



SUNLIGHTWELD



Copper Bonded Steel



Sunlight Chengdu Xihanggang Electric Manufacturing Co., Ltd

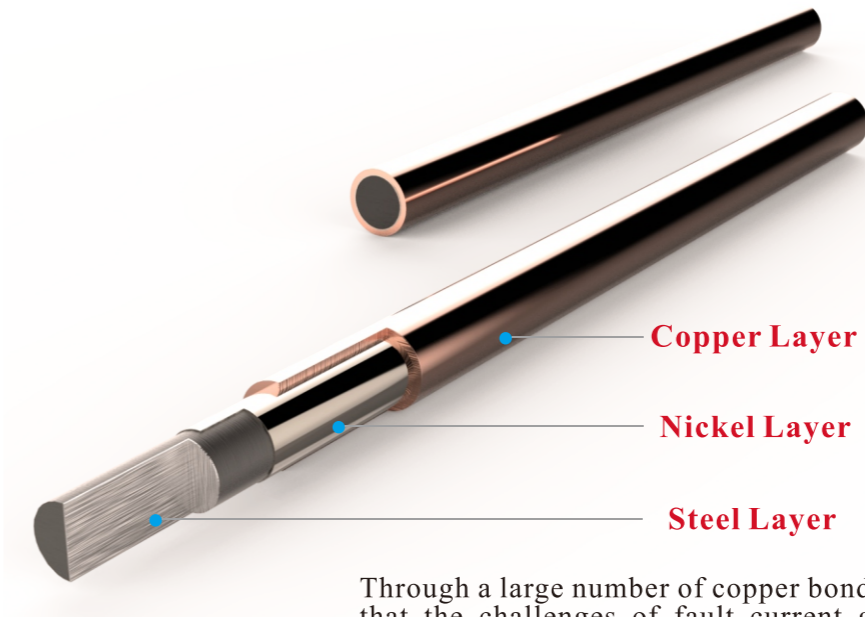
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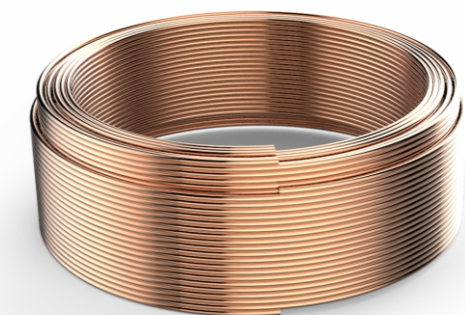
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1. Background



Copper bonded steel products have been used in electrical grounding technology for decades. In recent years, copper bonded steel wires have gained a lot of international scholars in terms of electrical performance, mechanical properties, corrosion resistance, and life cycle. Technical research results of copper bonded steel have a certain development and have been unanimously recognized in the world. Copper-bonded steel ground rods have been widely used and, gradually formed the IEC, IEEE, UL and other standard systems.

Through a large number of copper bonded steel applications in projects, we found that the challenges of fault current grounding projects such as power plants, substations, petrochemicals, etc., is that the copper bonded ground rods cannot meet the large grounding area and the long distance grounding requirement. The length of general copper bonded rod is less than 6 meters, when laying a large area horizontally, it needs to be connected every 6 meters. The huge number of welding joints will cost a lot of man-hour, which will increase the project time cost and material cost.



Copper bonded rod(100m)

According to the weakness, we have developed a copper bonded round wire and copper bonded tap with a length of 100 meters in coil.

1.1. Applicable Standards

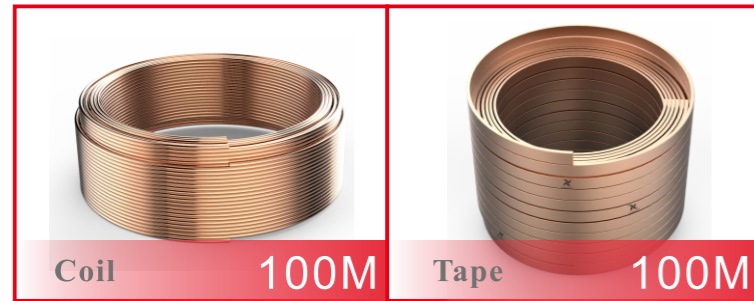
- UL 467 Grounding and Bonding Equipment.
- IEEE Std 837 Qualifying Permanent Connections Used in Substation Grounding.
- IEC 62561-2 Lightning protection system components(LPSC).
Part 2:Requirements for conductors and earth electrodes.

2.Copper bonded steel product

2.1. Copper- bonded steel grounding coil

2.1. 1. Introduction

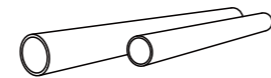
The physical properties of the copper-bonded steel in coil are bimetal composite materials composed of an inner steel core and an outer copper layer, which not only have high mechanical properties of the steel, but also have good electrical conductivity and corrosion resistance of the copper material. In terms of product form, it can realize a single package with a length of 100 meters, including all the physical properties of the copper bonded ground rod, and the length advantage of the specific copper bonded steel stranded wire. The copper bonded conductor laid over a long distance, in the form of cross-section, we recommend two types of structures, coil and tape, to meet the needs of different project.



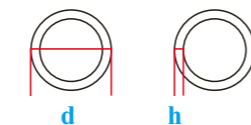
2.1.2. Product Size

1)Copper Bonded Coil

Model	Diameter (mm)/d	Diameter, Actual(″)	Copper Thickness (mm)/h	Length(m)	Reference Weight (kg)/100m
SRB08H025TBR	8	0.315″	0.254	100	40
SRB10H025TBR	10	0.393″	0.254	100	63
SRB12H025TBR	12	0.472″	0.254	100	90
SRB14H025TBR	14	0.551″	0.254	100	122
SRB16H025TBR	16	0.623″	0.254	100	160

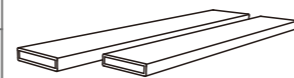


Graphic model

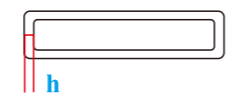
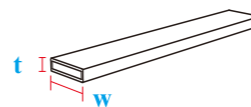


2) Copper Bonded Tape

Model	Width* Thickness (mm)(w*t)	Copper Thickness (mm)/h	Length(m)	Reference Weight (kg)/100m
SRB2503H025CFB	25×3	0.254	100	60
SRB2504H025CFB	25×4	0.254	100	80
SRB3003H025CFB	30×3	0.254	100	72
SRB4004H025CFB	40×4	0.254	100	128
SRB5005H025CFB	50×5	0.254	100	200
SRB5006H025CFB	50×6	0.254	100	201



Graphic model

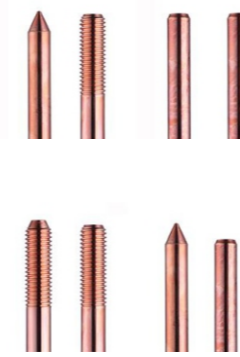


2.2. Copper Bonded Rod(vertical)

2.2.1. Introduction

The copper bonded rod belongs to the single-piece form of the copper-steel composite. The copper layer is made of copper with a purity of 99.9%, and the steel core is a high-quality carbon structural steel, which forms a composite metal material with high bonding force. It is used for horizontal and vertical placement. Which used to reduce the grounding resistance and improve the safety of the grounding system.

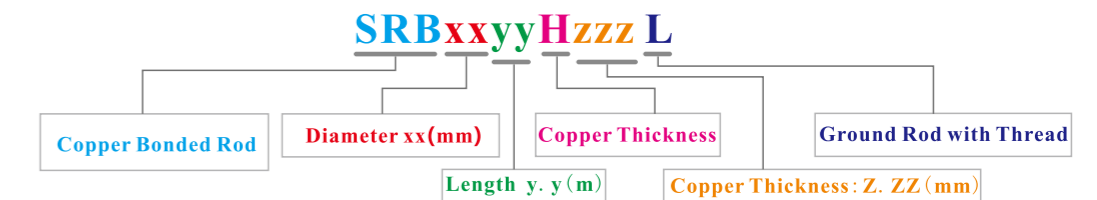
In a well-geological soil environment, a single grounding rod can be directly driven into the ground by the hammering action of the external force.



Examples:
SRB1212H025L
SRB1212H025L

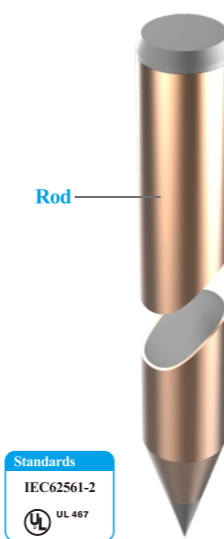
2.2.2. Product Size

Sunlight Ground Rod Numbering System:



2.2.3. Copper Bonded Rod (unthreaded)

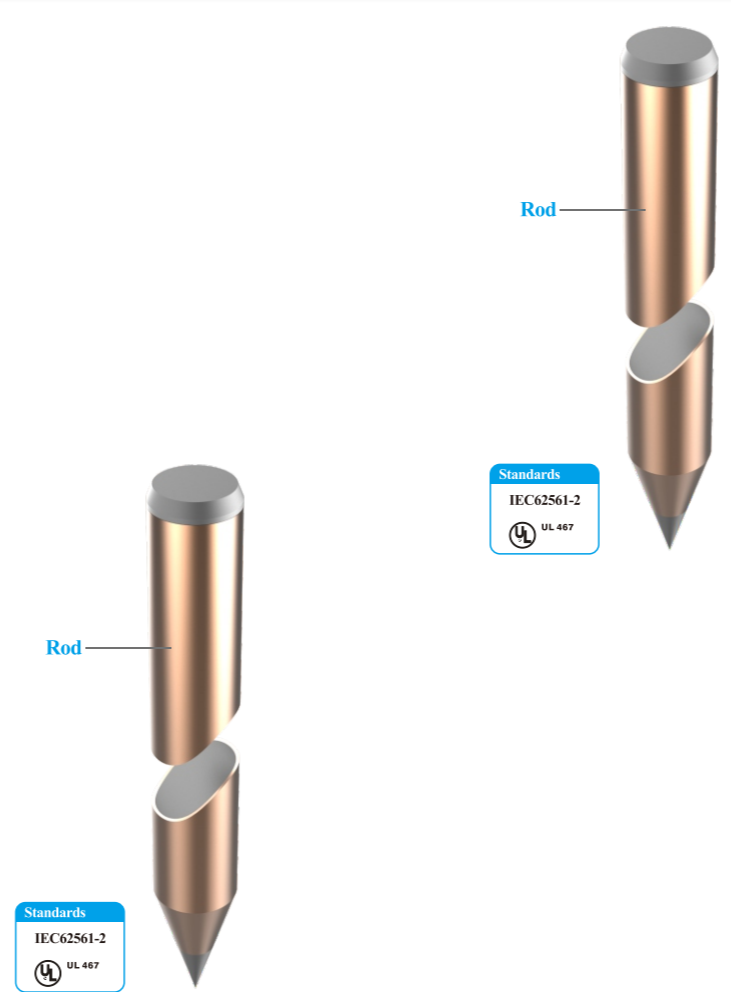
Model	Diameter, Nominnal(″)	Diameter, Actual(″)	Ground Rod Diameter(mm)	Copper Thickness (mm)	Length(m)	Reference Weight (kg)/Root
SRB0912H025	3/8″	0.354″	9.0	0.254	1.2	0.608
SRB0915H025	3/8″	0.354″	9.0	0.254	1.5	0.76
SRB0918H025	3/8″	0.354″	9.0	0.254	1.8	0.91
SRB0920H025	3/8″	0.354″	9.0	0.254	2	1.01
SRB0924H025	3/8″	0.354″	9.0	0.254	2.4	1.21
SRB0925H025	3/8″	0.354″	9.0	0.254	2.5	1.26
SRB0930H025	3/8″	0.354″	9.0	0.254	3	1.52
SRB12712H025	1/2″	0.500″	12.7	0.254	1.2	1.4
SRB12715H025	1/2″	0.500″	12.7	0.254	1.5	1.5
SRB12718H025	1/2″	0.500″	12.7	0.254	1.8	1.8
SRB12720H025	1/2″	0.500″	12.7	0.254	2	2.01
SRB12724H025	1/2″	0.500″	12.7	0.254	2.4	2.41
SRB12725H025	1/2″	0.500″	12.7	0.254	2.5	2.51
SRB12730H025	1/2″	0.500″	12.7	0.254	3	3.01



Note:

The right table includes general size. Other special size grounding rod (diam less than 25mm or length less than 3m) can be provided according to the project requirements.

Model	Diameter, Nominnal(")	Diameter, Actual(")	Ground Rod Diameter(mm)	Copper Thickness (mm)	Length(m)	Reference Weight (kg)/Root
SRB14212H025	5/8"	0.559"	14.2	0.254	1.2	1.5
SRB14215H025	5/8"	0.559"	14.2	0.254	1.5	1.88
SRB14218H025	5/8"	0.559"	14.2	0.254	1.8	2.26
SRB14220H025	5/8"	0.559"	14.2	0.254	2	2.51
SRB14224H025	5/8"	0.559"	14.2	0.254	2.4	3.01
SRB14225H025	5/8"	0.559"	14.2	0.254	2.5	3.13
SRB14230H025	5/8"	0.559"	14.2	0.254	3	3.76
SRB1612H025	-	0.630"	16	0.254	1.2	1.91
SRB1615H025	-	0.630"	16	0.254	1.5	2.38
SRB1618H025	-	0.630"	16	0.254	1.8	2.86
SRB1620H025	-	0.630"	16	0.254	2	3.18
SRB1625H025	-	0.630"	16	0.254	2.5	3.97
SRB1630H025	-	0.630"	16	0.254	3	4.77
SRB17212H025	3/4"	0.677"	17.2	0.254	1.2	2.2
SRB17215H025	3/4"	0.677"	17.2	0.254	1.5	2.75
SRB17218H025	3/4"	0.677"	17.2	0.254	1.8	3.3
SRB17220H025	3/4"	0.677"	17.2	0.254	2	3.67
SRB17224H025	3/4"	0.677"	17.2	0.254	2.4	4.41
SRB17225H025	3/4"	0.677"	17.2	0.254	2.5	4.59
SRB17230H025	3/4"	0.677"	17.2	0.254	3	5.51
SRB2012H025	-	0.787"	20	0.254	1.2	2.98
SRB2015H025	-	0.787"	20	0.254	1.5	3.72
SRB2018H025	-	0.787"	20	0.254	1.8	4.47
SRB2020H025	-	0.787"	20	0.254	2	4.96
SRB2025H025	-	0.787"	20	0.254	2.5	6.2
SRB2030H025	-	0.787"	20	0.254	3.0	7.44
SRB2112H025	-	0.827"	21	0.254	1.2	3.28
SRB2115H025	-	0.827"	21	0.254	1.5	4.1
SRB2118H025	-	0.827"	21	0.254	1.8	4.92
SRB2120H025	-	0.827"	21	0.254	2	5.47
SRB2125H025	-	0.827"	21	0.254	2.5	6.84



Note:
The right table includes general size. Other special size grounding rod (diam less than 25mm or length less than 3m) can be provided according to the project requirements.

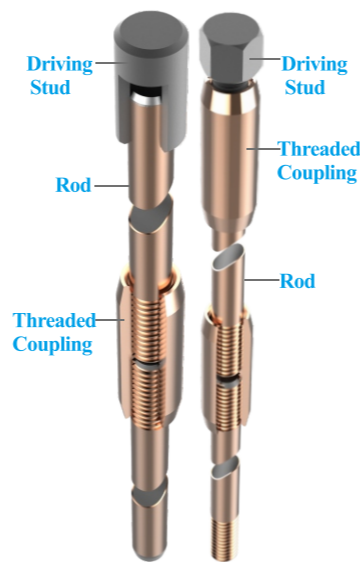
Model	Diameter, Nominnal(")	Diameter, Actual(")	Ground Rod Diameter(mm)	Copper Thickness (mm)	Length(m)	Reference Weight (kg)/Root
SRB2512H025	1"	0.984"	25	0.254	1.2	4.65
SRB2515H025	1"	0.984"	25	0.254	1.5	5.81
SRB2518H025	1"	0.984"	25	0.254	1.8	6.97
SRB2520H025	1"	0.984"	25	0.254	2	7.75
SRB2530H025	1"	0.984"	25	0.254	3	11.62

Note:
The right table includes general size. Other special size grounding rod (diam less than 25mm or length less than 3m) can be provided according to the project requirements.

2.2.4. Copper Bonded Rod (threaded)

Model	Diameter, Nominnal(")	Diameter, Actual(")	Diameter(mm)	Thread Size	Copper Thickness (mm)	Length(m)	Weight(kg) /Root
SRB0912H025L	3/8"	0.354"	9	M12	0.254	1.2	0.608
SRB0915H025L	3/8"	0.354"	9	M12	0.254	1.5	0.76
SRB0918H025L	3/8"	0.354"	9	M12	0.254	1.8	0.91
SRB0920H025L	3/8"	0.354"	9	M12	0.254	2	1.01
SRB0924H025L	3/8"	0.354"	9	M12	0.254	2.4	1.21
SRB0925H025L	3/8"	0.354"	9	M12	0.254	2.5	1.26
SRB0930H025L	3/8"	0.354"	9	M12	0.254	3	1.52
SRB12712H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	1.2	1.4
SRB12715H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	1.5	1.5
SRB12718H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	1.8	1.8
SRB12720H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	2	2.01
SRB12724H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	2.4	2.41
SRB12725H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	2.5	2.51
SRB12730H025L	1/2"	0.500"	12.7	9/16 UNC	0.254	3	3.01

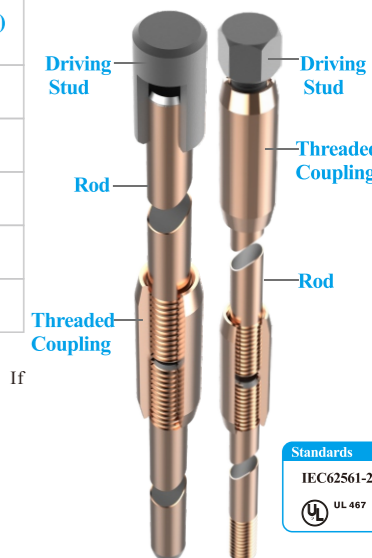
Model	Diameter, Nominal(“)	Diameter, Actual(“)	Diameter(mm)	Thread Size	Copper Thickness (mm)	Length(m)	Weight(kg) /Root
SRB14212H025L	5/8”	0.559”	14.2	5/8UNC	0.254	1.2	1.5
SRB14215H025L	5/8”	0.559”	14.2	5/8UNC	0.254	1.5	1.88
SRB14218H025L	5/8”	0.559”	14.2	5/8UNC	0.254	1.8	2.26
SRB14220H025L	5/8”	0.559”	14.2	5/8UNC	0.254	2	2.51
SRB14224H025L	5/8”	0.559”	14.2	5/8UNC	0.254	2.4	3.01
SRB14225H025L	5/8”	0.559”	14.2	5/8UNC	0.254	2.5	3.13
SRB14230H025L	5/8”	0.559”	14.2	5/8UNC	0.254	3	3.76
SRB1612H025L	-	0.630”	16	M18	0.254	1.2	1.91
SRB1615H025L	-	0.630”	16	M18	0.254	1.5	2.38
SRB1618H025L	-	0.630”	16	M18	0.254	1.8	2.86
SRB1620H025L	-	0.630”	16	M18	0.254	2	3.18
SRB1625H025L	-	0.630”	16	M18	0.254	2.5	3.97
SRB17212H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	1.2	2.2
SRB17215H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	1.5	2.75
SRB17218H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	1.8	3.3
SRB17220H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	2.0	3.67
SRB17224H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	2.4	4.41
SRB17225H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	2.5	4.59
SRB17230H025L	3/4”	0.677”	17.2	3/4 UNC	0.254	3	5.51
SRB2012H025L	-	0.787”	20	M22	0.254	1.2	2.98
SRB2015H025L	-	0.787”	20	M22	0.254	1.5	3.72
SRB2018H025L	-	0.787”	20	M22	0.254	1.8	4.47
SRB2020H025L	-	0.787”	20	M22	0.254	2	4.96
SRB2025H025L	-	0.787”	20	M22	0.254	2.5	6.2
SRB2112H025L	-	0.827”	21	M22	0.254	1.2	3.28
SRB2115H025L	-	0.827”	21	M22	0.254	1.5	4.1
SRB2118H025L	-	0.827”	21	M22	0.254	1.8	4.92
SRB2120H025L	-	0.827”	21	M22	0.254	2	5.47
SRB2125H025L	-	0.827”	21	M22	0.254	2.5	6.84



2.2.4. Copper Bonded Rod (threaded)

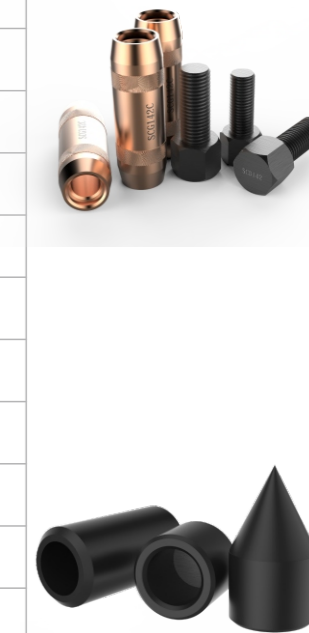
Model	Diameter, Nominal(“)	Diameter, Actual(“)	Diameter(mm)	Thread Size	Copper Thickness (mm)	Length(m)	Weight(kg) /Root
SRB2512H025L	1”	0.984”	25	1 UNC	0.254	1.2	4.65
SRB2515H025L	1”	0.984”	25	1 UNC	0.254	1.5	5.81
SRB2518H025L	1”	0.984”	25	1 UNC	0.254	1.8	6.97
SRB2520H025L	1”	0.984”	25	1 UNC	0.254	2	7.75
SRB2530H025L	1”	0.984”	25	1 UNC	0.254	3	11.62

Note: The grounding rod size listed in the above table (product code: SRB****H**L) have threaded at both sides generally. If customers have special requirements, please specify in enquiry.



2.2.5. Copper Bonded Rod Accessories

Item	Model	Description
Coupling	SCG127	For threaded copper bonded rod with a diameter of 1/2" (12.7mm)
	SCG142	For threaded copper bonded rod with a diameter of 5/8" (14.2mm)
	SCG172	For threaded copper bonded rod with a diameter of 3/4" (17.2mm)
	SCG200	For threaded copper bonded rod with a diameter of 1" (20mm)
	SCG250	For threaded copper bonded rod with a diameter of 1" (25mm)
Driving Stud/Cap	SCT127	For threaded copper bonded rod with a diameter of 1/2" (12.7mm)
	SCT142	For threaded copper bonded rod with a diameter of 5/8" (14.2mm)
	SCT172	For threaded copper bonded rod with a diameter of 3/4" (17.2mm)
	SCT200	For threaded copper bonded rod with a diameter of 1" (20mm)
	SCT250	For threaded copper bonded rod with a diameter of 1" (25mm)
Driving Head	SQT127	For threaded copper bonded rod with a diameter of 1/2" (12.7mm)
	SQT142	For threaded copper bonded rod with a diameter of 5/8" (14.2mm)
	SQT172	For threaded copper bonded rod with a diameter of 3/4" (17.2mm)
	SQT200	For threaded copper bonded rod with a diameter of 1" (20mm)
	SQT250	For threaded copper bonded rod with a diameter of 1" (25mm)
Driving bolt	SCD200	For threaded copper bonded rod with a diameter of 1" (20mm)



2.3.1. Main technical parameter

1. Tensile strength

Tensile strength Rm 300 Mpa (Copper bonded coil);
Rm 600 Mpa (Copper bonded rod);

Yield/tensile ratio 0.85-0.90

2. Copper thickness

H 0.254 mm

3. Plasticity of copper layer

When the product is bent at 90°C there is no crack in the inner and outer edge copper layer.

4. Copper layer bondability

When the product is placed between the clamp or the vise jaws, the spacing is smaller than the diameter of the sample steel core (W=d -0.1), hammer the end of the sample, cut off enough copper layer, fully expose the steel core, The exfoliated copper layer is allowed at the jaws of vise, However the remaining part of rod, exfoliated copper and steel is not allowed to be visible to the naked eye.

5. Electrical-corrosion performance

Simulated fault current releasing, after the electrical-corrosion cycle test, the final resistance value growth rate does not exceed 50% of the initial resistance value, Moreover, during the testing process the resistance growth rate of each test step does not exceed 15%. And the surface of the copper bonded steel sample is completed. Without cracks. pits, bubbling defects after the test.

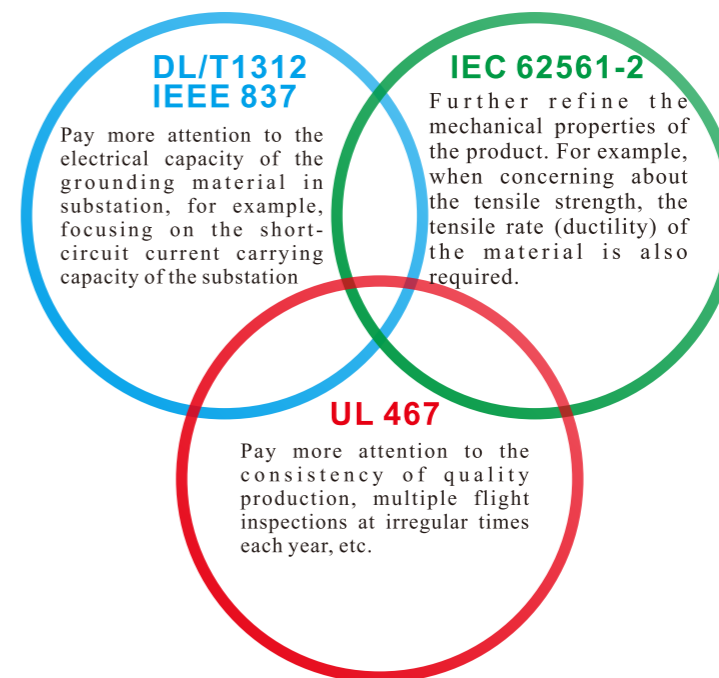
2.3.2. Performance testing and matching requirements for field applications

In terms of copper bonded steel product application technology, by analyzing IEEE 837, IEC 62561-2, UL 467 and other standards, sunlight experimental center is equipped with test equipments for all testing, including mechanical testing, electrical testing, corrosion testing, etc., for product development and production quality control.

Testing capability



The technical requirements for copper bonded steel in the above four standards are partly the same and differ in terms of details.



Note : IEC 62561-2, clause 4.4.2 states that the ground rod shall have mechanical strength to ensure proper installation. The material selected should be sufficiently malleable to ensure that the ground rod does not break during installation.

Project	Sunlight	Others
According to IEEE837, copper bonded ground rod fault current test.	Result : Dense smooth; Reason: The steel core is pre-plated with 3 μm nickel layer, the copper layer is more dense with better bonding . The oxide layer is compact after the test.	Result : copper layer warped ; Reason: Traditional pre-plating process, copper atomic crystals have directionality, with large crystal pores and weak copper layer bonding.

IEEE837

Good quality (Sunlight)	Bad quality (Others)
Electrical cycle test	
Good quality (Sunlight)	Bad quality (Others)
Fault current test	

Project	Sunlight	Others
According to IEC62561-2, copper bonded rod bent 90° ;	The result: good. Reason : Adopting high-quality carbon structural steel with high mechanical properties and good ductility. The tensile ratio is 0.80-0.95, the inside and outside copper layer without cracking when bending at 90° .	The result: easy to break. Reason : Using ordinary steel, which has high carbon content and poor ductility, easy to break.

Good quality (Sunlight)	Bad quality (Others)
Bending 90° test	
Good quality (Sunlight)	Bad quality (Others)
Tensile rate test	

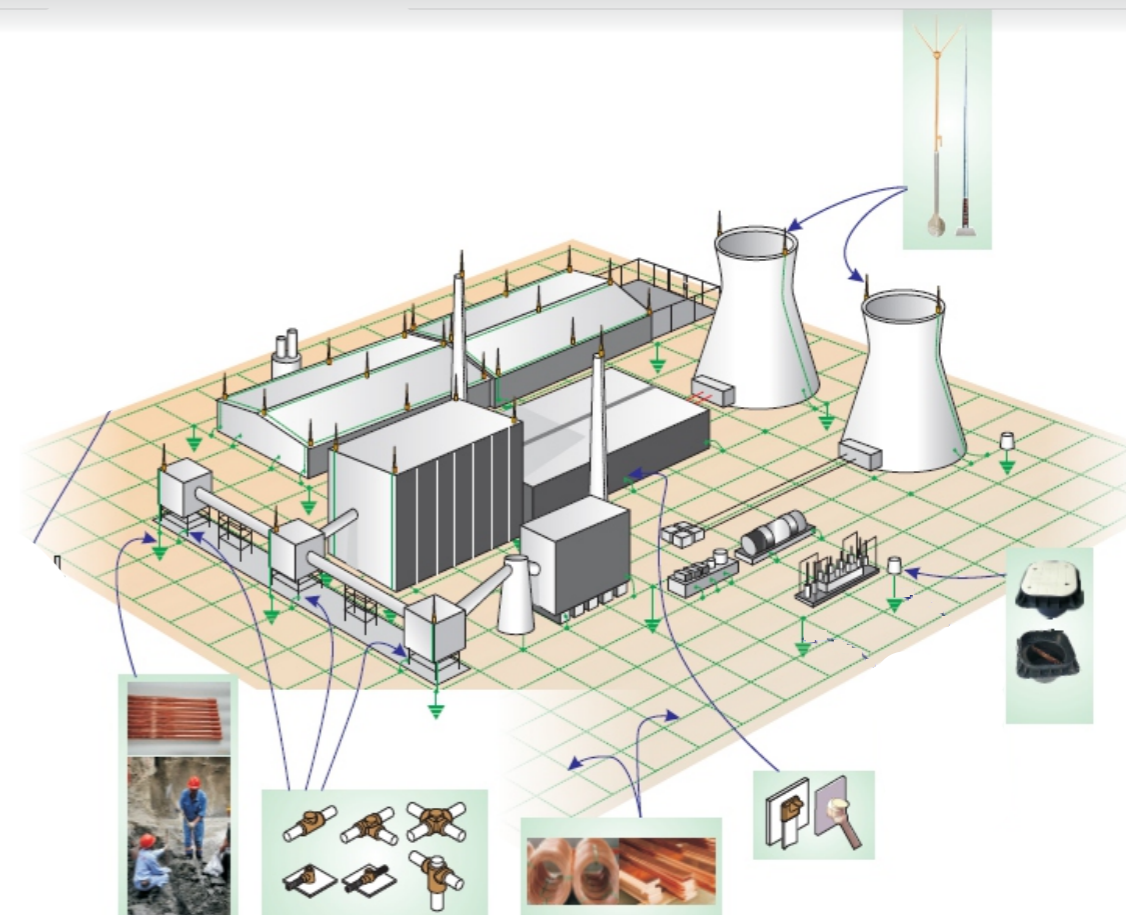
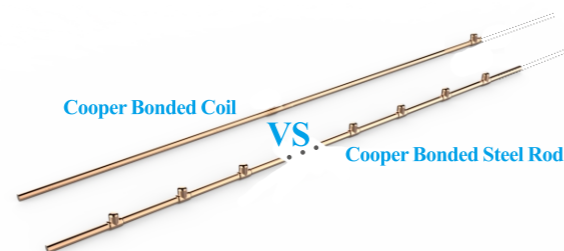
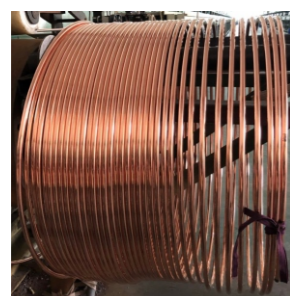
IEC62561-2

3.Application and Economy

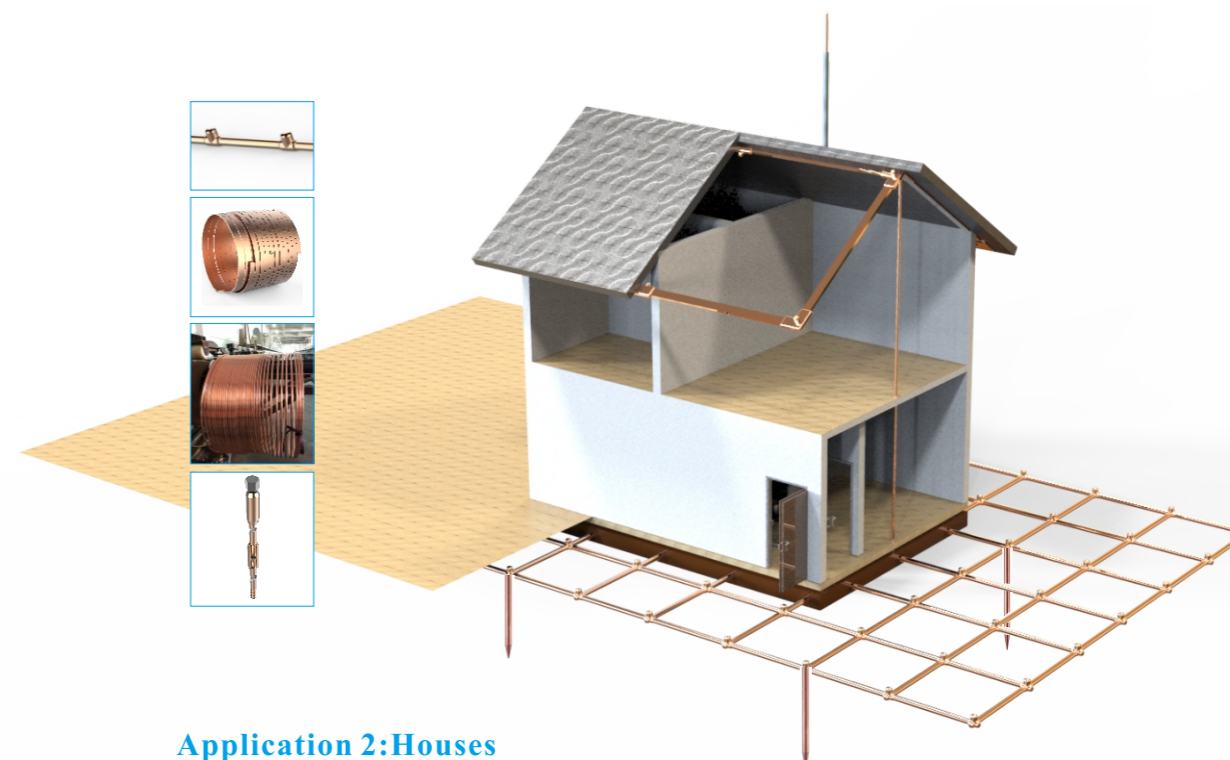
3.1. Industry application

The grounding system is concealed in the project. The joint of the grounding material should be minimized to reduce the risk of later maintenance and maintain the reliability of the grounding grid. The copper bonded grounding material (coil and tape) with a single 100-meter roll can be widely used in power plants, substations, petrochemical projects, etc. for large-scale grounding grid to meet the requirements of grounding resistance and potential difference in the grounding system.

Example: The grounding material is laid in a grounding groove with a length of 100 meters. If a single 100-meter copper bonded coil is used, only one connection joint is required. When using a copper bonded ground rod with a length of 6 meters, 16 joints (not including both ends) should be required. It can reduce the direct material cost of the connection joint by 90% and the labor cost of the labor.



Application 1: Power station



Application 2: Houses
(For reference only, subject to actual product and packaging.)

3.2. Economic explanation

(1) "Copper-clad and copper-bonded steel are common materials used for grounding systems, Especially where theft is a problem as described in Section 11.2.2 of the IEEE Guide for Safety in AC Substation Grounding.

(2) According to the 2013 document of China State Grid Corporation of China, "Guidelines for the Implementation of the Promotion and Application of New Technologies for the Release of Designs by the Infrastructure ministry of the State Grid", the copper bonded materials belong to the category of "safe and reliable, advanced technology and significant benefits"

--- **The conclusion from "Substation Copper bonded Grounding Material"** is after the research that: the electrical, mechanical, corrosion, economic, environmental performance and grounding properties of copper bonded materials, the technology is suitable for medium and severe corrosion for areas (Class II or III), if the full life cycle is 40 years, copper bonded saves more than 27% of grounding system compared to galvanized steel and 20% compared with copper in the cost.

— **The conclusion of the project "design technology of copper bonded grounding device for transmission line poles in severely corroded areas"** is that: the technology is suitable for the grounding device of various voltage levels of salt and alkali, coastal corrosion severe areas, copper bonded ,The corrosion resistance is more than 5 times higher than that of galvanized steel, which is equivalent to copper. If full life cycle is considered for 40 years. Copper bonded saves investment costs by 44% compared to galvanized steel, and saves about 15% compared to copper materials.

4.Note

(1) For the contents of exothermic welding, please refer to Sunlight exothermic welding product catalogue, or contact our sales staff .

(2) When the copper bonded is used in the construction with a length of 100 meters or more, you can also use the "steel straightening machine" to quickly straighten the copper bonded for installation. please note that when using the straightener, and the straightening speed should be controlled to avoid damage to the copper layer.

***The relevant product pictures in this brochure are for reference only, Sunlight reserve the final interpretation right .