**KR's Knife Steel Notes**
Updated 3/07

The 3 primary goals in creating blade steel: (1) Toughness, to resist deformation & shattering, which is of major concern in a hard-use or survival type knife which you might use to hack wood or drive through soft metals (toughness is the main nemesis of stainless steels, but many non-stainless steels are tough); (2) Edge holding, to resist dulling, which is of major concern when repeated slicing is called for, or you don't care to resharpen frequently (high carbon content and vanadium are often mentioned as key to edge holding); & (3) Corrosion resistance, of major concern to those using knives in salt-water or acidic environments. Corrosion also dulls the edge, so it's not just a cosmetic concern. Non-stainless steels aren't really competitive in this category unless they're coated or otherwise cared for.

This list doesn't consider some of the exotic blade materials such as ceramic (very brittle) or titanium (not a good choice for a blade, unless you are probing land mines that have magnetic triggers!) If a knife has a stainless blade, but doesn't say what kind of stainless it is, you may assume with reasonable confidence it's 420 or 440A or similar, which are very common steels that may be stamped. Once you get to 440C and upward, makers typically mark the type of steel because good steel is a selling point. There are a few exceptions to this rule, of course, such as Queen using ATS-34 steel in some of its 1990 knives without advertising it on the blade.

Regarding a bibliography, this is a collection of informed discussions I've found on the web, but I did not keep precise references for this material. MMost comments are direct quotes, so to find the source, you can copy and paste a sentence into Google. See the partial bibliography below--that will get you to most of the sources, but not all. There is of course considerable opinion mixed in with fact, as steel nuts are highly opinionated about their favorites.

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**8Cr13MoV**. "It has similar properties to AUS-8…" [which is not saying much]. A Chinese steel with similar performance characteristics to AUS-8. An excellent value priced steel for its performance. "8C13CrMoV is basically an upgrade to 13C26 in terms of wear resistance while reducing

edge stability. Thus it offers better extended slicing aggression though lower optimal push cutting sharpness and high sharpness edge retention."

**9Cr13CoMoV:** A Chinese made high-carbon stainless steel with increased levels of cobalt [compared to what?] added for greater edge retention. Offers a higher level of corrosion resistance at a great value.

**12C27** & 425M– Both very similar to 440A. 425M is used in Buck knives and the 12C27 is a Scandinavian material that is used in Finish and Norwegian knives. Both are less rust resistant.

**20CV** – a stainless steel. "Highly wear resistant, powder metallurgy stainless tool steel. Has a high wear, high corrosion, good impact toughness and very polishable."

**154CM**: "American made premium grade stainless steel that was initially developed for the blades in jet engines. It is the predecessor of ATS-34 steel. Has good corrosion resistance and excellent toughness and edge quality."A high grade steel. Considered by some as a Super Steel. Almost the same as "old" ATS-34. The US version of ATS-34. "154CM is modified 440C. 154CM/ATS-34 is a high carbon stainless steel generally regarded as a direct upgrade to 440C. It has a high wear resistance for a stainless steel and a low edge stability. It is one of the more brittle stainless steels and therefore works best on smaller blades indended for extended aggressive slicing." "Some 154CM made from the late 1980's to the mid 1990's was not as good as ATS-34 [due to a relaxation of the quality of processing, which several sources say has once again improved to previous standards]." "An American made premium grade stainless steel originally developed for tough industrial applications. Known for its best all-around qualities, it offers great corrosion resistance with good toughness and edge quality."

**420**: Widely denigrated. Avoid. Easy to sharpen. Popular with knife makers because it can be stamped. Extremely soft, and it doesn't hold an edge well. It is used often for diving knives, as it is extremely stain resistant. Variations are 420HC, 420J2, which is singled out as: "low achievable hardness and poor edge retention, but good corrosion resistance. Used in poor quality knives as it is easy to shear, grind, and heat treat."

**420HC**: 420HC is a medium carbon martensite stainless which has a corrosion resistance similar to Sandvik 12C27 and but has a lower hardness

and wear resistance than 12C27M. It offers similar ease of sharpening and relatively high edge stability due to the low carbide fraction.

**420J2** – Low carbon, high chromium that is a shock absorbing steel that bends instead of breaking. Has excellent resistance to corrosion and fair edge holding. Does not require a lot of maintenance. Rockwell hardness seen at 54-56. "420J2 is a low carbon martensite stainless, commonly used in fantasy knives and low end cutlery. It is also used as liner material for folding knives. It has a low hardness and wear resistance for a cutlery stainless steel but is fairly tough and very corrosion resistant." Also showing up as cladding material in laminated steel blades, since its qualities are ideal as an outer coating.

**420V**: Not really part of the 420 series. Opinion seen that it's better than BG-42 and VG-10, and also tough. Don't know much about this steel.

**440 Series**: 440 A - 440 B - 440C The carbon content (and hardenability) of this stainless steel goes up in order from A (.75%) to B (.9%) to C (1.2%). 440C is an excellent, high-end stainless steel, usually hardened to around 56-58 Rc. All three resist rust well, with 440A being the most rust resistant, and 440C the least. The SOG Seal 2000 is 440A, and Randall uses 440B for their stainless knives. 440C is fairly ubiquitous, and is generally considered the penultimate general-use stainless (with ATS-34 being the ultimate) [this is old information, probably written early 1990s]. If your knife is marked with just "440", it is probably the less expensive 440A; if a manufacturer had used the more expensive 440C, he'd want to advertise that. The general feeling is that 440A (and similar steels) is just good enough for everyday use, especially with a good heat treat (we've heard good reports on SOG's 440A heat treat). 440-B is a very solid performer and 440-C is excellent.

**440**: Widely denigrated. Avoid. Easy to sharpen. Popular with knife makers because it can be stamped. Comes in multiple grades: 440A, 440B, 440C, 440F, 440F-Se, 440XH, 440C.

**440A**: Widely denigrated. Avoid except as an outer lamination. "Resistant to corrosion, reasonably tough, and easy to sharpen." Popular with knife makers because it can be stamped. Softer than 440C."

**440B –** Same properties as 440A except carbon content (440A has 0.75% and 440B has 0.95%).

**440C**: 440C was originally developed for jet engine blades. For a long time, 440C was used extensively in custom knives. While its popularity has waned in favor of the other newer high performance steels, 440C remains a true workhorse steel that still has a large following of users. 440C is an excellent, high-end stainless steel, usually hardened to around 56-58 Rc. All three resist rust well, with 440A being the most rust resistant, and 440C the least. 440C is fairly ubiquitous, and is generally considered a very good general-use stainless, tougher and more stain resistant than ATS-34 but with less edge-holding. "440C is the basis in which most steels are compared as for this year [year unknown, but this is probably old information] it has, and to a degree still is, what the industry standard has been. It has good edge retention, great corrosion resistance, good impact resistance, is easy to sharpen, and relatively low cost." Exhibits good corrosion resistance, which is a reason why steels such as 440A and 440C are used for whitewater/dive knives and kitchen knives knives that are subject to marine environments or high moisture. [Recently high end mfgr's have moved to H1 for corrosion resistant knives, see below]. "High-carbon chromium stainless steel with good hardness and exemplarily corrosion resistance. This steel takes a good edge and easily comes back. A fair priced steel with performance." "A high-chromium stainless steel with a terrific balance of good hardness and corrosion resistance. 440C takes a nice edge and is fairly easy to resharpen. An excellent value priced steel for its performance." "440C is an excellent, high-end stainless steel, usually hardened to around 56-59 Rc, very tough and with good edge-holding at that hardness. 440C is generally considered a very good general-use stainless, tougher and more stain resistant than ATS-34 but with less edge-holding. I keep the hardness down to a maximum of 59 Rockwell C scale. Any harder than that I have experienced a fine gray line of edge chips when attempting to put the final edge on it. It makes excellent fillet knives at 56 Rc that will take 90 degee bends on 10" blades. Also makes very good kitchen cutlery at 56 Rc." "440C has an increased hardness and carbide fraction than 440B and thus offers a higher wear resistance but lower edge stability. 440C can be considered to be a high wear upgrade to 12C27 where a high edge stability isn't desired. However for this purpose, other alloys are generally regarded as superior such as 154CM." "440C (in theory) isn't the best steel for very acute edges." [Glowing reports of 440C are largely from the 1980s and 1990s when it was still a competitive steel – my impression is that it's the "minimum acceptable standard" to many afficionados today.]

**440V**: Not really part of the 440 series. Opinion of some to be better than BG-42 and VG-10. See discussion of CPM T440V below – same steel, different name? Some opinion says that it's a steel whose time has come and gone already. It's apparently the same as S60V. Difficult to sharpen.

**440XH** - Air-hardening alloy with high carbon and high chromium. It is corrosion resistant and can be described as a high hardness 440C stainless steel or a corrosion resistant D2 tool steel. Possesses corrosion resistance equivalent to 440C.

**1095** – High carbon alloy that is intended for high hardness and strength, but is susceptible to being brittle. Will rust if not protected. Not a corrosion resistant alloy, not a stainless steel.

**A-2**: Extremely tough, for high end combat knives. Great shock resistance. Tool steel, not stainless steel. "A2 is a tool steel used primarily by Chris Reeve in his Hollow Handled Fixed blades. It sports edge retention slightly less than D2, less corrosion resistance, and amazing impact resistance. In theory, a fixed blade should consider impact resistance above all others. (Opinion: "Reeve uses a coating on his blades which are one of the best in the business.") The heat treating makes these blades have a great edge retention...overall, I would tell you A2 is far superior to D2." "A2…one session in the kitchen and it's stained and pitted." "Keep in mind the major selling point of A2 is extreme impact resistance and good edge retention." "High Carbon, low chromium steel with improved toughness and abrasion resistance. Very receptive to corrosion and needs care. If Cryogenic treated, then toughness is increased and will have excellent edge holding capabilities." Commented on as a sort of gold-standard for toughness, which is "the main nemisis of stainless steels."

**ATS-34**: A high grade steel. Similar to 154CM, but is made in Japan. "The reigning king of 10 years ago [mid 1990s]." Most opinion is that BG-42, VG-10, S30V are upgrades to ATS-34. "ATS-34 has been the hottest high-end stainless in the 1990s." "154-CM is the original American version, but for a long time now has not been manufactured to the high quality standards knifemakers expect, so knifemakers switched over to ATS-34. But CPM is once again making a high-quality 154-CM." ATS-34 is a Hitachi product that is very, very similar to 154-CM. Normally hardened to around 60 Rc, (usually 59-61) it holds an edge very well and is tough enough even at that high hardness. Not as rust resistant as the 400 series. "ATS-34 is an older

1990s steel. It has great edge retention, so/so impact resistance, and horrible corrosion resistance. I have had many rust on me. It was replaced by 154CM, the first 'official' super-steel, and 154CM has been replaced by S30V (hold Benchmade which still uses 154 extensively) which is better than either in all three elements. Oddly enough, ATS-34 has seen a market resurgence as of late [due to low prices], and some William Henry Knifes still use it." "Japanese steel that is owned by Hitachi Steels that is a premium grade of stainless steel. 154CM is the American version of ATS-34. Steel made famous by Bob Loveless." One Forumite is already calling this a "dinosaur" steel that has made a bit of a comeback due to its low price. ATS-34 is more rust prone than other stainless steels.

**ATS-55**. "Japanese stainless steel similar to ATS-34, but with better edge holding capabilities and toughness." Gives ATS-34 like performance, cheaper because not a high speed steel like ATS-34. "ATS-55 Similar to ATS-34, but with the moly removed and some other elements added. Not much is known about this steel yet, but it looks like the intent was to get ATS-34 edge-holding with increased toughness. Since moly is an expensive element useful for high-speed steels, and knife blades do not need high speed, removing the moly hopefully drastically decreases the price of the steel while at least retaining ATS-34's performance. Spyderco is using this steel." "ATS-55 is something toyed mainly with by Spyderco. I cannot say too much about it but it did not seem as rust prone as ATS-34. ATS-55 was replaced by VG-10."

**AUS** series. AUS-4, AUS-6, AUS-8, AUS-10. [I don't like 'em, consider them equivalent to the 440 series.] "They're sort of the Japanese version of the 440 line."

**AUS-4**: Even worse that AUS-6, in the new CRKT line. Some opinion is that it "Dulls like pencil lead." Like 440A.

**AUS-6**: Japanese. Denigrated. Avoid. Some opinion is that it's better than 420, 440A but not much. Easy to sharpen. Loses edge quickly. "Even 440C is better." Falls between 420 and 440A. "Resistant to corrosion, reasonably tough, and easy to sharpen." Some say this is similar to the steel used in swiss army knives. Popular with knife makers because it can be stamped. Like 440B.

**AUS-8**: Japanese. “Not a premium steel but it does the job.” (Some people like AUS-6 better than 8!) Popular with knife makers because it can be stamped. Considered “a mid grade steel.” Durable. Like 440C. “It won't hold an edge like ATS-34.” “AUS-8 is a steel with similar properties to 440C. Some people love this, some people do not. I am in the latter as I do not find it to have edge retention anywhere near to other comparable steels. Companies usually use this on their entry level models.” (Also referred to as 8A) Japanese stainless steel with high-carbon, low chromium stainless steel that has a good balance of toughness, corrosion and edge sharpness. “A Japanese made medium-carbon, high chromium stainless steel, which offers a good balance of toughness, edge sharpness and corrosion resistance.” “However in general, in most knives it is run very soft so it tends to function as more of a tough knife than a cutting tool.”

**AUS-10**: AUS-10 has roughly the same carbon content as 440C but with slightly less chromium, so it should be a bit less rust resistant but perhaps a bit tougher than 440C. “Japanese stainless steel that has the same carbon content of 440C with less chromium and is less rust resistant than 440C.”

**BG-42**: “BG-42, an older ball bearing steel, was abandoned in favor of newer steels because BG-42 is amazingly hard to heat treat.” It’s like ATS-34 but it adds Vanadium. Bob Loveless announced recently that he's switching from ATS-34 to BG-42. BG-42 is somewhat similar to ATS-34…. look for significantly better edge-holding than ATS-34. The addition of vanadium and the clean manufacturing process also gives BG-42 better toughness than ATS-34. Excellent for kitchen knives. “BG-42 is a very high purity, high wear, martensitic stainless steel which offers very high heat resistance [which is of no consequence for knives, usually]. It is generally regarded to be in the same class as 154CM but better in most respects.” “High wear and corrosion resistance that produces an outstanding edge retention and longer life. Found to be similar to ATS-34 steel.” “Is somewhat similar to ATS-34, with some major differences: It has more manganese and molybdenum than ATS-34, and has 1.2% vanadium (ATS-34 has no vanadium), so look for better edge-holding than ATS-34. BG-42 is usually hardened to 61-63 Rc.” “BG-42 is a very high purity, high wear, martensitic stainless steel which offers very high heat resistance. The hot hardness is likely not of significant benefit for knife blades but the other attributes often cause it to be highly praised among discriminating users. It is generally regarded to be in the same class as 154CM but better in most respects for cutlery.” One forumite prefers BG-42 to VG-10 and S30V, but

few knife makers are using BG-42 anymore. “For the smaller and thinner edges BG-42 works well and holds the edge longer than ATS-34, however for the large, heavy-duty blades you can't really tell the difference.”

CPM 3V is still the undisputed toughness champ even surpassing some carbon steels like A-2. Don’t know much about this steel otherwise.

**CPM154**, CPM S60V (formerly CPM440V) – a powdered steel. See separate entry.

**(CPM) S30V** (aka SV30?), “A super steel,” but controversy surrounds it and opinions run strong about it. Considered among the best of the best, currently (mid 2000s). A high grade steel. A super steel. Super high carbon content (due to its powder construction). Specifically formulated for knives. More popular than S60V or S90V. SV30 is a powdered steel. Developed by Crucible Metals Corporation specifically for the cutlery market. “CPM-S30V was the first steel designed exclusively for knives, pioneered by Chris Reeve. It is an American steel, made by Crucible Materials Corporation in Syracuse, New York. When hardened correctly, it runs 58-60 on the Rockwell Hardness Scale with a pleasing edge retention even when sharpened on a 30 degree bevel, sports an impact resistance far superior to 154CM, D2, and 440C, has amazing pitting resistance, and is relatively easy to sharpen. While some people have reported issues with chipping, when hardened to a 59 HRC, this steel does not have this issue unless abused badly. Some people claim S30V is not impact resistant, but realistically, Strider abuse tests show how impact resistant properly made S30V steel is. This steel is not cheap and if it would not do the job, something else would be used. While obviously not as impact as high grade tool steels, it is one of the, possibly the most, impact resistant stainless steel.” [[The other side of the story & the controversy surrounding S30V: “Problems with S30V have been frequently reported on internet discussion forums just cutting soft materials such as cardboard, corn stalks, plastics and wood. (… After 100 cuts in cardboard, the Spyderco S30V had chipped in half a dozen places…the Benchmade Skirmish couldn’t be evaluated because the edges of both would not even sharpen due to the steel fracturing under the hones…) The frequency of defects is so high that users have reported several defective blades. Commonly it is found that S30V blades tend to blunt by chipping at a microscopic level. S30V is a powder metallurgy martensitic stainless steel made by Crucible. It has a high wear resistance which gives it high slicing edge retention on abrasive materials such as cardboard. Frequent

problems with edge chipping have been reported on online discussion forums, the performance was inconsistent in the blades used both in regards to edge retention and toughness…problems with the edge durability at low angles have been reported...” “S30V is more prone to small chips initially (sharpening the blade reduces this dramatically). Guys pry with their Striders and they are S30V. I've pried with my Manix and it did fine. 154CM breaks.” “As far as S30V chipping, it does. The prevelence of it is still disputed. I have never had it happen to me personally, but I only own about 40 S30V knives and almost all are Spyderco sporting an edge geometry which has been tested, revised, and proven for about 30 years. I do not use any other knife hard, hold the Sebenza which is also S30V. However, I do use my S30V Spyderco knives hard and do use them for chopping which is where the steel's toughness excels.” “We've all heard that even cruicible is working on other steels and is promoting CPM 154 cm, and now CP M4 over S30V.” “People talk about when they say about S30V that "it ( chipping) went away after a few sharpenings", which we have all heard.” “Sal [Spyderco’s CEO] has also said in the past that the chipping resistance of s30v versus other stainless steels is about the same.”]] “For what it's worth, S30V can be hardened to RC61 without becoming more brittle.” “An American made and developed premium grade stainless steel created especially for knives. It is a powder made steel with a uniform carbide distribution and clean steel properties. As a blade material it offers excellent corrosion resistance and superb edge qualities.” “S30V is the only steel on the market that has been designed for knifemaking. Its alloys have been chemically blended to bring out the best qualities of edge holding, toughness and stain resistance. Manufactured by Crucible, it too like S60V is made from powdered alloys heated in a cannister to bonding temperature. The resulting billet is then rolled or forged by conventional mills into sheets and bars. Edge holding is incredible! I personally find S30V easier to sharpen than BG-42 and S60V.” “In time CPM S-30V may hold the place as the best all purpose work horse stainless steel. It could edge out more widely known stainless steels like ATS 34, 154CM, BG-42 & 440C.” “S30V has higher wear resistance than VG-10. S30V will take about twice as long to sharpen compared to VG-10.” “Hardness is 58-61 with about 59-60 being ideal. It has an edge rention slightly higher than D2, considerably higher than 154, and much higher than 440C.  S30V also has an impact toughness about 4-6 times the toughness of 154 or 440. In terms of pitting, the test will speak for itself, but S30V crushes everything short of H1. In terms of wear resitance, S30V is actually better than S3V although S3V is undoubetly the toughest steel on the market. Spyderco, Strider (which in the thread here has been

shown to be the tank of knives), Microtech, Kershaw, Chris Reeve, Bradley Cutlury, Lone Wolf, others (and now finally Benchmade although they love their 154) are all using S30V exclusively or on their top knives. [Zac]"

**(CPM) S60V**: A high grade steel. A super steel. Super high carbon content. CPM S60V had shown promise, but had issues with hardness and chipping. – a Powdered Steel. "CPM-440V is also known as CPM-S60V. It was really pioneered by Spyderco and sports amazing corrosion resistance only losing to H1. It is notoriously the hardest steel to sharpen, and is rather low on the Rockwell Hardness Scale. Still people love the edge retention so the HRC may not say everything." A corrosion and wear resistant tool steel. It is basically 440C steel with greater blade toughness. "S60V is a steel that holds an edge superbly. This steel is made with Crucible's particle metallurgy process, a process that allows it to be packed with more alloying elements than traditional steel manufacturing methods would allow. Its very high vanadium content forms some vanadium carbides during the tempering process which accounts for the great edge holding. Depending on heat treatment, expect to have to work a bit harder to sharpen this steel. Don't expect ATS-34 type toughness. Due to the vanadium carbides that develop during heat treating, edge holding isn't dependent upon steel hardness alone, so it is typically hardened to just 57 Rc which helps hold down brittleness." Difficult to sharpen.

**(CPM) S90V**: A high grade steel. A super steel. Super high carbon content. (formerly CPM420V) – a Powdered Steel. Basically the same steel as CPM-S60V steel but with a better impact toughness. "CPM S-90V was introduced as an upgrade for CPM S-60V and met all the targets of improved corrosion resistance and toughness." "Again courtesy of Joe Talmadge: S30V - S60V (CPM T440V) - S90V (CPM T420V) Two steels that hold an edge superbly, world class type edge holding, but it can be difficult to get the edge there in the first place. These steels are made with Crucible's particle metallurgy process, and that process allows these steels to be packed with more alloying elements than traditional steel manufacturing methods would allow. Both steels are very high in vanadium, which accounts for their incredible wear resistance. Spyderco offers at least one model in CPM S60V. Spyderco, one major user of S60V, has cut back hardness down to 55-56Rc, in order to keep toughness acceptable, but that sacrifices strength so there is a tradeoff. S90V is CPM's follow-on to 440V, and with less chromium and almost double the vanadium, is more wear-resistant and tougher than S60V -- and, in fact, is probably more wear-resistant than any other stainless steel used in

the cutlery industry. As such, S90V is in the running with steels like BG-42 as among the best general-purpose stainless steels; however, S90V is even more expensive and difficult to work than BG-42, so it's strictly in the realm of custom makers currently.."

**CPM 440 V** See CPM T 440V

**CPM T440V** – "Also known as "Super Steel". "Outlasts all other stainless steels." Hard to resharpen, because of edge retention, but does not have to be sharpened as often. Used mainly by custom knife makers." With CPM T420V Two steels that hold an edge superbly, world class type edgeholding, but it's difficult to get the edge there in the first place. For 440V, don't expect ATS-34 type toughness. 420V is CPM's follow-on to 440V, and with less chromium and almost double the vanadium, is more wear-resistant and may be tougher than 440V. "440V is also known as 'Super Steel.' Outlasts all other stainless steels. Hard to resharpen, because of edge retention, but does not have to be sharpened as often. Used mainly by custom knife makers."

**D-2**: Hard to sharpen compared to 440C. Good edge retention. A "semi stainless" steel, 1% less than needed to claim stainless. It has excellent edge holding, but may be a little less tough than some of the steels mentioned above. And it does not take a beautiful finish [I disagree, Queen makes beautiful high-polish D-2 blades]. Bob Dozier uses D-2. "D2 is a tool steel which is seen on Randall (I think), Benchmade, Microtech, Queen, and a few others. It has an excellent edge retention, is said to have good edge retention (although I have had experiences otherwise), and is a relatively brittle steel." "D2 is a tool steel known for high wear resistance through its very heavy chromium carbide content and high obtainable hardness. In general it makes a nice steel for fine cutting blades, at moderate sharpening angles, and especially for coarse finishes. The corrosion resistance is high for a tool steel, though it tends to pit readily in salt water soaks, and the resistance to impact is also low." Air hardened tool steel. Good corrosion resistance. A good choice for hard use environments because of good corrosion resistance and excellent mileage. "An air-hardened tool steel, which offers good corrosion resistance and excellent mileage in wear resistance. A good choice for hard use applications." "In edge retention on hemp rope the D2 blade could cut double the amount of the VG-10 blade before achieving a similar state of significant blunting, and the VG-10 knife 50% more than the AUS-8A. When the influence of corrosion was added by

soaking the blades in lemon juice, the D2 blade was far behind the two stainless steels which were similar in edge retention on the hemp. The VG-10 blade consistently showed the lowest durability and the D2 the highest….one of the drawbacks for D2 in large blades as when it accidently hit a rock the edge chipped readily…" A forumite states that D2 has been "constantly shown to have properties inferior to S30V." Hardness seen from 56-62.

**G-2** Tool steel, not stainless steel. See GIN-1.

**GIN-1** – (Previously known as G2) A low cost steel that is slightly softer than AUS-8.

**H-1** "H1 is a nitrogen based steel which does not rust, scratches easily, sharpens easily, does not chip easily, has a good edge retention and good impact resistance. Marine apps excel with this steel." High-chromium stainless steel that offers maximum corrosion resistance in both salt water and fresh water which makes it 100% corrosion resistance. This makes it only good edge quality with good edge toughness. "H1 is a high-performance steel. It has one of the most lopsided performance-to-maintenance ratios I know." "The steel is a break through in corrosion resistance. Edge testing indicates cutting ability comparable to AUS-6 / AUS-8." "H1 can't be flat ground."

**L-6** Excellent shock resistance. With the proper heat treatment it can be banitic in structure which is extremely tough, but slightly softer than martensite. Used in swords. Tool steel, not stainless steel.

**M2**- not stainless, but a good steel for edge retention. "M2/M4-high carbon tool steels made famous for their edge retention. Corrosion resistance is awful and impact resistance isn't much more. These are what one calls cutting steels." Very tough, tool grade high-speed steel used primarily in the industrial sector for cutting steel. Very high strength and wear resistance. Is prone to corrosion, because of make-up. Should be coated for blade longevity. A forumite notes that "M2 died off…in favor of D2"

**MBS-26** – High carbon stainless steel that provides high corrosion resistance and good edge holding capabilities.

**N690**: It's a cobalt additive steel manufactured in Europe. it´s a steel made by böhler austria. english term: X105CrCoMo18 2. “N690 is a steel I am playing more with and thanks to Spyderco and Benchmade, I have concluded this is pretty good stuff, comparing to the industry standard 440C and probably beating it out.” Austrian made stainless steel that is comparable to 440C in value and performance. High corrosion resistance and edge qualities. “An Austrian made stainless steel, which is comparable to 440C in performance and value. Keen edge qualities with great corrosion resistance.”

**O-1** Tool steel, not stainless steel. High quality non-distorting cold work steel that has tungsten high chromium content which gives it improved wear resistance.

**Powder metallurgy** - Powder metallurgy allows the metallurgist to create alloys whose components would separate if they were allowed to exist in a molten state (which is the way non-powdered steels are made). For example, it allows exceedingly high concentrations of carbon to remain in steel. It is a forming and fabrication technique consisting of three major processing stages. First, the primary material is physically powdered, divided into many small individual particles. Next, the powder is injected into a mold or passed through a die to produce a weakly cohesive structure (via cold welding) very near the dimensions of the object ultimately to be manufactured. Finally, the end part is formed by applying pressure, high temperature, long setting times (during which self-welding occurs).

**S7** Tool steel, not stainless steel.

**S30V** – see CPM S30V

**Spyderco Notes:** “If Spyderco makes a knife it's going to be from its default steel for the country it's made in - VG-10 in Japan, S30V in the US.” VG-10 is found in Spyderco Persian & many others. CPM S-30V Used in Spyderco Manix and others. ZDP-189 found in limited run Spyderco Calypso, Jess Horn, Delica.

**SG2** – some kind of powdered steel, some say hardened 64-66 rockwell.

**VG-10**: Japanese steel. Widely considered a good steel. Great reputation. Good edge retention. Often mentioned as “the best of the best” with S30V.

However some opinion has it as a “mid grade steel.” “This fine-grained steel will resharpen up fairly easy to a wicked edge!” Thought by some to be better than ATS-34. Also seen: “VG10, another 440C variation, was developed specifically for the knives used in the Japanese grafting industry.” “VG-10 is a Japanese steel with good all around properties. Complaints are few on this blade. It sharpens easy, holds a pleasing edge retention, has decent corrosion resistance, and buffs to a gorgeous shine.” “VG-10 is a high carbon stainless steel, similar to 154CM ... Spyderco has performed testing which show VG-10 to be superior to ATS-34/55 in corrosion resistance, better initial sharpness and edge retention, and superior to S30V in terms of corrosion resistance, but lower in edge retention.” “VG-10 is a high wear stainless steel in the same class as 154CM, however has better edge stability and offers superior corrosion resistance and extended edge retention.” Contains chromium that aids in rust resistance and high carbon that provides exemplarily edge retention and ease of sharpening. Is considered “Super Steel.” “Most people seem to consider VG-10 to be one of the top-tier knife steels. It won't win every category, but it does pretty well in all of them. I don't know anyone who doesn't think it’s a high quality steel, though. Although there are some real "steel snobs" out there, my experience is that a decent knife made in VG-10, S30V, ATS-34, 154CM, or D2 (along with a few others) will perform "close enough" that in day-to-day use it's of small concern which one it is made out of. Each steel has some areas where it may do slightly better than others, and each will have some areas where it will do slightly less, but any of them will generally work just fine.” Rockwell hardness range found: 59-62.

**W-1**: Most popular, least expensive and versatile tool steel (not a stainless steel). Has high carbon content and is a fine grained electric furnace melted commercial tool steel.

**W-2** Tool steel, not stainless steel. Shallow hardening, rather weak, and make durable knives only if held below 54 HRC (hardness, Rockwell C-scale). Rusts very easily due to the lack of chrome and vanadium. Only alloying elements are carbon and manganese. Usually used in industry for inexpensive, low yield tooling.

**X15TN** or X-15 T.N. or X15 T.N or X15 - A French steel. [Benchmade marketing hype: This French steel was developed for the aircraft industry for jet ball bearings, as well as the medical industry for scalpels. It has the ability to resist rust in the worst of conditions while maintaining ample edge

retention. The capability behind this steel is in the way it is manufactured, resulting in the finest steel for use in harsh environments such as salt water. The edge on an X15 T.N blade is easier to maintain.] [Boker marketing hype: "X15 TN blade steel boasts an HRC of 58, with cutting power of 440C or ATS-34. A virtually rust proof stainless steel with good edge retention."] [Opinion: "X15 is along the lines of 440A…Boker is hyping that X-15 is being close to ATS-34. That's a big diffeence from 440A."] Have not found much information on this steel.

**ZDP-189**: "The next super steel is ZDP-189, This steel is incredible in edge holding and hardness. The heat treating process for this steel is a guarded secret. In tests conducted by Blade magazine ZDP-189 out performed VG-10 by a factor of 10X. But cost is about 20X higher than VG-10. I have noticed ZDP-189 will not take a super sharp edge like VG-10 or AUS-8 steel will. That does not mean it won't take a good edge; the factory edge would shave hair easily but when you run a finger over the edge it feels toothy and slightly rough. ZDP-189 under this magnification shows a very angular structure as compaired to VG-10." A potentially very hard stainless steel (Hardenable to a very hard 67-68 on the Rockwell hardness scale) has less brittleness than usually accompanies such a hard steel. The high hardness and carbide content results in superior edge retention in abrasive situations. Often laminated with tougher steels. "ZDP-189 is a steel that has unusually amazing edge retention and it has been measured as high as a 69 HRC. While it is a cutting steel and will chip, it is not as brittle as one would presume for such a hard steel." Manufactured by Hitachi in Japan. "It's like the Ferrari or Lamborghini of blade steels." "ZDP-189 is a powder metallurgy martensitic stainless steel made by Hitachi Metals. ZDP-189 is mainly promoted for the very high hardness 66/67 HRC which is rare in staniless steels…."

**Angles** for Sharpening: From web: Edge angles [per side, not inclusive] can vary from 10° to 40° , but most are between 15° (filet knives) and 30° (survival knives). Different angles are suited for different tasks. What's suitable in the kitchen will not do for camping. Twenty degrees [per side] is about right for kitchen knives, twenty two [per side] degrees is good for pocket knives, and twenty five degrees [per side] gives a long lasting edge to a camp knife. Use circular strokes until the old scratch pattern is gone. According to Lansky: 20° [per side]: A commonly used angle for higher grade, quality blades. Provides an excellent edge for these types of knives. Ideal for kitchen knives. 25° [per side]: The recommended angle for most

knives that need a durable, sharp edge. Ideal for hunting and outdoor knives. 30° [per side]: An outstanding angle for knives that see the heavy use of cutting cardboard or carpets. Only for heavy duty use. “You're less likely to chip S30V if you don't go lower than 30° (inclusive; or 15° per side) when sharpening. Going to 40° (inclusive; or 20 per side) will let you take even more advantage of its insane wear resistance, but you'll need more force to cut.” The Spyderco Sharpmaker only has two angles: 30° inclusive (15°/side) and 40° inclusive (20° per side), and generally people will use the 30° to shape the edge and the 40° to set a microbevel. “Sal (CEO of Spyderco) says he sharpens all his knives at 30° [inclusive; 15° side].” “Sebenza web site recommends a 40° [inclusive; 20° side] edge on their knives.” NOTE: Ceramic stick-type sharpeners (such as the Sharpmaker) tend to refer to inclusive angles; clamp-style sharpeners (such as the Lansky) often reference single-side angles.

**Comparisons:**

I think Joe Talmadge explains the relative properties pretty well. (editor’s note: Strength refers to edge roll resistance and toughness refers to chipping and cracking resistance.) To Quote: ATS-34/154CM, VG-10, and S60V are the next group up. It's difficult to make generalizations about ATS-34 and 154-CM -- they are in such widespread use that heat treat varies widely. These steels provide a high-end performance benchmark for stainless steels, and hold an edge well, and are tough enough for many uses (though not on par with good non-stainlesses). They aren't very stain resistant, however. VG-10 can be thought of as being like ATS-34 and 154-CM, but doing just about everything a hair better. It's a little more stain resistant, tougher, holds an edge a little better. And VG-10 has vanadium in it, it's fine-grained and takes the best edge of this group. S60V has by far the best wear resistance of the group, though consensus is becoming that it should be left around the same hardness as 440C (56ish Rc), which means it will be relatively weak compared to ATS-34, 154-CM, and VG-10, and so it will indent and lose its edge quickly when strength is required. BG-42, S90V, and S30V constitute the next group up. BG-42 has better wear resistance than all the previous steels except for S60V. It is tougher than ATS-34, and more stain resistant. It is wear resistant to the point where it can be difficult to sharpen. S90V represents the ultimate in wear resistance in the steels discussed so far. Also tougher than ATS-34, and more stain resistant. It can be very difficult to put an edge on. It is difficult enough to machine than it is used almost exclusively in custom knives, not production knives. In your buying

decisions, you might want to take into account the difficulty of sharpening these steels. S30V backs off on the wear resistance of S90V, but is significantly tougher and easier to sharpen. It is more wear resistant than BG-42. The jury is still out, but it may end up this week's ultimate high-end all-around stainless steel, due to high performance coupled with easier machinability and sharpenability than the other steels in this class.

| Steel..... Rc hardness | Edge Retention | Breaking Strength | Stain Resistance |
|---|---|---|---|
| ATS-34.....@ 61 | 5 | 8 | 6 |
| BG-42.....@ 62 | 6 | 7 | 8 |
| 440C.....@ 59 | 4 | 9 | 8 |
| S60V.....@ 57 | 9 | 5 | 6 |
| S30V.....@ 61 | 10 | 8 | 10 |

**Some Sources (not a complete list):**


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