Low and Medium Voltage Service
Low voltage circuit breaker refurbishment scope of work

I. Receipt inspection

1. Visually inspect breaker for any visible missing or damaged components prior to incoming testing. Record breaker nameplate and operations counter information.
2. Perform incoming operational testing to include (as applicable):
   - Manual and electrical functional operation tests
   - Check minimum and maximum coil operating voltages
   - Check the minimum coil pickup voltages and minimum and maximum coil operating voltages
   - Check for proper operation of anti-pump feature
   - Check for proper operation of electrical and mechanical safety interlocks
   - Check for operation of indicating devices, including all visual indicators and operational counter
   - Check for proper operation of racking device and check interlocks
3. Perform insulation resistance testing. All testing will be performed at 1,000 vdc. Individual tests on primary current carrying components will be performed to include phase to phase, phase to ground, and testing of each pole piece, with the main contacts open. Minimum acceptance value is 100 megohms or greater. Insulation resistance checks of secondary (control) circuits, to ground, will be conducted. Testing of the spring charging motor will be conducted at 500 vdc. Minimum acceptance value is one megohms or greater.
4. Perform main contact resistance checks. Maximum acceptable readings will be dependent on the breaker manufacturer and model, and whether or not the breaker has an electromechanical or solid state trip unit.
5. Perform over-current trip testing. Over-current device/unit pickup points (SS and MPS) and delay times (all types of trip devices) will be determined by primary current injection. Proper current sensor phase polarity will be checked, if applicable. Oil Displacement (OD) type trip units will be test on and off the circuit breaker at the “as found” settings only.
6. Test for proper operation of applicable circuit breaker trip features, including undervoltage and anti-single phasing devices (blown fuse indicators).
7. 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.

II. Refurbishment

1. The entire circuit breaker will be disassembled to sub-assembly component level. The operating mechanism, main contact moving and stationary assemblies, drawout 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, inspected for worn/degraded contacts, proper formation of armatures and cracked housings. Limit switch contacts will be burnished and/or polished as required. Coils will be checked, as will all terminal connections.
2. Each component will be thoroughly cleaned and inspected.
3. Some components that are damaged can be repaired/refurbished at a greater cost savings to the customer. These components are as follows:
   - Charge motors
   - Contacts (If wear on contact surface is <50 percent they will be resurfaced for optimal use. If wear on contact surface is >50 percent the component must be replaced.)
   - Re-plating of frame, mechanism and contact plated parts will be performed for an adder charge for that plating as necessary
4. All defective components will be documented, retained and returned to the customer, if requested.

III. Breaker re-assembly

1. 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. Mobile 28 grease can be used, if the customer request the lubricant in the purchase order. We ensure all excess exposed lubricant is removed to minimize contamination between maintenance periods.
2. All latches, roller clearances, adjustable spring tensions and mechanical adjustments within the operating mechanism will be setup per the applicable manufacturer's specification.
3. Main and arcing contact simultaneous make and wipe (main contact pressure) will be adjusted per manufacturer's specifications.
4. Electromechanical overcurrent trip devices will be adjusted, as required, to ensure they operate within applicable trip curves
5. Upon final assembly, all hardware will be inspected to ensure proper installation and that all parts are properly secured.
6. Setup testing and all initial adjustments will be performed by the assembly technician prior to final testing by one of our certified Inspectors.

IV. Final testing

1. Operate breaker electrically and manually. Check close, trip, latch and trip free operations. Visually check the operating mechanism for proper alignment of props, latches, toggle assemblies and operating levers and linkages.
2. Perform operational testing to include (as applicable):
   - Manual and electrical functional operation tests
   - Check pick-up, minimum and maximum coil operating voltages
   - A minimum of five manual and five electrical functional operational tests to each electrical device will be performed
   - Verify proper operation of anti-pump feature
   - Verify proper operation of electrical and mechanical safety interlocks
   - Check operation of indicating devices, including all visual indicators and operational counter
   - Verify proper operation of racking device and check interlocks
3. Perform over-current trip testing. Over-current device/unit pickup points and delay times will be determined by primary current injection. Proper current sensor phase polarity will be checked, if applicable. If applicable, OD's will be detail inspected for signs of leakage of oil and readjusted to the proper air gap. One tap setting of each function will be checked for proper calibration to the applicable time curve.
4. Test for proper operation of applicable circuit breaker trip and electrical features such as undervoltage, anti-single phasing devices (blown fuse indicators), auxiliary switches, power shield SCR leakage (if applicable) and alarm circuits.
5. Perform insulation resistance testing. Nine individual tests on primary current carrying components will be performed to include phase to phase, phase to ground, and testing of each pole piece, with the main contacts open. Insulation resistance checks of secondary (control) circuits, to ground, will be conducted. All testing will be performed at 1,000 vdc. Minimum acceptance value is 100 megohms. Testing of the spring charging motor will be conducted at 500 vdc. Minimum acceptance value is one megohms.
6. 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, and whether or not the breaker has an electromechanical or solid state trip unit.
7. 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
   - A list of any part painted or repaired
   - All final "as left" inspection and test results
8. If requested, the Plant Electrical System Engineer, Electrical Maintenance Supervisor, or other company representatives to witness all, or part, of the final testing. This requirement should be outlined in the purchase order. We will provide a minimum of twenty-four hours advance notice of our testing schedule.

Note: Upon request, all defective and rejected parts that are replaced can be returned to the customer.

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