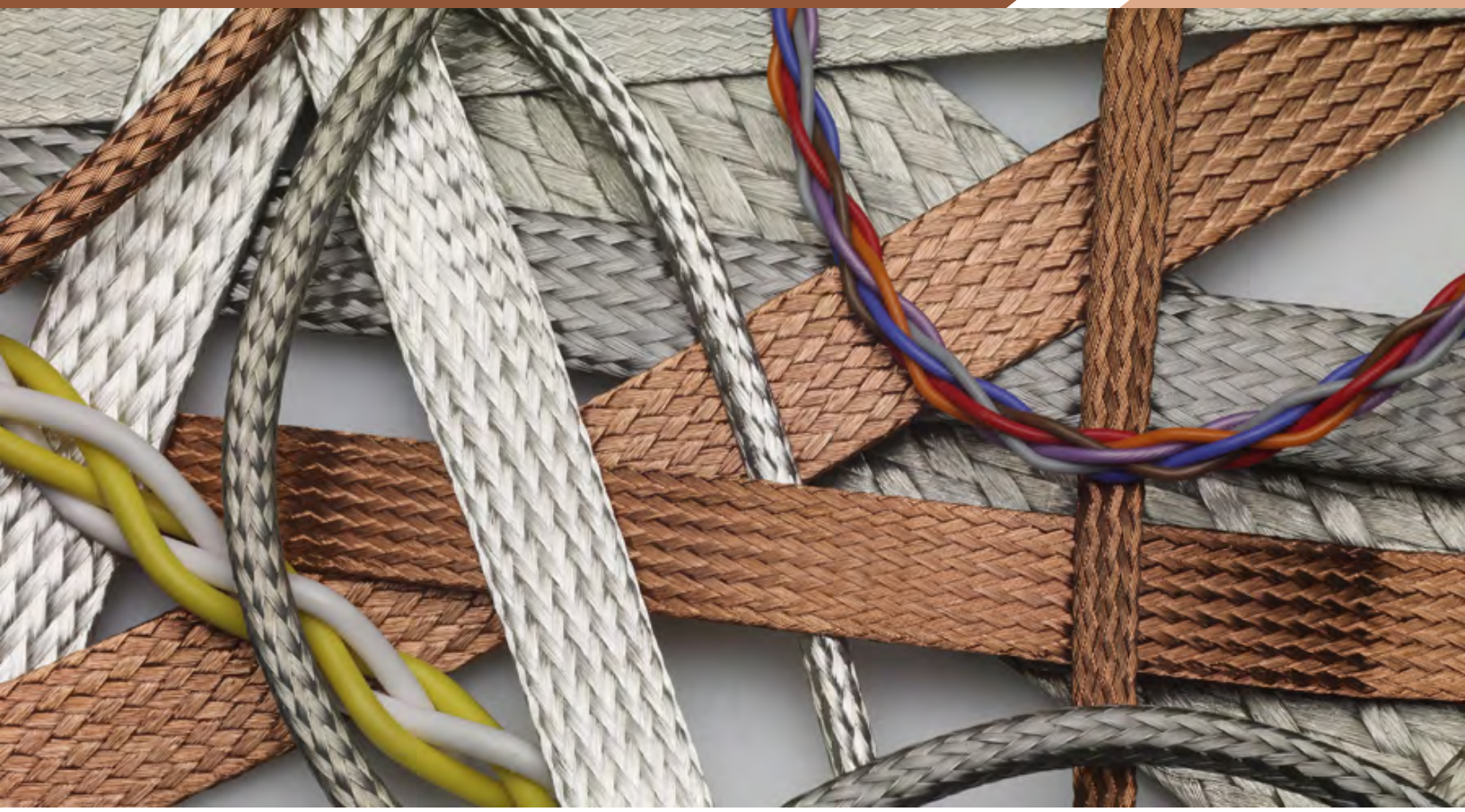
How to manufacture **Wire Braids**

INTERNATIONAL WIRE

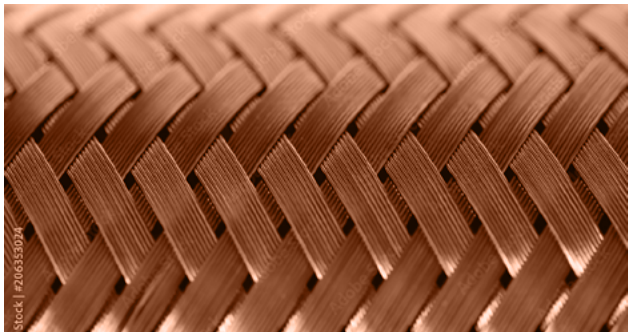


International Wire is an industry-leading wire braid engineering and manufacturing house. We offer a broad range of quality standard products and custom design services to meet the needs of many demanding applications. Our extensive product portfolio includes bare copper braids, tinned copper braids, silver-plated and nickel-plated copper braids, aluminum braids, and stainless-steel braids.

In this eBook, we will discuss how we manufacture wire braids and the constructions available before taking an in-depth look at some of the most common applications for these products.

How to Manufacture Braided Wire

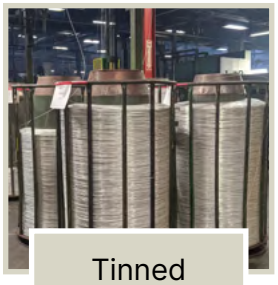
A braided wire is an assembly of wires, comprised of several carriers wound together, and each carrier might consist of several parallel or bunched single-end wires of a given diameter. Many materials can be used to create wire braids, depending on the needs of the end-use application and the environment where the wire will be used.



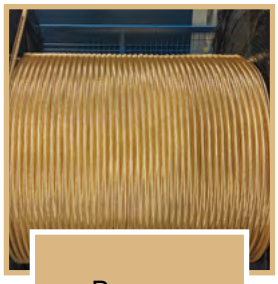
Choosing Base Materials for Wire Braids

At Continental Cordage, we make braided wire using a variety of materials:

Bare copper



Tinned copper

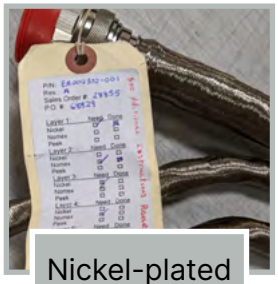


Bronze

Brass

Copper alloys

Silver-plated copper



Nickel-plated copper

Stainless steel

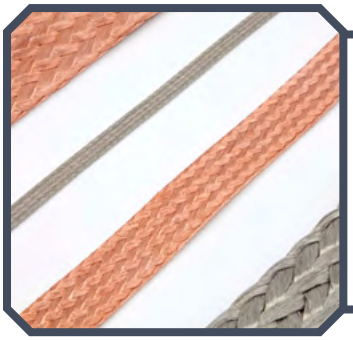
Textiles

Types of Wire Braids

There are many ways to braid wire:

Tubular braid

Used for shielding, for protection against EMI, and for mechanical protection, tubular braids have a cylindrical or round configuration. A tubular braid is typically braided with a specific number of wires to the specified nominal inside diameter.

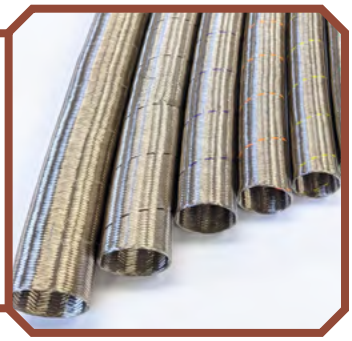


Flat braid

Flat braids begin as round configurations and are then rolled flat to the specified width and thickness. They are commonly used in grounding applications or flexible connections. A flat braid is also known as an earthing braid or ground strap.

Braided sleeves

Sleeves typically have a round shape and are used for mechanical or electromagnetic protection of cables and connectors.



Braiding over customer-supplied cable

Cable over braiding is used for cable mechanical protection and electromagnetic interference (EMI) protection.

Construction of Wire Braids

When decomposing wire braid construction, you have to understand the following factors:

- **Individual wire diameter (AWG)**
- **Number of wires per carrier**
- **Number of carriers**
- **Number of braid layers**

→ **Braid Construction**

For example, consider a wire braid construction 48X11/36 ½" T/C tubular. What does it mean and how does one read this construction? First, this wire braid has 48 carriers, with 11 wires per carrier. Thus, there are 528 wires in total. Each individual wire size is 36 AWG. This wire braid has a tubular configuration, and it is made of tinned copper wires. The nominal inside diameter of this wire braid is 1/2 inch.

As another example, we can look at a 3X24X32/30 1 ¼" T/C flat wire braid. This braid has 3 wire braid layers, with each following layer braided over the previous one. Each braid has 24 carriers, with 32 wires per carrier. There are 2,304 wires total (3x24x32), with an individual wire size of 30 AWG. This 3-layer flat braid is 1 1/4 inches in nominal width and is made of tinned copper wires.

Other Considerations for Wire Braid Design

There are a few other factors to consider when designing a wire braid, including coverage and picks per inch.

Wire braid coverage is a term that refers to the degree/percentage to which the wire braid covers the surface of the core.

The higher the percentage of braid coverage, the more effective the RFI (Radio Frequency Interference) and EMI (Electro-Magnetic Interference) shielding is.

90% coverage.

This product is using shielding to stop RFI and EMI frequencies.

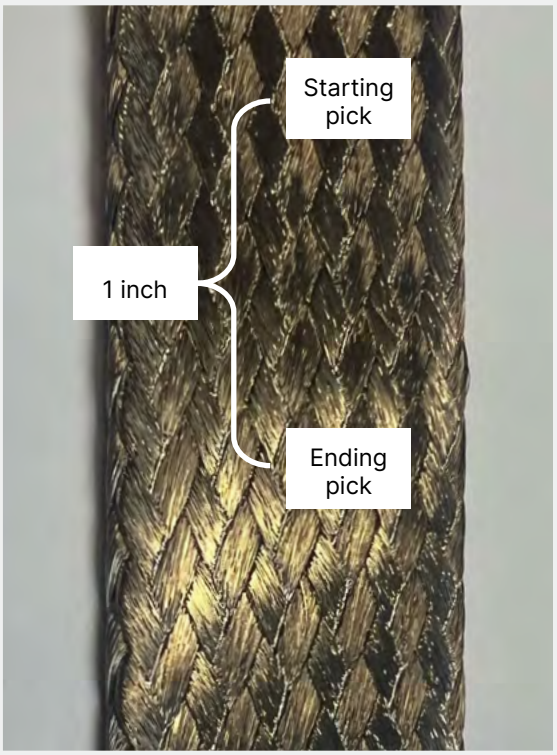
85% coverage.

This product is used in the Oil and Gas Industry.

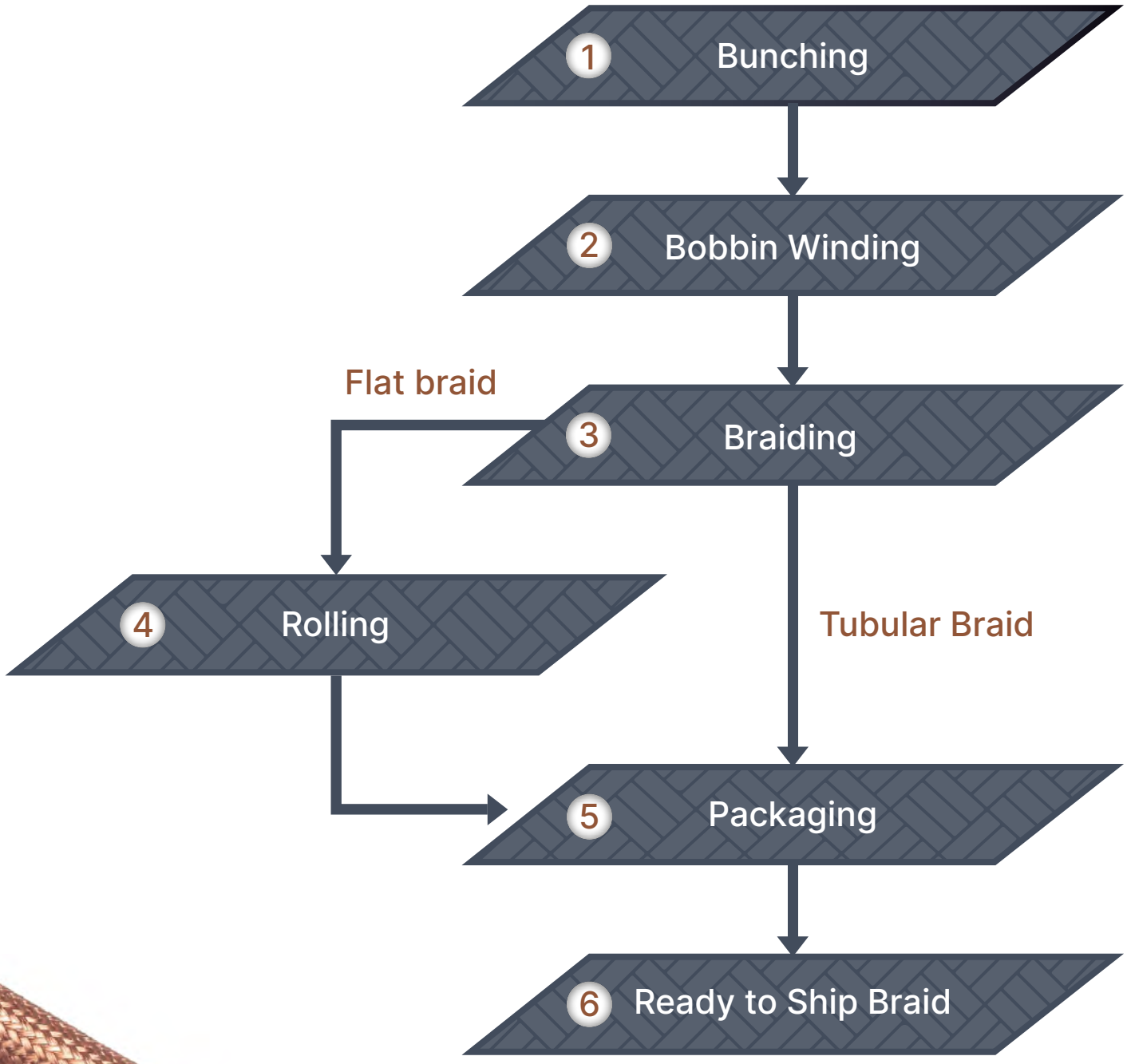
Picks per inch, or PPI, describes the number of times the braid's carriers cross over one another in the same direction for each inch of length. The picks per inch are used to determine the flexibility and coverage for flat, tubular, and overbraid material.

For flat braids, PPI determines the flexibility of the braid. More PPI will create a less flexible product while a decreased PPI will create a more flexible product.

For tubular braids and overbraids, PPI changes the coverage and flexibility. Increased PPI within a tubular braid will increase coverage while decreasing flexibility. Decreased PPI will create less coverage but increase the flexibility of the product.



Wire Braid Manufacturing Process



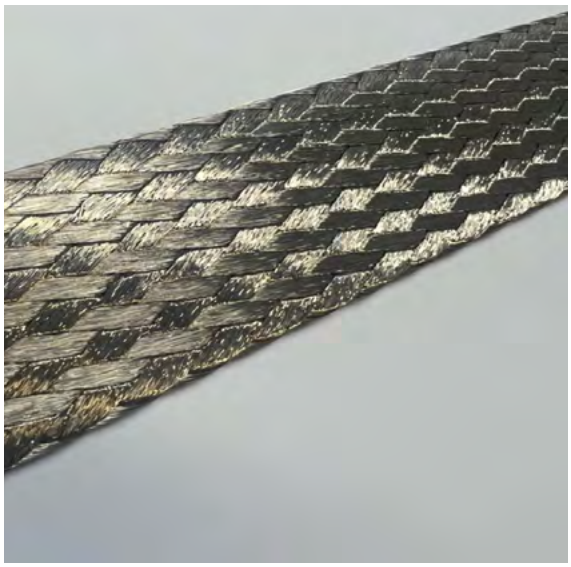
Wire Braid Manufacturing Process

The manufacturing process for wire braids involves the following six basic steps, using a 48X88/36 1 ⅝” NPC flat braid as an example:

Steps of Braid Manufacturing

Example Construction:

48x88/36 1 5/8” NPC Flat Braid



- **Number of carriers** = 48
- **Wires per carrier (number of ends)** = 88
- **Individual wire size** = 36 AWG (0.005”=0.127 mm)
- **Braid Dimension** = 1 5/8” Width
- **Metal Type** = NPC - Nickel Plated Copper

The braid is comprised of 48x88 = 4,224 wires, thickness of each is close to thickness of a human hair!

36 AWG single end wire

Wire Braid Manufacturing Process

The manufacturing process for wire braids involves the following six basic steps, using a 48X88/36 1 ⅝” NPC flat braid as an example:

1 Bunching

A given number of wires are twisted in the same direction in a random pattern. If a single braid carrier contains 23 or more wires, then the wires must first be bunched together. If the braid carrier contains less than 23 individual wires, they can go on the bobbin in parallel. To create the example braid, the machine would bunch together 88 wires, each with a size of 36 AWG, to produce 88/36 AWG bunch construction.

48× 88/36 1 ⅝” NPC Flat

1 bunch

The machine bunches together 88 nickel-plated wires, size of each wire is 36 AWG, to form 88/36 AWG bunch construction.

88/36 Bunched Wire

88/36 Bunch on Spool

2 Bobbin Winding

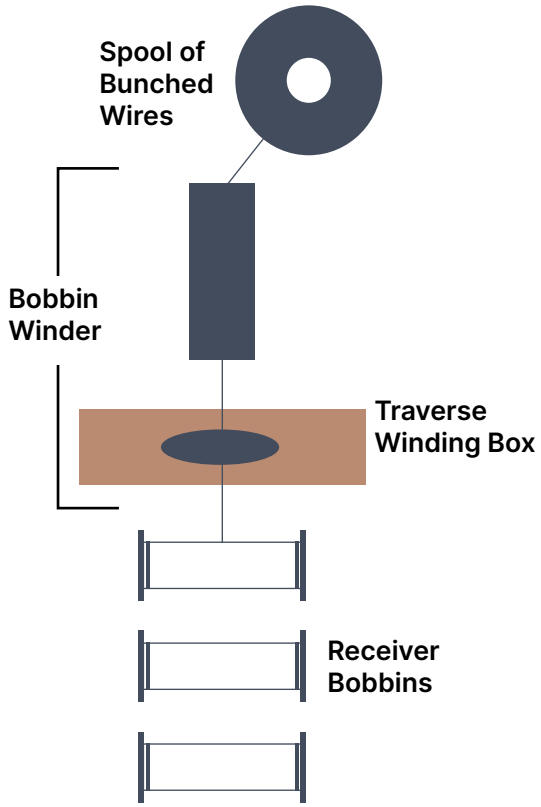
The bunched or single-ended wire is transferred onto a machine's bobbin. Depending on the braiding machine, the type of bobbin can be #2 NEB, Short Wardwell, Long Wardwell, or heavy braid bobbin. The size of the braiding machine and the braid recipe braider determine the number of bobbins, with options including 16-carrier, 24-carrier, 48-carrier, 64-carrier, and 72-carrier.

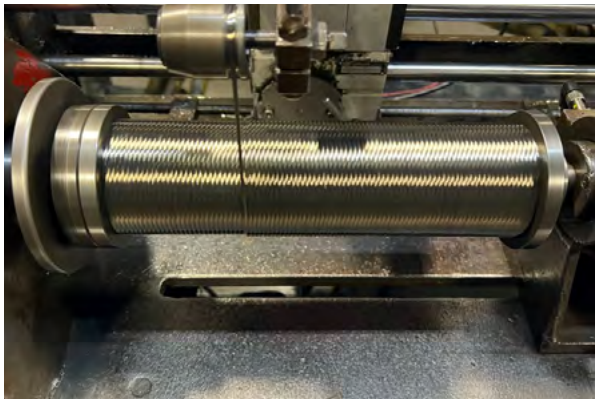
48× 88/36 1 ⅝" NPC Flat Braid

2 on bobbin

Bobbins utilized internally for braid production

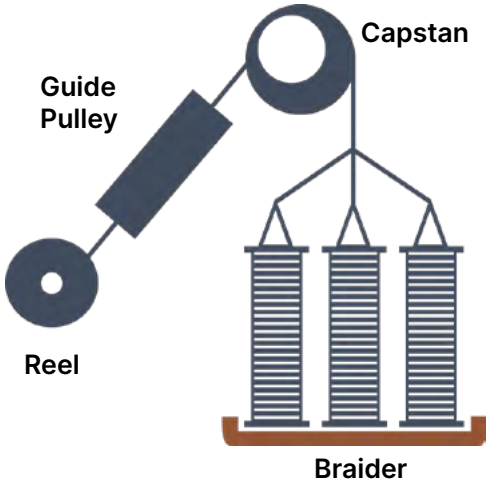
Bobbins, packed in boxes, prepared for shipping to customer





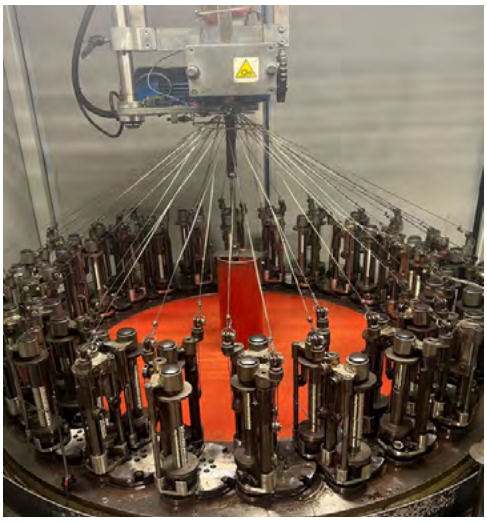
3 Braiding

Braiding is a complex process involving a braider, capstan, guide pulley, and reel. The bobbins are positioned onto the braiding machine's carriers, and the weave and wire tension are set.



48× 88/36 1 ⅝" NPC Flat Braid

3 braid



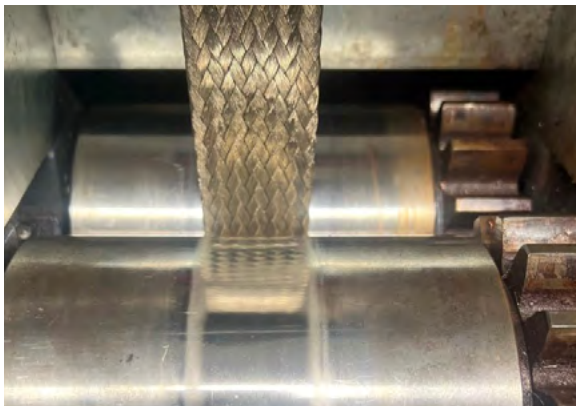
4 Rolling

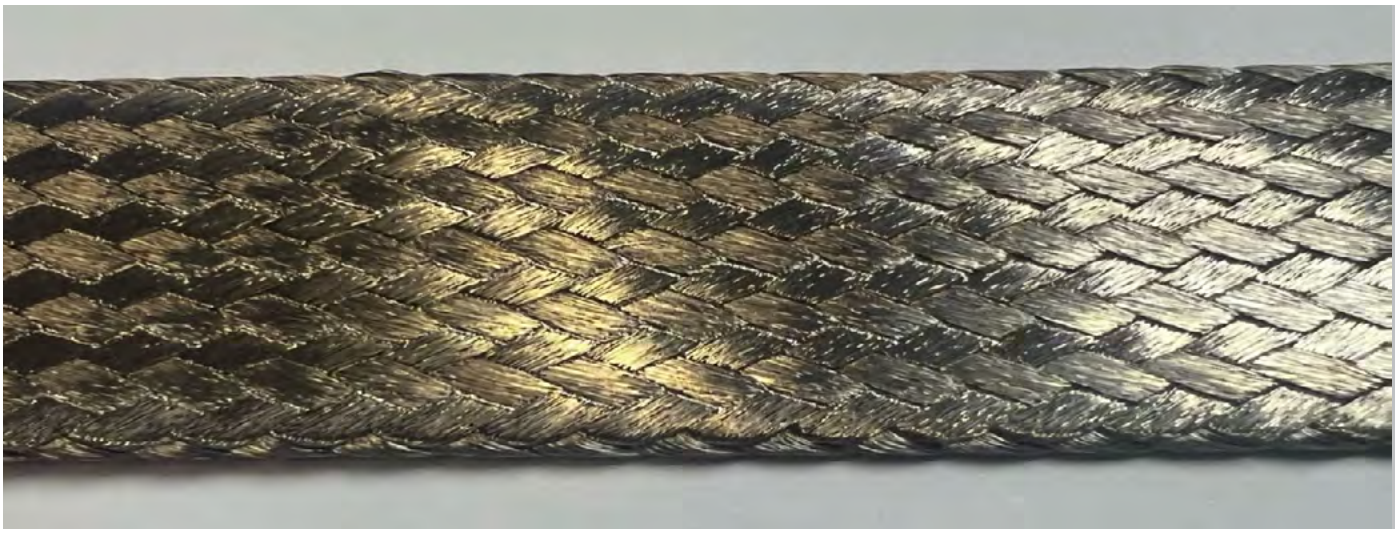
At International Wire, our engineers retrofit and machine custom-designed rollers in-house. To create flat braids, such as the example 48X88/36 1 ⅝" NPC flat braid, these rollers flatten the tubular braids into the specified width and thickness. Rolling usually takes place during respooling or during the final machine process. Those rolled during respooling are typically mass-produced or catalog items.

48× 88/36 1 ⅝" NPC Flat Braid

4 rolling

After completing the steps of manufacturing the braid, we have constructed our final product that meets the specification.





5 Packaging

International Wire packages the finished product by winding it onto various non-returnable wooden spools: 12” NR wood, 16” NR wood, or 20” NR wood. We can also transfer the material onto customer-supplied spools during the braiding process, and then safely package them inside cartons for protection.

6 Shipment

The product is shipped via ground carrier. Large shipments or spools are transported on high-grade skids, and overseas shipments are sent on heat-treated skids. International Wire provides a broad range of braid constructions for every application.

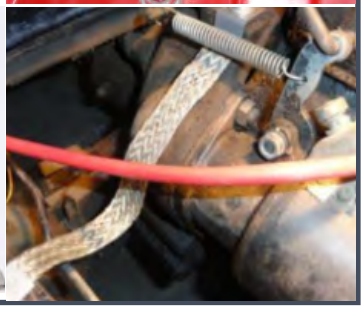
Braided Wire Applications

Braided wires are highly versatile products that are required in many demanding, industry-diverse applications. When selecting a type of braided wire, the first step is to look at the end-use environment, as this will determine which base material should be used. The following sections will discuss some of the most common applications for braided wires.

Grounding/Earthing/Lightning Protection

Applied across many industries, flat wire braids are utilized for grounding. These braids protect individuals and equipment by providing a safe path to grounding a live current. Examples of these types of braids include connections for lightning protection, power equipment grounding, and electrical bonding.

International Wire in US offers braided wire by the foot on spools, while European Business Unit offers finished products with ends:



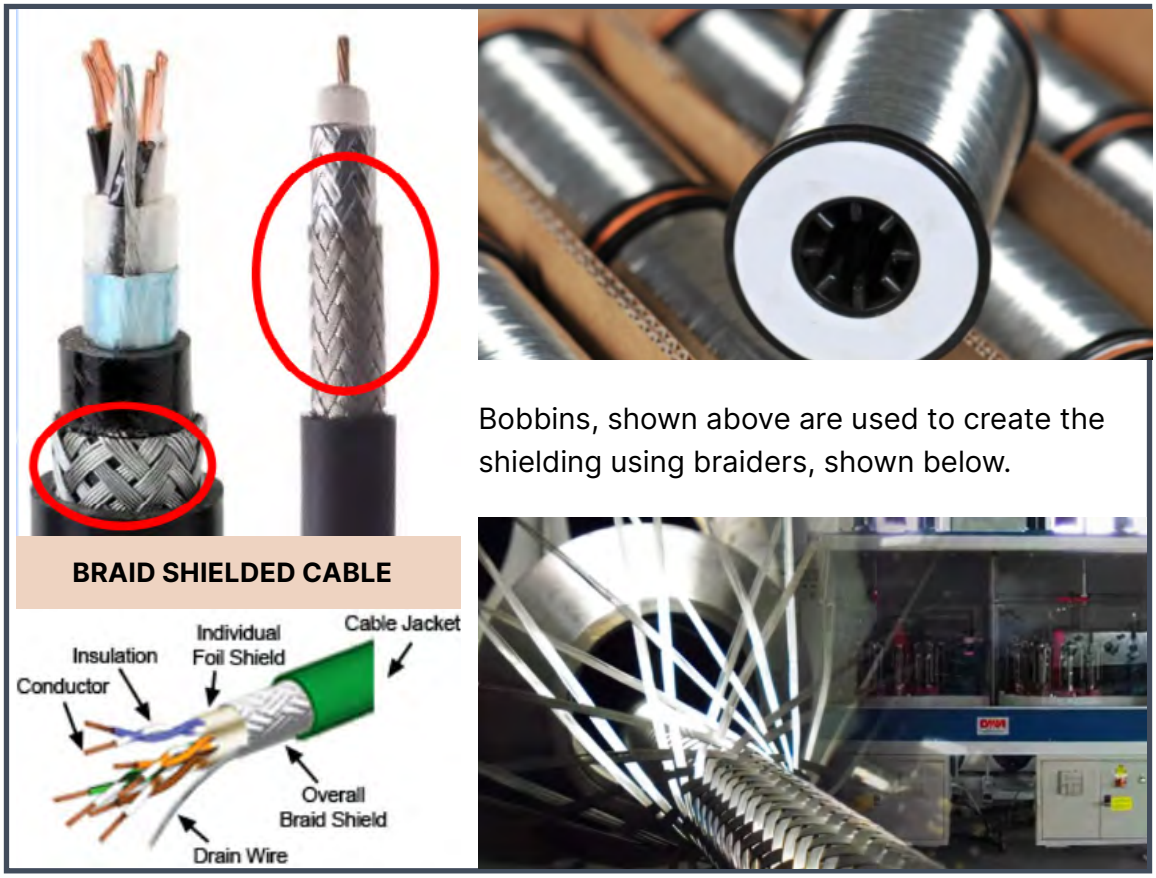
Products:
Flat Wire Braid

End Use:
Used in a multitude of industries for grounding

Application:
Wire braids are used for Earth/ground connections to protect individuals and equipment by serving as the safe path to grounding a live current. Power equipment grounding, connections for lightning protection, electrical bonding.

Shielding: EMI, RFI, or Protective

Cable over braids provide EMI, RFI, or protective shielding around one or more cables to minimize the effects of electromagnetic or radiofrequency interference. Braided shields are durable and offer effective performance in data centers, computers, electrical equipment, and other commercial and industrial applications.



Bobbins, shown above are used to create the shielding using braiders, shown below.

Products:

Cable overbraid

End Use:

Data centers, industrial settings, offices, and other settings where computer technology, electrical equipment, or electronic equipment is in heavy use in order to manage the effects of EMI and RFI.

Application:

Shielding over cables for multiple applications by over-braiding the conductor or group of conductors. Braided shields are durable and offer better performance.

Military/Aerospace Shielding for Wiring Harnesses

The aerospace and military industries require robust shielding solutions for their wiring harnesses, such as our nickel-plated braided sock with colored polyester tracers to identify size. These braided shielding materials come in 10 different sock diameters from 0.40” ID to 1.525” ID. These wire braids facilitate easy field repairs of faulty or damaged harness connectors.

Products:

Nickel-plated braided sock with colored Polyester tracer.

End User(s):

Bell Boeing V-22 Osprey, Bell Helicopter V-280 Valor

Application:

Shielding for wiring harness - 10 different sock diameters that range from .40” ID up to 1.525” ID with colored tracers to identify size. Primarily used to ease in-field repairs to damaged/faulty harness connectors.

Braided Wire Products from International Wire Group

Wire braids are versatile products used throughout many industries. At International Wire Group, we offer an expansive range of quality products developed to meet application-diverse needs. As the United States' largest non-vertically integrated copper products manufacturer, we're experienced in serving a multitude of market segments.

Whether you need a specialty engineered electrical product, copper-based alloy, aluminum conductor, or simply a high-quality bare wire, we can deliver the solution you need. You can learn more about our products by requesting information or contacting our team with any questions.

About International Wire

International Wire, headquartered in Camden, New York is the largest non-vertically integrated copper and copper-alloy wire products manufacturer in the United States. Our expanded operations in Europe further distinguish our unique footprint. Our strength lies in the capacity and breadth of products we offer, which service a wide range of applications represented in a variety of diverse major market segments.

Look no further than International Wire for the highest quality bare, tin-plated, silver-plated and nickel-plated copper wires, as well as specialty items such as copper-based alloys, aluminum conductors or engineered electrical solutions.

INTERNATIONAL WIRE

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