



Product Merchantability Standards

PURPOSE

This standard defines the most current capabilities of the processes at Copperweld Bimetallics, LLC to produce merchantable products supplied to existing customers as well as to inform new customers of our abilities to meet specific requirements. This standard shall be furnished as additional information that will be included with the TERMS AND CONDITIONS OF SALE to all new customers and existing customers that renew, revise, or amend current and existing contracts.

STANDARD

The aim of Copperweld is to provide our customers with Copper-Clad Steel and Copper-Clad Aluminum products that are superior to the competition by providing best-in-class quality, service, and merchantability. In order that we maintain consistent standards when it comes to producing our products and to capture the needs of our broad customer base, we have developed this standard to specifically communicate our capabilities and expected outputs in regards to merchantability and quality assurance specifications (**section 16 specifics**) outlined in our [TERMS AND CONDITIONS OF SALE](#).

This standard also includes customer processing methods and Copperweld's limited warranty when usage of Copperweld products are outside the suggested processing means.

Customer Specific Requirements will not supersede this standard unless agreed upon and documented in the purchase agreements.

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REVIEW OF THE REQUIREMENTS / FEASIBILITY REVIEW:

During the process of obtaining new business or revisions to existing contracts, Copperweld will evaluate the feasibility of producing products requested by the customer to ensure:

-) Requirements specified by the customer, including the requirements for delivery and post-delivery activities (if required) are achievable;
-) Requirements not stated by the customer but necessary for specified or intended use, where known are possible;
-) Statutory and regulatory requirements related to products can be met;
-) Additional requirements determined by Copperweld to be relevant to part quality can successfully be achieved.

This review is conducted by the Copperweld Operational Cross-Functional team prior to approval and contract agreements to ensure the ability to meet requirements for products to be offered to customers can be met and sustained appropriately.

MATERIAL / PHYSICAL PROPERTIES:

-) All material will be manufactured in accordance with the applicable ASTM requirements unless otherwise agreed upon in writing and annotated in the contract agreements.
-) All dimensional testing will be in accordance with the applicable ASTM requirements unless otherwise agreed upon in writing and annotated in the contract agreements. Additional testing requirements by customers must be approved by the Operational Cross-Functional team to ensure Copperweld can meet and maintain the requirements.
-) Standard testing offered by Copperweld is as follows:
 - o Outside Diameter
 - o Conductivity
 - o Resistance
 - o Breakload
 - o Elongation
 - o Tensile
-) Material Certifications per lot will be provided upon request, but must be requested at contract negotiations to ensure customer requirements are reviewed and approved. Copperweld makes a determination of lot sizes to ensure inspection frequencies are conducted in a manner that will maintain control over the product quality and prevent escape.
-) Additional testing or testing information or documentation requested post contract agreement will result in a new contract revision and will require approval through the Feasibility Review as stated above. This process is to ensure our laboratory has the capacity to produce additional requirements not previously reviewed and has the ability to meet those requirements and customer needs.

REELS AND PACKAGING:

- J Copperweld provides industry standard reel types and shipping skids and will strive to provide our customers with the appropriate reels and packaging that work best for their application. Copperweld provides metal, wood, and plastic reels, as well as stems and corrugated cardboard packaging. Based on customer needs, Copperweld will assist in the selection of the best possible reel and packaging application.
- J Packaging configurations requested by the customer that fall outside our standard packaging offerings may result in limited liability by Copperweld to guarantee quality of product upon delivery.
- J Upon request, Copperweld can perform durability testing for packaging configurations that fall outside the standard packaging options to determine performance and customer satisfaction level (see DFM section below).
- J Durability testing attributes and acceptance criteria shall be determined by both Copperweld and Customer to ensure proper testing is performed that would best represent the customers' needs, transportation method, and usage of the finished product. Approval of reliability results must also be a joint decision in order to proceed to contract agreements.
- J Additional packaging such as shrink wrap, containers, dividers, moisture barriers, and any other type of packaging materials are considered non-standard and will need to be specified by the customer and approved by the Copperweld Operational Cross-Functional team during contract negotiations

REELS:

- J All product will be supplied on reels specified by the customer and approved by Copperweld and shall be non-returnable unless otherwise stated in the purchase agreement.
- J Conditions of reels shall be in like new condition free from damage and within the specification as purchased from Copperweld suppliers.
Returnable Reels:
- J The use of returnable reels may result in limited liability by Copperweld to guarantee quality of product upon delivery and processing by the customer.
- J Using returnable reels will require packaging trials as well as durability studies to determine life cycle expectancy.
- J Returnable reels shall only be scrapped by Copperweld based on the determined life-cycle or current condition.
- J All damaged reels shall be returned to Copperweld regardless of condition.
- J Returnable reels will be evaluated on a continuous basis to determine time for disposal.
- J Reels must be returned in the same condition as received, no rust, damage, and no wire should remain on the reels unless otherwise agreed upon by Copperweld. Reels that are returned in unsatisfactory condition may be subject to additional fees.
- J Reels taken out of the supply chain or not returned by the customer may result in additional cost for replacements.

TRANSPORTATION / SHIPPING:

- J Copperweld default terms for transferring ownership of sold products to our customers is F.O.B Shipping point.
- J Additional terms may be negotiated during contract review, but must be agreed upon by both parties prior to contract approval.

PAYOFF:

- J Copperweld recommends ALL payoffs to be powered to prevent tangling and loose wire.
- J The recommended reel orientation is such that the arbor hole is set in the horizontal position. This prevents wire fall due to reel lag during start/stop

MATERIAL HANDLING:

To ensure proper payoff of material, it is extremely important to handle reels using the proper material methods using the proper material handling equipment. Below is the optimal handling methods suggested by Copperweld.

-) *Copperweld recommends reels be lifted using the following:*
 - o **Wood Reels:**
 - *Large – 2,000 Lbs. and above – **Should be lifted by forklift forks on flange***
 - *Medium – between 800 Lbs. and 2,000 Lbs.- **Should be lifted by forklift forks on flange***
 - *Small – between 0 Lbs. and 800 Lbs.- **Should be lifted by forklift forks on flange***
 - o **Metal Reels:**
 - *Large – 2,000 Lbs. and above- **Should be lifted by forklift forks through arbor hole***
 - *Medium – between 1,000 Lbs. and 2,000 Lbs. **Should be lifted by a pallet or lifted by crane flange hooks***
 - *Small – Up to 1,000 Lbs.- **Should be lifted by a pallet or lifted by crane flange hooks***
 - o **Stems:**
 - **Centered forklift forks through upper stem loops**
-) *Orientation of reel during transport or material handling:*
 - o *The reel orientation should be such that the arbor hole should be in the horizontal position at ALL times.*
-) *Limited liability for not following recommendations applies.*

MATERIAL PRESERVATION:

In order to sustain the shiny red-orange copper color and lustered appearance of Copperweld products, it is important to store materials in conditions that do not accelerate the normal copper oxidation process (also known as patina) until such time the material is placed into service.

Prior to use, material should not be exposed to moisture such as rain, mist, dew, humidity, extreme temperature changes that would allow the material to draw moisture, or stored outside unprotected. Material crossing oceans or stored in sea containers for prolonged periods of time are highly susceptible to accelerated oxidation. Proper protection is required to prevent premature oxidation.

Material exposed to climates where salt is abundant, such as coastal regions, should be stored in a manner that protects the material from being in contact with air. Sealed moisture barriers with additional moisture control such as Silica bags used to absorb moisture should be used to prevent oxidation.

Never expose material to acidic products such as vinegar or ascertic type acids prior to use to prevent oxidation.

TRAVERSE AND WINDING:

Copperweld standard for traverse and winding is as follows:

-) Flatness across traverse throughout the reel and for finished product shall be no more than:
 - o 1/4" deviation for wire OD under 0.040"
 - o 3/8" deviations for wire OD between 0.041 and 0.100
 - o 1/2" deviation for wire OD above 0.101
 - o Barber Pole effect – Not acceptable
-) Wire shall be wound tight throughout the reel to prevent soft spooling.

- Probe test – using a cylindrical object with a sharp tip (such as a builder’s punch or an ink pen), the intrusion into the wire layers shall not penetrate the 3rd layer.
-) Crossovers are not allowed that will entrap wire and prevent a smooth untangled payoff.
-) Reel spread from barrel (inside traverse width) to top of outside reel edge (at traverse width) cannot exceed ¾” when reel is fully loaded with wire.
-) Wire must be recessed from outside reel edge a minimum of:
 - 1” for wire OD under 0.08 and reel weight over 250 lbs.
 - ½” for wire OD under 0.08 and reel weight under 250 lbs.
 - ¼” for wire OD under 0.08 and reel weight under 50 lbs.
 - 1” for wire OD over 0.08 and reel weight over 251 lbs.
-) To prevent the potential of soft spooling (loose winding) on annealed materials, Copperweld suggest re-spooling of material be avoided. When smaller OD wire (at or below .0403”) is annealed and then re-spoiled, it has a high probability of becoming loose during shipment. For this reason, Copperweld will not provide warranty for soft spooling condition if the product configuration requires re-spooling after annealing. Please contact Copperweld Engineering for alternatives.

LABELING:

-) Copperweld uses an internal tracking system that identifies each reel produced with an internal label that includes:
 - Part Number
 - Job Number
 - Part Description
 - Date of Last Operation/Process
 - Heat Number
 - Quantity
 - Serial Number (The serial number is the tracking number for the material and must be furnished in the event credit is being requested for any reel).
-) Specific customer labeling of product is not available at this time

LUBRICANTS USED FOR PROCESSING MATERIALS:

-) Copperweld uses drawing lubricants and flash liquids to process materials.
-) These lubricants may remain on products that do not go through the annealing process (where it is evaporated) and may be present on received products at the customer.
-) Lubricants may be removed by the customer prior to processing by means of standard surface cleaner and/or wipes.
-) Copperweld does not offer a secondary cleaning process to remove lubricants as a standard practice.
-) Secondary cleaning may be negotiated into the contract provided the Copperweld Operational Cross-Functional team approves and can provide based on capacity.

COPPERWELD APPEARANCE STANDARDS:

-) Copperweld has developed an Appearance Standard (QP-15) and is used as the basis for acceptance criteria for all products produced. This procedure will be included with the TERMS AND CONDITIONS OF SALE along with this standard if requested.
-) Products will conform to the revision furnished to the customer during contract negotiations.
-) In the event of contract renewal, the latest revision of the Appearance Standard will become the default standard and will be provided to the customer prior to contract agreement.

DESIGN FOR MANUFACTURABILITY (DFM):

Copperweld conducts Design for Manufacturability (DFM) testing and analysis for all products that have not been previously approved for sale. This is to ensure we have the ability and capabilities to offer our customers products that meet Customer Specific Requirements (CSR's), internal requirements, regulatory and statutory requirements.

The DFM analysis will include but is not limited to:

- ✓ Optimizing manufacturing functions to produce material for specific customer specifications or requirements not previously approved (or non-standard) – Secondary operations or functions in-line processing, off-line processing, 3rd party processing, specific tooling requirements, customer owned or previously owned equipment usage
- ✓ Additional appearance requirements
- ✓ Additional spooling requirements
- ✓ Additional labeling requirements
- ✓ Additional testing requirements
 - 3rd party testing
 - Testing required by customer but not currently performed by Copperweld
 - Durability (packaging)
 - Application testing – simulate end customer usage testing
- ✓ Additional delivery methods
- ✓ Additional packaging configurations
- ✓ Additional preservation requirements during shipment
- ✓ Extended Warranties (usually applies to offshore customers only)
- ✓ Specified materials or Customer directed material sources

COPPER-CLAD STEEL WIRE INSPECTION AND TESTING REQUIREMENTS

| Process | Control Item | Apparatus | Responsible Party | Sample Frequency (minimum) | Record |
|------------------|---|------------------------------------|-------------------|-------------------------------|---|
| Steel Rod | Verification | Visual | Receiver | Each Lot | N/A |
| | Microstructure / Inclusion Control | Metallograph | Metallographer | Each Heat | Metallographer Log |
| | Certificate of Compliance or Analysis | Supplier | QA | Each Heat | Certificate of Compliance / Heat Tracking Database |
| Copper Flat Wire | Verification | Visual | Receiver | Each Lot | N/A |
| | Certificate of Compliance or Analysis | Supplier | QA | Each Lot | Certificate of Compliance |
| | Resistance | Wheatstone Bridge | | 100% | Electronic |
| | Thickness | Micrometer | | | |
| | Width | Caliper | | | |
| Clad Rod | Diameter | Micrometer | Operator | 100% Finish | Data Log or Electronic |
| | Diagonals | Micrometer | | | |
| | Copper Bond | Tensile Machine Torsion Machine | | | |
| | Temperature | Temperature Gun | | | |
| Final Inspection | Diameter | Micrometer | Operator | 100% | Electronic |
| | Torsion | Torsion Machine | | 20% | |
| | Tensile | Tensile Machine | | 20% | |
| | Elongation | Tensile Machine | | 20% | |
| | Resistance | Wheatstone Bridge | | 20% | |

COPPER-CLAD ALUMINUM WIRE INSPECTION AND TESTING REQUIREMENTS

| Process | Control Item | Apparatus | Responsible Party | Sample Frequency (minimum) | Record |
|-------------------|---------------------------------------|-------------------|--------------------|-------------------------------|---------------------------|
| Aluminum rod | Verification | Visual | Receiver | Each Lot | N/A |
| | Certificate of Compliance or Analysis | Supplier | QA | Each Heat | Certificate of Compliance |
| Copper Strip | Verification | Visual | Receiver | Each Lot | N/A |
| | Certificate of Compliance or Analysis | Supplier | QA | Each Lot | Certificate of Compliance |
| | Resistance | Wheatstone Bridge | | 100% | Electronic |
| | Thickness | Micrometer | | | |
| | Width | Caliper | | | |
| Clad Rod | Weld Seam | Eddy Current | Clad Line Operator | 100% | Electronic |
| | Copper Bond | Vise | | Each Reel | |
| Breakdown Drawing | Copper Bond (Delams) | Eddy Current | Operator | 100% | N/A |
| Final Inspection | Diameter | Micrometer | Operator | 100% | Electronic |
| | Break load | Tensile Machine | | 20% | |
| | Elongation | Tensile Machine | | 20% | |



Revisions:

| Date | Revision History |
|--------|------------------|
| 6/4/18 | Original |
| | |