



AEROSPACE MATERIAL SPECIFICATION

AMS7035™

Issued

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Precipitation Hardenable Steel Alloy, Corrosion and Heat-Resistant,
Powder for Binder Jet Additive Manufacturing,
16.0Cr - 4.0Ni - 4.0Cu - 0.30Nb
(Composition similar to UNS S17400)

RATIONALE

The purpose of this initial release is to produce a powder specification to cover alloy 630 powder, commonly referred to as 17-4 PH, for binder jet additive manufacturing applications.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant steel alloy in the form of pre-alloyed powder.

1.2 Application

This powder is intended to be used for the binder jet additive manufacturing (BJAM) of aerospace parts where oxygen and nitrogen are reduced during consolidation, but usage is not limited to such applications.

1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards that may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS7002 Process Requirements for Production of Metal Powder Feedstock for Use in Additive Manufacturing of Aerospace Parts

AMS7022 Binder Jet Additive Manufacturing (BJAM) Process

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Full document details: SAE AMS7035

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS7035/>

Documents

Document Sharing Hub

AMS7025 Metal Powder Feedstock Size Classifications

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B212 Apparent Density of Free-Flowing Metal Powders Using the Hall Flowmeter

ASTM B213 Flow Rate of Metal Powders Using the Hall Flowmeter

ASTM B214 Sieve Analysis of Granular Metal Powders

ASTM B243 Standard Terminology of Powder Metallurgy

ASTM B417 Apparent Density of Non-Free-Flowing Metal Powders Using the Carney Funnel

ASTM B703 Apparent Density of Metal Powders and Related Compounds Using the Arnold Meter

ASTM B822 Particle Size Determination of Metal Powders by Light Scattering

ASTM B923 Metal Powder Skeletal Density by He or Nitrogen Pycnometry

ASTM B964 Flow Rate of Metal Powder Using the Carney Funnel

ASTM E353 Chemical Analysis of Stainless Steel, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

ASTM E572 Analysis of Stainless and Alloy Steels by Wavelength Dispersive X-Ray Fluorescence Spectrometry

ASTM E415 Analysis of Carbon and Low-Alloy Steel by Spark Atomic Emission Spectrometry

ASTM E1019 Determination of Carbon, Sulfur, Nitrogen and Oxygen in Steel, Iron, Nickel, and Cobalt Alloys by Various Combustion and Fusion Techniques

ASTM/ISO 52900 Additive Manufacturing - General Principles - Terminology

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by chemical analysis in accordance with ASTM E1019, ASTM E353, ASTM E572, ASTM E415, or by other analytical methods acceptable to the purchaser. Carbon, sulfur, oxygen, and nitrogen content shall be determined by ASTM E1019.

Table 1 - Composition

	Min	Max
Carbon	-	0.07
Manganese	-	1.00
Phosphorus	-	0.040
Sulfur	-	0.030
Silicon	-	1.00
Chromium	15.00	17.50
Copper	3.00	5.00
Niobium + Tantalum	0.15	0.45
Aluminum	-	0.05
Nickel	3.00	5.00
Molybdenum	-	0.50
Tin	-	0.02
Oxygen	-	0.50
Nitrogen	-	0.35
Cobalt	-	0.40
Other Elements, Each (3.1.1, 8.10)	-	0.20
Other Elements, Total (3.1.1, 8.10)	-	0.50
Iron		remainder

3.1.1 Determination not required for routine acceptance with the exception of B, Mg, Ti (see 8.10), which shall be measured but reported collectively, with any other measured elements, as "Other Elements, Total."

3.2 Powder Production

Powder shall be manufactured in accordance with AMS7002, with the additional requirements defined in 3.2.1.

3.2.1 Melting

Melting shall be performed under one of the following conditions:

3.2.1.1 Air melting using electric or gas heat source, with or without an inert cover gas shroud. Molten material shall be converted to powder in an enclosed vessel using water and/or a fixed, controlled gas or gas mixture as defined in the PCD.

3.2.1.2 Melting in an enclosed vessel under a fixed, controlled atmosphere as defined in the PCD. If vacuum melting an argon, nitrogen, or helium gas, backfill after pulling vacuum is permissible. A fixed gas composition as defined in the PCD, or water, shall be used for metal atomization or powder spheroidization (see 8.12).

3.2.2 Powder Heats and Lots

Powder heats and lots definitions shall be in accordance with AMS7002.

3.3 Particle Size Distribution (PSD)

The particle size distribution shall be in accordance with the fine and coarse tolerances or limits for the metal powder feedstock size class, per AMS7025, specified in the purchase documents (see 8.3).

3.4 Apparent Density, Hall

Powder apparent density, Hall (AD_H) shall be 3.0 g/cm³ minimum, determined in accordance with ASTM B212.

3.4.1 If the powder is non-flowing and the apparent density cannot be determined using ASTM B212, the apparent density, Carney (ADC), shall be 3.0 g/cm³ minimum, determined in accordance with ASTM B417.

3.4.1.1 If the powder is non-flowing and the apparent density cannot be determined using ASTM B212 or ASTM B417, the apparent density, Arnold (ADA), shall be 3.2 g/cm³ minimum, determined in accordance with ASTM B703.