Application Note

Terminating Variable Frequency Drive (VFD) Cables

Overview

While it is acceptable to terminate the phase conductors of a Variable Frequency Drive (VFD) cable as you would any other industrial power cable, special attention needs to be paid to the termination of the cable shield. The shield is an important part of the VFD cable but if it is not terminated properly, most of the benefits that this shield provides are negated. If you don't properly terminate a VFD cable's shield you may as well have not spent the extra money on VFD cable to begin with!

VFDs, by their very nature, push high frequency common mode current down the cable from the inverter to the motor. Proper shield termination allows the shield to become a low impedance path for this high frequency common mode current to flow from the motor back to the inverter. Without this controlled path, these currents can travel through motor bearings and building infrastructure, causing problems with other sensitive equipment like PLCs, control, and communication systems located throughout your facility.

There are three main constructions of shields found in VFD cables and Southwire makes three. The shield constructions are: copper braid shield with aluminum foil (Copper Braid); helically applied copper tape (Copper Tape); and continuously corrugated welded aluminum armor (Welded Aluminum). This application note will detail how to terminate each of these shield types.

Terminating Copper Braid and Copper Tape Shields

These shields may be terminated with either a cable gland, or if used in conduit a termination kit. Both methods are described below. Both ends of the VFD cable need to be terminated in order to allow the high frequency common mode current to flow back through the shield to the drive[1].

• Using Cable Glands

To terminate this shield with a cable gland, use an EMC style cable gland which will provide a 360° connection to the shield at both the inverter and the motor. EMC cable glands are available from various manufactures. One such cable gland that works well with both a copper tape and a copper braid shield is the Remke Dome Cap Standard EMC Cable Gland (see attached). Follow the manufacturer's instructions for installing the cable gland.

• Using Termination Kits

If the cable is going in conduit and a cable gland cannot be used, you will need to create and install VFD terminations on the shield. Each termination will consist of a constant force spring sized for the overall shield diameter, a tinned copper flat grounding braid and vinyl electrical tape. All these materials are available from 3M and other electrical suppliers.

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Terminating VFD Cables

Installing the Termination

- Remove jacket and shield to allow wire leads long enough to make the connections to the equipment.
- Remove the jacket to expose the shield back from the initial jacket cutback 1.5 inches.
- Place a section of the tinned copper flat grounding braid long enough to be terminated to the enclosure longitudinally over the copper tape or braid shield.
- Wrap the constant force spring over the cable shield to secure the grounding braid to cable shield.
- Secure the constant force spring to the cable shield by applying two half-lapped layers of vinyl electrical tape.
- Terminate the free end of the grounding braid to the metal enclosure using a nut, bolt and large flat washer to allow for a large surface area connection. Be sure to clean the surface of the metal enclosure and broaden the grounding braid to maximize surface area.

Terminating Aluminum Armor Shields

Continuously corrugated welded aluminum armor shields are easy to terminate because the termination is performed with a cable gland specially made for Type MC cables. For the optimal physical and electrical performance, Southwire strongly recommends using American Connector metal clad cable connectors. Because of their unique screw on installation, these cable glands provide the maximum surface area connections possible which reduces the cable glands impedance. To source and size your connectors, please contact your Southwire sales representative. Follow American Connectors instructions for installing the cable gland. Information on American Connectors MC cable glands can be found at www.americanconnectors.com. Both ends of the VFD cable need to be terminated in order to allow the high frequency common mode current to flow back through the shield to the drive[1].

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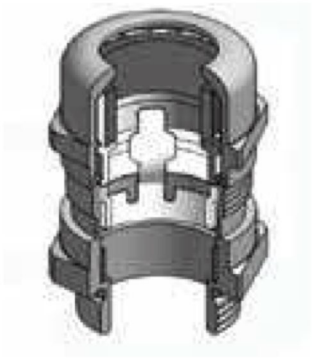
[1] Most drive manufacturers recommend terminating the shield at both ends of the cable but some do not. Always follow the recommendations of your drive manufacturer regarding cable installation.

SPECIFICATIONS	
Materials	Brass, Nickel-Plated
Clamping Insert	Polyamide 6 V2
Contact Spring	Special Copper Alloy
Protection Class	IP68 - 5 Bar
Seal	Chloroprene
O-Ring	NBR
Attachment Thread	EN60423

DOME CAP STANDARD EMC CABLE GLANDS WITH METRIC OR NPT THREADS



Dome Cable Glands	Locknuts	Thread Type & Size	Clearance Hole (inches)	Thread Length (inches)	Across Flats (inches)	Cable Range Ø (inches/min-max)	Shield Diameter Ø (inches/min)
EMC/METRIC THREADS							
BRM4E12	RLEM12	M12X1.5	0.47	0.24	0.55	.118 - .256	.078 - .197
BRM4E16	RLEM16	M16X1.5	0.63	0.24	0.79	.197 - .394	.138 - .314
BRM4E20-2S	RLEM20	M20X1.5	0.79	0.24	0.87	.236 - .472	.177 - .394
BRM4E20	RLEM20	M20X1.5	0.79	0.31	1.00	.295 - .551	.216 - .453
BRM4E25	RLEM25	M25X1.5	1.00	0.31	1.18	.394 - .709	.275 - .551
BRM4E32	RLEM32	M32X1.5	1.26	0.35	1.57	.630 - .984	.472 - .787
BRM4E40	RLEM40	M40X1.5	1.57	0.35	1.97	.866 - 1.260	.709 - 1.063
BRM4E50	RLEM50	M50X1.5	1.97	0.35	1.97	1.181 - 1.496	1.024 - 1.339
BRM4E60	RLEM60	M63X1.5	2.48	0.55	2.52	1.339 - 1.732	1.181 - 1.575
BRM4E63	RLEM63	M63X1.5	2.48	0.39	2.95	1.457 - 2.087	1.300 - 1.929

Part No.	Size	Cable Range Ømin-max mm	Shield Dia. Ømin-max mm	Thread Length	Across Flats
EMC/NPT THREADS					
BRN4E13	NPT 1/2"	.236 - .472	.177 - .394	0.314	0.866
BRN4E13S	NPT 1/2"	.295 - .551	.216 - .453	0.314	0.944
BRN4E21	NPT 3/4"	.394 - .709	.275 - .551	0.314	1.181
BRN4E29	NPT 1"	.630 - .984	.472 - .787	0.354	1.574
BRN4E36	NPT 1 1/4"	.866 - 1.260	.709 - 1.063	0.354	1.968
BRN4E42	NPT 1 1/2"	1.180 - 1.496	.1.024 - 1.338	0.551	2.362
BRN4E48	NPT 2"	1.338 - 1.732	1.181 - 1.575	0.551	2.677

Hub Size	Steel	Aluminum
OPTIONAL LOCKNUT PART NUMBERS		
NPT 1/2"	LN-50	LNA-50
NPT 3/4"	LN-75	LNA-75
NPT 1"	LN-100	LNA-100
NPT 1 1/4"	LN-125	LNA-125
NPT 1 1/2"	LN-150	LNA-150
NPT 2"	LN-200	LNA-200