

Maraging Steel for Die Casting Cores

Maraging steels harden by a low temperature age instead of a quench, so a core stays close to the size it was machined and still holds its strength at temperature. The tables below give the four grades in general service, their composition, the treatment that takes them from annealed bar to aged core, and the dimensional change that has to be allowed for in the machining.

Reference only. This is a reference summary of a published source and it is not a specification of ours. The values are reproduced from the source, which gives them as nominal analyses and property values for named commercial materials. What a particular die or machine reaches depends on the design, the alloy being cast and the cycle. Final specification is confirmed on the job.

Why a maraging steel instead of a hot work steel

The four grades in general service

Grade	C	Mn	Si	Mo	Ti	Al	Ni	Co
18 Ni 1400	0.03	0.1	0.1	3.0-3.5	0.15-0.25	0.05-0.15	17-18	8-9
18 Ni 1700	0.03	0.1	0.1	4.6-5.1	0.3-0.5	0.05-0.15	17-19	7-8.5
18 Ni 1900	0.03	0.1	0.1	4.6-5.2	0.5-0.8	0.05-0.15	18-19	8-9.5
18 Ni 2400	0.01	0.1	0.1	3.5-4.0	1.6-2.0	0.1-0.2	17-18	12-13

Nominal composition of the four maraging steel grades in general service for die casting cores, in weight percent. Manganese and silicon are in effect 0.12 percent maximum, but the total of manganese plus silicon must not exceed 0.2 percent. Iron balances the analysis in every grade.

From annealed bar to aged core

Step	Temperature	Hold and cool	Hardness after
As supplied, annealed	Not applicable	Not applicable	About 30 HRC, and easy to machine
Solution treatment	800 to 900 C	Cool in air or oil, fast enough to prevent age hardening	Soft martensite, ready for final machining
Age hardening	480 C	6 to 9 h according to section thickness, then air cool	About 50 to 54 HRC
Higher ageing temperature	Above 480 C	A shorter hold	A lower hardness

The treatment sequence for a maraging steel core. Machining is done before the age so that the small dimensional change of the age falls on the finished part and not on the stock to be cut.

The dimensional change that decides the machining allowance

Grade or condition	Dimensional change after ageing at 480 C	What drives it
18 Ni 1400	Less than 0.0004 mm per mm	The lowest titanium content of the four grades
18 Ni 1900	Less than 0.0008 mm per mm	A higher titanium content
Higher ageing temperature	A greater shrinkage	Must be allowed for in the machining

Dimensional change during the age hardening of maraging steel grades at 480 C, and the titanium content that drives it.

Repair welding a die with a maraging filler

Where maraging has worked and where it has not

Where to go next

Aobo Steel, tool steel supplier

Aobo Steel supplies tool steel to distributors and mold, tool and die shops, including D2, D3, DC53, A2, O1, H13, H11, H10, H21, S7, M2, M42, L6, P20 and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates.

Source, Die Casting Metallurgy, A. Kaye and A. Street, Butterworths Monographs in Materials, 1982.

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