

PB 316

Belden® VFD Cables

Belden, the innovator in VFD cable design, adds 2000V and Low Smoke Zero Halogen Classic Designs to its VFD line.



Belden Expands Its Line of Industrial Cables for Variable Frequency AC Motor Drive Applications

Variable frequency AC motor drive output cables are subject to harsh operating environments characterized by high voltage spikes, high noise levels and adverse environmental conditions. Typical cabling solutions for this application have been unshielded tray cables, single-conductor lead wire installed in conduit or continuously-welded armored cable. These solutions suffer from complex, costly installation and potential reliability problems. Belden Variable Frequency Drive (VFD) Cables were designed and engineered to overcome these challenges.

The Challenge of VFD Applications

VFD cables carry power from AC drive systems to AC motors. As a result, these cables must handle not only the overall high power levels of the pulse-width modulated (PWM) signals, but also the extremely high voltage which can occur when standing waves develop on the conductors. This high voltage can cause corona discharge between the conductors of conventional cables, causing damage not only to the cabling itself, but also to the motors, bearings, drives and related equipment. In turn, this damage can cause failure of the entire drive system, resulting in costly production downtime.

Limitations of Conventional VFD Cables

In addition to experiencing failures due to corona discharge and adverse environmental conditions, conventional cabling is difficult and expensive to install. Armored cable and lead wire in conduit are cumbersome and heavy and require extremely large installation bending radii, making installation both time-consuming and labor intensive. Yet they still do not solve noise and corona discharge problems, nor do they effectively address the high levels of noise generated by VFDs.

The Belden VFD Solution

Only Belden's series of VFD Cable in gauge sizes from 16 to 4/0 provide the robust construction required to deliver superior electrical performance and reliability, even in the most demanding industrial environments.

Thicker, Industrial-grade XLPE Insulation

- Provides more stable electrical performance than PVC
- Lower capacitance resulting in
 - Longer cable runs
 - Reduced peak motor terminal voltage for extended motor life
 - Reduced likelihood of corona discharge
 - Reduced magnitude of standing waves
 - Increased efficiency of power transfer

High-strand Tinned Copper Circuit Conductors

- More flexible for ease of installation
- Better vibration resistance
- Numbered for ease of identification

Industrial-grade PVC or Haloarrest Low Smoke Zero Halogen Jackets

- Sunlight Resistant
- Oil Resistant (PVC only)

Certified to Numerous Safety Standards

(Ratings Vary by Construction)

- 1000V UL Flexible Motor Supply
- 600V or 2000V UL1277 Type TC-ER per 2005 NEC Article 336
- 1000V CSA AWM I/II A/B FT4
- MSHA
- 90°C Wet/Dry
- Class I & II; Division 2 hazardous locations
- UL1685 Vertical Tray Flame Test
- IEEE 1202/383 Vertical Tray flame test at 70,000 BTU/hour
- UL Direct Burial
- RoHS compliant
- CE approved

Product Cross Reference

Belden VFD cable performance supports AC drives manufactured by the following companies: Rockwell Automation, AA Electric, ABB, Baldor, Cutler-Hammer, Emerson Process Management, Fivestar Electric Motors, General Electric, Hitachi, Magnetek, Mitsubishi Electric Automation, Motion Industries, Quality Drive Systems, Robicon, Siemens, Square D, Toshiba and TB Woods.

Product Availability

Belden Variable Frequency Drive cables are available in various standard lengths. Armored versions are also available. And now, with Belden offering VFD cables in a wider range of gauges, drive manufacturers have more options than ever before in specifying the appropriate sizes for their specific applications.

Encoder and Signal Cables

Belden also offers the following standard cables for encoder applications. Encoder cables help feed information to the microprocessor regarding both the speed and the position of the rotor. Signal cable can be used for brake or thermal contact applications.

Part Number	Pairs	AWG
8790 (Power Supply)	1	18
9729 (Encoder)	2	24
9730, 89730 (Encoder)	3	24
9728 (Encoder)	4	24
9892 (Encoder)	4	20
9860 (Signal)	1	16

Variable Frequency Drive Cable – Classic Design with Full-size Insulated Ground

16 to 2 AWG with Foil/Braid Shield

Belden's Classic line of VFD cables, with foil/braid shields offered in 16 to 2 AWG or 16 to 10 AWG conductors (with signal pair for brake), continues to be the highest-performing solution in the market. The oversized XLPE insulation provides low capacitance. Its highly effective dual

shielding provides the lowest resistance path to ground, which improves common mode current containment. Included is a full-sized, insulated Green/Yellow ground wire, as well as a full-sized shield drain wire for ease of termination and installation. The 85% braid

coverage and 100% overall Duofoil* shield offers highly effective radiated and conducted noise protection. Cables are round and smooth for proper sealing of glands and molding applications.

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius	
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm

Three Stranded TC Circuit Conductors + (1) Full-sized Insulated Ground* • Overall Duofoil + 85% TC Braid Shield • Full Sized TC Drain Wire*
(ICEA Method 4 Color Code: Black and Numbered, Green/Yellow Ground)

XLPE Insulated Circuit Conductors • Black Sunlight- and Oil-resistant PVC Jacket

1000V UL Flexible Motor Supply Cable 600V UL 1277 Type TC-ER per 2005 NEC Article 336 1000V CSA AWM I/II A/B FT4 IEEE 1202/383 UL Direct Burial XHHW-2, RHW-2 rated circuit conductors** 90°C Wet/Dry			29500	16	26x30	100	30.4	22.0	10.0	.53	13.46	128	570	4.3	109.2
						250††	76.2	47.0	21.3						
						500††	152.4	92.0	41.7						
						1000††	304.8	185.0	83.9						
						6000††	1828.8	1098.0	498.0						
			29501	14	41x30	100	30.4	27.0	12.2	.60	15.24	212	943	4.8	121.9
						250††	76.2	60.0	27.2						
						500††	152.4	118.0	53.5						
						1000††	304.8	235.0	106.6						
						5000††	1524.0	1430.0	648.6						
			29502	12	65x30	100	30.4	32.0	14.5	.65	16.51	336	1495	5.2	132.0
						250††	76.2	76.0	34.5						
						500††	152.4	145.0	65.8						
						1000††	304.8	298.0	135.2						
						5000††	1524.0	1695.0	768.8						
			29503	10	105x30	100	30.4	40.0	18.1	.69	17.53	592	2634	5.5	139.7
						250††	76.2	96.0	43.5						
						500††	152.4	185.0	83.9						
						1000††	304.8	396.0	179.6						
						5000††	1524.0	2095.0	950.3						
			29504	8	7x19x29	250††	76.2	157.0	71.2	.93	23.62	768	3418	7.5	190.5
						500††	152.4	314.0	142.4						
						1000††	304.8	680.0	308.4						
						5000††	1524.0	3544.0	1607.5						
			29505	6	7x19x27	250††	76.2	219.0	99.3	1.02	25.91	1220	5429	8.2	203.2
						1000††	304.8	906.0	411.3						
						3500††	1066.8	3117.0	1413.6						
			29506	4	7x19x25	250††	76.2	316.0	143.3	1.16	29.46	1940	8633	9.3	236.2
						1000††	304.8	1227.0	556.6						
						3000††	914.4	3731.0	1692.4						
			29507	2	7x19x23	250††	76.2	438.0	198.7	1.31	33.27	3088	13742	10.8	273.1
						500††	152.4	908.0	411.9						
						1000††	304.8	1766.0	801.0						
						2000††	609.6	3542.0	1606.6						

See footnotes on page 6.

Variable Frequency Drive Cable – Classic Symmetrical Design

1 to 4/0 AWG with Dual Copper Tape Shield

Belden's symmetrical ground design combines the benefits of our Classic line of VFD cables with additional features for use on larger, more powerful AC motor drives. Its highly effective shielding provides a low resistance path to ground, which improves

common mode current containment. The spirally applied dual copper tapes provide improved flexibility and highly effective radiated and conducted noise protection. Three symmetrical bare ground wires provide a balanced ground system. This

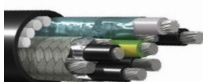
reduces AC motor shaft voltage, which in turn, reduces the likelihood of premature motor bearing or motor insulation failure.

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius		
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm	
Three Stranded TC Circuit Conductors + (3) Symmetrical BC Grounds • (2) Spiral Copper Tape Shields (100% Coverage) (ICEA Method 4 Color Code: Black and Numbered)														
XLPE Insulation • Black Sunlight- and Oil-Resistant PVC Jacket														
1000V UL Flexible Motor Supply Cable 600V UL 1277 Type TC-ER per 2005 NEC Article 336 1000V CSA AWM I/II A/B FT4 IEEE 1202/383 UL Direct Burial XHHW-2 rated circuit conductors 90°C Wet/Dry  MSHA P-07-KA070003		29528	1	7x19x22	250† 500† 1000† 3000†	76.2 152.4 304.8 914.4	399.0 814.0 1610.0 4841.0	181.0 369.2 730.3 2195.8	1.20	30.48	2650	11788	12.0	304.8
		29529	1/0	7x19x21	250† 500† 1000† 2000†	76.2 152.4 304.8 609.6	526.0 1040.0 2013.0 3954.0	238.6 471.7 913.1 1793.5	1.29	32.77	3537	15733	12.9	327.7
		29530	2/0	7x19x20	250† 500† 1000† 2000†	76.2 152.4 304.8 609.6	602.0 1192.0 2318.0 4656.0	273.1 540.7 1051.4 2111.9	1.40	35.56	4200	18682	14.0	355.6
		29531	3/0	7x19x19	250† 500† 1000† 2000†	76.2 152.4 304.8 609.6	700.0 1403.0 2708.0 5436.0	317.5 636.4 1228.3 2465.7	1.52	38.61	5025	22352	15.2	386.1
		29532	4/0	7x19x18	250† 500† 1500†	76.2 152.4 457.2	881.0 1717.0 5256.0	399.6 778.8 2384.1	1.68	42.67	6670	29670	16.8	426.7

See footnotes on page 6.

Variable Frequency Drive Cable – Classic Design with Signal Pair

16 to 10 AWG with Foil/Braid Shield Plus Signal Pair for Brake▲

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius			
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm		
Three Stranded TC Circuit Conductors + (1) Full-sized Insulated Ground* • Overall Duofoil + 85% TC Braid Shield • Full Sized TC Drain Wire* (ICEA Method 4 Color Code: Black and Numbered, Green/Yellow Ground) • (1) 16 AWG Shielded Signal Pair for Brake with Drain Wire (Black, White Color Code)															
XLPE Insulated Circuit Conductors • Black Sunlight- and Oil-Resistant PVC Jacket															
1000V UL Flexible Motor Supply Cable 600V UL 1277 Type TC-ER per 2005 NEC Article 336 1000V CSA AWM I/II A/B FT4 IEEE 1202/383 UL Direct Burial XHHW-2, RHHW-2 rated circuit conductors** 90°C Wet/Dry  MSHA		29510	Circuit Cond 16	26x30	100	30.5	36.0	16.3	.75	19.05	272	1210	7.5	190.5	
			Signal Pair 16	26x30	500	152.4	143.0	64.9							1000
						5000††	1524.0	1485.0	673.6						
		29511	Circuit Cond 14	41x30	100	30.5	68.0	30.8	.82	20.83	368	1638	8.2	208.3	
	Signal Pair 16		26x30	500	152.4	178.0	80.7								
				1000	304.8	340.0	154.2								
				5000††	1524.0	1565.0	709.9								
	29512	Circuit Cond 12	65x30	100	30.5	77.0	34.9	.90	22.86	527	2345	9.0	228.6		
		Signal Pair 16	26x30	500	152.4	227.0	103.0								
				1000	304.8	438.0	198.7								
				4000††	1219.5	1680.0	762.0								
	29513	Circuit Cond 10	105x30	100	30.5	89.0	40.4	.99	25.15	718	3195	9.9	251.5		
Signal Pair 16		26x30	500	152.4	287.0	130.2									
			1000	304.8	563.0	255.4									
			3000††	914.6	1671.0	758.0									

See footnotes on page 6.

Be Certain with Belden



Variable Frequency Drive Cable – Classic 2kV Design

14 to 2 AWG with Foil/Braid Shield

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius	
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm

Three Stranded TC Circuit Conductors + (1) Full-size Insulated Ground* • Overall Duofoil + 85% TC Braid Shield • Full Sized TC Drain Wire* (ICEA Method 4 Color Code: Black and Numbered, Green/Yellow Ground)

XLPE Insulated Circuit Conductors • Black Sunlight- and Oil-Resistant PVC Jacket

1000V UL Flexible Motor Supply Cable 2000V UL 1277 Type TC-ER per 2005 NEC Article 336 1000V CSA AWM I/II A/B FT4 IEEE 1202/383 UL Direct Burial XHHW-2, RHW-2 rated circuit conductors 90°C Wet/Dry 	29536	14	41x30	1000† 5000††	304.8 1524.0	338.0 1695.0	153.3 768.8	.68	17.30	212	943	6.8	172.72
	29537	12	65x30	1000† 5000††	304.8 1524.0	401.0 2010.0	181.9 911.7	.72	18.30	336	1495	7.3	185.42
	29538	10	105x30	1000† 5000††	304.8 1524.0	481.0 2270.0	218.2 1029.7	.79	20.10	592	2634	7.9	200.70
	29539	8	7x19x29	1000† 5000††	304.8 1524.0	754.0 3635.0	342.0 1648.8	.96	24.40	768	3418	9.6	243.84
	29540	6	7x19x27	1000† 3500††	304.8 1066.8	926.0 3090.0	420.0 1492.3	1.07	26.92	1220	5429	10.6	269.24
	29541	4	7x19x25	1000† 3000††	304.8 914.4	1284.0 3870.0	582.4 1755.4	1.21	30.50	1940	8633	12.1	307.34
	29542	2	7x19x23	1000† 2000††	304.8 609.6	1756.0 3520.0	796.5 1596.6	1.36	34.54	3088	13742	13.6	345.44

MSHA
P-07-KA070003

See footnotes on page 6.

Variable Frequency Drive Cable – Classic Symmetrical 2kV Design

1 to 4/0 AWG with Dual Copper Tape Shield

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius	
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm

Three Stranded TC Circuit Conductors + (3) Symmetrical BC Grounds • (2) Spiral Copper Tape Shields (100% Coverage) (ICEA Method 4 Color Code: Black and Numbered)

XLPE Insulation • Black Sunlight- and Oil-Resistant PVC Jacket

1000V UL Flexible Motor Supply Cable 2000V UL 1277 Type TC-ER per 2005 NEC Article 336 1000V CSA AWM I/II A/B FT4 IEEE 1202/383 UL Direct Burial XHHW-2, RHW-2 rated circuit conductors 90°C Wet/Dry 	29543	1	7x19x22	1000† 3000†	304.8 914.4	1693.0 5250.0	767.9 2381.4	1.36	34.54	2650	11788	13.6	345.44
	29544	1/0	7x19x21	1000† 2000†	304.8 609.6	2056.0 4334.0	932.6 1965.9	1.45	36.83	3537	15733	14.5	368.30
	29545	2/0	7x19x20	1000† 2000†	304.8 609.6	2389.0 5000.0	1083.6 2268.0	1.56	39.62	4200	18682	15.6	396.24
	29546	3/0	7x19x19	1000† 2000†	304.8 609.6	2989.0 6172.0	1355.8 2799.6	1.75	44.50	5025	22352	17.5	444.50
	29547	4/0	7x19x18	500† 1500†	152.4 457.2	1902.5 5820.0	863.0 2639.9	1.88	47.80	6670	29670	18.8	477.52

MSHA
P-07-KA070003

See footnotes on page 6.



Variable Frequency Drive Cable – Classic Low Smoke Zero Halogen Design
16 to 2 AWG with Foil/Braid Shield

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius	
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm

Three Stranded TC Circuit Conductors + (1) Full-size Insulated Ground* • Overall Duofoil + 85% TC Braid Shield • Full Sized TC Drain Wire* (ICEA Method 4 Color Code: Black and Numbered, Green/Yellow Ground)

XLPE Insulated Circuit Conductors • Black Sunlight-Resistant Haloarrest Jacket

1000V UL Flexible Motor Supply Cable
600V UL 1277 Type TC-ER per 2005 NEC Article 336
1000V CSA AWM I/II A/B FT4 IEEE 1202/383

UL Direct Burial XHHW-2, RHW-2 rated circuit conductors** 90°C Wet/Dry



MSHA
P-07-KA070003

29500T	16	26x30	1000†† 6000††	304.8 1828.8	191.0 1134.0	86.6 514.4	.53	13.46	128	570	4.3	109.2
29501T	14	41x30	1000†† 5000††	304.8 1524.0	243.0 1470.0	110.2 666.8	.60	15.24	212	943	4.8	121.9
29502T	12	65x30	1000†† 5000††	304.8 1524.0	306.0 1737.0	138.8 787.9	.65	16.51	336	1495	5.2	132.0
29503T	10	105x30	1000†† 5000††	304.8 1524.0	405.0 2141.0	183.7 971.1	.69	17.53	592	2634	5.5	139.7
29504T	8	7x19x29	1000†† 5000††	304.8 1524.0	696.0 3625.0	315.7 1644.3	.93	23.62	768	3418	7.5	190.5
29505T	6	7x19x27	1000†† 3500††	304.8 1066.8	924.0 3179.0	419.1 1442.0	1.02	25.91	1220	5429	8.2	203.2
29506T	4	7x19x25	1000†† 3000††	304.8 914.4	1248.0 3793.0	566.1 1720.5	1.16	29.46	1940	8633	9.3	236.2
29507T	2	7x19x23	1000†† 2000††	304.8 609.6	1789.0 3588.0	811.5 1627.5	1.31	33.27	3088	13742	10.8	273.1

See footnotes on page 6.

Variable Frequency Drive Cable – Classic Symmetrical Low Smoke Zero Halogen Design
1 to 4/0 AWG with Dual Copper Tape Shield

Description	Part No.	AWG	Cond. Stranding	Standard Lengths		Standard Unit Wt.		Nominal OD		Maximum Pull Tension		Minimum Bend Radius	
				Ft.	m	Lbs.	kg	Inch	mm	Lbs.	N	Inch	mm

Three Stranded TC Circuit Conductors + (3) Symmetrical BC Grounds • (2) Spiral Copper Tape Shields (100% Coverage) (ICEA Method 4 Color Code: Black and Numbered)

XLPE Insulation • Black Sunlight-Resistant Haloarrest Jacket

1000V UL Flexible Motor Supply Cable
600V UL 1277 Type TC-ER per 2005 NEC Article 336
1000V CSA AWM I/II A/B FT4 IEEE 1202/383

UL Direct Burial XHHW-2 rated circuit conductors 90°C Wet/Dry



MSHA
P-07-KA070003

29528T	1	7x19x22	1000† 3000†	304.8 914.4	1621.0 4874.0	735.3 2210.8	1.20	30.48	2650	11788	12.0	304.8
29529T	1/0	7x19x21	1000† 2000†	304.8 609.6	2025.0 3978.0	918.5 1804.4	1.29	32.77	3537	15733	12.9	327.7
29530T	2/0	7x19x20	1000† 2000†	304.8 609.6	2331.0 4682.0	1057.3 2123.7	1.40	35.56	4200	18682	14.0	355.6
29531T	3/0	7x19x19	1000† 2000†	304.8 609.6	2722.0 5465.0	1234.7 2478.9	1.52	38.61	5025	22352	15.2	386.1
29532T	4/0	7x19x18	500† 1500†	152.4 457.2	1725.0 5279.0	782.4 2394.5	1.68	42.67	6670	29670	16.8	426.7

See footnotes on page 6.

Interlocked Armor VFD Cables

16 to 4/0 AWG with Foil/Braid Shield & Dual Copper Tape Shield

Belden armored VFD cables are available in interlocked aluminum or steel type metal clad (MC) constructions. Belden MC cables are

designed to meet demanding industrial needs with rugged durability and corrosion resistance with flexibility and easy handling.

The products utilize Belden Classic or Classic Symmetrical designs.

Interlocked Armor • XLPE Insulation • Black Sunlight- and Oil-resistant PVC Inner and Outer Jackets

600V UL 1277 Type MC per
2005 NEC Article 330
Suitable for NEC Hazardous Location
Class I, Div.2
Class II, Div.2
CSA FT4



UL Direct Burial
XHHW-2, RHW-2 rated circuit conductors
(16 to 2 AWG)**
XHHW-2 rated circuit conductors
(1 to 4/0 AWG)
90°C Wet/Dry
IEEE 1202/383 (70,000 BTU)

AWG Size	16	14	12	10	8	6	4	2	1	1/0	2/0	3/0	4/0
AL Armor Part Number	1229500	1229501	1229502	1229503	1229504	1229505	1229506	1229507	1229528	1229529	1229530	1229531	1229532
Steel Armor Part Number	1329500	1329501	1329502	1329503	1329504	1329505	1329506	1329507	1329528	1329529	1329530	1329531	1329532
Min. Order	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1500
Max. Length	6000	5000	5000	5000	5000	3500	3000	2000	3000	2000	2000	2000	1500



BC = Bare Copper • TC = Tinned Copper • TC-ER = Tray Cable – Exposed Run per 2005 NEC Article 336 • XLPE = Cross-linked Polyethylene

* Ground(s) and drain wire(s) are same AWG as circuit conductors.
** 14 AWG and larger
▲ Other AWG sizes available upon request. Minimums may apply.
† Final put-up may vary $\pm 5\%$ from length shown.
†† Final put-up may vary $\pm 10\%$ from length shown.