

# SCOPE OF WORK

## CIRCUIT BREAKER SERVICES ACCEPTANCE TESTING 8X5

### SERVICE SUMMARY

Feature	Detail
On-site Service	Includes 1 Preventive Maintenance Service, scheduled by the customer between 8am-5pm, Monday-Friday (excluding national holidays).
Labor & Travel	Includes 100% labor and travel coverage within the 48 contiguous states and Hawaii.
Online Portal	Includes access to Vertiv Customer Services Network Online Internet portal.
Service Professional	Performed by NETA certified technician.

### SERVICE PERFORMED

#### **Customer / Contractor Responsibilities**

1. Customer is responsible for providing accurate information regarding breaker type (draw-out or bolt-on). Additional charges may be incurred by the customer if breaker type is not accurate per the quoted service. See additional information below regarding draw-out vs. bolt-on breakers
2. Customer shall provide convenient access to the equipment covered by the Scope of Work, and shall provide any special lifting or racking devices needed prior to start of any work by Vertiv
3. Customer shall provide utility power, as needed, to facilitate electrical testing of the equipment described in the Scope of Work prior to start of any work by Vertiv
4. Customer is responsible for providing acceptable access for test equipment
5. Customer is responsible for providing all breaker settings per their short circuit, coordination study
6. Customer is responsible for providing access to equipment for testing prior to cable termination on the equipment.
7. Visit must be scheduled 10 business days in advance of need by contacting the Vertiv Services Customer Response Center at 1-800-543-2378, or by contacting the region office.

#### **Vertiv Responsibilities**

Upon request, Vertiv can provide handwritten data sheets to customer at the end of each shift. Final reports will be supplied in electronic media within thirty days (30) days of completion.

#### **Purpose**

Ensure equipment is in the best possible operating condition to maximize system availability and prevent unexpected downtime.

#### **Procedures**

Procedures are in accordance with International Electrical Testing Association's Standard for Maintenance Testing Specification (ANSI/NETA ATS-2009)

### INSPECTION AND TEST PROCEDURES

Circuit Breakers, Air, Insulated-Case/Molded-Case and Air, Low-Voltage Power

#### **Visual and Mechanical Inspection**

1. Inspect physical and mechanical condition.
2. Inspect anchorage, alignment, and grounding.
3. Prior to cleaning the units, perform as-found tests, if required.
4. Clean the unit
5. For insulated-case/molded case breakers, operate the circuit breaker to insure smooth operation.

6. For low-voltage power breakers:
  - Verify that all maintenance devices are available for servicing and operating the breakers.
  - Inspect arc chutes
  - Inspect moving and stationary contacts for condition, wear, and alignment
  - Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct
  - Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism in accordance with manufacturer's published data
7. Inspect bolted electrical connections for high resistance using one or more of the following methods:
  - Use of a low-resistance ohmmeter in accordance with Section ANSI/NETA ATS-2009 7.6.1.1.2.
  - Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or ANSI/NETA ATS-2009 Table 100.12.
  - Perform thermographic survey in accordance with ANSI/NETA ATS-2009 Section 9.
8. Inspect operating mechanism, contacts, and arc chutes in unsealed insulated-case/molded-case breakers.
9. On low voltage power breakers:
  - I Verify cell fit and element alignment
  - II Verify racking mechanism operation
  - III Use appropriate lubrication on moving current-carrying parts and on moving and sliding surface
10. Perform adjustments for final protective device settings in accordance with coordination study provided by end user.
11. Perform as-left tests

### **Electrical Tests**

1. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with ANSI/NETA ATS-2009 Section 7.6.1.1.1
2. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase to ground with the circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use ANSI/NETA ATS-2009 Table 100.1.
3. Perform a contact/pole-resistance test.
4. Determine long-time pickup and delay by primary current injection.
5. Determine short-time pickup and delay by primary current injection.
6. Determine ground-fault pickup and time delay by primary current injection.
7. Determine instantaneous pickup by primary current injection.
8. Alternatively, when accessibility prevents primary current injection, determine all pickup and delay values by secondary current injection.
9. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with ANSI/NETA ATS-2009 Table 100.20
10. Verify correct operation of auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, anti-pump function, and trip unit battery condition. Reset all trip logs and indicators.
11. Verify operation of charging mechanism.

### **Test Values**

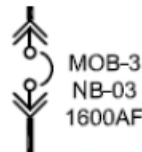
1. Test Values – Visual and Mechanical
  1. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  2. Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use ANSI/NETA ATS-2009 Table 100.12.
  3. Results of the thermographic survey shall be in accordance with ANSI/NETA ATS-2009 Section 9.
  4. Settings shall comply with coordination study recommendations.

## 2. Test Values – Electrical

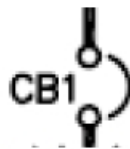
1. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
2. Insulation-resistance values shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use ANSI/NETA ATS-2009 Table 100.1. Values of insulation resistance less than this table or manufacturer's recommendations should be investigated.
3. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's published data is not available, investigate values that deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
4. Long-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors. If manufacturer's curves are not available, trip times shall not exceed the value shown in ANSI/NETA ATS-2009 Table 100.7.
5. Short-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
6. Ground fault pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
7. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances. In the absence of manufacturer's published data, refer to ATS-2009 Table 100.8.
8. Pickup values and trip characteristics shall be within manufacturer's published tolerances.
9. Minimum pickup voltage of the shunt trip and close coils shall conform to the manufacturer's published data. In the absence of the manufacturer's published data, refer to ANSI/NETA ATS-2009 Table 100.20.
10. Breaker open, close, trip, trip-free, anti-pump, and auxiliary features shall function as designed.
11. The charging mechanism shall operate in accordance with manufacturer's published data.

### **Additional Information – Draw-out vs. Bolt-on Circuit Breakers**

Service quote is based on customer providing accurate information regarding type of breaker, i.e., draw-out or bolt-on style circuit breaker. Below illustrates standard schematic symbols indicating the type of breaker in a typical one-line diagram.



Schematic symbol for draw-out breaker



Schematic symbol for bolt-on breaker

## **ASSUMPTIONS AND CLARIFICATIONS**

Does not include parts and labor coverage for repair of defects found.

Expenses incurred due to delays that are beyond the control of Vertiv Services may be billed at cost.

Any customer site visit is limited to eight (8) hours per visit. Any time beyond forty (40) hours/wk or eight (8) hrs/day or additional Startup visits will be billed separately.

## CUSTOMER RESPONSIBILITIES

In order to provide timely, accurate and thorough execution of the services described herein, Vertiv requests the following:

- Point of Contact: Provide an authorized point of contact(s), specific for the scope of work, for scheduling and coordination purposes.
- Scheduling: Make dates available for scheduling service. All visits must be requested 10 business days in advance of need by contacting the Vertiv Services Customer Resolution Center at 1-800-543-2378.
- Site Access: Prior to time of scheduled work, provide site access including any customer required escort, security clearance, safety training and badging for Vertiv service personnel.
- Equipment Access: Convenient access to the equipment covered by the Scope of Work. Prior to scheduled time of work, notify Vertiv service personnel of any special requirements for equipment access including lifts, ladders, etc.
- Shutdown: Service may require shutdown of load to ensure electrical connection integrity.
- Notification: If for any reason the work cannot be performed during scheduled time, notify Vertiv service personnel 24-hours prior to scheduled event.

## TERMS AND CONDITIONS

Subject to all Terms & Conditions as noted in the Vertiv Services Terms & Conditions or the terms of a Master Agreement between the parties, if any, shall apply.