# INDOOR-TYPE HIGH CAPACITY AIR BLAST CIRCUIT BREAKERS

Fuji Electric has developed a series of indoor high capacity air blast circuit breakers which employ slidetype contacts with a constantly pressurized nozzle packing system as shown in *Fig. 1*. As can be seen from this figure, the current carrying portion is in the form of a butt contact while the arcing contact is of the slide type made from arc-resistant metal. With this type of construction, the moving contact leaves the fixed contact rapidly during breaking. The nozzle packing system provides a strong initial blast which rapidly blows the arc into the nozzle. Thus, the contact surface for normal current flow is not damaged and metalic vapour generation is kept to a minimum which means that the restriking voltage characteristics are excellent.

The nozzle packing consists of heat resistant silicon rubber. This sillicon rubber is so resistant to heat that its characteristics will not deteriorate even under a constant temperature of 250°C. Even after a total breaking of 200 ka, there is no deterioration of rubber—surface cracks etc., and continuous operation is possible. The amount of permanent deformation of various rubbers was measured over long periods of exposure to high temperature during current flow and silicon rubbers showed the least deformation of all those tested. The amount of deformation reaches a plateau in about two weeks. The final deformation value of the interference is about 10% and presents no problem.

The insulators are made of epoxy resin and form a single casting with the flange parts. The disconnecting contact is surrounded by high-pressure air so that there is very little damage to the contacts by pre-strike on closing.

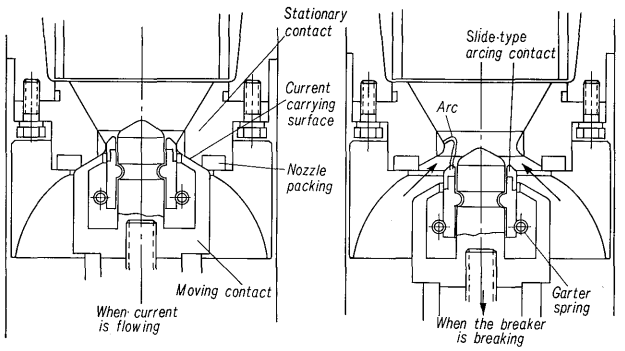


*Fig. 1* Construction of breaking contacts

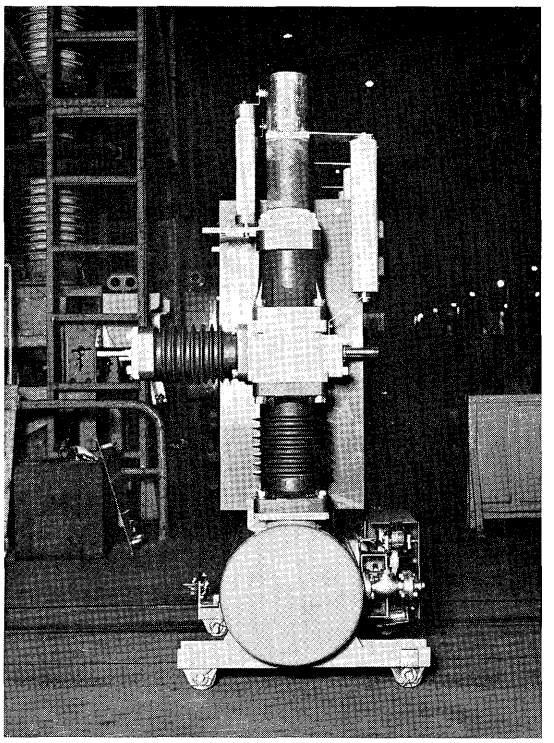

*Fig. 2* Side view of air blast circuit breaker 24 kv, 200 amp, 1500 Mva

When the breaking capacity is very large, a 2 breaking unit system is used in order to verify the breaking characteristics by direct testing (*Fig. 3*). When the rated current is over 3000 amp, a by-pass contact is provided in parallel with the breaking part so that the latter can be of standard design even for the large rated current. The by-pass contact opens before the breaking part (*Fig. 4*).

The same operating device can be used for all equipment of the above mentioned ratings, and the same breaking contacts are used in a rated breaking current range of 30～60 ka. Therefore, circuit breakers for almost any ratings can be obtained merely by assembling a few units.

***Table 1* Ratings of RF701 Type Air Blast Circuit Breakers**

| Type | Ratings | | | | | | | | | | | Air consumption (Atmospheric pressure conversion) (*l*) | | Control current (amp) | | operating pressure Rated | Weight | Number of serier breaking units | Breaking capacity for voltages other than the rated voltage | | Dimensions (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Voltage | Current | Breaking capacity | Insulation class No. | Restriking voltage No. | Short-time current | Closing current | Breaking time | Opening time | No-load closing time | Operational duty (No.) | Air tank capacity | Closing | Tripping | Dc 100 v Closing | Dc 100 v Tripping | | | | Voltage | Breaking capacity | Height | Width | Depth |
| | (kv) | (A) | (Mva) | | (kHz) | (ka) | (kA) | (~) | (s) | (s) | | (*l*) | | | | | (kg/cm²) | (kg) | | (kv) | (Mva) | | | |
| RF701d/10/1200D | 12 | 1200 | 500 | 10B | II15 | 24.1 | 65.5 | 3 | 0.025 | 0.06 | A (CO-15 minutes-CO) or A (O-1 minute-CO-3 minutes-CO) or A (O-3 seconds-CO) | 110 | 50 | 600 | 5 | 5 | 15 | 420 | 1 | | | 1668 | 1000 | 884 |
| RF701d/10/2000D | | 2000 | | | | | | | | | | | | | | | | | | | | 1668 | 1000 | 985 |
| RF701h/10/2000D | | 2000 | 1000 | 10A | | 48.1 | 131.3 | | 0.03 | | | 230 | 60 | 1200 | | | | 670 | | 7.2 | 500 | 2071 | 1220 | 1118 |
| RF701h/10/4000D | | 4000 | | | | | | 5 | 0.06 | | | | | | | | | 770 | | 14.4 | 1200 | 2071 | 1220 | 1160 |
| RF701h/20/1200D | 24 | 1200 | | 20B | II9 | 24.1 | 65.5 | 3 | 0.025 | 0.08 | | 135 | 50 | 700 | | | | 600 | | | | 1863 | 1220 | 971 |
| RF701h/20/2000D | | 2000 | | | | | | | | | | | | | | | | | | | | 1872 | 1200 | 1055 |
| RF701h/20/4000D | | 4000 | | | | | | 5 | 0.06 | | | | | | | | | 700 | | | | 1863 | 1200 | 1087 |
| RF701j/20/2000D | | 2000 | 1500 | | | 36.1 | 98.5 | | 0.03 | | | 230 | 60 | 1200 | | | | 670 | | | | 2071 | 1220 | 1118 |
| RF701j/20/4000D | | 4000 | | | | | | | 0.06 | | | | | | | | | 770 | | | | 2071 | 1220 | 1160 |
| RF701B/20/2000D | | 2000 | 2500 | | | 60.0 | 164 | 3 | 0.035 | | | 420 | 70 | 2400 | | | | 1200 | 2 | | | 2009 | 1440 | 1620 |
| RF701j/30/1200D | 36 | 1200 | 1500 | 30B | II7 | 24.1 | 24.1 | | 0.03 | | | 195 | 60 | 900 | | | | 660 | | | | 2051 | 1360 | 1071 |
| RF701j/30/2000D | | 2000 | | | | | | | | | | | | | | | | | | | | 2051 | 1360 | 1108 |
| RF701B/30/2000D | | 2000 | 2000 | | | 40.1 | 109.3 | | 0.035 | | | 420 | 70 | 2400 | | | | 1200 | 2 | | | 2069 | 1440 | 1700 |

The air tank capacity is enough for 1 "CO" without air supply.

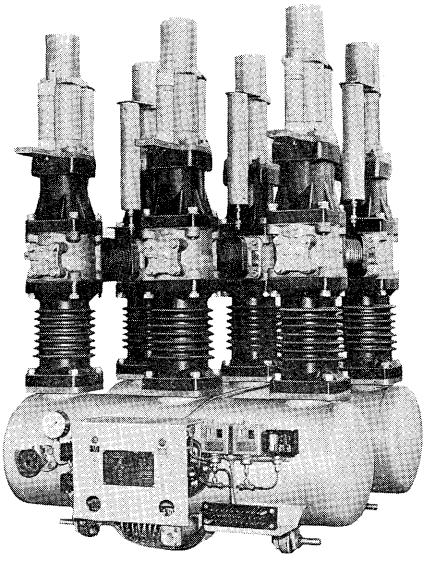

*Fig. 3* Air blast circuit breaker 36 kv, 2000 amp, 1500 Mva

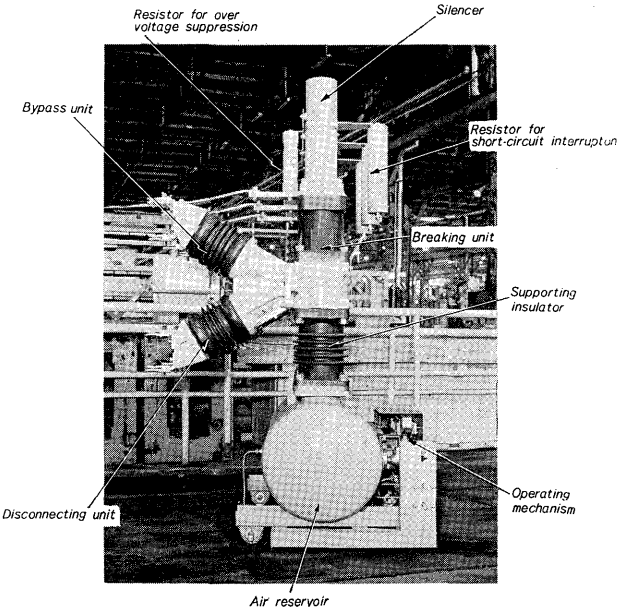


*Fig. 4* Side view of air blast circuit breaker 12 kv, 4000 amp, 1000 Mva

Short-circuit tests were conducted on 36 kv, 2500 Mva breakers at the High Voltage Power Laboratory Takeyama Laboratory.

# FUJI V-TYPE DISCONNECTING SWITCH

(Indoor-type, for 3/6 kv circuit) (Single pole, single throw, hook operation)

## Introduction

Fuji Electric is now producing a standard line of disconnecting switches for a wide range of voltages from low ratings of 600 v and below up to ultra-high voltages of 500 kv. These switches include Fuji's unique V-type series, the pantograph series etc. These switches are now widely used and have proven highly satisfactory.