

**NP 235**

**Belden® VFD Cables**

Belden, the innovator in VFD cable design, adds symmetrical 3-conductor 16 to 4/0 AWG VFD cables (including armored versions) to its VFD line to support a broader range of installation options and customer requirements—including MSHA approvals.



**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 VFD 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 VFD cable series of 1000V UL flexible motor supply cables in gauge sizes from 16-4/0 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 Jacket**

- Sunlight Resistant
- Oil Resistant

### Certified to Numerous Safety Standards

(Ratings Vary by Construction)

- MSHA
- 1000V UL Flexible Motor Supply
- 600V UL1277 Type TC-ER per 2005 NEC Article 336
- CSA AWM I/II A/B FT4
- 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 is tested and approved for use by Rockwell Automation for the following AC drives: PowerFlex Series, Series 1305, Series 1336 Plus and Plus II, Series 1336 Impact, and Series 1336 Force Field-Oriented Control.

Belden VFD cable is also appropriate for drives manufactured by: 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 16-2 AWG or 16-10 AWG conductors (with signal pair for brake), continues to be the highest-performing solution in the market. The oversized XLPE insulation provides the lowest capacitance available in a VFD cable.

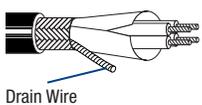
Its highly effective dual shielding provides the lowest resistance path to ground, which improves common mode current containment. Included is a full-sized, insulated Green/Yellow ground wire, as well as a full-sized shield drain wire for ease of termination and installation. The 85% braid

coverage and 100% overall Beldfoil® 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 PVC Ground\* • Overall Beldfoil + 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

<b>1000V UL Flexible Motor Supply Cable</b> 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   Drain Wire  MSHA P-07-KA070003	<b>29500</b>	16	26x30	100	30.4	21.2	9.6	.53	13.46	128	570	3.9	99.1	
				250††	76.2	46.2	21.0							
				500††	152.4	93.0	42.2							
	All Allen-Bradley Series 160 and 1305 drives.			1000††	304.8	182.0	82.6							
				6000††	1828.8	1080.0	490.3							
	<b>29501</b>	14	41x30	100	30.4	26.5	12.0	.60	15.24	212	943	4.8	121.9	
			250††	76.2	59.7	27.1								
			500††	152.4	120.0	54.5								
Allen-Bradley Series 1336F(S)-BRF05 through BRF100			1000††	304.8	233.0	105.8								
			5000††	1524.0	1215.0	551.6								
	<b>29502</b>	12	65x30	100	30.4	31.8	14.4	.65	16.51	336	1495	5.2	132.0	
			250††	76.2	75.2	34.1								
			500††	152.4	146.5	66.5								
			1000††	304.8	296.0	134.4								
Allen-Bradley Series 1336F(S)-BRF150, BRF200			5000††	1524.0	1475.0	669.6								
	<b>29503</b>	10	105x30	100	30.4	33.4	15.1	.69	17.53	592	2634	5.5	139.7	
			250††	76.2	79.5	36.1								
			500††	152.4	154.5	70.1								
			1000††	304.8	330.0	149.8								
Allen-Bradley Series 1336F(S)-B015			5000††	1524.0	1560.0	708.2								
	<b>29504</b>	8	7x19x29	250††	76.2	158.5	72.0	.93	23.62	768	3418	7.5	190.5	
			500††	152.4	332.0	150.7								
			1000††	304.8	660.0	299.6								
			5000††	1524.0	3135.0	1423.3								
Allen-Bradley Series 1336F(S)-B020														
	<b>29505</b>	6	7x19x27	250††	76.2	221.3	100.5	1.02	25.91	1220	5429	8.2	203.2	
			1000††	304.8	906.0	411.3								
			3500††	1066.8	3206.0	1455.5								
Allen-Bradley Series 1336F(S)-B025, B030														
	<b>29506</b>	4	7x19x25	250††	76.2	319.5	145.1	1.16	29.46	1940	8633	9.3	236.2	
			1000††	304.8	1231.0	558.9								
			3000††	914.4	3843.0	1744.7								
Allen-Bradley Series 1336F(S)-BX040, B040														
	<b>29507</b>	2	7x19x23	250††	76.2	437.8	198.7	1.34	34.04	3088	13742	10.8	273.1	
			500††	152.4	908.0	412.0								
			1000††	304.8	1711.0	776.8								
Allen-Bradley Series 1336F(S)-B050, BX060, B060			2000††	609.6	3682.0	1671.6								

See footnotes on page 4.

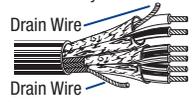


## Variable Frequency Drive Cable – Classic Design with Signal Pair

### 16 to 10 AWG with Foil/Braid Shield Plus Signal Pair for Brake<sup>^</sup>

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 PVC Ground\* • Overall Beldfoil + 85% TC Braid Shield • Full Sized TC Drain Wire\* + (1) 16 AWG Shielded Signal Pair for Brake with drain wire. (ICEA Method 4 Color Code: Black and Numbered, Green/Yellow Ground) + Black, White Signal Pair

XLPE Insulated Circuit Conductors • Black Sunlight- and Oil-resistant PVC Jacket													
<b>1000V UL Flexible Motor Supply Cable</b> 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	29510	Circuit Cond	26x30	100	30.5	34.5	15.7	.75	19.05	272	1210	7.5	190.5
				500	152.4	136.0	61.7						
	Signal Pair	26x30	1000	304.8	309.0	140.2	.82	20.83	368	1638	8.2	208.3	
			5000 <sup>††</sup>	1524.0	1415.0	641.8							
	29511	Circuit Cond	41x30	100	30.5	67.5	30.6	.90	22.86	527	2345	9.0	228.6
				500	152.4	177.5	80.6						
	Signal Pair	26x30	1000	304.8	340.0	154.2	.99	25.15	718	3195	9.9	251.5	
			5000 <sup>††</sup>	1524.0	1565.0	709.9							
	29512	Circuit Cond	65x30	100	30.5	77.3	35.1	.90	22.86	527	2345	9.0	228.6
				500	152.4	226.5	102.8						
	Signal Pair	26x30	1000	304.8	438.0	198.7	.99	25.15	718	3195	9.9	251.5	
			4000 <sup>††</sup>	1219.5	1680.0	762.0							
29513	Circuit Cond	105x30	100	30.5	89.3	40.5	.99	25.15	718	3195	9.9	251.5	
			500	152.4	286.5	130.1							
Signal Pair	26x30	1000	304.8	490.0	222.3	.99	25.15	718	3195	9.9	251.5		
		3000 <sup>††</sup>	914.6	1452.0	658.6								

See footnotes on page 4.

## Variable Frequency Drive Cable – Symmetrical Design

### 16 to 4/0 AWG with Dual Copper Tape Shield

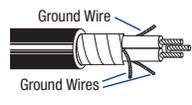
Belden's symmetrical ground design combines the benefits of our classic line of VFD cables with additional features for use on larger, more powerful AC motor drives. Its highly effective shielding provides a low resistance path to

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													
<b>1000V UL Flexible Motor Supply Cable</b> 600V UL 1277 Type TC-ER per 2005 NEC Article 336 600V 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	29520	16	7x24	100	30.4	17.0	7.7	0.40	10.11	107	476	4.0	101.6
				500	152.4	68.5	31.1						
	29521	14	7x22	100	30.4	19.2	8.7	0.42	10.74	162	721	4.3	109.2
				500	152.4	81.0	36.8						
	29522	12	7x20	100	30.4	24.2	11.0	0.48	12.19	258	1148	4.8	121.9
				500	152.4	108.5	49.3						
	29523	10	7x18	100	30.4	25.2	11.4	0.56	14.22	444	1975	5.6	142.2
				500	152.4	111.5	50.6						
	29524	8	7x16	100	30.4	37.8	17.2	0.66	16.76	576	2562	6.6	167.6
				500	152.4	194.0	88.1						
	29525	6	7x14	100	30.4	55.5	25.2	0.76	19.30	915	4070	7.6	193.0
				500	152.4	339.5	154.1						
29525	6	7x14	1000	304.8	645.0	292.8	0.76	19.30	915	4070	7.6	193.0	
			5000 <sup>††</sup>	1524.0	3000.0	1362.0							

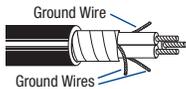
See footnotes on page 4.

## Variable Frequency Drive Cable – Symmetrical Design (continued)

### 16 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														
<b>1000V UL Flexible Motor Supply Cable</b> 600V UL 1277 Type TC-ER per 2005 NEC Article 336 600V 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	29526	4	7x12	100	30.4	92.3	41.9	0.89	22.61	1450	6450	8.9	226.1	
	<b>new</b>			500	152.4	470.5	213.6							
				1000	304.8	907.0	411.8							
				5000††	1524.0	4410.0	2002.1							
	29527	2	7x10	100	30.4	130.3	59.2	1.03	26.16	2300	10231	10.3	261.6	
	<b>new</b>			500	152.4	690.5	313.5							
				1000	304.8	1327.0	602.5							
				5000††	1524.0	6485.0	2944.2							
	29528	1	7x19x22	250†	76.2	398.8	181.0	1.20	30.48	2650	11788	12.0	304.8	
				500†	152.4	813.5	369.0							
				1000†	304.8	1642.0	746.0							
				3000††	1524.0	4779.0	2169.7							
29529	1/0	7x19x21	250†	76.2	525.8	238.7	1.29	32.77	3537	15733	12.9	327.7		
			500†	152.4	1039.5	471.5								
			1000†	304.8	2050.0	930.7								
			2000††	609.6	3954.0	1795.1								
29530	2/0	7x19x20	250†	76.2	602.0	273.3	1.40	35.56	4200	18682	14.0	355.6		
			500†	152.4	1192.0	540.7								
			1000†	304.8	2362.0	1072.4								
			2000††	609.6	4744.0	2153.8								
29531	3/0	7x19x19	250†	76.2	699.5	317.6	1.52	38.61	5025	22352	15.2	386.1		
			500†	152.4	1417.0	643.3								
			1000†	304.8	2708.0	1229.4								
			2000††	609.6	5436.0	2467.9								
29532	4/0	7x19x18	250†	76.2	881.0	400.0	1.68	42.67	6670	29670	16.8	426.7		
			500†	152.4	1873.0	850.3								
			1500††	457.2	5619.0	2551.0								

## Interlocked Armor VFD Cables

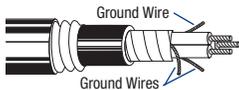
### 16 to 4/0 AWG with Dual Copper Tape Shield

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 the symmetrical, balanced ground design that features a dual copper tape shield for highly effective protection against radiated and conducted noise.

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

### 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  
 Class III Div.1 & Div.2  
 CSA FT4  
  
 UL Direct Burial XHHW-2 rated circuit conductors\*\* 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	1229520	1229521	1229522	1229523	1229524	1229525	1229526	1229527	1229528	1229529	1229530	1229531	1229532
Steel Armor Part Number	1329520	1329521	1329522	1329523	1329524	1329525	1329526	1329527	1329528	1329529	1329530	1329531	1329532
Min. Order	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1500
Max. Length	5000	5000	5000	5000	5000	5000	5000	5000	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 ±5% from length shown.  
 †† Final put-up may vary ±10% from length shown.