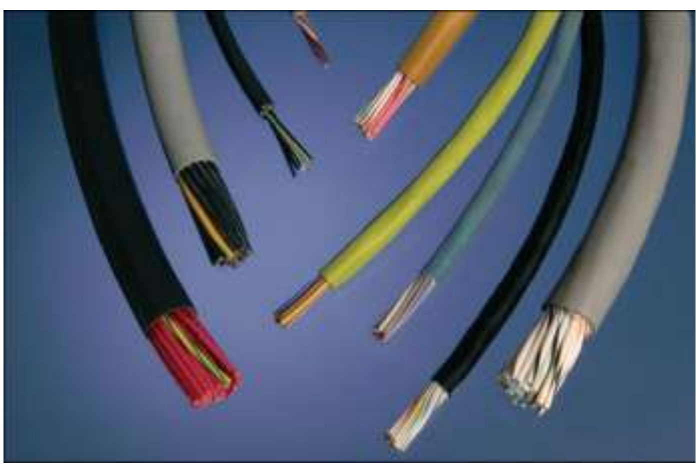
# How to Specify High-Performance Cables:
# The Devil Is In The Details

In today's world of sophisticated electronics, cable failure is not an option. There is no acceptable level of downtime and no one can afford to replace expensive machinery years before its predicted lifespan—not when profit margins are razor thin and competition is breathing down your neck from all four corners of the world.

The choice of cables grows, with expanding temperature ranges, shielding options, mechanical durability, flex cycle withstand and chemical resistance, among other performance characteristics designed into cables to meet the demands of extremely harsh environments (in chemicals, heat, cold, direct burial, 24/7 flexing, you name it) and increasingly complex applications.

### Still, cables fail and systems go down. Why?

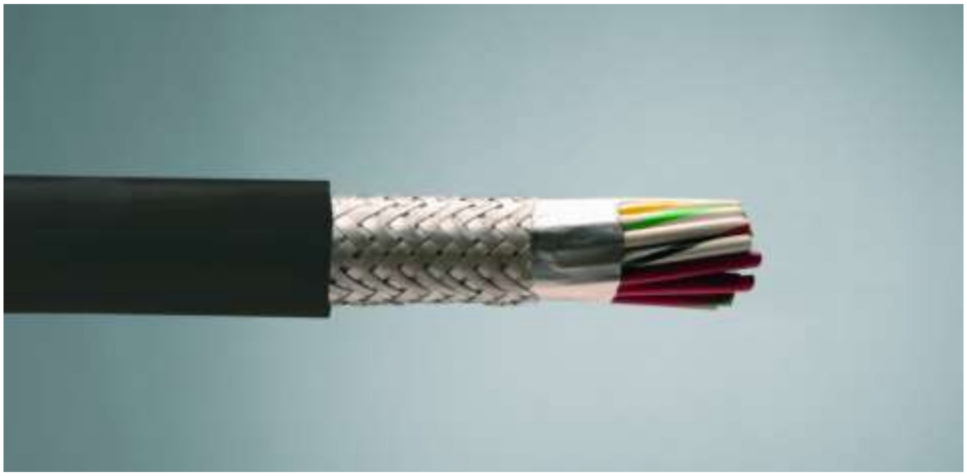
Many of the problems that surround cable failure, especially in extreme and harsh operating environments could have been avoided by selecting the correct cable from the outset. "But specifying cable is easy," you say. Well, yes and no. Sure, it's easy to match temperature ranges and then count on a PVC jacket for protection. But there's a lot more to it than that. Understanding how the cable will work when exposed to extreme temperatures; quantifying the type of chemical, oil, fuel or solvent the cable will be exposed to; understanding the difference between flexible and flexing, considering the level of mechanical abuse, UV exposure and EMI/RFI interference concerns are just a few of the details that engineers need to consider before "fully" specifying an appropriate "hazard-matched" cable.



**Cables should be hazard-matched to application requirements.**

## The first consideration: shielding

Cables require shielding to provide signal protection against conducted or emitted electrical noise of both high and low frequency, particularly in mission critical applications. But with so many environmental variations, it's difficult to know exactly what type of shielding is necessary for signal protection. Alpha Wire has tried to simplify specifying high-performance cables for engineers by offering interactive online parametric selection to assist engineers in correctly specifying cables (www.alphawire.com).



**Common shielding materials include foil and braid. Alpha Wire's SupraShield uses a triple-laminate foil and braid construction**

Not all shielding is created equal, which is why Alpha Wire has developed SupraShield® encompassing many shielding options. When the application calls for ultimate signal protection (including military applications, certain mil specs and applications requiring extreme protection from cable crosstalk and/or conducted EMI) specify triple-laminate foil and braid construction, which helps ensure ground path continuity and eliminates transmission gaps. If only moderate EMI protection (both conducted and radiated) is required, a more traditional foil shield will suffice.

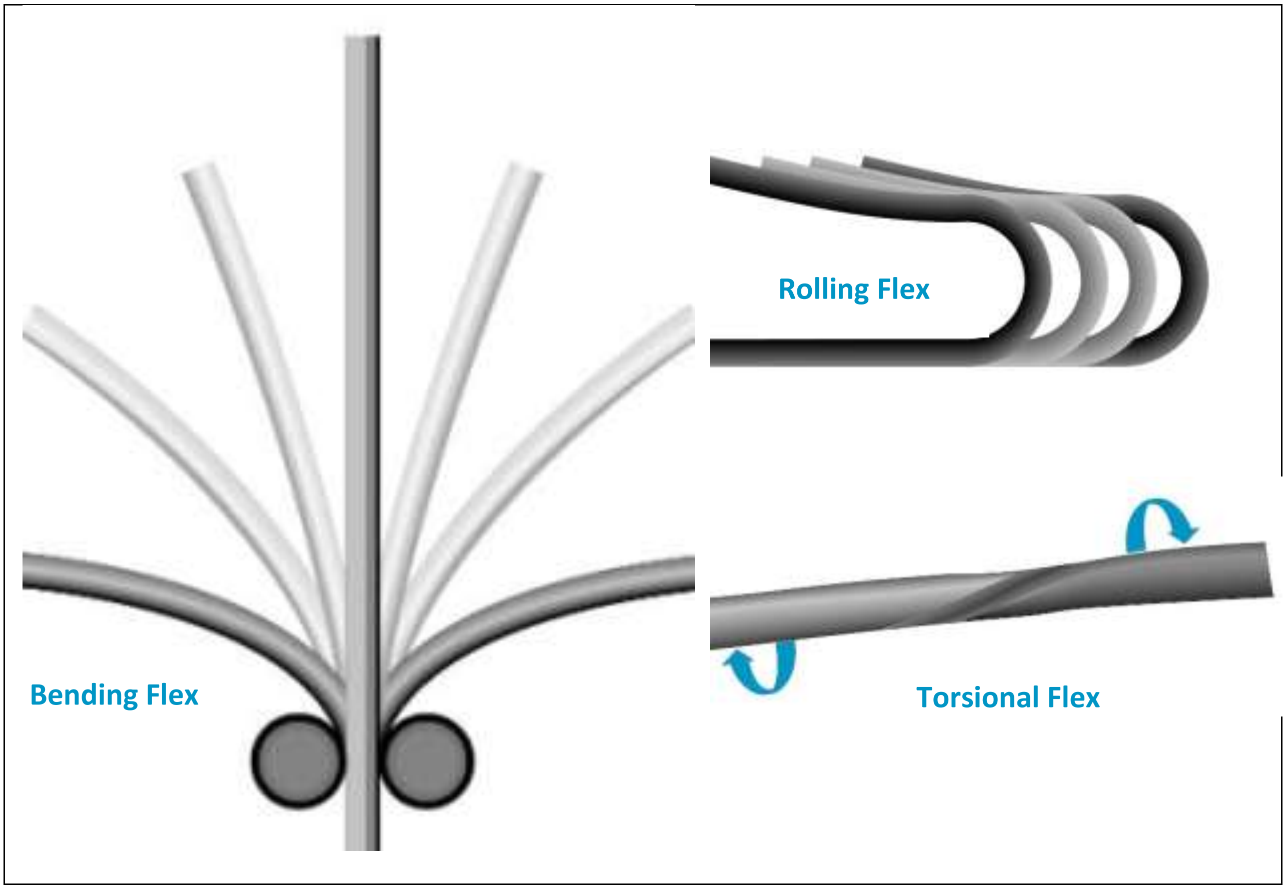
On the other hand, if flexible cables are called for, specific flex shielding is needed to address the stresses of motion. Selecting a standard foil shield will lead to system failure when the shielding tears and continuity is lost.

## Flexible or flex?

There's a big difference between flexible and flexing. The ability of the cable to be bent and routed in order to create a clean and tidy "dressed" installation is, of course, crucial. A flexible cable allows for easier installation and simplifies troubleshooting in the cabinet and/or cable tray. It should also be noted that a round-geometry cable provides a better seal than a typical convoluted cable in applications where cable interconnects cabinets. So, routing concerns should lead you to select a cable with the correct level of "bendability."

In many manufacturing applications cables are exposed to constant flexing. The ability to withstand millions of flex cycles is something far more complex than simple flexibility. So, how do you specify the correct flex cable? First, consider the type of flexing. Is it single axis, torsional or multi axis? Each requires a specific set of cable attributes. For example, single axis control cables, demanding the most extreme performance (up to 14 million flex life cycles), require flexible cable construction with continuous flex shielding. In less demanding single axis environments, look for a cable that has a minimum of 1 million flex life cycles and flexing style constructions.

In applications where the cables will be subject to torsional or variable flexing (robotics, for example), it is essential to specify sophisticated cables capable of twisting and random robotic flexing operation of ±360 degrees per meter.




**The type of flexing influences cable choice**

## Chemicals, oils, solvents and fuels

The impact of environmental chemicals on a cable is often overlooked unless the likely result is blatant, such as aggressive oils on a polymer based cable jacket. It is important to consider that many materials behave differently in the same chemical environment of varying strengths or levels of exposure. Other considerations are the impact of temperatures on any chemicals that might be present. For example, warmer temperatures may create vapors that can affect the integrity of the cable, whereas, in its liquid state, the cable would be impervious. Finally, it is worth considering not just the cable's resistance to chemicals but also the potential ingress of the fluid into connections. The external geometry of the cable can play a crucial role in overall system integrity.

## Demanding temperatures

No engineer or system designer worth his or her salt would specify a cable that couldn't meet the temperature demands of the working environment. Yet, it's easy to overlook the “full” implications of extreme temperatures. For example, a cable rated at -25 degrees F can function electronically, but the cold temperature will also affect the physical characteristics of the cable. Imagine, for example, that same cable at -25 degrees being run over by a fork lift. Can you hear the sound of the cable cracking? In heat, imagine the physical changes a cable will undergo at, say 110 degrees. Here's the point. Engineers will plan for the electronic/electrical characteristics needed in extreme temperatures, but may forget to “hazard-match” their choice of cable to accommodate the additional physical demands.

**Applications such as wind turbines can represent extreme environmental challenges for cable.**

## Summary

When it comes to specifying cables - particularly for use in extreme environments—the devil is in the details. And for temperature, shielding, contact with chemicals and fuels, abrasion, EMI/RFI, and any other possible hostile operating factors, there's more to specifying the “ideal” cable than meets the eye. Alpha Wire tries to offer the complete suite of information engineers need to help them specify the correct cables, including interactive, internet-based cable selection tools at www.alphawire.com. These are especially important as cables become more specialized. Yes, there is a cable for just about every extreme environment—if you know what you should be really looking for.

Sure, it takes time to consider the full spectrum of possibilities, but look at it this way: a little work up-front saves a lot of expensive time and effort after the cable is routed, the system is in place and profitability is on the line.

**GLOBAL HEADQUARTERS**
711 Lidgerwood Avenue
Elizabeth, NJ 07207-0711 USA
Toll Free: 1-800-52 ALPHA
Tel: 1-908-925-8000
Fax: 1-908-925-5411
E-mail: info@alphawire.com

**EUROPE**
Alpha Wire International
Sunbury Int’l Business Centre,
Brooklands Close Windmill Road,
Sunbury-on-Thames, Middlesex
United Kingdom TW16 7DX
Tel: +44 (0) 800 288 8809
Fax: +44 (0) 800 288 8810
E-mail: europe@alphawire.com

**ASIA PACIFIC**
Alpha Wire
Silver Center, Suite 1708, North
Shanxi Road 1388
Shanghai, China
Tel: +86-21-61498201/61498205
Fax:+86-21-61498001
E-mail: apac@alphawire.com



Lit. No: DevilishDetails-WP-1011
Supersedes: DevilishDetails-WP-1008