

Type SP & TCP circuit breaker maintenance programs

Service solutions for your T&D infrastructure

As the supplier of OEM parts for your SP and TCP circuit breakers, Siemens Energy is committed to supporting you with qualified parts and factory-trained field service support throughout your circuit breaker's lifecycle.

The TCP series SF₆ circuit breaker has offered dependable service for the past 20 years. The pneu-draulically operated TCP was rated from 121 up to 245 kV and up to 63 kA.



Figure 1 SP circuit breaker work

SP puffer and TCP pneu-draulic circuit breaker major maintenance programs

Maintenance intervals

Siemens Energy recommends that major maintenance be performed on your SP circuit breaker after 2,000 operations, accumulated fault duty equal to 20 times the circuit breaker kA rating, or eight years, whichever occurs first. Major maintenance involves an internal inspection of the circuit breaker and requires a major inspection kit that includes all the required gaskets, lubricants, and other consumables.

Siemens Energy recommends that major maintenance be performed on your TCP circuit breaker after 3,000 operations, accumulated fault duty equal to 20 times the circuit breaker kA rating, or 12 years, whichever occurs first. Major maintenance involves an internal inspection of the circuit breaker and requires a major inspection kit that includes all the required gaskets, lubricants, and other consumables.

Field service

With Siemens Energy services, an experienced, factory-trained engineer who specializes in high-voltage (HV) circuit breaker maintenance will be on site to assist each step of the way. Siemens Energy can assist with technical field assistance, turnkey maintenance, and turnkey breaker replacement.

Digital radiography (Type TCP)

Digital radiography combined with regular “external” preventive maintenance will improve circuit breaker reliability, ensure internal components are acceptable for continued use, and allow for tracking interrupter wear over the lifecycle of the circuit breaker. Depending on the circuit breaker type and size, digital radiography inspection could be as much as 50 percent less costly than traditional internal inspections.

Siemens Energy power circuit breaker training

The SP and TCP two-day training program is tailored to increase the knowledge of personnel responsible for the maintenance of HV SF₆ breakers and focuses on hands-on practical, rather than theoretical, training. Your personnel can attend a program conducted at our power circuit breaker factory in Jackson, Mississippi, or training can be combined with technical field assistance during a scheduled outage.

Customer benefits include:

- Hands-on experience for the crew
- Maintenance and repair sequencing
- Factory adjustment procedures and tolerances
- Problem analysis
- Final check-out.



Figure 2 Digital radiology

Type SP & TCP puffer circuit breaker renewal parts solutions

Renewal parts

If renewal parts are required during major maintenance, Siemens Energy maintains a multi-million-dollar inventory for rapid supply of many key components.

Customer benefits include:

- Experienced in-house renewal parts specialists
- Access to OEM engineering departments that understand your equipment design
- Parts manufactured and tested to OEM specifications that include the latest design and material improvements
- 24/7/365 parts availability.

Spare interrupters

To reduce outage downtime, particularly when several circuit breakers will be inspected, many customers order spare interrupters to have on hand to be prepared in the event their inspection reveals the need to replace the existing interrupter.

Major inspection kit

We provide all required O-rings, lubricants, and consumable materials to replace items subject to wear, thus potentially adding 15 to 20 years to equipment life.

There have been several design improvements in the SP circuit breaker since its introduction by Westinghouse in 1980. The following improvements, depending on your circuit breaker, can be field installed:

- **Interrupting rating**
Many SP circuit breakers were originally designed for 23 kA. Siemens Energy can increase this rating to 31.5 kA by replacing the interrupter and adding a tank liner. We can further increase this rating to 40 kA by adding line to ground capacitors.
- Many 121 145 kV TCP circuit breakers were originally designed for 40 kA. Siemens Energy can increase this rating to 50 kA by adding line to ground capacitors.
- Many 169 245 kV TCP circuit breakers were originally designed for 50 kA. Siemens Energy can increase this rating to 63 kA by adding line to ground capacitors.
- **Continuous circuit**
Many SP circuit breakers were originally designed for 1,200 amperes. Siemens Energy can increase this rating to 2,000 or 3,000 amperes by changing a bushing component and possibly the current transformers.

- **Voltage rating**
Siemens Energy can increase the voltage rating to 72 kV by adding voltage shields.

Available SP upgrades include:

- **SF₆ pressure monitoring**
Several methods were applied to monitor gas pressure. The later design incorporated a temperature compensated pressure switch in conjunction with a lockout relay that prevents the circuit breaker from operating while the pressure is below safe operating levels. Circuit breakers with other methods can be upgraded to this functionality.
- **Control cabinet anti-condensation**
Siemens Energy can prevent corrosion in the control cabinet by adding an anti-condensation heater assembly.
- **-40 °F temperature operation**
We can improve operating temperature to -40°F by adding tank heaters.
- **Replacement porcelain bushings**
SP circuit breakers manufactured prior to 1988 utilized epoxy bushings. Siemens Energy can field install replacement porcelain bushings.
- **Manifold assembly**
We can prevent corrosion and leakage on the manifold by replacing the original stainless-steel tubing with new copper tubing.

Available TCP upgrades include:

- **Pressure relief valve**
Prevent leakage by replacing "dart" type relief valve with direct acting "ball" type
- **Power unit modification**
Replace out-of-production Barnes pump with modern design
- **Dual trip coils**
Additional trip coils provide redundancy
- **Current transformer (CT) covers**
Prevent corrosion by replacing original steel plate with aluminum
- **-40 °F temperature operation**
Improve operating temperature to -40 °F by adding tank heaters
- **SF₆ manifold**
Upgrade SF₆ manifold with sampling valve.

SP Maintenance tips

The following tips are useful during major maintenance, troubleshooting, and long-term maintenance planning.

Mechanism hints

- **Air valve leaks**
Temperature plays a critical role in hardening air valve O-rings, which may result in leaks. A contributing factor is the air valve heater used to prevent condensation inside the mechanism and prevent ice from freezing the valve during operation when the ambient temperature is 45°F and below. Siemens Energy has developed an alternate heater arrangement, which consists of energizing another heater continuously to control condensation and controlling the air valve heater with a thermostat to be on only when needed. Upgrade kits include new valve O-rings, thermostat, heater, and installation drawings.
- **Pneumatic mechanism slow reset on trip-free latch**
Siemens Energy has received reports of type SP circuit breakers with slow reset times on the trip-free latch or the mechanism going trip-free on a close-open operation. Check that the circuit breaker lever system is set correctly using the horizontal linkage system setting gauge (part 7358D12H14). Trip-free latch problems may be caused by slight changes in the open position stop bolt setting.
- **Mechanism linkage lubrication**
Frequently operated SP circuit breakers should be checked and lubricated with Molykote at the following points:
 1. Horizontal linkage pins, particularly where the horizontal tie pipe connects to the drive levers
 2. Hydraulic shock absorber plunger nose that makes contact with the bell crank lever
 3. Rollers that move vertically in operating mechanism guide rails (on ends of A and B pins).

Interrupter bushing maintenance hints

- **Loose moving contact nuts**
Frequently operated SP circuit breakers built before January of 1988 have occasionally experienced loose nuts where the moving contact attaches to the interrupter tube and should be checked at the next major maintenance. Nuts should be cleaned with Loctite Primer, and a couple drops of Loctite 242 (blue) should be applied to the nut thread before retightening to 25 ft.-lbs. torque.

- **Interrupter lubrication**

In warmer climates, the Molykote lubrication in the interrupter may dry out. Relubricate with Beacon 325. The resistance (100A flowing) should be less than 40 microohms.

- **Leaking bushings at top**

When installing terminal pads, make sure that the terminal pad and bushing stud threads are free of burrs as they should screw on easily. If not, it may be possible to overcome the 100 ft.-lbs. torque used during bushing assembly, which may result in a loose stud and leaking bushing.

TCP Maintenance tips

The following tips are useful during major maintenance, troubleshooting and long-term maintenance planning.

Pressure relief valve

Type TCP circuit breakers built before January of 1992 had a "dart" type relief valve that was occasionally sensitive to foreign material. The valve could begin to leak high pressure to low pressure and would not reseal. As a result, the pump motor might run continuously causing circuit breaker damage. The problem is most common in locations where there are large daily temperature changes. The dart valve was changed in January of 1992 to a direct acting "ball" type (part # W43840801) and will fit directly into the cavity of the earlier valve. The new valve uses crushable copper washers as a means of sealing to atmosphere. These washers should be replaced if the cover is removed or the valve is adjusted. Use care on torquing the cover and locknut to 13 ft.-lbs.

Pressure switches

Hydraulic leaks have been reported at the adapter nipple used to connect the pressure switch to the manifold. This can normally be corrected by disassembling and retightening with Loctite 567-65 hydraulic sealant, which is Teflon filled. Let it harden for 16 hours before reinstalling. New circuit breakers no longer use this pipe nipple but will have a ring seal only. A kit that will convert the pipe thread seal system to the ring system is available (part #72-182-158-801).

Pressure gauge fitting

Some hydraulic leaks may develop at the back of the pressure gauge fitting. Due to its location, it is difficult to center the seal ring before tightening this fitting. A new USIT-ring (part # W37000613) has proven very easy to install and effective in solving leaks.

Rusting CT covers

On some TCP circuit breakers built before June of 1993, we have received reports of rusting on the CT can cover plate, typically in high humidity, salt-contaminated areas such as near seacoasts. The cover plate is a split-ring zinc dichromate-coated steel plate attached and sealed to the porcelain flange and the aluminum CT spinning with the screw and silicone rubber (RTV). This rust can be repaired in the following ways:

1. Light rust – wire brush, touch up with primer and paint.
2. Severe cases – wire brush, coat with Loctite Extend (let dry) and paint.

Touch up paint and Loctite Extend may not stick to the RTV but should help prevent rusting under the RTV. At the time of circuit breaker major maintenance, steel plates can also be changed out to aluminum.

Contact us

To find out how these services may give you a competitive advantage, contact your local Siemens Energy sales representative or our 24/7/365 call service 1-833-743-0880.

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