Bits We Have

0.01" Engraving
Name: Solid carbide single flute engraving
Part No: 30499-01
Description: Orange; Shank diameter 1/8 inch; V-shaped
Use: Doing fine work
Materials: Plastics, Woods, Soft materials
-Settings-
Preferred: V-bit, Proper angle 30 degrees, Requires Easel Pro to calculate paths
Suboptimal: Set to 0.01", Outline cut

1/32 Fishtail
Name: Solid carbide upcut fish tail spiral
Part No: 30423-03
Description: White; Shank diameter 1/8 inch; 2 Flute
Use: Upcut tip creates cleaner edge on backside of sheet when cutting through materials, Works well with materials that can melt when heated such as plastics
Materials: Corian, Plastic, Linoleum
-Settings-
Optimal: high speed spindles and high feedrates
Cutting Length (max depth?): 0.12 inches

1/16 Fishtail
Name: Solid carbide upcut fish tail spiral
Part No: 30423-01
Description: Blue; Shank diameter 1/8 inch; 2 Flute
Use: Upcut tip creates cleaner edge on backside of sheet when cutting through materials, Works well with materials that can melt when heated such as plastics
Materials: Corian, Plastic, Linoleum
-Settings-
Optimal: high speed spindles and high feedrates
Cutting Length (max depth?): 0.31 inches

1/8 Fishtail
Name: Solid carbide upcut fish tail spiral
Part No: 30423-07
Description: Green; Shank diameter 1/8 inch; 2 Flute
Use: Upcut tip creates cleaner edge on backside of sheet when cutting through materials, Works well with materials that can melt when heated such as plastics
Materials: Corian, Plastic, Linoleum, Aluminum
-Settings-
Optimal: high speed spindles and high feedrates
Cutting Length (max depth?): ??

1/8 Straight
Name: Solid carbide 2 flute straight end mill
Part No: 30237-02
Description: Black; Shank diameter 1/8 inch; 2 Flute
Use: This end mill has a 2 straight flutes. It works well for materials where the lifting affect of a spiral flute might cause unwanted results, like wood or things with thin laminates or veneers.
Materials: Corian, Plastic, Linoleum, Wood, Plywood, MDF
-Settings-
Optimal:
Cutting Length (max depth?):

1/8 Upcut
Name: Solid carbide single flute upcut end mill
Part No: 30238-02
Description: Grey; Shank diameter 1/8 inch; 1 Flute
Use: The spiral upcut bits pull chips from the cutting surface upwards, leaving a flat bottomed pocket. This provides accurate cuts without chatter in the plastic because the chips are being evacuated away from the cutting edges. Poor for wood, causes tearing.
Materials: Corian, Plastic, Linoleum, Aluminum
-Settings-
Optimal:
Cutting Length (max depth?): 0.87 inches

Drill vs Mill Bits

Drill bits cut down into your material. They are a great choice pre-drilling holes for screws, adding fixtures to drywall, or other tasks where you need to remove material straight down through an object.

Milling bits cut laterally across your material. The bits are designed to move across the surface of a material, clearing away chips as it moves from side to side. This is how you are able to achieve 2.5D and 3D designs with a 3D carving machine instead of a drill or drill press.

Bit Material

Steel (High-Speed Steel body, or HSS):
- Primarily used for hand-routing, but also good for 3d carving
- Sharper cutting edge than carbide. As such, they are often used for milling aluminum.
- Good for beginners!
- Cheaper than carbide bits
- More forgiving when carving (less likely to break)
- These bits often have a narrower cutting speed range than carbide bits. It’s important to know the recommended feeds/speeds for a specific bit. You can often find this information from the bit manufacturer.
- Steel bits tend to be specialized for certain tasks. We don't recommend them for generic projects across a lot of different materials.
**Solid carbide:**
- Most rigid. This is important for minimizing bit deflection and keeping straight toolpaths during a carve.
- Long tool life.
- More expensive, especially compared to HSS bits.

**Carbide-tipped:**
- Hybrid bit. Body is made from HSS, but the tip is carbide. Toughness of steel bit body; wear-resistance of carbide flutes.

**Number of Flutes**

Flutes are the cutting edges on the bits. They have different shapes, and bits have different numbers of flutes. The number of flutes on a bit determines the chip load (how quickly chips are removed from your material).

**1-2 flutes:**
- More material is ejected with each rotation. Chips are larger because the bit is removing more material each time the bit rotates.
- Faster, rougher cuts. These are great for prototyping,
- More room to eject the chip. Chips are dispersed farther away from the cutting surface.
  - **Materials:**
    - Aluminum
    - Soft plastics
    - HDPE
    - Acrylic: use 1 flute bits on plastics like HDPE and acrylic, clear chips away from the bit as quickly as possible. This prevents chips from sticking back to the material, your bit, or ruining the carve. The more flutes you use, the more heat that is generated by the bit. More heat means chips are more likely to reweld or gunk up the bit. Using fewer flutes helps minimize the number

**2+ flutes:**
- Less material ejected with each rotation
- Smoother surface finish. These bits are great for detailed work or finishing passes.
- Slower cuts
- Less room to eject the chip
  - **Materials:**
    - Corian
    - Hardwoods
    - Hard materials

**Flute Type**

Flute type determines the direction the chips are dispersed—up, down, or out—when the bit removes chips from the stock material. Chip dispersal is important for different material types.
**Upcut:**
-Ejects chips up and away from your bit and the stock materials. This minimizes chip rewelding for materials prone to melting (like acrylic and HDPE).
-Use upcut bits for a clean finish on the bottom surface of your material when cutting all the way through your material.
-For all toolpaths, this bit generates rough edges on the top surface of your material, known as tearout.
-**Materials:**
  - Plastics (acrylic, HDPE)
  - Aluminum
  - Expanded PVC
  - Any material where heat buildup is a concern
  - NOT plywood

**Downcut:**
-Pushes chips back down into the stock material.
-For all toolpaths, these bits leave a clean surface on the top side of your material. They leave a rough finish on the bottom surface of the material on thru-cuts.
-The downward motion of the flutes helps hold material down against the waste board. As such, downcut bits are great for thin pieces of materials (1/8" depth or thinner).
-Good for inlays or any cuts that do not go all the way through.
-**Materials:**
  - Plywood
  - Laminate
  - NOT acrylic
  - NOT hdpe
  - NOT aluminum

**Straight Flute:**
-Chips are dispersed out from the stock material: not up and not down.
-Excellent for minimizing chipping and fraying on the top surface of the material.
-These are good general purpose bits.
-**Materials:**
  - Bamboo
  - Plywoods
  - Any material where splintering and fraying is an issue
  - NOT acrylic
  - NOT expanded pvc

**Compression:**
-Flutes spiral in both directions: up and down. Upcut flutes on the bottom of each flute. Downcut flutes on top of each flute. This acts as a finishing path. Smoothes top surface of material of fringe generated by upcut flutes.
-These are the best bits for laminated materials or thru-cuts, because these bits leaves a good finish on the top and bottom of the material.
**Bit End**
The end of the bit impacts what the bottom of the toolpath looks like. This is important to consider for things like pockets or engravings.

**Fishtail:**
- Produce flat surface with a clean edge
- Good for plunge cutting. As such, suggested for thinner materials.
- To make pockets with flat bottoms
- Versatile but especially good for plastics

**Ball Nose:**
- Rounded end which produces a path with curved edges
- If you're cutting layers in several steps, ball nose bits reduce the risk of creating jagged steps. Great for sculpting and 3D modeling (i.e. domes, complex surface curves, etc.)
- This bit type can leave “rippled” grooves in pockets if your stepover is too high (e.g. if your toolpaths don't overlap enough).

**V-Bit:**
- V shaped (duh). Examples of v-carved toolpaths include tapered edges, varying widths and depths in the same toolpath, and beveled edges
- Use bits with different angles for different levels of detail.
  The lower the degree, the more detail you can get (i.e. a 60-degree bit will give you more detail than a 90-degree bit).
- Good for hardwoods. Bad for plywoods. Causes severe tear out and splintering.

**Engraving:**
- Engraving bits are essentially v-bits with a very, very low degree.
- These bits are incredibly fragile. Don’t use for anything other than engraving.
- You can carve precise details on softer carving materials, like wood.
- Not recommended for acrylic: bit is fragile and acrylic is hard.

Image examples of different bit qualities on different materials

https://inventables.desk.com/customer/portal/articles/2918214-bit-and-material-pairings---photos