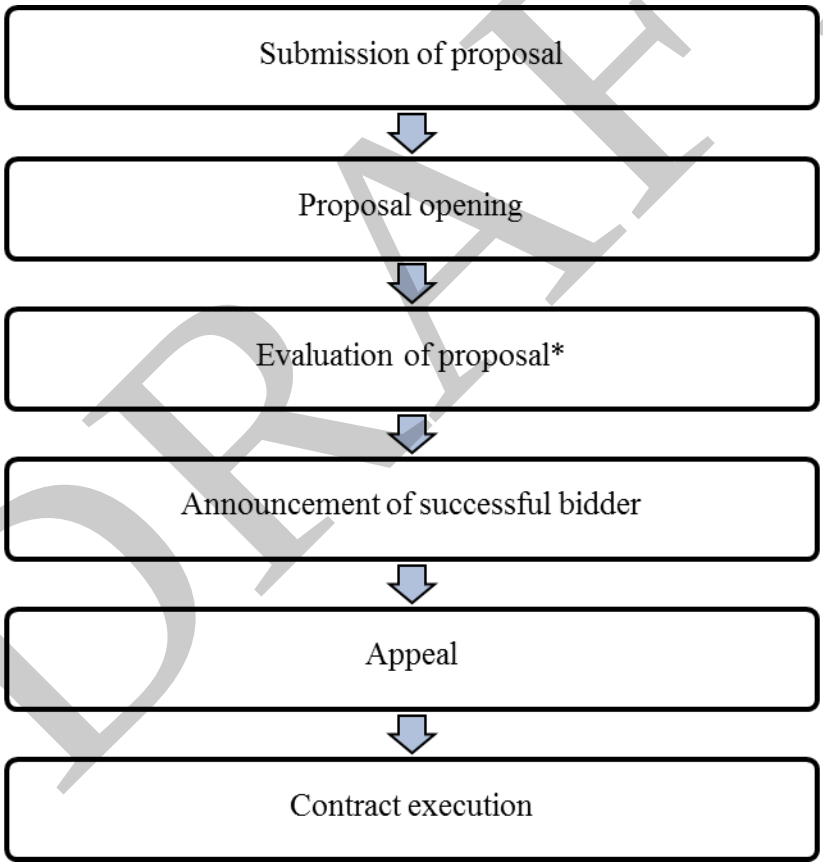
Overview of the Procurement Process

Bid prices and the Contract Price shall include value added tax (VAT) imposed under the law of Thailand. The medium cost announced by EGAT is inclusive of VAT and other relevant expenses.

The amounts of performance security, maintenance security, and liquidated damages shall also be based on the Contract Price which is inclusive of VAT (if any).

For evaluation and comparison of Bids, the bid price shall be evaluated according to the conditions specified in the bidding document.

The procurement process is summarized in the following diagram.



*Remarks

1. The Bidder shall be deemed to have carefully examined all of the terms, conditions and Specifications of the Bidding Documents.
2. EGAT will take into consideration the conformity of the bid to the requirements of the Bidding Documents as well as the suitability for the purpose intended.
3. EGAT will not be bound to accept the bid with the lowest indicated cost. EGAT reserves the right to accept the bid which in its judgement is the lowest evaluated bid.

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B-1. Preparation of Bids

a. Bids shall be prepared in English, in one (1) original ***hard copy clearly marked "Original" and one (1) electronic copy contained in USB flash drive,*** submitted at the place and time specified for receipt of bids.

In the event of any discrepancy between ***the original hard copy and the electronic copy, the original hard copy*** shall govern.

For Proposal Data, Bidder shall fill in information of Proposal Data in Excel files contained in the Bidding Documents, and submit one (1) original hard copy with the PDF and Excel files in USB flash drive to EGAT at the same time of bid submission.

For price quotation, Bidder ***shall*** fill ***in*** bid prices in an Excel files of Price Schedules contained in the Bidding Documents in accordance with Price Quotation Instructions in Section C, Part 1: Price Proposal, and submit one (1) original ***hard copy with the PDF and Excel files in USB flash drive*** to EGAT at the same time of bid submission.

VAT at the prevailing rate shall be filled automatically in the Summary of Bid Price of the price schedule in the Excel file subject to Article B-2. Bid Prices.

However, in case Bidder is a consortium formed of two or more companies, Bidder must also submit one (1) original hard copy ***with the PDF and Excel files*** of price schedules of the Work performed by each member of the consortium in addition to hard copies ***with the PDF and Excel files*** of the total bid price as specified above.

If any discrepancy between the bid prices of the Work performed by each member of the consortium and the bid prices of the Bidder occurs, the bid prices of the Bidder shall govern and the bid prices of the Work performed by each member of the consortium shall be adjusted accordingly.

In the event of discrepancy between the original hard copy ***and the PDF or Excel files*** submitted, the original hard copy shall govern**.**

b. Bidder shall not submit more than two (2) proposals and the proposal(s) to be submitted shall conform to the specifications. In case of any deviation from the specifications, Bidder shall follow the provisions under Article B-9. Deviations from Specifications.

c. The "Original" shall be prepared on the bid forms included and made a part of the Bidding Documents, which shall be submitted with all applicable blanks in the bid forms properly filled in, and shall be manually signed in ink by a person or

DRAFT

persons duly authorized. The letter of authorization shall be indicated by written power-of-attorney accompanying the bid.

All pages of the bid, except for unamended printed literature, shall be initialled by the person or persons signing the bid.

d. The bid shall contain no interlineations, erasures or overwriting except as necessary to correct errors made by the Bidder, in which case such corrections shall be initialled by the person or persons signing the bid.

e. Modification by letter or ***by letter submitted electronically or by electronic mail (E-mail) to*** bids already submitted will be considered if received prior to the time fixed for the receipt of bids. Confirmation by letter of any modification ***evidenced*** by post mark or by ***letter submitted electronically or by electronic mail (E-mail)*** should be sent to EGAT not later than the deadline for submission of Bids.

f. No Bidder will be permitted to alter his bid after the bids have been opened, but clarifications not changing the substance of the bid therein may be accepted.

g. Bidder may quote for any schedule or all schedules as called for, but shall quote for all items of the schedule(s) proposed. Consideration will be made as stipulated in Article B-12. Evaluation and Comparison of Bids.

h. Any price discount to be offered shall be clearly stated in the Discount Form accompanied with the Bid to be submitted on the bid opening date specified herein.

B-2. Bid Prices

Currency

Bid prices as shown in Article C-1. Price Schedule shall be firm, not subject to adjustment and payable in the currencies as follows :

a. The bid price shall be quoted in Thai baht, US dollar, euro, Japanese yen, renminbi (Chinese yuan), or in the Bidder's or Manufacturer's home currency only if his currency trading is prevailed at the time of bidding in any international market other than in Bidder's or Manufacturer's home country.

If the currencies quoted by the Bidder do not conform to the requirement set forth herein, EGAT reserves the right to convert the bid price to US dollars by using the exchange rate on the Bloomberg screen which is announced at 10.00 a.m. (Bangkok Time) on the bid opening date. Such converted bid price in US dollars shall be treated as the Bidder's proposed bid price. In such case the Contract Price for such portion under the Contract shall be made in US dollars.

DRAFT

Subject to paragraph a. above, in case the Bidder expects to incur a portion of its expenditures in the performance of the Contract in more than one currency and wishes to be paid accordingly, the bid price shall be expressed in different currencies and the respective amount in each currency together making up the total price.

b. Local expenditures shall be quoted in Thai Baht.

c. Payments will be made in the currency or currencies in which the bid prices have been stated.

Source of Supply and Service

a. Prices for Equipment manufactured in Thailand shall be firm ex-works prices and quoted in Thai Baht. Any import duty and taxes (value added tax included) assessed by the Government of Thailand at the port of entry on imported raw materials or components shall be paid by the Contractor and included in these ex-works prices.

b. Prices for Equipment manufactured outside Thailand (imported Equipment) shall be firm, stated both on FOB Port of Shipment/Vessel and CFR Thai Port basis, and quoted in currencies specified above. Any import duty, excise tax (if any) and value added tax to be assessed by the Government of Thailand at the port of entry shall not be included in the quoted bid prices.

Prices for the following Equipment manufactured outside Thailand which was imported before the bid opening date shall be firm ex-works and quoted in Thai baht, provided that the Bidder shall submit any document(s) evidencing the importation date of such Equipment:

- ***Power Fuse***
- ***Stationary Battery and Battery Charger***
- ***Insulator for substation***
- ***Cable Termination***
- ***Compression Connector and Miscellaneous Hardware***
- ***Bus Fittings***
- ***Grounding Material***
- ***Substation Miscellaneous***

c. Prices for services including cost of installation supervisor (if any) shall be firm.

d. All expenses incurred for the Work specified in Article F-1. Scope of Work shall be included in the quoted Bid Prices.

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Price Schedule

The Bidder shall enter a unit price, an amount, or a lump sum price, as required, for every item listed in the price schedule. If the unit price as entered does not conform to the amount entered for the same item, the unit price shall govern. If the sum of the amount entered for individual items does not conform to the total amount entered for these amounts under total bid prices, then the sum of the amount entered for the individual items shall govern.

Where quantity and total price only are required, the unit price shall be taken as the stated total price divided by the quantity specified.

Except for foreign supply, VAT at the prevailing rate shall be filled automatically in the Summary of Bid Price of the price schedule in the Excel file. However, the Contract Price shall include VAT only for the portion of Work which is subject to VAT.

B-3. Bid Security

The original of the bid submitted shall be accompanied with a bid security in the form of a cash deposit, or a cashier cheque issued by a local bank, or a bank guarantee or a letter of guarantee issued only by a local bank or an acceptable financial institution in Thailand, or by a foreign bank counter-guaranteed by a local bank as primary obligor. In case of a cash deposit or a cashier cheque, only Thai baht can be made.

The bid security shall be in a form as per specimen attached or in any other form with essential content in accordance with the specimen, and made payable to EGAT in the amount as specified in Data Sheet. Any bid not being accompanied with bid security shall be rejected. The bid security shall remain in force up to and including ninety (90) Days after the expiry date of the bid validity.

The bid security shall be forfeited in favor of EGAT if :

a. The Bidder withdraws his bid after the bid is opened; or

b. The successful Bidder fails for any reason to execute the Contract or to furnish a performance security.

The Bidder may, upon EGAT's request to extend the bid security when it has expired, refuse to do so without forfeiting the bid security. A Bidder granting the request will be neither required nor permitted to modify his bids.

The bid security of unsuccessful Bidder(s) will be returned as decided by EGAT or within thirty (30) Days following EGAT’s acceptance of the successful Bidder.

The bid security of the successful Bidder will be returned upon execution of the Contract and after the performance security furnished has been accepted by EGAT.

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B-4. Validity of Bids

The validity of the bid shall be as specified in Data Sheet.

In the event EGAT requires the validity period to be extended, EGAT may in writing or by ***letter submitted electronically or by electronic mail (E-mail)*** so notify the Bidders at least fourteen (14) Days prior to the expiry date of the validity period, in which event any Bidder not agreeing to such request for extension may withdraw his bid by so advising EGAT in writing or by ***letter submitted electronically or by electronic mail (E-mail)*** prior to the expiry date of the original validity period. If the advice of withdrawal shall not have been received by EGAT prior to the said date, the extension shall be deemed to have been accepted by the Bidder, and the Bidder shall be required to extend the effective period of the bid security accordingly.

B-5. Delivery of Bids

Where bids are submitted by mail, the hour and date of receipt of the bid will be taken as that certified by EGAT. For all bids delivered directly, a receipt will be furnished to the Bidder indicating the place, hour, and date of delivery. Late bids will be returned unopened.

B-6. Withdrawal of Bids

Bids may be withdrawn only on written requests which are received by EGAT prior to the time fixed for the receipt of the bids. Negligence on the part of the Bidder in preparing his bid confers no right for the withdrawal of the bid after it has been opened. Whenever a bid has been withdrawn, it will be returned unopened to the Bidder.

B-7. Interpretation of Bidding Documents before Bid Opening

If a prospective Bidder is in doubt about the true meaning of any part of the Bidding Documents, the Bidder may submit to EGAT a written request for a reply or an interpretation; provided that sufficient time is allowed for a reply to reach the prospective Bidder prior to the date specified for bid opening. An interpretation will be given in the form of a Supplemental Notice furnished to all prospective Bidders. Receipt of all Supplemental Notices shall be acknowledged by each prospective Bidder on the Proposal. Oral interpretation of the Bidding Documents will not be binding.

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B-8. Information to be Submitted with Bid

Each Bidder shall submit with his bid the following documents, data and information in English language in addition to any other information called for elsewhere in the Bidding Documents in order to enable EGAT to fully evaluate the Proposal of the Bidder :

a. Name of manufacturer and country of origin and type or model of Equipment he proposes to furnish.

b. Data, drawings, catalogue and descriptive materials which will show equipment arrangement, general dimensions, principles of operation, extent of factory assembly, and the materials from which parts are made.

c. Sufficient references describing the technical experience of the manufacturers, including lists of the Equipment supplied and installed overseas. If possible, certificates issued by the user and/or consulting engineers supporting the said work and record of commercial operation in good condition should also be submitted.

d. Copies of Auditor's certified balance sheet of the Bidder for the past three (3) consecutive years.

e. In case the local manufactured Equipment is proposed, the sufficient documentary evidence, if any, showing that the manufacturers have been acknowledged for producing standard product by the Thai Industrial Standard Institute (TISI), Ministry of Industry, or registered with TISI, or ISO 9000 certified by the National Accreditation Council of Thailand (NAC) or obtained the privilege from the Board of Investment or accepted by EGAT for manufacture of such Equipment, is required to be submitted with the Bid.

f. Sufficient evidence documents clearly demonstrating that a firm/company who changes its name, merges with, or acquires other company/companies, or forms a new company by merging its business unit with those of other companies, and the experience records of the new company clearly demonstrating that it has sufficient evidence of running the business as before.

g. A statement of proposed minor deviations from the Specifications along with complete specifications and all necessary descriptive literature for any proposed alternative Equipment or procedure, as required under Article B-9. Deviations from Specifications.

h. Where Proposal Data Forms are provided, the Bidder shall enter all information as directed.

DRAFT

i. Where the Specifications provide for submission of a sample or samples, the Bidder shall submit same together with his bid.

j. Joint Venture/Consortium Agreement with a statement that each member of a joint venture/consortium will be jointly and severally responsible and liable for the complete execution of the work (in case the Bidder is a joint venture or consortium).

k. Confirmation Form of not being a Jointly Interested Bidder with other Bidders and not being a person who undertakes any actions as an Obstruction of Fair Price Competition, and Registration/Non-registration with the Revenue Department as a VAT registrant.

If the Bidder has registered as a VAT registrant, he shall submit EGAT an evidence of VAT registration. On the contrary, if the Bidder is not registered as a VAT registrant, he shall inform EGAT whether he will register as a VAT registrant or not.

In case the Bidder is a consortium, each member of the consortium shall fill in the Confirmation Form provided for consortium Bidders.

l. Filled-in Documentary List and documents required according to Additional Regulation.

m. A statement indicating that the parent manufacturer shall certify and be responsible for the design, production process and quality control. This information is required only for the Equipment specified in Data Sheet.

Should the Bidder fail to submit any of the document described above and neglect to submit the same to EGAT within the time as specified by EGAT, such failure shall be sufficient reason for rejection of his bid.

Verbal statements made by the Bidder at any time regarding quality, quantity, or arrangement of Equipment will not be considered.

If alternative Equipment is indicated in the bid, it shall be understood that EGAT will have the option of selecting any one of the alternates so indicated and such selection shall not be a cause for extra compensation or extension of time.

In case the Bidder proposes alternative Equipment, with the condition to supply any one of the alternates so indicated at his option, such bid will be considered conditional and may be considered sufficient reasons for rejection.

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B-9. Deviations from Specifications

Unless otherwise provided in the Specifications, the quality of Equipment and workmanship shall comply in all respects with the Standards required under the bidding documents.

If the Bidder proposes any minor deviations from the specifications, he shall submit a statement of each proposed deviation referenced to the particular Article of these specifications, details on the design drawings or article, paragraph and section of referenced standards or specifications. Full details of all minor deviations together with confirmation shall be submitted with the bid in a form provided in Section C. The Bidder shall submit, with his bid, copies of the standards or specifications proposed for his deviations. In case there is no statement in the form provided in Section C in the Bidder's proposal on the proposed deviations, the bid shall be regarded by EGAT as conforming in all respects to the terms and conditions and Specifications as stated in the bidding documents at no additional cost to the bid price.

Notwithstanding the foregoing, it is at EGAT's sole discretion in determining whether any of such proposed deviations is acceptable and in determining whether it is minor or major deviation.

B-10. Rejection of Bids

EGAT reserves the right not to accept the lowest evaluated bid.

Bids shall be strictly based on the Specifications and terms and conditions in the Bidding Documents. Should any bid fail to comply with the terms and conditions stipulated in these Bidding Documents, especially those under Article pertaining to payment or be incomplete, conditional or obscure, or contain additions not called for, or irregularities of any kind, it will be liable to rejection.

EGAT also reserves the right to reject any or all bids submitted without giving reason or to reject the bid from any Bidder who fails to satisfy EGAT that the bid complies with the terms and conditions stipulated in these bidding documents without any non-compliance which is deemed substantial and advantageous over other Bidders.

B-11. Delivery Time

Delivery time required is indicated for each respective Price Schedule in the Proposal section of the Bidding Documents, and shall be carefully observed. However, no preference will be given in the bid evaluation for earlier delivery than the stipulated delivery period.

All bids specifying delivery time later than those indicated may be rejected.

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B-12. Evaluation and Comparison of Bids

Bid prices pursuant to Article B-2. Bid Prices will be evaluated as follows :

1. The evaluation of bid prices shall be specified in Data Sheet.

2. Bid prices will be converted into Thai Baht at the selling exchange rates, published by the Bank of Thailand, www.bot.or.th between Baht and other currencies on the bid opening date.

3. The rate of import duty prevailed on the bid opening date will be used for the purpose of bid evaluation of CFR Thai Port Price.

4. The prices to be used for evaluation and comparison purpose shall be as follows :

    1. Ex-works price including VAT for the final sale direct to EGAT for locally manufactured Equipment

    2. CFR Thai Port of Equipment to be imported plus the calculated insurance premium of 0.072% of [CFR price+10% (CFR price)], import duty, excise tax (if any), value added tax to be assessed by the Thai Government at the port of entry for imported Equipment , and 0.6 % of CFR price for customs clearance

        The rate of import duty to be used for price comparison shall be as follows:

        a) For Equipment consisting of separate components which are intended to contribute together as a functional unit and imported under partial import entry - using a normal single tariff rate published in the Customs Tariff Decree for such Equipment

        b) For other Equipment and spare parts

            i) In case any imported Equipment and spare part is proposed from one (1) country of origin for the same item:

            - Country of Origin Under Free Trade Agreement (FTA) – using lower comparing rate between the FTA rate and the normal rate published in the Customs Tariff Decree;

            - Country of Origin Under Non FTA – using a normal rate published in the Customs Tariff Decree.

            ii) In case any imported Equipment and spare part is proposed from different countries of origin for the same item, a normal rate published in the Customs Tariff Decree for such Equipment and spare part will be used for price comparison.

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3. Cost of local transportation including VAT, if any

4. Cost of installation supervisor including VAT, if any

5. Guaranteed losses of Equipment, if any, at the rate as stipulated in the Proposal Data.

Price for optional items, if any, will not be taken into consideration; however, Bidders shall also quote the prices thereof as required.

B-13. Acceptance of Bids

EGAT will not be bound to accept the bid with the lowest indicated cost. EGAT reserves the right to accept the bid which in its judgement is the lowest evaluated bid. In making its selection, EGAT will take into consideration the conformity of the bid to the requirements of the Bidding Documents and Specifications, guaranteed delivery time, the suitability for the purpose intended and whenever applicable, compensating factors will be applied to deviation or departures from Specifications. EGAT will also take into consideration whether the Bidder's experience, organization, facilities and financial resources will assure the successful carrying out of the Work under the Contract within the time specified.

B-14. Appeal

Disqualified or unsuccessful Bidders who see that their disqualification or failure are due to EGAT's non-compliance with EGAT's procurement regulations may appeal to EGAT within fifteen (15) Days from the date of receipt or announcement, whichever comes first, of EGAT's final evaluation result. An appeal shall be made in writing and clearly state the cause of appeal and argument with referred facts or regulations and related documents. Appealing does not constitute a ground for suspending the ongoing procurement process unless EGAT's Governor agrees otherwise.

The Contract or Purchase Order shall not be executed until the period of appeal has ended and there is no appeal. In the event there is an appeal during such period, the Contract or Purchase Order shall not be executed unless EGAT's Governor concurs.

Decision of EGAT's Governor is final and conclusive.

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B-15. Award of Contract

The Contract will be awarded as soon as practicable after opening of the bids, to the Bidder with the lowest evaluated bid. EGAT reserves the right to award the Contract on the basis of standards and specifications as proposed by the Bidder, if in the opinion of EGAT, they are considered acceptable.

At the time of execution of the Contract, the successful Bidder shall furnish the performance security in accordance with the conditions of Contract in the specimen of performance security provided in the bidding documents.

Failure to comply with the condition as expressed in the specimen of performance security will lead to withdrawal of award and cancellation of Contract, and in this respect EGAT reserves the right to award the Contract to the Bidder with the next lowest evaluated substantially responsive bid and the Bidder who defaults shall have his bid security forfeited in favor of EGAT.

After EGAT notifies the successful Bidder that his bid has been accepted, EGAT will send the Bidder the Contract Documents incorporating all agreements between the parties not later than ninety (90) Days after confirmation of Letter of Award of Contract.

Promptly but not later than fifteen (15) Days after receipt of the Contract, the successful Bidder shall sign and date the Contract and return it to EGAT.

B-16. Bidder's Responsibility

The Bidder shall be deemed to have carefully examined all of the terms, conditions and Specifications of this Invitation to Bid, and also to have fully informed himself as to all conditions, local or otherwise, affecting the carrying out of the Work of the Contract, and to have formulated an estimate of the facilities available and needed.

The Bidder shall also be liable to any rules and regulations as well as Acts enforced in the Kingdom of Thailand. Failure to do so will be at the Bidder's risk.

B-17. Supplemental Notices

Supplemental Notices to the Bidding Documents may be issued prior to the date of opening of bids to clarify the Bidding Documents or to reflect modifications in the design or Contract terms. Each supplemental notice issued will be distributed to each person or organization to whom the Bidding Documents have been issued. The recipient shall acknowledge receipt of each supplemental notice by signing and returning in a reasonable time the receipt form distributed with the supplemental notice. All supplemental notices issued shall become a part of the Contract Documents.

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B-18. Cost of Bidding

Bidders will not be reimbursed for any expenses they may incur in preparing and submitting their bids.

B-19. Cancellation of Bid

EGAT reserves the right not to accept any quantity or item or schedule or package, or to cancel the bid without purchasing any item. Bidders shall not be entitled to claim EGAT for any losses and/or damages in this connection. EGAT also reserves the right to cancel the bid should there be any reasonable grounds that bidder is not in good faith in submitting bid such as submitting false documents.

In case of bid cancellation, EGAT will not be responsible for any losses and/or damages and will not refund payment of Bidding Documents.

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SPECIMEN OF BID SECURITY

Whereas.....(hereinafter called "the Bidder") has submitted his bid dated.....for.....(hereinafter called "the Bid") under Invitation to Bid No.....KNOW ALL MEN by these presents that WE.....of.....having our registered office at.....(hereinafter called "the Guarantor") are bound unto Electricity Generating Authority of Thailand (hereinafter called "EGAT") in the sum of..... (in words : .....) for which payment well and truly to be made to EGAT, the Guarantor binds itself, its successors and assigns by these presents. Sealed with the Common Seal of the said Bank this.....(date).....day of…….(month)……., ……..(year).....

THE CONDITIONS of this obligation are :

1. If the Bidder withdraws his bid during the period of bid validity specified in the Bidding Documents; or

2. If the Bidder, having been notified of the acceptance of his bid by EGAT during the period of bid validity;

   (a) fails or refuses to execute the Contract, if required; or

   (b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders;

We, the Guarantor, unconditionally undertake to pay to EGAT as the primary obligor, up to the above amount upon receipt of its first written demand, without EGAT having to substantiate its demand.

This guarantee will remain in force up to and including ninety (90) Days after the expiry date of the bid validity.

_____

(Signature of the Bank)

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SECTION C

PROPOSAL

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

PROPOSAL

FOR

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

C-1. Price Schedule

The undersigned Bidder, having carefully examined the Bidding Documents, hereby offers and proposes to perform the services and to furnish the Equipment on the basis of FOB Port of Shipment/Vessel or CFR Thai Port as specified in the Delivery Schedule and Distribution List for foreign supply or Ex-works delivery for local supply, in accordance with all provisions and conditions as described herein, all for the prices stated in the Schedule(s) attached.

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Note : 1. Article C-1. Price Schedule

For imported Equipment, EGAT reserves the right to award the Contract on either FOB Port of Shipment/Vessel or CFR Thai Port basis.

2. Article E-12. Performance Security

The performance security required under Article E-12. Performance Security shall be ten (10) per cent, round up to the nearest whole number, of the Contract Price. Cost for furnishing the performance security shall be spread over the items proposed.

C-2. Penalty for Equipment Not Meeting Guaranteed Characteristics

The losses of Equipment shall be evaluated with the same rate as stipulated in the Proposal Data.

If the Equipment proposed fails to meet the guaranteed characteristics or the price of the measured losses is higher than the price of the guaranteed losses, the Contract price of Equipment shall be reduced by the different amount of the comparison between the price of the measured losses and the price of the guaranteed losses.

C-3. Guaranteed Delivery Time

Delivery Time of Equipment is required as indicated in the Delivery Schedule and Distribution List attached. The undersigned Bidder guarantees to make and to complete the delivery of Equipment proposed as required by EGAT.

Whenever the Equipment in any item are sub-itemized, the Contractor shall endeavor not to make partial shipment/delivery by sub-items.

In case of failure on the part of the Contractor to comply with the provision of the above paragraph, it is hereby understood that the Equipment in such particular items shall be deemed undelivered unless and until each all sub-items have been shipped/delivered.

C-4. Drawing and Document Submission Schedule

Drawing and Document Submission Schedule is required as indicated in Article F-11. Drawings and Documents to be Furnished by Contractor. The undersigned Bidder guarantees to submit all drawings and documents as required by EGAT.

C-5. Estimate of Deliveries

The estimated number of individual shipment/delivery, shipping point or points, estimated delivery date and estimated shipping weights and volumes for each individual shipping will be as follows :

Number of Shipments	Item No.	Shipping Point	Estimated Delivery Date from Shipping Point	Total Weight kg.	Total Volume Cu.m.

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C-6. Bid Security

Bid security in the amount of _____ (in words) _____ (number) has been deposited with EGAT.

C-7. Supplemental Notices

The undersigned Bidder certifies that the following Supplemental Notices have been received for the Contract Documents :

_____

_____

_____

_____

_____

Proposal Submission Date _____ Day of _____ A.D. _____

Firm's Name _____

By _____

Title _____

Firm's Address _____

_____

_____

_____

Witness

_____

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PART 1: PRICE PROPOSAL

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PART 1 : PRICE PROPOSAL

PRICE QUOTATION INSTRUCTIONS

This part of the Bidding Document comprises :

1. Summary of Bid Prices

2. Price Schedules

Cost of Supply of Equipment comprises Foreign Portion and Local Portion. For Foreign Portion, Bidder is allowed to quote price in only four (4) different currencies. For Local Portion, default currency is Baht (THB).

Bidder shall fill in the price schedules in the Excel file(s), item by item. Then, the total prices for each schedule and Summary of Bid Prices will be automatically calculated.

Filling-in the data shall be in accordance with the following instructions :

1. Bidder shall fill in all data required in blue cells of the price schedules - Currency and Unit Price.

2. For local portion, the default is THB.

3. For foreign portion, Bidder shall fill a currency code in a column “Currency”.

Remarks: Price Schedules are created in Microsoft Office Excel 2007.

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

SUMMARY OF BID PRICE

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3
TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

No.	Description	Currency	Supply of Equipment		Foreign Currency	Local Currency
			Foreign Supply	Local Supply		
			CFR Thai Port	Ex-works Price (excluding VAT) Baht	(excluding VAT)	(excluding VAT) Baht
			Amount	Amount	Amount	Amount
1	BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3					
2	TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY					
BID PRICE				Baht		Baht
VAT				Baht		Baht
SUMMARY OF BID PRICE				Baht		Baht

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Schedule A1 : 230 kV Shunt Capacitor Bank

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply CFR Thai Port		**Supply of Equipment** Local Supply Ex-works Price (excluding VAT) Baht		**Foreign Currency** (excluding VAT)		**Local Currency** (excluding VAT) Baht	
					Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
A1-1	230 kV 72 MVAR Shunt Capacitor Bank complete with switching devices as per Ratings and Features RF CK8705 and Dwg. No. SE-SC-8-04 and TP-E-10.7 (The given MVAR represents the total Reactive Power of Capacitor Units only)	3							XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
A1-2	Spare Parts for Item No. A1-1	lot							XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
A1-3	Service of Installation Supervisor of Circuit Breaker Item No. A1-1		man day		XXXXX	XXXXX	XXXXX	XXXXX				
Total Price for Schedule A1							**Baht**				**Baht**	

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. A1-1

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
A1-1.1	245 kV 4000 A 50 kA GCB 1&3 pole trip for capacitive current switching as per Ratings and Features RF CB895S(IEC)	1								
A1-1.2	245 kV 3150 A air switch (high creepage) manually gang operated as per Ratings and Features RF DS88BH(IEC) (Phase spacing = 3.50 m., H = 6.00 m.)	1								
A1-1.3	230 kV CT, 900 kV BIL, 300/-/3000:1&300/-/2000:1&300/-/3000:5&300/-/2000:5&100/-/1200:5&100/-/1200:5, 50 kA, oil filled as per Rating and Features RF CT89F8	3								
A1-1.4	Current limiting reactor for shunt capacitor bank as per Ratings and Features RF CK8705	3								
A1-1.5	Capacitor units 400 kVAR for shunt capacitor bank as per Ratings and Features RF CK8705	180								
A1-1.6	Current transformer unbalance for shunt capacitor bank as per Ratings and Features RF CK8705	3								
A1-1.7	Control cabinets including all devices and relays for shunt capacitor bank as per Ratings and Features RF CK8705	1			XXXXX	XXXXX	XXXXX	XXXXX		
A1-1.8	Capacitor rack for shunt capacitor bank as per Ratings and Features RF CK8705	lot			XXXXX	XXXXX	XXXXX	XXXXX		
A1-1.9	Central terminal box for shunt capacitor bank as per Ratings and Features RF CK8705	1			XXXXX	XXXXX	XXXXX	XXXXX		

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. A1-1

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
A1-1.10	Power & Control cable for shunt capacitor bank as per Ratings and Features RF CK8705 (including all Cables and Conductors necessary for Shunt Capacitor Bank)	lot			XXXXX	XXXXX	XXXXX	XXXXX		
A1-1.11	Insulators for shunt capacitor bank as per Ratings and Features RF CK8705 (≥ 50 kV)	lot								
A1-1.12	Insulators for shunt capacitor bank as per Ratings and Features RF CK8705 (< 50 kV)	lot								
A1-1.13	Connector and accessories for shunt capacitor bank as per Ratings and Features RF CK8705 (shall conform to NEMA Standard CC1)	lot								
A1-1.14	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for Circuit Breaker)*	lot			XXXXX	XXXXX	XXXXX	XXXXX		
A1-1.15	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for Disconnecting Switch)	lot			XXXXX	XXXXX	XXXXX	XXXXX		
A1-1.16	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for Current Transformer)	lot			XXXXX	XXXXX	XXXXX	XXXXX		
A1-1.17	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for others, except Circuit Breaker, Disconnecting Switch and Current Transformer)	lot			XXXXX	XXXXX	XXXXX	XXXXX		

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. A1-1

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
A1-1.18	Disconnecting switch operating platform for shunt capacitor bank as per Ratings and Features RF CK8705	1			XXXXX	XXXXX	XXXXX	XXXXX		
Total Breakdown Price Item No. A1-1									**Baht**	

*The design of supporting structures of circuit breaker shall be verified by circuit breaker manufacturer.

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. A1-2

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
A1-2.1	Capacitor units 400 kVAR for shunt capacitor bank as per Ratings and Features RF CK8705 (10% of total unit)	54								
Total Breakdown Price Item No. A1-2									**Baht**	

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Service of Installation Supervisor (Schedule A1)

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Item No.	Description	Qty.	Unit	Currency	**Foreign Currency** (excluding VAT)		**Local Currency** (excluding VAT) Baht	
					Unit Price	Amount	Unit Price	Amount
A1-3	Service of Installation Supervisor of Circuit Breaker Item No. A1-1		man day					

Note:

1. The quoted total man-days for installation supervisor shall be the required number of days for complete installation, erection, field test and commissioning of all equipment as specified.
2. In addition to the quoted total man-days above, EGAT will also pay the following :
   a. Travelling time from and to Supervisor's home office as well as travelling time from and to the installation site including ten (10) working days of operation, if any, which will be at the same rate as the cost quoted per man-day.
   b. Airfares round trip economy class between the Supervisor 's home office and Bangkok by the most expeditious and direct route.
3. Local transportation from and to installation site will be provided by EGAT.
4. If the working man-days are less than the quoted total man-days, the payment shall be on the basis of actual man-days.
5. For man-days exceeding the quoted total amount, no payment shall be made by EGAT. Any such additional man-days approved by EGAT shall be paid on the quoted man-days rate.

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Schedule B1 : 230 kV Shunt Capacitor Bank

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply CFR Thai Port		**Supply of Equipment** Local Supply Ex-works Price (excluding VAT) Baht		**Foreign Currency** (excluding VAT)		**Local Currency** (excluding VAT) Baht	
					Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
B1-1	230 kV 72 MVAR Shunt Capacitor Bank complete with switching devices as per Ratings and Features RF CK8705 and Dwg. No. SE-SC-8-05 and TP-E-10.7 (The given MVAR represents the total Reactive Power of Capacitor Units only)	1							XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
B1-2	Spare Parts for Item No. B1-1	lot							XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
									XXXXX	XXXXX	XXXXX	XXXXX
B1-3	Service of Installation Supervisor of Circuit Breaker Item No. B1-1		man day		XXXXX	XXXXX	XXXXX	XXXXX				
Total Price for Schedule B1							**Baht**				**Baht**	

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. B1-1

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
B1-1.1	245 kV 4000 A 50 kA GCB 1&3 pole trip for capacitive current switching as per Ratings and Features RF CB895S(IEC)	1								
B1-1.2	245 kV 3150 A air switch (high creepage) manually gang operated as per Ratings and Features RF DS88BH(IEC) (Phase spacing = 3.50 m., H = 6.00 m.)	1								
B1-1.3	230 kV CT, 900 kV BIL, 300/-/3000:1&300/-/2000:1&300/-/3000:5&300/-/2000:5&100/-/1200:5&100/-/1200:5, 50 kA, oil filled as per Rating and Features RF CT89F8	3								
B1-1.4	Current limiting reactor for shunt capacitor bank as per Ratings and Features RF CK8705	3								
B1-1.5	Capacitor units 400 kVAR for shunt capacitor bank as per Ratings and Features RF CK8705	180								
B1-1.6	Current transformer unbalance for shunt capacitor bank as per Ratings and Features RF CK8705	3								
B1-1.7	Control cabinets including all devices and relays for shunt capacitor bank as per Ratings and Features RF CK8705	1			XXXXX	XXXXX	XXXXX	XXXXX		
B1-1.8	Capacitor rack for shunt capacitor bank as per Ratings and Features RF CK8705	lot			XXXXX	XXXXX	XXXXX	XXXXX		
B1-1.9	Central terminal box for shunt capacitor bank as per Ratings and Features RF CK8705	1			XXXXX	XXXXX	XXXXX	XXXXX		

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. B1-1

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
B1-1.10	Power & Control cable for shunt capacitor bank as per Ratings and Features RF CK8705 (including all Cables and Conductors necessary for Shunt Capacitor Bank)	lot			XXXXX	XXXXX	XXXXX	XXXXX		
B1-1.11	Insulators for shunt capacitor bank as per Ratings and Features RF CK8705 (≥ 50 kV)	lot								
B1-1.12	Insulators for shunt capacitor bank as per Ratings and Features RF CK8705 (< 50 kV)	lot								
B1-1.13	Connector and accessories for shunt capacitor bank as per Ratings and Features RF CK8705 (shall conform to NEMA Standard CC1)	lot								
B1-1.14	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for Circuit Breaker)*	lot			XXXXX	XXXXX	XXXXX	XXXXX		
B1-1.15	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for Disconnecting Switch)	lot			XXXXX	XXXXX	XXXXX	XXXXX		
B1-1.16	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for Current Transformer)	lot			XXXXX	XXXXX	XXXXX	XXXXX		
B1-1.17	Steel supporting structure and skid steel base for shunt capacitor bank as per Ratings and Features RF CK8705 (for others, except Circuit Breaker, Disconnecting Switch and Current Transformer)	lot			XXXXX	XXXXX	XXXXX	XXXXX		

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. B1-1

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
B1-1.18	Disconnecting switch operating platform for shunt capacitor bank as per Ratings and Features RF CK8705	1			XXXXX	XXXXX	XXXXX	XXXXX		
Total Breakdown Price Item No. B1-1									**Baht**	

*The design of supporting structures of circuit breaker shall be verified by circuit breaker manufacturer.

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Breakdown Price Item No. B1-2

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Supply of Equipment** Foreign Supply				**Supply of Equipment** Local Supply	
					FOB Vessel	Cost of Transportation to Thai Port	CFR Thai Port		Ex-works Price (excluding VAT) Baht	
					Unit Price	Unit Price	Unit Price	Amount	Unit Price	Amount
B1-2.1	Capacitor units 400 kVAR for shunt capacitor bank as per Ratings and Features RF CK8705 (10% of total unit)	18								
Total Breakdown Price Item No. B1-2									**Baht**	

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Service of Installation Supervisor (Schedule B1)

SUPPLY OF SHUNT CAPACITOR BANK

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Item No.	Description	Qty.	Unit	Currency	**Foreign Currency** (excluding VAT)		**Local Currency** (excluding VAT) Baht	
					Unit Price	Amount	Unit Price	Amount
B1-3	Service of Installation Supervisor of Circuit Breaker Item No. B1-1		man day					

Note:

1. The quoted total man-days for installation supervisor shall be the required number of days for complete installation, erection, field test and commissioning of all equipment as specified.
2. In addition to the quoted total man-days above, EGAT will also pay the following :
   a. Travelling time from and to Supervisor's home office as well as travelling time from and to the installation site including ten (10) working days of operation, if any, which will be at the same rate as the cost quoted per man-day.
   b. Airfares round trip economy class between the Supervisor 's home office and Bangkok by the most expeditious and direct route.
3. Local transportation from and to installation site will be provided by EGAT.
4. If the working man-days are less than the quoted total man-days, the payment shall be on the basis of actual man-days.
5. For man-days exceeding the quoted total amount, no payment shall be made by EGAT. Any such additional man-days approved by EGAT shall be paid on the quoted man-days rate.

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PART 2: PROPOSAL DATA

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SHUNT CAPACITOR BANKS

FORM PD 374
Aug. 2024

PROPOSAL DATA
PROCUREMENT REFERENCE GBA3-SC-05 and TIWS-SC-05 **SCHEDULE NO.**

BIDDER. **ITEM NO.**

Capacitor Unit

a.	Make and Country of Origin		
b.	Type /Model /Cat. No		
c.	Applied Standards		
d.	Rated Voltage		kV
e.	Rated Current		A
f.	Frequency		Hz
g.	Basic Impulse Insulation Level (BIL)		kV
h.	Continuous Rated Capacity at Rated Voltage and Frequency		kVAR
i.	Max Permissible Working Voltage		kV
j.	Max Permissible Working Capacity		kVAR
k.	Internal Connection - No of elements per group - No of group	 ☐ Parallel ☐ Series ☐ Parallel ☐ Series	
l.	Type and Characteristics of dielectric Material		
m.	Type and Characteristics of Impregnate		
n.	Temperature Limit t_{min} /t_{max}	/	°C/°C
o.	Type of Bushing(Glass, Porcelain, etc)		
p.	Creepage Distance		mm
q.	Type of Container (Tank)		
r.	Provision Discharge Resistor	☐ Yes ☐ No	
s.	Discharge Time to 50 V Unit/Bank to ☐ V Unit/Bank	/ min/min / min/min	
t.	Overall Height Including Bushing		mm
u.	Overall Length x Width x Height		mmxmmxmm
v.	Weight		kg

Fuse ☐ External ☐ Internal

a.	Make and Country of Origin		
b.	Type /Model /Cat. No		
c.	Rated Voltage		kV
d.	Rated Current		A
e.	Frequency		Hz
f.	Max Service Voltage		kA
g.	Rated Interrupting Current rms Sym.		kA
h.	Rated Continuous Current of Fuse Link or Refill Unit		A

Current Limiting Reactors

a.	Make and Country of Origin		
b.	Type /Model /Cat. No		
c.	Rated Voltage		kV
d.	Rated Current		A
e.	Frequency		Hz
f.	Continuous Rated Capacity		kVA

DRAFT

PROPOSAL DATA
PROCUREMENT REFERENCE GBA3-SC-05 and TIWS-SC-05 **SCHEDULE NO.**

BIDDER. **ITEM NO.**

g.	Insulation Level		
	- Low Freq. (Dry)		kV
	- BIL		kV
h.	Inductance per phase		H
i.	Thermal Short-Time Current Rating for 1 s		kA
j.	Temperature Rise above Ambient Temperature at 105% Rated Voltage		°C
k.	Temperature Class of Winding Insulation		
l.	Minimum Magnetic Clearance		
	- To Other Reactors		mm
	- To Metallic Parts		mm
m.	Weight / Phase		kg

Current Transformer (for unbalance sensing relay)

a.	Manufacturer and Country of Origin		
	- For CT		
	- For Junction Box		
	- For Supporting Structure		
b.	Type /Model /Cat. No		
c.	Applied Standards		
d.	Rated Voltage / Frequency		kV/ Hz
e.	Rated Primary Current		A
f.	Rated Secondary Current		A
g	Max Service Voltage		kV
h.	Insulation Level		
	- 1 Minute Dry (50 Hz)		kV
	- 10 s Wet (50 Hz)		kV
	- BIL		kV
i.	Creepage Distance of Insulator		mm
j.	Metering or Relaying	☐ Metering	☐ Relaying
k.	Current Ratio		
	- Core No 1		
	- Core No 2		
	- Core No 3		
	- Core No 4		
l.	Accuracy Class		
	- Core No 1		
	- Core No 2		
	- Core No 3		
	- Core No 4		
m.	Continuous Thermal Current Rating Factor		
n.	Short Time Current Rating		
	- Thermal for 1 s		kA rms
	- Mechanical		kA peak
o.	Primary Protective Devices	☐ With	☐ Without
p.	Location of Core	☐ Top	☐ Bottom
q.	Oil Expansion System		
r.	Total Weight		kg
s.	Volume of Oil		litres
t.	Size and Spacing of Holes on the Base		

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SHUNT CAPACITOR BANKS

FORM PD 374
Aug. 2024

PROPOSAL DATA
PROCUREMENT REFERENCE GBA3-SC-05 and TIWS-SC-05 **SCHEDULE NO.**

BIDDER. **ITEM NO.**

Voltage Transformer (for unbalance sensing relay)

a.	Manufacturer and Country of Origin		
	- For VT		
	- For Junction Box		
	- For Supporting Structure		
b.	Type /Model /Cat. No		
c.	Applied Standards		
d.	Rated Voltage / Frequency		kV/Hz
e.	Max Service Voltage		kV
f.	Insulation Level		
	- 1 Minute Dry (50 Hz)		kV
	- 10 s Wet (50 Hz)		kV
	- BIL		kV
g.	Creepage Distance of Insulator		mm
h.	Voltage Ratio		
i.	Secondary Voltage Rating		
	- No 1 Secondary Winding		V
	- No 2 Secondary Winding		V
j.	Burden		
	- No 1 Secondary Winding		VA
	- No 2 Secondary Winding		VA
	- Simultaneous		VA
	- Thermal		VA
k.	Accuracy Class		
l.	Total Weight		kg
m.	Volume of Oil		litres
n.	Size and Spacing of Holes on the Base		

Guaranteed Maximum Loss at Rated Voltage,Current and Frequency for

a.	Capacitor Unit				
	- Initial	Wd/Wr/Wf	/		W/W/W
	- After 3 Months	Wd/Wr/Wf	/		W/W/W
	- Ultimate	Wd/Wr/Wf	/		W/W/W
b.	Current Limiting Reactor				W

Capacitor Bank

a.	Overall Length x Width x Height per Bank		mmxmmxmm
b.	Weight per Bank		kg

Note
Wd = Dielectric Loss of Capacitor
Wr = Loss of Discharge Resistor
Wf = Loss of Fuse (internally fuse only)

Discharge time and loss of capacitor unit at 50V/5min shall be offered and specified. These values shall be considered as required evidence for evaluation. Other values shall be considered as Alternatives.

The guaranteed loss evaluation of Shunt Capacitor Bank comprised of Capacitor units (at ultimate) and Current Limiting Reactors, shall be evaluated and included in the bid price for cost evaluation with the rate of 100 Baht per Watt.

If Shunt Capacitor Banks fail to meet the guaranteed loss characteristics herein indicated, the losses of each of Shunt Capacitor Bank shall be evaluated the same as stipulated above with the following comparison:

a. The combination price of the measured Capacitor unit losses (at ultimate) of each Shunt Capacitor Bank shall be compared with the price of the guaranteed characteristics.
b. The combination price of the measured Current Limiting Reactor losses of each Shunt Capacitor Bank shall be compared with the price of the guaranteed characteristics.

If any price of the measured losses is higher, the price of the Shunt Capacitor Bank shall be reduced by the different amount of the price so compared.

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POWER CIRCUIT BREAKER

FORM PD 156
Mar. 2025

PROPOSAL DATA

PROCUREMENT REFERENCE	GBA3-SC-05 and TIWS-SC-05	**SCHEDULE NO.**	
BIDDER		**ITEM NO.**	

a. Make and country of origin		
- Circuit breaker		
- Make		
- Country of origin		
- Steel supporting structure		
- Make		
- Country of origin		
b. Type		
- Interrupting medium (SF6, Vacuum, etc)		
- Tripping	☐ Three poles ☐ Single pole & Three poles	
c. Number of interrupter per pole		
d. Model no		
e. Applied standards		
f. Rated voltage		kV
g. First pole to clear factor		
h. Power frequency withstand voltage (rms)		
- Across open switching device		kV
- Phase-to-earth		kV
i. Lightning impulse withstand voltage, Peak		
- Across open switching device		kV
- Phase-to-earth		kV
j. Switching Impulse Withstand, Peak		
- Between phases		kV
- Phase-to-earth and across open switching device		kV
k. Frequency		Hz
l. Current rating		
- Rated continuous		A
- Rated short time withstand current (1 s)		kA
- Rated peak withstand current		kA
m. Interrupting rating		
- Rated short circuit breaking current		kA
- Max opening and interrupting time at rated control voltage		
- Opening time		ms
- Interrupting time		ms
- Mechanism stroke		mm
- Interrupter stroke		mm
- Opening velocity (contact part)		m/s
n. Closing rating		
- Making capacity-peak		kA
- Closing time at rated operations		ms
- Closing velocity (contact touch)		m/s

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POWER CIRCUIT BREAKER

FORM PD 156
Mar. 2025

PROPOSAL DATA

PROCUREMENT REFERENCE	GBA3-SC-05 and TIWS-SC-05	**SCHEDULE NO.**	
BIDDER		**ITEM NO.**	

o.	Capacitive current			
	- Rated capacitance current switching			
	- Line charging breaking current			A
	- Cable charging breaking current			A
	- Current (Back to back)			A
	- Inrush current (Back to back)			kA
	- Frequency of inrush current			Hz
	- Corresponding to a max line length of			km
	- Rated transient overvoltage factor			
	- Restrike free	☐ Class C1	☐ Class C2	
p.	Temperature rise of contacts at nominal current			°C
		Closing	Tripping	
q.	Mechanism type (Spring, Hydraulic, etc)			
r.	Control voltage rating			
	- Nominal voltage			Vdc
	- Operating voltage range (min/max)	/	/	Vdc
s.	Current at nominal control voltage			A
t.	Command duration			ms
u.	Reclosing duty cycle			
v.	Number of operations between servicing			
w.	Rated reclosing time			ms
x.	Heater in control cabinet			
	- Continuous operated heater			
	- Rating		Vac	W
	- Thermostat controlled heater			
	- Rating		Vac	W
	- Temperature setting range		°C to	°C
y.	Spring charged mechanism			
	- Model no			
	- Motor rating			
	- Nominal voltage			Vdc
	- Operating voltage range (Min/Max)	/		Vdc
	- Power rating			kW
	- Max charging time at nominal voltage			s
z.	Porcelain insulator	Chamber	Support	
	- Make			
	- Country of origin			
	- Applied standard			
	- Creepage distance			mm
	- Type (General use or Permanent gas pressure)*			
	- Design pressure			bar
	- Design bending			kN*m
	- Thinnest of wall thickness for electrical test*			mm
	- Greatest thickness for temperature-cycle test*			mm

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POWER CIRCUIT BREAKER

FORM PD 156
Mar. 2025

PROPOSAL DATA

PROCUREMENT REFERENCE	GBA3-SC-05 and TIWS-SC-05	**SCHEDULE NO.**	
BIDDER		**ITEM NO.**	

aa. Composite insulator		
- Make		
- Country of origin		
- Applied standard		
- Housing outside insulating tube	☐ Silicone rubber	
- Creepage distance		mm
ab. Height of breaker from lower energizing part to base plate		mm
ac. Net weight of breaker		kg
ad. Insulating SF6 gas required per breaker		kg
ae. Insulating SF6 gas furnished (115% of actual required)		kg
af. Rated gas pressure at 20 °C (gauge)		bar
ag. Minimum gas pressure at 20 °C (gauge)		bar
ah. Overpressure relief device		
- Equipped	☐ Yes ☐ No	
- Operating pressure		kg/cm^2
ai. Each breaker completely assembled and test at the factory	☐ Yes ☐ No	
aj. Time required for field installation of each breaker		Days
ak. Surge absorber capacitor (Supplied for 33 kV and below SF6 GCB if required)		
- Manufacturer		
- Country		
- Type/Model		
- Rated voltage		kV
- BIL		kV
- Capacitance		µF
al. Controlled switching device (if required)		
- Manufacturer/ Country		
- Type/Model		

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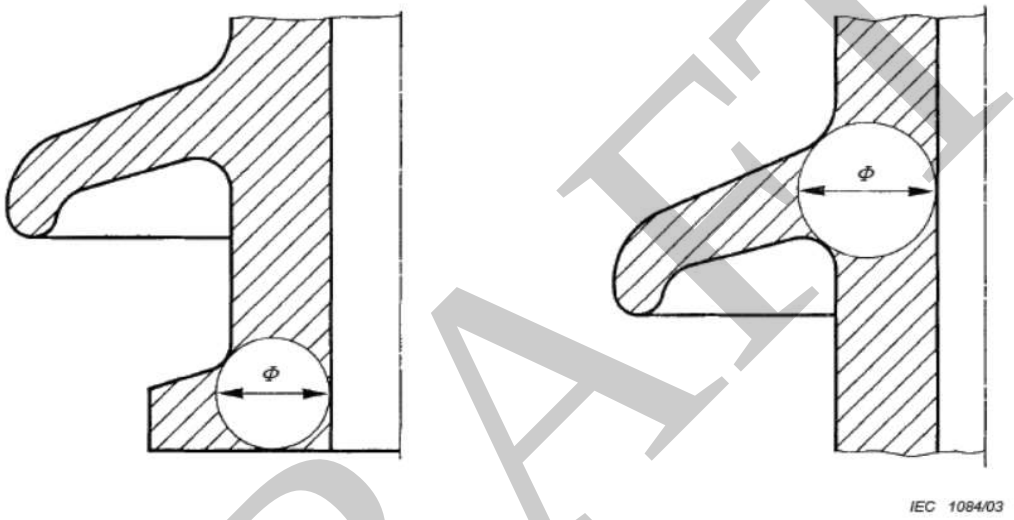
FORM PD 156
Mar. 2025

PROPOSAL DATA

PROCUREMENT REFERENCE	GBA3-SC-05 and TIWS-SC-05	**SCHEDULE NO.**	
BIDDER		**ITEM NO.**	

Note.
The reference mechanical characteristics with the prescribed envelope and insulator drawing shall be submitted together with the tender document during the bidding for consideration.

*Definition based on IEC 62155
Thickness for temperature-cycle



Thickness for temperature-cycle test

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AIR SWITCHES

FORM PD 202
Mar. 2025

PROPOSAL DATA
PROCUREMENT REFERENCE GBA3-SC-05 and TIWS-SC-05 **SCHEDULE NO.**

BIDDER **ITEM NO.**

a.	Manufacturer and Country of Origin	
	- Air Switch	
	- Manufacturer	
	- Country of origin	
	- Steel supporting structure	
	- Manufacturer	
	- Country of origin	
b.	Type /Model /Cat. No.	
c.	Applied Standards	
d.	Rated Voltage	kV
e.	Power Frequency Withstand, rms	
	- Across isolating distance	kV
	- Phase-to-earth	kV
f.	Lightning Impulse Withstand, Peak	
	- Across isolating distance	kV
	- Phase-to-earth	kV
g.	Switching Impulse Withstand, Peak	
	- Across isolating distance	kV
	- Between phases	kV
	- Phase-to-earth	kV
h.	Current Rating	
	- Main Blades	
	- Rated normal current	A
	- Rated short time withstand current (1 s)	kA
	- Rated peak withstand current	kA
	- Grounding Blades	
	- Rated short time withstand current	kA
	- Rated peak withstand current	kA
i.	Type and Material of Live Parts	
	- Main Blades	
	- Type (Tubular, Bar, etc)	
	- Material	
	- Grounding Blades	
	- Type (Tubular, Bar, etc)	
	- Material	
j.	Contact Material	
	- Exposed Contacts	
	- Fixed contacts	
	- Moving Contacts	
	- Other Current Carrying Contacts	
k.	Have the Main Blades a Twist Motion in Both Opening and Closing Cycles	☐ Yes ☐ No
l.	Have the Ground Blades a Double Motion in Both Opening and Closing Cycles	☐ Yes ☐ No
m.	Temperature Rise under Rated Current and Frequency of	
	- Contact	°C
	- Current Carrying Part	°C
	- Other Metalic Part	°C
	- Insulating Part	°C
n.	Mounting Position	
o.	Phase Spacing	m
p.	Clearance, Live Parts and Earth	m

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PROPOSAL DATA
PROCUREMENT REFERENCE GBA3-SC-05 and TIWS-SC-05 **SCHEDULE NO.**

BIDDER **ITEM NO.**

q.	Operating Mechanism	
	- Type	
	- Model /Cat. No.	
	- Operating Motion (Reciprocate, Torsion, etc)	
	- Manual Operating Force	kg, kg (peak)
	- Operating Lever Length	m
	- Motor Type / Rating	/ kW
	- Operating Voltage Range of Motor	Min = Vdc, Max = Vdc
	- Method of Interlocking	
	- Self Mechanical Interlocking between Main Blade and Its Grounding Blade	Yes No
	- Interlocking between Grounding Switch and Other Corresponding Switch by Key	Yes No
	- Key	Kirk / Other
	- Auxiliary Switches	
	- Number of Aux. Switches	
	- Type of Contacts	Interchangeable / Fixed Type
	- Current Rating	A
r.	Insulator	
	- Manufacturer / country of origin	/
	- Core Structure	
	- Insulator Technical Ref. No.	
	- Leakage Distance	mm
	- Color	Chocolate Brown
	- Weight of insulator	kg
s.	***Net weight of Disconnection Switch (Including insulator)***	kg
t.	Transformer Magnetizing Interruption Capability	A

Note. In order to guarantee the right working of the disconnector, manufacturer shall provide safety pins or spring pins to lock between rotating clamp, vertical shaft and operating mechanism shaft.

DRAFT

CURRENT TRANSFORMER

FORM PD 301.1, 306, 1001
Aug. 2024

PROPOSAL DATA
PROCUREMENT REFERENCE GBA3-SC-05 and TIWS-SC-05 **SCHEDULE NO.**

BIDDER **ITEM NO.**

a. Manufacturer / Country		
- For CT		
- For Supporting Structure		
b. Type / Model / Catalog No.		
c. Applied Standards		
d. Rated Voltage / Frequency		kV / Hz
e. Rated Current - Primary / Secondary		A / A
f. Number of Turns - Primary / Secondary		Turns / Turns
g. Maximum Service Voltage		kV
h. Insulation Level - 1 Min. Dry / 10 Sec. Wet		kV / kV
- BIL / BSL		kV / kV
i. Insulator - Creepage Distance		mm
- Color		
- Cemented Flange Type		☐ Yes ☐ No
j. Current Ratio - Core No. 1		
- Core No. 2		
- Core No. 3		
- Core No. 4		
- Core No. 5		
- Core No. 6		
k. Accuracy Class - Core No. 1		
- Core No. 2		
- Core No. 3		
- Core No. 4		
- Core No. 5		
- Core No. 6		
l. Continuous Thermal Current Rating Factor		
m. Ith (Thermal for 1 Sec.) / Idyn (Mechanical)		kA rms / kA peak
n. Primary Protective Device		☐ With ☐ Without
o. Core - Flux Density at Rated Burden		Tesla
- Cross Section Area of Core		mm^2
- Location		☐ Top ☐ Bottom
- Type of Core		☐ Non Gapped ☐ Gapped
p. Oil Expansion System - Type		☐ Bellow ☐ N_2 Cushion
		☐ Other
- Material of Bellow		☐ Metallic ☐ Rubber
		☐ Other
q. Total Weight / Volume of Oil		kg / Litres

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LOW VOLTAGE CABLE AND CONDUCTOR
(For Shunt Capacitor Bank)

FORM PD AB18.1
Nov. 2024

PROPOSAL DATA

PROCUREMENT REFERENCE	GBA3-SC-05 and TIWS-SC-05	**SCHEDULE NO.**	
BIDDER		**ITEM NO.**	

a. Power Cable and Control Cable
- Manufacturer
- Country
- Applied Standards

Power Cable	Control Cable

*in case of other, please specify in the box below :

b. Lighting cable (THW and/or NYY)
- Manufacturer
- Country
- Applied Standards

THW (IEC01)	NYY

*in case of other, please specify in the box below :

c. Aluminum Conductor
- Manufacturer
- Country
- Applied Standards

*in case of other, please specify in the box below :

Note: Routine tests and/or Quality Conformance Tests **are not required** for equipment in a, b, and c.

DRAFT

STATION POST INSULATOR

FORM PD 601
Apr. 2025

PROPOSAL DATA

PROCUREMENT REFERENCE	GBA3-SC-05 and TIWS-SC-05	**SCHEDULE NO.**	
BIDDER		**ITEM NO.**	

a. Manufacturer / Country
b. Applied Standards
c. Color

Note.
Certification of country of origin, production's lot no. and manufacturing date to be certified by Chamber of Commerce shall be submitted along with the Equipment at the time of shipment.

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Manufacturer's successful operation supply record in overseas country for Capacitor Unit

Manufacturer / Country :_____/_____

Customer / Country	Substation	Quantity	Equipment Rating		Applied System Rating		Type / Model No.	Internally or Externally fused capacitor	Date of Operation
			Voltage (kV)	Capacity (kVAR)	Voltage (kV)	Capacity (kVAR)			

The above information is to prove that manufacturer has experience conforming to that required by Article relevant to Eligibility of Bidders.

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Manufacturer's successful operation supply record in overseas country for Power Circuit Breaker

Manufacturer / Country :_____/_____

Customer / Country	Substation	Quantity	Equipment Rating			Applied System Rating			Type / Model No.	Type of Mechanism	Date of Operation
			Voltage (kV)	Current (A)	Short Circuit Current (kA)	Voltage (kV)	Current (A)	Short Circuit Current (kA)			

The above information is to prove that manufacturer has experience conforming to that required by Article relevant to Eligibility of Bidders.

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Manufacturer's successful operation supply record in overseas country for Disconnecting Switch

Manufacturer / Country :_____/_____

Customer / Country	Substation	Quantity	Equipment Rating			Applied System Rating			Type / Model No.	Type of Mechanism	Date of Operation
			Voltage (kV)	Current (A)	Short Time Withstand Current (kA)	Voltage (kV)	Current (A)	Short Time Withstand Current (kA)			

The above information is to prove that manufacturer has experience conforming to that required by Article relevant to Eligibility of Bidders.

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Manufacturer's successful operation supply record in overseas country for Current Transformer

Manufacturer / Country : _____/_____

Customer / Country	Qty. (3-phase sets)	Max. System Voltage (kV)	Equipment Rating				Type / Model No.	Date of Operation
			Basic Insulation level (kV)	Rated Continuous Current (A)	Short Time Current			
					kArms/sec	kApeak/sec		

DRAFT

The above information is to prove that manufacturer has experience conforming to that required by Article relevant to Eligibility of Bidders.

Manufacturer's successful operation supply record in overseas country for Current Limiting Reactor

Manufacturer / Country : _____/_____

Customer / Country	Qty. (3-phase sets)	Max. System Voltage (kV)	Equipment Rating				Application	Type / Model No.	Date of Operation
			Basic Insulation level (kV)	Rated Continuous Current (A)	Short Time Current (kArms/sec)	Inductance (mH)			

DRAFT

The above information is to prove that manufacturer has experience conforming to that required by Article relevant to Eligibility of Bidders.

DEVIATIONS

The undersigned Bidder confirms that the Proposal submitted by the Bidder

☐ complies with Specifications and commercial terms specified in the Bidding Documents.

☐ contains deviations from Specifications and/or commercial terms specified in the Bidding Documents as listed hereunder (Use continuation sheets, if required):

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DRAFT

Confirmed :

Firm : _____

By : _____

Title : _____

PART 3: DELIVERY SCHEDULE AND DISTRIBUTION LIST

DRAFT

INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Delivery Schedule and Distribution List

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

Schedule A1 : 230 kV Shunt Capacitor Bank

Item No.	Description	Qty	Job no.	Substation	Delivery Required by EGAT (within months after confirmation of Letter of Award of Contract)
					CFR Thai Port / Ex-works / DDP EGAT's Store
A1-1	230 kV 72 MVAR Shunt Capacitor Bank	3	GBA3-07-S02	ERW	30
A1-2	Spare Parts for Item No. A1-1	lot	GBA3-07-S02	ERW	30

Thai Port = BKK Port

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INVITATION TO BID NO. GBA3-SC-05 and TIWS-SC-05

Delivery Schedule and Distribution List

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

Schedule B1 : 230 kV Shunt Capacitor Bank

Item No.	Description	Qty	Job no.	Substation	Delivery Required by EGAT (within months after confirmation of Letter of Award of Contract)
					CFR Thai Port / Ex-works / DDP EGAT's Store
B1-1	230 kV 72 MVAR Shunt Capacitor Bank	1	TIWS-02-S02	PK3	30
B1-2	Spare Parts for Item No. B1-1	lot	TIWS-02-S02	PK3	30

Thai Port = BKK Port

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SECTION D

CONTRACT

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CONTRACT

SUPPLY OF SHUNT CAPACITOR BANK

BULK POWER SUPPLY FOR THE GREATER BANGKOK AND VICINITY AREA PHASE 3

TRANSMISSION SYSTEM IMPROVEMENT PROJECT IN WESTERN AND SOUTHERN REGIONS TO ENHANCE SYSTEM SECURITY

No._____

This Contract is executed and delivered this_____day of _____, B.E._____(A.D._____), between

ELECTRICITY GENERATING AUTHORITY OF THAILAND

represented by_____ of said Authority , hereinafter called "EGAT", and

_____(Contractor)_____

represented by_____, age_____years, nationality _____, hereinafter called the "Contractor".

EGAT and the Contractor mutually agree as follows :

D-1. Contract Documents

The following documents attached to this Contract are incorporated and made a part of this Contract, as though fully written out and set forth herein :

Data Sheet

A. Invitation to Bid
B. Instructions to Bidders
C. Contract Price, Delivery Time of Equipment and Proposal Data
D. Contract
E. General Conditions
F. Special Conditions
G. Ratings and Features
H. Bill of Materials (None)
I. Specifications
J. Drawings
K. Supplemental Notices

_____

_____

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L. Attachments :

_____

_____

_____

M. Changes :

_____

_____

_____

All of the foregoing documents are referred to herein as the Contract Documents. They are also incorporated into this Contract and made a part hereof all codes, designations, standards, standard specifications and similar Equipment which are referred to in the Specifications and Special Conditions.

D-2. Acceptance of Proposal

EGAT has accepted the proposal of the Contractor for furnishing the Equipment in conformity and in accordance with and subject to all the terms and conditions of these Contract Documents.

D-3. Agreement

The Contractor agrees to sell and EGAT agrees to buy the Equipment as described in these Contract Documents.

D-4. Obligation of Contractor

The Contractor agrees to perform well and faithfully all of the services and to furnish all of the Equipment described in these Contract Documents, and to supply and provide all Equipment, labor and other things requisite for or incidental to the said Work.

D-5. Obligation of EGAT

EGAT agrees, subject to the terms and conditions of these Contract Documents, to pay to the Contractor the amount shown, and at the rates and times and in the manner set forth in these Contract Documents.

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D-6. Mutual Obligations

EGAT and the Contractor mutually agree to perform, fulfill, abide by, and submit to any and all of the provisions and requirements and all matters and things contained or expressed in, or reasonably to be inferred from these Contract Documents.

D-7. Deposit of Performance Security

The Contractor agrees to deposit with EGAT an acceptable performance security in accordance with the Contract Documents.

D-8. Assignment

The Contract or any part thereof shall not be assigned or pledged without the written consent of EGAT, nor shall the Contractor assign or pledge any money due, or to become due, to him hereunder, without the prior written consent of EGAT.

D-9. Notices

All notices called for by the terms of this Contract shall be effective only at the time of receipt thereof and only when received by the parties to whom they are addressed at the following addresses :

EGAT : Governor
Electricity Generating Authority of Thailand
Bangkruai, Nonthaburi 11130
Thailand

Contractor : _____

_____

_____

_____

All notices called for by the terms of this Contract shall be in the form of registered letters or ***letters submitted electronically or electronic mails (E-mails)*** in the English language.

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D-10. Integration

EGAT and the Contractor agree that this Contract, including the Contract Documents, expresses all of the agreements, understandings, promises, and covenants of the parties, and that it integrates, combines, and supersedes all prior and contemporaneous negotiations, understandings, and agreements, whether written or oral, and that no modification or alteration of this Contract shall be valid or binding on either party, unless expressed in writing and executed with the same formality as this Contract, except as may otherwise be specifically provided in this Contract.

D-11. Counterpart

This Contract is executed in two (2) identical counterparts: one (1) for EGAT and one (1) for the Contractor.

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ELECTRICITY GENERATING AUTHORITY OF THAILAND	CONTRACTOR :
BY_____	BY _____
( )	( )
WITNESS :	WITNESS :
BY_____	BY _____
( )	( )

SECTION E

GENERAL CONDITIONS

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GENERAL CONDITIONS

E-1. Definitions

Whenever the following terms are used in the Contract Documents, they will have the following meanings :

EGAT	:	The Electricity Generating Authority of Thailand, having its Head Office at Nonthaburi, Thailand, and its authorized representative or representatives
Engineer	:	Firm or company assigned by EGAT to provide engineering, consulting or construction management services in support of EGAT
Bidder	:	Any person or firm or company or joint venture or consortium of firms submitting bid to EGAT for furnishing the services and Equipment described in the Contract Documents, in response to this Invitation to Bid
Contractor	:	Any person or firm or company or joint venture or consortium of firms including appointed representatives, successors and assignees thereof, whose bid has been accepted by EGAT for furnishing of the services and Equipment described in the Contract Documents
Subcontractor	:	Any person or firm or company (other than the Contractor) to whom any part of the Contract has been sublet, with the consent of EGAT, by the Contractor
Contract	:	The agreement between EGAT and the Contractor, and all Appendices and Schedules thereto including Invitation to Bid, Instructions to Bidders, Proposal, General Conditions, Special Conditions, Specifications, Ratings and Features, Drawings, Supplemental Notices and any other documents referred to in, or connected with the Contract, eventhough the said documents are issued after execution of the Contract
Contract Price	:	The sum specified in Section C which is inclusive of VAT (if any) subject to such additions thereto or deductions therefrom as may be made under the provisions hereinafter contained

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Equipment	:	Machinery, apparatus, materials, goods, including accessories and spare parts to be supplied under the Contract and specifically described in the Specifications
Work	:	All the work to be done by the Contractor for design manufacture, shop test, transportation, and delivery of the Equipment ex-works, FOB Port of Shipment/Vessel or CFR Thai Port or at EGAT's store/site as agreed, including, if required, supervision for installation at site and supervision for field tests of the Equipment under the Contract
Thai Port	:	Commercial ports in Thailand including but not limited to Bangkok Port, Laem Chabang Port, Sriracha Harbour Port, Siam Seaport, Maptaphut Port, Songkhla Port, Phuket Harbour Port or Suvarnabhumi Airport, as the case may be
Bangkok Port	:	Bangkok Wharf (Klong Toey Port) and all other commercial ports in Bangkok Metropolitan area
Supervisor (if required)	:	Contractor's employee assigned as installation supervisor including assistant supervisor, to supervise and be responsible for the installation, erection, adjustment, field tests, and commissioning of the Equipment supplied under the Contract
Option (if any)	:	Equipment to be quoted by the Bidder which EGAT reserves the right to accept or omit in whole or in part
Year	:	Calendar year
Month	:	Calendar month
Day	:	Calendar day

E-2. Intent of Contract Documents

All of the Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all. In the case of any discrepancy between any of the Contract Documents, or any defective description or ambiguity, the matter shall be promptly submitted to EGAT, which shall promptly make a determination in writing. Any adjustment by the Contractor without this determination shall be at the Contractor's own risk and expense. In all cases of discrepancy, defective description, or ambiguities, the interpretation given by EGAT shall be binding on the Contractor, subject to the provisions of Article E-31. Dispute Resolution, included in these General Conditions.

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E-3. Applicable Law and Legal Jurisdiction

The applicable law of this Contract shall be the law in force in the Kingdom of Thailand. Should there be any ambiguity or discrepancy rising out or in connection with the Contract Documents, the interpretation thereof shall be made in accordance with Thai laws. Any litigations between the parties that may arise out of or in connection with this Contract or the breach or termination thereof or the performance of work thereunder shall be submitted to the Court of Thailand for decision, except as may be otherwise specifically provided in these Contract documents.

E-4. Statutory Requirements

Throughout the continuance of the Contract, the Contractor shall conform to all laws of the Kingdom of Thailand, and to all regulations, by-laws, ordinances, or orders made thereunder, and to the lawful requirements of any public, municipal, or other authority, in any way affecting or applicable to the Contractor or its operations.

E-5. Patents and Copyrights

The Contractor shall indemnify and hold EGAT, its officers, agents, and employees harmless against and from liability of any nature or kind, including costs and expenses for or on account of any copyrighted or uncopyrighted composition, secret process, patented or unpatented invention, article, or appliance manufactured, delivered, or used in carrying out the Work under the Contract. All drawings and the information contained therein as well as the use of any process, material or Equipment developed in the course of carrying out the Work under the Contract shall become the property of EGAT where EGAT shall have the right to use any or all of them for any purpose either for present or future projects. For the avoidance of doubt, none of them will be used solely for any commercial benefit which is not related to EGAT work.

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E-6. Subcontracts

The Contractor shall not assign or transfer the Contract or any part thereof or any benefit or interest therein or thereunder, any monies due or become due under this Contract to any other person or persons.

The Contractor shall not be allowed to subcontract the whole of the Work under this Contract. Subcontracting of any part of the Work shall be subject to the prior written consent of EGAT. Such consent, if given**,** shall not relieve the Contractor from full and entire responsibility under this Contract.

If the Contractor desires to subcontract any part or parts of the Work called for by the Contract, he shall notify EGAT in writing to that effect and shall state in such notice the nature and extent of the part or parts of the Work called for by the Contract proposed to be subcontracted and name of the person proposed as Subcontractor. Unless and until written approval is given by EGAT, approval for which shall not be unreasonably withheld, the Contractor shall not subcontract any part of the Work. All requirements specified in these Contract Documents shall be applicable to Subcontractors also.

No contractual relation shall exist between EGAT and the Subcontractors, and the Subcontractors are not to enjoy any privileges conferred on the Contractor by this Contract.

Any Work done by any Subcontractor who has not been approved by EGAT shall be subject to rejection or stoppage of Work by EGAT. In such case the Contractor cannot claim delay or request for time extension of the Contract completion date and/or make financial claim to EGAT.

E-7. Export Charges

All tariffs, duties and other taxes or charges levied by the country of origin of the Equipment shall be paid by the Contractor, and such expenses shall be included in the cost of the Equipment.

E-8. Import Duty and Taxes

EGAT will pay all costs of procuring the necessary permits and licenses for importation into Thailand, and will pay import duty and any taxes including value added tax imposed at the port of entry on the Equipment to be supplied by the Contractor and imported into Thailand for the Work under this Contract.

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EGAT will not pay import duty and taxes on either the personal effects of the Contractor's employees, such as personal articles, household furnishings and appliances, and goods of any kind imported for the personal use of the Contractor's employees whether imported by an employee or by the Contractor, or in respect of food, tobacco, liquor and other commissary goods imported by the Contractor or by his employees.

EGAT will not pay import duty and taxes including value added tax on equipment, tools, instruments and machinery imported by the Contractor for purpose of carrying out the work under the Contract. All processes of importation shall be arranged by the Contractor.

Equipment, tools, instruments and machinery which are certified by the Contractor that they are required for installation, test and commissioning of the Work at the site and they are intended for re-exportation can be temporarily exempted from import duty and taxes including value added tax. All Equipment thereof shall be imported under the name of the Contractor and be in accordance with the rules and regulations of the Customs Department of the Kingdom of Thailand.

EGAT will assist the Contractor for such temporary exemption of import duty and taxes including value added tax by issuing a letter confirming such temporary import. Import duty and taxes including value added tax for the temporarily imported Equipment shall be paid by the Contractor to the Customs Department before re-exportation at the rate to be specified by the Customs Department at the time of importation for the whole period they have been imported into the Kingdom of Thailand. Temporary importation of the Equipment is subject to approval of the Customs Department and the deposit of a bond with the Customs Department in the amount to be notified by the Customs Department is required. All costs for submission of information and data if required by the Customs Department and the cost of provision of the bond shall be borne by the Contractor.

In view of numerous advantages, the ATA Carnet system or other systems may be arranged for shipment of the said temporarily imported equipment by the Contractor (if required). Any charge incurred and/or any liability shall be borne by the Contractor.

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E-9. Value Added Tax

Pursuant to the Revenue Code of Thailand, EGAT shall be responsible and pay when due for the value added tax imposed on the supply of Equipment, including local transportation (if any) and/or on the provision of services under this Contract. EGAT shall in no case be responsible for the value added tax collectible on any payment made by the Contractor under any subcontract or under any other circumstances and the Contractor shall comply with the rules and regulations of the Revenue Code of Thailand.

In case there is any change on the rate of value added tax imposed by the Government of Thailand, the amount of value added tax comprised in the Contract Price shall be adjusted to reflect such change, provided that the price of the Work shall remain unchanged.

E-10. <u>Income and Other Taxes</u>

Income and other taxes assessed or collected by the Government of Thailand, or any subdivision thereof, or any municipality therein on the Contractor and his employees shall be under the responsibility and account of the Contractor.

In accordance with the Revenue Code of Thailand, should the payment under this Contract be subject to income tax and withholding tax of any kind is required to be withheld by EGAT, such withholding tax shall be deducted by EGAT from each payment and EGAT will be responsible to remit such withholding tax to the Revenue Department of Thailand on behalf of the Contractor. In case any payment being made through the letter of credit or being made directly from foreign source whereby the withholding tax cannot be deducted from payment, the Contractor is required to immediately inform EGAT once each such payment is made to the Contractor, and the withholding tax of which will be paid from EGAT's own fund to the Revenue Department in the same manner as aforesaid. Such withholding tax amount as advanced by EGAT on behalf of the Contractor shall be reimbursed by the Contractor to EGAT within the period of time fixed by EGAT.

In the case where the Contractor considers that the transaction under this Contract is exempted from income tax of Thailand (under any circumstance), the Contractor shall submit, together with his proposal(s), a statement detailing such exemption and the valid documentary evidence. Should EGAT rely on the statement so submitted, no deduction for withholding tax shall be made from payment. However, if the tax authority of Thailand determines that such exemption is not applicable, the Contractor shall then be responsible for the amount(s) equal to the withholding tax, plus the amount(s) of tax exceeding those of withholding tax, including the surcharge and/or penalties imposed on EGAT and the Contractor. The responsibility and liability of the Contractor as provided in the preceding sentence shall survive termination of the Contract.

If the Contractor fails to immediately inform EGAT of the payment as required under the second paragraph preventing EGAT from remitting the withholding tax to the Revenue Department within seven (7) Days from the end of the month in which such payment is made, or fails to pay and/or reimburse EGAT for any amount required under this Article within the period of time fixed by EGAT, such period not to be shorter than fifteen (15) Days from the date of EGAT's notice for payment, EGAT has the right to claim directly from the Contractor or claim from Performance Security or Maintenance Security, as the case may be, or deduct or setoff from any money due to the Contractor under this Contract

DRAFT

for the outstanding amount, surcharge and/or penalty (if any) together with interest at the rate of Minimum Overdraft Rate (MOR) plus two (2) per cent calculated from the due date up to the date the payment is made in full.

EGAT will proceed with the tax matters under the Contract by relying on the information and document submitted by the Contractor in relation to the Bidder's status and tax liability. If the Revenue Department of Thailand differently determines the status and tax liability, the Contractor shall be responsible and liable for any cost and expense, penalty and/or surcharge incurred and/or imposed on him and EGAT in relation thereto.

E-11. Fees and Duties

Any and all immigration fees, stamp duties, and other fees assessed or collected by the Government of Thailand, or by any subdivision thereof, or by any municipality therein, on this Contract, on the Contractor and/or his personnel shall be paid by the Contractor. Any taxes collectible under this Contract, other than those stipulated in this Contract, shall be at the responsibility and account of the Contractor.

The stamp duty for any service contract (Construction, Hire of Work, Consultancy Service, Transportation, Supervisor, etc.) with the Contract value of the service portion lower than baht 200,000.- is required to be affixed by the Contractor on the original copy and the counterpart of the Contract. In case the value of the service portion is baht 200,000.- and over, payment of such stamp duty by the Contractor shall be made in cash to the Revenue Department of Thailand or its authorized subdistrict offices. In either case, the stamp duty is required to be affixed or paid, as the case may be, within fifteen (15) Days after the date of Contract execution, otherwise the Contractor shall be liable to pay for any and all penalties imposed for the delay as required by law.

The Contract value of the service portion to be calculated for stamp duty under this provision shall be the price excluding value added tax.

For a foreign Contractor who has no representative in Thailand, EGAT will, upon receipt of written request from the Contractor, affix or pay for stamp duties from EGAT's own fund on behalf of the Contractor, the Contractor is therefore required to reimburse EGAT for such stamp duties plus any and all penalties imposed by law for delay, if such delay is due to Contractor's failure to make written request to EGAT as aforesaid within a reasonable period of time.

If the Contractor fails to reimburse EGAT for any and all amount as required under this Article within the period of time fixed by EGAT, such period not to be shorter than fifteen (15) Days from the date of EGAT's notice for payment, EGAT has the right to claim directly from the Contractor or claim from Performance Security or Maintenance Security,

DRAFT

as the case may be, or deduct or setoff from any and all money due to the Contractor under this Contract for the outstanding amount together with interest at the rate of Minimum Overdraft Rate (MOR) plus two (2) per cent calculated from the due date up to the date the payment is made in full.

E-12. Performance Security

The Contractor shall, at the time of execution of the Contract, deposit with EGAT a performance security for the due and proper performance of this Contract in the amount of ten (10) per cent, round up to the nearest whole number, of the total Contract Price. The performance security shall insure payment of any obligations, penalty, damages, liquidated damages, or expenses for which the Contractor may become liable to EGAT.

The amount of the performance security shall be adjusted or the Contractor may deposit a new performance security in the amount of ten (10) per cent, round up to the nearest whole number, of the additional Contract Price to cover the Contractor's obligation in case the Contract Price is increased due to change of the Work under the Article E-21. Changes and Extra or Omitted Work.

The performance security shall be in the form of a cash deposit, or a cashier cheque issued by a local bank, or a bank guarantee or letter of guarantee issued only by a local bank or an acceptable financial institution in Thailand, or by a foreign bank counter-guaranteed by a local bank and, made payable to EGAT in the same currency as that of the Contract. In case of a cash deposit or a cashier cheque, only Thai baht portion of the Contract Price can be made. EGAT may at any time, upon application by the Contractor, approve the substitution for any performance security held under this Article by other performance security on such terms and conditions as may be approved by EGAT. The Contractor shall bear the cost of the performance security.

The conditions of the guarantor's obligations in the performance security shall include, inter alia, the following :

(1) The guarantor shall unconditionally guarantee, as primary obligor and not as surety merely, payment of any obligations, penalties, damages, liquidated damages, or expenses for which the Contractor may become liable to EGAT.

(2) No extension of time, change in, addition to, or other modification of the terms of the Contract or Work to be performed thereunder, or of the specifications or other Contract Documents shall in anyway release the guarantor from any liability under the performance security, and the guarantor shall thereby waive notice of any such extension of time, change, addition or modification.

DRAFT

(3) The performance security shall be valid and remain in full effect from the date of execution of the Contract until the issuance of the Acceptance Certificate by EGAT or the acceptance of Equipment deemed to be made by EGAT against submission of the Maintenance Security accepted by EGAT.

Unless and until an official receipt is issued in respect to a security deposit, EGAT will not recognize or accept any such deposit as fulfilling the requirements of this Article. Failure to deposit a performance security at the time specified above in this Article or such extended time as may be approved by EGAT shall be a breach of this Contract and EGAT is entitled to terminate the Contract or suspend any payment for Work performed until the performance security has been accepted by EGAT. EGAT shall not be liable for any losses, expenses and/or damages resulting from such payment suspension.

If any performance security furnished under this Article becomes unacceptable to EGAT, or if any guarantor fails to furnish reports as to guarantor's financial condition from time to time, as requested by EGAT, the Contractor shall promptly furnish such additional or alternative security as may be required by EGAT from time to time to protect the interests of EGAT up to an amount equal to the amount of the security.

In the event of any default or breach of this Contract by the Contractor, EGAT may convert into money any performance security which does not consist of money, and the proceeds shall be deemed to be a cash deposit under this Article. EGAT shall not be liable for any cost, expenses and/or loss incurred in connection with such conversion.

The performance security, in case of a bank guarantee, or letter of guarantee, shall be in conformity with the specimen acceptable to EGAT as shown herein at the end of these General Conditions.

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E-13. Inspection and Tests

All Equipment furnished and all Work performed under this Contract shall be subject to inspection by EGAT or EGAT's authorized representatives at its option. while such Work is in progress to ascertain that the completed Work will comply in all respects with the standards and requirements set forth in the Contract Documents. Notwithstanding such inspection, the Contractor will be responsible for the acceptability of the finished Work.

EGAT or EGAT's representatives shall at all times have access to the Work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and shall furnish promptly, without additional charge, all facilities, labor and material reasonably needed for safe and convenient inspection by EGAT or EGAT's representatives. The Contractor shall notify EGAT at least two (2) Months in advance

when and where the Equipment and the Work will be available for each inspection and test. Any expense incurred by EGAT or EGAT's representatives to inspect the Equipment and the Work or to attend the test caused by false call of the Contractor for inspection and tests shall be borne by the Contractor.

If any Work should be covered up, or otherwise made inaccessible, without the approval of EGAT, it shall, if required by EGAT, be uncovered and made accessible for examination. Any such cover, which is required in the finished Work, shall be restored to EGAT's satisfaction at the Contractor's expense.

The acceptance of any Work or Equipment covered by these Contract Documents, or the making or waiving of any inspection or witnessing of any tests shall in no way relieve the Contractor of full responsibility for the quality, character and satisfactory operation and performance of the complete Work, and every part of it, as outlined in these Contract Documents, nor shall it prejudice or affect the rights of EGAT as set forth in the Contract.

Unless otherwise specifically provided in the Contract, the expenses directly required for all labor, tools, instruments, other materials and Equipment necessary for performance of the tests shall be borne by the Contractor.

The Contractor shall at his own expense conduct shop tests in accordance with the Specifications and submit the results of the tests to EGAT upon completion of tests. EGAT reserves the right to inspect all Equipment either in person or via video conference during its manufacture or fabrication and prior to its preparation for shipment, to inspect its packing when ready for shipment, and to witness any or all tests.

In the event the results of the tests do not satisfy the requirements of the Specifications or the guaranteed performance, the Contractor shall rectify to improve the Equipment until satisfactory results are obtained and shall conduct all necessary retests at his own expense.

Any delay in delivery due to the retest shall not constitute a release of the Contractor from his responsibility for delay. Any expenses incurred by EGAT in attending these retests shall be borne by the Contractor.

EGAT reserves the right to send one or more of EGAT's employees, not as inspectors, to the Contractor's plant to witness the fabrication, assembly and testing of any or all parts of the Equipment being furnished under this Contract. Travelling expenses and per diem of such employee or employees shall be borne by EGAT.

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E-14. Preparation for Shipment and/or Delivery

The Contractor shall submit shipment and/or delivery schedule for EGAT's approval at least thirty (30) Days in advance before each shipment and/or delivery is made. No shipment and/or delivery shall be made prior to EGAT's approval which will be notified to the Contractor within fifteen (15) Days after receipt of the said shipment and/or delivery schedule.

All imported and local Equipment to be delivered under this Contract shall be satisfactorily packaged in such a manner to protect them from damage during transportation and for outdoor storage at the site in hot, wet, humid and dusty conditions. In addition, the imported Equipment shall also be satisfactorily packaged for moist tropical ocean shipment. Where necessary, heavy parts shall be mounted on skids so that cable slings for handling can readily be attached. Where it is unsafe to apply external slings to a package, attached slings shall be provided and shall project through the package so that attachment can readily be made.

In order to keep the damage to non-water proof Equipment during the transportation at minimum level, the Contractor and/or supplier is required to put an umbrella mark on every package of the Equipment.

In order to accelerate the dispatch of the Equipment to the site, the Contractor is required to arrange packaging of the Equipment in such a manner that a complete set of one unit shall be packed in package(s) or crate(s) with indication of designated substation but each individual package or crate shall contain the Equipment for only one unit or part of a complete set of one unit or otherwise as directed in the Instructions for Packaging attached at the end of Section E. General Conditions.

For Power Transformer and Shunt Reactor, in addition, all accessories, which are packed in aforesaid manner shall be contained in a container per transformer except for transformer insulating oil, radiators and conservator including other accessories which for dimensional reason after packaging are unable to be contained in the said container. However, spare parts shall be contained in a separate container per each shipment or Contract to be awarded. The containers to be used shall become the property of EGAT. The dimensions of containers shall be as follows : -

Container Dimensions	Door Dimensions
Height 2.59 m.	Height 2.28 m.
Width 2.44 m.	Width 2.33 m.
Length 6.05 m.	

In addition, details of Equipment and substation destination per container shall be identified in Bill of Lading.

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Detailed breakdown prices for spare parts of Equipment shall be also indicated in the invoice.

Prior to delivery of all Equipment, packaging details shall also be submitted to EGAT for approval.

The cost incurred for repair or replacement of any damages to the Equipment due to improper packaging shall be at the Contractor's expense.

Each individual package or crate shall be clearly and plainly tagged or marked for identification as follows:

EGAT, THAILAND
PROJECT NAME :_____
CONTRACT NO. :_____
SUBSTATION :_____
CASE NO. :_____
ITEM NO. :_____
DESCRIPTION :_____
EGAT'S SERIAL NO. :_____(if any)

In addition to this, the following instructions shall be observed :

a. Each box, crate, case, bundle or piece of loose Equipment shipped must show the following information clearly marked on its body :
   1. Gross weight in kilograms
   2. Net weight in kilograms
   3. Dimensions in centimeters

b. All boxes, crates, cases, bundles, loose pieces, etc. must be marked consecutively from No. 1 upward throughout all shipments to completion of the order without repeating the same number.

c. The packing list must indicate whether shipment is partial or complete, and shall incorporate the following information on each container, etc., according to its individual shipping number:
   1. Export case markings
   2. Case number
   3. Container number (for Power Transformer and Shunt Reactor)
   4. Item number
   5. Gross weight and net weight in kilograms
   6. Dimensions in centimeters
   7. Complete description of Equipment
   8. EGAT's serial No. (if any)

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E-15. Clearance and Weight Limitations

The largest unloading facilities at Bangkok Wharf are 35 metric ton cranes. Lifts heavier than 35 tons will have to be handled by ocean freighter on-board lifting equipment. Ocean freighters of the 10,000 tons class regularly calling at Bangkok Wharf have off-loading capacities to handle 50 tons.

The largest unloading facilities at Laem Chabang Port are 30 metric ton cranes. Lifts heavier than 30 tons will have to be handled by ocean freighter on-board lifting equipment.

Generally, unloading at Thai Port and highway transportation are subject to the following limitations:

Dimensions	Limitations		
	Unloading at Bangkok Wharf/ Highway Transportation		Unloading at Laem Chabang Port/Maptaphut Port
Weight (tons)	60.0	>60.0-135.0	120.0
Width (meters)	3.5	3.5	4.5
Length (meters)	10.0	10.0	25.0
Height from Loading Platform (meters)	3.7	4.0	4.0

The Contractor shall therefore exercise due care to pack the Equipment to meet the above transport limitations.

For Power Transformer and Shunt Reactor, the shipping weight of the largest part is indicated in Ratings and Features.

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E-16. Shipment

Shipment of Equipment from port of embarkation to the final port of discharge shall be effected by using Thai vessels through the sea freight forwarder appointed by the Contractor. The Contractor is required to notify EGAT of the name of the sea freight forwarder one (1) week prior to shipment.

According to the regulations of ***the Maritime Promotion Division***, Marine Department (as amended from time to time), shipments by non-Thai vessels can be made after receipt of permission granted by ***the Maritime Promotion Division***, Marine Department as requested by the Contractor.

The Contractor is, therefore, required to immediately contact ***the Maritime Promotion Division***, Marine Department for such permission with supporting documents of the case thereof for arrangement of the permission in advance.

The Contractor shall follow all other regulations stated in the Mercantile Marine Promotion Act B.E. 2521 and the regulations of ***the Maritime Promotion Division***, Marine Department (as amended from time to time).

The Contractor shall be liable for any and all costs and expenses, losses and/or damages suffered by EGAT as a result of the Contractor's failure to comply with such regulations.

For more information, the Contractor may contact ***the Maritime Promotion Division, Marine Department at telephone No. 66 2233 1311-8 extension 387 and facsimile No. 66 2639 4778, https://maritimepromotion.md.go.th/***

All imported Equipment shall be shipped on Conference Line or on seaworthy oceangoing vessels which are members or associate members of the International Association of Classification Societies (IACS) and ISM Code Certified Vessels. Vessels over fifteen (15) years of age shall not be used for shipment under this Contract unless they : -

a) have been used for the carriage of general cargo on an established and regular pattern of trading between a range of specified ports and do not exceed twenty-five (25) years of age, or

b) were constructed as containerships, vehicle carrier or double-skin open-hatch gantry crane vessels (OHGCs) and have been continuously used as such on an established and regular pattern of trading between a range of specified ports, and do not exceed thirty (30) years of age.

Shipment shall be made under deck except for such Equipment which for dimensional reasons cannot be stowed in the vessels hold. In case Equipment cannot be stowed in the vessel hold, permission shall be obtained from EGAT prior to loading such Equipment on deck. Such approval shall not be unreasonably withheld. The Contractor shall in any case be responsible for proper packing for protection of such Equipment loaded on deck of the vessel. Shipment of all Equipment by dry cargo container will be accepted, but all the incidental expenses shall be borne by the Contractor.

For shipment of Equipment under this Contract, transshipment is allowed.

DRAFT

Any delicate Equipment, materials, instruments and tools including but not limited to computers, electronic parts, etc., shall be shipped by airfreight. The Contractor shall be responsible for proper packing for protection of such Equipment loaded on cargo hold of the aircraft.

Air freight shipment to airport of disembarkation in Thailand shall be effected through the air freight forwarder appointed by the Contractor. The Contractor is required to notify EGAT of the name of the air freight forwarder one (1) week prior to shipment.

E-17. Documents Required for Each Shipment

a. For Seafreight

For accounting procedure, the Contractor is required to send to EGAT the bill of lading, invoice and master packing list immediately by ***letter submitted electronically or by electronic mail (E-mail)*** but not later than three (3) Days after the Equipment are actually loaded free on board (FOB Vessel) at the port of Shipment.

One (1) original negotiable bill of lading, three (3) original signed invoices and packing lists shall be mailed directly to EGAT by express airmail within four (4) working days after the date of departure of the ocean-going vessel from the port of shipment.

Two (2) original negotiable and five (5) copies of non-negotiable bill of lading, ten (10) original signed invoices and three (3) copies of packing lists shall be submitted to EGAT through the Bank within the time as specified in the letter of credit. - This requirement is applied only in case payment is made by letter of credit.

b. For Airfreight

For accounting procedure, the Contractor is required to send to EGAT the airway bill, invoice and master packing list immediately by ***letter submitted electronically or by electronic mail (E-mail)*** but not later than three (3) Days after the Equipment are actually loaded on the air carrier at the airport of departure.

Three (3) original signed invoices and packing lists shall be attached to the airway bill and dispatched together with the airfreight shipment.

One (1) copy of airway bill, two (2) original signed invoices and packing lists shall be sent directly to EGAT by courier within four (4) working days after the date of departure of the carrier from the airport.

Two (2) copies of airway bill, ten (10) signed invoices and three (3) copies of packing lists shall be submitted to EGAT through the bank within the time as specified in the letter of credit. - This requirement is applied only in case payment is made by letter of credit.

DRAFT

To act in accordance with the rules and regulations of the Customs Department of the Kingdom of Thailand, as well as to enable EGAT to expedite clearing the Equipment from the Customs House accordingly, the following declarations, other than regular statements, have to be made in English in the invoice for any transaction concluded with EGAT.

a. Country from which Equipment is purchased as well as country of origin; if the Equipment is produced in the country or group of countries where there are trade agreements between such country or group of countries and the Kingdom of Thailand, preferential treatment on import duty and taxes for importation of the Equipment is required;

b. Electricity Generating Authority of Thailand as consignee and Thailand as consigning country

c. Date and Number of Contract;

d. Name of Project, if any;

e. Marking and numbers, as well as gross weight and volume;

f. Details of Equipment, i.e. names, kinds, qualities, quantities, net weights, and other particulars as available for each type including trademarks or other symbols of such Equipment. If there are no trademarks or symbols, the invoice shall indicate "no trademarks", "no symbols", as the case may be;

g. Selling price or value of Equipment per unit expressed in the type of currency under transaction and representing actual price or value of Equipment as stated in the price schedules or price breakdown, as the case may be;

If the Contractor fails to specify the price or value of Equipment according to the Contract in the invoice prepared for shipment, the Contractor shall be held responsible for the following:

1. In case of over value or price of Equipment stated in the invoice, the Contractor shall be responsible for reimbursement to EGAT for the import duty and taxes (excluding value added tax) collected by the Customs Department and the insurance premium (excluding value added tax) on the over value or price of Equipment as well as interest. Value added tax imposed in connection thereto shall be EGAT's responsibility. The Contractor shall also refund to EGAT the amount of over value payment as well as interest. The interest to be applied under this Article shall be Minimum Overdraft Rate announced by Krung Thai Bank plus two (2) (MOR+2) percent calculated from the date of EGAT's payment of the over value payment, import duty and taxes as well as insurance premium until the date of the Contractor's settlement of the same in full.
2. In case of under value or price of Equipment stated in the invoice, the Contractor shall be responsible for reimbursement to EGAT the surcharges imposed on additional import duty and taxes at the rate currently established by

DRAFT

the Customs Department as well as interest (if any) and also shall be responsible for compensation to EGAT for cost incurred in repair or replacement of the damaged Equipment which is not covered by insurance due to under value or price of Equipment stated in the invoice.

h. Other expenses:

1. Packing charges (if any)
2. Insurance premiums (if insured)
3. Freight
4. Others (if any)

The Contractor shall, at the time of shipment, prepare and submit a certificate of origin(s) for the Equipment required as per point a. above together with the invoice and other shipping documents for EGAT to obtain the benefit from preferential treatment on import duty and taxes for importation of the Equipment from the country or group of countries where there are trade agreements between such country or group of countries and the Kingdom of Thailand. For each shipment, all items of Equipment requiring certificate of origin shall be included in only one (1) certificate of origin except as otherwise specified in any trade agreement. The trade agreements shall include but not be limited to the following:

1. Common Effective Preferential Tariff (CEPT) Scheme for the ASEAN Free Trade Area (AFTA);
2. Agreement between the Kingdom of Thailand and Japan for an Economic Partnership; and
3. Agreement between the Government of the Kingdom of Thailand and the Government of the People's Republic of China on Accelerated Tariff Elimination under the Early Harvest Programme of the Framework Agreement on Comprehensive Economic Cooperation between ASEAN and China.

If the Contractor advises EGAT in writing before shipment that it is unable to provide a certificate of origin to EGAT, the Contractor shall be responsible for all costs incurred including but not limited to reimbursement to EGAT for the excess amount of the import duty and taxes (except value added tax) paid by EGAT to Customs Department.

Further to the above, if the Contractor delays to provide a proper certificate of origin to EGAT, the Contractor shall be responsible for all costs incurred including but not limited to reimbursement to EGAT for the storage charges and the interest on the excess amount of import duty and taxes (except value added tax) paid by EGAT to the Customs Department at the rate of Minimum Overdraft Rate announced by Krung Thai Bank plus two (2) (MOR+2) percent calculated from the date of EGAT's payment of import duty and taxes up to the date of receipt of the excess amount of import duty and taxes refund from the Customs Department.

However, if the Contractor fails to provide such proper certificate to EGAT, the Contractor shall be responsible for all costs incurred including but not limited to reimbursement to EGAT for the storage charges and the excess amount of import duty and taxes (except value added tax) paid by EGAT to the Customs Department as well as interest on the said excess amount of import duty and taxes at the rate of Minimum

DRAFT

Overdraft Rate announced by Krung Thai Bank plus two (2) (MOR+2) percent calculated from the date of EGAT's payment of import duty and taxes up to the date of acknowledgement that the certificate cannot be issued in conformity with requirement of the Free Trade Agreement.

The Contractor is also required to study the existing trade agreements and any new trade agreement between the Kingdom of Thailand and a country or group of countries published in the website of Customs Department (www.customs.go.th) and/or Ministry of Commerce (www.moc.go.th), and ask for more information from EGAT in order that EGAT can obtain the benefit from preferential treatment on import duty and taxes for importation of the Equipment from the country or group of countries where there are trade agreements between such country or group of countries and the Kingdom of Thailand.

Fullest conformity with the requirements of the Customs Department of the Kingdom of Thailand mentioned above is essential as a condition precedent.

Unless by force majeure, failure to furnish EGAT with these shipping documents and the certificate of origin within the specified period and strictly in accordance with conditions stipulated above thereby causing impossibility of making prompt customs clearance of the Equipment from Thai Port, the Contractor shall, upon receipt of the EGAT's notice, reimburse EGAT for go down rent / storage charge and other expenses arising from or in consequence of the nonconformity with the above specified requirement.

E-18. Force Majeure

The Contractor shall not be in default under this Contract because of any delays in delivery or in completion of the Work on the separable parts thereof which delays are caused by force majeure; provided, that the Contractor shall notify EGAT in writing of the cause of any such delay within fifteen (15) Days after the end of the event which results in the delay. Upon receipt of any such notice of delay, EGAT will promptly ascertain the facts and the extent of the delay and will extend the time for the delivery and assembly of the Equipment or the time for completing the Work when, in the opinion of EGAT, the delay is caused by force majeure or the findings of fact to justify an extension. EGAT's decision shall be binding on the Contractor, subject to the provision of Article E-31. Dispute Resolution included in these General Conditions.

"Force Majeure" shall be defined as any event, the happening or pernicious results of which could not be prevented even though a person against whom it happened or threatened to happen were to take such appropriate care as might be expected from him in this situation. (Normal rains, inundation, dearth of water, and the overturning or sinking of barges in canals, rivers, or streams and similar events shall not be considered as force majeure).

DRAFT

E-19. Transportation Insurance

Transportation insurance from the port of shipment/from the Contractor's premise(s) to EGAT's Store and/or EGAT's site will be under the responsibility of EGAT.

E-20. Transfer of Title

The title of ownership for the Equipment furnished under this Contract shall be passed to EGAT at the time the Equipment is actually loaded onto the vessel at the port of shipment, or into charge of the air carrier at the port of departure, or at the time the Equipment is actually delivered ex-works and the Contractor's statement or delivery order confirming delivery of the Equipment ex-works has been certified by EGAT's representative. However, this transfer of title shall not be construed as an acceptance of the Equipment. The Contractor shall continue to be responsible for the quality and performance of the Equipment, and for their compliance with the Specifications as well as any loss, theft or damage of the Equipment during the course of execution of the Contract, until final acceptance of the Work by EGAT and the fulfillment of the guarantee provision of the Contract.

E-21. Changes and Extra or Omitted Work

EGAT may at any time authorize changes in, additions to, or deductions from the Equipment to be furnished under the Contract. Changes, additions, or deductions shall be authorized only by written notice served by EGAT upon the Contractor and such notice shall be treated as an integral part of the Contract. Adjustments, if any, in the amounts to be paid to the Contractor by reason of any such change, addition, or deduction shall be determined by one or more of the following methods :

a. by unit price contained in the Price Schedules

b. by an acceptable lump sum or unit price proposal from the Contractor

c. on a cost-plus limited basis not to exceed a specific limit. A cost-plus limited basis is defined as the cost of Equipment, labor, and insurance, plus fifteen (15) per cent of the said cost to cover superintendence, general expense, and profit.

No claim for an addition to the Contract Price shall be valid unless authorized as described in this Article. If the parties are unable to agree to the method to be employed in determining adjustments in the Contract Price, the method shall be determined by EGAT.

DRAFT

E-22. Termination and Suspension of Contract

EGAT may, by written notice sent to the Contractor, terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for EGAT's convenience, the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.

The Equipment that are completed and ready for shipment within thirty (30) Days after the Contractor's receipt of notice of termination shall be purchased by EGAT at the Contract terms and prices. For the remaining Equipment, EGAT may elect :

a. to have any portion completed and delivered at the Contract terms and prices and/or

b. to cancel the remainder and pay to the Contractor an agreed amount for partially completed Equipment and for materials and parts previously procured by the Contractor.

E-23. Default and Termination

Should the Contractor :

a. fail to furnish the Equipment or carry out the Work in accordance with this Contract; or

b. refuse or fail to prosecute the Work or any part thereof which shall ensure its completion within the time specified in this Contract or any authorized extension of time by EGAT; or

c. fail to furnish the Equipment and/or complete the Work or any part thereof within the time specified in this Contract or any authorized extension of time by EGAT; or

d. commit any breach or fail to comply with any of the provisions of this Contract; or

e. notify EGAT in writing that the Contractor is unable or unwilling to furnish the Equipment or complete the Work or any part thereof; or

f. become insolvent or bankrupt or make an arrangement or composition with the Contractor’s creditors or, being a corporation, go into liquidation whether compulsory or voluntary (except for the purpose of reorganization); or

g. by himself or by any person on his behalf, give or offer any money or benefit of forbearance to any employee of EGAT and/or any employee of the Engineer who has duties or responsibilities in connection with the acceptance of the proposal or the making of this Contract;

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then, in any of such events, the Contractor shall be in default under this Contract, and EGAT may at his sole discretion take any one or more of the following actions that it considers appropriate :

(i) suspend payments under this Contract until the default has been rectified;

(ii) cancel or terminate the Contract in whole or in part;

(iii) take that part of the furnishing of Equipment or the Work, in respect of which the delay or default has occurred, out of the hands of the Contractor or any other person in whose control or possession it is;

(iv) reduce the Contract Price by an amount equal to the reduction in value to EGAT of the Equipment as actually delivered.

The Contractor shall be liable for all losses and/or damages including but not limited to the increased installation costs and increased administrative costs, suffered by EGAT as a result of the Contractor's default. The Contractor shall have no claim for payment with respect to Work thereafter performed.

All such damages may be recovered by EGAT from the Contractor in any court of competent jurisdiction or, without prejudice to that right, by deduction from any money due or becoming due to the Contractor under this Contract, or from any security deposited, or, after use of the property and materials of the Contract for completion of the work, as provided in this Contract, such property and materials may be sold and the proceeds shall be applied to any remaining obligations of the Contractor.

E-24. Indemnification by the Contractor

The Contractor shall fully indemnify and hold harmless EGAT and its employees and officers from and against any and all suit, actions or administrative proceedings, claims (including any claim for copyright or patent infringement), demands, losses, costs, expenses (including attorney's fees and expenses) and damages of whatsoever nature except breach or default, in respect of death or injury of any person or loss of or damage to any property caused by any act or omission of the Contractor or the Contractor's own officers, directors, agents, employees, Contractors or Subcontractors arising in any manner whatsoever, except any injury, death or property damage caused by the negligence of EGAT, its contractors, employees, officers or agents.

DRAFT

E-25. Limitation of Liability

The liability of the Contractor to EGAT arising from default or termination under the Contract in aggregate shall not exceed the total Contract Price.

E-26. Consequential Damages

Neither party shall be liable to the other party for any indirect, incidental, consequential or punitive damages as a result of the performance or nonperformance of the obligations imposed pursuant to this Contract**,** unless such indirect, incidental, consequential or punitive damages are foreseen or could have been foreseen at the time of execution of the Contract.

E-27. Vesting of Contract in Receiver

If the Contractor shall compound with his creditors, or shall become bankrupt or insolvent, or carry on business under a receiver, or become incapable from any cause whatsoever of carrying out the Work, any such receiver or any person in whom by law the Contract shall become vested, shall forthwith give notice to EGAT of the fact that the Contract has become vested in it and shall take all reasonable steps to carry on the Work at a rate fulfilling the Contract requirements. Thereupon, if EGAT so desires, such receiver or other such person as aforesaid shall have the option, during the period of one (1) Month from the date when the Contract becomes so vested in it, of carrying out the Contract. In the event of the Work being stopped, this option shall be opened only for a period of fourteen (14) Days from the stoppage date. In the event of the receiver or such other person not electing to carry out the Contract or EGAT not approving the carrying out of the Contract by the receiver, the Contractor shall then be in default and EGAT may proceed in accordance with Article E-23. Default and Termination.

DRAFT

E-28. Extension of Time

If, by reason of any of the following :

a. Negligence or default on the part of EGAT or its agents,

b. Alteration in or addition to the Work,

c. Suspension of the Work at the written direction of EGAT for reasons beyond the control of the Contractor,

d. War, insurrection, riot or civil commotion or delay caused thereby,

e. Strikes, not caused by the Contractor's management,

f. Lawful order of civil or military authorities,

g. Unusually natural calamities, acts of God,

h. Any other unforeseen circumstance beyond the Contractor's control.

The Contractor claims that he has been unduly delayed in the progress of the Work, he shall make written request to EGAT for an extension of time for completion of the Work or any portion of it.

Should EGAT consider such claim to be valid, it will grant such extension of time as may seem reasonable to EGAT, without thereby prejudicing or in any manner affecting the validity of the Contract. No extension of time will be granted unless the Contractor makes the written request within fifteen (15) Days after the end of the event which results in the delay.

Other than claiming an extension of time for completion of the Work or any portion of it, the Contractor shall not have any further recourse or claim against EGAT, nor shall he have any right of action against EGAT for loss or damage suffered by reason of such delay.

E-29. Failure to Meet Requirements

EGAT shall have the right to require the Contractor to make any changes in the Equipment or Work covered by this Contract, which may be necessary in the opinion of EGAT, to make the Equipment or Work conform to the requirements of the Contract Documents, without additional cost to EGAT. Any defects in the Equipment or workmanship or other failure, to meet the requirements of the Contract, including errors and omissions on the part of the Contractor, which are disclosed prior to final payment or prior to acceptance by EGAT,

DRAFT

or after completion of all tests, whichever occurs at the later date, shall, if so directed by EGAT, be corrected or replaced promptly by the Contractor at the expense of the Contractor.

In case of replacement of Equipment due to non-conformity with EGAT's specifications and/or defects found prior to acceptance of Equipment by EGAT or replenishment for short pack or returning of repaired Equipment due to such defect, the Contractor shall, upon receipt of EGAT's written notice supported with the receipt issued by the relevant parties, be responsible for reimbursement of the expenses incurred for the following :

- All re-export charges (if any)
- Import duty and taxes
- Landing charges, rents and handling charges (ocean freight)
- Storage charges (air freight)
- Truck hire
- Labour charges

These expenses shall exclude value added taxes, which will be EGAT’s responsibility.

The contractor shall be also responsible for reimbursement of Service charges for customs clearance (if any) including value added tax.

Any latent defects not disclosed prior to the date of final payment or prior to acceptance or after completion of all tests, whichever occurs at the later date, but disclosed within the guarantee period as specified in Article F-10.a., shall be corrected or replaced promptly by the Contractor at the expense of the Contractor, except that the cost of import duty and taxes, inland transportation and installation of the replacement parts for foreign supply Equipment, and the cost of inland transportation and the installation of the replacement parts for local supply Equipment will be borne by EGAT.

For Equipment specified in Data Sheet, in case EGAT, at its sole discretion, requires the Contractor to replace any defected Equipment, the Contractor shall replace the Equipment with the whole new set at its own costs and expenses including the cost of all re-export charges (if any), import duty and taxes, landing charges, rents and handling charges (ocean freight), storage charges (air freight), truck hire, labour charges, service charges for customs clearance, inland transportation and installation of the Equipment.

The Contractor shall extend the provisions of his liability to cover all repair and replacement parts furnished from the day immediately following the date of completion of such repair or replacement as follows:

DRAFT

Time of Malfunctioning and/or Defect Found	Guarantee Period Extension				
	Equipment with 1-Year guarantee period	**Equipment with 2-Year guarantee period**	**Equipment with 3-Year guarantee period**	**Equipment with 4-Year guarantee period**	**Equipment with 5-Year guarantee period**
First Year	For a new period of one (1) Year.	For a new period of two (2) Years.	For a new period of three (3) Years.	For a new period of four (4) Years.	For a new period of five (5) Years.
Second Year	n/a	For a new period of one (1) Year.	For a new period of two (2) Years.	For a new period of three (3) Years.	For a new period of four (4) Years.
Third Year	n/a	n/a	For a new period of one (1) Year.	For a new period of two (2) Years.	For a new period of three (3) Years.
Fourth Year	n/a	n/a	n/a	For a new period of one (1) Year.	For a new period of two (2) Years.
Fifth Year	n/a	n/a	n/a	n/a	For a new period of one (1) Year.

The Contractor shall, if required by EGAT in writing, search under the directions of EGAT for the cause of any defect, imperfection or fault appearing prior to the acceptance of Equipment or in the period of maintenance guarantee. Unless such defect, imperfection or fault shall be one for which the Contractor is liable under the Contract, the cost of the work carried out by the Contractor in searching as aforesaid shall be borne by EGAT. If such defect, imperfection or fault shall be one for which the Contractor is liable under the Contract, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case repair, rectify and make good such defect, imperfection or fault at his own expense.

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E-30 Operation or Use of Unsatisfactory Equipment

If the operation or use of the Equipment proves to be unsatisfactory to EGAT, EGAT shall have the right to operate and use such Equipment until they can be taken out of service for correction by the Contractor of such latent defects, error, or omissions and for replacement in whole or in part, if correction is unsuccessful or infeasible. The period of such operation or use shall not exceed one (1) Year from the day immediately following the date of acceptance of Equipment by EGAT.

E-31. Dispute Resolution

Any dispute arising out of or in connection with this Contract, interpretation, breach, or termination thereof shall be settled by amicable discussion between authorized representatives of each Party. Either Party may at any time send a written notice to the other Party requesting for an appointment of authorized representative for a settlement of any dispute hereunder. The Parties agree to make diligent and good faith attempt to resolve such dispute in an equitable manner. If the authorized representatives of both Parties are unable to resolve such dispute within 30 Days after commencement of the discussion for dispute resolution or other extended period of time as mutually agreed by both Parties, either Party may file a lawsuit to the court having jurisdiction in Thailand for settlement of such dispute. Each Party agrees that the final court judgment shall be conclusive and binding upon the Parties.

Pending decision of the court, both Parties shall continue to perform their respective obligations under this Contract.

E-32. Language and Numbers

All drawings, designs, specifications, manuals, nameplates, markings, operating instructions, statements, schedules, notices, documents, and all written communications between EGAT and the Contractor, concerning this Contract, shall be in the English language and in the metric system of weights and measures unless otherwise specified.

DRAFT

SPECIMEN OF GUARANTEE

To : Date

Electricity Generating Authority of Thailand
Bangkruai, Nonthaburi, 11130

Thailand

Re : Performance Security for Contract No. _____

Gentlemen :

In accordance with the provision of the Contract for_____No. _____(hereinafter referred to as the Contract) the contents of which have been noted by us that Messrs._____(hereinafter referred to as the Contractor) has to deposit with Electricity Generating Authority of Thailand (hereinafter referred to as EGAT) a Performance Security for the proper and faithful performance of the Contract in the amount of _____ (in words :_____) which is_____per cent, round up to the nearest whole number, of the total Contract Price, we, the _____as instructed by the Contractor, agree unconditionally to irrevocably guarantee as primary Obligor, the payment to EGAT on its first demand, without whatsoever right of objection on our part and without its first claim to the Contractor, in the amount not exceeding : ____(in words :_____) in the event the obligations expressed in the above mentioned Contract have not been fulfilled by the Contractor, giving EGAT the right of claim for penalty, damages, liquidated damages or any expenses for which the Contractor may become liable to EGAT under the Contract.

We further agree that no extension of time, change in, addition to or other modification of terms of the Contract or Work to be performed thereunder, or of the Specifications or other Contract Documents, which may be made between EGAT and the Contractor, shall in any way release us from any liability under this guarantee, and we shall thereby waive notice of any such change, addition or modification.

This Performance Security shall be valid and remain in full effect from the date of execution of the Contract until the issuance of the Acceptance Certificate by EGAT or the acceptance of Equipment deemed to be made by EGAT against submission by the Contractor of the Maintenance Security accepted by EGAT.

Yours very truly,

_____
Authorized Signature

DRAFT

Instructions for Packaging

Name of Equipment	Packed per complete set of one unit/units	Packed per Substation
1. Power Transformer	√(1)	-
2. Distribution Transformer	√(1)	-
3. Shunt Reactor	√(1)	-
4. Surge Arrester	√(1)	-
5. Current Transformer	√(1)	-
6. CC, CCVT, VT	√(1)	-
7. GIS	-	√
8. Shunt Capacitor Bank	-	√
9. Power Circuit Breaker	√(1)	-
10. Disconnecting Switch	√(1)	-
11. AC/DC Dist. Board, LCUS, LRP	√(1)	-
12. Stationary Battery	√(1)	-
13. Lighting Fixture	-	√
14. Identification and Danger Notice Plate	-	√
15. Control and Protection System	√(1)*	-
16. Computerized Control System	-	√
17. Power Line Carrier	-	√
18. Teleprotection	-	√
19. Line Trap	-	√
20. Battery Charger	√(1)	-

Note : 1. Number in parenthesis represents maximum number of complete set of one unit/units packed in an individual package or crate.

2. * In case of spare for control and protection system, such Equipment shall be packed per board, but in case of loose control and protection system, such Equipment of whichever substation shall be packed in the same package or crate of that substation.

3. Other substation Equipment not mentioned shall be packaged in such a manner that it will not cause unreasonable expenses or delay to EGAT in distribution of such Equipment to the designated substation.

4. Prior to delivery of all Equipment, packaging details shall be submitted to EGAT for approval.

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SECTION F

SPECIAL CONDITIONS

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SPECIAL CONDITIONS

F-1. Scope of Work

The Contractor shall perform, furnish and deliver the Equipment as required by these Contract Documents.

For imported Equipment, Transportation from Thai Port to sites shall be EGAT's responsibility. However, the Contractor shall, at his own expenses and responsibility, perform unloading the Equipment at the port or airport of disembarkation in Thailand.

For local supply, Transportation from the Contractor's premises to the sites shall be EGAT's responsibility. However, the Contractor shall, at his own expenses and responsibility, perform loading the Equipment on EGAT's trucks or trailers at the Contractor's premises and shall be liable for all losses and/or damages to the Equipment as well as any expenses causing therefrom.

F-2. Responsibility of Contractor

The Contractor shall be solely responsible for ensuring that the Work throughout is executed in the most substantial, proper and workmanlike manner, with the best quality materials and conforming to the best engineering practice for the operating conditions specified; the drawings and quality control are performed or made in accordance with the Contract; and services reasonably to be furnished though not specifically provided in the Contract are furnished; all to EGAT's entire satisfaction notwithstanding that certain portions of the work may be executed by the Subcontractor.

F-3. Cooperation with Other Contractors

The Contractor, if required, shall exchange with other Contractor furnishing associated Equipment, all necessary drawings and other information required to insure the complete and proper design and manufacture of the Equipment to be furnished under these Specifications. One (1) copy of all drawings and correspondence, relating to information interchanged between Contractors, shall be sent to EGAT in Nonthaburi, Thailand.

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***F-4. Supervision of Installation**

Subject to the desire and decision of EGAT, the Contractor may be required to furnish the services of qualified and experienced supervisor(s) who has at least three years experience on the particular Work required under the Contract and shall be the permanent employee of the manufacturer of the Equipment. For 230 kV (or lower) Power Circuit Breaker and 115 kV (or lower) Gas-Insulated Switchgear, the permanent employee of the representative of the manufacturer is acceptable, provided that such employee is certified by the manufacturer.

The scope of responsibility of the supervisor on behalf of the Contractor is as follows :

a. Supervise and be responsible for the installation, erection, adjustment, field test and commissioning of the Equipment.

b. Prepare formulation sheets for a check list, test sheet, release form and field report to be discussed with EGAT before performing the installation work.

c. Submit four copies of report summarizing the work performance, from the beginning to the completion of the supervisory period, to EGAT within one month after finish the installation work or final inspection. The report shall include the following :
   1. Note on pending matter i.e. faulty and omitted equipment, performance deficiency etc.
   2. Problem concerning installation performance.
   3. Photographs showing progress of the installation work periodically until the work is completed.

The Contractor shall, in each and every instance, cooperate fully with the construction personnel installing and/or operating the Equipment and the Work, the operations of the supervisor shall be coordinated with the program of construction at the site as directed by EGAT.

The supervisor shall report at EGAT in Nonthaburi, Thailand, on the date designated by EGAT after a reasonable advance notice from EGAT, and shall remain until the Equipment have been in satisfactory operation for at least ten (10) working days as determined by EGAT, unless released earlier by EGAT.

The installation supervisor must be able to understand, speak, read and write the English language fluently. Should an interpreter be necessary, the cost of such interpretation service shall be at the Contractor's expense.

*If installation supervisor is required as specified in Price Schedule, this provision shall apply to this Contract.

DRAFT

F-5. Acceptance Tests

After the Equipment have been installed and placed in satisfactory operation, they may be tested by and at the expense of EGAT to determine whether or not all requirements of these Contract Documents have been met and the Contractor's guarantees have been fulfilled. The Contractor will be permitted to have his representative present at his own expense. If the tests show that the requirements or guarantee have not been met, the Contractor shall, at his own expense, make all necessary corrections. Additional tests will then be made to demonstrate to EGAT's satisfaction the effectiveness of these corrections. These additional tests will be at the Contractor's expense. Unless the necessary corrections have been made, the conditions of the Contract shall be considered unfulfilled.

All tests will be performed in accordance with the latest applicable Test Codes, unless otherwise stated.

F-6. Failure to Meet Performance Guarantees

If EGAT elects to accept the Equipment which do not meet any performance guarantee or which do not meet other requirements of these Contract Documents, as may be determined by factory test, field test or operation under service conditions, appropriate adjustment will be made of the Contract Price for such Equipment; provided that no such adjustment will be made until after the Contractor has been given a reasonable opportunity to repair, improve, or replace defective Equipment or parts thereof wherever practicable.

F-7. Acceptance Certificate

When EGAT is satisfied with the Equipment or agrees to accept the Equipment under the provision of Article F-6. Failure to Meet Performance Guarantees and there are no major unsettled claims against the Contractor by EGAT, EGAT will issue a written Acceptance Certificate against submission by the Contractor of maintenance security(ies) as specified in Article F-12. Maintenance Security and effective for a period of time as specified in Article F-10.a.

The Acceptance Certificate will list all deficiencies and reservations as a result of the inspection and tests performed, if any.

The purpose of the maintenance security is to guarantee the proper functioning of the Equipment supplied by the Contractor with a provision that the effective period of the maintenance security shall automatically be extended in case that the obligations stipulated in Article F-10. Maintenance Guarantee are not fulfilled.

A form of maintenance security acceptable to EGAT is shown in Article F-12. Maintenance Security.

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F-8. Payment

Payment in foreign currency will be made in the currency or currencies in which the price has been stated in the price schedules. The Contractor has to inform EGAT the mode of payment he requires for payment for foreign currency portion together with detail of bank account No., beneficiary's name and address etc. If the Contractor requires the payment of foreign currency portion to be paid directly to the suppliers, he has to inform EGAT which portion of the Contract Price, as stipulated in the term of payment of the Contract, to be paid accordingly. In case the local Contractor requires foreign currency or currencies to be paid directly to him, payment of such foreign currency or currencies will be made to the local Contractor in Thai Baht by using the selling exchange rate published by the Bank of Thailand on the payment date.

In case the Contractor requires the payment of foreign currency portion to be made through letter of credit, EGAT will, if there is no fault or any delay caused by the Contractor, establish the letter of credit in the name of the Contractor or Suppliers not later than thirty (30) Days after signing the Contract. The Contractor shall be responsible for all bank charges inside and outside Thailand and including opening, amendment, reimbursing charges, payment commission, cable charges, discrepancy fee, acceptance commission and others (if any) arising from Letter of Credit.

Payment in local currency will be made directly by EGAT.

The Contractor or beneficiary has to inform EGAT by mailed letter or ***letter submitted electronically or by electronic mail (E-mail)*** immediately the date upon which he has received the original letter of credit ***to be*** opened in his favour.

Payment will be made in the following manner :

a. Payment for Equipment (except Spare Parts and Optional Items)

Foreign Supply

1. Eighty (80) per cent of the Contract Price will be paid after delivery FOB Port of Shipment (FOB Vessel) on the basis of pro rata value of each shipment against presentation of invoices, shipping documents, EGAT's letters of approval for shipment and EGAT's letter of approval for test report* of the relevant Equipment including EGAT's letter(s) of approval for final drawings only for Control and Protection Equipment.

   *Test report means the report of tests specified in Article E-13. Inspection and Tests.

DRAFT

2. Ten (10) per cent of the Contract Price of each Schedule will be paid against presentation of Drawing and Document Acceptance Certificate to be issued by EGAT to certify the receipt of all drawings and documents required from the Contractor under Article F-11. Drawings and Documents to be Furnished by Contractor for such schedule, provided that payment shall not be made until EGAT has received from the Contractor the original signed negotiable Bill of Lading and appertaining documents giving evidence of shipment of the main Equipment of that Schedule.

3. Ten (10) per cent of the Contract Price of each Schedule will be paid after the Equipment have been installed, tested and operated or used for a period of 30 Days and the acceptance of the said Equipment has been made by EGAT against presentation of Acceptance Certificate to be issued by EGAT and submission of maintenance security by the Contractor. EGAT will list the minor pending claim(s), if any, and payment will be made by deducting such claimed amount.

   However, if, through no fault of the Contractor or of the Equipment, such installation, test and operation or use of the Equipment are delayed beyond a period of six (6) Months after complete delivery at Thai Port; payment of this ten (10) per cent will be made as soon as possible but not later than the ninth (9^{th}) Month after complete delivery and it shall be deemed as if acceptance of Equipment is made by EGAT at the end of the said sixth (6^{th}) Month and the guarantee period shall start therefrom against submission of maintenance security by the Contractor.

   In case there is some minor claim(s) or minor fault of the Contractor, the payment of this ten (10) per cent shall be made by deducting such claimed amount and the guarantee period of this part will start after such minor claim(s) has been settled by the Contractor and acceptance of which has been made by EGAT.

Local Supply

1. Eighty (80) per cent of the Contract Price will be paid on the basis of pro rata value of each delivery against presentation of the Contractor's statement or delivery order confirming the ex-works delivery of Equipment duly certified by EGAT's representative*, EGAT’s letters of approval for delivery and EGAT's letter of approval for test report** of the relevant Equipment including EGAT’s letter(s) of approval for final drawings only for Control and Protection Equipment.

DRAFT

*EGAT's representative means the authorized EGAT's Store personnel to verify the quantity of Equipment according to the packing list to be delivered to the Site.

**Test report means the report of tests specified in Article E-13. Inspection and Tests.

2. Ten (10) per cent of the Contract Price of each Schedule will be paid against presentation of Drawing and Document Acceptance Certificate to be issued by EGAT to certify the receipt of all drawings and documents required from the Contractor under Article F-11. Drawings and Documents to be Furnished by Contractor for such schedule, provided that payment shall not be made until EGAT has received from the Contractor the statement or delivery order and appertaining documents giving evidence of delivery of the main Equipment of that Schedule.

3. Ten (10) per cent of the Contract Price of each Schedule will be paid after the Equipment have been installed, tested and operated or used for a period of 30 Days and the acceptance of the said Equipment has been made by EGAT against presentation of Acceptance Certificate to be issued by EGAT and submission of maintenance security by the Contractor. EGAT will list the minor pending claim(s), if any, and payment will be made by deducting such claimed amount.

However, if, through no fault of the Contractor or of the Equipment, such installation, test and operation or use of the Equipment are delayed beyond a period of six (6) Months after complete ex-works delivery; payment of this ten (10) per cent will be made as soon as possible but not later than the ninth (9^{th}) Month after complete delivery and it shall be deemed as if acceptance of Equipment is made by EGAT at the end of the said sixth (6^{th}) Month and the guarantee period shall start therefrom against submission of maintenance security by the Contractor.

In case there is some minor claim(s) or minor fault of the Contractor, the payment of this ten (10) per cent shall be made by deducting such claimed amount and the guarantee period of this part will start after such minor claim(s) has been settled by the Contractor and acceptance of which has been made by EGAT.

DRAFT

b. Payment for Spare Parts

One hundred (100) per cent will be paid after complete delivery against presentation of invoices, shipping documents and EGAT's letter of approval for shipment for foreign supply or the Contractor's statement or delivery order confirming the delivery of Equipment ex-works duly certified by EGAT's representative* and EGAT's letter of approval for test report** of the relevant Equipment and the acceptance has been made by EGAT. The guarantee period shall start from the day immediately following the date of the acceptance of the Spare Parts.

*EGAT's representative means the authorized EGAT's Store personnel to verify the quantity of Equipment according to the packing list to be delivered to the site.

**Test report means the report of tests specified in Article E-13. Inspection and Tests.

c. Payment for Optional Items

Payment for Equipment

One hundred (100) per cent will be paid after complete delivery with presentation of invoices, shipping documents and EGAT's letter of approval for shipment and the acceptance has been made by EGAT. The guarantee period shall start from the day immediately following the date of the acceptance of Equipment.

Payment for Mechanical Operation Life Test (if any)

One hundred (100) per cent of the cost of the Mechanical Operation Life Test will be paid after the test has been performed successfully and test report has been accepted by EGAT.

d. Payment for Field Test Cost

One hundred (100) per cent of Field Test Cost will be paid after the test has been performed successfully and the test report has been accepted by EGAT.

e. Payment for Installation Supervisor

Payment for the services of the installation supervisor will be made within thirty (30) Days after his release by EGAT. Payment will be made on the basis of actual working man-days at the quoted cost per man-day up to a maximum equal to the total man-days quoted. For man-days exceeding the quoted total man-days, no payment shall be made by EGAT unless the Contractor can claim for any delays in

DRAFT

the progress of the work caused by EGAT. Any such additional man-days approved by EGAT shall be paid on the basis of the quoted man-day rate.

The number of quoted man-days shall include Sundays and shall cover a seven (7) day workweek, if required by the construction program. The working hours shall be forty-eight (48) hours per week, eight (8) hours per day, the working hours over 8 hours per day if requested by EGAT will be counted as overtime at 1½ times the regular hourly rate.

The amount to be paid for each Day for the services of the supervisor shall include for all salary, subsistence expense, insurance, compensations and personal expense of the supervisor, and all liabilities and responsibilities thereto. EGAT will pay for round-trip economy class air transportation for the installation supervisor between the Contractor's home office and Bangkok by the most expeditious and direct route on trip basis by draft after receipt of the Contractor's invoice supported with the used air ticket of such supervisor. The remission of immigration fees and taxes collectible by the Kingdom of Thailand shall not be paid by EGAT, as described in Article E-11. Fees and Duties.

After each payment is made, the Contractor or beneficiary shall issue and submit the receipt to EGAT at e-mail : FFMS@egat.co.th within three (3) calendar days upon receipt of such payment. The details of receipt shall include but not be limited to the following:

- ***Company name and address***
- ***The receipt date of payment***
- ***Lists of Goods/Services the payment is made for***
- ***Payment amount in numbers and in words***
- ***Recipient signature***

F-9. Liquidated Damages for Late Delivery of Equipment

In the event of failure by the Contractor to make delivery of any Equipment within the time set forth in the Contract, plus any extension thereof authorized by EGAT as provided in the Contract, such failure shall be a default under the Contract for which the Contractor shall be liable for payment to EGAT as liquidated damages at the rate specified in Data Sheet.

Whenever any Equipment under any item is to be used together with other Equipment in other item as specified in Price Schedule as a complete set or unit, the Contractor shall make sure that they shall be shipped together as a complete set or unit. Failure on the part of the Contractor to comply with this requirement, the liquidated damages for late delivery of partial shipment shall be imposed on the Contractor for the whole amount of the Contract Price of such related items.

DRAFT

Notwithstanding, in case the Contractor fails to make delivery of minor part of any Equipment within the time set forth in the Contract and such late delivery does not have any effect to the performance of the Equipment, the Contractor shall be liable for payment to EGAT as liquidated damages at the rate of one-tenth of one (0.10) per cent of the total price of the minor part of the Equipment not timely delivered for each Day of delay. The price of such delayed minor part of the Equipment shall be determined by EGAT. EGAT shall, at his own discretion, determine whether such late delivery Equipment is the minor part and has any effect to the performance of the Equipment or not.

The payment of such liquidated damages shall not relieve the Contractor of his obligations to complete the Work under the Contract.

In case any Equipment is defective or does not conform to the requirements or specifications of the Contract where replenishment or correction or replacement must be made by the Contractor as per Article E-29. Failure to Meet Requirements, it shall be deemed that such Equipment has not yet been delivered unless such Equipment has been replenished or corrected or replaced, as the case may be, and delivered to EGAT at the delivery point specified in the Contract.

Payment of liquidated damages is contingent exclusively upon late delivery; in no case shall EGAT be required to substantiate any claim for payment of liquidated damages with proof of loss and/or damages. The liquidated damages shall be calculated for each Day of delay until the Equipment is delivered to EGAT excluding a period of time from the actual delivery date at the delivery point set forth in the Contract until the issuance of notification of defect or short pack or out of specification made by EGAT to the Contractor. This sum is payable regardless of the actual loss and/or damages incurred.

The Contractor shall not be liable for liquidated damages in the event of delay caused by force majeure.

F-10. Maintenance Guarantee

a. The Contractor shall guarantee the proper functioning of the Equipment for a period as specified in Data Sheet from the day immediately following the date of acceptance of Equipment by EGAT; provided, however, that should any malfunctioning and/or latent defect in Equipment under normal use and service be found during the said period, and such malfunctioning and/or defective portion be repaired or replaced as stipulated in (c) and (d) hereinafter, then the guarantee period for such portion shall be extended from the day immediately following the date of completion of such repair or replacement as follows:

DRAFT

Time of Malfunctioning and/or Defect Found	Guarantee Period Extension				
	Equipment with 1-Year guarantee period	**Equipment with 2-Year guarantee period**	**Equipment with 3-Year guarantee period**	**Equipment with 4-Year guarantee period**	**Equipment with 5-Year guarantee period**
First Year	For a new period of one (1) Year.	For a new period of two (2) Years.	For a new period of three (3) Years.	For a new period of four (4) Years.	For a new period of five (5) Years.
Second Year	n/a	For a new period of one (1) Year.	For a new period of two (2) Years.	For a new period of three (3) Years.	For a new period of four (4) Years.
Third Year	n/a	n/a	For a new period of one (1) Year.	For a new period of two (2) Years.	For a new period of three (3) Years.
Fourth Year	n/a	n/a	n/a	For a new period of one (1) Year.	For a new period of two (2) Years.
Fifth Year	n/a	n/a	n/a	n/a	For a new period of one (1) Year.

The premium for the maintenance guarantee shall be paid by the Contractor.

b. On the expiration of the maintenance guarantee period and if the Equipment is functioning normally, the Contractor shall thereafter be released of all obligations and responsibilities under the Contract and the maintenance security deposited in accordance with Article F-7. Acceptance Certificate, will be released and returned to the Contractor.

c. If during the guarantee period EGAT finds any malfunctioning and/or defect in the Equipment, EGAT shall inform without delay the Contractor thereof, stating in writing the nature of the malfunctioning and/or defect, and the Contractor shall promptly commence to repair and make good or replace such malfunctioning and/or defect at the expense of the Contractor, except that the cost of import duty and taxes,

DRAFT

inland transportation and installation of the replacement parts for foreign supply Equipment, and the cost of inland transportation and the installation of the replacement parts for local supply Equipment will be borne by EGAT.

For Equipment specified in Data Sheet, in case EGAT, at its sole discretion, requires the Contractor to replace any defected Equipment, the Contractor shall replace the Equipment with the whole new set at its own costs and expenses including the cost of all re-export charges (if any), import duty and taxes, landing charges, rents and handling charges (ocean freight), storage charges (air freight), truck hire, labour charges, service charges for customs clearance, inland transportation and installation of the Equipment.

d. If, after the repair or replacement performed in accordance with this Article, such Equipment continues to show malfunctioning and/or defect, EGAT may, at its option, demand further repair or replacement, and reserve the right to claim damages, if applicable, arising therefrom.

e. If the Contractor fails to take action for starting up the necessary works for repair or replacement within fourteen (14) Days after receipt of EGAT's written notice of defect, the defect will be corrected by EGAT or any third party selected by EGAT at EGAT's discretion, and the cost of the corrections shall be on the responsibility and account of the Contractor.

In the event of an emergency where in the judgement of EGAT the delay resulting from giving formal notice would cause serious loss or damage which could be prevented by immediate action, defects may be corrected by EGAT or a third party chosen by EGAT without giving prior notice to the Contractor, and the cost of the corrections shall be paid by the Contractor. In the event such action is taken by EGAT, the Contractor will be notified promptly and shall assist wherever possible in making the necessary corrections.

DRAFT

F-11. Drawings and Documents to be Furnished by Contractor

EGAT reserves the right to require the Contractor to submit the drawings and documents listed in the tables attached at the end of this Section by the designated dates either by registered airmail for foreign mail and registered mail for local mail and/or by electronic files uploaded via document management system. However, cover letters shall be submitted in hard copy to EGAT.

After the requirement under this Article has been fulfilled by the Contractor, a Drawing and Document Acceptance Certificate will be issued by EGAT to certify the receipt of all required drawings and documents:

a. Drawings

(1) Drawing Title and Sizes. The title of Contractor's drawing shall also include the followings :

ELECTRICITY GENERATING AUTHORITY OF THAILAND

EGAT's Contract No._____

Item No._____

Subs. Name_____

The sizes of the drawings except otherwise specified in the Specification shall be as follows :

Size Designation	Dimensions in MM	Dimensions in Inches
A0	841 x 1,189	(33.11 x 46.81)
A1	594 x 841	(23.39 x 33.11)
A2	420 x 594	(16.54 x 23.39)
A3	297 x 420	(11.69 x 16.54)
A4	210 x 297	(8.27 x 11.69)

(2) Reference Drawings and Catalogues. General drawings showing principal dimensions and weights of Equipment, including controlling dimensions which affect space and handling requirements.

(3) Drawings and Data for Approval. The Contractor shall submit for approval checked detail assembly drawings including firm dimensions, foundation details and setting diagrams, physical size and weights of all principal parts, complete operating characteristics and ratings of Equipment, connection and schematic wiring diagrams, descriptive information and any other information sufficient to demonstrate fully that the Equipment to be furnished will conform to the requirements and intent of these Contract Documents.

Schematic diagrams shall indicate the operation and function of all electrical Equipment, accompanied, where necessary, with explanatory notes. Wiring diagrams shall show the external connection required, sufficient for EGAT to complete interconnection cable diagrams.

One print each of the drawings submitted for approval will be returned to the Contractor by EGAT or its authorized representative within thirty (30) Days after receipt at EGAT's office, marked either "Approved",

DRAFT

"Approved Except as Noted", or "Returned for Correction"/"Not Reviewed". The notations"Approved" or "Approved Except as Noted" will authorize the Contractor to proceed with the manufacture of the Equipment covered by such drawing, subject to the correction, if any, indicated thereon. When prints of drawings have been "Returned for Correction"/"Not Reviewed"., the Contractor shall make the necessary revisions on the drawings and shall within thirty (30) Days resubmit drawings for approval in the same manner as before.

Any manufacturing done before approval of the drawings will be at the Contractor's risk. EGAT shall have the right to require the Contractor to make any changes in the design which may be necessary, in the opinion of EGAT, to make the Equipment conform to the requirements and intent of these Contract Documents without additional cost to EGAT. Approval of the Contractor's drawings shall not be held to relieve the Contractor of any part of his obligation to meet all of the requirements of these Contract Documents or of the responsibility for the correctness of his drawings.

(4) Reproducibles of all final approved drawings shall be made on mylar films.

b. Report of Shop Test. The Contractor shall furnish certified copies of reports of all tests required of the manufacturer to show compliance with the applicable standards and specifications. The cost of all tests and reports shall be borne by the Contractor.

c. Instruction Manuals. The Contractor shall furnish complete set of instruction manuals and all final approved drawings (if any) for erection, operation, maintenance and repair of the Equipment, and for identification of parts. The instruction manuals shall be combined, assembled and bound in binders. Each binder cover shall be stamped with proper identification indicating name of Equipment, manufacturer's name and address, EGAT's Contract number, manufacturer's reference, etc.

Prior to the assembly and submittal of the instruction manuals, a proof of the cover lettering and the table of contents shall be submitted in sufficient time for EGAT's acceptance without delaying submittal of the finished manuals.

The CD-ROM (Compact Disc-Read Only Memory) of final drawings, final documents, test report and instruction manual, if required, shall conform to the applicable International Standard Organization 9660 (ISO 9660) and have capacity of approximately 700 Mbytes.

DRAFT

The data in CD-ROM shall be created by the following software :

Drawing

The Contractor shall submit all drawings created by CAD software as follows:

1. MICROSTATION software Version SE or
2. AUTOCAD software Version 2000

Any necessary information supporting the completion of reading files (such as special font etc.) shall be included in CD-ROM.

Documents

The Contractor shall submit all documents in Adobe Portable Document Format File (PDF format) and also Program of Acrobat Reader in order to read the file completely in CD-ROM.

Drawing/Document List

The Contractor shall submit the drawings/documents listing information in work sheets file provided by EGAT in CD-ROM in Microsoft Excel file format.

Drawing list of design drawings, as built drawings, manufacturing drawings shall also be submitted together with the drawings in the CD-ROM.

F-12. Maintenance Security

The Contractor shall provide to EGAT prior to the issuance of the acceptance certificate and as a condition for the release of the payment of the last instalment as specified in Article F-8. Payment, maintenance security(ies) in the amount of ten (10) per cent, round up to the nearest whole number, of the total Contract Price or ten (10) per cent, round up to the nearest whole number, of each schedule, excluding the cost of installation supervisor and cost of test(s), guaranteeing the Contractor's performance of the provision of Article F-10. Maintenance Guarantee. The Contractor shall oblige himself to attend to and replace, during the period of maintenance, all malfunctioning parts and for repair of all defects noted in the Work and communicated to the Contractor in writing by EGAT. In case of extended guarantee of the repaired or replaced Equipment, the Contractor may request for return of the original maintenance security and submit a new maintenance security in the amount of ten (10) per cent, round up to the nearest whole number, of the Contract Price of Equipment under the extended guarantee.

The maintenance security shall be in the form of a cash deposit, or a cashier cheque issued by a local bank, or a bank guarantee or letter of guarantee issued only by a local bank or an acceptable financial institution in Thailand, or by a foreign bank counter-guaranteed by a local bank, and made payable to EGAT in the same currency as that of

DRAFT

the Contract. In case of a cash deposit or a cashier cheque, only Thai baht portion of the Contract Price can be made. EGAT may at its absolute discretion refuse to approve any maintenance security offered or may at any time, upon application by the Contractor, approve of the substitution for any maintenance security held under this Article by other maintenance security on such terms and conditions as may be approved by EGAT.

The conditions of guarantor's obligations in the maintenance security shall include, inter alia; the following :

1. The guarantor shall unconditionally guarantee, as primary obligor and not as surety merely, payment of any obligations, damages, liquidated damages, performance penalties, or expenses for which the Contractor may become liable to EGAT.

2. No extension of time, change in, addition to, or other modification of the terms of the Contract or Work to be performed thereunder, or of the Specifications or other Contract Documents shall in anyway release the guarantor from any liability under the maintenance security, and the guarantor shall thereby waive notice of any such extension of time, change, addition or modification.

3. The maintenance security shall be valid and remain in full effect from the date of acceptance of Work until all obligations on the part of the Contractor under the Contract have been fulfilled.

Unless and until an official receipt is issued in respect to a maintenance security deposit, EGAT will not recognize or accept any such deposit as fulfilling the requirements of this Article. Failure to deposit a maintenance security at the time specified above in this Article or such extended time as may be approved by EGAT shall be a breach of this Contract and EGAT may, at its discretion, retain the payment of the last instalment of the total Contract Price.

If any maintenance security furnished under this Article shall become unacceptable to EGAT, or if any guarantor shall fail to furnish reports as to guarantor’s financial condition from time to time, as requested by EGAT, the Contractor shall promptly furnish such additional or alternative maintenance security as may be necessary to satisfy the Contract requirements for a maintenance security.

In the event of any default or breach of this Contract on the part of the Contractor, EGAT may convert into money any maintenance security which does not consist of money, and the proceeds shall be deemed to be a cash deposit under this Article. EGAT shall not be liable for any cost, expenses and/or loss resulting from the conversion of any maintenance security deposit into money as herein provided. The Contractor shall bear the cost of the maintenance security.

The maintenance security, in case of a bank guarantee, or letter of guarantee, shall be in conformity with the following specimen.

DRAFT

SPECIMEN OF MAINTENANCE GUARANTEE

To : Date :

Electricity Generating Authority of Thailand
Bangkruai, Nonthaburi 11130
Thailand

Re : Maintenance Security for Contract
No. EGAT_____

Gentlemen :

In accordance with the provision of the Contract for _____No. EGAT_____dated_____(hereinafter referred to as the Contract), the contents of which have been noted by us that Messrs._____(hereinafter referred to as the Contractor) has to deposit with Electricity Generating Authority of Thailand, (hereinafter referred to as EGAT) a Maintenance Security to guarantee the proper functioning of the_____ of the Contract as specified in Article F-10. Maintenance Guarantee in the amount of _____ (in words : _____) which is ten (10) per cent, round up to the nearest whole number, of the total Contract Price or ten (10) per cent, round up to the nearest whole number, of each schedule of the said Work, excluding the cost of installation supervisor and cost of test(s), we, the _____ as instructed by the Contractor, agree unconditionally to irrevocably guarantee as primary Obligor, the payment to EGAT at its first demand, without whatsoever right of objection on our part and without its first claim with the Contractor giving EGAT the right of claim for penalty, damages, liquidated damages or any expenses for which the Contractor may become liable to EGAT under the Contract.

We further agree that no extension of time, change in, addition to or other modification of terms of the Contract or work to be performed thereunder, or of the Specifications or other Contract Documents, which may be made between EGAT and the Contractor, shall in any way release us from any liability under the Maintenance Security, and we shall thereby waive notice of any such extension of time, change, addition or modification.

This Maintenance Security shall be valid and remain in full effect for a period of _____ (…) Year(s) from the day immediately following the date of the acceptance of Equipment. If necessary, this Maintenance Security shall be extended as specified in Article F-10. Maintenance Guarantee.

Yours very truly,

_____
Authorized Signature

DRAFT

Drawings and Documents to be Furnished by the Contractor
(For Control and Protection Equipment)

The Contractor shall submit by registered mail and/or by electronic files uploaded via document management system with the drawings and other documents listed below by the designated deadlines.

Should EGAT require the Contractor to submit the drawings and documents in electronic files via EGAT's document management system, the Contractor is also required to submit the drawings and documents in Print and CD-ROM at the number of copies listed in the parenthesis below.

Drawings/Documents	No. of copies		Deadline and Remarks
	P	CD-ROM	
Manufacturing and Delivery Schedule	1 (-)	- (-)	Within 60 Days after confirmation of Letter of Award of Contract
Quality Assurance Program (If requested by EGAT)	1 (-)	- (-)	Within 60 Days after confirmation of Letter of Award of Contract
Drawings or Documents "RELAY AND EQUIPMENT INSTRUCTION MANUAL"	1 (-)	- (-)	Within 90 Days after confirmation of Letter of Award of Contract
Drawings or Documents "FOR APPROVAL"	1 (1)	- (-)	Within 90 Days after confirmation of Letter of Award of Contract
Drawings or Documents "FOR REAPPROVAL"	1 (1)	- (-)	Within 30 Days after receipt of returned approval drawings for correction
Drawings "DRAFT-FINAL DRAWING"	1 (1)	- (-)	Within 30 Days for P and 60 Days for CD-ROM after receipt of returned approved drawings
Drawings and Documents "FINAL DRAWING or FINAL DOCUMENT"	1 (1)	1 (1)	Within 20 Days after Equipment delivery
Test Procedure (Factory Test)	1 (-)	- (-)	Within 90 Days after confirmation of Letter of Award of Contract
Test Schedule (Factory Test)	1 (-)	- (-)	Not less than 60 Days before testing for foreign supply Not less than 30 Days before testing for local supply
Test Report (Factory Test)	1 (-)	- (-)	Upon completion of tests
Instruction Manuals	- (-)	3(3)	30 Days before first shipment/delivery

Note : P = Print Drawing or Document
CD-ROM = Compact Disc-Read Only Memory with capacity of approximate 700 Mbytes conforming to ISO 9660

DRAFT

Drawings and Documents to be Furnished by the Contractor
(For All Equipment except Control and Protection Equipment)

The Contractor shall submit by registered mail and/or by electronic files uploaded via document management system with the drawings and other documents listed below by the designated deadlines.

Should EGAT require the Contractor to submit the drawings and documents in electronic files via EGAT's document management system, the Contractor is also required to submit the drawings and documents in Print and CD-ROM at the number of copies listed in the parenthesis below.

Drawings/Documents	No. of copies		Deadline and Remarks
	P	CD-ROM	
Manufacturing and Delivery Schedule	1 (-)	- (-)	Within 60 Days after confirmation of Letter of Award of Contract
Quality Assurance Program (If requested by EGAT)	1 (-)	- (-)	Within 60 Days after confirmation of Letter of Award of Contract
Drawings or Documents "FOR REFERENCE"	4 (2)	- (-)	Within 90 Days after confirmation of Letter of Award of Contract
Drawings or Documents "FOR APPROVAL"	4 (-)	- (-)	Within 60 Days for foundation, steel supporting structure (if any) and within 90 Days for others after confirmation of Letter of Award of Contract
Drawings or Documents "FOR REAPPROVAL"	4 (-)	- (-)	Within 30 Days after receipt of returned approval drawings for correction
Drawings and Documents "FINAL DRAWING or FINAL DOCUMENT"	4 (2) *4 (-)	- (-)	Within 30 Days after receipt of approved drawings
Final Design Data	4 (-)	- (-)	Within 150 Days after confirmation of Letter of Award of Contract
Test Procedure (Factory Test)	1 (-)	- (-)	Within 150 Days after confirmation of Letter of Award of Contract
Test Schedule (Factory Test)	1 (-)	- (-)	Not less than 60 Days before testing for foreign supply Not less than 30 Days before testing for local supply
Test Report (Factory Test)	1 (-)	- (-)	Upon completion of tests
Installation Instruction	9 (7)	5 (5)	60 Days before first shipment/delivery
Instruction Manuals	9 (7)	5 (5)	Before shipment/delivery

Note : P = Print Drawing or Document

CD-ROM = Compact Disc-Read Only Memory with capacity of approximate 700 Mbytes conforming to ISO 9660

*For Transmission Line Insulator, Hardware Assemblies and Line Accessories, Transmission Line Steel Tower, HTLS Transmission Line Conductor and Invar Transmission Line Conductor.

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SECTION G

RATINGS AND FEATURES

DRAFT

G. RATINGS AND FEATURES

G -1. Ratings and Features

The following Ratings and Features sheets are attached hereto and made a part of the Contract Documents :

RF No.	Description	Page
CK8705	Shunt Capacitor Bank	G2
CB895S(IEC)	Power Circuit Breaker	G3
DS88BH(IEC)	Air Switch	G4
CT89F8	Current Transformer	G5

DRAFT

Ratings and Features	**Designed :** via ECM system	**Validated :** via ECM system	**Revision 2**	**Page 1/1**
RF No. CK8705	**Verified :** via ECM system	**Approved :** via ECM system	**Dated :** via ECM system	

SHUNT CAPACITOR BANK

a.	Type	outdoor installation	
b.	Nominal System Voltage	230	kV
c.	Frequency	50	Hz
d.	Capacity / Voltage Rating	72	MVAR/239 kV
e.	Impulse Withstand (BIL), Peak	900	kV
f.	Creepage Distance of Insulator	≥ 25 mm / kVmax	

CAPACITOR UNIT

a.	Type	outdoor, Non PCB, internal fuse	
b.	Unit Voltage	6.9	kV
c.	Unit Capacity	400	kVAR
d.	Impulse Withstand (BIL), Peak	125	kV
e.	Internal Connection	9 or 12 Parallel, 4 Series	

CAPACITOR BANK ASSOCIATED EQUIPMENT See Ratings and Features

a.	Power Circuit Breaker	RF CB895S(IEC)
b.	Vacuum Switch	RF -
c.	Air Switch	RF DS88BH(IEC)
d.	Current Transformer	RF CT89F8
e.	Power Fuse	RF -

CURRENT LIMITING REACTOR

a.	Type	Outdoor, dry type, air core, with top hat	
b.	Quantity	One reactor per phase	
c.	Inductance per phase	1	mH
d.	Continuous Current Rating	250	A
e.	Short Time Thermal Current Rating for 1 s	50	kA
f.	Impulse Withstand (BIL), Peak	900	kV
g.	Limits of Temperature Rise		
	- Winding Temperature Rise	100	°C
	- Hottest Spot Winding Temperature Rise	110	°C

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Ratings and Features	**Designed :** via ECM system	**Validated :** via ECM system	**Revision 3**	**Page 1/1**
RF No. CB895S(IEC)	**Verified :** via ECM system	**Approved :** via ECM system	**Dated :** via ECM system	

a.	Type	SF6 gas, outdoor installation **Spring Mechanism** Live tank, Class C2	
b.	Rated Voltage	245	kV
c.	Rated Frequency	50	Hz
d.	Rated Insulation Level		
	- Power Frequency Withstand, rms	395	kV
	- Lightning Impulse Withstand, Peak	950	kV
e.	Current Ratings		
	- Rated Normal Current	4,000	A
	- Rated Short Time withstand Current	50	kA
f.	Breaking Ratings		
	- Rated Short Circuit Breaking Current	50	kA
	- Rated Duration of Short Circuit	1	s
	- Rated Breaking Time	3	cycles
g.	Rated Capacitance Switching Current		
	- Line Charging Breaking Current	125	A rms
	- Cable Charging Breaking Current	250	A rms
	- Capacitor Bank Breaking Current	400	A rms
	- Capacitor Bank Inrush Making Current (Back to Back)	20	kA
	- Frequency of Inrush Current	4,250	Hz
h.	Rated Peak Withstand Current	125	kA
i.	Rated Operating Sequence	O + 0.3 s + CO + 15 s + CO	
j.	Number of Operations between servicing	Class M2 (≥ 10,000 Operations)	
k.	Rated Reclosing Time	20	cycles
l.	Type of Tripping	Single pole and Three pole trip	
m.	Creepage Distance	≥ 6,125 mm (≥ 25 mm/kVmax)	
n.	Control Circuit Voltage		
	- Nominal Voltage	125	Vdc
	- Tripping Circuit, min - max	87.5 – 137.5	Vdc
	- Closing Circuit, min - max	106.25 – 137.5	Vdc
o.	External Power Source	400 / 230 V, 50 Hz	
p.	Terminal Connectors	Horizontal take-off terminal pad 6-Hole Wide NEMA PAD (2x3 Bolt Hole Pattern)	
q.	Insulator Material	Porcelain or Composite (Silicone rubber over fiberglass core)	
r.	Applicable Standards	IEC 62271-100 (for Breaker) IEC 62155 (for Porcelain Insulator) or IEC 61462 (for Composite Insulator)	

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Ratings and Features	**Designed :** via ECM system	**Validated :** via ECM system	**Revision 7**	**Page 1/1**
RF No. DS88BH(IEC)	**Verified :** via ECM system	**Approved :** via ECM system	**Dated :** via ECM system	

a.	Type	3-pole, double side break, outdoor	
b.	Rated Voltage	245	kV
c.	Rated Frequency	50	Hz
d.	Rated Insulation Level		
	- Power Frequency Withstand (Dry), rms		
	- Common value	395	kV
	- Across the isolating distance	460	kV
	- Lightning Impulse Withstand, Peak		
	- Common value	950	kV
	- Across the isolating distance	1050	kV
	- Switching Impulse Withstand, Peak	-	kV
e.	Current Rating		
	- Rated normal current	3,150	A
	- Rated short time withstand current	50	kA
	- Rated peak withstand current	125	kA
	- Rated duration of short circuit	1	s
f.	Insulator Technical Ref. No.	308 (Post type) Leakage distance ≥ 6,125 mm	
g.	Earthing Blades for Earthing Switch		
	- Type	-	
	- Rated short time withstand current	-	kA
	- Rated peak withstand current	-	kA
h.	Mounting Position	Horizontal	
i.	Phase Spacing	As specified in Price Schedule	
j.	Operating Mechanism	Manually gang operated	
k.	Terminal Connectors	Horizontal take-off terminal pad 6-Hole NEMA PAD Ø-hole = 14.3 mm (2x3 Bolt Hole Pattern)	
l.	Applicable Standards	IEC 62271-102	
m.	Interlocks	See interlocking sheet attached	

Note

-	Applicable Standards for Insulator Technical Ref. No. 308 (Post type)	ANSI C29.9

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Ratings and Features	**Designed :**	**Validated :**	**Revision 0**	**Page 1/1**
RF No. CT89F8	**Verified :**	**Approved :**	**Dated :** 26 มิ.ย. 61	

a.	Type	Outdoor, Oil Filled	
b.	Rated Frequency	50	Hz
c.	Nominal System Voltage	230	kV
d.	Max. Continuous System Voltage	242	kV
e.	Insulation Level (BIL)	900	kV
f.	Creepage Distance of Insulator	≥ 6050*	mm
g.	Rated Primary Current	3000	A
h.	Rated Secondary Current	5	A
i.	Current Ratio		
	- Core No.1	300/500/800/1000/1200/1500/2000/2200/2500/3000:1	
	- Core No.2	300/400/500/800/1100/1200/1500/1600/2000:1	
	- Core No.3	300/500/800/1000/1200/1500/2000/2200/2500/3000:5	
	- Core No.4	300/400/500/800/1100/1200/1500/1600/2000:5	
	- Core No.5	100/200/300/400/500/600/800/900/1000/1200:5	
	- Core No.6	100/200/300/400/500/600/800/900/1000/1200:5	
j.	Accuracy Class		
	- Core No.1	C800	
	- Core No.2	C800	
	- Core No.3	C800	
	- Core No.4	C800	
	- Core No.5	C800	
	- Core No.6	C800	
k.	Continuous Thermal Current Rating Factor	1.00	
l.	Short Time Current Rating		
	-Thermal for 1 second	50	kA rms
	-Mechanical	135	kA peak
m.	Polarity	Subtractive	
n.	Line Terminals	Horizontal Take-off Terminal Pad	
		6-Hole NEMA Pad	
		2x3 Bolt Hole Pattern	
o.	Mounting	Pedestal	
p.	Applicable Standard	IEEE Std C57.13	

Note : * Special Creepage Distance ; Base on 25 mm/$kV_{max.L-L}$

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SECTION I

SPECIFICATIONS

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I. SPECIFICATIONS

I-1. Specifications

The following specifications are attached hereto and made a part of the Contract Documents :

Specification No.	Description	Page
SP-156 (Apr. 2024)	Power Circuit Breaker	156.1 – 156.20
SP-202 (Feb. 2021)	Disconnecting Switches (Disconnectors)	202.1 – 202.15
SP-301 (Dec. 2021)	Instrument Transformer	301.1 – 301.16
SP-323(L) (Mar. 2024)	Power Cable, Control Cable and Switchboard Wire	323(L).1 – 323(L).11
SP-328 (Mar. 2024)	Lighting Cable	328.1 – 328.4
SP-374 (July 2017)	Shunt Capacitor Bank	374.1 – 374.16
SP-502 (Mar. 2024)	All Aluminum Conductor (AAC) and Aluminum Conductor Steel Reinforced (ACSR)	502.1 – 502.6
SP-601 (Apr. 2019)	Insulators	601.1 – 601.13
SP-1009 (June 2017)	Capacitor Bank Control and Protection Equipment	1009-1 – 1009-16

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Specification No 156

Power Circuit Breaker

156-1 **General.** This specification covers the general requirements for design, manufacture, test and supply of the outdoor power circuit breaker.

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are given in the accompanying Ratings and Features sheet (if any).

156-2 **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.

156-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

156-4 **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 referred therein.

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IEEE	The Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
ICEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturers Association

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.

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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 manufacture 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 referred herein.

The latest issue of all codes, specifications and standards 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.

156-5 **Design and Construction.** The power circuit breaker shall be new and a current standard production model. Liberal factors of safety shall be used throughout, especially in the design of all parts subject to reversal of stress or shock. They shall be designed, rated, tested and manufactured in accordance with applicable portions of IEC 62271-100 or approved equivalent standards, unless otherwise specified. Each power circuit breaker shall be of the 3-pole, outdoor type, trip free, suitable for remote electrical closing and tripping, as well as for single-pole and/or three-pole tripping and reclosing (as specified in the Ratings and Features sheets) and furnished complete with operating mechanism and other accessories. The circuit breaker control system shall be completed with the anti-pumping circuit. Mounting wheels will not be accepted.

156-5.1 **Bushings and Insulators.** Material, dimensions, general contour or profile, structural, mechanical and electrical characteristics of bushings and insulators units of assemblies shall comply with the applicable requirements of ANSI and NEMA bushings and IEC insulators standards. The colour of all bushings and insulators shall be chocolate brown ***or grey polymer***.

156-5.2 **Interrupters.** Interrupter unit contact current carrying surfaces shall not be subject to deterioration caused by arcing. Arcing contacts faced with arc resistant material sufficient to interrupt circuit breaker full interrupting capability arcs shall be provided.

156-5.3 **Operating Mechanism.** The operating mechanism shall have supply records with successful manufacturing and operation / use of at least three (3) consecutive years.

Each mechanism shall consist of two (2) operation counters (One shall be resettable and the other shall be non resettable). The operating mechanism shall be mounted and enclosed in a weather-

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proof housing whose doors are so arranged as to make accessible parts of the mechanism usually requiring inspection or maintenance without removing interrupter or releasing SF_6 gas ***or non SF_6*** from the interrupter.

For purposes of inspection and adjustment, means shall be provided for safe manual closing of the breaker at a conveniently accessible place. The maintenance closing device shall be designed for the propose that the contacts can be operated slowly by one man to adjust the breaker when it is not in service. The maintenance closing device shall be provided in the quantity shown in the Price Schedule.

a. Spring Operating Mechanism. A mechanical spring mechanism usually consists of two springs, one for open and one for close operation. The closing spring generates the required force to close the circuit breaker and charge the opening spring. The energy stored in the spring will be released and transmitted through a system of levers and links and the contacts will move to the open or closed position. A complete and separate spring operating system shall be furnished and installed for each three pole breaker or for each single pole breaker. This spring operating system shall be in accordance with applicable portion of IEC 62271-100.

Each operating mechanism shall be provided with its own motor spring-charge equipped with a common control cabinet and shall be provided for :

1. The time required to charge the closing spring after the closing operation shall not exceed 15 s.

2. Under-voltage alarm relay with contact suitable for operation on 125 Vdc circuit to permit remote indication of loss of potential on the supply to the spring charged motor and its controls. ***Moreover motor overrun time protection shall be provided and can be adjusted. Motor overrun contact shall be provided and wired to terminal block for remote alarm, blocking motor and closing operation.***

3. Spring-charged indicator to indicate the state of energy stored in the spring.

4. Means shall be provided to prevent the operation of the mechanism when maintenance work is being done. The mechanism shall be so arranged that emergency manual charging and release of the spring is possible without electrical means. Hand crank shall be provided for each circuit breaker.

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The spring-charged motor shall be rated 125 Vdc.

The manual spring-charged hand crank shall be provided for each circuit breaker.

156-5.4 **Control Cabinet.** A control cabinet shall be furnished with each breaker. This cabinet shall have a blank, removable, accessible steel plate, with a gasket, through which the control and power leads will enter the bottom of the cabinet. All material necessary to interconnect the various components of the circuit breaker, including control, and operating mechanism facilities shall also be furnished. Each control cabinet shall be equipped with lighting, outlet and suitable heater complete with miniature circuit breaker, and shall be designed to maintain the temperature rise inside the cabinet within 5°C above the surrounding temperature. Electrical schematic and wiring diagram drawing shall be provided on the control cabinet of every circuit breaker.

A 25 mm wide x 6 mm thick copper ground bus with 4 mm drilled and taped holes shall be provided near the bottom of the control cubicle, control cabinet and/or operating mechanism for cable shield grounding. The ground bus shall be solidly bolted to the steel framework as to make good electrical contact. The holes shall be spaced on 20 mm center-lines minimum. A 10 mm long binding neat screw or screw with bronze spring washer shall be provided in each hole. The ground bus shall have a minimum of ten holes and screws for control cable shields and shall be solidly connected to ground terminal connector located the control cabinet housing.

The control cabinet shall be installed at the place convenient for operation and maintenance. Any necessary supported equipment; ladder for example, shall be supplied to enable the possible operation and maintenance.

156-5.5 **Supporting Structures.** The breaker supporting structure shall be hot-dip galvanized after fabrication, in accordance with ASTM A123, A153 and A53. All necessary galvanized bolts, nuts and washers to complete the erection shall be furnished, including embedded anchor bolts for securing the supporting structure to the concrete foundation.

The zinc coating shall be uniform clean of a standard thickness on the entire surface of all materials.

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 and steel plate	6 mm and over	more than 702	more than 610
	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, filters	5 mm and over	more than 381	more than 305
	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.

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.

The breaker supporting structure with clamp type ground terminal connector shall be supplied to provide adequate isolation above ground, of energized portions of each circuit breaker with minimum vertical clearance as follows :

500 kV : 5.65 m (18 ft 7 in)

230 kV : 4.60 m (15 ft)

138 and 115 kV : 3.60 m (11 ft 7 in)

69 kV : 3.20 m (10 ft 6 in)

33 kV and below : 2.75 m (9 ft)

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156-5.6 **Multiratio Bushing-Type Current Transformers.** All current transformers, if required, shall be in accordance with the latest standards of the IEEE Std. C57.13. All secondary leads from all current transformers furnished with each circuit breaker shall be brought to short-circuiting-type terminal blocks located in the circuit breaker control cabinet.

156-5.7 **Terminal Pad.** Each equipment terminals for connecting to the line or other equipment shall be equipped with a suitable terminal pad unless otherwise specified. The terminal pad shall be provided with 14.3 mm (9/16 in) diameter holes with 45 mm (1 3/4 in) spacing between the centers of each hole in accordance with the NEMA Standards CC1.

The terminal pad shall be of high conductivity bronze, copper or aluminum alloy and, unless it is made of aluminum alloy, shall be plated with electro-tin to a thickness of not less than 0.0127 mm (0.0005 in).

156-5.8 **Ground Terminal Connector.** The grounding terminal of the equipment shall be of the clamp type suitable for 4/0 AWG copper stranded conductor. Terminal connector shall be made of high conductivity material and shall be complete with corrosion resistance bolts, nuts and lock washers.

156-5.9 **Brass Pipe.** Brass pipe shall conform to the requirements of ASTM Specifications B 43 for "Seamless Red Brass Pipe, Standard Sizes".

156-5.10 **Copper Pipe.** Steel pipe shall conform to the requirements of the latest issue of ASTM Specifications B 42 for "Seamless Copper Pipe, Standard Sizes".

156-5.11 **Steel Pipes.** Steel pipe shall conform to the requirements of ASTM Specification A 53 "Welded and Seamless Steel Pipe".

156-5.12 **Copper Tubing.** Copper tubing shall conform to requirements of the latest issue of ASTM Specification B 88-78 or "Seamless Copper Water Tube", Type K.

156-5.13 **Welding.** All welding shall be in accordance with AWS and ASTM Specifications and standards for Unfired Pressure Vessels, as they may apply.

156-5.14 **Rigid Conduit.** Rigid Conduit shall conform to the requirements of ANSI C80.1 for "Rigid Steel Conduit Zinc Coated"

156-5.15 **Overpressure Relief Device.** Each circuit breaker shall be equipped with overpressure relief device to relieve abnormal pressure occurred in interrupter compartment. Each pressure relief device shall have a metallic protective cover to ensure the protection it against environment condition. ***Over pressure relief is not necessary or needed when using polymer insulators.***

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156-6 **Control Circuit.** The functional control requirement shall be according to the functional control requirement as shown on the typical schematic diagram attached.

a. The tripping circuit shall be directly connected to the power supply and two (2) sets of separating current and magnetic circuit tripping coils for primary and back-up tripping shall be provided for the following circuit breakers.

(a) Single-pole and three-poles operated circuit breaker.

(b) 115 kV and above three-poles operated circuit breaker.

b. For single-pole and three-poles operated circuit breaker, pole disagreement shall be provided. The necessary relays shall be provided to trip all phases of each circuit breaker in the event that the three poles are not closed properly after a close signal is given to the circuit breaker.

In the event that all three poles of the generator transformer breaker do not trip properly after a trip signal, the pole disagreement relays shall also operate the breaker failure timers and trip appropriate circuit breakers after a time delay, similar to a normal breaker failure protection. The pole disagreement relays shall be heavy duty type.

The time setting range of the pole disagreement timer shall be 0.05 to 2.0 second.

Any additional equipment required for complete functions of the pole disagreement circuits shall also be included with each pole disagreement scheme.

Each pole disagreement protective relaying scheme shall be ABB (Sweden, Switzerland and U.S.A.), GE (U.S.A., Canada), ALSTOM (U.K.), or SIEMENS (Germany).

156-7 **Interrupting Performance.** The circuit breaker shall be suitable for reclosing duty cycle as specified in Ratings and Features sheet.

156-8 **Design Load.** The circuit breaker including its supporting structure shall be designed to withstand without damage to or impairments operation of the equipment wind with a velocity up to 125 km/h.

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156-9 **Insulated Wire.** Insulated wire shall be tin coated copper conductor and shall not be less than 1.5 mm^2, minimum voltage classification of 600 V with high temperature PVC insulation. Hinge wire shall be extra flexible Class K stranding or equal and current transformer secondary leads shall not be less than 6 mm^2 stranded.

156-10 **SF_6 Gas *or non SF_6*.** The Contractor shall furnish SF_6 gas ***or non SF_6*** for use with SF_6 gas ***or non SF_6*** circuit breaker under this specification. The amount furnished shall be sufficient for filling all breakers plus 15%. The SF_6 gas ***or non SF_6*** shall be shipped in non-returnable steel bottles which shall become the property of EGAT. Specification of the SF_6 gas ***or non SF_6*** used shall be furnished with the breakers.

156-11 **Cleaning and Painting.** All interior and exterior surfaces of ferrous metalwork shall be either galvanized in accordance with ASTM Designation A123 and A153 or painted. Surfaces to be painted shall be thoroughly cleaned to base metal by sand blasting or shot blasting and shall be thoroughly dry before the application of any paint. After cleaning, the surfaces shall be give priming or sealing coat of paint followed by two coats of light gray Munsell Notation No 7.5 BG 6/1.5.

156-12 **Accessories**

156-12.1 **Gas Density Detector.** The gas density detector, responding to the gas temperature and pressure, shall have two different functions according to the gas condition. The first step for alarm and the second step for locking the operation or automatically trip shall be provided for each pole of the single pole tripping circuit breaker or each circuit breaker of the three pole tripping circuit breaker.

156-12.2 **Pressure Switches.** The pressure switches of monitoring air or hydraulic fluid pressure. Electrically separate air or hydraulic fluid pressure switch contacts that close when the pressure falls to approximately 110% of the minimum operating pressure shall be provide and wired to operating mechanism cabinet terminal block for remote alarm. Pressure switch contacts shall be provided to prevent the operating mechanism from attempting a closing operation when the pressure is too low to complete close-open operations at rated short circuit current or at other related required capabilities.

The pressure switches shall be provided for each pole of the single pole tripping circuit breaker or each circuit breaker of the three pole tripping circuit breaker.

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4 มิถุนายน 2568

156-12.3 **Pressure Gauges**. Pressure gauge shall be gas-filled type or oil seal type and it shall be precisely shown in figure with SI unit in bar or kg/cm^2, having transparent window on a part of the control cabinet shall be provided.

156-12.4 **Auxiliary Switches.** All contacts shall be conformed to class 1 according Table 6 of IEC 62271-1 at 125 Vdc ungrounded circuit.

Each circuit breaker shall be equipped with auxiliary switches providing not less than twenty independent single-pole control circuits, which shall be readily changeable to "circuit opening" or "circuit closing" as required, in addition to those required by the manufacturer for the circuit breaker standard control scheme.

156-12.5 **Selector Switches.** Each mechanism shall be equipped with a selector switch for Local - Test - Remote position. The test position shall disconnect the circuit to remote closing, reclosing and tripping.

156-12.6 **Position Indicator.** The mechanical position indicator shall be equipped with each pole of the single-pole tripping circuit breaker or each circuit breaker of the three-pole tripping circuit breaker. The indicator shall be of white letter "I" on red background and white letter "O" on green background for closed and open position respectively and shall be located in such a way that visible from the far distance is possible.

156-12.7 **Lighting and Universal Outlet.** Lighting, completed with control switch and two sets of 10 A, 250 V, universal outlet, one of two-pole outlet with side earthing contacts (conformed to IEC 83) and one of two-pole three wire grounding device outlet for connection to the EGAT-furnished single phase alternating current supply, shall be furnished and mounted in control cubicle, control cabinet and/or operating mechanism where specified.

156-12.8 **Terminal Blocks.** All accessories and control devices shall be completely wired. Both ends of wires shall be terminated by compression type, ring tongue type terminal lug and shall be provided with terminal number rings. The terminal number shall be recorded in the wiring diagram. All wiring which connects to the external circuits shall terminate on the terminal blocks installed in the control cabinet. The terminal block shall be of 600 V molded block type with insulating barrier between terminals. Terminal blocks used for current transformer leads shall be of the short circuit type. Each terminal block shall have marking strips, and shall be equipped with the compression type, ring tongue type terminal lugs for 4 mm^2 or higher to make connection with the outgoing cable. The terminal blocks shall be provided with 10% but not less than 10 additional terminals as spares besides the

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necessary number. Two (2) or more external wires shall not be connected in one (1) terminal.

The terminal blocks shall have the size suitable for the termination of the following cables :

For AC supply and DC supply	:	6 - 35 mm^2
For CT leads	:	2 x 6 mm^2
For others and spares	:	2 x 4 mm^2

The terminal blocks for AC circuit and the terminal blocks for DC circuit shall be separately grouped as well as the AC terminal blocks shall be covered with transparent plastic box.

156-12.9 **Nameplates.** Nameplates of anodized aluminum or stainless steel shall be provided for all equipment including control cabinet and local control component identification. The nameplate of a circuit-breaker and its operating devices shall be conformed to IEC 62271-100 and shall be visible in the position of normal service and installation.

In addition to all nameplate data, the EGAT serial number of the equipment shall be indicated on the nameplate of each unit of equipment. If possible, it should be indicated close to the manufacturer serial number.

The EGAT serial numbers of the equipment will be advised after the Contract is signed.

156-13 **Test.** Test of equipment shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

156-13.1 **Type Test.** The proposed equipment shall already have the type test record of the same type and same rating as EGAT called for, in accordance with the tests specified in each equipment test items, which is subject to EGAT′s approval (unless otherwise specified in each equipment test item). The type test record shall be required and submitted together with the tender document during the bidding.

156-13.2 **Routine Test.** Each equipment shall be completely assembled at the factory or shall be conformed to IEC 62271-1 and subject to the tests specified in each equipment test item.

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4 มิถุนายน 2568

156-13.3 **Sample Test.** The sample test shall be performed by selecting the sample from each lot of equipment. The numbers of samples for the test shall be as specified in the Standard.

156-13.4 **Test Report.** The report of all tests, curves and standard application data shall be furnished to EGAT immediately after the completion of the tests.

156-13.5 **Test Procedure.** The Contractor shall submit the test procedure of specified 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.

156-13.6 **Test Items for Power Circuit Breaker.** The tests shall be performed in accordance with IEC 62271-100, unless otherwise specified.

a. Type Tests

(a) Dielectric tests

(b) ***Resistance measurement***

(c) ***Continuous current tests***

(d) Short-time withstand current and peak withstand current tests

(e) Additional tests on auxiliary and control circuits

(f) Mechanical operation test at ambient temperature ***(Class M1)***

(g) ***Terminal fault tests***

(h) Radio interference voltage tests (Rated voltage ≥ ***245*** kV)

(i) Tightness test

(j) EMC tests (Electronic equipment or components are included in the secondary system)

(k) Extended mechanical endurance tests on circuit breakers for special service conditions (Class M2 rating assigned)

(l) Short-line fault tests

(m) Capacitive current tests

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b. Routine Tests

(a) Dielectric test on the main circuit

(b) Tests on auxiliary and control circuits

(c) Measurement of the resistance of the main circuit

(d) Tightness test

(e) Design and visual checks

(f) Mechanical operating tests

(g) Timing and motion tests, oscillograph shall be provided ***including the open operations for all trip coils, close operation, close-open operation, and rapid auto-reclosing operation O-t-CO where t shall not be more than the time interval that is specified in the rated operating sequence.***

Note. To ensure that mechanical behavior of open operations and close operation conforms to the type test, the proof in one of the following method shall be provided:

1. Envelope curve method as described in IEC 62271-100
2. Parameter method by providing the following test values:
- operating time
- operating velocity
- contact stroke
- over travel (if any)
- rebounce (if any)

156-13.7 Test Item for Bushing Current Transformer. The test shall be performed in accordance with the latest IEEE Std. C57.13.

a. 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 for relaying class)

(d) Polarity check

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4 มิถุนายน 2568

(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 or Insulation power factor measurement.

156-13.8 **Test Items for Insulators.** The tests shall be performed in accordance with IEC 62155 ***(for porcelain) or IEC 61462 (for composite) as specified in Ratings and Features sheets.***

156-13.9 **Test Items for Bushing.** The tests shall be performed in accordance with IEEE Std. C57.19.

156-14 **Spare Parts.** All spare parts subject to damage or deterioration by moisture shall be packed in moisture-proof material. All spare parts shall be of the same materials and workmanship as the corresponding original parts and shall be interchangeable therewith. The Bidder shall include in his bid a list of recommended spare parts for maintenance.

156-15 **Appliances & Tools.** The Contractor shall furnish all tools and appliances necessary for satisfactory installation, operation and maintenance of the equipment, including any special tool or appliance that are necessary for assembling and disassembling the equipment. The Contractor shall submit to EGAT for approval a list of all appliances and tools required for the above stated purposes and shall indicate thereon all appliances and tools he proposes to furnish.

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156-16 Drawings and Documents for Circuit Breaker

Drawings and documents shall at least comprise the followings :

Item	Drawings Title	Approval and Final Dwgs	CD-ROM (Including CAD Files)
1	Drawing list of drawings submitted for approval	x	-
2	Circuit breaker outline including legend of each component	x	x
3	Steel supporting structures and anchor bolt (The normal size of drawings shall be A1)	x	x
4	Circuit breaker nameplate	x	x
5	Shipping sketch	x	-
6	Schematic diagram	x	x
7	Wiring diagram	x	x
8	Terminal blocks arrangement	x	-
9	Control cubicle outline including component layout completed (if any)	x	-
10	Terminal pads of circuit breakers and of current transformers (if any)	x	-
11	Earthing terminal	x	-
12	CT nameplate (if any)	x	x
13	Outline, schematic diagram and wiring diagram for motor compressor set, or the like for hydraulic system (if any)	x	x
14	Manufacturing schedule and test schedule	x	
15	Operating time chart of main contacts, auxiliary contacts and command duration of closing and opening signal completed with Time travel recordings.	(For Reference only)	(For Reference only)

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156-17 Instruction Manual for Power Circuit Breaker

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

Part A The instruction including installation, operation adjustment and maintenance of circuit breaker and operating mechanism, circuit breaker accessories, current transformer, bushings and support insulators.

a. Detailed equipment description.

b. Receiving, inspection, storage, handling and damage claim instruction.

c. Assembly and disassembly instructions including a complete list of required tools.

d. Drawings, photographs and other material showing all adjustment, lubrication, test and check points.

e. Complete component parts list including ordering numbers, designation of part number and part identification drawings.

Part B All applicable manufacturer bulletins, instructions and other descriptive material.

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

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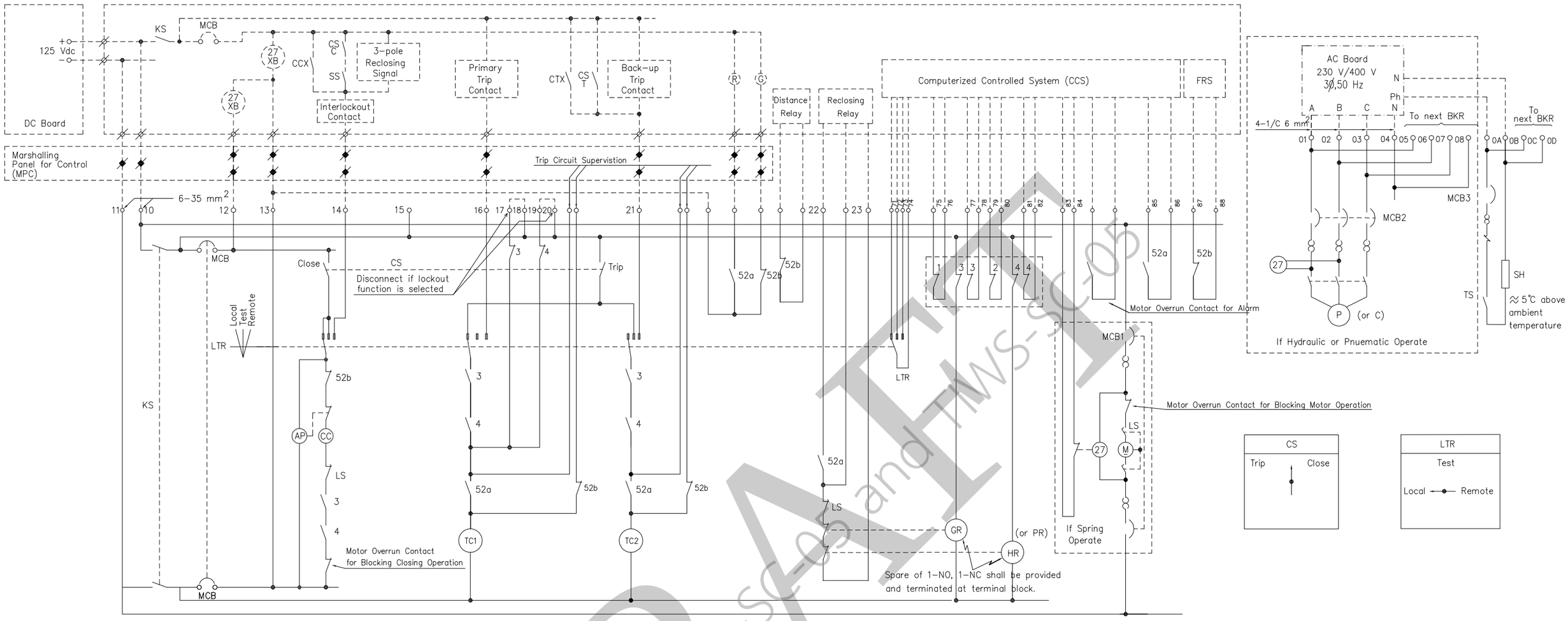


LOCKOUT (CLOSE CIRCUIT) CONTACT

- Low hydraulic pressure (stage 2) or
  Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

LOCKOUT (TRIP CIRCUIT) OR TRIP CONTACT

- Low hydraulic pressure (stage 2) or
  Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

CONTACT OF DENSIMETER OR PRESSURE RELAY

- Low SF6 gas density (stage 1)
- Low SF6 gas density (stage 2)
- Low hydraulic pressure (stage1)
  Low pnuematic pressure (stage1) or
- Low hydraulic pressure (stage2)
  Low pnuematic pressure (stage2) or

LOW SF6 GAS DENSITY,LOW HYDRAULIC OR PNUEMATIC PRESSURE

- Stage 1 = Alarm
  Gas density (1) = _____
  H (or P) Pressure (2) = _____ at _____ °C
  = _____ at 40 °C
- Stage 2 = Lock (close) and lock (trip) or trip
  Gas density (3) = _____
  H (or P) Pressure (4) = _____ at _____ °C
  = _____ at 40 °C

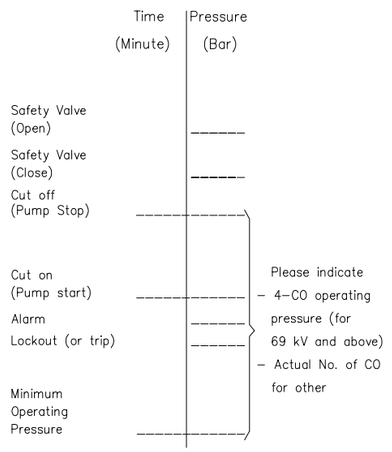
LOCKOUT AT CB IN CLOSE POSITION

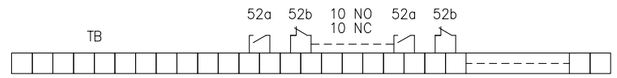
Suitable means shall be provided to keep circuit breaker at close position, automatic self opening of circuit breaker at further lower pressure is not accepted.

DEVICE	DESCRIPTION	RATING	TYPE	MANUFACTURER
CS	Trip/Close Control Switch	_____ V ,_____ A		
LTR	Local/Test/Remote Selector Switch	_____ V ,_____ A		
CC	Closing coil	90–140 Vdc, _____A_____mS		
TC1	Primary Tripping coil	70–140 Vdc, _____A_____mS		
TC2	Back–up tripping coil	_____ Vdc,_____ A_____mS		
AP	Antipumping relay	_____ Vdc,_____ A_____mS		
GR	Gas density auxiliary relay	_____ V ,_____ A		
HR (or PR)	Hydraulic (or Pnuematic) pressure auxiliary relay	_____ V ,_____ A		
M	Motor	_____ V ,_____ A_____HP		
P (or C)	Pump (or Compressor)	_____ V ,_____ A_____HP		
27	DC under voltage alarm relay, Slow drop out	125 Vdc		
KS	Knife switch	_____ V ,_____ A		
MCB	Molded case circuit breaker with thermal trip, 2–pole	_____ V ,_____ KA _____ AT ,_____ AF		
MCB1	Molded case circuit breaker with thermal trip, 2–pole	_____ V ,_____ KA _____ AT ,_____ AF		
MCB2	Molded case circuit breaker with thermal trip, 3–pole	_____ V ,_____ KA _____ AT ,_____ AF		
MCB3	Molded case circuit breaker with thermal and instantaneous trip,1–pole	_____ V ,_____ A _____ AT ,_____ AF		
TS	Thermostat	Range _____°C		
SH	Space heater	_____ V ,_____ A_____W		
TB	Terminal block	600 V ,_____ A		
LS	Limit switch for spring charge motor	_____ V ,_____ A		
1	Gas density switch (stage 1)	_____ V ,_____ A		
2	Pressure switch (P or H) (stage 1)	_____ V ,_____ A		
3	Gas density switch (stage 2)	_____ V ,_____ A		
4	Pressure switch (P or H) (stage 2)	_____ V ,_____ A		

Hydraulic (or Pnuematic)

Pressure and Operating Time





Terminal block diagram including spare (10 % but not less than 10 terminals)

The Schematic Status

- CB at open position
- Gas at low density (stage 2)
- Hydraulic or Pnuematic at low pressure (stage 2)
- Voltage at under voltage
- Mechanism closing springs charged

Note

This schematic diagram is intended to show functional control requirement only, actual schematic diagram corresponding to this functional requirement shall be designed by manufacturer.

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4 มิถุนายน 2568

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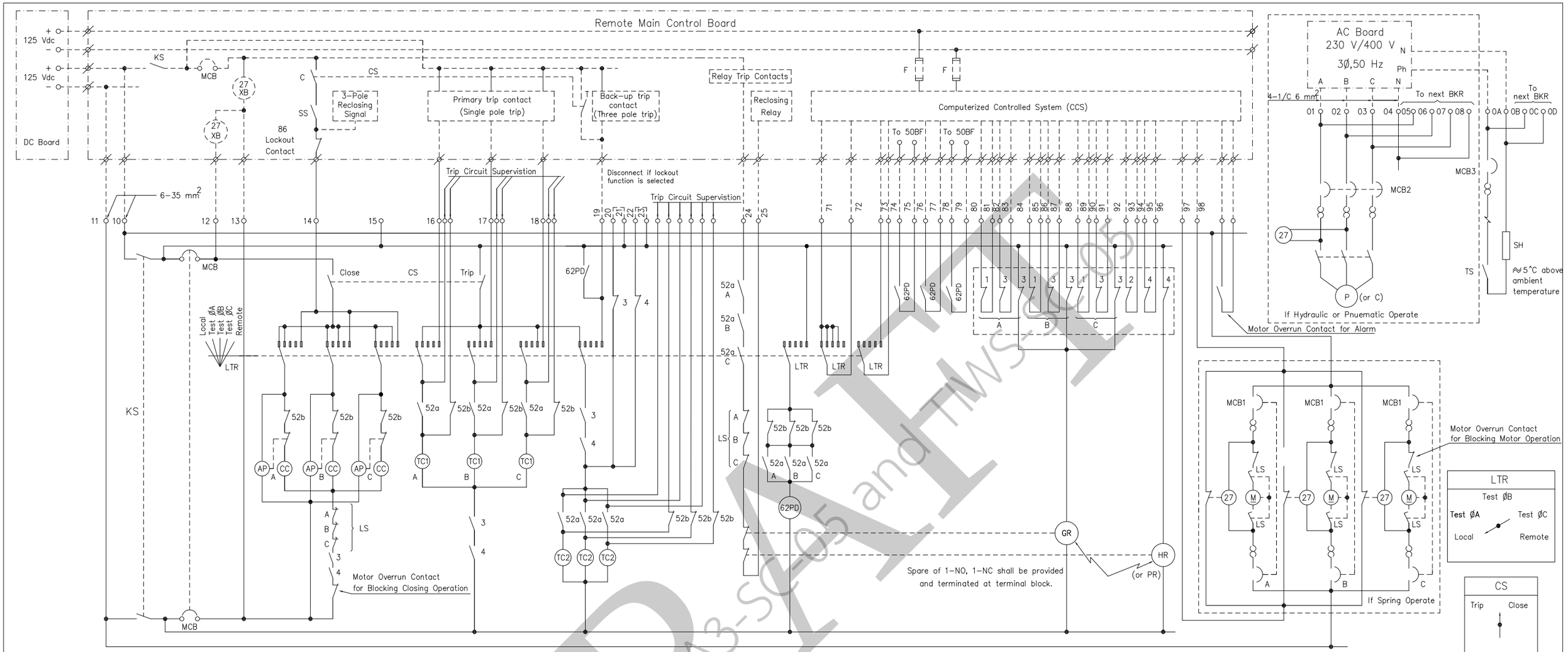
Bid No. EBA3-SC-05 and TWS-SC-05

SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT			
THREE POLE OPERATED CIRCUIT BREAKER TYPICAL SCHEMATIC DIAGRAM			
Date : 03/2016	Dwg. No. : TP–E–CB 6.1	SH. 01/01	Rev. 6



LOCKOUT (CLOSE CIRCUIT) CONTACT

- Low hydraulic pressure (stage 2) or Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

LOCKOUT (TRIP CIRCUIT) OR TRIP CONTACT

- Low hydraulic pressure (stage 2) or Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

CONTACT OF DENSIMETER OR PRESSURE RELAY

- Low SF6 gas density (stage 1)
- Low SF6 gas density (stage 2)
- Low hydraulic pressure (stage 1) or Low pnuematic pressure (stage 1)
- Low hydraulic pressure (stage 2) or Low pnuematic pressure (stage 2)

LOW SF6 GAS DENSITY,LOW HYDRAULIC OR PNUEMATIC PRESSURE

- Stage 1 = Alarm
  - Gas density (1) = _____
  - H (or P) pressure (2) = _____ at _____ °C
  - = _____ at 40 °C
- Stage 2 = Lock (close) and Lock (trip) or trip
  - Gas density (3) = _____
  - H (or P) pressure (4) = _____ at _____ °C
  - = _____ at 40 °C

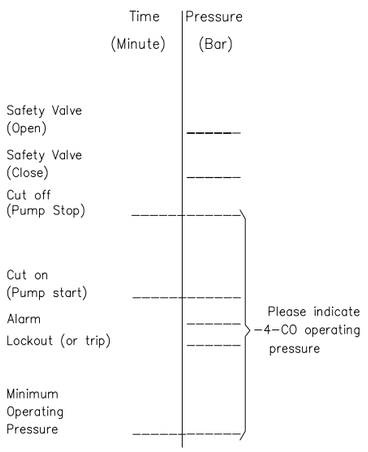
LOCKOUT AT CB IN CLOSE POSITION

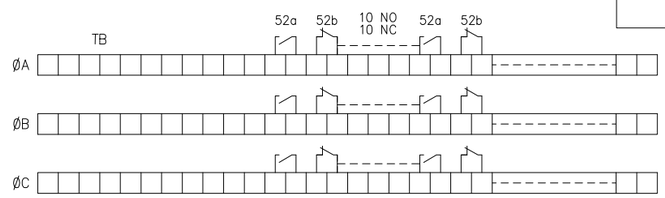
Suitable means shall be provided to keep circuit breaker at close position, automatic self opening of circuit breaker at further lower pressure is not accepted .

DEVICE	DESCRIPTION	RATING	TYPE	MANUFACTURER
CS	Trip/Close Control Switch	_____ V ,_____ A		
LTR	Local/Test/Remote Selector Switch	_____ V ,_____ A		
CC	Closing coil	90-140 Vdc,_____ A_____mS		
TC1	Primary tripping coil	70-140 Vdc,_____ A_____mS		
TC2	Back-up tripping coil	70-140 Vdc,_____ A_____mS		
AP	Antipumping relay	_____Vdc,_____ A_____mS		
62PD	Pole disagreement relay	50-1000 mS		
GR	Gas density auxiliary relay	_____ V ,_____ A		
HR (or PR)	Hydraulic (or Pnuematic) pressure auxiliary relay	_____ V ,_____ A		
M	Motor	_____ V ,_____ A_____HP		
P (or C)	Pump (or Compressor)	_____ V ,_____ A_____HP		
27	DC under voltage alarm relay, slow drop out	125 Vdc		
KS	Knife switch	_____ V ,_____ A		
MCB	Molded case circuit breaker with thermal trip, 2-pole	_____ V ,_____ KA _____ AT,_____ AF		
MCB1	Molded case circuit breaker with thermal trip, 2-pole	_____ V ,_____ KA _____ AT,_____ AF		
MCB2	Molded case circuit breaker with thermal trip, 3-pole	_____ V ,_____ KA _____ AT,_____ AF		
MCB3	Molded case circuit breaker with thermal and instantaneous trip,1-pole	_____ V ,_____ A _____ AT,_____ AF		
TS	Thermostat	Range _____ °C		
SH	Space heater	_____V ,_____ A_____W		
TB	Terminal block	600 V ,_____ A		
LS	Limit switch for spring charge motor	_____ V ,_____ A		
1	Gas density switch (stage 1)	_____ V ,_____ A		
2	Pressure switch (P or H) (stage 1)	_____ V ,_____ A		
3	Gas density switch (stage 2)	_____ V ,_____ A		
4	Pressure switch (P or H) (stage 2)	_____ V ,_____ A		

Hydraulic (or Pnuematic)

Pressure and Operating Time





Terminal block diagram including spare (10 % but not less than 10 terminals)
Terminals for remote shall be terminated at ØB terminal block

Close Command

Remote = 3Ø
Local = 3Ø
Test ØA, Test ØB, Test ØC } 1Ø

Trip Command

Remote = 1Ø (primary tripping coil)
= 3Ø (back-up tripping coil)
Local = 3Ø (back-up tripping coil)
Test ØA, Test ØB, Test ØC } 1Ø (primary tripping coil)

The Schematic Status

- CB at open position
- Gas at low density (stage 2)
- Hydraulic or Pnuematic at low pressure (stage 2)
- Voltage at under voltage

Note

This schematic diagram is intended to show functional control requirement only, actual schematic diagram corresponding to this functional requirement shall be designed by manufacturer.

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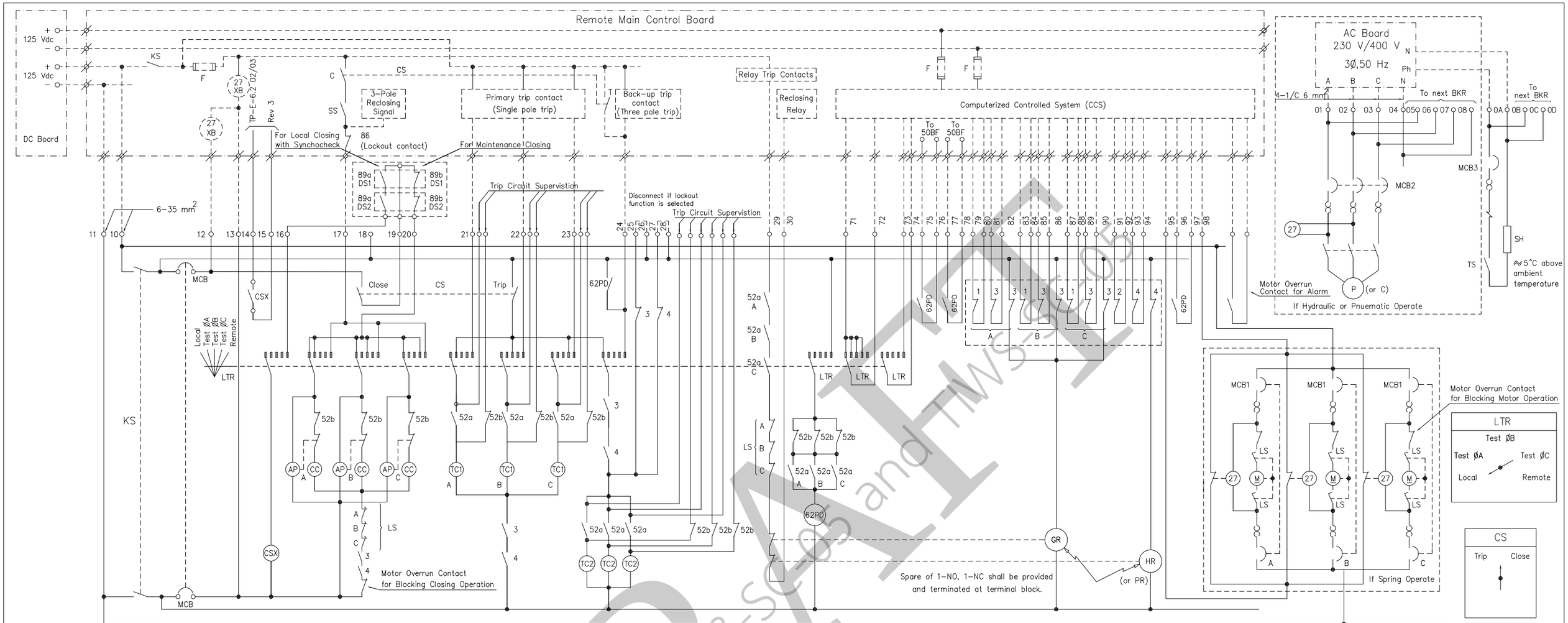
Bid No. EGAT-SC-05 and TWS-SC-05

SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT			
SINGLE POLE & THREE POLE OPERATED CIRCUIT BREAKER TYPICAL SCHEMATIC DIAGRAM			
Date : 03/2016	Dwg. No. : TP-E-CB 6.2	SH. 01/01	Rev. 7



LOCKOUT (CLOSE CIRCUIT) CONTACT

- Low hydraulic pressure (stage 2) or Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

LOCKOUT (TRIP CIRCUIT) OR TRIP CONTACT

- Low hydraulic pressure (stage 2) or Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

CONTACT OF DENSIMETER OR PRESSURE RELAY

- Low SF6 gas density (stage 1)
- Low SF6 gas density (stage 2)
- Low hydraulic pressure (stage 1) or Low pnuematic pressure (stage 1)
- Low hydraulic pressure (stage 2) or Low pnuematic pressure (stage 2)

LOW SF6 GAS DENSITY,LOW HYDRAULIC OR PNUEMATIC PRESSURE

- Stage 1 = Alarm
  - Gas density (1) = _____
  - H (or P) pressure (2) = _____ at _____ °C
  - = _____ at 40 °C
- Stage 2 = Lock (close) and Lock (trip) or trip
  - Gas density (3) = _____
  - H (or P) pressure (4) = _____ at _____ °C
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LOCKOUT AT CB IN CLOSE POSITION

Suitable means shall be provided to keep circuit breaker at close position, automatic self opening of circuit breaker at further lower pressure is not accepted .

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CS	Trip/Close Control Switch	_____ V ,_____ A		
LTR	Local/Test/Remote Selector Switch	_____ V ,_____ A		
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TC1	Primary tripping coil	70-140 Vdc,_____ A_____mS		
TC2	Back-up tripping coil	70-140 Vdc,_____ A_____mS		
AP	Antipumping relay	_____ Vdc,_____ A_____mS		
62PD	Pole disagreement relay	50-1000 mS		
GR	Gas density auxiliary relay	_____ V ,_____ A		
HR (or PR)	Hydraulic (or Pnuematic) pressure auxiliary relay	_____ V ,_____ A		
M	Motor	_____ V ,_____ A_____HP		
P (or C)	Pump (or Compressor)	_____ V ,_____ A_____HP		
27	DC under voltage alarm relay, slow drop out	125 Vdc		
KS	Knife switch	_____ V ,_____ A		
MCB	Molded case circuit breaker with thermal trip, 2-pole	_____ V ,_____ KA _____ AT,_____ AF		
MCB1	Molded case circuit breaker with thermal trip, 2-pole	_____ V ,_____ KA _____ AT,_____ AF		
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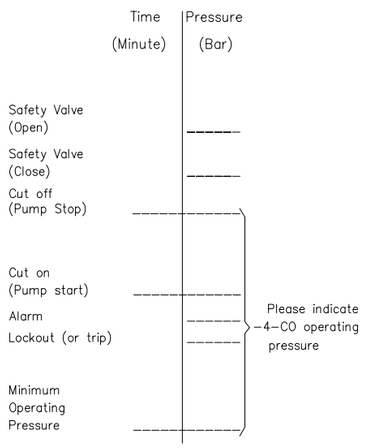
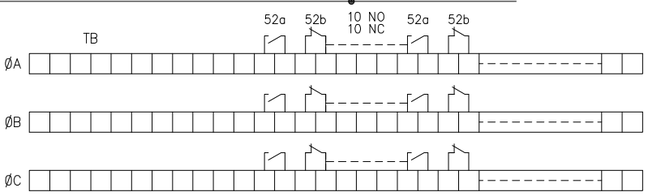
MCB3	Molded case circuit breaker with thermal and instantaneous trip,1-pole	_____ V ,_____ A _____ AT,_____ AF		
TS	Thermostat	Range _____°C		
SH	Space heater	_____V ,_____ A_____W		
TB	Terminal block	600 V ,_____ A		
LS	Limit switch for spring charge motor	_____ V ,_____ A		
1	Gas density switch (stage 1)	_____ V ,_____ A		
2	Pressure switch (P or H) (stage 1)	_____ V ,_____ A		
3	Gas density switch (stage 2)	_____ V ,_____ A		
4	Pressure switch (P or H) (stage 2)	_____ V ,_____ A		
89DS	Disconnecting Switch aux. contacts (Motor Operated)			
CSX	AUX. relay for back-up closing 2 NO contacts, 125 VDC, 10 A continuos setting			

Hydraulic (or Pnuematic)

Pressure and Operating Time





Terminal block diagram including spare (10 % but not less than 10 terminals)
Terminals for remote shall be terminated at ØB terminal block

Close Command

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Trip Command

Remote = 1Ø (primary tripping coil)
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Test ØA, Test ØB, Test ØC } 1Ø (primary tripping coil)

The Schematic Status

- CB at open position
- Gas at low density (stage 2)
- Hydraulic or Pnuematic at low pressure (stage 2)
- Voltage at under voltage

Note

This schematic diagram is intended to show functional control requirement only, actual schematic diagram corresponding to this functional requirement shall be designed by manufacturer.

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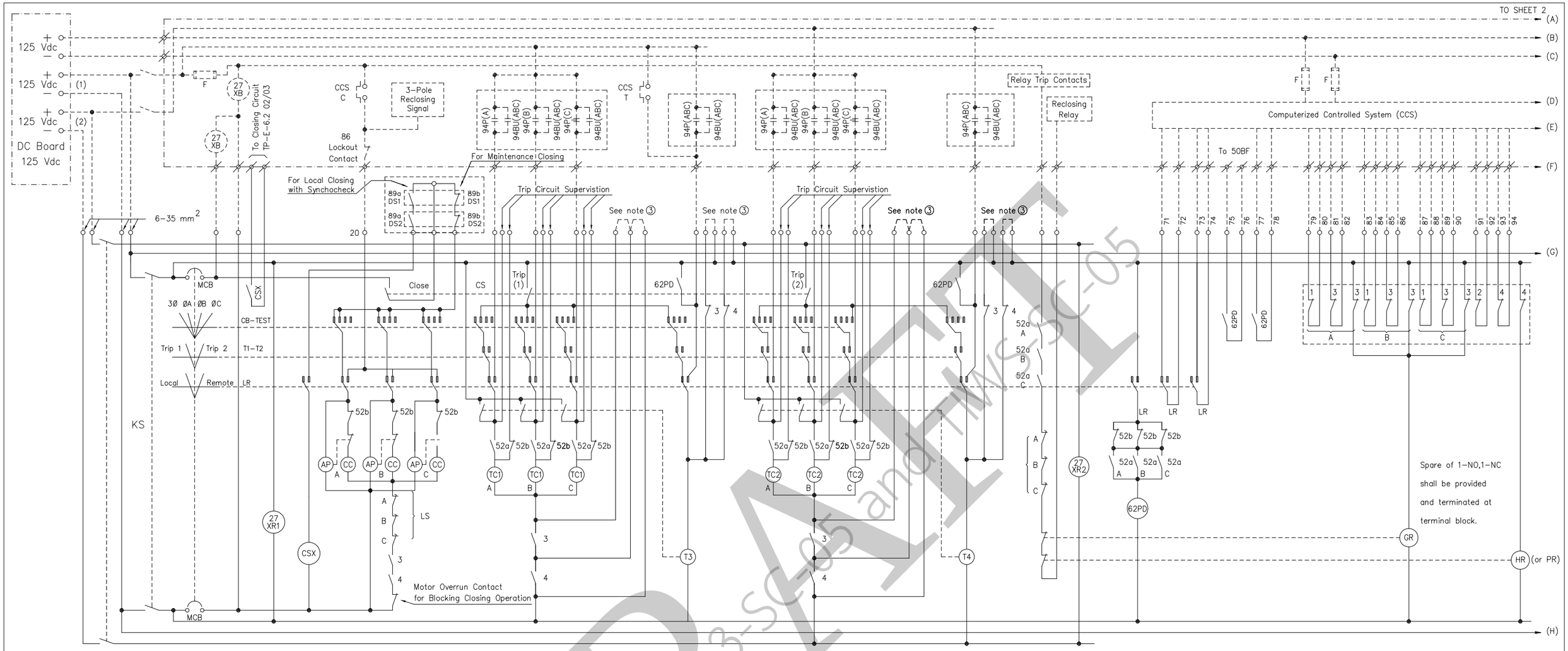
SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT			
SINGLE POLE & THREE POLE OPERATED CIRCUIT BREAKER WITH SYNCHOCHECK CLOSING TYPICAL SCHEMATIC DIAGRAM			
Date : 03/2016	Dwg. No. : TP-E-CB 6.3	SH. 01/01	Rev. 5

Bid Doc. RK3-SE
SE-05 and TWS-SE-05

TO SHEET 2



LOCKOUT (CLOSE CIRCUIT) CONTACT

- Low hydraulic pressure (stage 2) or
  Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

LOCKOUT (TRIP CIRCUIT) OR TRIP CONTACT

- Low hydraulic pressure (stage 2) or
  Low pnuematic pressure (stage 2)
- Low SF6 gas density (stage 2)

CONTACT OF DENSIMETER OR PRESSURE RELAY

- Low SF6 gas density (stage 1)
- Low SF6 gas density (stage 2)
- Low hydraulic pressure (stage 1) or
  Low phuematic pressure (stage 1)
- Low hydraulic pressure (stage 2) or
  Low phuematic pressure (stage 2)

LOW SF6 GAS DENSITY,LOW HYDRAULIC OR PNUEMATIC PRESSURE

- Stage 1 = Alarm
  Gas density (1) = _____
  H (or P) pressure (2) = _____ at _____ °C
  = _____ at 40 °C
- Stage 2 = Lock (close) and Lock (trip) or trip
  Gas density (3) = _____
  H (or P) pressure (4) = _____ at _____ °C
  = _____ at 40 °C

LOCKOUT AT CB IN CLOSE POSITION

Suitable means shall be provided to keep circuit breaker at close position,automatic self opening of circuit breaker at further lower pressure is not accepted.

DEVICE	DESCRIPTION	RATING	TYPE	MANUFACTURER
CB-TEST	3Ø/ØA/ØB/ØC Selector Switch	____ V ,____ A		
CCS	Computerized control system			
LR	Local/Remote Selector Switch	____ V ,____ A		
CC	Closing coil	90-140 Vdc,____ A____mS		
TC1	Primary tripping coil 1	70-140 Vdc,____ A____mS		
TC2	Primary tripping coil 2	70-140 Vdc,____ A____mS		
T3	Back-up three pole tripping 1	70-140 Vdc,____ A____mS		
T4	Back-up three pole tripping 2	70-140 Vdc,____ A____mS		
AP	Antipumping relay	____ Vdc,____ A____mS		
GR	Gas density auxiliary relay	____ V ____ A		
HR (or PR)	Hydraulic (or Pnuematic) pressure auxiliary relay	____ V ,____ A		
M	Motor	____ V ,____ A ____ HP		
P (or C)	Pump (or Compressor)	____ V ,____ A ____ HP		
27	Under voltage alarm relay,slow drop out	125 Vdc or 400 Vac		
KS	Knife switch	____ V ,____ A		
MCB	Molded case circuit breaker with thermal trip, 2-pole	____ V ,____ KA ____ AT ,____ AF		
MCB1	Molded case circuit breaker with thermal trip, 2-pole	____ V ,____ KA ____ AT ,____ AF		
MCB2	Molded case circuit breaker with thermal trip, 3-pole	____ V ,____ KA ____ AT ,____ AF		
MCB3	Molded case circuit breaker with thermal and instantaneous trip,1-pole	____ V ,____ A ____ AT ,____ AF		
CSX	AUX. relay for back-up closing 2 NO contacts, 125 VDC, 10 A continuous setting			
TS	Thermostat	Range _____°C		
SH	Space heater	____ V ,____ A ____ W		
TB	Terminal block	600 V ,____ A		
LS	Limit switch for spring charge motor	____ V ,____ A		

DEVICE	DESCRIPTION	RATING	TYPE	MANUFACTURER
1	Gas density switch (stage 1)	____ V ,____ A		
2	Pressure switch (P or H) (stage 1)	____ V ,____ A		
3	Gas density switch (stage 2)	____ V ,____ A		
4	Pressure switch (P or H) (stage 2)	____ V ,____ A		
62PD	Pole disagreement relay	50-1000 mS		

The Schematic Status

- CB at open position
- Gas at low density (stage 2)
- Hydraulic or Pnuematic at low pressure (stage 2)
- Voltage at under voltage

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4 มิถุนายน 2568

Note
① This schematic diagram is intended to show functional control requirement only, actual schematic diagram corresponding to this functional requirement shall be designed by manufacturer.
② Any auxiliary relays for amplifying of any 52a and 52b contacts shall be of latching relay type.
③ Disconnect if lockout function is selected.

SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT			
500 kV SINGLE POLE & THREE POLE OPERATED CB TYPICAL SCHEMATIC DIAGRAM			
Date : 03/2017	DWG.NO. TP-E-CB-6.4	SH. 1/2	REV. 4

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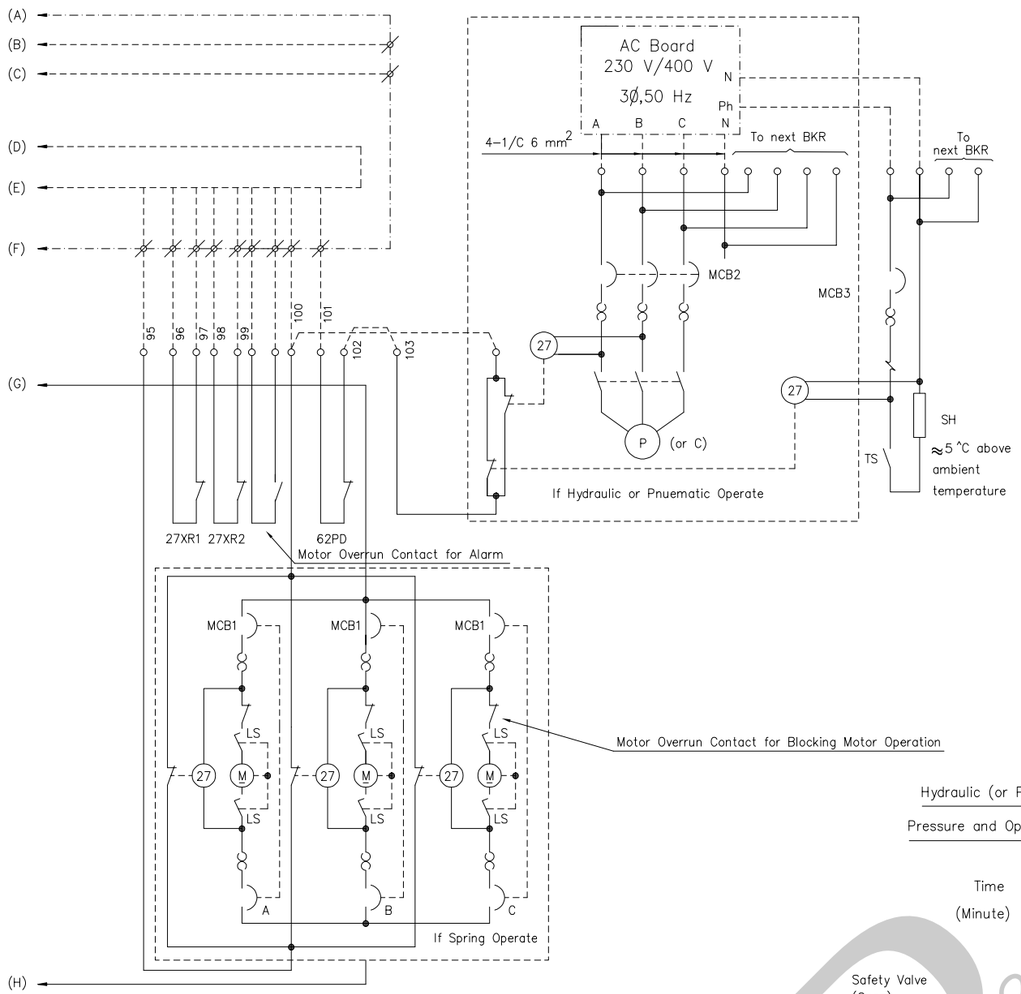
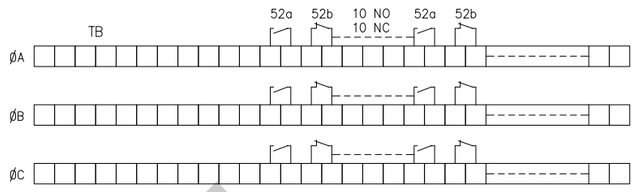
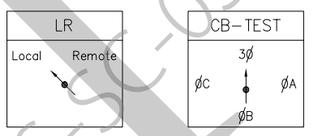




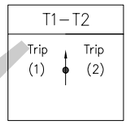
Terminal block diagram including spare (10 % but not less than 10 terminals)

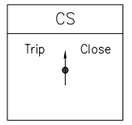
Terminals for remote shall be terminated at ϕB terminal block



Spare of 2–NO contacts for each Local and Remote position shall be provided and terminated at terminal block.

Spare of 2–NO contacts for each 3ϕ,ϕA,ϕB and ϕC position shall be provided and terminated at terminal block.

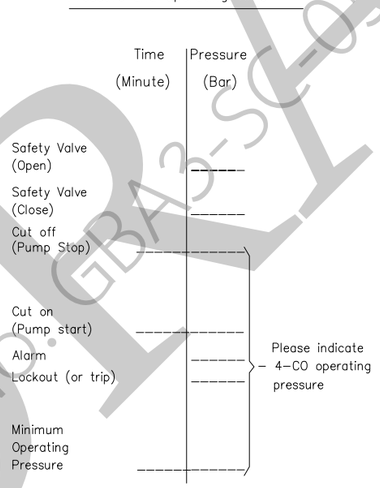




Slip contacts shall be provided.

Hydraulic (or Pnuematic)

Pressure and Operating Time



Close Command

Remote = 3ϕ
Local = 3ϕ
Test ϕA, Test ϕB, Test ϕC = 1ϕ

Trip Command

Remote = 1ϕ (1st trip coil)
= 1ϕ (2nd trip coil)
= 3ϕ (T3)
= 3ϕ (T4)

Local = 1ϕ (1st trip coil)
= 1ϕ (2nd trip coil)
= 3ϕ (T3)
= 3ϕ (T4)

Test 3ϕ = 3ϕ (T3)
= 3ϕ (T4)

Test ϕA, Test ϕB, Test ϕC = 1ϕ (1st and 2nd trip coil)

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500 kV SINGLE POLE & THREE POLE OPERATED CB TYPICAL SCHEMATIC DIAGRAM			
Date : 03/2017	DWG.NO. TP–E–CB–6.4	SH. 2/2	REV. 4

Specification No 202

Disconnecting Switches (Disconnectors)

202-1 **General.** This specification covers the general requirements for design, manufacture, test and supply of the outdoor disconnecting switches.

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 (if any).

202-2 **Materials and Workmanship.** All materials shall be new and 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.

202-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

202-4 **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 referred therein.

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IEEE	The Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
ICEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturers Association

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4 มิถุนายน 2568

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 manufacture 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 referred herein.

The latest issue of all codes, specifications and standards 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.

202-5 **Design and Construction.** All switches shall be three poles or single pole, single throw, outdoor, vertical break, double side break or center side break, group operated type or etc. as specified.

All switches shall be designed and fabricated in accordance with IEC 62271-1 and IEC 62271-102. Each switch shall be complete with bases, insulators, contacts, terminals, blades, operating mechanisms and mounting bolts. Linking Rod shall be supplied in one piece. Welded rod is not acceptable.

All switch bases, operating mechanisms, rods and other steel parts shall be hot-dip galvanized after all machining and threading operations have been complete. Threads shall be undercut to allow for galvanizing.

Liberal factors of safety shall be used throughout, especially in the design of all part subject to reversal of stress or shock.

202-5.1 **Contacts.** The main blades of all switches shall have adequate strength and current carrying capacity conforming to the maximum ratings of the switches. The main blade shall be counter balanced to prevent them from falling closed from any position. The current path shall not be through any springs or movable pin connection. The contacts shall be designed to be adjustable, self-aligning, high pressure, providing self-cleaning action.

Exposed contacts shall be self-wiping, silver to silver. All other current carrying contacts, including hinged end contacts, shall be silver to silver, unless sealed and insulated from contamination and corrosion. Internal sealed contacts may be either silver to silver or silver to copper. All exposed contacts, both fixed and movable, shall be replaceable in the field.

The thickness of silver coating for external contact surface shall be suitable for equipment but not less than 20 μm.

202-5.2 **Grounding Switch (Earthing Switch).** Grounding switch shall be either cooperative grounding switch furnished for installation on the main switch or independent grounding switch as specified. The

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cooperative grounding switch shall be three poles, manually group operated. Each cooperative grounding switch shall be interlocked with its own main switch and, if specified, with another corresponding main switch to prevent closure of the ground blades when the main blades are closed and to prevent closure of the main blades when the ground blades are closed.

Each grounding switch shall have a rated short-time withstand current as specified in Ratings and Features sheets. Each grounding switch shall be supplied with all necessary linkages, clamps, couplings, operating pipes, operating handle, supporting bracket, guide plates, auxiliary switches and other miscellaneous equipment to make a complete installation.

The current path from grounding blade shall be connected directly to the clamp type grounding connector at switch base for common ground wire connection and shall not be through any spring or movable pin connection.

202-5.3 **Insulators.** Material, dimensions, general profile, structural, mechanical and electrical characteristics of insulators, units or assemblies shall be in compliance with the applicable requirements of IEC or ANSI bushings and insulators standards as specified in Ratings and Features sheets. The color of all insulators shall be chocolate brown.

202-5.4 **Operating Mechanism.** The switch operating mechanism shall be so designed and fabricated that it will not cause excessive deflections on the member to which it is attached.

All switches shall be self-locking in the open and closed positions independent of the control shaft restraint. Each mechanism shall be provided within an indicator showing direction of rotation for opening or closing, and shall be provided for grounding and for pad locking in the open and closed positions.

The switch operating mechanism shall be mounted in an enclosure which is made of a weather-proof, rigidly framed stainless steel, aluminum or hot-dipped galvanized sheet steel and suitable for secure mounting on the switch supporting structure.

Each operating mechanism shall be furnished complete with all necessary operating pipes, interphase shafts, pipe couplings, guide bearings, ground braids, mounting brackets, mounting bolts, operating lever or hand-crank, auxiliary switches, and offsets required for operation from the ground. All operating rods and levers shall be cut to length and all machining operations and threading shall be complete in the factory.

Bearings and gears. All switch bearings and gears shall be contained in a weather sealed housing and shall be designed to provide maximum axial and lateral loading capacity with minimum friction.

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4 มิถุนายน 2568

All ball or roller bearings shall be stainless steel packed with a permanent type grease and with a corrosion inhibitor to eliminate future lubrication or maintenance.

Each cabinet shall be equipped with suitable heater completed with miniature circuit breaker and shall be design to maintain the temperature rise inside the cabinet within 5°C above the surrounding temperature.

The ground bus with ground terminal connector shall be provided inside each cabinet for connection of the cable shield grounding.
All switches with electrical control for closing and opening operation shall be 2-pole controls.

The functional control requirement shall be according to the functional control requirement as shown on the typical schematic diagram attached.

a. **Manual Operating Mechanism.** All switches shall be equipped with a manual operating mechanism. The manual operating mechanism shall be of torsion type suitable for operation in the horizontal plan with an operating force should not exceed 250 N. A peak value of 450 N is accepted during a rotation of 15° maximum. The manually gang-operated mechanism shall affect a thoroughly smooth controlled movement throughout the entire operating cycle. The operating ***levers*** shall be equipped with each switch and shall be arranged for mounting on the steel base supporting structures at approximately 1.05 m above the foundation. Means shall be provided on each switch for taking up loose motion in the operating mechanism and for adjusting the travel of each blade independently. The Contractor shall furnish all supplemental members required to secure the installation of the complete switch mechanism to the supporting structures.

b. **Motor Operating Mechanism.** The switch motor operating mechanism shall be of the dead-front type with a hinged door complete with a keyed latch. The housing shall be provided with a detachable conduit plate suitable for drilling in the field.

   The mechanism shall be of torsion type and provided with the necessary gear drive assembly, with an electrical interlock to cut-out the motor on manual operation. The (emergency) manual operation shall be possible and, in this case, the maximum operating force shall not be higher than 60 N with a possible peak of 120 N during a maximum of 10% of the total required revolutions. (For the complete operation requiring more than one revolution)

   Hand-crank shall be provided for each switch and, if detachable, the hand-crank shall be arranged for mounting inside the operating mechanism housing.

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The motor operating mechanism shall have an operating time as followings:

For voltages up to 230 kV	:	not exceeding	10 s
For 500 kV	:	not exceeding	20 s

The motor operated mechanism shall be equipped with a high-starting torque, reversible motor wound with moisture resistance insulation. The motor shall be capable of operating at a nominal voltage ratings as specified with a voltage variation between ***15***% under and ***10***% over the rated voltage. The motor shall be protected with suitable fused cut-out switches, over travel limit switches, and magnetic disc brakes or other suitable protection for the operating mechanism. The magnetic disc brakes shall be spring set and solenoid released with long wearing friction linings for minimum adjustment. All brakes shall be tested and set for maximum torque.

The motor operated mechanism shall be furnished complete with operation "**Local-Remote**" selector switch and control switch for opening and closing operation.

202-5.5 **Equipment Supporting Structure.** The equipment supporting structure shall be hot-dip galvanized after fabrication, in accordance with ASTM A123, A153 and A53. All necessary galvanized bolts, nuts and washers to complete the erection shall be furnished, including embedded anchor bolts for securing the supporting structure to the concrete foundation.

The zinc coating shall be uniform clean of a standard thickness on the entire surface of all materials.

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
	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, filters	5 mm and over	more than 381	more than 305
	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

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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.

202-5.6 **Terminal Pad.** Each equipment terminals for connecting to the line or other equipment shall be equipped with a suitable terminal pad unless otherwise specified. The terminal pad shall be provided with 14.3 mm (9/16 in) diameter holes with 45 mm (1 3/4 in) spacing between the centers of each hole in accordance with the NEMA Standards CC1.

The terminal pad shall be of high conductivity bronze, copper or aluminum alloy and, unless it is made of aluminum alloy, shall be plated electro-tin to a thickness of not less than 0.0127 mm (0.0005 in).

202-5.7 **Ground Terminal Connector.** The grounding terminal of the equipment shall be of the clamp type suitable for 4/0 AWG copper stranded conductor. Terminal connector shall be made of high conductivity material and shall be complete with corrosion resistance bolts, nuts and lock washers.

202-5.8 **Brass Pipe.** Brass pipe shall conform to the requirements of ASTM Specifications B 43 for "Seamless Red Brass Pipe, Standard Sizes".

202-5.9 **Copper Pipe.** Steel pipe shall conform to the requirements of the latest issue of ASTM Specifications B 42 for "Seamless Copper Pipe, Standard Sizes".

202-5.10 **Steel Pipes.** Steel pipe shall conform to the requirements of ASTM Specification A 53 "Welded and Seamless Steel Pipe".

202-5.11 **Copper Tubing.** Copper tubing shall conform to requirements of the latest issue of ASTM Specification B 88-78 or "Seamless Copper Water Tube", Type K.

202-5.12 **Welding.** All welding shall be in accordance with AWS and ASTM Specifications and standards for Unfired Pressure Vessels, as they may apply.

202-5.13 **Rigid Conduit.** Rigid Conduit shall conform to the requirements of ANSI C80.1 for "Rigid Steel Conduit Zinc Coated"

202-5.14 **Temperature Rise.** When the rated current flows through the disconnecting switch, the temperature rise of its various parts shall not exceed the values specified in Table 3 of IEC 62271-1.

202-5.15 **Radio and Telephone Interference.** All equipment shall be designed and constructed in accordance with IEC 62271-102 such that no interference shall be caused to radio reception or to telephone communication circuits.

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4 มิถุนายน 2568

202-6 **Insulated Wire.** Insulated wire shall be tin coated copper conductor and shall not be less than 1.5 mm2, minimum voltage classification of 600 V with high temperature PVC insulation. Hinge wire shall be extra flexible Class K stranding or equal.

202-7 **Cleaning and Painting.** All interior and exterior surfaces of ferrous metalwork shall be either galvanized in accordance with ASTM Designation: A123 and A153 or painted. Surfaces to be painted shall be thoroughly cleaned to base metal by sand blasting or shot blasting and shall be thoroughly dry before application of any paint. After cleaning, the surfaces shall be given a priming or sealing coat of paint followed by two coats of light gray Munsell Notation No 7.5 BG 6/1.5.

202-8 **Accessories**

202-8.1 **Auxiliary Switches.** All contacts shall be conformed to class 1 in Table 6 of IEC 62271-1 at 125 Vdc ungrounded circuit. All contacts shall be electrically independent and adjustable for late on early opening or closing and all "a" and "b" contacts shall be readily interchangeable.

Each main switch and grounding switch mechanism shall be provided with a mechanically driven auxiliary switch with all necessary contacts for proper motorized disconnect operation, electrical interlocking (For main and cooperative grounding switch) remote indication and control, local control and indication including eight (8) "a" and eight (8) "b" spare contacts.

The auxiliary switch shall be supplied in a weather-proof housing provided with detachable conduit plates suitable for drilling in the field.

202-8.2 **Interlocks.** All main switches without cooperative grounding switch, the main blades shall be interlocked with grounding switches of another corresponding switches with key interlock when specified.

The key interlock shall be kirk key or approved equal.

The interlocking arrangement shall be as shown on EGAT's Drawing No 202-1. Each key for motor operating mechanism shall include one normally open and one normally close electrically separate auxiliary switch rated 125 Vdc, 10 A continuous.

All main switches, with and without grounding blades, for which key interlocks are not specified, shall have all provisions necessary to accommodate the future addition of the key interlocks.

202-8.3 **Terminal Blocks.** All accessories and control devices shall be completely wired. Both ends of wires shall be terminated by compression type, ring tongue type terminal lug and shall be provided with terminal number rings, the terminal number shall be recorded in the wiring diagram. All wiring which connects to external circuits

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4 มิถุนายน 2568

shall terminate on terminal blocks installed in the control cabinet. The terminal block shall be of 600 V molded block type with insulating barrier between terminals. Terminal blocks used for current transformer leads shall be of the short circuit type.

Each terminal block shall have marking strips, and shall be equipped with the compression type, ring tongue type terminal lugs for 4 mm^2 or higher to make connection with outgoing cable. The terminal blocks shall be provided with ten (10) percent but not less than ten (10) additional terminals as spares besides the necessary number. Two (2) or more external wires shall not be connected in one (1) terminal.

The terminal blocks shall have the size suitable for termination of the following cables:

For AC supply and DC supply : 6 - 35 mm^2

For others and spares : 2 x 4 mm^2

The terminal blocks for AC circuit and the terminal blocks for DC circuit shall be separately grouped as well as the AC terminal blocks shall be covered with transparent plastic box.

202-8.4 **Nameplates.** Nameplates of anodized aluminum or stainless steel shall be provided for all equipment including control cabinet and local control component identification. The nameplate of disconnecting switches and earthing switches (and their operating devices) shall be conformed to IEC-62271-102 and shall be visible in the position of normal service and installation.

In addition to all nameplate data, the EGAT serial number of the equipment shall be indicated on the nameplate of each unit of equipment. If possible, it should be indicated close to the manufacture serial number.

The EGAT serial numbers of the equipment will be advised after Contract signed.

202-9 **Test.** Test of equipment shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

202-9.1 **Type Test / Design Test.** The proposed equipment shall already have the type test / design test record of the same type and same rating as EGAT called for, in accordance with the tests specified in each equipment test items, which is subject to EGAT's approval (unless otherwise specified in each equipment test item). The type test / design test record shall be required and submitted together with the tender document during the bidding.

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202-9.2 **Routine test.** Each equipment shall be completely assembled at the factory and subject to the tests specified in each equipment test item.

202-9.3 **Sample Test / Quality Conformance Test.** The sample test / quality conformance test shall be performed by selecting the sample from each lot of equipment. The numbers of samples for the test shall be as specified in the Standard.

202-9.4 **Test Report.** The report of all tests, curves and standard application data shall be furnished to EGAT immediately after completion of the tests.

202-9.5 **Test Procedure.** The Contractor shall submit the test procedure of specified 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.

202-9.6 **Test Items for Disconnecting Switches.** The tests shall be performed in accordance with the latest IEC 62271-102 unless otherwise specified.

a. Type Tests

(a) Dielectric tests

(b) Measurement of the resistance of main circuit

(c) Continuous current tests

(d) Short-time withstand current and peak withstand current tests

(e) Mechanical endurance tests

(f) Radio interference voltage (RIV) test (For rated voltages 245 kV and above)

(g) EMC tests (Presence of electronic components)

b. Routine Tests. The routine test shall be made with each transport unit and at the manufacturer's work.

(a) Tests on auxiliary and control circuits

(b) Measurement of the resistance of the main circuit

(c) Mechanical operating tests. One unit of switch for each type and rating shall be subjected to this test.

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202-9.7 **Test Items for Insulators.** The tests shall be performed in accordance with the latest IEC 60168 or ANSI C29.9 as specified in Ratings and Features sheets.

202-10 **Spare Parts.** All spare parts subject to damage or deterioration by moisture shall be packed in moisture-proof material. All spare parts shall b of the same materials and workmanship as the corresponding original parts and shall be interchangeable therewith. The Bidder shall include in his bid a list of recommended spare parts for maintenance.

202-11 **Appliances and Tools.** The Contractor shall furnish all special tools and appliances necessary for satisfactory installation, operation, maintenance and disassembling of the equipment. The Contractor shall submit to EGAT for approval a list of all appliances and tools required for the above stated purposes and shall indicate thereon all appliances and tools he proposes to furnish.

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202-12 Drawings and Documents for Disconnecting Switches

Drawings and documents shall at least comprise the following:

Item	Description	Approval and Final Dwgs	CD ROM (Including CAD Files)
1	Drawing list of all drawings submitted for approval	x	*x*
2	Outline drawing of disconnecting switches showing a) Mounting dimension b) Terminal location and dimensional data including hole size and spacing c) Main and grounding blade arc travel dimensional data d) Open gap e) Total net weight for the purpose of the foundation design	x	x
3	Insulator stack outline drawing showing all pertinent dimensions with electrical and mechanical characteristical and mechanical vibration, leakage distance and mounting details	x	*x*
4	Detailed wiring diagram showing all internal and external connections including those for auxiliary and limit switches	x	*x*
5	Nameplate	x	*x*
6	Complete three pole schematic diagrams for the motor operator control scheme, auxiliaries, auxiliary and limit switches and heater circuit. The list of accessories equipment including type, rating, and manufacturer shall also be indicated.	x	*x*

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4 มิถุนายน 2568

Item	Description	Approval and Final Dwgs	CD ROM (Including CAD Files)
7	Outline drawing of operating mechanism showing the dimensions including the connection diagram for auxiliary switches and terminals	x	*x*
8	Outline drawing showing the position and operation of the key interlock	x	*x*
9	If the supporting structure is required the following drawings shall be submitted : (The normal size of drawings shall be A1)		
	9.1 Outline drawing of supporting structure showing :	x	*x*
	a. Dimensional data showing attachment to the switch and operating mechanism including hole size and spacing		
	b. Dimension of anchor bolt and anchor bolt setting plan		
	c. Position of earthing terminal		
	9.2 Erection drawing of supporting	x	*x*
	a. Size and length of all members		
	b. Mark number of all members		
	9.3 Bill of material of erection of the supporting structures with the list of members per set of all the following details :	x	*x*
	a. Erection member b. Section c. Length d. No of piece e. Weight		
10	Manufacturing schedule and test schedule	x	-

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4 มิถุนายน 2568

202-13 Instruction Manual for Disconnecting Switches

Instruction manual shall consist of all necessary information including table of contents and shall comprise at least the following parts.

Part A The instruction including installation, operation adjustment and maintenance of disconnecting switches and accessories.

a. Detailed equipment description.

b. Manufacturer's design specifications and complete certified test data.

c. Receiving, inspection, storage, handling and damage claim instruction.

d. Assembly and disassembly instructions including a complete list of required tools.

e. Drawing, photographs and other materials showing all adjustment and lubrication points.

f. Complete component parts list including ordering part numbers, destination of part number and part identification drawings.

Part B All applicable manufacturer bulletins, instruction and other descriptive material.

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

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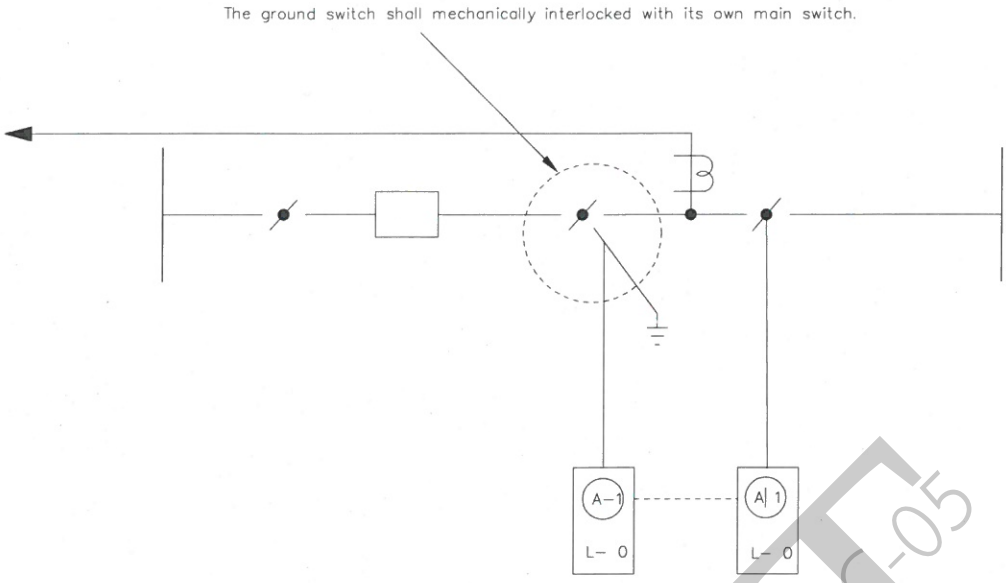

Fig.1

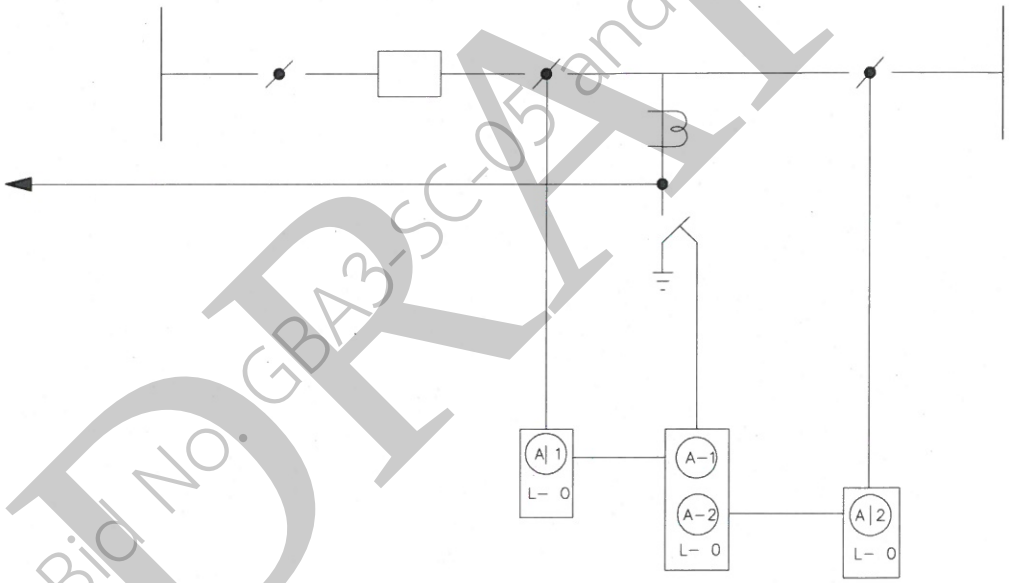

Fig.2

INTERLOCK BETWEEN GROUNDING SWITCH AND ANOTHER CORRESPONDING SWITCH

SHALL BE KEY INTERLOCK AS SHOWN

L- O = interlock used to lock switch open

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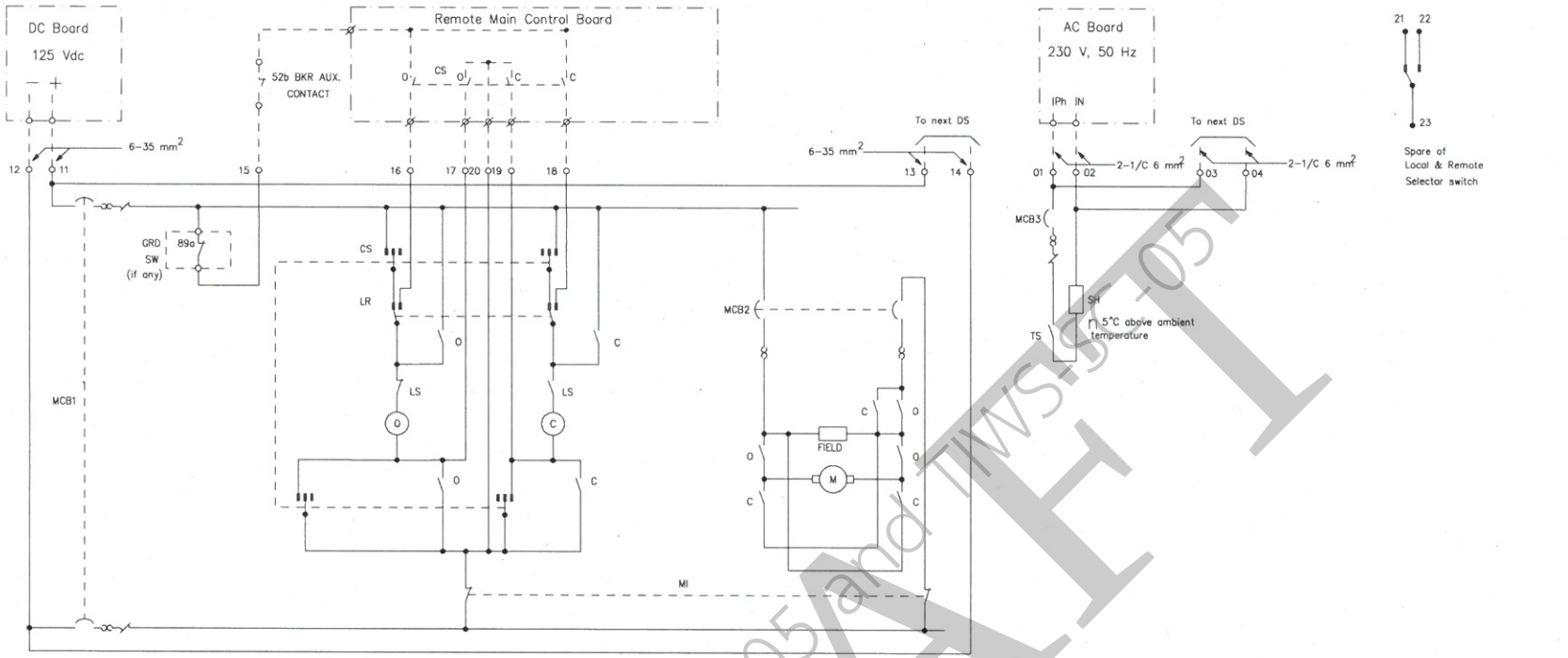
SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT			
KEY INTERLOCK SCHEME			
	DWG.NO. 202-1	SH. 1/1	REV. 2



AC Supply | Control | Spare | Auxiliary Contact 8a + 8b

01	02	03	04	11	12	13	14	15	16	17	18	19	20	21	22	23	–	–	–	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
																				89a	89b	89a	89b	89a	89b	89a	89b	89a	89b	89a	89b	89a	89b	89a	89b	89a	89b	89a	89b												

This side to remote

Terminal blocks shall be arranged and specified no. as shown.

LEGEND	DESCRIPTION	RATING	TYPE	MANUFACTURER
MI	Motor-Manual Interlock,Normally			
	Close,except manual operation			
	at local position.			
O	Opening Coil	125 Vdc,____A		
C	Closing Coil	125 Vdc,____A		
M	Motor	125 Vdc, +15 % -25 %		
LR	Local/Remote Selector Switch			
CS	Open/Close Motor Operated Control Switch			
TS	Thermostat	Range setting____ °C		
LS	Limit Switch			
TB	Terminal block	___V,___A,___mm2		
MCB1	Molded case Circuit Breaker with thermal and instantaneous trip,2-pole	125 Vdc,____KA ____AT,____AF		
MCB2	Molded case Circuit Breaker with thermal trip,2-pole	125 Vdc,____KA ____AT,____AF		
MCB3	Molded case Circuit Breaker with thermal and instantaneous trip,1-pole	400/230V,____KA ____AT,____AF		

NOTE

This schematic diagram is intended to show functional control requirement only, actual schematic diagram corresponding to this functional requirement shall be designed by manufacturer.

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Bid No. GBASE-05 and TWS-E-05

SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT			
MOTOR OPERATED DISCONNECTING SWITCH TYPICAL SCHEMATIC DIAGRAM			
Date : 03/98	Dwg. No. : TP-E-DS 6.1	SH. 01/01	Rev. 2

Specification No 301

Instrument Transformer

301-1 General. This specification covers the general requirements for design, manufacture, test and supply of current transformer (CT), *inductive* voltage transformer (*I*VT), coupling capacitor (CC) and coupling capacitor voltage transformer (CCVT)

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are given in the accompanying Ratings and Features sheet (if any).

301-2 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.

301-3 Service Conditions. All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

301-4 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 referred therein.

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IEEE	The Institute of Electrical and Electronics Engineers
IEC	*International Electrotechnical Commission*
ICEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturers Association

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.

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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 manufacture 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 referred herein.

The latest issue of all codes, specifications and standards 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.

301-5 Design and Construction

301-5.1 Type and Construction. The type and ratings of equipment shall be 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 of 69 kV and above, the metallic bellow shall be used only, other oil expansion systems are not acceptable.

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

The both ends of porcelain housing shall be cemented to the transformer base and head flanges. The porcelain which is fixed by clamps is not acceptable.

For 33 kV current transformer and below, the inverted (top core) type current transformer is not acceptable.

For coupling capacitor voltage transformer, a meaningful ferro-resonance circuit shall be provided for effective suppression of ferroresonance conditions. Ferroresonance suppression device used of electronic circuit is not acceptable.

The instrument transformer secondary circuit connection to ground, the carrier lead-in terminal and carrier drain coil grounding terminal of coupling capacitor and coupling capacitor voltage transformer shall be made in such a way as to permit convenient temporary removal for isolation or testing.

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4 มิถุนายน 2568

301-5.2 **Terminal Pad.** Each equipment terminals for connecting to the line or other equipment shall be equipped with a suitable terminal pad unless otherwise specified. The terminal pad shall be provided with four 14.3 mm (9/16 in) diameter holes with 45 mm (1-3/4 in) spacing between the centers of each hole in accordance with the NEMA Standards CC1, *number of holes specified in Ratings and Features sheet.*

The terminal pad shall be of high conductivity bronze, copper or aluminum alloy and*, unless it is made of aluminum alloy,* shall be plated with electro-tin to a thickness of not less than 0.0127 mm (0.0005 in). Whenever the larger terminal pads are required for higher current rating, the mounting holes shall conform to NEMA Standards CC1, and details of the mounting holes shall be submitted for approval.

301-5.3 **Porcelain 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.

301-5.4 **Ground Terminal Connectors.** *Two (2) units of* 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.

301-5.5 **Secondary Terminal Boxes**

a. For 69 kV Instrument Transformer and above. Knock-out type hole shall be provided at the bottom of secondary terminal box suitable for 2 in (outside diameter of 62 mm) rigid steel conduit of the following quantity.

(a) **Current Transformer**

Secondary winding	- 5 *or 6* cores	:	3 holes
	- 3 or 4 cores	:	2 holes
	- The rest	:	1 hole

(b) ***Inductive*** **Voltage Transformer** : 1 hole

(c) **Coupling Capacitor Voltage Transformer** : 1 hole

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b. For 33 kV Instrument Transformer and below. Flexible sealing cable gland shall be provided at the bottom of secondary terminal box suitable for cable of 26 mm outside diameter of the following quantity :

(a) **Current Transformer**

Relaying class	:	2 sets of cable
Metering class	:	1 set of cable

(b) ***Inductive*** **Voltage Transformer** : 1 set of cable

301-5.6 Terminations

a. Current Transformers. All current transformer secondary winding terminals which connected to terminals on terminal blocks located in the junction boxes, shall have the size suitable for termination of 6 mm^2 cable and shall be short-circuit, *ring tongue crimp* type terminal for each maximum ratio of each core at the terminal blocks in both the secondary terminal box and junction box.

b. *Inductive* Voltage Transformers, Coupling Capacitor Voltage Transformers and Coupling Capacitors. All *inductive* voltage transformer and coupling capacitor voltage transformer secondary terminals which connected to terminals on terminal blocks located in the junction boxes, shall have the size suitable for termination of 4 mm^2 cable *and shall be ring tongue crimp type*. all coupling capacitor voltage transformers and coupling capacitors completed with carrier accessories shall be equipped with carrier terminal connectors suitable for 16 mm^2 copper cable and located inside of secondary terminal box for easy access of connection. The cable hole with cable gland suitable for 18 mm outside diameter cable shall be provided at the bottom of secondary terminal box. The insulation level of carrier terminal shall be the same as carrier drain coil as specified in Ratings and Features sheet.

301-5.7 Transient Performance. *The design of secondary cores of 500 kV Current Transformer 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.

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4 มิถุนายน 2568

301-5.8 **Protective Devices**. All current transformers, rated 69 kV and above, shall be equipped with a primary bypass protective device or surge arrester for protection of the winding from high voltage surges. In case of current transformers rated 69 kV and above, supplied without primary bypass protective device or surge arrester, calculation data of high voltage surge withstanding for primary winding shall be submitted to EGAT for approval.

301-5.9 **Supporting Structures.** Supporting structures, if specified in the Price Schedule, shall be hot-dip galvanized after fabrication in accordance with ASTM A123, A153 and A53. 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
	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, filters	5 mm and over	more than 381	more than 305
	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 No 4/0 AWG copper stranded conductor.

301-6 **Special Requirement.** In case inverted type (top core) is proposed for 69 kV current transformer and above, type test record of multiple chopped impulse 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.

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4 มิถุนายน 2568

301-7 Test. Test of equipment shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

301-7.1 Design Test. The proposed equipment shall already have the design test record of the same type and *similar* rating as EGAT called for, in accordance with the tests specified in each equipment test items, which is subject to EGAT's approval (unless otherwise specified in each equipment test item). The design test record shall be required and submitted together with the tender document during the bidding.

301-7.2 Routine Test. Each equipment shall be completely assembled at the factory and subject to the tests specified in each equipment test item.

301-7.3 Test Report. The report of all tests, curves and standard application data shall be furnished to EGAT immediately after completion of the tests.

301-7.4 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.

301-7.5 Test Items for Current Transformer. The tests shall be performed in accordance with the latest *IEEE standard or IEC standard as specified in Ratings and Features Sheet.*

Test in according to IEEE Std C57.13 are as following.

a. 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 (wet) test.

(e) Impulse test.

(f) *Inter-turn overvoltage test.*

(g) Multiple chopped impulse test.

The design test record, in accordance with the following items below, of the inverted type (top core) current transformer, which is subject to EGAT's approval, is required and shall be submitted together with tender document during the bidding.

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22 Dec 2021

If actual multiple chopped impulse test is required to be performed, the current transformer required for the test shall be subject to the sequence of tests listed below.

1. Routine test *for item (a), (b), (g) and (h)* according to the requirements of this specification and oil sampling for dissolved gas analysis before multiple chopped impulse test.

2. Apply a series of 12 sets of 50 chopped waves impulse of negative polarity (total of 600 chopped waves impulse) at the rate of, about 1 impulse per minute.

   The test voltage amplitude shall be approximately 70% of the BIL rating (with the tolerance of ± 5%). The chopping time shall be within 0.5 μs after reaching the crest voltage. The waveshape oscillogram and the total secondary current shall be recorded on the first chopped wave application and every $50^{\underline{th}}$ chopped wave application.

3. Routine tests *for item (a), (b), (g) and (h)* according to the requirements of this specification.

4. *72 hours* after completion of all tests, oil sampling for dissolved gas analysis shall be carried out.

   The maximum increase of the content of the following gases shall be as follows :

   H_2 : 5 ppm , CH_4 : 2 ppm , C_2H_6 : 2 ppm ,
   C_2H_2 : 1 ppm , C_2H_4 : 1 ppm

(h) *Wet and dry switching impulse voltage withstand test (for 500 kV Current Transformer).*

(i) *Transient performance test (if required on Ratings and Features sheet).*

(j) *Ground shield check (for 72 kV and above)*

b. 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 for relaying class).

(d) Polarity check.

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นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(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) *Measurement of capacitance and dielectric dissipation factor.*

(h) Partial discharge measurement.

(i) *Determination of the secondary loop time constant. (for TPY class)*

(j) Creepage distance measurement. One unit of each type and rating shall be subject to this test.

Test in according to IEC Std 61869-1, 61869-2 are as following.

a. *Design Tests*

(a) *Short-time dynamic current test.*

(b) *Short-time thermal current tests.*

(c) *Temperature rise test at maximum rated current (of continuous thermal current rating factor).*

(d) *Wet test for outdoor type transformers.*

(e) *Impulse voltage withstand test (including chopped impulse voltage withstand test).*

(f) *Multiple chopped impulse test.*

The design test record, in accordance with the following items below, of the inverted type (top core) current transformer, which is subject to EGAT's approval, is required and shall be submitted together with tender document during the bidding.

If actual multiple chopped impulse test is required to be performed, the current transformer required for the test shall be subject to the sequence of tests listed below.

1. *Routine test for item (a), (g) and (h) according to the requirements of this specification and oil sampling for dissolved gas analysis before multiple chopped impulse test.*

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Bid No. GBA3-SC-05 and TIWS-SC-05

นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

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ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

2. *Apply a series of 12 sets of 50 chopped waves impulse of negative polarity (total of 600 chopped waves impulse) at the rate of, about 1 impulse per minute.*

   The test voltage amplitude shall be approximately 70% of the BIL rating (with the tolerance of ± 5%). The chopping time shall be within 0.5 μs after reaching the crest voltage. The waveshape oscillogram and the total secondary current shall be recorded on the first chopped wave application and every 50th chopped wave application.

3. *Routine tests for item (a), (g) and (h) according to the requirements of this specification.*

4. *72 hours after completion of all tests, oil sampling for dissolved gas analysis shall be carried out.*

   The maximum increase of the content of the following gases shall be as follows :

   H_2 : 5 ppm , CH_4 : 2 ppm , C_2H_6 : 2 ppm ,
   C_2H_2 : 1 ppm , C_2H_4 : 1 ppm

(g) *Switching impulse voltage test (for 500 kV Current Transformer).*

(h) *Transient performance test (if required on Ratings and Features sheet).*

a. *Routine Tests*

(a) *Power frequency voltage withstand test.*

(b) *Inter-turn overvoltage test.*

(c) *Accuracy test for each ratio of all winding (including excitation curve of one unit of each item for relaying class).*

(d) *Verification of markings.*

(e) *Determination of the secondary winding resistance 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) *Measurement of capacitance and dielectric dissipation factor. (This test result shall be provided for every rating)*

(h) *Partial discharge measurement.*

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Bid No. GBA3-SC-05 and TWS-SC-05

นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร, กสส-ร, อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(i) *Determination of the secondary loop time constant. (for TPY class)*

(j) *Creepage distance measurement. One unit of each type and rating shall be subject to this test.*

301-7.6 **Test Items for *Inductive* Voltage Transformer.** The tests shall be performed in accordance with the latest *IEC Std 61869-1, 61869-3 and the following requirements.*

a. Design Tests

(a) Short circuit *withstand* capability test.

(b) Temperature-rise test.

(c) *Wet test for outdoor type transformers.*

(d) Impulse *voltage withstand* test. *(including chopped impulse voltage withstand test).*

(e) *Radio interference voltage tests.*

(f) *Test for accuracy.*

b. Routine Tests

(a) *Power-frequency voltage withstand tests.*

(b) *Test for accuracy.*

(c) *Verification of markings.*

(d) Winding resistance measurement for each ratio of all windings.

(e) Insulation resistance measurement.

(f) *Measurement of capacitance and dielectric dissipation factor. (This test result shall be provided for every rating)*

(g) Partial discharge measurement.

(h) Creepage distance measurement. One unit of each type and rating shall be subject to this test.

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Bid No. GBA35C-05 and EWS-SC-05

นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

เอกสารไม่ควบคุม
รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

301-7.7 **Test item for Coupling Capacitor Voltage Transformer.** The tests shall be performed in accordance with the latest ANSI *standard or IEC standard as specified in Ratings and Features Sheet.*

Test in according to ANSI Std C93.1 are as following.

a. Design Tests

(a) Power frequency withstand voltage (wet) test.

(b) Impulse test.

(c) Radio-influence voltage test.

(d) Accuracy test.

(e) Short-time overvoltage test.

(f) Thermal burden test.

(g) Short circuit test.

(h) Ferroresonance test.

(i) Transient response test.

(j) Carrier frequency insertion loss.

(k) Carrier drain coil rated frequency voltage drop and insulation level tests.

(l) Low voltage terminal stray capacitance and stray conductance tests.

(m) Carrier frequency capacitance and dissipation factor tests.

(n) Mechanical test (Cantilever test)

(o) Low voltage terminal insulation level test.

b. Routine Tests

(a) On the capacitor divider

1. Capacitance and dissipation factor measurement before and after power frequency withstand voltage (dry) test.

2. Power frequency withstand voltage (dry) test.

3. Partial discharge measurement

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Bid No. GBA3-SC-05 and TIWS-SC-05

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รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

(b) On the electromagnetic unit

1. Induced potential test on the primary circuit.

2. Applied potential test on the secondary circuit.

3. Insulation power factor measurement.

(c) On the complete CCVT

1. Accuracy tests.

2. Polarity check.

3. Protective gap setting.

4. Ferroresonance test. ***The actual test shall be performed on one unit of CCVT being supplied as per Ratings and Features sheet.***

5. Transient response test. ***The actual test shall be performed on one unit of CCVT being supplied as per Ratings and Features sheet****. 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.*

6. Creepage distance measurement. One unit of each type and rating shall be subject to this test.

Test in according to IEC Std 61869-1, 61869-5 are as following.

a. ***Design Tests***

(a) *Wet test for outdoor type transformers.*

(b) *Impulse voltage withstand test. (including chopped impulse voltage withstand test).*

(c) *Radio-influence voltage test.*

(d) *Test for accuracy.*

(e) *Temperature-rise test (Thermal burden shall be applied).*

(f) *Short circuit withstand capability test.*

(g) *Ferroresonance test.*

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Bid No. GBA3-SC-05 and TW3-SC-05

นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

เอกสารไม่ควบคุม
รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Ferroresonance test for Potential Grounding Switch. The CCVT shall be energized at 110% of maximum rated voltage with essentially zero burden (that burden imposed only by the recording equipment and in no case exceeding 5 VA) on the secondary winding. The potential grounding switch shall be closed and opened a minimum 30 times.

(h) *Transient response test.*

(i) *Carrier frequency insertion loss. (ANSI C93.1)*

(j) *Carrier drain coil rated frequency voltage drop and insulation level tests. (ANSI C93.1)*

(k) *Low voltage terminal stray capacitance and stray conductance tests. (ANSI C93.1)*

(l) *Carrier frequency capacitance and dissipation factor tests. (ANSI C93.1)*

(m) *Mechanical test*

(n) *Low voltage terminal insulation level test. (ANSI C93.1)*

b. Routine Tests

(a) *Power-frequency voltage withstand tests.*

(b) *Partial discharge measurement.*

(c) *Test for accuracy.*

(d) *Ferro-resonance check.*

(e) *Measurement of capacitance and dielectric dissipation factor. (This test result shall be provided for every rating)*

(e) *Verification of markings.*

(f) *Ferroresonance test.* ***The actual test shall be performed on CCVT being supplied as per Ratings and Features sheet.***

Ferroresonance test for Potential Grounding Switch. ***The actual test shall be performed on one unit of CCVT being supplied as per Ratings and Features sheet.*** *The CCVT shall be energized at 110% of maximum rated voltage with essentially zero burden (that burden imposed only by the recording equipment and in no case exceeding 5 VA) on the secondary winding. The potential grounding switch shall be closed and opened a minimum 30 times.*

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นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร, กสส-ร, อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(g) *Transient response test.* ***The actual test shall be performed on one unit of CCVT being supplied.***

(h) *Creepage distance measurement. One unit of each type and rating shall be subject to this test.*

301-7.8 **Test Items for Coupling Capacitor.** The test shall be performed in accordance with the latest ANSI C93.1.

a. Design Tests

(a) Power frequency withstand voltage (wet) test.

(b) Impulse test.

(c) Radio influence voltage test.

(d) Low voltage terminal stray capacitance and stray conductance tests.

(e) Carrier drain coil insertion loss rated frequency voltage drop, and insulation level test.

(f) Carrier frequency capacitance and dissipation factor tests.

(g) Mechanical test (Cantilever test).

(h) Low voltage terminal insulation level test.

b. Routine Tests

(a) Capacitance and dissipation factor measurements before and after power frequency withstand voltage (dry) test.

(b) Power frequency withstand voltage (dry) test.

(c) Partial discharge measurement.

(d) Creepage distance measurement. One unit of each type and rating shall be subject to this test.

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นางสุดารัตน์ ไชยพันธ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021
เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

301-8 Drawings and Documents for Instrument Transformer

Drawings and documents shall at least comprise the followings:

A. Drawings for Approval

Item	Description	Approval and Final Dwgs	CD-ROM *or* *Other Storage Device*
1	Outline drawing	x	x
2	Nameplate including ratings, connection diagram and EGAT's Contract No, Item No and EGAT Serial No	x	x
3	Line terminal pad	x	-
4	Ground terminal connector	x	-
5	Detail of secondary terminal box	x	-
6	Junction box outline drawing and details of internal view	x	-
7	Steel supporting structure (if any) including bill of material	x	-
8	Detail of primary protective device (for CT only, if any)	x	-
9	Detail of carrier terminal and accessories (for CCVT and CC only)	x	-
10	*Assembly drawing of equipment completed with steel supporting structure*	x	-

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เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

B. Drawing and Documents for Reference

1. Internal cross-section view
2. Characteristics of insulating oil
3. Fabrication, painting and finishing process of junction box

นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021

301-9 Instruction Manual for Instrument Transformer

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

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

a. Instrument transformer general technical information.

b. Installation instruction including but not limited to

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

c. Operation and maintenance instruction

- Method of adjustment of transformer ratio and phase angle (for CCVT)
- Method of reactor tuning (for CCVT)
- Routine inspection
- Maintenance

d. Catalogs

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

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Bid No. GBA3-SC-05 and TIWS-SC-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
นางสุดารัตน์ ไชยพันธุ์
ผู้อำนวยการฝ่ายวิศวกรรมระบบส่ง
22 Dec 2021
4 มิถุนายน 2568

Specification No 323(L)

Power Cable, Control Cable and Switchboard Wire

323L-1 **General.** This specification covers the general requirements for design, manufacture, test and supply of the power cable, control cable and switchboard wire.

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are given in the accompanying Ratings and Features sheet (if any).

323L-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.

323L-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

323L-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 referred therein.

TIS Thai Industrial Standards Institute

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 manufacture 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 itemised list of specific deviations from the requirements of codes, specifications and standards referred herein.

The latest issue of all codes, specifications and standards 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.

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ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

323L-5 Construction

323L-5.1 Power and Control Cable. The general construction of the power and control cable shall be suitable for installation in wet and dry locations. The power and control cable shall meet the following specific requirement.

a. Conductors. The conductor shall consist of plain annealed copper. Construction shall be stranded conformable to the applicable requirements of TIS 2427-2552. Minimum number of wires in each conductor shall be 7 and conform to Table 2 of TIS 2427-2552.

In case of twisted pair type control cable, the nominal cross-sectional area of conductor, the number and nominal diameter of each wire shall be as specified in Price Schedule.

b. Insulation. The insulation of power cable shall be polyvinyl chloride compound of the type PVC/C for cables suitable for fixed installation as indicated in TIS11. Thickness of insulation shall conform to Table 323L-1 and Table 323L-2.

The insulation of control cable shall be polyvinyl chloride and conform to Table 10 of TIS 838-2531.

In case of twisted pair type control cable, the insulation thickness shall not be less than 0.76 mm (0.03 in.).

c. Fillers. Fillers shall be used in the interstice of the multiconductor, cable where necessary to give the complete cable a substantially circular cross section.

d. Wrapping. The cable shall be helically wrapped over the filler and copper shielding with 0.0254 mm (0.001 in) thickness non-hygroscopic mylar or polyester tape.

e. Inner Jacket. The inner jacket shall be polyvinyl chloride of at least 1.14 mm (0.045 in) thickness and shall be applied over the wrapping.

f. Shielding. The shielding shall be annealed copper tape of suitable width and shall be helically applied over the inner jacket with a minimum 10% lap.

The annealed copper tape shall be at least 0.1 mm (0.004 in) thickness and substantially free from burrs.

g. Outer Jacket. The outer jacket applied over the wrapping shall be black polyvinyl chloride compound of the type PVC/ST4 for cables suitable for fixed installation as indicated in TIS 11. Thickness of outer jacket shall conform to Table 323L-1 and Table 323L-2.

The jacket thickness of control cable shall conform to Table 10 of TIS 838-2531 respectively.

DRAFT
Bid No. GBA3-SC05 and TM3-SC05
Mar. 24
เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

h. Circuit Identification. The assembly of conductors in power and control cable composed of 30 conductors or less shall be in accordance with the combinations given in Table 323L-3.

In case of twisted pair type control cable, two insulated conductors shall be uniformly twisted together with suitable length of lay to form a pair. The assembly of conductors in cable composed of 17 pairs or less shall be in accordance with the combinations given in Table 323L-4.

323L-5.2 **Switchboard Wire.** The switchboard wire shall meet the following specific requirement:

a. Conductor stranding

Each strand of switchboard wire shall be tin-coated copper conductor. The nominal cross-sectional area of conductor and number of wires shall be as indicated below:

Nominal Cross-Sectional Area (mm^2)	Number of Wires (strands)
1.5	30
2.5	50
4.0	56
6.0	84

b. Insulation

The insulation shall be polyvinyl chloride and suitable for use at conductor temperatures not exceeding 70°C. The thickness of insulation shall not be less than 1.14 mm. Type and color of insulation shall be as specified in Price Schedule.

323L-5.3 **Cable and Wire Markings.** The following information shall be printed on the surface of cable and wire:

(a) Name of manufacturer

(b) Size of cables and wires and number of conductors

(c) Type of insulation

(d) Voltage classification

(e) Year of manufacture

In addition to cable marking, length mark at each meter shall be printed on the surface of the cable, starting from zero through the whole length of cable in each reel.

DRAFT
Bid No. GBA-SC-05 and TWS-SC-05
เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

323L-5.4 **Cable Ends.** An end cap shall be provided on the cable end to which special attention shall be paid to prevent penetration of moisture during transportation.

323L-6 **Packing.** All cables and wires shall be packed on reels. The reels shall be nonreturnable and shall be included in the prices of the cables and wires offered. The minimum length of the cable and wire to be packed on each reel shall be as indicated below:

Power and control cables : 500 or 1000 m

Switchboard wires : 100, 150 or 200 m

The following information shall be displayed:

(a) Name of manufacturer

(b) Size and number of conductors

(c) Type of insulation

(d) Voltage classification

(e) Year of manufacture

(f) Length of cable

(g) Reel number and other suitable identification for reel and reel size

(h) Net weight and Total weight (kg.)

(i) Item No.

(j) Contract No.

Additionally, the information in (f), (g), (h), (i) and (j) shall be highlighted in contrasting colors for clearly visual inspection.

323L-7 **Test.** Test of equipment shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

323L-7.1 **Design Test.** The proposed equipment shall already have the design test record of the same type and same rating as EGAT called for, in accordance with the tests specified in each equipment test items, which is subject to EGAT′s approval (unless otherwise specified in each equipment test item). The design test record shall be required and submitted together with the tender document during the bidding.

323L-7.2 **Routine test.** Each equipment shall be completely assembled at the factory and subject to the tests specified in each equipment test item.

DRAFT
Bid No. GBA3-SC-05 and TWS-SC-05
เอกสารไม่ควบคุม
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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

323L-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.

323L-7.4 **Test Procedure.** The Contractor shall submit the test procedure of specified 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.

323L-7.5 **Test Items for Power Cable, Control Cable and Switchboard Wire.** The tests shall be performed in accordance with TIS 11-2553 and TIS 838-2531.

a. **Design Tests.** These tests may be omitted if a design test record can be submitted. Sampling method for representative cables shall be selecting a sample from each group according to Nominal Cross-Sectional Area as follows:

For single core cable, groups are categorised into 1-16 mm^2, 25-120 mm^2 and 150-500 mm^2.

For multicore cable, groups are categorised into 1-35 mm^2 and 50-300 mm^2. For the cables in the same group, a cable with any number of cores can be used as a candidate for testing.

(a) **Conductor tests.** Tests shall be performed on selected samples of the conductor before the application of any covering in accordance with TIS 11-2553 and TIS 838-2531.

1. Electrical resistance.

2. Dimension measurement.

(b) **Physical and Aging Tests on the Cable, Insulation and Outer Jacket.** Tests shall be performed on selected samples of the cable insulation and jackets in accordance with TIS 11-2553 and TIS 838-2531.

1. Thickness measurement.

2. Tensile strength test before and after aging.

3. Elongation test before and after aging.

4. Heat distortion test. (Pressure test at high temperature)

5. Loss of mass test.

6. Heat shock testing.

7. Flame spread test.

DRAFT
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เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
4 มิถุนายน 2568

b. Routine Tests. Electrical test shall be performed on the entire length of completed cables in accordance with TIS 11-2553 and TIS 838-2531.
(Routine Tests of Power Cable and Control Cable in the procurement of SHUNT CAPACITOR BANK shall be subjected to agreement between EGAT and the contractor)

1. Voltage test.

2. Conductor resistance test.

3. Insulation resistance test.

Insulation resistance test shall be performed under ambient the value of insulation resistance and ambient temperature shall be recorded. In addition, insulation resistance test on the sample shall be performed in accordance with TIS 11-2553 and TIS 838-2531 with none of the resulting values shall be below the minimum insulation resistance value prescribed in the Table 323L-1 and 323L-2.

323L-8 Drawings and Documents for Power Cable, Control Cable and Switchboard Wire

Drawings and documents shall at least comprise the followings:

A. Documents

Item	Description	Printed Documents	CD-ROM
1	Manufacturing and delivery schedule	x	-
2	Test procedure (Factory test)	x	-
3	Test schedule (Factory test)	x	-
4	Test report (Factory test)	x	-

DRAFT
Bid No. GBA3-SC-05 and TWS-SC-05
เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Table 323L-1

Thickness of Insulation and Outer Jacket for Single Core Power cable

Nominal Cross-Sectional Area (mm^2)	Thickness of Insulation* (mm)	Thickness of Outer Jacket* (mm)	Minimum Insulation Resistance at 70˚C* (MΩ·km)
1.5	1.5	1.8	0.0175
2.5	1.5	1.8	0.0146
4	1.5	1.8	0.0124
6	1.5	1.8	0.0107
10	1.5	1.8	0.0088
16	1.5	1.8	0.0074
25	1.5	1.8	0.0061
35	1.5	1.8	0.0053
50	1.5	1.8	0.0046
70	1.5	1.8	0.0039
95	1.7	1.8	0.0038
120	1.7	1.8	0.0034
150	1.9	2.0	0.0034
185	2.1	2.0	0.0034
240	2.3	2.2	0.0033
300	2.5	2.2	0.0032
400	2.7	2.2	0.0030
500	3.1	2.4	0.0031

*In compliance with Table 3 of TIS 11 Part 101-2559

DRAFT
Bid No. GBA3-SC-05 and TIWS-SC-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Table 323L-2

Thickness of Insulation and Outer Jacket for Multicore Power cable

Nominal Cross-Sectional Area (mm^2)	Thickness of Insulation* (mm)	Thickness of Outer Jacket* (mm)			Minimum Insulation Resistance at 70 ˚C* (MΩ·km)
		2 cores	3 cores	4 cores	
1.5	0.8	1.8	1.8	1.8	0.0116
2.5	0.8	1.8	1.8	1.8	0.0093
4	0.9	1.8	1.8	1.8	0.0085
6	0.9	1.8	1.8	1.8	0.0073
10	1.1	1.8	1.8	2.0	0.0069
16	1.1	2.0	2.0	2.0	0.0057
25	1.3	2.0	2.0	2.0	0.0054
35	1.3	2.0	2.0	2.2	0.0047
50	1.5	2.2	2.2	2.2	0.0046
70	1.5	2.2	2.2	2.4	0.0039
95	1.7	2.2	2.4	2.6	0.0038
120	1.7	2.4	2.6	2.8	0.0034
150	1.9	2.6	2.8	3.0	0.0034
185	2.1	2.8	3.0	3.2	0.0034
240	2.3	3.0	3.2	3.4	0.0033
300	2.5	3.2	3.4	3.8	0.0032

*In compliance with Table 4 of TIS 11 Part 101-2559

DRAFT
Bid No. GBA3 SC-05 and TWS-SC-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Table 323L-3

Colors Sequence for Power and Control Cables

Conductor Number	Background or Base Color	Tracer Color
1	Black	-
2	White	-
3	Red	-
4	Green	-
5	Orange	-
6	Blue	-
7	White	Black
8	Red	Black
9	Green	Black
10	Orange	Black
11	Blue	Black
12	Black	White
13	Red	White
14	Green	White
15	Orange	White
16	Blue	White
17	Black	Red
18	White	Red
19	Green	Red
20	Orange	Red
21	Blue	Red
22	Black	Green
23	White	Green
24	Red	Green
25	Orange	Green
26	Blue	Green
27	Black	Orange
28	White	Orange
29	Red	Orange
30	Green	Orange

DRAFT
Bid No. GBA3-SC-05 and TIWS-SC-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Table 323L-4

Colors Sequence for 17 Pairs Control Cable

Pair Number	Color	
	1 st core	2 rd core
1	White	Blue
2	White	Orange
3	White	Green
4	White	Brown
5	White	Grey
6	Red	Blue
7	Red	Orange
8	Red	Green
9	Red	Brown
10	Red	Grey
11	Black	Blue
12	Black	Orange
13	Black	Green
14	Black	Brown
15	Black	Grey
16	Yellow	Blue
17	Yellow	Orange

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Bid No. GBA3-SC-05 and TIWS-SC-05

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รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Single Core

- Annealed copper conductor
- Insulation
- Polyester or mylar tape
- Polyvinyl chloride inner jacket (Black)
- Copper tape
- Polyester or mylar tape
- Polyvinyl chloride jacket (Black)

Multi Core

- Annealed copper conductor
- Insulation
- Polyester or mylar tape
- Polyvinyl chloride inner jacket (Black)
- Copper tape
- Polyester or mylar tape
- Polyvinyl chloride jacket (Black)
- Polyvinyl chloride rod or polypropylene filler (If necessary)

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Bid No. GBA3-SC-06 and TIWS-SC-05

Rev.	Description	Date	SUBSTATION ELECTRICAL EQUIPMENT ENGINEERING DEPARTMENT
			CROSS SECTION POWER AND CONTROL CABLE
			Date : 04/06 Dwg. No. : LC-323L Sht. 01/01 Rev 0

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ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Specification No 328

Lighting Cable

328-1 **General.** This specification covers the general requirements for design, manufacture, test and supply of the lighting cable.

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are given in the accompanying Ratings and Features sheet (if any).

328-2 **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.

328-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

328-4 **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 referred therein.

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ICEA	Insulated Cable Engineer Association
NEMA	National Electrical Manufacturers Association
TIS	Thai Industrial Standards Institute

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 manufacture 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

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

with an itemized list of specific deviations from the requirements of codes, specifications and standards referred herein.

The latest issue of all codes, specifications and standards 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.

328-5 **Construction.** The general construction of the lighting cable shall be as shown on attached drawing being furnished with the characteristics described herein. The lighting cable to be supplied for outdoor conditions shall be suitable for installation in wet and dry locations. The lighting cable shall meet the following specific requirement.

a. **Conductor.** Conductors shall be formed of individually annealed copper solid or stranded wire and shall conform to Table 1 or Table 2 of TIS 2427-2552.

b. **Insulation.** Insulation shall be polyvinyl chloride and shall conform to Table 1 of TIS 11 Part 3-2553 or Table 3 or Table 4 of TIS 11 Part 101-2553.

c. **Insulation Colour Sequence.** Insulation colour shall comform to TIS 11 Part1-2553.

d. **Inner and Outer Jacket.** Black polyvinyl chloride jackets shall be complied in all respects with to Table 1 of TIS 11 Part 3-2553 or Table 3 or Table 4 of TIS 11 Part 101-2553.

328-6 **Cable Markings.** The following items of marking shall be printed unobstructively on the cable surface at suitable intervals.

(a) Name of manufacturer

(b) Size and number of conductors

(c) Type of insulation

(d) Voltage classification

(e) Year of manufacture

328-7 **Cable Ends.** An end cap shall be provided on the cable end to which special attention shall be paid to prevent penetration of moisture during transportation.

DRAFT
Bid No. GBA-SC-05 and EWS-SC-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

328-8 **Packing.** All cables shall be packed on reels. The length of the cable to be packed on each reel shall be 500 m + 0.5 %. The following information shall be displayed on the reel.

(a) Name of manufacturer

(b) Size and number of conductors

(c) Type of insulation and voltage classification

(d) Length of cables

(e) Reels number of other suitable identification for reel and size

(f) Year of manufacture

(g) Total weight

328-9 **Test.** Test of equipments shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

328-9.1 **Quality Conformance Test.** The quality conformance test shall be performed by selecting the sample from each lot of equipment. The numbers of samples for the test shall be as specified in the Standard.

328-9.2 **Test Report.** The report of all tests, curves and standard application data shall be furnished to EGAT immediately after completion of the tests.

328-9.3 **Test Procedure.** The Contractor shall submit the test procedure of specified 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.

328-9.4 **Test Items for Lighting Cable.** The tests shall be performed in accordance with Table 2 of TIS 11 Part 3-2553 or Table 6 of TIS 11 Part 101-2553.

a. Quality Conformance Tests
(Quality Conformance Tests of Lighting Cable in the procurement of SHUNT CAPACITOR BANK shall be subjected to agreement between EGAT and the contractor)

(a) Construction check.

(b) Conductor resistivity and resistance tests.

(c) High voltage test.

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เอกสารไม่ควบคุม
รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

328-10 Drawings and Documents for Lighting Cable

Drawings and documents shall be at least comprise the followings:

Item	Description	Approval and Final Dwgs	Reproducible Dwgs	CD-ROM
1	Cross section including dimension	x	-	-
2	Technical data	x	-	-

DRAFT
Bid No. GBA3-SC-05 and TIWS-SC-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Specification No 374

Shunt Capacitor Bank

374-1 General. This specification covers the general requirement for design, manufacture, test and supply of shunt capacitor banks in outdoor racks, switching device, instrument transformer, control devices and protective relays.

The specific rating, characteristics and the special requirements and features of the equipment not cover herein are given in the accompanying Ratings and Features sheet (if any).

374-2 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.

374-3 Service Conditions. All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

374-4 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 referred therein.

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IEEE	The Institute of Electrical and Electronics Engineers
ICEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturers Association

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รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

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 manufacture 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 referred herein.

The latest issue of all codes, specifications and standards 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.

374-5 Design and Construction. The capacitor banks, including all associated equipment of current limiting reactor, instrument transformer, switching device, etc. (if any) connected as shown on the relevant single line diagram shall be supplied for complete bank as follows :

374-5.1 For 24 and 36 kV Capacitor Banks. The capacitor bank shall be mounted on the skid steel base with upper side and top casing of stainless steel mesh or perforation and lower casing of perforated stainless steel sheet enclosed around all sides as shown on the "Typical Drawing of 36 & 24 kV Capacitor Bank" attached drawing. Each side of the casing shall be able to fully open in order to easily replace and maintain the capacitor unit. the terminator complete with terminal connector for connection to the overhead cable shall remain fixed though the casing is opened. Provision shall be made for manual operation of the switching device at the casing in case of emergency and in such a way that misoperation by unauthorized person is prevented.

The skid steel base and associated construction shall be designed and lifting lugs shall be provided for capable of transportation the whole banks including associated equipment and switching device.

The capacitor banks shall not produce any harmful voltages during switching of up to six (6) capacitor banks.

374-5.2 For 72.5 and 121 kV Capacitor Banks. The capacitor bank shall be connected, arranged and mounted on separate skid steel bases as shown on the single line diagram and the "Typical Drawing of 121 & 72.5 kV Capacitor Bank" attached drawing. Steel supporting structures shall be provided for shunt capacitor bank and all associated equipment in order to elevate the live parts from ground levels. Means shall be provided for prevention of any damage, especially to capacitor units, caused by bird as shown on Typical drawing of C unit bush cover. Connection between capacitor units shall be made by insulated copper cable.

For 121 kV capacitor bank, the capacitor rack shall be designed for possible mounting the capacitor units of each bank up to 48 MVAR.

The capacitor banks shall not produce any harmful voltages during switching of up to six (6) capacitor banks.

374-5.3 For 242 kV Capacitor Banks. The capacitor bank and all associated equipment and steel supporting structure shall be connected, arranged and mounted as shown on the single line diagram and the "Typical drawing of 242

DRAFT
Bid No. GBA 3-SC-05 Tender Issue 05
เอกสารไม่ควบคุม
รับรองสำเนาโดย หพอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่งกฟผ.
4 มิถุนายน 2568

kV Capacitor Bank" attached drawing. Means shall be provided for prevention of any damage, especially to capacitor units, caused by bird as shown on Typical drawing of C unit bush cover. Connection between capacitor units shall be made by insulated copper cable.

The capacitor banks shall not produce any harmful voltages during switching of up to six (6) capacitor banks. Design features of common connecting the bank neutrals together and grounding at one point as well as cable shielding to effectively control any harmful voltage shall be used unless alternative method is recommended and approved by EGAT.

374-5.4 Capacitor Units. The capacitor units shall be of modern design in current production and shall have standard ratings according to IEEE Std 18.

(a) The working elements shall be of aluminum foil, synthetic film with dielectric fluid. The elements shall be designed, fabricated and assembled to give a stable value of capacitance with a low loss and a long service life. The assembly with overall insulation shall be sealed in a welded stainless steel case after drying, impregnating and filling with the insulation fluid under vacuum. The stainless steel case shall be finished with one coat of primer plus at least one coat of durable paint to assure resistance to corrosive atmosphere.

The capacitor unit shall be equipped with a discharge resistor inside the container, permanently connected across the terminals. The resistor shall be designed to reduce the residual voltage to 50 V or less within 5 minutes after the capacitor bank is disconnected from the source of supply.

Due to the environmental hazard and toxic to human beings and animals of polychlorinated biphenyl (PCB), the PCB type dielectric fluid is not accepted.

(b) The capacitors shall operate satisfactorily at 135 percent of rated kVAR with the condition conform to IEEE Std 18.

(c) The capacitors shall be suitable for continuous operation at a terminal-to-terminal voltage (including harmonics but excluding transients) of 110% of rated voltage rms provided that the peak voltage including harmonics does not exceed 1.2xv2 times rated voltage rms and provided that the maximum permissible 135% of rated kVAR is not exceeded.

(d) The capacitors shall be rated in continuous kVAR, voltage and frequency. They shall be designed to give not less than rated kVAR at rated voltage and frequency and not more than 110 percent of this value when measured at a capacitor temperature of 25°C.

(e) The capacitors shall be capable of withstanding the momentary overvoltages and overcurrents as specified in IEEE Std 18.

(f) The bushings of the capacitor units shall have the characteristics as specified in IEEE Std 18. For 72.5, 121 and 242 kV capacitor bank, each capacitor unit shall have two bushings.

DRAFT
Bid No. GBA-SC-75 and TW-SC-75
ฉบับร่าง ไม่ควรนำไปใช้งาน
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ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(g) In case of internal fuse, the capacitor units shall comprise series and parallel of capacitor elements protected by an individual internal fuse. The rating of the individual internal fuse shall be designed properly to disconnect the faulty element before a breakdown has occurred.

In case of external fuses, the internal connection of the capacitor unit shall have the parallel group of at least three (3) elements in parallel and the capacitor units shall be protected by an individual external fuses. The voltage rating of the individual fuses shall be equal to or greater than the rated voltage of the capacitor unit. The fuses shall be a visual indicating type when blown.

The current rating of the fuse links shall have an adequate capacity to withstand the inrush current and shall have a time-current clearing characteristic in the safe-zone of the capacitor case-rupture curve. Time current curves of minimum melting and maximum clearing for each size of fuse shall be submitted.

(h) The nameplate marking for capacitor units shall be as specified in IEEE Std 18.

374-5.5 Capacitor Rack, Steel Supporting Structure and Skid Steel Base. The capacitor racks designed for mounting of capacitor units shall have hole spacing as specified in IEEE Std 18. The complete racks assembly with capacitor units shall withstand the wind load of 120 km/h. All steel support members, skid steel base (if any), bolts, nuts, washers and similar hardware shall be galvanized after fabrication and shall meet the requirements of ASTM A-123 and ASTM A-153.

One of each type of capacitor rack, steel supporting structure and skid steel base shall be assembled in the shop to such an extent as to insure proper field erection. Reaming of untrue holes will not be permitted. A reasonable amount of drifting will be allowed in assembling. Shop-assembled parts shall be dismantled for shipment.

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. After galvanizing, the marks shall be circled or bracketed with paint by stamping. In the designation of the members, the Contractor shall endeavor to use designations with the least number as possible, and each member of identical size shall have the same designation, regardless of its position in the structure.

374-5.6 Insulators. The support insulators shall be suitable for the system voltages and shall be of chocolate brown manufactured according to ANSI C29.8 and ANSI C29.9.

The supporting insulators for reactor shall be equipped with non-magnetic fittings to avoid heating effects.

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

374-5.7 Switching Device. The switching device shall be three poles or single pole & three pole as specified, electrically operated suitable for switching the specified capacitor bank without any restriking as well as having withstand capability for inrush current due to capacitor bank connection up to six (6) banks. The switching device shall be operated to disconnect the capacitor bank either by an unbalance sensing relay in case of capacitor bank fault or manually by an ON-OFF momentary spring return control switch switching on control cabinet. For manual operation, the switching device shall possibly be operated either at Local or Remote, therefore "Local-Remote" selector switch with two (2) spare contacts for each position of Local and Remote position shall be provided. The manual operating mechanism shall be provided for possible switching in case of power supply failure. Spares contacts of "changeable" 3a-3b and 6a-6b shall be provided for 24 & 36 and 72.5, 121 & 242 kV switching device respectively. An operation counter and a clearly visible position indicator shall be furnished with switching device.

If air switch is required the air switch shall meet the requirements of the attached Specification No 202.

374-5.8 Current Limiting Reactor. Current limiting reactors shall be provided for each bank. The reactors shall be designed to limit the inrush current and harmonics when switching six (6) banks in parallel.

374-5.8.1 Design and Construction.

(a) The reactor shall be designed and constructed to withstand the mechanical and thermal stress produced by continuous operation, short circuit current with 105% rated voltage maintained across the terminals, wind speed or other environmental factors.

(b) The maximum mechanical stresses in the winding caused by electromagnetic forces are occurring at the maximum peak short circuit current, resulting by multiplying the short time current (rms) with asymmetry factor K of 2.55 (according to Std. IEEE C57.16)

For reactors with the ratio of the short circuit current (Isc,rms) to the rated continuous current (Ir, rms) greater than or equal to twenty (20), The maximum mechanical (tensile) stress shall be less than 0.7σ 0.2 of conductor being used.*

For reactors with the ratio of the short circuit current (Isc,rms) to the rated continuous current (Ir, rms) less than twenty (20), The maximum mechanical (tensile) stress shall be less than 0.5σ 0.2 of conductor being used.*

The short circuit capability test record of reactor, having similar design as proposed, shall be submitted together with tender document during the bidding.

Similar reactor

1. *The short circuit current, Isc, of the tested reactor shall be greater than or equal to the proposed reactor.*
2. *The ratio of the maximum mechanical (tensile) stress to the σ 0.2 of conductor being used, of the tested reactor, shall be greater than or equal to the proposed reactor.*

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เอกสารควบคุม ไม่ควบคุม
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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Detailed calculation showing all parameters of electro-mechanical stress and force results shall be submitted together with tender document during the bidding. The results shall include the magnetic field plot.

(c) *Temperature Rise. The average winding temperature rise as measured by resistance method and hottest spot winding temperature rise shall not exceed 100 ℃ and 110 ℃ respectively. The temperature rise for terminals shall be within limitation as specified in Std. IEEE C57.16. The thermal class of insulation shall be Class F (155 ℃) or better.*

(d) *The insulation film for turn-to-turn insulation shall be made of Polyimide-PI or Polyetheretherketone-PEEK.*

(e) *All reactors shall be coated with layer of paint and an additional layer of RTV silicone coating.*

(f) *The magnetic field strength at any point where personnel have access during operation should not exceed 1 mT.*

374-5.8.2 Accessories. *Each reactor shall be equipped with, but are not limited to, the following accessories.*

(a) *Aluminum nameplate.*

(b) *Lifting eyes to facilitate rapid erection and replacement of the reactors.*

(c) *All mounting hardwares including, but not limited to supporting structures, insulators, bolts, nuts, washers and any other equipments required for mounting the reactors.*

(d) *Top hats shall be installed on the reactors. The design should take into account the reduced convection caused by the top hat.*

374-5.8.3 Final Design Data. *The Contractor shall furnish the following final design data for each reactor based on final design calculations :*

(a) *Losses in kilowatts at rated voltage and frequency.*

(b) *Temperature rise including with hottest spot winding temperature rise.*

(c) *Detailed calculation showing all parameters of electro-mechanical stress and force results shall be submitted to demonstrate that the reactor as designed can withstand the effects of through faults both in magnitude and frequency. These data shall be compared to critical failure stress for each major failure mode such as tensile stress in conductor, compressive stress, conductor tilting and stress on spacer / spider arms. The results shall include the magnetic field plot.*

EGAT reserves the right to review the detailed design of reactor without changing the guaranteed losses values.

374-5.9 Instrument Transformer. Instrument transformer shall meet the requirement of the attached Specification No 301.

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

374-5.10 Surge Protection. To protect the current transformer against transient current which occurs during back-to-back switching, the surge arrester with suitable characteristics shall be provided unless technical support to verify that the need of such surge arresters are not necessary shall be submitted and approved by EGAT.

374-5.11 Terminal Boxes (if any). Terminal boxes shall be rigid waterproof type completed with terminal blocks. Cover of the terminal box shall be of hinge door type completed with door handle. All wiring which is connected to external circuits shall be terminated on terminal blocks. Suitable gutter shall be provided for the wiring. The terminal block with marking strips shall be of 600 V molded block type with insulating barrier between terminals and shall have the size suitable for termination of the following cables :

For AC supply and DC supply	:	6 - 35 mm^2
For CT leads	:	2 x 6 mm^2
For others and spares	:	2 x 4 mm^2

Terminal blocks for external connection shall be arranged according to the "Cable Routing" attached drawing.

The terminal blocks shall be provided with ten (10) percent but not less than ten (10) additional terminals as spares besides the necessary numbers.

374-5.12 Accessories. The insulators, bus and wiring material, interconnecting fittings, fuses (if any), mounting hardware and accessories shall be furnished for the required complete bank connection.

374-6 Test. Test of equipments shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

374-6.1 Design Test. The proposed equipment shall already have the design test record of the same type and same rating as EGAT called for, in accordance with the tests specified in each equipment test items, which is subject to EGAT's approval (unless otherwise specified in each equipment test item). The design test record shall be required and submitted together with the tender document during the bidding.

374-6.2 Routine Test. Each equipment shall be completely assembled at the factory and subject to the tests specified in each equipment test item.

374-6.3 Test Report. The report of all tests, curves and standard application data shall be furnished to EGAT immediately after the completion of the tests.

374-6.4 Test Procedure. The Contractor shall submit the test procedure of specified 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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ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

374-6.5 Test Items for Capacitor Unit. The tests shall be performed in accordance with IEEE Std 18.

a. Design Test

(a) Dielectric withstand test

(b) Impulse withstand test

(c) Bushing test

(d) Thermal stability test

(e) Radio influence voltage

(f) Voltage decay test

(g) Endurance test (in accordance with IEC report 871-2) The endurance test record is required to be submitted with tender documents during the bidding as required evidence for consideration of evaluation.

b. Routine Test. All capacitor units shall be tested according to IEEE Std 18

(a) Short time overvoltage test (Terminal-to-terminal insulation test voltage shall be a direct current test voltage of 4.3 times rated (rms) voltage)

(b) Capacitance test

(c) Leak test

(d) Discharge resistor test

(e) Loss determination test

(f) Fuse capability tests for internally fused capacitors

374-6.6 Test Items for Switching Device

a. Design Test

(a) Insulation (dielectric) test

(b) Short time current test

(c) Rated making current test

(d) Capacitive current switching test

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(e) Operating duty test

(f) Temperature rise test

(g) Radio influence voltage test

(h) Mechanical life test

(i) Control wiring test

If air switch is provided, the test shall be performed in accordance with the relevant specifications.

b. Routine Test. All switching devices shall be tested as follows :

(a) One-minute dry withstand low frequency test

(b) Control wiring check test

(c) Manual operation

(d) Electrical operation

(e) Dielectric test on control wiring

(f) Timing test

(g) Contact resistance measurement

If air switch is provided, the test shall be performed in accordance with the relevant specifications.

374-6.7 Test Items for Power Fuse (if any). The test shall be conformed to ANSI C37.41.

a. Design Test

(a) Dielectric test

(b) Radio influence test

(c) Temperature rise test

(d) Interrupting test (Simulated test acceptable)

(e) Time current test

374-6.8 Test Items for Current Limiting Reactor. The test shall be conformed to *latest revision of Standard IEEE C57.16.*

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ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

a. Design Test *(One unit of reactor being supplied for each capacity and voltage rating shall be subjected to the following tests.) The design test record, in accordance with item (b) and (c) below, of the reactor identical design, which is subject to EGAT's approval, is required and shall be submitted together with tender document during the bidding.*

(a) Temperature rise test. *The test shall be performed at rated continuous current on reactor with top hat. The result shall be shown the average winding temperature rise, the hottest spot winding temperature rise and the temperature rise of terminals.*

(b) Mechanical *short-circuit test. The mechanical capabilities of reactors can be verified by calculation.*

(c) Thermal *short-time overcurrent test. The thermal capabilities of reactors can be verified by calculation.*

(d) *Inrush current withstand test. This test can be verified by calculation.*

(e) *Lightning impulse test. (For reactor with nominal system voltage at 34.5 kV or below.)*

(f) *Switching impulse test. The test shall be made on the support structure (insulators) of reactors rated nominal system voltage 230 kV or above.*

(g) *Chopped-wave impulse test.*

(h) *Audible sound test.*

(i) *Mechanical resonance test. This test can be verified by calculation.*

b. Routine Test

(a) Impedance *measurement.*

(b) Resistance with direct current *measurement.*

(c) *Total loss and Q-factor measurement.*

(d) Applied *voltage* test.

(e) *Turn to turn test. (For reactor with nominal system voltage at 34.5 kV or below.)*

(f) *Lightning impulse test. (For reactor with nominal system voltage greater than 34.5 kV.)*

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

374-6.9 Test Items for Capacitor Racks, Steel Supporting Structure and Skid Steel Base (if any). The following tests shall be performed with relevant provisions of the ASTM :

a. Routine Test

(a) General inspection

(b) Material test

(c) Galvanizing test

374-6.10 Field Test and Conformance Test

a. Field Test. After the installation and within the performance guarantee period, the capacitor shall be tested by EGAT as follows :

(a) Capacitance measurement for each capacitor unit. The capacitance discrepancy value between the measurement and the value indicated on the name plate shall not be more than 0% to +10%.

(b) Internal discharge resistor measurement for each capacitor unit. The resistance discrepancy value between the measurement and the value from the factory (routine) test shall not be more than ±20%.

(c) Capacitance measurement for whole capacitor bank. The measured capacitance values are for reference.

The capacitor unit shall be replaced by the Contractor if any measurement having the discrepancy more than the values specifying in either item a or b.

b. Conformance Test. To check the condition of capacitor after it has been in service, the following shall be tested by EGAT within the maintenance guarantee period.

(a) Capacitance measurement for each capacitor unit. The capacitance discrepancy value between the measurement and the value from the field test shall not be more than ±2%.

(b) Internal discharge resistor measurement for each capacitor unit. The resistance discrepancy value between the measurement and the value from the factory (routine) test shall not be more than ±20%.

(c) Capacitance measurement for whole capacitor bank. The measured capacitance values are for reference.

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(d) Capacitor loss measurement to verify the guaranteed values at ultimate.

The capacitor unit shall be replaced by the Contractor if any measurement having the discrepancy more than the values specifying in either item a or b.

374-6.11 ***Material Tests Report****. Test report of the following material and accessories used in each item of reactor shall be submitted.*

a. *Conductor.*

b. *Insulation film.*

c. *UV-Protection paint.*

d. *Silicone coating.*

374-7 Spare Parts. All spare parts subject to damage or deterioration by moisture shall be packed in moisture-proof material. All spare parts shall be of the same materials and workmanship as the corresponding original parts and shall be interchangeable therewith. The Bidder shall include in his bid a list of recommended spare parts.

374-8 Appliance and Tools. The Contractor shall furnish all appliance and tools necessary for satisfactory installation, operation and maintenance of the equipment, including any special tools or appliances necessary for assembling and disassembling the equipment.

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

374-9 Drawings and Documents for Capacitor Bank.

Drawings and documents shall at least comprise the following :

Item	Description	Approval and Final Dwgs	CD-ROM
1	Drawing list of all drawings submitted for approval	x	-
2	Outline drawing for complete set of C-Bank including connection diagram	x	x
3	Foundation plan	x	-
4	Steel supporting structure and/or skid steel base for (showing overall dimension, mounting dimension, position of earthing terminal, size and length of all members, mark number of all members)		
	a) C-Bank	x	-
	b) Current limiting reactor	x	-
	c) Instrument transformer (CT or VT)	x	-
	d) Switching device (if any)	x	-
5	Bill of material for erection of capacitor rack, supporting structure and/or skid steel base for		
	a) C-Bank	x	-
	b) Current limiting reactor	x	-
	c) Instrument transformer (CT or VT)	x	-
	d) Switching device (if any)	x	-
6	Steel rack for capacitor unit (showing overall dimension, mounting dimension)	x	-
7	Outline of all insulators	x	-
8	Outline of all		
	- Connectors and terminals	x	-
	- Cable	x	-

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Item	Description	Approval and Final Dwgs	CD-ROM
9	Capacitor unit		
	- Outline including internal construction and internal construction diagram	x	x
	- Nameplate	x	x
	- Dielectric fluid characteristics	x	-
10	Current limiting reactor		
	- Outline	x	x
	- Nameplate	x	x
11	Instrument transformer (CT or VT)		
	- Outline	x	x
	- Nameplate	x	x
	- Detail of secondary terminal box	x	-
12	Fuse		
	- Outline (if external fuse)	x	x
	- Time current characteristic of fuse including case rupture curve	x	-
	- Nameplate (if external fuse)	x	x
13	Switching device (if any)		
	- Outline	x	x
	- Nameplate	x	x
	- Schematic diagram	x	x
	- Wiring diagram	x	x
14	Control cabinet		
	- Outline	x	x
	- Internal cross sectional view showing the location of all devices	x	-
	- Front cover plate	x	-
	- Schematic diagram	x	x
	- Wiring diagram (point to point lineless type)	x	x
	- List of all devices in control cabinet	x	-
15	Protective relays		
	- Outline and cataloque	x	-
	- Connection diagram	x	-
16	Manufacturing schedule and test schedule	x	-

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Item	Description	Approval and Final Dwgs	CD-ROM
17	Final calculation of inrush current and harmonics when switching six (6) capacitor banks in parallel	For reference	
18	Documents showing the coordinating operation among fuse (if external fuse), unbalance sensing device and capacitor unit rupture curve.	For reference	
19	Documents recommending capacitance For reference value of the capacitor unit which should be discarded.	For reference	
20	*Final design data of reactors.*	*For Approval*	

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ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

374-10 Instruction Manual for Shunt Capacitor Bank.

Instruction manual shall consist of all necessary information including table of contents and shall comprise at least the following parts.

Part A Instruction including receiving inspection, storage, handling and damage claim instruction

Part B Operation including precaution for switching in and out of (six) 6 steps shunt Capacitor Banks

Part C Maintenance

C-1 Assembly and disassembly instruction including complete part list and ordering part numbers.

C-2 Procedure for replacement of capacitor unit after the operation of unbalance protective device.

Part D Other documents such as catalogue and information of each equipment and relay.

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

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Specification No 502

All Aluminum Conductor (AAC) and Aluminum Conductor Steel Reinforced (ACSR)

502-1 **General.** This specification covers the general requirements for design, manufacture, test and supply of the conductor.

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are given in the accompanying Ratings and Features sheet (if any).

502-2 **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.

502-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

502-4 **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 referred therein.

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
NEMA	National Electrical Manufacturers Association

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 manufacture 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 referred herein.

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

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

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.

502-5 Design and Fabrication. This Specification covers the detailed requirements for the design, fabrication of substation line conductor.

502-5.1 Conductor Characteristics

a. All Aluminum Conductor (AAC). The conductor to be supplied shall be all aluminum conductor, Class AA, in accordance with ASTM B231 Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors and shall have characteristics as shown on Table 502-1 attached.

b. Aluminum Conductor Steel Reinforced (ACSR). The conductor to be supplied shall be aluminum conductor, steel reinforced, Class AA, in accordance with ASTM B232 Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced and shall have characteristics as shown on Table 502-2 attached.

All Requirements for the ASTM Specifications shall apply unless superseded or modified by this Specification.

502-5.2 Requirements for Wires

(a) Before stranding, the aluminum wires shall meet all of the requirements of ASTM B230 Specification for Aluminum 1350-H19 Wire for Electrical Purposes.

(b) Before stranding, the steel core wires shall meet all of the requirements of ASTM B498 Specification for Zinc-Coated (Galvanized) Steel Core Wire for Aluminum Conductors, Steel Reinforced Class A coating (ACSR/GA) .

502-5.3 Joints. Extreme care shall be taken in the conductor stranding to prevent breaking the aluminum wires, particularly in the outer layer. Joints will be permitted in aluminum wires unavoidably broken during stranding operation provided such breaks are not associated with inherently defective wire. However, no joints shall occur within 15 m of a joint in the same wire or in another wire of the complete conductor. Joint in the outer shall not exceed 4 per nominal conductor length. All joints shall be made by electric butt welding or cold pressure welding in accordance with good commercial practice. Joints made by electric butt welding shall be electrically annealed for not less than 25 cm on both sides of the weld.

If the workmanship and quality of any repair is not acceptable to the EGAT, or its representative, or if the foregoing requirements have not been met, the entire length of the conductor will be rejected.

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ต้องเป็นฉบับ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

502-6 **Packing.** The complete conductor shall be packed on reels. The packing shall be carried out with caution to protect the conductor from moisture, salt or any impurities which may cause rust or harmful effects. The following information shall be displayed on the reel.

(a) Name of manufacturer

(b) Size and number of conductors

(c) Length of conductor

(d) Reel number and other suitable identification for reel and reel size

(e) Date of manufacture

(f) Total weight

502-7 **Test.** Test of equipment shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

502-7.1 **Quality Conformance Test.** The quality conformance test shall be performed by selecting the sample from each lot of equipment. The numbers of samples for the test shall be as specified in the Standard.

502-7.2 **Test Report.** The report of all tests, curves and standard application data shall be furnished to EGAT immediately after completion of the tests.

502-7.3 **Test Procedure.** The Contractor shall submit the test procedure of specified 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.

502-7.4 **Test Items for All Aluminum Conductor (AAC) and Aluminum Conductor Steel Reinforced (ACSR).** The tests shall be performed in accordance with ASTM B231 for AAC and ASTM B232 for ACSR.

a. Quality Conformance Tests
(Quality Conformance Tests of All Aluminum Conductor (AAC) and Aluminum Conductor Steel Reinforced (ACSR) in the procurement of SHUNT CAPACITOR BANK shall be subjected to agreement between EGAT and the contractor)

(a) Construction test.

(b) Tensile strength test.

(c) Conductor resistivity test.

(d) Dimension measurement.

(e) Surface finish inspection.

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4 มิถุนายน 2568

(f) Weight of conductor.

502-8 Drawings and Documents for All Aluminum Conductor (AAC) and Aluminum Conductor Steel Reinforced (ACSR)

Drawings and documents shall at least comprise the followings :

A. Documents

Item	Description	Printed Documents	CD-ROM
1	Manufacturing and delivery schedule	x	-
2	Test procedure (Factory test)	x	-
3	Test schedule (Factory test)	x	-
4	Test report (Factory test)	x	-

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4 มิถุนายน 2568

Table 502-1

Characteristics of All Aluminum Conductors (AAC)

Description		4/0 AWG	336.4 MCM	477 MCM	477 MCM	795 MCM	1272MCM
Code name		OXLIP	TULIP	COSMOS	SYRINGA	ARBUTUS	NARCISSUS
Ultimate strength	kg	1, 740	2, 785	3, 782	3, 930	6, 300	9,979
Outside diameter	mm	13.26	16.92	20.13	20.16	26.04	33.02
Aluminum strand (before stranding) :							
Number		7	19	19	37	37	61
Diameter	mm	4.42	3.38	4.02	2.88	3.72	3.67
Elongation in 254 mm, average, not less than	%	2.0	1.8	2.0	1.7	1.9	1.9
Ultimate tensile strength, average, not less than	kg/mm^2	16.87	17.58	16.87	17.93	17.23	17.23
Cross-sectional area	mm^2	107.2	170.5	241.7	241.7	402.8	644.5
Approximate weight	kg/m	0.291	0.470	0.667	0.678	1.111	1.778
Nominal length, not less than	m	2, 150	3, 650	2, 550	2, 500	1, 500	1,250

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Table 502-2

Characteristics of Aluminum Conductors Steel Reinforced (ACSR/GA)

(Class A zinc-coated steel wire)

Description		4/0 AWG	266.8 MCM	336.4MCM	477 MCM	477 MCM	795 MCM	954 MCM	1272 MCM
Code name		PENQUIN	PARTRIDGE	LINNET	HAWK	HEN	CONDOR	CARDINAL	-
Ultimate strength	kg	3, 790	5, 120	6, 400	8, 860	10, 800	12,800	15,200	14, 050
Outside diameter	mm	14.30	16.28	18.31	21.81	22.40	27.73	30.38	33.91
Approximate weight	kg/m	0.433	0.546	0.689	0.978	1.112	1.523	1.7996	2.040
Aluminum strand (before stranding):									
Number		6	26	26	26	30	54	54	42
Diameter	mm	4.77	2.57	2.89	3.44	3.20	3.08	3.375	4.42
Elongation in 254 mm, average, not less than	%	2.1	1.6	1.7	1.8	1.8	1.8	1.8	2.0
Ultimate tensile strength, average, not less than	kg/mm^2	16.87	18.28	17.93	17.58	17.58	17.58	17.58	16.87
Galvanized steel strand (before stranding) :									
Weight of zinc coating	g/m^2	305	214	214	244	259	259	259	229
Number		1	7	7	7	7	7	7	7
Diameter	mm	4.77	2.00	2.245	2.675	3.20	3.08	3.375	2.46
Elongation in 254 mm, not less than	%	4.0	3.0	3.0	3.5	4.0	4.0	4.0	3.5
Stress at 1 percent extension, not less than	kg/mm^2	120	134	134	130	127	127	127	130
Ultimate tensile strength, not less than	kg/mm^2	141	148	148	144	144	144	144	144
Nominal length, not less than	m	1, 850	3, 150	2, 500	1, 760	2, 030	1, 800	1,460	1, 140

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Specification No 601

Insulators

601-1 **General.** This Specification covers the general requirements for design, manufacture, test and supply of the insulators.

The specific ratings, characteristics and the special requirements and features of the equipment not covered herein are given in the accompanying Ratings and Features sheet (if any).

601-2 **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.

601-3 **Service Conditions.** All materials shall be suitable for installation and use at an altitude of 1000 m or less in a tropical climate with a maximum ambient temperature of 45°C and 100% relative humidity for outdoor equipment (or a maximum ambient temperature of 40°C and 90% relative humidity for indoor equipment) without corrosion, deterioration or degradation of performance characteristics.

601-4 **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 referred therein.

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
NEMA	National Electrical Manufacturers Association

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 manufacture 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 referred herein.

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

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

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.

601-5 Design and Construction.

601-5.1

Suspension Insulators. The insulator discs shall be porcelain or glass with cap and pin, ball and socket type, radio interference free. Each insulator shall be furnished to meet the requirements described herein and on the Technical Data sheet. The suspension insulators shall meet all of the requirements of ANSI C29.2 and ANSI C29.1.

a. Insulator shells.

Porcelain Insulator shells. The porcelain insulator shells shall be cylindrical headed with sanded surface, completely and uniformly vitrified throughout to produce uniform mechanical and electrical strength and long life service. The insulators shall be wet-process porcelain of the highest grade, dense and homogenous. The glaze shall be smooth, hard, dense and uniform and shall not be effected by weather, ozone, nitric acid, nitric oxides, alkali, dust or sudden change in temperature and salt laden atmosphere in an area subject to intense lightning storms at certain periods of the year. The entire porcelain surface of the insulator that will be exposed after assembly shall be glazed and shall be relatively free from imperfections. Color of porcelain surface shall be chocolate brown or as specified in Price Schedule.

Toughened glass Insulator shells. The toughened glass insulator shells shall be made of the highest grade, dense, homogeneous, toughened glass possessing uniform mechanical and electrical strength and suitable for long life service. The glass shall be free from warping, roughness, cracks, blisters, laminations, projecting points, foreign matter and other defects, except those within the limits of standard accepted practice. The glass surface shall be smooth, hard, dense and shall not be effected by weather, ozone, nitric acid, nitric oxides, alkali, dust or sudden change in temperature within the atmosphere range.

b. Cap and Pin. The cap and pin shall be of such design that it will not yield or distort under the specified mechanical load in such a manner as to change the relative spacing of the insulators or add other stresses to the shells and shall be made of a good commercial grade of malleable iron, ductile iron or steel. The insulator caps shall be of the socket type, provided with stainless steel cotter key. The cap shall be truly circular, with the inner and outer surfaces concentric, and shall be free from cracks, shrinks, air holes, burrs and rough edges, to minimize field concentrations and radio disturbances. The insulator pins shall be free from cracks and air-holes. All bearing surfaces shall be smooth and uniform so as to distribute the loading stresses evenly.

The cap and pin shall have practical hot-line maintenance capability.

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

c. Cementing. High quality cement shall be used for cementing the insulator body to the cap and pin.

d. Marking. Each insulator unit shall bear legible and indelible symbols identifying the manufacturer, the year of manufacture, the tension-proof test load and the rated combined mechanical and electrical strength. Marking on porcelain shall be printed, not impressed, and shall be applied before firing.

601-5.2 **Station Post Insulators.** The station post insulators shall be furnished to meet the requirements described herein and on the Technical Data sheet. The station post insulators shall be solid core and shall meet all of the requirements of ANSI C29.9 and ANSI C29.1.

The insulators shall be wet-process porcelain of the highest grade, dense and homogenous. The glaze shall be smooth, hard, dense and uniform and shall not be effected by weather, ozone, nitric acid, nitric oxides, alkali, dust or sudden change in temperature and salt laden atmosphere in an area subject to intense lightning storms at certain periods of the year. The entire porcelain surface of the insulator that will be exposed after assembly shall be glazed and shall be relatively free from imperfections. Color of porcelain surface shall be chocolate brown.

The station post insulator shall be furnished complete with all mounting hardware including fittings, nuts, bolts, spring washers, etc.

601-6 **Galvanizing.** All ferrous metals shall be galvanized by hot-dip process. The minimum of zinc coating shall comply to the requirements of ASTM A153. Bolts and nuts shall be galvanized after being threaded and excessive zinc shall be removed, and the nuts shall run freely (by hand) over the entire length of the thread.

601-7 **Test.** Test of equipments shall be performed according to the requirements specified in each referred test item. The costs of all tests and reports shall be borne by the Contractor.

601-7.1 **Design Test.** The proposed equipment shall already have the design test record of the same type and same rating as EGAT called for, in accordance with the tests specified in each equipment test items, which is subject to EGAT's approval (unless otherwise specified in each equipment test item). The design test record shall be required and submitted together with the tender document during the bidding.

601-7.2 **Routine test.** Each equipment shall be completely assembled at the factory and subject to the tests specified in each equipment test item.

601-7.3 **Quality Conformance Test.** The quality conformance test shall be performed by selecting the sample from each lot of equipment. The numbers of samples for the test shall be as specified in the Standard.

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

601-7.4 **Special Test.** If specified in the Price Schedule of the Contract, the manufacturer shall also perform special test on equipment to meet the requirements of this specification.

601-7.5 **Test Report.** The report of all tests, curves and standard application data shall be furnished to EGAT immediately after completion of the tests.

601-7.6 **Test Procedure.** The Contractor shall submit the test procedure of specified 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.

601-7.7 **Test Items for Suspension Insulators.** The tests shall be performed in accordance with ANSI C29.1 and C29.2.

a. Design Tests.

(a) Low-frequency dry flashover voltage test.

(b) Low-frequency wet flashover voltage test.

(c) Critical impulse flashover voltage tests-positive and negative.

(d) Radio-influence voltage test (RIV).

(e) Thermal-mechanical load cycle test.

(f) Thermal shock test.

(g) Residual-strength test.

(h) Impact test.

(i) Cotter key test.

(j) Cement expansion.

(k) Steep front wave impulse test.

(l) Power arc test.

b. Routine Tests.

(a) Cold-to-Hot thermal shock test. (For toughened glass only)

(b) Hot-to-Cold thermal shock test. (For toughened glass only)

(c) Tension-proof test.

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

(d) Flashover voltage test. (For porcelain only)

c. Quality Conformance Tests.

(a) Visual and dimension test.

(b) Porosity test. (For porcelain only)

(c) Galvanizing test.

(d) Combined mechanical and electrical-strength test. The acceptance criteria is as follows :

$$\overline{X} \geq \text{rating} + 3S$$

Where :

$\overline{X}$ = average value obtained on the sample of the ten insulators tested

S = standard deviation for the ten insulators tested

Each value measured shall not be lower than the specified mechanical and electrical strength. In addition, electrical puncture shall not occur before reaching ultimate failure.

(e) Puncture test.

(f) Verification of coupling lock system.

(g) Creepage distance measurement. One unit of each rating and type shall be subject to this test. The test shall be performed on insulators being supply.

d. Special Tests.

(a) Steep front wave impulse test. If required in the Contract, ten (10) insulator units of each type shall be selected by EGAT at random from the first lot brought forth for acceptance. These units shall be tested as follows :

(1) The insulator units shall be subjected to five successive positive and negative impulse flashovers with a wave having and effective rate of rise of 2,500 kV per microsecond. These insulators shall be tested singly.

(2) Each unit shall then be subjected to five flashovers of the low frequency dry flashover test of ANSI C29.1 and shall have a flashover value not less than 95 % of the rated value.

(3) Failure of any one unit to pass either test of (1) or (2) above shall be the cause for testing another twenty (20) units in accordance with (1) and (2) above. Failure of

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any one unit of the second sample to pass either test shall be the cause for rejection of the entire lot brought forth for acceptance.

(4) If a lot brought forth for acceptance is rejected due to (3) above, then subsequent lots brought forth for acceptance shall be tested in accordance with (1) through (3) above until a successful test sequence indicates the design of the insulators has been corrected.

(b) Power arc test. If required in the contract, insulators of each type shall be selected by EGAT at random from the first lot brought forth for acceptance. Three strings of insulators shall be assembled in a vertical configuration without conductors. Number of insulators in each string shall be as specified below :

Insulator Class	Number of Insulators
52-3 & fog type (18,000 lb)	3
52-8 & fog type (36,000 lb)	6

The string shall be energized at the bottom and grounded at the top. The insulator strings shall be subject to a 50 hertz power arc as specified below :

Insulator Class	Power Arc
52-3 & fog type (18,000 lb)	12,000 amps rms sustained for 0.1 sec or 6,000 amps rms for 0.2 sec
52-8 & fog type (36,000 lb)	20,000 amps rms sustained for 0.1 sec

The insulators shall be tensioned to 40 percent of their rated strength prior to initiation of the arc and this tension shall be maintained for the duration of the arc and for five minutes following its extinction. There shall be no separation of cap and pin during this portion of the test.

After arcing, each string of insulators shall be mechanically tested in accordance with paragraph 5.1 of ANSI C29.1, except that the load may be increased rapidly to only 45 percent of the rated strength of the insulator. The rate of increase of load from 45 percent to failure shall be as given in Table 1 of ANSI C29.1. If any insulator fails at less than 60 percent of its rated strength, the insulator design fails to meet these specifications.

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

601-7.8 **Test Items for Station Post Insulators.** The tests shall be performed in accordance with ANSI C29.1 and C29.9.

a. Design Tests. These tests may be omitted if a design test record can be submitted.

(a) Low frequency wet withstand voltage test

(b) Critical-impulse flashover voltage test, positive.

(c) Impulse withstand voltage test.

(d) Radio-influence voltage test (RIV).

(e) Thermal shock test.

(f) Compression strength test.

(g) Torsional strength test.

b. Routine Tests.

(a) Mechanical proof.

c. Quality Conformance Tests. Number of samples required, for each lot of station post insulator, for the tests shall be performed in accordance with ANSI C29.9 except that specifically noted herein.

(a) Visual and dimension test.

(b) Porosity test.

(c) Galvanizing test.

(d) Cantilever strength test. Number of samples shall be 0.5 % of the number of insulators in the lot. If the percentage does not give a whole number, then the next whole number above shall be chosen.

(e) Tensile strength test. Number of samples shall be 0.5 % of the number of insulators in the lot. If the percentage does not give a whole number, then the next whole number above shall be chosen.

(f) Creepage distance measurement. One unit of each rating and type shall be subject to this test. The test shall be performed on insulators being supply.

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601-9 Drawings and Documents for Insulators

Drawings and documents shall at least comprise the followings :

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

A. Documents

Item	Description	Printed Documents	CD-ROM
1	Manufacturing and delivery schedule	x	-
2	Test procedure (Factory test)	x	-
3	Test schedule (Factory test)	x	-
4	Test report (Factory test)	x	-
5	Instruction manual	x	-

601-10 Instruction Manuals for Insulators

Instruction manuals shall consist of all necessary information and shall comprise at least the following parts.

Part A Instruction

1. Unpacking
2. Assembly instruction

Part B Complete set of all drawings, technical data sheets or catalogs arranged in order of each complete item.

1. Outline drawings including dimension and technical data of insulators
2. Outline drawings including dimension of all mounting hardware for station post insulator

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

Technical Data

Suspension Insulator for 230 kV and below

1.	TYPE		BALL AND SOCKET TYPE	BALL AND SOCKET FOG TYPE
2.	TECHNICAL REFERENCE NUMBER		52-3	-
3.	DIMENSIONS			
	a. Type of ball and socket coupling		ANSI Type B	ANSI Type B
	b. Leakage distance	in	11.50	17
	c. Max. porcelain disc diameter	in	10.75	10.75
	d. Unit spacing	in	5.75	5.75
4.	MECHANICAL VALUES			
	a. Combined M&E strength	1b	15,000	18,000
	b. Mechanical impact strength	in-1b	55	90
	c. Tension proof	1b	7,500	9,000
5.	ELECTRICAL VALUES			
	a. Low Frequency dry flashover	kV	80	80
	b. Low Frequency wet flashover	kV	50	50
	c. Critical impulse flashover-positive	kV	125	125
	d. Critical impulse flashover-negative	kV	130	130
6.	RADIO INFLUENCE VOLTAGE DATA			
	a. Test Voltage to Ground	kV rms	10	10
	b. Max. RIV at 1,000 kHz	µV	50	50
7.	WOODEN CRATE PACKING	Unit	5 or 6	5 or 6

Note :

1. Pins for fog type insulators shall be corrosion proof type.
2. Withstand voltage of fog type at ESDD 0.06 mg/cm^2 (Light Contamination Level) must not be less than 13.0 kV/unit.

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4 มิถุนายน 2568
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Technical Data

Suspension Insulator for 500 kV

1.	TYPE		BALL AND SOCKET TYPE	BALL AND SOCKET FOG TYPE
2.	TECHNICAL REFERENCE NUMBER		52-8	-
3.	DIMENSIONS			
	a. Type of ball and socket coupling		ANSI Type K	ANSI Type K
	b. Leakage distance	in	11.00	17
	c. Max. porcelain disc diameter	in	11.75	11.75
	d. Unit spacing	in	5.75	5.75
4.	MECHANICAL VALUES			
	a. Combined M&E strength	lb	36,000	36,000
	b. Mechanical impact strength	in-lb	90	90
	c. Tension proof	lb	18,000	18,000
5.	ELECTRICAL VALUES			
	a. Low Frequency dry flashover	kV	80	80
	b. Low Frequency wet flashover	kV	50	50
	c. Critical impulse flashover-positive	kV	125	125
	d. Critical impulse flashover-negative	kV	130	130
6.	RADIO INFLUENCE VOLTAGE DATA			
	a. Test Voltage to Ground	kV rms	10	10
	b. Max. RIV at 1,000 kHz	μV	50	50
7.	WOODEN CRATE PACKING	Unit	5 or 6	5 or 6

Note :

1. Pins for fog type insulators shall be corrosion proof type.
2. Withstand voltage of fog type at ESDD 0.06 mg/cm^2 (Light Contamination Level) must not be less than 13.0 kV/unit.

Bid NO. GBA3-SC-05 and TIWS-SC-05
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4 มิถุนายน 2568
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Technical Data

Non-Stacking Station Post Insulators

(7.5, 15, 23, 34.5 and 69 kV Voltage Class)

1. TECHNICAL REFERENCE NUMBER		216	210	208	205	202
2. BOLT CIRCLE DIAMETER, TOP AND BOTTOM,	in	3	3	3	3	3
3. DIMENSIONS						
a. Height	in	30	18	14	10	7.5
b. Leakage Distance	in	72	37	24	15.5	10.5
4. MECHANICAL VALUE						
a. Cantilever Strength : Upright, Underhung	1b	1500	2000	2000	2000	2000
b. Tensile Strength	1b	16000	12000	10000	8500	7000
c. Torsional Strength	in-lb	15000	10000	8000	7000	6000
d. Compression Strength	lb	25000	15000	10000	10000	10000
5. ELECTRICAL VALUES						
a. Voltage Rating	kV	69	34.5	23	15	7.5
b. Low Frequency Withstand Wet	kV	145	80	60	45	30
c. Impulse Withstand	kV	350	200	150	110	95
6. RADIO INFLUENCE VOLTAGE DATA						
a. Test Voltage to Ground	kV rms	44	22	15	10	5
b. Max. RIV at 1,000 kHz	µV	200	100	100	50	50
7. WOODEN CRATE PACKING	Unit	1	3	3	3	3

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4 กันยายน 2568

Technical Data

Non-Stacking, Tapered Stacks, & Uniform-Diameter Stacks Station Post Insulators

(69, 115, 138, 230 and 500 kV Voltage Class)

1. TECHNICAL REFERENCE NUMBER		391	316	308	289	288	287	286	278
2. TYPE		Tapered Stacks	Uniform-Diameter Stacks	Uniform-Diameter Stacks	Non-Stacking	Non-Stacking	Non-Stacking	Non-Stacking	Non-Stacking
3. BOLT CIRCLE DIAMETER, TOP AND BOTTOM,	in	5 and 7	5	5	5	5	5	5	5
4. DIMENSIONS									
a. Height	in	152	92	80	54	54	45	45	30
b. Leakage Distance	in	330	198	165	116	116	99	99	72
5. MECHANICAL VALUE									
a. Cantilever Strength : Upright	lb	1400	1250	1450	2200	1450	2600	1700	3000
: Underhung	lb	-	1250	1450	2200	1450	2600	1700	3000
b. Tensile Strength	1b	20000	25000	25000	25000	20000	25000	20000	25000
c. Torsional Strength	in-lb	40000	90000	90000	90000	40000	90000	40000	40000
d. Compression Strength	lb	60000	75000	75000	75000	60000	75000	60000	60000
6. ELECTRICAL VALUES									
a. Voltage Rating	kV	525	230	230	138	138	115	115	69
b. Low Frequency Withstand Wet	kV	710	455	385	275	275	230	230	145
c. Impulse Withstand	kV	1800	1050	900	650	650	550	550	350
7. RADIO INFLUENCE VOLTAGE DATA									
a. Test Voltage to Ground	kV rms	318	146	146	88	88	73	73	44
b. Max. RIV at 1,000 kHz	μV	2000	500	500	200	200	200	200	200
8. WOODEN CRATE PACKING	Unit	1/3 or 1/2	1/3 or 1/2	1/3 or 1/2	1	1	1	1	1

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4 มิถุนายน 2568
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Technical Data

Tapered Stacks Station Post Insulators

1.	EGAT TAG NO		10.55	10.56
2.	BOLT CIRCLE DIAMETER			
	a. Upper Units, Top Fitting	in	5	5
	b. Bottom Units, Bottom Fitting	in	7	7
3.	DIMENSIONS			
	a. Height	in	80	92
	b. Leakage distance	in	165	198
4.	MECHANICAL VALUES			
	a. Cantilever strength	lb	2750	2300
	b. Tensile Strength	lb	25000	25000
	c. Torsional Strength	in-lb	90000	90000
	d. Compression Strength	lb	75000	90000
5.	ELECTRICAL VALUES			
	a. Voltage Rating	kV	230	230
	b. Low Frequency Withstand wet	kV	385	455
	c. Impulse Withstand	kV	900	1050
6.	RADIO INFLUENCE VOLTAGE DATA			
	a. Test Voltage to Ground	kV rms	146	146
	b. Max. RIV at 1,000 kHz	µV	500	500
7.	WOODEN CRATE PACKING	Unit	1/3 or 1/2	1/3 or 1/2

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4 ธันวาคม 2568

SPECIFICATION NO. 1009
CAPACITOR BANK CONTROL AND PROTECTION EQUIPMENT

		PAGE
1009-1.	General Requirements	1009-1
1009-2.	Information Required of the Bidder	1009-1
1009-3.	Codes and Standards	1009-1
1009-4.	Materials and Workmanship	1009-1
1009-5.	Special Climatic Treatment	1009-1
1009-6.	Control and Protection Panel	1009-2
1009-7.	Drawings and Data Requirements	1009-3
1009-8.	Ground Buses	1009-4
1009-9.	Wiring	1009-5
1009-10.	Power Supply Disconnects	1009-5
1009-11.	Terminal Block, Wire and Device Designations	1009-6
1009-12.	Instrument Transformer Secondary Ratings and Station Service Power Supply Ratings	1009-6
1009-13.	Auxiliary Transformers	1009-7
1009-14.	Indicating Lamps	1009-7
1009-15.	Test Switches	1009-7
1009-16.	Terminal Blocks	1009-7
1009-17.	Nameplates	1009-8
1009-18.	Symbols and Mimic Buses	1009-8
1009-19.	Control and Instrument Switches	1009-9
1009-20.	Relays	1009-9
1009-20.1	Current Detector Relays (50BF)	1009-11
1009-20.2	Breaker Failure Timer (62BF)	1009-12
1009-20.3	Auxiliary Tripping and Lockout Relays (86BF)	1009-12
1009-20.4	Non-Directional Overcurrent Relays (51C/51CG)	1009-12
1009-20.5	Auxiliary Tripping Relays (94C)	1009-12
1009-20.6	Loss of DC Alarm Relays with Special Provision for Slow Dropout (27XB, 27XR)	1009-12
1009-20.7	Overvoltage Relays (59C)	1009-13
1009-20.8	Unbalance Relays (60C)	1009-13
1009-20.9	Undervoltage Relays (27C)	1009-13
1009-20.10	Breaker Close Delay Timer (62C)	1009-13
1009-21.	230 kV, 115 kV and 69 kV Capacitor Bank Protection	1009-13

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.

		PAGE
1009-22.	33 kV and 22 kV Capacitor Bank Protection	1009-14
1009-23.	Auxiliary and Control Relays	1009-15
1009-24.	Size of Drawings	1009-15
1009-25.	Factory Tests	1009-15
1009-26.	Finishing and Painting	1009-16
1009-27.	Tools and Accessories	1009-16

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

SPECIFICATION NO. 1009
CAPACITOR BANK CONTROL AND PROTECTION EQUIPMENT

1009-1. General Requirements. The equipment under this Specification will be used for shunt capacitor banks at substations of EGAT power system. The equipment will be extended to the existing equipment or newly constructed as indicated on the drawings for each substation. The Contractor shall furnish, assemble and wire all instruments, control and instrument switches, protective relays and other equipment mounted on the panels. All equipment must meet the requirements as defined in this Specification.

1009-2. Information Required of the Bidder. The Bidder shall submit with his bid the name of the manufacturer, and the type or model of the equipment offered. Technical data, descriptive information, drawings and catalogs showing all significant characteristics and details, principles of operation, general arrangement and dimensions, shall also be included to enable EGAT to determine the suitability of the equipment for its purposes. Where Proposal Data Forms are provided, the Bidders shall enter all information as directed. These requirements from the Bidders are very essential, and failure of any Bidder to comply with these requirements may constitute reasonable cause for EGAT to cancel a part or all the Proposal from that Bidder.

1009-3. Codes and Standards. All equipment, materials, fabrication and testing under this Specification shall conform to the latest applicable standard specifications and codes contained in the following list, or to equivalent applicable standard specifications and codes established and approved in the country of manufacturer of the equipment. Where standards are mentioned by name, equivalent applicable standards may be used.

IEEE	Institute of Electrical and Electronic Engineers
ANSI	American National Standards Institute Incorporated
NEMA	National Electrical Manufacturers' Association
NEC	National Electrical Code
ASTM	American Society of Testing Materials
IEC	International Electrotechnical Commission

Any details not specifically covered by these standards shall be subject to the approval of EGAT. In the event of contradictory requirements between such standards and this Specification, the terms of the Specification shall govern.

1009-4. Materials and Workmanship. All materials shall be new and shall be the best available for the purpose for which used, considering strength, durability, life expectancy, operational reliability, suitability and ease of maintenance for the intended service and best engineering practice. Workmanship shall be of the highest grade, and in accordance with the best modern standard practice.

1009-5. Special Climatic Treatment. All materials shall be selected and especially treated so that they will be satisfactory for use under the following climatic conditions:

Ambient temperature range	:	5 °C to 55 °C
Relative humidity	:	95%

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4 มิถุนายน 2568

The equipment, however, shall meet the ANSI/IEEE C37.90 ambient temperature requirement of 55°C.

1009-6. Control and Protection Panel. The control and protection panel shall be provided for each bank and shall be of the freestanding, indoor type (NEMA 1). The control and protection panel under this Specification shall be designed for the control and protection as indicated by the drawings and bill of materials, and as specified herein. Protective relays and their associated auxiliary relays shall perform the functions as shown on the drawing entitled : "Protective Device Functions", for each substation. The Contractor shall furnish any necessary control and protection functions indicated, mounted and wired as required, whether such devices are itemized herein or not.

Any modifications to the arrangement indicated or arrangement of equipment not shown shall be subject to the approval of EGAT.

Each control and protection panel shall consist of an assembly made from not less than No. 2.5 mm leveled sheet steel and formed steel members as required to form a rigid self-supporting structure. No butt surface joints shall be made on the outside surfaces of the panel. No holes or fasteners shall be visible as viewed from the front of the panel. Each control and protection panel shall be designed without any permanent bottom braces and the bottom shall be closed with floor channel closing plates that shall be strong enough to withstand the weight of operators. The panel shall be furnished with channel bases and shall have bent angle or flange edges with an outside radius not exceeding 10 mm. The access door shall be equipped with handle, lock, latches and fully concealed hinges.

Each relay rack assembly shall be arranged to swing through not less than 120 degrees from closed position to allow easy access to the back of the equipment mounted on the rack and to the interior of the control and protection panel.

The control and protection panel size shall be 600 mm deep. The height, channel base, and panel width shall be as indicated on the drawings entitled : "Protective Relay Switchboard Equipment Layout" for each substation.

The construction details of the control and protection panel shall be as shown on Drawing No. TP-E-10.7.

No auxiliary equipment or any other accessories except lighting fixtures shall be mounted on the ceiling inside the panel. The equipment installation shall facilitate operation and maintenance processes, permit operation in close proximity to other live equipment and provide convenience and safety for operators.

The control and protection panel shall be equipped with:

- One (1) on-off momentary spring return control switch of pistol grip, black handle type.
- Two (2) indicating lamps (green and red) installed in the left and right of the front view respectively to indicate operation of switching device of each bank.
- Mimic bus.

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

- One (1) manually operated mimic disconnected device to indicate the disconnecting switch position status (for Capacitor Bank 230, 115 & 69 kV)
- Overall protection relays
- Auxiliary relays
- Terminal blocks
- Other necessary equipment

Each control and instrument switch shall be in accordance with the requirements of Article 1009-19.

1009-7. Drawings and Data Requirements. The Contractor shall submit for approval the following drawings and data, sufficient to demonstrate fully that the equipment to be furnished will conform to the requirements and intent of this Specification.

1009-7.1 Metering and Relaying Diagrams. The Contractor shall supply single line diagrams showing conformity with the specified requirements indicating clearly changes necessitated by the proposed equipment.

1009-7.2 Panel Equipment Layouts. Each panel equipment layout shall specify the positions of the control and protection equipment inside the control and protection panel.

1009-7.3 Protective Device Function Diagrams. All diagrams shall show the connection among all the protection equipment as specified in Articles 1009-7.1 and 1009-7.2, circuit breakers and disconnecting switches.

1009-7.4 Three Line Diagrams. Each three line diagram shall show voltage and current connections to all metering and relaying equipment.

1009-7.5 AC Schematic Diagrams. All diagrams shall show AC connections such as AC supply to all metering and relaying equipment, synchronizing schematic diagrams, etc.

1009-7.6 DC Schematic Diagrams. All diagrams shall show the DC wiring for control, indication, protection, etc., arranged in a schematic form and shall include the necessary wiring of all power circuit breakers that received a trip signal from the protective relays that are listed in the drawings, "Protective Device Functions", for each substation.

1009-7.7 Logic Diagrams. Logic diagrams shall show details of the logic circuits for each individual relay. These diagrams shall be required for the system as a whole as well as for each individual relay and component.

1009-7.8 Wiring Diagrams. Wiring diagrams shall show connections from point to point for all control and protection equipment. All the wiring connections to the equipment on any one panel shall be shown on the same drawing. Inter-panel connections shall be properly identified on both the incoming and outgoing panel drawings. Wiring list or tabular type wiring diagrams shall not be accepted.

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

1009-7.9 Control and Instrument Switch-Switch Position Tabulation Diagrams. Switch position tabulation diagrams of control and instrument switches shall show terminal arrangement, escutcheon plate and contact tabulation. On each schematic diagram where switch contacts are shown, switch position tabulations for the indicated switches shall be included somewhere on the same drawing.

1009-7.10 Nameplate Schedule Diagrams. A nameplate schedule diagram for each substation shall show designations on all nameplates. The wording of each nameplate designation may be revised to satisfy physical limitations subject to the approval of EGAT.

1009-7.11 Equipment Layout Diagrams of Control and Protection Panels. Each equipment layout diagram shall show dimensions, location, and general layout of all panels and all equipment to be located in the panels.

1009-7.12 Control and Protection Panel Construction. The Contractor shall provide for approval the general assembly drawings including dimensions, details of arrangement plan, section plan and floor plan complete with anchor bolt setting plan.

1009-7.13 Bill of Materials. Enlisting major equipment to be mounted on the panels, if not otherwise indicated elsewhere in this Specification, the bill of materials shall cover only the major equipment, or such equipment as will require particular information from the Bidder. It is to be understood that, all other associated auxiliary equipment and accessories, although not listed in the bill of materials, but necessary for the complete and sound functions of the panels as described in this Specification, and as generally accepted as the applicable standards, shall be furnished by the Contractor. The Bidder at the time of bidding shall, to the best of his knowledge, furnish the list showing quantity and details of all the equipment he intends to supply.

The panels proposed shall give the best optimum result as called for in this Specification, and as basically required by standard electrical engineering practice.

The Contractor, after having finished the design of the panels shall submit EGAT for approval all the design details including individual equipment of the control and protection panels, and to all associated equipment in the substation, and showing overall functions of the schematic diagrams. EGAT shall then review the schemes, and should any proper functions required in this Specification or required for sound engineering practice of the panels entail necessary modifications to the scheme or additional equipment other than those originally proposed by the Bidder at the time of bidding, EGAT will return the scheme to the Contractor to carry out the modification required without any extra charge to EGAT.

1009-8. Ground Buses. A 6 mm by 25 mm cross-section bare copper ground bus shall be provided at the bottom of each panel, to which the metallic cases of instruments, relays and grounding circuits of all other equipment shall be connected. The grounding buses shall be solidly bolted to the steel framework so as to make good electrical contact. Solderless lugs or terminals shall be provided on the ground

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4 มิถุนายน 2568

buses for terminating No. 4/0 AWG stranded copper ground cables from the substation grounding system.

1009-9. Wiring. All wiring used within the control and protection panel shall conform to the NEC and NEMA standards and shall be rated 600 V, tinned, stranded copper switchboard wire, polyvinyl chloride insulated and in gray color. All wiring shall be 1.5 mm^2 except for current transformer circuits which shall be 2.5 mm^2. All hinged wiring shall be extra flexible. After assembly, all control wiring shall be given a dielectric test of 1,500 V between live parts and ground, and between opposite polarities. Internal wiring of each basic panel assembly and each panel shall be neatly and carefully installed in suitable wiring ducts with removable covers and complete to conveniently located terminal blocks for connecting to incoming and outgoing leads.

Before being connected to the terminal blocks or the equipment terminal, all wiring shall be terminated with appropriate cable lugs. Multiple wires in one cable lug shall not be acceptable. The cable lugs shall be insulated. They shall perfectly match the terminal blocks or the equipment terminal and shall be plugged in without any modifications.

The terminal arrangement shall group all leads for each particular function to facilitate connections to the incoming and outgoing cables. The arrangement shall be subject to the approval of EGAT. Terminals for each CT circuit shall be grouped together and separated from terminals for other CT circuits. At least 25 percent spare terminals shall be provided on each group of terminal blocks for terminating spare conductors in control cables and for future use, however a minimum of one spare terminal shall be provided on each group of terminal blocks.

Wiring between inter-panels shall be made and routed through vertical raceways of the panels. Such wiring shall also be terminated and reconnected in terminal blocks in order to permit convenient separation of individual panels or panels.

All incoming and outgoing cables shall enter the panels through cable slots in the floor underneath the panels.

Splices or tee connections shall not be permitted in control wiring or instrument leads.

Any control and protection panels that are split for shipment shall have terminal blocks adjacent to the split and shall be provided with wiring required to interconnect the split units.

1009-10. Power Supply Disconnects. Power supplies for panel mounted devices shall be provided with miniature circuit breaker (MCB) connected to isolate the devices from power supplies in the tripped or open condition. MCB shall be located within the panels. Engraved nameplates shall be installed beside each set of MCB for identification.

Power supply to each nature of control circuit and the potential transformer secondary supply to each metering circuit shall be separated and required MCB protection provided, including, but not limited to the following :

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4 มิถุนายน 2568

1009-10.1 DC Control Circuits.

1009-10.1.1 One (1) control circuit including relay trip circuit, for each power circuit breaker of 69 kV capacitor bank and above.

1009-10.1.2 One (1) control circuit for each voltage level of 69 kV capacitor bank protection and above.

1009-10.1.3 One (1) control circuit for each set of 69 kV breaker failure relaying scheme and above.

1009-10.1.4 One (1) control circuit for each three (3) units of 22 kV and 33 kV capacitor bank control and protection panel.

1009-10.1.5 Any other individual control circuit

1009-10.2 AC Supply Circuits.

1009-10.2.1 Power supply for the illumination and Outlet

1009-10.2.2 Any other individual supply circuit

1009-10.3 Potential Transformer Secondary Supply Circuits.

1009-10.3.1 Potential circuit for each set of capacitor bank protection

1009-10.3.2 Any other individual potential circuit

Detail circuit arrangements and MCB protection shall be approved by EGAT at the time approval drawings are submitted by the Contractor.

1009-11. Terminal Block, Wire and Device Designations. Every point of terminal block and wire shall be assigned a designation, with identical designation on each corresponding terminal block and wire. This same designation shall also be indicated in the schematic and wiring diagrams. As a rule, a designation will not change until the wire is terminated or connected to other equipment. All wiring shall be designated at both ends by printing on wire designation sleeves.

Wire designation shall be by permanent method unaffected by heat, solvents, or steam, and not easily dislodged. Each designation on the terminal blocks shall be machine-lettered, stamped, engraved or neatly marked with permanent ink on the removable marking strips provided for each terminal block. Approximately 20% of spare wire designation sleeves shall be furnished. Adhesive labels shall not be acceptable.

The name of ANSI standard device number of each device shall be marked on the rear of the panels directly behind or adjacent to the corresponding device.

1009-12. Instrument Transformer Secondary Ratings and Station Service Power Supply Ratings. Ratings of instrument transformers and station service power supply will be indicated in bill of materials, and except as otherwise specified, all equipment shall be designed and supplied to the following ratings :

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ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

System Frequency	:	50 Hz
Potential Transformer Secondary Ratings	:	115 V
Current Transformer Secondary Ratings	:	1 A or 5 A
AC Station Service	:	400/230 V 3 phase, 4 wire, wye grounded neutral
DC Station Service	:	125 V, ungrounded station battery

Power Supply for Substation Equipment
Control and Protection Circuits,
Control and Protection Equipment Circuits,
Interposing Relay Control Circuits
(PT and CT ratios will be indicated in the drawings and bill of materials)

1009-13. Auxiliary Transformers. Where auxiliary transformers are required for the correct operation of specific metering, relaying, and control equipment furnished under this Specification, the Contractor shall furnish such additional transformers as required without additional cost to EGAT.

1009-14. Indicating Lamps. All indicating and pilot lamp assemblies shall be of the light emitting diode (LED), 125 V, switchboard type with color caps. The color caps shall be red or green as required. All lamp bulbs shall be interchangeable, and shall be replaceable from the front of the panels.

1009-15. Test Switches. Test switches shall be of the built-in type or separate type as specified. Separate test switches shall be of the switchboard, back-connected type, finished in dull black for front-of-panel mounting. All test switches shall be arranged to completely isolate the instruments from the instrument transformers and other external circuits and to provide means for testing either from an external source of energy or from the instrument transformers by means of multipole test plugs which shall be provided for the purpose. A sufficient number of test plugs to make a complete test on one instrument, or relay shall be furnished for each type of test switch. All test switches shall be arranged so that the current transformer secondary circuits cannot be open-circuited in any position while the test plugs or cover plugs are being inserted or removed.

The internal contacts shall be normally sprung together by themselves to complete the circuit link.

1009-16. Terminal Blocks. The control and protection panel shall be supplied with terminal blocks for termination of all wiring devices mounted in the panels and all external circuits. The terminal blocks shall be of non-flammable, self-extinguishing, non-hygroscopic insulating material, rated for 400 V and shall conform to IEC 947-7-1 and IEC 947-1 standards. The terminal blocks shall have adequate current carrying capacity and shall be suitable for use in tropical climate. Terminals shall maintain good electrical, mechanical, chemical, and other properties even at operating temperature as high as 120°C and shall have excellent mechanical strength and hardness; they shall be flexible but difficult to bend or break even applied with thread and torque from the connected wires. Insulating barrier between adjacent terminals

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shall be integral part of the terminal block. All terminal blocks and terminations shall be grouped according to circuit functions. Each terminal block shall have removable white marking strip for marking circuit designation. One spare blank marking strip shall be furnished with each terminal block. The terminal blocks shall be well arranged in order that they permit safe wiring works on any terminals while all adjacent terminals are live.

The terminal blocks shall be of the spring loaded screw-on type, screw-on type or screwless type. The screw-on type terminals shall be designed in such a way that after the terminal block is unscrewed, the wire is still engaged to the terminal block. The screwless type terminals shall be designed to clamp the wire automatically after releasing or withdrawing the screwdriver.

The terminal blocks used for termination of the wiring to RTU and FRS shall be knife disconnecting type.

All CT terminals shall be provided with sliding switch bridge and test socket screws.

The terminal blocks shall be sized and rated in accordance with current carrying capacity of wires. The terminals for power and CT circuits shall be sized for 2x6 mm^2 conductors, and those for PT and control circuits shall be sized for 2x4 mm^2 conductors. The terminals for alarm/status circuits, RTU circuits and marshalling panels shall be sized for 2x2.5 mm^2 conductors.

The arrangement of all terminal blocks shall be such that incoming and outgoing leads can be easily arranged for connections to terminals. Terminal blocks shall be located so that the accessibility to them will not be lessened by interference from structural members or panel instruments. Ample space shall be provided to terminal blocks for termination of all external circuits.

Terminal blocks for blank panels will not be required; however, mounting brackets for these future blocks shall be provided.

1009-17. Nameplates. Nameplates shall be furnished and mounted by the Contractor. Each assembly, each piece of equipment mounted on an assembly, and each power and control circuit shall be provided with a nameplate. All nameplates shall be of laminated plastic material, black on the surface with a white internal layer. Lettering shall be machine-engraved into the nameplate to form white letters against a black background. All panel mounted nameplates shall be in accordance with the respective drawings showing nameplate schedule. A sample nameplate, showing the style of engraving to be used shall be submitted to EGAT for approval. Nameplate engraving shall be subject to the approval of EGAT.

1009-18. Symbols and Mimic Buses. All symbols, devices and painted mimic buses, 10 mm in width, shall be provided on the control and protection panel to form single line diagrams which will simulate actual electrical connections as indicated on the drawing entitled "Protective Relay Switchboard Equipment Layout". Mimic disconnect devices for disconnect switches shall be manually operated. The mimic buses shall be painted on the front of the panels with lacquer or enamel. Color of mimic buses shall be as follows :

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4 มิถุนายน 2568

230 kV - Bright Red
115 kV - Light Orange
69 kV - Yellow
33 kV - Dark Green
22 kV - Blue

1009-19. Control and Instrument Switches. The control and instrument switches shall be of the multistage, rotary type, rated 600 V, 10 A, continuous duty, for both AC and DC services. Each contact shall be of the readily renewable, self-cleaning type and shall be of the wipe-type. A rectangular front-of-panel escutcheon plate shall be furnished and engraved showing the switch position of control and instrument switches. The switch identification shall be engraved on the escutcheon plate, or if necessary, on a separate adjacent nameplate furnished by the Contractor.

The types of control switch handles and colors preferred shall be provided as follows :

Circuit breaker control switches - pistol grip (black)
Other cut-off switches - oval (black)

Details of individual control and instrument switches shall be as described below. The total number of contacts and the total number of contact arrangements shall be adequate for their required functions but minimum number of contacts and contact arrangements shall be at least as shown on Drawing No. TP-E-9.1.

If the schemes for control, protection and other equipment as proposed by the Contractor and approved by EGAT, require additional contacts than those listed in this Specification and shown in the above drawing, the Contractor shall furnish these extra contacts and contact arrangements without additional cost to EGAT.

1009-19.1 Breaker Control Switches (CS). Each breaker control switch shall be of the momentary contact type, with fixed, modern, pistol grip, black handle with red and green mechanical target indicator to show the last function of the switch. Each switch shall be furnished with separately mounted red and green indicating lights. Breaker control switches shall be suitable for use with reclosing equipment.

1009-19.2 Breaker Failure Cut-off Switches (50BF-CO). Each breaker failure cut-off switch shall be of the maintained contact type, with fixed, oval black handle and complete with separately mounted red indicating lamp assembly.

1009-20. Relays. All relays shall be designed for continuous operation at any voltage from 80 percent to 115 percent of rated DC voltage as specified and at a range of ambient temperatures of 10°C to 55°C. All binary inputs shall be triggered by any voltage over a range from 80 percent to 115 percent of the rated DC voltage only. Each protective relay shall be suitable for operation with instrument transformer ratios and connections as shown on the metering and relaying diagrams under both normal and short circuit conditions.

All relays contacts for tripping duty shall be rated to carry 10 A, 300 V for 1 second, 4 A, 300 V at continuous duty, and be capable of interrupting of 0.2 A of inductive current (L/R ≤ 40 ms) in a 125 VDC control circuit.

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4 มิถุนายน 2568

Except as otherwise specified, each protective relay shall be furnished with at least two (2) electrically separate normally open contacts in addition to those required by the functions of each protective relay. These contacts shall be : one contact shall be wired to initiate the remote terminal unit (RTU) and one contact shall be wired to initiate the fault recorder.

All protective relays shall be connected to EGAT's operation LAN in order to perform the data communication between the relays at the remote substations and the PC at the central office.

All protective relays shall support IRIG-B signal input and disturbance recorder function.

Numerical relays shall be supplied as complete relaying system. All relays and components necessary to complete a system shall be fully tropicalized, contained in a common enclosure, and shall be complete with all interconnections and wiring for back-connection. Enclosures shall be rectangular, finished dull-black, dustproof, suitable for semi-flush switchboard panel mounting or rack mounting as specified, with a removable transparent cover, or a cover with a transparent window, with provision for sealing. Operation indicating lights and identifying labels shall be provided with each relaying system and shall be clearly visible and identifiable.

Each relaying system shall be provided with test facilities for secondary injection testing and for isolating the DC supply, current circuits, potential circuits, tripping circuits, and all other output contacts. All test switches shall be arranged so that the current transformer secondary circuit cannot be open-circuited in any position while the test plugs or cover plugs are being inserted or removed. The internal contacts of test switches shall be normally sprung together by themselves to complete the circuit link.

Test plugs shall be furnished with each type of test switches.

The Contractor shall ensure that each protection function is independent of others and can be individually isolated to allow each alone to be taken out of service for testing or operational purposes.

All numerical relays shall be adequately protected against damage from incoming surges and shall meet ANSI SWC test standard.

Each relay shall utilize a DC-to-DC converter-type regulated power supply to provide transient surge isolation between the station battery and the electronic components of the relay system. Each DC-to-DC converter shall be designed to protect it from high voltage and surge, and shall provide two electrically separate contacts for remote annunciation of output voltage failure. Each power supply shall be designed for continuous operation at any voltage from 80 percent to 115 percent of rated DC voltage as specified and at a range of ambient temperature of 10°C to 55°C and 0 to 95 percent humidity. Each power supply shall be immune to damage from accidental short circuiting of the input or output DC supply. Each shall not generate any signal, noise, or impulse on the input DC supply leads which is greater than 300 millivolts peak to peak.

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4 มิถุนายน 2568

Relays utilizing voltage divider type regulated power supplies shall not be accepted.

All modules of numerical type protective relays shall consist of highly reliable logic circuits and circuit components. All modules shall be mounted on plug-in circuit cards. Wiring boards shall be epoxy-fiberglass construction. Printed circuit wiring shall be employed with soldered or welded connections to circuit components. Wiring board shall be provided with heavy-duty circuit connectors.

Each numerical relay shall have provisions for monitoring any hardware failures so they can be repaired before they affect relay operation. These provisions shall also include output contacts for initiating the remote terminal unit (RTU). All output contacts shall be electrically separate normally open contacts.

Each numerical relay shall be configured to comply with all EGAT's needed functions before delivery. Configuration setting of the relay, which is programmable, shall be supplied in CD-ROM.

The instruction manuals shall be prepared with the object of providing sufficient detailed technical information of each type of protective relays to enable EGAT to efficiently carry out commissioning and routine testing. In this regard, each instruction manual shall give full details of circuit operation, circuitry and components. All technical data, operating time curves, sample calculations and other characteristics shall be based upon 50 hertz operation. The manuals shall also provide guidelines on the tracing of faults, ease the ordering of the replacement parts and meet the requirements as listed in Drawings and Documents to be Furnished by the Contractor under Special Conditions of Contract Documents. The manuals shall be submitted to EGAT at least three (3) months prior to the beginning of the commissioning process.

The main protective relays shall be products of the approved manufacturers specified in EGAT ACCEPTED MANUFACTURER LIST FOR PROTECTIVE RELAY. The type/model of the main protective relays shall be as specified in EGAT ACCEPTED MAIN RELAY LIST No.1 and EGAT ACCEPTED MAIN RELAY LIST No.2.

The procedures for being listed in EGAT ACCEPTED MANUFACTURER LIST FOR PROTECTIVE RELAY and EGAT ACCEPTED MAIN RELAY LIST can be requested from Transmission System Engineering Division.

1009-20.1 Current Detector Relays (50BF). Each current detector relay shall be non-directional instantaneous overcurrent relay with fast-resetting time of less than 30 ms when the current drops from 5 times of the pickup to zero. Each relay shall be of the numerical type. Each shall contain two or three phase units and one ground unit with 0.1-2I_n A pickup range. The setting for the phase and ground units shall be independently adjustable. The indicating target shall be provided with each relay.

A cut-off switch (50BF-CO) with a separate red indicating lamp shall be furnished with each set of the relays, to segregate the auxiliary tripping and lockout relay from the current detector relay. Each cut-off switch shall be in accordance with the requirements of Article 1009-19.

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4 มิถุนายน 2568

1009-20.2 Breaker Failure Timer (62BF). Each timer shall be a time delay relay with timing range of 0.05 to 1.0 second and shall be continuously adjustable. An output contact with an indicating target shall be provided with each timer. The timer may be included with the current detector relay.

1009-20.3 Auxiliary Tripping and Lockout Relays (86BF). Auxiliary tripping and lockout relays shall be provided for each set of breaker failure protection. Each relay shall be of the high speed, draw out and DC voltage operated type. All contacts shall be rated to carry 30 A, 300 V for 3 second, 5 A, 300 V at continuous duty, and be capable of interrupting of 0.2 A of inductive current ($L/R \leq 40$ ms) in a 125 VDC control circuit. The operating time including bouncing time shall not exceed 10 ms. There shall be coil transient suppression device in order to protect the relay coil from electromotive force. Both electrical reset (from push button) and manual reset shall be performed. A manual reset control switch with cut-off contact shall be provided to interrupt the operating coil. The minimum number of contacts shall be sufficient and correct as specified in the protective device function or bill of materials.

1009-20.4 Non-Directional Overcurrent Relays (51C/51CG). Each non-directional overcurrent relay shall be of the single-phase or three-phase, numerical type with independent measuring units and multiple time current characteristics according to IEC 255-3 standard. Each relay shall have an instantaneous trip attachment and shall provide means to select appropriate values of both current setting and operating characteristics for phase and ground protection independently. The three-phase relay shall be able to identify the faulty phase. For phase overcurrent protection, the operating current shall be adjustable over a wide range from approximately 20 to 300 % of the protected equipment's rated current for the time-delay unit, and 400 to 2,000% of the protected equipment's rated current for the instantaneous unit, unless otherwise specified. For ground overcurrent protection, the operating current shall be adjustable over a wide range from approximately 10 to 50% of the protected equipment's rated current for the time-delay unit, and 200 to 2,000 % of the protected equipment's rated current for the instantaneous unit. Operating time shall also be adjustable.

Each overcurrent relay shall be furnished with at least four (4) electrically separate normally open contacts in addition to those required by the overcurrent protection functions. These contacts shall be one (1) contact for trip, one (1) contact for alarm and two (2) contacts for spare.

1009-20.5 Auxiliary Tripping Relays (94C). Each auxiliary relay shall be high speed, draw out, self-reset, DC voltage operated type. All contacts shall be rated to carry 30 A, 300 V for 3 second, 5 A, 300 V at continuous duty, and be capable of interrupting of 0.2 A of inductive current ($L/R \leq 40$ ms) in a 125 VDC control circuit. They shall have an operating time including bouncing time not exceeding 10 ms at 250 Watt load. There shall be coil transient suppression device in order to protect the relay coil from electromotive force. The minimum number of contacts shall be sufficient and correct as specified in the protective device function or bill of materials.

1009-20.6 Loss of DC Alarm Relays with Special Provision for Slow Dropout (27XB, 27XR). All DC control circuits shall be monitored by a loss of DC alarm

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relay. Each shall be auxiliary relay, standard speed with slow dropout characteristics. Each relay shall be furnished with at least two (2) electrically separate normally closed contacts. These contacts shall be : one contact shall be wired to initiate the remote terminal unit (RTU) and the other shall be wired to terminal blocks for future use.

1009-20.7 Overvoltage Relays (59C). Each relay shall be of the numerical type, three-phase, 50 Hz, overvoltage type with adjustable time delay which is provided for tripping off the capacitor bank in case of overvoltage condition. Each relay shall have at least four (4) electrically separate normally open contacts, for 1-trip, 1-alarm and 2 spares, and able to perform the above functions satisfactorily.

1009-20.8 Unbalance Relays (60C). The relay shall receive the signal through current transformer connected as indicated on relevant diagram. For internal fuse, if any capacitor elements fail, the relay shall be set to alarm at appropriate value which is 150 mA at the minimum and to trip the capacitor bank if the 110% rated voltage appears on any remaining unit in the group. The unbalance relay shall be flush mounted, numerical type having at least four (4) electrically separate normally open contacts, DC voltage, for 1-trip, 1-alarm and 2 spares, and able to perform the above functions satisfactorily.

1009-20.9 Undervoltage Relays (27C). The relay equipped with adjustable time delay of 0-10 second shall be provided for tripping off the capacitor bank in case of undervoltage condition. The relay shall be numerical type, three-phase, suitable for use with PT secondary voltage as indicated on relevant diagram. The relay shall have at least four (4) electrically separate normally open contacts, for 1-trip, 1-alarm and 2 spares, and able to perform the above functions satisfactorily.

1009-20.10 Breaker Close Delay Timer (62C). Each timer shall be a time delay relay with timing range of 1.0 to 10.0 minute and shall be continuously adjustable. An output contact with an indicating target shall be provided with each timer.

1009-21. 230 kV, 115 kV and 69 kV Capacitor Bank Protection. Each capacitor bank protection shall consist of the protective relay as required and as specified for each capacitor bank on the drawings entitled : "Metering and Relaying Diagrams" and as described below.

1009-21.1 Non-Directional Overcurrent Relays (51C/51CG). Each non-directional overcurrent relay shall be in accordance with the requirements of Article 1009-20.4.

1009-21.2 Overvoltage Relays (59C). Each overvoltage relay shall be in accordance with the requirements of Article 1009-20.7.

1009-21.3 Unbalance Relays (60C1 & 60C2). Two (2) sets of unbalance relay shall be supplied per each capacitor bank. Each unbalance relay shall be in accordance with the requirements of Article 1009-20.8.

1009-21.4 Undervoltage Relays (27C). Each undervoltage relay shall be in accordance with the requirements of Article 1009-20.9.

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4 มิถุนายน 2568

1009-21.5 Auxiliary Tripping Relays (94C). Each auxiliary relay shall be in accordance with the requirements of Article 1009-20.5.

1009-21.6 Loss of DC Alarm Relays with Special Provision for Slow Dropout (27XB, 27XR). Each auxiliary relay shall be in accordance with the requirements of Article 1009-20.6.

1009-21.7 Breaker Failure Protection. The necessary relays shall be provided so that upon failure of a circuit breaker to trip within its normal time, the trip circuit of all the appropriate circuit breakers necessary to isolate the faulted line shall be energized to trip and lockout. Lockout relays shall be provided to prevent reclose, either manual or automatic, until lockout relays are reset. Sensing for breaker failure shall be by instantaneous overcurrent relays in conjunction with timing relays. Provision shall also be made so that the remote end relays, of the line with the faulted breaker, may trip the remote end breaker instantaneously.

1009-21.7.1 Current Detector Relays (50BF). Each current detector relay shall be in accordance with the requirements of Article 1009-20.1.

1009-21.7.2 Breaker Failure Timer (62BF). Each timer relay shall be in accordance with the requirements of Article 1009-20.2.

1009-21.7.3 Auxiliary Tripping and Lockout Relays (86BF). Each lockout relay shall be in accordance with the requirements of Article 1009-20.3.

Current detector relay and breaker failure timer shall be especially designed for the breaker failure function and it is unnecessary to create any logic to form the breaker failure function.

Any additional equipment required for complete functions of the breaker failure protection shall also be included with each breaker failure relay system.

1009-21.8 Breaker Close Delay Timer (62C). Each timer relay shall be in accordance with the requirements of Article 1009-20.10.

1009-22. 33 kV and 22 kV Capacitor Bank Protection. Each capacitor bank protection shall consist of the protective relay as required and as specified for each capacitor bank on the drawings entitled : "Metering and Relaying Diagrams" and as described below.

1009-22.1 Overvoltage Relays (59C). Each overvoltage relay shall be in accordance with the requirements of Article 1009-20.7.

1009-22.2 Unbalance Relays (60CH & 60CL). Two (2) sets of unbalance relay shall be supplied per each capacitor bank. Each unbalance relay shall be of the numerical type, overvoltage type with adjustable time delay which is provided for tripping off the capacitor bank in case of unbalance condition only in capacitor bank. Each relay shall have at least four (4) electrically separate normally open contacts, for 1-trip, 1-alarm and 2 spares, and able to perform the above functions satisfactorily.

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1009-22.3 Loss of DC Alarm Relays with Special Provision for Slow Dropout (27XB, 27XR). Each auxiliary relay shall be in accordance with the requirements of Article 1009-20.6.

1009.22.4 Breaker Close Delay Timer (62C). Each timer relay shall be in accordance with the requirements of Article 1009-20.10.

1009-23. Auxiliary and Control Relays. Additional auxiliary and control relays shall be used to complete the control function of power circuit breaker tripping, trouble alarm, or any indication etc., as required in this Specification. Unless otherwise specified or recommended by the relay manufacturer, all auxiliary and control circuits shall operate on the rated DC voltage as specified for each substation, which shall be the nominal rated voltage of each relay to be furnished.

Auxiliary and control relays shall be of the semi-flush mounted type if feasible, otherwise of the surface mounted, switchboard type, with a removable cover and transparent window, where applicable, and shall be finished dull black.

There shall be coil transient suppression device in order to protect the relay coil from electromotive force.

The coils of relays shall be suitable for continuous duty at their normal operating voltage. All contacts shall be of the renewable type with ample current-carrying and tripping duty shall be rated to carry 10 A, 300 V for 1 second, 4 A, 300 V at continuous duty, and be capable of interrupting of 0.2 A of inductive current ($L/R \leq 40$ ms) in a 125 VDC control circuit. Auxiliary relays of the mechanically latched-in type shall have manual reset devices operable from the front of the panel and shall have an operating time not to exceed 30 ms. Auxiliary relays of the self-reset, standard-speed type shall have an operating time not to exceed 40 ms. Auxiliary relays of the self-reset, medium speed type shall have an operating time not exceeding 30 ms. Auxiliary relays of the self-reset, high speed type shall have an operating time including bouncing time not exceeding 20 ms.

1009-24. Size of Drawings. All drawings and transparent reproducibles of all final approved drawings of metering and relaying diagrams, control and protection panel equipment layout, AC schematic, DC schematic, internal wiring diagram of each panel, and nameplate shall be as follows :

Size of Sheet	Dimensions in mm
A1	594 x 841
A2	420 x 594
A3	297 x 420

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4 มิถุนายน 2568

1009-25. Factory Tests. After the control and protection panel structures have been fabricated and all components assembled, the complete gear including instruments, relays and devices shall be given standard factory tests and all others in accordance with the latest applicable standards of NEMA and ANSI. These tests shall include, but not be limited to, the following :

1009-25.1 Dielectric Tests

1009-25.2 Sequence Tests

1009-25.3 Check of Control Wiring

1009-25.4 Mechanical Tests

1009-26. Finishing and Painting. Finished panel surfaces shall be free from waves, bellies, or other imperfections. Exterior and interior surfaces shall be cleaned by sanding and steam cleaning, ground smooth, filled, primed, sanded and shall be finish-painted inside and outside with ANSI 61 medium gray (RAL 7036 semi gloss).

One quart of matching paint shall be furnished under each item of equipment for touching up damaged places.

1009-27. Tools and Accessories. All special tools and accessories required for installation and normal operation and maintenance of the equipment shall be furnished to the System Protection Department. The notebook computer, software (stored in diskette or CD-ROM), manual to used the software and connector links between relays and PC should be furnished to the System Protection Department for each substation which relays protection can be connect by the computer. The specification of notebook computer should be clarified by user of the System Protection Department.

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4 มิถุนายน 2568

SECTION J

DRAWINGS

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J. DRAWINGS

J-1. Drawings

The following drawings are attached hereto and made a part of the Contract Documents:

No.	Description	Dwg. No.	Sheet	Rev.
1	230 KV SHUNT CAPACITOR BANK	SE-SC-8-04	01/01	3
2	230 KV SHUNT CAPACITOR BANK (RC. SLAB)	SE-SC-8-05	01/01	0
3	230 KV CAPACITOR BANK SINGLE LINE DIAGRAM AND CONTROL CABINET EQUIPMENT LAY-OUT	TP-E-10.7	1/3	4
4	69/115/230 KV CURRENT TRANSFORMER SUPPORT STRUCTURE	ST-CT-4-01	01/01	2
5	DISCONNECTING SWITCH OPERATING PLATFORM (OP002)	ST-OP-0-02	01/01	-
6	CONTROL SWITCH AND SELECTOR SWITCH CONTACT TABULATION	TP-E-9.1	-	10
7	CT JUNCTION BOX TYPICAL CONSTRUCTION	TP-E-18.2	-	6
8	PT AND CT JUNCTION BOX TYPICAL CONSTRUCTION	TP-E-18.4	-	11
9	DETAILS OF STANDARD BOLTS, NUTS, RING FILLERS, SPRING LOCK WASHERS	SD-AB-0-01	01/01	7
10	DISCONNECTING SWITCH STRUCTURE	ST-DS-4-01	01/01	3
11	CABLE ROUTING OF 22 OR 33 KV, 69 OR 115 KV AND 230 KV SHUNT CAPACITOR BANK	STD-CAP-E-7.1	00/00	0
12	C UNIT BUSH COVER	-	-	-

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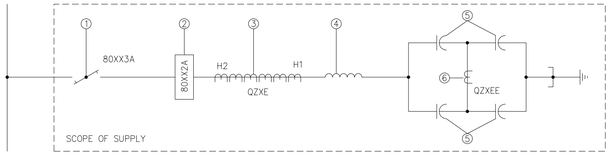


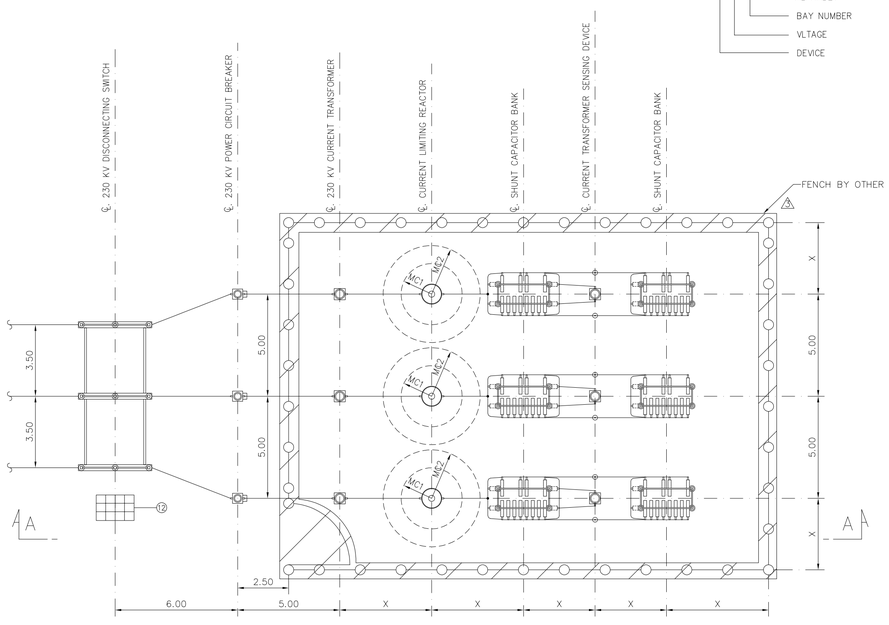
SINGLE LINE DIAGRAM

SWITCHING NUMBER

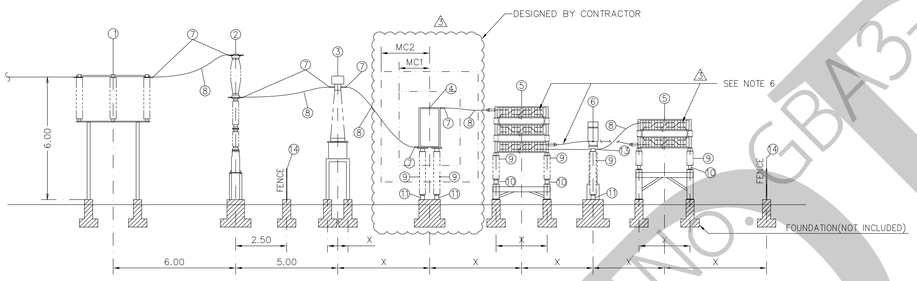
80 X X X A
- A — ALPHABET (IF APPLICABLE)
- X — DEVICE
- X — ROW NUMBER
- X — BAY NUMBER(THE NUMBER THAT THE C-BANK CONNECTED)
- 80 — VOLTAGE

DEVICE NUMBER

Q Z X E
- E — ALPHABET
- X — BAY NUMBER
- Z — VLTAGE
- Q — DEVICE

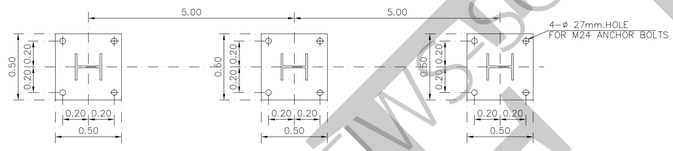


230kV SHUNT CAPACITOR BANK
(NOT TO SCALE)

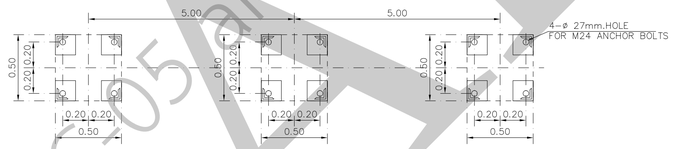


SECTION A–A
(NOT TO SCALE)

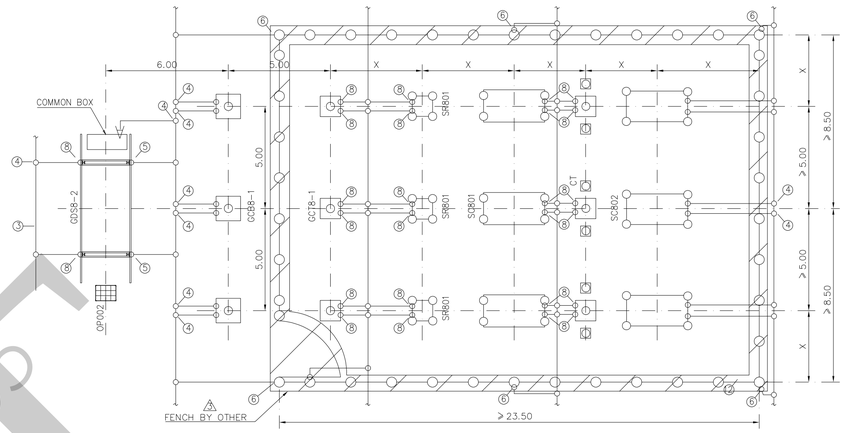
ITEM	DESCRIPTION	Q'TY	REMARK
①	230 kV Disconnecting switch	1	
②	230 kV Power circuit breaker	1	
③	230 kV Current transformer	3	
⚠ ④	Current limiting reactor (By Contractor)	3	
⑤	Capacitor unit	6	
⑥	Current transformer (for unbalance sensing device)	3	
⚠ ⑦	Terminal connector weld type for 1272 MCM ACSR. ,4 holes NEMA pad	LOT	
⚠ ⑧	Aluminum conductor 1272 MCM ACSR.	LOT	
⑨	Station post insulator	LOT	
⑩	3½" subbase 5" bc	LOT	
⑪	6" subbase 5" bc	LOT	
⑫	Disconnecting switch operating platform	1	
⑬	Bus support clamp	LOT	
⑭	Wire mesh fence (By other)	LOT	



DETAIL "A"
(NOT TO SCALE)
BASE PLATE OF CIRCUIT BREAKER TYPE"A"



DETAIL"B"
(NOT TO SCALE)
BASE PLATE OF CIRCUIT BREAKER TYPE"B"



TYPICAL FOR GROUNDING & STEEL STRUCTURE 230kV.SHUNT CAPACITOR BANK

ITEM	DESCRIPTION	REMARK
①	Copper covered ground rod ⅝"x10'–0"	
②	Ground connection for No.4/0 AWG.to ground rod of item 1	
③	Ground wire bare copper cable No.4/0 AWG.19 strands	
④	Ground connection for No.4/0 AWG.run & tap	
⑤	Ground connection for No.4/0 AWG.to vertical steel flat surface	
⑥	Ground connection for No.4/0 AWG.to ø 2"–4" steel pipe	
⑦	Ground connection for No.4/0 AWG.across	
⑧	Ground connection for No.4/0 AWG.vertical through to steel flat surface	
⑨	Ground connection for No.250 MCM.run & 4/0 AWG.tap	
⑩	Single hole terminal lug socket type for 2/0–4/0 AWG.copper cable	
⑪	Ground clamp for No.4/0 AWG.to steel flat surface	
⑫	Flexible copper braid 14"long	
⑭	Single hole terminal compression type for 4/0 AWG.copper cable	

NOTES

1. All dimensions are in meters, except as noted.
2. The ground mat, taps and riser conductors shall be No.4/0 AWG. bare stranded copper conductor.
3. The number of taps and riser conductors shall be specified in substation grounding system according to the substation fault current.
4. Detail of notes, grounding connection and details shall be done and correspond to Dwg.No.SE-GD-8-04-02/02 (Typical Grounding Connection)
5. The dimension " x " shall be specified by the Contractor.
6. Either 2x50Sq.mm.insulated copper cables or insulated copper bars are required for capacitor unit connection. If the insulated copper bars is selected, it shall be the type suitable for outdoor application with the proper size designed by the manufacturer.
7. The base plate of 230kV circuit breaker can be used type "A"or type "B"
8. The dimension MC1 is the minimum magnetic clearance to metallic part and dimension MC2 is the minimum magnetic clearance to metallic part not forming closed loop. The magnetic clearance MC1 and MC2 shall be specified by manufacturer.
- ⚠ 9. Cable tray (HDG.) which connected between equipment shall be provided by contractor

REFERENCE DRAWINGS

1. Disconnecting Switch Structure.....Dwg.No.ST-DS-4-01
2. 69/115/230 kV. Current Transformer Support Structure.....Dwg.No.ST-CT-4-01
3. Disconnecting Switch Operating Platform (OP002).....Dwg.No.ST-OP-0-02
4. Typical Grounding Connection.....Dwg.No.SE-GD-8-04-01/02
5. Typical Grounding Connection.....Dwg.No.SE-GD-8-04-02/02

เอกสารไม่ควบคุม
รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

0 1 2 3 4 5 6 7 8 9 10
SCALE 1 : 150

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
⚠	–	REVISED ALUMINUM CONDUCTOR, CURRENT LIMITING REACTOR AND NOTES.	–	–	–	–	–	–	–	–
⚠	–	REVISED DISCONNECTING SWITCH PHASE SPACING, SWITCHING No., NOTE AND GROUNDING DETAIL	–	–	–	–	–	–	–	–
⚠	–	ADDITIONAL NOTE NO.3	–	–	–	–	–	–	–	–

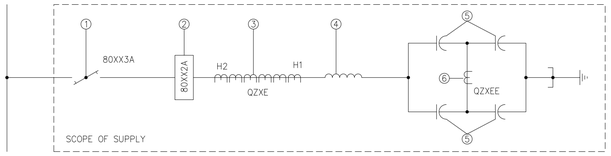
ELECTRICITY GENERATING AUTHORITY OF THAILAND

DRAWN PAKANAI.Y	RECOMMENDED AND VALIDATED KORANEE P. CHIEF,SUBSTATION ENGINEERING DEPARTMENT	DRAWING NAME STANDARD DRAWING
DESIGNED Sarunrat.	CONCURRED ASSISTANT DIRECTOR,TRANSMISSION SYSTEM ENGINEERING DIVISION–2	DESCRIPTION OF DETAIL DRAWING 230 KV SHUNT CAPACITOR BANK
VERIFIED	APPROVED DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION DATE 12 Nov 2024	JOB NO. – / REPLACING DWG.NO. / DWG.NO. SE-SC-8-04 / REV. 01 ⚠

ISO 9001 TSE : 2015
CAD CENTER
DO NOT AMEND MANUALLY

DRAFT
Bid NO. GBA3-SC-05 and TWSESC-05

REV.	DWG.NO.
01	SE-SC-8-05
0	



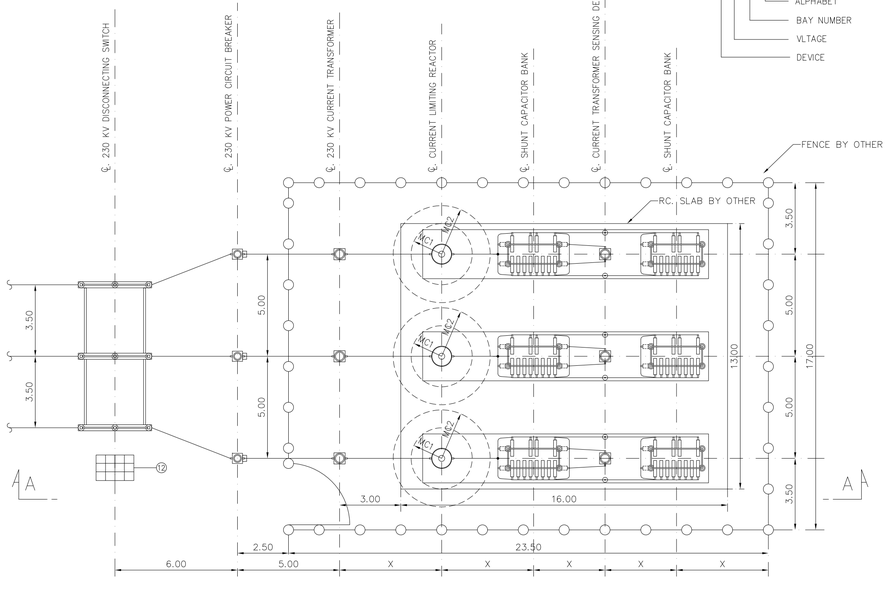
SWITCHING NUMBER

80 X X X A
- A — ALPHABET (IF APPLICABLE)
- X — DEVICE
- X — ROW NUMBER
- X — BAY NUMBER(THE NUMBER THAT THE C-BANK CONNECTED)
- 80 — VOLTAGE

DEVICE NUMBER

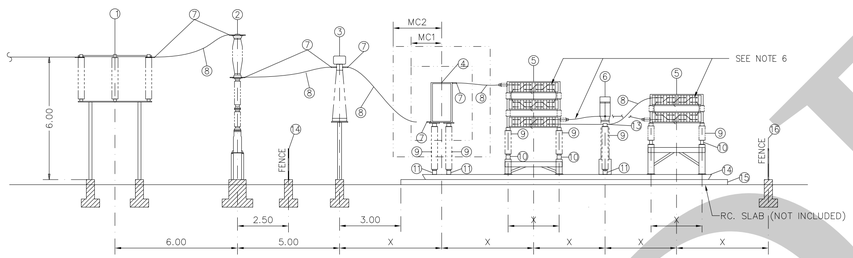
Q Z X E
- E — ALPHABET
- X — BAY NUMBER
- Z — VLTAGE
- Q — DEVICE

SINGLE LINE DIAGRAM



230 kV SHUNT CAPACITOR BANK

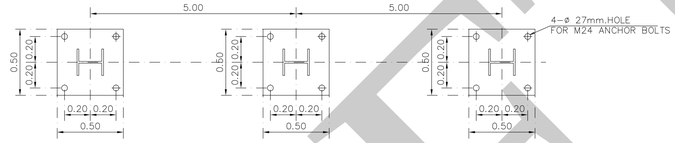
(NOT TO SCALE)



SECTION A–A

(NOT TO SCALE)

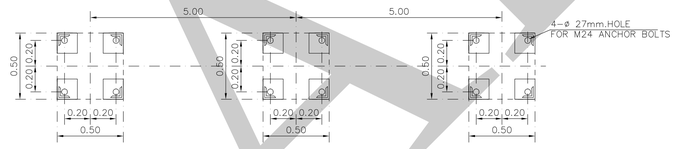
ITEM	DESCRIPTION	Q'TY	REMARK
①	230 kV Disconnecting switch	1	
②	230 kV Power circuit breaker	1	
③	230 kV Current transformer	3	
④	Current limiting reactor (By Contractor)	3	
⑤	Capacitor unit	6	
⑥	Current transformer (for unbalance sensing device)	3	
⑦	Terminal connector weld type for 1272 MCM ACSR. ,4 holes NEMA pad	LOT	
⑧	Aluminum conductor 1272 MCM ACSR.	LOT	
⑨	Station post insulator	LOT	
⑩	3½" subbase 5" bc	LOT	
⑪	6" subbase 5" bc	LOT	
⑫	Disconnecting switch operating platform	1	
⑬	Bus support clamp	LOT	
⑭	Skid base	LOT	DESIGN BY CONTRACTOR
⑮	RC. SLAB (By other)	1	
⑯	Wire mesh fence (By other)	LOT	



DETAIL"A"

(NOT TO SCALE)

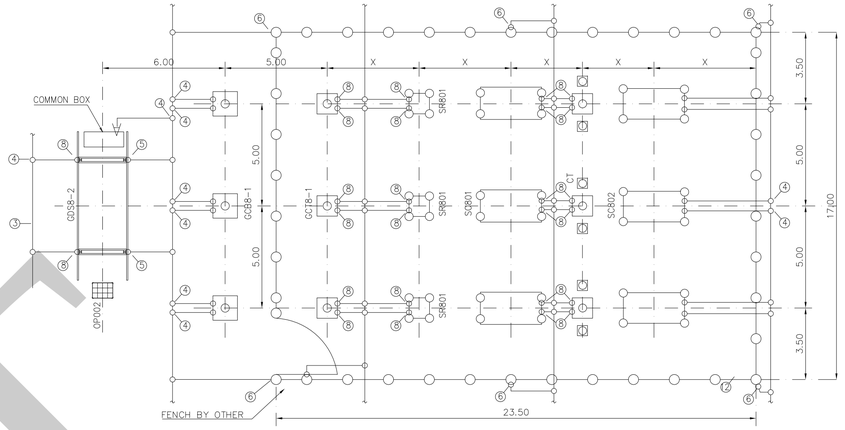
BASE PLATE OF CIRCUIT BREAKER TYPE"A"



DETAIL"B"

(NOT TO SCALE)

BASE PLATE OF CIRCUIT BREAKER TYPE"B"



TYPICAL FOR GROUNDING & STEEL STRUCTURE 230 kV SHUNT CAPACITOR BANK

ITEM	DESCRIPTION	REMARK
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⑥	Ground connection for No.4/0 AWG.to ø 2"–4" steel pipe	
⑦	Ground connection for No.4/0 AWG.across	
⑧	Ground connection for No.4/0 AWG.vertical through to steel flat surface	
⑨	Ground connection for No.250 MCM.run & 4/0 AWG.tap	
⑩	Single hole terminal lug socket type for 2/0–4/0 AWG.copper cable	
⑪	Ground clamp for No.4/0 AWG.to steel flat surface	
⑫	Flexible copper braid 14"long	
⑭	Single hole terminal compression type for 4/0 AWG.copper cable	

NOTES

1. All dimensions are in meters, except as noted.
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3. The number of taps and riser conductors shall be specified in substation grounding system according to the substation fault current.
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7. The base plate of 230 kV circuit breaker can be used type "A"or type "B"
8. The dimension MC1 is the minimum magnetic clearance to metallic part and dimension MC2 is the minimum magnetic clearance to metallic part not forming closed loop. The magnetic clearance MC1 and MC2 shall be specified by manufacturer.
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4. Typical Grounding Connection.....Dwg.No.SE–GD–8–04–01/02
5. Typical Grounding Connection.....Dwg.No.SE–GD–8–04–02/02

ได้ตรวจสอบแล้ว
ลงชื่อ KORANEE P.
(นางสาวกรณี พงษ์คุ้มภัย)
วันที่ 17 Mar 2025
กองวิศวกรรมสถานีไฟฟ้าแรงสูง

0 1 2 3 4 5 6 7 8 9 10

SCALE 1 : 150

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
0	–	–	–	–	–	–	–	–	–	–

ELECTRICITY GENERATING AUTHORITY OF THAILAND

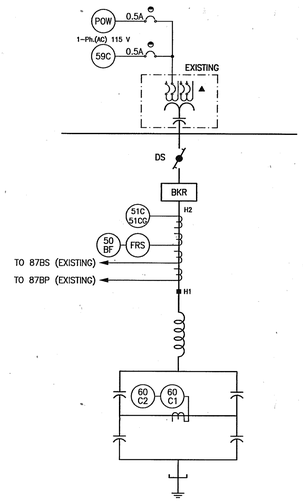
DRAWN PAKANAI.Y	RECOMMENDED AND VALIDATED ..... CHIEF,SUBSTATION ENGINEERING DEPARTMENT	DRAWING NAME: STANDARD DRAWING
DESIGNED	CONCURRED ..... ASSISTANT DIRECTOR,TRANSMISSION SYSTEM ENGINEERING DIVISION–2	DESCRIPTION OF DETAIL DRAWING: 230 kV SHUNT CAPACITOR BANK (RC. SLAB)
VERIFIED		
APPROVED ..... DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION	DATE	JOB NO. – / REPLACING DWG.NO. / DWG.NO. SE–SC–8–05 / 01 / REV. 0

ISO 9001 TSE : 2015 — CAD CENTER — DO NOT AMEND MANUALLY

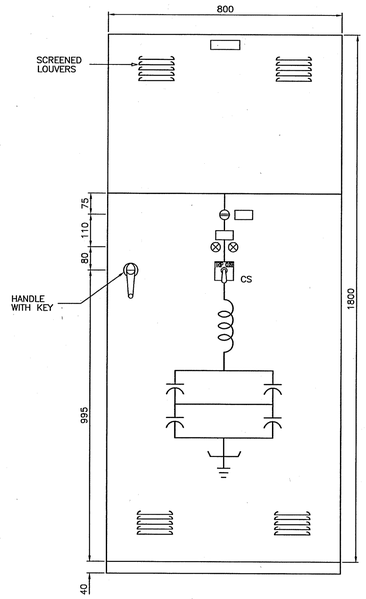
DRAFT

DWG.NO. TP – E – 10.7

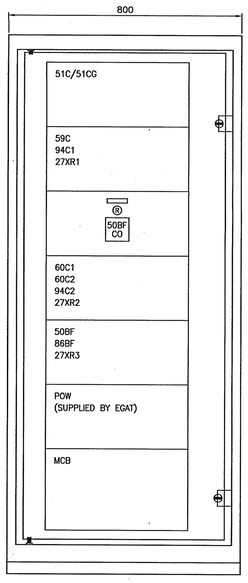
REV. 1 3 4



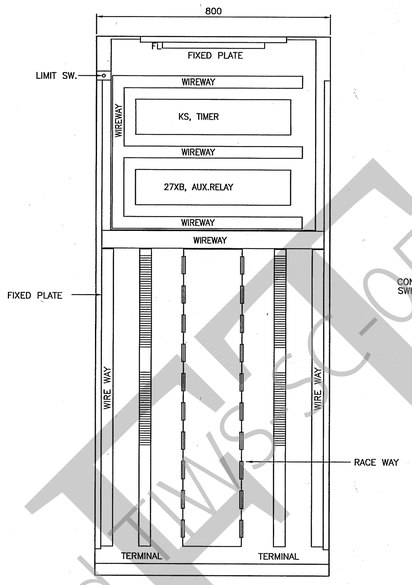
SINGLE LINE DIAGRAM



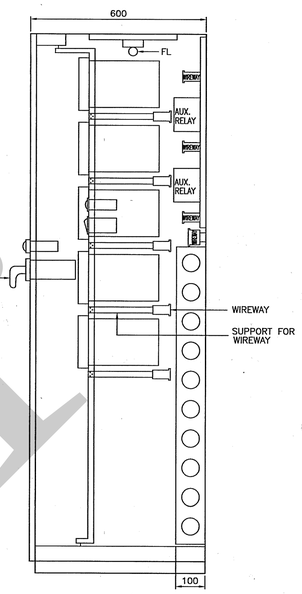
FRONT VIEW



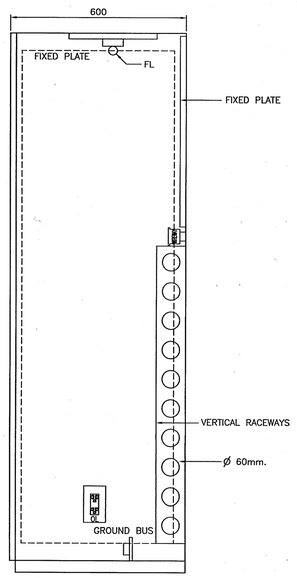
INSIDE FRONT VIEW



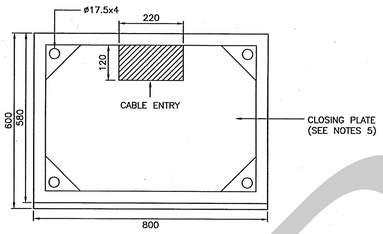
INSIDE FRONT VIEW
WITHOUT SWING RACK



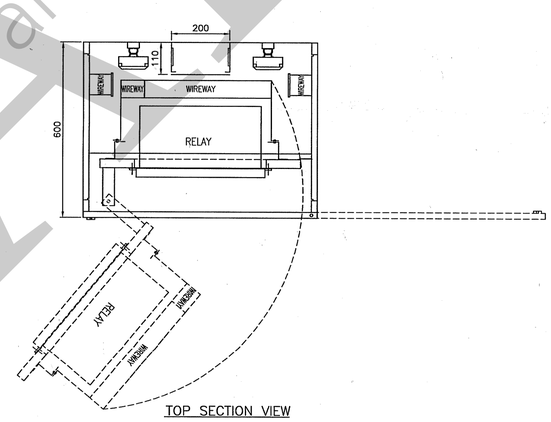
SIDE VIEW



SIDE VIEW
WITHOUT SWING RACK

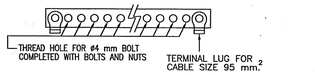


FOUNDATION



TOP SECTION VIEW

GROUND BUS DETAIL



NOTES

1. ALL DIMENSIONS IN THIS DRAWING ARE IN MILLIMETERS; SCALE 1:10
2. THE CONTRACTOR SHALL PROVIDE THE FOLLOWING DRAWINGS AND DOCUMENTS FOR APPROVAL:
   - 2.1 BILL OF MATERIAL SHOWING DEVICE DESCRIPTION, REFERENCE NO., MANUFACTURRER RATING, SETTING RANGE, REFERENCE DRAWINGS OR DOCUMENTS NO. AND QUANTITY.
   - 2.2 AC/DC SCHEMATIC DIAGRAM OF ASSOCIATED EQUIPMENT.
   - 2.3 WIRING DIAGRAM OF ASSOCIATED EQUIPMENT.
   - 2.4 CONTROL CABINET GENERAL AND EQUIPMENT LAY–OUT DRAWINGS GIVING NECESSARY DIMENSIONAL DETAIL.
   - 2.5 CALCULATION SHEETS OF
     - – INRUSH CURRENT
     - – UNBALANCE CURRENT OR VOLTAGE
     - – PROTECTIVE RELAY SETTING
   - 2.6 TEST REPORT FOR
     - – INDIVIDUAL TEST
     - – FUNCTIONAL TEST
3. THE SAMPLE OF WIRING ACCESSORIES SHALL BE SUBMITTED TO EGAT FOR APPROVAL.
4. THE CLOSE BLOCKING TIMING RELAY (62–52b) WITH TIME SETTING RANGE OF 0–10 MINUTES SHALL BE PROVIDED FOR EACH CONTROL CABINET.
5. THE CLOSING PLATE SHALL BE STRANG ENOUGH TO WITHSTAND THE WEIGHT OF OPERATORS.
6. THE RELAY RACK ASSEMBLY SHALL BE ABLE TO SWING THROUGH 120° FROM THE CLOSED POSITION AND INSTALLED WITH TOOL TO HOLD IT OPEN.

LEGEND	DESCRIPTION
50BF	BREAKER FAILURE RELAY
51C	OVERCURRENT RELAY
59C	OVERVOLTAGE RELAY
60C	UNBALANCE SENSING RELAY
27C	UNDERVOLTAGE RELAY
	CURRENT TRANSFORMER
	POTENTIAL TRANSFORMER
	MCB LOCATED AT SWITCHYARD
	MCB LOCATED AT MAIN CONTROL BOARD
	NAME PLATE
CS	CONTROL SWITCH
G, R	INDICATING LAMP : G–GREEN, R–RED
	MANUALLY OPERATED MIMIC DISCONNECT DEVICE
27XB, 27XR	DC UNDERVOLTAGE ALARM RELAY
POW	POINT ON WAVE CLOSING EQUIPMENT (SUPPLIED BY EGAT)
FRS	FAULT RECORDING SYSTEM (DONE BY EGAT)

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

DRAFT
Bid NO. GBA3-SC-05 and TWS-SC-05

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
4	–	ADDITION OF SCREENED LOUVERS	P.Jirasak	–	–	–	–	–	–	–
3	–	REVISION PER SPECIFICATION NO.SP–374 Rev.1 (May.09), AND CONTROL AND PROTECTION STANDARD (Mar.07)	J.Surapong	–	–	–	–	–	–	–
2	–	REVISION PER CONTROL AND PROTECTION STANDARD (Sep.02)	J.Surapong	–	–	–	–	–	–	–
1	–	REARRANGEMENT OF EQUIPMENT, RESIZING 230 kV AND 115 kV C–BANK CABINETS, SEPARATING DRAWING INTO 3 SHEETS AND ADDITION NOTE 5 AND 6	J.Surapong	–	–	–	–	–	–	–

ISO 9001 TSEB1999 CAD CENTER DO NOT AMEND MANUALLY

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$Filename
$$$$$$$$$$$$$$$Date
$$$$$$$$$$$$$$$Name

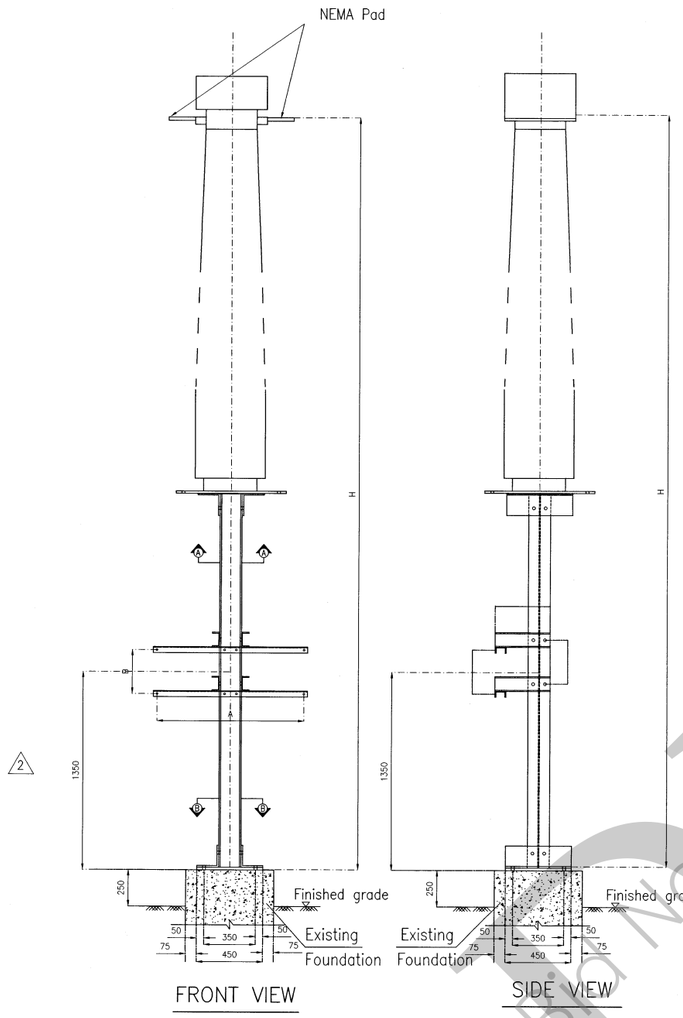
ELECTRICITY GENERATING AUTHORITY OF THAILAND

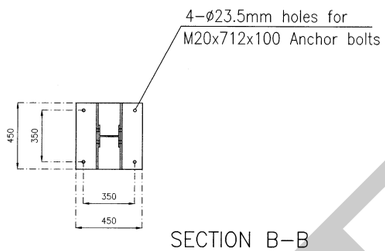
DRAWN	P.Jirasak	VALIDATED — CHIEF, CONTROL AND PROTECTION ENGINEERING DEPARTMENT	DRAWING NAME: TYPICAL DRAWING
DESIGNED	P. Hmm	RECOMMENDED — ASSISTANT DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION	DESCRIPTION OF DETAIL DRAWING: 230 kV CAPACITOR BANK SINGLE LINE DIAGRAM AND CONTROL CABINET EQUIPMENT LAY–OUT
VERIFIED	P. Hmm	CONCURRED — DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION	
APPROVED	ASSISTANT GOVERNOR – TRANSMISSION SYSTEM ENGINEERING	DATE 30/9/11	JOB NO. / REPLACING DWG.NO. / DWG.NO. TP – E – 10.7 / REV. 3 4

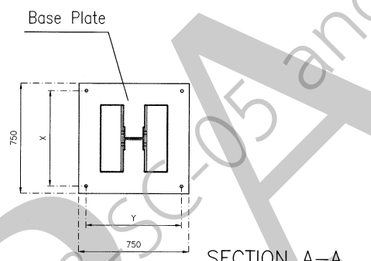
CABINET NO. W1
RUN NO. 159

DWG.NO.	REV.
ST-CT-4-01	01
	2

ITEM	DESCRIPTION	STR MKD	HIGH, H (mm)
1	69 kV. Current transformer support structure	GCT6-1	3680
2	69 kV. Current transformer support structure	GCT6-2	4500
3	115 kV. Current transformer support structure	GCT7-1	4500
4	230 kV. Current transformer support structure	GCT8-1	5500







NOTES

1. All dimensions are in millimeters,except otherwise shown.
2. Quality of materials
   All member shall conform to ASTM A36 or equivalent.
   Bolt and nut shall conform to ASTM A394 TYPE "0" or equivalent.
   Spring washer shall be carbon steel conforming to ASA B27.1, regular type.
3. All material shall be hot-dip galvanized after farbrication and cleaning.
   Members and plates shall conform to ASTM A123
   Bolts and nuts shall conform to ASTM A153
4. All welding shall be with E70 electrode (SMAW) for minimum and shall conform to all requirements of the latest AWS Code.
5. Detail of standard bolts, nuts, ring fillers, spring lock washers shall be according to Dwg.No. SD-AB-0-01 01/01 rev.7
6. Dimension "A" and "B" shall be as shown in Dwg.No. TP-E-18.4 rev.9.

REFERENCE DRAWINGS

1 Detail of standard bolts, nuts, ring fillers, spring lock washer.....Dwg.No. SD-AB-0-01 01/01 rev.7.
2 PT and CT junction box typical construction.....Dwg.No. TP-E-18.4 rev.9

เอกสารไม่ควบคุม
รับรองสำเนาโดย หผอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

CABINET NO. V1
RUN NO. 500 C

DRAFT
Bid No. GBA3-SC-05 and TIWS-SC-05

ISO 9001 TSE-TSP : 2008
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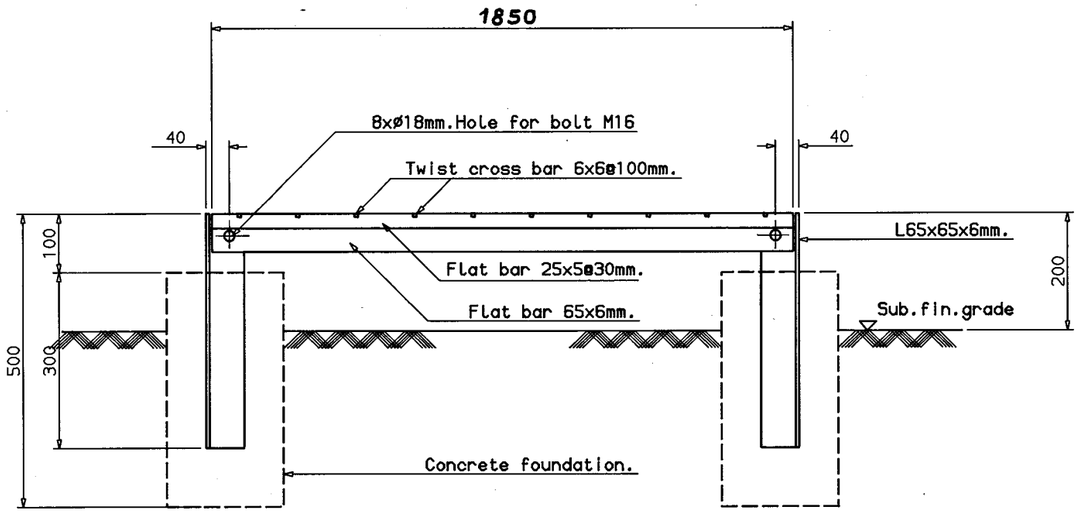
REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
-	2	REVISED THE HEIGHT OF JUNCTION BOX FROM 1.50 m. to 1.35 m.	-	-	-	-	-	-	-	-
-	1	ADDITIONAL HOLE SIZE FOR ANCHOR BOLT	-	-	-	-	-	-	-	-

Filename
Date
Name

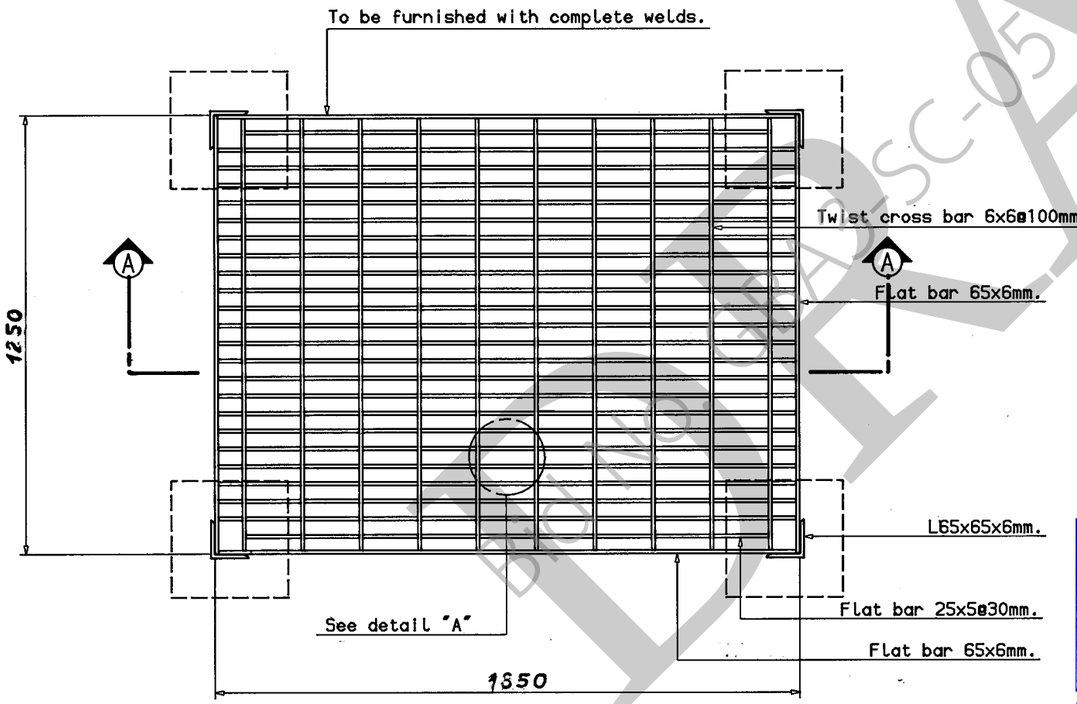
ELECTRICITY GENERATING AUTHORITY OF THAILAND

DRAWN THITIWAT	VALIDATED CHIEF,SUBSTATION ENGINEERING DEPARTMENT	DRAWING NAME: STANDARD DRAWING
DESIGNED WUTTHICHAI	RECOMMENDED ASSISTANT DIRECTOR,TRANSMISSION SYSTEM ENGINEERING DIVISION	DESCRIPTION OF DETAIL DRAWING: 69/115/230kv. CURRENT TRANSFORMER SUPPORT STRUCTURE
VERIFIED	CONCURRED DIRECTOR,TRANSMISSION SYSTEM ENGINEERING DIVISION	
APPROVED ASSISTANT GOVERNOR -- TRANSMISSION SYSTEM ENGINEERING	DATE 27/12/14	JOB NO. - / REPLACING DWG.NO. ST-CT-4-01 01/01 rev.1 JOB NO. TS7 / DWG.NO. ST-CT-4-01 / REV. 01 2

DWG.NO. ST-OP-0-02 | 01 | 01



SECTION Ⓐ - Ⓐ 1:10



PLAN 1:10

NOTES.

1. All dimensions are in millimeters,except otherwise shown.
2. Quality of materials.
   All structure steel shall conform to JIS G3101 SS41.
   Bolt and nut shall conform to ASTM A394 or equivalent.
   Spring washer shall be carbon steel conform to ASA B27.1, regular type.
3. All materials shall hot-dip galvanized after fabrication- and cleaning.
4. All bolts shall be M16 with 1nut & 1spring washer unless otherwise noted.

REFERENCE DRAWINGS.

1. Disconnecting switch operation platform foundation.....Dwg.No.FD-OP-0-02
2. Standard bolt.....Dwg.No.SD-AB-0-01

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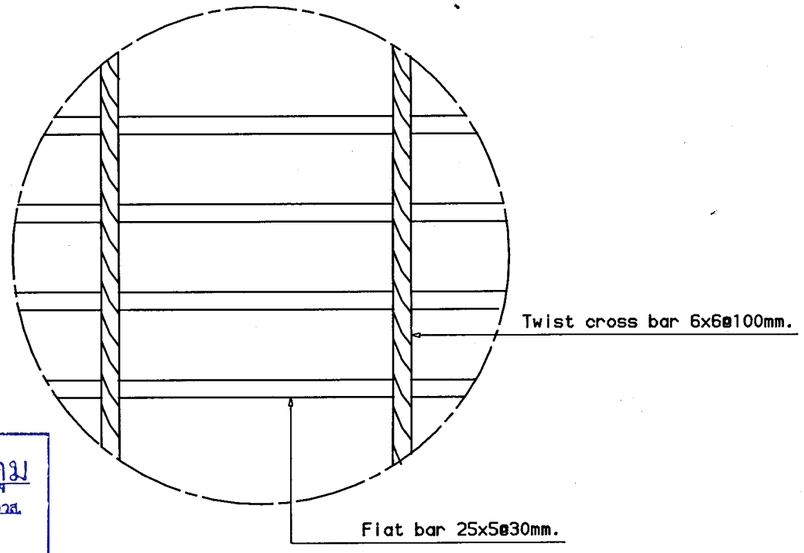
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568



DETAIL "A" : grating product.

V1
3103

NO.	JOB ASSIG.	JOB DESCRIPTION & REVISION	DRAWN	DESIGNED	CHECKED	ACCE	SUBMITTED	RECOMMENDED	CONCURRED	APPROVED	DATE

ELECTRICITY GENERATING AUTHORITY OF THAILAND

DESIGNED	ACCE	SUBMITTED	STANDARD DRAWING
DESIGNED		RECOMMENDED	DISCONNECTING SWITCH OPERATING PLATFORM (OP002)
DRAWN Pongsak.		CONCURRED	
CHECKED		APPROVED	DATE 7/6/96

JOB NO.	REPLACING DWG.NO.	DWG.NO.	REV.
		ST-OP-0-02	01

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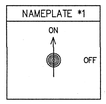
PV 0

DRAFT
BUTWG-ASC-05 and TIWS-SC-05

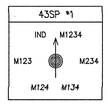
NAMEPLATE *1



CONTACT	POSITION	
	ON	OFF
1 – 2	X	
3 – 4	X	
5 – 6	X	
7 – 8	X	
9 – 10	X	
11 – 12	X	
13 – 14	X	
15 – 16		X
17 – 18		X
19 – 20		X

FIGURE 1	MAINTAINED CONTACT TYPE
87–CO	DIFFERENTIAL CUT–OFF SWITCH
DTT–CO	DIRECT TRANSFER TRIP CUT–OFF SWITCH
86A–CO	TRANSFORMER LOCKOUT CUT–OFF SWITCH

43SP *1

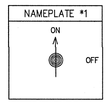


CONTACT	POSITION					
	IND	M1234	M234	M134	M124	M123
1 – 2	X		X			
3 – 4	X		X			
5 – 6	X		X			
7 – 8	X		X			
9 – 10		X		X	X	X
11 – 12		X		X	X	X
13 – 14		X		X	X	X
15 – 16		X		X	X	X
17 – 18		X			X	X
19 – 20		X		X		X
21 – 22		X		X	X	
23 – 24		X		X	X	X
25 – 26	X			X		
27 – 28	X			X		
29 – 30	X			X		
31 – 32	X			X		
33 – 34	X		X	X		
35 – 36		X		X	X	X
37 – 38			X			
39 – 40			X			
41 – 42			X			
43 – 44			X			
45 – 46			X			
47 – 48		X	X		X	X
49 – 50			X			
51 – 52					X	
53 – 54				X		
55 – 56	X					
57 – 58			X			
59 – 60		X				
61 – 62						X
63 – 64					X	
65 – 66	X				X	
67 – 68	X				X	
69 – 70	X				X	
71 – 72	X				X	
73 – 74	X				X	
75 – 76		X			X	X
77 – 78		X	X	X		X
79 – 80		X	X	X		X
81 – 82	X					X
83 – 84	X					X
85 – 86	X					X
87 – 88	X					X
89 – 90	X					X
91 – 92		X	X	X	X	
93 – 94		X		X	X	X
95 – 96		X	X		X	X
97 – 98		X	X	X		X
99 – 100		X	X	X	X	
101 – 102			X			
103 – 104	X					

FIGURE 2	MAINTAINED CONTACT TYPE
43SP	TRANSFORMER PARALLEL MODE SELECTOR SWITCH

NOTE
1. THE NAMEPLATE SHOULD BE FOLLOWED UP ON TP–E–11

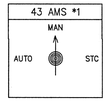
NAMEPLATE *1



CONTACT	POSITION	
	ON	OFF
1 – 2	X	
3 – 4	X	
5 – 6	X	
7 – 8	X	

FIGURE 3	MAINTAINED CONTACT TYPE
SS	SYNCHRONIZING SWITCH
50BF–CO	BREAKER FAILURE CUT–OFF SWITCH
43RCC	SYSTEM REMOTE CONTROL SWITCH
EPS	EMERGENCY PERMISSION SWITCH
50/51S–CO	STUB CUT–OFF SWITCH
86EF–CO	EARTH FAULT LOCKOUT CUT–OFF SWITCH
81–CO	UNDER FREQUENCY CUT–OFF SWITCH
27–CO	UNDER VOLTAGE CUT–OFF SWITCH
50/51OL–CO	OVERLOAD SHEDDING CUT–OFF SWITCH

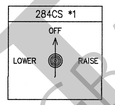
43 AMS *1



CONTACT	POSITION		
	AUTO	MAN	STC
1 – 2			X
3 – 4	X		
5 – 6		X	
7 – 8	X		
9 – 10	X		
11 – 12			X
13 – 14			X
15 – 16	X		
17 – 18		X	
19 – 20			X
21 – 22	X		
23 – 24		X	
25 – 26			X
27 – 28	X		

FIGURE 4	MAINTAINED CONTACT TYPE
43AMS	AUTOMATIC–MANUAL–STATION CONTROL SELECTOR SWITCH

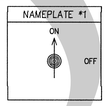
284CS *1



CONTACT	POSITION		
	LOWER	OFF	RAISE
1 – 2	X		
3 – 4			X
5 – 6	X		
7 – 8			X

FIGURE 5	MAINTAINED CONTACT TYPE
284CS	TRANSFORMER ON LOAD TAP CHANGER CONTROL SWITCH

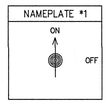
NAMEPLATE *1



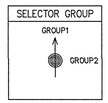
CONTACT	POSITION	
	ON	OFF
1 – 2	X	
3 – 4	X	
5 – 6	X	
7 – 8	X	
9 – 10	X	
11 – 12	X	
13 – 14	X	
15 – 16	X	
17 – 18	X	
19 – 20	X	
21 – 22	X	
23 – 24	X	

FIGURE 6	MAINTAINED CONTACT TYPE
RSS	RESTORATION SYNCHRONIZING SWITCH

NAMEPLATE *1



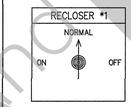
SELECTOR GROUP



CONTACT	POSITION	
	ON	OFF
1 – 2	X	
3 – 4	X	
5 – 6	X	
7 – 8	X	
9 – 10	X	
11 – 12	X	
13 – 14	X	
15 – 16	X	
17 – 18	X	
19 – 20	X	
21 – 22	X	
23 – 24	X	
25 – 26	X	
27 – 28		X
29 – 30		X
31 – 32		X
33 – 34		X
35 – 36		X
37 – 38		X
39 – 40		X

FIGURE 7	MAINTAINED CONTACT TYPE
PTT–CO	PERMISSIVE TRANSFER TRIP CUT–OFF SWITCH
43CCS	LOCAL/RTU CONTROL MODE SELECTOR SWITCH
85–CO	CARRIER CUT–OFF SWITCH
21–SG	GROUP SETTING SELECTOR GROUP SWITCH

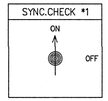
RECLOSER *1



CONTACT	POSITION		
	ON	NORMAL	OFF
1 – 2	X	→	
3 – 4	X	→	
5 – 6	X	→	
7 – 8	X	→	
9 – 10		←	X
11 – 12		←	X
13 – 14		←	X
15 – 16		←	X

FIGURE 8	MOMENTARY CONTACT TYPE
79CO	RECLOSER CUT–OFF SWITCH

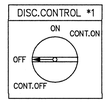
SYNC.CHECK *1



CONTACT	POSITION	
	ON	OFF
1 – 2	X	
3 – 4	X	
5 – 6	X	
7 – 8	X	
9 – 10		X
11 – 12		X
13 – 14		X
15 – 16		X

FIGURE 9	MAINTAINED CONTACT TYPE
25CO	SYNCHRO CHECK CUT–OFF SWITCH

DISC.CONTROL *1

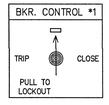


PUSH TURN 45°

CONTACT	POSITION			
	CONTROL "ON"	ON	OFF	CONTROL "OFF"
1 – 2			X	X
3 – 4	X	X		
5 – 6	X			
7 – 8	X			
9 – 10	X			
11 – 12				X
13 – 14				X
15 – 16				X

FIGURE 10	MAINTAINED CONTACT TYPE
DCS	DISCREPANCY CONTROL SWITCH

BKR. CONTROL *1



CONTACT	POSITION				
	PULL TO LOCKOUT	TRIP	RETURN AFTER TRIP	RETURN AFTER CLOSE	CLOSE
1 – 2				←	X
3 – 4	X	→			
5 – 6			→	←	
7 – 8			→	←	
9 – 10				←	X
11 – 12				←	X
13 – 14		→			
15 – 16				←	X
17 – 18		→			
19 – 20				←	X

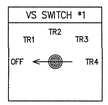
FIGURE 11	MOMENTARY CONTACT TYPE
CS	BREAKER CONTROL SWITCH

TRIP TRANSFER *1

CONTACT	POSITION	
	NORMAL	TIE
1 – 2		X
3 – 4	X	
5 – 6		X
7 – 8	X	
9 – 10		X
11 – 12	X	
13 – 14		X
15 – 16	X	
17 – 18		X
19 – 20	X	
21 – 22		X
23 – 24	X	
25 – 26		X
27 – 28	X	
29 – 30		X
31 – 32	X	
33 – 34		X
35 – 36	X	
37 – 38		X
39 – 40	X	
41 – 42		X
43 – 44	X	
45 – 46		X
47 – 48	X	
49 – 50		X
51 – 52	X	
53 – 54		X
55 – 56	X	
57 – 58		X
59 – 60	X	
61 – 62		X
63 – 64	X	
65 – 66		X
67 – 68	X	
69 – 70		X
71 – 72	X	

FIGURE 12	MAINTAINED CONTACT TYPE
43	TRIP TRANSFER SWITCH

VS SWITCH *1



CONTACT	POSITION				
	OFF	TR1	TR2	TR3	TR4
1 – 2		X			
3 – 4		X			
5 – 6			X		
7 – 8			X		
9 – 10				X	
11 – 12				X	
13 – 14					X
15 – 16					X

FIGURE 13	MAINTAINED CONTACT TYPE
VS	VOLTMETER SELECTOR SWITCH

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวล.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

CABINET NO W1
RUN NO 4015

Bid No. TBA-SSC-05 and TWSC-05

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
10	–	ADD 81–CO, 27–CO AND 50/51OL–CO. REVISE CONTACTS OF 21–SG, PTT–CO, 43CCS AND 85–CO.	P.SIRAWICH	P.SIRAWICH						
9	–	ADD 21–SG, 86EF–CO, RSS CHANGE CONTACTS OF 87–CO, DTT–CO, 86A–CO, 43RCC, EPS, 50/51S–CO, PTT–CO, 43CCS, 85–CO,43, VS AND DELETE VTS, AS	J.WEERAYUT	J.WEERAYUT						
8	–	ADD STUB CUT–OFF SWITCH	S.Jirapa	–						
7	–	ADD PTTCO, EPS, CHANGE CONTACTS OF 43RCC,43CCS,85CO AND DELETE LOCKOUT RELAY	J.Surapong	–						
6	–	REPLACE MO BY DCS, CHANGE CONTATS OF 79CO,85CO AND LOCKOUT RELAY	–	–						

ISO 9001 TSEB1999
CAD CENTER
DO NOT AMEND MANUALLY

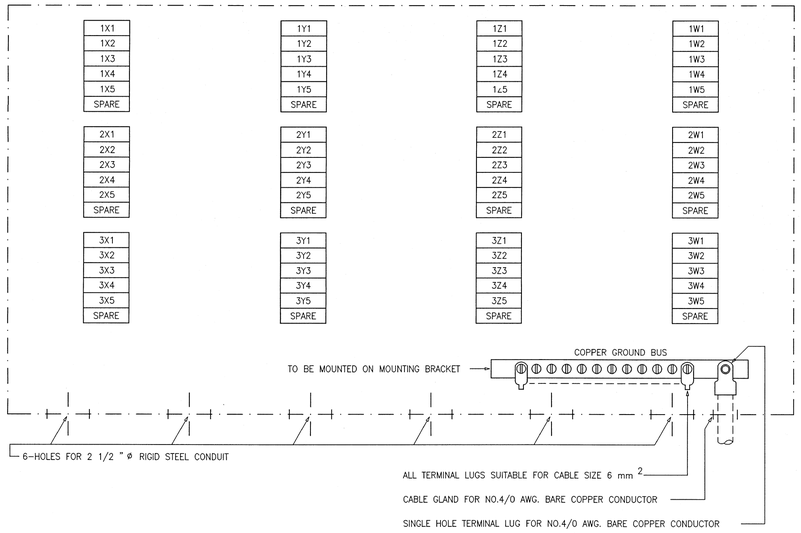
$$Filename
$$$$$$$$$$$$$Date
$$$$$$$$$$$$$Name

ELECTRICITY GENERATING AUTHORITY OF THAILAND

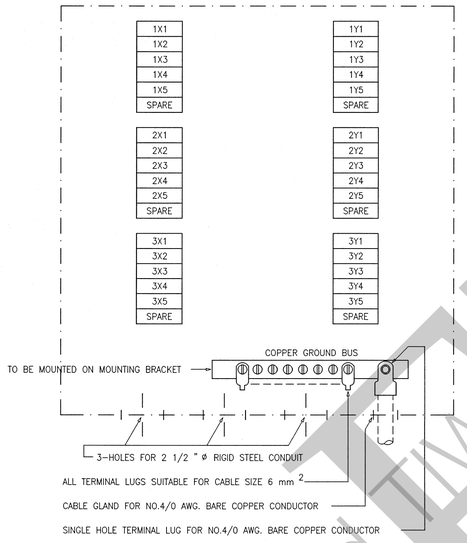
DRAWN	P.SIRAWICH	VALIDATED (CHIEF, CONTROL AND PROTECTION SYSTEM ENGINEERING DEPARTMENT)	DRAWING NAME: TYPICAL DRAWING
DESIGNED	P.SIRAWICH	RECOMMENDED (ASSISTANT DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION–1)	DESCRIPTION OF DETAIL DRAWING: CONTROL SWITCH AND SELECTOR SWITCH CONTACT TABULATION
VERIFIED	H. KANAPOT	CONCURRED (DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION)	
APPROVED (ASSISTANT GOVERNOR – TRANSMISSION SYSTEM DEVELOPMENT)		DATE 1 Mar 2024	JOB NO. – / REPLACING DWG.NO. – / DWG.NO. TP – E – 9.1 / REV. – 10

DWG.NO. TP- E - 18.2 | REV. - | 6

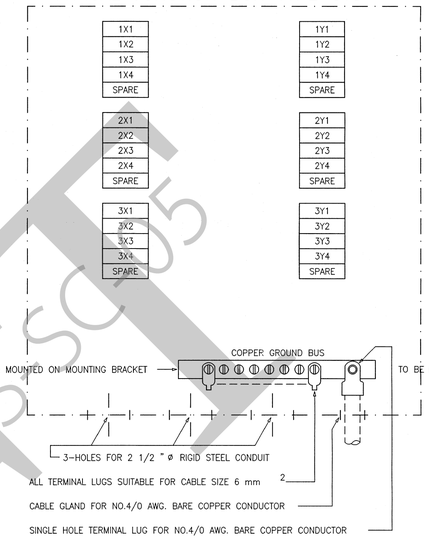
TYPICAL JUNCTION BOX TYPE CT1



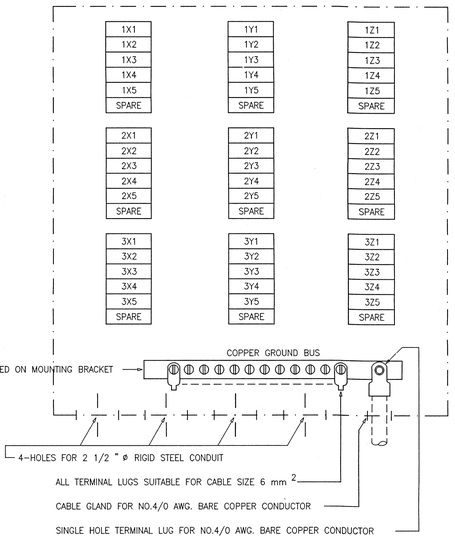
TYPICAL JUNCTION BOX TYPE CT2



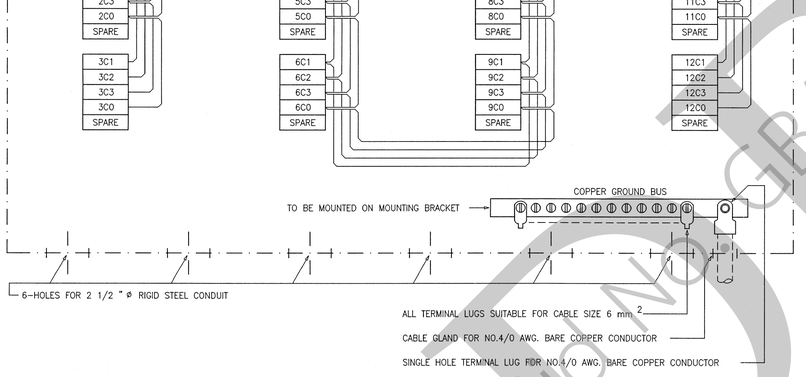
TYPICAL JUNCTION BOX TYPE CT3



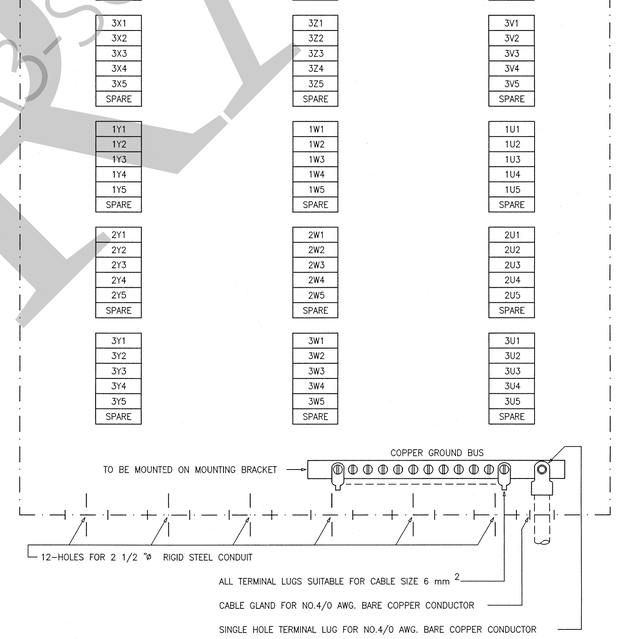
TYPICAL JUNCTION BOX TYPE CT7



TYPICAL JUNCTION BOX TYPE CT4



TYPICAL JUNCTION BOX TYPE CT6



NOTES

- THE FOLLOWING ACCESSORIES AND WIRING CONNECTION SHALL BE PROVIDED BY THE CONTRACTOR
  1. TERMINAL BLOCKS WITH DESIGNATION LABEL SUITABLE FOR COPPER CABLE SIZE UP TO 2x6 Sq.mm.PER TERMINAL,THESE TERMINAL BLOCKS SHALL BE OF 600 V MOLDED NONFLAMABLE THERMOSETTING MATERIAL TYPE WITH INSULATING BARRIER BETWEEN ADJACENT TERMINALS AND QUALITY SUITABLE FOR USE IN OUTDOOR CUBICLE.
  2. WIRING CONNECTION INDICATED BY SOLID LINE SHALL BE 6 Sq.mm. COPPER CABLE
  3. THE COPPER GROUND BUS SIZE SHALL BE 6 mm. THICK, 25 mm. WIDE OR 5 mm. THICK, 30 mm. WIDE, AND 530 mm. LONG COMPLETED WITH THE FOLLOWING ACCESSORIES :
     A. SCREWS 4 mm.DIAMETER AND TERMINAL LUGS AS SHOWN ON THIS DRAWING
     B. SINGLE HOLE TERMINAL LUG SUITABLE FOR BARE COPPER CONDUCTOR NO.4/0 AWG.
     C. STUD BOLT FOR FIXING WITH COPPER GROUND BUS
     D. CABLE GLAND SUITABLE FOR NO.4/0 AWG. BARE COPPER CONDUCTOR
  4. NAMEPLATE INDICATING TYPE OF JUNCTION BOX (AT THE FRONT OF THE BOX).
- THE FOLLOWING ACCESSORIES AND WIRING CONNECTION SHALL BE PROVIDED BY EGAT (FOR SUPPLY EQUIPMENT) OR BY CONTRACTOR (FOR TURN-KEY PROJECT)
  1. NO.4/0 AWG. BARE COPPER CONDUCTOR
  2. RIGID STEEL CONDUIT
  3. ALL SHIELD OF CONTROL CABLE SHALL BE SOLDERED TO 6 Sq.mm. INSULATED COPPER WIRE THEN CONNECTED TO COPPER GROUND BUS.
- THE DETAILS OF CT. JUNCTION BOXES CONSTRUCTION ARE SHOWN ON DWG.NO.TP-E-18.4

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

CABINET NO. W1
DWG. NO. 16.15

DRAFT
BIDDING GBA3-SC05 and TWSC05

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
6	-	REARRANGE TERMINAL BLOCKS OF CT6 JUNCTION BOX	P.Sarinya							
5	-	REVISE DETAIL FOR CT4	L.Ekarat							
4	-	REARRANGE TERMINAL BLOCKS OF ALL JUNCTION BOXES,REVISE CT6 AND VOID CT5	M.Chao							
3	-	REVISE NUMBER OF RSC CONDUIT BLOCK-OUT HOLES OF CT7 FROM 6 TO 4 AND REVISE TERMINAL BLOCKS OF CT3	J.jatupum	-	-	-	-	-	-	-
2	-	REVISE DETAIL FOR CT3 AND ADD CT7	S.thinnakorn	-	-	-	-	-	-	-

ISO 9001 TSEB1999
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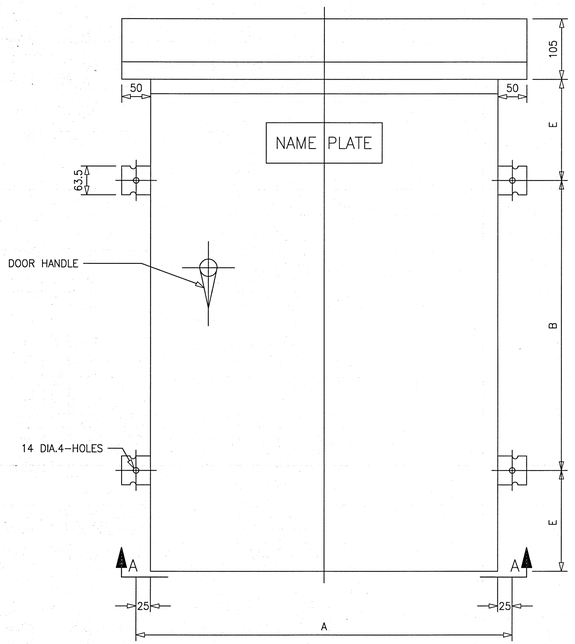
$$$$$$$$$$$$$$$$$$$$Date
$$$$$$$$$$$$$$$$$$$$Name

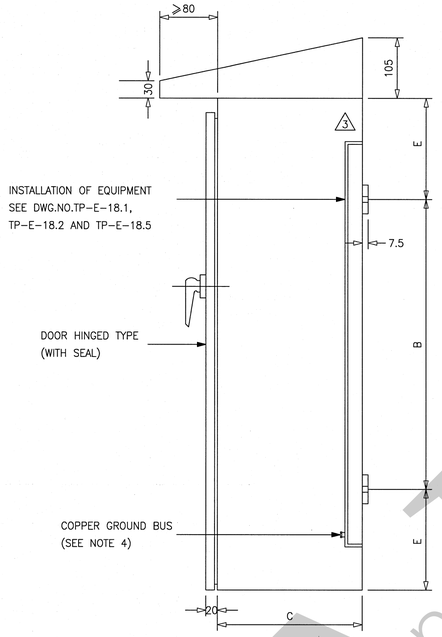
ELECTRICITY GENERATING AUTHORITY OF THAILAND

DRAWN	P.Sarinya	VALIDATED CHIEF, CONTROL & PROTECTION SYSTEM ENGINEERING DEPARTMENT	DRAWING NAME: TYPICAL CT.JUNCTION BOXS
DESIGNED	P.Sarinya	RECOMMENDED ASSISTANT DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION-1	DESCRIPTION OF DETAIL DRAWING: CT.JUNCTION BOX TYPICAL CONSTRUCTION
VERIFIED	H. KANAPOT	CONCURRED DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION	
APPROVED	ASSISTANT GOVERNOR – TRANSMISSION SYSTEM DEVELOPMENT	DATE 3/5/19	JOB NO. – / REPLACING DWG.NO. / DWG.NO. TP – E – 18.2 / REV. - 6

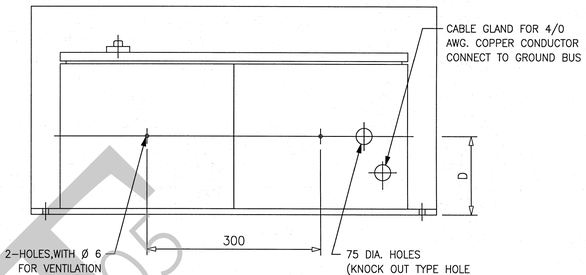
DWG.NO.	TP-E-18.4
REV.	-
11	-



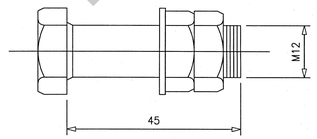
FRONT VIEW



SIDE VIEW



SECTION A-A



FIXING BOLT FOR JUNCTION BOXES
STAINLESS STEEL
4 PCS. FOR 1 SET

SIZE & DIMENSION OF JUNCTION BOXES

TYPE OF JUNCTION BOX	SYMBOL & DIMENSIONS IN MILLIMETERS A	B	C	D	E	NUMBER OF HOLES (KNOCK OUT TYPE)	REFERENCE DWG. DWG.NO.	SHEET
PT1	1100	900	250	125	150	6	TP-E-18.1	1
PT3	650	500	250	125	150	3	TP-E-18.1	1
PT4	450	500	250	125	150	2	TP-E-18.1	2
PT5	650	500	250	125	150	3	TP-E-18.1	2
PT6	650	500	250	125	150	3	TP-E-18.1	2
PT7	850	600	250	125	150	6	TP-E-18.5	1
PT8	450	500	250	125	150	2	TP-E-18.5	1
PT9	750	500	250	125	150	3	TP-E-18.1	2
PT11	650	500	250	125	150	3	TP-E-18.1	2
PT13	450	500	250	125	150	2	TP-E-18.1	4
PT14	850	600	250	125	150	6	TP-E-18.1	4
PT15	450	500	250	125	150	2	TP-E-18.1	4

SIZE & DIMENSION OF JUNCTION BOXES

TYPE OF JUNCTION BOX	SYMBOL & DIMENSIONS IN MILLIMETERS A	B	C	D	E	NUMBER OF HOLES (KNOCK OUT TYPE)	REFERENCE DWG.NO.
CT1	850	300	250	125	150	6	TP-E-18.2
CT2	450	300	250	125	150	3	TP-E-18.2
CT3	450	300	250	125	150	3	TP-E-18.2
CT4	850	300	250	125	150	6	TP-E-18.2
CT6	1000	700	250	125	150	12	TP-E-18.2
CT7	650	300	250	125	150	4	TP-E-18.2

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER.
2. THE DEGREE OF PROTECTION SHALL BE IP43 AS PER IEC 60529.
3. MATERIAL – STAINLESS STEEL SHEET WITH 2 mm THICK AND PAINT FINISHED AFTER FABRICATION AS INDICATED IN SPECIFICATION
4. THE COPPER GROUND BUS SIZE SHALL BE 6 mm THICK, 25 mm WIDTH AND THE LENGTH SHALL BE NOT LESS THAN 40 PERCENT OF DIMENSION "A" OF EACH JUNCTION BOX.
5. THE DIMENSION OF JUNCTION BOX SHALL BE AS SHOWN IN THE TABLE HERE IN. HOWEVER THE DIMENSION "B" MAY BE ADJUSTED TO SUIT THE SIZE OF TERMINAL BLOCK PROVIDED.

REFERENCE DRAWINGS

TYPICAL PT & CCVT JUNCTION BOXES.....DWG.NO.TP-E-18.1 SHEET 1, 2 & 4, TP-E-18.5 SHEET 1

TYPICAL CT JUNCTION BOXES.....DWG.NO.TP-E-18.2

CABINET NO. W1
RUN NO. 4030

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
11	-	ADD PT14 & PT15, REMOVE PT10 & PT12 AND REVISE PT4	P. Rakneung	-	-	-	-	-	-	-
10	-	REVISE TO CONFORM WITH CONTROL AND PROTECTION'S STANDARD 2015	R.RUHARN	-	-	-	-	-	-	-
9	-	REVISE ALL DIMENSIONS OF JUNCTION BOXES, ADD PT6	S.Jirapa	-	-	-	-	-	-	-
8	-	REVISE ALL DIMENSIONS OF JUNCTION BOXES AND ADD PT12	J.Surapong	-	-	-	-	-	-	-

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ELECTRICITY GENERATING AUTHORITY OF THAILAND

DRAWN P. RAKNEUNG	VALIDATED CHIEF, CONTROL AND PROTECTION SYSTEM ENGINEERING DEPARTMENT	DRAWING NAME	TYPICAL DRAWING
DESIGNED P. RAKNEUNG	RECOMMENDED ASSISTANT DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION-1	DESCRIPTION OF DETAIL DRAWING	PT AND CT JUNCTION BOX TYPICAL CONSTRUCTION
VERIFIED	CONCURRED DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION		
APPROVED ASSISTANT GOVERNOR – TRANSMISSION SYSTEM DEVELOPMENT	DATE 28 June 2021	JOB NO. -	REPLACING DWG.NO. TP-E-18.4 REV.10 / DWG.NO. TP-E-18.4 / REV. - 11

DRAFT
BID NO. GRASS-SC-05 and TIWS-SC-05

DWG.NO. SD-AB-0-01 | REV. 01 | 01 | 7

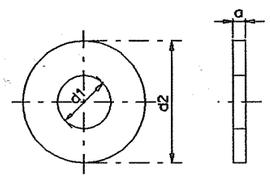
TABLE FOR RING FILLERS Unit : mm

Nominal Diameter d	d1 Nominal	d1 Tolerance	d2 Nominal	d2 Tolerance
M12	13.5	+0.7 −0	30.0	+0 −1.0
M16	17.5	+0.7 −0	40.0	+0 −1.0
M20	21.5	+0.8 −0	50.0	+0 −1.0
4 M22	23.5	+0.8 −0	57.0	+0 −1.0
M24	25.5	+0.8 −0	65.0	+0 −1.0
M28	29.5	+0.8 −0	75.0	+0 −1.0
M32	33.5	+0.8 −0	85.0	+0 −1.0

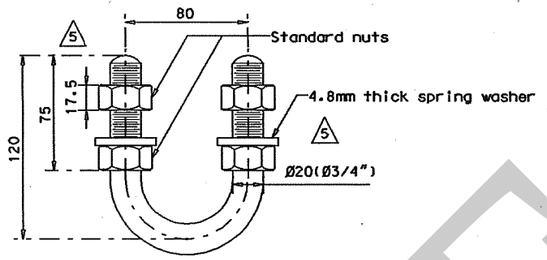
RING FILLERS

Unit : mm

a	Tolerance
4, 5	±0.5
6	±0.7
8	±0.7
9	±0.7
12	±1.0



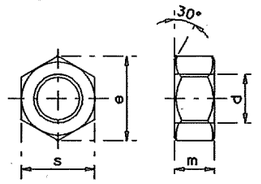
RING FILLER



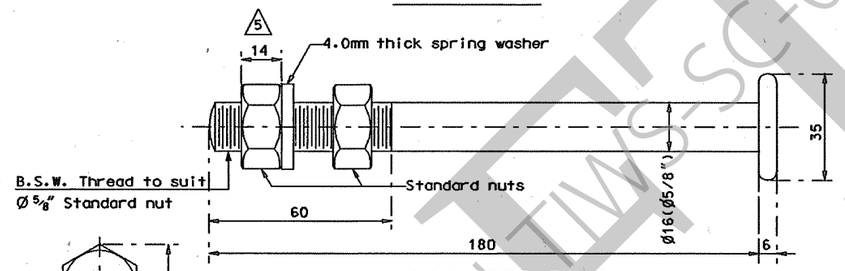
M20 U-BOLT

4 TABLE FOR HEX NUT Unit : mm

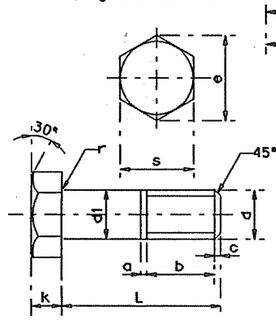
Nominal Diameter d	m Nominal	m Tolerance	s Nominal	s Tolerance	e Approx
M12	10.5	±0.8	18.0	+0 −0.8	20.8
M16	14.0	±0.9	24.0	+0 −0.8	27.7
M20	17.5	±0.9	30.0	+0 −0.8	34.6
7 M22	19.2	±0.9	32.0	+0 −1.0	38.1
M24	21.0	±1.0	36.0	+0 −1.0	41.6
M28	24.5	±1.0	42.0	+0 −1.0	48.5
M32	28.0	±1.0	48.0	+0 −1.0	55.4
M36	31.5	±1.0	54.0	+0 −1.2	62.4
M39	34.1	±1.2	58.5	+0 −1.2	67.6
M42	36.1	±1.2	63.0	+0 −1.2	72.7
M60	52.5	±1.2	90.0	+0 −1.4	103.9



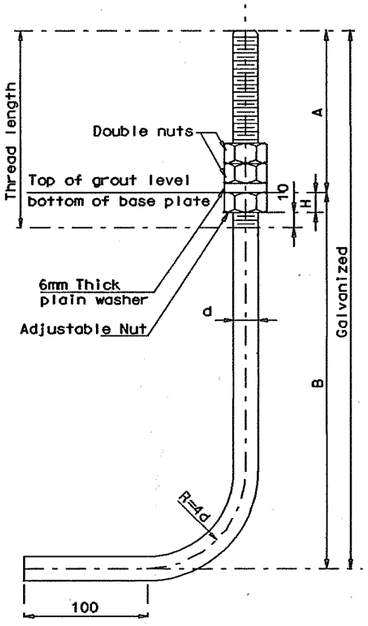
HEX NUT



M16 STEP BOLT



HEX BOLT



ANCHOR BOLT DETAIL

TABLE FOR ANCHOR BOLTS

Anchor bolt size (mm)	Diameter d (mm)	A (mm)	Embeded Length B (mm)	Nut Width H (mm)	Radius R (mm)
M 16x555x100 128mm Thread length	16	105	450	13	64
M 20x712x100 138mm Thread length	20	112	600	16	80
M 22x818x100 146mm Thread length	22	118	700	18	88
M 25x924x100 (OR M24) 153mm Thread length	24 25	124	800	19	100
M 28x1036x100 168mm Thread length	28	136	900	22	112
M 32x1142x100 178mm Thread length	32	142	1000	26	128
M 35x1253x100 192mm Thread length	35	153	1100	29	140
M 38x1357x100 198mm Thread length	38	157	1200	31	152
M 42x1427x100 221mm Thread length	42	177	1250	34	168
5 M 45x1585x100 231mm Thread length	45	185	1400	36	180
M 60x2142x100 250mm Thread length	60	192	1950	48	240

TABLE FOR HEX BOLTS(JIS) 6

Unit : mm

Nominal Diameter d	d1 Nominal	d1 Tolerance	k Nominal	k Tolerance	s Nominal	s Tolerance	e Approx	r Nominal	c Approx	a Approx	b Nominal	b Tolerance	L Tolerance Upto 50	L Tolerance Over 50 upto 120
M12	12.0	+0.9 −0.2	8.0	±0.8	19.0	+0 −0.8	21.9	0.6	2.0	2.0	19.5	+1.0 −0	±1.0	±1.4
M16	16.0	+0.9 −0.2	10.0	±0.8	24.0	+0 −0.8	27.7	0.6	2.0	2.0	22.0	+1.0 −0	±1.0	±1.4
M20	20.0	+0.95 −0.35	13.0	±0.9	30.0	+0 −0.8	34.6	0.8	2.5	2.5	26.5	+1.0 −0	±1.0	±1.4
M24	24.0	+0.95 −0.35	15.0	±0.9	36.0	+0 −1.0	41.6	0.8	2.5	3.0	34.0	+1.0 −0	±1.0	±1.4
M28	28.0	+0.95 −0.35	18.0	±0.9	42.0	+0 −1.0	48.3	1.0	2.5	3.0	40.5	+1.0 −0	±1.0	±1.4
M32	32.0	+1.20 −0.40	21.0	±1.0	50.0	+0 −1.0	57.7	1.0	2.5	3.5	47.0	+1.0 −0	±1.0	±1.4

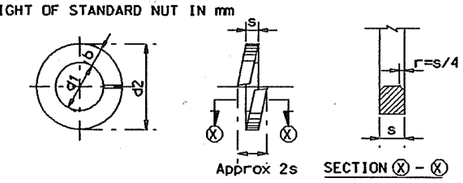
TABLE FOR HEX BOLTS(ANSI) 4

Unit : mm

Nominal Diameter d	d1 Nominal	d1 Tolerance	k Nominal	k Tolerance	s Nominal	s Tolerance	e Approx	r Nominal	c Approx	a Approx	b Nominal	b Tolerance	L Tolerance Upto 50	L Tolerance Over 50 upto 120
M12	12.0	+0.9 −0.2	8.2	±0.8	17.7	+0 −0.8	23.0	0.6	2.0	2.0	19.5	+1.0 −0	±1.0	±1.4
M16	16.0	+0.9 −0.2	10.1	±0.8	24.0	+0 −0.8	27.1	0.6	2.0	2.0	22.0	+1.0 −0	±1.0	±1.4
M20	20.0	+0.95 −0.35	13.0	±0.9	30.0	+0 −0.8	33.9	0.8	2.5	2.5	26.5	+1.0 −0	±1.0	±1.4
M22	22.0	+0.95 −0.35	14.6	±1.1	33.0	+0 −0.8	37.3	0.8	2.5	2.5	30.0	+1.0 −0	±1.0	±1.4
M24	24.0	+0.95 −0.35	17.0	±1.3	36.0	+0 −0.8	40.6	0.8	2.5	2.5	34.0	+1.0 −0	±1.0	±1.4
M28	28.0	+0.95 −0.35	18.8	±1.5	40.0	+0 −0.8	47.4	0.8	2.5	2.5	40.5	+1.0 −0	±1.0	±1.4
M32	32.0	+0.95 −0.35	21.5	±1.6	43.4	+0 −0.8	54.2	0.8	2.5	2.5	47.0	+1.0 −0	±1.0	±1.4

5 NOTES

1. ALL DIMENSIONS ARE IN MILLIMETER.UNLESS OTHERWISE SHOWN
2. ALL MATERIAL SHALL CONFORM TO THE FOLLOWING DESIGNATION OR EQUIVALENT
   - HEX.BOLT.....ASTM A394 TYPE O
   - HEX. NUT.....ASTM A563 CLASS A
   - U-BOLT.....ASTM A394 TYPE O UNLESS OTHERWISE NOTED
   - SPRING WASHER.....ASTM A394 TYPE O UNLESS OTHERWISE NOTED.
   - RING FILLER.....JIS SS 400
   - PLAIN WASHER .....JIS SS 400
   - ANCHOR BOLTS .....A 307 CLASS C
   - STEP BOLTS .....A 307 CLASS A
3. ALL MATERIALS SHALL BE HOT-DIP GALVANIZED TO MEET THE REQUIRMENT OF ASTM A 153 AFTER FABRICATION
4. LENGTH OF ANCHOR SHALL BE AS SHOWN IN TABLE FOR ANCHOR BOLT UNLESS OTHERWISE SHOWN ON THE INDIVIDUAL TYPICAL DRAWING.
5. COMPLETE SET OF BOLT SHALL BE AS FOLLOWING ASSEMBLY UNLESS
   - CONNECTION BOLT.....1 BOLT. 1 NUT AND 1 SPRING WASHER
   - ANCHOR BOLT.....1 BOLT. 3 NUT AND 2 PLAIN WASHER OF 6mm.THK.
   - STEP BOLT.....1 BOLT.2 NUT AND 1 SPRING WASHER
   - U-BOLT.....1 BOLT.4 NUT AND 2 SPRING WASHER
6. THREADS FOR STEP BOLT TO BE UNDER CUT BY 0.3mm FOR GALVANIZING
7. ALL NUTS SHALL BE STANDARD HEXAGONAL.
8. H=HEIGHT OF STANDARD NUT IN mm



SPRING LOCK WASHER

6 TABLE FOR SPRING LOCK WASHERS(JIS)

Unit : mm

Nominal Diameter d	d1 Nominal	d1 Tolerance	d2 Max.	b Min.	s Min.
M12	12.2	+0.6 −0	21.5	4.2	3.0
M16	16.2	+0.8 −0	28.0	5.2	4.0
M20	20.2	+0.8 −0	33.8	6.1	5.1
M24	24.5	+1.0 −0	40.3	7.1	5.9
7 M28	28.2	+1.2 −0	46.3	8.2	7.0
M32	32.2	+1.4 −0	53.7	9.1	8.0

4 TABLE FOR SPRING LOCK WASHERS(ANSI)

Unit : mm

Nominal Diameter d	d1 Nominal	d1 Tolerance	d2 Max.	b Min.	s Min.
M12	12.2	+0.8 −0	21.5	4.3	3.2
M16	16.2	+0.8 −0	27.6	5.2	4.0
M20	20.2	+0.8 −0	33.3	6.0	4.8
M22	22.2	+0.8 −0	36.5	6.6	5.4
M24	24.2	+0.8 −0	39.8	7.2	5.9
M28	28.2	+0.8 −0	46.2	8.3	7.0
M32	32.2	+0.8 −0	52.5	9.3	8.1

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสธร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
7 มิถุนายน 2568

CABINET NO. V5
RUN NO. 1601

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
7	-	Revised size of Nut & Washers	P.ธรรศวัฒน์	P.Lerwate	-	-	-	-	-	-
6	-	Add JIS Hex bolts and spring washers tables	P.ธรรศวัฒน์	P.Lerwate	-	-	-	-	-	23/9/2553
5	-	Add size of M45 anchor bolt and revise notes and illustrations	P.ธรรศวัฒน์	P.Lerwate	-	-	-	-	-	8/9/2552
4	-	Add details of M22 hex bolt and spring lock washer and revise drawing as per ANSI standards	P.ธรรศวัฒน์	P.Lerwate	-	-	-	-	-	19/6/2552
3	-	Additional sizes of ring filler, hex nut, hex bolt , and spring washer	P.ธรรศวัฒน์	P.Lerwate	-	-	-	-	-	12/6/2551

ELECTRICITY GENERATING AUTHORITY OF THAILAND

DRAWN P.ธรรศวัฒน์ | DESIGNED เสถียร | VERIFIED | APPROVED | DATE 17/10/11

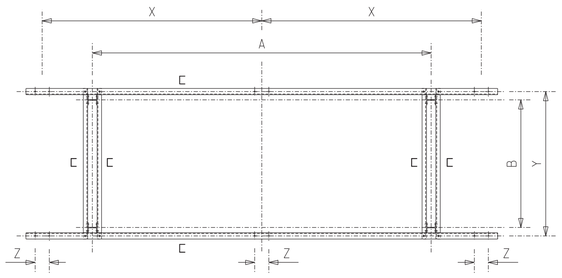
VALIDATED ... CHIEF, TRANSMISSION SYSTEM CIVIL ENGINEERING DEPARTMENT
RECOMMENDED ... ASST.DIR.TRANSMISSION SYSTEM ENGINEERING DIV.-TRAN.LINE
CONCURRED ... DIRECTOR TRANSMISSION SYSTEM ENGINEERING DIVISION
ASSISTANT GOVERNOR - TRANSMISSION SYSTEM ENGINEERING

DRAWING NAME: STANDARD DRAWING
DESCRIPTION OF DETAIL DRAWING: DETAILS OF STANDARD BOLTS, NUTS, RING FILLERS, SPRING LOCK WASHERS
JOB NO. -
REPLACING DWG.NO. SD-AB-0-01-01/01r.6
DWG.NO. SD-AB-0-01
REV. 01 | 7

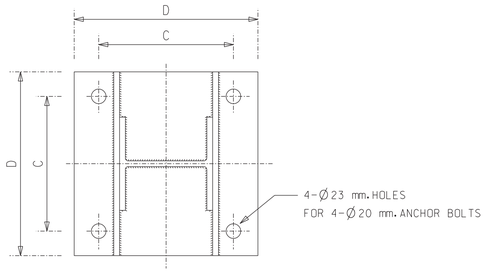
DRAFT
BIDP No. GB63-SC05

SD-AB-0-01R7.DGN
2011 09:55

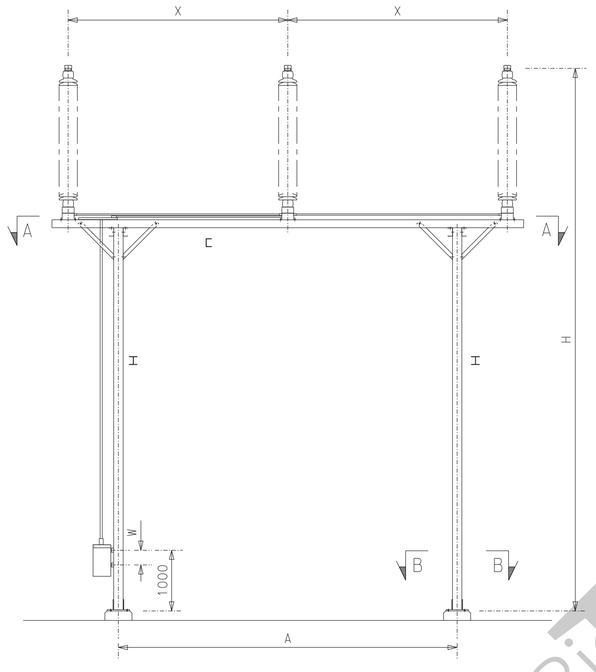
DWG.NO.	ST-DS-4-01	01	REV.



SECTION A-A



SECTION B-B



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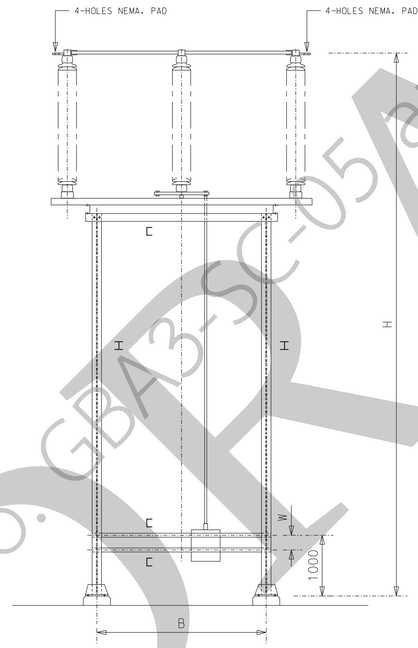


SIDE VIEW

ITEM	DESIGNATION	STR. MKD.	DIMENSION (mm.) A	B	C	D	H	X	W	Y	Z	REMARK
1	69 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS6-1	2,400	1,000	220	300	5,000	2,000				
2	69 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS6-2	2,400	1,000	220	300	5,000	1,550				
3	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-1	2,900	1,100	220	300	5,000	2,250				
4	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-2	2,900	1,100	220	300	5,300	2,250				
5	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-3	2,900	1,100	220	300	5,500	2,250				
6	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-4	2,900	1,100	220	300	5,053	2,250				
7	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-5	2,900	1,100	220	300	4,100	2,250				
8	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-6	2,900	1,100	220	300	5,800	2,250				
9	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-7	2,900	1,100	220	300	7,300	2,250				
10	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-8	2,900	1,100	220	300	5,300	2,130				
11	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-9	2,900	1,100	220	300	3,800	2,250				
12	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-10	2,900	1,100	220	300	7,300	2,000				
13	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-11	2,900	1,100	220	300	3,800	2,000				
14	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-12	2,900	1,100	220	300	4,500	2,250				
15	115 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS7-13	2,900	1,100	220	300	4,500	2,500				
16	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-1	4,500	2,200	220	300	5,250	3,500				
17	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-2	4,500	2,200	220	300	6,000	3,500				
18	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-3	4,500	2,200	260	350	9,000	3,500				
19	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-4	6,000	2,200	260	350	6,000	5,000				
20	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-5	4,500	2,200	220	300	5,520	3,500				
21	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-6	4,500	2,200	260	350	8,520	3,500				
22	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-7	4,500	2,200	260	350	8,250	3,500				
23	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-8	6,000	2,200	220	300	5,720	4,500				
24	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-9	6,000	2,200	260	350	9,000	5,000				
25	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-10	4,500	2,200	220	300	5,250	3,400				
26	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-11	4,500	2,200	220	300	6,000	3,400				
27	230 kV DISCONNECTING SWITCH SUPPORTING STRUCTURE	GDS8-12	4,500	2,200	220	300	9,000	3,400				

DEPEND ON THE MANUFACTURE'S DESIGN

DEPEND ON THE MANUFACTURE'S DESIGN

DEPEND ON THE MANUFACTURE'S DESIGN

Bid No. GBA3-SC-0505 and Twsp-05

DRAFT

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-ร. กสส-ร. อวส.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

NOTE

1. ALL DIMENSION ARE IN MILLIMETER EXCEPT AS NOTED

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE
3	-	ADDITIONAL ITEM GDS7-13	-	-	-	-	-	-	-	-
2	-	ADDITIONAL ITEM NO.14	-	-	-	-	-	-	-	-
1	-	ADDITIONAL ITEM NO.25, 26 AND 27	-	-	-	-	-	-	-	-
-	-	ADDITIONAL ITEM NO.11, 12, 13 AND 23	-	-	-	-	-	-	-	-

ISO 9001 TSE-TSP : 2008

CAD CENTER

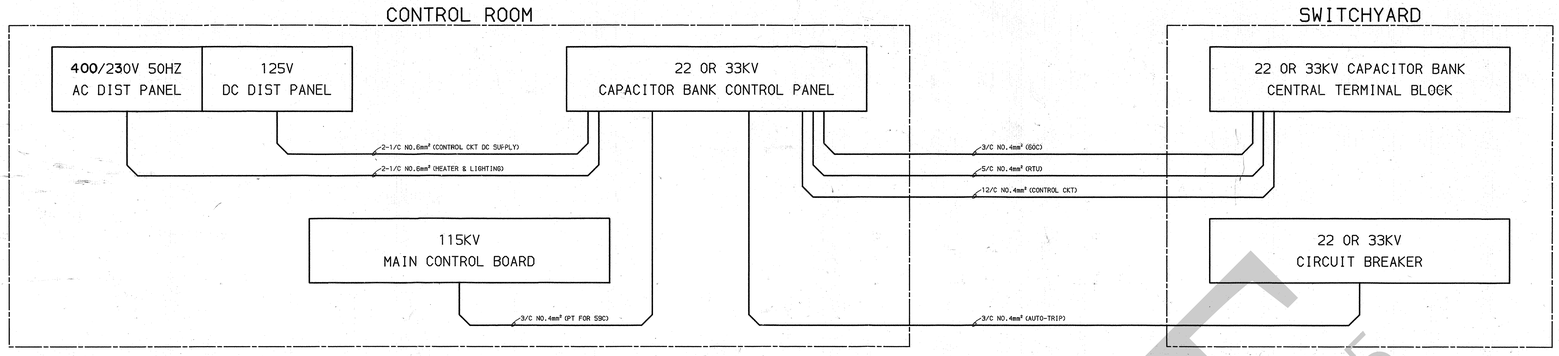
DO NOT AMEND MANUALLY

ELECTRICITY GENERATING AUTHORITY OF THAILAND

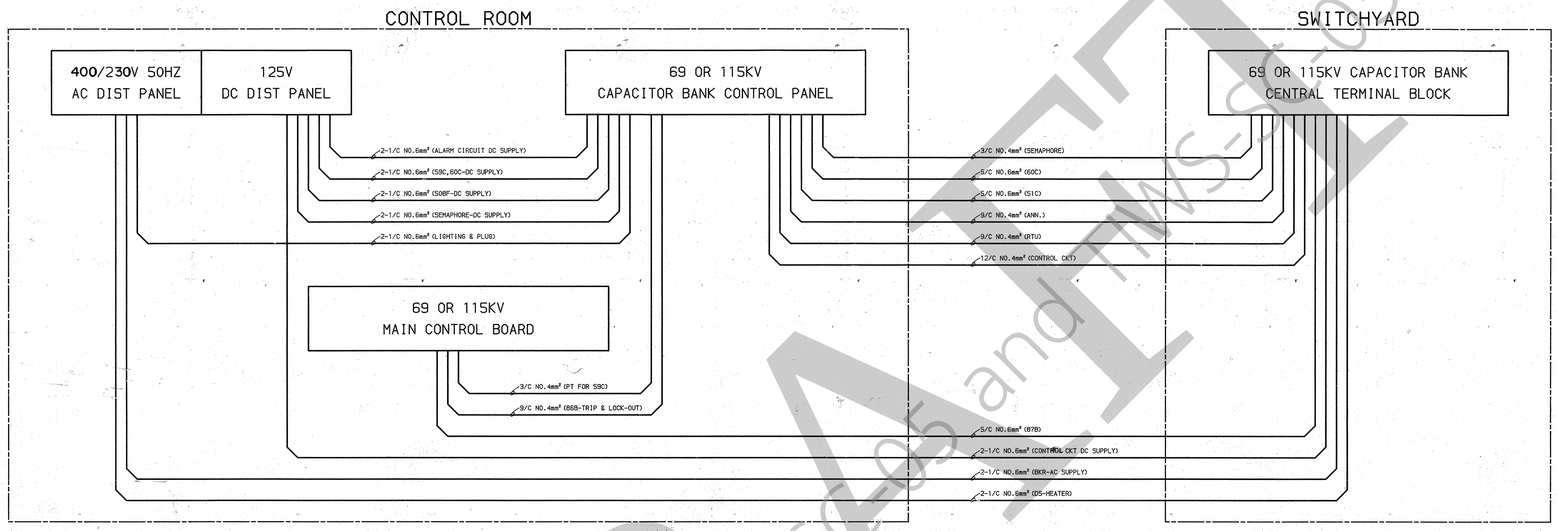
DRAWN M.TACHAKORN	RECOMMENDED AND VALIDATED ..... CHIEF-SUBSTATION ENGINEERING DEPARTMENT	DRAWING NAME	STANDARD DRAWING
DESIGNED	CONCURRED ..... ASSISTANT DIRECTOR-TRANSMISSION SYSTEM ENGINEERING DIVISION	DESCRIPTION OF DETAIL DRAWING	DISCONNECTING SWITCH STRUCTURE
VERIFIED	APPROVED ..... DIRECTOR, TRANSMISSION SYSTEM ENGINEERING DIVISION DATE 21 Feb 2024	JOB NO. -	REPLACING DWG.NO. ST-DS-4-01 (REV.2)
		DWG.NO. ST-DS-4-01	REV. 01 / 3

DWG.NO.	STD-CAP-E-7.1
REV.	00
	0

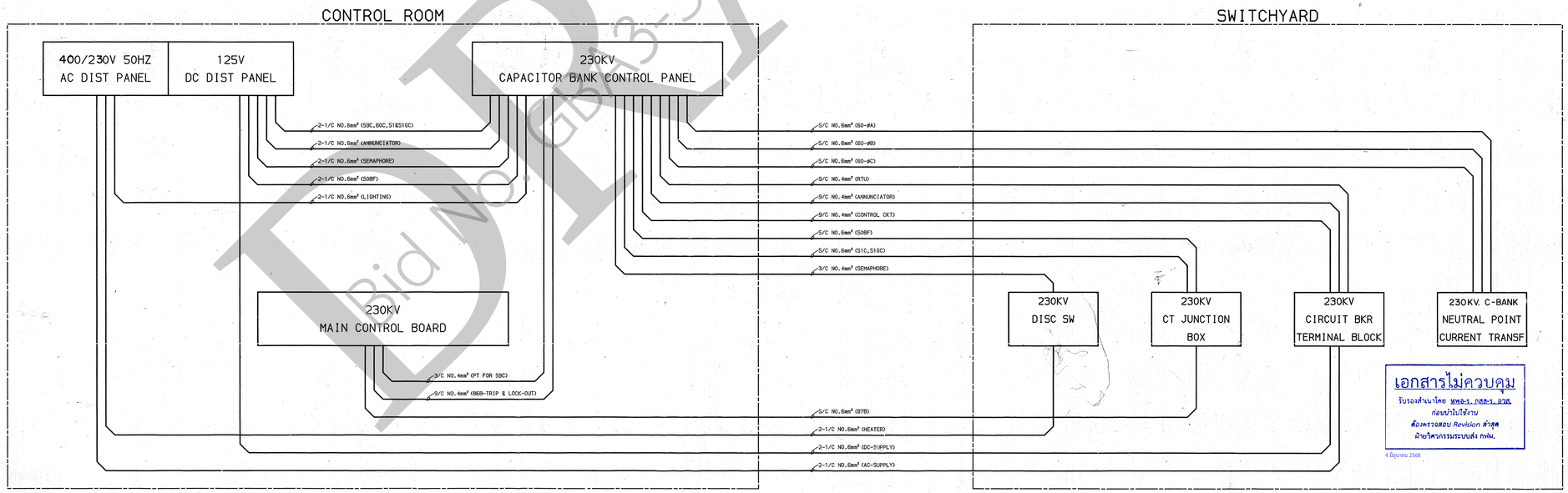
22KV OR 33KV CAPACITOR BANK



69KV OR 115KV CAPACITOR BANK



230KV CAPACITOR BANK



NOTES

1. THIS DRAWING SHOWS THE SIZE AND NUMBER OF THE CABLES THAT LINK BETWEEN THE EQUIPMENT IN SWITCHYARD AND THE EQUIPMENT IN CONTROL ROOM FOR 22KV OR 33KV SHUNT CAPACITOR BANK, 69KV OR 115KV SHUNT CAPACITOR BANK, AND 230KV SHUNT CAPACITOR BANK.
2. FOR THE DISTANCE BETWEEN THE EQUIPMENT IN SWITCHYARD AND THE EQUIPMENT IN CONTROL ROOM OF EACH SUBSTATION SEE THE RELEVANT DRAWINGS OF THAT SUBSTATION.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETING ALL INSTALLATION WORK OF SHUNT CAPACITOR BANKS UNDER THE SUPERVISION OF EGAT'S ENGINEERS.
4. ALL MATERIALS REQUIRED FOR THIS INSTALLATION WORK SHALL BE SUPPLIED BY EGAT.

Bid No. IGBA 13-SCA-05 and TWS-SA-05

เอกสารไม่ควบคุม
รับรองสำเนาโดย หหอ-1, กสธ-1, ลวช.
ก่อนนำไปใช้งาน
ต้องตรวจสอบ Revision ล่าสุด
ฝ่ายวิศวกรรมระบบส่ง กฟผ.
4 มิถุนายน 2568

NO.	JOB ASSIG.	JOB DESCRIPTION & REVISION	DRAWN	DESIGNED	CHECKED	ASST.CSE	ENGR.IC				SUBMITTED	RECOMMENDED	CONCURRED	APPROVED	DATE

ELECTRICITY GENERATING AUTHORITY OF THAILAND

DESIGNED Kasem	ASST. CSE.	ENGR.IC Jarus	SUBMITTED Chi. Suwich CHIEF INDUSTRIAL CONSULTANT DIV.	STANDARD CAPACITOR BANK
DESIGN Suthee			RECOMMENDED Suthee ASST.DIRECTOR TRANSMISSION SYSTEM ENGINEERING DEPT.	CABLE ROUTING OF 22 OR 33KV,69 OR 115KV AND 230KV SHUNT CAPACITOR BANK
DRAWN S.NOPPAKUN			CONCURRED K.Chai DIRECTOR TRANSMISSION SYSTEM ENGINEERING DEPT.	
CHECKED				
APPROVED S. Chaupo DEPUTY GENERAL MANAGER-POWER PLANS AND TRANSMISSION SYSTEM DEVELOPMENT			DATE Sept 2,'92	JOB NO. / REPLACING DWG.NO. / DWG.NO. STD-CAP-E-7.1 / REV. 00 0

CABINET NO. W1 1093

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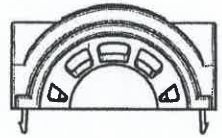
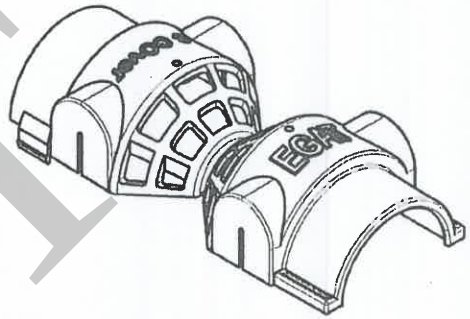
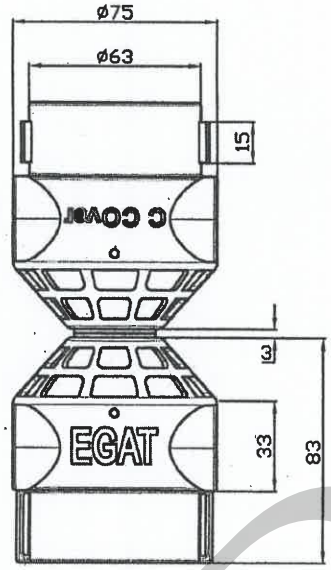
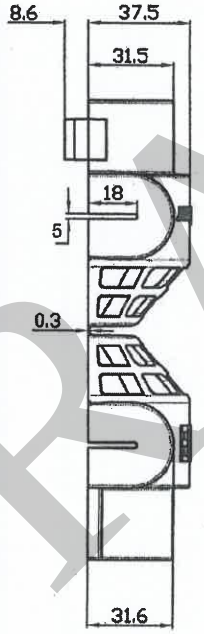
11-AUG-92 10:34:20
V 8

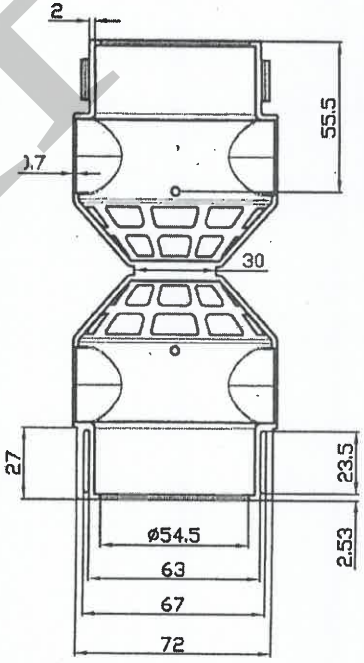
RevNo	Revision note	Date	Signature	Checked











DRAFT

PART NAME : MODEL	MAT. :	UNIT IN : MM.	PAPER SIZE: A4
PART No : –	SIZE :	SCALE : 2:5	
TITLE : C UNIT BUSH COVER	DATE :	DESIGN By :	
DRW No	SHRINKAGE	CHECK By :	
VENDOR	PLASTIC MAT.	APPROVE By :	