Power Circuit Breakers

Insulating Oil and Oil Handling

Insulating oil sufficient to fill the tanks to proper level is supplied for each circuit breaker. Oil is usually shipped in steel drums, but large quantities may be shipped in tank cars. The oil is pure mineral oil especially refined for use in oil circuit breakers. Purchase specifications for the insulating oil, based on ASTM test methods, include the following:

Flash point .....not less that 145 C
Pour point .....not more than −40 C
Viscosity (Saybolt) at 40 C ..... not more than 66 sec
Neutralization number (mg of
KOH per g of oil) ..... not more than 0.03
Color ..... not more than 0.5
Dielectric strength (1.00-in. diameter disk at
0.1-in. separation at 25 C) .....not less than 30 kv
Specific gravity at 15 C ..... not more than 0.91
Corrosive sulfur .....none

Because the dielectric quality of the oil circuit breaker depends so much on the insulating quality of the oil, it is necessary to follow definite routines for the handling of the oil at all stages of use. Tests must be made before the oil is run into the tanks and at intervals afterward, depending on the number of fault interruptions and other factors. Any improper condition disclosed by the tests or by inspection of the oil must be remedied by suitable methods such as filtering for removal of carbon, dirt, and moisture; treatment for removal of acids.

STORAGE

When the oil is not for immediate use, it should be protected from the weather by storing it indoors in a place that has only a slight temperature variation. To reduce moisture condensation in the drum as a result of temperature change and entry of outside air, the drums should not be opened or unsealed until the oil is actually needed.

If drums of oil are brought into a room warmer than they are, the drums should be allowed to stand before opening until there is no condensation on the outside and they are thoroughly dry.

PREPARATION OF CIRCUIT BREAKER TANKS

All accessories such as valves and gages must be fitted to the tanks and made oil tight. The threads should be shellacked—or equivalent—before the fittings are screwed in place. The interior of the tanks should receive a final inspection and cleaning.

CAUTION

Before entering the tanks of large oil circuit breakers after oil has been drained, care should be taken to see that sufficient time has elapsed in order to permit the gas residue remaining in the breaker tank to escape.

Assuming the oil to be of proper dielectric strength, the tanks should be filled to the indicated oil level. As this level is based on cold oil at 25 C (77 F), a temperature correction should be made if the temperature differs greatly from this amount. Some gages indicate the level for various temperatures.

The dielectric strength of oil in the circuit breaker tank should not be permitted to drop below 25,000 volts when tested as described in Dielectric Testing of Oil. If below this amount, the oil should be filtered and otherwise conditioned until its dielectric strength attains at least 28,000 volts. New oil should not be admitted to the tank unless it has a dielectric strength of at least 30,000 volts.

SAMPLING OIL FOR TESTING

The sampling container should be a large-mouthed glass bottle with a cork stopper. The bottle should be cleaned and dried, free of moisture, before it is used. The sample for dielectric tests should be at least 1 pt (16-oz bottle) and, if a number of tests are to be made, 1 qt (32-oz bottle).

Test samples should be taken only after the oil has settled for some time. Cold oil is much slower in settling. Oil samples from large circuit breakers should be taken from the valve at the bottom of the tank. Oil samples from small oil circuit breakers that have no valves should be taken from the bottom. A brass or glass thief can be used conveniently for this purpose. The same method should be used for cleaning the thief as that used for cleaning the container for the oil sample.

When drawing samples from the bottom of a large oil circuit breaker or large tank, sufficient oil must first be drawn off to make sure that the sample will be composed of oil from the bottom of the tank and not from oil stored in the sampling pipe. A glass receptacle is desirable for receiving the oil so that any free water in the oil may readily be observed from its settling to the bottom. If moisture is found, an investigation should be made and a remedy applied.

McGRAW-EDISON COMPANY
Power Systems Division
Canonsburg, Pennsylvania 15317

September 1977
Supersedes 7/75

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Contact Opening and Closing Speeds

The tabulated values in Service Information S290-05-1 represent recommended ranges for opening and closing speeds of McGraw-Edison Company power circuit breakers. Contact speeds are measured in oil; values listed are in feet per second (ft/sec).

Contact Speed in Oil, Measured in Feet per Second

Breaker Type	Service Information	Opening Speed (ft/sec)		Closing Speed (ft/sec)	
		Minimum	Maximum	Minimum	Maximum
CF-37	S290-15-2	15.0	17.5	15.5	17.5
CF-40	S290-15-2	15.0	17.5	15.5	17.5
CF-48	S290-15-2	15.0	17.5	15.5	17.5
CF-56	S290-20-1	12.0	15.0	15.5	17.5
CF-56A	S290-21-1	13.5	15.5	16.5	17.5
CG-38	S290-15-5	13.5	15.5	16.0	17.0
CG-48	S290-15-5	13.5	15.5	16.0	17.0
CGH-50	S290-16-1	13.5	15.5	16.0	17.0
CH-60	S290-20-1	12.0	15.0	15.5	17.5
CH-60A	S290-21-1	13.5	15.0	16.5	17.5
AHE-48	S290-40-1	17.0	21.0	16.5	18.0
AHE-54	S290-40-1	17.0	21.0	16.5	18.0
AHF-48	S290-40-2	15.0	17.0	20.0	21.0
AHF-54	S290-40-2	15.0	17.0	20.0	21.0
AHJ-48	S290-30-2	15.0	17.0	13.0	14.5
AHJ-54	S290-30-1	15.0	17.5	18.0	22.0
AHJ-60	S290-30-1	15.0	17.5	20.0	22.0
ALP-54	S290-32-1	15.5	17.5	16.0	17.0
ALP-60	S290-32-1	15.5	17.5	16.0	17.0
AHP-60	S290-31-1	14.0	15.5	16.0	17.0
RHE-78	PTI-S-693-1	14.0	18.5	15.0	17.0
RHE-84	PTI-S-693-1	14.0	18.5	15.0	17.0
	S290-45-2	14.0	18.5	17.0	18.0
RHE-90	PTI-S-674-1	14.0	17.5	15.0	17.0
	S290-45-3	14.0	17.5	17.0	20.0
RHF-90	S290-46-1	14.0	17.5	22.5	23.5
RHF-84*	S290-46-2	14.0	17.5	18.0	20.0
RHF-90*	S290-46-2	14.0	17.5	21.0	22.5

* Low-profile breaker.

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