



## 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/TS 16949: 2009 and ISO 14001. We are committed to an ongoing and never ending process of quality improvement and total customer satisfaction.

## Design Guidelines

### 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

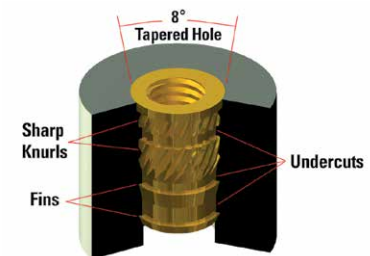
Dodge inserts are traditionally made from 360 brass which falls under the designation UNS C36000 ½ hard free-cutting brass. The CDA specification is C360, ½ hard per ASTM B-16.

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 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.

## Design Guidelines

### 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.

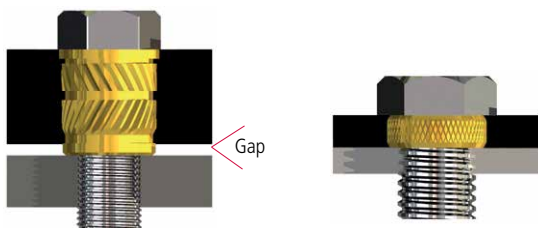
### Types of Applications

#### 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.

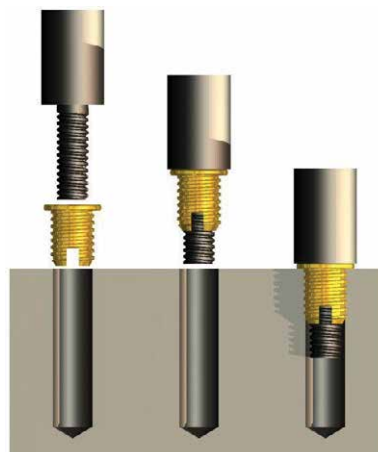
An ultrasonic horn then contacts the insert and begins to vibrate the insert. This vibration creates frictional heat which melts the plastic allowing the horn to lower the insert into position. Once installed to the appropriate depth, the cycle is repeated for the next insert.

### 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

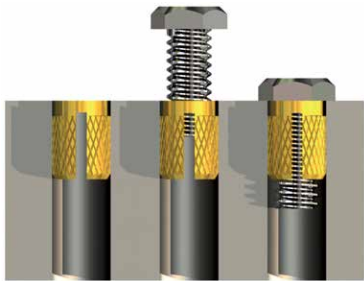
Economical and easy to install. Provides excellent pull out resistance. Insert design features a cutting edge slot which assists in installation.



# Design Guidelines

## c2. Spred-Lok Inserts

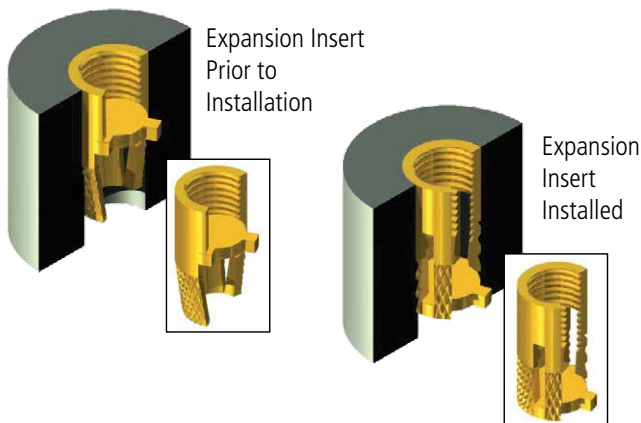
Economical and easy to install. Designed for non-critical applications. Insert is pressed into a straight prepared hole, expansion of the insert is accomplished through the installation of the mating fastener. Mating bolt should be long enough to extend at least two full threads beyond the insert length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

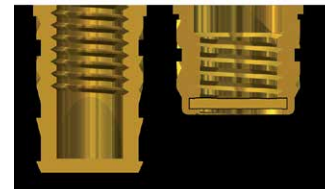
The Flange Insert, in addition to having all of the design features of the Standard Insert, has a flange with a large bearing surface. The flange can be used to make an electrical contact or to fasten a terminal connector. The flange can also be used to join mating parts by inserting the body of the 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.

## Dodge Capabilities

### Quality

- » ISO/TS 16949: 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

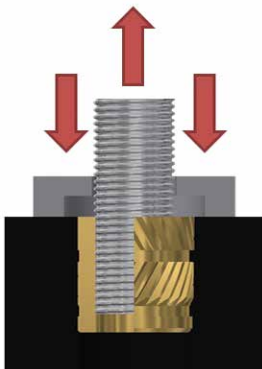
### Product Development

- » 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

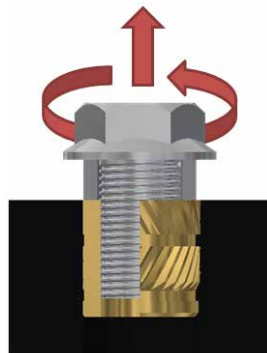
- » Lunch and Learn Seminars offered to engineering, manufacturing, purchasing and quality teams
- » Instructors include representatives from our sales engineering, applications engineering and/or marketing teams

## Testing Terminology



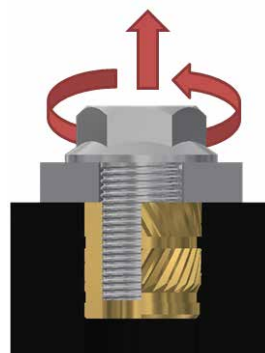
### Tensile Strength

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



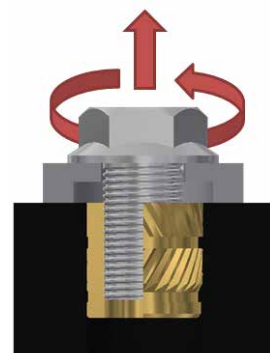
### Rotational Torque

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.

# Troubleshooting Guide

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 weldtime										
Decrease downspeed										
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.

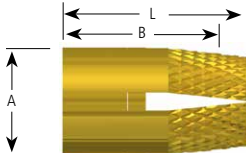
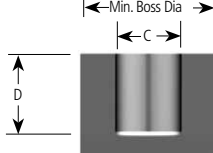
- » Company Name / Contact Name
- » Insert part number
- » Tooling information/Method of Installation
- » Address / Tel. # / Fax # / EMail
- » Affected quantities
- » 25 suspect inserts
- » Distributor or Sales representative
- » Affected lot numbers
- » Sample of application with and without installed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



## Expansion – Standard

**Expandable two piece inserts for blind holes in thermoset or thermoplastic materials.**

- » Simple, press in application
- » Versatile; can be used in all plastics

INCH INSERT SPECIFICATIONS					HOLE SIZE RECOMMENDATIONS		
							
Thread Size	Part Number	Installed Length	Body Diameter	Minimum Threaded Length	Diameter*	Depth	Minimum Boss Diameter
		L ± .004	A ± .003	B	C ± .001	D Ref.	
4-40	70015-04-250	.250	.156	.178	.158	.250	.312
5-40	70015-05-313	.313	.188	.240	.190	.313	.376
6-32	70015-06-313	.313	.188	.240	.190	.313	.376
6-32	70015-06-375	.375	.188	.303	.190	.375	.376
8-32	70015-2-313	.313	.219	.240	.221	.313	.438
8-32	70015-2-375	.375	.219	.303	.221	.375	.438
10-24	70015-3-375	.375	.250	.303	.252	.375	.500
10-24	70015-3-438	.438	.250	.365	.252	.438	.500
10-32	70011-3-313	.313	.250	.240	.252	.313	.500
10-32	70011-3-375	.375	.250	.303	.252	.375	.500
10-32	70011-3-438	.438	.250	.365	.252	.437	.500
1/4-20	70015-4-500	.500	.313	.428	.315	.500	.626
5/16-18	70015-5-625	.625	.438	.537	.440	.625	.876

METRIC INSERT SPECIFICATIONS					HOLE SIZE RECOMMENDATIONS		
Thread Size	Part Number	Installed Length	Body Diameter	Minimum Threaded Length	Diameter*	Depth	Minimum Boss Diameter
		L ± 0.10	A ± 0.08	B	C ± 0.03	D Ref.	
M3x0.5	70017-3-064	6.35	3.97	4.52	4.01	6.40	7.92
M3.5x0.6	70017-3.5-080	7.96	4.78	6.10	4.83	8.00	9.56
M4x0.7	70017-4-080	7.96	5.56	6.10	5.61	8.00	11.13
M4x0.7	70017-4-095	9.53	5.56	7.70	5.61	9.50	11.13
M5x0.8	70017-5-080	8.00	6.35	6.10	6.40	8.00	12.70
M5x0.8	70017-5-095	9.53	6.35	7.70	6.40	9.50	12.70
M6x1	70017-6-127	12.70	7.96	10.87	8.00	12.70	15.90

(\*) Diameter "C" is for Thermoset Plastics. For Thermoplastic materials, refer to page 29.

## Expansion Insert – Test Data\*\*

EXPANSION INSERTS			ABS		POLYCARBONATE		PHENOLIC	
Inch Size	Metric Size	Insert Length	Rotation lbs-in.	Tensile lbs	Rotation lbs-in.	Tensile lbs	Rotation lbs-in.	Tensile lbs
No. 4	M2.5	.250	13	105	24**	215	24**	171
No. 5	—	.313	21	181	31	239	35**	196
No. 6	M3 & M3.5	.375	22	173	34	231	41**	199
No. 8	M4	.375	44	257	54	317	73**	318
No. 10	M5	.438	55	342	81	354	93	364
1/4	M6	.500	88	436	101	465	97	497
5/16	—	.625	105	606	133	699	110	600

(\*\*) To achieve maximum strength, spreader plate must be pushed to the bottom of the hole. See page 29.

Note: Test data applies to all types of expansion inserts of comparable length.