BEST Inc. PCB Repair Manual

Introduction

The procedures in this instruction manual comply with IPC-standards for printed circuit board repair. These standards include the following

- IPC J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies
- IPC-7711/7721 Rework, Repair and Modification of Printed Boards and Assemblies
- IPC-A-610 Acceptability of Electronic Assemblies
- IPC-A-600 Acceptability of Printed Boards

General handling guidelines for electronic components and assemblies are applicable to any rework or repair done to PCBs. These guidelines are referred to in the following:

- IPC/J-STD-033 Standards for Handling, Packing, Shipping and Use of Moisture Sensitive Surface Mount Components
- ANSI/ESD-S-20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment

Why BEST Inc. Repair Kits?

- BEST Repair Kits feature the right "tools of the trade" selected by BEST Inc. repair technicians who have restored thousands of PCBs over the years. For instance, "tools of the trade" such as dental pics are great for digging out burnt PCB laminate materials and are included in our standard PCB Repair Kit.
- Compare the number of patterns available for BEST circuit frames with those of other manufacturers and you will agree that you get more for your money with BEST circuit frames. You will get **MORE** repairs out of BEST Circuit Frames. We can customize circuit frames for you in house. There are no minimums for this service.
- Easy to follow instructions including "how to" photos allow you to more accurately repeat the procedures. We can also follow on with hands on instruction.
- Instruction, either through a video medium or in person, is available from an IPC Master Instructor employed by BEST to teach you how to perform for PCB repairs.

Repair procedures are highly labor intensive and as such rely on the individual skills of the operator. Repair of printed circuit boards is based on the experience of the operators and should not be performed by personnel who are only performing the repairs a few hours per week or on a rotational basis with other job functions. PCB repair is a highly specialized skill requiring caring and creativity normally found and practiced by artisans.

Compliance of products to IPC Procedures

Most of the products herein are designed to comply with procedures referenced in IPC 7711/7721 Modification and Repair of Printed Boards and Assemblies.

Table of Contents

Trace Repair – *Epoxy Method*

This procedure is designed to repair damaged SMT land/trace combinations using **the epoxy method**. The traces you cut from the BEST circuit frame library are joined to existing printed circuit board traces.

IPC Referring Procedures: IPC 7721 4.2.1

Tools Required:

Small c-clamps
Cleaning solvent*
BEST Circuit Frame
BEST epoxy
Kapton tape*
Knife
ESD-safe cutting surface*
Orange sticks
Flux*
Microscope*
Dental pics
Solder*
Soldering Iron*
Wipes*
Popsicle sticks
(* Not included with standard repair kit)

Procedure:

- Clean the area with an approved solvent.
- Remove the damaged circuitry from the board utilizing the cutting knife supplied in the repair kit. The damaged conductor should be trimmed on the PCB to a point where it is still well-bonded to the PCB.

 **Heat can be applied to the damaged conductor using a soldering iron to allow the trace to be removed more easily.**

- Clean any excess solder off the existing trace for a distance of 2-3 trace widths.
- Apply flux and tin the area to a distance of 2-3 trace widths where the new trace will overlap the existing trace. Clean the board with an approved solvent.
- Match up the trace from the BEST Frame or circuit track. Be sure to remember the identifying letter or number on the circuit frame for any further procedures which may be required.

 **For custom sizes use a knife to trim the proper trace from the circuit frame or call BEST @ (847) 797-9250 for custom trace requirements.**

 **DO NOT CUT THE SELECTED REPLACMENT CIRCUIT AT THIS TIME**

- Scrape the excess oxides from the copper surface where you will be making the lap solder connection to the existing circuit trace. (Bottom side of BEST frame)

- Cut the replacement circuitry from the frame using the knife provided.

 **Do not stretch or damage the trace prior to placement.**

- Position the replacement trace section at the proper location. If necessary bend the trace using the orange sticks.

 **Wooden sticks can be used to help bend the new traces. Use one orange stick to hold the new trace at the location of the bend, while using the other wood stick to form the shape as needed.**

 **For wider traces you may need to fold over the trace to produce sharp bends.**

Form the final trace shape and hold the new trace in place with ESD-safe tape.

- Apply flux and form a lap solder joint at the overlap on both ends of the new trace.
- Clean the board with an approved solvent.
- Visually examine the proper alignment of the trace and the overlap of the trace.
- Test the site for electrical continuity as applicable.
- Remove the tape.
- Mix the epoxy per manufacturer's instructions. Coat the bottom of the trace with epoxy using the ends of the wooden orange stick or dental pick.
- Apply epoxy over the lap solder connections.

 **In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.**

- Cure the epoxy per the manufacturer's instructions
- Clean the repair area with an approved solvent.
- Apply any coating to the board that was previously existent.
- Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A) test method 2.4.1.Test the site for electrical continuity as applicable.

Trace Repair *–Dry Film Method*

This procedure is designed to repair damaged SMT land/trace combinations **using the dry film method**. The traces you cut from the BEST circuit frame library are joined to existing printed circuit board traces.

IPC Referring Procedures: IPC 7721 4.5.2

Tools Required:

Small c-clamps
Cleaning solvent*
BEST Circuit Frame
BEST epoxy
Kapton tape*
Knife
ESD-safe cutting surface*
Orange sticks
(* Not included with standard repair kit)

Flux*
Microscope*
Dental pics
Solder*
Soldering Iron*
Wipes*
Popsicle sticks
Bonding iron and tips*

Procedure:

- Clean the area with an approved solvent.
- Remove the damaged circuitry from the board utilizing the cutting knife supplied in the repair kit. The damaged conductor should be trimmed on the PCB to a point where it is still well-bonded to the PCB.

Heat can be applied to the damaged conductor using a soldering iron to allow the trace to be removed more easily.

- Apply flux and tin the area to a distance of 2-3 trace widths where the new trace will overlap the existing trace.
- Clean the board with an approved solvent.

Match up the trace from the BEST dry film adhesive frame. Be sure to remember the identifying letter or number on the circuit frame for any further procedures which may be required

For custom sizes use a knife to trim the proper trace from the circuit frame or call BEST @ (847) 797-9250 for custom trace requirements.

DO NOT CUT THE SELECTED REPLACMENT CIRCUIT AT THIS TIME

- Scrape the excess oxides from the copper surface where you will overlap the existing circuit trace (Bottom side of BEST frame)
- Cut the replacement circuitry from the frame using the knife provided.

 **Do not stretch or damage the trace prior to placement.**

- Position the replacement trace section at the proper location. If necessary bend the trace using the orange sticks

 **Wooden sticks can be used to help bend the new traces. Use one orange stick to hold the new trace at the location of the bend while using the other to bend the other wood stick to form the shape as needed.**

 **For wider traces you may need to fold over the trace to produce sharp bends.**

- Place ESD-safe tape over the new trace.
- Select the proper bonding tip with the shape matching the new trace as closely as possible.
- Follow bonding tip manufacturer's instructions for tip setup.

- Place the bonding tip directly on to the new trace pattern. Apply pressure as recommended for approximately 15 seconds.

- Carefully remove the tape after the bonding operation has been completed.

- Apply flux and form a lap solder joint at the overlap. Clean the repair area with an approved solvent.

- Test the site for electrical continuity as applicable.

- Apply any coating to the board that was previously existent.

- Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A) test method 2.4.1.

- Test the site for electrical continuity as applicable.

Plated Hole Repair

(See "Plated Hole Instructions" instructional slides)

This procedure is designed to repair damaged vias/barrels with no interlayer connections. Damage to the hole is repaired with an eyelet. Additional damage to the pad is repaired with the eyelet flanges replacing the pads on the PCB.

IPC Referring Procedures: IPC 7721 5.1

Tools Required:

Caliper*
Cleaning solvent*
Knife
Eyelet kit
Eyelet forming tools
Soldering Iron*
Hammer
Flux*
Microscope*
Drill Press or hand drill*
Wipes*
Solder*
Drill bits or ball mills*

(* Not included with standard repair kit)

Choosing the right eyelet for the repair:

Chose the proper eyelet keeping the following in mind:

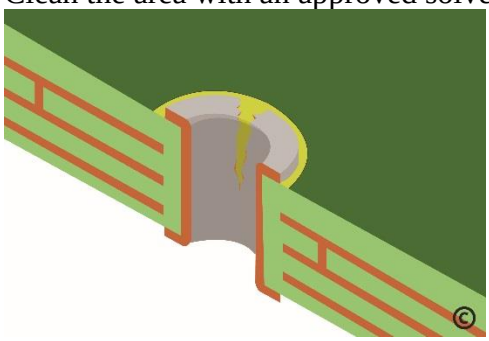
- **LUF-** The length of the eyelet barrel under the flange should be 0.630-0.890mm greater than the thickness of PCB(this allows the for the right length after the flange is formed)
- **ID-** Eyelet inside diameter should be 0.075-0.500mm greater than the component lead diameter for proper fit of the through-hole component lead.
- **FD-** The flange diameter should be sized so that it does not protrude out onto other pads or conductors in the vicinity
- **OD-** The clearance in the PCB hole should allow the eyelet to be inserted without undue force but, but should not exceed 0.125mm greater than the eyelet outside diameter.

Or use the eyelet chart found in the appendix of this user manual.

NOTE: There are many different eyelet sizes available from BEST. Call BEST Inc. @ (847) 797-9250 for further details.

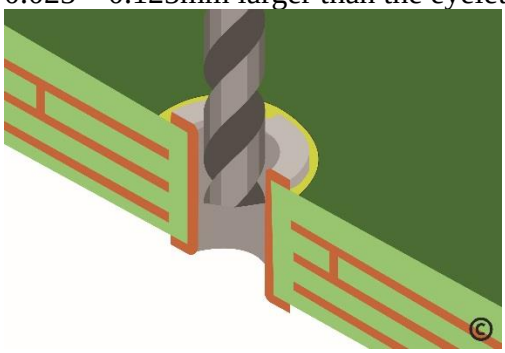
Procedure:

- Clean the area with an approved solvent.



- Select the proper eyelet as per the criteria mentioned above. Calipers will aid you in confirming all of the dimensions.

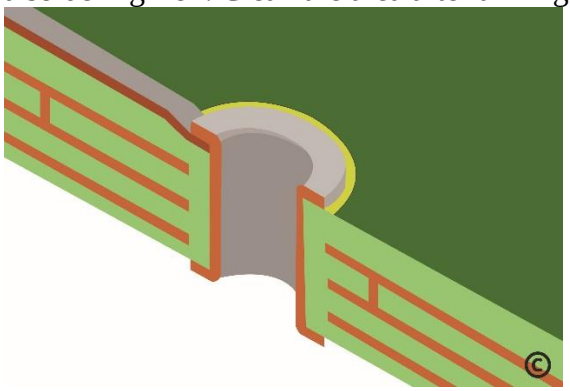
- Using a ball mill or conventional drill bit, drill out the hole needing repair. Make sure the plating is removed on the interior of the hole. The drilled hole should be 0.025 – 0.125mm larger than the eyelet O.D.



When possible drill should enter from the undamaged side of the PCB to exit on the damaged side. This prevents further PCB damage.

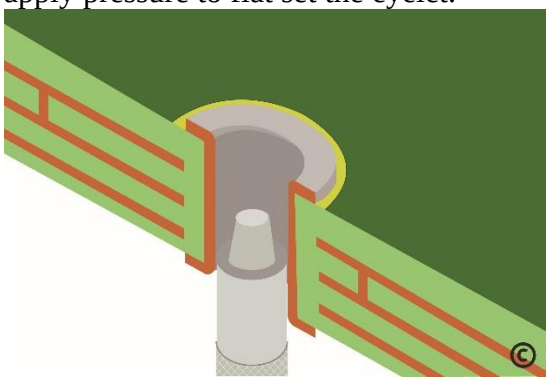
- Clean the area with an approved solvent.

- Apply a small amount of liquid flux to the conductor or pad area on the PCB surface (if there is one connected to the hole to be repaired). Tin with solder using a soldering iron. Clean the area after tinning.

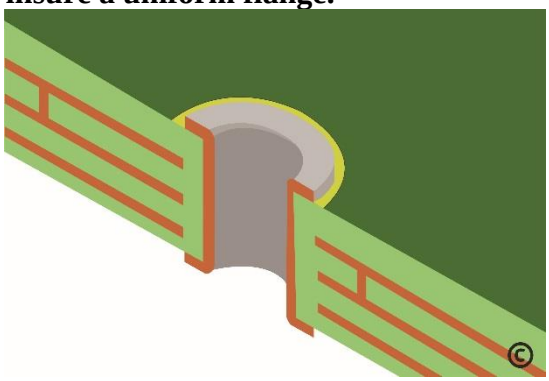


- Insert the replacement eyelet into the hole. If a replacement conductor is required it may extend into the drilled hole. The flange of the new eyelet will hold the new conductor in place.

- Flip the PCB board over and rest the eyelet flange on the lower setting tool/tool base. Stabilize the board using a board holder or your hands. Using the upper flaring tool flare the extension of the eyelet to form a cone. Using the setting tool apply pressure to flat set the eyelet.



Make sure the board is supported and flat prior to striking the upper eyelet forming tool. This will insure a uniform flange.



Inspect eyelet per IPC 610 Acceptability Criteria.

- Apply a small amount of liquid flux and solder the eyelet flanges to the pads of the PCB if necessary. Clean the area. Inspect for a good solder connection. It should be properly wetted and should have flowed to the proper areas.

- Inspect the pad diameter both inside and outside.

- Make any electrical continuity measurements.

Lifted Conductor/Pad Repair

This procedure describes how to re-attach a lifted conductor /pad using the epoxy technique. Liquid epoxy is inserted under and around the conductor in order to bond it back down to the PCB surface.

IPC Referring Procedures: IPC 4.1.1.

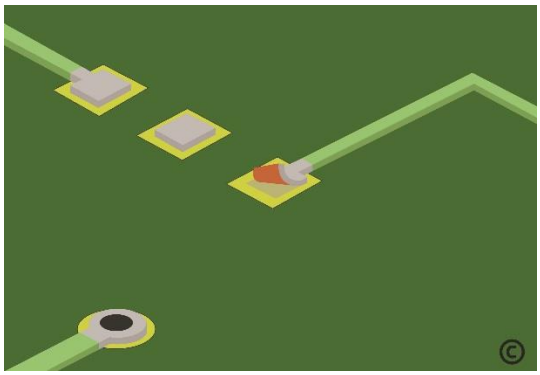
Tools Required:

Cleaning Solvent*
Wipes*
Epoxy
Knife
Dental Pick
Kapton tape*
C-clamp
Popsicle sticks

(* Not included with standard repair kit)

Procedure:

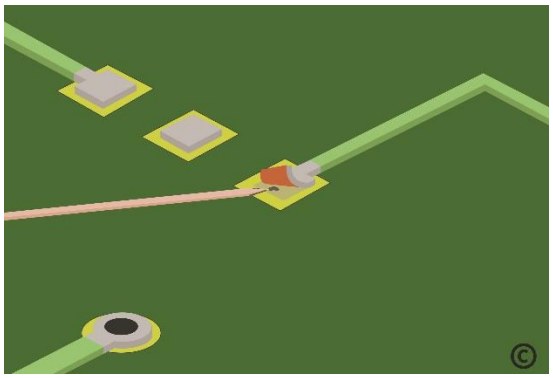
- Clean the area with an approved solvent. Remove any loose material preventing the lifted conductor from making contact with the base PCB material.



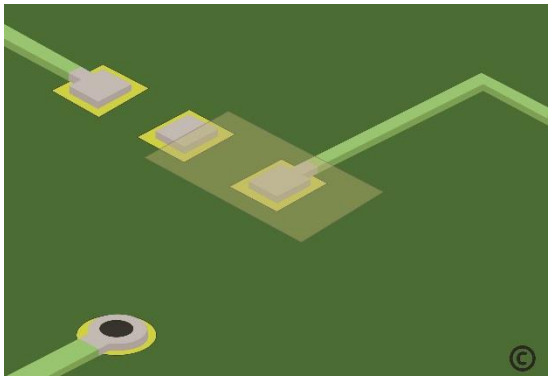
Mix the epoxy per the specified instructions:

- Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
- Mix both resin and hardener on a clean, dry, flat surface which can later be discarded.
- Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
- Mix thoroughly until both the Resin and Hardener blend into one uniform color.
- Apply adhesive within 50 minutes after mixing.

- Carefully apply a small amount of epoxy under the entire lifted area of the conductor.



- Use either a knife tip or a small orange stick to get the epoxy underneath the conductor area.
- Press the lifted pad or conductor down into the epoxy and into contact with the base PCB material.



- Apply additional epoxy to all sides as needed.

In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.

- Cure the epoxy per the instructions
- If there was previously a surface coating, re-apply the same coating. Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A).Test method 2.4.1.
- Make appropriate electrical tests.

Edge Contact Repair – *Epoxy Method*

This procedure describes the replacement of damaged and missing edge contacts using the epoxy technique.

IPC Referring Procedures: 4.6.2

Tools Required:

Cleaner*
Wipes*
Epoxy
Knife
Solvent*
Soldering Iron*
ESD cutting surface*
Small flat file*
(* Not included with standard repair kit)

C-clamps
Popsicle sticks
BEST Circuit Frame
Dental Pick
Solder*
Flux*
Kapton tape

Procedure:

- Clean the area with an approved solvent.
- Remove the damaged edge connector from the board using the appropriate cutting tool Trim the trace from the circuit frame to a point where the trace is still well bonded to the PCB. Heat from the soldering iron will allow the old contact to be removed more easily.
- Using a knife or dental pick, scrape off the area of any coating, epoxy or burnt board material from the PCB surface.
- Remove any coatings on the existing trace on the PCB for a length of at least 3 trace widths using the knife Tin the trace where the new trace will overlap.
- Clean the board using an approved solvent.
- Overlay the edge connector frame so that the damaged or missing connector is aligned.

DO NOT CUT THE EDGE CONNECTOR FROM THE FRAME AT THIS TIME.

THE CIRCUIT TRACE WIDTH, LENGTH, AND THICKNESS MUST BE EQUAL TO THE ORIGINAL FOR CURRENT HANDLING CAPABILTIIES.

- Cut the replacement edge connector (with trace) from BEST circuit frame. Use the cutting tool handle and an ESD safe cutting surface.

- Position the replacement edge connector at the proper location. The area where the new connector will be placed should be flat and smooth. If NOT then refer to other laminate repair procedures. Kapton tape can be used at the replacement edge connector in order to properly hold it into position. The trace overlap should be at least 2 times the circuit trace width.

 **In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.**

Mixing epoxy according the instructions:

- Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
- Mix both resin and hardener on a discardable, clean, dry and flat surface.
- Squeeze an even amount of Resin and Hardener parallel to each other onto the mixing surface.
- Mix thoroughly until both the Resin and Hardener blend into one uniform color
- Apply adhesive within 50 minutes after mixing.

- Apply a small amount of epoxy to the surface of the PCB where the new contact will be placed. Place the new contact onto the PCB.

In order to continue to apply even pressure over the bonded area use the appropriate small c-clamp and popsicle sticks. Cut and stack the sticks on both sides of the PCB. Clamp against these popsicle stick wedges to apply firm even pressure over the bond area. Be careful to not apply too much pressure as components and coatings can be crushed.

- After the epoxy has cured, remove any tape that was used. Inspect for placement. Champfer the edge of the replacement edge connector with a file. This will help provide a smooth surface while lessening edge damage not causing the edge connector.

 **ADDITONAL EPOXY CAN BE APPLIED TO THE PERIMETER OF THE NEW EDGE CONTACT TO PROVIDE BOND STRENGTH.**

- Flux the area where the trace is attached to the PCB. Create a lap joint by soldering the circuit traces together overlapping one with the other.
- Clean the area with an approved solvent.
- Examine visually. Confirm pad and trace dimensions.
- Check electrical continuity
- If plating is required refer to the appropriate procedures.
- If sealing of the lap joint is required, coat the lap solder joint solder connections with epoxy.

Edge Contact Repair – *Dry Film Method*

This procedure describes the replacement of damaged and missing edge contacts using the dry film technique.

IPC Referring Procedures: 4.6.2

Tools Required:

Cleaner*
Wipes*
Bonding Iron/Tips*
Knife
Solvent*
Soldering Iron*
ESD cutting surface*
Small flat file*
(* Not included with standard repair kit)

C-clamps
Popsicle sticks
BEST Circuit Frame
Dental Pick
Solder*
Flux*
Kapton tape

Procedure:

- Clean the area with an approved solvent.

- Overlay the edge connector frame so that the damaged or missing connector is aligned.

  DO NOT CUT THE EDGE CONTACT FROM THE FRAME AT THIS TIME.

  THE CIRCUIT TRACE WIDTH MUST BE THE SAMES AS THE ORIGINAL FOR CURRENT HANDLING CAPABILTIIES.

- Remove the damaged edge connector from the board using the appropriate cutting tool. Trim the trace from the circuit frame to a point where the trace is still well bonded to the PCB. Heat from the soldering iron will allow the old contact to be removed more easily.

- Using a knife or dental pick, scrape off the area of any coating, epoxy or burnt board material from the PCB surface

- Remove any coatings on the existing trace on the PCB for a length of at least 3 trace widths using the knife. Tin the trace. Clean the board using an approved solvent.

- Match up the edge connector from the BEST dry film adhesive frame. Be sure to remember the identifying letter or number on the circuit frame for any further procedures which may be required

- Cut the replacement edge contact (with trace) from the BEST circuit frame. Use the cutting tool and an ESD safe cutting surface.

- Position the replacement edge contact at the proper location. The area where the new contact will be placed should be flat and smooth. If NOT then refer to other laminate repair procedures. Place a piece of Kapton tape over the replacement edge contact in order to properly hold it into position for bonding. The trace overlap should be at least 2 times the circuit trace width.

 **For custom sizes use a knife to trim the proper edge connector from the circuit frame or call BEST @ (847) 797-9250 for custom edge connector requirements.**

- Select the proper bonding tip with the shape matching the new trace as closely as possible. Follow bonding tip manufactures instructions for tip setup instructions.

- Place the bonding tip directly on to the new trace pattern. Apply pressure as recommended for approximately 30 seconds.

- Carefully remove the tape. After this the bonding operation has been fully completed, remove the tape used for alignment.

- Apply flux and form a lap solder joint at the overlap.

- Clean the repair area with an approved solvent. Examine visually. Confirm pad and trace dimensions.

- Test the site for electrical continuity as applicable. If sealing of the lap joint is required, coat the lap solder joint solder connections with epoxy.If plating is required refer to the appropriate procedures.

- Apply any coating to the board that was previously existent.

- Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A) test method

- Champfer the edge of the replacement edge connector with a file. This will help provide a smooth surface while lessening edge damage not causing the edge connector.

 **ADDITONAL EPOXY CAN BE APPLIED TO THE PERIMETER OF THE NEW EDGE CONTACT TO PROVIDE BOND STRENGTH.**

- Check electrical continuity.

Base Board Repair

This procedure describes how to "fill" holes, gouges or large scratches in the PCB laminate. Liquid epoxy is selectively filled in to areas of the PCB where scratches, holes, gouges are located.

IPC Referring Procedures: IPC 7711 4.1.1.

Tools Required:

Cleaning Solvent*
Wipes*
Epoxy
Knife
Dental Pick
Ball mill, large and small*
Kapton 2" wide tape*
C-clamp
Popsicle sticks
Scraper*
Hand drill*

(* Not included with standard repair kit)

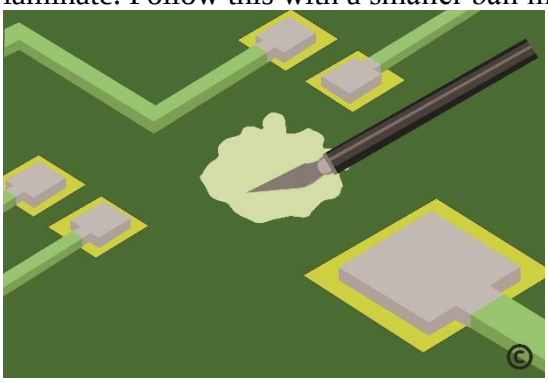
Procedure:

- Clean the area with an approved solvent.

- Remove any components or materials preventing access to the area requiring repair.

- Clean the area with an approved solvent.

- Remove the laminate or any sharp edges or exposed fibers on the corner of that laminate
- Use oversized ball mill or sharp knife to remove any signs of the damaged or charred laminate. Follow this with a smaller ball mill to "smoothen out" the edges of the repair.

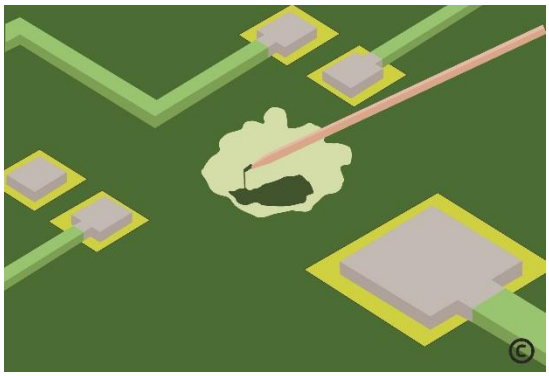


- Use a scraper to “flatten out” the bottom of the hollowed out area of the removed area such that it is parallel to the surface of the laminate.

- Clean the area with an approved solvent (NOTE: In order to make sure all of the damaged laminate and PCB solder mask are “seen”, flood the area being repaired with alcohol. If any of the PCB internal fibers are damaged, then they will likely show up at this time).

  Prepare the two-part epoxy resin supplied as per the instructions:

  - Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
  - Mix thoroughly until both the Resin and Hardener blend into one uniform color. Dispense onto a discardable, clean, dry, flat surface.
  - Prepare the color of the epoxy using the color agents provided (if required).
  - Apply epoxy within 50 minutes after mixing.



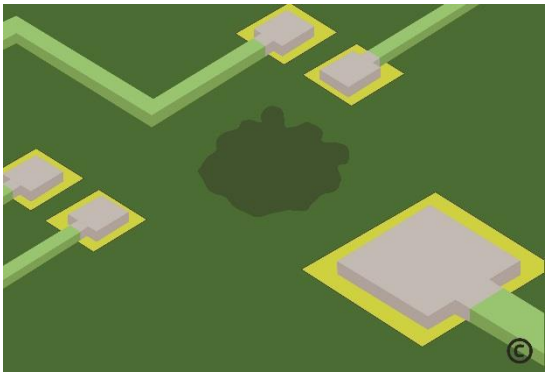
- Cure the epoxy as per the manufacturers' guidelines. It should dry somewhat concave (protruding from the surface of the circuit board)

NOTE: Protect heat sensitive components or remove them prior to heat curing the epoxy.

- Wet sand with a fine grit emery paper until the epoxy is flust the surface of the PCB.

- Apply butter coat finish. Use some of the epoxy /resin and add a small amount of isopropyl alcohol to the mixture. Mix this in with the epoxy/resin compound. Apply a “skim coat” or very thin layer to the top of the PCB in order to smooth out the surface finish.

- If there was previously a surface coating, re-apply the same coating



- Visually examine the repair.

- Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A) test method.

- Make appropriate electrical tests.

Solder Mask Repair

The procedure described below is used to replace solder mask on printed circuit boards. The repair uses the brushing technique to apply the repair material.

IPC Referring Document: IPC 7721 2.4.1

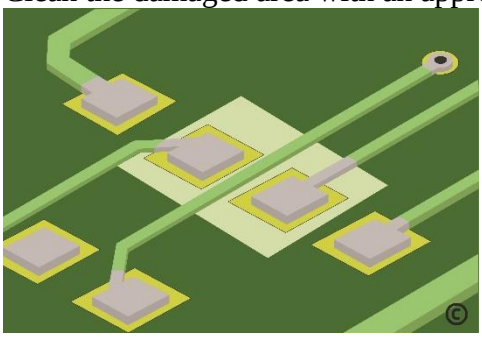
Tools Required:

Cleaning Solvent*	Utility knife
Drill bits or ball mills *	Microscope*
Color agent, variety of colors*	Oven*
Epoxy	Wipes*
Kapton tape*	

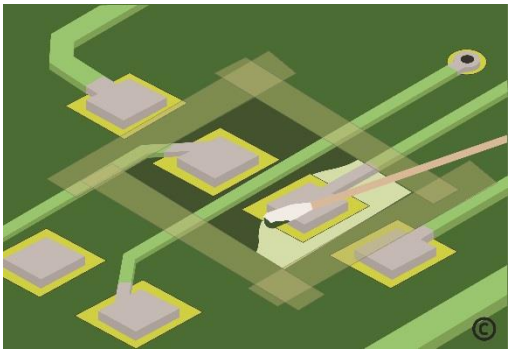
(* Not included with standard repair kit)

Procedure:

- Clean the damaged area with an approved solvent.



- Apply Kapton tape to protect the parts of the PCB that need protection and as a "mask" to the area being repaired.

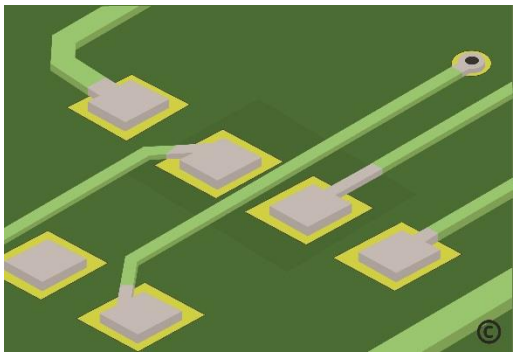


- Mix the two-part epoxy resin supplied as per the instructions.
- Prepare the color of the epoxy using the color agents provided (if required).

- Mix the epoxy per the specified instructions:
  - Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.
  - Mix both resin and hardener until the color is uniform on a clean, dry, flat surface.
  - Prepare the color of the epoxy using the color agents provided (if required)
  - Mix thoroughly until both the resin and hardener blend into one uniform color

- Apply epoxy with a small brush or dental pick within 50 minutes after mixing.

- Cure the epoxy as per the manufacturers' guidelines. It will dry somewhat concave (protruding from the surface of the circuit board).



NOTE: Protect heat sensitive components or remove them

- Remove the Kapton tape.

- Clean the area with an approved solvent. If there was previously a surface coating, re-apply the same coating.

- Visually examine the repair. Tape test as per IPC-TM-650 (ANSI/IPC-FC-250A) test method.

Damaged Corner or Laminate Edge Repair

This procedure describes how to repair a damaged PCB laminate edge or corners. These damages are usually the result of handling or packaging damage.

IPC Referring Document: IPC 7721 3.5.3

Tools Required:

Cleaning solvent*	Utility knife
Drill bits or ball mills*	Microscope*
Color agent, variety of colors*	Oven*
Epoxy	Scraper*
Hand-held drill*	Wipes*
Kapton tape*	Plastic box*

(* Not included with standard repair kit)

Procedure:

- Clean the area with an approved solvent

Remove any items preventing you from having complete access to area requiring repair.

- Remove the laminate or any sharp edges or exposed fibers on the corner of that laminate.

- **NOTE**: In order to make sure all of the damaged laminate and PCB solder mask are "seen", flood the area being repaired with alcohol. If any of the PCB internal fibers are damaged, then they will likely show up at this time.

- Find a small plastic box such as used in holding electronic components. All you will need is a single corner of the box matching the peripheral lengths of the corner area of the PCB. FR4 or some kind of laminate material.

- Align the box to the corner of the PCB Fixture or tape the PCB and lined up box into place.

  Mix the epoxy per the specified instructions:

  - Before mixing, prepare surfaces to be clean, dry and free of oil, grease or wax.

  - Mix both resin and hardener until uniform in color. Dispense onto a clean, dry, flat surface.

  - Add colorant if required.

  - Apply adhesive within 50 minutes after mixing.

- Backfill the mixed epoxy into the corner of the box until the level of the epoxy is even with the level of the PCB laminate surface.

- Cure the epoxy as per the manufacturers' guidelines. It will dry somewhat concave (protruding from the surface of the circuit board)

NOTE: Protect heat sensitive components or remove them.

- Wet sand with a fine grit Emory paper.

- Apply butter coat finish. This is done by taking some of the epoxy /resin previously mixed and adding a small amount of isopropyl alcohol to the mixture. Mix this in with the epoxy/resin compound. Apply a “skim coat” or very thin layer to the top of the PCB in order to smooth out the surface finish.

- Clean the repair area using isopropyl alcohol.

- Dry with antistatic wipes

- Visually inspect

Gold Finger Replating

This procedure describes the replating of gold edge contacts by selective brush plating via a handheld swab system. When edge contacts are scratched or become "splashed" with excess solder or they do not meet the minimum thickness specifications they need to be replated. This procedure allows you to do this with the BEST replating kit.

This brush plating process uses an easy-to-use cleaning and replating system. It includes a miniature variable DC power supply. One lead (- BLACK) is connected to an installed "bus" on the PCB. A second lead is connected to the plating wand (+ RED). This wand has swab tips where solution is absorbed. When the tip of this plating wand is swabbed across the edge connector contacts the material contained in the swab tip is plated wherever electrical contact has been made.

IPC Referring Procedures: IPC 7721 4.6.3

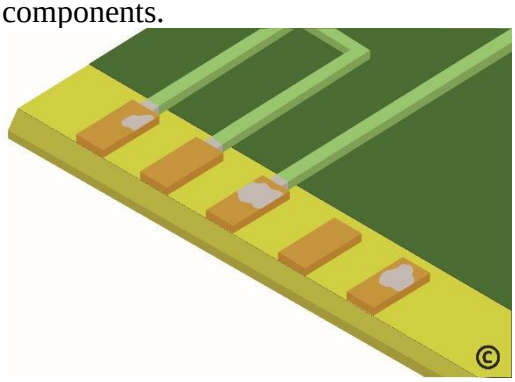
Tools Required:

Microscope*	Polyimide Tape*
Soldering Iron*	Lint Free Wipes*
Solder*	Power Supply with Integrated Cables
Solder Wick*	Nickel Tip/Swab
Liquid Flux*	Gold Tip/Swab
DI Water*	Cerium Oxide
Isopropyl Alcohol*	Nickel Solution
Safety Gloves*	Gold Solution
Safety Glasses*	Pull Testing Tape

(* Not included with standard repair kit)

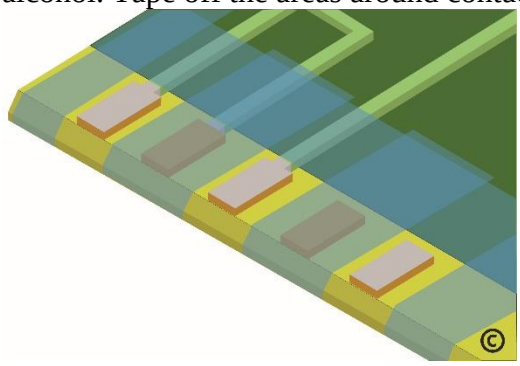
a. Clean the area with an approved solvent.

b. Apply polyimide tape around the site to be replated to protect the surrounding area and components.

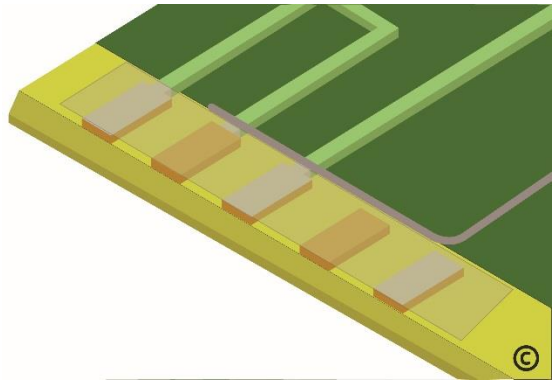


c. Wick off solder using a soldering iron and braid such that the surfaces to be plated are flat.

d. Clean with isopropyl alcohol prior to plating. Use a lint free wipe and dab off excess isopropyl alcohol. Tape off the areas around contacts that will be replated.



A conductive bus can be attached to all contacts that need plating. While there are other connection options the bus method produces the highest quality replating. For other connection methods call BEST @ (847) 797-9250



The Plating Process

e. Plug the power supply into the proper outlet. Make sure the output voltage setting is correct as given in the chart in this manual. Set the power supply to 6 V for nickel.

f. Attach the probe system to the power supply using the black connector. Attach the plating pen to the (+RED) connector.

g. Install the nickel tip/swab into the plating pen. Dip the tip into the nickel solution and saturate the tip.

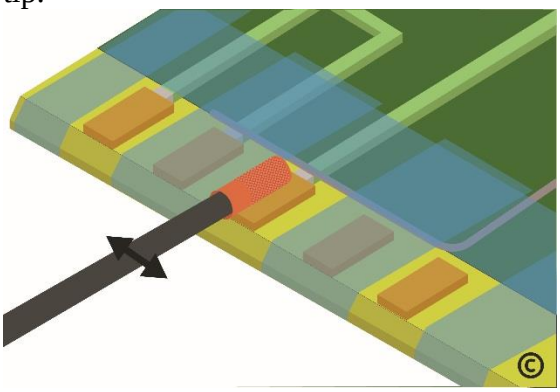
h. Touch the contact probe (-BLACK) to the inboard edge of each contact being replated or to the conductive bus if used. Using the saturated plating pen, swab the entire surface to be plated by brushing the surface with the swab. The plating swab should be moved back and forth briskly to prevent burning and to provide even coverage. Refer to the plating thickness vs. time chart in this manual for approximate coating thickness.

i. Recap container when step is completed. Remove the nickel plating tip/swab. (NOTE: Do not cross contaminate nickel and gold tips)

j. Buff with the powder slurry made of cerium oxide and water. Rinse the contact pads thoroughly with water.

k. Set the output voltage of the power supply to 8V for gold.

l. Install the gold tip/swab into the plating pen. Dip the tip into the gold solution and saturate the tip.



m. Touch the contact probe (-BLACK) to the inboard edge of each contact being replated or to the conductive bus if used. Using the saturated plating pen, swab the entire surface to be plated by brushing the surface with the plating probe. The plating probe should be moved back and forth briskly to prevent burning and to provide even coverage. Refer to the plating thickness vs. time chart in this manual for approximate coating thickness.

n. Recap the container when this step is completed. Remove the gold plating tip/swab (**NOTE**: Do not cross contaminate nickel and gold tips).

o. Buff rework area with the powder slurry made of cerium oxide and water. Rinse thoroughly with water.

p. Evaluate/inspect the replated area. Make sure the coverage is complete and the finish is uniform on the surface to be plated. No extraneous plating or nickel foot or edge pull back nor skip plating shall be on the plated surfaces (See IPC A610 Acceptability Requirements)

q. Measure the nickel and gold thicknesses via the proper measuring equipment. The nickel thickness shall be between 3 and 6 um (118.1 to 236.2 u in). Gold thickness shall be a minimum of 0.05um (1.97 u in). The typical range is 0.075 to 0.125 um (2.955 to 4.925 u in of gold)

r. Using IPC TM-650 check the peel strength of the plating material using the peel tape test

s. Use 3M brand 600 tape ½" in width.

t. Apply 50 mm length of tape to plated area. Make sure all entrapped air is out from underneath the tape. The time from application until the peel test shall be less than 1 minute. The strip must be unused to perform this test.

u. Remove the tape by rapid perpendicular pull force relative to the board.

v. Visually examine tape and test area for any remnant plating material. Remnants on either shall be a fail.

w. Examine the rework area for color and luster at 1.75x magnification.

x. Remove polyimide tape from surrounding area and remove any remaining residues. Inspect the surrounding area for any defects.

y. Test the site for electrical continuity as applicable.

Recommended Output Voltage for Each of Plating Pens

BEST P/N	Description	Voltage	Usage
PP1	Absorbent Pen	10-12V	Cleaning of metals prior to plating
PP2	Gold-24K	6-8V	Plating over gold and nickel
PP3	Nickel	5-6V	Plating over copper

Epoxy Mixing & Curing

The BEST 2-part epoxy is used to adhere replacement pads, traces and lands to the PCB as well as being used for the repair of the PCB base material or solder mask. The epoxy system has been used for 25 plus years and features: a clear color, room temp or heat cure and is easy to mix.

Tools Required:
Premixed epoxy/resin package
Flat plate for mixing epoxy
Orangewood stick for mixing epoxy
Dental pick or other device for applying mixed epoxy to small areas

Procedure:

MIXING

- Clean the epoxy mixing surface with an approved solvent. Make sure it is dry.

- Combine the resin and the hardener by activating the burst pack and mixing until the mixture is uniform in color. Dispense onto a flat surface.

 Mixing the adhesive just prior to use is recommended. Heat buildup during or after mixing is normal. The bonded parts should be held in contact until the part has developed holding strength.

CURING

- This adhesive system can be completely cured with heat for 2 hours at 60ºC (140ºF), 1 hour at 80ºC (180º F) or 30 minutes at 121ºC (250º F). Heat cures can be used to achieve a desired degree of cure from handling strength to the full cure. After 24 hours at room temperature 90% of the full cure properties are obtained. The parts will be completely cured after 3 days at room temperature.

 Store the epoxy elements in an unopened container in a cool dry location. Ideal storage conditions are between 8 and 21º C (46 to 70º F). Exposure to temperatures over 28ºC (82º F) for prolonged periods should be avoided as this can adversely impact product properties.

PCB Repair Kits Available

BEST PCB Repair Kit

BEST PCB repair kits give you the tools you need for fast repair and modification of lands, traces, contact fingers, SMT pads, plated hole connections and PCB base board material. These materials, packaged together and designed by one of the premier PCB repair companies, BEST Inc., allow you to meet original PCB quality standards. Both dry film and epoxy circuit frames are available.

BEST Epoxy Repair Kit

This kit contains 10 packages of clear, low viscosity, superior strength epoxy, precisely measured out into two-compartment plastic packages so it's easy to use and there's no measuring. Once cured, this epoxy makes an effective electrical insulator with good high temperature mechanical and impact resistance properties. The epoxy can be used to fill in holes, gaps, burns or to inject into delaminated locations. The kit also contains mixing sticks, mixing cups and foam swabs.

BEST Plated Hole Repair Kit
Here are all the tools and materials you'll need to repair damaged plated holes in circuit boards. Kit includes 8 different sizes of eyelets.

BEST Pad Repair Kit
This kit includes everything you need to reliably replace damaged surface mount and BGA pads. The replacement pads use the epoxy technique. Both dry film and epoxy circuit frames are available.

BEST Gold Replating Kit
In this kit you will find all of the necessary materials for the replating of gold contact fingers and gold plated areas.

ACCESSORY PARTS/SPARES

Part Number	Description
ResinHarnerforPCBRepKit2gm	Resin/Hardner, 2gms with divider
PopSickleStickWood-10	Popsicle sticks for clamping down for PCB repairs, 10 count
OrangeStickWood-10	Orange sticks for mixing, 10 count
SwageToolBase	Swaging tool for through hole repairs-base
SwageToolFixture	Swaging tool for through hole repairs-fixture
Eylt021030078-100	Eyelet .021" ID, .030" OD, .078" LUF 100 pcs
Eylt034046093-100	Eyelet .034" ID, .046" OD, .093" LUF 100 pcs
Eylt058068102-100	Eyelet .058" ID, .068" OD, .102" LUF 100 pcs
Eylt076040093-100	Eyelet .076" ID, .040" OD, .093" LUF 100 pcs
Eylt064076091-100	Eyelet .064" ID, .076" OD, .091" LUF 100 pcs
Eylt048059093-100	Eyelet .048" ID, .059" OD, .093" LUF 100 pcs
BEST1ACktTrack	Surface Mount Pad Circuit Frame, tin plated, for epoxy use
BEST1BCktTrack	Surface Mount Pad Circuit Frame, tin plated, for epoxy use
BEST1CCktTrack	Surface Mount Pad Circuit Frame, tin plated, for epoxy use
BEST1ACktTrackDF	Surface Mount Pad Circuit Frame, tin plated, for dry film
BEST1BCktTrackDF	Surface Mount Pad Circuit Frame, tin plated, for dry film
BEST1CCktTrackDF	Surface Mount Pad Circuit Frame, tin plated, for dry film
BEST2ACktTrack	Edge Connector Circuit Frame, tin plated, for epoxy use
BEST2BCktTrack	Edge Connector Circuit Frame, tin plated, for epoxy use
BEST2ACktTrackDF	Edge Connector Circuit Frame, tin plated, for dry film
BEST2BCktTrackDF	Edge Connector Circuit Frame, tin plated, for dry film
BEST3ACktTrack	SMT Trace Circuit Frame, tin plated, for epoxy use
BEST3BCktTrack	SMT Trace Circuit Frame, tin plated, for epoxy use
BEST3ACktTrackDF	SMT Trace Circuit Frame, tin plated, for dry film
BEST3BCktTrackDF	SMT Trace Circuit Frame, tin plated, for dry film
BEST4ACktTrack	Through Hole Circuit Frame, tin plated, for epoxy use
BEST4BCktTrack	Through Hole Circuit Frame, tin plated, for epoxy use
BEST4ACktTrackDF	Through Hole Circuit Frame, tin plated, for dry film
BEST4BCktTrackDF	Through Hole Circuit Frame, tin plated, for dry film
BEST5ACktTrack	BGA Pad Circuit Frame, tin plated, for epoxy use
BEST5BCktTrack	BGA Pad Circuit Frame, tin plated, for epoxy use
BEST5CCktTrack	BGA Pad Circuit Frame, tin plated, for epoxy use
BEST5ACktTrackDF	BGA Pad Circuit Frame, tin plated, for dry film

BEST5BCktTrackDF	BGA Pad Circuit Frame, tin plated, for dry film
BEST5CCktTrackDF	BGA Pad Circuit Frame, tin plated, for dry film
BEST6ACktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST6BCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST6ACktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST6BCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST7ACktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST7BCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST7CCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST7ACktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST7BCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST7CCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST8ACktTrack	Land Repair Circuit Frame, tin plated, for epoxy use
BEST8BCktTrack	Land Repair Circuit Frame, tin plated, for epoxy use
BEST8CCktTrack	Land Repair Circuit Frame, tin plated, for epoxy use
BEST8ACktTrackDF	Land Repair Circuit Frame, tin plated, for dry film
BEST8BCktTrackDF	Land Repair Circuit Frame, tin plated, for dry film
BEST8CCktTrackDF	Land Repair Circuit Frame, tin plated, for dry film
BEST9ACktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST9BCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST9CCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST9ACktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST9BCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST9CCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST10ACktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST10BCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST10CCktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST10ACktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST10BCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST10CCktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST11ACktTrack	Trace Repair Circuit Frame, tin plated, for epoxy use
BEST11BCktTrack	Trace Repair Circuit Frame, tin plated, for epoxy use
BEST11ACktTrackDF	Trace Repair Circuit Frame, tin plated, for dry film
BEST11BCktTrackDF	Trace Repair Circuit Frame, tin plated, for dry film
BEST12ACktTrack	Through-Hole repair Circuit Frame, tin plated, for epoxy use
BEST12ACktTrackDF	Through-Hole repair Circuit Frame, tin plated, for dry film
BEST13ACktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST13ACktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST14ACktTrack	SMT + TH Variety Circuit Frame, tin plated, for epoxy use
BEST14BCktTrack	SMT + TH Variety Circuit Frame, tin plated, for epoxy use
BEST14ACktTrackDF	SMT + TH Variety Circuit Frame, tin plated, for dry film
BEST14BCktTrackDF	SMT + TH Variety Circuit Frame, tin plated, for dry film
BEST15ACktTrack	Surface Mount pad Circuit Frame, tin plated, for epoxy use
BEST15ACktTrackDF	Surface Mount pad Circuit Frame, tin plated, for dry film
BEST16ACktTrack	Surface mount pad Circuit Frame, tin plated, for epoxy use
BEST16BCktTrack	Surface mount pad Circuit Frame, tin plated, for epoxy use
BEST16CCktTrack	Surface mount pad Circuit Frame, tin plated, for epoxy use
BEST16DCktTrack	Surface mount pad Circuit Frame, tin plated, for epoxy use
BEST16ACktTrack	Surface mount pad Circuit Frame, tin plated, for dry film
BEST16BCktTrackDF	Surface mount pad Circuit Frame, tin plated, for dry film
BEST16CCktTrackDF	Surface mount pad Circuit Frame, tin plated, for dry film
BEST16DCktTrackDF	Surface mount pad Circuit Frame, tin plated, for dry film
BEST17ACktTrackDF	Pad surface mount pad Circuit Frame, tin plated, for epoxy use
BEST17BCktTrack	Pad surface mount pad Circuit Frame, tin plated, for epoxy use
BEST17ACktTrackDF	Pad surface mount pad Circuit Frame, tin plated, for dry film
BEST17BCktTrackDF	Pad surface mount pad Circuit Frame, tin plated, for dry film

CerOxide	Cerium oxide, 2 oz.
Goldplatsoln	Gold plating solution, 2 oz.
Nickplatsoln	Nickel plating solution, 2 oz.
Absorbenttipsmall	Absorbent tips, small
Absorbenttiplarge	Absorbent tips, large
Plating Power Supply	Plating power supply for re-plating gold contacts, 3-9V

A. Frames

Frame Material:	Copper foil 0.036 mm (0.0014")-backside micro-etched for adhesion
Frame Size:	Frame Size: 57 x 38 mm (2.25" x 1.50")
Plating:	Tin coating standard on all except edge connector frames
Plating Thickness:	Tin – 0.0036mm (0.002 inches)-lead-free compatible Gold- 0.0013 mm (0.001 inches)
Pull/Peel Strength:	Greater than 11lbs/in (1.61 kg/cm) post cure to FR-4
RoHS Compliance:	YES

The dry film backing is a low stress epoxy film adhesive with a Tg at –60ºC. This minimizes the thermal stress on bonded parts during thermal cycling or shock testing from –55 to 150ºC. It is a clear 1mil (0.0254mm) in thickness material which helps to make for an aesthetically pleasing repair. It has a 6 month minimum shelf life and is date-coded on the circuit frame.

Adhesive Backing:	Phenolic film adhesive 0.0254 mm (0.001") thick.
Electrical Resistivity:	Greater than 1014 ohm-cm
Dielectric Strength:	750 Volts/mil
Glass Transition Temp:	-60º C
Device push off strength:	Greater than 2,000psi, or 13.8N/mm2
Peel Strength:	Greater than 9lbs/in (1.61 kg/cm) post cure to FR-4
Hardness:	65 Type A
Cured density:	1.2 gm/cc
Thermal Conductivity:	1.2 BUT-in/hr-ft2-ºF
Linear Therm Expansion:	110 ppm/ºC
Max Cont. Oper Temp:	150ºC
Bonding Time:	15 seconds
Bonding Temperature:	200ºC

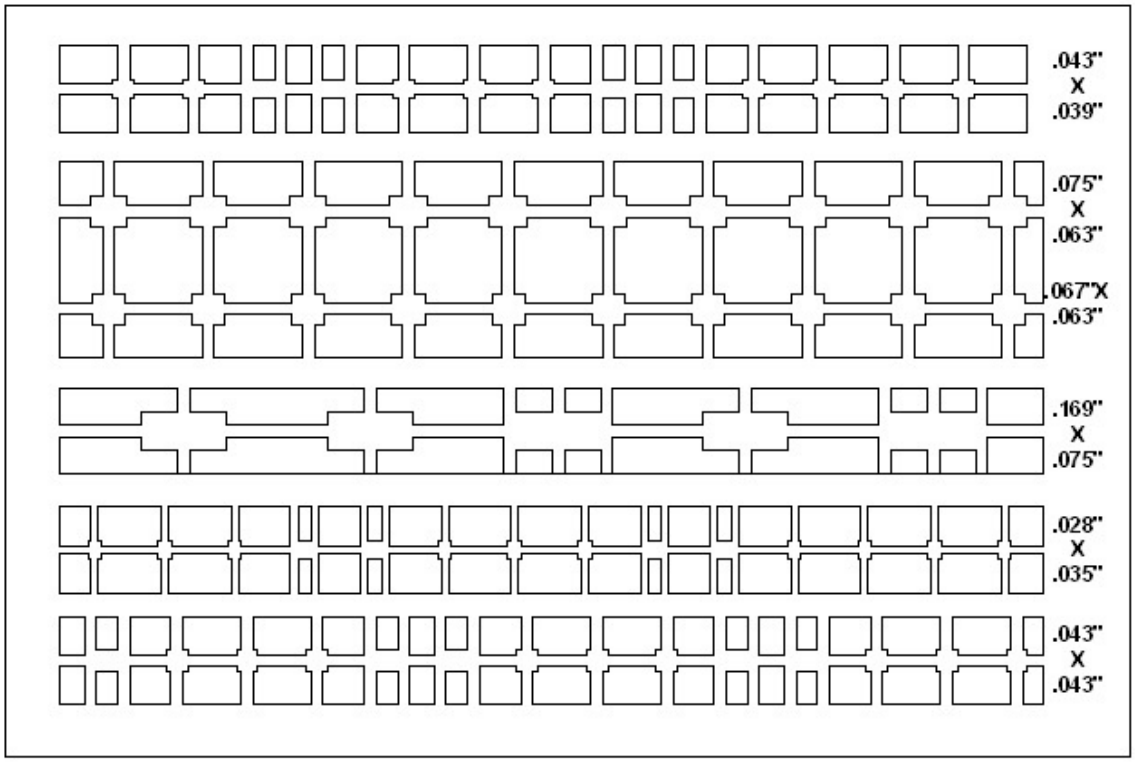


Figure - Format 1B

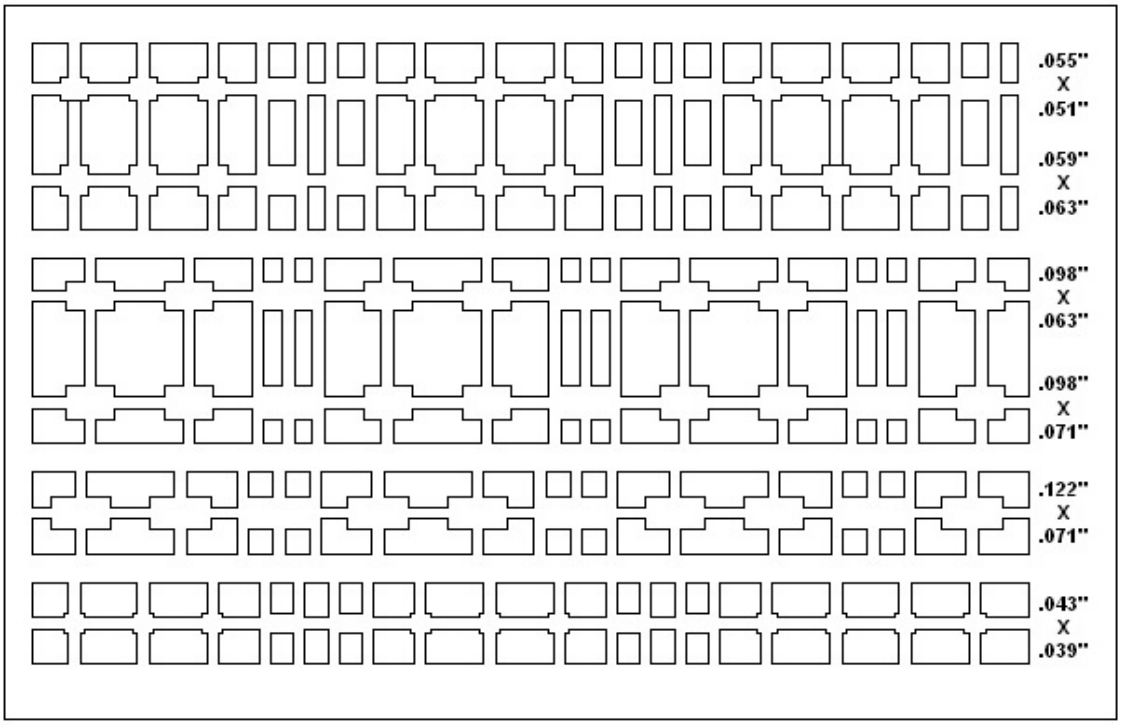


Figure -BEST2A

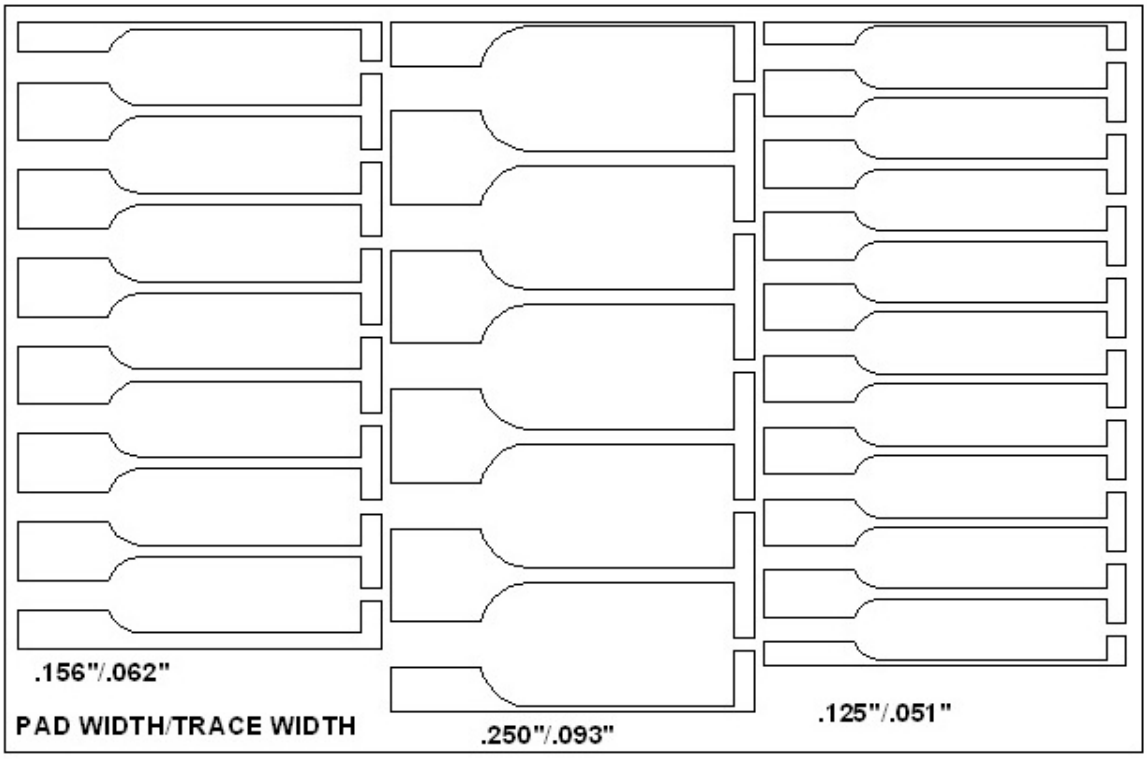


Figure -BEST2B

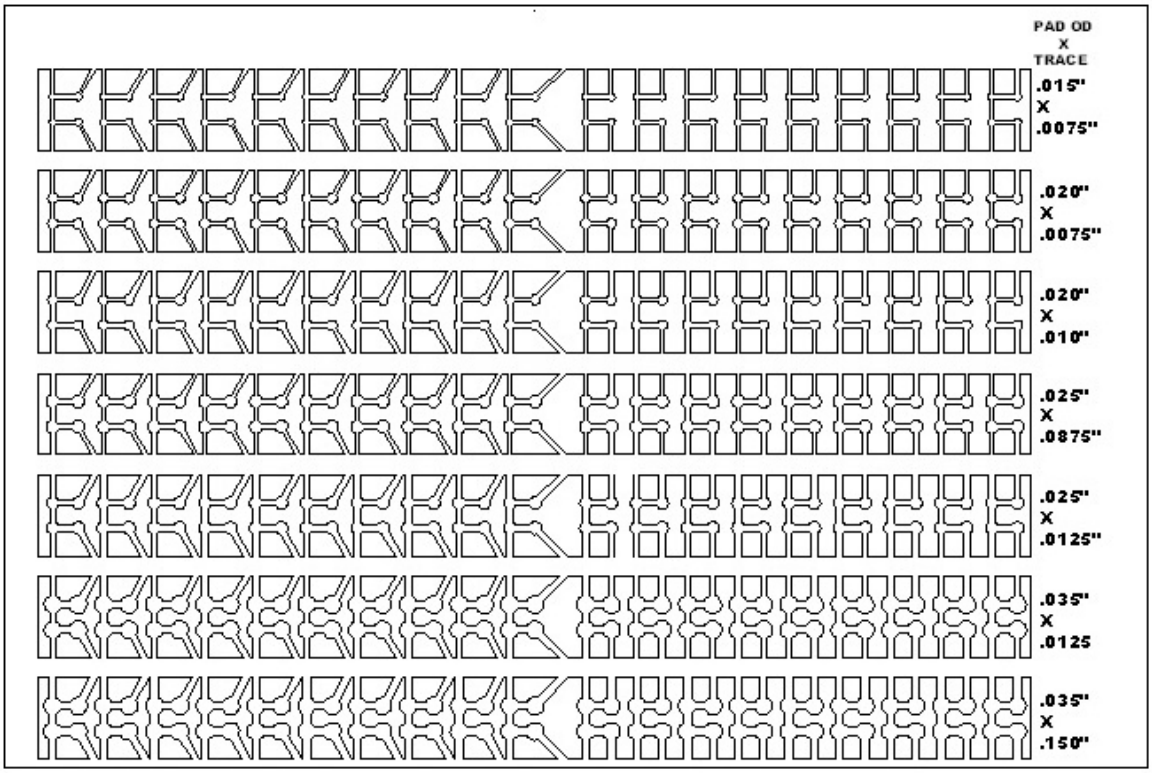


Figure -BEST5C

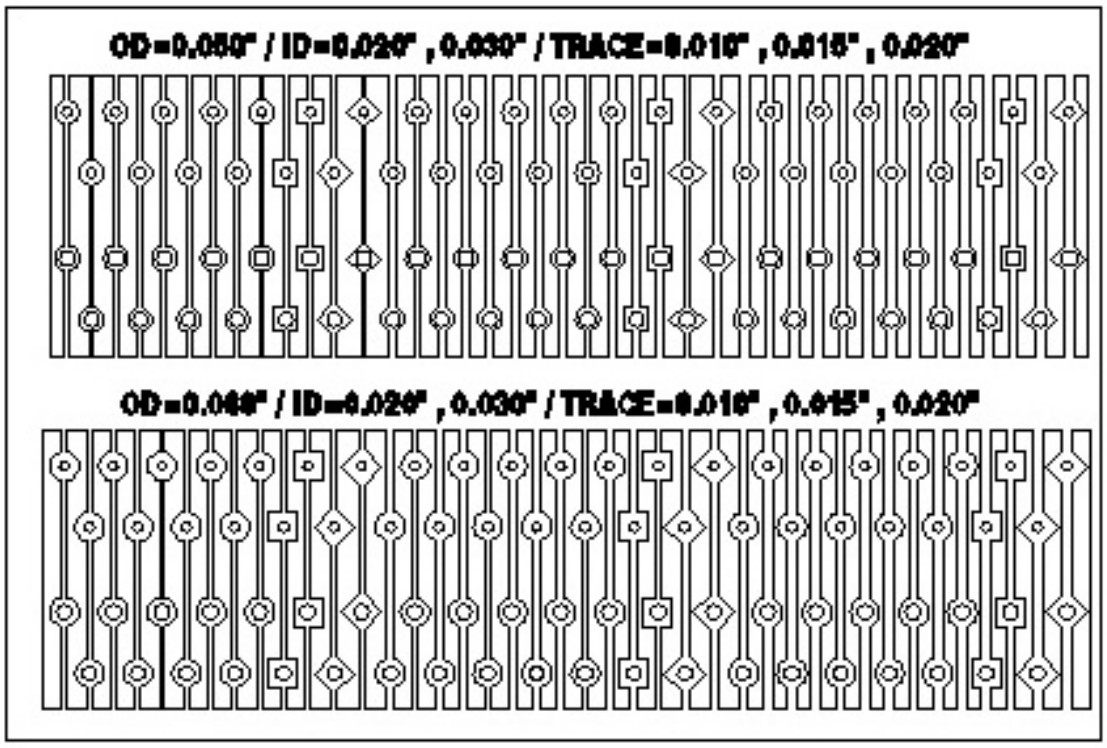


Figure -BEST8A

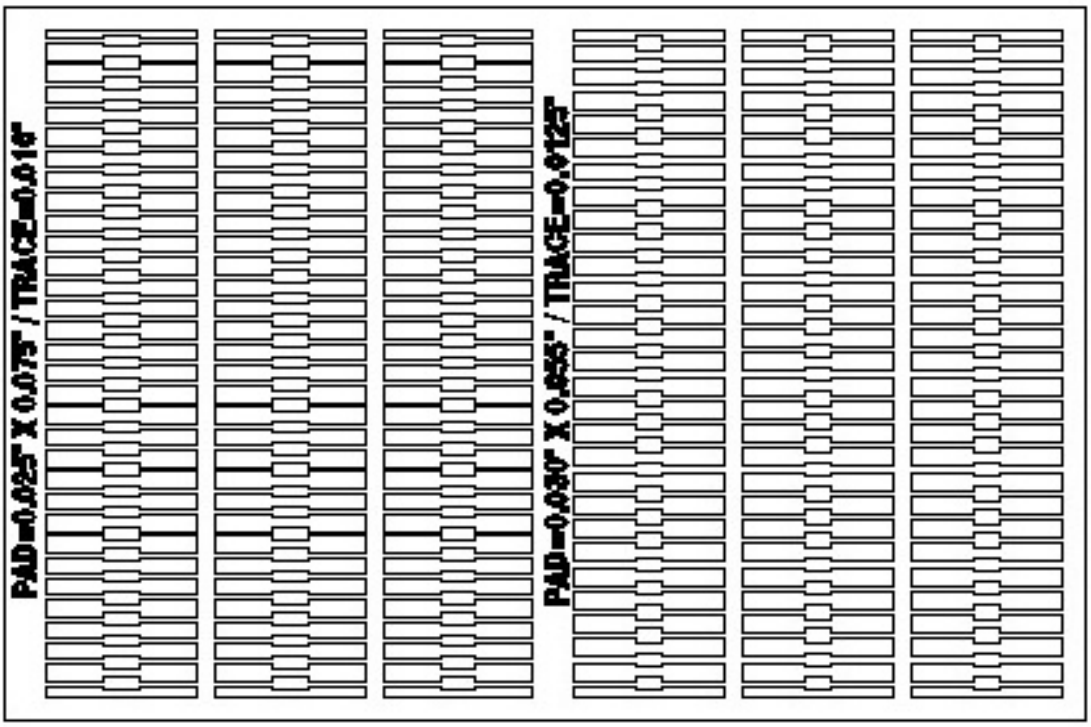


Figure -BEST6A

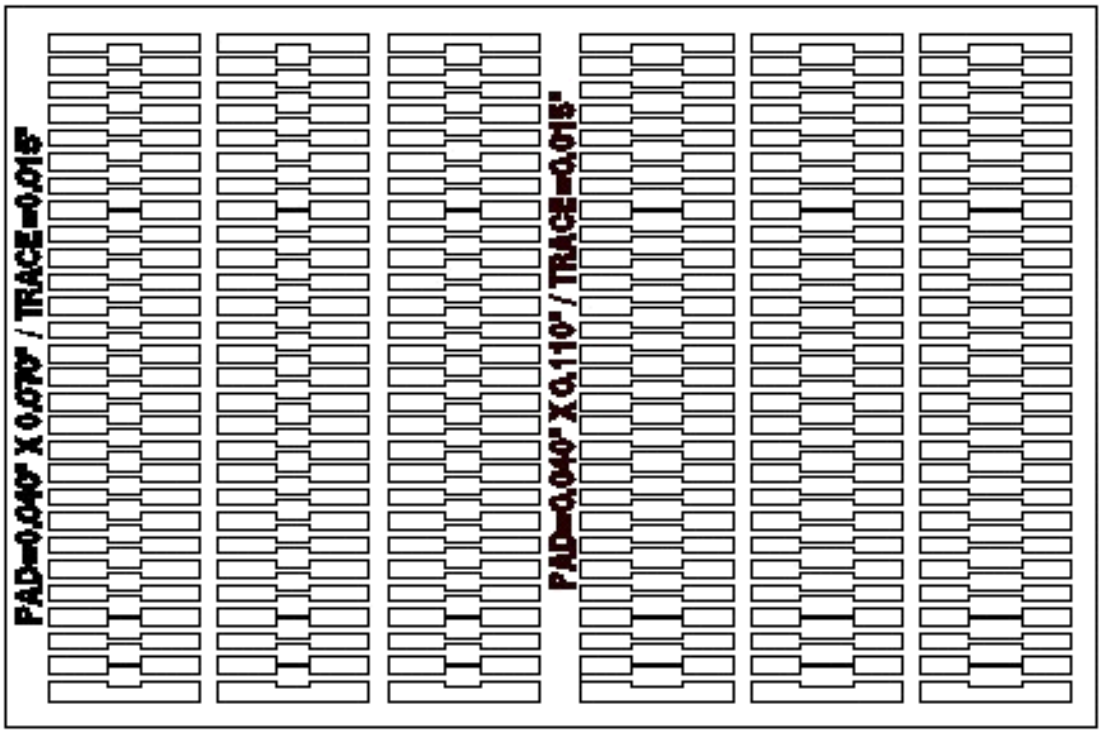


Figure -BEST6B

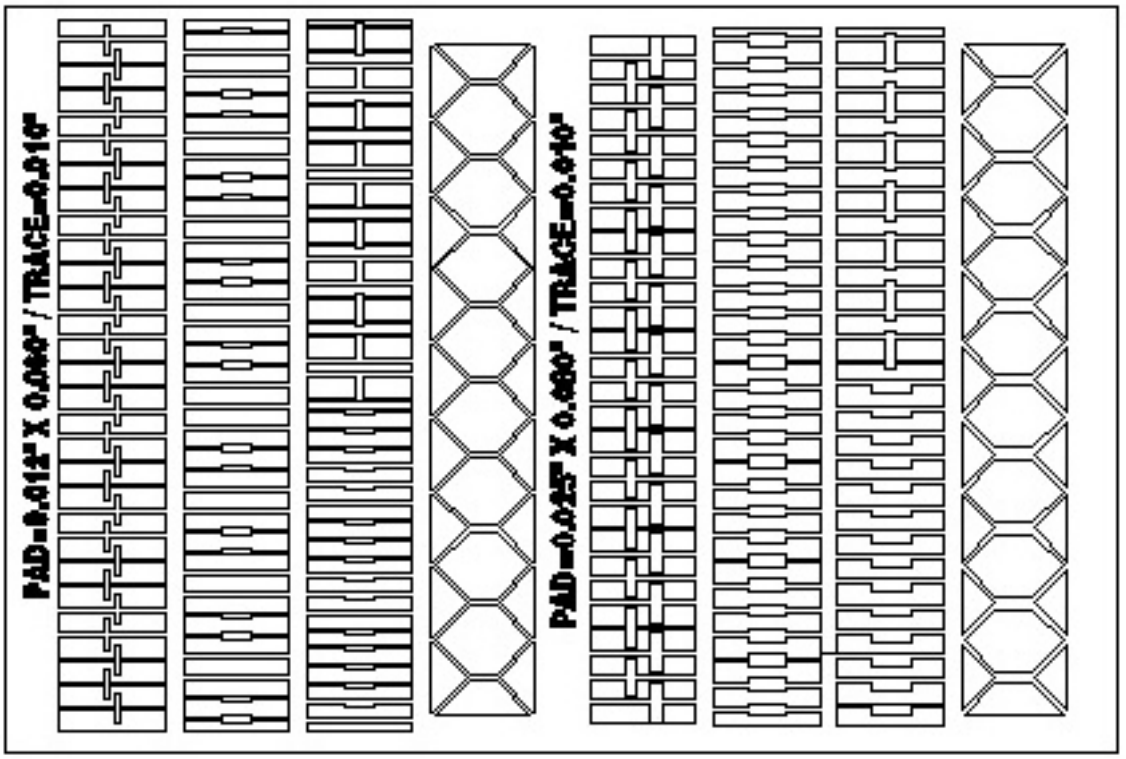


Figure -BEST7A

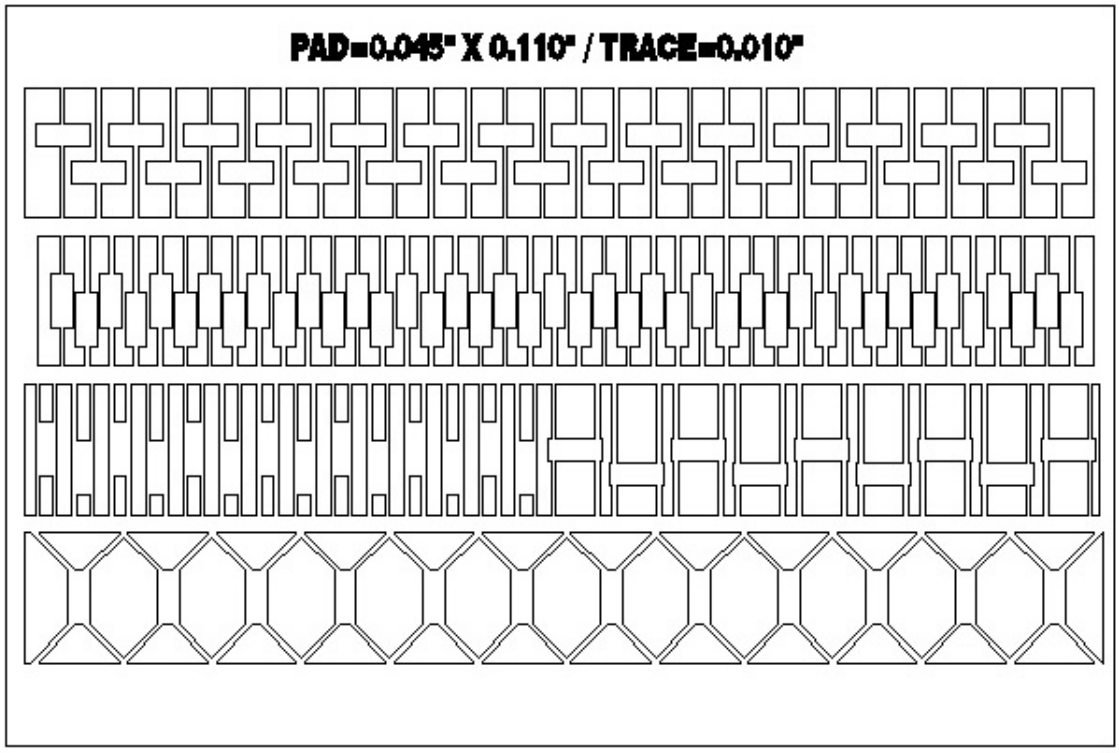


Figure -BEST7B

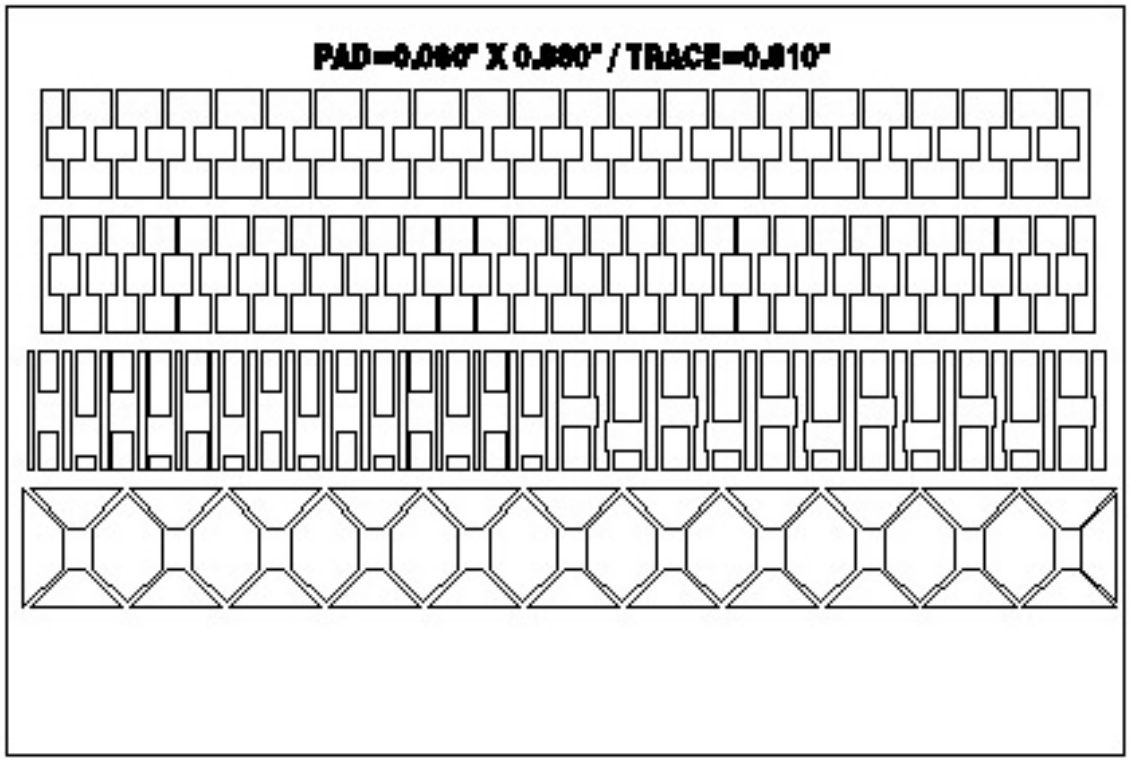


Figure -BEST7C

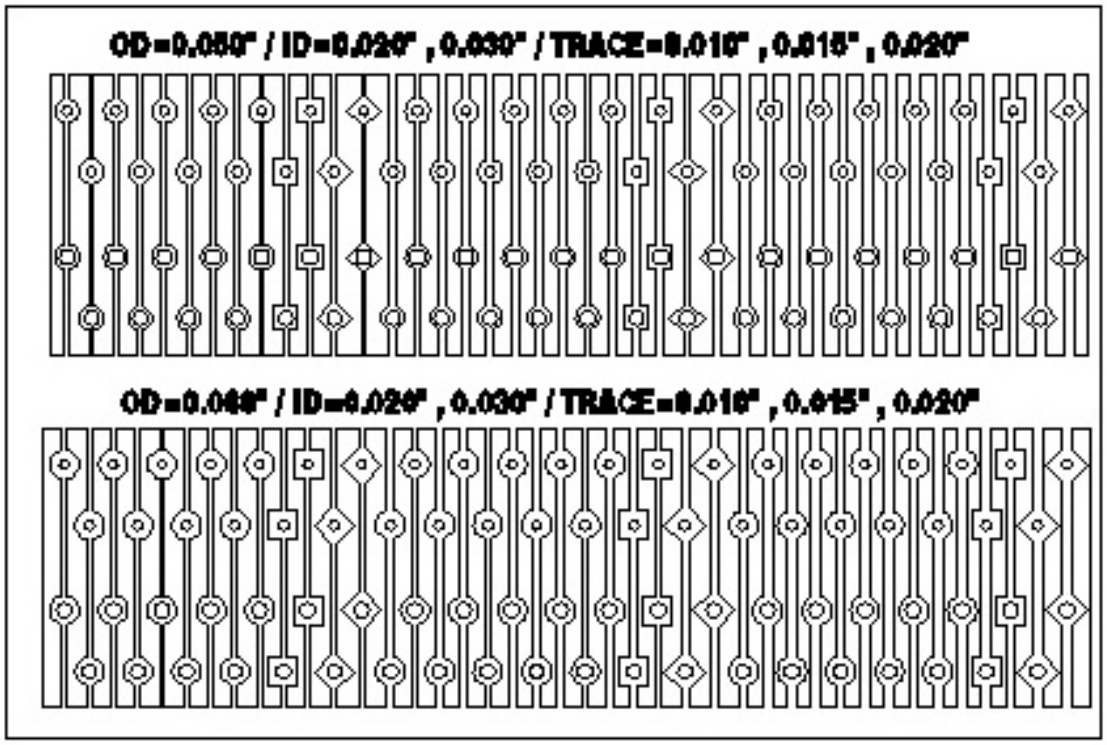


Figure -BEST8A

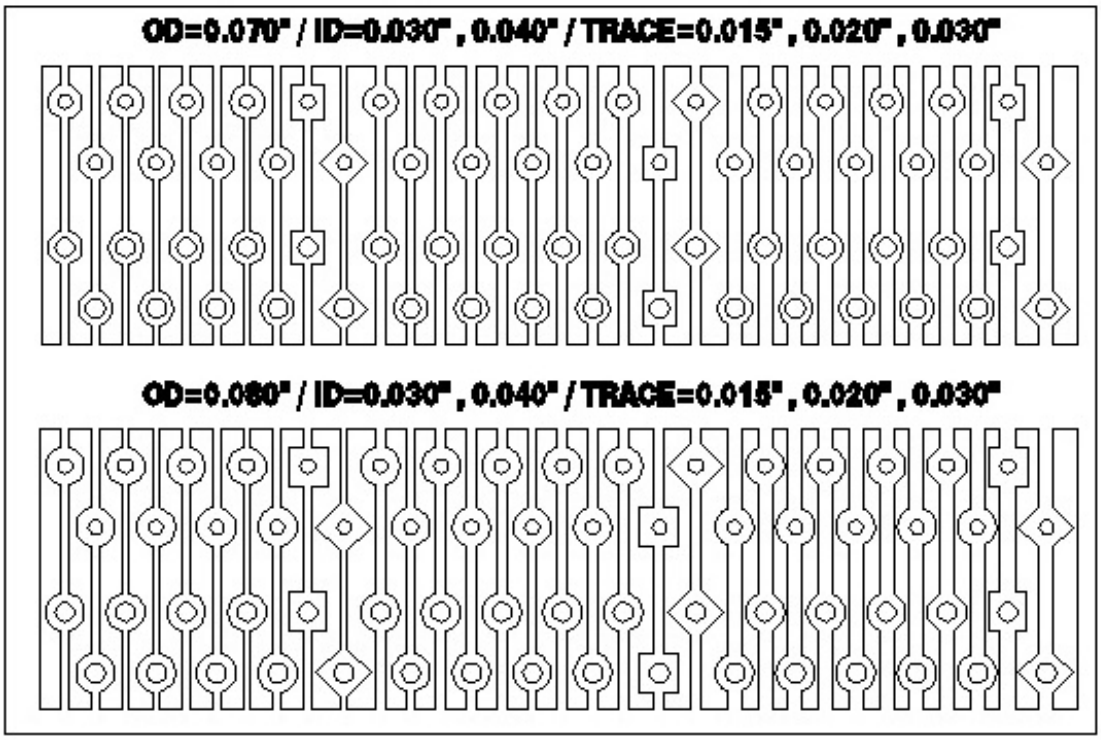


Figure -BEST8B

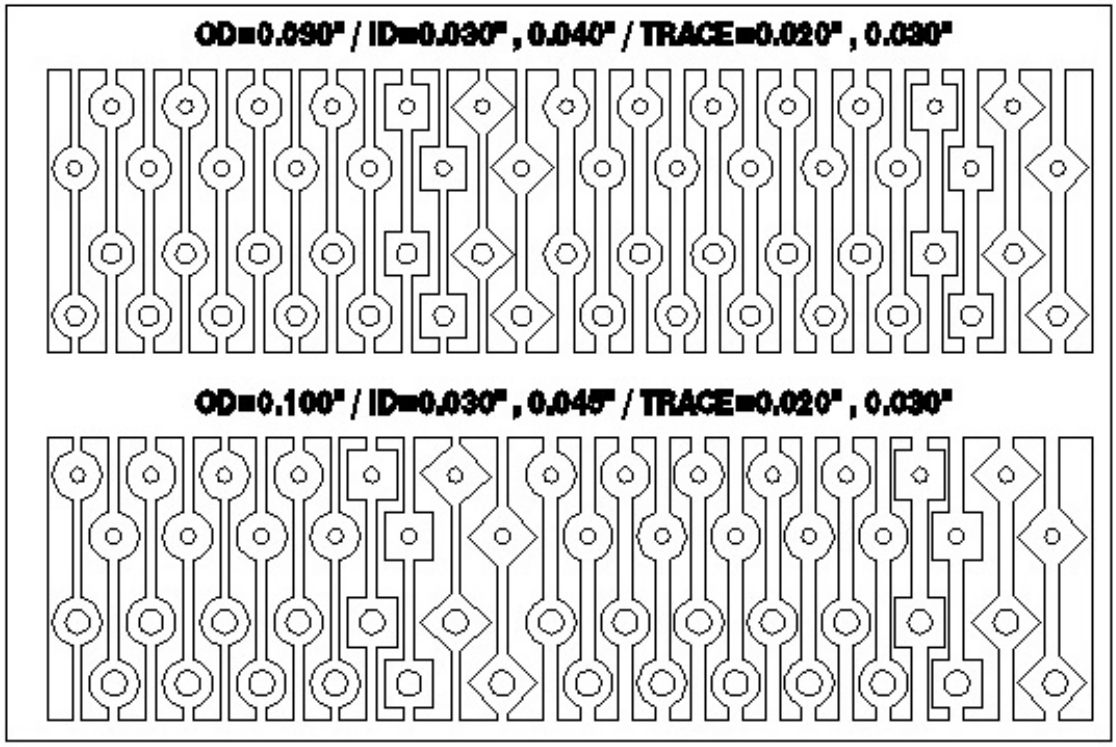


Figure -BEST8C

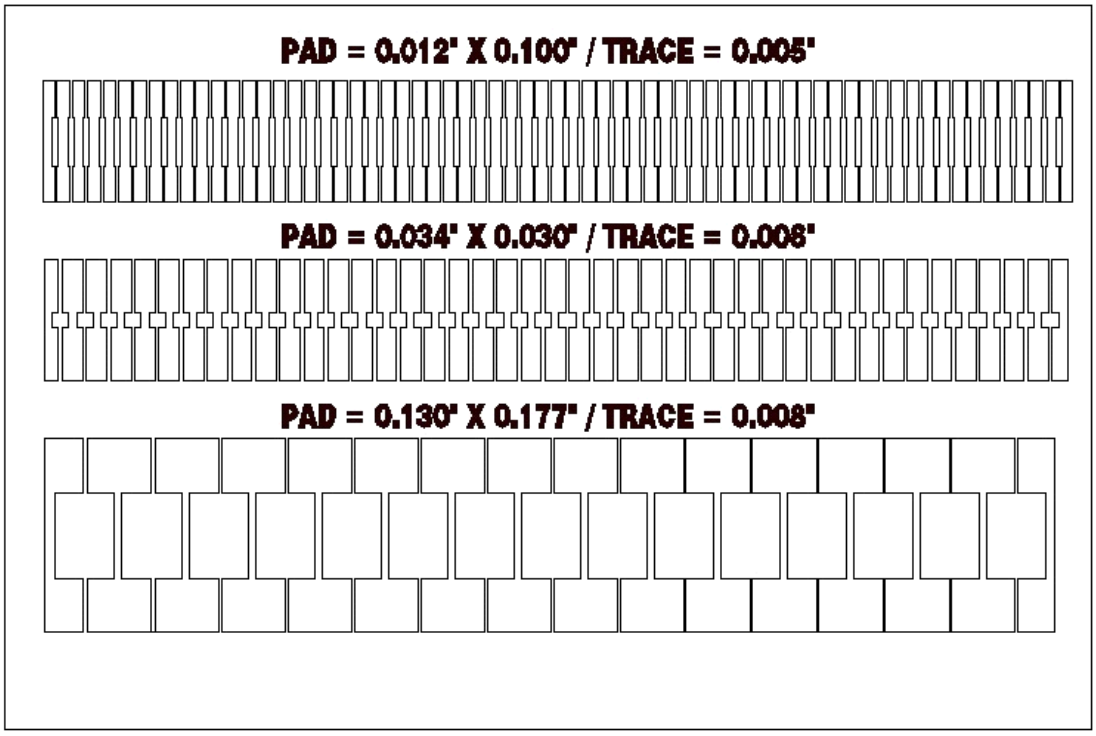


Figure -BEST9A

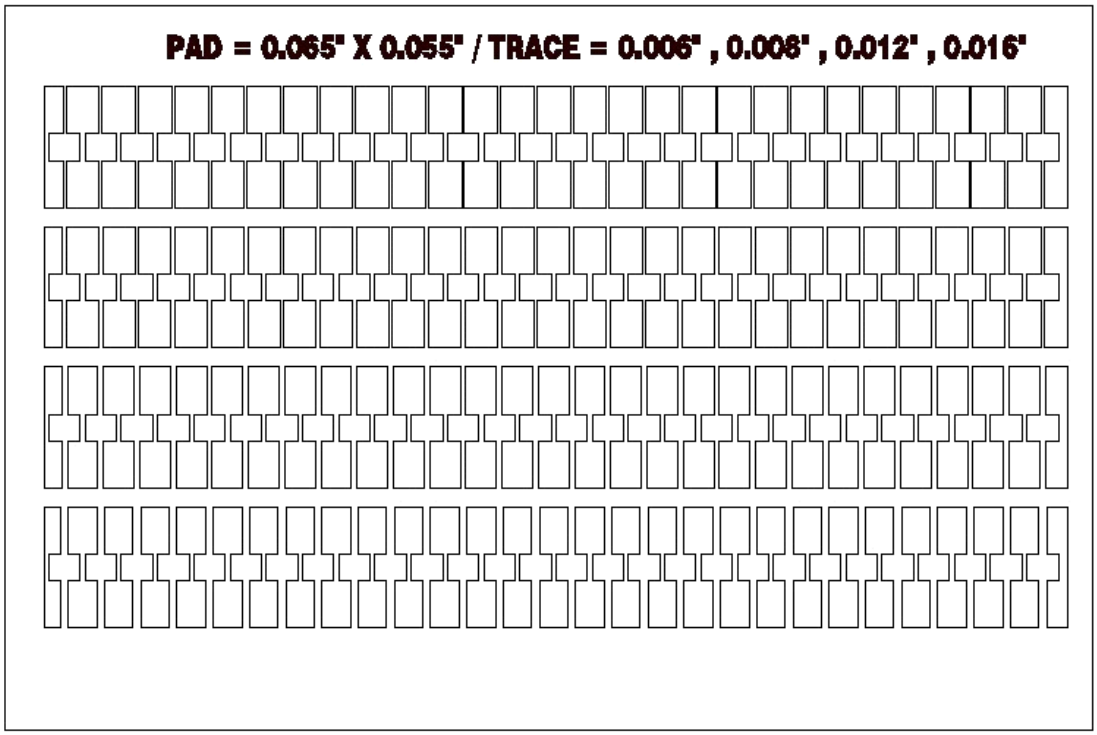


Figure -BEST9B

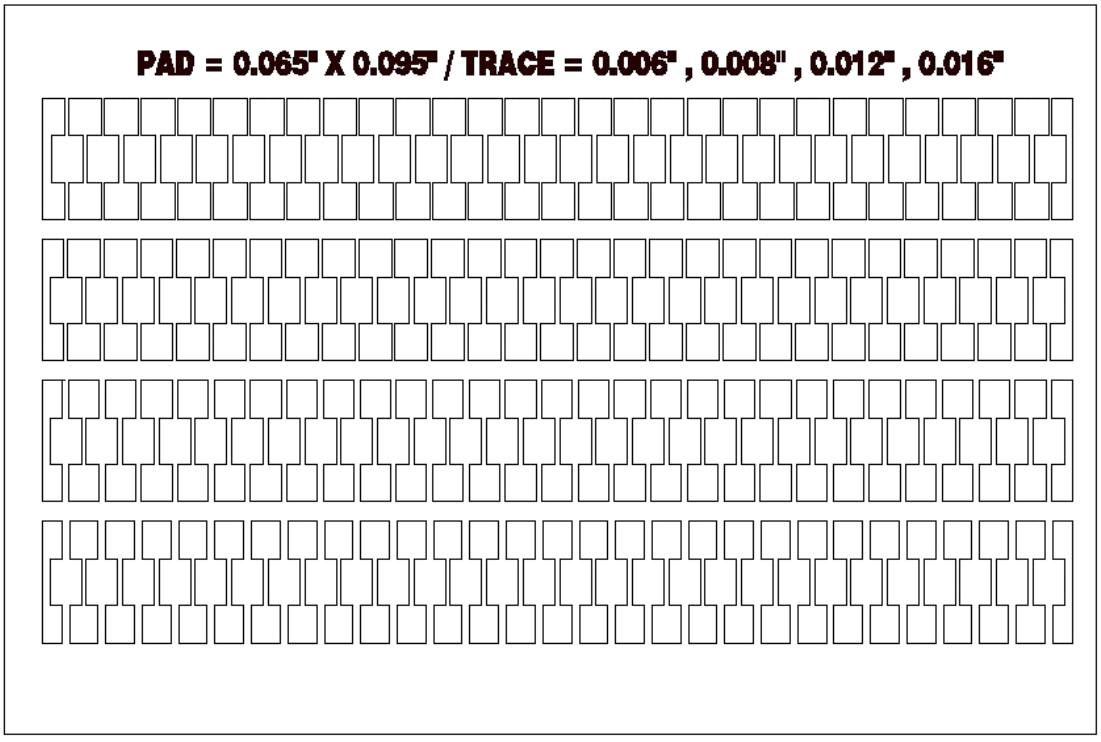


Figure -BEST9C

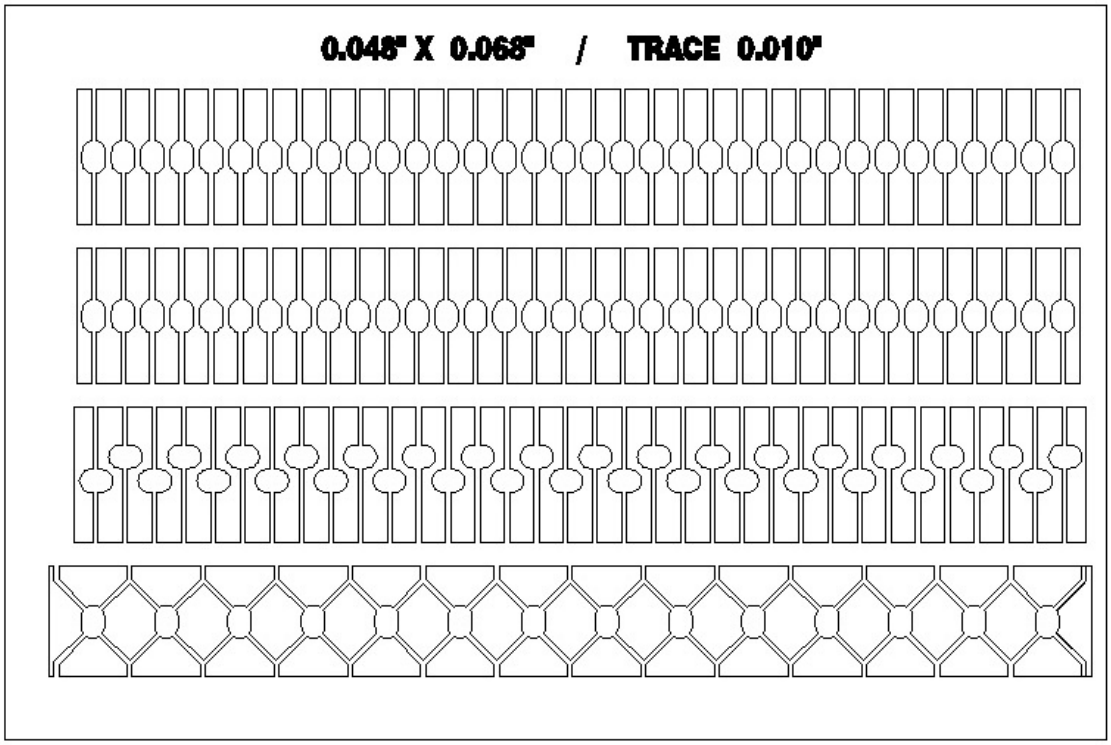


Figure -BEST10A

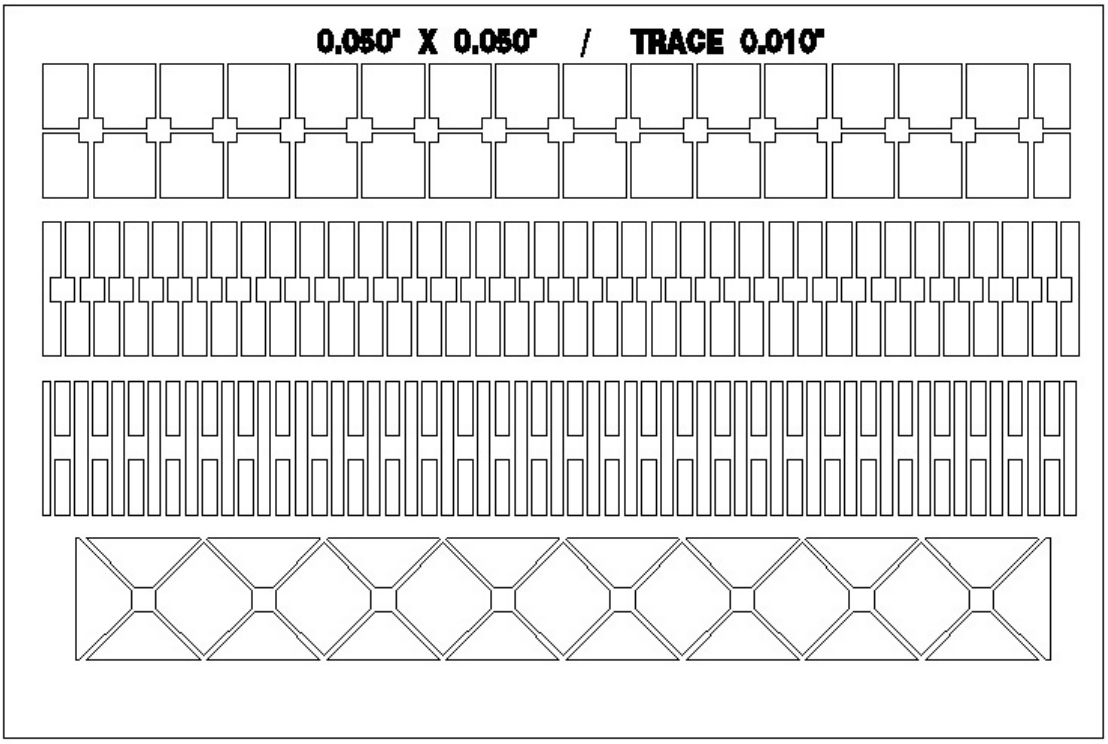


Figure -BEST10B

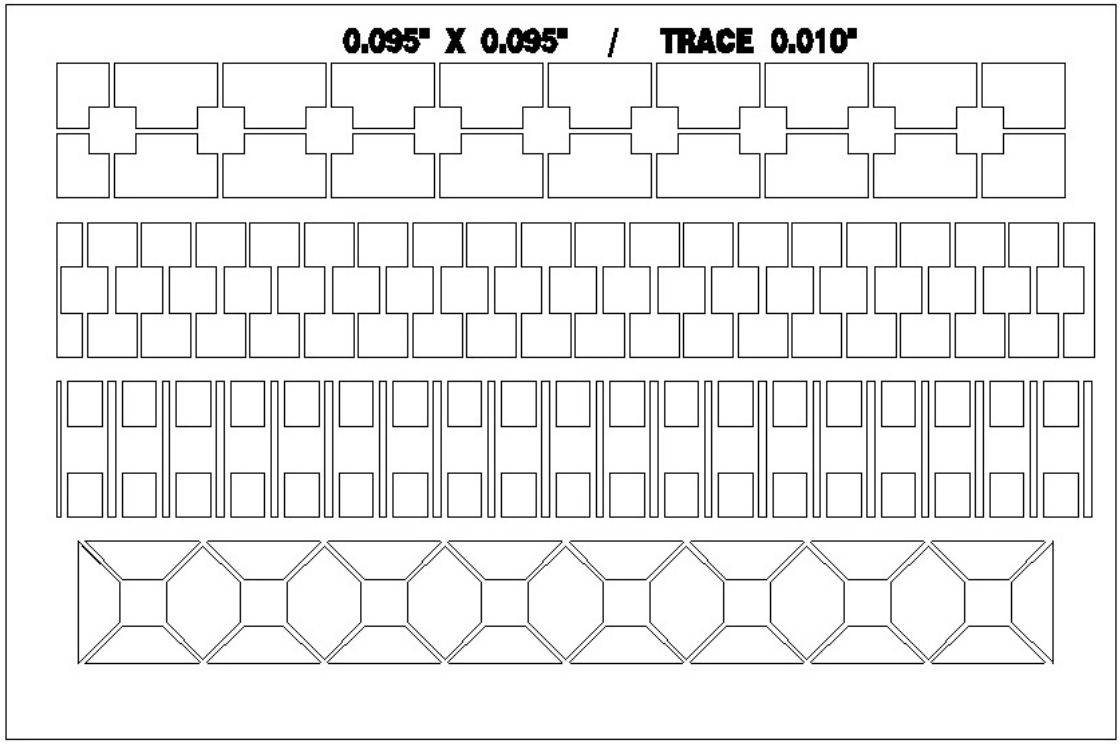


Figure -BEST10C

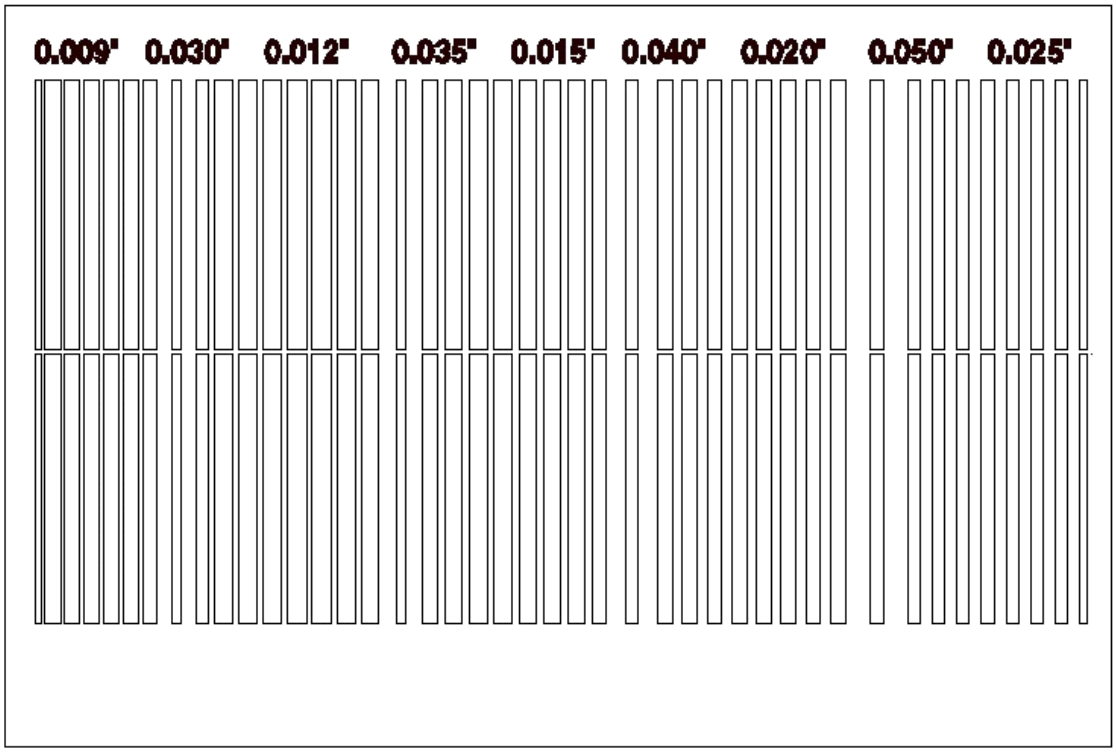


Figure -BEST11A

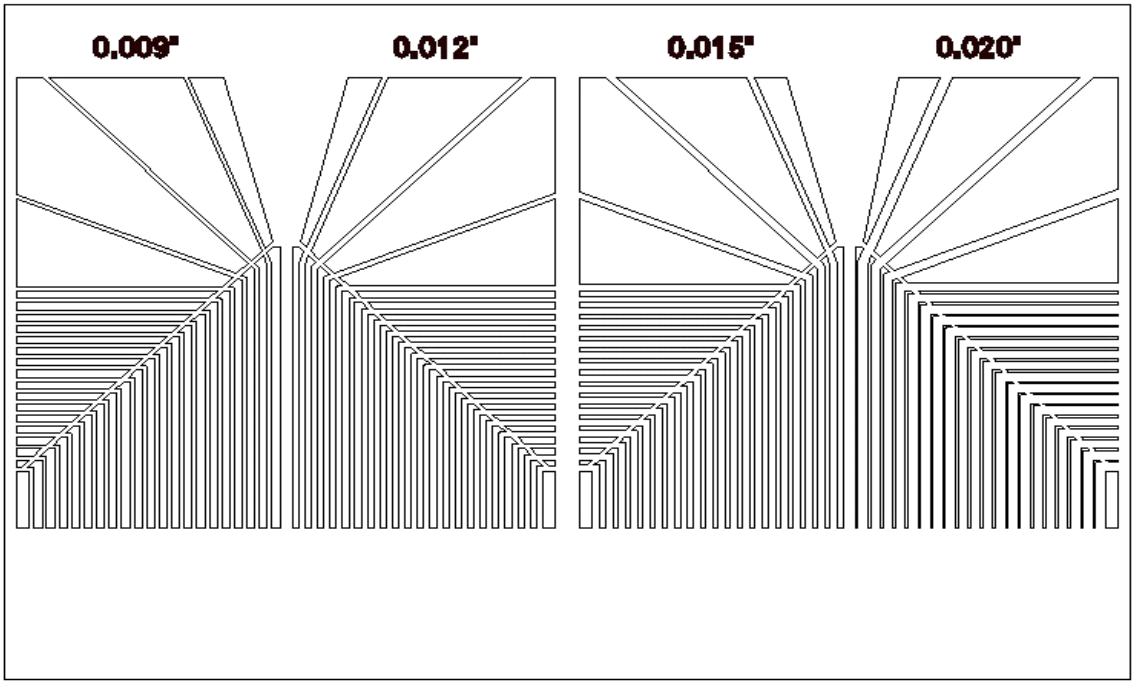


Figure BEST11B

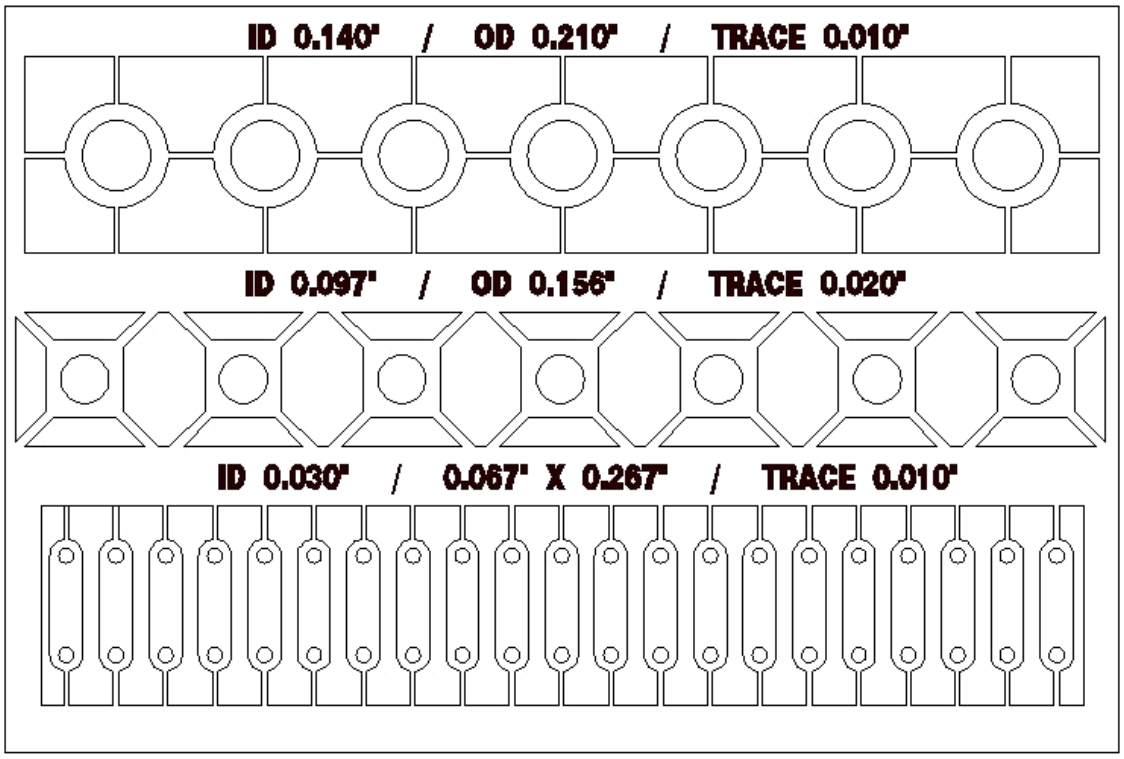


Figure -BEST12A

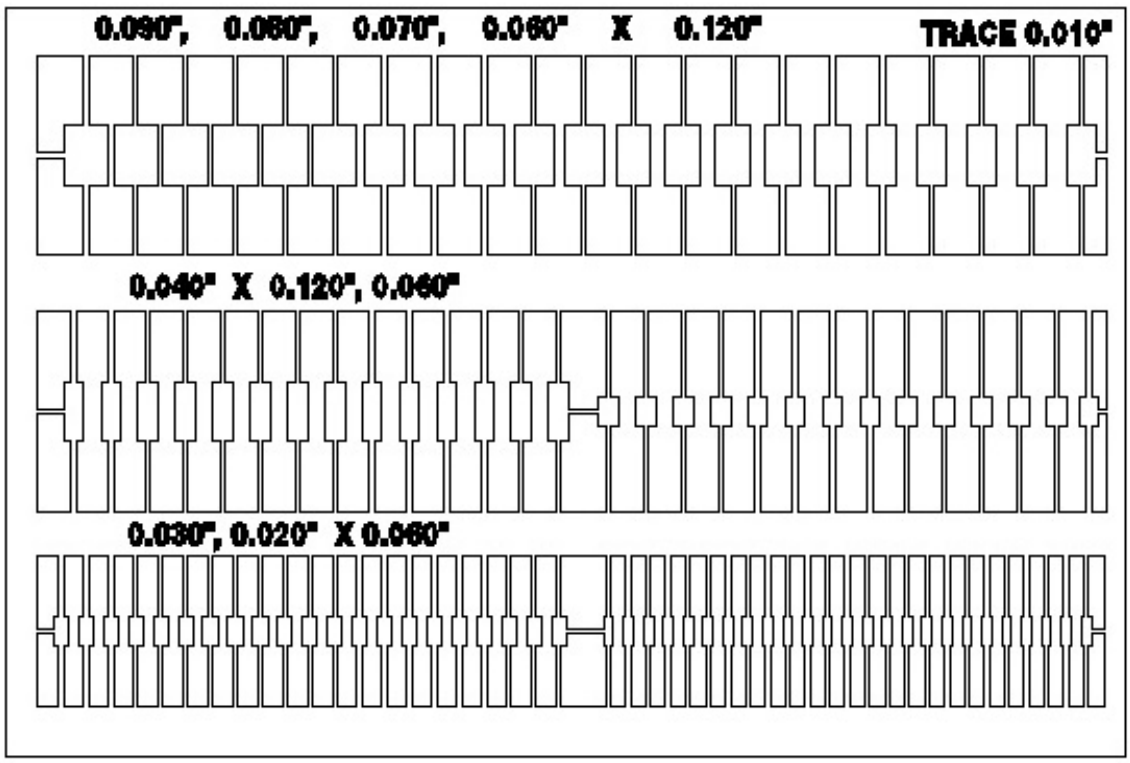


Figure -BEST13A

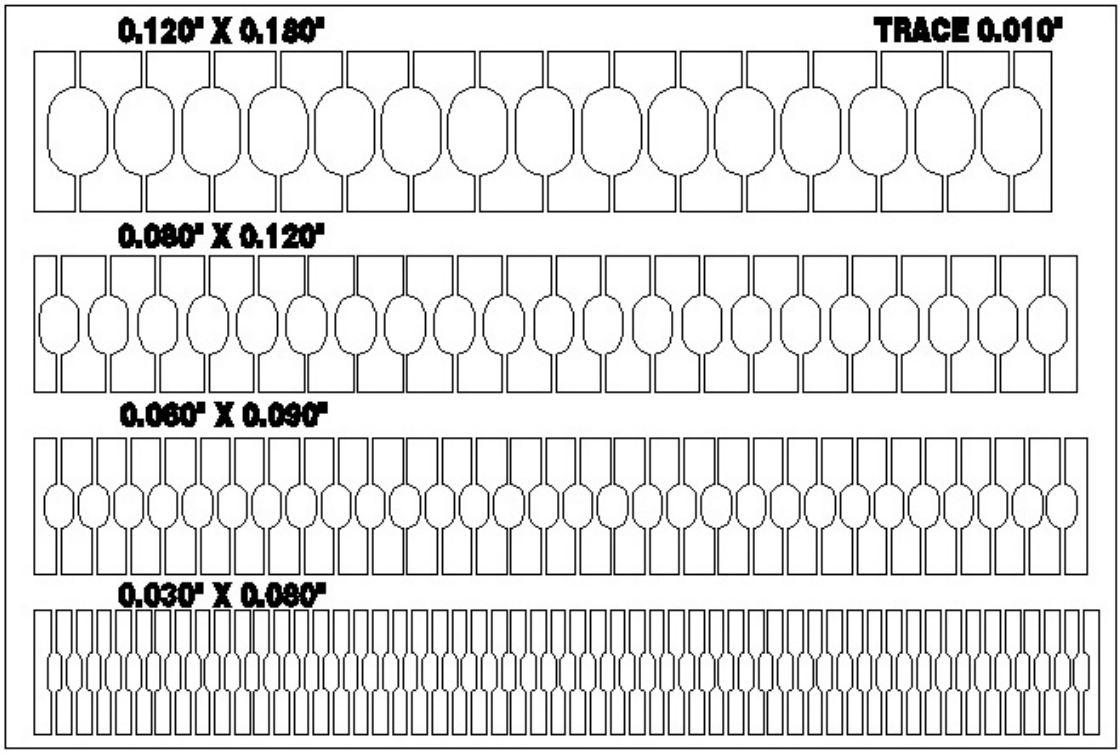


Figure -BEST13B

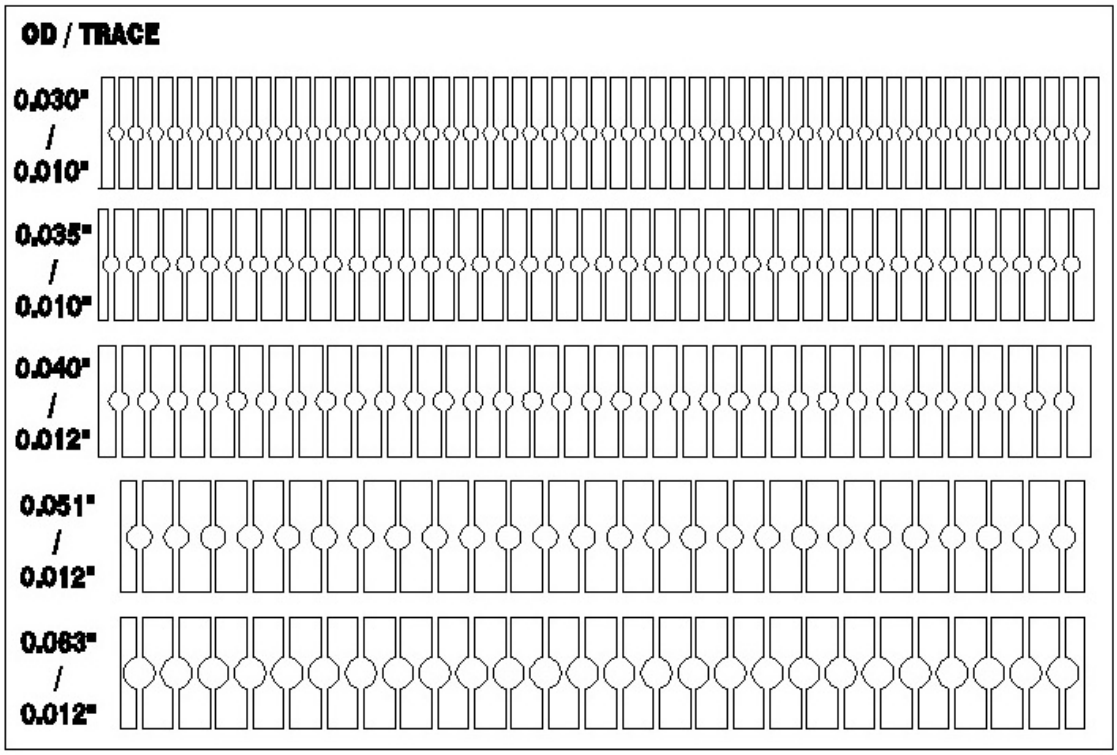


Figure -BEST13C

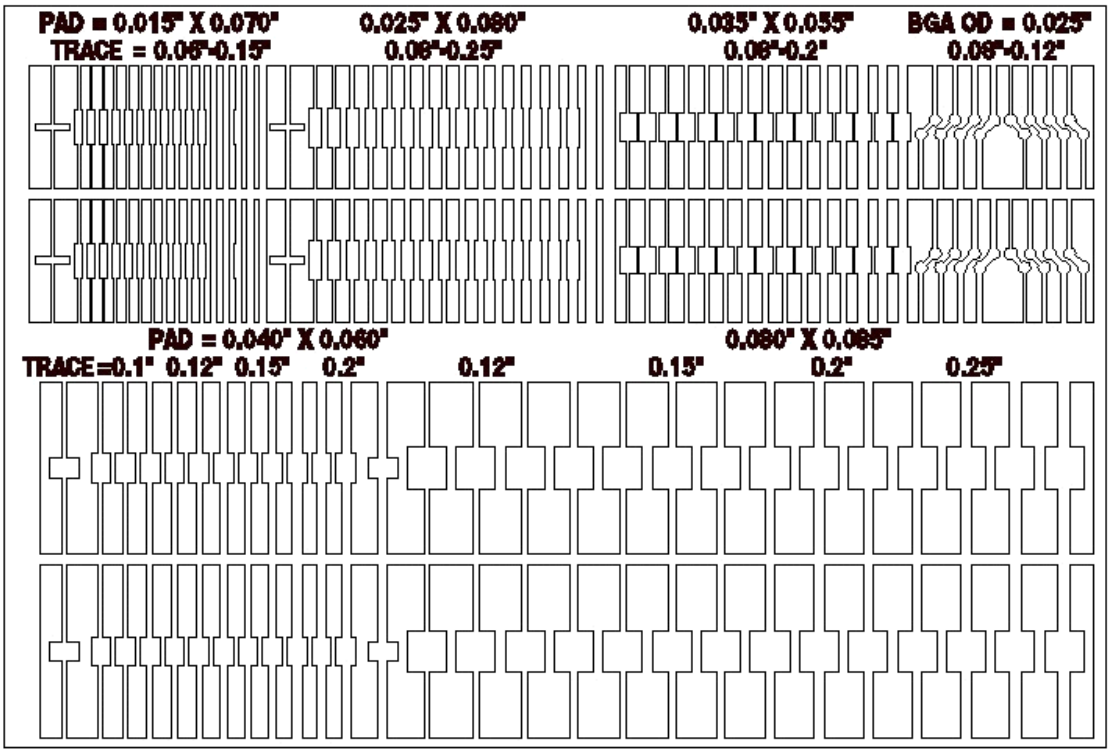


Figure -BEST14A

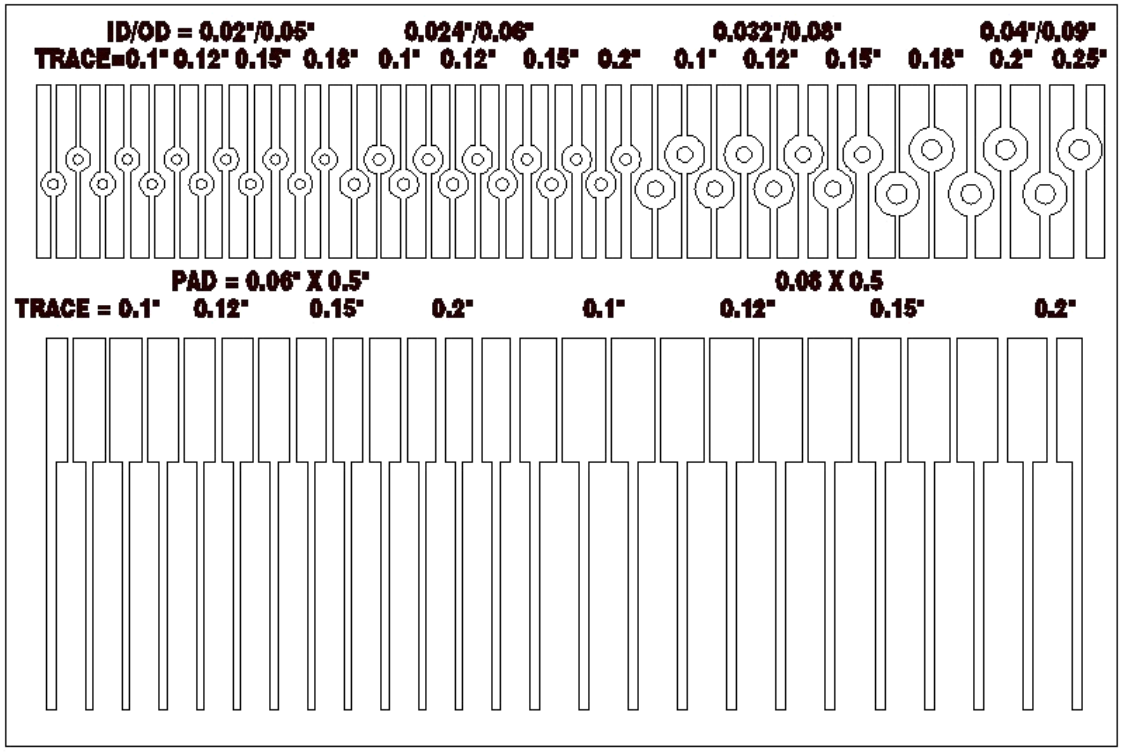


Figure -BEST14B

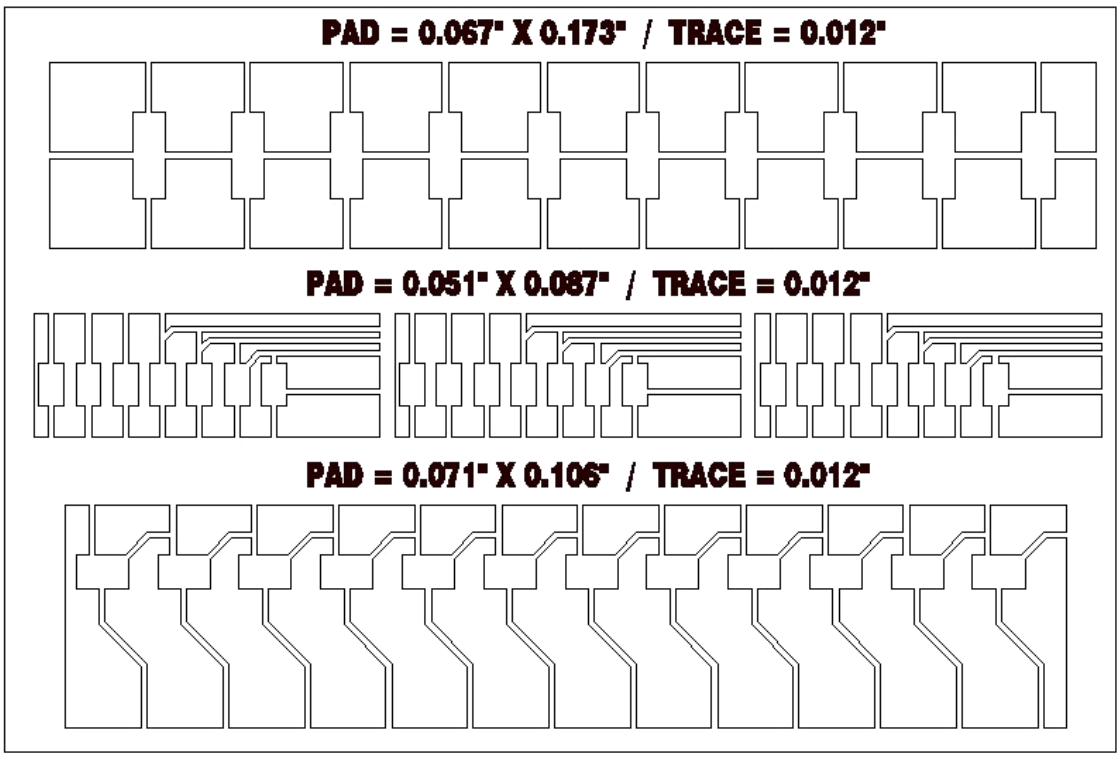


Figure -BEST15A

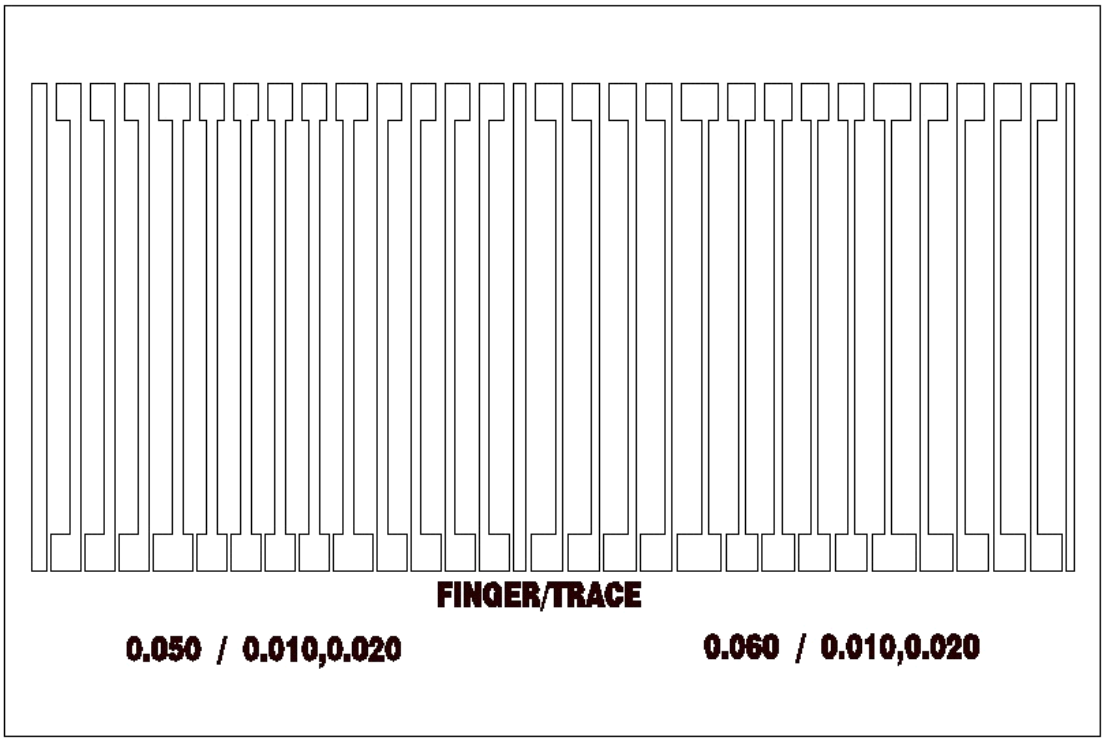


Figure -BEST16A

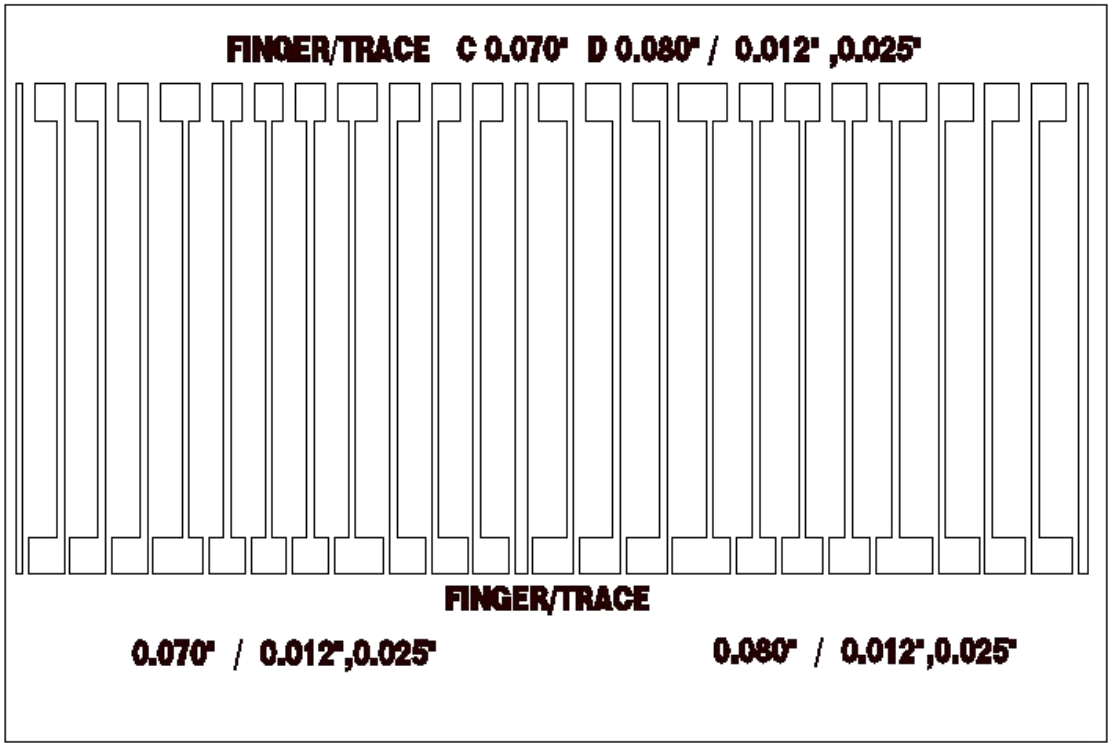


Figure -BEST16B

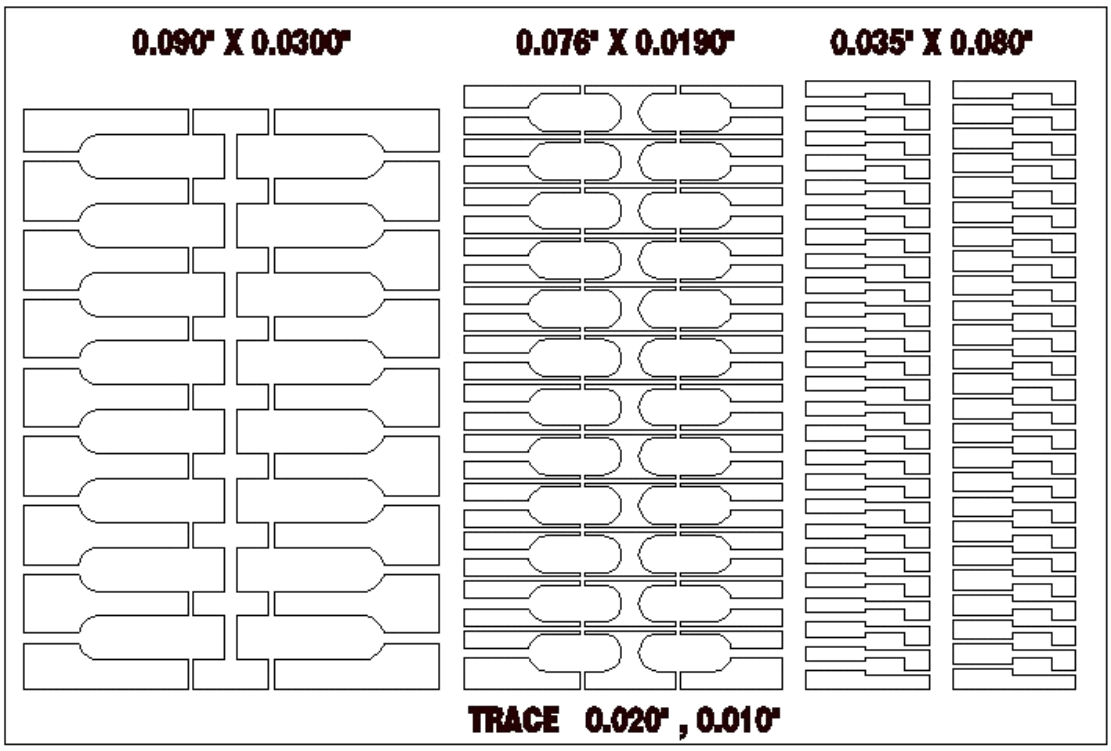


Figure -BEST16C

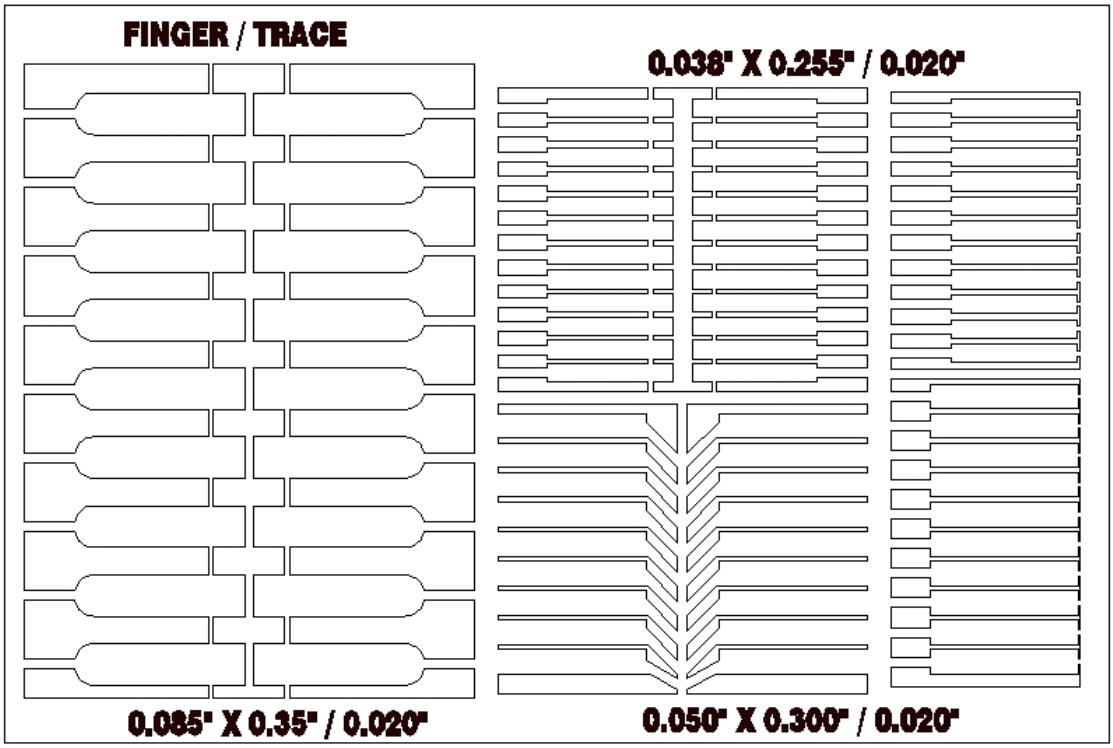


Figure -BEST16D

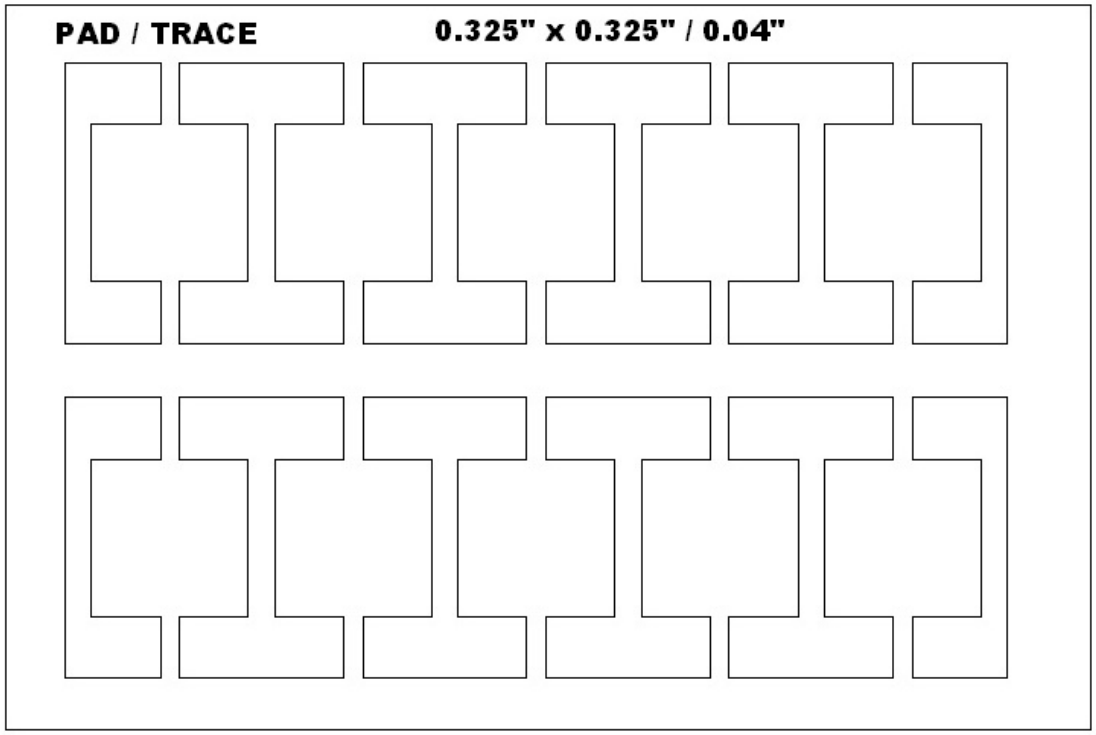


Figure -BEST17A

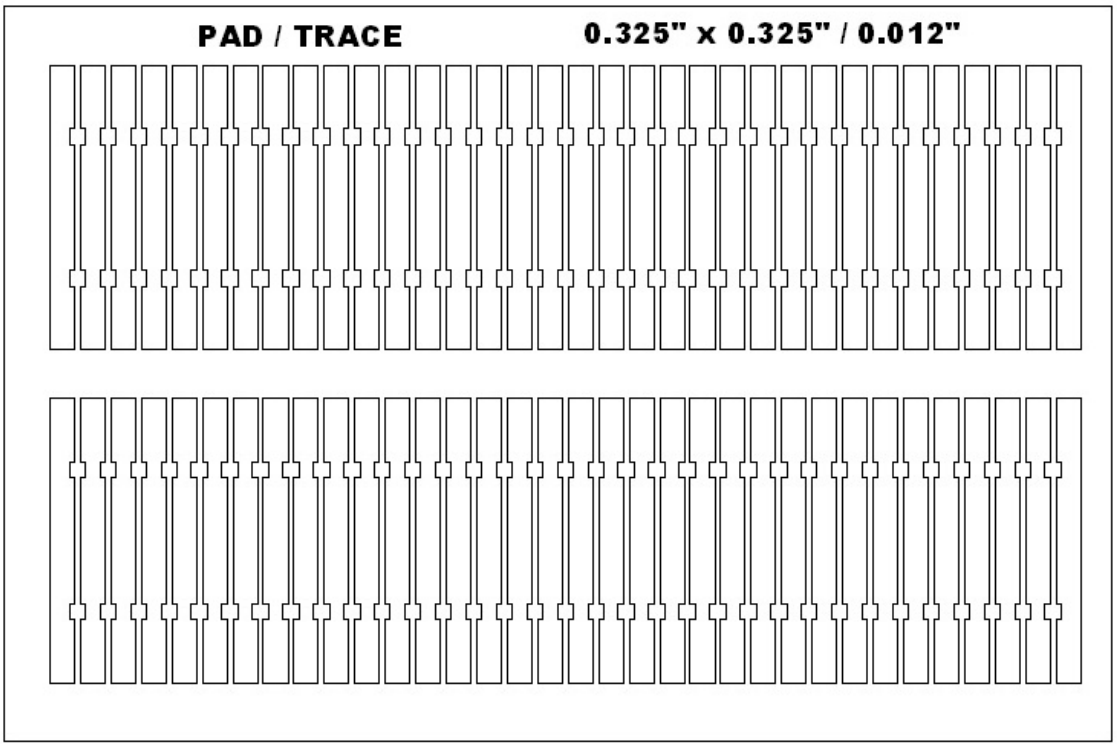


Figure -BEST17B

Eyelets

BEST Eyelet Part Number	PCB Thickness (inches)	PCB Thickness (mm)	Max'm Lead Diameter (inches)	Max'm Lead Diameter (mm)	Flange Diameter (inches)	Flange Diameter (mm)	Length Under Flange (inches)	Length Under Flange (mm)
Eylt021030078	0.031	0.38	0.02	0.5	0.046	1.17	0.088	2.24
Eylt034046093	0.062	1.6	0.02	0.64	0.06	1.52	0.093	2.36
Eylt048059093	0.062	1.6	0.03	0.89	0.078	1.98	0.0925	2.35
Eylt058068102	0.062	1.6	0.04	1.14	0.09	2.29	0.093	2.36
Eylt064076091	0.062	1.6	0.06	1.63	0.11	2.79	0.084	2.13
Eylt035040093	0.062	1.6	0.05	1.47	0.114	2.9	0.102	2.59

Reference Material

Basics of IPC-TM-650 Tape Test Method (for adherence of new mask or coating to PCB)

- Press a strip of pressure-sensitive tape (3M Brand 600 ½ " wide) , 50mm in length, firmly across the test area making sure to remove any entrapped air
- Within 1 minute of application test by rapidly pulling the tape perpendicular to the board from the test area
- Visually examine tape and look for evidence of any portion of the material tested having been removed from the specimen

Where to go for assistance on PCB repair techniques:
BEST can provide PCB repair technician training through IPC 7721 PCB repair technician training.

Product Sale Terms
All products sold by BEST are warranted to be free of manufacturing and design defects. Any warranty claim must be presented to BEST by Purchaser within six months of Purchaser's receipt of the goods purchased from BEST. Upon receipt of a warranty claim, and due inquiry by BEST, the product will be replaced, or a refund issued for the purchase price as deemed appropriate by BEST. All other warranties of merchantability and/or fitness are specifically disclaimed by BEST. The express warranty made by BEST is specifically limited to product replacement and/or the return of the purchase price. No other remedies are available to a Purchaser under the terms of this limited warranty. Any and all claims for direct or consequential damages against BEST for any breach of the limited product warranty contained herein are specifically disclaimed and released by Purchaser in conjunction with the purchase of goods from BEST. This limited warranty and its exclusions are material parts of each product transaction by and between Purchaser and BEST.

For questions and comments:
BEST Inc.
3603 Edison Place
Rolling Meadows IL 60008
www.solder.net
E-Mail: info@solder.net
Phone: (847) 797-9250; Fax: (847) 797-9255
For purchasing kits and replacement parts go to www.soldertools.net