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AUTHOR: (10) Mačat, Jaroslav, Engineer

TITLE: (6) Problems of nonsimultaneous short circuits in three phase networks of high power laboratories II

PERIODICAL: (2) Przeglad Elektrotechniczny, no. 12, 1962, 507-511

TEXT: Nonsimultaneous short circuits were investigated in the high-power laboratory USE in Běchovice, Czechoslovakia, to determine the conditions of occurrence of symmetrical short circuits. Formulas are given for phase currents with nonsimultaneous make of the form:

$$i_1 = I_{3fm} \left[ -\cos(\omega t + \alpha + \frac{\pi}{3} - \varphi) + e^{-\frac{Rt}{T}} \cos(d + \frac{\pi}{2} + \varphi) \right] +$$

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$$+ I_{2fm} e^{-\frac{Rt}{T}}$$

where  $I_{3fm}$  is the amplitude of the a.c. component of 3 phase short circuit,  $I_{2fm}$  is the amplitude of the a.c. component of 2 phase short circuit. Graphs are shown illustrating how the a.c. component varies with the instant of make. Possibility of d.c. component > 100% of a.c. component was shown. The author draws attention to the requirements for making switches, preferably single-phase units individually controlled, to delay the make of the last phase. He mentions the effect of pre-arcing and necessity of low contact erosion to obtain accuracy of make. The author proves that the third pole of the making switch should have a contact gap dielectric strength  $\sqrt{3}$  times greater than that of the other two poles or that the speed of travel should be  $\sqrt{3}$  times greater. The effect of damping on surge current is considered. The analysis shows that the damping should be carefully dealt with and that large transformers and generators often have lower damping than envisaged. Graphs are

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given for  $\cos \varphi / \text{MVA}$  for generators and also for various transformers in the ranges 8 - 63 MVA at 110/3.15 - 75 kV, and 2 - 10 MVA and 50 - 1600 kVA at lower voltages. Increase of short circuit current due to nonsimultaneous short circuits is shown. The author quotes Czechoslovakian test standards and discusses test tolerances of the spread of nonsimultaneous making and states that from a large number of tests the delay between the poles of a combined 3 phase making switch was never above 10 milliseconds. For 3 single phase switches used on very high voltages this spread is lower. The author concludes that reduction of tolerance on making times would be advisable and stresses the importance of nonsimultaneous short circuits and their effects especially in design of rectifier transformers. There are 10 figures.

ASSOCIATION: Výskumný ústav silnoproudé elektrotechniky Běchovice,  
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