

Changes to IEC 61000-4-11 in Ed.2:2004

Aim of this document is to inform about the changed and new requirements for voltage dips and interruption testing as per IEC 61000-4-11 Ed.2 published in 2004.

New test level introduced for voltage dips

Apart from the test levels for voltage dips as already known from the former IEC 61000-4-11 standard the current edition has been introducing an additional test level of 80%. Hence for voltage dip tests the voltage is reduced to 0% and 70% of the nominal voltage for Class 2 equipment respectively to 0%, 40%, 70% and 80% of the nominal voltage for Class 3 equipment.

New duration's specified for voltage dips and interruptions

The duration's of dips has also been specified differently in the current edition. Please refer to the table here below for details:

Table 1 – Preferred test level and durations for voltage dips

Class ^a	Test level and durations for voltage dips (r_g) (50 Hz/60 Hz)				
Class 1	Case-by-case according to the equipment requirements				
Class 2	0 % during ½ cycle	0 % during 1 cycle	70 % during 25/30 ^c cycles		
Class 3	0 % during ½ cycle	0 % during 1 cycle	40 % during 10/12 ^c cycles	70 % during 25/30 ^c cycles	80 % during 250/300 ^c cycles
Class X ^b	X	X	X	X	X
^a Classes as per IEC 61000-2-4; see Annex B. ^b To be defined by product committee. For equipment connected directly or indirectly to the public network, the levels must not be less severe than Class 2. ^c "25/30 cycles" means "25 cycles for 50 Hz test" and "30 cycles for 60 Hz test".					

The duration of a voltage dip is now directly linked to the level of voltage reduction and is fix. For all levels other than a complete interruption of the voltage the duration is of a fixed period of time giving a different number of cycles for 50Hz or 60Hz.

Table 2 – Preferred test level and durations for short interruptions

Classes *	Test level and durations for short interruptions (t_s) (50Hz/60Hz)
Class 1	Case-by-case according to the equipment requirements
Class 2	0% during 250/300 cycles
Class 3	0% during 250/300 cycles
Class X**	X
Notes * Classes as per 61000-2-4, see Annex B in this present document ** to be defined by product committee. For equipment connected directly or indirectly to public network, the levels must not be below class 2.	

The above table (Table 2) shows the duration's specified for short interruptions.

Requirements for three-phase voltage dips and interruption testing

More accurate requirements are given in IEC 61000-4-11 Ed.2 compared to the previous edition. This edition clearly separates between three-phase supplies with neutral and without neutral line.

Voltage dips and interruptions on a three-phase mains supply system with neutral line

For the voltage dips test of a three-phase system with neutral line each individual voltage (phase-to-neutral and phase-to-phase) shall be tested, one at a time. This implies six different series of tests to be applied as illustrated in the figure here below.

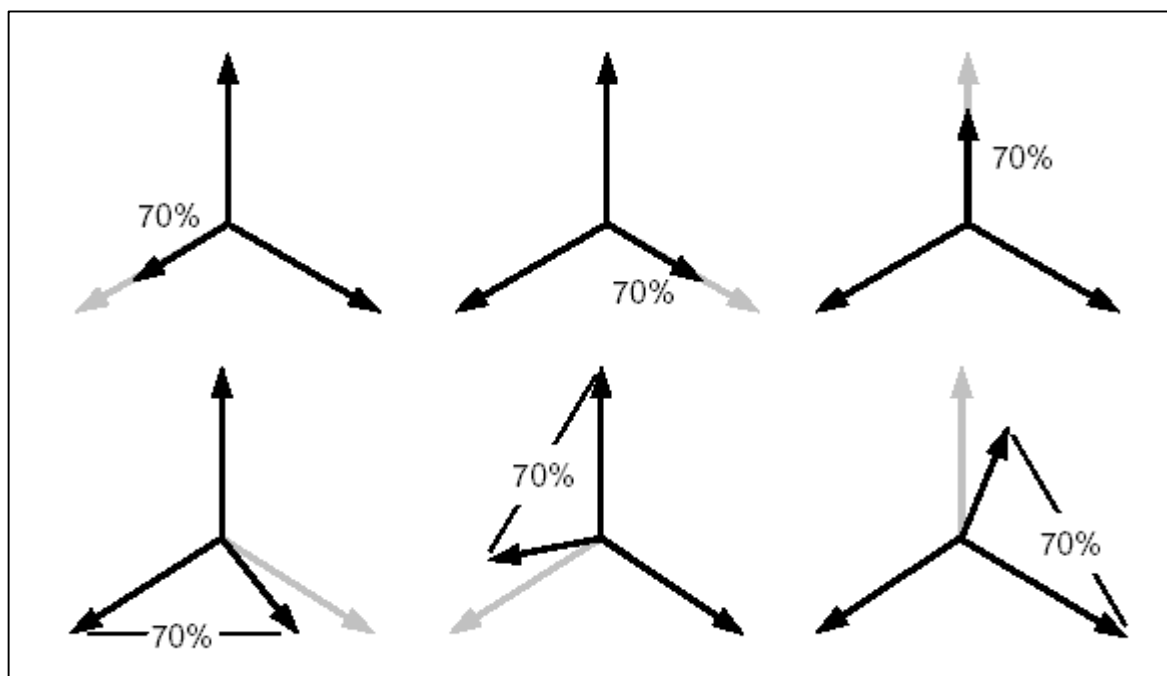


Figure 1: Tests to be effected on a three-phase system with neutral line

For the phase-to-phase tests it is to be noted that the phase with the reduced voltage shows a phase shift.

Voltage dips and interruptions on a three-phase mains supply system without neutral line

For the voltage dips test of a three-phase system without neutral line each individual voltage (phase-to-phase) shall be tested, one at a time. This implies three different series of tests to be applied as illustrated in the figures here below.

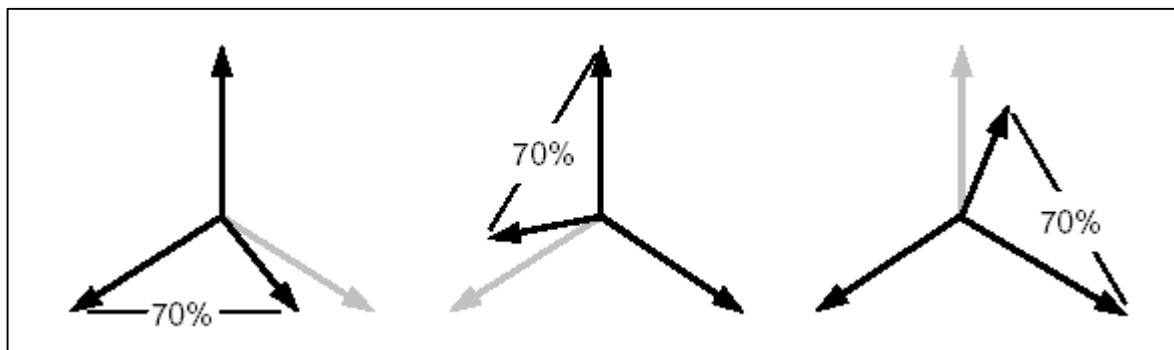


Figure 2: Tests to be effected on a three-phase system without neutral line

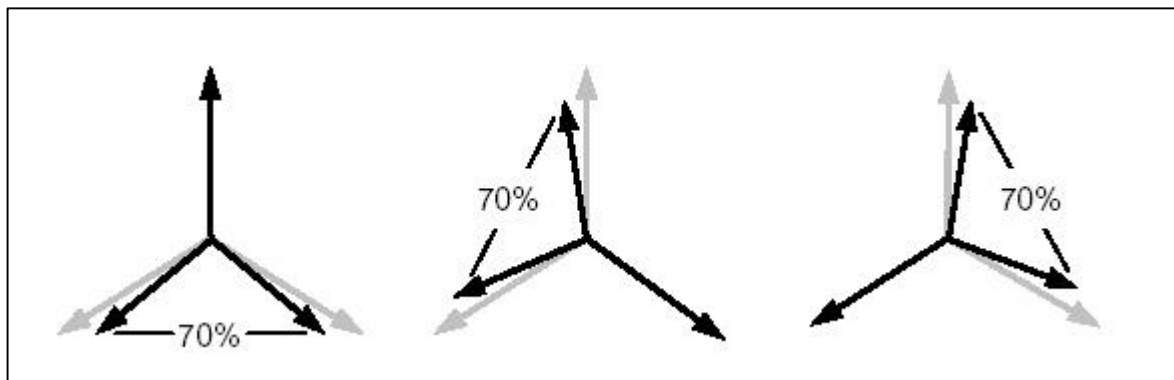


Figure 3: Tests to be effected on a three-phase system without neutral line

Figure 2 shows the preferred method showing the proper phase shift due to the voltage reduction of a single phase while Figure 3 shows an alternative method that gives an acceptable phase shift condition.

Figure 4 on the next page shows the method of testing which according to standard is not accepted. The voltage is reduced same as for phase-to-neutral testing with no phase shift of the corresponding phase(s). This actually represents a voltage source in star connection being use for testing rather than a voltage source in delta connection.

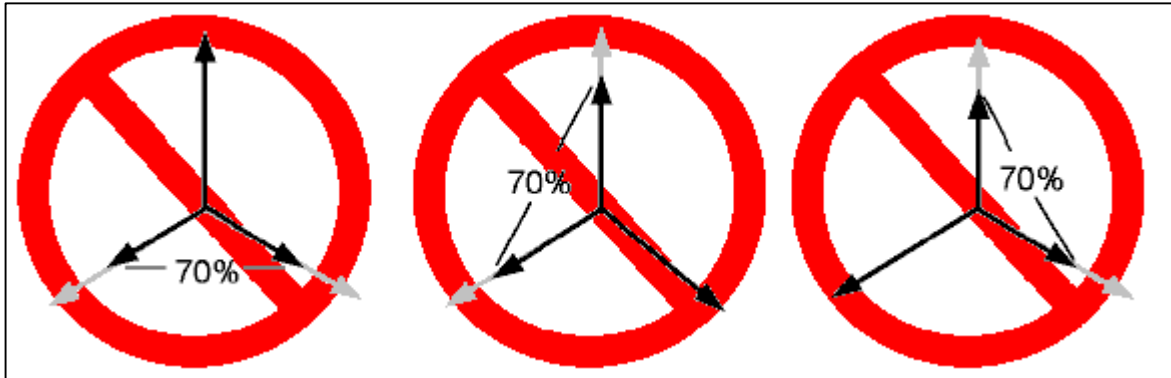


Figure 4: Voltage source in star connection used for testing phase-to-phase in delta mode.

Proper solution by EM TEST for full compliant PowerFail testing on three-phase supplies as per IEC 61000-4-11 Ed.2

EM TEST offers a true three-phase PowerFail test equipment consisting of a three-phase PowerFail simulator, model PFS503 and a motor variac with delta/star connection on its output.

The PFS503 models include three individual pairs of semiconductor switches for each phase. The switches allow the switching between the nominal voltage and the dip voltage within the required 1 .. 5 μ s during abrupt changes when the generator is loaded with a 100 Ω resistive load. The PFS503 models also fulfill the requirement for inrush current not limiting this current to less than 500A.

The motor variac can be connected either in star or delta connection to support all specified requirements of IEC 61000-4-11 Ed.2. by a corresponding mode selector.

The EM TEST three-phase PowerFail system is fully contained in a rack and is available for tests up to 16A or 32A per phase.



Alternatively a programmable voltage source could be used as per IEC 61000-4-11 Ed.2 to perform these tests. However, good care must be taken that the equipment complies with the requirements for performance. Most important points here are the rise and fall times in the range of only a few microseconds and the inrush current capability which normally is far below the recommended 500A @230V respectively 250V @115V. Hence this solution manifests some clear restrictions in testing capabilities compared to the EM TEST solution.