



Alloying Material Specification

Applies To: Copper Metal
Type: Copper Scrap, No. 1 Grade

Specification No. MS 4-Cu01-B
Revision No. G
Effective Date 11/13/2023

Form Briquette, Clips, Punchings,
Chopped, Flake, Powder

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SUPPLIER / CUSTOMER INFORMATION

This document may contain sensitive technical information that has been reviewed in confidence between Arconic, Inc. and the manufacturer (“vendor”) of alloying materials. Therefore, the contents of this specification should be divulged only to persons who by nature of their duties require access to such information.

1. Scope and Classification

This purchase specification defines minimum metallurgical, chemical, dimensional, quality and general requirements of materials used to produce aluminum alloys for re-melting and/or fabrication. Additional material requirements may be specified by individual locations and communicated directly to the supplier.

2. Applicable Reference Documents

Current revisions of the following documents in effect on the date of purchase order, unless a specific issue is referenced, form a part of this specification to the extent specified herein. In the event of conflict between the requirements of this specification and the requirements of any other applicable document, the requirements of this specification shall prevail.

2.1 The Aluminum Association

Registration Record of Aluminum Association Designations and Chemical Composition Limits for Aluminum Hardeners

2.2 European Standard

EN 575:1995 Aluminum and aluminum alloys – Master alloys produced by melting - Specifications

2.3 American Society for Testing and Materials

ASTM E3 Preparation of Metallographic Specimens



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- ASTM E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- ASTM E88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition
- ASTM E53 Standard Test Method for Chemical Analysis of Copper
- ASTM E255 Sampling Copper and Copper Alloys for the Determination of Chemical Composition

2.4 American National Standards Institute

- ANSI/ASQC Q-1 Generic Guidelines for Auditing of Quality Systems
- ANSI H35.3 Designation for Aluminum Hardeners
- ANSI Z34.2 Self Certification by Producer or Supplier
- ANSI Z540.1 Calibration Laboratories and Measuring and Test Equipment – General Requirements

2.5 Government and Industry Standards

- ISO 10012 Quality Assurance Requirements for Measuring Equipment
- TSCA Toxic Substance Control Act
- CONEG Coalition of Northeastern Governors Requirements
- CFR 29, CFR 49 Code of Federal Regulations – Hazardous Materials
- CFR 40 Part 82 Protection of Stratospheric Ozone, Subpart E: Labeling of Products Using Ozone Depleting Substance.



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3. Product Requirements

Each shipment shall be subject to inspection by the receiving location. NOTE: The term “commercially free of” is a subjective (non-quantified) statement that defines quality that must meet industry norms. If, in the buyer’s opinion, the product does not meet expected normal industry standards, the material may be subject to rejection.

3.1 Material Condition

3.1.1 External: Product shall be commercially free of surface or entrained oxides, salts, and reaction products.

3.1.2 Internal: Product shall not include hollow copper materials, tubing, etc.

3.1.3 Contamination: Materials shall be commercially free of contamination and products of corrosion. The presence of foreign substances, on the surface or imbedded, such as discrete non-metallic fragments, iron, oxide flakes, rust, fertilizers, nitrates, oxidizers, hygroscopic salts, and heavy oxidation shall be cause for rejection.

3.1.4 Purity: Product shall be commercial pure unalloyed No. 1 copper scrap (Cu-CATH-1 or equal) per paragraph 3.2.

3.2 Chemical Composition

Element(s)	Minimum	Target	Maximum
Cu (Copper)	99.9		
Be (Beryllium)			See Note
Pb+Cd			<0.010
Others Each Max	Not Specified		
Others Each Total	Not Specified		

NOTES: CONEG requirements apply per paragraph 4.7.2.4. The supplier shall certify that materials are "Beryllium Free" (< 0.0001%) based on statistical sampling or testing each production lot.

3.3 Metallurgical Requirements

Structures of briquettes shall display cleanliness and uniformity characteristic of consistent selection of copper scraps and acceptable briquetting operations.

3.4 Microstructure Requirements

Specific microstructures and metallurgical features or characteristics are not specified for this material.



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3.5 Performance Requirements

Minimum rate of dissolution is not specified. However, a 99% minimum recovery should be achieved. Performance is routinely monitored under plant-scale conditions. Internal and external cleanliness can affect safety in handling and charging, overall recovery, dross generation and final product quality.

3.6 Dimensional Requirements

The following represents typical ordered dimensions and weights. Specific requirements and alternate dimensions shall be specified on the order:

<u>Form</u>	<u>Dimension</u>	<u>Weight</u>
Briquette	6 x 6 x 12 inch (152 x 152 x 305 mm)	Approx. 50 lb. (22.7 kg.)
Chopped	Wire diameters shall not be less than 12 AWG gauge (0.0808 inch, 2.05 mm). Length varies. Supply of product containing wire below 12 gauge subject to prior approval	Loose or packed in 5 lb +/- 5% (2.25 kg.), 10 lb +/-5% (4.5 kg.) cotton cloth (or paper) bag. Use of plastic lining or coatings is not acceptable. Product containing wire below 12 gauge must be packed in approved containers. Weights to be advised by Arconic locations
Clips / Punchings	Thickness shall not be less than 0.080" (for example, 13 "sheet metal" gauge (0.090 inch, 2.28 mm)). Supply of product with thickness below 0.080" subject to prior approval.	Loose packed, weight varies. Product with thickness below 0.080" must be packed in approved containers, weight to be advised by Arconic location. Use of plastic lining or coatings is not acceptable.
Flake / Powder	Varies	Must be packed in 5 lb +/- 5% (2.25 kg.), 10 lb +/- 5% (4.5 kg.) cotton cloth (or paper) bag or according to local requirements. Use of plastic lining or coatings is not acceptable.



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4. Quality Assurance Requirements

The vendor's Quality System shall conform to requirements of ISO 9001:2008 (current revision) or comparable quality standard. The Quality System shall be available at all times for review and approval by Arconic personnel.

4.1 Identification

4.1.1 Alphanumeric Marking: Each pallet or packaged unit shall display easily referenced and legible identification that includes the name of the vendor, product identification (product type), heat identification traceable to the manufacturing process, lot identification if separate, and producing location. Bar coding, supported by written information, is desirable.

4.1.2 Color Coding: Each package of material shall be color coded in accordance with the most current color codes registered and published in the Aluminum Association (AA) – “International Designations and Chemical Composition Limits for Aluminum Hardeners” (ANSI H35.3), or the European Committee for Standardization (CEN) - EN 575:1995. Non-standard color codes may be used as agreed upon in writing between the supplier and the receiving location. In such cases, the expectation is that the aforementioned industry standard codes will be adopted for future shipments.

<u>Form</u>	<u>Color Coding</u>	<u>Special Marking</u>
Briquette	None	Clearly marked "Cu-99.9%"
Chopped	None	Clearly marked "Cu-99.9%"
Clips / Punchings	None	Clearly marked "Cu-99.9%"
Flake / Powder	None	Clearly marked "Cu-99.9%"

4.2 Quality Control / Statistical Process Control

4.2.1 Quality Systems & Procedures: Manufacturing facilities (vendors) shall maintain consistent operations and demonstrate adherence to their formal Quality Systems. Quality Systems shall consist of written or electronic controls including Standard Operating Procedures, inspection and testing procedures (methods, frequency, acceptance limits) and records retention. Procedures shall ensure timely delivery and product performance consistent with terms of this specification.



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4.2.2 Calibration Requirements: The vendor's calibration system shall conform to ISO 10012 and be compliant with the requirements of ANSI Z540.1, or an approved equivalent standard.

4.2.3 Statistical Process Control: Vendors should use Statistical Process Control (SPC) techniques relevant to their processes to evaluate state of control, to determine process capability, to verify product acceptability, to evaluate measurement/testing process repeatability and reproducibility, and to aid in improvement of process and product performance. In cases where SPC is not used, an exception should be requested, in writing, by the vendor.

- The vendor must demonstrate minimum expected process capability and/or develop action plans to achieve the expected capability for the following Critical Product Characteristics:

%Cu, %Cd, %Pb, Piece Weight

For Initial Qualification: The Process Performance Index (Ppk) shall be at least 1.67. Results from preliminary statistical capability studies shall be submitted for approval and recorded per paragraph 6.1. For Qualified Standard Production: The Process Capability Index (Cpk) shall be at least 1.33.

- Gauge R&R Studies should be performed on devices used to measure the Critical Product Characteristics. Measurement processes shall be documented and proven to be stable over time.
- Real-Time SPC Control Charts should be used as basis for making process adjustments. Copies of capability indices (Ppk or Cpk) and/or SPC charts shall be provided to the buyer (receiving plant) on a quarterly basis or as specified in the purchase order.
- Corrective Action Plans should describe how to respond to an out-of-control condition and the process for determining root cause.
- Containment Plans shall ensure that no out-of-spec materials are inadvertently shipped. The Containment Plan must define inspection and release procedures and the disposition process for non-conforming.
- Continuous Improvement Plans shall be implemented to address process control and capability issues. Tools such as Failure Modes Effects Analysis (FMEA) are recommended to identify weaknesses and to guide appropriate action.

4.3 Record Retention

Quality Records related to production and processing of this order shall be maintained for minimum of 7 years after the material has been shipped. Longer record retention periods may be required by the receiving location or BU.



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4.4 Supplier Audits

4.4.1 Arconic selects and approves suppliers based on evaluations of their quality systems and on demonstrated performance of the product(s) and service(s) being purchased. Periodic formal on-site audits may be performed to assess supplier's practices, procedures, operations and safety for conformance to Arconic's standards.

4.4.2 For quality audit purposes, Arconic, Arconic's customer and regulatory agencies will have access to approved supplier's facilities including subcontractor facilities with approved notifications for the purpose of verifying the quality of the product or service. This includes access to all facilities involved in this order and all applicable quality records including those of the calibration system.

4.5 Product Testing

The vendor shall make sure that product is properly tested to ensure consistency in manufacturing, material characteristics and product performance.

4.5.1 Chemical Composition: In addition to all elements specified, the manufacturing facility (vendor) shall perform additional testing as required to define and control impurity content and identify and correct trends detrimental to product performance.

4.5.2 Metallographic Examination: As required for process control and validating product acceptance and performance, or as dictated by other agreement.

4.5.3 Mechanical Properties and Material Characteristics: When applicable, vendor(s) shall determine mechanical properties or characteristics considered critical for control of process and product performance that may affect fines generation, conveyance, payoff of coiled materials, etc.

4.5.4 Qualification Testing: Initial qualification or re-qualification of product and/or process shall be established using the procedure described in Paragraph 6: Informational Notes.



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4.5.5 Performance Testing: Vendor(s) shall perform routine testing to qualify manufacturing procedures and to determine acceptability of process adjustments. Arconic shall perform evaluations to establish qualified vendors and for periodic surveillance.

4.6 Packaging

4.6.1 Pallet: When specified, product shall be packed on a wooden pallet suitable for handling by forklift truck. Other requirements for pallets, including EUR-pallets, may be specified by the purchasing location. Also, when specified, materials shall be covered with polyethylene wrap (shrink or stretch) and steel banded to the pallet. If more than one heat is packed on a pallet, materials from the individual heats shall be clearly identified by heat number. Package information shall include chemical composition by heat number.

4.6.2 Package Standard: Packages shall be designed so as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery.

4.6.3 Size and Weight: Pallet dimensions and weight shall be as follows unless specified different on the order.

<u>Form</u>	<u>Package Size and Weight</u>
Briquette	Briquettes shall be palletized and steel banded to 2700 lb (1225 kg.) or 4000 lb.(1814 kg.) maximum Gross Weight. Alternate Packaging: Loose Containerized, Gaylord boxes. 4000 - 5000 lb (1814 - 2268 kg.)
Chopped	Pre-weighed 5 lb or 10 lb (+/- 5%) bags shall be packed in 2000 (907 kg.) up to 4500 lb (2041 kg.) Gaylord box. Bag type must be specified and approved by the receiving location. Alternate: Loose in 2000 lb (907 kg.) Super sac.
Clips / Punchings	Loose in drums or Gaylord box. Order specific.
Flake / Powder	Loose in drums, super sac or plastic lined Gaylord box. Order specific.

4.6.4 Purchasing location may specify additional packaging requirements on the purchase order.



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4.1 Certification Documentation

4.1.1 Chemical Composition:

4.1.1.1. Certification Report: The manufacturing facility (vendor) shall furnish a certified chemical composition report and a statement of compliance referencing this specification with each shipment.

The chemical composition certificate shall contain:

- Arconic purchase order / release number and order item number
- Supplier's product batch number
- Quantity
- Test results for each element specified in paragraph 3.2
- A statement of test method(s) used to determine composition
- The name of person responsible for the certification
- Production date(s) of material
- Certification date

4.1.1.2. Statistics: The supplier may be asked to furnish statistical-based information regarding specification compliance.

4.7.2. Environmental Requirements:

4.7.2.1. Toxic Substances: By accepting this specification, the vendor is indicating compliance with regulations described by Title 40, Part 710, of the Toxic Substance Control Act (TSCA), or equivalent international standard. The vendor also represents that none of the purchased materials contain polychlorinated biphenyls (PCBs).

4.7.2.2. Hazardous Materials: For any material furnished to this specification which is or contains hazardous materials as defined by Code of Federal Regulations 29CFR 1910.1200 and/or CFR 49 (or equivalent international standard), the vendor shall furnish 2 copies of a Material Safety Data Sheet (MSDS), or equivalent, to the buyer's facility and 1 copy to the Manager, Health & Safety – Compliance & Service, 201 Isabella Street, Pittsburgh, PA (USA) 15212-5858. The MSDS must be in the buyer's possession at least 48 hours before the material arrives at the buyer's plant site. The MSDS shall include the buyer's purchase order number or release number. Any change to the MSDS shall be promptly provided to the buyer, not to exceed 3 months following the revision.



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- 4.7.2.3. Non-Hazardous: For any material(s) furnished to this specification not considered hazardous as defined by 29CFR 1910.1200 and/or CFR 49 (or equivalent international standard), the vendor shall certify in writing to the buyer. Such certification shall be in the buyer's possession at least 48 hours before the material arrives at the buyer's plant site.
- 4.7.2.4. CONEG Requirements: The vendor shall certify that no lead, cadmium, mercury, or hexavalent chrome has been added to materials supplied and that lead and cadmium are reported as impurities in accordance with Chemical Composition, Paragraph 3.2 This requirement applies only to materials with the sum concentration Pb+Cd specified at less than 0.010%.
- 4.7.2.5. Clean Air Act Product Labeling: The vendor shall not supply any materials that contain or have been manufactured using an Ozone Depleting Substance unless the supplier has received prior written approval from Arconic, Inc. Upon receiving written approval, the vendor shall label materials in accordance with Clean Air Act Product Labeling; Code of Federal Regulations, Title 40 Part 82 "Protection of Stratospheric Ozone," Subpart E "Labeling of Products Using Ozone Depleting Substance" (or equivalent international standard).

4.2 Shipping

- 4.8.1. General: Prior to order entry, the receiving plant shall establish specific requirements for overland and overseas shipments (e.g. containers, trucks, and/or rail, etc.). Material must be stored and transported under cover at all times. Local storage facilities shall be open to inspection by authorized Arconic (or subsidiary) personnel.
- 4.8.2. Manifest: A shipping manifest and documentation shall accompany all shipments. They shall contain the purchase order, product identification, manufacturing source (name), chemistry certification, weights (e.g. package, pallets, etc.) and reference to this specification. An additional copy shall be mailed to the procurement department of the receiving plant.
- 4.8.3. Weights: The receiving plant may weigh trucks before and after unloading using certified scales. Deviations that exceed 2% of the stated



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weight shall be resolved between Arconic, Inc. and the vendor. Piece count may be employed at Arconic's option.

- 4.8.4. Truck Shipments: The receiving facility shall specify type of trailer or special carrier. Equipment shall be clean and in safe operating condition. Material shall be shipped in covered van or trailer.
- 4.8.5. Rail Shipments: Rail cars shall be clean and in safe operating condition. Loading shall be conducted to facilitate safe rapid unloading by industrial trucks at the receiving facility.
- 4.8.6. Boat Shipments: The receiving facility shall specify loading that facilitates safe and rapid handling upon receipt. Storage areas and/or containers should be clean, and the vessel should be in safe operating condition. Material must be packaged in a manner to avoid exposure to moisture.
- 4.8.7. Shipping Order:
Reference Paragraph 4.8.2
- 4.8.8. Driver's Documents: The Truck Driver shall be presented with the following documents and paraphernalia:
- Bill of Lading
 - Packing List
 - Carrier's Information Packet*
 - Placards (hazardous material labels)*
 - Certificate of Analysis
- *For specific hazardous materials, the driver shall initial the appropriate space on the Bill of Lading to indicate receipt of Carrier's Information Packet and Placards.

4.3 Basis of Acceptance

- 4.9.1. Inspection and Test: Unloading does not imply acceptance. Failure to meet the requirements of this specification may result in product rejection. Physical testing and/or other inspections including chemical analysis may establish cause(s) for rejection of shipments in part or total. The receiving location shall notify vendor of any refusal to receive shipment. Extra handling charges may be assessed with vendor's approval.



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4.9.2. Radioactive Material: By accepting this specification, the vendor shall warrant that all supplied materials are free of any regulated radioactive components and materials. Purchasing location may require specific radiation levels on the purchase order. Supplier agrees to indemnify and hold Arconic harmless from any and all claims, demand costs, and expenses (including attorney's fees), resulting from or arising under, in whole or in part from a breach of this warranty. The supplier shall be responsible for proper removal and disposal of any such materials, of which they supplied, brought to any Arconic location (including subsidiaries and partnerships) and shall pay the costs of any necessary clean up.

5. Ordering Information

Orders must specify any desired options offered in this specification as well as the following:

- Number and date or revision of this specification
- Product or material name or description
- Quantity
- Special packaging requirements
- Modes of shipping transportation and special loading.

6. Informational Notes

6.1 Product Approval / Qualification

Characteristics and performance of materials and products shall be evaluated under laboratory conditions and approved by the location listed below or by a regional equivalent.

Casting Technology
Arconic Technical Center (ATC)
100 Technical Drive
New Kensington, PA 15069

Performance of materials under plant trial and full scale applications shall be coordinated and approved by the location listed below or by a regional equivalent.

Arconic, Inc. – Cast House Center of Excellence
2300 N. Wright Rd.
Arconic, TN 37701



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Commercial approval of vendor shall be obtained through
 Arconic, Inc. - Metal Purchasing Dept.
 2300 N. Wright Rd.
 Arconic, TN 37701-3141
 or the appropriate regional purchasing department.

6.2 Process Change Evaluations / Approvals

The manufacturing facility (vendor) shall not make any changes in approved product formulation, raw materials, basic methods of manufacture or plant site without notification and prior approval in writing from ATC, Casthouse MTE, and Metal Purchasing per Paragraph 6.1.

6.2.1. Disqualification: In the event that investigations of reported nonconformance reveal that materials purchased under this specification are inadequate for intended use, and if a mutually agreeable solution cannot be established with the vendor, Arconic, Inc. may consider disqualification of the producing facility.

6.2.2. Re-qualification: Steps for re-qualification due to an approved process change or due to a disqualification shall be accomplished in accordance with Paragraph 6.1.

6.3 Specification Change History / Approvals

Unless designated otherwise, the same functions and organizations that reviewed and approved this specification shall approve changes and modifications. Reviewers have access to pertinent background information upon which to base their review and approval.

Revision Date	No.	Description of Change
11/1/1995		Original Issue
10/19/2001	A	7/17/2001: General re-write, editing and format layout. Change spec. prefix from PMS to MS. Revised list of applicable documents Sect. 2. Added Notes Sect. 6.



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		10/4/2001: Revised para. 3.6 to include paper bags and limited wire gauge. Deleted reference to Appendix I (para. 6.3). 10/19/2001: Revised product marking. Added supplier to certify Be < 0.0001%.
12/12/2001	B	12/12/2001: Revised acceptable minimum gauge of scrap wire, clips, punchings to not less than 16-gauge (paragraph 3.6). Revised Performance Requirements (Para. 3.5) specifying 99% minimum recovery.
9/1/2002	C	9/1/2002: Revised Basis of Acceptance (Para. 4.9.2) specifying supplier warranty of shipping all materials free of radioactivity. Supplier agrees to indemnify Arconic harmless for all associated claims, costs and expenses. Supplier shall be responsible for proper removal, disposal and clean up costs due to such materials for which they supplied and/or shipped.
4/21/05	D	4/21/2005: Revised weight variance for packaged cooper shot, copper flake and copper powder. Allow for seudronic needles to be used as an approved material.
10/25/2006	E	Revised Section 4.4 Supplier Audits to include quality audit statement (Paragraph 4.4.2)
9/13/2013	F	Updates and modifications to make the specification more globally acceptable.
1/13/2017		Document modified to reflect changes in company name and contacts. No change to revision number.
11/13/2023	G	Updated Section 3.1.3 to specify heavy oxidation not allowed. Updated Section 3.6 wire sizing to conform to sizing specified in 47.0.2. Added Appendix to include copper oxidation pictures.



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Acknowledgement

The vendor shall indicate agreement to the subject specification as described below.

Arconic Metal Buyer
Arconic, Inc.
Knoxville, TN

Process Consultant – Casthouse MTE
Arconic, Inc.
Knoxville, TN

Technical Consultant - Casting
Technology
Arconic, Inc.
New Kensington, PA

Vendor: _____

Plant Address: _____

Check (√) one of the following:

____ We certify that we are in agreement with the subject specification and shall comply with all the requirements as written.

____ We certify that we are in agreement with the subject specification provided that the attached exceptions are incorporated.

Signature

Signature (2nd Optional)

Title

Title

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Appendix

Examples of copper oxidation per Section 3.1.

Acceptable:



Not Acceptable:

