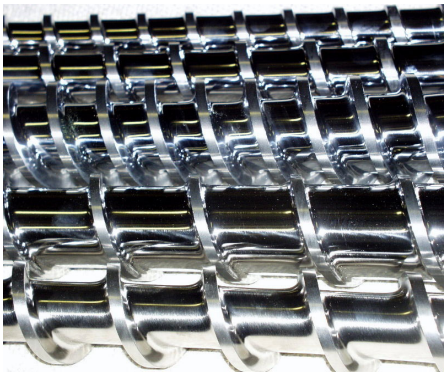
Feed Screws

Plasti-Co is a leading supplier of Injection, Blow Molding and Extruder Feed Screws





Design

Plasti-Co is an industry leader in feed screw design. Plastic-Co will design general-purpose screws with the flexibility to run a wide variety of materials or design a custom screw to match your material needs. These designs incorporate mixing, improved output, low shear designs for heat sensitive plastics, venting, up-sizing and down-sizing injection units.

Materials

With today's wide variety of plastics ranging from mild to very abrasive and corrosive, what is often over looked is the need to balance the screws yield strength with it's wear resistance and overall hardness. The right screw materials can greatly improve your screws life and the quality and consistency of your final product. Below is a list of the more common steels used for feed screws.

Alloy steels- AISI 4140, AISI 4150, AISI 4340, Nitralloy 135M
Alloy steels are very high in yield strength and low cost. They have relatively low abrasion and corrosion resistance. For this reason, they are almost always combined with welded hard-surfacing and root treatments, like chrome or nitriding.

Stainless steels- 300 & 400 series, 17-4PH, 15-5PH.
These steels provide good corrosion resistance and both the 17-4PH and 51-5PH have higher yield strength than most alloy steels. The wear resistance is poor. Stainless steels can be heat treated or hard-faced welded to improve the wear resistance of the flights. These steels will stop or lessen the problem of corroded internal threads, often a concern to injection molders. For extremely corrosive plastics like fluorocarbons there are specialty steels like **Hastelloy C-276 & Duranickel.**

Tool steels- AISI S-7, AISI D-2, AISI M-2, H-13, CPM-9V, CPM-440V.
After heat treat, tool steels have high abrasion resistance both on the flights and roots, better corrosion resistance than alloy steels, but very low yield strength. The cost to use tool steels for feed screws is much higher than alloy steels due to the material cost, merchantability and heat-treating costs. The cost difference is not significant on smaller screws, but can be as much as 5 times the cost of alloy steels on large screws.

MIXING SCREWS

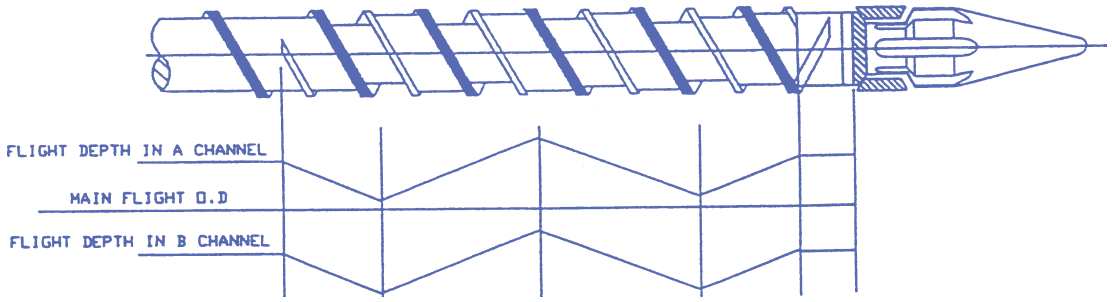
Most feed screw manufactures offer a "ONE SIZE FITS ALL" mixing screw or a section in their general purpose screw, without even knowing what the customer's problems or needs are. They often charge a very high premium for their screw which more often then not, does not solve the problem and may even make it worse.

At Plasti-Co each customer needs are evaluated. A new screw is designed or a change to the customers screw design is proposed to overcome a problem or improve their process.

Plasti-Co's **P-3000** is a very versatile mixer with 18 parameters that can be changed to more effectively fit a customers needs. Most mixing sections use sample back pressure or flow restriction to cause mixing, which is no more effective then turning up the back pressure on the machine. These types of mixers over shear the material and can burn or degrade the plastic, which greatly reduces the machines output and are difficult to purge.

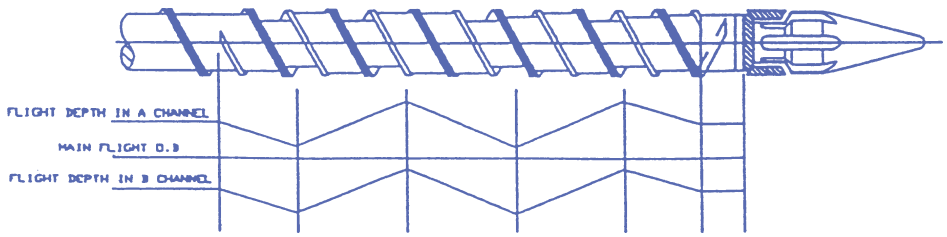
More important than the mixing section itself is the profile of the screw, it's section lengths and flight depths. A screw cut too deep in the feed section or with a transition section that is to short can render a screw with the most elaborate mixer useless.

1st - STAGE MINIMAL P-3000 MIXER



The **P-3000** can be used where minimal mixing is needed or with very shear sensitive material like PVC, some vinyl and rubbers. It may be used on short L/D ratio screws with a higher compression ratio for mixing standards thermoplastics.

2nd - STAGE P-3000 MIXER



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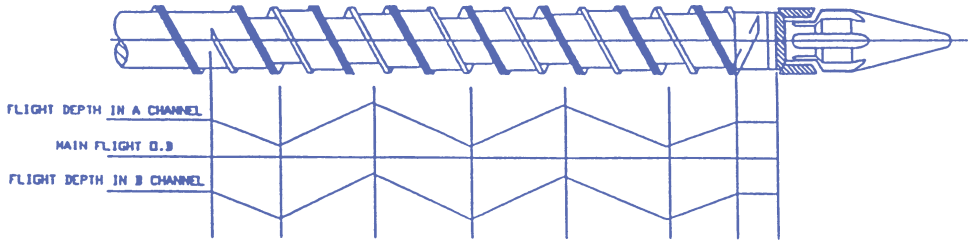
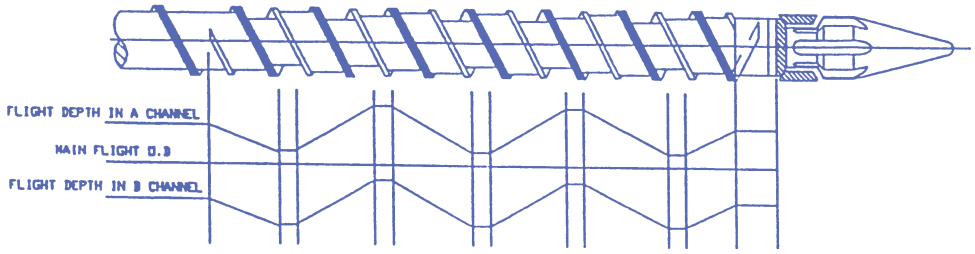
MIXING SCREWS Con't

3rd - STAGE P-3000 MIXER



VERY AGGRESSIVE P-3000 MIXER



The **P-3000** concept has worked well in a very wide variety of applications. Compounding companies using it to mix as much as 60% talc powder into P.P. for a more homogeneous
parison flow on a high production blow molder. But by far the most common usage is by injection molders for color mixing. Following are the reasons why:

A. Lower percentage of color concentrate required.

B. Improved overall dispersion and homogeneous melt.

C. Low shear with no "dead ends".

D. Higher outputs or faster screw recovery in most applications.

E. Easy purging.

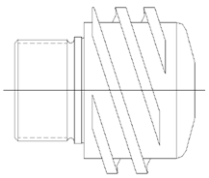
F. Flexibility to run a very wide variety of materials with one screw.

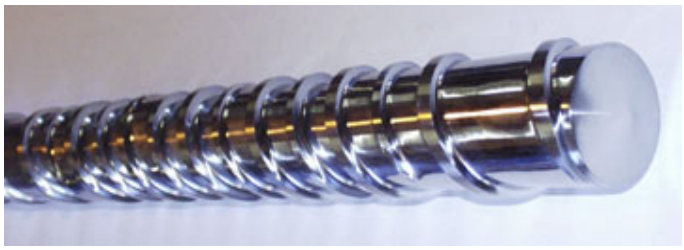
G. Higher percentage of regrind can be used.

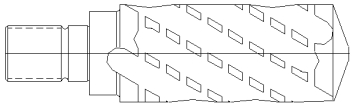
H. Efficient and cost effective.

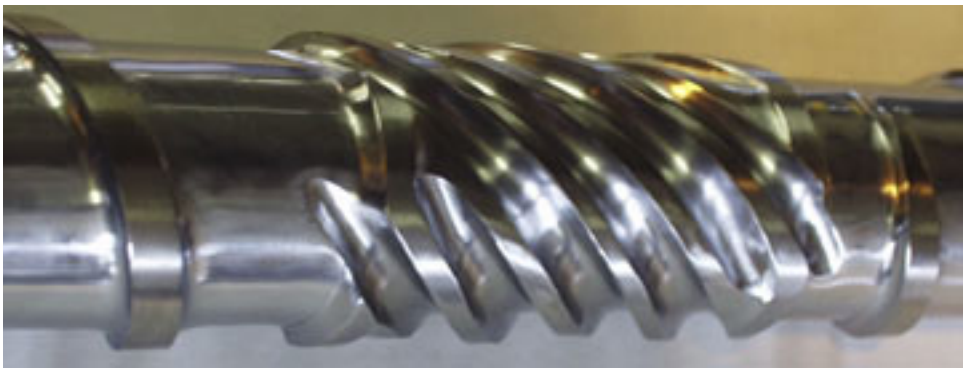
SPECIALTY & MIXING FEED SCREWS

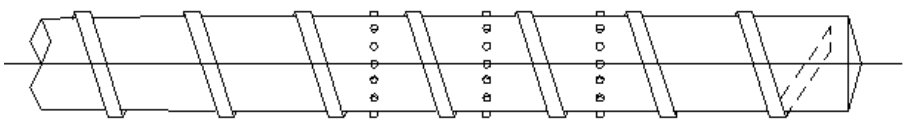
Plasti-Co can build screws with many types of flight designs for different applications. Plasti-Co can improve your screws output, make your process more profitable and improving the mixing action for color or other additives. The right screw for your needs can improve overall part quality and reduce scrap rates.

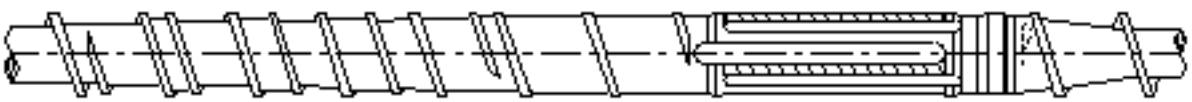










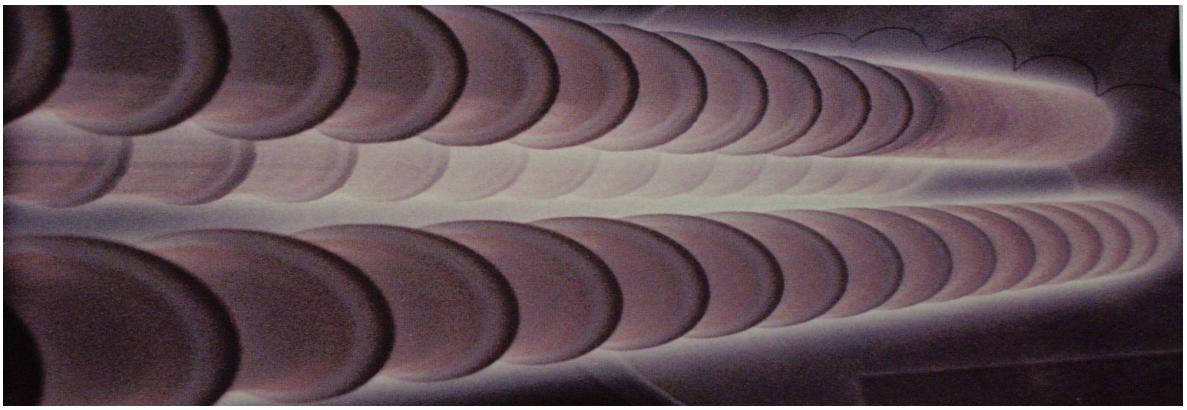


Coatings & Treatments

Nitriding

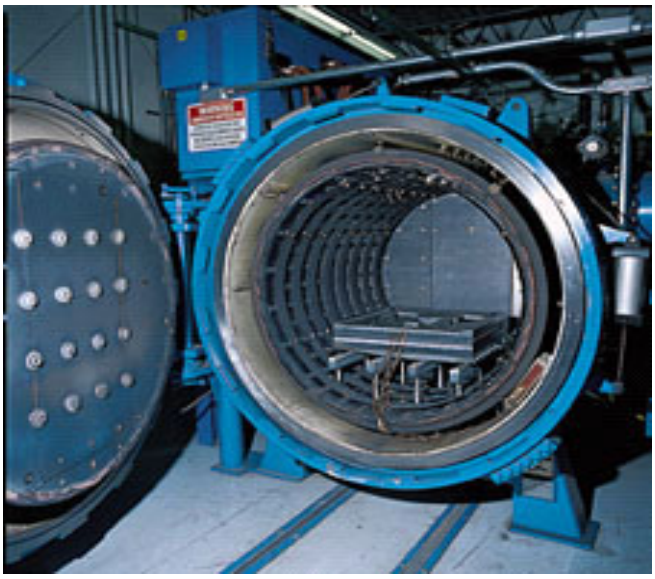
Nitride is a case hardening process that can be performed on a wide range of steels. For the best results the steel used should contain nitride-forming elements such as aluminum, chromium, molybdenum, vanadium or tungsten. There are two types of nitriding Ion nitride and Gas nitride. The ion process is newer and primarily used at Plasti-Co. In this process feed screws are placed into a vacuum chamber with ionized nitrogen gas and other gases. High voltage is applied to the screw. When the nitrogen comes in contact with the screw it disassociates into hydrogen and or atomic nitrogen. It is this atomic nitrogen, which combines with molecules on the steel surface to form the nitrided case. The nitride surface will range from 65 to 70 Rockwell. The nitride will range from .015" to .024" deep.

Feed Screws in Ion Nitride Process



Heat Treating

The increasing use of tool steels in feed screws requires innovative techniques and sound metallurgical know-how when heat treating. Feed screws have high torque loads and very tight straightness requirements. This requires a balance between the finished screws harness to improve wear resistance and it toughness or ability to twist without braking. Screws can be heat-treated to different hardness in certain areas, the shank or drive end of a screw can be softer to resist cracking due to shock loads whale keeping the flight area much harder to maximum wear resistance.



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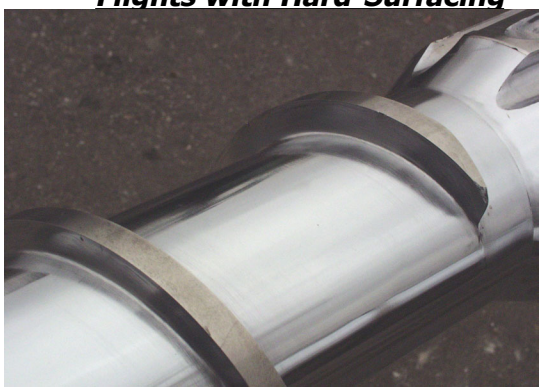
Hard-Surfacing

Hard surfacing is a process of protecting metal parts from wear by binding a wear-resistant alloy to the ferrous or alloy base metal. Mostly used on flight tops, it is applied for a final thickness of around 1/16" (.062"). As the wear progresses, the wear resistance will not decrease until the hard surfacing is worn off.

Hard-Surfacing Feed Screw Mixer

Flights with Hard-Surfacing



The two most widely known brands of hard surfacing are **Colmonoy** and **Stellite.** Each supplier manufactures a number of formulations that are well suited for feed screw use. Colmonoy's products are nickel based and Stellite uses a cobalt base. These products are specially formulated alloys that contain both wear and corrosion resistant materials like Chromium, Carbon, Nickel, Cobalt, Tungsten and Boron. They range in hardness from 37 to 64 Rockwell.

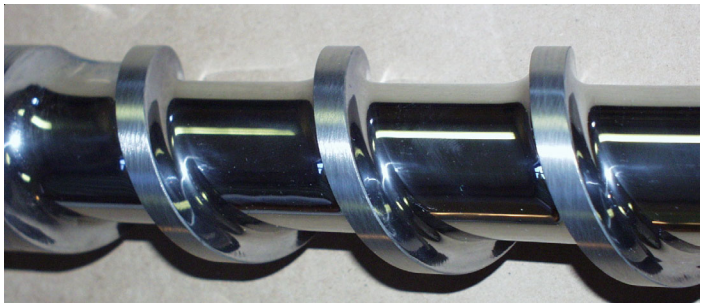
Coatings & Treatments

The most common screw coating used is chrome plating on the screw root area. Today we have a wide variety of coatings and treatments to improve a feed screws longevity and performance.

Chrome Plating-
Chrome is usually applied .0010"-.0015" thick. Chrome is often applied to improve the screw corrosion resistance and to ease in screw cleaning.

Nickel Plating-
Nickel done with the electroless method and baked will have a much better corrosion resistance and is harder than chrome. The cost is much higher than chrome.

Chrome plated screw



PCS

Plasti~Co Equipment Company

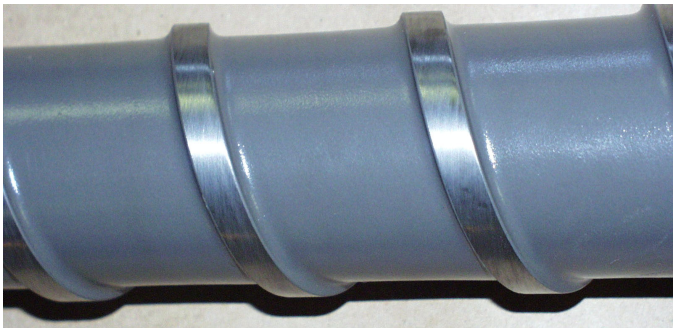
Carbide Coating Feed Screws

Plasti-Co provides carbide coating on our feed screws and other high wear components; we offer a full line of abrasion and corrosion resistant coating products to meet the needs of today's most demanding abrasive and corrosive compounds.

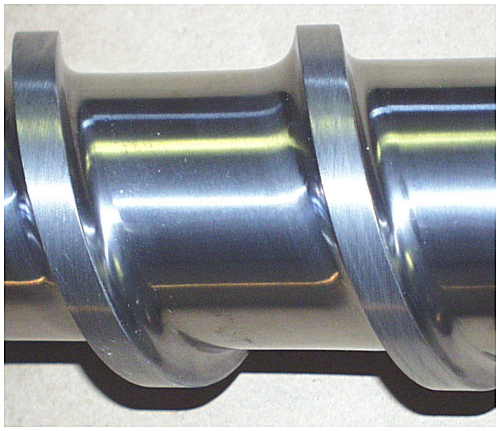
The Process

Very high velocity thermal spray technology uses extremely high temperatures above 6000 F, to heat ultra-fine particles of the coating material, typically less then 0.0003" in diameter. The molten particles are applied to the feed screw at very high velocities of approximately 2,500 feet per second. Upon impact the particles flatten, solidify, and form an interlocking bond to themselves and the screw substrate. The kinetic energy released by impingement upon the substrate contributes additional heat and promotes bonding. The coating is built up to the specified thickness while the screw is rotated and passed in front of the gun. ***The sound level of the spray gun is the same as that of a jet engine during take off.***

The Coating



Plasti-Co's "PCS" brand carbide coatings provides abrasion resistant characteristics unmatched by any of the conventional hard-surfacing alloys and treatments offered. It provides a crack free coating of 80 to 90% sub-micron sized Tungsten Carbide, with an overall hardness of 68 to 71 Rockwell. The common flight hard-surfacing alloys only have a 53 to 58 Rockwell.



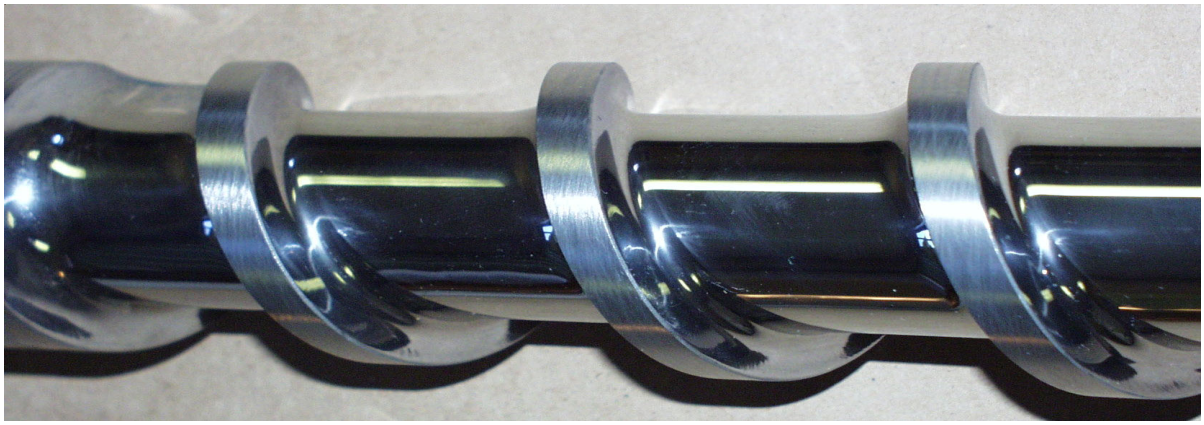
Thickness & Finish

Thickness is determined by application and feed screw size. The coating can be applied in thickness of .005" to .015" per side, providing .010" to .030" of total wear protection.

We offer a variety of root and flight side surface finishes ranging from +/-140 RMS to our 16-32 RMS finish, which rivals chrome plating in appearance. Carbide coated screws that are not polished after the coating is applied can in some cases, cause feed problems and can take much longer to purge or change materials.

PCS Carbide Coatings

Type	Rockwell	Description
PCS-888	**Rc68 - 71**	A composition of Cobalt or Nickel saturated with 80 - 90% Sub-Micron sized Tungsten Carbide with a particulate hardness range of Rc82, providing ultimate abrasion resistance.
PCS-865	**Rc67 - 70**	A composition of 83% Tungsten Carbide and 17% Cobalt. Higher concentration of Cobalt provides more ductility than PCS-888. Recommended for smaller screw.
PCS-860	**Rc55 - 65**	A composition of Nickel, Chromium, and Chromium Carbide producing an abrasion resistant coating with extreme corrosion resistance and excellent ductility, relative to hardness.
PCS-999	**Rc65 - 70**	A Tungsten Carbide/Cobalt using a unique sub-micron manufacturing process providing improved wear resistance over traditional Tungsten coatings. Excellent for sub-micron particle abrasion.



Beneficial characteristics of our coatings include:

Excellent wear resistance.
Can be stripped when worn.
Corrosion resistance.
Low coefficient of friction when high polished.

Rebuilding PCS coated screws:

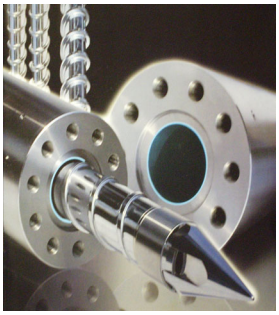
When worn, our coatings can be stripped and the screw recoated.

Plasti-Co Equipment Company

Barrels

Plasti-Co's expertise in the design and manufacture of plastics machinery barrels is second to none.

New Barrels	Barrel Repair
Plasti-Co supplies new barrels manufactured from a wide variety of materials, from tool steels to centrifugal cast bimetallic linings.	Plasti-Co can repair most injection molding barrels by installing a sleeve manufactured from any of the materials used on new barrels.



Tool Steel Barrels

New tool steel barrels are manufactured from a liner of heat-treated tool steel and installed in to a backing tube of softer alloy steel. This combination provides for excellent abrasion and corrosion resistance for the materials being processed and the high strength required for the high pressures of injection molding and extrusion.

AISI, D-2 TOOL STEEL

A high carbon, high chromium heat treatable tool steel offers high wear resistance and good corrosion resistance. Typical hardness is 58-60 Rockwell.

AISI, M-2 TOOL STEEL

Tungsten-molybdenum high steed tool steel often used to manufacture End Mills, Broaches and taps. M-2 offers excellent wear resistance and good toughness.

CPM-10V (1) TOOL STEEL

Unique tool steel made by Crucible using the particle metallurgy process. CPM-10V offers exceptional wear resistance.

CPM-420V (2) TOOL STEEL

A high vanadium steel designed for abrasive wear applications, requiring good corrosion resistance as well.

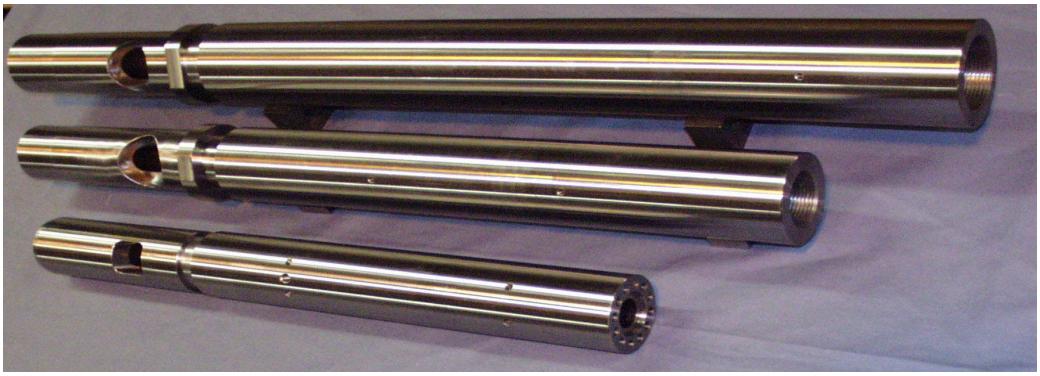
HESTELLOY (3)& DURANICAL (4)

Mainly used for feed screws, these special steels have excellent chemical resistance. This material is for use with fluorocarbons and other highly corrosive materials.

See next page for Plasti-Co's bimetallic linings.

Plasti-Co Equipment Company

Bimetallic Barrels



Plasti-Co offers a complete range of bimetallic alloys as each customer has different requirements. All Plasti-Co's bimetallic barrels are manufactured as One Piece units. This is unlike the induction coil technology that often cast short thin wall segments that have to be assembled into a separate outer shell, similar to repairing a barrel with short sleeves. Our superior one-piece design eliminates distortion related problems common with multi-piece designs.

PC-100 ABRASION RESISTANT NICKEL/BORON BIMETALLIC LINING.

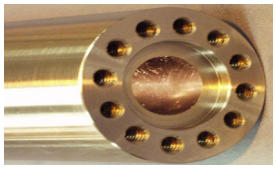
Plasti-Co's PC-100 is a nickel-boron base iron alloy with very high hardness. It has an excellent abrasion resistance and a very low friction coefficiency for the prevention of screw and check ring galling. With hardness range of Rockwell C58-65 the PC-100 is recommended for use with low to moderately abrasive materials.

PC-500 CORROSION RESISTANT BIMETALLIC LINING.

Plasti-Co's PC-500 is a cobalt/nickel base alloy with high chromium and boron content offering excellent corrosion resistances and moderate wear resistance. With hardness range of Rockwell C50-55 the PC-500 is recommended for use in severely corrosive atmospheres. The PC-500 is ideal for processing fluoropolymers and polyvinyl chloride resins.

PC-800 HIGH ABRASION TUNGSTEN CARBIDE BIMETALLIC LINING.

Plasti-Co's PC-800 is a high tungsten carbide content alloy with a chromium-boron-nickel alloy matrix. Over 80% of the alloy is occupied by tungsten carbides and chromium borides, which have a hardness of over Rockwell C70. It is the best wear and corrosion resistant alloy available.



Barrel Repair & Alterations

Injection Barrel Re-Sleeve

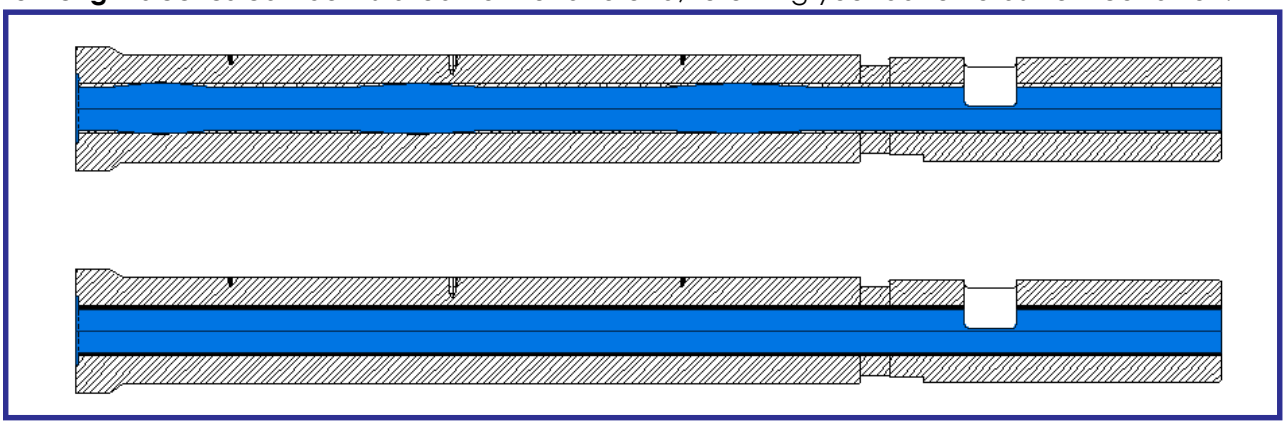
Plasti-Co can install a sleeve into the inside of most worn injection barrels, these sleeves can be manufactured from most any material new barrel are supplied with, heat-treated tool steel liners are less costly than bimetallic in smaller sizes and often faster to produce. Larger barrels above 3.00" (76MM) are less costly using bimetallic liners.

Plasti-Co will inspect your old barrel and supply a detailed report with recommendations to help you make a decision on what type and length of sleeve to install as well as whether to repair or replace your worn barrel.

Short sleeves can be installed in the screw tip travel area, this section of most injection barrels is the first and worst area of wear and in impact your screw tip valves function. It is normal to sleeve a minimum of 5 to 6 times a barrel bore size. Example: a 2.0" (50MM) barrel X 6 = 12.00" long sleeve. This will put the start of the sleeve past the stroke length of your injection unit.

Extended length sleeves can be installing up to a point just forward of your feed port, this is often a very economical way to repair many barrels, this returns the barrels bore back to OEM sizes in the area that counts most. With the use of extended sleeve there is no expense to re-install the feed port.

Full length sleeves can be installed from end to end, returning your barrel to as new condition.



Extrusion Barrel Repair

Extrusion barrel are normally much longer in terms of there length to diameter ratio and use a much thinner walls, installing sleeves into most extrusion barrels not cost effective.

If the barrel is manufactured using a bimetallic lining it can be honed to new size and the screw built new or rebuilt to match this new barrel size. The area of the screw that fits into the feed throat casting needs to be undercut to match the normal machines sizes. This is a low cost option that is not often recommended as it locks one screw to one barrel and makes replacing any one component imposable.

Other Barrel services

Removing broken studs from barrel threads.
Replacing high pressure sleeves.
Installing added thermocouple or pressure wells.
Replacing broken flanges.
Install vent ports.