



# Design Guide: Creation and Innovation Without Limitation



Since 1976, ThermoFab has been bringing customer designs to life using a proprietary, blended thermo pressure forming process for heavy-gauge plastic enclosures. Our uncompromising focus on quality means you get superior, high-quality products with fewer restrictions and less frustration.

There are many details to consider during the design and engineering phases. With that in mind, we created this Design Guide to help you design your products efficiently and cost effectively.

**Let's get started!**

## Tips before we begin...

### We can help!

If you don't have an industrial designer or plastics engineer, we can help. We are happy to create new CAD files in SolidWorks or help with the design for manufacture.

### Always keep the end result in sight, even in the prototype phase.

We believe the prototype should provide a clear idea of what the final manufactured product will look like. Think about your brand, colors, the location of labels, and other details now.

### Use production-grade plastic.

Production-grade plastics provide a better idea of how the final product will look and work. It is worth the investment to have a working prototype (emphasis on "working"). At the same time, be mindful of where you can save money. We can help you to identify cost-saving opportunities in the design process.



## Focus on...

### Design

Giving your product every chance to succeed is your top priority. At ThermoFab, we feel the same way. We work with your designers and engineers to incorporate all of the details and get your product to market with the highest design quality.

### Details

As the saying goes, the devil is in the details, and that's true for plastic enclosures that house sensitive medical, computer, electrical, and other products. Our proprietary process offers close tolerances, tight specifications, and sharp attention to detail.

### Timeframe

We know that you have a tight time to market. From the moment you contact us, we respond promptly and clearly to your questions and requests. We will not commit to manufacturing your product unless we know we can deliver a quality custom plastic enclosure on time, within your tolerances and specifications.

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## From idea to implementation...

ThermoFab knows what's required to take your design files and transform them into products your clients need.

- We offer design, CAD, tooling, painting, graphics, EMI shielding and other custom processes to provide a level of detail and quality not found elsewhere.
- We work closely with product designers to review your designs and provide the tooling you need to ensure manufacturability. Our experienced staff then produces your custom plastic enclosures exactly to your specifications.
- From design review through tooling, manufacturing, painting and shielding and assembly, we have the systems in place to ensure your finished product delivers.



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## 1. What to Expect

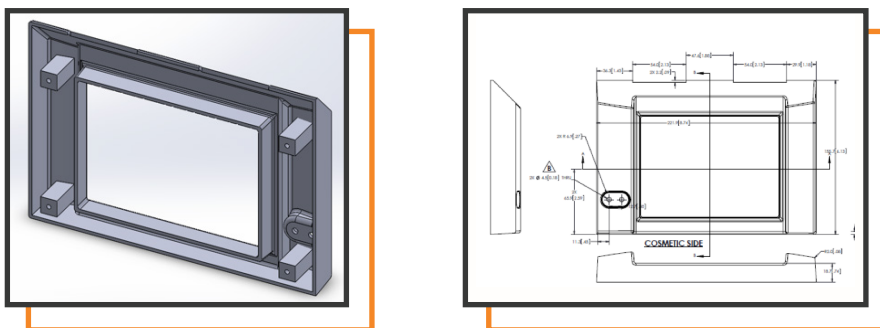
1. We review your CAD in terms of a manufacturing design. Most clients CNC a limited quantity to use for photos, product testing, introduction or customer evaluation.

2. The tooling process can begin during the CNC phase or after the initial unit is built and reviewed for changes. Most product runs last 4 to 8 years, with tooling modified 2-3 times based on availability of internal components. Tool modifications usually involve removing features using CNC equipment and inserting others in aluminum or steel, based on CAD updates.

3. All tools and modifications are made to expedite product development. The average tooling is completed in 5-7 weeks and parts can ship right away if production is planned when your tooling order is placed. Based on Lean Manufacturing, most of our large clients place yearly orders to keep the pipeline full and running seamlessly.

## From Initial Concept to Final Look

- Initial Design Rendering Concepts are created for Phase I of the design process. Typically, 2-3 concept views are created.
- The initial renderings are reviewed and preferred details are chosen.
- This process narrows down the possible design elements to create a final look



## Quality Assurance


### Quality You Can Count On

- ThermoFab is committed to staying ahead of the competition and to helping you do the same. To us, Quality Assurance is not just a department, it's an ongoing commitment to control, improve and innovate.
- Our stringent QA process ensures that we meet your standards on the exterior finish in our final inspection, including Paint Color Min/Max Chips for Process Control, Logos and Silk-screening.
- From tooling to final delivery, ThermoFab inspects every step of the process to make sure the product you bring to market exceeds your expectations for detail, craftsmanship and performance.



## 2. The Overview:

With ThermoFab's many design options, there are a number of possibilities to consider for your product's design.



# Material Options

## Materials

Starex Flame-retardant ABS

Kydex Acrylic/PVC

Sabic Polycarbonate ABS blends

Polycarbonate

ABS

PVC

Acrylics

High Impact Polystyrene (HIPS)

Polypropylene

HDPE

## Typical Products

Equipment Housings

Shrouds

Covers

Bases

Bezels

Component Parts

Internal Parts

## Applications

Computers/Peripherals

Business Machines

Telecommunications

Electronics

Biomedical Instruments

Lab Equipment

Robotic Covers

Drone Enclosures



## Base Materials – A Foundation for Color

We'll help you select a base color that meets your needs. This image shows a three-color paint process applied to a base color. A nominal wall of .100 to .140" is recommended for a quality feel and function

Examples of base colors include:

- Black
- Grey
- Natural
- White

This image shows a Single piece cover painted three tone using part detail for masking

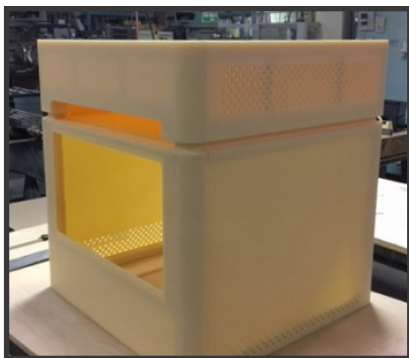


## Creating a Prototype CNC

Precision parts are machined from your CAD file on a five axis CNC for design verification, photo shoot, trade show or production shipment.

We use a smooth coat of urethane and a fine texture coat for a true class A finish.

- Delivery is typically two to three weeks



CNC assembly in ABS



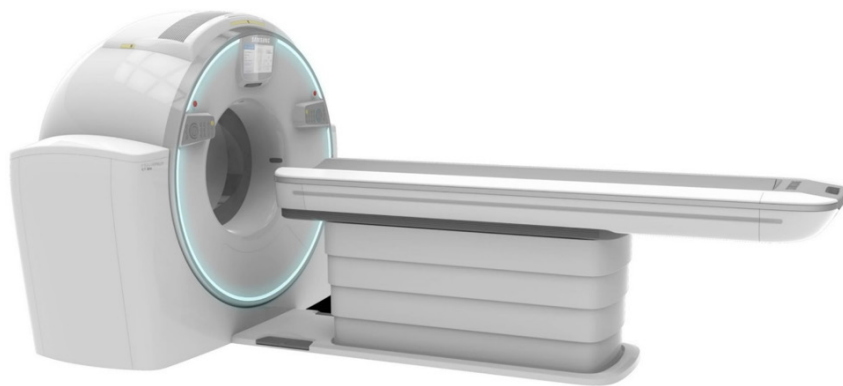
Painted and screened CNC assembly for product launch



## Example: CNC Prototype



CAT Scanner CNC Parts



Completed CNC Assembly For Beta Testing



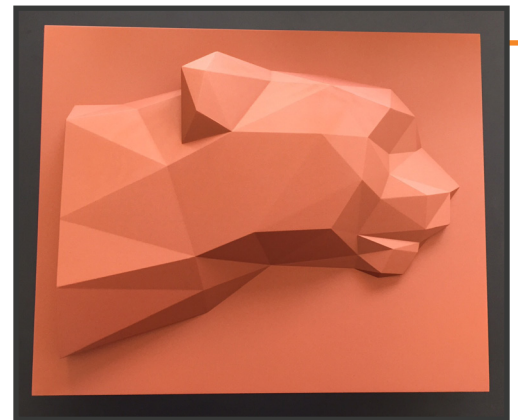
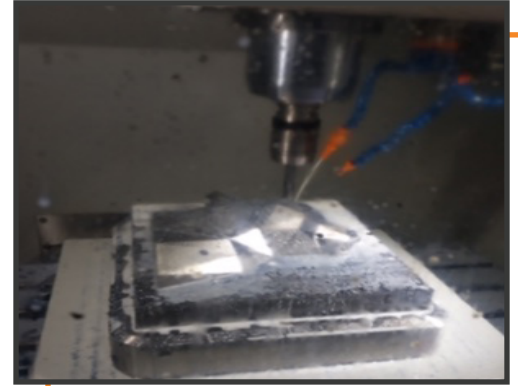
## Expert Tooling

Temperature Controlled Aluminum Tooling provides maximum control over the tooling process.

Temperature Controlled Aluminum Tooling provides maximum control over the tooling process.

### Successful tooling requires:

- Temperature Controlled Aluminum Tooling provides maximum control over the tooling process.
- Skilled craftsmanship that considers the plastic, shrink and aluminum tooling necessary to create parts from your 3D files.
- The ability to make necessary changes and refinements quickly so your project stays on deadline and your product performs as intended.
- Special tooling features, including:
  - Blind venting
  - Louvers
  - Undercuts
  - Molded logos



Production part in custom copper colored fire rated UL94V-0 ABS

## Tooling Finish for Clear and Tinted Parts

We recommend A-2 Finish for Clear and Tinted Parts

### Tooling Finish Polish Guide Examples:

#### Polish Guide

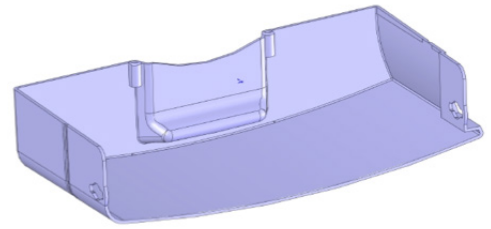
A - 1	GRADE #3 DIAMOND BUFF
A - 2	GRADE #6 DIAMOND BUFF
A - 3	GRADE #15 DIAMOND BUFF
B - 1	600 GRIT PAPER
B - 2	400 GRIP PAPER
B - 3	320 GRIP PAPER
C - 1	600 STONE C - 2 400 STONE
C - 3	320 STONE
D - 1	DRY BLAST GLASS BEAD #11
D - 2	DRY BLAST #240 OXIDE
D - 3	DRY BLAST #24 OXIDE



## Undercuts and Action

**Image 1** is a model for a unique part. The color is tinted and two-toned. The handle design and pivot point were created with undercut action designed into the tooling.

1.



**Image 2** shows the integrated door with the undercut handle at the top of the completed assembly.

2.



## Vent Details

**Temperature Controlled Aluminum Tooling** provides maximum control over the tooling process.

**Successful tooling requires:**

- Vent details create needed airflow and can enhance the design style.
- Design lines ranging from simple to intricate can include a venting detail.

These examples show rectangular, oval and even cylindrical vent detail.



## Internal Pressure Vents and Formed Details

- One of the keys to our proprietary process is creating a core to produce a part with significant detail molded in.
- This process allows for an extra 40 to 50 percent more detail than traditional thermoforming. In fact, our detailing is so precise, our thermoformed plastic enclosures look like they were injection molded.
- The interior view below shows the pressure vent indentations that make this detailing possible.



## Perforation Options

- Aluminum Hex perforation – (Images 1 & 2)
- 1/8" PVC Round perforation – (Images 3, 4 & 5)

Image 1

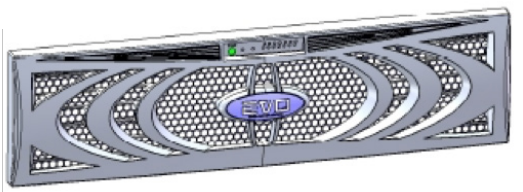
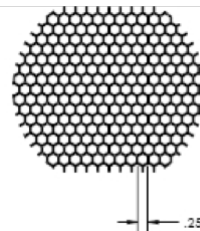


Image 2



1/4" ALUMINUM HEX

Image 3

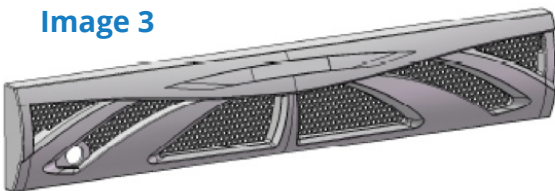
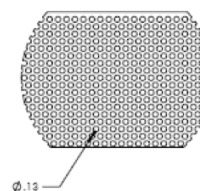


Image 5



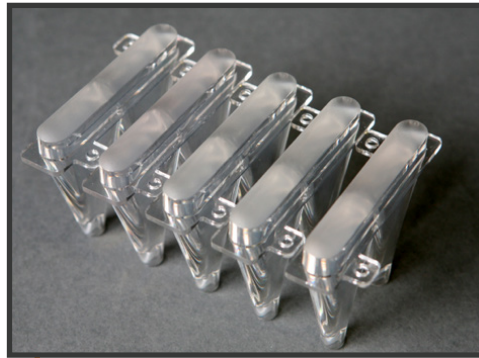
1/8" PVC ROUND

Image 4



## Custom Lightpipe Designs

- Custom lightpipes are created with specific diffusing properties, according to the project requirements.
- Back lighting the lightpipe creates an additional visual highlight.



## RFI and EMI Shielding

Thermofab's certified spraying technique applies nickel acrylic or copper conductive coatings to our pressure formed enclosures.

Typically only the back side is coated but all surfaces can be coated as needed. The shielding can be painted to create highly cosmetic surfaces.



## EMI Gasketing Provides Additional Levels of Protection

**Knitted Wire Mesh EMI/RFI Shielding Tape** - a double-layered strip of knitted wire mesh that provides an effective electromagnetic and radio frequency interference shield for electrical and electronic cable assemblies.

**Metallized Fabric Shielding Gasketing** - combines a metallized, woven nylon cover over a foam core, providing superior electromagnetic and radio frequency interference (EMI/RFI) shielding.

**Wire Mesh Over Elastomer Core Gasketing** - with two layers of mesh over an elastomer, the elastomer under pressure protrudes through the mesh to give sealing protection, offering effective EMI/RFI shielding and environmental protection.



## Color!

The Right Color Makes Your Product Shine

ThermoFab executes painting in-house to ensure maximum control over color, gloss and texture. For the product exterior, we can color match using your color sample or specification. We use Dupont Spectramaster to ensure the right color is applied every time.

**Detail and color make your products stand out from the crowd.**

**We offer:**

- Painting and interior EMI/RFI spray shielding solutions
- Sky's-the-limit design options
- Unique detailing
- Custom Paint Processes



## Logo Options

Logos can be tooled in, and are often highlighted with finishing options such as paint, texture, appliques or lightpipes.



## Logo and Label Artwork


Have your logo silk-screened onto your finished parts to call calling attention to your brand, and to add a pop of color and style.





## 3. The Details:

Here are the specific elements you'll need to incorporate in your design.





## Custom Design Details

You may be thinking, I've never designed with ThermoFab before – where do I start? How do I know I'm incorporating all of the specifics needed to make my product turn out the way I want it?

While it's true there are many details to consider during the design and engineering phases, this section will assist you as you put the finishing touches on your 3D Model Files. Our experts are available to answer any questions you have about the process (see contact information at the end of this Guide).

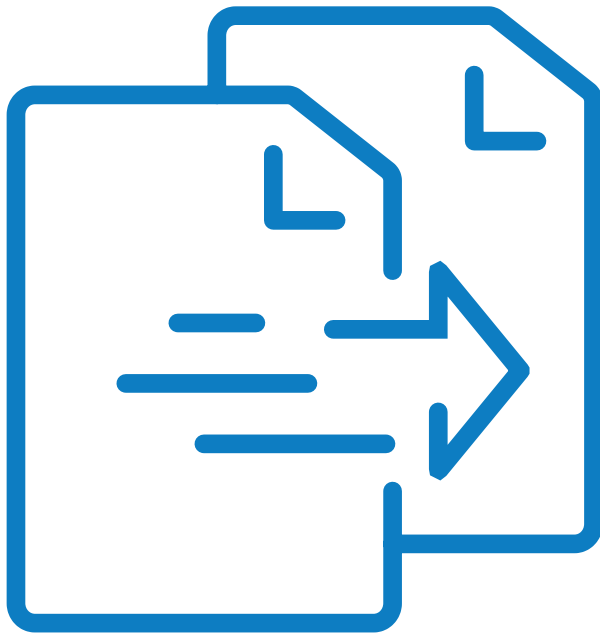
## File Types

### Solid Model File Formats:

- SolidWorks Native Files (please let us know which version you use)
- IGES
- Parasolid (.XT Files)
- ProEngineer Native Files

### 2D Drawing File Formats:

- SolidWorks .DWG Files
- DXF
- DWG
- PDF



# Lap Joint Design

## Image 1: Preferred Lap Joint Design

- Minimum Wall is 0.06", preferred is 0.14"
- Minimum Draft @ Joint Interface= 3 Degrees

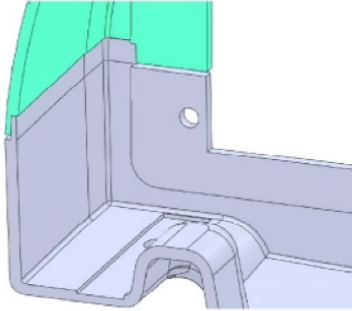


Image 1

## Image 2: Not recommended

Example of Undercut Design that does not meet recommendations – the undercut around the part traps the inner core.

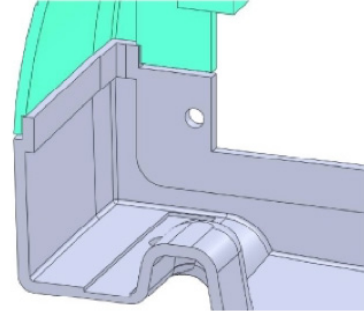
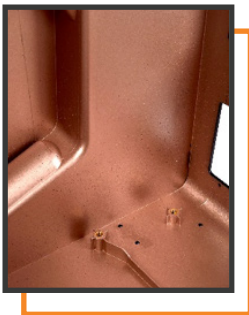


Image 2

# Internal Ribs

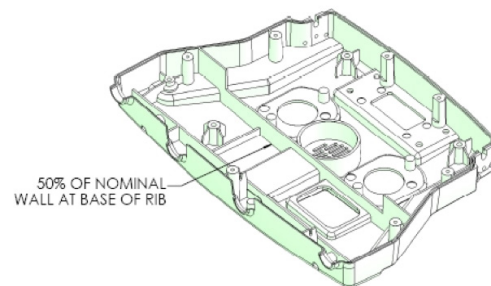
## Image 1: Underside ribbing structure

- Base of the rib should be no more than 2/3 of the thickness of the nominal wall.
- Top of the rib should be no less than .035 thick



## Image 2

Walls highlighted in green show recommended minimum 1/2 degree of draft per side for tall ribs. Preferable 1 degree draft per side.



## Labels

- Labels work best in a thermoformed piece when recessed into the design itself.
- Recessing provides a finished look that cannot be achieved by affixing the label any other way. It also prevents the label from being damaged in shipping or worn off from every day use.



## Designing to Accommodate a Label

Images 3 and 4 show the design details of a label recess

- Recess should be 0.005-.0.010 deeper than label thickness.
- We recommend a 0.005-0.010 margin all around.



SECTION A-A  
SCALE 1 : 2

Image 3

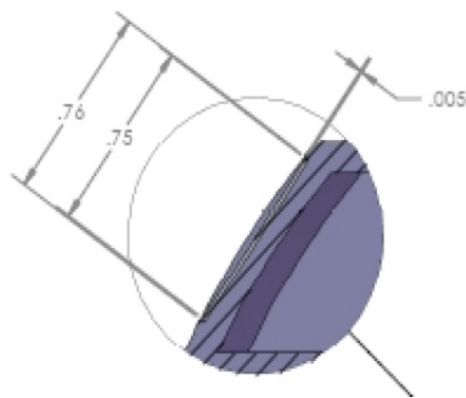


Image 4

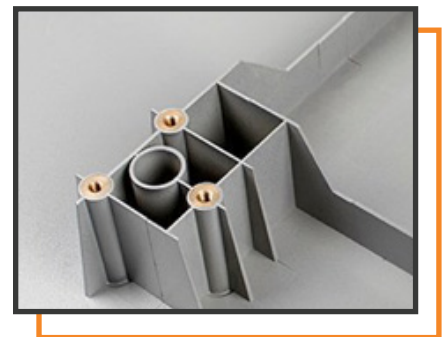
## Logo and Label Artwork Details

- Line art is required for traditional screen printing. Photographic images may be printed onto components if the part is no more than 2" thick.
- Gradients are not recommended, as each color is screened individually onto a part; however, dot patterns may be used to mimic the look of a gradient. The result is a pixilated image best viewed from a distance.
- DPI: If your vector-based artwork is from any of the file types listed below, DPI does not matter. If it is raster-based, a higher DPI will produce a better look.
- Preferred File types: Adobe Illustrator, Photoshop, Acrobat, and Distiller (.pdf, .eps, .ai, .ps, .psd); AutoCad (.dwg, .dxf); Corel Draw (.cdr), and Corel Photo (.cpt).
- We cannot accept JPEGs, GIFs, or bitmaps (BMPs).

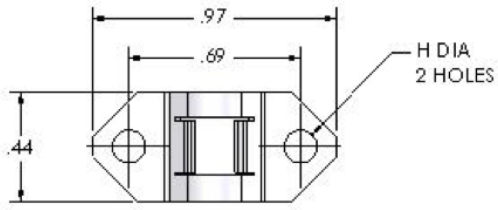
## Attachment Hardware Considerations

**Questions to consider regarding the design of attachments include:**

- How will your products attach to the inner framework chassis?
- How will the structure be laid out in the design detail?
- How will your bezel front attach to the metal frame?
- Does the product have to hinge open? Lock? Have specific access requirements?



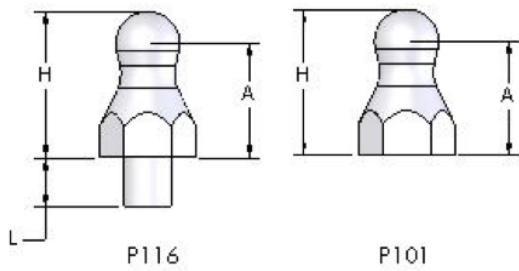
# Ball Stud Specs



**Image 1:**  
Fastening Clip Top view



**Image 2:**  
Fastening Clip Side view



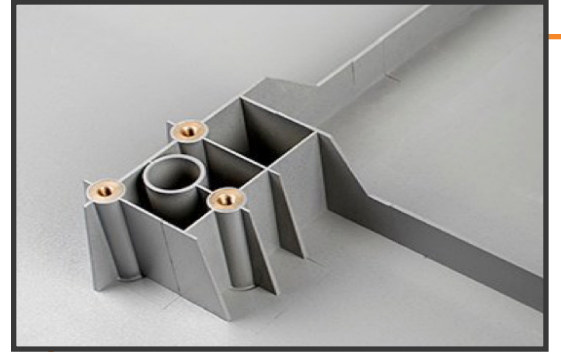
**Image 3:**  
Ball lock stud detail



## Insert Specs

Insert Specifications and Boss design are critical elements to the design of your plastic enclosure. Be sure to consider:

- How it will attach to the chassis
- How best to attach the exterior plastic to the frame,
- How best to streamline the attachment hardware with multiple components.



### Why use ThermoFab's insert specs in your design?

Our specs are tried and tested, and using them is the best way to ensure reliability. It also reduces your design work (no need to research inserts on your own). Since we buy inserts in bulk we extend our savings to you, making this the most cost-effective choice for your project.

[Download ThermoFab's Insert Specs!](#)

# Short Inserts

Use the following table when designing for short inserts

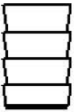


SHORT SERIES				
ANSI	METRIC	ANSI	METRIC	HOLE
PART NUMBER	PART NUMBER	THREAD	THREAD	SIZE
256SR5-3	2004SR5-3	2-56	M2.0	.118
440SR6-4	3005SR6-4	4-40	M3.0	.148
632SR7-5	3506SR7-5	6-32	M3.5	.180
832SR8-6	4007SR8-5	8-32	M4.0	.205
1024SR9-7		10-24		.230
1032SR9-7	5007SR9-7	10-32	M5.0	.230
2502SR12-9	6010SR12-9	1/4-20	M6.0	.312

SEE INSERT BOSS DESIGN FOR DETAILS

# Regular Inserts

Use the following table when designing for regular inserts:

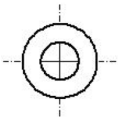


REGULAR SERIES				
ANSI	METRIC	ANSI	METRIC	HOLES
PART NUMBER	PART NUMBER	THREAD	THREAD	SIZE
256S5-6	2004S5-6	2-56	M2.0	.118
440S6-7	3005S6-7	4-40	M3.0	.148
632S7-8	3506S7-8	6-32	M3.5	.180
832S8-10	4007S8-10	8-32	M4.0	.205
1024S9-12		10-24		.230
1032S9-12	5008S9-12	10-32	M5.0	.230
2502S12-16	6010S12-16	1/4-20	M6.0	.312

SEE INSERT BOSS DESIGN FOR DETAILS

# Flanged Inserts

Use the following table when designing for flanged inserts



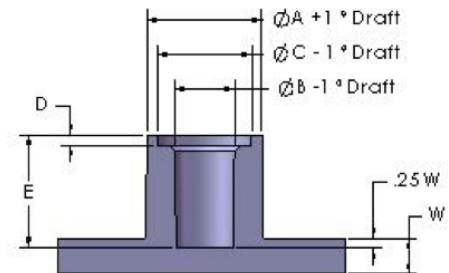
FLANGED SERIES				
ANSI	METRIC	ANSI	METRIC	HOLE
PART NUMBER	PART NUMBER	THREAD	THREAD	SIZE
440SF8-7	3006SF8-7	4-40	M3.0	.148
632SF9-8	3506SF9-8	6-32	M3.5	.180
832SF10-10	4007SF10-10	8-32	M4.0	.205
1024SF12-12		10-24		.230
1032SF12-12	5008SF12-12	10-32	M5.0	.230
2502SF16-16	6010SF16-16	1/4-20	M6.0	.312

SEE INSERT BOSS DESIGN FOR DETAILS

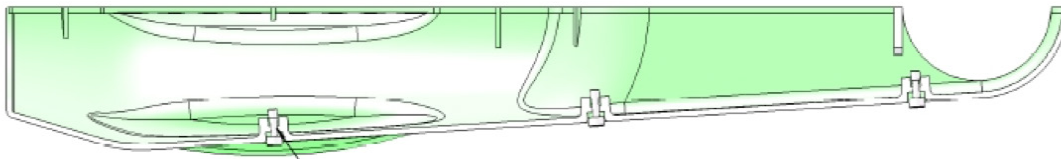
## Boss Design for Flanged Inserts

- The chart and boss design diagram works best when designing a layout for the flanged insert sizes listed.
- For unflanged inserts – eliminate the counter bore portion of the hole.

Insert Size		A	B	C	D	E Min
4-40	M3.0	.330	.148	.260	.035	.27
6-32	M3.5	.376	.180	.306	.035	.33
8-32	M4.0	.392	.205	.322	.035	.35
10-24	M5.0	.455	.230	.385	.035	.41
1/4-20	M6.0	.580	.312	.510	.040	.53



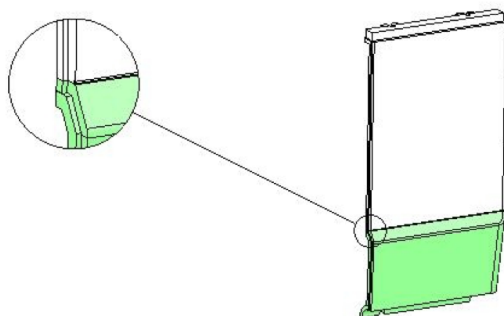
## Captive Screws



- Screws thread through minor diameter hole in plastic
- Includes an outer counterbore for screw head
- Inner counterbore for threaded portion of screw shank

## Formed Part Recess Detail For Multiple Colors On A Single Part

- A 0.06" wide by 0.06" deep groove at the paint line is required for masking.





## Ready to get started? Here are your next steps!

1. [Click here to request a proposal](#) – make sure your design files are ready to upload. [Review file types here](#).
  2. We will review your design and provide a proposal within two to four days.
  3. Place your order – include part sets such as top/bottoms or left/rights in the same quantities, with the same due date.
  4. Prototype CNC Machining
  5. Tooling
  6. Production and delivery!
- 

## Questions?

If you have questions about the design process, please email Michael Wahl at [sales@thermofab.com](mailto:sales@thermofab.com). If you prefer, you can text or call Michael at 978-835-7979.

If you have questions during production, or after delivery, please email us at [customerservice@thermofab.com](mailto:customerservice@thermofab.com) or call 978-425-2311.



## What Customers Say About ThermoFab



“Thermofab saved our company from a crisis when our former thermoforming supplier let us down after weeks of delays. Michael and the Thermofab team provided quick service, were able to refurbish our existing tooling reclaimed from the other supplier, and did it fast! They worked with us to make sure that we are getting the parts we need, in the material we need in a timely fashion at a value cost.”

**Mordecai, Mechanical Engineer at Durrige**



“In this world of ever merging/acquired/re-created - or off-shore - manufacturers, privately owned and managed ThermoFab never ceases to amaze with high quality production parts and their awesome attention to details. ThermoFab’s uniquely inventive pressure forming, rapid tooling, and CNC processing methods, together with in-house painting - not only facilitate cost effective integration of otherwise challenging component assemblies - but have also enabled nearly spontaneous turn-around of multiple sets of large accurate complex production quality prototypes. Michael Wahl’s commitments to delivering on such “we can do that” promises, consistently exceed expectations. A home run for each of now three times called to the plate!”

**Paul Mulhauser, President FactorsNY**

