SPIROL®

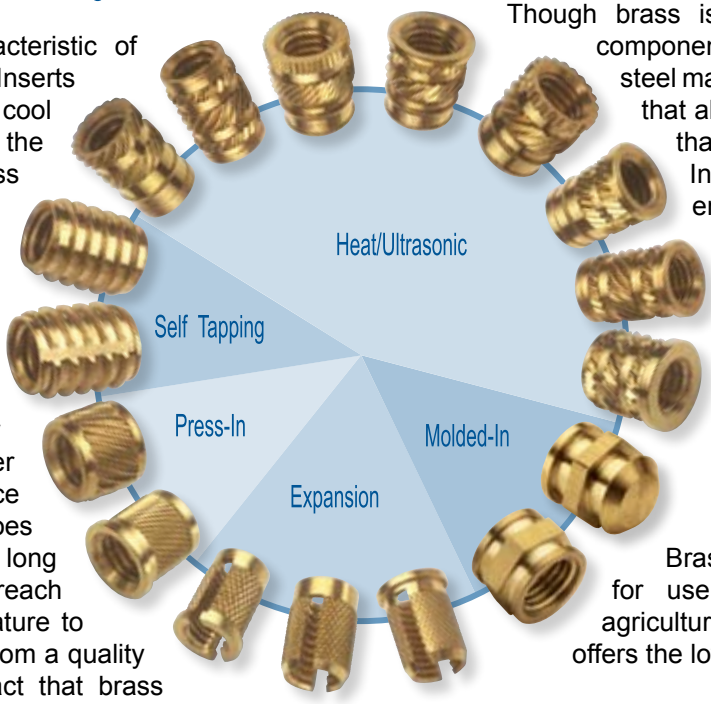
WHITE PAPER | 2009

Insert Material – Brass versus Stainless Steel

by Michael Pasko, Application Engineer
SPIROL International Corporation, U.S.A.
September 15, 2009

SPIROL manufactures all standard Inserts from brass, the accepted industry standard. In the majority of situations brass will exceed the performance requirements of the application while providing the lowest installed cost solution. This is mainly due to the thermal conductivity as well as the machinability of brass compared to other materials that are sometimes used for threaded Inserts.

SPIROL has a broad range of Inserts for Plastics.



The thermal characteristic of brass enables the Inserts to heat up and cool down quickly during the installation process into molded plastic parts. For those Inserts that are installed with heat or ultrasonics, the fact that the brass Insert heats up quickly translates into faster installation time since the operator does not have to wait long for the Insert to reach the proper temperature to melt the plastic. From a quality perspective, the fact that brass cools quickly means that immediately after the heat is removed from the Insert the plastic will start to coagulate which will secure the Insert in position and prevent it from "floating" within the hole. Compare this to a steel Insert that takes significantly more time to heat up — the time it takes to melt the plastic and the total installation time is longer. Since it also takes more time for steel to cool down, the Insert must remain stationary in the plastic part until the plastic has solidified enough to prevent it from moving around in the hole.

When it comes to machining, brass is much easier to cut than most ferrous materials. Whereas brass and stainless steel generally cost about the same per pound in the "raw state", it's the significant increase in manufacturing time for stainless steel that drives up manufacturers' costs. The fact that stainless steel is much harder than brass also means that tooling must be replaced more often than when cutting brass. This also increases costs and "cuts" into manufacturing time on the machine. Another significant advantage of brass is that the scrap that is generated during the machining operation can be sold back to the raw material supplier for about the same cost per pound as what it was purchased for in the raw state. Therefore, a significant portion of the material cost is recovered; whereas steel scrap is basically worthless.

Though brass is an excellent choice for use in most components, there are instances where stainless steel may be required. It is important to understand that all materials possess unique characteristics that must be considered when selecting an Insert. A material that is functional in one environment may be problematic in another. For example, brass and stainless steel are both corrosion resistant, yet each will react differently to various corrosive agents. This document will summarize the most common features and benefits of brass and stainless steel as well as outline some of their limitations.

Brass

Brass is an excellent material for use in most industrial and agricultural applications and typically offers the lowest cost solution:

Primary Features, Benefits, and Limitations of Brass

- Brass offers much better thermal conductivity than carbon or austenitic stainless steel. In fact, brass is 2X as conductive as carbon steel and 15X as conductive as austenitic stainless steel. As a result, it is the optimal material for heat and ultrasonic installation of Inserts and other turned products.

- Excellent thermal conductivity also translates into better positional accuracy of brass Inserts. Considering that brass cools quickly means that it can be "set" quickly and accurately in a component without fear that it will move within the plastic hole. On the contrary, a steel Insert must be braced within the molten plastic after it is put into position or else

it will “float” out of position and compromise the joint integrity of the finished assembly.

- Brass is a much more efficient material to machine than stainless steel. This decreases cycle time and lowers the cost of manufacture. The machinability rating of brass grade C36000 is 100, and it is the material against which others are measured for efficiency.

- Brass scrap is more valuable than stainless steel scrap. As a result, a larger percentage of material cost can be recovered after manufacture.

- Brass is excellent for use in hot and cold water industrial/residential systems including those carrying potable water.

- Brass is suitable for use in some marine environments including brackish and seawater with moderate currents. Exposure to fast or higher velocity currents should be avoided. If exposed to marine atmospheres brass will develop a protective green patina.

- Brass offers excellent performance in cryogenic applications, an important consideration as this makes it an alternative to 300 series stainless steel in some environments where it may not have been considered.

- Brass is typically useful in environments with exposure to mild alkaline solutions, though strong solutions such as hydroxides and cyanides should be avoided.

- Brass offers good resistance to corrosion in non-oxidizing acids, though oxidizing acids should be avoided.

- Brass provides excellent resistance to corrosion in contact with petroleum products.

- Brass offers good strength and actually overlaps the tensile strength of 12L14 low carbon steel. When the strength of a threaded part must be improved, a simple increase in thread length is often adequate and the added cost of stainless steel can be avoided.

- Brass can be nickel plated to further reduce tarnishing and corrosion or to simply provide a ‘silver’ finish. Nickel finishes may also be useful if a hard wear surface is required. Some examples of applications that are nickel plated for these purposes are door knobs, plumbing fixtures, gears, bearings.

Stainless Steel

Many varieties of stainless steel are available though 300 series, or austenitic stainless steel, is most comparable to brass in terms of those Insert applications where stainless is commonly used. It is critical to understand that the properties of stainless steel vary dramatically from one alloy or family to the next, and it is difficult to make general statements regarding performance. For this reason any request for stainless steel Inserts — and other special turned products — is evaluated through **SPIROL**’s Application Order process so that we can ensure that the material that is chosen is the best solution for the particular application.

Primary Features, Benefits, and Limitations of Stainless Steel

- Stainless steel is more difficult to machine than brass and cycle times are much longer which increases cost significantly. Tool life is also severely limited which further increases cost.

- Stainless steel scrap is not as valuable as brass scrap. As a result there is a significant reduction in the percentage of material cost that can be recovered after manufacture.

- Stainless steel is 1/15th as conductive as brass. The most common methods of post-mold installation for Inserts and many turned products entails using heat and ultrasonics, so reduced conduction increases installation time and reduces assembly efficiency.

- Certain grades of stainless steel, such as 316, are superior to brass in more aggressive marine environments such as fast moving currents, but this may not apply to other grades. Please note, the most common turning stainless, 303, offers a superior machining rating as compared to other 300 series stainless steels because sulfur has been added. However, sulfur also significantly decreases resistance to corrosion in seawater. Brackish or slow moving sea water may also increase crevice and/or pitting corrosion in various grades.

- Stainless steel offers excellent resistance to many acids and it can be passivated in either citric or nitric solutions. Hydrochloric acids should be avoided.

- Stainless steel, like brass, provides excellent resistance to corrosion in contact with petroleum products.

- Stainless steel can provide higher strength than brass dependant upon the grade/alloy.

- Certain grades of austenitic stainless steel such as 302, 304, and 316 are FDA approved for food contact and therefore a good choice for use in food and beverage applications. 303 is not approved for use in contact with food.

- Austenitic stainless steel provides higher service temperatures than brass. However, it is important to note that the service temperature of the assembly is usually limited by the heat deflection temperature of the plastic host. This is because the plastic would most likely melt before any metal Insert.

Insert Installation Technology

As much as 75% of an Insert's performance is the direct result of how well it was installed. For those Inserts that are installed after the molding process, **SPIROL** offers flexible, versatile solutions for Insert installation into thermoplastic and thermoset plastics.

Basic models include manual, semi-automatic and automatic machines. These standardized, time-tested, modular designs are robust, reliable and easily adjustable — allowing simple customization to meet the specific needs of your application.

More than 80% of the components in the machines are pre-tested and production-proven standard items. This translates into faster delivery, greater reliability and lowest cost for equipment of comparable quality.

The automatic machines are the ideal foundation for stand-alone systems and enhanced assembly systems.

Optional equipment and features include:
- Pick and place systems
- Rotary and linear part indexing
- Part and Insert presence sensing
- Torque monitoring for self-tapping Insert installation

SPIROL offers free Insert samples and Application Engineering support.

SPIROL Application Engineers will review your application needs and work with your design team to recommend the best solution. One way to start the process is to select **Inserts in Plastic** in our **Optimal Application Engineering** portal at www.**SPIROL**.com.

U.S.A.

Spirol International Corporation
30 Rock Avenue
Danielson, Connecticut 06239
Tel. +1 (1) 860.774.8571
Fax. +1 (1) 860.774.2048

Spirol West Inc.
1950 Compton Avenue, Unit 111
Corona, California 92881-6471
Tel. +1 (1) 951.273.5900
Fax. +1 (1) 951.273.5907

Spirol International Corporation
Shim Division
321 Remington Road
Stow, Ohio 44224
Tel. +1 (1) 330.920.3655
Fax. +1 (1) 330.920.3659

Spirol Distribution
(For U.S. Distributors)
30 Rock Avenue
Danielson, Connecticut 06239
Tel. 1.860.774.8571
Fax. 1.860.774.0487

Canada

Spirol Industries, Ltd.
3103 St. Etienne Boulevard
Windsor, Ontario
Canada N8W 5B1
Tel. +1 (1) 519.974.3334
Fax. +1 (1) 519.974.6550

Mexico

Spirol México, S.A. de C.V.
Carretera a Laredo KM 16.5 Interior E
Col. Moisés Saenz
Apodaca, N.L. 66613 México
ó Apdo. Postal 151 de Apodaca, N.L.
Tel. +52 (01) 81 8385 4390
Fax. +52 (01) 81 8385 4391

Europe

Spirol Industries, Ltd.
Princewood Road
Corby, Northants
England NN17 4ET
Tel. +44 (0) 1536 444800
Fax. +44 (0) 1536 203415
(UK Distributors: Tel. 0800 3890034)

Spirol SAS
Rue Henri Rol Tanguy
Z.A. Les Naux
51450 Bétheny - Reims
France
Tel. +33 (0) 3 26 36 31 42
Fax. +33 (0) 3 26 09 19 76

Spirol GmbH
Brienner Strasse 9
80333 Munich
Germany
Tel. +49 (0) 931 454 670 74
Fax. +49 (0) 931 454 670 75

Asia Pacific

Spirol International Engineered Fastener Trading Co. Ltd.
No. 11 Xi Ya Rd. North
Section A, 1F, Building 14
Wai Gao Qiao Free Trade Zone
Shanghai, China 200131
Tel. +86 (0) 21 5046-1451/1452
Fax. +86 (0) 21 5046-1540

ISO/TS 16949:2002 Certified

e-mail: info@spirol.com

SPIROL.com