CARPENTER ADDITIVE®

DATASHEET

PowderRange M300 LT

Applicable specifications: ASTM A646 (Marage 300)

Associated specifications: AMS6514, AMS6521, AMS6463, AMS-S-46850, ASTM A579 (73), SAE J1099 (A538C), MIL-S-46850, UNS K93120, K93130, K93160

Type analysis

Single figures are nominal except where noted.

Iron	Balance	**Nickel**	17.0–19.0 %	**Cobalt**	8.5–10.0 %
Molybdenum	4.50–5.20 %	**Titanium**	0.50–0.80 %	**Chromium**	0.25 %
Manganese	0.15 %	**Nitrogen**	0.10 %	**Oxygen**	0.10 %
Silicon	0.10 %	**Carbon**	0.030 %	**Phosphorous**	0.010 %
Sulfur	0.010 %				

Description

PowderRange M300 LT is an age hardenable martensitic tool steel with exceptional mechanical properties, specifically a high tensile strength and hardness. It is easily heat treated with superior mechanical properties being achieved after age hardening.

The high carbon tool steels such as H13 or M2, which are typically used in tooling and molding applications, are very difficult to process by conventional Laser Powder Bed Fusion. PowderRange M300 LT offers a comparable alternative in terms of mechanical properties, but with proven additive manufacturing suitability. PowderRange M300 LT maintains strict control over residual alloying elements to optimize for AM.

Key Properties:

- Exceptional strength
- Heat resistant to 900°F

Markets:

- Automotive
- Industrial

Applications:

- Tool inserts for molding and casting
- Tire sipes
- Functional components

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> PowderRange M300 LT

Powder properties

PART NUMBER	PowderRange M300LT F
APPLICATION	L-PBF[1]
MAXIMUM PARTICLE SIZE	Max 1 wt% > 53 µm[2]
MINIMUM PARTICLE SIZE	Max 10 vol% < 15 µm[3]
LSD PERCENTILE	D10, D50, D90[3], reported
ATOMIZATION	Vacuum Induction Melted, Nitrogen Gas Atomized
APPARENT DENSITY (G/CM³)	Measured according to ASTM B212[4] and reported
HALL FLOW (S/50G)	Measured according to ASTM B213[5] and reported

[1] ASTM/ISO 52900: Laser—Powder Bed Fusion (L-PBF), Electron-Beam Powder Bed Fusion (EB-PBF), Directed Energy Deposition (DED)
[2] ASTM B214 Standard Test Method for Sieve Analysis for Metal Powders
[3] ASTM B822 Standard Test Method for Particle Size Distribution of Metal Powders and Related Compounds by Light Scattering
[4] ASTM B212 Standard Test Method for Apparent Density of Free-Flowing Metal Powders Using the Hall Flowmeter Funnel
[5] ASTM B213 Standard Test Method for Flow Rate of Metal Powders Using the Hall Flowmeter Funnel
Testing of powder will fulfill certification requirements to Nadcap Materials Testing and ISO/IEC 17025 Chemical, per relevant ASTM procedures

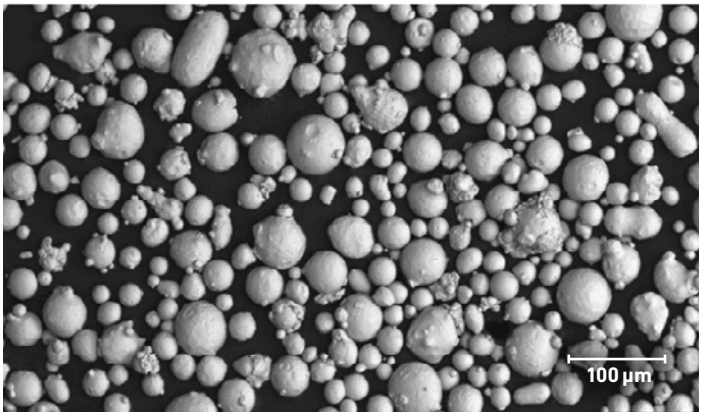

FIGURE 1—SEM IMAGE OF TYPICAL PowderRange M300 LT POWDER

> PowderRange M300 LT

Additive manufacturing process guidance

ASTM/ISO 52900: LASER-POWDER BED FUSION (L-PBF)	
Laser-Powder Bed Fusion (L-PBF) As-built	PowderRange M300 LT is compatible with all commercially available L-PBF equipment. To achieve mean, as-built density >99.9%, 20 to 60 µm layer thicknesses and Specific Energy ≥ 65 J/mm^3 is recommended.
Stress Relief, Solution Anneal and Age (SR/Sol/Age)	PowderRange M300 LT is typically stress relieved and solution annealed simultaneously following L-PBF. Annealing and solution treating are performed simultaneously by heating to 1500-1600°F (816-870°C) for a minimum of 30 minutes at temperature, followed by air cooling to room temperature. Following Solution Annealing, M300 is typically aged at 900°F (482°C) for a minimum of 3 hours followed by air cooling. **Schedules tailored better to the AM process thermal history may be available. Please contact Carpenter Technology for information.**
Hot Isostatic Pressed condition (HIP/Sol/Age)	We recommend HIP'ing as standard practice for microstructure homogenization; removal of residual spatter-induced voids, trapped gas porosity in powder and keyhole porosities; as well as to heal any shrinkage-induced micro-cracks in the material. **To achieve up to full density (100%):** Process components under inert atmosphere at not less than 14.5 ksi (100 MPa) at approximately 2050°F (1220°C); hold at the selected temperature for approximately 240 minutes or more. Follow with Solution and Age treatment as described above.
Machinability	PowderRange M300 LT is readily machined in the Solution Annealed condition (see above). Limited machining can be performed in the fully treated condition. Annealed hardness is typically 30 Rc.

> PowderRange M300 LT

Similar materials

COMPANY	ALTERNATIVE TITLE
Other Generic Names	Maraging Steel, ISO X3NiCoMo-Ti18-9-5
3D Systems	LaserForm Maraging Steel
GE Additive (Concept Laser)	M300
EOS	MS1
DMG Mori (Realizer)	—
Renishaw	—
SLM Solutions	1.2709

For additional information, please contact your nearest sales office:
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The mechanical and physical properties of any additively-manufactured material are strongly dependent on the processing conditions used to produce the final part. Significantly differing properties can be obtained by utilizing different equipment, different process parameters, different build rates and different geometries. The properties listed are intended as a guide only and should not be used as design data.

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