Bus Spacings in Metal-Enclosed Switchgear

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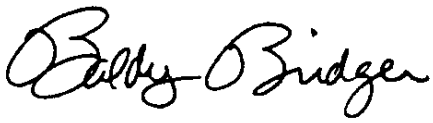
From time to time we are asked what bus spacings are required by ANSI standards for switchgear. Those who ask are frequently surprised by the answer: None. ANSI switchgear standards are generally performance standards. Dielectric tests, power frequency withstand for all voltages and impulse withstand for medium voltage, are specified in the standards. The design must pass these tests. How a manufacturer designs equipment to meet the requirements is up to the manufacturer. If you can place bare conductors 1/2" apart and meet the test requirements for 15kV equipment, that is fine. And before you conclude that I'm being ridiculous, remember that we do this every day in vacuum interrupters.

When considering bus spacings, two dimensions are important. The first is clearance, or the distance through air between conductors of opposite polarity or between an energized conductor and ground. The second is surface creepage, or the distance across an insulating surface. The distances are measured from metal to metal, and vary with voltage and also with whether or not the conductors are insulated. Phase-to-phase and phase-to-ground dimensions are the same because switchgear used on ungrounded or impedance grounded systems will have phase to phase voltage between the unfaulted phases and ground during a ground fault condition.

It is not possible to test every configuration of bus used in switchgear, so every manufacturer has a working guide of dimensions to be used for configurations that aren't tested. Remember that these are dimensions used within metal-enclosed switchgear equipments. They do not apply for overhead lines, pole-top hardware, outdoor substation construction, etc. The dimensions used by different manufacturers may differ a bit, but they are usually pretty consistent. The following table shows some of the more common dimensions we use at Powell.

Voltages			**Air Clearance**		**Surface Clearance**	
Rated Maximum	Low-Frequency Withstand	Impulse Withstand	Insulated Conductors	Bare Conductors	Insulated Conductors	Bare Conductors
635 V	2.2 kV	N/A	N/A	1"	N/A	2"
4.76 kV	19 kV	60 kV	2"	3 1/2"	3"	5"
15 kV	36 kV	95 kV	3"	6"	5"	7"
27 kV	60 kV	125 kV	6"	9"	9"	14"
38 kV	80 kV	150 kV	7 1/2"	10 1/2"	11"	17"



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