

# Japanese White & Blue Steels

The blades of western woodworking tools are most commonly made of either O-1 or A-2 tool steel. The former preferred for edge quality, the latter for edge retention. Japanese chisels and plane blades are for the most part made of different tool steels. Japanese tools are either of White Paper steel (Shirogami) or Blue Paper steel (Aogami). The colours referring to the paper used to wrap the steel by the manufacturer, Hitachi Yasugi.



Over 1,500 years ago Japanese smiths perfected a method of smelting steel that had a high degree of purity. Using charcoal as a fuel rather than coke, they smelted iron sands obtained from the bed of the Hino River. The result, known as Tamahagane steel, was used to produce the legendary Samurai swords, famed for their incredible sharpness.

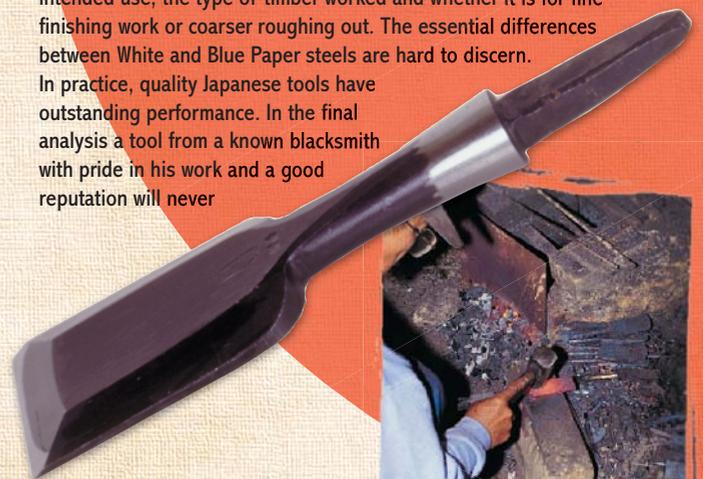
The city of Yasugi is the traditional centre of Japanese steel making. Hitachi Metals Ltd of Yasugi now produces the steels that maintain the renowned quality of Japanese tools. These carbon steels use high quality iron sand smelted using methods similar to those used to make traditional sword steel. They have the highest purity of any commercial steel used for making tools and are commonly forge-welded to a softer wrought iron base to make high quality laminated blades. Sometimes termed Yasuki steel or YSS, the steel used by Japanese tool makers is Hitachi's YSS High Class Cutlery steel and the colour of the wrapping paper denotes its type.

To the naked eye, White Paper steel and Blue Paper steel look identical; the difference lies in their composition. White Paper steel begins with JIS SK steel which after undergoing several purification processes becomes White Paper steel #2. This pure form of high carbon steel contains 1.05-1.15% carbon, with very low levels of sulphur and phosphorus. Further processing of White Paper steel #2 and adding more carbon produces White Paper steel #1. The additional carbon increases hardness, but decreases toughness. Taking White Paper steel #2 and adding tungsten and chromium as alloying agents, results in Blue Paper steel #2. A further addition of more carbon, tungsten, and chromium creates Blue Paper steel #1, with an increase in hardness but again a decrease in toughness. Finally, if you then take Blue Paper steel #1, add more carbon, more tungsten plus molybdenum and vanadium, you get Super Blue steel, which has even more abrasion resistance. A fine balancing act, additional amounts of carbon in the steel decrease the toughness but increase the potential hardness. Alloying it with other elements increases abrasion resistance, but of course as sharpening is an abrasive process these steels are harder work to bring to a good edge. White paper steel (Shirogami) is one of the purest steels available anywhere in the world. Similar to crucible steel it is extremely fine grained and once forged and heat treated, displays phenomenal sharpening and edge holding characteristics. Blue Paper Steel (Aogami) slightly alloyed carbon steel is tougher and more resistant to wear. To put things into context, compared with their western equivalents, white and blue paper #2 steels contain more carbon than either O-1 (0.9%) or A-2 (1.0%). Just as O-1 is easier to sharpen but A-2 holds an edge longer, white and blue paper steels are similar except the Japanese steels will harden to a much higher degree.

The steel used to make a tool isn't the whole story; a further factor lies in the skill of the blacksmith. Although White paper steel is cheaper than Blue, it requires greater precision to produce a quality tool. The temperature range necessary to correctly anneal, harden and temper White Paper steel is much narrower.

When purchasing any tool, any decision also needs to take into account its intended use, the type of timber worked and whether it is for fine finishing work or coarser roughing out. The essential differences between White and Blue Paper steels are hard to discern.

In practice, quality Japanese tools have outstanding performance. In the final analysis a tool from a known blacksmith with pride in his work and a good reputation will never



*Japanese chisel blade forged with White Paper Steel #2*

