

THYRISTOR OVERVOLTAGE LIMITER type TOP-3

Application. The thyristor overvoltage limiter TOP-3 type is designed for installation in DC substation circuits - parallel to the cathode choking coil (see fig.1) and limits overvoltages on the choking coil and rectifier output and arc energy generated in the high speed breaker (HSB) arc chute (triggered by switching processes). The limiter is adapted for operation with six- and twelve-pulse rectifiers.

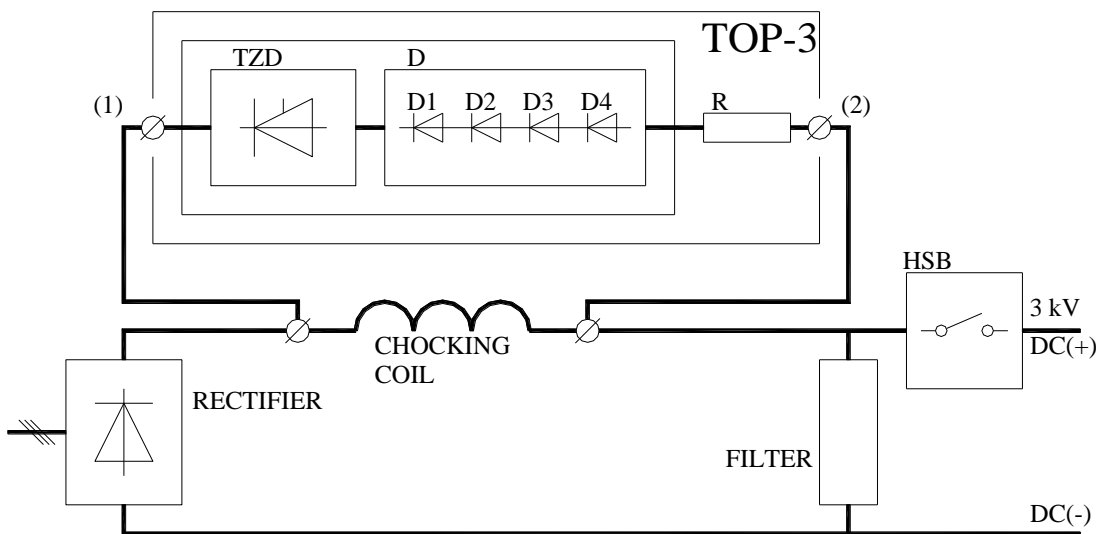


Fig. 1. Thyristor overvoltage limiter – connection with other main circuit elements

Characteristics. When the current in the coil decays rapidly on its terminals the overvoltage appears. When the overvoltage reaches about 600 V, the limiter bridges the choking coil terminals closing the circuit for the coil current (current decreases slowly with the high time-constant of the circuit: coil-limiter) and it allows rapid current decay in the circuit outside coil. It is important in the short-circuit switching off – it limits significantly the HSB arcing time and overvoltages (to hundreds of volts) generated in circuit inductances. As a result the amount of released energy in the HSB arc chute is considerably decreased.

It was confirmed by laboratory and operational tests during introduction of substation with the one-step transformation 110/3 kV (the scientific works: of PW and CNTK titled: „Test report of the Gamma type filter” and of CNTK nr 3038/28 titled: „Rectifier operational tests with the one-step transformation 110/3 kV and filtering equipment”). Further experiences were gained during HSB BWS type tests performed by CNTK in the Warsaw East substation and published under the title: „Report of HSB BWS-50 switching capability in the container DC switchboard KRWN-3 type” and „Report of HSB BWS-50 switching capability in the DC switchboard RPS/K type”. Simulation calculations done after tests confirm, that amount of arc energy released in the HSB - when the limiter is parallel connected with the choking coil (regardless of rectifier type) – equals about 100 kJ. Without the limiter the amount of energy reaches (for following rectifiers): PK-17 - about 250 kJ, PD-16 about 350 kJ, PW-17 about 500 kJ. The application of limiter,



particularly in high energy (in a close distance) short-circuits, results in limiting (several times) the energy released in the HSB arc chute.

Control features. The application of the thyristor overvoltage limiter TOP3 in rectifier choking coils enables:

- extension of the arc chute lifetime,
 - extension of the time between HSB inspections,
 - parallel operation of more than two rectifiers (now the operation of two parallel rectifiers is allowed).
- The year operation of TOP-3 limiters in Warszawa Wschodnia substation confirmed their advantages. The solution received the CNTK positive opinion (dated - October 2002 r.).

Basic technical parameters

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| • withstand voltage (in reverse direction) | 10 kV, |
| • current overloading - 10ms | 20 kA, |
| • current capacity - 1s | 3 kA, |
| • switching on threshold voltage | 600 ± 25 V, |
| • ambient working temperature | (-30÷+45)°C, |
| • overall dimensions (H * W * D) (see fig.2) | 750 * 560 * 380, |

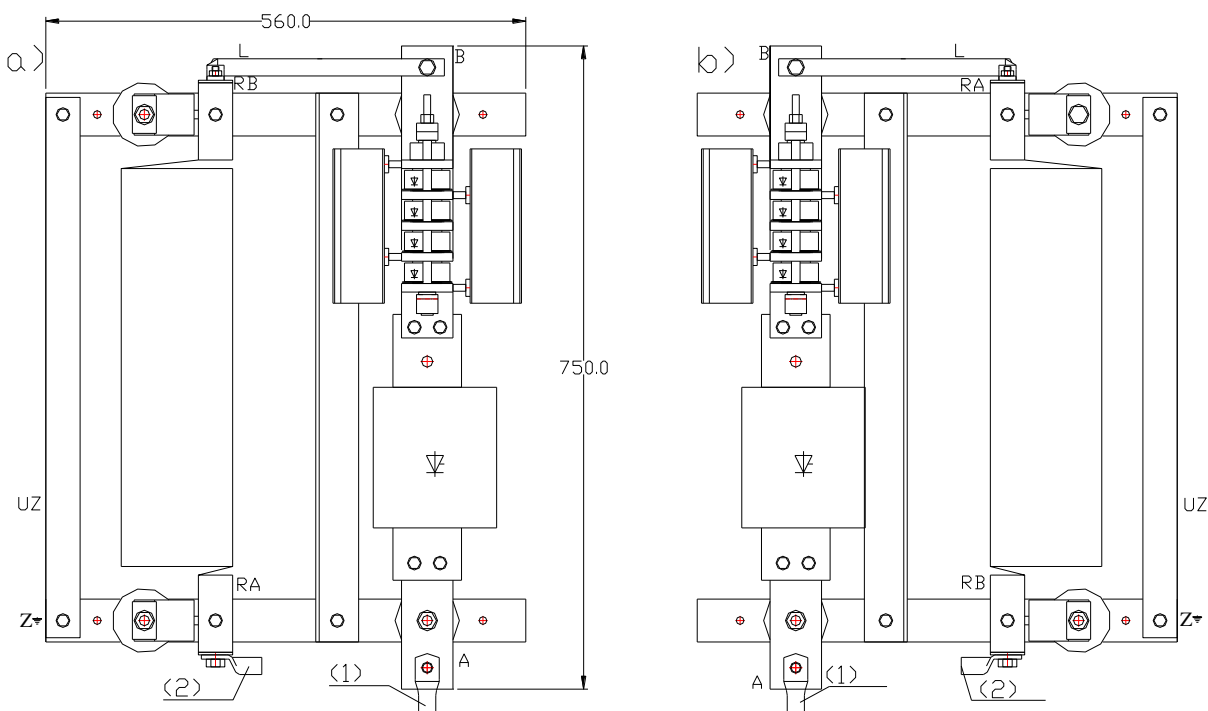


Fig. 2. Thyristor overvoltage limiter TOP3 - dimensions

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