



AEROSPACE MATERIAL SPECIFICATION

AMS7055™

Issued

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Carburizing Steel Alloy, Powder for Additive Manufacturing
3.5Cr - 7.5Ni - 16.3Co - 1.75Mo - 0.2W - (0.10 - 0.15 C)
(Composition similar to UNS K92731)

RATIONALE

The purpose of this document is to produce a powder specification to cover carburizing steel alloy powder for additive-manufacturing applications.

1. SCOPE

1.1 Form

This specification covers a carburizing alloy steel in the form of powders in the form of a pre-alloyed powder.

1.2 Application

This powder is intended to be used in various additive-manufacturing applications for the production of aerospace parts where a combination of high core strength and core toughness is required. Such mechanical properties are achieved following further carburization thermal processing. Usage of powder controlled by this document is not limited to such applications.

1.3 Classification

Maximum oxygen concentration is specified as follows:

- Class A: Maximum oxygen concentration of 0.020% (200 ppm). Hall flow rate requirement.
- Class B: Maximum oxygen concentration of 0.025% (250 ppm).
- Class C: Maximum oxygen concentration of 0.045% (450 ppm).

1.4 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.

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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 +1 724-776-4970 (outside USA), www.sae.org.

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

AMS7025 Metal Powder Feedstock Size Classifications

AS7766 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 A751 Standard Test Methods and Practices for Chemical Analysis of Steel Products

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 B243 Standard Terminology of Powder Metallurgy

ASTM B417 Standard Test Method for Apparent Density of Non-Free-Flowing Metal Powders Using the Carney Funnel

ASTM B703 Standard Test Method for Apparent Density of Metal Powders and Related Compounds Using the Arnold Meter

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

2.3 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO/ASTM 52900 Additive manufacturing - General Principles - Fundamentals and Vocabulary

2.4 Definitions

Terms used in AMS are defined in AS7766. Definitions of terms used in AMS7055 are presented in ASTM B243, AMS7002, and ISO/ASTM 52900. The priority of definitions, unless otherwise stated, is: (1) this document, (2) AMS7002, (3) AS7766, (4) ISO/ASTM 52900, and (5) ASTM B243.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1 and Table 2, determined in accordance with ASTM A751 or by other methodologies acceptable to the purchaser. Carbon, sulfur, oxygen, and nitrogen content shall be determined by ASTM E1019.

Table 1 - Composition

Element	Min	Max
Carbon	0.10	0.15
Manganese	--	0.1
Silicon	--	0.1
Copper	--	0.04
Phosphorus	--	0.008
Sulfur	--	0.006
Chromium	3.0	4.0
Nickel	7.2	7.8
Cobalt	15.5	17.0
Molybdenum	1.5	1.9
Tungsten	0.10	0.30
Vanadium	--	0.06
Titanium	--	0.045
Aluminum	--	0.1
Oxygen	--	See Table 2
Nitrogen	--	0.015 (150 ppm)
Iron		Balance
Other Elements, each (see 3.1.1)	--	0.0025 (25 ppm)

Table 2 - Oxygen limits based on powder classification

Class	Percent Maximum
A	0.020 (200 ppm)
B	0.025 (250 ppm)
C	0.045 (450 ppm)

3.1.1 Other Elements

Determination not required for routine acceptance with the exception of B, Hf, Mg, Nb, Ta, Y, and Zr (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

Metal shall be melted in an enclosed vessel under vacuum, argon, or helium gas atmosphere or a fixed, controlled atmosphere as defined in the process control document (PCD). An argon or helium gas backfill after pulling vacuum is permissible. Air melting under a cover gas is not permitted. A fixed gas composition primarily comprised (i.e., >50 vol%) of either argon or helium gas, as defined in the PCD, shall be used for metal atomization or powder spheroidization (see 8.6).