EML2322L – Design & Manufacturing Laboratory

Abrasive Water Jet Guidelines

The purpose of this document is to explain the capability of abrasive water jet (AWJ) manufacturing and present guidelines regarding its allowable use on the course design project.

AWJ Overview

As covered in detail **during lecture**, AWJ is a process which uses an ultra-high pressure stream of water mixed with naturally occurring abrasive crystals to cut a 2D profile through a workpiece via a high speed erosion process. Since abrasive crystals are very hard, the process is capable of cutting virtually any material, regardless of its hardness, and because the machine is computer controlled in an XY plane, virtually any 2D profile can be cut. While the AWJ process allows tremendous freedom to create a variety of shapes, the 2D restriction limits its use to parts with features which are cut all the way through the workpiece. **Click here for a short video showing the process on a typical sheetmetal part.**

AWJ in EML2322L

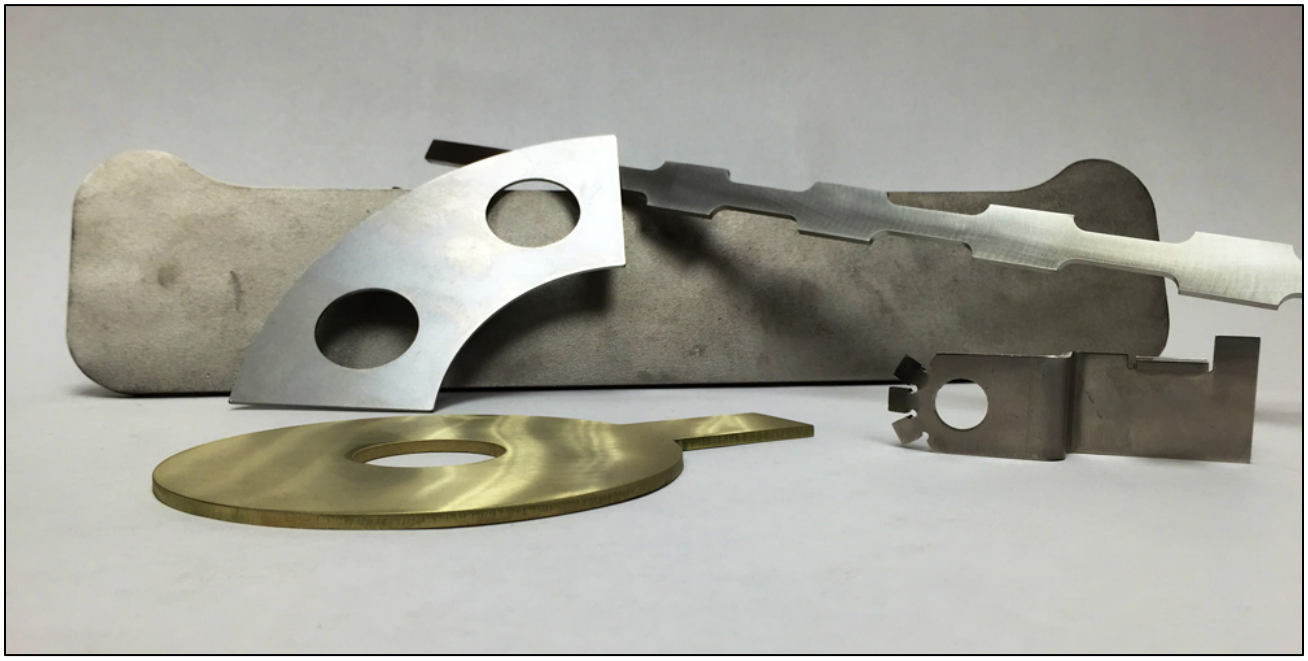
Although EML2322L focuses on traditional manufacturing processes to provide you hands-on experience with the methods most commonly used for production in industry today, exposure to newer contemporary processes like AWJ broadens your manufacturing experience & understanding.

Guidelines for AWJ Manufacturing in EML2322L

Please read the following points to determine if AWJ may be the right manufacturing solution for your group's needs in EML2322L.

1. Parts which have complex 2D shapes which cannot be easily made using the traditional processes taught in the first half of the semester are ideal for AWJ manufacturing. A course instructor or TA is always available to assess designs and provide feedback on whether parts can be redesigned to use the traditional manufacturing resources provided in the lab.
2. Sheetmetal parts that would require more than 15 minutes to make using traditional processes in the lab are ideal for cutting using AWJ. Since AWJ performs shearing, drilling, punching, notching, and lancing operations all in one machine, it is very versatile for cutting sheetmetal parts. The only other restriction on cutting sheetmetal parts with AWJ in EML2322L, is that holes smaller than Ø0.1" may not be cut.
3. Components which are easily manufactured using traditional processes (e.g. typical drive wheel motor mounts and drive wheel motor hubs) may not be cut using AWJ because we want you to obtain experience using traditional drilling, milling, and turning processes, since these are so common in industry.

Examples of Parts Suitable for AWJ Cutting in EML2322L



Design Tips for AWJ Manufacturing

Heed the following tips when designing parts to be manufactured using the AWJ process:

1. **Make proper drawings**. Sketches and drawings must be properly constrained and contain closed geometric paths (i.e. ***no gaps between lines and arcs***). The drawings will be turned into tool paths, so do not draw lines on top of lines.
2. **Draw parts true scale.** ALWAYS DOUBLE CHECK each part drawing was created using a scale of 1:1. For clarity, ***always include one reference dimension*** so the manufacturer can check the final drawing is scaled as intended.
3. **Draw all features true size.** If a circle is drawn as Ø1.0″, but dimensioned as Ø 1.1″, it will still be cut at Ø 1.0″; therefore, ***ensure drawings match dimensions.***
4. **Include only the part features to be cut in the cut file.** ***Every line in the cut file should belong to the cut part,*** with the exception of the one reference dimension noted in Tip #2 above. Do not include related parts, bend lines, construction notes, title blocks, etcetera.
5. **Design for a vertical wall taper of 0.005″ per 0.25″ of material thickness.** This means if you are designing a 0.257″ clearance hole through a 0.25″ piece of aluminum, the hole size should be drawn and dimensioned as 0.267″. Since AWJ moves the cutting jet around any desired 2D profile, there is no concern for using commonly available hole sizes. In general, specifying free fit clearance holes in sheetmetal parts will allow adequate fastener clearance.
6. **Try to design parts with radii which are as large as permissible**, as these cut much faster than smaller corners, due to the AWJ needing to slow down much more to cut the latter. In general, do not design for corner radii smaller than 0.03″.

Submitting Part Files for AWJ Manufacturing

Once designs are finalized for DR3, there will be a one week window for AWJ parts to be submitted for approval and manufacturing. To submit part drawings please follow the instructions below:

1. Make sure you read and follow the Design Tips for AWJ parts presented above.
2. Save the SW part drawing (NOT the part model) as a DXF file with the following filename format: *GroupNumber_PartName_PartThickness_MaterialType_PartQuantity.dxf:*
    - File > Save As > Save As Type > DXF
    - For example, **1A_BallRamp_16GA_Steel_2.dxf** would be the appropriate naming convention for two 16 gage steel sheetmetal ball ramps submitted by Group 1A
2. Open the file and ensure the part is scaled correctly; incorrectly sized parts will not be recut
3. E-mail the file(s) with the subject line ***"EML2322L AWJ request from Group XX"*** to the course instructor
4. A notification will be placed on the course webpage indicating the dates and times AWJ manufacturing will take place for students wanting to see or learn about the process