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Overview

DIY Thermal Insert Press
In this project we’re building a rig for heat set inserts. When working with 3D printed parts, a press can help you install inserts. This holds a soldering iron vertically and allows you to press down, perfectly straight. The tip of the iron heats up the brass and softens the plastic. Pressing down pushes the insert into the part and once it cools down, it’s locked in place. This could be handy for folks doing a small production run or if you’re looking for a tool to make this easier.

Heat Set Inserts
The knurling on the outside of these brass inserts are design for heat setting plastic. Threaded inserts are great for making bolted connections when securing parts together. Adding metal threads to your parts will significantly increase the durability. You can also loosen the connection and take it apart without wearing out the threads.

Insert Installation Tips
A tip specifically designed for installing inserts works better than regular soldering tips. These are compatible with irons that use internal ceramic heaters like Hakko’s and Weller’s. The longer shank reaches deeper into parts and tight corners without touching plastic.
The tip may be a little bit loose when installed in the 60W soldering iron. This is normal. One option to fix this is to use the sleeve from a 50W iron, which has a very tight fit. Another option is to remove the sleeve and shorten it a bit by setting it up vertically and flattening the flange on both ends very slightly with a hammer.

Parts List

- **Soldering Iron 60W**
- **Heat-Set Solder Iron Tips (M3, M5, 4-40 size)**
- **610mm 2020 Aluminum**

Hardware

Total Hardware

- 3x ball bearings (625Z) with wheels
- 1x ball bearing (10x15x4mm)
- 4x No. 4x 1/2in flat head wood screws
- 4x M4x8mm metric button head screws
- 11x M3x6mm metric button head screws
- 4x M3x8mm metric button head screws
- 3x M5x25mm flat head metric screws
- 3x M5 hex nylon lock nuts
- 4x M4 slim t-nuts
- 15x M3 heat inserts
• Braided Nylon String / Rope / Paracord (2.5mmØ)
• Weight (nuts, screws, bolts, BB’s, etc.)

Hardware used in Assemblies

• Roller Carriage
  ◦ 3x M5 x 25mm flat head metric screws
  ◦ 3x M5 hex nuts
  ◦ 2x M3 x 8mm button head metric screws
  ◦ 3x Ball Bearings (625Z) with wheels ()
  ◦ 1x Ball Bearing (10x15x4mm) ()

• Pulley Idler
  ◦ 1x M4 x 8mm button head metric screws ()
  ◦ 1x M4 Slim T-Nut ()
  ◦ 5x M3 x 8mm button head metric screws
  ◦ 5x M3 heat set inserts

• Solder Pen Holder
  ◦ 6x M3 x 8mm button head metric screws
  ◦ 4x M3 heat inserts

• Arm
  ◦ 4x M3 heat inserts

• Extrusion Mount
  ◦ 4x No. 4x 1/2in flat head wood screws ()
  ◦ 2x M4 x 8mm button head metric screws ()
  ◦ 2x M4 Slim T-Nuts () (2020 ext.)

M3 Heat Set Inserts

• M3 – McMaster Carr ()
• M3 – Amazon [Initeq] ()
Adjustable 60W Pen-Style Soldering Iron - 120VAC USA Plug
You re-work hard all day, so treat yourself with the BEST portable Adjustable Soldering Iron we carry! OK, "Best" may be subjective, but it's also... https://www.adafruit.com/product/3685

Heat-Set Insert For Soldering Irons - #4-40 / M3 Inserts
Wanna improve the connection strength between your project's 3D-printed parts, and also have nice clean surfaces? Instead of gluing bits together, or screwing plastic screws...
https://www.adafruit.com/product/4239

Brass Heat-Set Inserts for Plastic - M3 x 4mm - 50 pack
Wanna improve the connection strength between your project's 3D-printed parts, and also have nice clean surfaces? Instead of gluing bits together, or screwing plastic screws...
https://www.adafruit.com/product/4255

Slotted Aluminum Extrusion - 20mm x 20mm - 610mm long
Oh boy, now you have no excuse for not building that robot! Nothing is easier or faster than building with extrusion and we've added 20mm square aluminum extrusion and components...
https://www.adafruit.com/product/1221
Stickvise PCB Vise
Are you still looking for that perfect PCB holder? The low profile PCB Stickvise might be just the thing you need! In performing the simple task...
https://www.adafruit.com/product/3197

Monoprice Inventor II 3D Printer with Touchscreen and WiFi
The Monoprice Inventor II 3D Printer Touchscreen with WiFi is a perfect entry-level 3D printer with small footprint and reliable performance. It comes equipped with...
https://www.adafruit.com/product/3897

Filament for 3D Printers in Various Colors and Types
Having a 3D printer without filament is sort of like having a regular printer without paper or ink. And while a lot of printers come with some filament there's a good chance...
https://www.adafruit.com/product/2080

Designer Notes:
I'd like to give Bill Binko (@atmakers) of ATMakers.org a huge thanks for his contributions to this project. Bill designed his own version with similar components. Check out his demo on the Adafruit Show & Tell (Youtube Video: 10min 3sec).
References & Links

While working on this project I did some research and found some interest articles on how to properly install heat set inserts. There’s also some great video content on testing threaded inserts.

- CNC Kitchen – How Strong Are Inserts? ()
- FormLabs – Adding Screw Threads to 3D Prints ()
- Hackaday – How to use Inserts ()
- Hackaday – DIY Thermal Insert Press ()
- Hackaday – Heat-set Insert Jig ()

3D Printing

3D Printed Parts

The parts in this kit are designed to be 3D printed with FDM based machines. STL files are oriented to print "as is". Parts require tight tolerances that might need adjustment of slice settings. Reference the suggested settings below.
Parts List
List of all the parts used in this assembly.

clamp-mount.stl
clamp-cover.stl
arm.stl
2020-mount.stl
idler-coupler.stl
idler-cover.stl
idler-holder.stl
idler-mount.stl
pulley-wheel.stl
roller-handle.stl
roller-plate.stl
weight-holder.stl

Download CAD files from Github

Alternate Download Links:


ATMakers Version – Design by Bill Binko
This design utilized compatible parts and built for a more study and rigid construction. Get the files from the thingiverse page.

Watch Bill demo his build on Adafruit Show & Tell show.
CURA Slicing

Parts were sliced using Ultimaker's CURA 4.x software and tested with an Ultimaker 3 and Flashforge Inventor II. The kit requires a minimum build volume of 150mm cubed. No support material is necessary for any of the parts. Double check parts are positioned in the center of the build plate before printing.

Settings

Use these settings as reference. Values listed were used in Ultimaker's CURA 3.X slicing software.

- 0.2mm Layer Height / 0.4mm nozzle
- 0.38mm Line Width (inner & outer widths)
- 40mm/s printing speed
- 20% infill
- Supports: No

Designing Things

The fusion 360 source file is included and features original sketches and feature timeline along with easily editable user parameters. The parts can further be separated into small pieces for fitting on printers with smaller build volumes. Note: STEP file is included for other 3D surface modeling programs such as Onshape, Solidworks and Rhino.

Layer by Layer

Interested in CAD tutorials? Check out my playlist on YouTube – There's over 100 of them! My personal favorite is the snap fit tutorial for cases and enclosures.

CAD Tutorials – YouTube Playlist
Roller Assembly

Roller Parts
Get the parts ready to assemble the roller carriage. We'll need the following hardware:

- 3x M5 x 25mm flat head screws
- 3x M5 hex nuts

Side Note: This roller assembly was inspired by a cheap roller carriage design by Hidetoshi Niisaka on Thingiverse.
Install Bearings

Insert a M5x10mm flat head screw into one of the three mounting holes on the plate. The head of the screw is counter sunked. Hold the screw in place and insert a ball bearing with the wheel over the thread of the screw. Insert and fasten an M5 hex nut onto the screw thread and tighten. Repeat this for the other two wheels. Test and make sure the wheels are freely spinning.
Handle Parts
Get the handle ready to install onto the roller plate. We'll need the following hardware:

- 2x M3 heat set inserts
- 2x M3 x 6mm button head machine screws

Heat Set Handle
The handle is designed to use M3 heat set inserts. The two holes are 5.6mm in diameter and 10mm distance apart from each other.

Install Handle to Roller Plate
Place the handle over the tab on the roller plate. Line up the two mounting holes. While holding the parts, insert and fasten each screw. Use M3 x 6mm button head screws.
Handle Installed
The handle can be reversed for right/left handed operation. The orientation of the roller plate will have the center tab pointing up in the final build.

Arm Clamp

Arm Heat Set
The arm uses four M3 heat set inserts to secure the pen clamp to the roller carriage. The photo to the right shows both sides of the part that have threaded inserts.
Clamp Heat Set

The clamp uses four M3 heat set inserts for securing a soldering iron. Use four M3 x 6mm button head metric machine screws to secure the cover over the mount.
Secure Arm to Clamp
Align the clamp mount and the arm together. Orient the mount with the arm so that the mounting holes line up. Insert and fasten two M3 x 8mm button head metric machine screws.

Counter Weight

Rope & Counter Weight
We'll need a piece of nylon rope – I used a piece of braided nylon string about 30cm in length (2.5mmØ). We'll need to add weight to the holder. You can use material such as BB ammo, hardware screws, bolts, ball bearings, etc. I used a dozen 608ZZ ball bearings from an old pair of inline skates.

Our ball bearings weighed in at 132 grams. This should be enough to counter balance the solder iron.
Add Weight & Tie Rope
Add material to the holder and tie the rope to the hole near the top. The container has an inner diameter of 24mm with a depth of 81.5mm.
Carriage Assembly

Install Nylon Rope
Insert one of the ends of the nylon rope through the hole on the tab of the roller plate. The tab has two holes, 3mm ø. I used a pair of tweezers to push and pull the rope through the hole.

To prevent the strands from fraying, use a heat air gun or lighter to melt the tip. The molten strands can be formed into a rivet. Optionally tie a knot to secure the rope to the roller plate.
Secure Roller to Arm
Align the roller carriage and arm together. Use two M3 x 8mm button head metric machine screws to secure the roller plate to the arm. Place the roller plate over the arm and line up the mounting holes.

Roller Carriage Assembled
The assembled roller carriage has the handle and rope installed.
Idler Assembly

Idler Pulley Parts
Get the parts ready to assemble the idler pulley. We'll use the following parts to assemble the idler pulley.

- 5x M3 heat set inserts
- 1x M4 slim t-nuts
- 1x Ball Bearing (10x15x4mm)
- 1x M4 x 8mm button head metric screws
- 3x M3 x 6mm button head metric screws
- 2x M3 x 8mm button head metric screws

Bearing Pulley
Fit the pulley wheel over the ball bearing. It should press fit with a tight tolerance. The groove on the wheel is designed to couple a rope or piece of string. Side Note: This idler pulley component was used in our New Year's Eve Ball Drop project.
Heat Set Parts
Install M3 heat set inserts into the pulley holder and coupler parts. Reference the photo for best placement.

Install Ball Bearing
Place the ball bearing over the peg in the center of the holder. Press it flush up against the post, it should have a tight fit.
Secure Ball Bearing Cover
Insert an M3 x 6mm screw through the ball bearing cover. Place the screw into the insert on the bearing holder. Fasten to tighten the screw. Check and make sure the wheel can spin freely.

Secure Holder to Mount
Place the coupler over the mount and line up the mounting holes. While holding the parts together, insert and fasten machines screws and tighten. Use two M3 x 8mm button head screws.
Secure Mount to Coupler
Place the mount over the coupler and line up the mounting holes. While holding the parts together, insert and fasten machines screws and tighten. Use two M3 x 6mm button head screws.

Install T-Nut
The coupler will fit over the piece of 2020 aluminum extrusion. Use an M4 x 8mm button head screw and slim T-nut to secure the coupler to the 2020.

Idler Pulley Assembled
Here’s the final idler pulley assembled.
2020 Assembly

2020 Aluminum Extrusion
The 2020 aluminum extrusion in the Adafruit shop is 610mm in length. If used as is, the soldering iron will be higher than you might need. I cut mine in half to make two pieces that are roughly 305mm in length. I used a compound miter saw to cut the piece of 2020. I used a titanium blade saw that is graded for cutting soft metals. I made sure to clamp it down to the support base while cutting.

Base Parts
Get the parts ready to assemble the platform. I used a piece of pine wood that measures to about 19cm x 25cm (7.5x10in) and 1.7cm(0.65in) thick. I suggest using M3 (#4-40) wood screws to secure the 2020 bracket to the platform.
Install 2020 Bracket
Grab the piece of 2020 and fit the bracket over it with the tabs. Make sure they are flush with the bottom. Use two M4 x 8mm button head screws and slim t-nuts to secure the bracket to the 2020.

Mount Holes in Base
Place the bracket over the platform and decide where you want to mount it. I choose to place it centered over to one side. Use a pencil to trace the mounting holes onto the wood. Use a drill or rotary tool to make pilot holes (use a drill bit smaller than the screw).
Secure 2020 Bracket
Insert and fasten the four wood screws into the platform. Make sure the screws are not longer the thickness of the platform.

Final Build

Assemblies
Now to secure the sub-assemblies together. Start with installing the roller carriage onto the piece of 2020, followed by the counter weight. The rope is then strung over the idler pulley and installed on top of the 2020. Lastly, the soldering iron can be clamped to the arm mount.
Install Roller
Orient the roller carriage so the tab with the rope is facing up. Gently place it over the top of the piece of 2020. Guide the wheels into the slots and push it down the rail. The roller carriage should smoothly go up and down the piece of 2020. At this point, it's a good idea to check the position of the handle and adjust as desired.

Install Weight to 2020
Grab the weight holder and insert the T-rail so it's on the opposite side of the roller plate. The rail from the weight holder should have a loose tolerance when sliding up and down the piece of 2020.
Install Rope to Pulley
Now is a good time to string the rope over the wheel of the pulley idler. With the roller carriage and counter weight already installed, the idler pulley is the last component in the assembly. It's easier to handle the rope at this stage of the build. I tend to pinch a piece of the rope in between the wheel and holder. Now we can spin it until it fully catches. If it's too difficult, you can unscrew the cover from the bearing and thread it by hand. And because the part uses heat set inserts, the threads won't wear out!

Install Idler to 2020
Once the rope is strung over the wheel, the idler can fit over the 2020. The slim t-nut might need to be adjusted, so loosen the M4 screw as necessary. At this point, the build can be flipped over to better handle the t-nut and screw.

Fasten Idler T-Nut
With the t-nut in place, tighten the M4 screw to secure the idler to the 2020.
Install Solder Pen
Grab the soldering iron and place it over the clamp. The shaft of the pen should rest over the mount. If the pen has a loose fit, wrap a piece of gaffers tape around to thicken the shaft. It's designed to fit a cylindrical pen with a diameter of 14mm - 17mm.

Secure Pen Cover
Place the clamp cover over the mount. Insert and fasten 4x M3 x 6mm button head metric machine screws.

End Stop T-Nut
Install a slim t-nut and M4 x 8mm button head screw onto the slot of the 2020. It should be on the side with the roller plate. This is used to prevent the tip of the iron from hitting the platform. Adjust the slim t-nut and screw as necessary.

Final Build
And the heat press solder rig is ready for use! While operating, take proper safety precautions. Keep the power cord away from the tip. Remember to turn off the soldering iron after use.
The soldering iron will get very hot while energized. Please keep body parts, flammables, etc. away from the hot parts. Do not keep heating the inserts after placement to prevent plastic melting and damage. Please avoid fires around heating devices and use safety glasses during use. Stay safe.

Share Your Build

Make something cool you want to share with us? Please post, share and join our **LIVE Show & Tell show** (), every Wednesday @ 7:30PM ET.