Engineering Drawings Guidelines

Engineering Drawings are to serve as professional documentation of the design and a tool for construction/assembly. The technical accuracy and quality of the drawings is important. The goal of these drawings is to define the product (robot) with sufficient detail so that a person unfamiliar with the design could reproduce it accurately using only the drawings.

Some guidelines/recommendations for your Engineering Drawings:

Drawings Development

1. Use a professional 3D solid modeling Computer Aided Design (CAD) software.
    a. Solidworks
    b. AutoCAD/ Fusion360
    c. SolidEdge

Drawing Package Content

1. Drawing package should include:
    a. list of drawings with drawing reference numbers,
    b. bill of materials,
    c. drawings pages
    d. electrical wiring diagrams, when appropriate
2. Drawing package may include:
    a. cut sheets, if appropriate.
3. Drawing package should not include:
    a. photographs
    b. scanned documents/pages.
4. Using CAD tools to produce a top assembly model, sub-assemblies, and piece parts, derive your drawing pages from each of these modeling levels.
5. Drawings will be delivered as a single PDF file for BEST Competition

Bill of materials (BOM)

1. Bill of materials must contain EVERYTHING used in the construction, including all fasteners, electrical/electronics, carpet, etc.
2. All source part numbers should be exact. It is highly desirable to provide multiple sources whenever possible.
3. If a source part number may vary, by geographical region for example, make note of this and provide a very clear specification for the item.
4. Anything purchased online should have the web address of the supplier provided.
5. All parts should have clear and specific descriptions sufficient to allow sourcing from multiple sources when possible.

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Presentation Guidelines

1. Use a standard drawing template.
2. A list of drawings and reference numbers shall be included in the final document prior to the drawing pages.
3. Drawing pages should be 11” x 17” (C Size), landscape orientation.
4. Explanatory text can and should be added directly to the drawing page.
5. Always reference drawings by their drawing reference number (never refer to the drawing title alone without the number)
6. Introductory text like definitions, bill of materials, etc. can be merged or pre-pended to the drawing pages. This can be accomplished through Adobe Acrobat or other PDF merging tools.
7. When applicable, provide cut-sheets that maximize the use of the purchased materials.
8. Each drawing page should specify a title, the material used, the scale of the drawing, and the drawing reference number, and page numbers. Assembly and sub-assembly may not specify the material since it consists of multiple parts.
9. Drawing pages should be organized by assembly with each assembly having an isometric view, followed by exploded view, followed by sub-assembly pages or individual part drawing pages. Isometric views do not include dimensions.
10. Provide **multiple views** (top, bottom, side) on a page, only if additional information can be provided by the view. Don’t include multiple views without a reason. You don’t always need all the views – particularly if there’s no additional information provided by the view, or if the information can be provided via the material spec. For example, if the material is plywood or other flat stock, you really only need a top view showing the layout.
11. All dimensions must have units.
12. All dimensions should be from a similar reference point. (e.g., all references from the right edge of a part vs. from the right edge, left edge, and some mid-point).

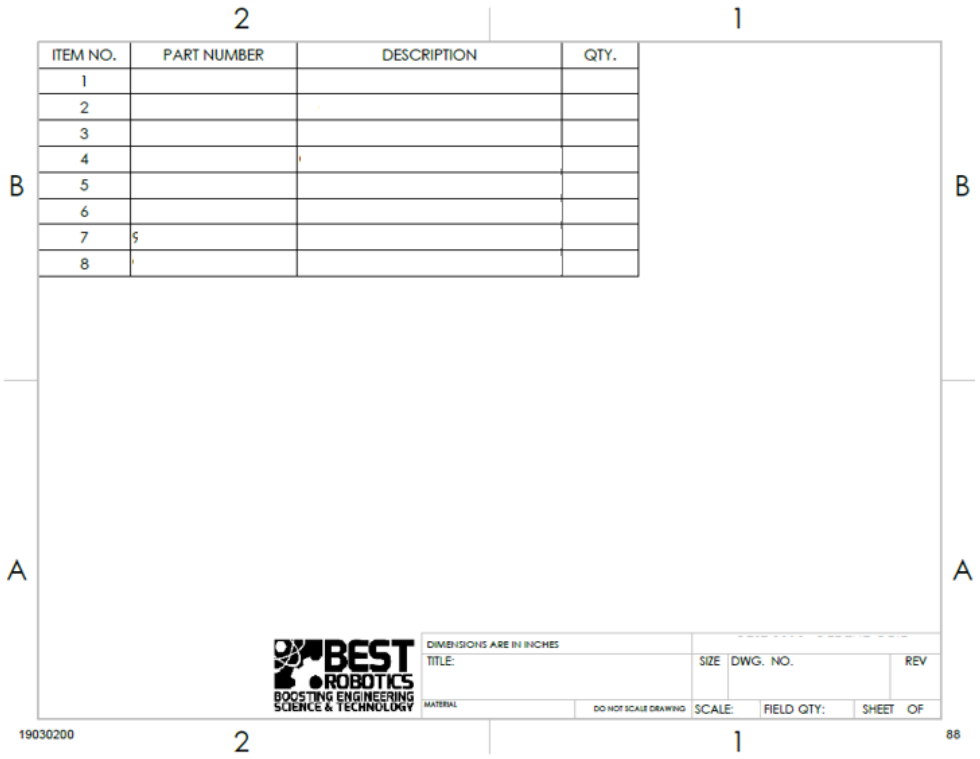
Engineering Drawings Guidelines

Types of Drawings

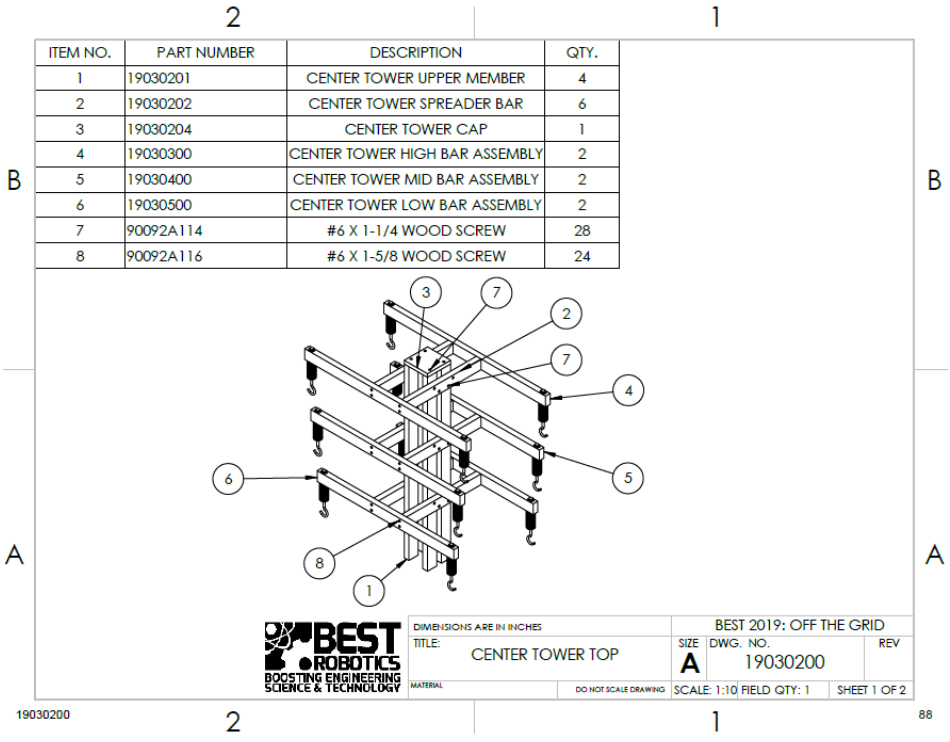
- Isometric View
- Exploded View
- Orthographic (Multi-View) - top, bottom, side
- Sectioning

Standard Drawing Template

Blank:



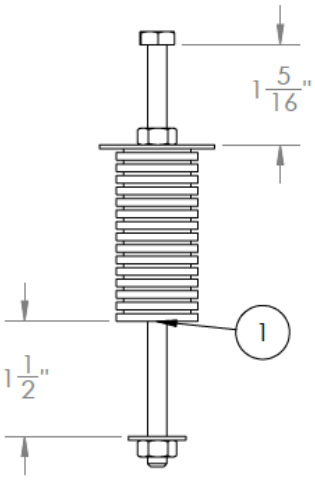
Example Assembly Level Drawing Page (Filled):

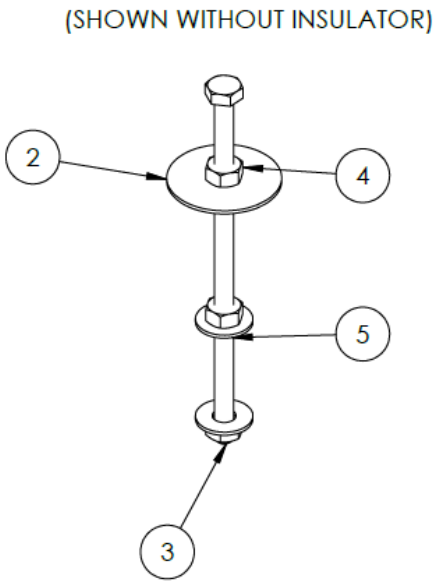


Removing Parts for Clarity

Sometimes a view with parts removed is needed to reveal what is hidden in the assembled view.

Example, Off-The-Grid, page 31

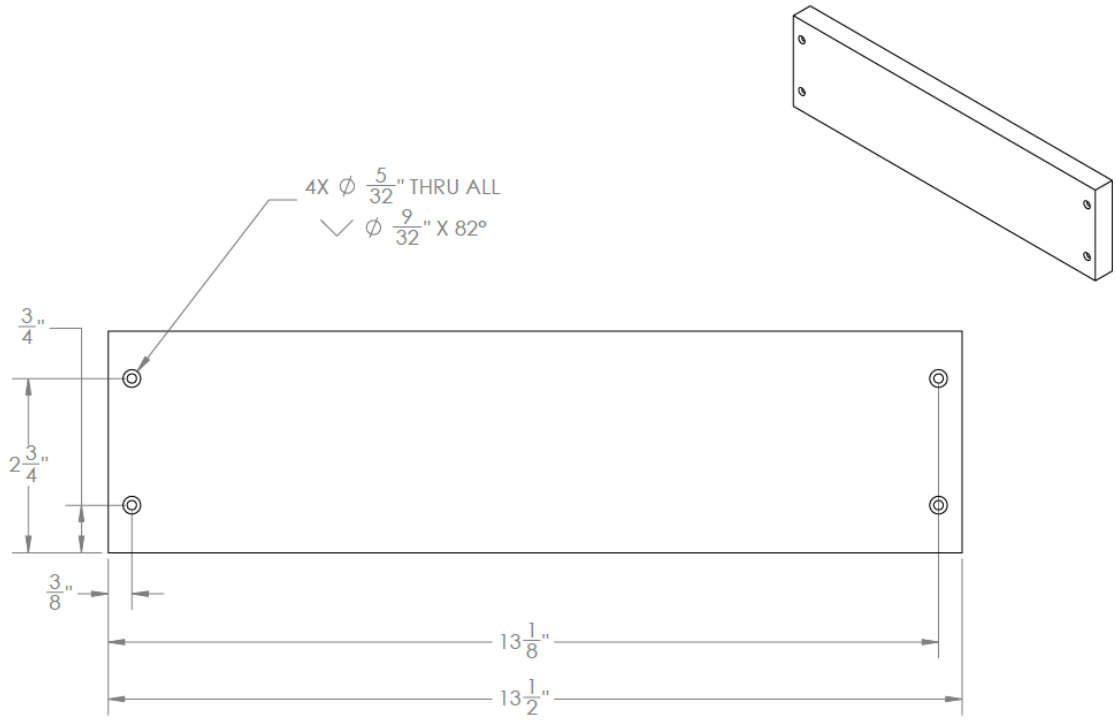




Specifying Holes:

In solidworks, you can use a “hole wizard” to automatically size clearance holes for standard screw sizes (you just tell it the screw size, and it provides an appropriate clearance hole), that can include countersinks for flat head screws, and counterbores for other screw heads.

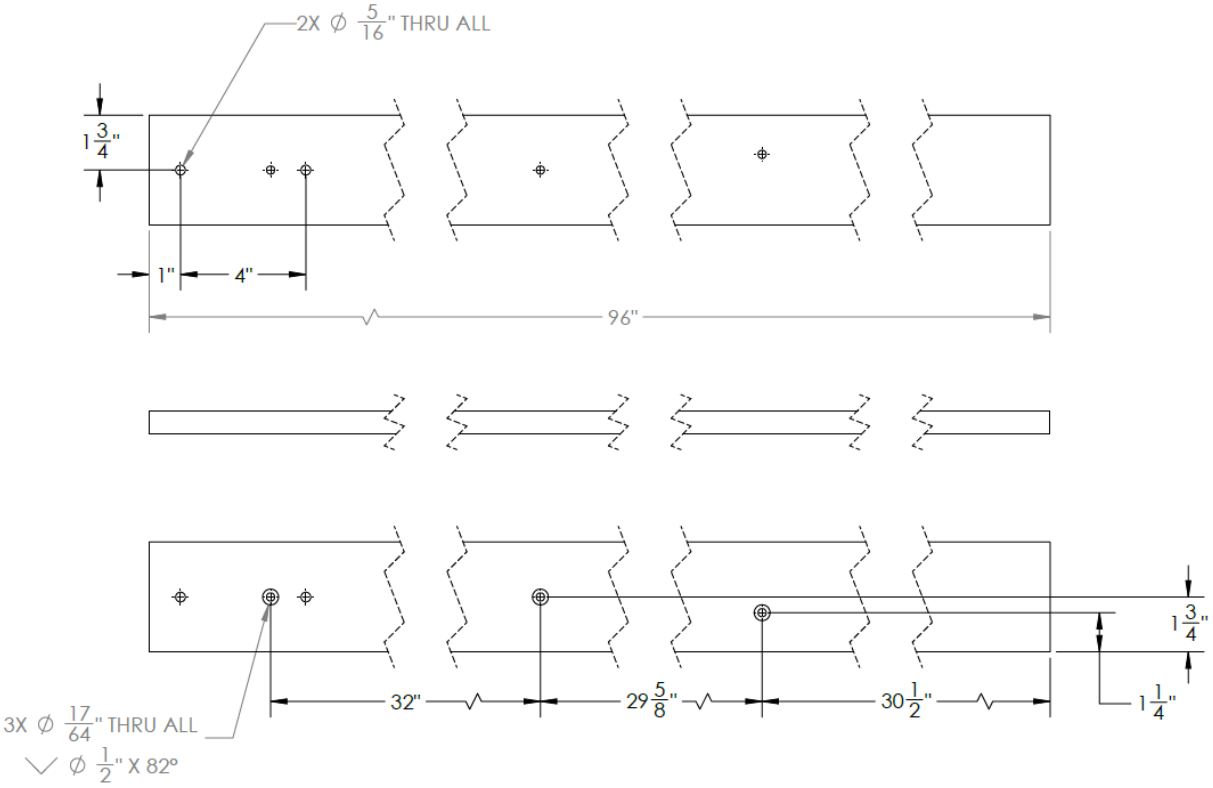
Example, Off-The-Grid, page 73



Engineering Drawings Guidelines

Use **“part breaks”** for items like boards (the borders for off the grid) to allow better detail for parts with wide aspect ratios.

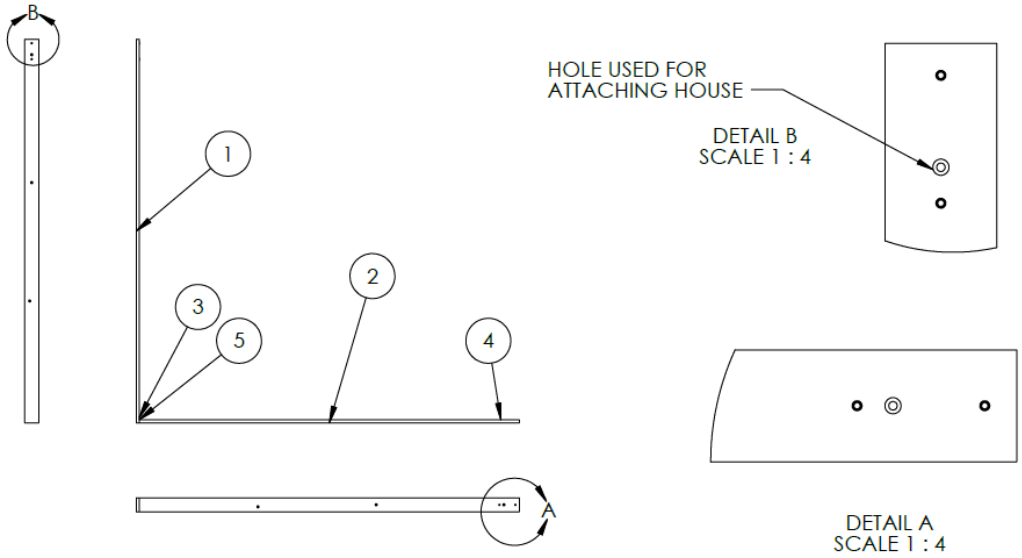
Example, Off-The-Grid, page 56>



Engineering Drawings Guidelines

Detail views can help clarify information in a drawing and can reduce dimension clutter and confusion. Section views can do the same thing – reveal detail that is otherwise obscured by the "normal" view.

Example, Off-The-Grid, Page 54>



Non-orthogonal views may need to be added to provide a view of a surface/feature that doesn't align with one of the primary directions.

Example, Off-The-Grid, Pages 69-70>

- Multiple pages for a part
- Non-orthogonal detail view