STANLEY®
Engineered Fastening

Rivetwise®

Fastening Solutions for Plastics

Dodge®

Dodge® Inserts

Dodge inserts for plastics are the most widely recognized and highly regarded products in the fastening market. Since the 1950's, Dodge has been identified as the leader in its industry which can largely be attributed to its focus on providing high quality products.

Plastic Parts, Metal Threads

Threaded Inserts

Dodge inserts are designed to provide the high performance strength values of molded-in inserts while retaining all of the economical advantages of insert installation after molding.

Compression Limiters

Dodge non-threaded bushings expand the Dodge offering and are custom designed for your specific application. The Limiters can be pressed in or installed with either heat or ultrasonics. They are designed to minimize any cracking of plastic parts due to bolt load.

Engineering

Dodge Sales Engineers have broad experience in insert technology and are available to provide answers to any of your technical questions. Our highly trained Applications Engineering staff in Danbury, Connecticut will be glad to furnish technical assistance, compile test data, prepare samples for your evaluation and make specific recommendations on insert designs, installations and assembly systems. Our fastening experience and expertise is available for designing special inserts for unique or critical applications.

Quality

Dodge products are manufactured to the same exacting quality systems required by the military, aerospace and automotive standards. The Danbury manufacturing facility has been certified ISO/TS16949: 2009 and ISO 14001. We are committed to an ongoing and never ending process of quality improvement and total customer satisfaction.

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The test data included in this catalogue should be considered as average values for the general families of plastics indicated.
Critical application requirements may necessitate further specific testing.
As a result of continuous design improvement, Dodge products are subject to modification.
Current technical data and drawings are available upon request.

1. Plastic Overview

The two main categories of plastics where threaded inserts are used:

a. Thermoset Plastics

Thermoset plastics cannot be re-melted using heat or pressure once they are formed into their desired shape, These plastics tend to be hard and brittle. Since they will not re-melt, inserts installed by heat or ultrasonic can't be used in these materials. Recommended insert types include:

» Self-Threading » Expansion » Press-In designs

Thermoset Types

» Phenolic » Epoxies » Vulcanized rubber » Polyamide

b. Thermoplastics

Thermoplastic materials can be re-melted and re-formed once formed into their desired shape.

Heat and Ultrasonically installed inserts perform best in thermoplastic types of materials however Self-Threading, Expansion and Press-in style inserts may also be utilized in these materials.

Thermoplastics Types

» ABS » PVC » Polycarbonate » Nylon

Fills (Additives)

Thermoplastic materials may be unfilled or may have a wide variety of fillers added to them to increase the stiffness or toughness properties of the material for specific applications. These fillers may include nylon or carbon fiber, mineral or even metal.

2. Insert Characteristics

Dodge Inserts for Plastics are designed to provide the strength necessary to allow bolts and screws to be tightened to the levels required to stretch the fastener and maintain a sufficient bolted joint assembly.

The insert must also provide resistance to rotation and pull-out under a wide variety of load and atmospheric conditions in a given assembly.

The optimum insert design depends on several factors including:

» Plastic resin
» Type and percentage of fill
» Preferred insert installation method
» Application strength requirements
» Environmental concerns

3. Material And Plating

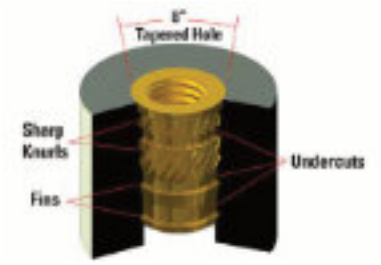
Material

Dodge inserts are traditionally made from 360 brass which falls under the designation UNS C36000 ½ hard free-cutting brass. The CDA specification is C360, ½ hard per ASTM B-16.

Dodge inserts are also available in alternate materials including Steel and Aluminum. Contact Applications Engineering for further information.

Plating

Inserts and Compression Limiters may be processed with a variety of finishes from nickel plates and automotive finishes to colored dyes to distinguish insert types or installations. Please consult our Applications Engineering team for assistance with your requirements.



4. Insert Geometry

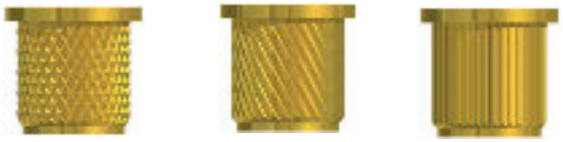
a. Undercuts

To accommodate the best overall balance of rotational and pull-out strength of an insert, the knurl bands are combined with undercuts, fins or a combination of both.

b. Knurl Patterns

The most common design methods used to increase rotational strength of an insert include increasing body diameter or increasing or changing the knurl pattern on a given insert design. The rotational resistance of an insert design can change dramatically by altering the coarseness or fineness of a knurl.

Coarser knurl patterns can provide a significant increase in rotational strength but can also induce significant stress into the insert/plastic assembly which could ultimately lead to cracking and premature failure.



Diamond Helical Straight

» **Diamond Knurls**
Generally the most effective when the insert design is large and the knurl is coarser.

» **Helical Knurls**
While normally not as aggressive as a straight knurl, they are the more common solution. These knurls will provide adequate resistance to insert rotation.

» **Straight Knurls**
Effective in applications focused on high rotational strength.

» **Multiple Knurls**
It is common practice to utilize more than one knurl style and direction on the same part to reach the most optimum combination of rotational and torque resistance.

c. Tapers
To eliminate installation issues, many inserts are designed to be installed into a tapered hole. This allows for the insert to "self-align" during installation and requires less heat energy as the mass of plastic resin that is required to melt is less than with other hole designs. A tapered insert must always be used in a tapered hole.

d. Flanges
In certain applications, it is advantageous to have a large bearing surface to distribute the load applied when fastening mating parts. A large flange not only increases the bearing surface but also allows for adjustment of the mating part without a negative effect on insert strength.

e. Custom Capabilities
Dodge Threaded Inserts can also be custom designed for specific applications. Examples include undercut configurations, closed ends, platings, flange modifications, etc. Contact your Sales Engineer or Applications Engineering at (866) 364-2781 for assistance.

5. Best Practices

a. Hole Preparation Considerations

Each Style of insert listed throughout the catalogue features the recommended hole preparation dimensions.

» **Hole Preparation Method** – Molded holes are the preferred method of hole preparation. A barrier of denser material is formed around the internal surface of the hole resulting in a stronger assembly.

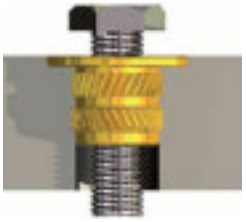
» **Recommended Hole Diameter** – Proper hole preparation is crucial in obtaining maximum strength results. Oversize holes will result in a degradation of strength and undersize holes can potentially result in the cracking of the parent material. Deviations from the recommendations may prove necessary dependent upon plastic / fill combinations. The general rule of thumb is to increase the hole diameter by 0.003 inch if the fill is between 15% and 35%.

Straight vs. Tapered Holes - Straight hole preparation allows for a taper that should not exceed a 1 degree included angle. Tapered holes require an 8 degree included angle. Tapering permits easy release of the core pin, aids in insert alignment, which in turn reduces installation time.

» **Counterbores** – Traditionally are not recommended as they may interfere with proper insert alignment. Self threading inserts, or flanged inserts which should be installed flush, are the exception to the rule.

» **Recommended Hole Depth** - Allows for proper insert set down (flush to 0.005 inch below the surface), prevents excessive flash, and prevents back filling of plastic from entering bottom threads.

» **Flanges**
In some applications, a large flange insert is installed from the opposite end of the part and when the screw or bolt is assembled, the tensile load is applied to the flange, increasing resistance to pull-out.



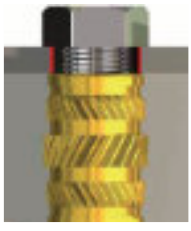
Typical Flange Installation

Optional Flange Installation

b. Boss Diameter/Wall Recommendations
Traditionally a boss diameter is two times the insert diameter for inserts ¼" and under, 3mm wall thickness applies for all inserts that are larger. Exceptions include applications incorporating supported bosses, reinforced materials, and heat installation. Special consideration should be given to cold press installations where stress will be increased and will require larger boss diameters.

c. Assembly Guidelines For Mating Parts
Clearance Holes – It is important that the insert bear the load and not the plastic to avoid jacking the insert out. The mating component hole should be smaller than the face of the insert yet allow the connecting threaded fastener ample space to function normally.

Correct



Incorrect

d. Compression Limiters Considerations

Strength – The head of the bolt being used in the assembly must seat against the compression limiter to avoid potential failure due to plastic creep.

Mating Components– The mating component must also withstand the stress generated by the clamping force. In instances where the mating component will also be plastic, the use of a secondary insert should be considered.

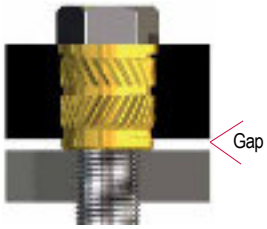
Types of Applications

Structural

- » Insert is equal to or larger than the flange
- » Provides higher axial strength
- » Failure mode is the bolt

Non-Structural

- » Insert is smaller than the flange
- » Has simple OD configuration
- » Applies to smaller inserts under ½" OD



Structural

Non-Structural

Note: Gap allows for a gasket, (e.g., manifold applications)

6. Methods Of Installation

Dodge Inserts are designed for post mold and molded-in installations.

Post molding is cost effective in that it generally shortens cycle time of the molding process, reduces rejects and damage from inserts that could potentially come loose and damage the mold. Molded-In inserts offer higher torque and pull-out resistance.

Several Dodge insert designs are available for Post-Molding using Ultrasonic installation or Heat installation.

a. Heat Installation

Heat installation involves positioning the insert into the molded or drilled hole. A heated tip is then inserted into the inside diameter of the threaded insert.

Localized melting begins to take place and with the downward pressure, the insert begins to install. Plastic flows into the varying undercuts and knurls.

Benefits of thermal installation include:

- » installation of multiple inserts at a given time
- » ability to install inserts beyond ¼"
- » superior strength assemblies

b. Ultrasonic Installation

Ultrasonic Installation involves positioning the insert into a molded or drilled hole.

An ultrasonic horn then contacts the insert and begins to vibrate the insert. This vibration creates frictional heat which melts the plastic allowing the horn to lower the insert into position. Once installed to the appropriate depth, the cycle is repeated for the next insert.

c. Self -Tapping/Self Threading, Spred-Lok, Expansion Inserts and Mold-In

Designed for ease of installation. Primarily involves preparing straight holes and driving the insert into place, pressing the insert into place, or pressing and then expanding the insert into place. Minimal tooling is required.

c1. Self Tapping

Economical and easy to install. Provides excellent pull out resistance. Insert design features a cutting edge slot which assists in installation.

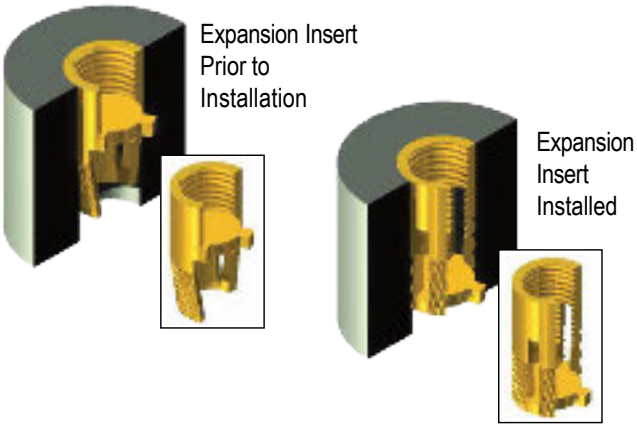
c2. Spred-Lok Inserts

Economical and easy to install. Designed for non-critical applications. Insert is pressed into a straight prepared hole, expansion of the insert is accomplished through the installation of the mating fastener. Mating bolt should be long enough to extend at least two full threads beyond the insert length to ensure insert retention.

c3. Expansion Inserts

» **Standard Expansion**

Economical and easy to install. Expansion inserts feature a two piece design consisting of a threaded insert and a captivated spreader plate. The insert is installed into a blind, straight hole and the spreader plate is then depressed. As the spreader plate is engaged, the knurled portion of the insert expands, anchoring the insert into place.



» **Clinch Expansion**

Clinch inserts feature a pilot and a flange and have the same design characteristics as Standard Expansion Inserts. The inserts are used extensively in the electrical industry. The pilot can be clinched over a terminal connector with the flange providing a large surface for electrical contact. The installation and clinching operations are simultaneous using a simple press-in type tool. Like the Flange Insert, much of the installation force is absorbed by the flange allowing for use in thin-section applications.

» **Flange Expansion**

The Flange Insert, in addition to having all of the design features of the Standard Insert, has a flange with a large bearing surface. The flange can be used to make an electrical contact or to fasten a terminal connector. The flange can also be used to join mating parts by inserting the body of the insert through the mating part and into the receiving hole in the parent material. The insert is excellent for use in thin section applications since the flange absorbs much of the installation force.

c4. Mold In Inserts

While the trend is to install inserts into Thermoplastics by post mold, some highly filled plastics (above 35% fill) will benefit from a mold-in insert design. The Dodge Ultramold insert is a unique two-piece insert providing full thread to the bottom of the insert. This design also features a controlled minor diameter and innovative counterbore design to insure proper placement on molding pins. This insert design provides optimum strength in a space saving design.

» **Ultra-Mold® Inserts**

The unique two-piece concept allows full and complete threads throughout the entire length of the insert. This saves space and weight and reduces costs. Below is an image of a conventional insert (on left) and the unique design of the Ultra-Mold (at right).

c5. Sealing Inserts

When an insert is heat or ultrasonically installed into a plastic component, the difference in cooling rates of the metal and plastic create a “stress relief zone” or microscopic void between the insert external geometry and the plastic. While this is beneficial in reducing the stress between the two materials, it can pose challenges to those applications requiring a leak-proof interface between the insert and the plastic.

Dodge has addressed this situation with the Ultraseal® insert. The Ultraseal utilizes an O-ring as an integral component of the insert design. When heat installed into the proper geometry hole, the O-ring seals against the plastic and provides a leak-proof assembly.

Applications

Dodge Inserts and Compression Limiters are widely used in critical applications in the automotive, electronics, medical, transportation and general industrial markets.

Aircraft

Threaded Inserts for Plastic Components

In the overhead aircraft interiors, brass inserts are used to strengthen and maintain joint integrity in brittle and soft material extending service life and value.

Automotive

Air Intake Manifold

Using the TaperTuff® and Ultrasert® in the intake manifold allows the OEM to create strong reusable threads that eliminated cracking from bolt load.

Automotive

Grab Handle

Using Compression Limiters eliminates cracking of plastic sub-component automotive interior parts due to bolt loading. The Dodge Compression limiter significantly reduces the warranty and replacement costs.

Automotive

Sunroof Assembly

A key component in the sunroof sub assembly is the power actuating motor. OEM's rely on the Dodge Ultrasert® for mounting the motor to the frame for both stability and high quality.

Electronics

Cell Phone Housing Assembly

Dodge's unique line of Miniature Inserts are used in the Smartphone industry to mate the two plastic outer housings together, resulting in a structural assembly with long service life.

Electronics

GPS Enclosure

GPS Tracking and security devices require consistency and reliability. Manufacturers of GPS assemblies turn to Ultrasert® for quality and reliable fastening every time.

Industrial Appliance

Fan Module

Manufacturers of fan modules around the world depend upon Dodge Ultrasert® brass inserts for reliability and performance.

Industrial

Power Tool Housing

Power tool manufacturers count on the Dodge Ultrasert® to provide the superior joint strength, vibration proof properties and high serviceability required of their products.

Industrial

Pump Housing

Multiple Ultrasert® inserts are used in pump assemblies to provide high shear, tensile and torque necessary to handle the load of the fluctuating stresses in the application.

Lawn and Garden

Engine and Component Assembly

In the high vibration world of lawn and garden equipment, the high strength characteristics of the Ultrasert® inserts provide superior retention in brittle and soft materials when fastening plastic components to the engine.

Medical

Medical Device Enclosure

The Dodge Ultrasert® line of threaded inserts are utilized to maintain joint integrity when assembling critical component parts in many types of medical equipment.

Dodge Capabilities

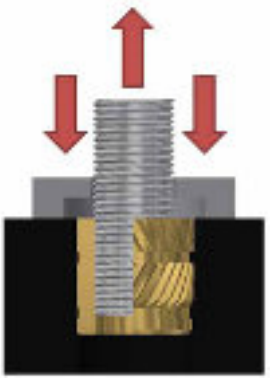
Quality
» ISO/TS16949: 2009 certified
» Lot control ensures product traceability
» Statistically controlled manufacturing processes
» PPAP, IMDS, Material Certifications

Sales & Applications Engineers
» Strategically located throughout North America
» Offer expertise in insert design, applications engineering and current assembly technologies
» Offer cost effective fastening solutions; includes:
  – Modifications to our standard products
  – Custom solutions for your specific applications
  – Conduct Line Walks, Value Analysis / Value Engineering

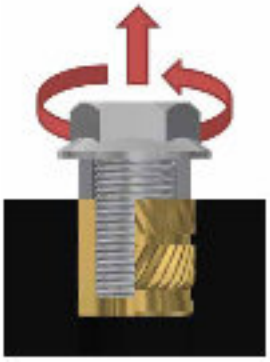
Product Development
» Our Technical Center offers review of your application, product evaluation, analysis and recommendations to help reduce your assembly costs
» Development support includes conceptual ideas, preliminary designs and drawings
» Engineering prototypes and pre-production sampling resources available

Technical Product Seminars
» Lunch and Learn Seminars offered to engineering, manufacturing, purchasing and quality teams
» Instructors include representatives from our sales engineering, applications engineering and/or marketing teams

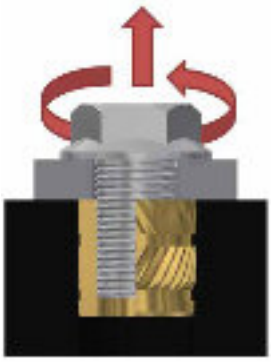
Testing Terminology



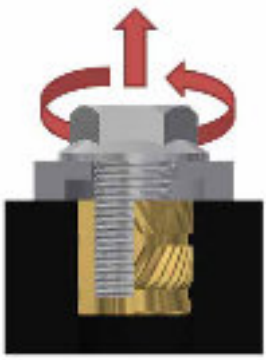
Tensile Strength
Axial force required to pull the insert out of the parent material at least 0.020 inches (0.5mm).



Rotational Torque
Rotational force required to rotate the insert in the parent material. Note that the hardened steel spacer only contacts the insert. It is a good comparative measure of the overall strength of the assembly.



Clampload Torque
Rotational force required to rotate the insert in the parent material. Note that the hardened steel spacer contacts both the parent material and the insert. Mainly used as a strength measure for compression limiters.



Jack-Out Torque
Rotational force required to pull the insert out of the parent material. Note that the hardened steel spacer only hits the parent material. This will allow both rotational and axial forces to be applied simultaneously. The ultimate test of assembly strength. Results may vary depending on the type of bolt used.

Note: The test data included in this catalogue should be considered as average values for the general families of plastics indicated. Critical application requirements may necessitate further specific testing.

Potential Solutions	PROBLEM									
	Insufficient insert strength (pull-out, rotation)	Insert not completely seated	Excessive installation time	Excessive flash on top surface	Excessive flash under insert	Plastic boss bulges or cracks	Welder overloads (cuts out)*	Insert damaged (deformed)	Insert rises above top surface after top installation	Installation too noisy
Increase hole diameter		■		■	■	■	■	■		■
Increase hole depth		■					■	■	■	
Increase boss diameter	■					■				
Decrease hole diameter	■									
Verify plastic melt	■	■				■	■	■		
Incorrect fixture design	■	■	■							
Countersink/Counterbore hole				■					■	
Increase amplitude*	■									
Increase pressure		■	■	■	■					■
Increase weld time	■	■								
Decrease down speed	■					■	■	■		
Increase hold time									■	
Decrease pressure	■					■	■	■	■	
Decrease amplitude*		■	■			■	■	■		
Decrease weld time			■	■	■					■
Adjust welder stroke stop		■								
Pre-trigger/Pre-heat	■						■			■
Tune power supply							■			
Tighten horn, booster, or transducer*							■			
Use more powerful welder			■				■			

(*) Refers to Ultrasonic welder only.

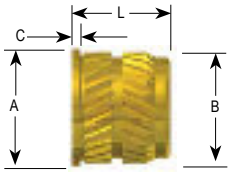
If you need further assistance, please contact our Application Engineers, at which time, you will be asked to provide the following information about your application.

- Company Name / Contact Name
- Address / Tel. # / Fax # / EMail
- Distributor or Sales representative
- Frequency of failure
- Insert part number
- Affected quantities
- Affected lot numbers
- Hole sizes (tolerances)
- Tooling information/Method of Installation
- 25 suspect inserts
- Sample of application with and without installed inserts

For applications where a molded-in design is more economical than post molding.

- » 2 piece design provides full threads through entire length of insert
- » Controlled minor diameter reduces insert movement during molding for accurate alignment
- » Unique counterbore positions insert over molding pin and allows for easy bolt entry
- » Eliminates machine chips and oil residue that could contaminate molded product

INCH STANDARD SPECIFICATIONS



Thread Size	Part Number	Length L ± .008	Diameter A ± .005	Diameter B ± .005	Flange Thickness C ± .005	Minimum Boss Diameter
8-32	6176-2BA297	.297	.281	.250	.020	.486
10-24	6176-3BA347	.347	.312	.280	.025	.512
10-32	6177-3BA347	.347	.312	.280	.025	.512
1/4-20	6176-4BA442	.442	.375	.340	.030	.576
1/4-28	6177-4BA442	.442	.375	.340	.030	.576
5/16-18	6176-5BA556	.556	.438	.405	.035	.641
5/16-24	6177-5BA556	.556	.438	.405	.035	.641
3/8-16	6176-6BA645	.645	.593	.514	.040	.750
3/8-24	6177-6BA645	.645	.593	.514	.040	.750

METRIC INSERT SPECIFICATIONS

Thread Size	Part Number	Length L ± 0.20	Diameter A ± 0.13	Diameter B ± 0.13	Flange Thickness C ± 0.13	Minimum Boss Diameter
M4x0.7	6175-4BA075	7.55	7.14	6.35	0.50	12.35
M5x0.8	6175-5BA088	8.82	7.93	7.12	0.64	13.11
M6x1.0	6175-6BA1123	11.23	9.53	8.64	0.77	14.64
M8x1.25	6175-8BA1413	14.13	11.13	10.29	0.89	16.29
M10x1.5	6175-10BA1639	16.39	15.07	13.06	1.020	19.06

Ultra-Mold - Test Data

INCH		ABS		POLYCARBONATE		NYLON 6/6	
Thread Size	Part Number	Rotation lbs-in.	Tensile lbs	Rotation lbs-in.	Tensile lbs	Rotation lbs-in.	Tensile lbs
8-32	6176-2BA297	54	456	69	593	85	813
10-24	6176-3BA347	85	632	107	744	128	1137
10-32	6177-3BA347	85	632	107	744	128	1137
1/4-20	6176-4BA442	170	993	249	1393	230	1454
1/4-28	6177-4BA442	170	993	249	1393	230	1454
5/16-18	6176-5BA556	302	1428	457	2097	389	2957
5/16-24	6177-5BA556	302	1428	457	2097	389	2957
3/8-16	6176-6BA645	538	2138	567	2710	812	4107
3/8-24	6177-6BA645	538	2138	567	2710	812	4107

METRIC		ABS		POLYCARBONATE		NYLON 6/6	
Thread Size	Part Number	Rotation lbs-in.	Tensile lbs	Rotation lbs-in.	Tensile lbs	Rotation lbs-in.	Tensile lbs
M4x0.7	6175-4BA075	6.10	2028	7.80	2638	9.60	3616
M5x0.8	6175-5BA088	9.60	2811	12.15	3311	14.46	5057
M6x1.0	6175-6BA1123	19.21	4417	28.13	6196	25.99	6467
M8x1.25	6175-8BA1413	34.12	6352	51.63	9327	43.95	13153
M10x1.5	6175-10BA1639	60.78	9510	64.06	12054	91.74	18268

STANLEY®
Engineered Fastening

STANLEYEngineered Fastening, a Stanley Black & Decker Inc. Company has been revolutionizing fastening and assemblytechnologies for a variety of industries for more than 40 years.

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www.StanleyEngineeredFastening.com

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