Engineered Fastening

Engineered Threaded Fasteners for Plastics

Fastening & Assembly Solutions for Plastic Applications

Plastics continue to open up a world of design opportunities, yet present some unique fastening problems. Whether you're fastening plastic to plastic or plastic to another material, STANLEY Engineered Fastening offers a wide selection of high-performance fasteners engineered to meet the requirements of your application.

Selecting the Right Fastener

With thousands of different polymers available today, there can be no absolute guidelines to follow when fastening these materials. 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. STANLEY Engineered Fastening applications engineers are available to help you every step of the way, from selection and testing to boss design.

Why use Special Fasteners for Plastics?

Each type of plastic has its own set of performance issues, such as ductility, thermal expansion and clamp retention. Selecting a fastener that can best match these requirements is critical to the overall performance of an application.

Type B, type AB and other standard fasteners, with wide flank angles and shallow threads, were designed for use in sheet metal and can not meet the dynamic requirements of plastics.

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

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

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Table of Contents

Threaded Fasteners for Plastics

- Threaded Fasteners for Plastics vs. Standard Screws 4

Joints in Plastics

- Properties of Plastics 5
- Installing a Threaded Fastener in Plastics 6
- Design Issues and Fastener Selection 7
- Fastener Selection Chart 9

Threaded Fasteners for Thermoplastics

- Delta PT® Fasteners 10
- PT® Fasteners 12
- DST Fasteners 15
- PLASTITE® 48 Fasteners 17
- PLASTITE® 45 Fasteners 20

Threaded Fasteners for Thermoset Plastics

- Duro PT® Fasteners 23

Other Threaded Fastening Solutions

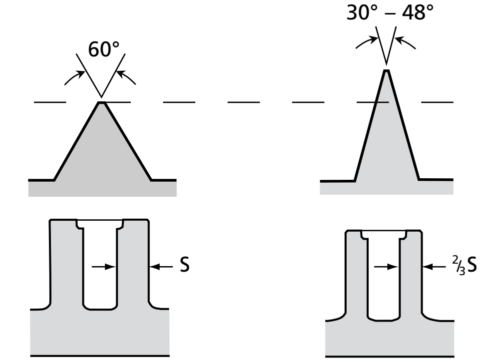
- Powergrip® Fasteners for Layered Assemblies 26
- PlasTORX® Fasteners for Molded Assemblies 27
- Other Threaded Fasteners for Plastics 29
- TORX PLUS® Drive System 30

Definitions

- Glossary 31

Fasteners for Plastics vs. Standard Screws

Standard Fastener | **Special Fastener for Plastics**



Typical Boss Design for Standard Screw

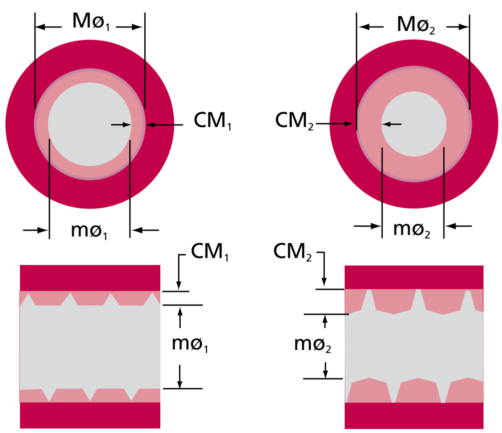
Typical Boss Design for Fastener for Plastics

Narrow Thread Profiles Maximize Performance

Type B, type AB and other standard fasteners have a wide thread profile (also called flank angle) of 60°.

Special fasteners for plastics have special thread profiles to meet the needs of these unique materials. These narrower thread profiles, ranging from 30° to 48°, reduce radial stress and expansion. This in turn maximizes fastener performance.

Because radial stress is reduced, special fasteners for plastics allow the use of smaller bosses than standard screws, as shown at left. Using smaller bosses can reduce your overall costs through decreased material usage and molding cycle times.



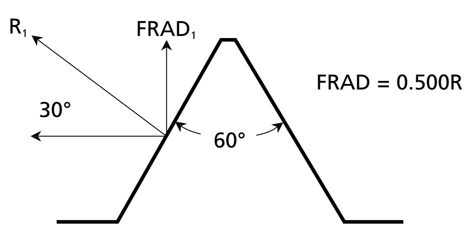
Standard Fastener | **Special Fastener for Plastics**

Increased Resistance to Pull-Out

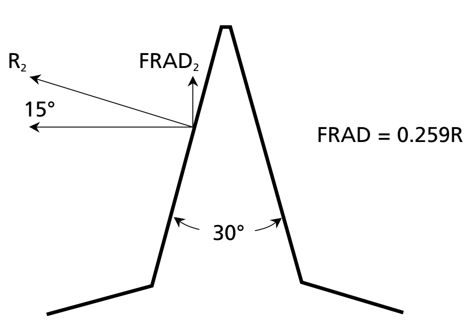
In the illustrations at left, CM represents the area subjected to shear when an axial load is applied.

Because the special fastener for plastics has a smaller minor diameter (mø) and a higher thread profile, it contains a larger volume of material (CM) and has a larger axial shear area.

This greater area of thread engagement means the special fastener for plastics is more resistant to pull-out.



Standard Fastener



Special Fastener for Plastics

Lowered Radial Stress Prevents Boss Damage

Radial force (FRAD) is an undesirable force since it creates outward stress and can damage the boss.

Although the same volume of material is displaced between the 60° thread and the 30° thread, the radial force generated by the 30° thread is approximately one-half that of the 60° thread.

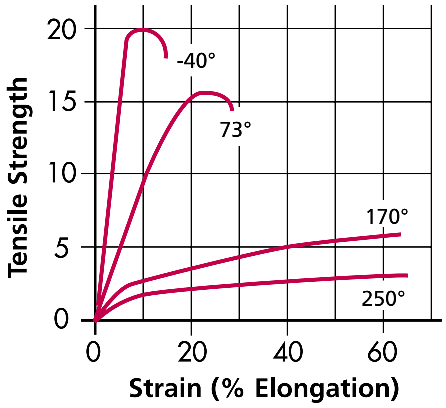
In the photo at right, the plastic boss with a 60° thread fastener shows radial stress and subsequent damage. The plastic boss with a special fastener for plastics shows **reduced radial stress.**

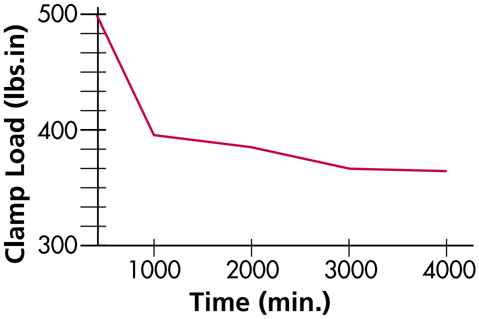
Standard Fastener | Special Fastener for Plastics

The Properties of Plastics

The fastening performance of plastics is affected by several factors:

- Flexural modulus (stiffness of material)
- Filler and/or reinforcement content (amount of glass, etc. added to material)
- Thermal expansion rate
- Creep rate





Flexural Modulus

Flexural modulus is the best indicator of how a plastic will respond to fasteners. Generally, the lower the flexural modulus, the more the material will flow and allow the formation of threads.

Thermoplastics with a higher flexural modulus also allow the formation of threads, but usually require a fastener with a low helix angle to avoid excessive drive torque.

Plastics with a high flexural modulus, including thermosets, are too stiff for thread forming and will require thread-cutting fasteners.

There are definite exceptions to these guidelines which can adversely affect fastening performance. Involve our application specialists early in the design process to maximize joint reliability.

The Effects of Fillers on Fastening

Fillers and reinforcements change one or more properties of the thermoplastic. They can also affect fastening performance.

For example, impact-resistant resins tend to act more ductile than their flexural modulus would indicate. Lubricants added for molding, such as silicone, tend to reduce drive torque but can negatively affect clamp load.

Again, it is important to test your application early in the design process to ensure optimal performance.

Thermal Expansion Rate

The stress/strain curve for thermoplastics is very temperature dependent. Plastics expand much faster than metals do when subjected to the same thermal loading.

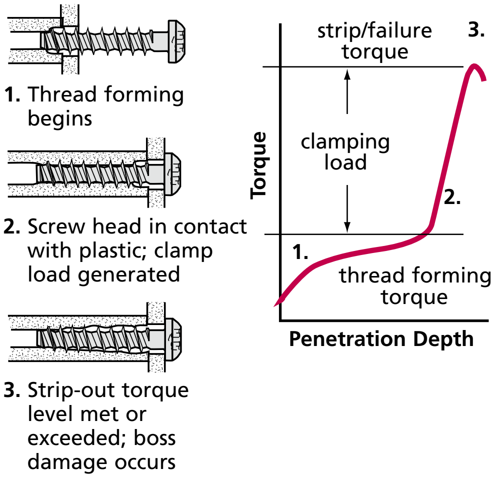
Since very few joints operate at constant temperatures, thermal expansion or contraction is virtually universal. This will affect clamp load. However, this is only a problem if the application uses materials with dissimilar expansion rates and the temperature change is significant.

Creep Rate

Under load or heat all plastics will creep, or permanently deform. Creep will, in turn, cause a loss in clamp load. The chart at left demonstrates the loss of clamp load, at a stable temperature, over 64 hours for a #8 PLASTITE® fastener driven into acetal resin.

However, creep can be compensated for in joint design through a variety of methods. See page 8 for more details.

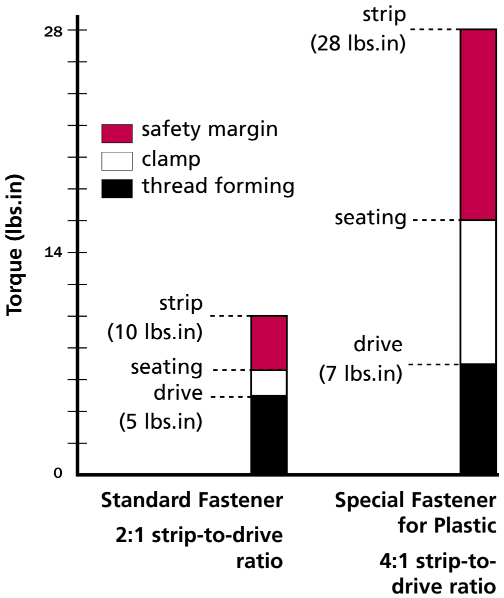
Installing a Threaded Fastener in Plastics



Thread forming and Stripping Torque

Because friction increases as penetration increases, the differential between the thread forming torque and the strip (failure) torque must be maximized.

Proper seating torque varies from application to application, so contact a STANLEY Engineered Fastening applications engineer for assistance.



Drive-to-Strip Ratio

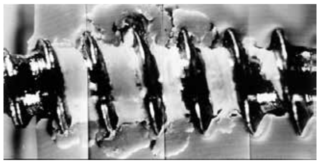
As demonstrated in the chart to the left – based on testing – the fastener for plastic has a much higher drive-to-strip ratio, so the joint is less likely to be damaged during installation.

The standard screw has a safety margin of only 3.5 lbs.in. The special fastener for plastic has a safety margin of 12 lbs.in.

Note: The chosen seating torque was 65% of the failure torque, based on testing.

Influence of Driver Speed

Increased drive gun speed can negatively affect the quality of the joint.



During installation, as the RPMs increase, so does the amount of heat that is generated. Too much heat can break down the plastic and lower the failure torque level.

Determining Proper Seating Torque

STANLEY Engineered Fastening can run complete tests on your application to determine your optimal fastening solution, including fastener selection, joint design and seating torque.

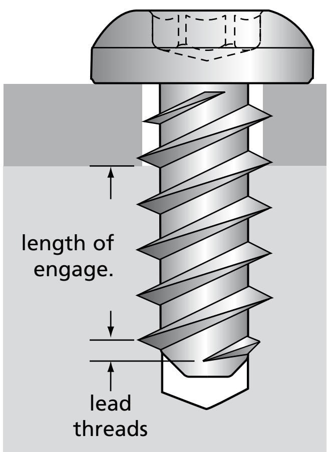
For a recommendation on how to run your own tests to determine proper seating torque, please see page 8.

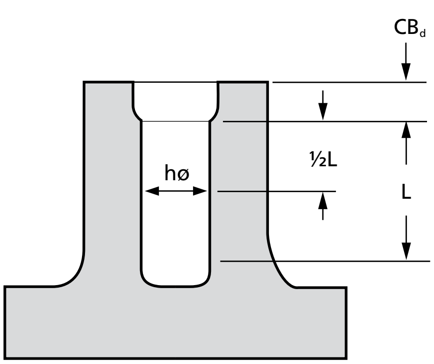
Design Issues and Fastener Selection

There are several factors which can affect a fastener's ability to achieve satisfactory performance, including:

- Pilot hole diameter
- Length of engagement
- Boss design

Though product design may dictate certain restrictions, laboratory testing will determine the proper combination of these factors for your application.





Thread Engagement & Pilot Hole Diameter

Thread engagement is the amount of thread flank depth that is filled by the application material. It is often expressed as a percentage. A hole diameter equal to the major diameter of the threads would have a thread engagement of 0%. In moderately stiff materials, you should start with a hole size that provides 75% to 80% thread engagement.

A hole that creates a thread engagement of over 100% does not improve performance. It will, however, increase required drive torque, because the walls of the hole must expand to make room for the screw.

If the hole size is fixed, you will need to adjust the thread style or length of engagement to reach the appropriate performance requirements.

Each fastener for plastics has its own parameters. For optimal performance, contact a STANLEY Engineered Fastening applications engineer for assistance.

Length of Engagement

Length of engagement is the measurement of full-sized fastener threads engaged in the nut material. The length of the lead thread (usually about one-half the fastener diameter) is not counted in the length of engagement, since its reduced size minimizes any performance benefits.

Length of engagement is often expressed in relationship to the nominal diameter of the screw; e.g. 2 to 2-1/2 diameters of engagement.

Boss Design

Drafted holes ease molding in thermoplastics, but can affect thread engagement. Always utilize the minimum amount of draft possible to retain good mold function.

Generally, the nominal hole size (hø) is calculated at a depth equal to half of the fastener's total length of engagement (L), not including the counterbore.

Follow the specific boss design recommendations listed for each threaded fastener.

Design Issues and Fastener Selection

Compensating for the Effects of Creep in a Joint

As stated previously, under load or heat, all plastics will creep. There are several methods to compensate for, or reduce, the effects of creep in a joint.

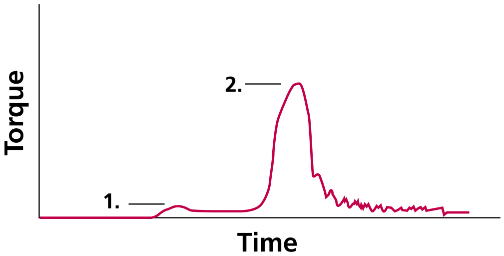
- Reduce the stress at the bearing surface by one or more of the following:
  - – increase the fastener head diameter
  - – add a flat washer
  - – reduce the clearance hole diameter
  - – reduce initial clamp load at assembly
- Add a spring element to the joint such as a helical and flat washer combination
- Add a metal sleeve in the clamped component to carry some of the clamp load
- Use a shoulder bolt to transfer the load to the nut member
- Increase stiffness of plastic by adding a filler or changing the base resin

Testing to Determine Proper Seating Torque

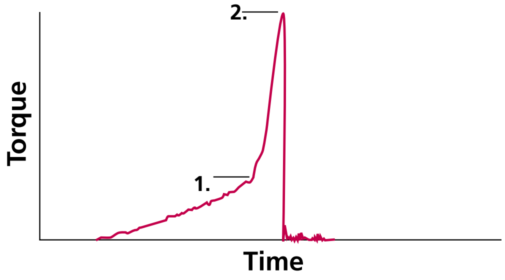
The following are general recommendations only.

1. Gather enough sample applications to generate a statistically significant sampling – a minimum of 30 per specific joint condition. These samples must include all components in the joint stack-up such as clamping components, nut members and fasteners.
2. Use a drive gun that can torque the fasteners to failure and has the same RPM as the drive gun that will be used in production.
3. Use a torque measuring device and a strip chart or graph and capture the peak drive torque and ultimate torque values. Drive the fasteners to failure. Calculate the average of the peak drive values and of the ultimate torque values.
4. Next calculate the average of these two resulting values. This is the target seating torque. Factor a value of ±10% for gun accuracy. Compare this torque window to +3SD (standard deviation) of the average drive torque value and -3SD of the average ultimate torque value. If there is no overlap of the two regions, the torque window will allow the fasteners to be seated without failure at assembly. If there is overlap in either of the two regions, a redesign of the joint is warranted.

For assistance, please contact a STANLEY Engineered Fastening applications engineer.



Through Hole Signature Curve



Blind Hole Signature Curve

1 – Peak Drive Torque: level at which the materials are drawn together and the fastener seats

2 – Ultimate Torque: level at which the joint fails; usually from strip-out

Selecting the Right Threaded Fastener

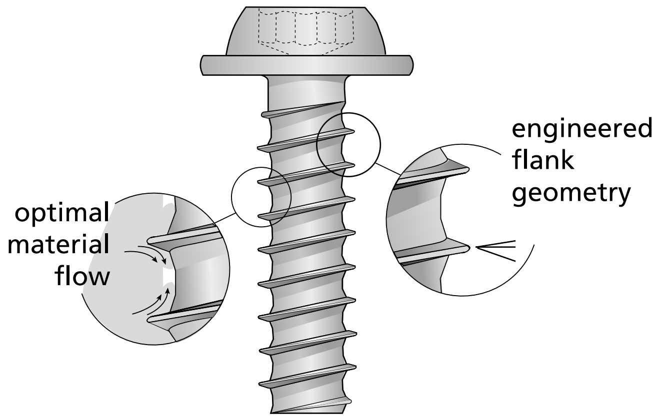
The following chart is intended only as a starting point in the selection of fasteners. The fastener must be matched to the properties of the material. Drive to strip ratios, clamp retention, and other performance issues are directly affected by the fastener you choose. Please contact a STANLEY Engineered Fastening applications engineer for assistance in selecting the optimum fastener for your design.

		Included Materials	Flexural Modulus (PSI)	Fastening Solution
Thermoplastics	ductile	Polyethylene (PE)	150,000	Delta PT® fastener, PT® fastener, or DST fastener
		Polypropylene (PP)	200,000	
		Polycarbonate (PC)	340,000	Delta PT® fastener, PT® fastener, twin helix PLASTITE® fastener, or DST fastener
		ABS, 0-20% glass fill	350,000	
		Polyamide 66 (PA)	350,000	
		Acetal (AC)	400,000	
		Polystyrene (PS)	430,000	
		Polypropylene, 40% talc fill (PP40)	500,000	
		Polypheylene Sulfide	550,000	
	moderate	ABS, 20% glass fill	650,000	Delta PT® fastener, twin helix PLASTITE® 48 fastener, or PT® fastener
		Polyamide 66, 12% glass fill	800,000	
		Polycarbonate, 20% glass fill (PC20)	850,000	
	stiff	Polycarbonate, 30% glass fill (PC30)	1,100,000	Delta PT® fastener, single-helix PLASTITE® 48 or 45 fastener, or PT® fastener
		Polybutylene Terephthalates 30% glass fill (PBT30)	1,100,000	
		Polyamide 66, 30% glass fill (PA30)	1,200,000	
		Liquid Crystal Polymer (LCP)	1,400,000	
Thermosets		Polyphenylene Sulfide, 40% fill (PPS40)	1,700,000	Duro PT® thread-cutting fastener
		Phenolic, 20% glass fill	1,750,000	
		Polyester, 50% glass fill	2,100,000	

	Type of Application	Fastening Solution
All Plastics	Plastic or other materials to thin metal	Powergrip® fasteners
	Molded assemblies	PlasTORX® fasteners

Delta PT® Thread Forming Fasteners

Delta PT® fasteners are engineered to provide maximum performance in a wide range of thermoplastics. The improved design results in a stronger fastener that creates optimal material flow during installation, providing higher performance, better clamp loads and increased joint life.



Delta PT® Fastener

Key Advantages

- Provides optimal performance in all types of thermoplastics
- Provides increased torsional and tensile strength over PT fasteners
- Provides high strength and in-place reliability
- Can achieve higher clamp loads and seating torques

Features & Benefits

Flank geometry engineered to provide better material flow during installation

- Provides high flank engagement
- Can achieve higher clamp loads and seating torques
- Optimizes material flow
- May permit use of shorter fasteners and/or smaller diameters, if necessary

Larger fastener cross-section

- Increases shear area and fastener strength
- Offers increased fatigue life
- Provides increased torsional and tensile strength

Optimized pitch

- Allows high clamp load with smaller contact pressure
- Minimizes radial stress

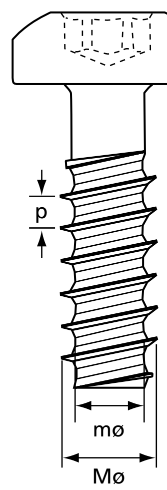
Specifications

- Sizes: Delta PT® 14 – 70 (1.4mm – 7.0mm); other sizes may be available
- Head Styles: Can be used with any head design
- Specials: Shoulder screws, sems, double end studs, collar studs; others as required
- Drive Systems: TORX PLUS® Drive is recommended to facilitate the proper amount of torque transfer required for forming threads. Other styles also available.

Applications

Thermoplastics with a flexural modulus up to 1,400,000 p.s.i.

Delta PT® Thread Forming Fasteners

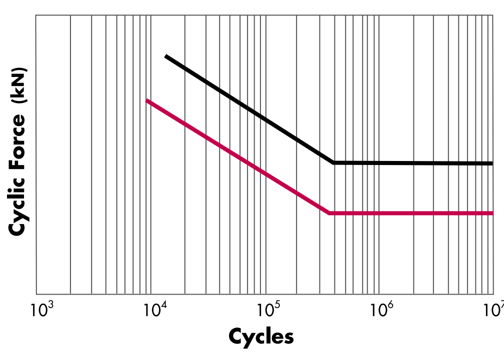


Dimensional Data

*PT fastener standards are true metric sizes.

Nom. Size	Metric Size	p Thread Pitch (mm)	Mø Major Dia. (mm)	mø Minor Dia. (mm)
Delta PT 14	1.4	0.57	1.4	0.9
Delta PT 16	1.6	0.64	1.6	1.1
Delta PT 18	1.8	0.71	1.8	1.2
Delta PT 20	2.0	0.78	2.0	1.4
Delta PT 22	2.2	0.85	2.2	1.5
Delta PT 25	2.5	0.95	2.5	1.7
Delta PT 30	3.0	1.12	3.0	2.1
Delta PT 35	3.5	1.29	3.5	2.5
Delta PT 40	4.0	1.46	4.0	2.8
Delta PT 45	4.5	1.63	4.5	3.2
Delta PT 50	5.0	1.80	5.0	3.5
Delta PT 60	6.0	2.14	6.0	4.3
Delta PT 70	7.0	2.48	7.0	5.0

Increased Strength



Delta PT fastener — R = 0.1
PT fastener — Cycle stress; breakage of the fastener cross section

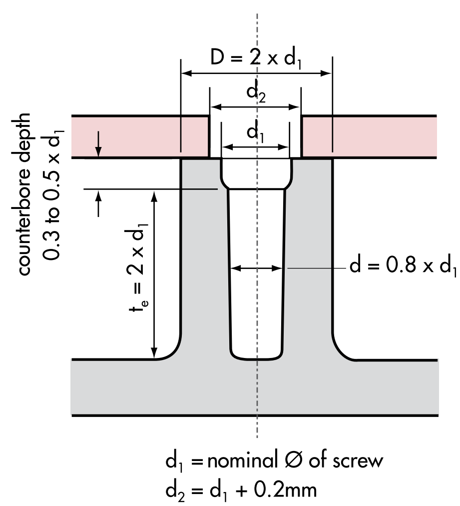
With its extended core diameter and optimum thread design, the Delta PT® fastener offers a longer fatigue life than the PT® fastener. The Delta PT® design provides better thread engagement and, therefore, better conditions against stress fractures of the thread flank.

The chart above demonstrates that the Delta PT® fastener provides greater resistance against screw breakage than the PT® fasteners under in-service loads.

Boss Design Recommendations

The criteria for optimum hole diameter is to obtain the maximum clamp load during the installation process. A good starting point in determining the proper hole diameter is

$$d = 0.8 \times d_1$$

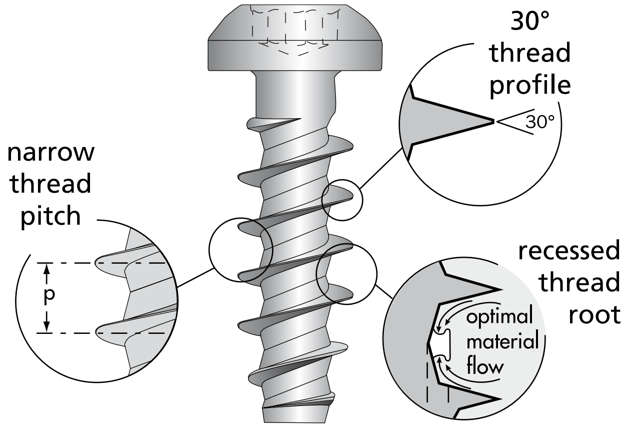


Specific applications will require some modifications to allow for the flexural modulus of the material, molding conditions, mold tool design, feed distance from gate, weld lines, structural heterogeneity and amount of reground material.

In order to ensure optimal performance, we recommend testing on initial samples. Please contact a STANLEY Engineered Fastening applications engineer for assistance.

PT® Thread Forming Fasteners

With a high thread profile and recessed thread root, the PT® fastener provides increased thread engagement with minimal stress on the boss. It provides optimal performance in a wide range of thermoplastics.



PT® Fastener

Key Advantages

- Optimizes performance in all types of thermoplastics
- Provides maximum resistance to back-out and pull-out
- Minimizes boss failure
- Increases product reliability

Features & Benefits

Narrow 30° thread profile minimizes radial expansion and stress in boss

- Permits use of thinner bosses, which can reduce cycling times and material usage
- Reduces back-out caused by relaxation
- Increases load-carrying capability through increased thread engagement
- Can be used in repeat assembly operations

Optimum thread pitch allows deeper thread engagement

- Provides increased pull-out values
- Optimizes non-reversibility
- Balances load ratio between plastic and screw

Recessed thread root allows optimal material flow

- Minimizes installation torque
- Improves clamp load
- Minimizes potential of boss cracking

Round body evenly distributes surface contact between application and screw

- Improves load ratio
- Reduces high points of stress on the boss

Through hardened to Rc 33-39

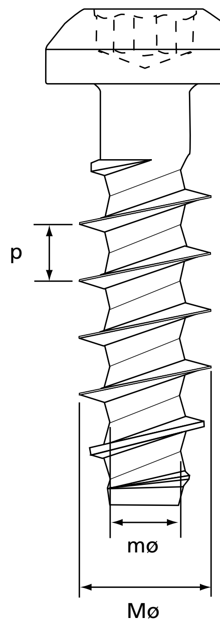
Specifications

- Sizes: K15 – K100 in diameter up to 127mm under head
- Head Styles: Can be used with any head design
- Specials: Shoulder screws, sems, double end studs, collar studs; others as required
- Drive Systems: TORX PLUS® Drive is recommended to facilitate the proper amount of torque transfer required for forming threads. Other styles also available.

Applications

Thermoplastics with a flexural modulus up to 1,400,000 p.s.i.

PT® Thread Forming Fasteners



Dimensional Data

*PT fastener standards are true metric sizes.

Nom. Size	Metric Size	p Thread Pitch (mm)	Mø Major Diameter (mm)	mø Minor Diameter (mm)
K15	1.5	0.67	1.50	0.89
K18	1.8	0.80	1.80	1.04
K22	2.2	0.98	2.20	1.25
K25	2.5	1.12	2.50	1.40
K30	3.0	1.34	3.00	1.66
K35	3.5	1.57	3.50	1.91
K40	4.0	1.79	4.00	2.17
K50	5.0	2.24	5.00	2.68
K60	6.0	2.69	6.00	3.19
K70	7.0	3.14	7.00	3.70
K100	10.0	4.49	10.00	5.23

Hole Sizes per Percentage of Thread Engagement

	100%		90%		80%		70%		60%		50%		40%	
Size	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
K15	1.21	.048	1.24	.049	1.27	.050	1.30	.051	1.33	.052	1.35	.053	1.38	.054
K18	1.40	.055	1.44	.057	1.48	.058	1.52	.060	1.56	.061	1.60	.063	1.64	.065
K22	1.66	.065	1.71	.067	1.77	.070	1.82	.072	1.88	.074	1.93	.076	1.98	.078
K25	1.85	.073	1.92	.076	1.98	.078	2.05	.081	2.11	.083	2.18	.086	2.24	.088
K30	2.18	.086	2.26	.089	2.34	.092	2.42	.095	2.51	.099	2.59	.102	2.67	.105
K35	2.50	.098	2.60	.102	2.70	.106	2.80	.110	2.90	.114	3.00	.118	3.10	.122
K40	2.82	.111	2.94	.116	3.06	.120	3.17	.125	3.29	.130	3.41	.134	3.53	.139
K50	3.46	.136	3.62	.142	3.77	.148	3.92	.155	4.08	.161	4.23	.167	4.39	.173
K60	4.11	.162	4.30	.169	4.49	.177	4.68	.184	4.86	.192	5.05	.199	5.24	.206
K80	5.40	.212	5.66	.223	5.92	.233	6.18	.243	6.44	.253	6.70	.264	6.96	.274
K100	6.68	.263	7.02	.276	7.35	.289	7.68	.302	8.01	.315	8.34	.328	8.67	.341

PT® Thread Forming Fasteners

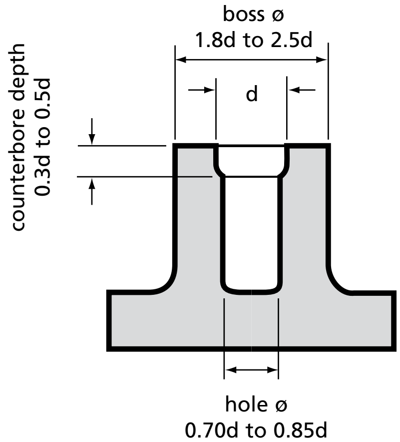
Laboratory testing and service applications have produced the general recommendations shown here. Specific applications may, however, require some modifications to allow for:

- molding conditions
- mold tool design
- amount of reground material
- weld lines
- structural heterogeneity
- feed distance from gate

In order to ensure optimal performance, we strongly recommend testing on initial samples.

Counterbore Size

The width of the counterbore should be equal to the major diameter of the screw (d). The height of the counterbore should be 0.3 to 0.5 times the nominal screw diameter.



Boss Design Example

Material: ABS

To calculate boss size based on fastener size:

Screw size:	K40
Major diameter:	4mm
Boss O.D. =	2 x screw dia.
	2 x 4mm = 8mm
Boss I.D. =	0.8 x screw dia.
	0.8 x 4mm = 3.2mm
Min. length of engagement =	2 x screw dia.
	2 x 4mm = 8mm

To calculate screw size based on (predetermined) boss size:

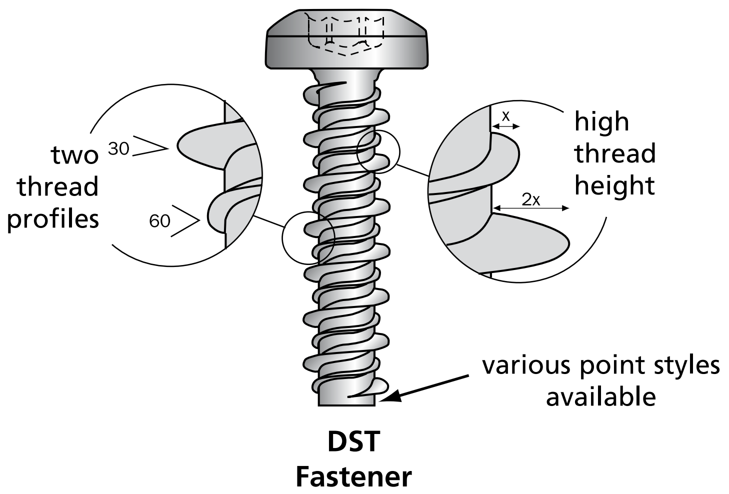
Boss O.D.:	8mm
Boss I.D.:	3.2mm
Screw dia. =	Boss O.D. ÷ 2
	8mm ÷ 2 = 4mm

PT Fastener Boss Design Recommendations

Material	Hole Dia.	Boss Dia.	Length of Engagement
ABS (acrylonitrile)	0.80 x d	2.00 x d	2.00 x d
ASA (acrylonitrile styrene acrylic)	0.78 x d	2.00 x d	2.00 x d
Nylon: PA6 (polyamide)	0.75 x d	1.85 x d	1.70 x d
Nylon: PA-GF30	0.80 x d	2.00 x d	1.90 x d
Nylon: PA6.6	0.75 x d	1.85 x d	1.70 x d
Nylon: PA6.6-GF30	0.82 x d	2.00 x d	1.80 x d
PBT (polybutylene terephthalate)	0.75 x d	1.85 x d	1.70 x d
PBT-GF30	0.80 x d	1.80 x d	1.70 x d
PC (polycarbonate)	0.85 x d	2.50 x d	2.20 x d
PC-GF30	0.85 x d	2.20 x d	2.00 x d
PE soft (polyethylene)	0.70 x d	2.00 x d	2.00 x d
PE hard (polyethylene)	0.75 x d	1.80 x d	1.80 x d
PET (polyethylene terephthalate)	0.75 x d	1.85 x d	1.70 x d
PET-GF30	0.80 x d	1.80 x d	1.70 x d
POM acetal	0.75 x d	1.95 x d	2.00 x d
PP (polypropylene)	0.70 x d	2.00 x d	2.00 x d
PPO (polyphenylene oxide)	0.85 x d	2.50 x d	2.20 x d
PS (polystyrene)	0.80 x d	2.00 x d	2.00 x d
PVC hard (polyvinyle chloride)	0.80 x d	2.00 x d	2.00 x d
SAN (styrene acrylonitrile)	0.77 x d	2.00 x d	1.90 x d

DST Thread Forming Fasteners

The high thread height and wide thread spacing of the DST (Dual-Spaced Thread) fastener allows increased thread engagement in softer thermoplastics, increasing resistance to pull-out and improving product performance.



Specifications

- Sizes: #5 to 5/16 (metric 3.5 – 8)
- Head Styles: Pan, hex, flat, oval, hex washer
- Point Styles: Blunt, gimlet, pilot
- Drive Systems: Can use any system, including TORX PLUS® Drive

Applications

Thermoplastics with a flexural modulus up to 600,000 p.s.i.

Key Advantage

- Performs well in softer thermoplastics

Features & Benefits

High thread with a 30° flank angle to reduce radial stress in the boss

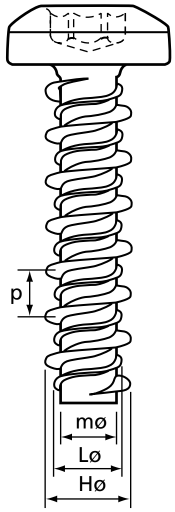
- Requires lower driving torque
- Reduces cracking of boss
- Allows use of smaller bosses

Smaller minor diameter than standard screws allows greater shear area

- Increases thread engagement
- Increases resistance to pull-out

Shank slot for thread-cutting can be added. Please contact a STANLEY Engineered Fastening applications engineer for appropriate dimensional information.

DST Thread Forming Fasteners



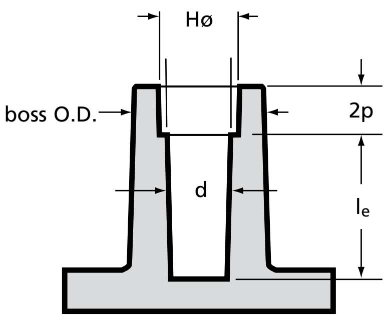
Dimensional Data – Inch

Screw Size	p Thread Pitch (per in.)	Hø High Thread Dia.	Lø Low Thread Dia.	mø Ref. Minor Dia.
#5	20	.119 - .125	.100	.073
#6	19	.135 - .145	.108	.080
#7	19	.148 - .158	.130	.090
#8	18	.160 - .170	.130	.095
#10	16	.185 - .195	.145	.105
#12	16	.210 - .220	.167	.125
#13	16	.220 - .230	.180	.132
1/4"	15	.250 - .260	.200	.165
9/32"	16	.275 - .285	.230	.188
5/16"	14	.307 - .317	.250	.208

Dimensional Data – Metric

Screw Size	p Thread Pitch	Hø High Thread Dia.	Lø Low Thread Dia.	mø Ref. Minor Dia.
3.5	1.34	3.43 - .3.68	2.74	2.0
4.0	1.34	3.76 - 4.01	3.30	2.3
4.2	1.41	4.06 - 4.32	3.30	2.4
4.8	1.59	4.70 - 4.95	3.68	2.6
5.3	1.59	5.03 - 5.33	3.81	2.9
5.5	1.59	5.33 - 5.59	4.24	3.5
6.0	1.59	5.84 - 6.10	4.83	3.7
6.3	1.69	6.35 - 6.60	5.08	4.2
7.2	1.59	6.98 - 7.24	5.84	4.8
7.5	1.59	7.24 - 7.49	6.10	5.1
8.0	1.81	7.80 - 6.35	6.35	5.3

Boss Design Recommendations



The recommended hole size (d) can be found in the chart to the right.

The length of engagement (l_e) should be 3 times the high thread diameter (see chart above).

Counterbore depth is 1 to 2 times the thread pitch length (see chart above). Counterbore depth is equal to the high thread diamter (Hø).

The boss O.D. should be at least 2 times the high thread diameter.

Recommended Hole Sizes

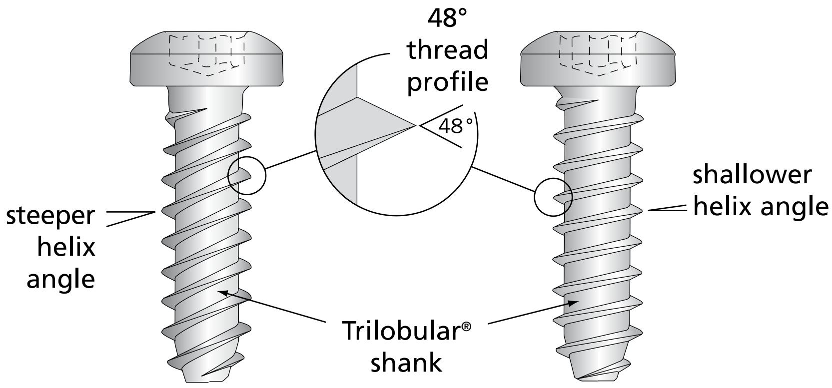
Screw Size (inch)	Hole Size (d) (in.)
#5	.099
#6	.110
#7	.125
#8	.128
#10	.144
#12	.166
#13	.180
1/4"	.201
9/32"	.234
5/16"	.250

Screw Size (metric)	Hole Size (d) (mm)
3.5	2.79
4.0	3.17
4.2	3.26
4.8	3.65
5.3	3.96
5.5	4.21
6.0	4.85
6.3	5.10
7.2	5.95
7.5	6.14
8.0	6.35

NOTE: Recommended hole sizes for DST thread-cutting fasteners are not shown. Please contact a STANLEY Engineered Fastening applications engineer for assistance.

PLASTITE® 48 Thread Forming Fastener

The PLASTITE® 48 fastener combines a unique TRILOBULAR® body with a 48° thread profile to maximize performance and reliability. Two thread forming styles are available to meet the specific requirements of a wide range of thermoplastics.



PLASTITE® 48 Fasteners

Specifications

- Sizes: #00 – 5/16"; other sizes may be available upon request
- Head Styles: Can be used with any external or internal head designs; pan, hex washer, and flat styles standard
- Drive System: Can use any system, including TORX PLUS® Drive
- Finish: As required

Applications

- Twin Helix Style: Thermoplastics with a flexural modulus up to 850,000 p.s.i.
- Single Helix Style: Thermoplastics with a flexural modulus between 850,000 p.s.i. and 1,400,000 p.s.i.

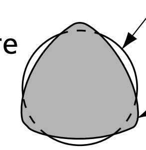
Key Advantages

- Reduces possibility of boss failure
- Increases product reliability
- Eliminates need for inserts and lock washers

Features & Benefits

Trilobular® configuration allows displaced material to cold flow back into relief areas

- Minimizes radial stress
- Reduces possibility of boss failure
- Eliminates need for inserts and lock washers
- Allows design of thinner bosses



48° thread profile allows threads to penetrate deeply into plastic material

- Generates strong mating threads
- Resists vibration loosening
- Reduces probability of strip-out and pull-out

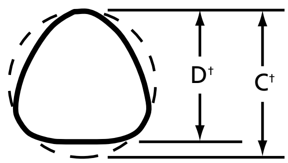
Twin lead design and steep helix angle provides greater shear area in softer plastics (with a flexural modulus up to 850,000 p.s.i.)

- Increases holding power
- Allows faster seating of fastener

Single lead design and narrow helix angle lowers drive torque and failure torque in stiffer thermoplastics (with flexural modulus between 850,000 and 1,300,000 p.s.i.)

- Creates less stress on the boss

PLASTITE® 48 Thread Forming Fastener



† C dimension measured with Tri-Flute Micrometer
D diameter measured with Standard Micrometer

Dimensional Data – Inch Sizes

Nom. Size	Thread Pitch (per inch)	C Dimension max-min (in.)	D Dimension max-min (in.)	Screw Length Tolerance	
				under 3/4" (in.)	over 3/4" (in.)
#00	51	.0496 - .0466	.0475 - .0445	±.015	±.015
#0	42	.0665 - .0635	.0635 - .0605	±.015	±.015
#1	32	.081 - .078	.078 - .075	±.030	±.030
#2	28	.092 - .086	.089 - .083	±.030	±.030
#3	24	.110 - .104	.106 - .100	±.030	±.030
#4	20	.127 - .121	.123 - .117	±.030	±.050
#6	19	.147 - .141	.143 - .137	±.030	±.050
#7	18	.166 - .160	.160 - .154	±.030	±.050
#8	16	.185 - .179	.179 - .173	±.030	±.050
#9	15	.199 - .193	.193 - .187	±.030	±.050
#10	14	.212 - .206	.208 - .202	±.030	±.050
#12	14	.232 - .226	.226 - .220	±.030	±.050
1/4"	10	.276 - .270	.268 - .262	±.050	±.050
5/16"	9	.345 - .335	.335 - .325	±.050	±.050

Dimensional Data – Metric Sizes*

*soft converted metric sizes

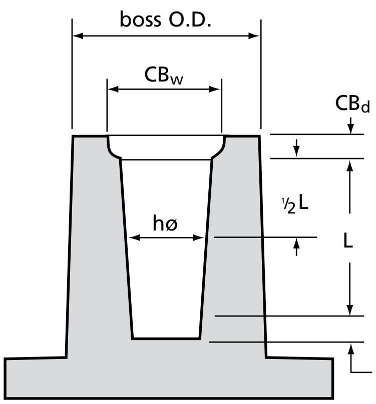
Nom. Size	Thread Pitch	C Dimension max.-min. (mm)	D Dimension max.-min. (mm)	Screw Length Tolerance	
				under 19.05mm (mm)	over 19.05mm (mm)
1.12	0.50	1.26 - 1.18	1.21 - 1.13	±0.38	±0.38
1.59	0.60	1.69 - 1.61	1.61 - 1.54	±0.38	±0.38
1.91	0.79	2.06 - 1.98	1.98 - 1.91	±0.76	±0.76
2.26	0.91	2.34 - 2.18	2.26 - 2.11	±0.76	±0.76
2.63	1.06	2.79 - 2.64	2.69 - 2.54	±0.76	±0.76
3.12	1.27	3.23 - 3.07	3.12 - 2.97	±0.76	±1.27
3.63	1.34	3.73 - 3.58	3.63 - 3.48	±0.76	±1.27
4.06	1.41	4.22 - 4.06	4.06 - 3.91	±0.76	±1.27
4.55	1.59	4.70 - 4.55	4.55 - 4.39	±0.76	±1.27
4.90	1.69	5.05 - 4.90	4.90 - 4.75	±0.76	±1.27
5.28	1.81	5.38 - 5.23	5.28 - 5.13	±0.76	±1.27
5.74	1.81	5.89 - 5.74	5.74 - 5.59	±0.76	±1.27
6.81	2.54	7.01 - 6.86	6.81 - 6.65	±1.27	±1.27
8.51	2.82	8.76 - 8.51	8.51 - 8.26	±1.27	±1.27

* Plastite® 48 fasteners are not available in true metric sizes. The chart above provides nominal inch dimensions converted to millimeters.

PLASTITE® 48 Thread Forming Fastener

Hole Sizes per Percentage of Thread Engagement

	100%		90%		80%		70%		60%		50%		40%	
Size	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
#00-51	.0377	0.957	.0386	0.980	.0395	1.003	.0404	1.026	.0413	1.049	.0423	1.074	.0432	1.097
#0-42	.0498	1.265	.0510	1.295	.0523	1.328	.0535	1.359	.0548	1.392	.0560	1.422	.0573	1.455
#1-32	.0621	1.577	.0632	1.605	.0646	1.641	.0658	1.671	.0671	1.704	.0683	1.735	.0695	1.765
#2-28	.0743	1.887	.0757	1.923	.0771	1.958	.0785	1.994	.0799	2.029	.0813	2.065	.0827	2.101
#3-24	.0855	2.172	.0873	2.217	.0890	2.261	.0908	2.306	.0925	2.350	.0943	2.395	.0960	2.438
#4-20	.0970	2.464	.1000	2.540	.1020	2.591	.1050	2.667	.1070	2.718	.1100	2.794	.1130	2.870
#6-19	.1180	2.997	.1200	3.048	.1230	3.124	.1250	3.175	.1280	3.251	.1300	3.302	.1320	3.353
#7-18	.1370	3.480	.1390	3.531	.1420	3.607	.1440	3.657	.1460	3.708	.1490	3.785	.1510	3.835
#8-16	.1440	3.658	.1480	3.759	.1510	3.835	.1550	3.937	.1580	4.013	.1620	4.115	.1650	4.191
#9-15	.1570	3.988	.1590	4.039	.1610	4.089	.1640	4.166	.1660	4.216	.1680	4.267	.1700	4.318
#10-14	.1700	4.318	.1740	4.420	.1770	4.496	.1810	4.597	.1850	4.699	.1890	4.801	.1920	4.877
#12-14	.1880	4.775	.1920	4.877	.1960	4.978	.1990	5.055	.2030	5.156	.2070	5.258	.2110	5.359
1/4"-10	.2180	5.537	.2230	5.664	.2280	5.791	.2330	5.918	.2380	6.045	.2430	6.172	.2480	6.299
5/16"-9	.2840	7.214	.2910	7.391	.2980	7.569	.3050	7.747	.3110	7.899	.3180	8.077	.3250	8.255



Boss Design Recommendations

The length of engagement (L) should be 2 to 3 times the fastener's C dimension. Testing should be done to determine optimal thread engagement on any application with a lower length of engagement.

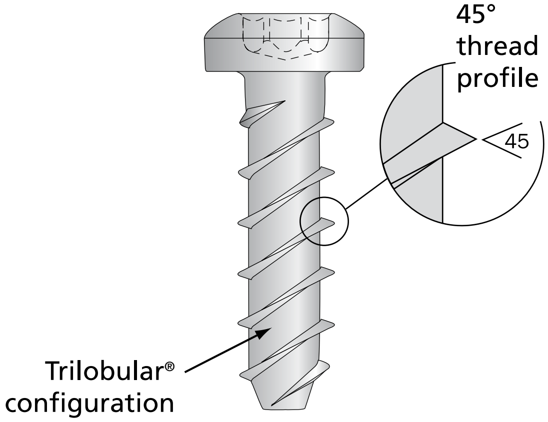
The nominal hole size (hø) must be established based on the amount of thread engagement (see chart above). For optimum performance, the hole size should provide a minimum 70% thread engagement.

The outside diameter of the boss (boss O.D.) should be 2.5 to 3 times the nominal diameter of the screw (C dimension). The boss height should not exceed 2 times the boss O.D.

The counterbore width (CB_W) should be slightly larger than the C dimension. Its depth (CB_d) should be 1/4 to 1/2 the thread pitch.

PLASTITE® 45 Thread Forming Fastener

The PLASTITE® 45 fastener is designed to facilitate thread forming in less-compressable plastics while providing high resistance to strip-out and pull-out. It has smaller root and major diameters than a 48° PLASTITE®, so it can be used in smaller bosses.



PLASTITE® 45 Fastener

Specifications

- Sizes: #2 – 3/8" (metric sizes 2 – 8); other sizes may be available upon request
- Head Styles: Can be used with any external or internal head designs; pan, hex washer, and flat styles standard
- Drive System: Can use any system, including TORX PLUS® Drive
- Finish: As required

Applications

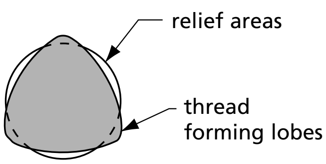
Engineering-grade thermoplastics (with a flexural modulus over 850,000 p.s.i.)

Key Advantages

- Can be used in smaller bosses than PLASTITE® 48 fasteners
- Increases product reliability
- Lowers required drive torque when fastening stiffer thermoplastics

Features & Benefits

Trilobular® configuration allows displaced material to cold flow back into relief areas



- Minimizes radial stress
- Reduces possibility of boss failure
- Eliminates need for inserts and lock washers
- Allows design of thinner bosses

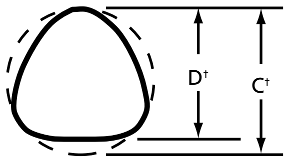
45° thread profile allows threads to penetrate deeply into plastic material

- Generates strong mating threads
- Resists vibration loosening
- Increases resistance to strip-out
- Achieves wide differentials between drive and fail torque

Single lead design and narrow helix angle lowers drive torque and failure torque in thermoplastics with a flexural modulus over 850,000 p.s.i.

- Creates less stress on the boss

PLASTITE® 45 Thread Forming Fastener



† C dimension measured with Tri-Flute Micrometer
D diameter measured with Standard Micrometer

Dimensional Data – Inch Sizes

Nom. Size	Thread Pitch (per inch)	C Dimension max.-min. (in.)	D Dimension max.-min. (in.)	Screw Length Tolerance under 3/4" (in.)	Screw Length Tolerance over 3/4" (in.)
#2	19	.0875 - .0835	.0845 - .0805	± .030	±.050
#3	18	.101 - .097	.098 - .094	± .030	±.050
#4	17	.1145 - .1095	.111 - .106	± .030	±.050
#5	15	.1275 - .1225	.1235 - .1185	± .030	±.050
#6	13	.141 - .136	.137 - .132	± .030	±.050
#7	12	.153 - .148	.1485 - .1435	± .030	±.050
#8	11	.167 - .161	.162 - .156	± .030	±.050
#9	10	.179 - .173	.174 - .168	± .030	±.050
#10	9	.194 - .188	.189 - .183	± .030	±.050
#12	9	.220 - .214	.2145 - .2085	± .030	±.050
1/4"	8	.253 - .247	.247 - .241	±.050	±.050
9/32"	8	.284 - .278	.278 - .272	±.050	±.050
5/16"	8	.316 - .308	.309 - .301	±.050	±.050
21/64"	8	.332 - .324	.325 - .317	±.050	±.050
11/32"	8	.349 - .341	.342 - .334	±.050	±.050
3/8"	7	.379 - .371	.371 - .363	±.050	±.050

Dimensional Data – Metric Sizes

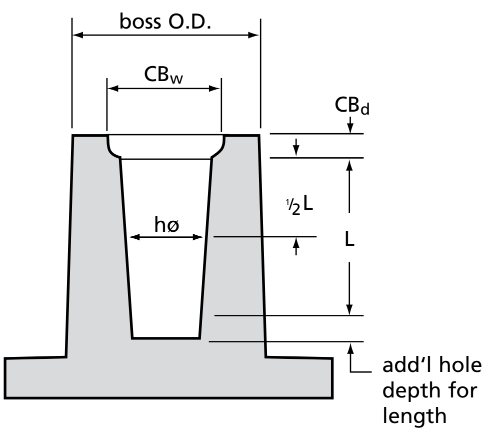
Nom. Size	Thread Pitch	C Dimension max.-min. (mm)	D Dimension max.-min. (mm)	Screw Length Tolerance under 19.05mm (mm)	Screw Length Tolerance over 19.05mm (mm)
2	1.35	2.04 - 1.92	1.99 - 1.87	±.08	±1.3
2.5	1.4	2.53 - 2.41	2.49 - 2.37	±.08	±1.3
3	1.5	3.04 - 2.92	2.99 - 2.87	±.08	±1.3
3.5	1.65	3.54 - 3.42	3.48 - 3.34	±.08	±1.3
4	1.75	4.04 - 3.89	3.94 - 3.79	±.08	±1.3
4.5	2.0	4.54 - 4.39	4.43 - 4.28	±.08	±1.3
5	2.2	5.04 - 4.89	4.94 - 4.79	±1.3	±1.3
5	2.3	5.04 - 4.89	4.94 - 4.79	±1.3	±1.3
6	2.5	6.04 - 5.89	5.93 - 5.78	±1.3	±1.3
8	3	8.04 - 7.86	7.89 - 7.71	±1.3	±1.3

PLASTITE® 45 Thread Forming Fastener

Hole Sizes per Percentage of Thread Engagement

Inch Sizes	100% (in.)	90% (in.)	80% (in.)	70% (in.)	60% (in.)
2-19	.065	.067	.069	.071	.073
3-18	.076	.078	.081	.083	.085
4-17	.087	.090	.093	.095	.098
5-15	.099	.102	.104	.107	.110
6-13	.101	.105	.109	.112	.116
7-12	.112	.116	.120	.124	.128
8-11	.125	.129	.133	.137	.141
9-10	.131	.136	.141	.145	.150
10-9	.148	.152	.157	.161	.166
12-9	.167	.172	.177	.182	.187
1/4-8	.196	.202	.207	.213	.219
9/32-8	.221	.227	.233	.239	.245
5/16-8	.251	.257	.264	.270	.276
21/64-8	.265	.271	.278	.284	.291
11/32-8	.281	.288	.294	.301	.307
3/8-7	.302	.310	.317	.325	.332

Metric Sizes	100% (mm)	90% (mm)	80% (mm)	70% (mm)	60% (mm)
2 x 1.35	1.36	1.41	1.46	1.51	1.57
2.5 x 1.4	1.78	1.83	1.88	1.94	2.00
3 x 1.5	2.25	2.30	2.37	2.43	2.50
3.5 x 1.65	2.68	2.74	2.80	2.88	2.95
4 x 1.75	3.11	3.18	3.25	3.33	3.41
5 x 2.2	3.70	3.80	3.91	4.03	4.16
5 x 2.3	3.67	3.76	3.86	3.98	4.10
6 x 2.5	4.57	4.68	4.79	4.91	5.05
8 x 3.0	6.36	6.49	6.62	6.77	6.92



Boss Design Recommendations

The length of engagement (L) should be 2 to 3 times the fastener's C dimension. Testing should be done to determine optimal thread engagement on any application with a lower length of engagement.

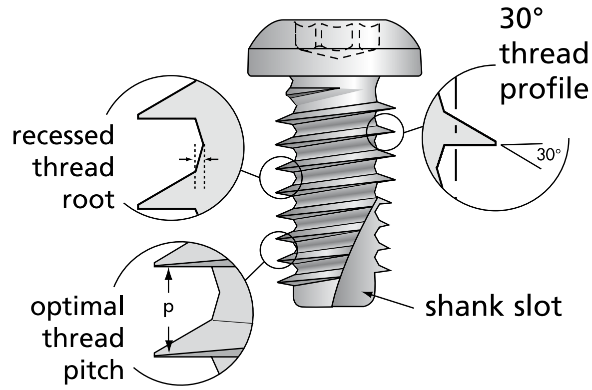
The nominal hole size (hø) must be established based on the amount of thread engagement (see chart above). For optimum performance, the hole size should provide a minimum 70% thread engagement.

The outside diameter of the boss (boss O.D.) should be 2.5 to 3 times the nominal diameter of the screw (C dimension). The boss height should not exceed 2 times the boss O.D.

The counterbore width (CB_W) should be slightly larger than the C dimension. Its depth (CB_d) should be 1/4 to 1/2 the thread pitch.

Duro PT® Thread Cutting Fasteners

The Duro PT® thread cutting fastener is engineered to meet the demanding requirements of thermoset plastics, easing assembly and ensuring a strong, reliable joint to maximize assembly performance.



Duro PT® Thread Cutting Fastener

Specifications

- Sizes: S22 to S80 in diameter; up to 152mm under head. Other sizes may be available upon request.
- Head Styles: Pan, flat, hex, round washer, hex washer, oval, button head, fillister
- Specials: Shoulder screws, sems, double end studs, collar studs; others as required
- Drive Systems: TORX PLUS® Drive System is recommended to facilitate the proper amount of torque transfer required for cutting threads. Other styles are available.

Applications

Thermoset plastics

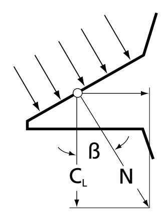
Key Advantages

- Cuts threads in stiffer plastics
- Minimizes installation torque
- Maximizes assembly performance

Features & Benefits

Asymmetrical 30° thread profile, inclined towards load surface to increase friction (FR) between the application and the fastener

- Reduces radial stress
- Reduces back-out caused by relaxation
- Increases strip resistance
- Eliminates need for supplementary locking devices



$F_R = \mu \times N$

$N = C_L / \cos\beta$

Optimal thread pitch for deeper thread engagement

- Increases pull-out strength
- Increases resistance to vibration loosening
- Increases load-carrying capability

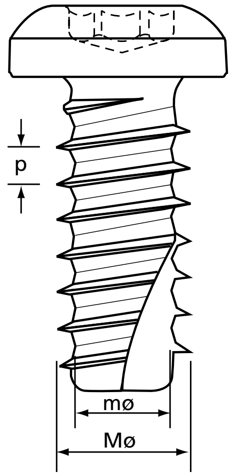
Recessed thread root provides space for displaced material

- Minimizes installation torque
- Minimizes risk of clogging and galling of threads during assembly

Shank slot minimizes chip production

Through hardened to Rc 33-39

Duro PT® Thread Cutting Fasteners



Dimensional Data

Nom. Size	Metric Size	Thread Pitch (mm)	Mø Major Diameter (mm)	mø Minor Diameter (mm)
S22	2.2	0.71	2.20	1.59
S25	2.5	0.77	2.50	1.81
S30	3	0.86	3.00	2.18
S35	3.5	0.95	3.50	2.56
S40	4	1.04	4.00	2.93
S50	5	1.23	5.00	3.68
S60	6	1.42	6.00	4.42
S70	7	1.60	7.00	5.20
S80	8	1.79	8.00	5.91

Hole Sizes per Percentage of Thread Engagement

	100%		90%		80%		70%		60%		50%		40%	
Size	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
S22	1.71	.067	1.77	.070	1.83	.072	1.88	.074	1.94	.076	1.99	.078	2.05	.081
S25	1.95	.077	2.01	.079	2.07	.082	2.13	.084	2.20	.086	2.26	.089	2.32	.091
S30	2.34	.092	2.41	.095	2.48	.098	2.56	.101	2.63	.104	2.70	.106	2.78	.109
S35	2.73	.107	2.81	.111	2.90	.114	2.99	.118	3.07	.121	3.16	.124	3.24	.128
S40	3.12	.123	3.21	.127	3.31	.130	3.41	.134	3.51	.138	3.60	.142	3.70	.146
S50	3.90	.153	4.01	.158	4.13	.163	4.25	.167	4.37	.172	4.49	.177	4.61	.182
S60	4.67	.184	4.82	.190	4.96	.195	5.10	.201	5.24	.206	5.38	.212	5.52	.217
S70	5.45	.215	5.62	.221	5.78	.228	5.95	.234	6.12	.241	6.28	.247	6.45	.254
S80	6.23	.245	6.42	.253	6.61	.260	6.80	.268	6.98	.275	7.17	.282	7.36	.290

Suggested Thread Engagement

Based on testing and past performance, a thread engagement of 50% to 60% is recommended. For optimal fastener performance, please contact a STANLEY Engineered Fastening applications engineer. See following page for boss design recommendations.

Duro PT® Thread Cutting Fasteners

Boss Design Recommendations

Laboratory testing and service applications have produced the general recommendations shown. Specific applications may, however, require some modification in order to allow for:

- molding conditions
- mold tool design
- type of resin
- type of filler
- material density

Determining Optimum Boss & Hole Sizes

A hole diameter of .85d to .89d is permissible for most thermoset applications. In order to properly determine boss and hole sizes, it is recommended that testing be done on several different hole sizes. This will allow you to determine the optimum drive-to-strip ratio that is required for your application.

Boss Hole Diameter (db)

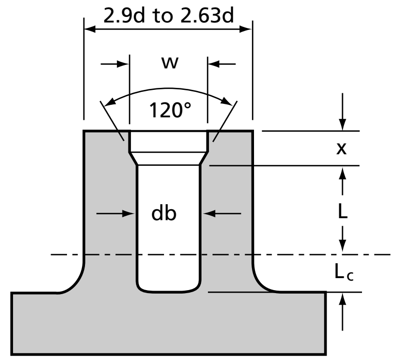
d = nominal screw diameter

	.85d		.86d		.87d		.88d		.89d	
Size	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
S22	1.87	.074	1.89	.074	1.91	.075	1.94	.076	1.96	.077
S25	2.12	.083	2.15	.085	2.17	.085	2.20	.087	2.23	.088
S30	2.55	.100	2.58	.102	2.61	.103	2.64	.104	2.67	.105
S35	2.97	.117	3.01	.119	3.04	.120	3.08	.121	3.12	.123
S40	3.40	.134	3.44	.135	3.48	.137	3.52	.139	3.56	.140
S50	4.25	.167	4.30	.169	4.35	.172	4.40	.173	4.45	.175
S60	5.10	.201	5.16	.203	5.22	.206	5.28	.208	5.34	.210
S70	5.95	.234	6.02	.237	6.09	.240	6.16	.243	6.23	.245
S80	6.80	.268	6.88	.271	6.96	.274	7.04	.277	7.12	.280

Boss Outer Diameter (O.D.)

d = nominal screw diameter

	.85d		.86d		.87d		.88d		.89d	
Size	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
S22	6.38	.251	6.23	.245	6.09	.240	5.94	.234	5.79	.228
S25	7.25	.285	7.08	.279	6.92	.272	6.75	.266	6.58	.259
S30	8.70	.343	8.50	.335	8.30	.327	8.10	.319	7.90	.311
S35	10.15	.400	9.92	.391	9.68	.381	9.45	.372	9.21	.363
S40	11.60	.457	11.33	.446	11.07	.436	10.25	.425	10.53	.415
S50	14.50	.571	14.15	.557	13.83	.544	13.50	.531	13.17	.519
S60	17.40	.685	17.00	.669	16.60	.654	16.20	.638	15.80	.622
S70	20.30	.799	19.38	.781	19.37	.763	18.90	.744	18.43	.726
S80	23.20	.913	22.67	.893	22.13	.871	21.60	.850	21.07	.830



d = nominal screw diameter

Boss Counterbore Size

High tightening torques and large tensile stresses may cause a cone-shaped expansion and failure at the bottom of the boss. Designing the boss with the appropriate counterbore (CB) reduces edge stress and alleviates cracking.

CB depth: x = 0.5d

CB width: w = 1.08 x d

Length of Engagement

The length of engagement (L) should be 2 to 3 times the nominal screw diameter. This calculation should exclude counterbore depth.

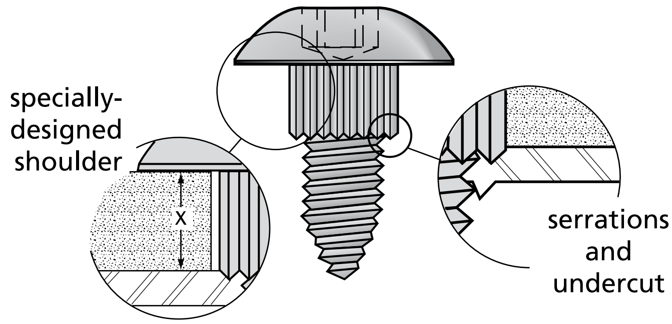
Chip Space Depth

The depth of space (L_c) for chips removed during thread cutting operations should be between 0.8 and 1.2 the nominal screw diameter.

NOTE: The information in this manual is not to be considered a specification.

Powergrip® Fasteners for Layered Assemblies

Ideal for attaching soft materials, such as plastics and elastomers, to a single thickness of sheet metal, Powergrip® fasteners maintain the integrity of the soft material while providing resistance to strip-out and loosening.



Powergrip® Fastener

Key Advantages

- Overcomes loosening in metal to plastic/elastomer applications
- Prevents soft material from being crushed during assembly
- Can be used in a variety of materials, soft or brittle, where there is a chance that cracking or crushing of the overlay material may occur

Features & Benefits

Individually engineered to meet the unique requirements of each application

- Can be used in a variety of materials, soft or brittle, where there is a chance that cracking or crushing of the overlay material may occur

Specially designed shoulder designed to match the thickness of the soft material in each application

- Prevents soft material from being crushed during assembly

Serrations and a small undercut on the bottom of shoulder to decrease the distance between the last thread and the shoulder

- Increases thread engagement
- Increases strip-out resistance
- Prevents vibration loosening
- Increases torque resistance
- Provides tight, uniform joint

Specifications

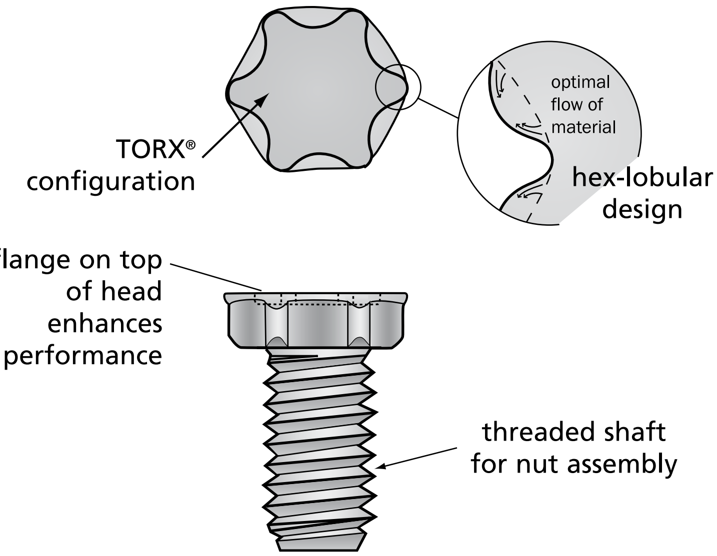
- Sizes: M3 – M8 (#4 – 3/8")
- Thread Styles: Type CA threads are recommended for maximum thread engagement; others as required
- Head Styles: Hex washer, pan, round, truss, hex
- Drive Styles: TORX PLUS® Drive; also cross, slotted, and hex

Applications

Soft materials such as plastic, rubber and elastomers to sheet metal

PlasTORX® Fasteners for Plastic Assemblies

Developed to be molded into plastic and replace metal stamping and fastener assemblies, PlasTORX® studs are engineered to provide high resistance to rotation and pull-out, ensuring a high-performance assembly. Its hex-lobular design helps reduce stress risers, so it can be used in materials susceptible to cracking or breaking.



PlasTORX® Fastener

Key Advantages

- Molded directly into application which increases assembly efficiency
- Provides maximum resistance to rotation and pull-out
- Can be used in materials susceptible to cracking

Specifications

- Sizes: M4 – M12 (#8 - 1/2")
- Lengths: Per customer design
- Thread Styles: Machine screw; others as specified
- Specials: Completed assemblies available

Applications

Injection-molded thermoplastics and rubber

Features & Benefits

Hex-lobular TORX® configuration allows deep lobe engagement

- Increases torsional resistance
- Increases pull-out resistance
- Reduces stress risers

Flange on top of head enhances performance

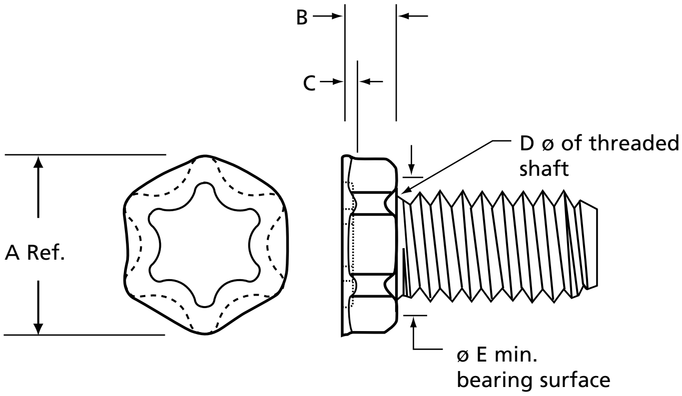
- Increases pull-out resistance

Threaded shaft for seating nut member

Designed to be molded directly into component or carrier strips, allowing multiple fasteners to be installed at one time

- Reduces assembly time
- Reduces part numbers and associated costs
- Reduces overall costs

PlasTORX® Fasteners for Plastic Assemblies



- Contour may vary between lobes within specifed dimensions.
- Dimensions shown are for low carbon steel fasteners. For other materials or modified designs, contact a STANLEY Engineered Fastening applications engineer.
- Performance is determined by application material.

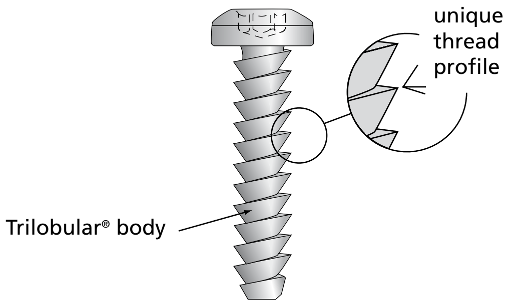
Dimensional Data – Metric Sizes

Thread Size	A ref.	B ±0.13	C ±0.25	D max.	E min.	Min. Molded Mat'l Width	Min. Molded Mat'l Height (B + 25%)
M4	9.19	1.84	0.50	0.8	6.30	12.41	2.30
M5	10.95	2.28	0.80	0.8	7.35	14.85	2.85
M6	14.50	3.00	0.80	0.8	10.00	20.25	3.75
M8	16.38	3.68	1.00	1.0	11.30	23.10	4.60
M10	19.99	4.88	1.00	1.0	15.75	28.50	6.10
M12	23.60	6.88	1.14	1.0	18.50	33.90	8.60

Dimensional Data – Inch Sizes

Thread Size	A ref.	B ±.005	C ±.010	D max.	E min.	Min. Molded Mat'l Width	Min. Molded Mat'l Height (B + 25%)
#8	.362	.072	.030	.031	.248	.489	.090
#10	.431	.090	.041	.031	.289	.585	.113
1/4	.571	.118	.041	.031	.394	.797	.148
5/16	.645	.145	.049	.039	.445	.909	.181
3/8	.787	.192	.049	.039	.620	1.122	.240
1/2	.929	.271	.055	.039	.728	1.335	.339

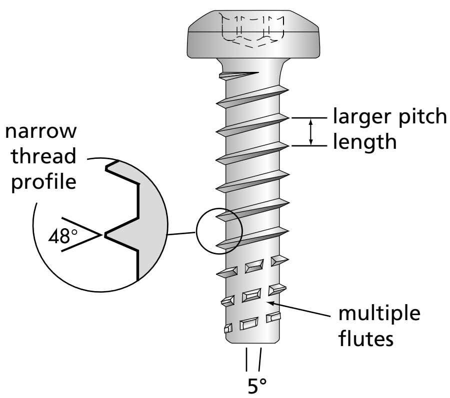
Other Threaded Fasteners for Plastics



PUSHTITE® & PUSHTITE® II Thread Forming Fasteners

The unique thread profile of PUSHTITE® fasteners allows them to be simply pressed into place, virtually eliminating strip-out during initial assembly and providing high pull-out strength.

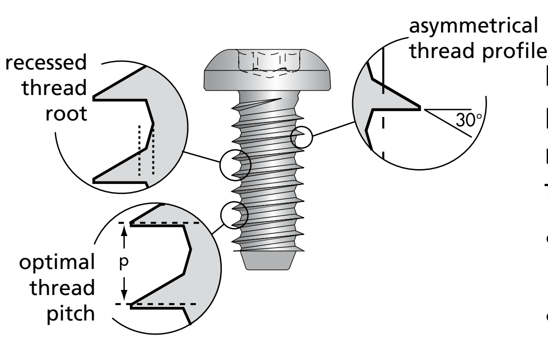
- Trilobular® shape minimizes stress on the boss
- Screws can be removed and reinserted if necessary, or can be made tamper-resistant
- Can be gang-driven, which can cut costs
- Allows displaced air to escape during insertion to prevent pneumatic failure of boss



BF-Plus Thread Cutting Fasteners

The unique thread cutting flutes of the BF-Plus fastener were designed to provide deep, fully-cut mating threads with minimal contamination. It helps ensure reliable fastening in harder plastics.

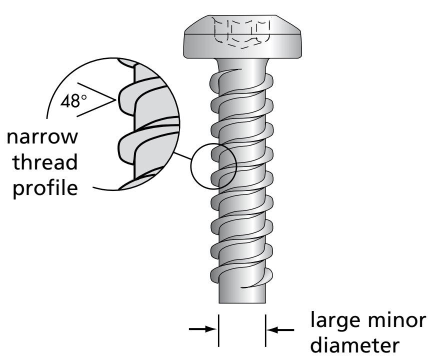
- Multiple flutes for thread cutting extend through first full thread diameter to reduce radial stress and boss damage
- 5° reverse angle of flutes retains chips to minimize contamination
- 48° thread profile with extended height, combined with a longer pitch length, increases flank and shear area to increase pull-out resistance and strip-out resistance



Duro PT® Thread Forming Fasteners

Duro PT® thread forming fasteners are engineered to meet the unique requirements of reinforced thermoplastics and light alloys.

- Asymmetrical 30° thread profile reduces radial stress and minimizes installation torque
- Allows deep thread engagement to increase pull-out strength and increase resistance to vibration loosening
- Eliminates need for supplementary locking devices
- Recessed thread root provides space for displaced material, minimizing risk of clogging and galling during assembly

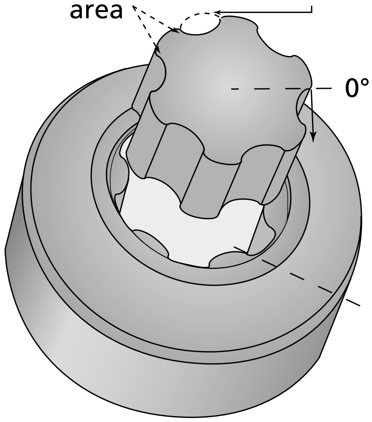


Hi-Wide Thread Forming Fasteners

- Large minor diameter
- 40°, 45°, or 48° thread profiles available
- Wide thread spacing for greater shear area to increase pull-out resistance
- Thread forming and thread-cutting styles are available
- Variety of point styles available for thread forming screws

TORX PLUS® Drive System

The TORX PLUS® Drive System is the ideal drive system for screws for plastics, since it provides optimum torque transfer, even when forming or cutting threads in reinforced plastics. Its unmatched ability to increase productivity by outperforming competing drive systems can lower assembly costs.



TORX PLUS® Drive System

Key Advantages

- Allows optimum torque transfer for forming or cutting threads in plastic applications

Features & Benefits

Unique, elliptically-based geometric configuration to maximize engagement between driver and fastener

True 0° drive angle virtually eliminates the radial forces that cause stress on fastener recesses with vertical walls

- Allows optimum torque transfer, even in plastics reinforced with nylon or carbon fibers

Vertical sidewalls completely enclose the driver tip, reducing tool slippage and virtually eliminating camout

- Prevents damage to the fastener and surrounding surfaces, which often occurs with cross recess fasteners
- Eliminates the debris camout can create, which can damage sensitive applications
- Minimizes damage to application

Higher torque removal capability than any other drive system

- Helps minimize damage to boss from removal and reinsertion of the screw

Improved fit between fastener and tool minimizes wear on the drive bit

- Drive bit life lengthened as much as 12 times
- Downtime and costs are reduced since significantly fewer drive bit changes are required

Specifications

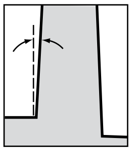
- Drive Sizes:1IP – 100IP (recess) to fit screw sizes M0.9 – M24 (#0 – 1")
- Styles: Internal, external, low-profile external, tamper-resistant, TORX PLUS® Drive/external hex or TORX PLUS® Drive/slotted
- Drive Tools: TORX PLUS® Drive tools fit both inch and metric fasteners. Standard and special tooling is available from over 3,000 outlets around the world. For more information, please contact STANLEY Engineered Fastening.

Glossary

BOSS: Protuberance on a plastic part designed to add strength and/or facilitate fastening or alignment.

CREEP: Permanent deformation of a material caused by time, temperature and pressure.

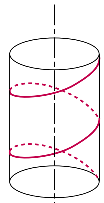
DRAFT ANGLE: The amount of slope in the boss hole and/or outside edge, measured from a line perpendicular to the bottom of the boss.



draft angle

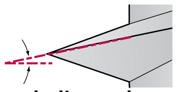
FILLERS: Additives or reinforcements that are added to a polymer to change one or more of its characteristics such as strength, wear resistance, etc.

FLANK ANGLE: See thread profile.



helix

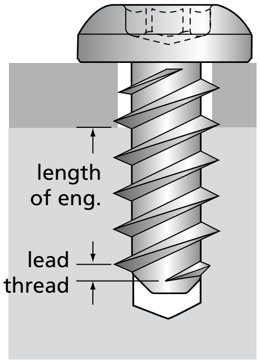
HELIX ANGLE: The angle between the helix of the thread and a line perpendicular to the axis of the screw.



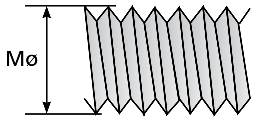
helix angle

LEAD THREAD: The thread length from where it starts to where it becomes full size. This distance is usually one-half the fastener diameter.

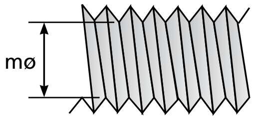
LENGTH OF ENGAGEMENT: The length of full-sized fastener threads that engage in the nut material. The length of the lead thread is not counted in the length of engagement, since its reduced size minimizes any performance benefits. The length of engagement is usually expressed in relationship to the nominal diameter of the screw (e.g. 2 to 2-1/2 diameters of engagement).



MAJOR DIAMETER: The outside or largest diameter of an external thread.



MINOR DIAMETER: The inside or smallest diameter of an external thread.



NOMINAL DIAMETER: The major diameter of a screw or, in Trilobular® fasteners, the "C" dimension.

PEAK DRIVE TORQUE: Amount of force required to pull the members of a joint together; the point at which clamp begins to generate.

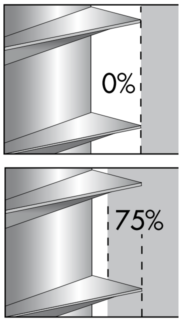
RADIAL STRESS (hoop stress): Forces that propagate from the screw towards the outside diameter of the boss.

SHEAR: Force that tends to divide an object along a plane parallel to the opposing stresses.

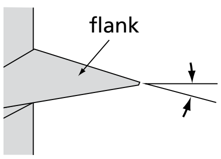
THERMOPLASTIC: These widely used polymers are characterized by their ductility (fillers may be added to increase stiffness). Thermoplastics can be remelted and reformed several times without degrading the material.

THERMOSET: These polymers are characterized by extreme stiffness. The initial molding process causes a chemical reaction which "cures" the material, so the resin cannot be reprocessed.

THREAD ENGAGEMENT: The amount of thread tooth that is filled by the application material. This measurement is usually expressed as a percentage and is used to determine optimal hole size.

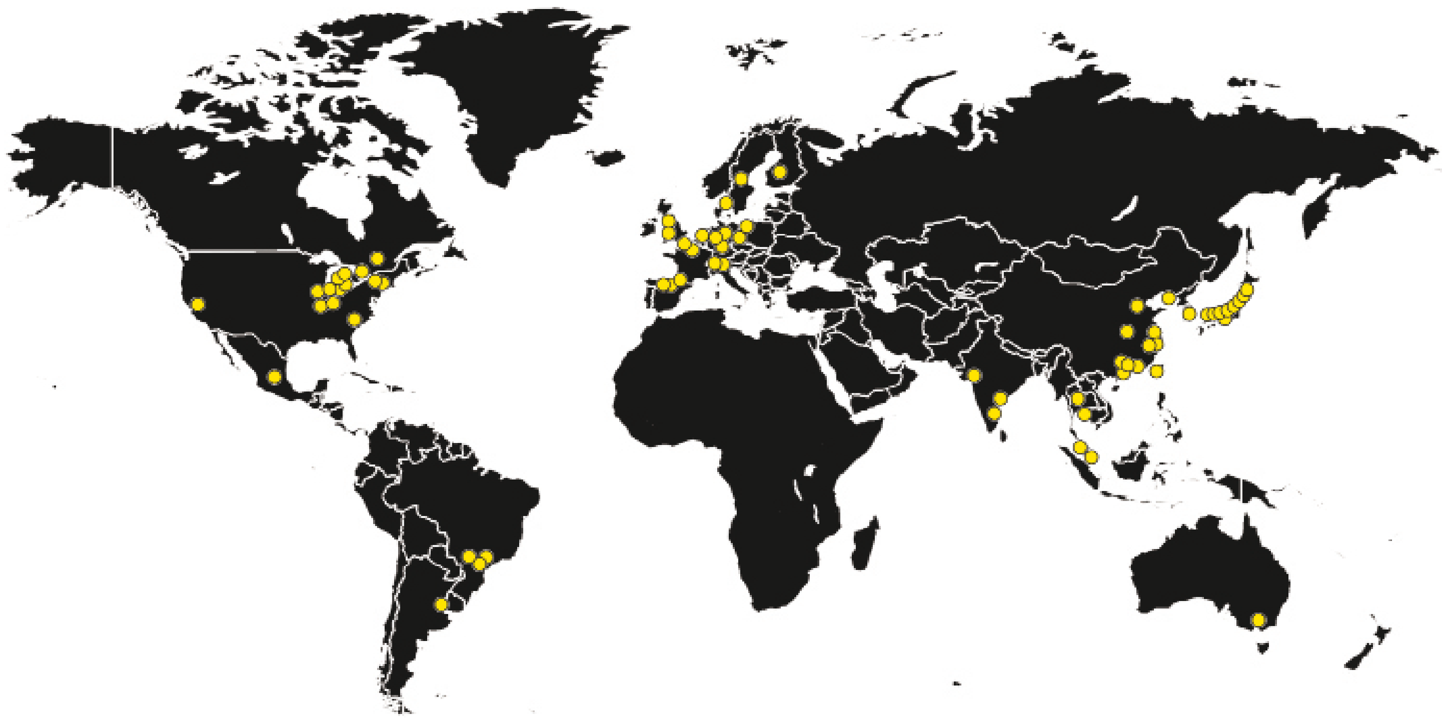


THREAD PROFILE: The angle between the flank of the thread and a line perpendicular to the screw axis.



ULTIMATE TORQUE: The amount of force at which a fastener begins to strip or otherwise fail in a joint.

STANLEY®
Engineered Fastening



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