

(Sample Specification)

## **LOW VOLTAGE AIR REPLACEMENT BREAKERS LV-AR**

### **1.01 SCOPE**

- A. The contractor shall provide all project management, factory and field engineering, short circuit coordination studies (if required), supervision, labor, material, tools, rental, test equipment and transportation as defined by this specification for a complete breaker replacement of the existing, vintage Low Voltage Air Power Circuit Breakers (LVAPCBs) listed in Section 2.03 "Equipment List."
- B. The breakers shall be rated with one or more voltage class. Maximum voltages are 635V (Fused units at 600V max), 508V, or 240V with nominal voltages of 600V, 480V, and 240V respectfully.

### **1.02 RELATED SECTIONS**

### **1.03 REFERENCES**

- A. All low voltage replacement circuit breakers shall be designed, manufactured and tested in accordance with the applicable sections of:
  - 1. C37.59-2007 IEEE Standard Requirements for Conversion of Power Switchgear Equipment
  - 2. C37.16 American National Standard Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors- Preferred Ratings, Related Requirements, and Application Recommendations
  - 3. C37.13 IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures
  - 4. C37.20.1 IEEE Standard for Metal-Enclosed Low-Voltage Power Circuit Breakers Switchgear
  - 5. C37.50-1989 American National Standard Low-Voltage AC Power Circuit Breakers Used in Enclosures- Test Procedures
  - 6. C37.17 American National Standard for Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers
  - 7. IEEE STD 4-1995
  - 8. ANSI/NFPA 70 (NEC)

### **1.04 SUBMITTALS – FOR REVIEW/APPROVAL**

- A. The following information shall be submitted to the Engineer:
  - 1. Equipment list
  - 2. Project work schedule
  - 3. Product data sheets
  - 4. Major component ratings including:
    - a. Voltage
    - b. Continuous current rating
    - c. Interrupting ratings.

### **1.05 SUBMITTALS – FOR CONSTRUCTION**

- A. The following information shall be submitted for record purposes:
  - 1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
  - 2. Wiring diagrams
  - 3. Certified production test reports

#### 4. Installation information

### 1.06 QUALIFICATIONS

- A. The supplier or manufacturer, hereafter designated as “contractor,” must meet the following qualifications to be considered for the award of the contract.
- B. The contractor shall have a minimum of 25 years experience in a combination of performing replacement breaker conversions and/or the manufacture of low voltage power circuit breakers and switchgear.
- C. Contractor shall supply evidence of ANSI certification of the circuit breaker element and the completed assembly prior to delivery.
- D. Contractor shall have local switchgear service engineers within a 150-mile radius of the job site. The contractor shall have a minimum of 25 years experience in the maintenance of low voltage switchgear and 10 years of ANSI retrofit experience. Provide address and telephone number of the service office nearest to the job site with the bid proposal.
- E. All contractors are required to verify nameplate data, control wiring requirements and cell-to-breaker interface. If the contractor requires a site visit, contact the department issuing the request for bid to coordinate.

## **PART 2 PRODUCTS/SERVICES**

### 2.01 MANUFACTURERS

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.
- B. This specification covers the design, testing and manufacturing requirements for New Replacement Low Voltage Air Power Circuit Breakers (LVAPCBs), draw-out type, installed in LV Metal Enclosed Switchgear originally manufactured by Federal Pacific Electric (USA), Allis-Chalmers, ITE, General Electric or Westinghouse DB vintage. Eaton Low Voltage AR-Series or **Air-Replacements** or approved equal, is the basis for design in this specification.

The terms contractor and converter shall be considered interchangeable within the context of the specification.

### 2.02 CUBICLE MODIFICATIONS

- A. The replacement breakers shall be new and rated identically to the existing, vintage breakers including maximum frame continuous current (Amps), withstand rating (kA), and interrupting capacity (kAIC). There is no exact replacement for any type breaker except for a complete duplicate of the original. Modifications to the existing breaker cubicle (cell) shall be either minimal and/or reversible.
- B. New replacement breakers categorized as “interchangeable replacements” in IEEE/ANSI C37.59-2007 shall require no cell modifications and shall be electrically and mechanically interchangeable with existing air-magnetic circuit breakers. New replacement breakers categorized as “non-interchangeable replacements” in IEEE/ANSI C37.59-2007 may require some cell modifications to upgrade to newer technologies and increased ratings. These designs shall not be interchangeable with existing air-magnetic circuit breakers and any modifications required to the cells to accommodate the new replacement breakers, shall be reversible, except for minor cutting of the existing structures. All “non-interchangeable replacements” shall require changes to the cell coding system or cell code plates to reject the original breakers. Increased short circuit and/or continuous current ratings shall require a modification to the cubicle coding system to prevent the insertion of lower rated breakers or

the existing breakers into the cubicles intended for use with the new higher short circuit and/or continuous current class breakers.

- C. The replacement breaker process shall be designed such that, bus modifications are not required. No modifications to the existing bus, either in the breaker cell compartment or in the bus compartment, will be permitted.
- D. The new replacement breaker shall plug into the existing stabs of the vintage breaker compartment. New doors with shrouds shall be provided when required.
- E. Switchgear line-ups designated for new replacement breakers with either increased short-circuit ratings or continuous current capability shall have the bus and bracing verified by Eaton Electrical Services and Systems Division (EESS) to comply with the new maximum short-circuit ratings and/or new increased continuous current capabilities. The converter shall perform a study to determine the current bracing capabilities and provide mathematical documentation to support the findings. The converter shall state that the entire switchgear is sufficiently braced to handle the new ratings or supply the cost as a separate item to increase the bus bracing in all cubicles in each line-up to comply with the increased ratings. Following the study and/or the bracing modifications, the converter shall affix a label to the switchgear structure stating the new ratings, the converter's name and the re-certification date.

### **2.03 EQUIPMENT LIST**

- A. No components or subassemblies from the existing, vintage LVAPCB shall be used on the new replacement breaker. All parts and subassemblies of the new replacement breaker shall be 100% new.
- B. The new breakers must be of current design and be plug-in compatible with the existing control circuitry and cubicle bus work, including cell secondary contacts.
- C. All components used in the new replacement LVAPCB must be manufactured and purchased through a major circuit breaker manufacturing corporation. Major manufacturers will be world-class, fully ISO certified and shall have been designing and manufacturing LVAPCBs for at least 50 years.
- D. The manufacturer of the replacement breaker must provide proof of previous design and development of product using their standard-production LVAPCB element adapted to replace the circuit breakers within the existing, vintage cubicles.
- E. The new circuit breaker element must meet or exceed all applicable ANSI, IEEE standards. Also, the replacement breaker must be tested to ANSI standards to confirm its compatibility within the existing, vintage cubicle.

### **2.04 BID EVALUATION**

- A. All bids will be evaluated on the following criteria. All items will carry equal weight.

### **2.05 CONTRACTOR EXPERIENCE AND REFERENCES**

- A. Supply a list of (5) previous similar projects with customer name and phone number.
- B. Contractor shall have a minimum net worth of \$500 million insuring financial stability.

### **2.06 MANUFACTURING FACILITIES**

- A. The contractor's facility shall be dedicated to conversion and replacement breaker manufacturing.
- B. The buyer reserves the right to send a representative to visit the contractor's manufacturing facilities prior to the award of a contract.
- C. The buyer further reserves the right to send representatives to the contractor's manufacturing facilities during the course of the project for inspection and witness testing for a nominal fee.

## **2.07 QUALITY ASSURANCE AND TOTAL QUALITY PROCESS**

- A. The contractor shall have in place a functional Total Quality Process. The plan shall be pursuant to ISO 9001 compliance.

## **2.08 TECHNICAL SPECIFICATION**

- A. Comply with ANSI production and design test requirements as stated in IEEE/ANSI C37.59 and relevant standards.

## **2.09 SCHEDULE**

- A. Contractor must comply with requested delivery schedule.
- B. Provide the following schedules with the bid proposal:
  - 1. Drawings for approval (include review time)
  - 2. Final factory drawings
  - 3. Equipment delivery
  - 4. Final test reports
- C. The bid shall include approval drawing preparation time and best delivery of the replacement breaker(s).
- D. Total installed price shall be quoted as shown on the bid form.

## **2.10 CIRCUIT BREAKER ELEMENT FEATURES**

- A. The conversion shall utilize low voltage air power circuit breaker elements manufactured by Eaton or approved equal.
- B. Acceptable conversion elements are part of the AR-Series offering. The Eaton MDS LVAPCBs are used as the base elements or approved equal.
- C. The circuit breaker mechanism shall open and close all three phases and any auxiliary devices via a common operating shaft to ensure consistent and simultaneous operation of the main contacts. The shaft shall be supported at the ends and along its length with bearings. The main drive shaft shall be connected to the individual pole assemblies via insulated drive links.
- D. The mechanism shall have front accessible manual close and trip operators that are directly connected to the breaker operating mechanism and are integral to the electrical close and trip coils.
- E. Each operating mechanism shall be equipped with a visible indicator to show the state of the stored energy mechanism. The indicator shall show when the spring is fully charged or discharged.
- F. The new circuit breakers must be equipped with the Eaton Digitrip solid state trip units, or approved equal, having the necessary trips functions, as required by the buyer, to meet or exceed the original breaker requirements.
- G. The new circuit breaker operation mechanism shall be a "true Trip-Free" design. When the trip function is mechanically engaged and held and the close function is initiated either electrically or mechanically, the contacts shall not close. The contacts shall be restricted to 10% of the total travel.
- H. Each new replacement breaker shall have a mechanical status indicator with the word "CLOSED" on a red background when the breakers are closed and the word "OPEN" on a green background when the breakers are open.

## **2.11 REPLACEMENT BREAKER ASSEMBLY**

- A. The frame shall be constructed from steel. A combination of bolting and welding to assemble the frames is acceptable. All frame designs shall be zinc-plated with a yellow dichromate finish
- B. All hardware shall be a minimum of grade five (5), zinc-plated with a yellow dichromate finish or black oxide.
- C. A silver/tin-plated copper; self-coupling, separable grounding contact shall be supplied and sized to carry the maximum line-to-ground fault for a solidly grounded three-phase system for 0.5 seconds.
- D. The replacement breaker shall incorporate a manual system to completely discharge all stored energy before the circuit breaker is fully withdrawn from the switchgear housing. The system shall never automatically discharge the stored energy while in the connected position.
- E. Locking means shall be provided to lock the circuit breaker while in the fully connected or disconnected positions. The lock shall prevent the insertion or removal of the breaker. The lock shall not prevent the breaker from being operated while in the fully connected position.
- F. Control wiring connections, when specified by the buyer, between stationary structure and the removable breaker shall be provided with automatic, self-coupling secondary contacts. These secondary contacts shall be new and fully compatible with the original stationary contact blocks within the breaker cubical.

## **2.12 DESIGN AND CERTIFICATION TESTING**

- A. The replacement breaker supplied shall have type tests performed on its base design. Extrapolation of test values based on individual components is unacceptable. The tests shall be performed on the complete assemblies. All type tests will be performed in the actual switchgear cell or an equivalent structure where permitted by C37.59.
- B. Temperature test shall be conducted by the guidelines found within C37.50 and C37.20.1.
- C. The following test shall be performed: Continuous Current, Short Circuit Withstand, Short Time Current, Dielectric Withstand, and Mechanical Insertion. These tests shall be performed to show the compatibility of the Eaton replacement breaker or approved equal in the existing, vintage cubicle.

## **PART 3 EXECUTION**

### **3.01 FIELD QUALITY CONTROL**

- A. The contractor shall utilize his factory trained and certified field engineer to perform the installation of each breaker at the customer's site. The field engineer shall be familiar with Eaton AR-Series Replacement Breakers or approved equal to the point that he/she can offer initial training to the owner's on-site operators and maintenance personnel.
- B. The owner's maintenance personnel will provide the necessary switching and breaker operation to accommodate the requirements of the Vendor/Contractor to perform the removal, and reinstallation of the breakers.
- C. Perform ground fault testing (if applicable) shall be done in the switchgear unit with primary injection testing to document proper operation and establish base line data.

### **3.02 TRAINING**

- A. The contractor shall provide training on the new replacement breaker operation and maintenance.