Product News
TECHNICAL PRODUCT INFORMATION

September, 1991 5600PN9101

BUSWAY GROUNDING—QUESTIONS AND ANSWERS

Q. *Why is a grounding system required in busway systems?*

A. To provide a return path to earth for fault currents.

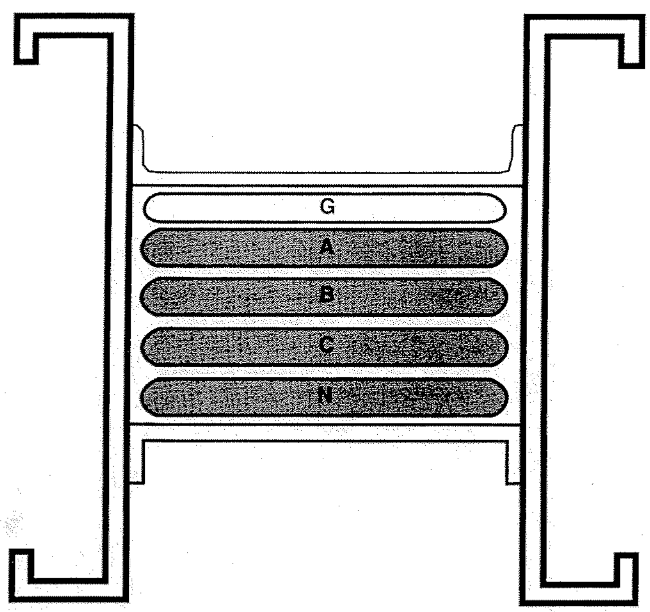
Q. *What codes and standards apply to grounding of busway systems?*

A. Article 250 of the National Electrical Code and Underwriters Laboratories' *Standard of Safety Publication UL857*.

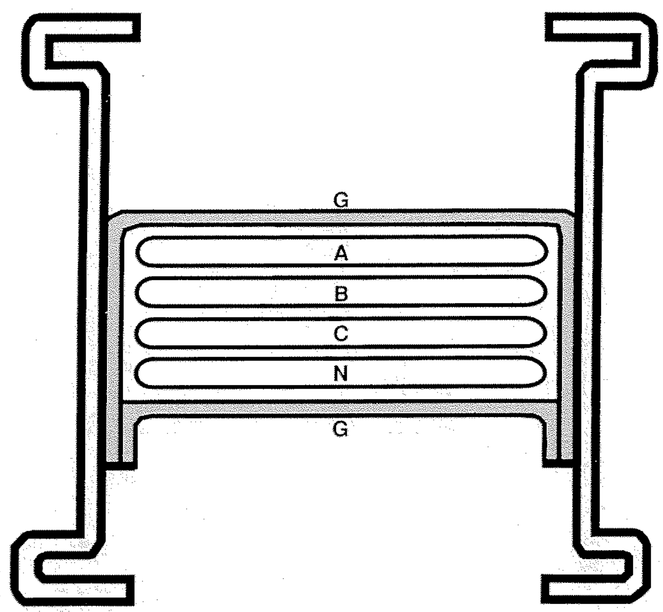
Q. *What's the difference between "internal" and "integral" ground?*

A. An "internal" ground busway system is constructed with separate ground bars inside the busway, sandwiched with the phase and neutral bus bars. These ground bars are generally smaller than the phase and neutral bus bars.

An "integral" ground busway system uses all or part of its external housing as the ground system, hence the name "integral" (designed-in/built-in; not added-on).



INTERNAL Ground



INTEGRAL Ground

Q. *Is one system better than the other?*

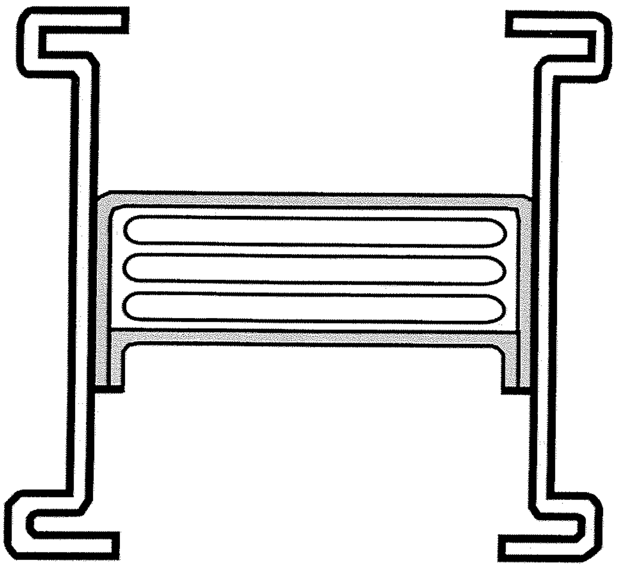
A. This is a good question, one we'll answer in some depth.

Square D has always strived for Underwriters Laboratories' listing on all our busway products. Our I-LINE® II Busway, featuring an integral ground system, is listed to the present UL Standard of Safety, UL857. To gain our UL listing, I-LINE II Busway passed a series of rigorous *short circuit withstand* and *phase-to-ground* tests, and met all written specifications in the UL standard.

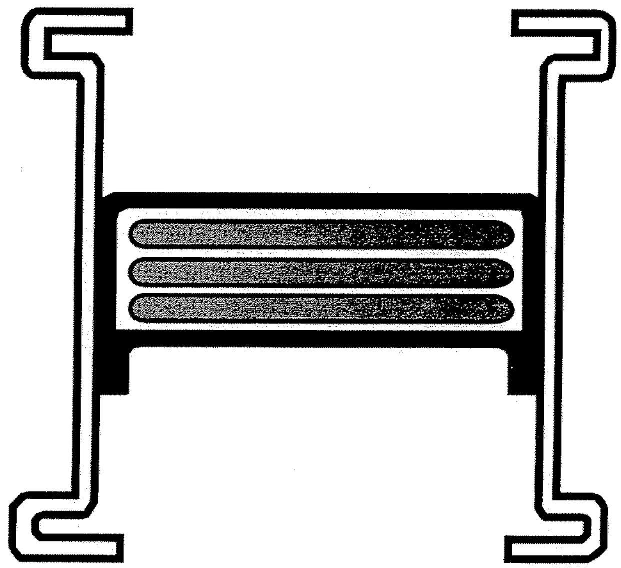
In addition to conventional tests, however, Square D wanted to investigate the behavior of fault currents in busway as they made their way to ground. Normally, under fault conditions, the fault current splits from the ground wire and "leaks" onto the metal exterior housing. We suspected that such leakage would occur even in electrical systems with a full-rated ground (such as a separate ground wire in a metallic conduit system).

Q. *What was the nature of Square D's investigative test?*

A. For purposes of this test, we used 30-3W I-LINE II Busway similar to our normal busway, but with an "all-steel" housing. This busway had steel around all four surfaces of the busbar sandwich instead of our standard aluminum top and bottom, which normally form the integral ground.



Normal Construction

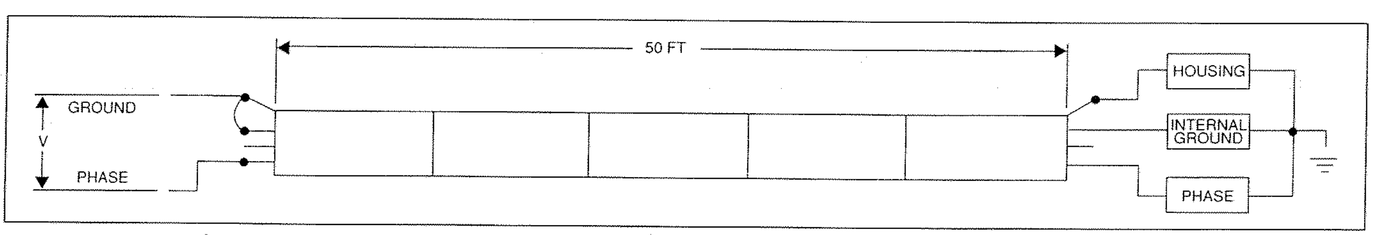


Steel Top & Bottom

This all-ferrous housing design provided a worst-case condition — steel presents a potential ground path significantly less conductive than the electrical-grade aluminum we routinely use in production. Thus, the housing should allow the least possible "leakage" of ground current to the system's outer housing .

We connected the three-wire busway as follows: one busbar did not carry any current at all, the second busbar was used as the phase current bar, and the third busbar was used as an *internal* ground bar. The internal ground bar was a full-size bar, providing a 100% capacity ground instead of the 50% capacity used in most ground busway systems. The all-steel housing was then connected, in parallel, to this internal ground busbar.

We connected five 10-foot lengths of this busway (1200 amperes, copper, "feeder"-type construction) together and began the test. The test is illustrated below:



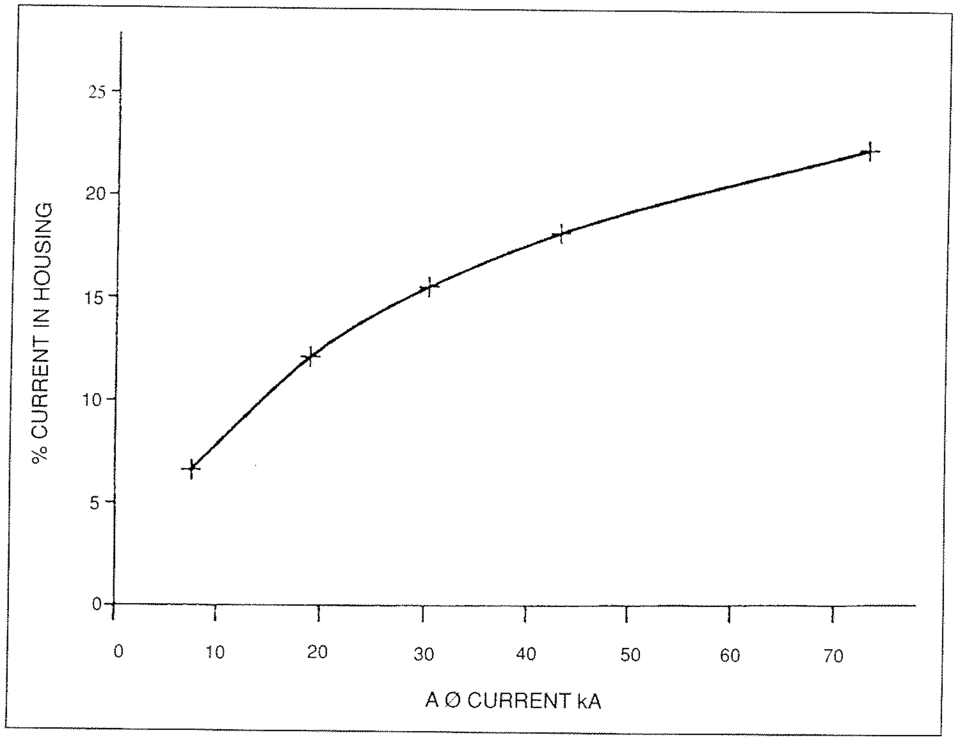
Test Setup

Q. What were the results of the test?

A. The busway was tested five separate times at various voltages and current levels. Each test lasted three electrical cycles.

The tests show that, as the fault current level increases, the amount of ground current conducted by the all-steel housing also increases. The graph below illustrates that the housing carries more than 20% of the fault current, with the ground current at the 70,000A range.

Again, we want to emphasize that this test was done with an internal 100% capacity ground bar. Had it been a 50% capacity bar, the leakage to the outer housing may have been even greater.



Current Split

Q. *What conclusions were drawn from this testing?*

A. Because the steel housing conducts ground current, it is important that the housing carries this current as efficiently as possible. Since the housing carries current anyway, we decided to design the housing as the ground path.

That is why Square D employs the *integral ground bus* in every piece of I-Line® II Busway that we manufacture. The table below compares the cross-sectional area of Square D's integral ground bus with that of a conventional 50% ground capacity, 1/8" thick internal ground bar. UL requirements are also listed.

The table shows our aluminum 50% capacity integral ground bus has 2–3 times more cross sectional area than required by UL, and 7–42% more cross-sectional area than a conventional 1/8" thick internal ground bar.

	ALUMINUM BUSBARS					COPPER BUSBARS				
			CROSS-SECTIONAL AREA (Sq. In.)					CROSS-SECTIONAL AREA (Sq. In.)		
AMPS	SQUARE D BAR WIDTH (Inches)	NO. OF BARS PER PHASE	UL GROUND REQUIREMENT	CONVENTIONAL 1/8" INTERNAL GROUND BUS	SQUARE D INTEGRAL GROUND BUS	SQUARE D BAR WIDTH (Inches)	NO. OF BARS PER PHASE	UL GROUND REQUIREMENT	CONVENTIONAL 1/8" INTERNAL GROUND BUS	SQUARE D INTEGRAL GROUND BUS
800	3.00	1	0.166	0.372	0.443	2.50	1	0.166	0.309	0.380
1000	4.00	1	0.196	0.497	0.568	3.00	1	0.196	0.372	0.443
1200	5.00	1	0.227	0.622	0.693	4.00	1	0.227	0.497	0.568
1600	7.50	1	0.294	0.934	1.005	5.40	1	0.294	0.672	0.743
2000	4.50	2	0.353	1.118	1.521	6.50	1	0.353	0.809	0.880
2500	6.00	2	0.515	1.498	1.959	4.50	2	0.515	1.118	1.521
3000	7.50	2	0.589	1.868	2.271	5.00	2	0.589	1.243	1.834
4000	6.50	3	0.810	2.427	3.131	4.50	3	0.810	1.677	2.881
5000	–	–	–	–	①	6.00	3	1.276	2.240	3.069

① 5000 ampere not available in aluminum.

Reference: Underwriters Laboratories' *Busways And Associated Fittings* (UL 857).

We Respond.®

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