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## Cutting and Drilling Clear Acrylic Sheet [↗](#)

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*In Development*

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### ABSTRACT

A clear acrylic sheet is cut to form a transparent platform, on which the algal cell cultures in flasks are being shaken.

**This document is part of the Illuminated Orbital Shaker for Microalgae Culture project:**

- Procuring Parts for Algal Shaker
- Assembling LED Controller Electronics
- 3D Printing Case for LED Controller
- Assembling Cooled LED Illuminator (this document)
- Cutting and Drilling Clear Acrylic Sheet
- Assembling Algal Shaker

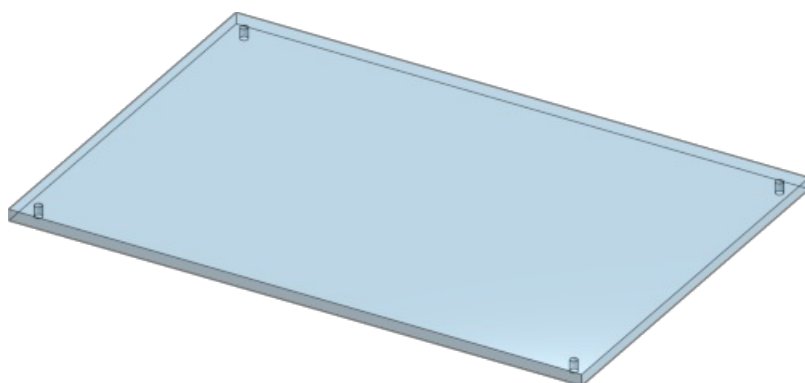
### EXTERNAL LINK

<https://app.labstep.com/sharelink/935f8eef-e367-4290-906d-2d27494a80c6>

### GUIDELINES

#### Introduction

A clear acrylic sheet is cut to form a transparent platform, on which the algal cell cultures in flasks are being shaken. Orbital shakers come with a shaking platform. In the case of the illuminated orbital shaker, this integrated shaking platform holds the cooled LED illuminator, not the algal cell cultures. The clear acrylic sheet is raised above the cooled LED illuminator on four raisers (stand-offs) attached to the shaking platform. Both platforms, the original integrated platform and the raised one made of the clear acrylic sheet, shake together. The aim is to cut a sheet that is roughly the same size as the integrated orbital shaker platform and drill four holes in each corner that align with the holes in the orbital shaker platform for fixing.



3D rendered model of the clear acrylic sheet with four mounting holes near the corners.

Here, a 4 mm thick ( $\approx 5/32$ " ) clear acrylic sheet was used, which was freely available in the workshop. The acrylic sheet was marked with cut lines and hole position marks using a ruler and carpenters square. It was cut with a hacksaw and holes were drilled using a hand drill.

With the wide availability of laser cutting, it may be easier and faster to cut the clear acrylic on a laser cutter. Despite this option not being tested, the design files for the acrylic sheet are provided in this document for others to try out.

#### MATERIALS TEXT

- **4 mm thick clear acrylic sheet:** The sheet needs to be of size comparable to or exceeding the size of the orbital shaker platform. The 4 mm ( $\approx 5/32$ " ) thickness is optimal. It is strong enough, but also thin enough for the metal stand-off threads to go through with leaving sufficient thread for the washer and nut.
- **Hacksaw, hand or pillar drill, 4 mm (5/32" or 3/16") drill bit, and medium grit sandpaper**
- **Laser cutter:** The above tools are not needed if the cutting is done using a laser cutter.

#### SAFETY WARNINGS

*Working with workshop tools and laser cutters involves hazards to health and personal safety. The use of workshop tools can lead to repetitive strain injury, cuts, and bruises of varying severity. The use of an electrical drill carries the risk of long loose hair becoming trapped, resulting in a serious injury. Cutting, sanding, drilling holes produces dust that may be harmful when breathed and may cause damage or sensitisation to eyes.*

*The use of electrical drill and laser cutter carries the wide risks associated with mains electricity, such as electrocution and fire. These risks are further augmented by the the presence and use of sharp cutting tools in the workshop environment that could inadvertently cut through their power supply leads or otherwise damage the integrity of their protective casing.*

*Laser cutters use powerful lasers that can cause damage to skin, eyes or cause fire, in addition to being mains-supplied electrical equipment. The laser cutting process may release harmful fumes to the surrounding environment.*

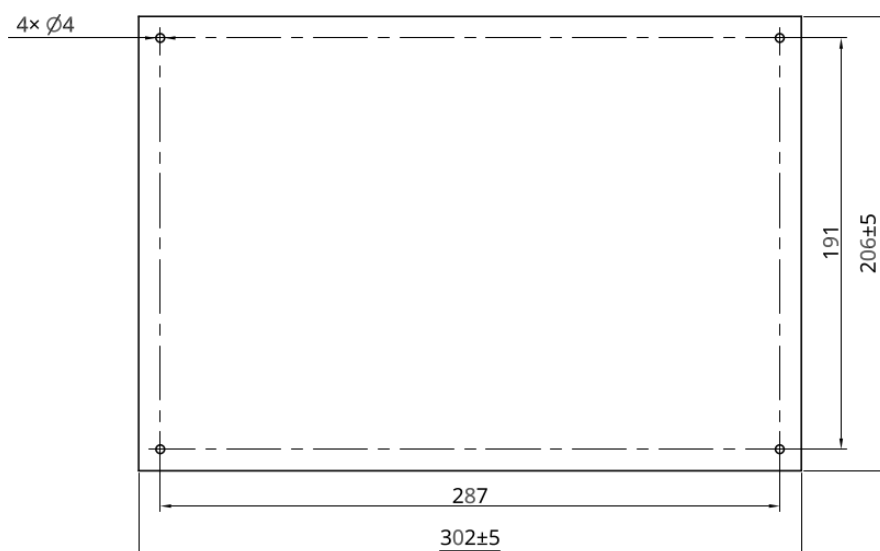
*Consider the listed and other hazards associated with the workshop environment. Assess the risks according to the local conditions, regulations, and individual needs. Use protective equipment and measures to mitigate all risks. Observe local regulations. Never let untrained people use workshop equipment.*

## 1 Technical Drawing for the Clear Acrylic Platform

Measure the size and positions of mounting holes on your orbital shaker. There is a technical drawing file available for the orbital shaker KJ-201BD used in this project, available in Onshape:

### Orbital Shaker Platform

A technical drawing of the clear acrylic platform for the KJ-201BD orbital shaker, including the four mounting holes, is in the image below. The dimensions are in millimeters. Notice, the actual dimensions of the sheet are not critical, what matters is the spacing of the fixing holes (287 mm and 191 mm). These must match the holes in the orbital shaker platform.



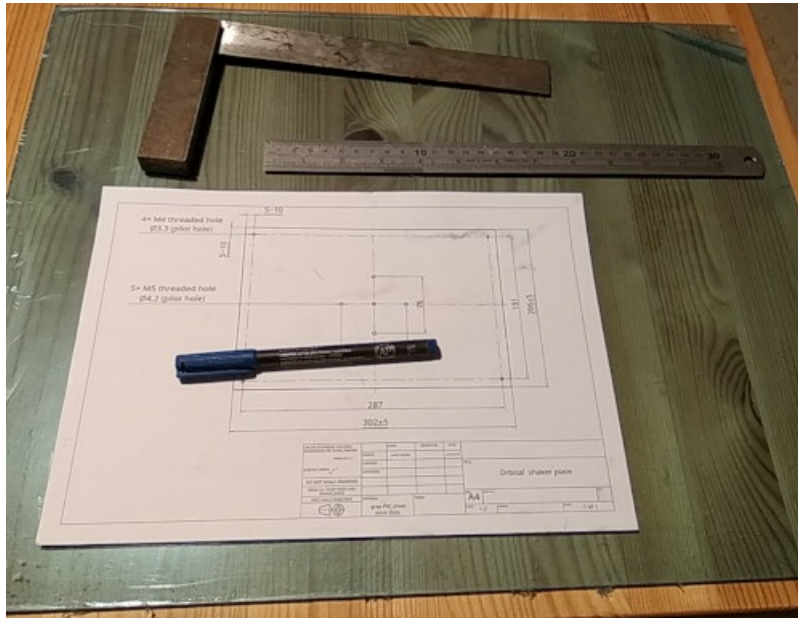
Technical drawing of a clear acrylic platform compatible with the KJ-201BD orbital shaker. The critical dimensions are the spacing of the mounting holes. Other orbital shakers will require custom technical drawings to reflect the size of the shaking platform and the position of its mounting holes.

If you have a different shaker, prepare a technical drawing for the clear acrylic platform, based on the dimensions and hole placement of your shaker platform.

## 2 Cut and Drill the Clear Acrylic Platform

This section describes the cutting and drilling of the acrylic using workshop tools. If a laser cutter is available and will be used for cutting the acrylic, skip to the next step.

Prepare the acrylic sheet, technical drawing, fine tip permanent marker, ruler and a square or a protractor:



Clear acrylic sheet, technical drawing, carpenter square, and a ruler used to draw guidelines for the cutting and drilling.

Draw the outline of the platform onto the clear acrylic sheets and mounting holes in positions according to the technical drawings.

Use a hacksaw to cut along the drawn lines to cut out a sheet of the desired dimensions.



Cutting with a hacksaw along the guide lines drawn on the acrylic sheet.

Use a medium grit (P80–P180) sandpaper to deburr the cut edges.

Use a drill with 4 mm (5/32" or 3/16") multipurpose drill bits to drill the holes in the marked locations. Special drill bits for plastics exist and would be preferable for drilling these holes. Their use would minimize the risk of cracking of the sheet, but they are not widely available.



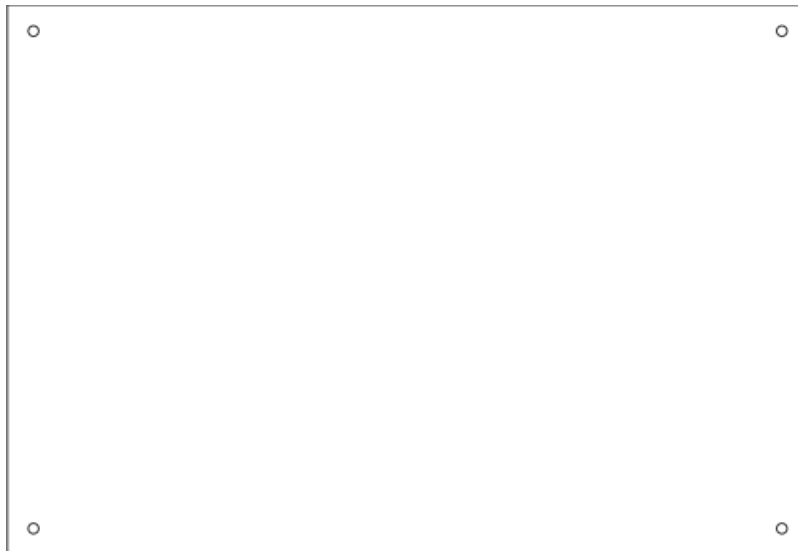
Drill and a drill bit with the cut clear acrylic sheet having marks for the holes drawn nears the corners.

### 3 Laser Cutting Clear Acrylic Sheet

This step has not been tested. It should be possible to laser cut the acrylic sheet, instead of cutting and drilling it by hand. The resulting sheet should have cleaner cuts and more accurate holes placement, compared to the hand-made one described above. For the KJ-201BD orbital shaker, you can use a DXF file to guide the laser cutter:

[Orbital Shaker Clear Acrylic Sheet.dxf](#)

The file has been created by exporting the drawing of the Onshape model of the [Orbital Shaker Platform](#). The file was edited in [LibreCAD](#) to remove all unwanted text and lines, leaving the outline of the sheet and the four mounting holes only, as seen in the image below.



The outlines guiding the laser cutter to produce the transparent platform for the orbital shaker from clear acrylic sheet.

If your orbital shaker has different shaking platform dimension and/or mounting hole positions, create a custom drawing reflecting the actual dimensions.

Use manufacturer instructions to operate the laser cutter. Observe local safety rules. Allow only trained staff operate the laser cutter.

### 4 Summary

This document describes the steps to cut a clear acrylic sheet and drill holes into it to create a transparent shaking platform to place the culture flasks on. It offered a solution for laser cutting the sheet instead of doing it by hand. The sheet will be mounted on top of the orbital shaker, as explained in the next document on the final assembly.

### 5 References

- [Orbital Shaker Platform](#): Onshape document with the model and technical drawing of the clear acrylic platform designed to fit the KJ-201BD orbital shaker.
- [LibreCAD](#): 2D CAD program that allows editing the technical drawing in DWG or DWF formats exported from Onshape to remove unwanted details for laser cutting.
- [Orbital Shaker Clear Acrylic Sheet.dxf](#): DXF file for laser cutter to produce clear acrylic platform designed to fit the KJ-201BD orbital shaker. Different file will be needed for orbital shakers of different sizes and mounting hole positions.

## 6 This document is part of the Illuminated Orbital Shaker for Microalgae Culture project:

- Procuring Parts for Algal Shaker
- Assembling LED Controller Electronics
- 3D Printing Case for LED Controller
- Assembling Cooled LED Illuminator
- Cutting and Drilling Clear Acrylic Sheet (*this document*)
- Assembling Algal Shaker



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