

Carbon Penetration in Gas Carburizing

Carbon content in each half millimetre layer of a round bar after seven hours in carburizing gas, at temperatures from 700 to 1150 degrees C, and the temperature at which the case stops growing in a controlled way.

Reference only. The values on this sheet are reproduced from the source named at the foot of it. They are a published reference rather than a specification of ours, and the sheet carries no tolerances. A round bar was exposed to illuminating gas for seven hours at each temperature, then turned down half a millimetre at a time and each layer analysed for carbon. A dash means the source gives no figure for that layer. The figures are experimental values and actual results vary with the atmosphere, the steel and the furnace.

Per cent carbon in each 0.5 mm layer, seven hours in carburizing gas

Source, the carburizing table on printed page 122 of The Heat Treatment of Tool Steel (Harry Brearley), which is PDF page 140 of the copy consulted.

Temperature	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5
700 °C	0.096	0.045	0.036	—	—
800 °C	0.210	0.105	0.048	—	—
900 °C	0.363	0.210	0.057	—	—
1000 °C	0.579	0.321	0.241	0.152	0.091
1050 °C	0.594	0.365	0.332	0.212	0.150
1100 °C	1.522	1.487	1.284	1.147	0.988
1150 °C	1.637	1.604	1.382	1.330	1.195

A round bar was exposed to illuminating gas for seven hours at each temperature, then turned down half a millimetre at a time and each layer analysed. Values are per cent carbon as the source publishes them. A dash means the source gives no figure, which is why the three lowest temperatures carry no reading below the third layer.

At 1000 degrees C the first layer reaches 0.579 per cent and the fifth has fallen to 0.091 per cent, a drop of roughly six to one across 2.5 mm. The gradient is what a machining allowance has to clear. If a shop takes off a quarter of a millimetre after carburizing to true up a surface, it removes part of the richest layer and the finished case starts softer than the table suggests. The same reading works in the other direction when a part is ground after hardening.

The 1100 and 1150 degrees C rows also show how quickly the profile flattens once the surface is saturated. Layer 1 and layer 2 differ by only 0.035 per cent at 1100 degrees C and 0.033 per cent at 1150 degrees C, against 0.258 per cent at 1000 degrees C. Once the surface can take no more carbon, further time and temperature push carbon inward instead of upward, and the case grows deeper rather than richer.

Aobo Steel, tool steel supplier

Aobo Steel supplies tool steel to distributors and mold, tool and die shops, including D2, D3, O1, O2, A2, S7, H13, H11, H10, H21, M2, M42, L6, P20 and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates.

Compiled from The Heat Treatment of Tool Steel (Harry Brearley), the carburizing table on printed page 122, from experiments by R. Bruch published by the Metallurgical School at Aachen. The figures are reproduced from the published table and are a reference summary rather than an Aobo Steel specification.

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