

# VFD CABLES

## 100% EMI CONTAINMENT

### FOR INDUSTRIAL APPLICATIONS



AmerCable

# INDUSTRIAL VFD CABLES

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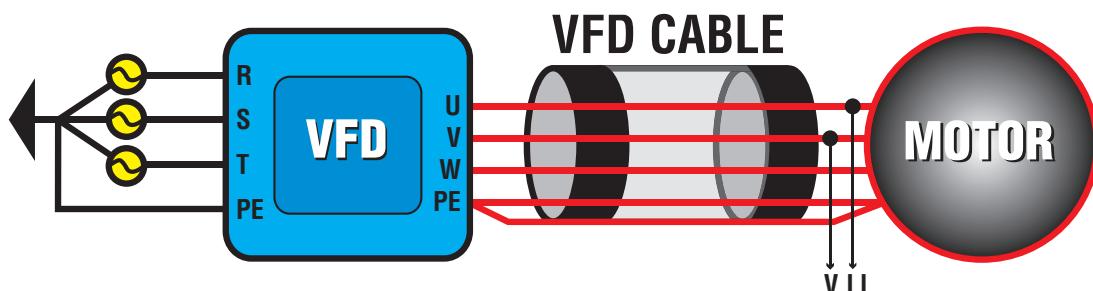
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Low-Smoke Halogen-Free and Fire Resistant

constructions available.

Contact your AmerCable rep.



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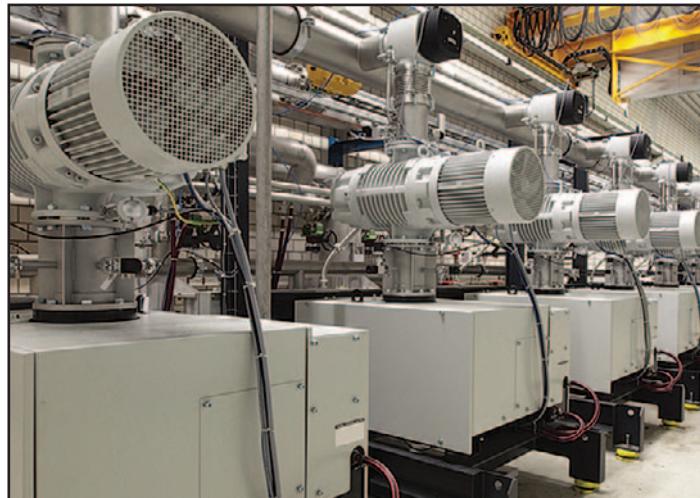
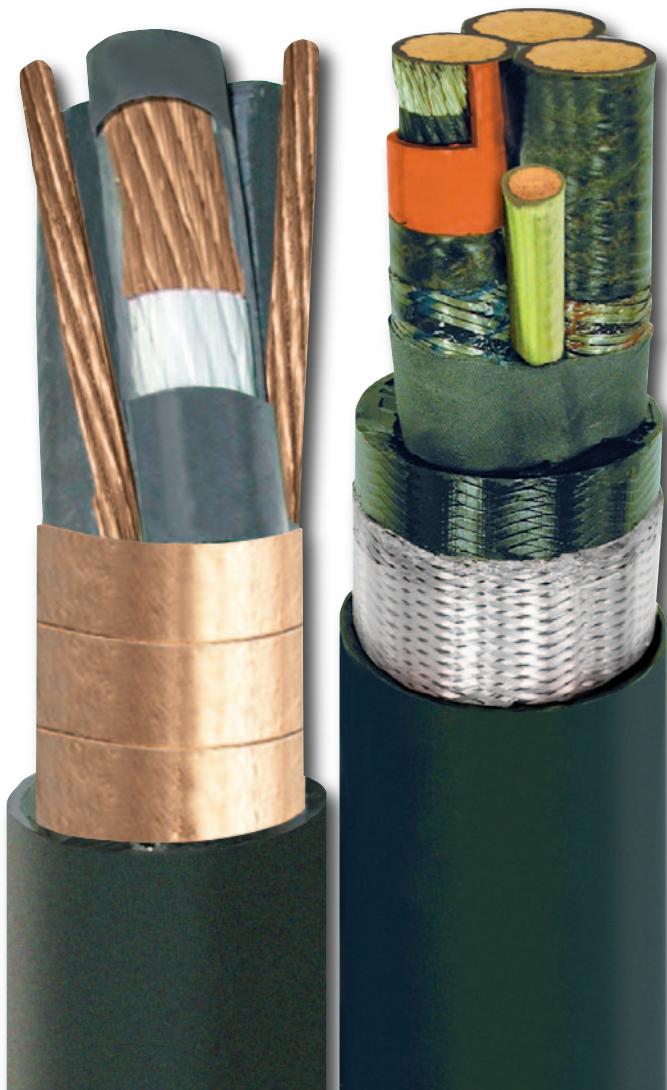
# OUR COMMITMENT TO INDUSTRIAL PRODUCTIVITY



AmerCable's Industrial VFD Cables are specially engineered to provide 100% containment of EMI emissions and provide longer cable life in harsh operating conditions.

AmerCable VFD cables feature symmetrical ground conductors that reduce induced voltage imbalances and carry common mode noise back to the drive.

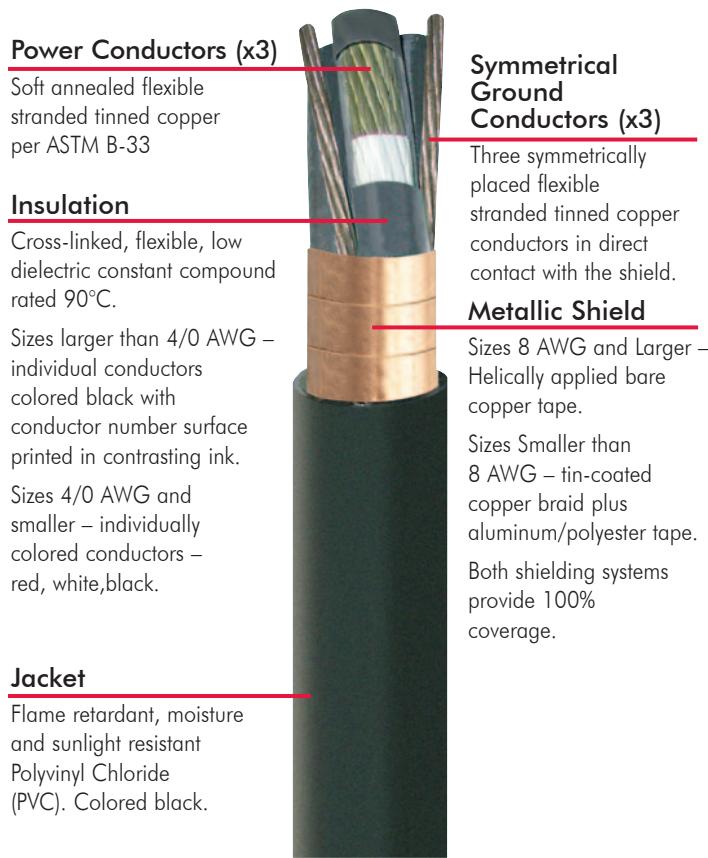
AmerCable's high strand count conductors and braid-shield design is much more flexible, easier to install and more resistant to vibration than Type MC cable.



[www.AmerCable.com](http://www.AmerCable.com)

# FLEXIBLE TC-ER VFD POWER CABLE

Three Conductor • 90°C • 1000V\*



## TC-ER Ratings & Approvals

- \* ■ UL Listed as Type TC-ER 600V
- \* ■ UL Listed as 1000V flexible motor supply cable (up to 4/0 AWG)
- 90°C Temperature Rating
- FT-4 and IEEE 1202 flame ratings
- Sunlight resistant
- Direct burial



## APPLICATION

A flexible shielded power cable specifically engineered for use in variable frequency AC motor drive (VFD) applications.

## FEATURES

- Specially engineered cable design produces a longer cable life in VFD applications.
- Overall shield provides 100% coverage containing VFD EMI emissions.
- Symmetrical ground conductors reduce induced voltage imbalances and carry common mode noise back to the drive.
- High strand count design is much more flexible, easier to install and more resistant to vibration than Type MC cable.
- Meets crush and impact requirements for Type MC cable.
- AmerCable's specially formulated insulation material has a lower dielectric constant (standard XLPE and EPR insulation materials have higher dielectric constants) which withstands reflected voltages. This allows for longer output cable distances and minimizes the effect of high frequency noise induced into the plant ground system.
- Permitted for Exposed Run ("ER") use in accordance with the NEC.
- Permitted for use in Class I, Division 2 and Zone 2 industrial hazardous locations per the NEC.
- Gas and vapor tight – impervious to water and air.
- Reduced tray fill (up to 35% less) than Type MC.
- Reduced installation time and cost compared to Type MC.
- Glands for this product cost up to 50% LESS than those for Type MC.
- Bend radius 12X O.D.

**37-108 VFD • FLEXIBLE TC-ER VFD • 1000 VOLTS**

Size AWG/ kcmil	Size (mm <sup>2</sup> )	Part No. 37-108	Nominal Diameter (inches)	Weight (lbs/ 1000ft)	DC Resistance at 25°C (ohms/1000ft)	AC Resistance 90°C, 60Hz (ohms/1000ft)	Inductive Reactance (ohms/ 1000ft)	Voltage Drop 90°C, 60Hz (Volts/Amp/ 1000ft)	Grounding Conductor (x3) Size (AWG)	Ampacity		
										In Free Air	In Cable Tray	In Conduit
14	2.08	-508VFD	0.466	158	2.907	3.635	0.036	5.069	18	15	15	15
12	3.29	-516VFD	0.509	199	1.826	2.283	0.034	3.195	16	20	20	20
10	5.23	-308VFD	0.522	258	1.153	1.441	0.032	2.028	14	30	30	30
8	8.30	-309VFD	0.653	368	0.708	0.885	0.036	1.262	14	65	55	48
6	13.21	-310VFD	0.737	517	0.445	0.556	0.034	0.804	12	87	75	65
4	21.17	-312VFD	0.956	814	0.300	0.376	0.031	0.552	12	114	95	89
2	35.00	-314VFD	1.103	1178	0.184	0.230	0.030	0.349	10	152	130	119
1	42.52	-315VFD	1.221	1462	0.147	0.184	0.031	0.287	10	177	145	137
1/0	50.00	-316VFD	1.447	1714	0.117	0.147	0.030	0.235	10	205	170	163
2/0	66.12	-317VFD	1.538	1951	0.093	0.117	0.029	0.193	10	237	195	186
4/0	95.00	-319VFD	1.883	3102	0.058	0.075	0.028	0.133	8	316	260	253
262	120	-320VFD	1.981	3642	0.048	0.063	0.026	0.114	6	362	297	284
313	150	-321VFD	2.082	4185	0.040	0.053	0.026	0.100	6	403	328	319
373	185	-322VFD	2.215	4834	0.034	0.045	0.025	0.088	6	449	362	358
444	240	-323VFD	2.371	5634	0.028	0.039	0.025	0.079	6	498	400	396
535	272.68	-324VFD	2.616	7592	0.024	0.033	0.025	0.071	6	555	445	441
646	300	-326VFD	2.878	9183	0.020	0.028	0.025	0.065	4	618	491	487
777	400	-327VFD	3.089	10834	0.016	0.025	0.025	0.060	4	687	546	537

- Cable diameters are subject to a +/- 5% manufacturing tolerance
- Ampacity in Free Air: Based on 30°C ambient temperature per 2023 NEC Table B.2(3)
- Ampacity in Cable Tray: Based on 30°C ambient temperature per 2023 NEC Table 310.16
- Ampacity in Conduit: Based on 30°C ambient temperature per 2023 NEC Table B.2(1)

**STRANDING PROFILE**

Size AWG/kcmil	Size (mm <sup>2</sup> )	Number of Strands	Uninsulated Conductor Diameter (inch)
14	2.08	19	0.074
12	3.29	19	0.093
10	5.23	37	0.113
8	8.30	133	0.159
6	13.21	133	0.201
4	21.17	259	0.255
2	35	259	0.321
1	42.52	259	0.361
1/0	50	266	0.413
2/0	66.12	323	0.455
4/0	95	532	0.584
262	120	646	0.654
313	150	777	0.720
373	185	925	0.785
444	240	1110	0.860
535	272.68	1332	0.941
646	300	1591	1.029
777	400	1924	1.132



# TC-ER VFD POWER CABLE

PVC Jacket • Three Conductor • 90°C • 600V



## POWER CONDUCTORS (X3)

Soft annealed stranded bare copper per ASTM B3, B496



## SYMMETRICAL GROUND CONDUCTORS (X3)

Three symmetrically placed stranded bare copper conductors in direct contact with the shield.

## INSULATION

Low dielectric constant XLPE meeting XHHW-2 per UL 44

## METALLIC SHIELD

Helically applied bare copper tape for provide 100% coverage.

## JACKET

Flame retardant, moisture and sunlight resistant Polyvinyl Chloride (PVC) per UL 1277. Colored black.

## APPLICATION

TC-ER VFD cable is used to supply power to motors, or for connection to other power devices in industrial settings. Primary installations include cable trays, raceways, and outdoor locations supported by a messenger wire. Type TC-ER VFD is Listed for direct burial or in underground ducts and for use in Class 1, Division 2 hazardous locations and Class 1 control circuits. This cable may be used in wet or dry locations at temperatures not to exceed 90°C. The cable is specifically engineered for use in variable frequency AC motor drive (VFD) applications.

## FEATURES

- Specially engineered cable design produces a longer cable life in VFD applications.
- Overall shield provides 100% coverage containing VFD EMI emissions.
- Symmetrical ground conductors reduce induced voltage imbalances and carry common mode noise back to the drive.
- Meets crush and impact requirements for Type MC
- AmerCable's specially formulated XLPE insulation material has a lower dielectric constant which withstands reflected voltages. This allows for longer output cable distances and minimizes the effect of high frequency noise induced into the plant ground system.
- Permitted for Exposed Run ("ER" use in accordance with the NEC 336.10(7).
- Permitted for use in Class I, Division 2 and Zone 2 industrial hazardous locations per the NEC.
- Gas and vapor tight – impervious to water and air.
- Bend radius 12X O.D.
- Color code per ICEA S-58-679 Method 4



**37-600VFD • FLEXIBLE TC-ER VFD • 600 VOLTS**

Conductor Size	Wire Count	Part No. 37-600	Conductor Diameter	Insulation Thickness	Insulation Diameter	Ground Size	Jacket Thickness	Jacket Diameter	Weight	NEC Ampacities					
										In Free Air		In Cable Tray		In Conduit	
										90°C	75°C	90°C	75°C	90°C	75°C
14	7	-508VFDCT	0.073	0.030	0.145	18	0.060	0.460	162	15	15	15	15	15	15
12	7	-516VFDCT	0.092	0.030	0.165	16	0.060	0.495	208	20	20	20	20	20	20
10	7	-308VFDCT	0.112	0.030	0.180	14	0.060	0.530	269	30	30	30	30	30	30
8	7	-309VFD	0.141	0.045	0.242	14	0.060	0.665	384	65	57	55	50	48	43
6	7	-310VFD	0.169	0.045	0.269	12	0.060	0.725	522	87	77	75	65	65	58
4	7	-312VFD	0.213	0.045	0.312	12	0.060	0.820	719	114	101	95	85	89	79
2	7	-314VFD	0.268	0.045	0.369	10	0.080	0.980	1090	152	133	130	115	119	105
1	18	-315VFD	0.299	0.055	0.416	10	0.080	1.085	1321	177	156	145	130	137	121
1/0	18	-316VFD	0.336	0.055	0.451	10	0.080	1.160	1569	205	181	170	150	163	145
2/0	19	-317VFD	0.379	0.055	0.497	10	0.080	1.255	1904	237	208	195	175	186	166
3/0	18	-318VFD	0.423	0.055	0.540	8	0.080	1.355	2381	274	241	225	200	214	189
4/0	18	-319VFD	0.475	0.055	0.595	8	0.080	1.470	2847	316	277	260	230	253	223
250	36	-330VFD	0.520	0.065	0.667	6	0.080	1.630	3479	352	310	290	255	276	245
350	36	-331VFD	0.616	0.065	0.757	6	0.110	1.880	4662	433	381	350	310	345	305
500	36	-333VFD	0.736	0.065	0.880	6	0.110	2.145	6402	536	470	430	380	427	3798
750	61	-334VFD	0.908	0.080	1.090	4	0.110	2.600	9447	677	591	535	475	529	466

- Cable diameters are subject to a +/- 5% manufacturing tolerance
- Ampacity in Free Air: Based on 30°C ambient temperature per 2023 NEC Table B.2(3)
- Ampacity in Cable Tray: Based on 30°C ambient temperature per 2023 NEC Table 310.16
- Ampacity in Conduit: Based on 30°C ambient temperature per 2023 NEC Table B.2(1)



**37-000VFD**

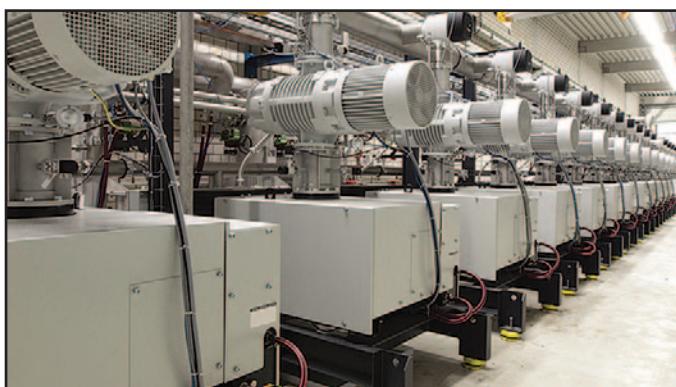
# **XLPE/PVC TC-ER VFD POWER CABLE**

THREE CONDUCTOR • 90°C • 2000V



## **RATINGS & APPROVALS**

- UL Listed as Type TC-ER 2000V
- 90°C Wet/Dry Temperature Rating
- FT-4/ IEEE 1202 Flame Rating
- Sunlight Resistant
- For Direct Burial



## **APPLICATION**

TC-ER VFD cable is used to supply power to motors, or for connection to other power devices in industrial settings. Primary installations include cable trays, raceways, and outdoor locations supported by a messenger wire. Type TC-ER VFD is Listed for direct burial or in underground ducts and for use in Class 1, Division 2 hazardous locations and Class 1 control circuits. This cable may be used in wet or dry locations at temperatures not to exceed 90°C. The cable is specifically engineered for use in variable frequency AC motor drive (VFD) applications.

## **FEATURES**

- Specially engineered cable design produces a longer cable life in VFD applications.
- Overall shield provides 100% coverage containing VFD EMI emissions.
- Symmetrical ground conductors reduce induced voltage imbalances and carry common mode noise back to the drive.
- Meets crush and impact requirements for Type MC
- AmerCable's specially formulated XLPE insulation material has a lower dielectric constant which withstands reflected voltages. This allows for longer output cable distances and minimizes the effect of high frequency noise induced into the plant ground system.
- Permitted for Exposed Run ("ER" use in accordance with the NEC 336.10(7)).
- Permitted for use in Class I, Division 2 and Zone 2 industrial hazardous locations per the NEC.
- Gas and vapor tight – impervious to water and air.
- Bend radius 12X O.D.
- Color code per ICEA S-58-679 Method 4
- Cables are fully compliant with NFPA 79-2018

**37-000VFD • TC-ER VFD • 2000 VOLTS**

Size AWG/ kcmil	Size mm <sup>2</sup>	Part No. 37-000	Nominal Diameter Inches*	Weight (Lbs./ 1000 Ft.)	DC Resist. @ 25°C (Ohms/ 1000 Ft.)	AC Resist. @ 90°C, 60 Hz (Ohms/ 1000 Ft.)	Inductive Reactance (Ohms/ 1000 Ft.)	Voltage Drop (Volts/Amp/ 1000 Ft.)	Grounding Conductor Size (3x) (AWG)	NEC Ampacities					
										In Free Air 90°C	In Cable Tray 75°C	In Conduit 90°C	In Conduit 75°C		
14	2.1	-508VFDCT	0.570	158	2.680	3.350	0.046	4.684	18	15	15	15	15	15	
12	3.3	-516VFDCT	0.610	199	1.680	2.100	0.043	2.951	16	20	20	20	20	20	
10	5.2	-308VFDCT	0.655	258	1.060	1.325	0.040	1.876	14	30	30	30	30	30	
8	8.3	-309VFD	0.770	368	0.6663	0.8329	0.040	1.194	14	65	57	55	50	48	
6	13.2	-310VFD	0.885	517	0.4192	0.5240	0.038	0.765	12	87	77	75	65	65	
4	21	-312VFD	0.975	814	0.2636	0.3295	0.036	0.493	12	114	101	95	85	89	
2	35	-314VFD	1.090	1178	0.1659	0.2074	0.034	0.322	10	152	133	130	115	119	
1	43	-315VFD	1.225	1462	0.1315	0.1644	0.034	0.263	10	177	156	145	130	137	
1/0	50	-316VFD	1.330	1714	0.1042	0.1304	0.033	0.215	10	205	181	170	150	163	
2/0	66	-317VFD	1.420	1951	0.0827	0.1034	0.032	0.176	10	237	208	195	175	186	
3/0	86	-318VFD	1.520	2607	0.0655	0.0819	0.031	0.146	8	274	241	225	200	214	
4/0	95	-319VFD	1.635	3102	0.0520	0.0653	0.030	0.122	8	316	277	260	230	253	
250	126	-330VFD	1.855	3836	0.0440	0.0553	0.030	0.108	8	352	310	290	255	276	
350	178	-331VFD	2.060	5141	0.0314	0.0396	0.029	0.085	6	433	381	350	310	345	
500	250	-333VFD	2.325	6977	0.0220	0.0280	0.028	0.068	6	536	470	430	380	427	
750	379	-334VFD	2.809	10051	0.0147	0.0191	0.028	0.055	4	677	591	535	475	529	
														467	

- Cable diameters are subject to a +/- 5% manufacturing tolerance
- Ampacity in Free Air: Based on 30°C ambient temperature per 2023 NEC Table B.2(3)
- Ampacity in Cable Tray: Based on 30°C ambient temperature per 2023 NEC Table 310.16
- Ampacity in Conduit: Based on 30°C ambient temperature per 2023 NEC Table B.2(1)



# EXTRA FLEXIBLE VFD POWER CABLE

## GEXOL® INSULATED • TC-ER

Three Conductor • 2kV • Rated 110°C



**Note:** For armored versions the braid is placed between the inner jacket and outer sheath where it serves as both the EMI shield and armor.

### Ratings & Approvals

- 110°C Temperature Rating
- UL Listed as Marine Shipboard Cable: (E111461)
- UL Listed as Type TC-ER (E123629)
- United States Coast Guard: November 2, 1987 / 9304
- CSA listed as Marine Shipboard Cable (82346)
- Flame resistance: IEEE 1202/FT-4
- Sunlight resistant

**Halogen-Free and Fire Resistant constructions available by request.**

### APPLICATION

A flexible, braid and foil shielded, 2kV power cable specifically engineered for use in variable frequency AC motor drive (VFD) applications.

### FEATURES

- Specially engineered cable design produces a longer cable life in VFD applications.
- Overall braid plus foil shield is engineered with 100% coverage and a surface transfer impedance <50 milliohms at 10MHz to contain EMI.
- Symmetrical insulated ground conductors reduce induced voltage imbalances and carry common mode noise back to the drive.
- High strand count conductors and braid shield design is much more flexible, easier to install and more resistant to vibration than Type MC cable.
- Gexol's lower dielectric constant (standard XLPEs, EPRs and other Type P insulation materials have higher dielectric constants) reduces reflected wave peak voltage magnitudes. This allows for longer output cable distances and minimizes the effect of high frequency noise induced into the plant ground system.
- 2kV insulation thickness is used to resist the potential 2-3x reflected voltages experienced in 600V VFD applications.
- Dual certified IEEE 1580 Type P and UL 1309/CSA 245 Type X110.
- Highest ampacity ratings: ABS 100°C, DNV 95°C, LRS 95°C, Transport Canada 95°C.
- Severe cold durability: exceeds CSA cold bend/cold impact (-40°C/-35°C).
- Flame retardant: IEC 332-3 Category A and IEEE 1202.
- Optional braid armor of bronze, aluminum or tinned copper.

## 37-102VFD • EXTRA FLEXIBLE VFD POWER CABLE GEXOL® INSULATED

Size AWG/ kcmil	mm <sup>2</sup>	Unarmored			Armored & Sheathed (TS)			Grounding Conductor* Size (AWG)	NEC Ampacities		
		Part No. 37-102	Nominal Diameter Inches*	Weight Lbs./ 1000 Ft.	Part No. 37-102	Nominal Diameter Inches*	Weight Lbs./ 1000 Ft.		In Free Air	In Cable Tray	In Conduit
4	21	-312VFD	1.100	925	-312TSVFD	1.262	1138	12	114	95	89
2	34	-314VFD	1.235	1421	-314TSVFD	1.392	1512	10	152	130	119
1	43	-315VFD	1.340	1517	-315TSVFD	1.509	1851	10	177	145	137
1/0	54	-316VFD	1.450	1803	-316TSVFD	1.615	2136	10	205	170	163
2/0	70	-317VFD	1.580	2120	-317TSVFD	1.792	2660	10	237	195	186
3/0	86	-318VFD	1.750	2827	-318TSVFD	1.959	3269	8	274	225	214
4/0	109	-319VFD	1.900	3416	-319TSVFD	2.101	3864	8	316	260	253
262	132	-320VFD	2.050	4210	-320TSVFD	2.258	4661	6	362	297	286
313	159	-321VFD	2.130	5105	-321TSVFD	2.353	5325	6	403	328	319
373	189	-322VFD	2.275	5521	-322TSVFD	2.483	6674	6	449	362	358
444	227	-323VFD	2.425	6440	-323TSVFD	2.634	6994	6	498	400	396
535	273	-324VFD	2.643	7547	-324TSVFD	2.931	8477	6	556	445	441
646	326	-326VFD	2.920	8916	-326TSVFD	3.178	9888	4	618	491	487
777	394	-327VFD	3.102	10909	-327TSVFD	3.510	11803	4	687	546	537

- Cable diameters are subject to a +/- 5% manufacturing tolerance
- Ampacity in Free Air: Based on 30°C ambient temperature per 2023 NEC Table B.2(3)
- Ampacity in Cable Tray: Based on 30°C ambient temperature per 2023 NEC Table 310.16
- Ampacity in Conduit: Based on 30°C ambient temperature per 2023 NEC Table B.2(1)



# CIR®-2 TYPE VFD POWER CABLE

## UL LISTED AS TYPE TC-ER

THREE CONDUCTOR • GEXOL® INSULATED • 600V • RATED 90°C



AmerCable

### POWER CONDUCTORS (3)

Soft annealed flexible stranded tinned copper per IEEE 1580 Table 11.

### INSULATION (2kV)

Gexol® cross-linked flame retardant polyolefin, meeting the requirements for Type P of IEEE 1580 and Type X110 of UL 1309/CSA 245. Color: Gray with printed phase I.D. (Black-Red-Blue)

### JACKET

A black, flame retardant, oil, abrasion, chemical and sunlight resistant thermoset CPE meeting UL 1309/CSA 245 and IEEE 1580.

### GROUND CONDUCTORS (3)

Soft annealed flexible stranded tinned copper per IEEE 1580 Table 11. Gexol® insulation sized per UL 1277. Color: Green

Note: Sizes over 1" OD have uninsulated grounds

### SHIELD

Overall tinned copper braid plus aluminum/polyester tape providing 100% coverage.



## CIR-2 VFD POWER CABLE RATINGS & APPROVALS

- 90°C temperature rating
- UL Listed as Type TC-ER – Suitable for use in Class I, Div 2 and Zone 2 environments
- Flame Retardant – IEEE 1202
- Suitable for use in Class I, Div 2 and Zone 2 environments

## APPLICATION

A flexible braid and foil shielded power cable specifically engineered for use in variable frequency AC motor drive (VFD) applications where user requires crush and impact protection.

## FEATURES

- Specially engineered cable design produces longer service life in VFD applications.
- Overall braid and foil shield provides 100% coverage containing VFD EMI emissions.
- Symmetrical insulated ground conductors reduce induced voltage imbalances and carry common mode noise back to the drive.
- High strand count conductors and braid shield design is much more flexible, easier to install and more resistant to vibration than Type MC.
- GEXOL's lower dielectric constant (standard XLPEs, EPRs and other Type P insulation materials have higher dielectric constants) reduces reflected wave peak voltage magnitudes. This allows for longer output cable distances and minimizes the effect of high frequency noise induced into the plant ground system.
- 2kV insulation thickness resists the repetitive 2x voltage spikes from 600V VFDs and reduces drive over current trip problems due to cable charging current.
- Passes the same stringent crush and impact testing required by UL 2225 for Type MC-HL
- Gas & vapor tight – impervious to water and air

## CIR-2 vs. TYPE MC

- Smaller bend radius (up to 40% smaller)
- Reduced tray fill (up to 35% less)
- Considerably more flexible
- Reduced installation time and cost
- Glands cost up to 50% LESS

## 37-102 CIRVA2 • FLEXIBLE TC-ER GEXOL® INSULATED

Size AWG/ kcmil	Part No. 37-102-	Nominal Diameter Inches	Weight Per 1000 Ft.	DC Resistance @ 25°C (Ohms/1k ft)	AC Resistance @ 90°C, 60 Hz (Ohms/1k ft)	Inductive Reactance (Ohms/1k ft)	Voltage Drop @ 90°C (Volts/Amp/ 1k ft)	Green Insulated Grounding Size (AWG)	NEC Ampacities		
									In Free Air	In Cable Tray	In Conduit
14	508CIRVA2	0.742	283	2.907	3.635	0.040	5.073	18	15	15	
12	516CIRVA2	0.815	378	1.826	2.283	0.038	3.199	18	20	20	
10	308CIRVA2	0.871	473	1.153	1.441	0.036	2.032	14	30	30	
8	309CIRVA2	0.893	553	0.708	0.885	0.037	1.263	14	65	55	
6	310CIRVA2	1.093	797	0.445	0.556	0.033	0.804	12	87	75	
4	312CIRVA2	1.225	929	0.300	0.376	0.031	0.552	12	114	95	
2	314CIRVA2	1.341	1276	0.184	0.230	0.029	0.348	10	152	130	
1	315CIRVA2	1.447	1576	0.147	0.184	0.029	0.285	10	177	145	
1/0	316CIRVA2	1.566	2144	0.117	0.147	0.029	0.234	10	205	170	
2/0	317CIRVA2	1.733	2144	0.093	0.117	0.028	0.192	10	237	195	
4/0	319CIRVA2	1.874	3131	0.058	0.075	0.027	0.132	8	316	260	
262	320CIRVA2	2.031	3875	0.048	0.063	0.027	0.115	6	362	297	
313	321CIRVA2	2.130	4709	0.040	0.053	0.026	0.100	6	403	328	
373	322CIRVA2	2.257	5209	0.034	0.045	0.025	0.088	6	449	362	
444	323CIRVA2	2.400	6310	0.028	0.039	0.025	0.080	6	498	400	
535	324CIRVA2	2.705	7193	0.024	0.033	0.026	0.072	6	555	445	
646	326CIRVA2	2.898	9217	0.020	0.028	0.026	0.065	4	618	491	
777	327CIRVA2	3.102	10340	0.016	0.025	0.025	0.060	4	687	546	
										537	

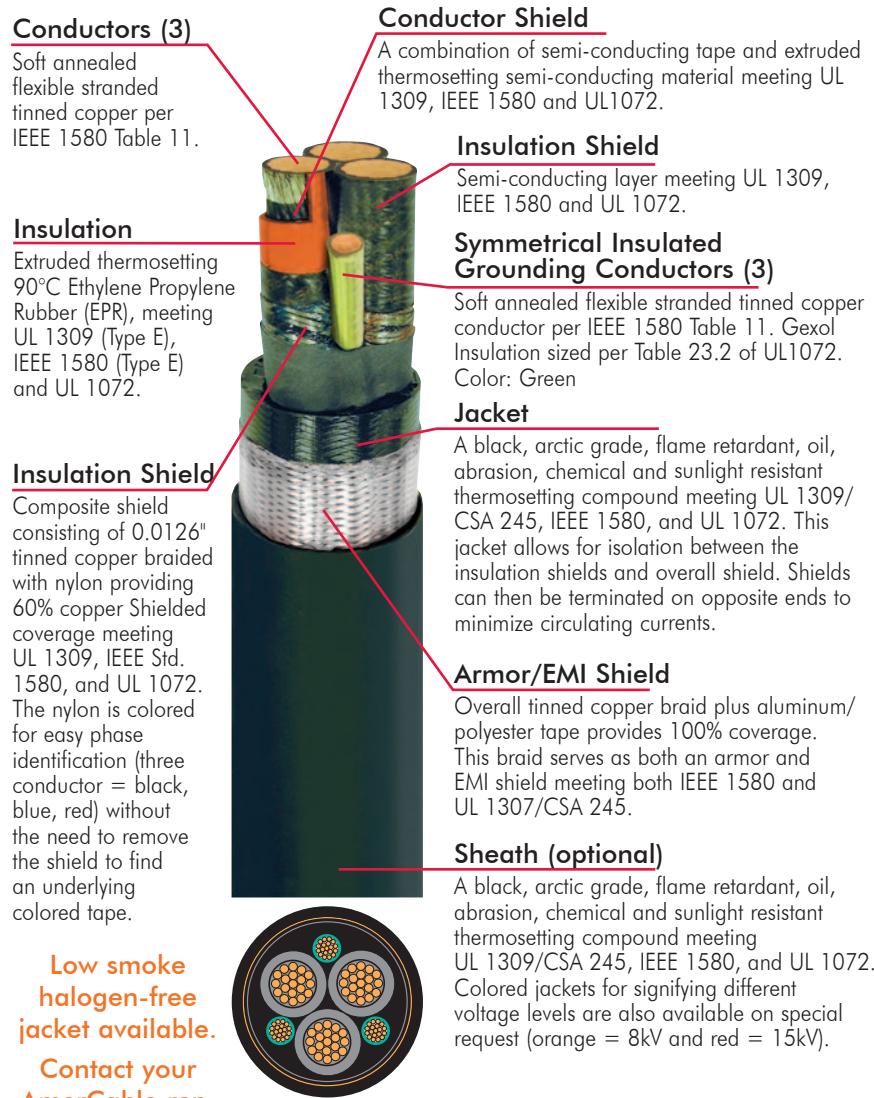


- Cable diameters are subject to a +/- 5% manufacturing tolerance
- Ampacity in Free Air: Based on 30°C ambient temperature per 2023 NEC Table B.2(3)
- Ampacity in Cable Tray: Based on 30°C ambient temperature per 2023 NEC Table 310.16
- Ampacity in Conduit: Based on 30°C ambient temperature per 2023 NEC Table B.2(1)

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# MMV-VFD POWER CABLE

Three Conductor: 8kV – 15kV • 133% Insulation Level • Rated 90°C



## Ratings & Approvals

- UL Listed as Marine Shipboard Cable (E111461)
- American Bureau of Shipping (ABS)
- Det Norske Veritas (DNV) Pending
- Lloyd's Register of Shipping (LRS) Pending
- 90°C Temperature Rating
- Voltage Rating – 8kV to 15kV (25kV available on request)

## APPLICATIONS

A flexible, braid and foil shielded, power cable specifically engineered for use in medium voltage variable frequency AC drive (VFD) applications.

## FEATURES

- Flexible stranded conductors and braided shields. Suitable for applications involving repeated flexing and high vibration.
- Small minimum bending radius (8x OD) for easy installation.
- Insulation has a very low dielectric constant. This allows for longer output cable distances and minimizes common mode current.
- Overall braid plus foil shield is engineered with 100% coverage and a surface transfer impedance <50 milliohms at 10MHz to contain EMI.
- Symmetrical insulated ground conductors reduce induced voltage imbalances and carry common mode noise back to the drive.
- High strand count conductors and braid shield design is much more flexible, easier to install and more resistant to vibration than Type MC cable.
- Severe cold durability: exceeds CSA cold bend/cold impact (-40°C/-35°C).
- Flame retardant: IEC 332-3 Category A and IEEE 1202.
- Suitable for use in Class I, Division 1, and Zone 1 environments.

## THREE CONDUCTOR TYPE MMV-VFD MEDIUM VOLTAGE – 8KV • 133% INSULATION LEVEL

Ampacity											
Size AWG/ kcmil	mm <sup>2</sup>	Part No. 37-105	Nominal Diameter (inches)	Weight (Lbs./ 1000 Ft.)	In Free Air (amps)	Single Banked in Trays (amps)	DC Resistance at 25°C (ohms/1000 Ft.)	AC Resistance at 90°C, 60Hz (ohms/1000 Ft.)	Inductive Reactance (ohms/ 1000 Ft.)	Voltage Drop (Volts per amp per 1000 Ft.)	Green Insulated Grounding Conductor (3x) Size (AWG)
6	12.5	-332TSVFD	1.687	1634	93	83	0.445	0.556	0.048	0.820	10
4	21	-333TSVFD	1.868	2074	120	105	0.300	0.376	0.043	0.564	10
2	34	-334TSVFD	2.071	2625	165	145	0.184	0.230	0.040	0.359	10
1	43	-335TSVFD	2.161	3022	185	165	0.147	0.184	0.038	0.294	8
1/0	54	-336TSVFD	2.262	3373	215	195	0.117	0.147	0.037	0.242	8
2/0	70	-337TSVFD	2.381	3826	245	220	0.093	0.117	0.036	0.199	8
3/0	86	-338TSVFD	2.489	4411	285	250	0.074	0.094	0.035	0.166	6
4/0	109	-339TSVFD	2.631	5093	325	290	0.058	0.075	0.033	0.139	6
262	132	-340TSVFD	3.857	5993	369	323	0.048	0.063	0.032	0.121	6
313	159	-341TSVFD	3.030	6867	407	359	0.040	0.053	0.032	0.106	6
373	189	-342TSVFD	3.164	7810	450	398	0.034	0.045	0.031	0.094	4
444	227	-343TSVFD	3.319	8855	497	438	0.028	0.039	0.030	0.085	4
535	273	-344TSVFD	3.492	9905	554	484	0.024	0.033	0.030	0.076	4

• Cable diameters are subject to a +/- 5% manufacturing tolerance

## THREE CONDUCTOR TYPE MMV-VFD MEDIUM VOLTAGE 15KV • 133% INSULATION LEVEL

Ampacity											
Size AWG/ kcmil	mm <sup>2</sup>	Part No. 37-105	Nominal Diameter (inches)	Weight (Lbs./ 1000 Ft.)	In Free Air (amps)	Single Banked in Trays (amps)	DC Resistance at 25°C (ohms/1000 Ft.)	AC Resistance at 90°C, 60Hz (ohms/1000 Ft.)	Inductive Reactance (ohms/ 1000 Ft.)	Voltage Drop (Volts per amp per 1000 Ft.)	Green Insulated Grounding Conductor (3x) Size (AWG)
2	34	-357TSVFD	2.403	3231	165	145	0.184	0.230	0.0440	0.364	10
1	43	-358TSVFD	2.468	2959	185	165	0.147	0.184	0.0430	0.299	8
1/0	54	-359TSVFD	2.596	4090	215	195	0.117	0.147	0.041	0.246	8
2/0	70	-360TSVFD	2.714	4615	245	220	0.093	0.117	0.0390	0.203	8
3/0	86	-361TSVFD	2.875	5306	285	250	0.074	0.094	0.038	0.170	6
4/0	109	-362TSVFD	3.028	6131	325	290	0.058	0.075	0.037	0.142	6
262	132	-363TSVFD	3.260	7074	369	323	0.048	0.063	0.035	0.124	6
313	159	-364TSVFD	3.363	7787	407	359	0.040	0.053	0.034	0.109	6
373	189	-365TSVFD	3.500	8703	450	398	0.034	0.045	0.034	0.097	4
444	227	-366TSVFD	3.652	9912	497	438	0.028	0.039	0.033	0.080	4

• Cable diameters are subject to a +/- 5% manufacturing tolerance

• Ampacity in Free Air: Based on 90°C conductor temperature and 40C ambient temperature per 2023 NEC Table 315.60(C)(5)

• Ampacity in Tray: Based on 90°C conductor temperature and 40C ambient temperature per 2023 NEC Table 315.60(C)(9)

# CABLE SELECTION GUIDE FOR VFD APPLICATIONS



The circuit of a typical voltage source PWM drive is shown in Figure 1. Each part of the equipment is bonded to the safety earth system to ensure personnel safety if faults occur.

All parts have capacitance to ground shown by:

- CM for the motor windings.
- CC1 and CC2 for the power converter circuits.
- CT for the transformer's secondary winding to the transformers' screen.

The IGBT switches are in constant operation at high frequency and this produces an inverter output voltage with a PWM wave shape as shown by the voltage  $V_1$  (Figure 1).

This IGBT switches also cause a motor line to ground voltage  $V_2$  (Figure 1), normally called a common mode voltage.

The common mode voltages cause short high-frequency pulses of common mode current to flow in the safety earth circuits, shown by currents  $I_1$  and  $I_2$  (Figure 1), unless the design includes cable features to stop this from happening.

It is essential that the common mode currents return to the inverter without causing EMC - EMI problems in other equipment, and this means that the common mode currents  $I_1$  and  $I_2$  must not flow in the safety earthing system.

For the motor, this is achieved by connecting a set of wires from the motor to the inverter that run with the main power cables. These are called symmetrical grounding conductors, see Figure 2. These conductors have a very low impedance compared with the other return path via the safety earthing system.

The three symmetrical grounding conductors and overall shields are connected as shown in Figure 3. This  $360^\circ$  connection is essential.

The common mode currents  $I_1$  and  $I_2$  now flow in the symmetrical grounding conductors. This happens because the symmetrical grounding conductors are close to the power conductors giving a low impedance route for the currents  $I_1$  and  $I_2$  compared with the safety earthing system. As  $I_1$  and  $I_2$  flow near the power conductors this avoids creating external EMC - EMI problems.

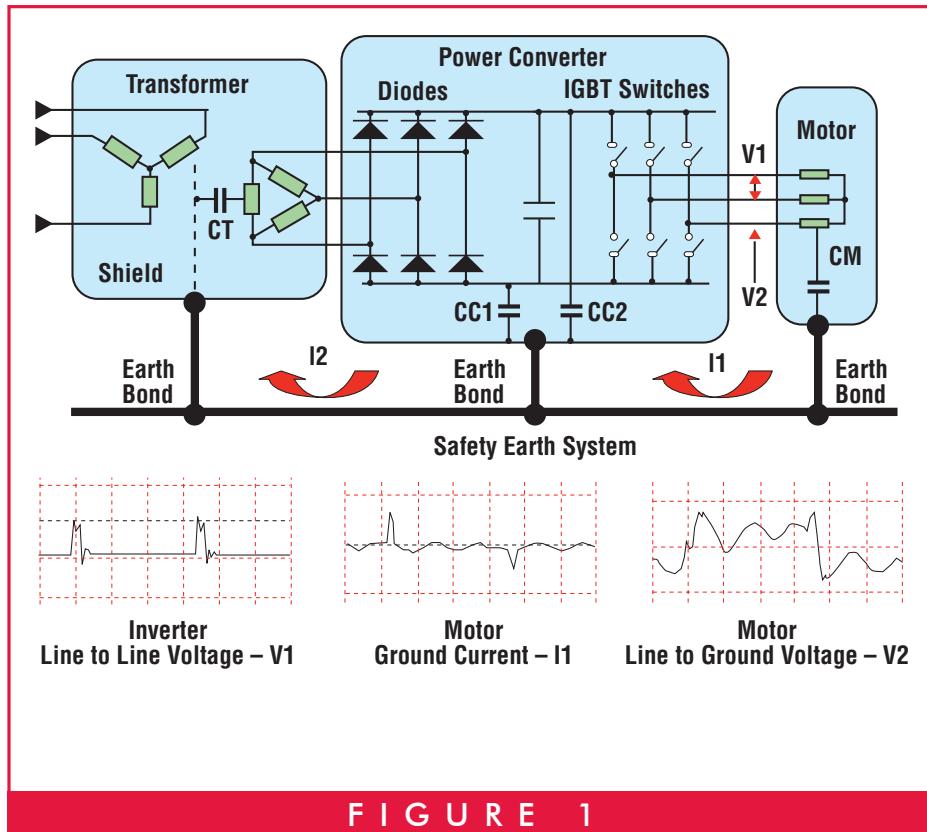
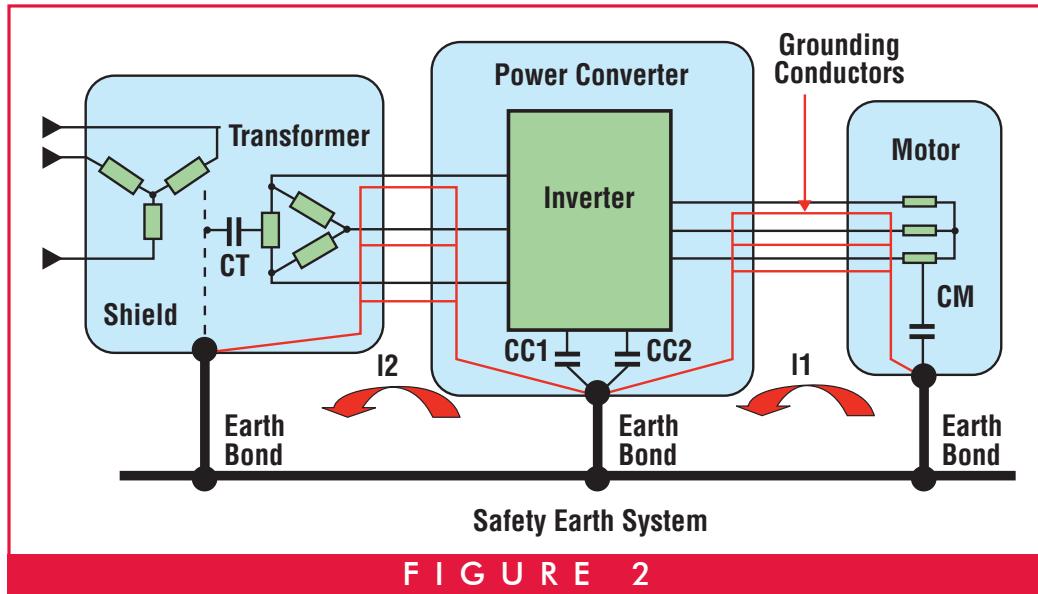


FIGURE 1

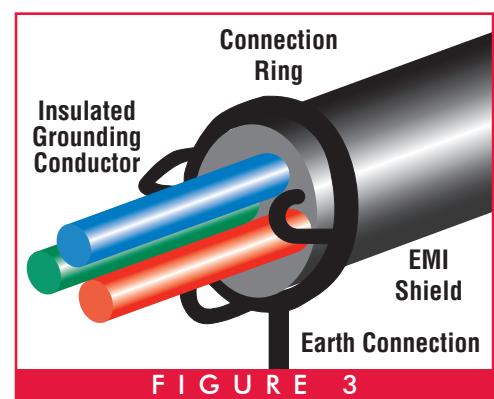


If symmetrical grounding conductors and an overall EMI shield are not used, EMC - EMI problems are very likely to occur.

For cables used with voltage source PWM drives, a number of features are required to ensure correct operation, avoid overheating and achieve longer service life.

The essential features of a medium voltage cable for PWM drives are :

- Insulation designed to withstand the transients produced by the PWM
- Insulation with a dielectric constant no greater than 3.0 to minimize capacitance
- Voltage rating of 3x the operating voltage to prevent corona
- Three symmetrical grounding conductors. Some cables only have one grounding conductor. This is not acceptable as it produces circulating currents in the earth system
- Extremely fine strands to carry the harmonic currents without overheating (i.e. the inductance of fine stranded conductors is less than 7, 19, 37 strand conductors)
- Overall shield to stop the radiation of voltage EMI fields
- Correct termination at both ends
- Semi-conducting shield around each insulation layer (MMV only)
- Metallic layer around each semi-conducting shield to earth the semi-conducting shield (MMV only).



Figures 1 - 3 courtesy of Converteam



AmerCable manufactures high-quality flexible VFD cables for a wide variety of specialized industrial applications. As an ISO 9001:2015 certified cable manufacturer, AmerCable combines leading-edge technology, proven manufacturing techniques, and high-quality service to deliver the finest industrial and utility cable products available.

AmerCable serves a worldwide customer base from our manufacturing facility in El Dorado, Arkansas. Our professional field engineering and sales force work directly with customers, or in partnership with our network of independent distributors, to identify and fulfill your specific cable requirements.



Manufacturing facility and corporate headquarters - El Dorado, Arkansas.



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## VFD Maximum Horsepower\*

Part Number <sup>†</sup>	AWG/kcmil	230V 3Φ	460V 3Φ	575V 3Φ
-508VFD	14	3 HP	7.5 HP	10 HP
-516VFD	12	5 HP	10 HP	10 HP
-308VFD	10	7.5 HP	15 HP	20 HP
-309VFD	8	15 HP	40 HP	50 HP
-310VFD	6	25 HP	50 HP	60 HP
-312VFD	4	30 HP	60 HP	75 HP
-314VFD	2	40 HP	75 HP	100 HP
-315VFD	1	50 HP	100 HP	125 HP
-316VFD	1/0	60 HP	125 HP	150 HP
-317VFD	2/0	60HP	150 HP	200 HP
-319VFD	4/0	100 HP	200 HP	250 HP
-320VFD	262	100 HP	200 HP	300 HP
-321VFD	313	125 HP	250 HP	300 HP
-322VFD	373	125 HP	250 HP	350 HP
-323VFD	444	150 HP	300 HP	400 HP
-324VFD	535	150 HP	350 HP	450 HP
-326VFD	646	200 HP	400 HP	500 HP
-327VFD	777	-	450 HP	-

\*Recommended horsepower are based on the Full-Load Current in Table 430.250 of the 2008 NEC and multiplied by 1.25 according to Article 430.22(A). The cable ampacities are based on 90°C conductor and cable installed in free based on Table B.310.3 in the NEC.

Actual horsepower will be subject to drive/motor manufacturer nameplate full-load current and local authority having jurisdiction.

<sup>†</sup> Complete part number can be determined by selecting the appropriate construction and adding the part number prefix (e.g. 37-102-319VFD for 4/0 Standard Gexol VFD)



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