PRINCETON PLASMA PHYSICS LABORATORY

ENG-060 - SOW - STATEMENT OF WORK

Medium Voltage Breaker Purchase and Replacement

NSTXU_1-5-1-1-4_SOW_101

Work Planning #: **3032**
Effective Date: **11/25/2019**
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PRINCETON PLASMA PHYSICS LABORATORY
P.O. BOX 451 PRINCETON, N.J. 08543

STATEMENT OF WORK AND TECHNICAL SPECIFICATIONS

FOR

Medium Voltage Breaker Purchase and Refurbishment

CAT: A1

NSTXU_1-5-1-1-4_SOW_101

REVISION 0

Reference Work Planning # 3032

DATED November 19, 2019

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PRINCETON PLASMA PHYSICS LABORATORY

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609-243-2000

RECORD OF CHANGES

Rev #	Date	Description of Changes
0	11/19/19	Initial Release

1.0 INTRODUCTION & SCOPE

1.1 Princeton Plasma Physics Laboratory (PPPL), on Princeton University's Forrestal Campus in Plainsboro, N.J., is devoted to understanding the physics of plasmas and to developing practical solutions for the creation of fusion energy. PPPL is managed by Princeton University for the U.S. Department of Energy's Office of Science, which is the largest single sponsor of basic research in the physical sciences in the United States.

1.2 In furtherance of its mission, PPPL will require support (hereinafter referred to as "Work") from a qualified firm (hereinafter referred to as "Subcontractor") to provide new ABB replacement medium voltage circuit breakers, and to modify and refurbish existing medium voltage circuit breakers and cubicles. Work will include but is not limited to:

1.2.1 Furnish two (2) new ABB Type VHKX medium voltage circuit breakers as prescribed in Attachment 3 herein.

1.2.2 Perform in situ modifications on one (1) existing spare switchgear cubicle (S1-B1) to accept one of the two new breakers identified in 1.2.1 above (one breaker will be a PPPL spare) as prescribed in Attachment 3 herein.

1.2.3 Modify and refurbish twenty four (24) 15 kV ABB Type HK, and six (6) ABB Type VHKX circuit breakers, including installation of under-voltage (UV) trip devices on all refurbished circuit breakers as prescribed in Attachment 4 herein..

2.0 APPLICABLE DOCUMENTS

The codes and standards listed below shall be considered part of this Specification. The latest revision in effect on the date of this Specification shall apply to all codes and standards referenced.

2.1 IEEE C37.06 AC High-Voltage Circuit Breakers Rated on Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities

2.2 IEEE C37.09 Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

2.3 IEEE C37.010 Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

2.4 IEEE C37.11 Requirements for Electrical Control for AC High Voltage Circuit Breakers

2.5 IEEE C37.12 Guide to Specifications for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis or a Total Current Basis

2.6 IEEE C37.20.2 Standard for Metal-Clad Switchgear

2.7 IEEE C37.59 Requirements for Conversion of Power Switchgear Equipment

2.8 Original 13.8 kV breaker replacement specifications Ebasco Services Inc., *PPPL Project I.D. 0401, 13.8 KV 60 Hertz Switchgear, Removable Circuit Breaker Type* (reference only, furnished under separate cover).

3.0 APPLICABLE DRAWINGS

3.1 Gould Switchgear Division 160239, Rev. 0, 2 sheets, *HK Wiring Diagram/AC/DC Charge, DC Close, AC/DC Trip* (reference only, furnished under separate cover)

4.0 RESPONSIBILITIES

4.1 PRINCETON PLASMA PHYSICS LABORATORY

4.1.1 PPPL shall designate a technical contact, the Princeton Technical Representative (PTR) and a Quality Assurance (QA) contact at the time of the award. All communications on administrative matters shall be directed to the PPPL Procurement Representative.

4.1.2 The PTR will coordinate all work by the Subcontractor on-site, including scheduling, de-energizing, equipment staging, and site access authorization for Subcontractor personnel and equipment. PTR will coordinate to minimize systems down time.

4.1.3 All communications on technical matters shall be directed to the assigned PTR.

4.1.4 PPPL permits all employees to issue a “STOP WORK” Order, if unsafe work practices are observed.

4.1.5 PPPL will approve submittal drawings for release.

4.1.6 PPPL will provide approval for recommendations given by Subcontractor in the detailed incoming inspection report for all refurbished circuit breakers.

4.1.7 PPPL will provide means for loading and removing the breakers from delivery trucks when they arrive on site.

4.1.8 Installation and onsite testing of newly-purchased and refurbished breakers will be performed by PPPL in accordance with PPPL-prepared procedures. PPPL will collaborate with the Subcontractor in preparation of these procedures.

4.2 SUBCONTRACTOR

4.2.1 The Subcontractor shall provide a single point of contact for any communication between PPPL and the Subcontractor.

4.2.2 In the event work has stopped, due to unsafe conditions or other related construction activity, the Subcontractor shall notify the Princeton Technical Representative immediately. See “Notification Requirements Off-Normal Events and Issues” (Attachment 1).

4.2.3 The Subcontractor shall provide all labor, materials, equipment, and construction supervision services necessary to complete the proposed work in accordance with this Statement of Work and Technical Specifications (hereinafter referred to as "SOW"), the referenced codes and standards, and the project requirements. Means and methods to complete the specified project scope are the responsibility of the Subcontractor and shall be reviewed by PPPL. Conditions requiring temporary services (i.e. electric, water, HVAC, lighting, etc.) shall be provided by the Subcontractor.

4.2.4 The Subcontractor is responsible to verify and confirm the scope of work within this Statement of Work and referenced construction documents. All questions regarding the scope of work shall be received prior to bid.

4.2.5 Work shall be performed in accordance with OSHA requirements.

4.2.6 The Subcontractor is responsible for maintaining their work areas clean and free of hazards; work areas shall be left in a safe and clean condition at completion of work day.

4.2.7 All work should be completed during normal working hours of 7:00 AM to 5:00PM, Monday through Friday. Alternate work hours may be negotiated by mutual agreement between PPPL and the Subcontractor.

4.2.8 Periodic status meetings shall be held by the Subcontractor with PPPL representatives present. Status meetings shall be held on a weekly basis unless otherwise agreed upon by the PTR. Meeting minutes delineating all action items shall be kept by the Subcontractor and distributed to all attendees.

4.2.9 A government issued Photo ID is required for Subcontractor access to PPPL.

4.2.10 The Subcontractor shall notify and obtain PPPL written approval for any lower-tier Subcontractor proposed for this project, prior to their arrival on site.

4.2.11 The Subcontractor shall protect any and all infrastructure within the project limits to prevent damage during work activities.

4.2.12 Subcontractor agrees to employ in the performance of Work only qualified personnel. Qualification documentation (certifications, training/experience statements, licenses, etc.) shall be provided to the PTR prior to the arrival of personnel on-site so that a review can be completed without delaying the work.

4.2.13 The Subcontractor shall verify functional operation of all circuit breaker interlocks, cell interfaces and levering assembly at the cell location for which the new circuit breaker is installed. The services of a factory trained service technician shall be included to accomplish and verify this conformance.

4.2.14 The Subcontractor shall verify functional operation of the new circuit breaker cell modifications. This includes functional racking, breaker frame grounding, interlocking, secondary disconnect, auxiliary switch, MOC switch and TOC switches.

4.2.15 The Subcontractor shall provide drawing and circuit breaker specification (New Circuit Breakers) information to PPPL for review and approval.

4.2.16 The Subcontractor shall provide a project schedule for the refurbishment of thirty (30) circuit breakers as prescribed in Attachment 4.

4.2.17 The Subcontractor shall provide not less than six (6) re-usable shipping crates for shipment of the circuit breakers.

4.2.18 The Subcontractor shall provide pick-up and delivery of circuit breakers to PPPL site.

4.2.19 Prior to submitting their Offer, the Subcontractor shall perform an onsite inspection.

5.0 REQUIREMENTS

5.1 PERFORMANCE REQUIREMENTS

Note: See Attachment 3, *Technical Specification for Medium Voltage Breaker Purchase & Switchgear Cell Modification* and Attachment 4, *Technical Specification for Medium Voltage Breaker Refurbishment* as applicable, for Performance Requirements.

5.2 EQUIPMENT DEFINITION

Note: See Attachment 3, *Technical Specification for Medium Voltage Breaker Purchase & Switchgear Cell Modification* and Attachment 4, *Technical Specification for Medium Voltage Breaker Refurbishment* as applicable, for Equipment Definition.

5.2.1 Subcontractors must provide their own equipment and not use government equipment. Work activities anticipated to be performed by the Subcontractor shall be reviewed by PPPL Environmental, Safety and Health (ES&H) and the respective Subject Matter Expert (SME). Subcontractors shall provide evidence of qualification and competence in the performance of their duties including the use of powered equipment.

5.2.2 Should the use of government equipment become absolutely necessary, that use of equipment will require a liability release, covering the use of PPPL equipment. All vehicles being used for work activities on the PPPL site, regardless of their maximum capable speed, must be equipped with safety belts prior to entrance.

6.0 TEST & INSPECTION REQUIREMENTS

See Attachment 3, *Specification for Medium Voltage Breaker Purchase/Switchgear Cell Modification* and Attachment 4 *Specification for Medium Voltage Breaker Refurbishment as applicable*, for Test & Inspection Requirements.

7.0 QUALIFICATIONS

7.1 The Subcontractor shall be an established firm in operation for not less than 10 years, certified to ISO 9001, specializing in the design, manufacture, assembly, testing and service of medium voltage circuit breakers previously manufactured and serviced by firms operating as the following:

7.1.1 ITE Circuit Breaker Corporation

7.1.2 ITE Imperial Corporation

7.1.3 Gould, Inc.

7.1.4 Gould-Brown-Boveri

7.1.5 Brown-Boveri Electric

7.1.6 BBC Brown Boveri

7.1.7 Asea Brown Boveri

8.0 ENVIRONMENT, SAFETY, AND HEALTH

8.1 All work shall comply with PPPL ESHD 5008. The manual is available on the internet at: http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html

8.2 The Subcontractor must comply with:

8.2.1 The specific PPPL documents, requirements, permits and courses listed in this SOW;

8.2.2 All applicable Federal, State, and local laws, regulations and requirements whether or not they are specifically listed in the SOW or subcontract.

8.3 All work shall be in accordance with all OSHA, DOE and PPPL requirements. Care shall be taken to protect personnel, employees and surroundings.

8.4 The Subcontractor's safety record will be considered in the bid evaluations.

8.5 All Subcontractor vehicles and equipment must be in good working order with no leaks of any kind. Any spills must be reported immediately to PPPL and work stopped until spill is addressed. The Subcontractor is responsible for remediation costs caused by negligence and or faulty equipment. PPPL Environmental Services will determine the proper method of remediation.

8.6 PPPL has safety programs that include the following areas: Confined Space Permits, Digging Permits, Penetration and Fire Seal permits, Flame permits, Radiation Work permits, Lock-out/Tagout of energy sources, and restrictions on working alone. The Subcontractor must confirm with their PPPL contact person that all prerequisites have been met before initiating any activity that involves these areas.

8.7 No burning or welding is permitted without a PPPL Hot Work Permit.

8.8 When Work requires a Hot Work Permit, the Subcontractor shall provide a PPPL-qualified Fire Watch. Fire Watch training is available from PPPL and may be scheduled by the PTR.

8.9 Safety Data Sheets for all paints adhesives, chemicals, stains and solvents must be provided prior to the start of work.

8.10 Barricade tape, when needed, shall only be red "Danger" tape where personnel hazards exist. Yellow "Caution" tape may only be used for equipment protection. All barricade tape will be posted with the name and phone number of a contact. The PPPL representative may provide the contact information.

8.11 All requirements of this SOW apply to all sub-tier contractors.

8.12 Subcontractor must have their employees trained and provide PPPL with their qualification prior to performing this work. PPPL ES&H training courses that are more specific to the Subcontractor's laboratory work scope may also be required. If PPPL determines that training of Subcontractor employees is inadequate, PPPL reserves the right to require Subcontractor to obtain certified training.

8.13 A PPPL-approved lock-out tag-out (LOTO) procedure, and application of locks and tags by affected individuals, is required in most cases to mitigate hazards associated with any potential energy sources (electrical, mechanical, cryogenic, etc.).

Note 1: In lieu of Subcontractor's own procedure, Subcontractor may utilize PPPL's LOTO procedure. In this case, the Subcontractor's ISM Plan shall invoke PPPL's LOTO in the procedure body - PPPL LOTO procedure, ESH-016 "Control of Hazardous Energy (Lockout/Tagout)" current revision. The procedure can be found here: http://bp.pppl.gov/procedures.html

Note 2: If Subcontractor uses the PPPL LOTO procedure, all workers shall be required to complete PPPL LOTO training. Training will be arranged by the PTR.

9.0 QUALITY ASSURANCE REQUIREMENTS

9.1 Inspection / Surveillance / Audit by PPPL

Authorized representatives of PPPL and the U. S. Government shall have the right at all reasonable times to visit the Subcontractor's premises and those of Subcontractor's suppliers during the performance of the procurement for the purposes of inspection, surveillance, audit and/or obtaining any required information as may be necessary to assure that items or services are being furnished in accordance with specified requirements. Such visits shall be coordinated with the Subcontractor's personnel to minimize interference with the normal operations of said premises. The Subcontractor shall make available records and documentation necessary for this function and shall provide all reasonable facilities and assistance for the safety and convenience of PPPL and/or U. S. Government representatives in the performance of their duties. PPPL and the U. S. Government recognize the Subcontractor's right to withhold information concerning proprietary processes. The Subcontractor agrees to insert the paragraph above in each lower-tier procurement issued hereunder.

9.2 Subcontractor's Responsibility for Conformance

Neither PPPL's review and/or approval of Subcontractor's documents nor PPPL's inspection of Subcontractor's items or services shall relieve the Subcontractor of responsibility for full compliance with requirements of the purchase order/contract. The Subcontractor is responsible for assuring that all requirements and restrictions are imposed on any sub-tier suppliers.

9.3 Changes to PPPL Approved Documents

Revisions or changes by the Subcontractor to documents approved by PPPL shall be reviewed and approved by PPPL prior to use.

9.4 Subcontractor Quality Assurance Program

The Subcontractor shall establish and maintain an effective Quality Assurance Program to assure that the Subcontractor's work meets the required level of quality and is performed in accordance with contractual requirements.

- Subcontractor's quality assurance function shall be organized to have sufficient authority and independence to identify quality problems, verify conformance of supplied items or services to specified requirements and obtain satisfactory resolution of conflicts involving quality.
- The Subcontractor’s Quality program will be evaluated for Subcontractor qualification prior to award.

9.5 Submittal of Quality Assurance Plan for this procurement

Subcontractor shall submit within 10 working days of award and prior to start of manufacture, unless another time period has been agreed to, a plan describing the specific quality assurance and quality control procedures and practices to meet the requirements of this particular subcontract/purchase order, for PPPL review and approval.

9.6 Submittal of Manufacturing/ Inspection/Test (MIT) Plans

The Subcontractor shall submit the Plans within 10 working days after receipt of the Subcontract for PPPL approval prior to start of Work. PPPL may designate selected operations as mandatory "witness" points based on the MIT Plan. Subcontractor shall provide PPPL with notice ten (10)working days in advance of such witness points. Revisions or changes to the approved MIT shall be reviewed and approved by PPPL prior to use.

9.6.1 Newly-Furnished ABB Medium Voltage Breakers (Attachment 3)

The plan shall identify parts; show their integrated flow into end items; identify critical manufacturing operations; and show inspections and the characteristics/dimensions to be inspected. The Plan may include flow chart(s), Process Sheets, Shop Travelers, and inspection sheets, etc.

9.6.2 Modifications to Cubicle S1-B1 (Attachment 3)

The Subcontractor shall provide a Work Plan with Shop Drawings for modification of Cubicle S1-B1 (Attachment 3, 6.1.6). The plan shall identify parts; show their integrated flow into end items; identify critical manufacturing and installation operations; and show inspections and the characteristics/dimensions to be inspected. The Plan may include flow chart(s), Process Sheets, Shop Travelers, and inspection sheets, etc.

9.6.3 Refurbishment of Medium Voltage Breakers (Attachment 4)

The plan shall identify parts; show their integrated flow into end items; identify critical manufacturing and installation operations; and show inspections and the characteristics/dimensions to be inspected. The Plan may include flow chart(s), Process Sheets, Shop Travelers, and inspection sheets, etc.

9.7 Process and Sequence

The Subcontractor shall maintain a system to define the sequence and document the performance of manufacturing, inspection, installation, and test activities. These shall provide for signoff and date by designated inspection personnel at specified process, inspection, and test points and shall be traceable to the items.

9.8 Document Traceability and Records

The Subcontractor shall maintain a system of documentation whereby the results of required operations, inspections, examinations, and tests is systematically compiled, indexed and stored. Such objective evidence may include "travelers"; and material test, certification, inspection, examination, test and discrepancy reports; which shall be complete, legible, signed, and dated and shall be traceable to subject items.

9.9 Inspection and Test Control

Inspections and tests shall be performed in accordance with written procedures referencing criteria for acceptance or rejection. Adequate records shall be maintained and available for PPPL's review.

9.10 Submittal of Acceptance Test Procedures (ATPs) For PPPL Approval

Acceptance Test Procedures (ATPs), the procedures including pass/fail criteria and reporting requirements, required to demonstrate conformance to PPPL's requirements shall be submitted to PPPL for review and approval prior to use of such procedures. Additionally, these procedures shall include:

9.10.1 Newly-Furnished ABB Medium Voltage Breakers (Attachment 3)

The Subcontractor shall submit copies of Design Test and Production Test procedures per Sections 4 and 5 of IEEE C37.9, prior to performing tests on newly-manufactured breakers as detailed in Attachment 3, Section 5.0, Testing, prior to use.

9.10.2 Modifications to Cubicle S1-B1 (Attachment 3)

Test procedure(s) for this modification will be prepared by PPPL in collaboration with the Subcontractor.

9.10.3 Refurbishment of Medium Voltage Breakers (Attachment 4)

The Subcontractor shall submit copies of Production Test procedures per Section 5 of IEEE C37.9, prior to performing tests on refurbished breakers as detailed in Attachment 4, Section 4.0, *Testing*, prior to use.

9.11 Performance and Documentation of Inspections & Tests

Each item to be delivered to PPPL shall be inspected and tested by the Subcontractor to verify that they meet PPPL's requirements. The inspection/test report(s) shall provide sufficient information to replicate the test or inspection; shall indicate the results of inspections and tests; shall provide the make and model of test equipment used, including calibration dates and shall be dated and signed.

9.11.1 Newly-Furnished ABB Medium Voltage Breakers (Attachment 3)

Additionally, the Subcontractor shall submit certified copies of completed Design Test and Production Test procedures per Sections 4 and 5 of IEEE C37.9, as detailed in Attachment 3, Section 5.0, *Testing*, prior to shipment.

9.11.2 Modifications to Cubicle S1-B1 (Attachment 3)

Installation and onsite testing of newly-purchased and refurbished breaker operation in modified cubicle S1-B1 will be performed in accordance with PPPL-prepared procedures. PPPL will collaborate with the Subcontractor in execution of these tests.

9.11.3 Refurbishment of Medium Voltage Breakers (Attachment 4)

Additionally, the Subcontractor shall submit certified copies of completed Production Test procedures per Section 5 of IEEE C37.9, prior to performing tests on refurbished breakers as detailed in Attachment 4, Section 4.0, *Testing*, prior to shipment.

9.12 Equipment/Material Identification and Status

Material and equipment identification shall be maintained throughout processing and be traceable to the records. Status of acceptability shall be readily discernible through the Subcontractor's use of tags, stamps, serial numbers or other positive means.

9.13 Document Review, Approval and Control

The Subcontractor shall implement a system for review and approval of design documents (drawings, specifications, etc.), prior to issuance for use, and for approval and incorporation of changes in a formal and orderly manner. The system shall control obsolete documents to prevent inadvertent use. The system shall also control PPPL-furnished design documents, shall ensure that any models are in sync with the applicable drawings, and that obsolete information is not used.

9.14 Acceptability of Purchased Items and Services (Procurement Control)

The Subcontractor shall verify conformance of purchased items or services to drawing and specification requirements and shall provide objective evidence of such verifications to PPPL if requested.

9.15 Non-conformance & Corrective Actions and Notification

Non-conforming items or services shall be identified, and, where possible, segregated to prevent use. The Subcontractor shall document each nonconformance. The written approval of PPPL is required prior to the use of the nonconforming item or service. The Subcontractor's system shall provide not only for timely resolution of non-conformances but also for analysis of non-conformances to determine causes and to implement appropriate corrective actions (determination of cause and corrective action may be waived by PPPL for specific situations).

9.16 Measuring Equipment / Calibration

Acceptance inspections and tests shall be performed using properly calibrated measuring equipment. Calibration standards shall be traceable to the National Institute for Standards and Technology (NIST) or equivalent. Where such standards do not exist, the basis used for calibration shall be documented. Standards used for calibration shall not be used for shop inspections and shall be protected against damage or degradation.

9.17 Welding and Brazing

- Welder(s) and welding procedure(s) shall be qualified to ASME B&PV Code Section IX or to AWS D1.1.
- Brazer(s) and brazing procedure(s) shall be qualified to ASME B&PV Code Section IX.
- Flame brazing procedures shall minimize the embrittlement of copper in copper-to-copper joint.

9.18 Submittal of Completed Release for Shipment Form

Subcontractor shall not ship without a "Product Quality Certification and Shipping Release" Form (Attachment 5) signed by PPPL's Representative. Subcontractor shall complete and sign the certification section, fax or email the form to PPPL's Quality Assurance (QA) Representative, and hold shipment until PPPL signs and returns the form, authorizing shipment. A copy of the fully executed form shall accompany each full or partial shipment.

9.19 Submittal of Completed Process History (Documentation Package)

Subcontractor shall deliver, along with the completed item(s), one digital or two hard copies of the Process History, a compilation of documents, detailing the objective evidence of the acceptability of the work performed. Some parts of the Process History, typically inspection and test reports, will be required with the Shipping Release request. The Process History shall include as a minimum, the following:

- Subcontractor's Certificate of Compliance (CofC), signed by the Quality Manager, stating that the work performed conforms in every respect to PPPL the physical configuration and functional inspection/test requirements and that personnel performing or interpreting the results of special processes (i.e., welding, soldering, electronic assembly, brazing, nondestructive examination, etc.) were properly trained and qualified. Subcontractor's Quality Assurance (QA) Manager shall sign the CofC. Where the Subcontractor has used PPPL-furnished material, such certification shall also include the statement: "Material furnished by PPPL has been inspected by the Subcontractor and used by the Subcontractor as specified by PPPL with no unauthorized substitutions".

- For any high strength fasteners (as defined in 9.21 below) , the Subcontractor shall submit the manufacturer's Material Test Reports (MTR) showing actual relevant chemical, and mechanical properties of materials used and providing traceability to the actual material.
- Signed and dated reports for all required inspections and tests.
- Copies of Non-Conformance Report

9.20 Age/Shelf Life Storage Control and Records

Subcontractor shall maintain records that verify that materials with a specified limited shelf life shall have been stored in accordance with manufacturer's recommendations. Materials shall possess at least 35% (or higher if specified elsewhere by PPPL) of the initial 100% shelf life at the time they are used in the respective manufacturing process.

9.21 High Strength Fasteners

Subcontractor shall provide high strength fasteners (tensile strength equal to or greater than 100 ksi) in accordance with the Fastener Quality Act. Fasteners shall exhibit grade marks and the manufacturer's identification symbol (headstamp) as specified in the referenced Material Specification. Fasteners having a headmark shown on the suspect fastener list will not be accepted. Certified Material Test Reports (CMTR), showing actual material composition and physical properties and traceable to the actual fasteners, are required for each lot supplied. Results must be on the original letterhead of the entity performing the tests and not transferred to alternate letterhead. Where high strength fasteners are not required, it is recommended that they not be used. If used, the requirements above shall be implemented.

10.0 SHIPPING, STORAGE AND HANDLING

10.1 Subcontractor shall control items during handling and shipping and while in storage to assure that materials and items are adequately protected from damage or deteriorations, with special attention to packaging for shipment to PPPL. Packaging, shipping and storage systems shall provide adequate marking or labeling to clearly and readily identify the items.

10.2 PPPL will provide services for loading breakers for shipping to the Subcontractor's facility and for unloading of the breakers upon return to PPPL.

11.0 WARRANTY

11.1 The Subcontractor shall warranty all Work, including equipment and parts, to be free from defects in installation, design, manufacturing, and material.

11.2 The warranty shall extend for a minimum of one (1) year after completion of acceptance testing and operation at PPPL or eighteen (18) months from delivery. If, during the warranty period, modifications or repairs of the subject equipment are necessary, the warranty period shall be extended for a minimum of one (1) year from the date of the completion of repair or modification.

12.0 ATTACHMENTS

12.1 Attachment 1 – Notification Requirements Off-Normal Events and Issues

12.2 Attachment 2 - DOE Headmark List

12.3 Attachment 3 - Scope of Work and Technical Specification for Medium Voltage Breaker Purchase & Switchgear Cell Modification

12.4 Attachment 4 - Scope of Work and Technical Specifications for Medium Voltage Circuit Breaker Refurbishment

12.5 Attachment 5 – PPPL Product Quality Certification & Shipping Release

13.0 DOCUMENTATION & DELIVERABLES

Deliverables List

PO / Subcontract / BOA / BPA #:_____

#	Physical Deliverables Required	When Deliverable Is Required	Deliverable Received (✓)
1	Two (2) new ABB Type HK breakers per Attachment 3, Section 7.0, DELIVERABLES	Delivery	
2	Modify PPPL Breaker Cubicle S1-B1 per Attachment 3, Section 6.0, DELIVERABLES	Work completion	
3	REFURBISHED (6) 15 kV, 1200A, 750 MVA VHKX Breakers per Attachment 4, Section 6.0, DELIVERABLES	Delivery	
4	REFURBISHED (24) 15 kV, 1200, 500 MVA HK Breakers per Attachment 4, Section 6.0, DELIVERABLES	Delivery	
Exceptions (Add justification for any missing physical deliverables that will not be received):			

#	Document Deliverables Required for Medium Voltage Breaker Purchase & Switchgear Cell Modification (Attachment 3)	When Deliverable Is Required	Deliverable format (paper, electronic etc.)	Storage Location for Deliverable	Deliverable Received (✓)
1	Circuit breaker specifications (Attachment 3, 6.1.1)	Prior to fabrication	Electronic	Ops Center	
2	Spare parts list (Attachment 3, 6.1.2)	Prior to fabrication	Electronic	Ops Center	
3	Schematics/Wiring Diagram (Attachment 3, 6.1.3)	Prior to fabrication	Electronic	Ops Center	
4	UV trip device ratings (Attachment 3, 6.1.4)	Prior to fabrication	Electronic	Ops Center	
5	MIT Plan (newly-furnished breakers, 9.6.1)	Prior fabrication	Electronic	Ops Center	
6	MIT Plan (cubicle S1-B1 modifications, 9.6.2)	Prior construction	Electronic	Ops Center	
7	Acceptance Test Procedures (newly-furnished breakers, 9.10.1)	Prior to use	Electronic	Ops Center	
8	Acceptance Test Procedures (breaker refurbishment, 9.10.3)	Prior to use	Electronic	Ops Center	
9	Inspection and Test Documentation (newly-furnished breakers, 9.11.1)	Prior to shipment	Electronic	Ops Center	
10	Process History (9.1.19)	Prior to shipment	Electronic	Ops Center	
11	Installation/Operation/Maintenance Manual(s) (Attachment 3, 6.2.2)	Prior to delivery	Electronic	Ops Center	
Exceptions: None					

#	Document Deliverables Required Medium Voltage Breaker Refurbishment (Attachment 4)	When Deliverable Is Required	Deliverable format (paper, electronic etc.)	Storage Location for Deliverable	Deliverable Received (✓)
12	MIT Plan (breaker refurbishment, 9.6.3)	Prior to refurbishment	Electronic	Ops Center	
13	ABB Level 3 Refurbishment Incoming pre-refurbishment inspection report (Attachment 4, 5.1.1)	Prior to refurbishment	Electronic	Ops Center	
14	Spare parts list (Attachment 4, 5.1.2)	Prior to refurbishment	Electronic	Ops Center	
15	Schematic/wiring diagram(s) (Attachment 4, 5.1.3)	Prior to refurbishment	Electronic	Ops Center	
16	UV trip device ratings (Attachment 4, 5.1.4)	Prior to refurbishment	Electronic	Ops Center	
17	ABB Level 3 Refurbishment Comprehensive Condition Report (Attachment 4, 5.2.1) (see Exceptions below)	Prior to refurbishment	Electronic	Ops Center	
18	Inspection and Test Documentation (breaker refurbishment, 9.11.3)	Prior to shipment	Electronic	Ops Center	
19	Process History (9.1.19)	Prior to shipment	Electronic	Ops Center	
20	Installation/Operation/Maintenance Manual (3 Copies) (Attachment 4, 5.2.2)	Prior to shipment	Electronic	Ops Center	
21	Schematics/wiring diagrams (Attachment 4, 5.2.3)	Prior to shipment	Electronic	Ops Center	
Exceptions: The ABB Level 3 Refurbishment Comprehensive Condition Report (4.5.2.1) may be included in the Process History (9.1.19)					

Princeton Technical Representative:_____

(Sign-off and provide to the Operations Center when job is completed and deliverables are dispositioned and placed/filed in Operations Center (or other Project, Department or Division designated file center)

Attachment 1

Notification Requirements Off-Normal Events and Issues

-

Note: Contacting the PPPL Emergency Services Unit at X3333 to obtain emergency assistance and taking immediate actions to protect workers, guests and visitors takes precedence over the notification requirements described herein.

The Subcontractor shall notify PPPL within 15 minutes of becoming aware of off-normal events and issues; off-normal events and issues include:

- Personnel injuries of any kind
- Near misses that could have resulted in significant (recordable injury or worse) worker injuries
- Uncontrolled or unforeseen personnel exposure to chemical, biological or physical hazards (e.g., noise, laser, ultraviolet light, heat, etc.)
- Fire emergency of any kind
- Any unexpected discovery of an uncontrolled hazardous energy source (e.g., live electrical power circuit, etc.) not including discoveries made by zero-energy checks and other precautionary investigations made before work is authorized to begin
- Any failure to follow a prescribed hazardous energy control process (e.g., lockout/tagout)
- Damage of any kind to Laboratory property
- Damage of any kind to personal property owned by PPPL employees, guests and visitors
- Any spills of chemicals, fuels, lubricants, etc.
- Other off-normal events and issues deemed by the Subcontractor to require notification

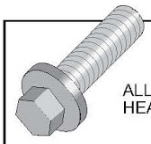
In the event of an off-normal event or issue, the Subcontractor and its lower-tier Subcontractors SHALL:

- Notify PPPL Emergency Services Unit at X3333 for emergency response, if required
- Take immediate action to evacuate and post affected area, if required
- Cease related work or work in the affected area
- Take actions to post and safe-off affected area
- Within 15 minutes: Contact Subcontractor Site Supervisor, PPPL PTR, ESH Construction Safety Engineer and ESH Head

Regarding these off-normal events or issues, no recovery actions (other than those immediately required to preserve life safety) or repairs are to take place until they are reviewed by the Subcontractor and PPPL, and specifically authorized by the PPPL PTR or ESH Department Head. Resumption of work that has been stopped by PPPL due to off-normal events and issues must follow the provisions of PPPL Policy P-012.

Attachment 2
ANY BOLT ON THIS LIST SHOULD BE TREATED AS DEFECTIVE WITHOUT FURTHER TESTING

DOE HEADMARK LIST



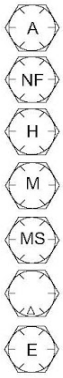
ALL GRADE 5 AND GRADE 8 FASTENERS WHICH DO NOT BEAR ANY MANUFACTURERS' HEADMARKS

 Grade 5  Grade 8

GRADE 5 FASTENERS WITH THE FOLLOWING MANUFACTURERS' HEADMARKS:

MARK	MARK
J	KS

GRADE 8 FASTENERS WITH THE FOLLOWING MANUFACTURERS' HEADMARKS:

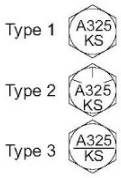


MARK		MARK	
A	A	KS	KS
NF	NF	RT	RT
H	H	FM	FM
M	M	KY	KY
MS	MS	J	J
	Hollow Triangle (CA TW JP YU) (Greater than 1/2 inch dia)		
E	E	UNY	UNY

GRADE 8.2 FASTENERS WITH THE FOLLOWING HEADMARKS:

MARK
KS

GRADE A325 FASTENERS WITH THE FOLLOWING HEADMARKS:



	MARK
Type 1	A325 KS
Type 2	
Type 3	

Headmarkings are usually raised – sometimes indented.

KEY: CA-Canada, JP-Japan, TW-Taiwan, YU-Yugoslavia

Reference: This tool was derived from the U.S. Customs Service. Dated: 1992

1.0 SUMMARY

This Specification covers the design, manufacturing, testing, and delivery of two (2) ABB Type VHKX medium voltage circuit breakers. These circuit breakers, one of which will be a spare, will be replacing a Gould/ITE dummy breaker currently installed in cubicle S1-B1. Additionally prescribed herein is in-situ modification of cubicle S1-B1 by the Subcontractor in order to accept the new breakers. The Subcontractor will be required to verify the as-constructed configuration of the cubicle at PPPL prior to submitting design documents.

2.0 SCOPE OF WORK

2.1 The Scope of Work and Technical Requirements prescribed in this Attachment consists of furnishing all labor, material, and equipment necessary to complete the following:

2.1.1 Furnish two (2) fully-tested ABB Type VHKX circuit breakers as specified in 3.0 and 4.0 herein configured to operate in PPPL breaker cubicle S1-B1.

2.1.2 Perform on-site inspection of switchgear cubicle S1-B1 to ascertain dimensional and operational requirements for the breakers furnished in 2.1.1.

2.1.3 Perform in-situ modifications to PPPL breaker cubicle S1-B1 necessary to accept new breakers provided in 2.1.1.

- Subcontractor shall be responsible for installing and verifying functional operation of all circuit breaker interlocks, MOC and TOC switches, cell interfaces and levering assembly in the cell location for which the breaker will be installed.
- PPPL will provide necessary assistance in these tasks.

2.1.4 Submit for PPPL review and acceptance, documents specified in Section 6.0, SUBMITTALS, herein.

3.0 TECHNICAL SPECIFICATIONS – ABB Type VHKX Circuit Breaker

3.1 The Subcontractor shall have full responsibility for compliance with the requirements of these Specifications. Review and/or approval of drawings or data does not constitute acceptance of any designs, materials, or equipment that will not fulfill the functional or performance requirements established herein.

3.2 Whenever equipment proposed by the Subcontractor cannot satisfactorily meet the intent of this Specification in any respect, such exceptions shall be clearly stated by the Subcontractor.

3.3 All new materials used shall be first quality and the best of each class and shall meet with the recommendations and standards of the various engineering and manufacturing associations. It shall be new, unused, with full warranty life.

3.4 The circuit breaker data requirements for this item can be found in the Circuit Breaker Data in 4.0 below.

3.5 New circuit breakers shall be in accordance with the most recent draft of the IEEE Standard C37.09 in all regards except required testing that is described in 5.0, *Testing*, of this Specification.

3.6 The new circuit breaker's capabilities shall meet performance levels defined in published ANSI/IEEE standards.

3.7 Each vacuum breaker shall contain three vacuum interrupters separately mounted in a self-contained, removable, self-aligning pole unit.

3.8 Main current carrying parts, insulators, supports and housing of the circuit breaker shall have sufficient mechanical strength to withstand the effects of rated short circuit currents without damage.

3.9 The circuit breaker shall be held trip free during breaker levering. Safety interlocks shall interface with the breaker cell to prevent the breaker levering into the primary contacts with the breaker closed.

3.10 The primary connections and/or finger clusters shall be new, designed and tested to carry the full nameplate rating of the replacement circuit breaker without exceeding the allowable temperature rise as indicated by ANSI/IEEE.

3.11 The secondary contact block shall be capable of interfacing with the existing contact block located in the existing cell.

3.12 The existing dummy breaker cubicle shall be modified to install a fully functional circuit breaker. This includes functional racking, breaker frame grounding, interlocking, secondary disconnect, auxiliary switch, MOC switch and TOC switches as required.

3.13 The breaker closing springs are to automatically discharge upon moving the breaker into the disconnect position.

3.14 Each operating mechanism shall be equipped with a visible indicator to show the state of the stored energy mechanism.

3.15 Breaker open and close semaphore shall be red for close and green for open.

3.16 Manual provisions shall be provided for tripping the circuit breaker element. These provisions shall be installed and easily accessible at the front of the circuit breaker element.

3.17 All control wiring shall be a minimum of #14 AWG stranded, tinned type SIS wire and shall terminate with crimp-type lugs (Burndy Type VAV or approved equal). All contact ratings shall be greater than or equal to the original manufacturer's nominal ratings. Nominal voltage of all related devices is 125VDC.

3.18 Each new circuit breaker shall retain the copper connection to the ground bus throughout the racking process.

3.19 The operating mechanism shall be mounted to the front of the breaker frame assembly for ease of access and maintainability. All mechanism functions such as stored energy control and breaker tripping and closing shall be accessible from the front.

3.20 An operation counter shall be provided to register one count for each trip operation and shall be non-resettable. It shall be visible from the front of the breaker.

3.21 The circuit breaker shall be completely assembled and wired in preparation for inspection and testing.

4.0 Circuit Breaker Data

4.1 Circuit breaker Type: ABB Type VHKX

4.2 Each circuit breaker shall have the following characteristics:

- Rated Maximum Voltage: 15 kV max, 13.8 kV rated, rms
- Rated Continuous Current: 3000 A
- Frequency: 60 HZ
- Rated Voltage Factor (k): 1.0
- Power Frequency Withstand: 36 kV, rms (Dry 1 min)
- Basic Impulse Level (BIL): 95 kV, peak
- Interrupting Capability: 1000 MVA
- Interrupting Time (3 or 5 cycles): 3 cycles
- 2-Second Short Time Current Carrying Capability: 48 kA, rms
- Closing and Latching Capability: 80 kA, peak
- Control Voltages
- Spring Charging Motor or Power Supply: 125v [dc]
- Close Coil: 125v [dc]
- Trip Coil: 125v [dc]
- Optional Accessories
    - Under-voltage Trip Release (UVR): 125v [dc]

5.0 TESTING

5.1 Design Tests

5.1.1 Prior to manufacture of new ABB Type VHKX circuit breakers, a complete Design Test conducted and documented in accordance with Section 4 of IEEE C37.09, *Design Tests,* shall be performed on a completed prototype unit.

5.1.2 Prior to performance of the Design Tests, the Subcontractor shall submit for PPPL approval, a copy of the test procedure as prescribed in paragraph 9.10, *Submittal of Acceptance Test Procedures (ATPs) For PPPL Approval*.

5.1.3 Upon completion of Design Tests, and prior to commencement of manufacture, the Subcontractor shall submit for PPPL approval a certified copy of the test reports as prescribed in paragraph 9.11, *Performance and Documentation of Inspections & Tests.*

5.1.4 If the Design Tests have already been performed on an identical unit, certified copies of these test reports shall be submitted for PPPL review and approval prior to commencement of manufacture.

5.2 Production Tests

5.2.1 Prior to shipment of new ABB Type VHKX circuit breakers, a complete Production Test conducted and documented in accordance with Section 5 of IEEE C37.09, *Production Tests* shall be performed on each breaker.

5.2.2 Prior to performance of the Production Tests, the Subcontractor shall submit for PPPL approval, a copy of the test procedure as prescribed in paragraph 9.10, *Submittal of Acceptance Test Procedures (ATPs) For PPPL Approval*

5.2.3 Upon completion of Production Tests, and prior to shipment, the Subcontractor shall submit for PPPL approval a certified copy of the test reports as prescribed in paragraph 9.11, Performance *and Documentation of Inspections & Tests*.

5.3 PPPL reserves the right to witness factory tests and is to be notified at least 10 working days prior to these.

6.0 SUBMITTALS

6.1 The Subcontractor shall submit to PPPL for approval the following prior to commencement of fabrication of new breakers:

6.1.1 Circuit breaker specification, including breaker rating

6.1.2 Recommended spare parts list

6.1.3 Breaker Schematics/Wiring Diagrams

6.1.4 Data sheet of UV trip device ratings including nominal voltage, continuous current draw, pick-up and drop-out voltages.

6.1.5 MIT for newly-furnished breakers (see 9.6.1, *Newly-Furnished ABB Medium Voltage Breakers*)

6.1.6 MIT with Work Plan and Shop Drawings for modification of cubicle S1-B1 to accept new ABB VHKX circuit breakers (see 9.6.2, *Modifications to Cubicle S1-B1*).

6.1.7 Copies of Design Test and Production Test procedures (see 9.10.1, *Newly-Furnished ABB Medium Voltage Breakers*).

6.2 The Subcontractor shall submit to PPPL for approval the following prior to shipment:

6.2.1 Inspection and Test Documentation (see 9.11.1, *Newly-Furnished ABB Medium Voltage Breakers*).

6.2.2 Process History (see 9.19, *Completed Process History*)

6.2.3 Installation/Operation/Maintenance Manual (3 Copies)

Dummy Breaker Photos

Figure 3.1 GOULD/ITE 13.8 kV Dummy Breaker Nameplate	Figure 3.2 GOULD/ITE 13.8 kV Dummy Breaker Photo
	

Dummy Breaker Photos (cont'd)

Figure 3.3 GOULD/ITE 13.8 kV Dummy Breaker Cubicle	Figure 3.4 GOULD/ITE 13.8 kV Dummy Breaker Cubicle
	

Figure 3.5 GOULD/ITE 13.8 kV Dummy Breaker Cubicle	Figure 3.6 GOULD/ITE 13.8 kV Dummy Breaker Cubicle
	

1.0 WORK OVERVIEW

The Work prescribed in this Specification entails the refurbishment of thirty (30) medium voltage circuit breakers presently installed. PPPL will remove and package each of the breakers in Subcontractor-provided shipping containers for shipment to the Subcontractor's facility.

Upon receipt, the Subcontractor will refurbish and modify each breaker as prescribed in Section 2.0 herein. Breaker refurbishment shall be equivalent to ABB "Level 3 Factory Refurbishment." Upon completion of Work at the Subcontractor's facility, the breakers will be returned to PPPL for installation and acceptance testing.

2.0 SCOPE OF WORK AND TECHNICAL SPECIFICATIONS

2.1 The Work under this section consists of furnishing all labor, material, and equipment necessary to complete the Work described.

2.2 All new materials used shall be first quality and the best of each class and shall meet with the recommendations and standards of the various engineering and manufacturing associations.

2.3 Visually inspect breaker for any visible missing or damaged components prior to incoming testing. Record breaker nameplate and operations counter information

2.4 Physical Inspection – visual check of hardware, springs, control devices and cams

2.5 Perform incoming operational testing to include (as applicable):

2.5.1 Manual and electrical functional operation

2.5.2 Check minimum and maximum coil operating voltages

2.5.3 Check the minimum coil pickup voltages

2.5.4 Check for proper operation of anti-pump feature

2.5.5 Check for proper operation of electrical and mechanical safety interlocks

2.5.6 Check for operation of indicating devices, including all visual indicators and operational counter

2.5.7 Check for proper operation of racking device and check interlocks

2.5.8 Check geared motor (if applicable)

2.5.9 Check opening and closing release

2.5.10 Check auxiliary contacts (Change of State), check auxiliary switch and associated wiring for damage

2.5.11 Perform AC high-potential (hi-pot test) test on each pole of breaker with breaker open and closed for one minute per the applicable standards. Perform AC Hi-pot on the control wiring for one minute at 1500VAC and on the control motor for one minute at 1000VAC

2.5.12 Perform circuit breaker opening and closing tests at normal operating control voltage

2.5.13 Perform main contact resistance checks. Maximum acceptable readings will be dependent on the breaker manufacturer and model

2.5.14 Test for proper operation of applicable circuit breaker trip features

2.6 A detailed Incoming Inspection Report documenting all test results, observations, findings and recommendations will be prepared for inclusion in the condition report located in the work package. Subcontractor shall submit a list of test equipment that is utilized to test the refurbished circuit breakers. All test equipment shall be calibrated and traceable to the National Institute of Standards and Technology.

2.7 The entire circuit breaker will be disassembled to subassembly component level. The operating mechanism, main contact moving and stationary assemblies, draw-out bar assembly and jackshaft assembly will completely disassembled to the individual component level. Any moving parts and/or components on other sub-assemblies requiring lubrication will also be dissembled. Control devices will be disassembled to check for internal damage. The electrical control device will be disassembled and inspected for worn/ degraded contacts, proper formation of armatures and cracked housings. Limit switch contacts and coils will be checked, as will all terminal connections.

2.8 Each component will be thoroughly cleaned and inspected for cracks, deterioration, or worn areas with special consideration being given to latch surfaces, cams, rollers, followers, and pivot areas. The contact surface areas shall be cleaned.

2.9 Inspect all terminal blocks and secondary contact blocks for cracking or breakage. Replace as required.

2.10 Clean all current carrying components by using a method which will not deteriorate original plating which is still intact. Clean all non-current metal parts by methods which remove all foreign material but do not adversely affect the materials dielectric or structural properties. Note – If more than 50% of the main contact surface is damaged, worn, or cracked, the main contact shall be replaced.

2.11 Clean all barriers and insulating parts. After cleaning, inspect for cracks and deterioration.

2.12 Re-painting of frame/re-plating mechanism and contact parts will be performed.

2.13 All silver plated current carrying parts will be re-plated.

2.14 All yellow chromate plated steel will be re-plated as needed.

2.15 All defective components will be documented, retained and returned to the customer, if requested.

2.16 Each individual moving component, including pivot pins, needle, roller and sleeve bearings, thrust washers, cams and gears will be lubricated per specific manufacturer's standards. No-Ox-ID lubricant shall be used. Ensure all excess exposed lubricant is removed to minimize contamination between maintenance periods. Lube the primary contacts.

2.17 All latches, roller clearances, adjustable spring tensions and mechanical adjustments within the operating mechanism will be setup per the applicable manufacturer's specification.

2.18 Main and arcing contact simultaneous make and wipe (main contact pressure) will be adjusted per manufacturer's specifications.

2.19 The auxiliary circuits of the circuit breakers shall be rewired, if necessary, using conductor rated for the particular voltage of the circuit breaker with flame retardant insulation. Conductor temperature and ampacity ratings shall meet or exceed that of the original manufacturer. Ring type terminals shall be used for termination of all control wiring where applicable. These lugs shall be installed with tooling certified for the particular type and brand of lug to be installed.

2.20 UV trip device will be installed and wired per approved schematic/wiring diagram.

2.21 During assembly, hardware will be inspected to ensure proper installation and that all parts are properly secured.

2.22 Setup testing and all initial adjustments will be performed by a technician before final testing.

2.23 Operate breaker electrically and manually. Check close, trip, latch and trip free operations. Visually check the operating mechanism for proper alignment of latches, toggle assemblies and operating levers and linkages.

2.24 Perform operational testing to include (as applicable):

2.25 Manual and electrical functional operation tests

2.26 Check pick-up, minimum and maximum coil operating voltages. This will include functional tests on the newly installed UV trip device

2.27 Check closing and opening times and verify results are within time ranges for normal operation.

2.28 A minimum of five manual and five electrical functional operational tests to each electrical device will be performed

2.29 Verify proper operation of anti-pump feature

2.30 Verify proper operation of electrical and mechanical safety interlocks

2.31 Check operation of indicating devices, including all visual indicators and operational counter

2.32 Verify proper operation of racking device and check interlocks

2.33 Hi-pot test of primary and secondary circuits:
- Perform AC hi-pot test on each pole of breaker with breaker open and closed for one minute per the applicable standards.
- Perform AC Hi-pot on the control wiring for one minute at 1500VAC and on the control motor for one minute at 1000VAC.

2.34 Perform circuit breaker opening and closing tests at normal operating control voltage.

2.35 Perform main contact resistance checks and ensure they are within the manufacturer's limits. Maximum acceptable readings will be dependent on the breaker manufacturer and model.

2.36 Upon completion of refurbishment and modification, a Comprehensive Condition Report will be prepared. This report will include:
- All incoming inspection and test results
- An incoming "as found" condition report
- A listing of all components replaced during the refurbishment and an explanation of the defect to determine the impact of the failure. Standard refurbish parts, as defined by this work scope, will not be dispositioned.
- All final "as left" inspection and test results
- Contractor will affix a label to each circuit breaker bearing PPPL's name and address, contract number, date of work performed, and job information to ensure future traceability of the work and component used within the breaker.
- All work will be traceable by breaker serial number

3.0 Circuit Breaker Data

3.1 Circuit Breaker Data – BBC/ITE 13.8 kV/750 MVA Type VHKX Circuit Breakers

3.1.1 Six (6) total

3.1.2 Each circuit breaker has the following characteristics:
- Rated Maximum Voltage: 15 kV max, 13.8 kV rated, rms
- Rated Continuous Current: 3000 A
- Frequency: 60 HZ
- Rated Voltage Factor (k): 1.0
- Power Frequency Withstand: 36 kV, rms (Dry 1 min)
- Basic Impulse Level (BIL): 95 kV, peak
- Interrupting Capability: 1000 MVA
- Interrupting Time (3 or 5 cycles): 3 cycles
- 2-Second Short Time Current Carrying Capability: 48 kA, rms
- Closing and Latching Capability: 80 kA, peak

- Control Voltages:
  - Spring Charging Motor or Power Supply: 125v [dc]
  - Close Coil: 125v [dc]
  - Trip Coil: 125v [dc]
- Optional Accessories
  - Second Trip Coil: 125v [dc]
  - Under-voltage Trip Release (UVR): 125v [dc]

3.2 Circuit Breaker Data – Gould/ITW 13.8kV/500 MVA Type HK Circuit Breakers

3.2.1 Twenty four (24) total

3.2.2 Each circuit breaker has the following characteristics:

- Rated Maximum Voltage: 15 kV max, 13.8 kV rated, rms
- Rated Continuous Current: 1200 A
- Frequency: 60 HZ
- Rated Voltage Factor (k): 1.0
- Basic Impulse Level (BIL): 95 kV, peak
- Interrupting Capability: 500 MVA
- Interrupting Time (3 or 5 cycles): 5 cycles
- Control Voltages:
  - Spring Charging Motor or Power Supply: 125v [dc]
  - Close Coil: 125v [dc]
  - Trip Coil: 125v [dc]
- Optional Accessories
  - Second Trip Coil: 125v [dc]
  - Under-voltage Trip Release (UVR): 125v [dc]

4.0 TESTING

4.1 Production Tests

4.1.1 Prior to shipment circuit breakers, a complete Production Test conducted and documented in accordance with Section 5 of IEEE C37.09, *Production Tests* shall be performed on each breaker.

4.1.2 Prior to performance of the Production Tests, the Subcontractor shall submit for PPPL approval, a copy of the test procedure as prescribed in paragraph 9.10, *Submittal of Acceptance Test Procedures (ATPs) For PPPL Approval*

4.1.3 Upon completion of Performance Tests, and prior to shipment, the Subcontractor shall submit for PPPL approval a certified copy of the test reports as prescribed in paragraph 9.11, *Performance and Documentation of Inspections & Tests*.

4.1.4 PPPL reserves the right to witness factory tests and is to be notified at least 10 working days prior to these.

5.0 SUBMITTALS

5.1 The Subcontractor shall submit to PPPL for approval the following prior to commencement of refurbishment and modification of new breakers:

5.1.1 ABB Level 3 Refurbishment Incoming Inspection Report for each of the thirty (30) breakers to include identification recommended work and replacement parts.

5.1.2 Recommended spare parts list.

5.1.3 Breaker Schematics/Wiring Diagrams reflecting modified configuration.

5.1.4 Data sheet of UV trip device ratings including nominal voltage, continuous current draw, pick-up and drop-out voltages.

5.1.5 MIT Plan for breaker refurbishment (see 9.6.3, *Refurbishment of Medium Voltage Breakers*).

5.2 The Subcontractor shall submit to PPPL for approval the following prior to shipment:

5.2.1 Inspection and Test Documentation (see 9.11.3, *Refurbishment of Medium Voltage Breakers*).

5.2.2 Process History (see 9.1.19, *Completed Process History)*.

5.2.3 Installation/Operation/Maintenance Manual (3 Copies)

5.2.4 Final Circuit breaker schematic/wiring drawings.

ATTACHMENT 5
PRINCETON UNIVERSITY PLASMA PHYSICS LABORATORY—PPPL
PRODUCT QUALITY CERTIFICATION & SHIPPING RELEASE

To be completed by supplier and submitted to PPPL with the Documentation package.
Shipment (full or partial) is not authorized until PPPL returns this form signed.

Completed by Supplier

PPPL SUBCONTRACT/ ORDER #	ITEM #(s)	QUANTITY SHIPPED

ITEM DESCRIPTION	SUPPLIER REFERENCE #	SHIPMENT #

SUPPLIER'S CERTIFICATION

This is to certify that the products and services identified herein have been produced under a controlled quality assurance program and are in conformance with the procurement requirements including applicable codes, standards and specifications as identified in the above-referenced documents unless noted below. Any supporting documentation will be retained in accordance with the procurement requirements.

SIGNED: _____ DATE: _____

TITLE: _____ COMPANY: _____

Completed, signed, and returned by PPPL before shipment

PPPL (AUTHORIZED REPRESENTATIVE) SHIPPING RELEASE

This is to certify that evidence supporting the above Supplier's Certification statement has been reviewed and no product/service nonconformances from procurement requirements have been identified unless noted below. This product/service is hereby released for shipment.

This section serves as the Quality Assurance release for the above described product for shipment. It does not constitute an acceptance thereof and does not relieve the Supplier, Manufacturer or Contractor of any and all responsibility or obligation imposed by the purchase contract. It does not waive any rights the Purchaser may have under the purchase contract, including the Purchaser's right to reject the above described material upon discovery of any deviations from requirements of the purchase contract, drawings and specifications.

NONCONFORMANCES FROM PROCUREMENT QUALITY REQUIREMENTS:

REMARKS/PRODUCT SERIAL NUMBERS:

BY PPPL QA REPRESENTATIVE (OR DESIGNEE)	DATE