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J.C. GUPTA & SONS

Fastener Super Speciality

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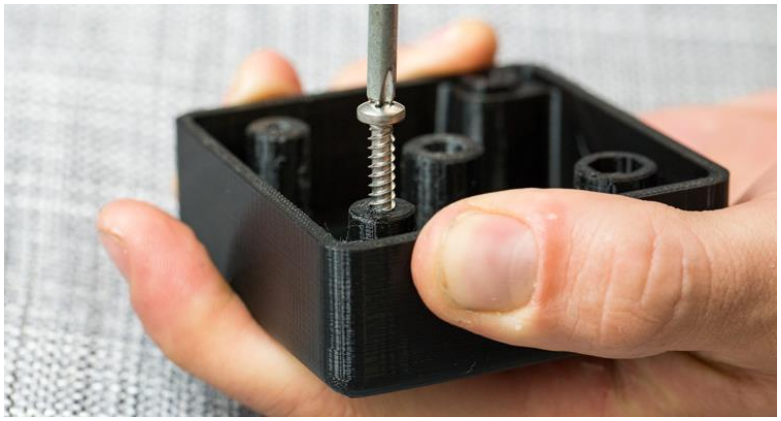
THREAD FORMING SCREWS TECHNICAL GUIDE

JCPlas

The reliable thread forming screw for easy fastening into thermoplastics.

Plastic is proving to be a versatile material for the future in spite of the hue and cry against it. It is opening up a world of innovations where smaller, lighter and cheaper is driving the markets. But it comes with its own technological challenges such as suitable fastening solutions. The regular screws are completely unsuitable leading to development of specialised screws for use in plastics.

Fastening plastics using standard self-tapping screws frequently causes assembly problems. The plastic material is liable to burst due to stresses that build up in the assembly.
One solution is inserting the screws into metal inserts but this adds to the procurement and assembly costs.
Fastening thermo plastic materials during construction and assembly as well as their load capacities prove to be challenging issues for industrial users on a regular basis.



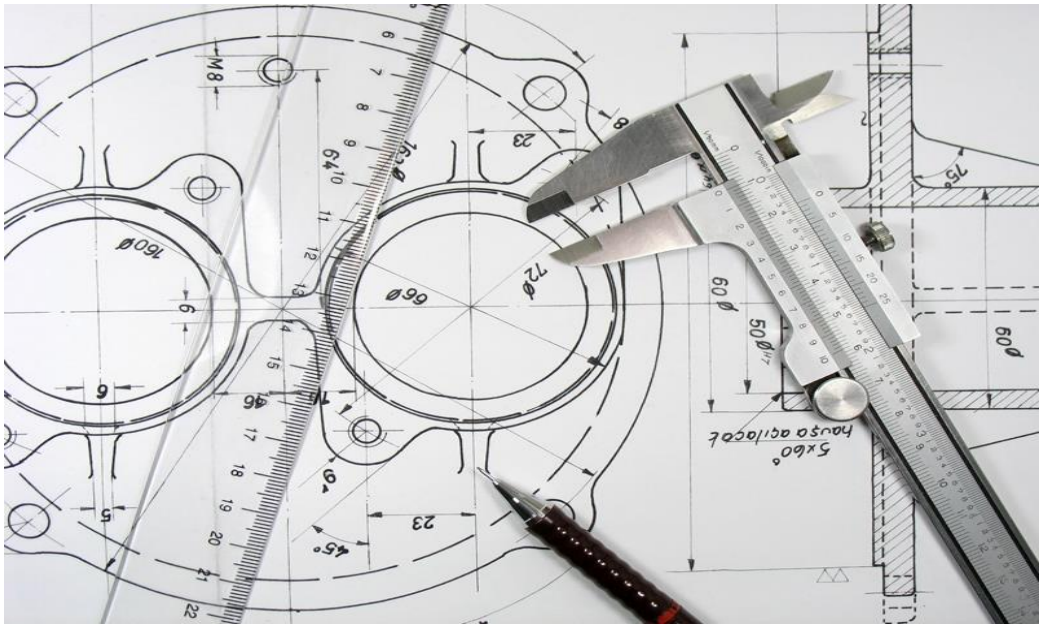
With the increasing use of 3D printing technology, it has become imperative that a reliable screw capable of providing a secure strong joint in plastics is available.

Selecting the Right Fastener

With thousands of different polymers available today, there can be no absolute guidelines to follow when fastening these materials.

The dynamics of plastic vary according to the type of plastic used. The screw selected needs to take into account the thermal expansion, clamp retention and tractile capability of the material Laboratory testing of fasteners in the subject material is the only way to determine if acceptable performance levels can be achieved.

For maximum performance, a fastener should be selected early in the design process. This would have many potential benefits.



Reduced In-Place Costs

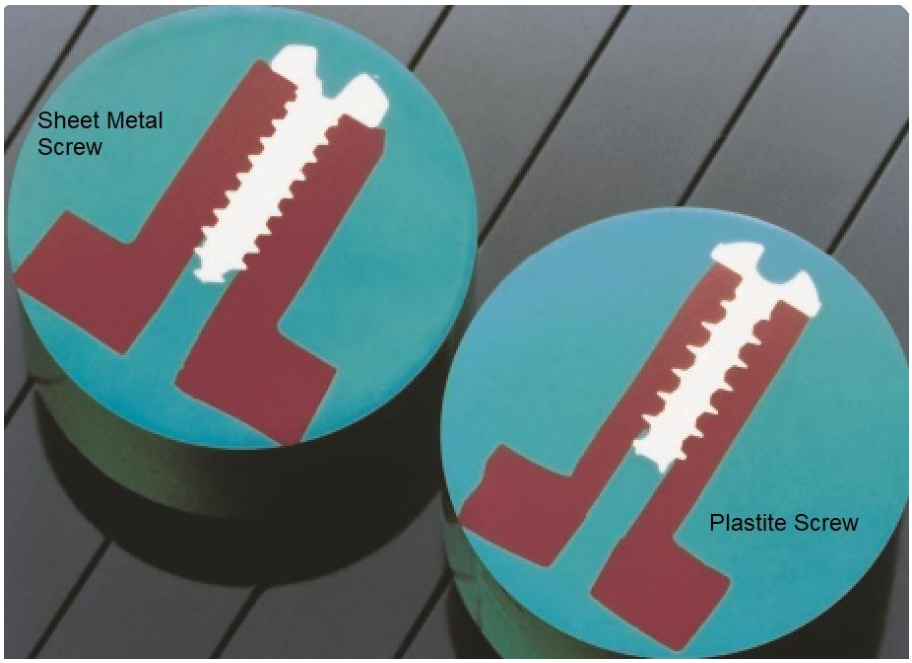
Proper fastener selection may allow the use of thinner bosses and eliminate the need for supplementary locking devices. This can reduce in-place costs through:

- Reduced material usage
- Reduced cycling times
- Elimination of inserts and adhesives
- Streamlined assembly.

Optimal Performance

Fasteners specially designed for plastics can optimize performance in specific types of materials. By selecting the proper fastener, you may obtain:

- Higher strip-out torque values
- Increased resistance to loosening
- Higher pull-out values



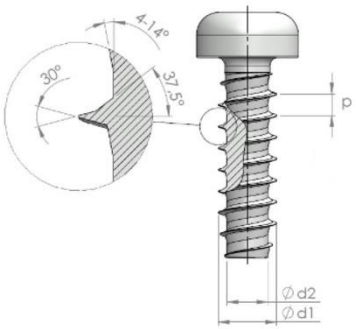
Thread Forming Screws.

Screws that deform the base material to form their own threads are called thread forming screws. The thread-forming screws deform a lot of plastic when they are driven.

This produces a high resistance to back-out but also creates large concentration of stresses in the material.

For harder plastics, this can result in failure. Therefore, correction selection of hole diameter based upon the type of plastic is very important.

Another effective solution is to use thread-forming screws with 30° thread form.



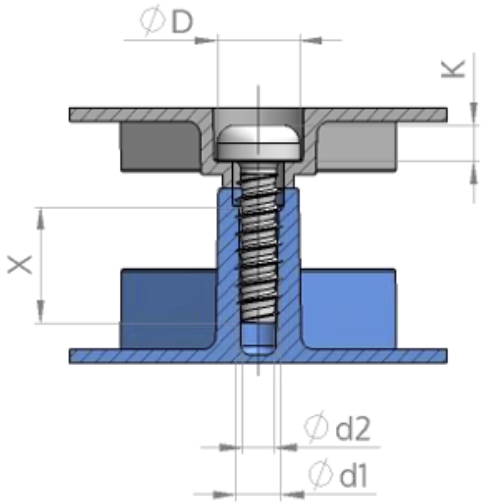
This feature allows the screw to make deeper grooves into the material and capture more of it between the threads, creating an even greater resistance to shear force while reducing stress.

The JCPLAS screw uses this design form which provides many benefits like:

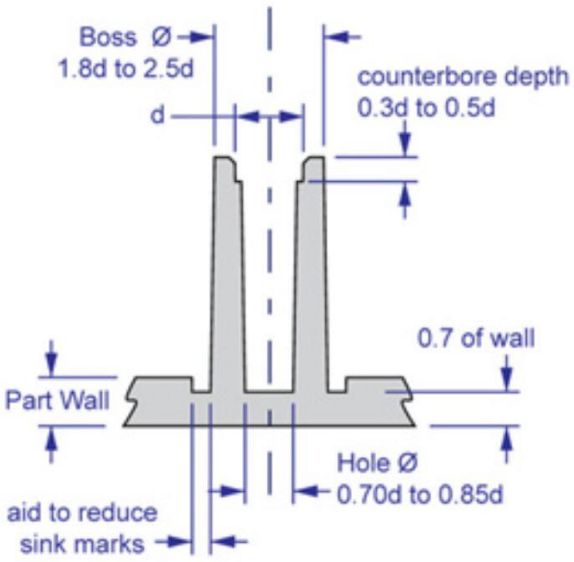
1. Optimal connection of plastic parts
2. Minimal radial stress
3. Considerably increased durability of screw connection in static and dynamic tensile loading.
4. Low thread forming torque ensuring safety of the plastic recipient
5. Elimination of the risk of relaxation
6. A guaranteed tenfold re-assembly
7. The thread's one-of-a-kind geometry results in an optimal fastening and self-locking mechanism for thermoplastics.

8. Increases preload force by higher flank overlapping on pressure side
9. These Screws with large than normal threads increase the load bearing capacity of the plastic and provide high quality internal threads with no damage to the molecular structure of the plastic, significantly reducing the danger of material failure.
10. Fast, cost-effective application.
11. The easy starting, easy driving capabilities of **JCPLAS screws** cut assembly time and costs.
12. Exceptional holding power eliminates the need for thread inserts.

Boss Design

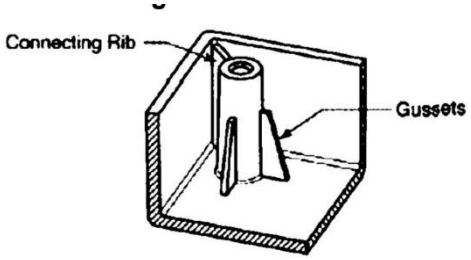


Bosses are used to facilitate the registration of mating parts, for attaching fasteners such as screws, or for accepting threaded inserts.



Boss Cross Section:

Wall thickness for bosses should be less than 60 percent of the nominal wall to minimize sinking. However, if the boss is not in a visible area, then the wall thickness can be increased to allow for increased stresses imposed by self-tapping screws. The diameter of the hole in the boss should be equal to at least 0.7 X diameter of the screw. The boss radius should be a minimum of 0.25 X Thickness.



Bosses can be strengthened by incorporating gussets at the base or by using connecting ribs.

For optimal joints in thermoplastics, we recommend designing the bore geometry in relation with the screw diameters and materials. Please use the table below as a guide.

Material	Hole Ø d_b	External Ø d_A	Installation Depth t_1
ABS	0,80 x d	2,00 x d	2,00 x d
ABS PC Blend	0,80 x d	2,00 x d	2,00 x d
ASA	0,78 x d	2,00 x d	2,00 x d
PA 4.6	0,73 x d	1,85 x d	1,80 x d
PA 6	0,75 x d	1,85 x d	1,70 x d
PA 6.6	0,75 x d	1,85 x d	1,70 x d
PBT	0,75 x d	1,85 x d	1,70 x d
PE - LD	0,70 x d	2,00 x d	2,00 x d
PE - HD	0,75 x d	1,80 x d	1,80 x d
PET	0,75 x d	1,85 x d	1,70 x d
PET - GF 30	0,80 x d	1,80 x d	1,70 x d
POM	0,75 x d	1,95 x d	2,00 x d
POM - GF 30	0,80 x d	1,95 x d	2,00 x d
PP	0,70 x d	2,00 x d	2,00 x d
PP - GF 30	0,72 x d	2,00 x d	2,00 x d
PP - TV 20	0,72 x d	2,00 x d	2,00 x d
PS	0,80 x d	2,00 x d	2,00 x d
PVC (hart)	0,80 x d	2,00 x d	2,00 x d
SAN	0,77 x d	2,00 x d	1,90 x d

Keep-in-mind that specific applications need to allow for various molding conditions, tool design, weld lines, and proximity to any injector gates, etc. will affect the boss.

Also, a designer needs to notice the different recommendations for the inner diameter (i.d.) hole size for the screw – as it is dependent on the specific thermoplastics being used in the product design. As each plastic has its own molecular composition, some polymers are prone to cracking under expansion stress, while others are more capable of resisting those pressures when the screw is driven into place. Knowing your product material early on in the design process helps you create the optimal boss dimensions.

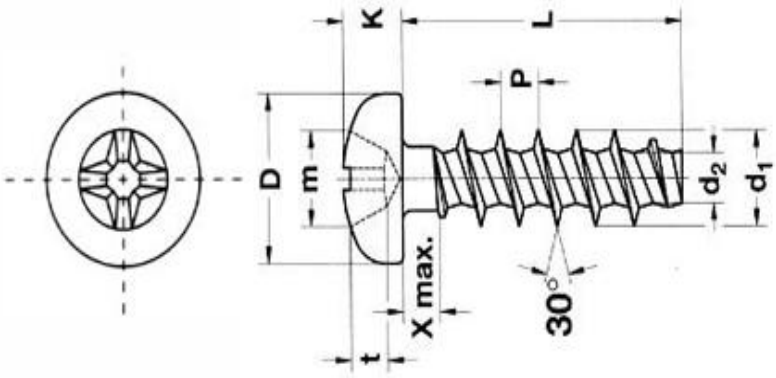
Joint Evaluation

The following factors should be considered when designing for screws:

• Boss Hole Dimension – For higher strip torque, use a hole diameter close to 0.7 times the diameter of the screw.

• Screw Length – The thread engagement length should be 2.0 to 2.5 times the diameter of the screw.

TERMINOLOGY



d1 External Thread diameter

d2 Core Thread diameter

D HEAD DIAMETER

E SLOT WIDTH

K HEAD HEIGHT

P THREAD PITCH

X THREAD RUNOUT

Usage Recommendations

- For optimal joints in thermoplastics, we recommend designing the bore geometry in relation with the screw diameters and materials.
- Screw Length – The thread engagement length should be 2.0 to 2.5 times the diameter of the
  screw.
- Always use trials to determine the optimal hole size and screw length. This will be dependent on depth of engagement, ease of driving required and material being tapped.
- Ensure trials are made to determine the best tightening torque for your application. Use up to 80% of the values suggested by your trials.