

National FFA
Agricultural Technology and Mechanical
Career Development Event
Team Activity
November 1, 2023

Fabricating a Bale Spear Bracket for a Caterpillar Skid Steer

Scenario

Freddie Farmer owns a Caterpillar Skid Steer. He would like to use this machine to move some large round bales. To do this, he will need to add some spears to the bucket. An illustration of these spears can be seen in Figure 1. His challenge is to make brackets that will support the spears.

The objective of this team activity is to fabricate a bracket for a Caterpillar Skid Steer that will accommodate a spear that can be used to pick up round bales. This is illustrated in Figure 1.



Figure 1. Illustration of bale spears and bracket for Caterpillar Skid Steer.

While the skid steer will require two brackets, your team is to fabricate only one of the brackets. Time and materials will not allow for fabricating two brackets.

The spears are to be level with the floor of the bucket. Each team will have a level and a t-bevel square to determine this angle. Figure 2 illustrates how the bracket will fit on the bucket of the Caterpillar Skid Steer.

Note that this illustration might not be the same angle as the machine that you are measuring. Your team will need to determine this angle.



Figure 2. Illustration of leveling the Spear Bracket.

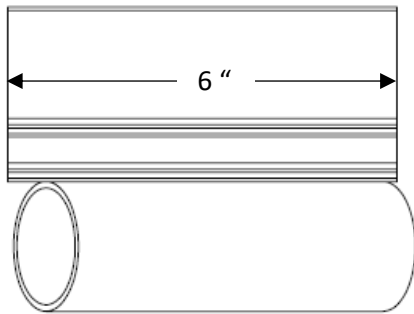
Your team will make a
bracket for the right side
of the bucket.



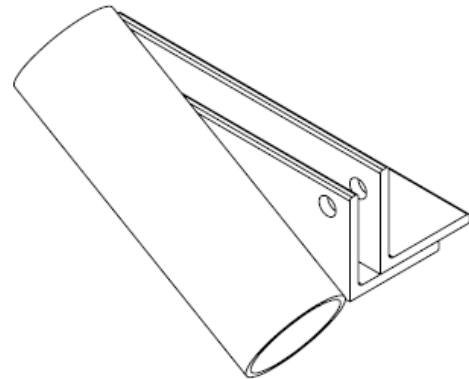
Figure 3. Illustration of brackets on bucket.

Orthographic and Isometric drawing of the bracket

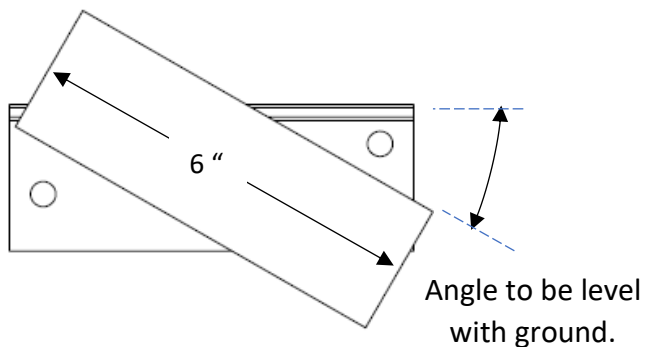
This page shows an orthographic drawing of the finished bracket. It also shows an isometric view of the bracket. The two angle iron pieces are six inches long. The pipe is also six inches long. The team will need to determine the angle to weld the pipe to the angle irons to make the spear level with the bucket. The team will also need to measure the thickness of the side wall of the bucket to know the width of the gap between the two angle irons when welding them together.



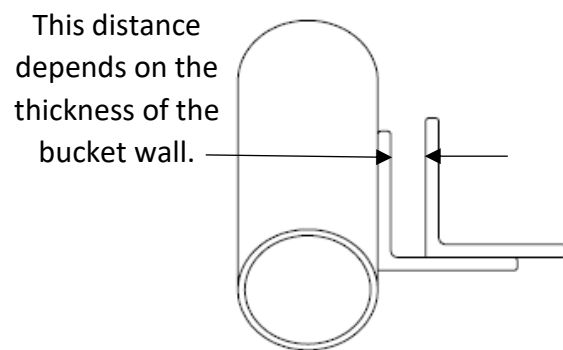
Top View



Isometric View



Front View



Right Side View

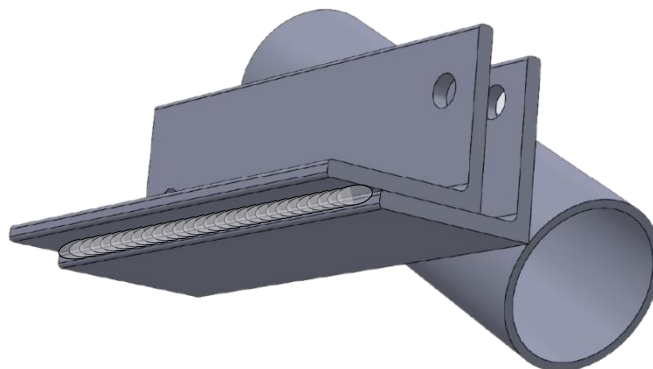


Figure 4. Orthographic, Isometric, and 3-D views of the Spear Bracket.

Details for Drilling Holes in the Angle Iron Pieces

Your team has been provided two 6-inch pieces of 2" x 2" x $\frac{3}{16}$ " angle iron. It will be helpful to identify one piece as Angle Iron A and the other as Angle Iron B. Holes need to be drilled in these pieces so they can be fastened on the side of the skid steer bucket. Figure 5 illustrates the placement of these holes.

Use the dimensions illustrated to drill holes in the angle iron pieces.

- Mark the holes in the correct location on Angle Iron A. Mark the holes on Angle Iron B to match the holes on Angle Iron A when they are welded together.
- Use a center punch to prevent the drill bit from walking.
- Drill a $\frac{1}{8}$ th inch pilot hole. Cutting oil is provided to prevent the bits from overheating.
- Drill a $\frac{3}{8}$ th inch hole through the pilot holes.

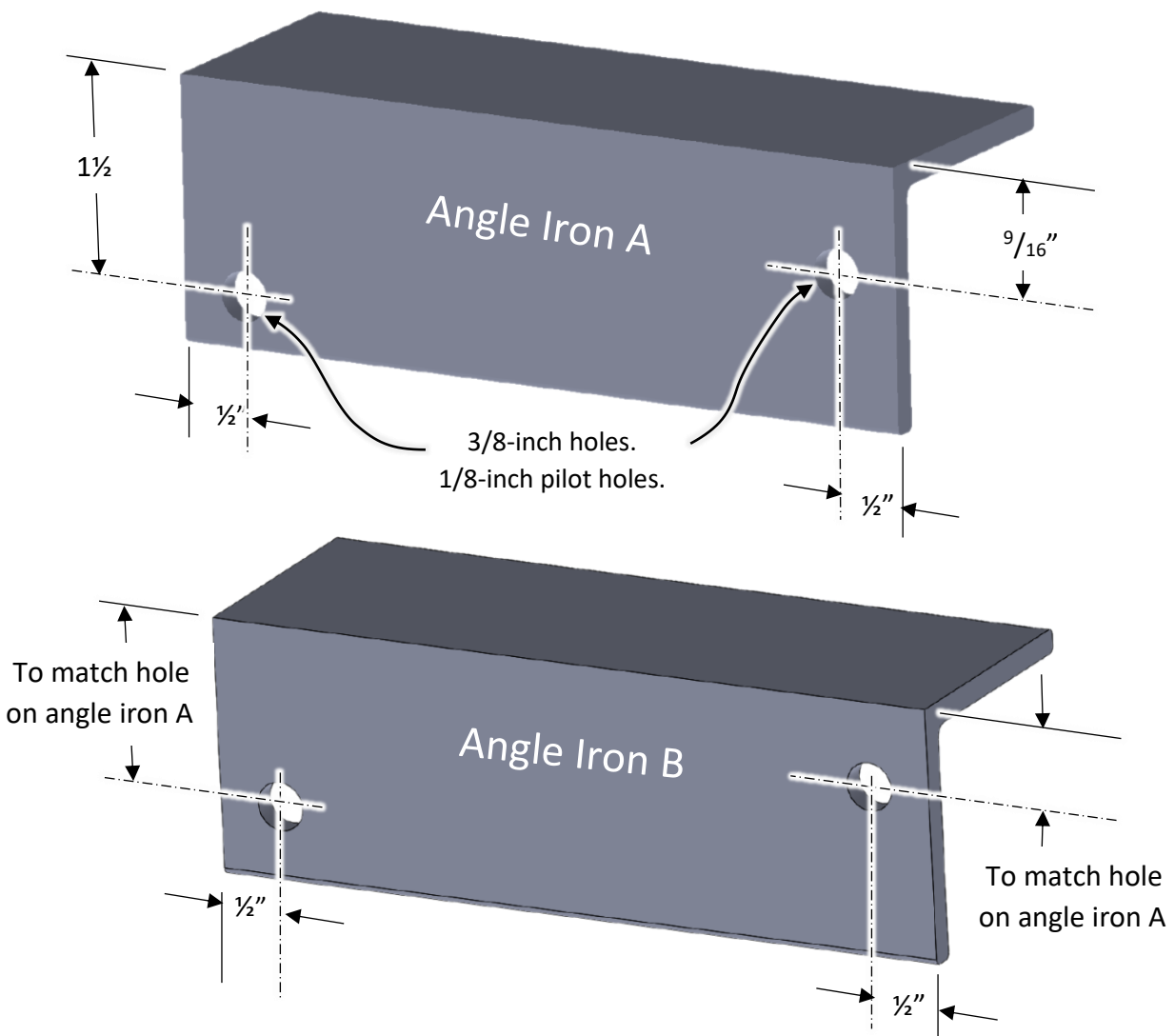


Figure 5. Details for marking and drilling holes in Angle Iron A and Angle Iron B

Welding Detail

Use the following illustration to weld the bale spear bracket together.

- Weld angle iron A on to angle iron B as illustrated below.
- Use the correct spacing to allow the bracket to fit over the side of the Caterpillar Skid Steer bucket.
- Measure the needed angle on the skid steer bucket to allow the spear to be level when the bucket is level.
- Set the pipe at this angle.
- Weld the pipe to the angle iron on both sides.

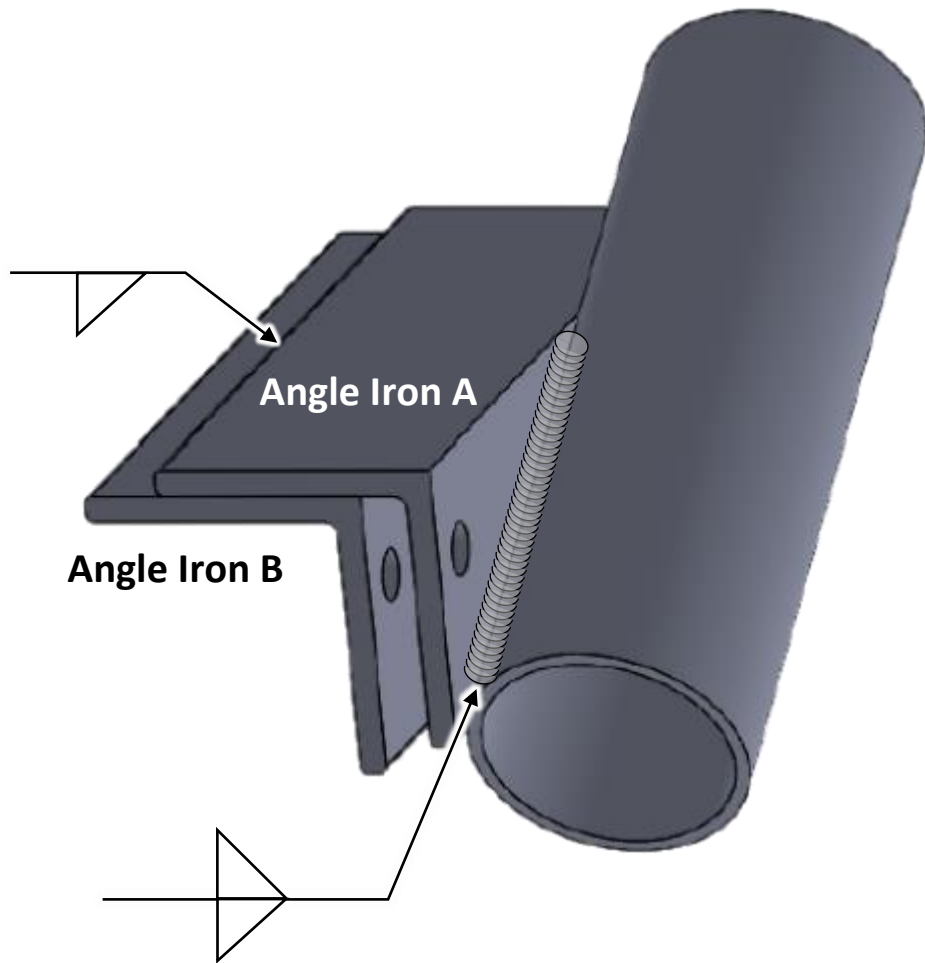


Figure 6. Illustration of welding pipe to angle irons

Tools needed:

You will be provided these tools to use when making this bracket:

- Carpenter's level
- T-bevel square
- Tape measure
- Hammer
- Center punch
- Welder, welding table, chipping hammer
- 1/8-inch drill bit
- 3/8-inch drill bit
- Heavy Duty ½-inch DeWalt drill
- Wood block for drilling (do not drill into the table or into the concrete floor)
- Cutting oil

Personal protective equipment that your team will provide:

- Safety glasses
- Welding helmet
- Welding gloves

Steps: The order of completing these steps will depend upon the availability of items. For example, your team will need to wait to take measurements from the bucket if another team is taking their measurements.

1. Read through the materials carefully.
2. Measure the angle on the bucket needed for the pipe to be level with the ground.
3. Measure the thickness of the bucket wall.
4. Mark and drill the holes on Angle Iron A and Angle Iron B.
 - a. Mark the holes on Angle Iron A as illustrated in Figure 5. Mark the holes in Angle Iron B so they line up with the holes in Angle Iron A when welded together.
 - b. Center-punch the marks to prevent the bits from walking when drilling.
 - c. Use the block to drill holes (see illustration in Figure 7 below).
 - d. Drill a 1/8th inch pilot hole for each hole. Use the wood block provided to hold the angle iron.
 - e. Drill a 3/8th inch holes through the pilot hole. Again, use the wood block provided to hold the angle iron.
5. Set up the angle irons and the pipe to prepare to make the bracket to fit on the bucket so that it will be level with the ground.
6. Weld the bracket together.
 - a. Weld Angle Iron A to Angle Iron B.
 - i. Make sure the holes line up.
 - ii. Make sure the spacing between Angle Iron A and Angle Iron B will accommodate the width of the side of the Caterpillar Skid Steer bucket.
 - iii. Make a single lap weld to weld the angle irons together.
 - b. Weld the pipe to the angle irons.
 - i. Make sure the angle iron and the pipe are at the correct angle so the spears will be level to the ground.
 - ii. Make sure the bolts can fit through the holes.
 - iii. Weld on both sides of the pipe.
7. Turn your finished product in to the event officials to be graded.
 - a. Attach a tag to identify your state.
 - b. Give your bracket to the event officials.

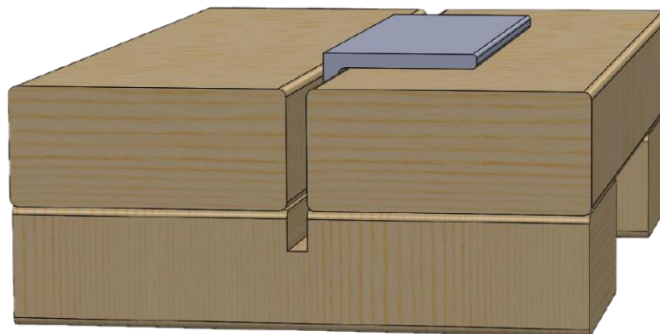


Figure 7. Block for drilling holes

Calculate the cost of production.

While he is making a pair of brackets for his skid steer, Freddie figures he can make and sell more brackets. He considers making an additional 100 sets of brackets. In this activity, your team is to calculate the costs of the angle iron and pipe needed to fabricate 100 pairs of brackets. Use the following given information:

- 10 feet of 2" x 2" x 3/16" angle iron weighs 24.4 pounds.
- 10 feet of 2" pipe weighs 20.4 pounds.
- The average price of mild steel is \$0.42 per pound.

Include your cost of production in the written report. In the report, identify other costs that should be considered in the production of these brackets, besides the cost of the steel.

Written report.

Your team is to submit a summary report at the conclusion of the team activity. The purpose of this report is to summarize your activities as well as provide a document that a construction business could use as a guide to fabricate this Caterpillar Skid Steer bracket.

You are advised to work on this summary report throughout this timed event. The summary report is to include the following items in the order listed:

1. A title page including the title of this project, the name of your FFA chapter including city and state, the names of your team members and today's date. See example on the last page of this document.
2. Begin with a brief introductory paragraph describing the entire project completed.
3. A description of the roles of your team members that completed these activities.
4. The instructional steps you developed to guide an individual to fabricate this bracket.
5. Cost of materials to fabricate 100 pairs of these brackets.
6. Identification of other cost considerations in fabricating the 100 pairs of brackets.
7. A concluding paragraph that includes your team as contact for technical support in fabricating the brackets.

Team Evaluation

Your team will be evaluated on the following:

- Teamwork process: 100 points
- Team report: 50 points
- Finished product: 250 points
- Total for team activity: 400 points

Caterpillar Skid Steer Bracket Construction Works

By

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Team members:

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