

# Meltio Tool Steel H11

Material Group: Tool Steels

A chromium-based steel alloy, it's one of the most commonly used tool steels, thanks to its outstanding impact toughness. H11 is widely used for hot tooling applications, in the manufacturing of dies, and in aerospace applications.

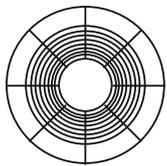
## Nomenclature Standards

EN ISO 14343 - A _____ S Fe3
Material N° _____ 1.2606

## Chemical Composition

C	Si	Mn	Cr	Mo	V	W
0.35	1.1	0.4	5.5	1.2	0.25	1.3

## Spool Specs



<b>Diameter</b>	1 mm
<b>Weight</b>	15 kg
<b>Volume</b>	1920 cm <sup>3</sup>
<b>Density</b>	7.81 g/cm <sup>3</sup>
<b>Spool Type</b>	BS300

## Applications



Aerospace industries



Tools and prototypes

## Mechanical Properties

Results show Meltio's wire LMD 3D printed specimens to perform at the same level as conventional manufacturing methods, with low deviations and near isotropic properties between vertical (XZ) print orientations.

		Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Hardness (HV-30)
<b>Wrought Properties</b>		1990	1650	9	558
<b>Meltio as Built</b>	<b>XZ</b>	1771.34	1170.14	3.46	561
<b>Meltio Post Temper Heat - Treatment</b>	<b>XZ</b>	2086	1735	12	558

## Heat Treatment

### HT.1 Annealing

- Heat up to 820°C hold for 4h
- Slow cooldown in oven

### HT.2 Hardening

- Heat up to 1025°C for 1h
- Forced air cooling

### HT.3 Tempering

#### First tempering

- Heat up to 550°C for 1h
- Air cooling

#### Second tempering

- Heat up to 550°C for 1h
- Air cooling

## Printing Parameters Used

Print Speed	Deposition Width	Layer Height	Laser Power
300 mm/min	1 mm	1.2 mm	1100 W

## Tomography

In this tomography we can observe the internal structure of the material and see its good density, absence of porosity or internal defects that put at risk the structure of the sample.

The resolution used for the CT inspection is 24 micrometros por pixel.



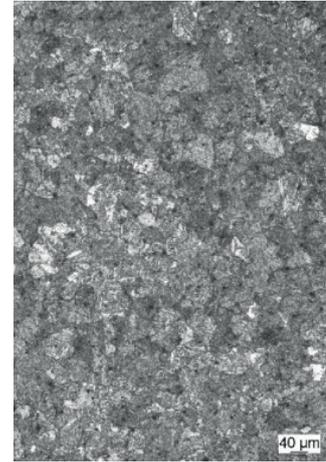
## Metallography

The microstructure in "As Build " state for H11 is composed mostly of tempered martensite, fresh martensite and helded austenite. The morphology of the grains vary in dependance on the orientation of the paths, it's possilbe to identify columnnar grains that follow the direction of the solidification front of the meltpool. After the heat treatment the presence of austenite has been reduced drastically, leaving all the martensite tempered. The grain size has been refined during the process showing an equiaxial morphology.

Before Heat Treatment



After Heat Treatment



**Shielding gas: Argon > 99.996% purity.**

Machine Used: Meltio M450

**Laser System: 6x200W Fiber coupled diode lasers. 976nm wavelength.**

\* Data represent tycal reference values from Worught and Cast material classification compared to Meltio (M450) vertical (XZ) specimens extracted from 3D printed walls and tensile tested according to UNE EN ISO 6892-1

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