



Understanding Nexans DriveRx® VFD Cables

September 16, 2025



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Applications Engineer

HOUSEKEEPING

- Questions can be asked at any time using the chat function on the webinar screen
- Any unanswered questions will be followed up through email
- This presentation, a recording of the webinar and a brief survey will be emailed to all registrants

ABOUT MYSELF



Wissam Geahchan, P. Eng
Applications Engineer

- Licensed Professional Engineer (P. Eng.) in Ontario
- Experience applying the CE Code in a variety of applications
- Active member on several industry standards committees at CSA, UL, and ICEA.
- Licensed soccer coach

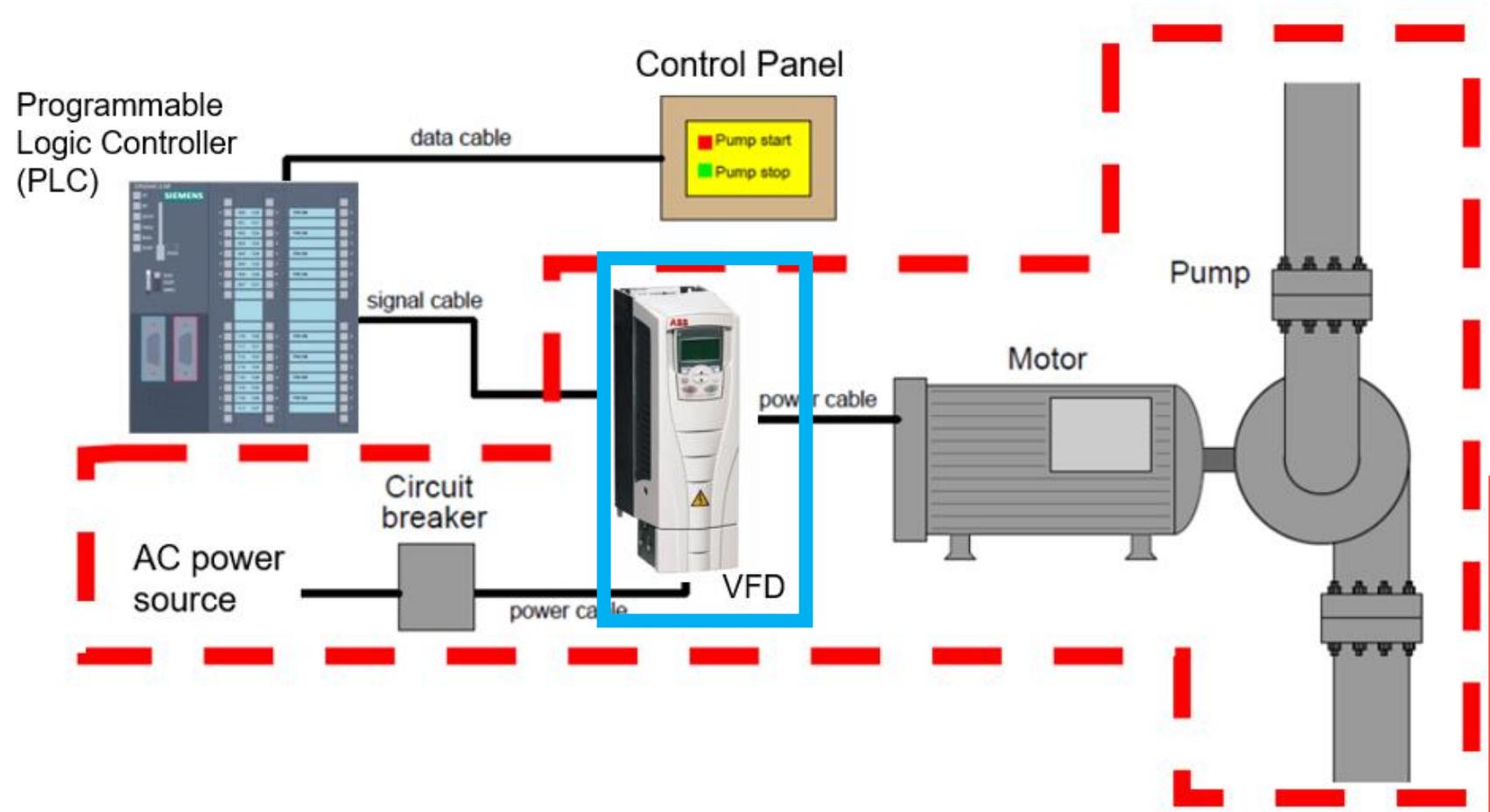
- 1 | Introduction: What is a VFD? VFD Applications/System
- 2 | VFD Benefits and Complications
- 3 | Nexans Solution: DriveRx VFD Cable
- 4 | Why use Nexans DriveRx VFD Cables?
- 5 | Alternative VFD Cable Designs
- 6 | Installation Recommendations
- 7 | Summary

Agenda

1. INTRODUCTION

What is a VFD?

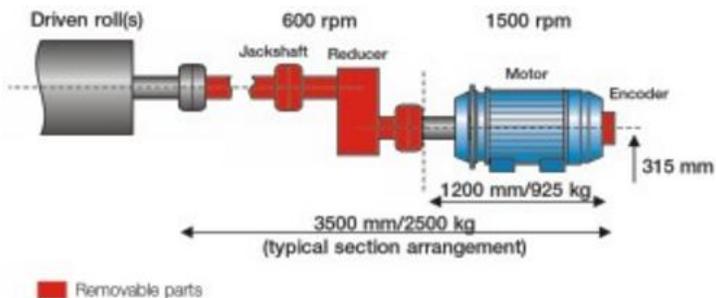
A VFD or “Variable Frequency Drive” is a device that controls the speed of an AC motor by adjusting the voltage and frequency of the power supplied to it.



Traditional Drives vs Modern Drives

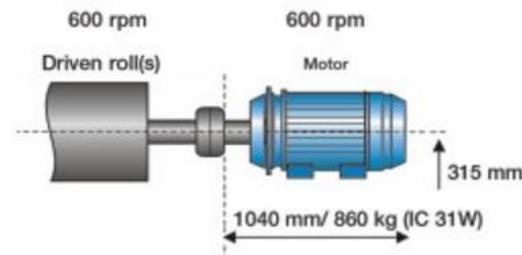
TRADITIONAL

- Single-speed drive
- Mechanical speed control
- Electrical or mechanical direction control



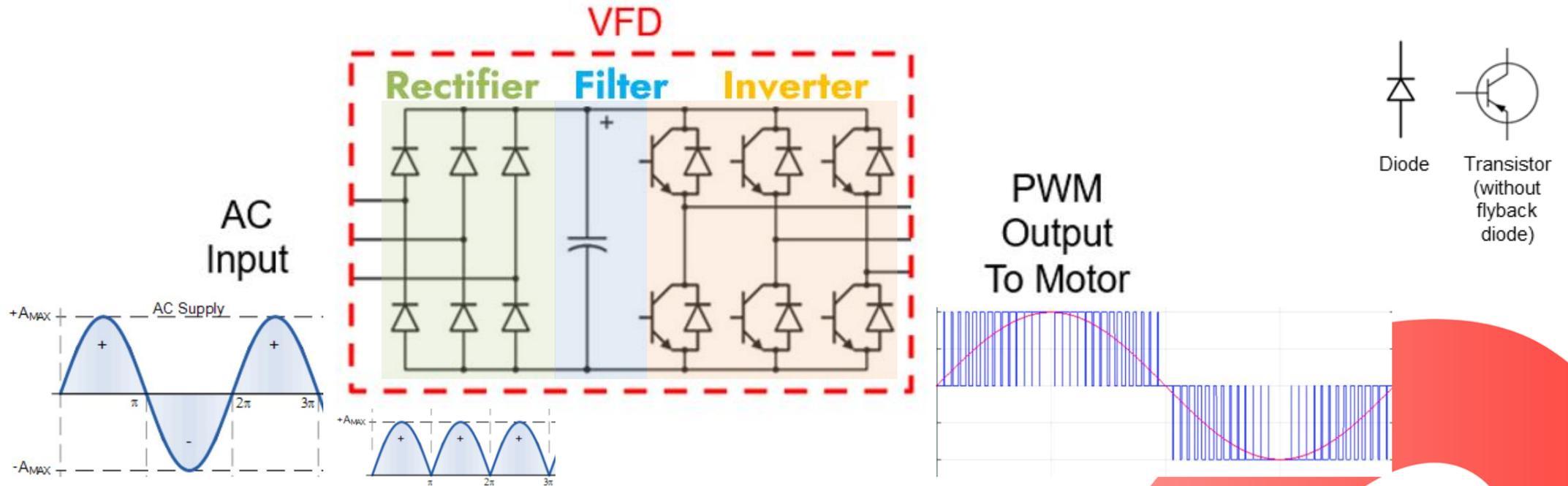
MODERN

- Variable Frequency Drive
- Electrical speed control, plus torque and direction



1. INTRODUCTION

How Does a VFD Work?



Rectifier

Transforms
AC into DC

Filter

Creates a constant
DC power source

Inverter

Transforms DC into a
Pulse-Width Modulated
(PWM) waveform

Typical VFD Applications

Industrial:

- Wood processing
- Automotive
- Pulp, paper, & printing
- Food and beverage
- Power plants
- Mining
- Metal industry
- Machine shop
- Plastics
- Textiles



Non-Industrial:

- Water and Sewage Treatment
- Heating, Ventilation, and Air Conditioning (HVAC)



1. INTRODUCTION

VFD Manufacturers

**Rockwell
Automation**

 **Allen-Bradley**


EMERSON™

HITACHI

Schneider
 **Electric**

ABB

EAT•N

TOSHIBA

YASKAWA

BALDOR®

 **Nexans**

2. VFD BENEFITS AND COMPLICATIONS

Benefits

**Increased
Productivity**

**High quality
output**

**Smooth start
and stop**

**Lower
maint. costs**

**Energy
savings**

**< physical
space**

Complications

**Electromagnetic
interference**

**High voltage
spikes**

**Corona
discharge**

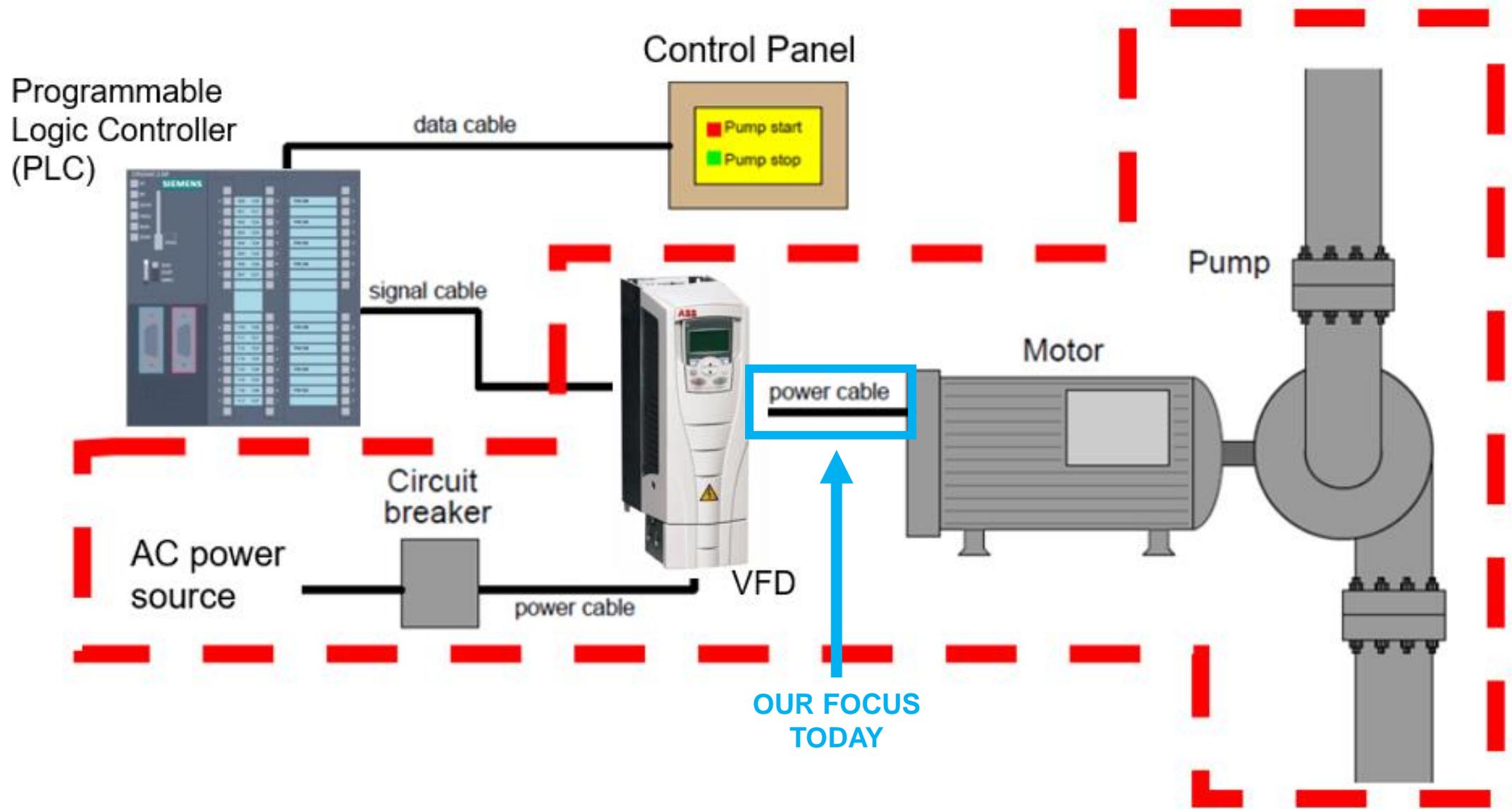
**Reflected &
standing waves**

**Motor bearing
failures**

**Limited motor
cable length**

Properly installed "VFD cables" significantly reduces these complications!

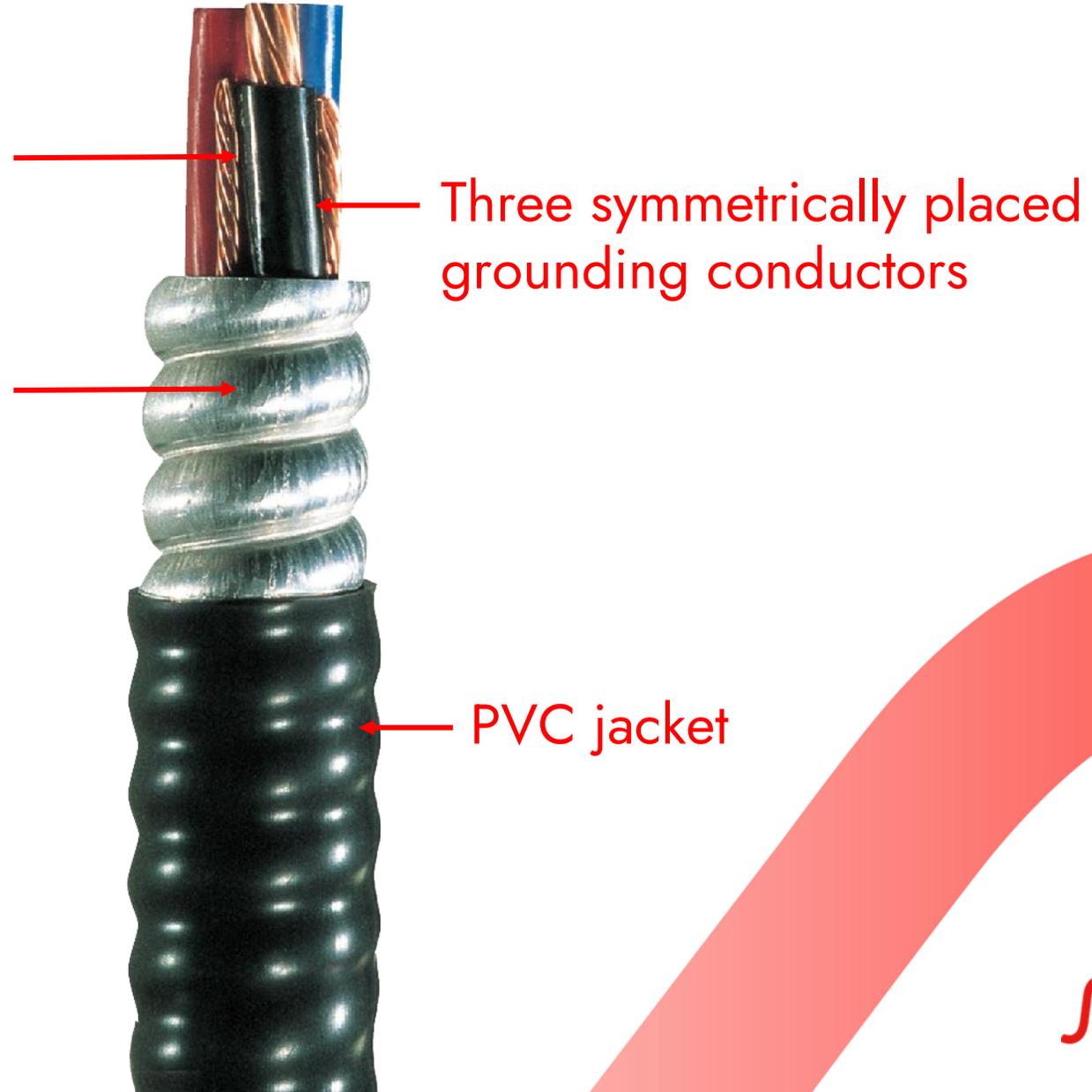
3. OUR FOCUS TODAY



3. NEXANS SOLUTION: DRIVERX VFD CABLE

1 kV rated XLPE insulated
conductors

Continuously corrugated
welded aluminum sheath



Standards

CSA C22.2 No. 123 – Metal Sheathed Cables

CSA C22.2 No. 174 – Hazardous Locations

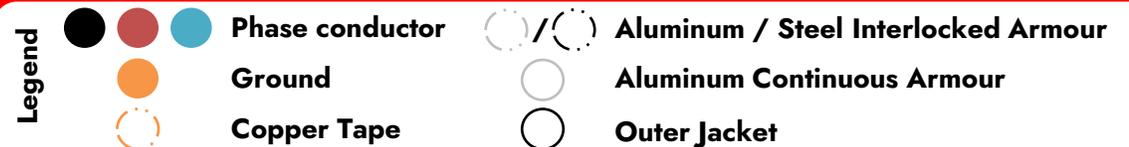
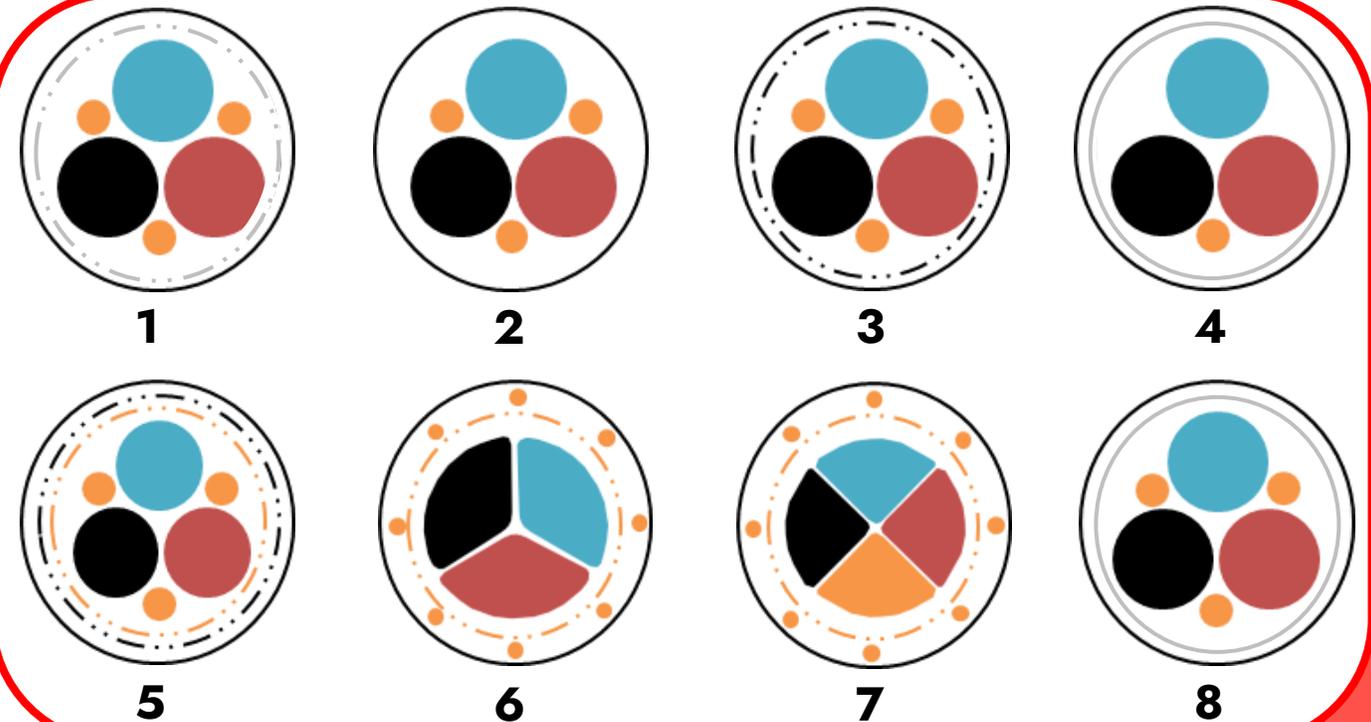
4. WHY USE NEXANS DRIVERX VFD CABLES?

Five performance concerns were addressed in an IEEE paper titled "**Evaluation of Motor Power Cables for PWM AC Drives**" published in 1996.

Performance Concerns

- ① Minimize net injected ground current
- ② Minimize common-mode currents
- ③ Minimize motor frame standing voltage
- ④ Best possible cable shielding
- ⑤ Best possible ground path in a cable

8 Cable Designs Studied

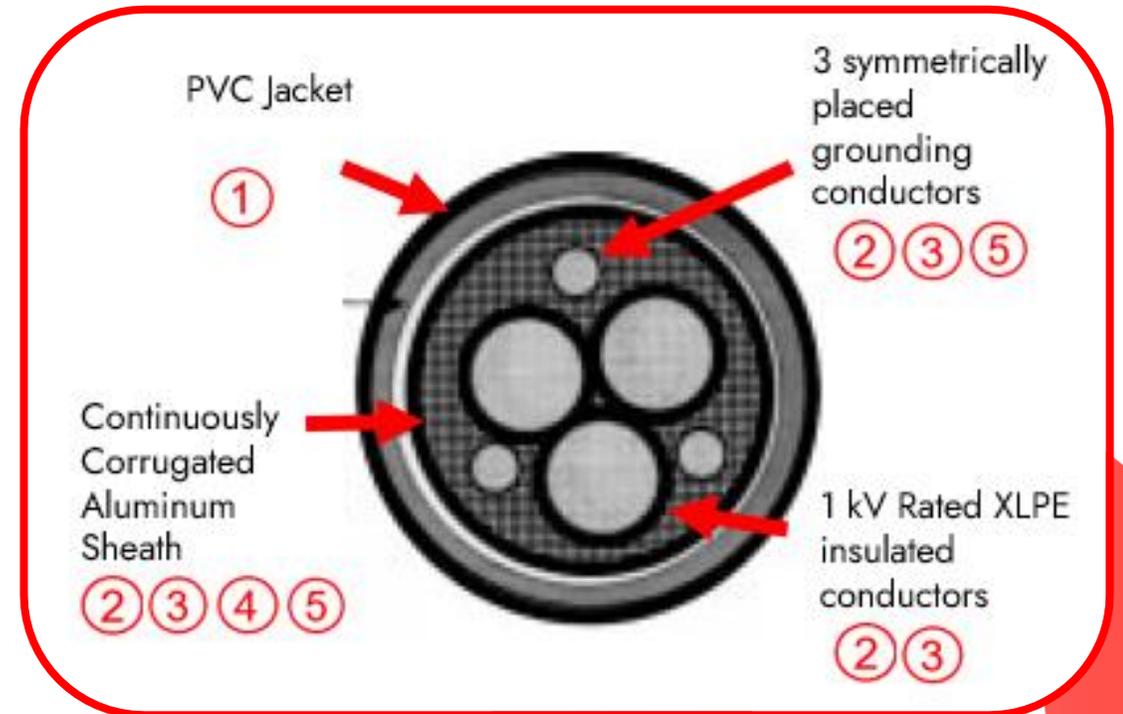


4. WHY USE NEXANS DRIVERX VFD CABLES?

The **DriveRX[®] VFD cable** design was **#1** out of 8 cable constructions studied for use between a VFD and the motor.

Performance Concerns:

- ① Minimize net injected ground current
- ② Minimize common-mode currents
- ③ Minimize motor frame standing voltage
- ④ Best possible cable shielding
- ⑤ Best possible ground path in a cable



**DriveRX[®] VFD
cable construction**

4. WHY USE NEXANS DRIVERX VFD CABLES?

- ① Minimize net injected ground current into ground bus

Why?

- Improve drive system performance
- Increase reliability of drive electronics

DriveRx[®] VFD cable solution:

- **PVC jacket**
 - *Ensures grounding at cable ends only*
 - *Eliminates ground loops*
 - *Result → no injected ground current*



4. WHY USE NEXANS DRIVERX VFD CABLES?

② Minimize common-mode currents

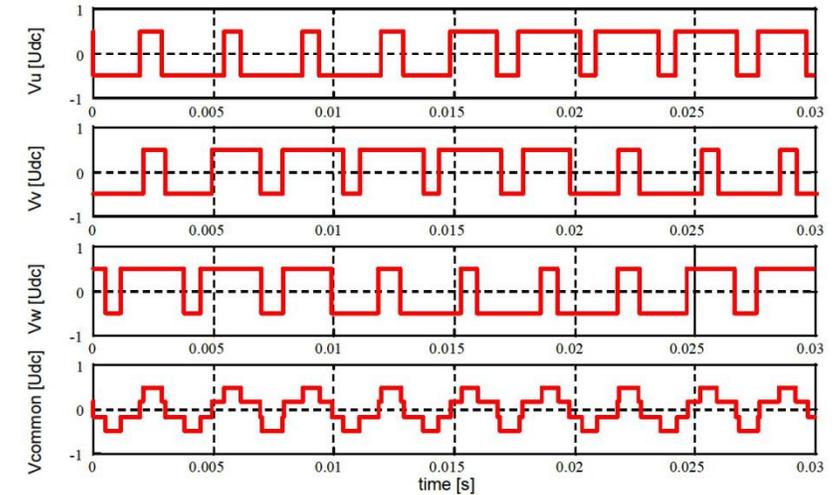
Why?

- Reduce possibility of bearing currents

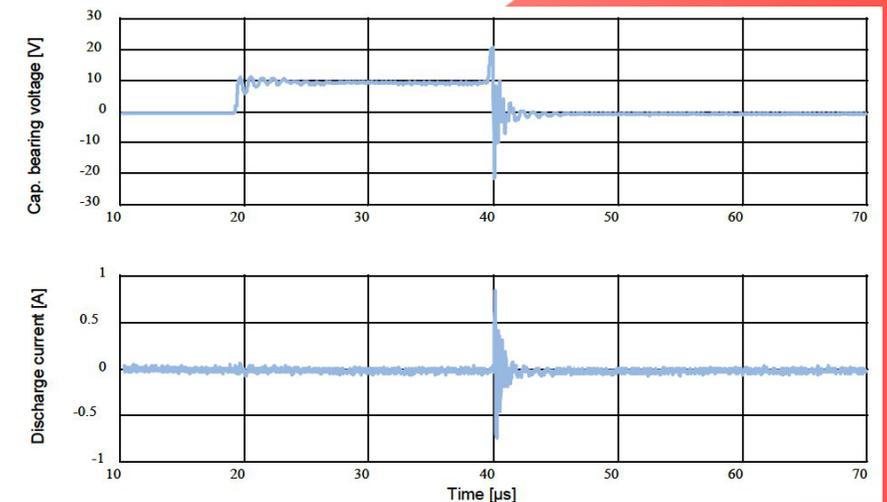
What is Common Mode Current?

- Modern AC drives produce 3 independent switching waveforms. These waveforms do not add up to zero.
- Result = common mode voltage and current
- Common mode voltage and current produce repetitive voltage spikes.
- These voltage spikes reach 3.1x the nominal voltage rating of the VFD output.

Motor Phase Voltages



Capacitive Bearing Voltage & Discharge Current



4. WHY USE NEXANS DRIVERX VFD CABLES?

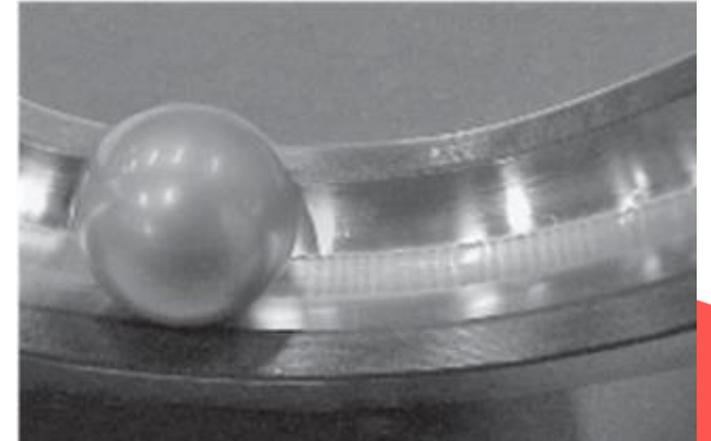
② Minimize common-mode currents

Why?

- Reduce possibility of bearing currents

What are Bearing Currents?

- Rapid switching in modern AC drive systems may generate high frequency current pulses through bearings
- When the energy of these pulses is sufficiently high, metal transfers from the ball bearings and the races to the lubricant
- This is known as Electrical Discharge Machining (EDM)
- Each tiny pit is a discontinuity that will collect more current pulses and expand into a crater
- Craters quickly accumulate causing the bearing to fail after a short time in service



4. WHY USE NEXANS DRIVERX VFD CABLES?

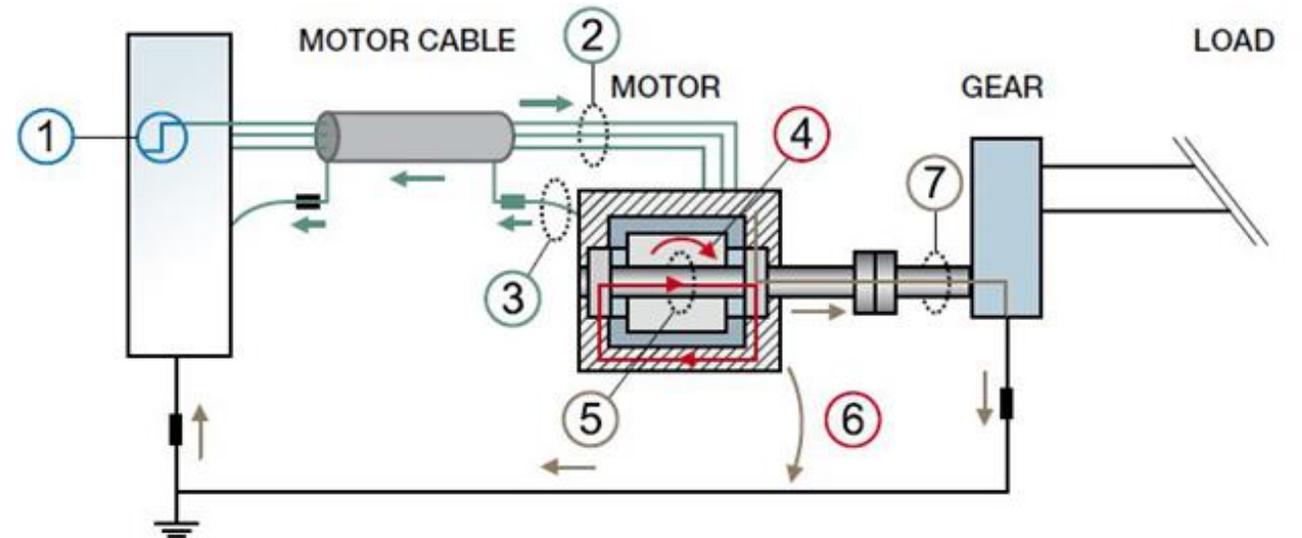
② Minimize common-mode currents

Why?

- Reduce possibility of bearing currents

How are Bearing Currents Generated?

- High frequency voltage can be induced over a bearing in three different ways:
 - High frequency circulating current
 - Shaft grounding current
 - Capacitive discharge current



4. WHY USE NEXANS DRIVERX VFD CABLES?

② Minimize common-mode currents

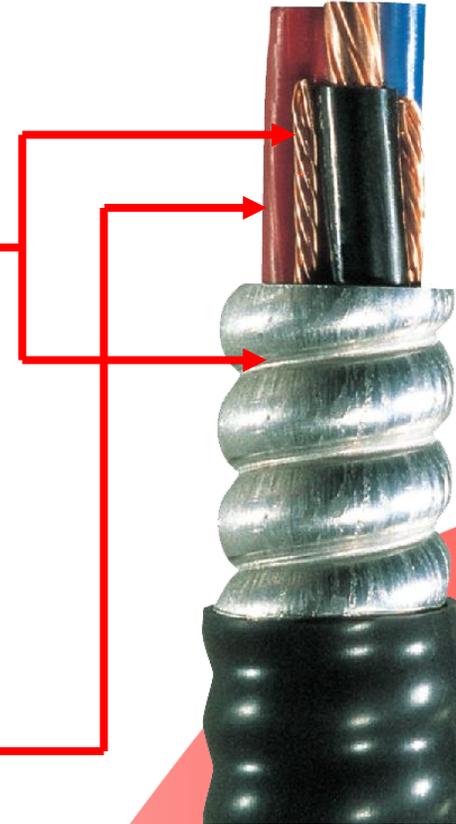
DriveRx® VFD cable solution:

Three symmetrically placed grounding conductors + continuously welded corrugated aluminum sheath

- Provide best cancellation of common mode currents
- Provide a balanced, wide frequency range, low impedance path to ground
- Eliminates bearing currents
- Eliminates shock hazard

1 kV rated XLPE insulated conductors

- High dielectric strength to withstand repetitive high voltage spikes of 2 to 3 times the nominal system voltage rating



4. WHY USE NEXANS DRIVERX VFD CABLES?

③ Minimize motor frame standing voltage

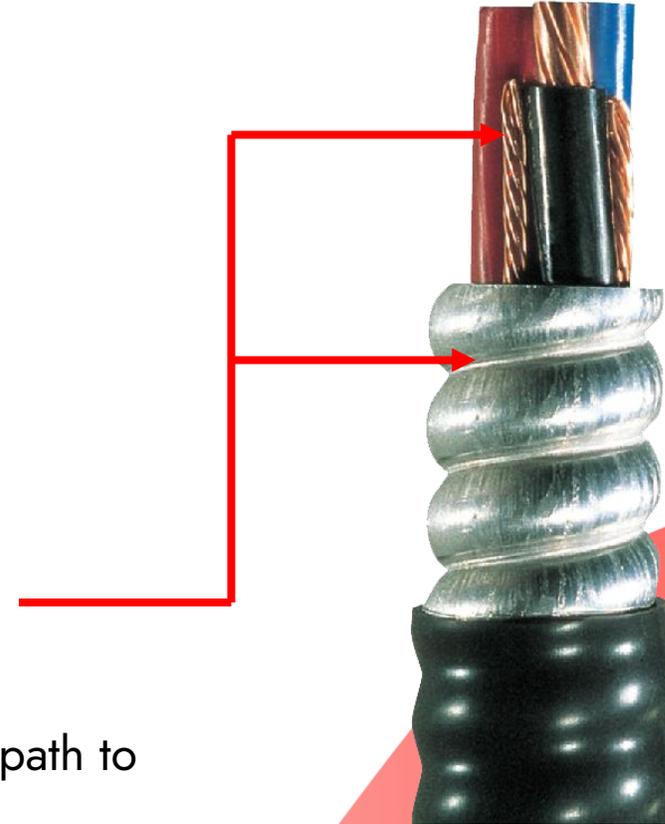
Why?

- Reduce possibility of bearing current
- Increase safety

DriveRx® VFD Cable Solution:

Three symmetrically placed grounding conductors plus a continuously corrugated and welded aluminum sheath

- Provide a balanced, wide frequency range, low resistance path to ground
- Eliminate bearing currents
- Eliminate the electrical shock hazard

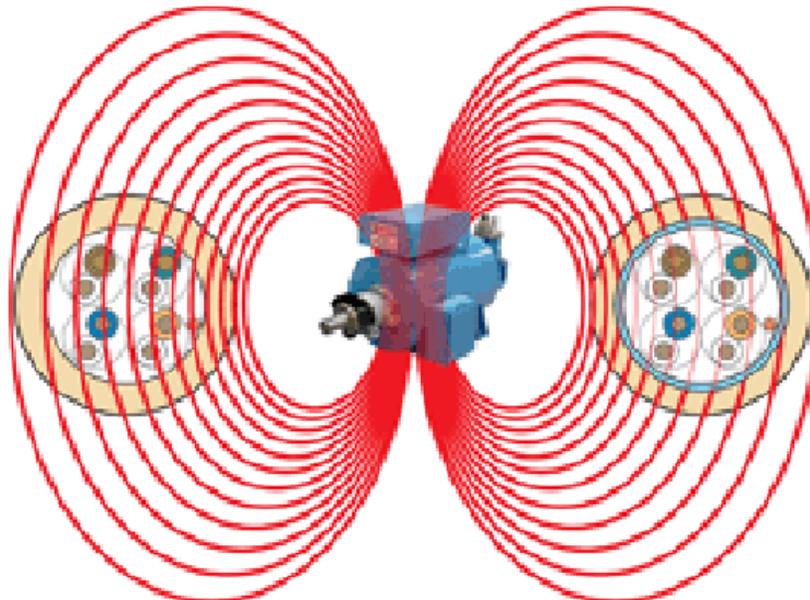


4. WHY USE NEXANS DRIVERX VFD CABLES?

④ Best possible cable shielding (and minimize cross-talk)

Why?

- Reduce crosstalk between adjacent cables
- Reduce inductive and capacitive coupling causing induced current or voltage, which could be a safety hazard

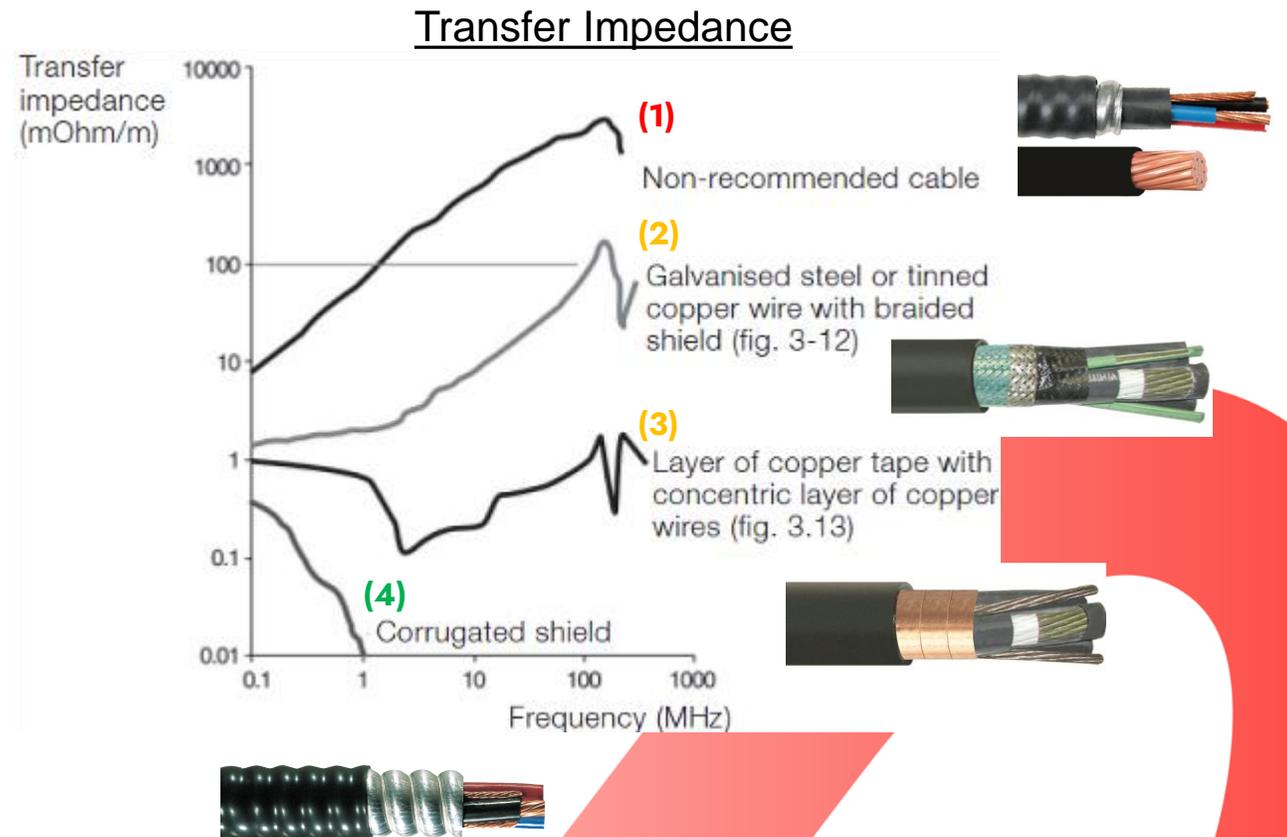


4. WHY USE NEXANS DRIVERX VFD CABLES?

④ Best possible cable shielding (and minimize cross-talk)

Shielding Comparison

1. Building Wire or Cable in Conduit
 - TECK90
 - RW90 in EMT
2. Tinned Copper Braid
 - Very flexible VFD cable
3. Copper Tape with Wires
 - Flexible VFD cable
4. Corrugated Aluminum Sheath
 - DriveRx[®] VFD Cable: Trainable, Self-supporting VFD cable



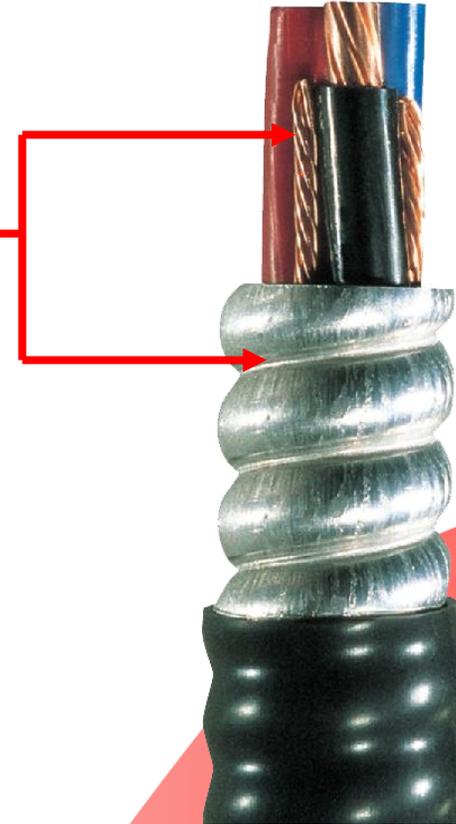
4. WHY USE NEXANS DRIVERX VFD CABLES?

- ④ Best possible cable shielding (and minimize cross-talk)

DriveRx® VFD Cable Solution:

Three symmetrically placed grounding conductors plus a continuously corrugated and welded aluminum sheath

- Provides an excellent shield for high frequency electrical noise
- Prevents interference with data and control signals
- Prevents interference with both wired and wireless systems



4. WHY USE NEXANS DRIVERX VFD CABLES?

⑤ Best possible ground path in a cable

Why?

- Long term low impedance ground path from the motor back through the cable to the drive

DriveRx® VFD Cable Solution:

Three symmetrically placed grounding conductors plus a continuously corrugated and welded aluminum sheath

- Provides an excellent shield for high frequency electrical noise
- Prevents interference with data and control signals
- Prevents interference with both wired and wireless systems



4. WHY USE NEXANS DRIVERX VFD CABLES?

Bringing it all together

1 kV rated XLPE insulated conductors

- Withstand repetitive high voltage spikes of 2 to 3 times

Continuous aluminum sheath

- Excellent shield for high frequency electrical noise
- Prevents interference with data & control signals
- Tough armour to protect the cable



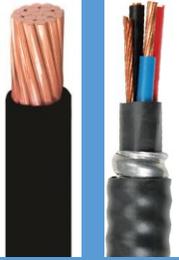
Three symmetrically placed grounding conductors

- Best cancellation of common mode currents
- Lowest net injected ground current
- Grounding conductors plus sheath provide balanced, wide frequency range, low resistance path to ground eliminating bearing currents and electrical shock hazard

PVC jacket (FT4)

- Grounds at cable ends only
- Eliminates ground loops; no injected ground current

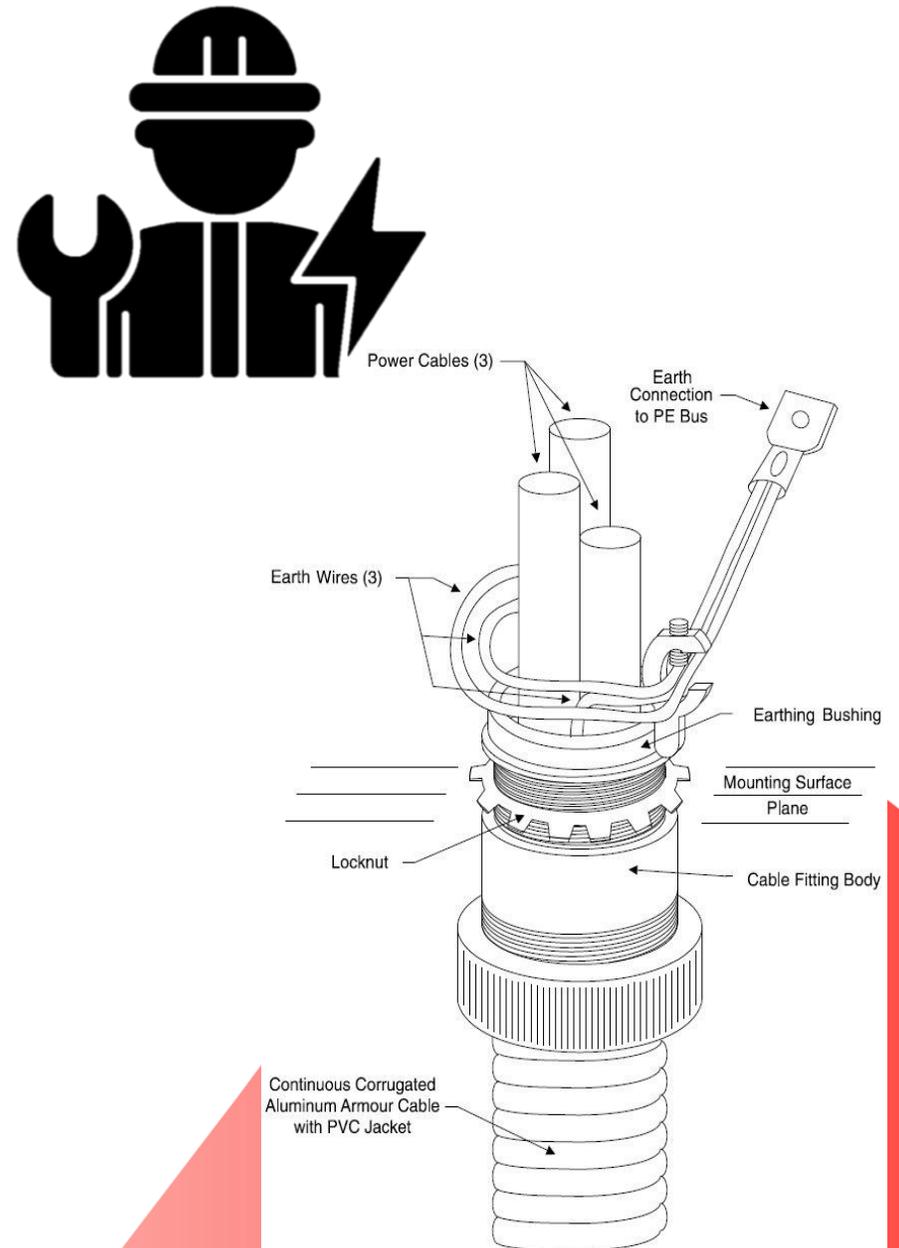
5. ALTERNATIVE VFD CABLE DESIGNS

Characteristic	Al Sheath, with XLPE Conductors 	Cu Tape, with XLPE Conductors (TC rated) 	Braided wire, with XLPE Conductors (TC Rated) 	Any Wire or Cable, w/ XLPE Conductors 
High Frequency Bonding	✓	✓		
Flexibility	✓	✓	✓	
Self-Supporting	✓			
Mechanical Protection	✓			
Suitable as a VFD Cable	✓	✓	✓	✗

Note – There is no CSA standard for “VFD cables”

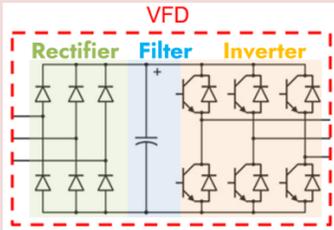
6. INSTALLATION CONSIDERATIONS

- Use only symmetrical 3 conductor shielded VFD cables.
- Do not break the cable shield except when terminating in a shielded environment (enclosure).
- Cable shield should be connected to ground by a short pigtail.
- Route power and control cables separately.
- Use cable connectors that maintain 360° contact with the cable shield and the shielded enclosure.
- Follow VFD manufacturer's instructions!



7. SUMMARY

Variable Frequency Drive (VFD) components include a rectifier, filter and inverter.



VFDs control a motor's speed, torque, and direction, resulting in **improved efficiency**



Using VFDs may result in **EMI, high voltage spikes, corona discharge, and possibility of motor bearing failures**

Nexans DriveRx® VFD Cables

do a great job reducing the complications associated with using VFDs.



Alternative VFD cable designs available in the market.

Installation tips relevant to VFD cable installations



Q&A

▼ Chat ☐ ✕

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