CERTIFIED ISO 13485:2016

MWS Wire Industries

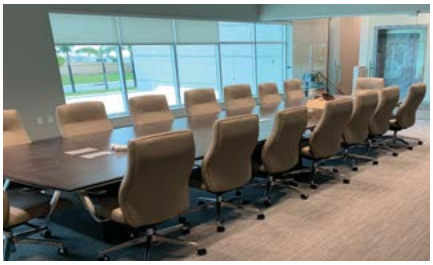
MediMicro®

Medical Grade Wire

Ultra Fine Wire up to 60 AWG
Rapid Development and Sampling
Customizable Wire Constructions
Fully Integrated Quality Management System
Value Added Services

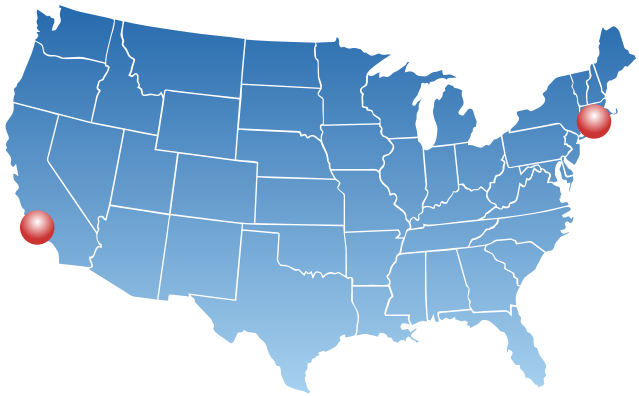
A History of Innovation and Quality Producing Ultra Fine Medical Wire

MWS Wire Industries was founded in 1968 around the idea of winning the trust and loyalty of customers by providing exceptional service and always honoring our commitment to quality. This often meant exploring new and innovative ways of solving product challenges presented by customers in various industries. The result is one of the most customized and specialized fine wire manufacturing facilities in the world. In the last 50 years, MWS has grown into a globally recognized provider of specialized wire for the medical device industry, while never losing sight of our commitment to quality, innovation and superior customer service. In 2014 MWS joined the Elektrisola Group – an international producer of fine and ultra-fine wire. This gives MWS access to some of the leading raw materials and process technology available in the wire market today.



- Established in 1968 as a specialty fine wire manufacturer and distributor
- New facility is located about 50 miles north of Los Angeles (Ventura County)
- Over 60,000 ft of manufacturing and warehouse area
- Management with over 250 years of combined specialty wire experience
- Serving over 7,000 customers on 6 continents across multiple industries
- Over 200 Billion feet of wire sold

MWS Wire Industries
Oxnard, California



ELEKTRISOLA
Enamelled Copper Wire

The Elektrisola Group
Boscawen, New Hampshire
+ 8 additional plants worldwide

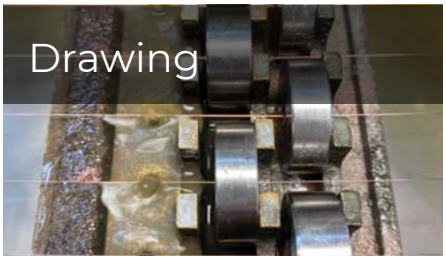
Medical Wire Manufacturing

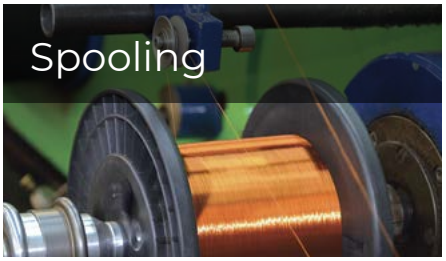
At the heart of MWS Wire Industries is our new fully integrated 60,000 sq. ft. manufacturing plant, warehouse, and one of the most comprehensive testing laboratories in the wire industry. Designed for efficiency and flexibility, MWS's state-of-the-art facility combines a mix of modern equipment with unique custom-built machines to address all different volume options, from low-speed precision R&D work to high volume equipment running continuously to feed large scale demand from Original Equipment Manufacturers (OEMs).

Customers have access to the most innovative wire manufacturing technology available, which allows MWS to offer the extensive matrix of design variables required in the medical device market.

Medical fine wire products can be manufactured down to sizes of 60 AWG (0.0003" / 0.008 mm), which specifically addresses the growing need for miniaturization.

A leading example is our exclusive XHTW and EHTW high-performance alloys, which retain the high conductivity of copper, while increasing tensile strength through a blend of other metals. This can be especially valuable in finer wire that is pulled or pushed. These alloy options for the conductor expand into plated wire variants as well. The same variety is available for insulation coating to accommodate the need for thermal endurance, dielectric strength, solderability, resistance, color coding, and more.

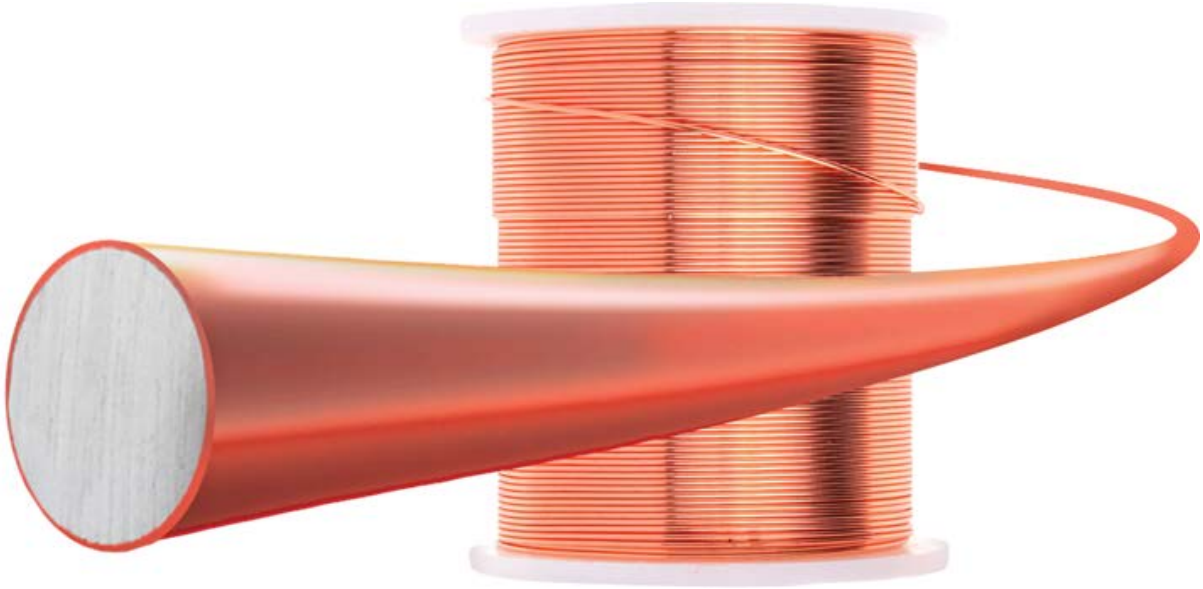




Quality At Our Core

Reputable and reliable quality is one of the most crucial factors for medical devices and their components. MWS understands the no-compromise approach needed in the medical market and has built one of the strongest departments centered around quality testing and control. Our commitment to quality throughout the entire organization is documented in our ISO 13485:2016 and ISO 9001:2015 certifications.

Conductor Material Options



The variety in applications and targeted functionality of medical wire places significant emphasis on the choice of alloy (conductor material) used. Characteristics to consider are electrical conductivity and resistivity, strength, fatigue life, ductility, thermoelectric properties, biocompatibility, high tensile strength, expansion coefficient, magnetism, melting point and resistance to oxidation or corrosive environments. This elevates the importance of material science and availability of alloy choices provided by MWS to our medical customers.

Copper Alloys

OFHC Copper C101 (99.99%)
OFHC Copper C102 (99.95%)
ETP Copper C110 (99.90%)

High Performance Copper Alloys

IHTW – 340 N/mm2
SHTW – 370 N/mm2
XHTW – 385 N/mm2
ECONFLEX70 – 485 N/mm2

Stainless Steel

302
304
304 V / LV
316 / L / LVM

Nickel Alloys

Ni200
Ni205
Ni270
Monel 400
MP35N (High Performance)

Clad Metals

Cu Clad Steel (CCS 30% or 40%)
Cu Clad Stainless Steel (CCSS)
Cu Clad Aluminum (CCA 10% to 50%)
HTCCA 10%, 15%, 20%, 25%, 30%, 50%

Thermocouple

Alumel KN Thermocouple Grade
Chromel KP Thermocouple Grade
Constantan TN Thermocouple Grade

Precious Metals

Gold
Silver
Platinum
Tungsten
Titanium

Plating Options

(applied to any metal)

Gold
Silver
Tin
Copper
Nickel

Others

Drawn Filled Tubing
Nitinol

Medical Wire Insulation Guide

Thermal Class	Insulation Type	MWS Product Code	NEMA Standard (MW 1000)	Insulation Characteristics	Bio Compatible / Exposure time *
155°C	Polyurethane 155	P155	MW 79	Polyurethane-155 is a 155°C thermal class solder strippable insulation produced primarily 30 AWG and finer with quick soldering characteristics at 390°C.	Implant Limited
	Polyurethane Nylon 155	PN155	MW 80	Polyurethane Nylon-155 is similar to the 155°C Polyurethane with the additional Nylon overcoat to improve the abrasion resistance and heat shock characteristics for coil and motor windings. Produced 10 AWG to 55 AWG, soldering temperatures are 430°C for 10 – 23 AWG, and 390°C for 24 – 55 AWG.	Implant Limited
180°C	Polyurethane 180	P180	MW 82	Polyurethane-180 combines the thermal properties of a class 180°C insulation, while offering low temperature solderability at 390°C (24 AWG and finer).	Implant Limited
	Polyurethane Nylon 180	PN180	MW 83	Polyurethane Nylon-180 offers excellent abrasion resistance for ferrite core coils and transformers, while exhibiting high temperature thermal stress and low temperature solderability at 430°C (14 – 23 AWG) and 390°C (24 AWG and finer).	Implant Limited
	Solderable Polyester	SPT	MW 77	Solderable Polyester wire is an ester-imide insulated wire which solders at 470°C. Since thermoplastic flow values equal or exceed 280°C, the insulation has shown excellent promise in transfer molding applications.	Implant Permanent
200°C	Polyester 200	PT200	MW 74	Polyester-200 is a modified theic-polyesterimide one-part system. It has high temperature thermal properties and good chemical resistance. Normally produced in sizes 34 -56 AWG.	Implant Permanent
	Polyester A / I Topcoat	APT	MW 35 (RD) MW 36 (SQ & RECT)	Polyester-amide-imide wire is a two-part insulation consisting of a modified polyester basecoat with a superimposed amide-imide outer coating. This wire exhibits exceptional windability, heat shock resistance, and ability to withstand overloads. Chemical resistance to most solvents and insulating varnishes is extremely good. It is not softened by refrigerants and extractions are essentially zero.	Implant Permanent
220°C	Polyamide-Imide	PAI	NEMA MW81-C	Polyamide-imides display a combination of properties from both polyamides and polyimides, such as high strength, melt processibility, exceptional high heat capability, and broad chemical resistance. PAI enamel is very thermally stable as well as abrasion and chemical resistant. PAI is often used over polyester wire enamels to achieve higher thermal ratings.	Implant Limited
240°C	Polyimide – ML	ML	MW 16 (RD) MW 20 (SQ & RECT)	ML is a film insulation made of polyimide resins and is the most popular insulation used in medical application, also for its biocompatibility characteristics. It is a Class 240°C thermal rated insulation with exceptional resistance to chemical solvents and burnout. The outstanding thermoplastic flow of over 400°C and its ability to withstand excessive overloads extends the use of wire in extreme conditions. ML is unaffected by prolonged exposure to varnish solvents and its compatible with virtually all systems.	Implant Limited

MWS offers custom insulation options, including High Temp and extrusions including PTFE, ETFE, FEP, PFA.

*Unverified, subject to verification by customer

1. **Limited** - Less than 24 hour exposure
2. **Prolonged** - 24 hours to 30 day exposure
3. **Permanent** - 30 days and longer

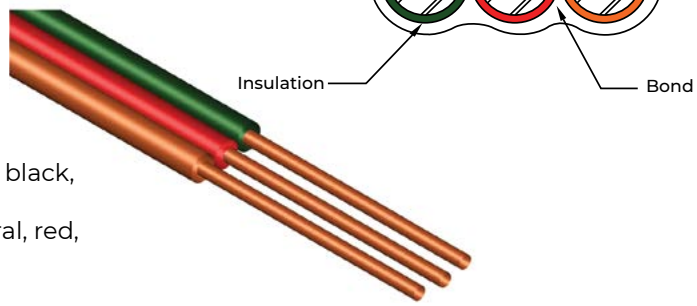
When determining biocompatibility, devices are categorized as follows:

1. **Surface Devices** - Items such as electrodes for monitoring, contact lenses, catheters, endotracheal tubes, sigmoidoscopes and similar devices.
2. **Externally Communicating Devices** - such as laprascopes, blood administration devices, pacemakers, oxygenators and the like.
3. **Implant Devices** - such as orthopedic pins or plates, heart valves, grafts, stents and similar devices.

Unique Medical Wire Constructions

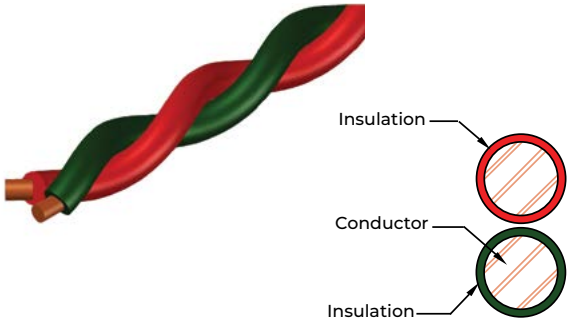
Multifilar® Single Strand and Bonded Wire

- Single strand wire (Single Filar)
- Parallel bonded and aligned wire up to 20 strands
- Various bond materials and strengths
- Color coordinated for better visibility during assembly and to avoid termination errors
- Wide range of colors
    - Polyurethane – Natural (clear), red, green, blue, black, violet, orange, yellow, white
    - All other insulations including polyimide - Natural, red, green, black



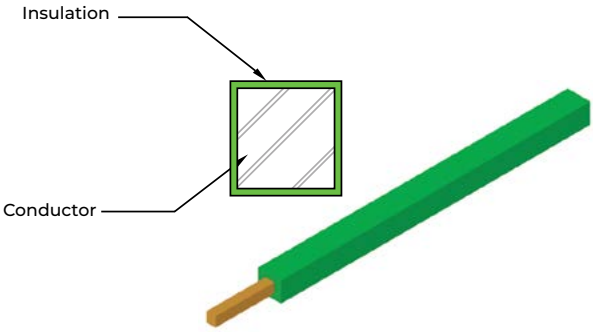
Twistite® Medical Wire

- Up to 33 twists per inch on fine wire
- Twisting tolerance as tight as +/-1%
- Tightly controlled capacitance, inductance and impedance characteristics
- Up to 10 colors in some sizes for conductor identification
- Huge selection of insulations including NEMA MW1000 105 – 240°C; (single through quadruple film builds)
- Wide range of sizes: 16 through 52 AWG
- Wide variety of conductor materials: copper; silver, plated conductors; and specialty alloys



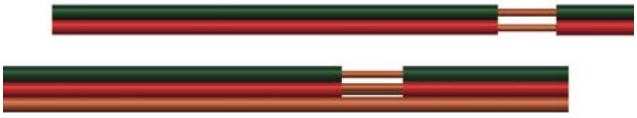
Shaped Medical Wire

MWS is capable of shaping different wire types into miniature rectangular and square form factors to accommodate the need for optimal use of space in a medical device. Shaped wire is available in a wide range of solderable and high-temperature insulations and a variety of colors, with or without bondable overcoats. This capability is industry leading.



Laser Ablation

MWS offers laser ablation or stripping, whereby enamel coatings are removed from precise locations with a non-mechanical means, thus creating laser ablated wire. Enamels may be stripped into small “windows” at precise lengths in a reel-to-reel process that allows for continuous length of wire delivered on spools for further processing. The process involves use of laser energy to ablate precise layers of enamel without impacting the metallic conductor.



We Specialize in Medical Grade Thermocouple Wire

Medical grade thermocouple (TC) wires are used in temperature sensing devices and consist of two or more legs of dissimilar metals joined together at the sensing end. Thermal differences in the metals produce a thermoelectric voltage that varies with temperature and is output as an accurate measurement. Thermocouple wire is typically used in catheter applications and provides precise measurement of delivered energy and tissue temperature during radiofrequency ablation procedures. Common thermocouple wires include Type T (oxygen free copper and constantan) and Type K (nickel chromium and nickel aluminum).

Available in sizes 36 to 48 AWG, the wire can be produced as parallel bonded or twisted wire constructions with two or more legs. It is available in a variety of film insulations including polyimide in contrasting colors red, green, black, and natural. MWS can further offer laser ablation, cutting, straightening and welding services to provide a more finished TC product. The wire is supplied to customer specified lengths or packaging requirements.

- Available in sizes 36 to 48 AWG
- Parallel bonded or twisted wire constructions
- Two or more legs
- Variety of film insulations including polyimide in colors red, green, black, and natural
- Delivered in specific lengths and packaging

MWS offers a comprehensive range of bare and insulated fine wire options that are utilized in various medical applications as electrical signal wire, structural or guide wire and thermocouple wire.

Sensing Solutions

Vascular Therapy

Electrophysiology

Cardiac Ablation

Mapping

Stimulation Therapy

Pain Management

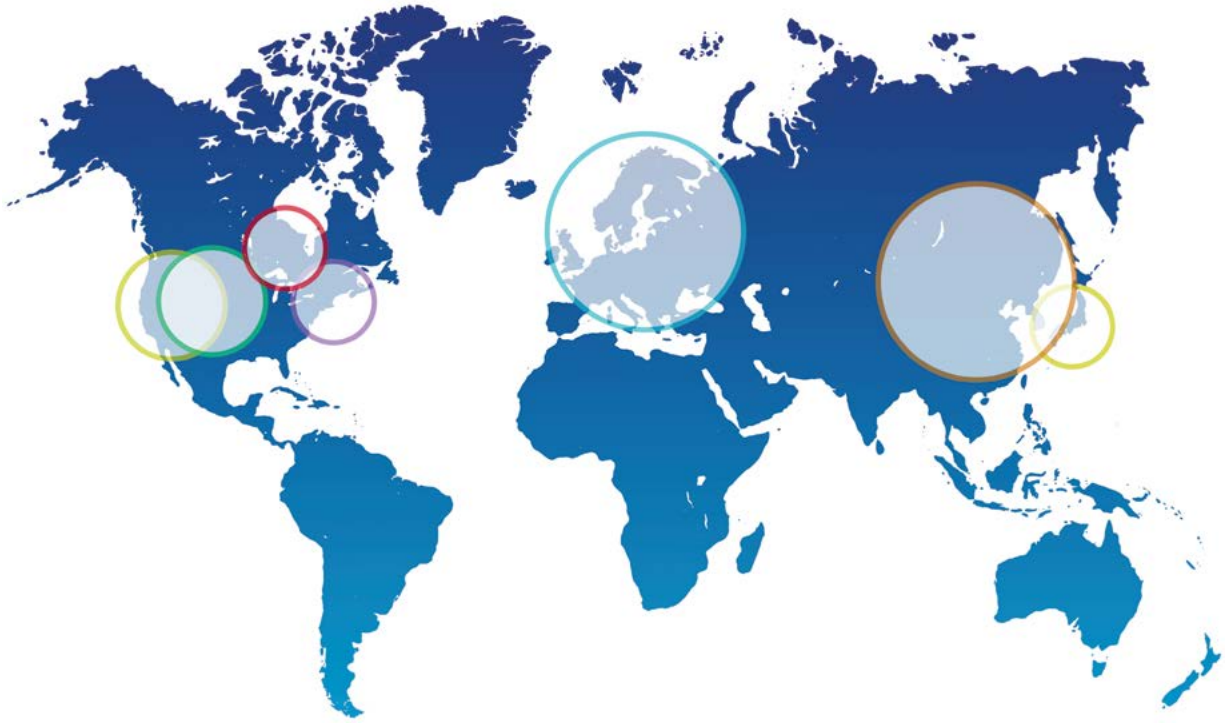
Hearing Aids

Miniature Electronics

Probes and Implants

Global Reach. Local Service.

MWS has highly qualified representatives located throughout the world.



Sales Representatives:

Haldeman & Frazier
CA, CO, AZ, UT, OR, WA

PrincipiaMed
CA, CO, AZ, UT, OR, WA, NV, ID, NM, WY, MT, TX, FL, GA, MS, AL

Betz-Tek
Minnesota, Illinois, Wisconsin

Symphony Sales
MA, NH, VT, ME, RI, CT, NC, NY, NJ, MD, DE, VT, WD, SC, DC

Albatroz Consulting
Europe

Joint Med
China, Taiwan, Hong Kong

JM Associates
Japan

MWS Wire Industries

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NEMA National Electrical Manufacturers Association

EPA GREEN POWER PARTNER

REGISTERED ISO 9001:2015 QUALITY MANAGEMENT SYSTEM