



# SCREW SELECTION GUIDE



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Without question, buying the right screw can be a daunting task with so many variations from which to choose – especially when you have three different people recommending three different solutions. But an educated, informed buyer always makes the best choices at the best prices. This Guide, and the dozens of years of MSI experience behind it, will help you determine which screw is best for your organization by providing guidelines based on applications, usage and overall requirements.

## Construction

**Welded Screws:** A welded screw begins with a base material, to which a hard surface material is applied as a weld to the flight OD, and the finished product is then usually nitrided or chrome plated. Welded screws are a very cost-effective option for 90% of molders that process resins with filler contents up to 40%. The beauty of this type of screw is the ability to specify the base steel you need to withstand abrasive or corrosive wear, apply the appropriate weld material for the filler content you process, and then prescribe the case finishing you desire. Minor repairs can easily be performed on welded screws when needed, and it is often economical to rebuild welded screws over 80mm in low abrasion applications with few exceptions.

**Tool Steel Screws:** Tool steel screws are constructed from a thru-hardened “tool” grade steel and then heat-treated for maximum hardness. There are several grades of tool steels to satisfy abrasion, corrosion, rigidity, and cost requirements. A major consideration with tool steel screws is that they can become very expensive in diameters over 40mm, exceeding even the cost of encapsulation once you reach diameters over 70mm. Repairing or rebuilding of tool steel screws is impossible since the steel cannot accept new welds once heat treated. Most Japanese OEMs are heavily invested in the tool steel industry and many of them are subsidiaries of Japanese steel producers (i.e. Toyo, JSW, Niigata). As a result, they often only offer tool steel options as aftermarket replacements. Please beware that buying these screws can be very costly for an uninformed buyer. A recent comparison performed for one of our clients showed screw prices up to three times more expensive than MSIs recommended solutions for the same level of durability!

**Encapsulated Screws:** For molders who process resins over 40% filler content, have experienced excessive root wear or undercutting on welded or tool steel screws, or have excessive corrosion problems, full encapsulation is the recommended option. These screws are made from an economical base steel, such as 4140, and then fully coated with a high tungsten carbide coating. While this is a proprietary coating method applied by the patent-holding supplier and available to any screw manufacturer in the industry, there are several high performance variations offered by Molders Services that are rarely offered by other suppliers. While many sell only standard carbide encapsulation, Molders Services offers the entire line of coating formulas to address nearly every processing condition – including high heat molding, exotic fillers, and unwanted chemical reactions.

It is important to note that aside from high cost, the main concern in purchasing and using an encapsulated screw is the coating's propensity to chip off. Once the coating begins to chip, glass-filled materials will quickly erode the screw, rendering it unusable in as little as a few shifts. To avoid this problem, Molders

Services offers an alternative exclusively manufactured by us. Our process includes a carbide flight weld to the screw before it is coated, thus providing both a significant service life extension in many situations and virtually eliminating the coating's propensity to chip.



*In certain situations, a carbide coating can be applied only to the flight land of a CPM screw using this process, making for a highly abrasion-resistant alternative to full encapsulation. This option does not have the same tendency to crack or chip and offers significant benefits in durability and reliability. Since price considerations may make this screw alternative unattractive, please ask one of our technical specialists if it is worthy of consideration and economical for you.*

*One final point needs to be made here. Carbide encapsulated screws can have minor repairs done on chipped sections if any damage is detected early enough. Encapsulated screws can also be stripped and re-coated if the coating begins to chip or wear away as long as no major wear or undercutting has been sustained by the underlying substrate. These may be important cost saving alternatives to purchasing brand new screws. Talk to your Molders Services professional for guidance.*

## **Hard Surface (Weld) Materials**

**Colmonoy #83:** *Colmonoy #83 is the gold standard of hard surface materials. The extremely high tungsten carbide content, combined with a nickel-based matrix, allows it to withstand highly abrasive environments while also withstanding corrosion. Many suppliers do not offer Colmonoy #83 welded screws because of their precision and the resultant higher manufacturing cost due to the sophisticated welding and grinding processes involved. Regardless, the vast majority of screws sold by Molders services are of the welded variety, and utilize Colmonoy #83, a significant benefit for our customers.*

**Colmonoy #56:** *This is, by far, the most common hard surface material sold on the U.S. market. It is made from a nickelcarbon- chromium matrix, which offers a good balance of abrasion resistance and cost effectiveness for low to moderate filler content.*

### **Wallex**

*This is a hard surface weld material engineered specifically for high-temperature molding applications.*

### **Carboride PTA**

*This product offers slightly higher tungsten carbide content than Colmonoy #83, but is costly to grind and tends to fracture easily. This is an obscure option and should only be used for very specific applications.*

### **Stellites**

*There are several grades of Stellite hard surface materials available, with the most durable options offering abrasion resistance comparable to Colmonoy #56. Stellite hard surface materials have recently seen increasing use by European OEMs.*

## **Base Steels**

**4140HT:** *used in all low abrasion welded screws, as well as the substrate for encapsulated screws.*

**4340HT:** *this is a variant of 4140 that has a higher molybdenum content and added nickel giving it a slightly higher strength and corrosion resistance than 4140. The durability advantage of using this steel offers only about a 10% improvement over 4140, making it a seldom used alternative. Many Chinese suppliers refer to their version of 4140 as 4340; however, it has nothing near the chemical or mechanical properties of true 4340. The recommendation of 4340 by a supplier is usually an indication that you are working with someone who sells inferior components that should be avoided.*

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**Nitralloy #135:** known as a “Nitriding Steel” due to its ability to take a much harder case than 4140 when nitrided, Nitralloy #135 is used for all high-abrasion welded screws. The improved hardness provides better abrasion resistance in the root of the screw.

**17-4PH:** is a stainless grade of steel used for larger screws where corrosion resistance is required. These screws are recommended for operations that process large volumes of corrosive, non-abrasive resins, as well as polycarbonate.

**CPM 9V:** a very abrasion-resistant tool steel with high vanadium content, generally employed on screws 40mm and under, and used in environments where no corrosive conditions are present.

**CPM 420V / S90V:** a stainless variant of CPM 9V tool steel, also generally employed on screws 40mm & under. These are most often recommended for organizations that process a mix of both corrosive and abrasive materials. While providing a significant increase in corrosion resistance, abrasion resistance is less than CPM 9V.

**H13:** a high-speed grade of tool steel recommended for smaller screws that must be highly resistant to torque.

**D-2:** a high chromium content tool steel that derives its toughness from a high proportion of carbides as compared to other steels. This type of screw is an economical alternative for moderate filler content and has the added bonus of corrosion resistance.

**Inconel:** a relatively obscure option in the injection molding industry, this proprietary steel is outstanding in extremely high temperature applications and is the required component in a Fluoropolymer processing operation.

## Case Finishing

The last construction topic to discuss is the method by which a welded screw is finished. Since we at Molders Services rarely vary from one practice – nitriding – we don’t consider this a major topic, although it is worthy of mention and will be discussed later in this Guide.

When a welded screw is manufactured, there are essentially two options to “case finish” the root: nitriding or chrome plating. Because a chrome plated surface cannot be nitrided and a hardened (nitrided) surface will not accept chrome plating, a choice must be made.

In the 1980’s chrome plating was the rave because it added lubricity to the screw, allowing it to be easily cleaned while minimizing the potential for the material to hang up, burn, and degrade on its surface. Of course, this was long before the importance of the correct screw profile and level of polish were understood.

While the case for chrome is still somewhat factually correct, the major point often ignored is that chrome plating is only about 0.0005” - as in one-half of one thousandth of an inch thick! Chrome plating also has little or no abrasion resistance, making a screw that regularly processes glass filled resins high susceptible to premature root wear. While there are very specific applications that benefit from chrome, we rarely encounter them. Usually, the vast majority of chrome plated screws we inspect have little or no chrome plating left at all! Thus, there is little long-lasting benefit to using a chrome plated screw.

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## **Case Finishing (Continued)**

*Some suppliers are touting a relatively new “triple chrome-plating” process that attempts to overcome the extremely thin case depth and claims to add some durability to the finish. In reality, however, this is just more of essentially the same thing. Chances are, if you have an issue that would have been “solved” by chrome plating several dozen years ago, there are other issues like processing conditions, screw design, and polish levels that would beg for the more appropriate alternatives available today.*

*The one application where chrome plating is of benefit is in an operation where PVC is processed exclusively. While chrome is beneficial when processing these resins to block the chemical reaction between high carbon steel and the hydrochloric acid off-gassed by the PVC resin, there is a much better coating available today. It is called DuraChrome CPR® and we would be delighted to discuss its advantages with you. This proprietary coating offers all the benefits of chrome plating while adding other elements that provide superior abrasion resistance, especially necessary when processing PVC-R.*

*As is true with those recommending 4340, chrome plating offerings often indicate a supplier that is selling under-performing Chinese components. Because of the extremely high proportion of impurities in Chinese steel, combined with overseas (salt!) transportation, Chinese screws are often extremely susceptible to corrosion. The best way to overcome this deficiency is with chrome. After all, it is inexpensive and provides a product that looks showroom new, despite having spent one or more months in a shipping container. Please beware of individuals or suppliers that recommend chrome plating. Few will have an informed reason for their recommendation and thus, should likely be dismissed from your consideration.*

## **RECOMMENDATIONS:**

*As with so many products offered in today’s markets, a lot of incorrectly specified, sub-standard, and poorly performing products are being sold to unsuspecting buyers. Sadly, they often suffer the consequences and financial burden of uninformed decisions.*

*We hope you will use this Guide as an informative resource for advising what is best for your organization and application. But as always, MSI strongly recommends speaking with us before making a purchasing decision. There are simply too many alternatives and too many considerations to trust anyone other than a proven, knowledgeable, experienced supplier. We are Molders Services and we ARE that expert supplier.*

*Molders Services maintains an extensive inventory so we can deliver most any of the above-mentioned options. We even provide many of the more obscure alternatives with these goals in mind: To always supply our clients with exactly what is best for running their applications and businesses at the lowest cost and with the highest quality, assuring minimal downtime. Let us earn your screw business.*

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