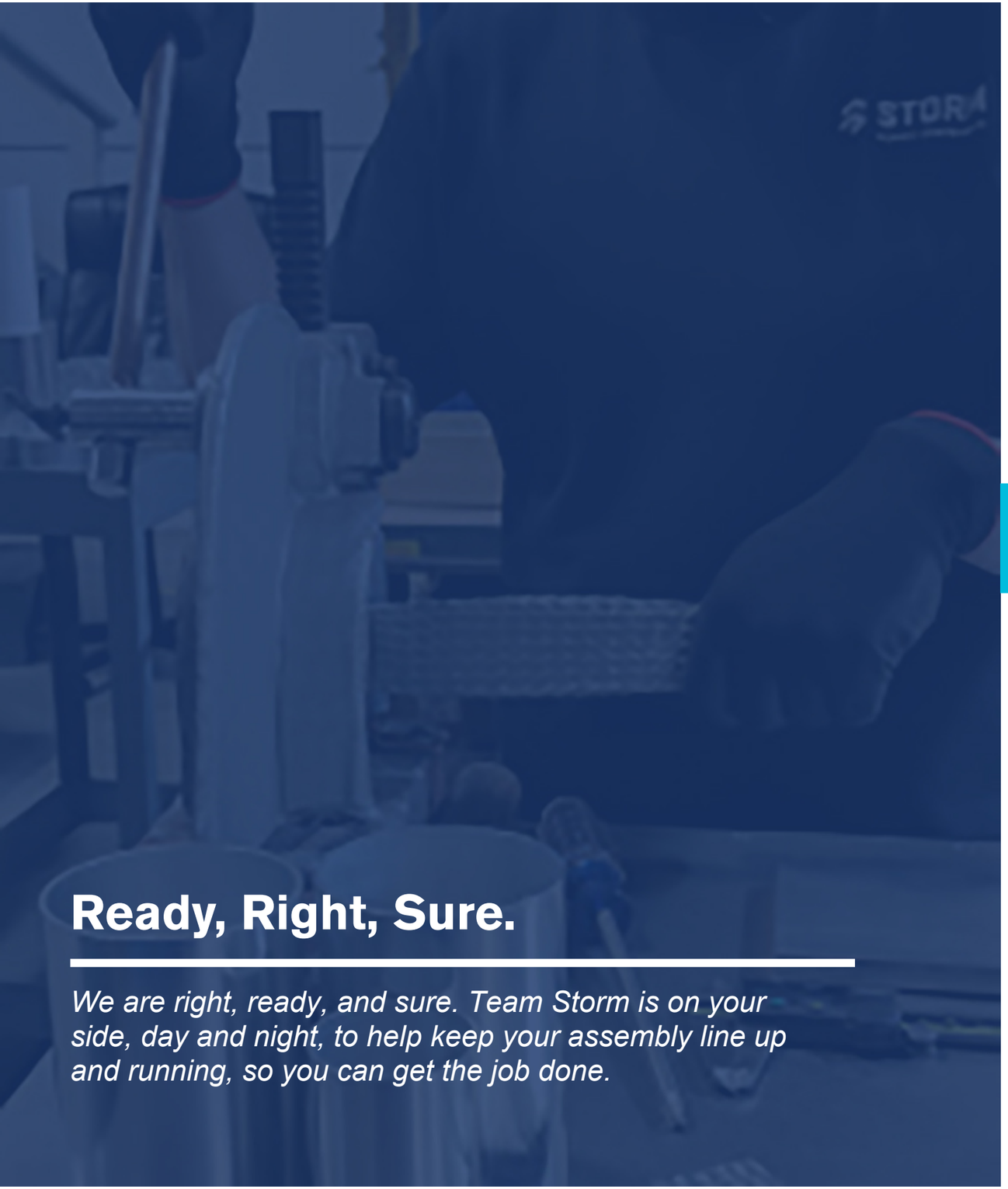
STORM™
POWER COMPONENTS

DESIGN GUIDE

Flexible Electrical Copper Connectors

Everything you need to know...



FlexBraid — Flexible Electrical Copper Connectors

The power supply industry is plagued by the vibrations from generators, transformers, motors, and turbines because solid (non-flexible) connections will transmit vibration. Excessive vibration can convert into premature hazardous termination failures. However, flexible electric copper connectors offer a unique feature – increased maneuverability - that allows power supply networks to become safe and long-lasting. Space-limited connections such as ground straps within switchgear enclosures or custom high-ampacity busbar arrangements to accommodate instrument transformers can also take advantage of the increased maneuverability of flexible electrical connectors.

A Flexible Solution to a Solid Problem

Generators, turbines, and transformers are primary causes of vibration at critical distribution points in electrical power supplies, substations, and power plants. Typically, conductors are terminated onto the transformer bushings, and will be solidly connected to either nearby conduit or uni-strut. If the conductor is solid (ex. Teck cable), it will transmit the vibration to the nearby conduit causing the terminations to eventually shake loose. Even with the addition of dampening pads and mounts, over time these vibrations loosen lugs and electrical connectors, resulting in faulty termination, loss of performance, and ultimately equipment failure.

Loose terminations are therefore a major cause of electrical system failure. This could ultimately cause a domino effect because when a termination loses its necessary conductivity, large amounts of heat is generated, which leads to a second problem, insulation failure. However, there is a solution that can halt vibration at the source – flexible electrical connectors or more commonly called "flexbraid."

Flexible copper connectors dampen and diminish vibration

Flexbraid connectors isolate the vibration-producing equipment from the main electrical bus network. Beyond halting vibration, they can also provide a comparatively easier ability to maneuver within electrical enclosures and do not suffer from limited bending radii. As a result, flexible connectors decrease the potential cost of downtime and maintenance created by loose electrical connections.

Flexbraid Characteristics

Conventional cables consist of single or multiple conductor cores. Although flexible in low-current applications, to handle high current the cables must have ever increasing cross sectional area. Cables in high-ampacity applications are very difficult to pull and terminate, especially within tight electrical enclosures and cabinets. Flexbraid eliminates this issue, as it is composed of numerous thin strands of copper wire braided together. The braided wire has space to move when bending. It is also tin-plated to reduce oxidation and ensure protection in an array of environmental conditions.

How It's Made

Beyond the material characteristics, the manufacturing process by which flexible copper connectors are constructed offers alternatives to straight busbar. Flexible copper connectors are made using heavy-duty presses that compress the ends of multiple layers of copper material into copper ferules. This process forms a solid contact pad which eliminates chaffing of the flexible connector. The pads, which may be tin, silver or lead plated or bare to meet the client's specifications, are also constructed and connected. Finally, holes are then punched or drilled to the client's specification resulting in reliable connector. All standard drilling patterns comply with NEMA standards.

Current Capacity

Reaching the correct ampacity for a given application is achieved through the addition of multiple layers of copper braid. Braid layers are selected based on total amperage requirements or current density then assembled in a parallel or stacked format according to a customer's specification.

There are four common series in the flexbraid design, each with different layering options and current capacity ratings:

Series

- BD - The BD series layered flex braid connector has the lowest current capacity and smallest dimensions compared to the other series. This is ideal for low power applications such as low power transformers. The flexbraid connector offers a unique advantage of high-ampacity and dynamic movement isolation.
- BE - The BE flex braid connector offers a unique of advantage of high-ampacity and dynamic movement isolation. It's slightly larger with higher current rating and thinner wire braids than the BD series, and is ideal for small-medium transformer or power applications.
- BG – this series has the highest current capacity and flexibility of all the layer series, ideal for industrial-sized power applications.
- BF -The BF series is an intermediate between the BD and BE series. The BF flex braid offers lower ampacity and dynamic movement isolation than the BE variation, but with similar dimensions and higher specifications in respect to the BD models.

The right flexbraid connector must be selected with the ampacity that exceeds the design load requirements. This prevents the connector from experiencing immediate or gradual deterioration or exceeding its temperature rating.

Flexible Copper Connectors Design Guide

PART NO.	BRAIDS	L	C	T	D	E	K	N	CIRCULAR MILS*	AMPACITY
SC-BD (12-48)	1	12-48	0.94	0.14	2.5-3.0	1.25-1.75	0.44-0.56	0.62	76800	190
SC-BF (12-48)	1	12-48	1.19	0.28	3.0	1.5-1.75	0.44-0.56	0.62-0.75	168000	360
SC-BE (12-48)	1	12-48	1.5	0.21	3.0	1.5-1.75	0.44-0.56	0.62-0.75	211200	375
SC-BG (12-48)	2	12-48	0.94	0.23	2.5-3.0	1.25-1.75	0.44-0.56	0.62	144000	380
SC-B2D (12-48)	3	12-48	1.19	0.27	2.5-3.0	1.25-1.75	0.44-0.56	0.62-0.75	259200	470
SC-B3D (12-48)	2	12-48	1.62	0.35	3.0	1.25-1.75	0.44-0.56	0.62-0.75	336000	550
SC-B2E (12-48)	2	12-48	1.19	0.35	3.0	1.25-1.75	0.44-0.56	0.62-0.75	422400	600
SC-B2G (12-48)	4	12-48	1.19	0.34	2.5-3.0	1.25-1.75	0.44-0.56	0.62-0.75	345600	600
SC-B3E (12-48)	3	12-48	2.0	0.28	3.0	1.25-1.75	0.44-0.56	0.62-0.75	460800	700
SC-B3F (12-48)	3	12-48	1.44	0.52	3.0	1.25-1.75	0.44-0.56	0.62-0.75	633600	820
SC-B4E (12-48)	4	12-48	1.77	0.39	3.0	1.25-1.75	0.44-0.56	0.62-0.75	499200	850
SC-B3G (12-48)	3	12-48	1.69	0.59	3.0	1.25-1.75	0.44-0.56	0.62-0.75	921600	960
SC-B4F (12-48)	4	12-48	1.50	0.69	3.0	1.25-1.75	0.44-0.56	0.62-0.75	844800	1000
SC-B4G (12-48)	4	12-48	1.69	0.83	3.0	1.25-1.75	0.44-0.56	0.62-0.75	1344000	1200

*Note: Ampacity Ratings (below) are based on Conductors in Free Air / Ambient Temperature of 30 degrees C (86F). Continuous-use temperature rating

Electrical Design & Physical Considerations

Single vs. Multiple Layer

There are several factors to consider when determining the correct flexbraid for certain conditions. Determine the length from end to end; while considering slightly longer lengths than expected. Having a loose flexbraid connector allows maneuverability to connection end, and decreases the chance of loosened termination due to thermal expansion.

What to Consider

Hole Pattern:

Consider the hole pattern, diameter, and distance between holes needed for the intended connection setup. What hole pattern does your application require? What are the number of holes need at end terminations? What hole pattern, and distance between end terminations is necessary? Punching holes is the most economical option, but drilling custom diameters are common.

A standard cable with the same ampacity rating is stiff and hard to route around objects. Flexbraid is easy to maneuver, allowing versatile connections with as much current-carrying capacity as thick rigid power cable.

Ampacity:

Proper ampacity must be selected for its application as specified in the National Electric Code. Check the NEC code, and build your load accordingly.

Physical parameters:

Physical parameters such as conductor gap spacing and conventional conductor bending radii must be determined. In addition, width is usually a critical design factor. It is often the limiting factor due to available connection space. Width is also directly proportional to the ampacity. If a wide connection is undesirable consider parallel flexbraid layers to meet the specific design load. Layers go from a single layer to a quadruple layer. Configurations can be multiple layers, both wide and thick.

Braid type:

Will you need flat, round, multi-layer or single layer? Typically, flat copper braid is common because it works in vertical application or direct connections where horizontal flexibility is not a factor. Flat braid also offers a low profile in tight-space situations. If horizontal flexibility is required, round copper braid is best, because it bends and flexes in all directions.

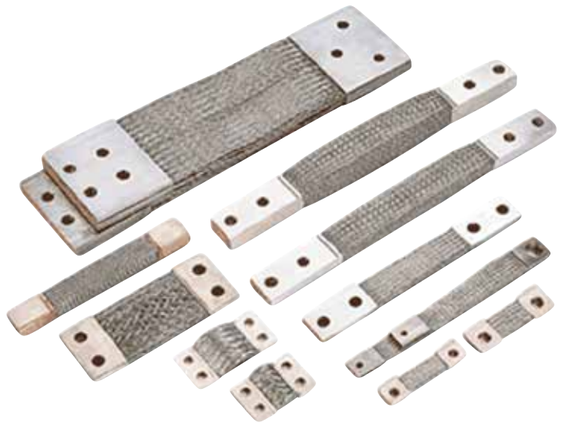
Stranding Pattern:

The number of strands and the size of strands are pre-determined by the manufacturer for each size of braid. Braid comes in bulk from the manufacturer with markings that indicate its specifications. A designation of 24-30 means that the braid is made of 24 strands of 30-gauge wire. The higher the gauge number, the finer the wire. Also, be careful of specifying custom stranding. It is very expensive and generally not desirable especially because there is a wide variety of standard stranding available that can meet most application requirements.

Choosing Between Flat vs. Round Braid

Typically, flat copper braid is used more often because it works well in vertical applications or direct connections where horizontal flexibility is not an issue. Flat braid also has a lower profile and takes up less room in tight quarters. However, when horizontal flexibility is specified, round copper braid is used because it bends and flexes equally in any direction.

Use the following specifications charts when design a flexible copper connector using either Round or Flat Copper Rope and Braids:



Rope, Tin-Plated, Flexible Copper Braid Specifications Table

PRODUCT DESCRIPTION	> APROX AWG	DIAMETER	CIRCULAR MIL	WIRE BUNDLE
Rope Braid .220 (26250)	7	.220"	26250	7x150/36
Rope Braid .232 (31499)	6	.232"	31499	7x7x65/40
Rope Braid .250 (41300)	5	250"	41300	7x59/30
Rope Braid .342 (66150)	3	.342"	66150	7x7x54/36
Rope Braid .431 (105350)	1	.431"	105350	7x7x86/36
Rope Braid .520 (166600)	2/0	.520"	166600	7x7x34/30
Rope Braid .625 (212800)	4/0	.625"	212800	19x7x64/36
Sold in 25', 50', 100' and 250' lengths in various widths and thickness				

Flat, Tin-Plated, Flexible Copper Braid Specifications Table

PRODUCT DESCRIPTION	> APROX AWG	THICKNESS	WIDTH	CIRCULAR MIL	WIRE BUNDLE
Flex Braid .02 x .375 (7200)	12	.020"	.375"	7200	48-6-36
Flex Braid .032 x .5 (9600)	11	.032"	.500"	9600	48-8-36
Flex Braid .063 x .625 (18000)	8	.063"	.625"	18000	48-15-36
Flex Braid .075 x .5 (26400)	6	.075"	.500"	26400	24-11-30
Flex Braid .08 x .7 (40800)	5	.080"	.700"	40800	48-34-36
Flex Braid .065 x 1.0 (48000)	4	.065"	1.00"	48000	48-40-36
Flex Braid .063 x 1.375 (56966)	3	.063"	1.375"	56966	48-120-40
Flex Braid .187 x .94 (72000)	2	.187"	.940"	72000	2 x 24-15-30
Flex Braid .19 x 1.0 (76800)	2	.190"	1.00"	76800	2 x 24-16-30
Flex Braid .06 x 2.0 (76800)	2	.060"	2.00"	76800	48-16-30
Flex Braid .09 x 1.187 (86400)	1	.090"	1.187"	86400	48-18-30
Flex Braid .08 x 1.62 (100800)	1	.080"	1.62"	100800	48-84-36
Flex Braid .125 x 1.5 (105600)	1/0	.125"	1.50"	105600	48-22-30
Flex Braid .093 x 1.75 (124800)	1/0	.093"	1.750"	124800	48-23-30
Flex Braid .125 x 1.25 (153600)	2/0	.125"	1.25"	153600	2 x 24-32-30
Flex Braid .125 x 2.0 (153600)	2/0	.125"	2.00"	153600	48-23-30
Flex Braid .30 x 1.25 (168000)	3/0	.300"	1.25"	168000	2 x 24-35-30
Flex Braid .125 x 1.62 (168000)	3/0	.125"	1.62"	168000	48-35-30
Flex Braid .125 x 2.5 (168000)	3/0	.125"	2.50"	168000	48-35-30
Flex Braid .187 x 1.38 (211200)	3/0	.187"	1.38"	211200	2 x 24-44-30
Flex Braid .15 x 2.75 (225600)	4/0	.150"	2.75"	225600	48-47-30
Flex Braid .19 x 3.0 (225600)	4/0	.190"	3.00"	225600	48-47-30
Flex Braid .25 x 1.75 (249600)	4/0	.250"	1.75"	249600	2 x 48-26-30
Flex Braid .312 x 1.187 (302400)	300 mcm	.312"	1.187"	302400	3 x 24-42-30
Flex Braid .25 x 1.5 (307200)	300 mcm	.250"	1.50"	307200	2 x 48-32-30
Flex Braid .312 x 1.5 (336000)	300 mcm	.312"	1.50"	336000	2 x 48-35-30

About Storm Power Components

Storm Power Components is a fabricator of custom copper components. From back-up power systems, cell towers, and sub stations, to earth-moving equipment, motive power, and alternative energy applications, our industrial-strength parts are trusted by original equipment manufacturers around the world to power, connect, and protect their products.

As an industry veteran for more than 25 years, the company is squarely focused on delivering improved responsiveness, price advantage, and shorter distribution channels. The result is its ability to manufacture superior-quality parts with speed and accuracy, while providing customers a delightfully uncommon experience. Storm Power Components, a privately held company, is an AS9100:D and ISO 9001:2015 certified organization headquartered in Decatur, Tennessee. For more information, please visit www.stormpowercomponents.com.

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