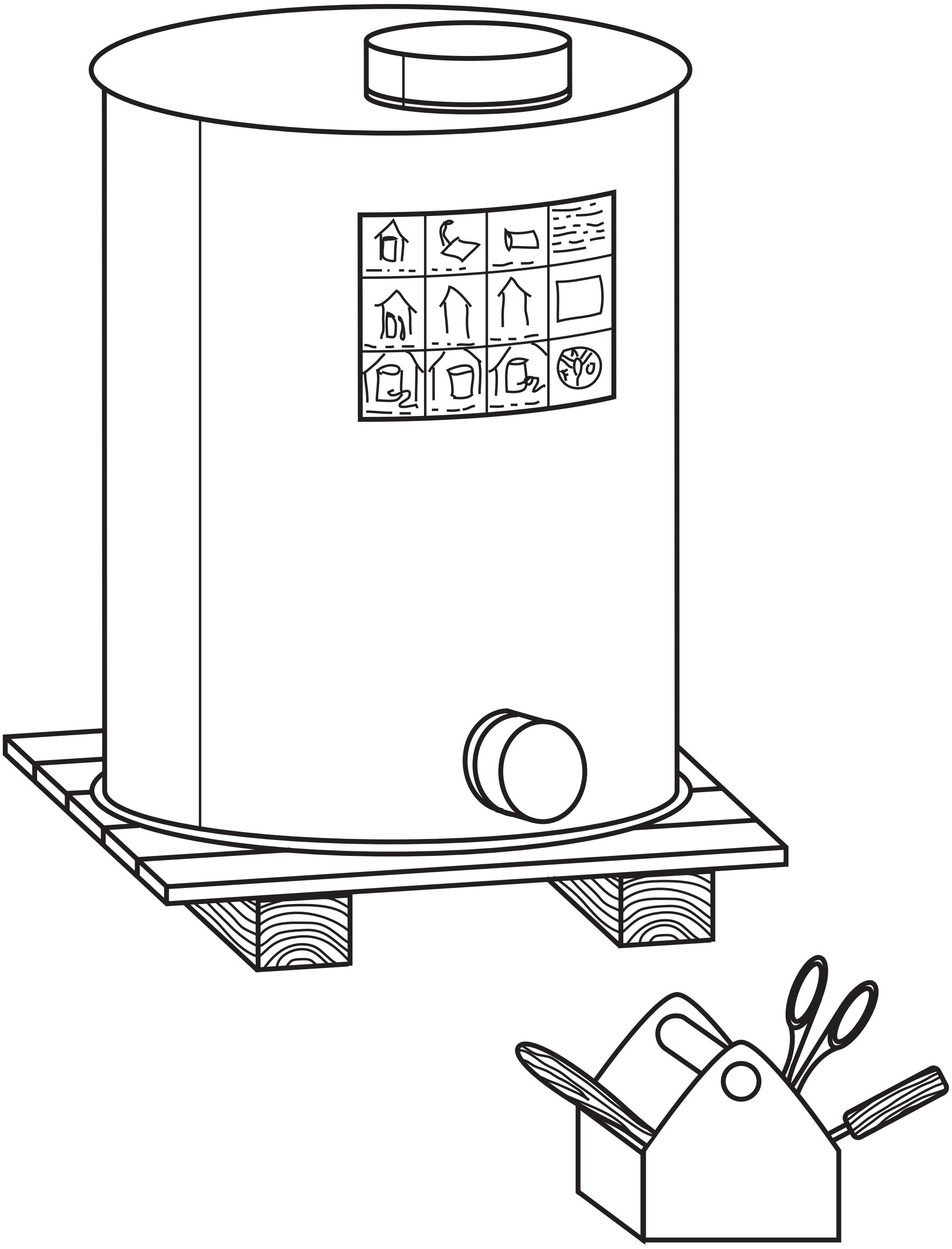
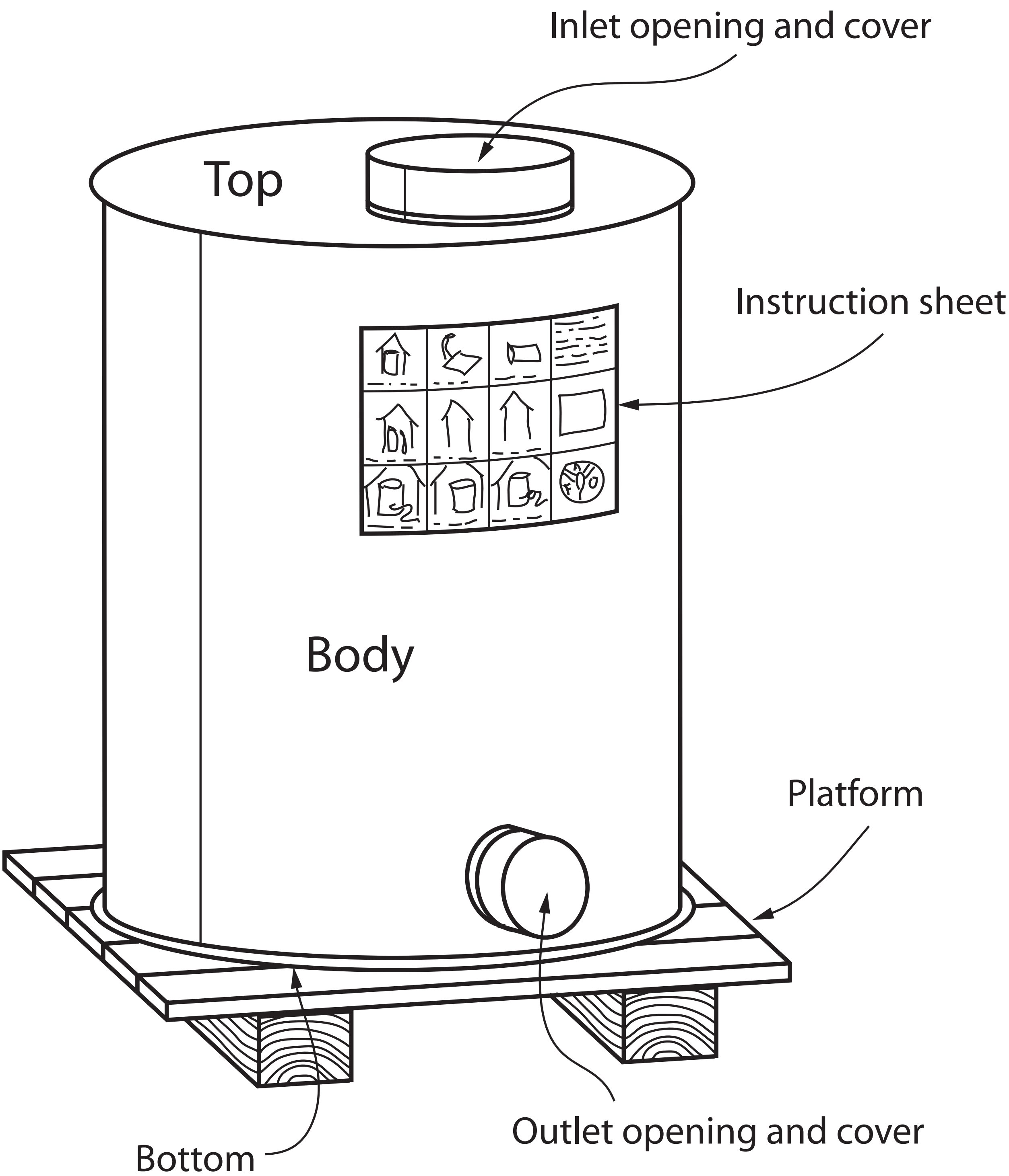
Technical Manual for the Construction of Small Metal Silos



Agricultural and Food Engineering Technologies Service (AGST)
Food and Agriculture Organization of the United Nations (FAO)

Parts of the Silo



Acknowledgements

This document is largely based on previous materials produced by the Swiss Agency for Development and Cooperation (SDC). The structure of some sections has been used almost directly. Earlier efforts by those working within the FAO such as A. Arancibia and Y. Calvamontes contributed aspects such as the material-use plans for the five regularly sized silos and the basis for some of the illustrations.

This revision and simplification has been carried out under the supervision of D Mejía and F. Mazaud of the FAO.

M. Howell, January 2005

Things to Think About

Flexibility

When you are gathering all the tools and materials you need to build the first silo, you may not find everything on the list. Be resourceful. If you can't find certain tools, ask the hardware dealer to help you. Maybe something else will work. Ask other metal workers or jewellers for advice about alternative sources for solder, cleaners and fluxes.

The thickness of the steel sheets can be changed slightly. Remember that thicker sheets will be more difficult to cut with the shears and much thinner sheets will not be strong enough for large silos. Don't use sheets less than 0.4 mm. The ratio of tin to lead in the solder is also flexible. 50% / 50 % is the best but 35% tin / 65% lead is also acceptable.

Copper soldering irons heated in charcoal are reliable, low-cost tools which can be made and used in almost any community. In some areas, propane gas cylinders may be available and inexpensive. In that case, gas soldering torches can be used and may actually be more valuable for doing other kinds of metalwork.

Safety

Some of the materials can be hazardous to your health. The acid and the flux should be used carefully. These materials can also damage your tools and the silo if they are not used properly. The solder used to make the silo contains lead.

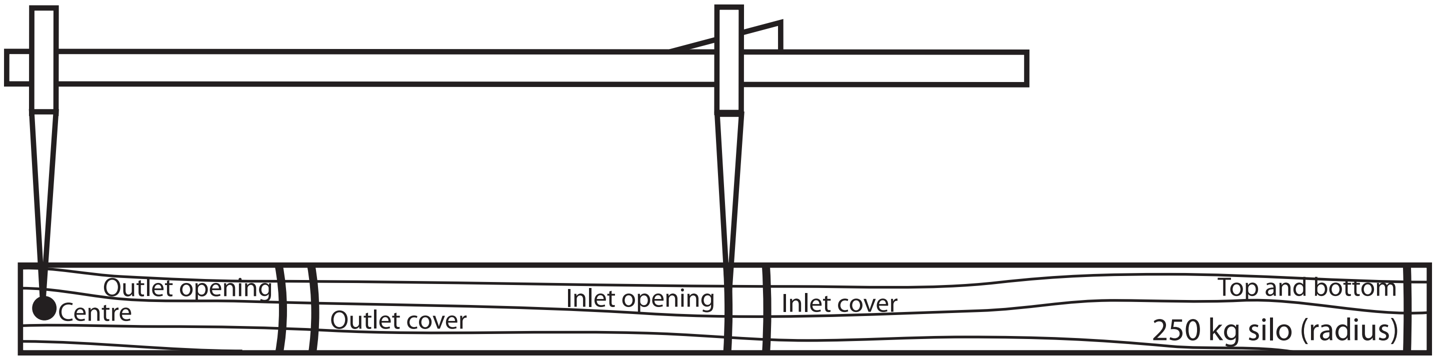
Precautions for you and your family against lead exposure.
Do not breathe the vapours while soldering. Have good ventilation in the workshop.
Do not eat, drink or smoke until you have washed your hands.
Do not allow children into the work area.
Wet the floor when you sweep to reduce dust.
Save the solder drops in a bucket to return to the metal recycler.
Wear over-clothes and leave them in the workshop or remove them before you go into the house.
Never dump or bury lead near homes, water or agricultural land.

The cut edges of the metal pieces are very sharp. Wear gloves and shoes and sweep the scraps off the bench and floor with a brush.

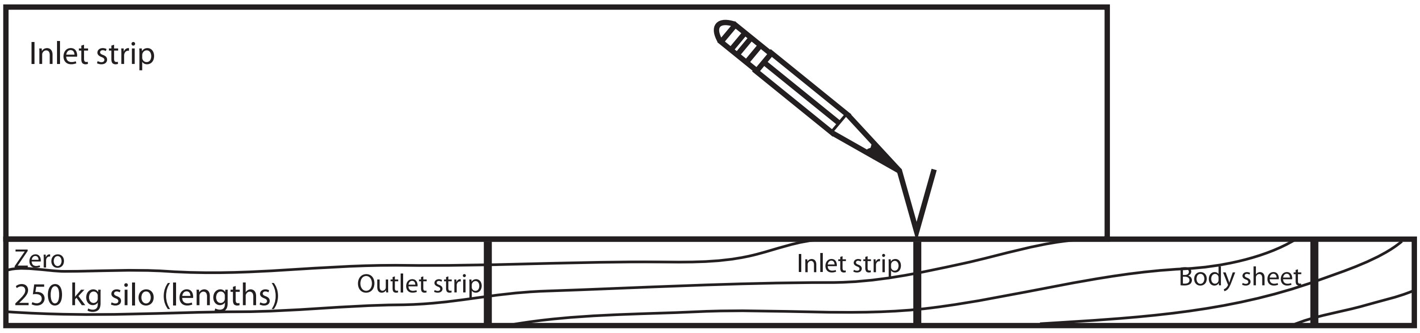
Protect eyes with glasses or goggles especially when using the acid. Always have in the shop clean water and something to neutralise the acid such as sodium bicarbonate (baking soda) or calcium carbonate. Do not use the acid directly from the one litre bottle. It will be expensive and dangerous if it spills. Use a small glass jar, 50-100 ml, with a lid or stopper. Clearly mark the jar "ACID" and keep it in a safe place.

Story Sticks

A story stick is very useful for keeping track of the measurements for each size of silo. It is especially helpful with the larger pieces which would require large patterns. It is a piece of wood with labeled markings that help you set your compass and mark large pieces without using your tape measure every time. This can help reduce measuring mistakes.



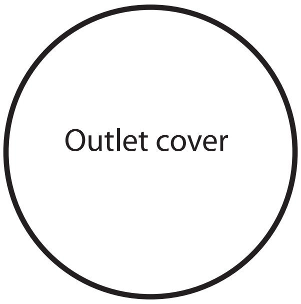
Using a story stick to set the compass for marking the hole for the inlet opening.



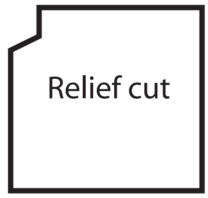
Using a story stick to mark the length of the inlet strip.

Patterns

Think about making patterns for some of the smaller pieces of the silo. This can save time when drawing on the sheets before cutting. You can use wood, plastic, cardboard, heavy paper or scrap metal. Make the patterns carefully. Label them clearly. Write the name of the piece and the size of the silo. Keep patterns for each size of silo together.



A pattern for marking the size of the outlet opening hole



A metal pattern for marking the relief cut at each corner of the body sheets

A metal pattern for drawing large circles if no large compass can be found

Waste and Recycling

Sweep your workspace often and save the extra metal. Put the small pieces in a bucket. Maybe you can sell them to the metal recycler. Put aside any large scraps for yourself. You can use them to make repairs to damaged silos. You can use them to make other small projects or try to sell them to another metalworker.

Improve the Workshop

Some simple improvements to your workshop may help you work faster and more comfortably. For example, if you are going to build many silos then maybe you will buy many sheets of metal at one time. You can build a rack to store the sheets so they don't get in your way or become damaged.

Supplies and Equipment

Here is a list of all of the things that you need to build a silo. You also need a place to work and a bench to work on. The following pages show what everything looks like.

Tools

Common tools

Most of these tools can be found at the hardware dealer.

One square, 25 cm or more
One tape measure, at least 3 m with a hook at the zero point
One pair of pliers, 1 cm wide
One hammer with flat face, 300-400 g
One metal working chisel, 1.5 cm wide
One pair of metal cutting shears, Number12. These must be good quality.
One wire brush
One small acid brush
One large, flat screw driver
One paint brush, about 5 cm wide
Two small clamps, minimum opening 6 cm
Two or three soldering irons with copper heads, 500-750 g
One small charcoal heater for the soldering irons
A pair of gloves and a brush to sweep away small scraps to protect your hands.
Some kind of glasses, goggles or visor to protect your eyes.

Special tools

A carpenter or metal worker can make some of these tools. You can make some of the tools yourself.

One large compass or set of trammels able to open 65 cm
A smaller compass for drawing the small circles will be useful, too.
One wooden mallet
One bending tool
One counterblow
One marking gauge

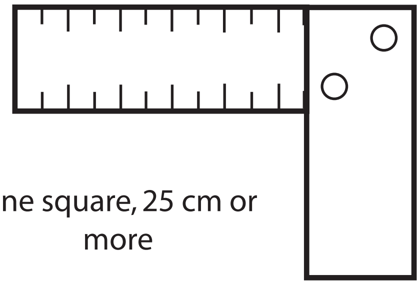
One simple box to hold all of the small tools.

Materials

Galvanised steel sheets, 0.5 mm (26 gauge). The number needed depends on the silo you plan to build.
Solder, the best is 50%lead/ 50%tin
Hydrochloric or muriatic acid 10% Concentration
Flux such as rosin or sal ammoniac (ammonium chloride)
Paint, never use lead based paint!
Soap powder and rags
Charcoal

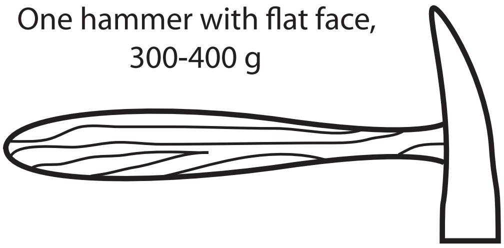
Common Tools

Most of these tools can be found at the hardware dealer.

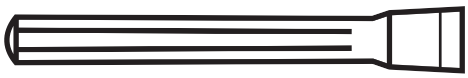


One square, 25 cm or more

One hammer with flat face, 300-400 g

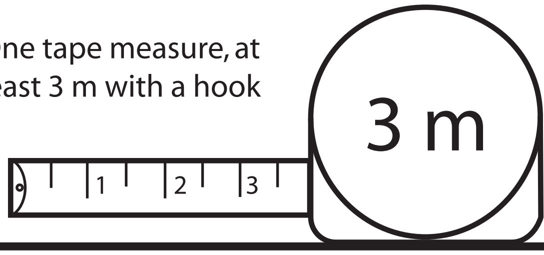


One metal-working chisel, 1.5 cm wide

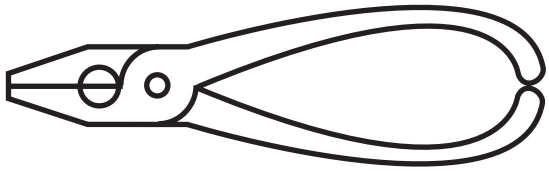


Pencil

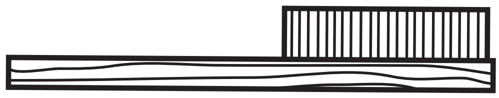
One tape measure, at least 3 m with a hook



One pair of pliers, 1 cm wide

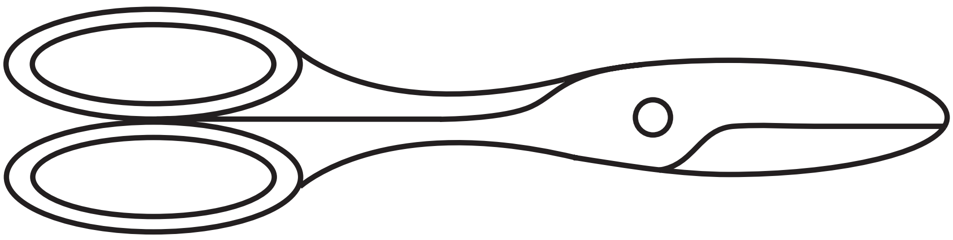


One wire brush

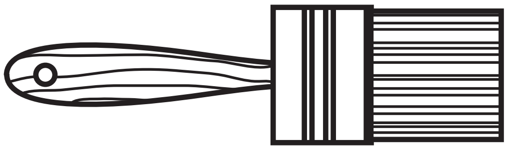


Two or three soldering irons with copper heads, 500-750 g

One pair of metal-cutting shears. These must be good quality!

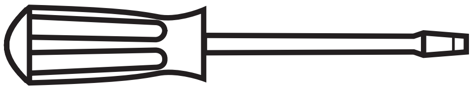


One paint brush, about 5 cm wide

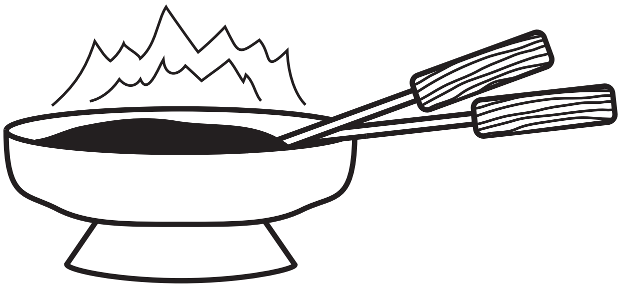


One small acid brush

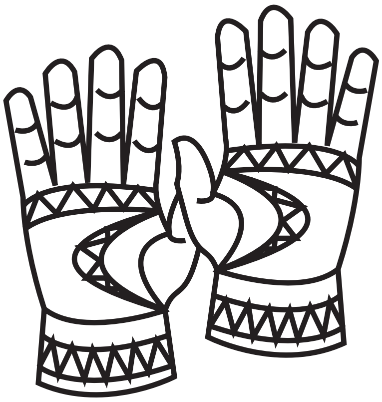
One large, flat screwdriver



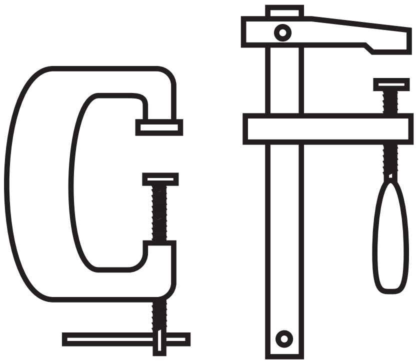
One small heater for the soldering irons, either for gas or charcoal



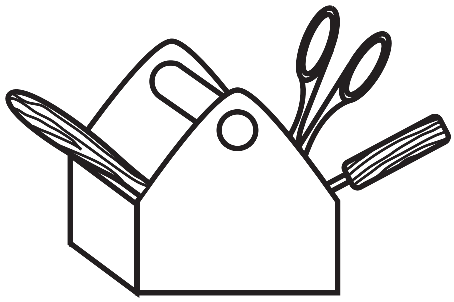
One pair of gloves to protect your hands.



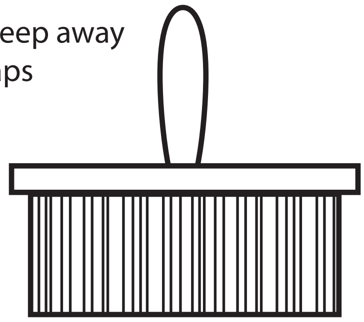
Two small clamps, minimum opening 6 cm



One simple tool box to hold all of the small tools.



One brush to sweep away small scraps

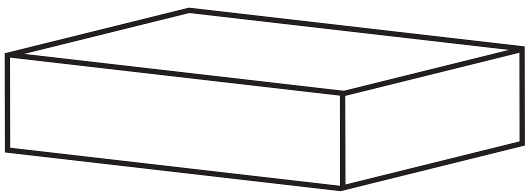


Some kind of glasses or goggles to protect your eyes.

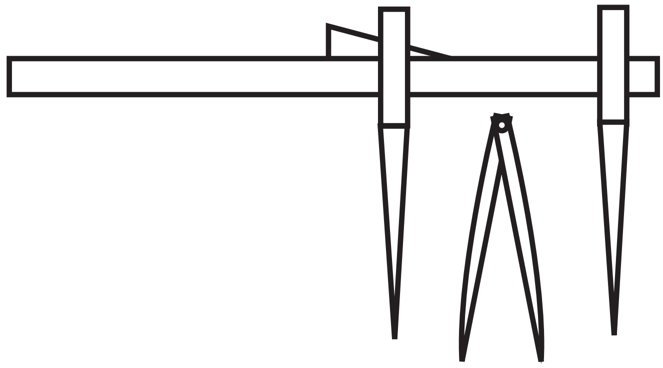
Special Tools

A carpenter or metal worker can make some of these tools. You can make some of the tools yourself.

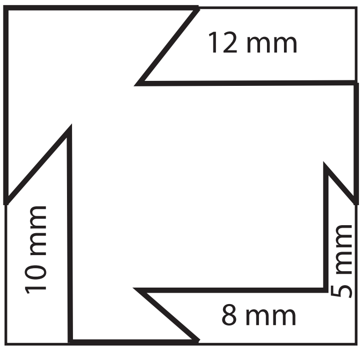
One counterblow
This is a heavy piece of metal, about 500 g. It could be something like an old cast iron clothes iron or an old sledge hammer head.



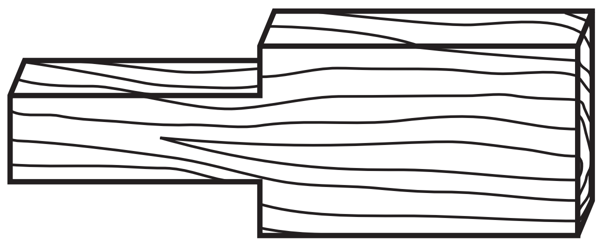
One large compass able to open 65 cm.
A small compass will be useful, too.



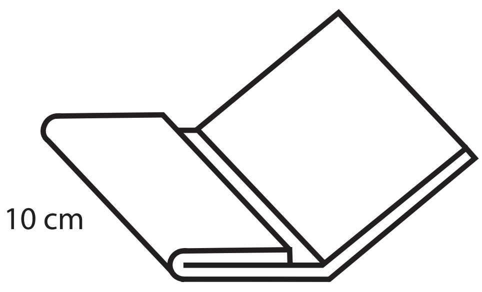
One marking gauge.
The measurements must be accurate.



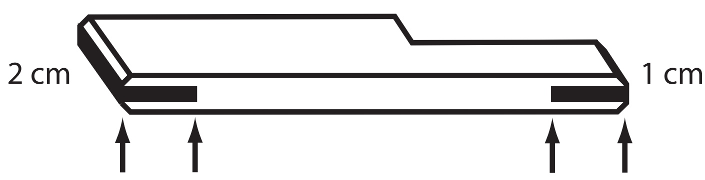
One wooden mallet
Use a piece of scrap wood, about 5 cm x 10 cm x 30 cm. Make a 10 cm handle at one end.



One spacer piece
This is a piece of the same metal used for making the silo. Fold one edge over.



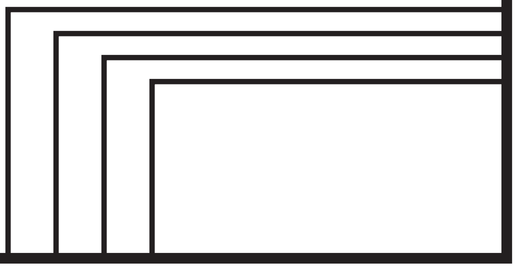
One bending tool
This is a small piece of metal bar, about 2 cm wide, 0.5 cm thick and 5-10 cm long. It has a cut in each end. The cuts must be 8 mm deep. This measurement is important.



Materials

Materials are the things you consume when you build a silo. The amounts needed for a 100 kg silo and a 1800 kg silo are listed.

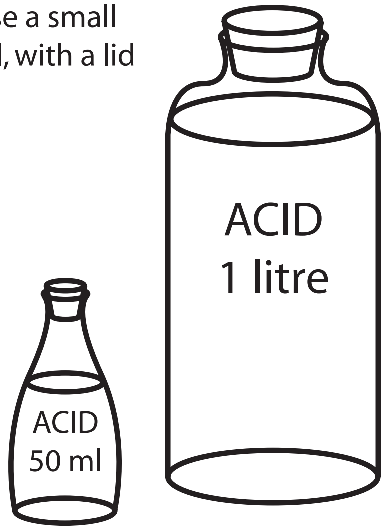
Galvanised steel sheets, 0.5 mm (26 gauge)
(1 - 6 sheets / silo)
Be careful when moving and storing the sheets that they don't become damaged. Any scratches in the zinc coating will have to be painted to prevent rust.



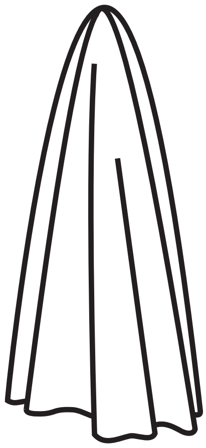
Solder, stick or roll. The best is 50% tin / 50% lead
(300g - 1 kg / silo)

Flux such as rosin or sal ammoniac (ammonium chloride).
(20 - 50g / silo)

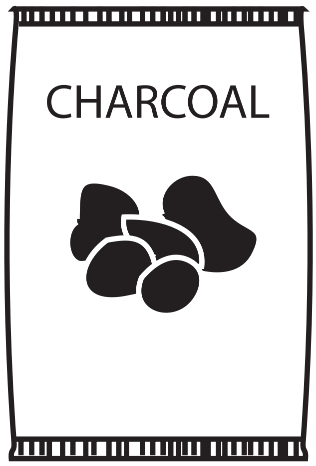
Hydrochloric or muriatic acid 10% Concentration. Do not use the acid directly from the one litre bottle. Use a small glass jar, 50-100 ml, with a lid or stopper.
(20 - 50 ml / silo)



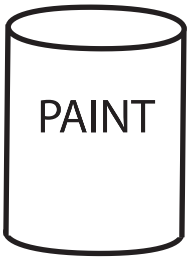
Soap powder and rags.



Charcoal for heating the soldering irons.
(2 - 6 kg / silo)

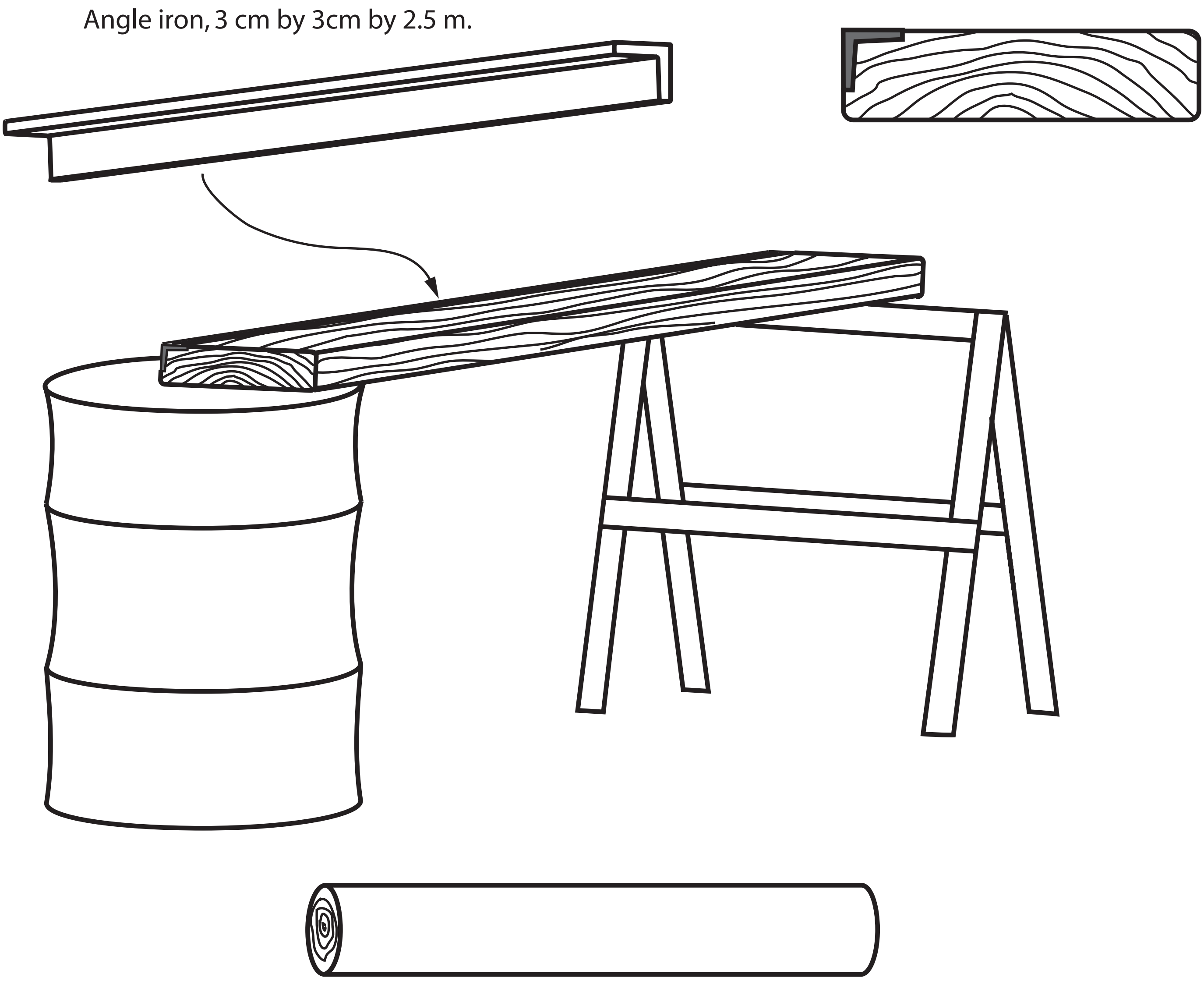


Anti-rust paint,
never use lead based paint!
(80 - 250 ml / silo)



Bench

At the very least, you need a simple bench. You can make the one shown in the drawing. One edge of the wooden plank is covered with a piece of angle iron.
Wooden plank, 5 cm x 25 cm x 2.5 m long.
Wooden log, 10 cm diameter x 1 m.
One piece of angle iron, 3 cm x 3 cm x 2.5 m.
Two barrels or sawhorses, about 80 cm high.
If you have a good, sturdy worktable then you can attach the angle iron to the table.



Workshop

The work space can be very simple. In order to build the largest silos, a workshop should be at least 2.5 m by 5 m. It should have a hard floor; the best is cement. A small table for your tools will be useful.
Your workshop must be secure. Your tools are valuable and are the key to your livelihood. If you can't lock them safely then bring them home.

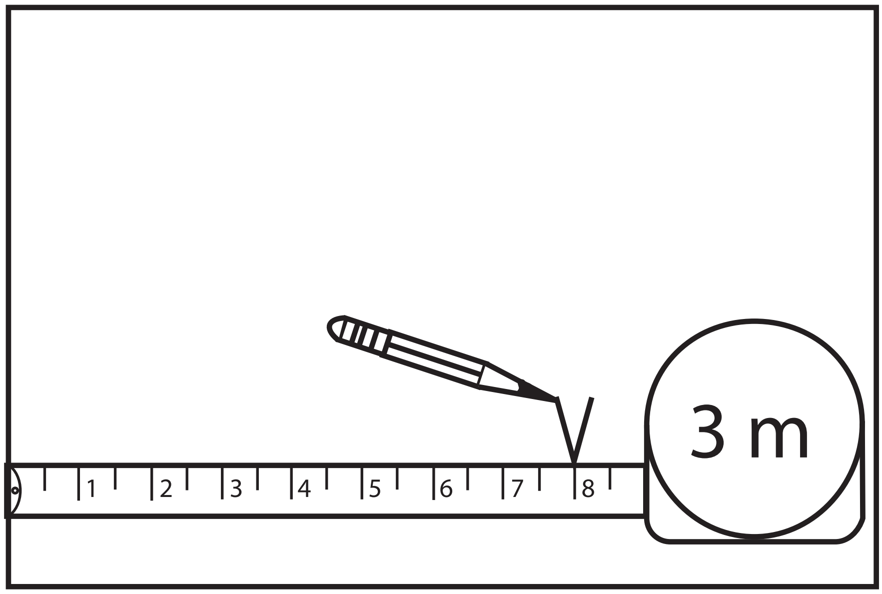
Basic Skills

These are skills that you will use at almost every step of the process of making a silo.

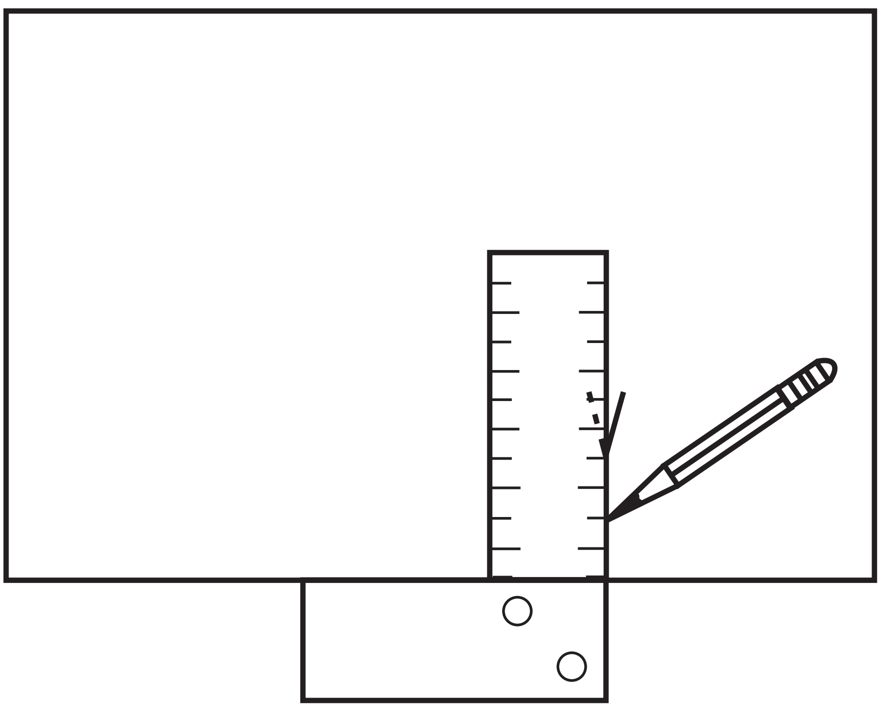
Measuring and Marking

Careful measuring is very important. This section explains how to use the measuring and marking tools.

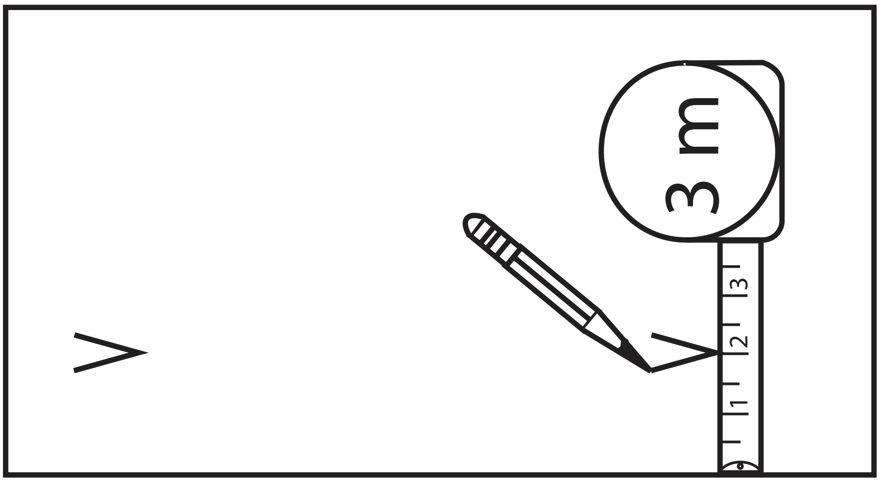
The tape measure has a hook at the end. Put the hook on the edge of the sheet and make a V-shaped mark with the point of the V at your measurement. Hold the tape parallel to the edge that you are measuring along. Here you see a mark at 8 cm.



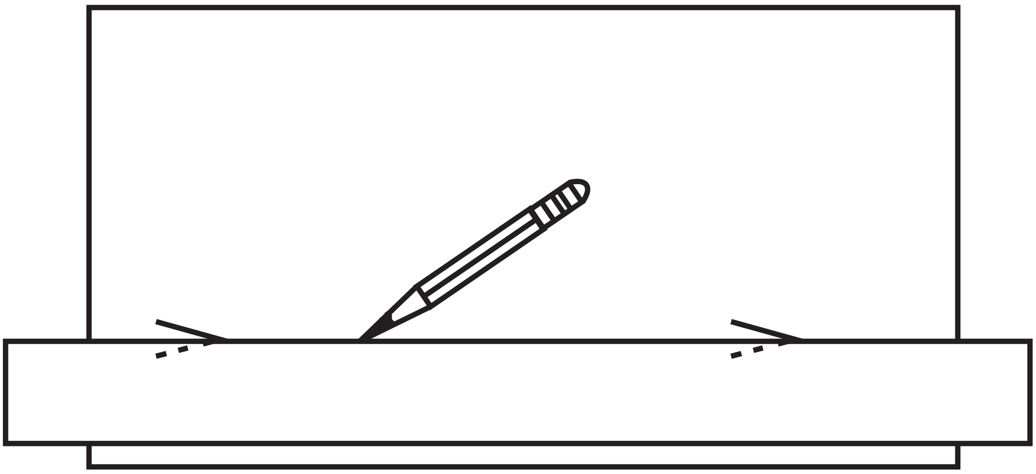
The square makes marks 90 degrees to the edge of the sheet. Use it to mark short lines. Put the stock of the square along the edge of the sheet and put the blade at the point of the V mark that you made with the tape measure.



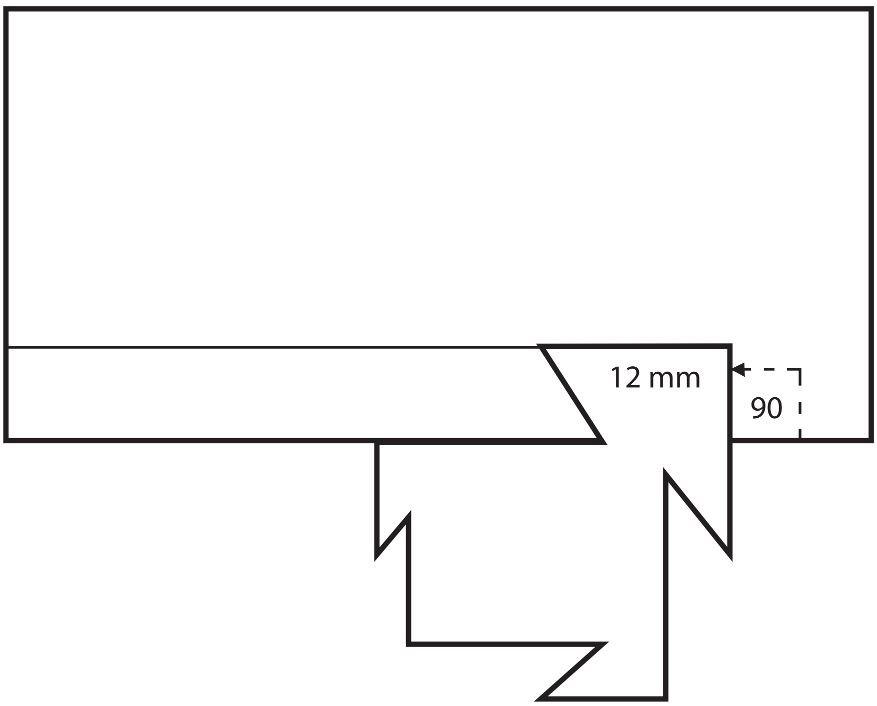
You need two marks to draw a long line. Here the tape measure is used to make two marks 2 cm from the edge of the sheet.



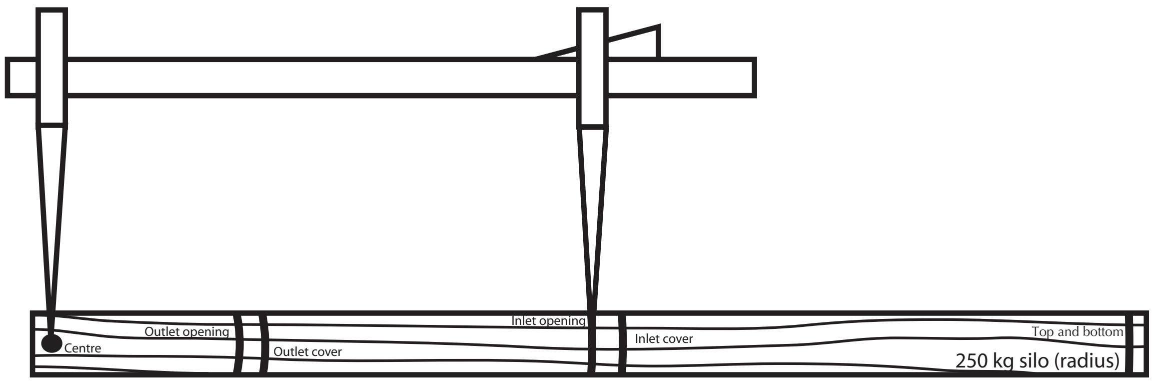
Use a straight edge to connect the marks.

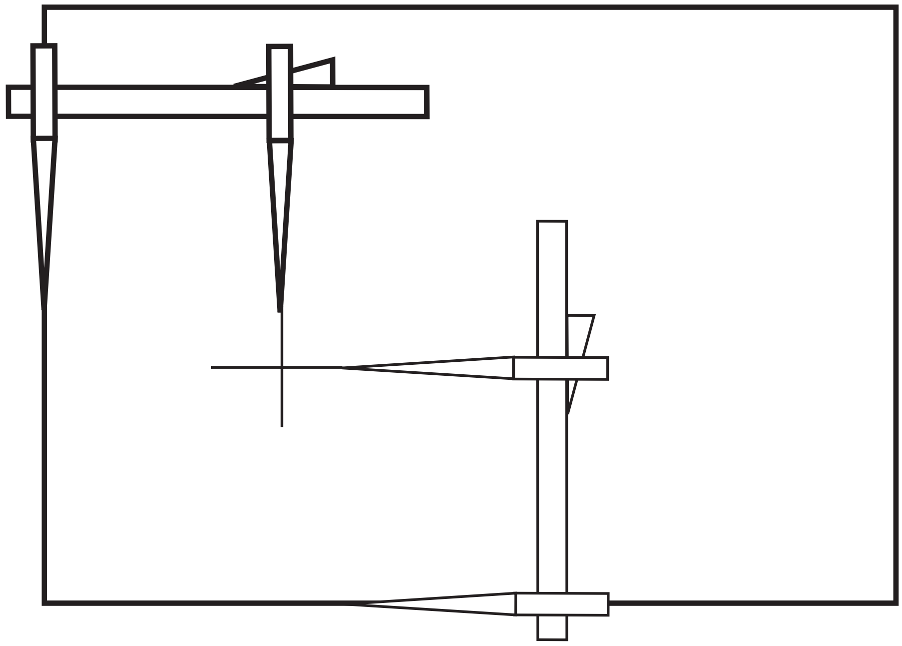


The marking gauge scratches a line parallel to the edge of the sheet. Here the gauge is used to make a line 12 mm from the edge. Hold the marking gauge 90 degrees to the edge of the sheet.

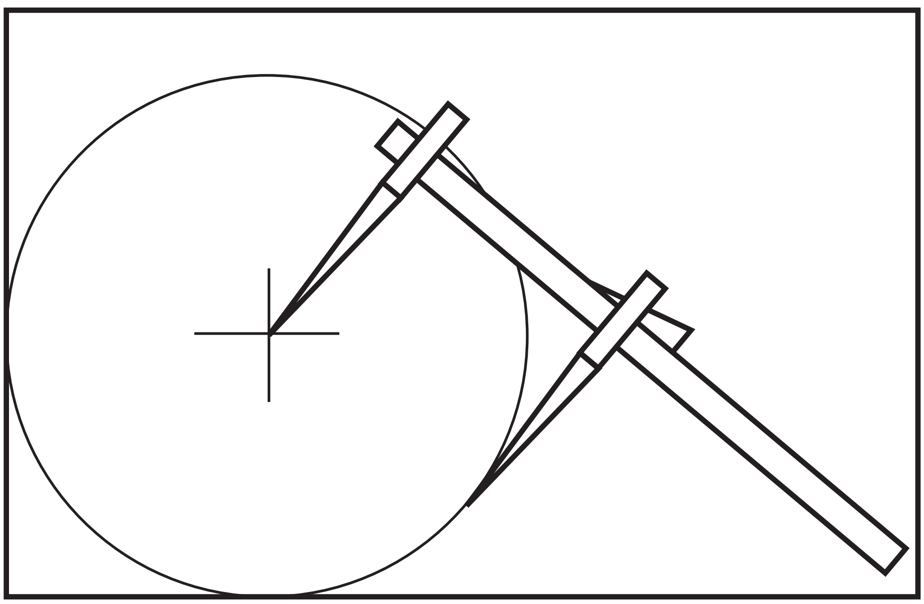


The compass makes all of the circles. To measure the opening of the points of the compass, use the story stick and adjust the compass to the mark.





When the measurement is set, use the compass as shown in the illustration to find where to place the centre point of the circle. Don't scratch too hard or you will damage the galvanisation.

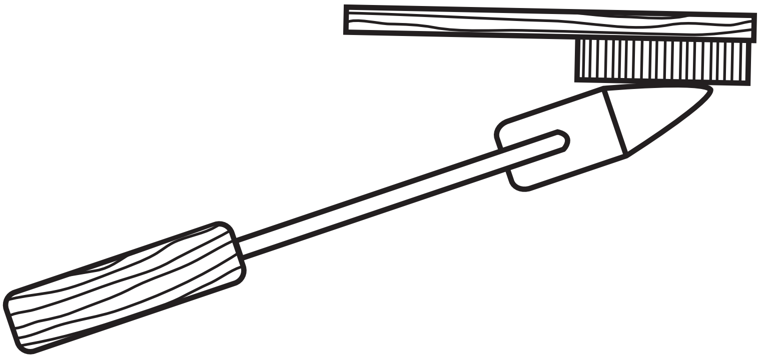


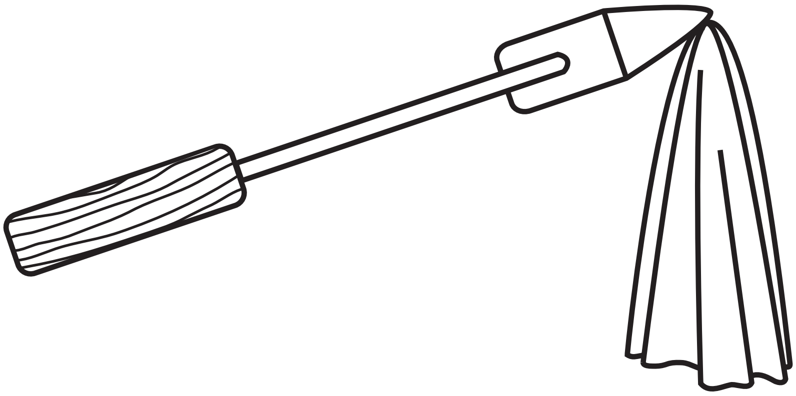
Draw the circle.

Soldering

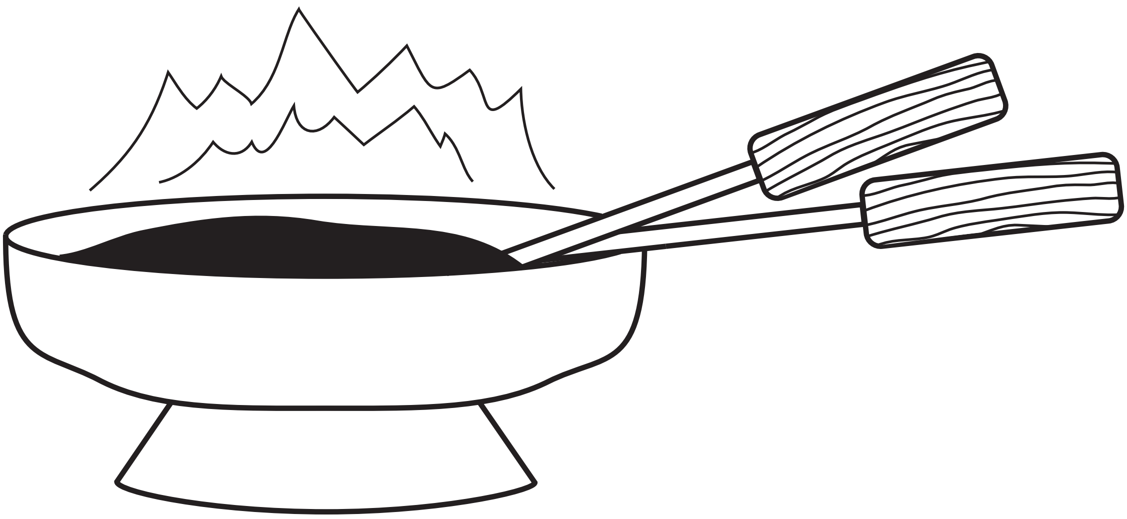
Soldering is another very important part of this process. Learning to solder well and quickly will save time, solder and charcoal. It will also help you make good quality silos that last for a long time.

First you must prepare the soldering irons. The face of the iron that you will use for soldering must be cleaned and coated with tin. Begin by scrubbing the face of the iron with the wire brush. Wipe the iron with a rag.

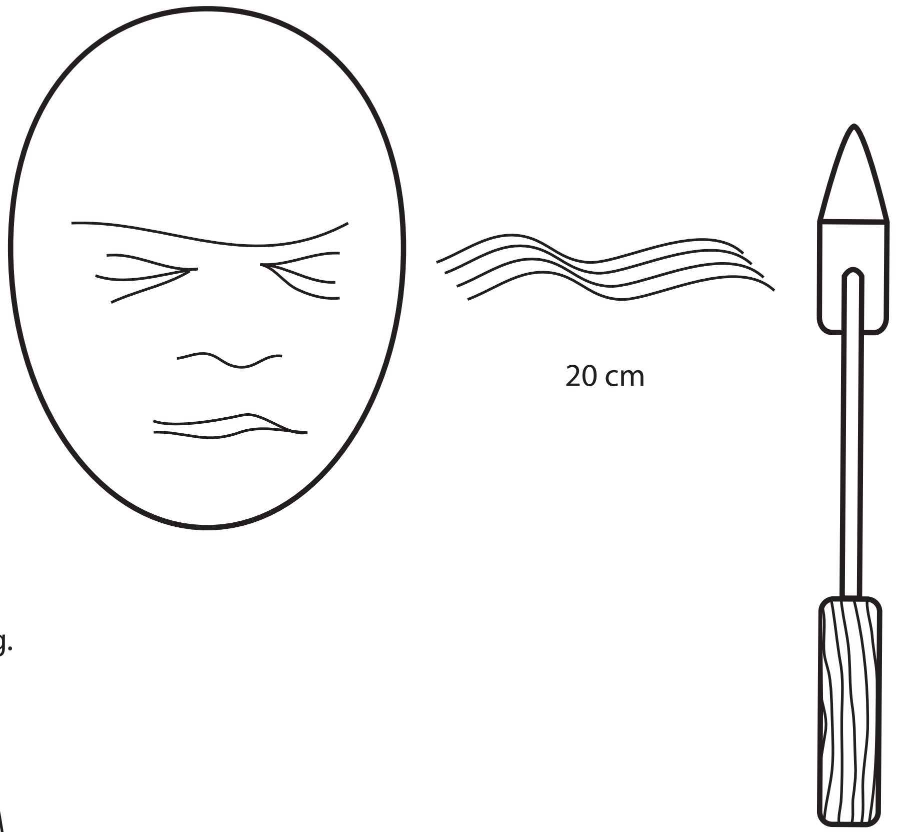




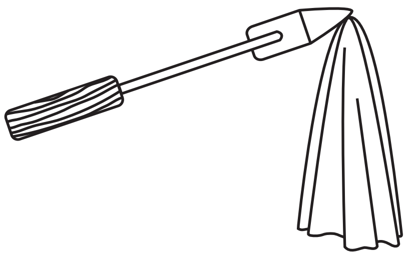
Heat the irons in the fire. When you heat the irons for soldering they should never glow red hot. This will damage the copper and waste time and charcoal.



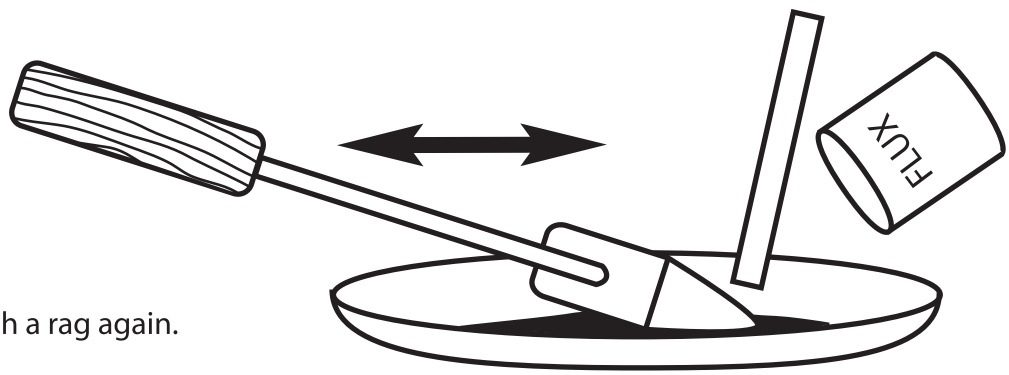
Remove one of the irons to see if it is hot enough. It is ready when it is uncomfortable to hold 20 cm from your face.



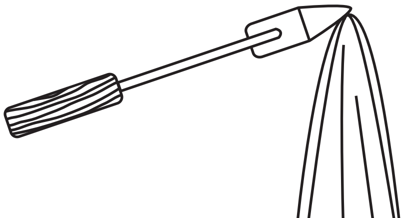
Wipe the iron with a rag.



Rub the face of the hot iron in a shallow metal dish. If you are using resin then also add a little fine sand. Ammonium chloride is more corrosive than resin. It will cause the copper in the irons to deteriorate faster. Avoid breathing the vapours.



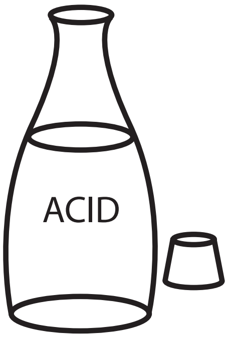
Wipe the iron with a rag again.

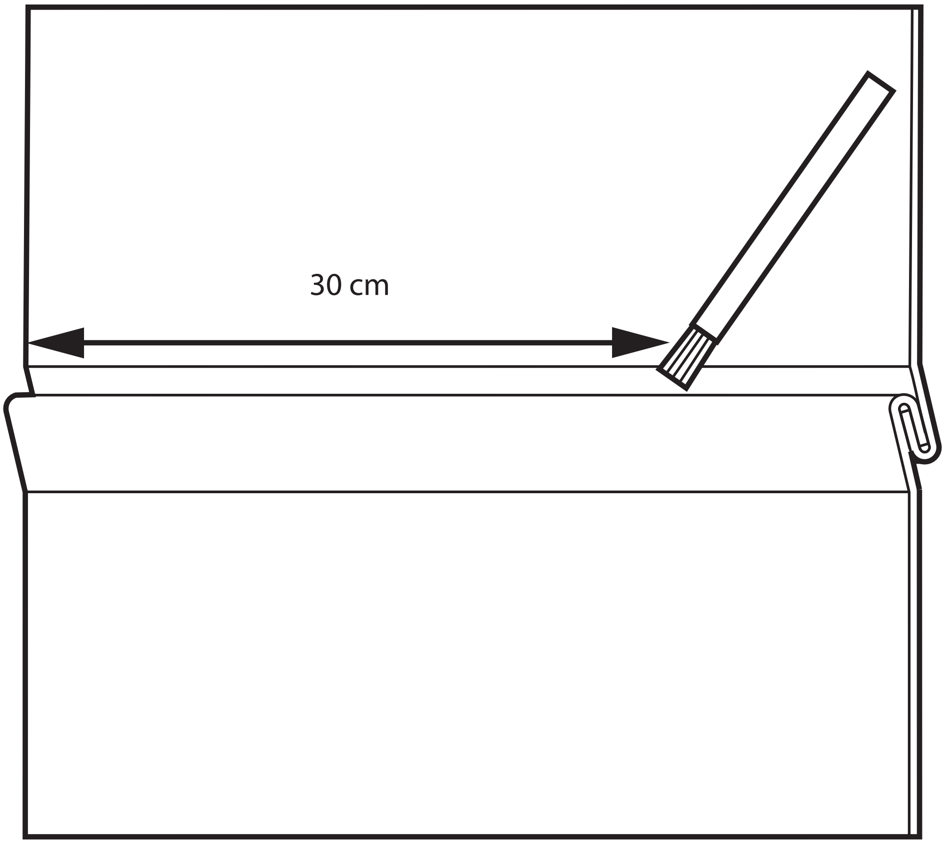


Apply a little acid to clean the joint just before soldering.

For long joints, only apply the acid for about 30 cm at one time.

Be careful not to spread the acid on other parts of the metal.

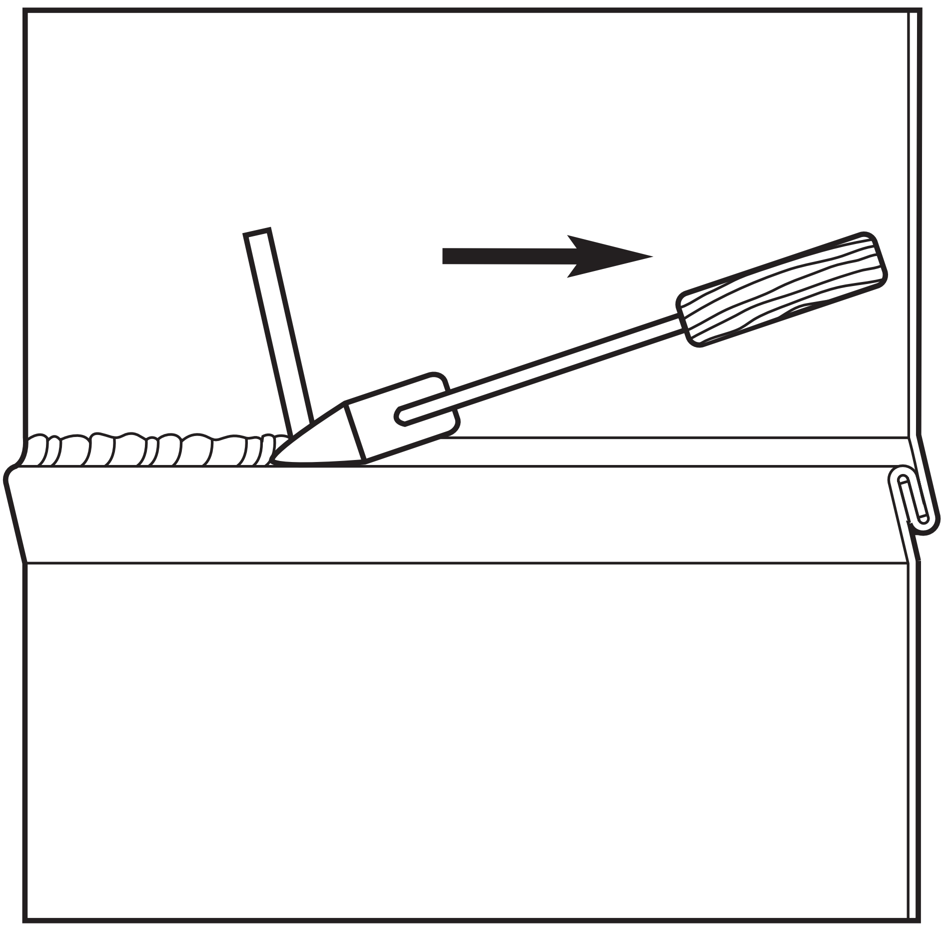


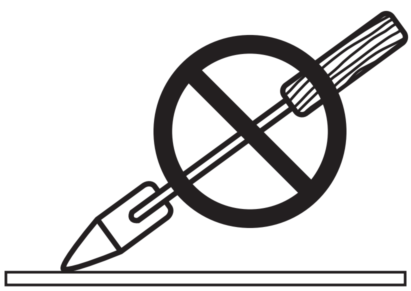


Use the clean face of the iron to melt solder into the joint. Hold the whole face of the iron on the joint.

Drag the iron slowly along while melting solder from the bar. If you see any holes, go back and fix them.

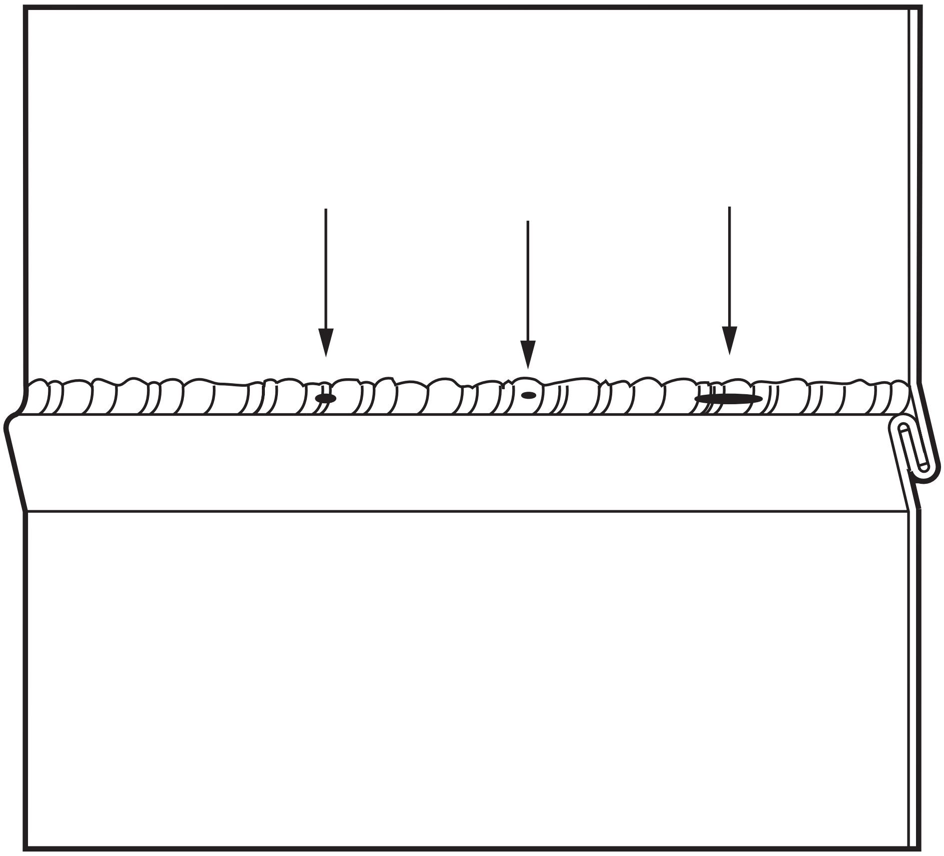
When the solder no longer melts easily, return the iron to the fire and use another one.

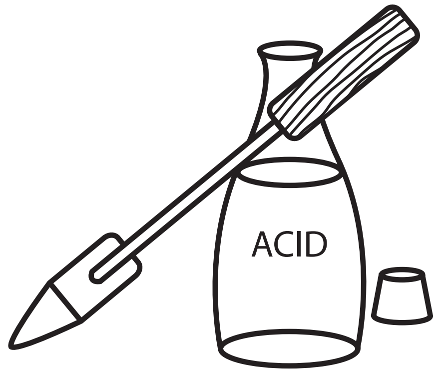




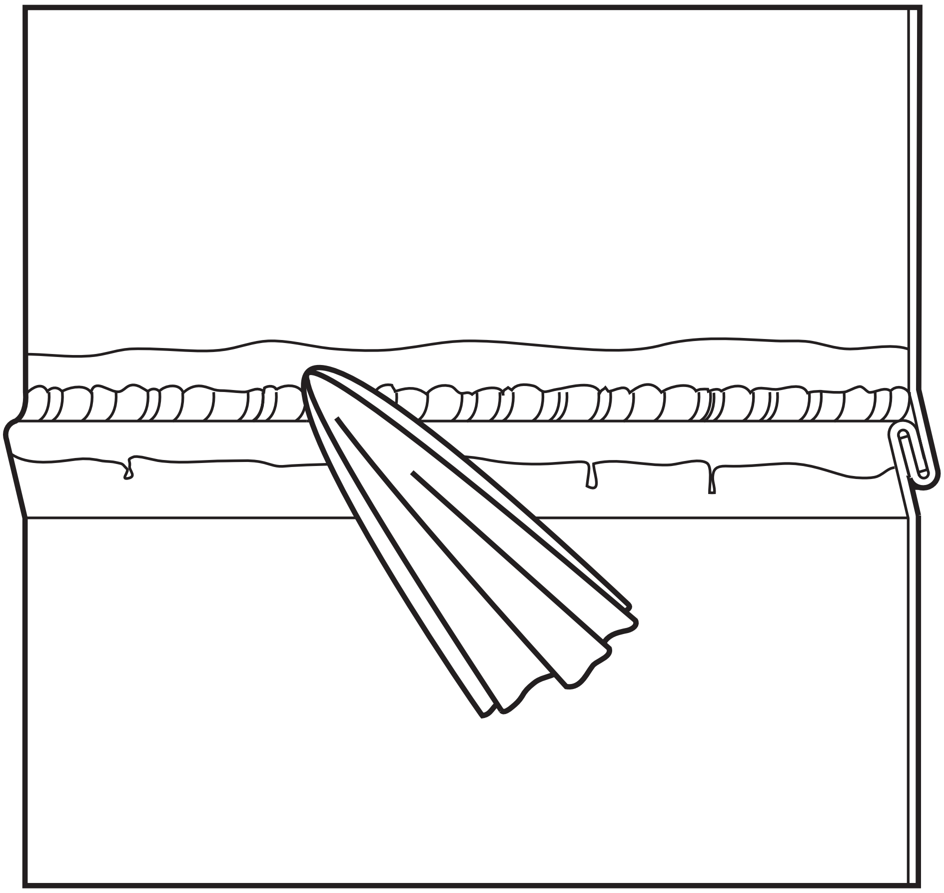
Use the whole face of the iron, not only the tip!

Check for holes along the whole joint. If you find any then fix them now. Apply a drop of acid at the spot and melt a little solder into the hole.





Use a rag with soap and water to clean the areas where the acid touched. Dry the area with a cloth.



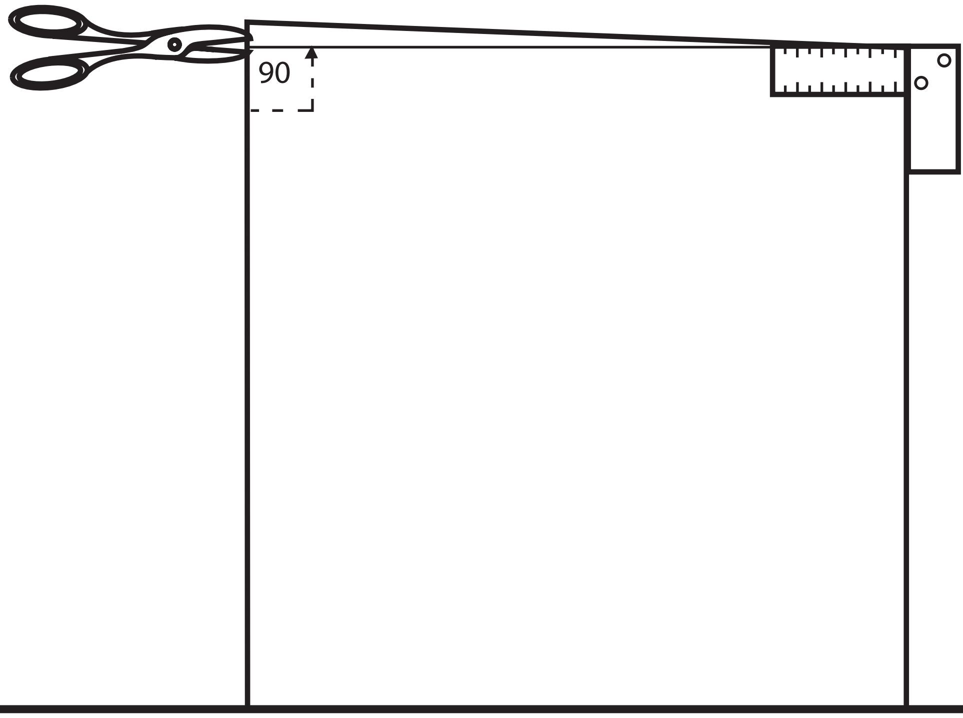
Building the Silo

Look through the manual before you start so that you understand the basic process.

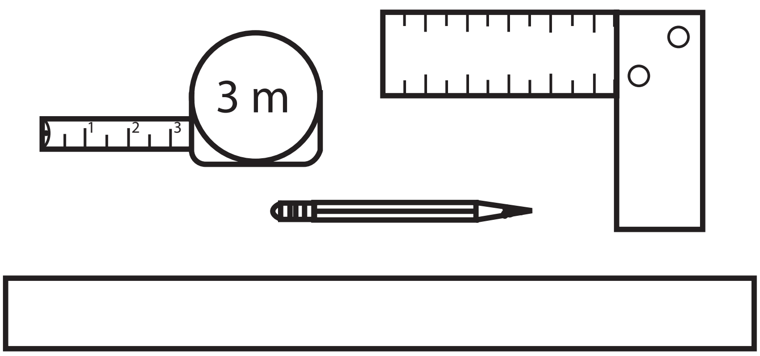
First Steps

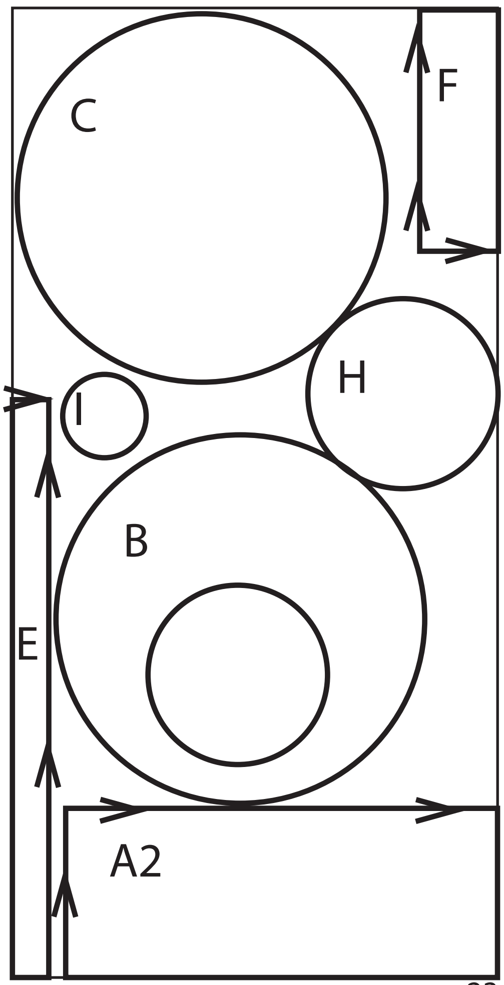
Before you start to build a silo you need to assemble all of your tools and materials. Clean your workspace.

Using the square, check that the corner angles of each sheet are 90 degrees. This is especially important for the sheets that will be used for the body of the silo. Cut off only the smallest amount necessary to make the end of the sheet square.

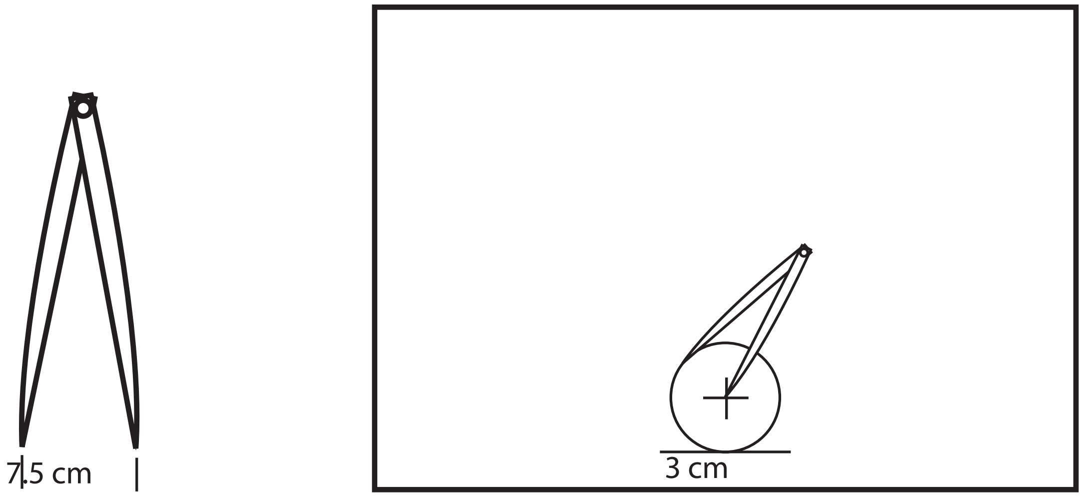


Using the measurement tools or patterns, mark the pieces for the body, openings and covers of the silo. Refer to the pages that show plans for the silo you want to build. Before starting to cut, be sure to write on each piece so you know which is which.

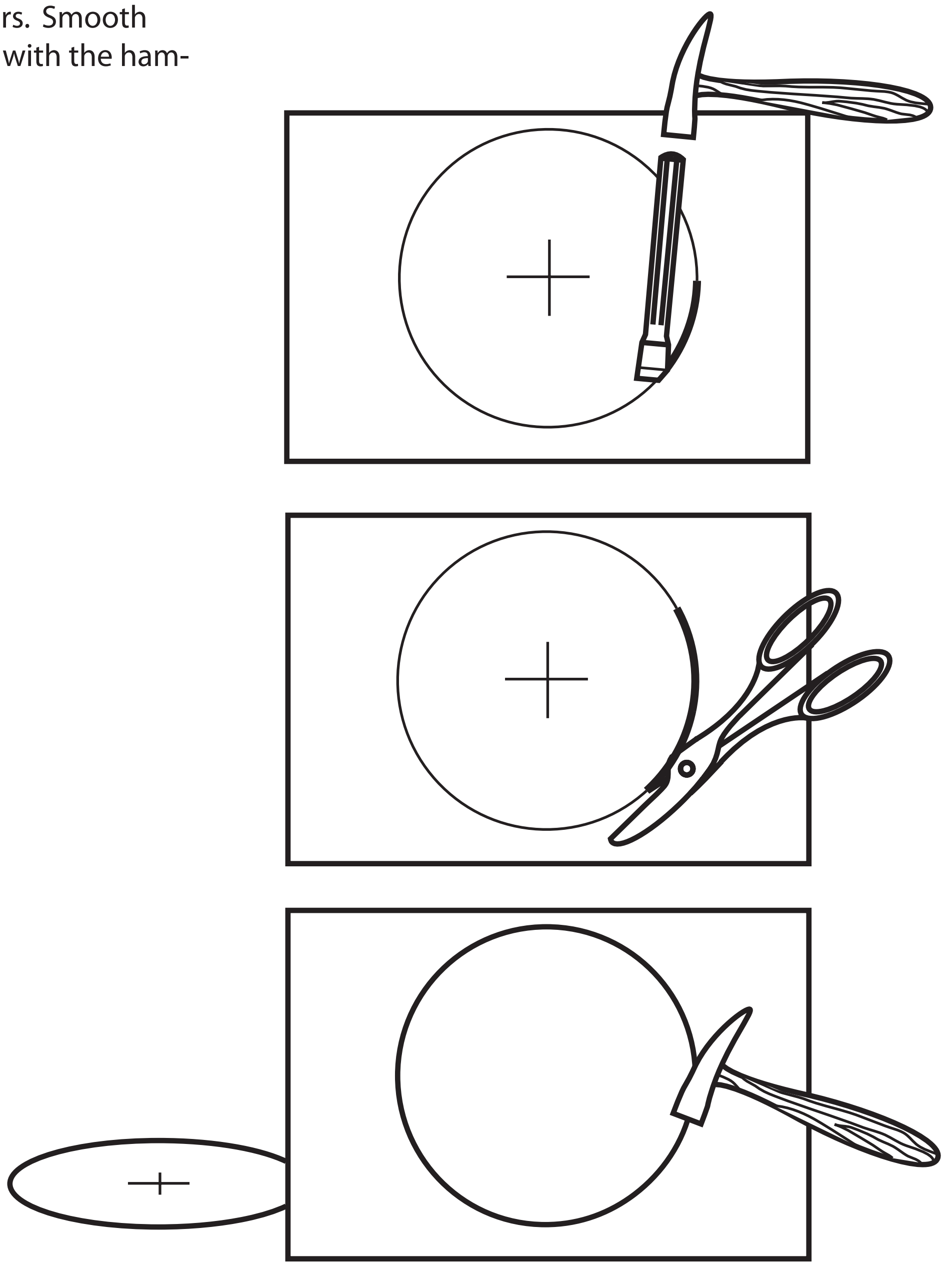




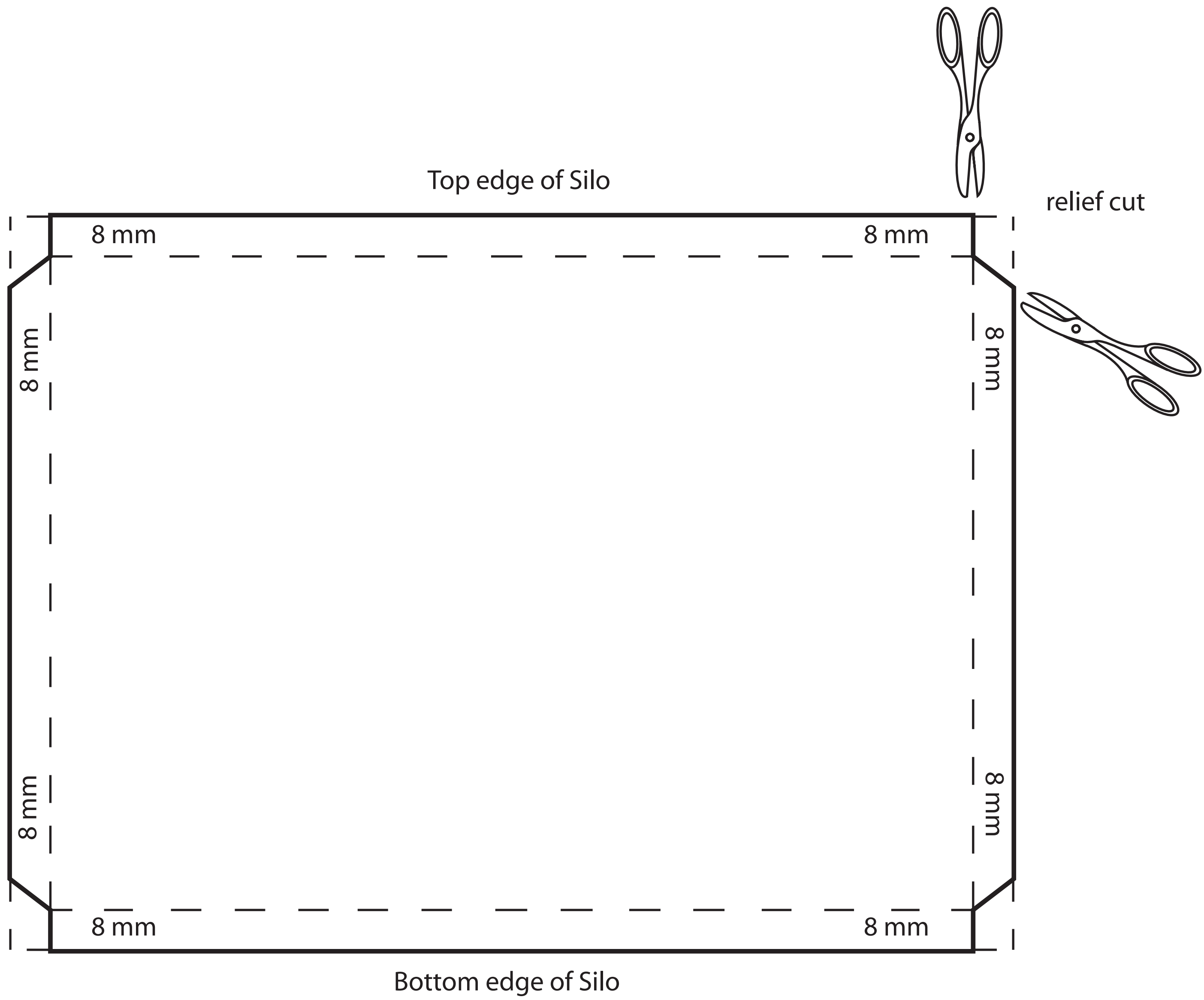
Cut the hole for the outlet opening in one of the body sheets. The edge of the hole must be 3 cm from the edge of the sheet.



Use the hammer and chisel to start the cut. Finish with the shears. Smooth the cut edge of the hole with the hammer on the bench.



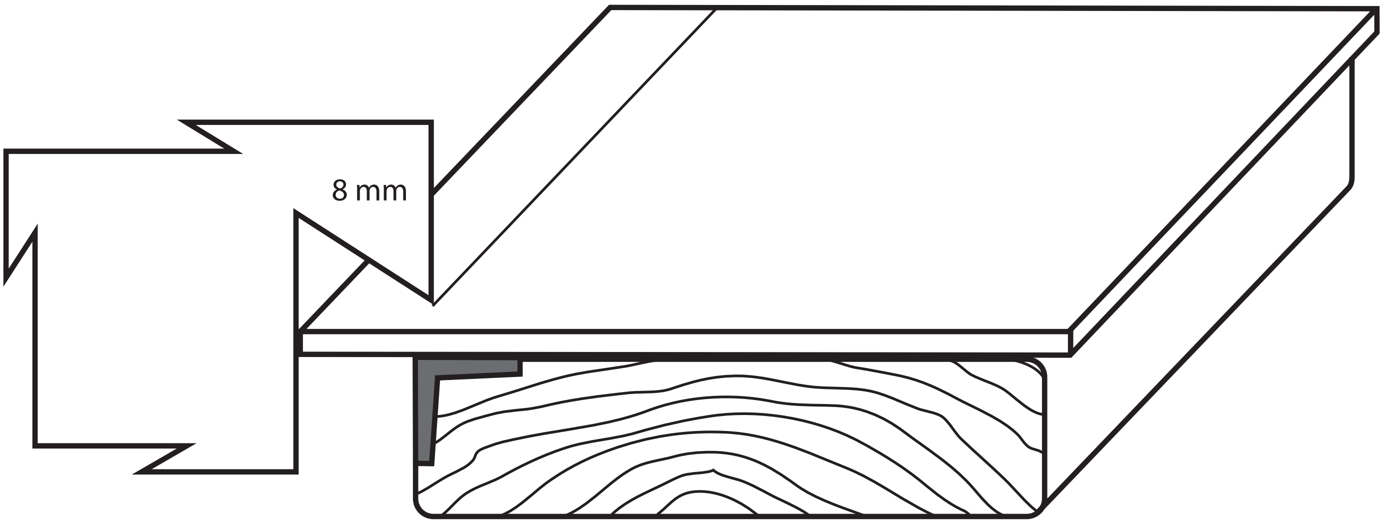
Make the relief cut at all four corners of the sheets that make the body. Make the square cuts on the edges that will join to the top and to the bottom. Make the angled cuts on the edges that will join to each other to make the body of the silo.



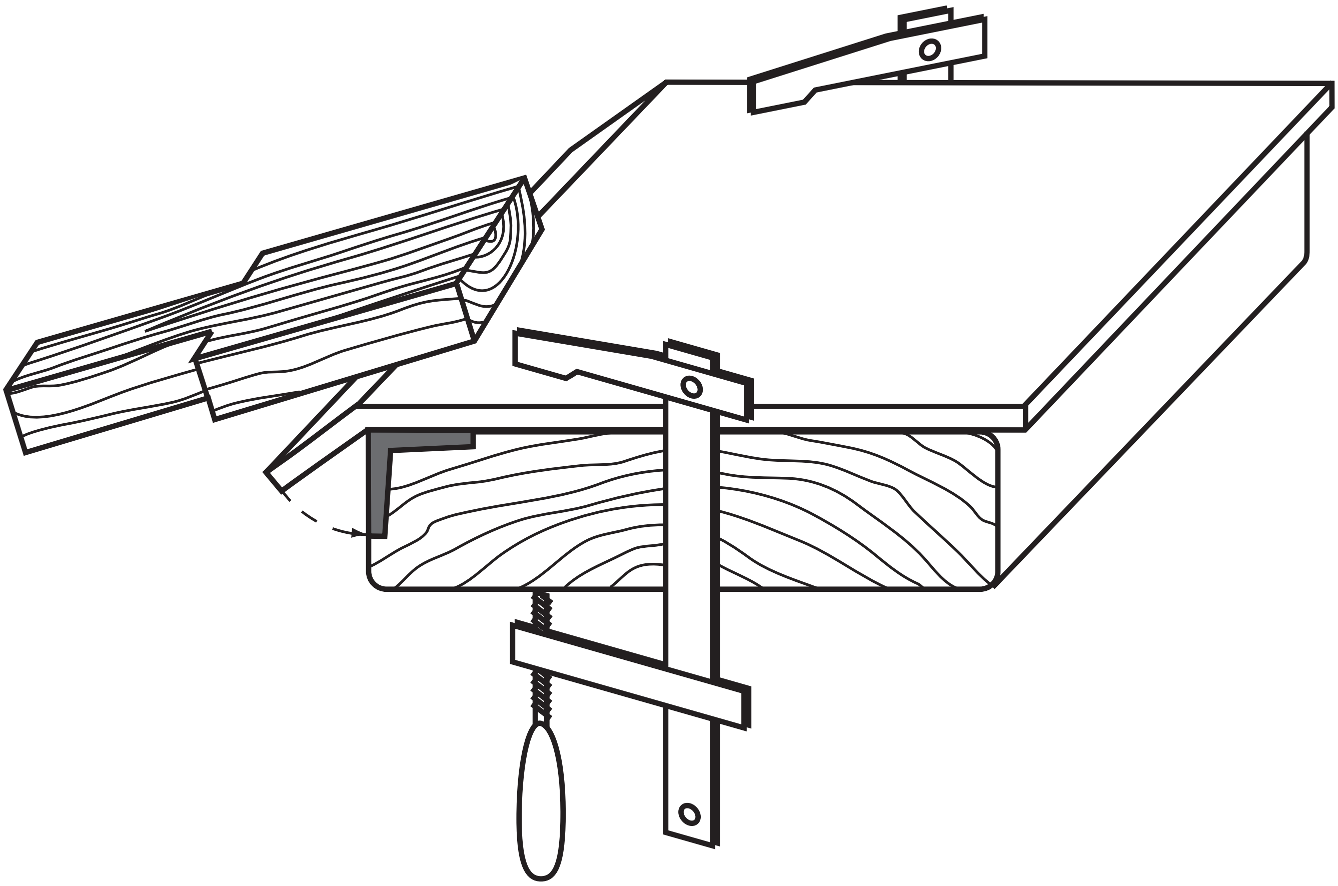
Forming the Body of the Silo Using the Seam Method

The seam method is used to join the sheets that make the body of the silo. Do this whole process on two opposite edges of every sheet so that they look exactly like the drawing.

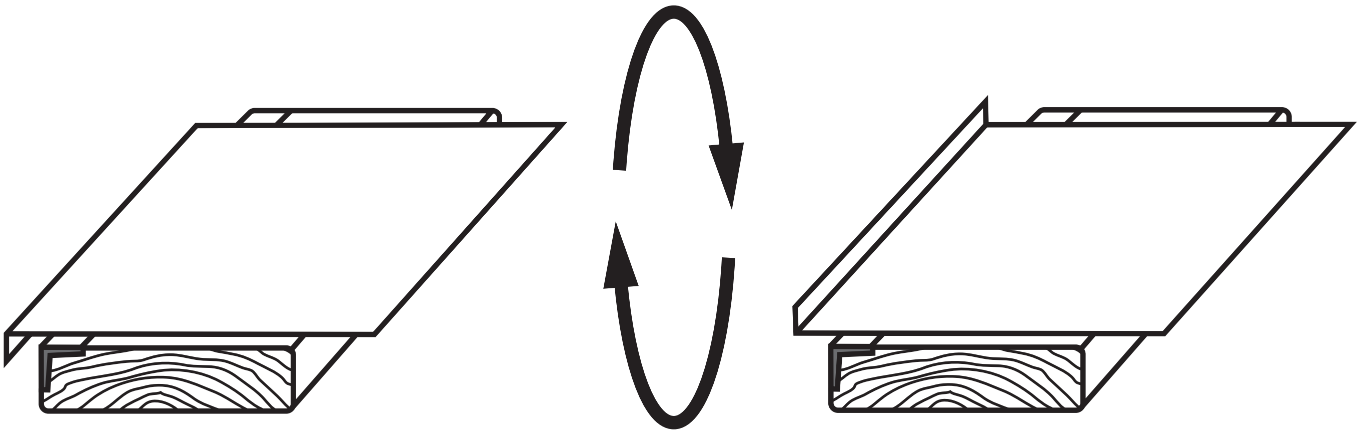
Use the marking gauge to make an 8 mm mark along the edge you are going to fold.



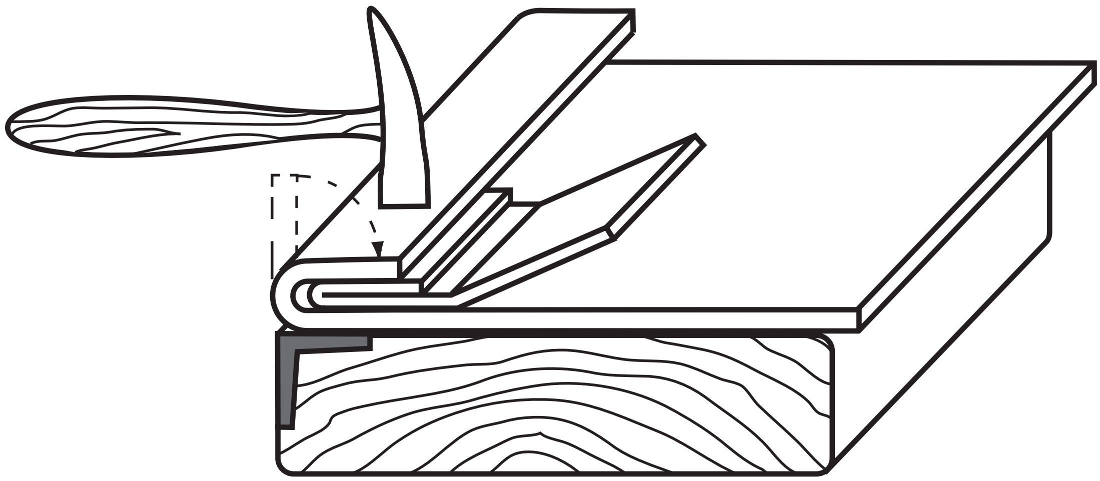
Use the wooden mallet and the edge of the bench with the angle iron to begin the fold.



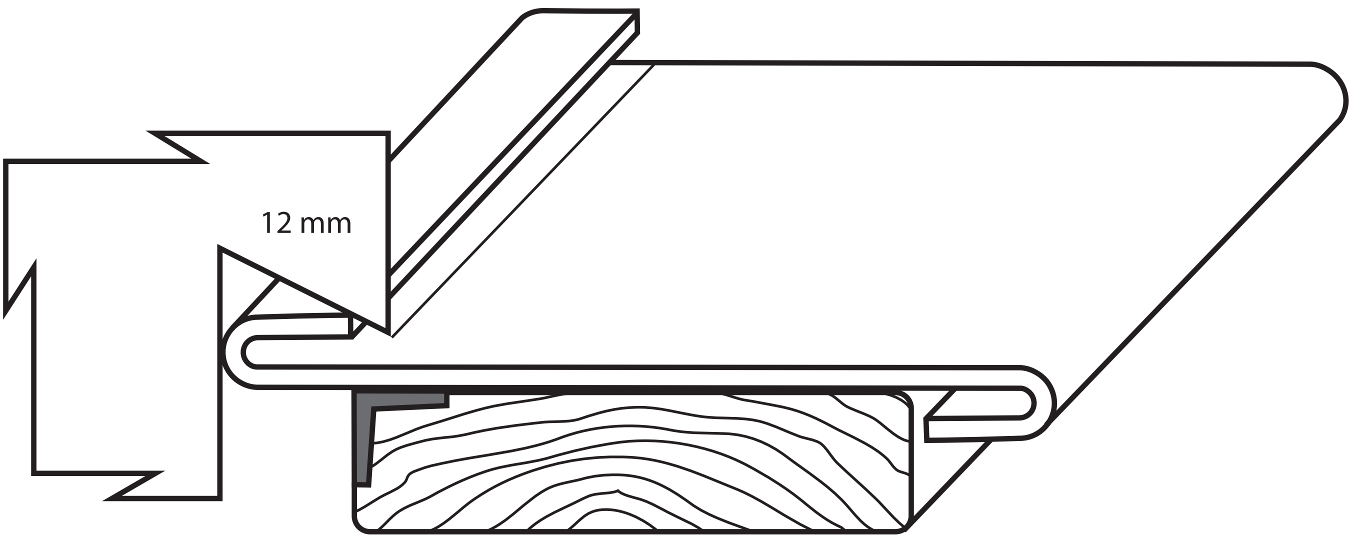
Turn the sheet over.



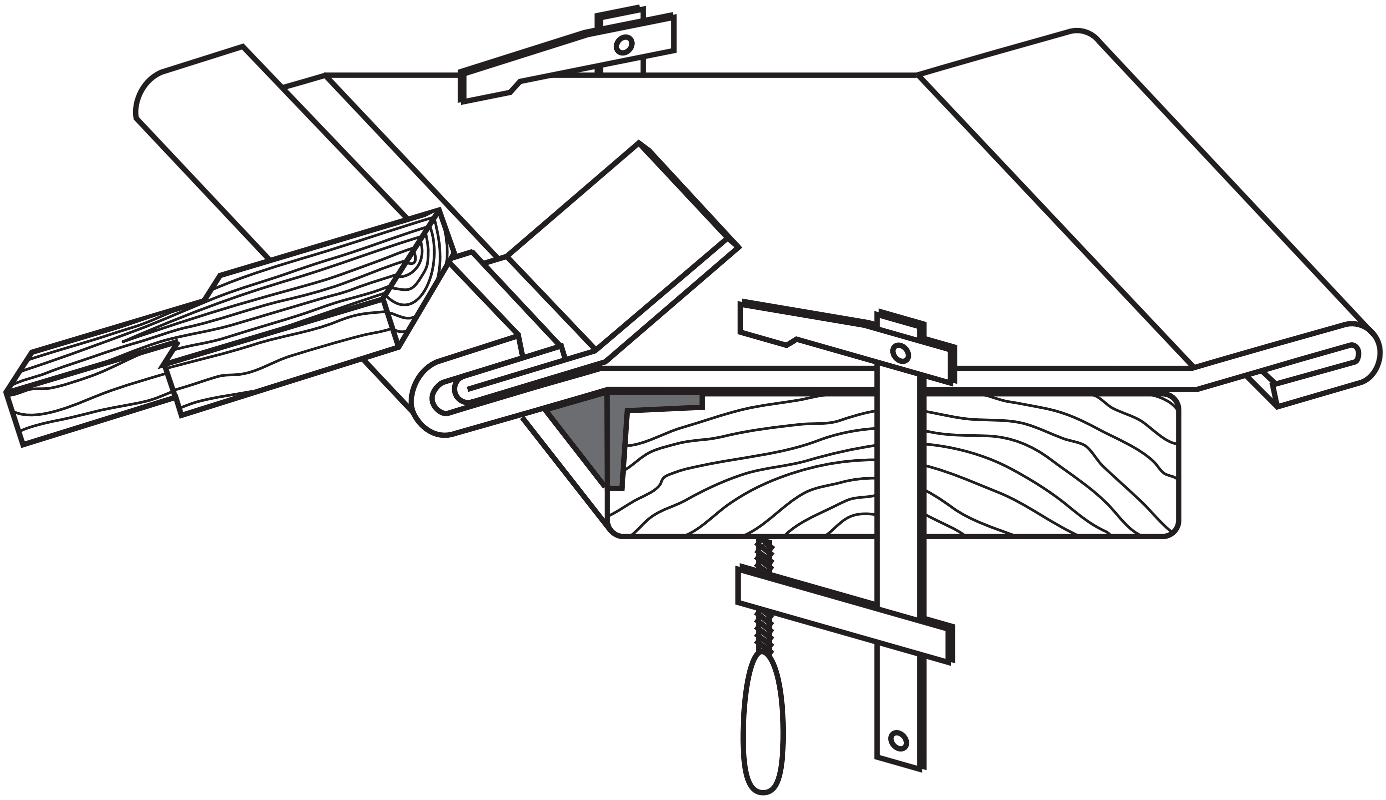
Use the spacer while you close the fold along the entire edge. At this point, the fold should be uniform and even.



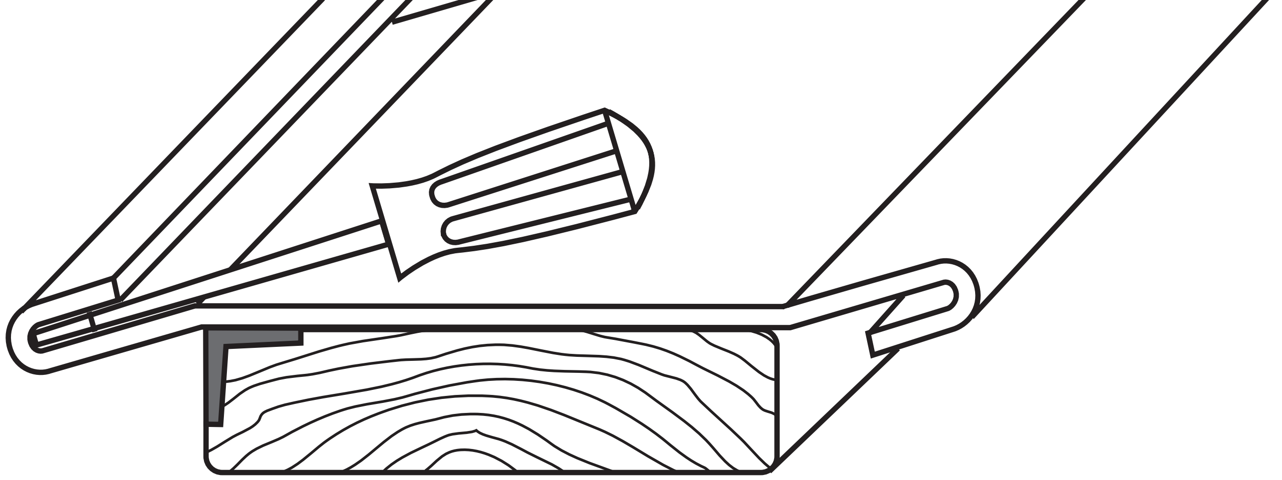
Now use the marking gauge to make a 12 mm mark on the same side of the sheet as the fold.



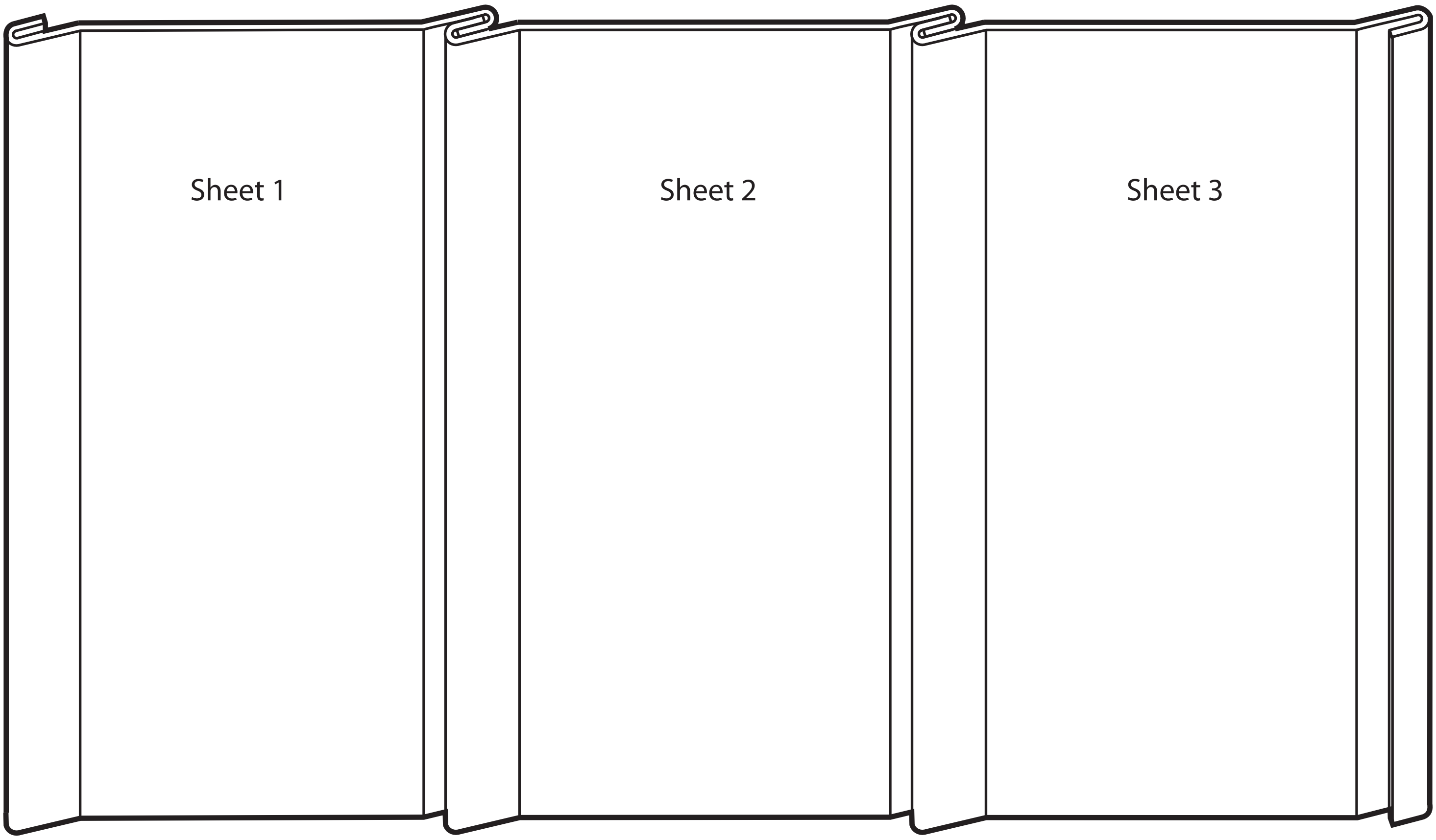
Use the spacer and the wooden mallet. Bend the edge to about 20 degrees on the bench. The edge must be bent away from the side with the fold.



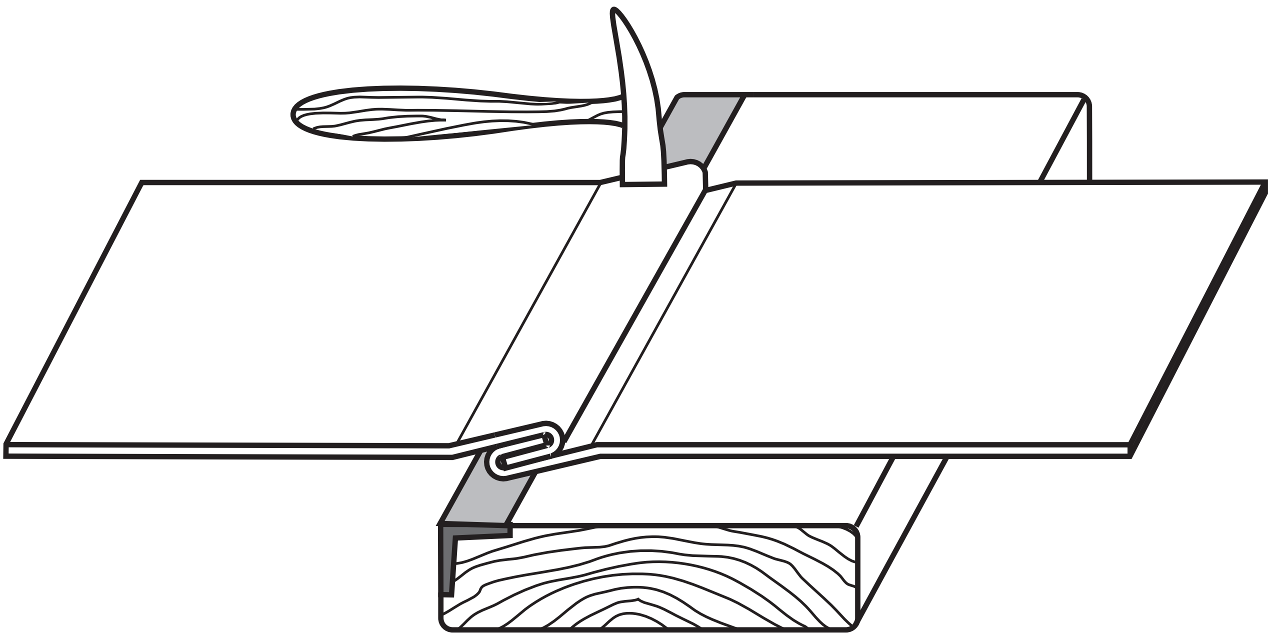
You may need to use the screwdriver to reopen the folded edge.



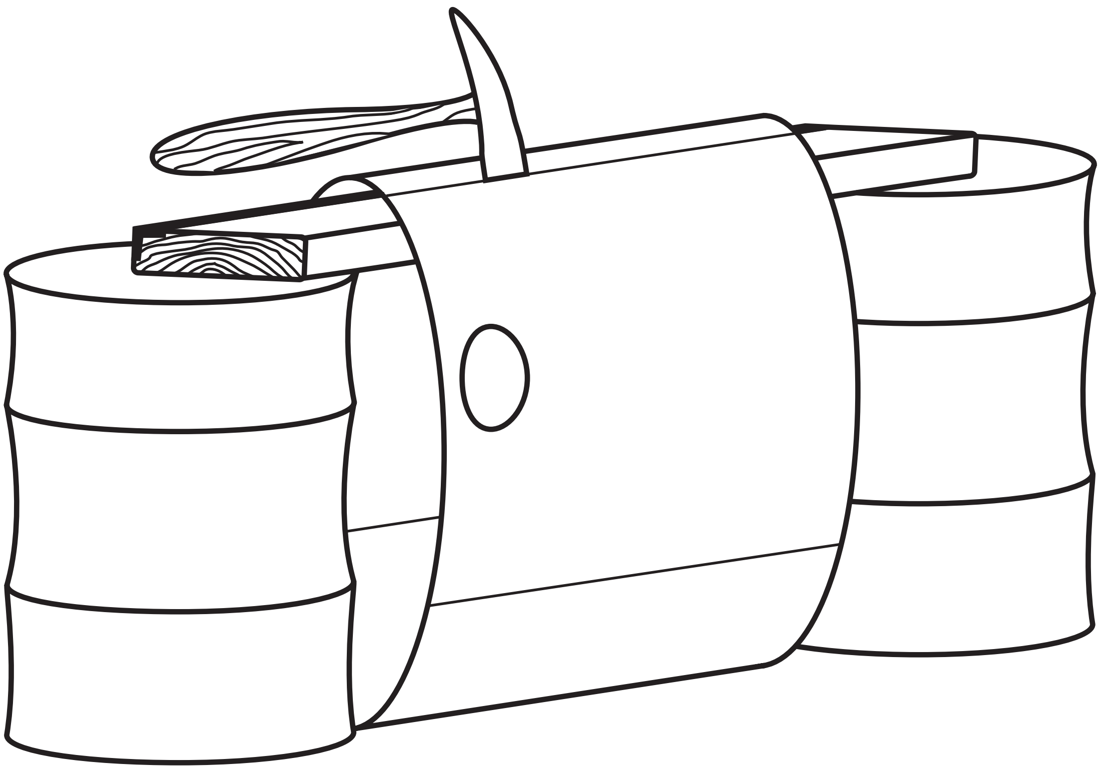
The body of the silo you are making may be made of more than one sheet. Fit the sheets together on the bench or on the floor. Lay the sheets out flat. This is very important. Make sure that the seam comes together along the entire edge of the sheet. Make sure that the top and bottom of the two sheets are well aligned.



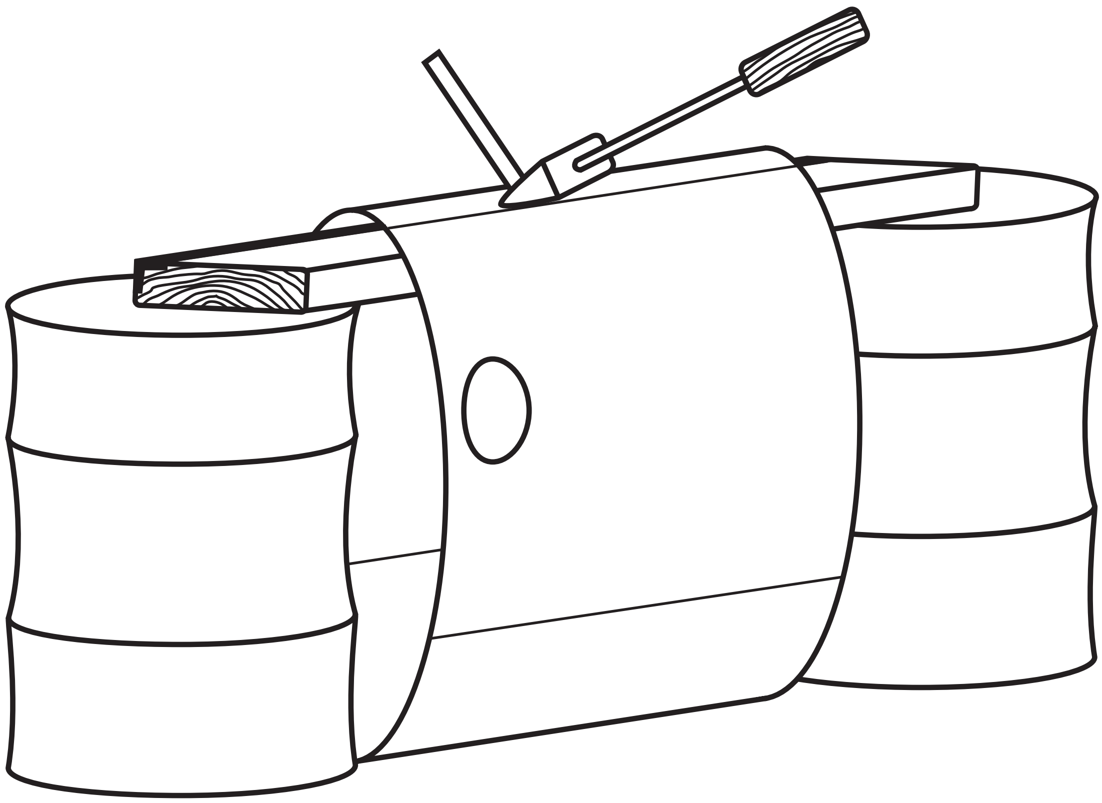
Pound the seams closed with the hammer.



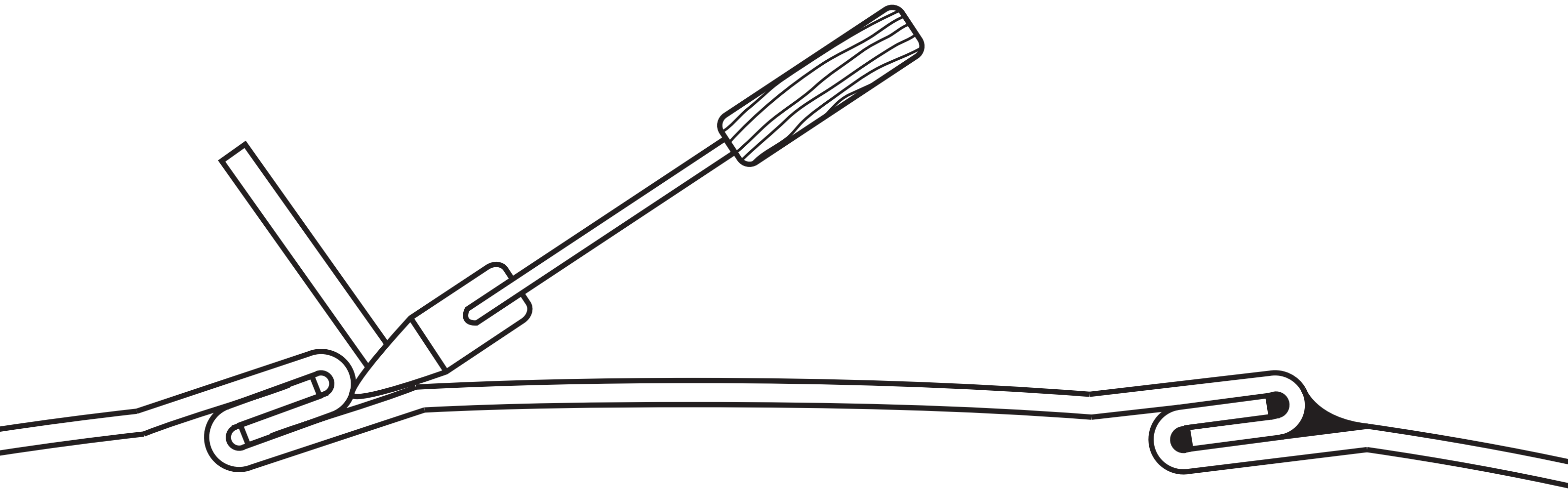
Join the last seam over the bench. Close the last seam the same way you did the others.



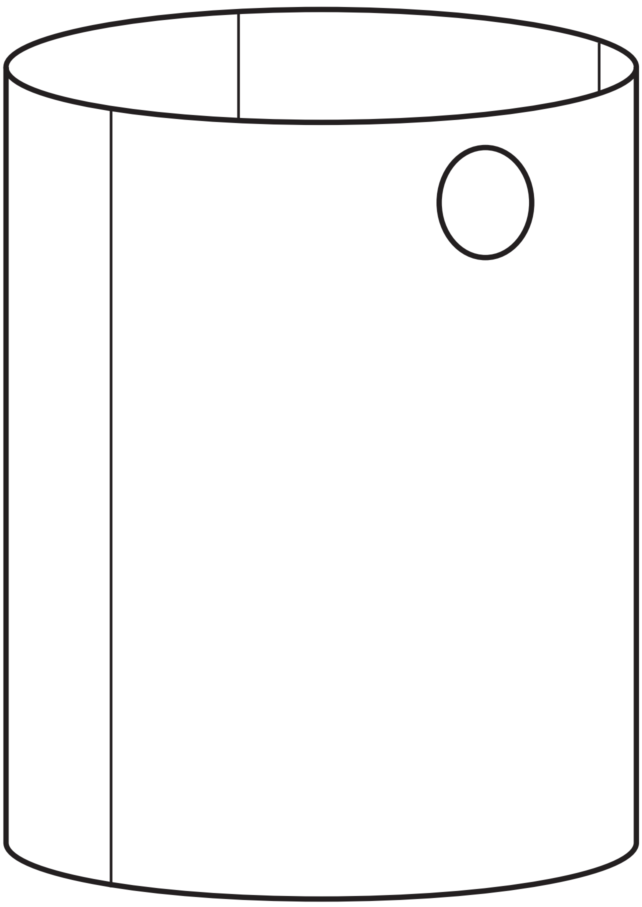
Solder the seams on one side of the sheet. The seam must be completely sealed with solder. The side with the solder will be the outside of the silo.



Solder only on the outside of the silo.



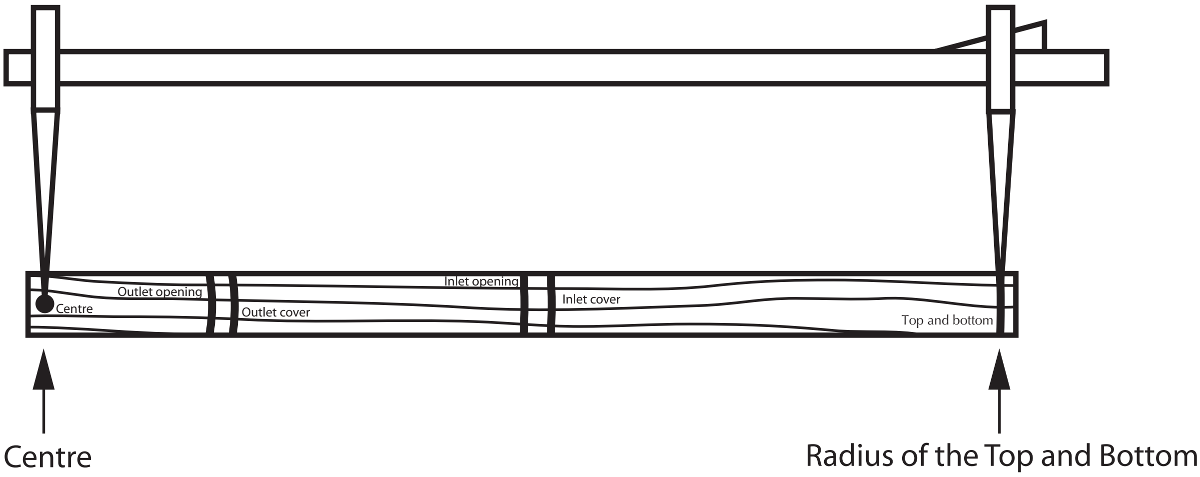
Stand the silo with the outlet opening up to begin the process of joining the bottom of the silo to the body.



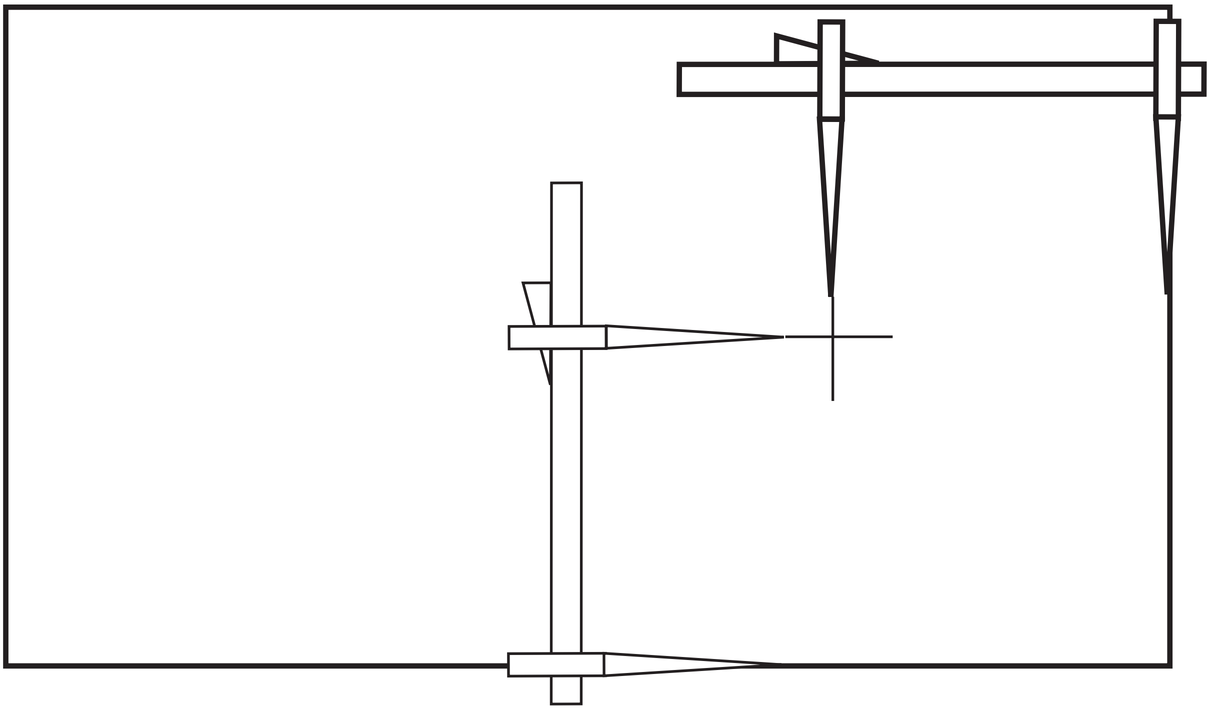
Making the Top and Bottom of the Silo

Smaller silos have tops and bottoms made from one piece. Larger silos have tops and bottoms made of two pieces. This section shows how to make both types.

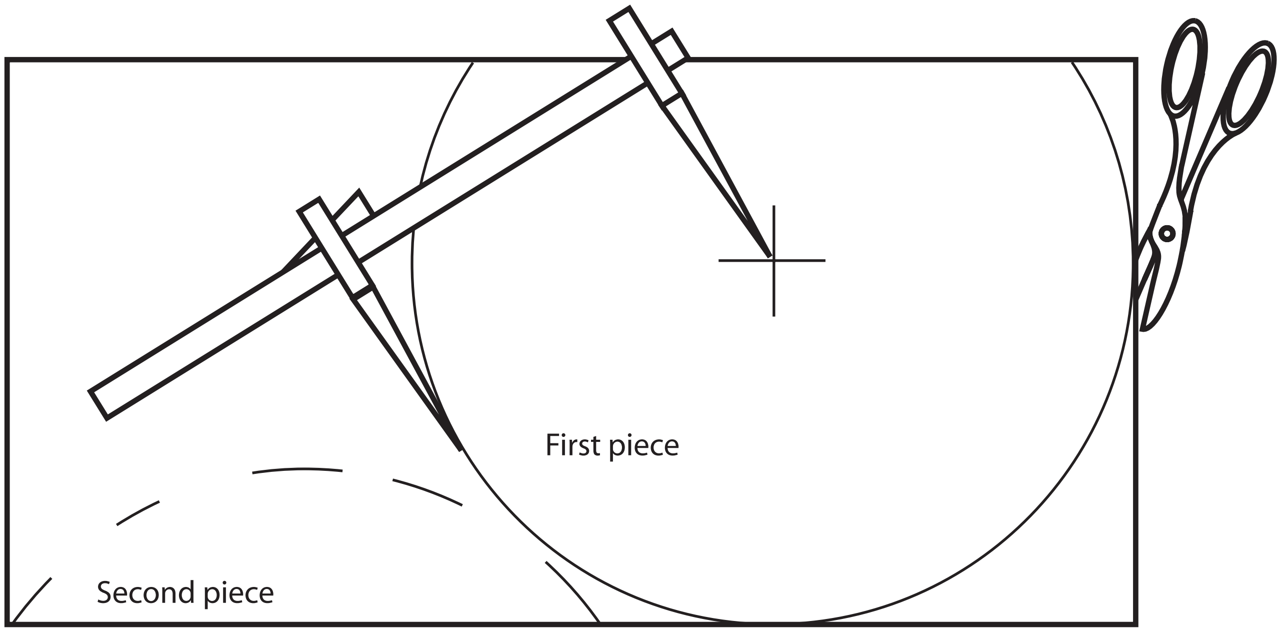
The compass draws the large circles. To measure the opening of the points of the compass, use the story stick and adjust the compass to the mark for the top and bottom radius.



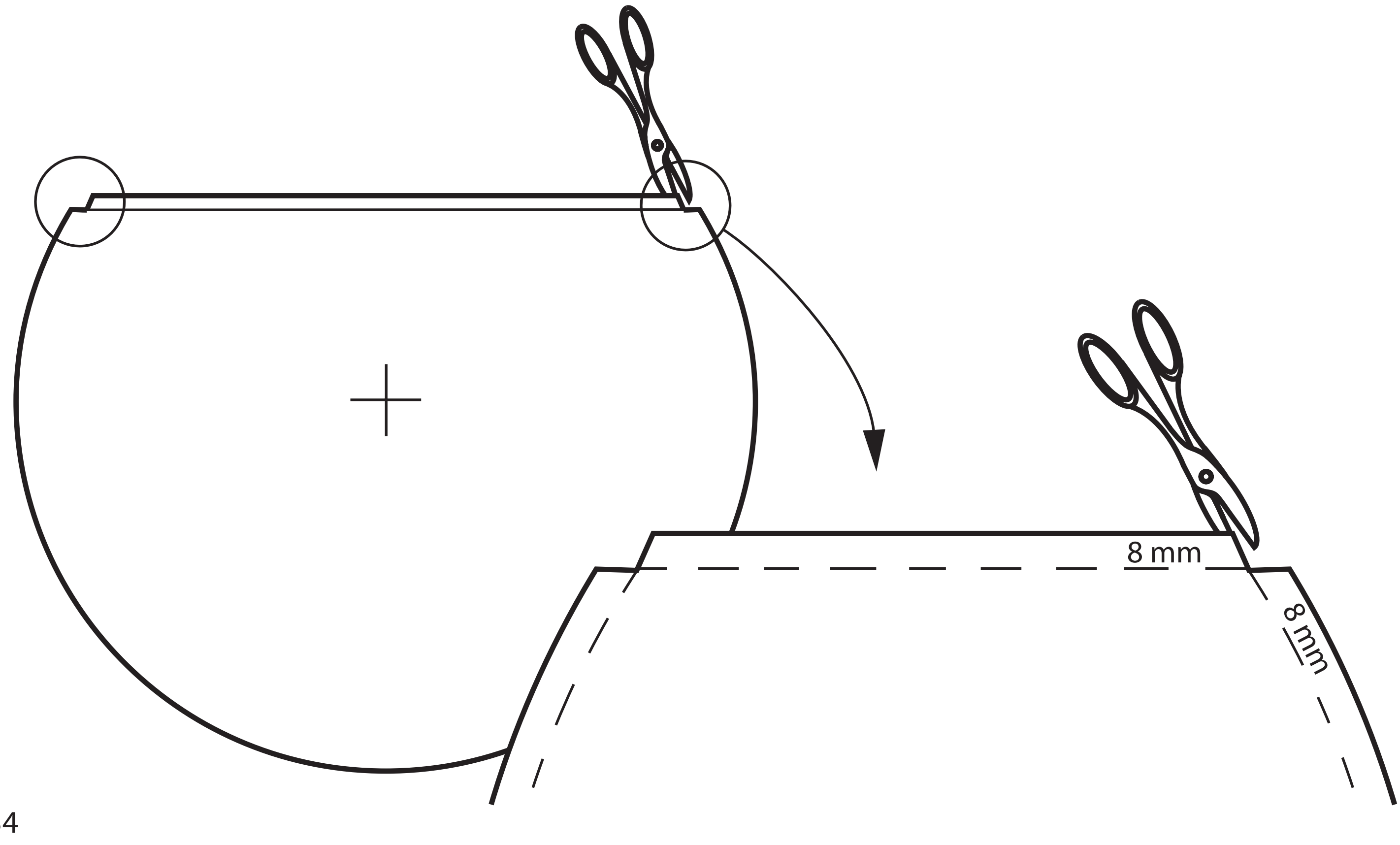
When the measurement is set, use the compass as shown in the illustration to find where to place the centre point of the circle.



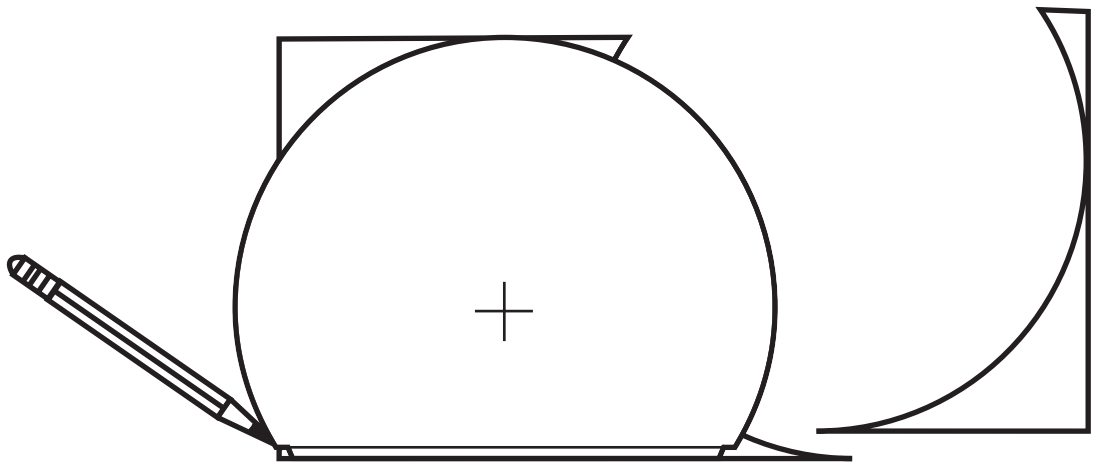
The next steps show how to make tops and bottoms from two pieces. Make sure you clearly mark the centre point. You will need to find the centre again later to draw the smaller part of the circle. Be careful not to poke a hole at the centre point.



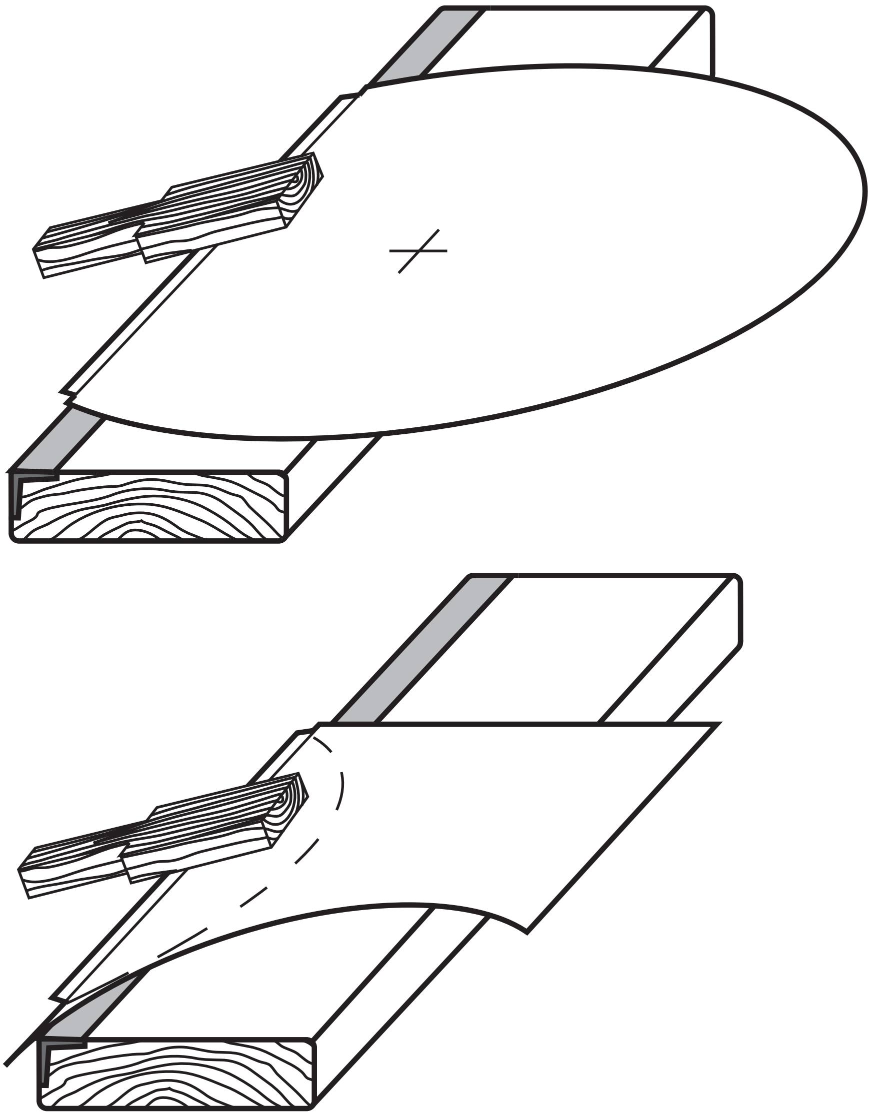
Make relief cuts at the ends of the straight edge where the seam will be.



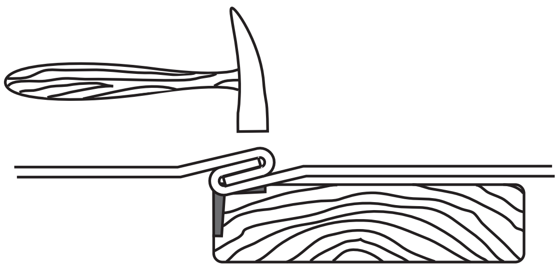
Put the larger piece of the circle on top of the sheet that you will use for the smaller piece. Align the edges and trace the relief cuts.

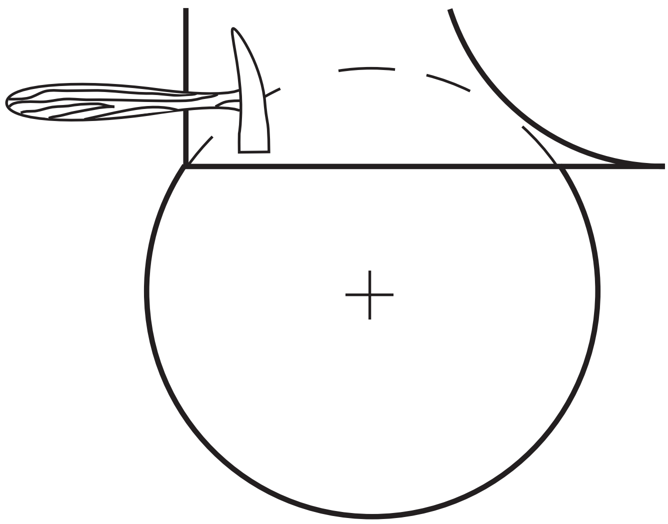


Use the seam method to join the pieces together.

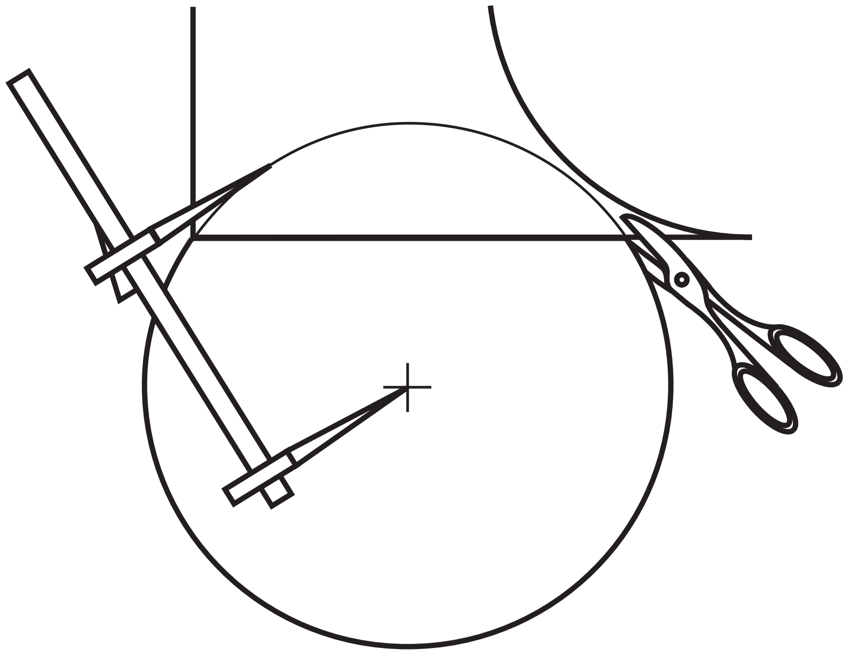


Pound the seam closed with the hammer but do not solder yet.

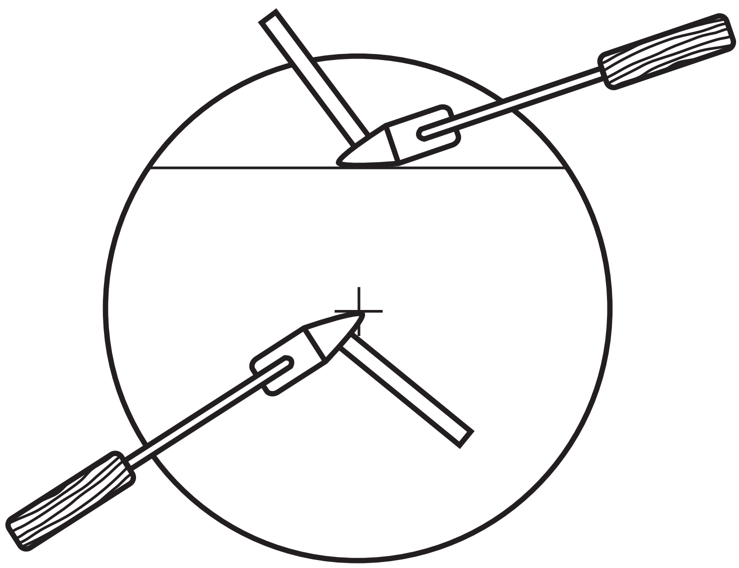




Use the same centre point. Mark and cut the rest of the circle.



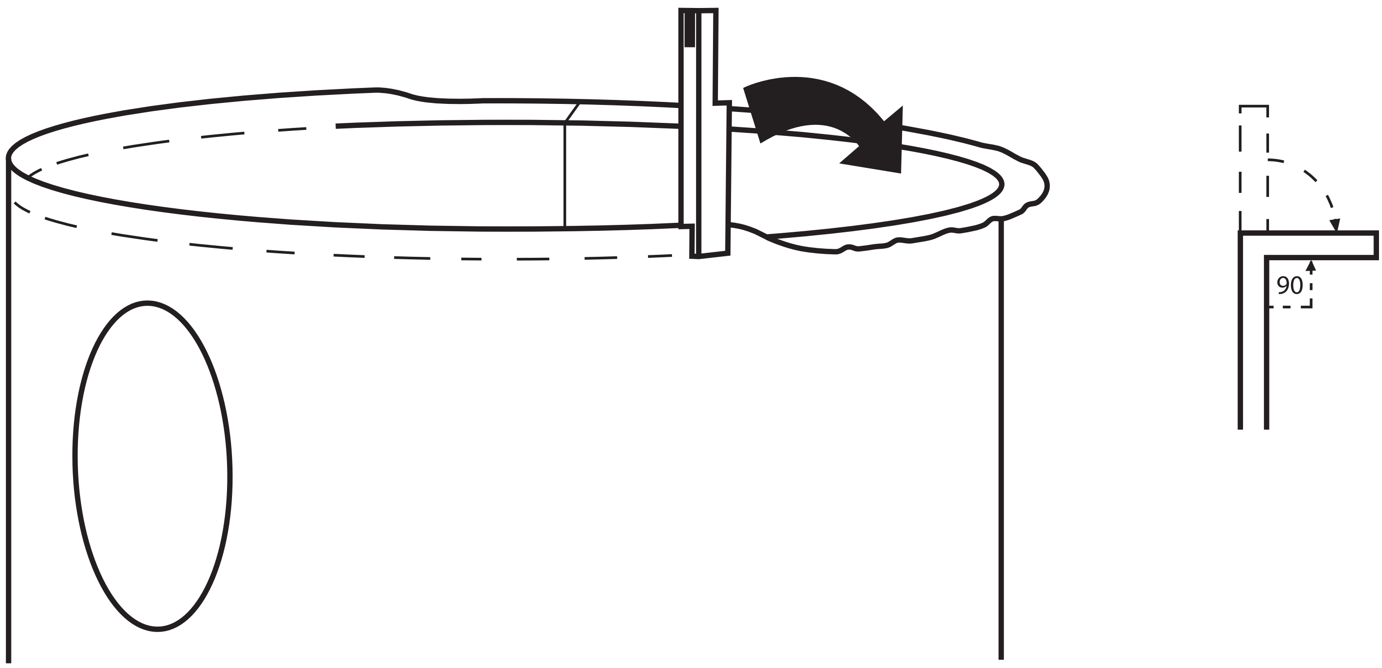
Solder only on the side that will be the outside of the silo. Put a drop of solder to cover the centre point of the circle.



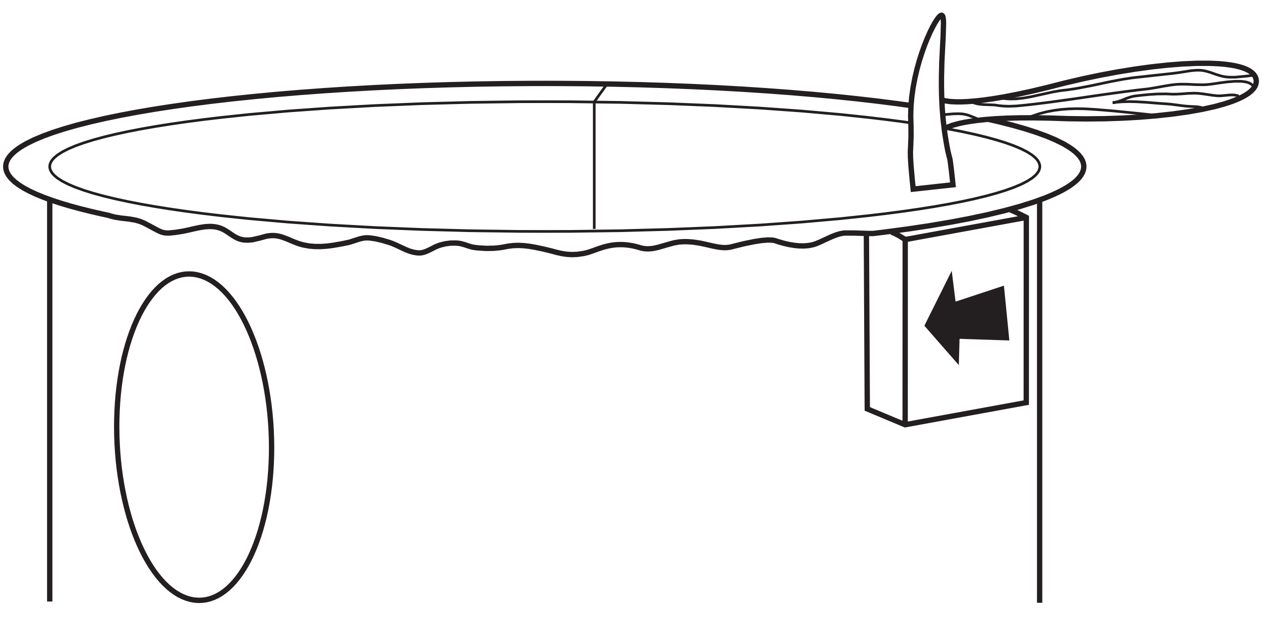
Joining the Bottom of the Silo to the Body Using the Flange Method

The flange method is used to join the top and bottom of the silo to the body of the silo. This section describes joining the bottom of the silo to the body but the method is the same for the other assemblies.

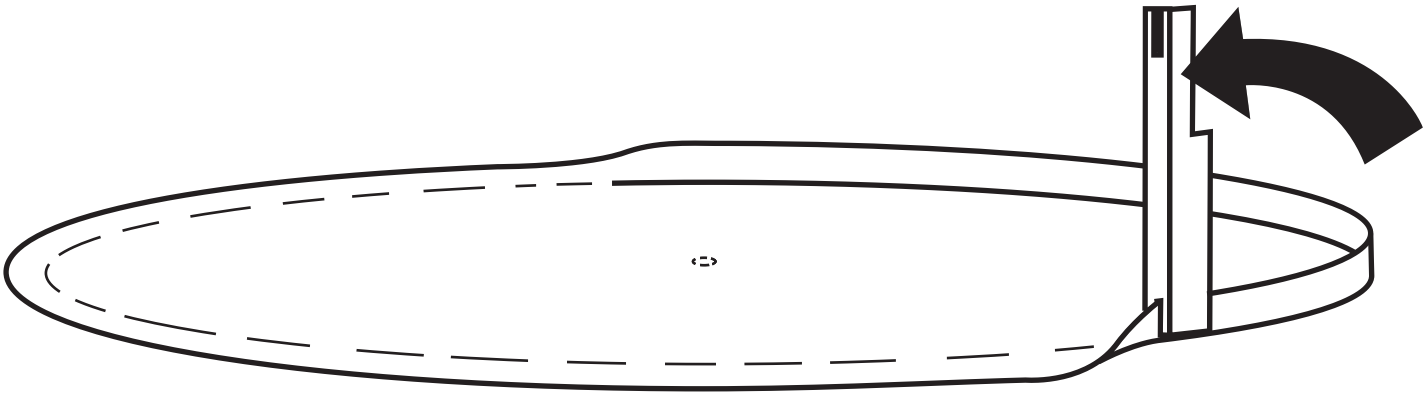
Use the 8 mm bending tool to create a flange around the entire circumference of the cylinder. The flange must be bent to 90 degrees toward the outside of the silo.



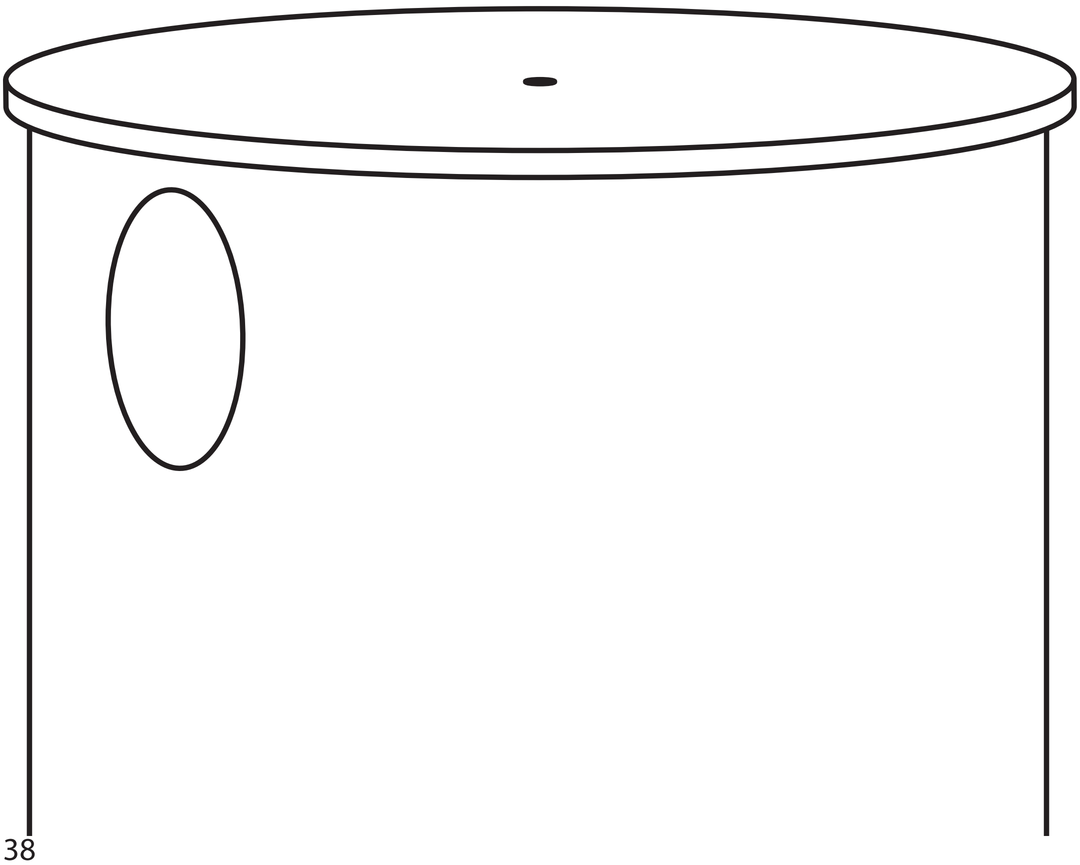
After using the bending tool, the flange will be wavy and uneven. Go around the edge carefully with the hammer and the counterblow to smooth out the flange. Stop when the flange is flat and even.

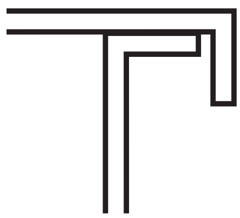


Now use the 8 mm bending tool to create another flange around the edge of the bottom piece. Bend the entire edge up 90 degrees all the way around. There is no need to smooth this flange like you did before because it will be completely folded when you are finished.

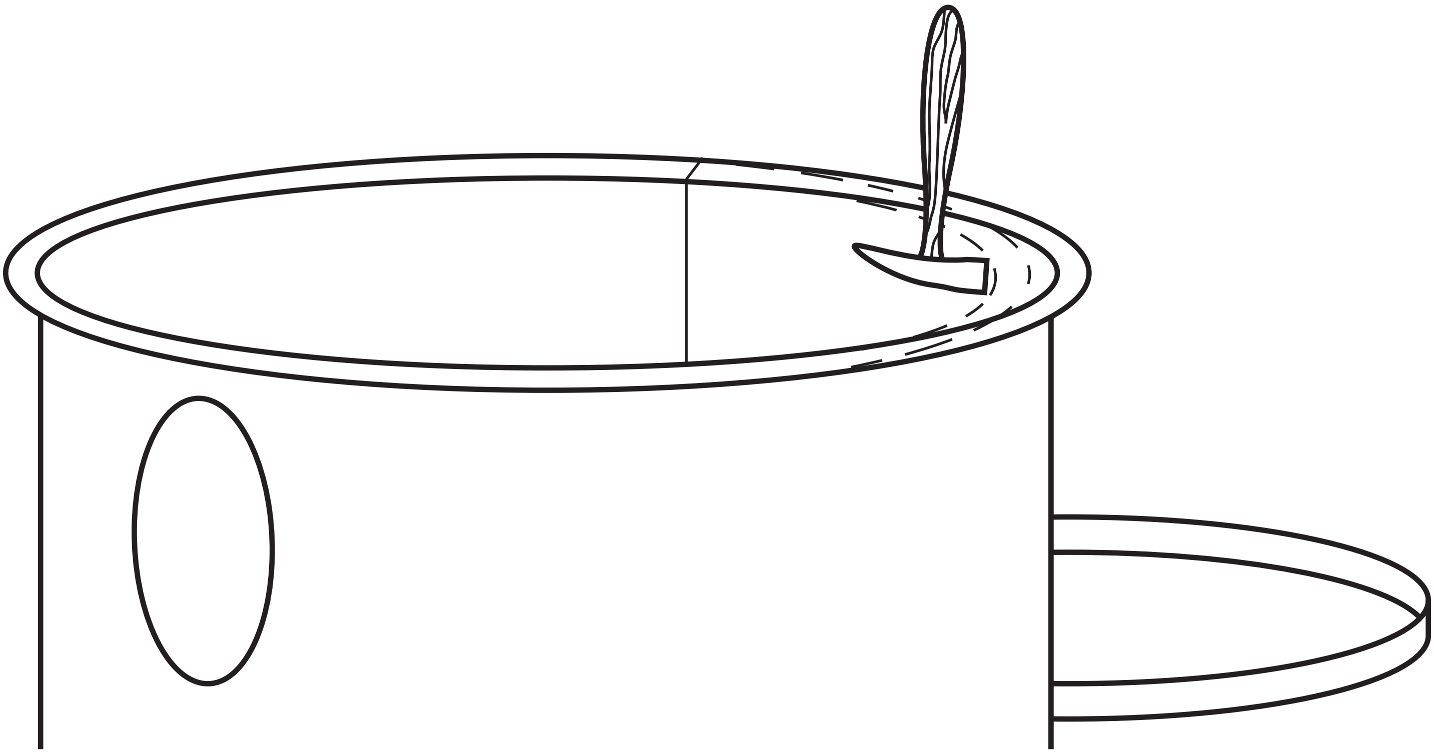


Put the bottom piece, flange down, over the body of the silo to see if they are the same shape.

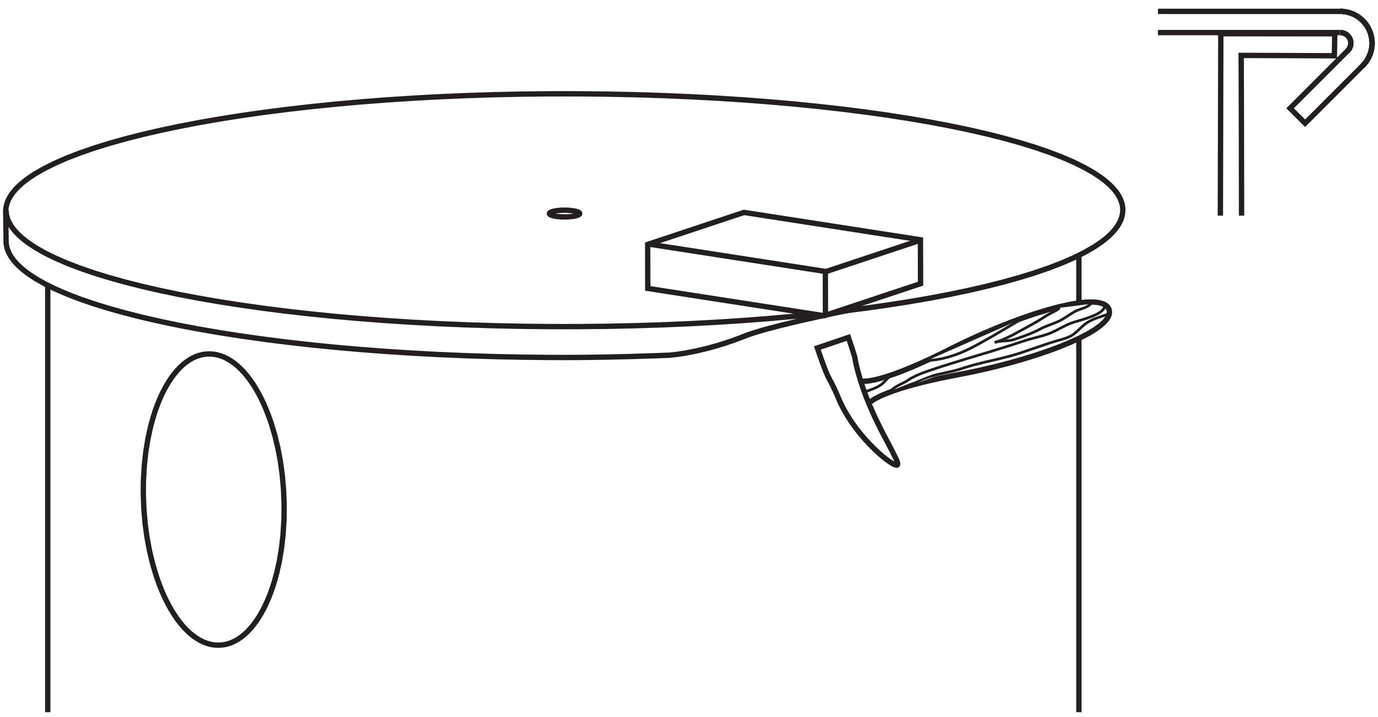




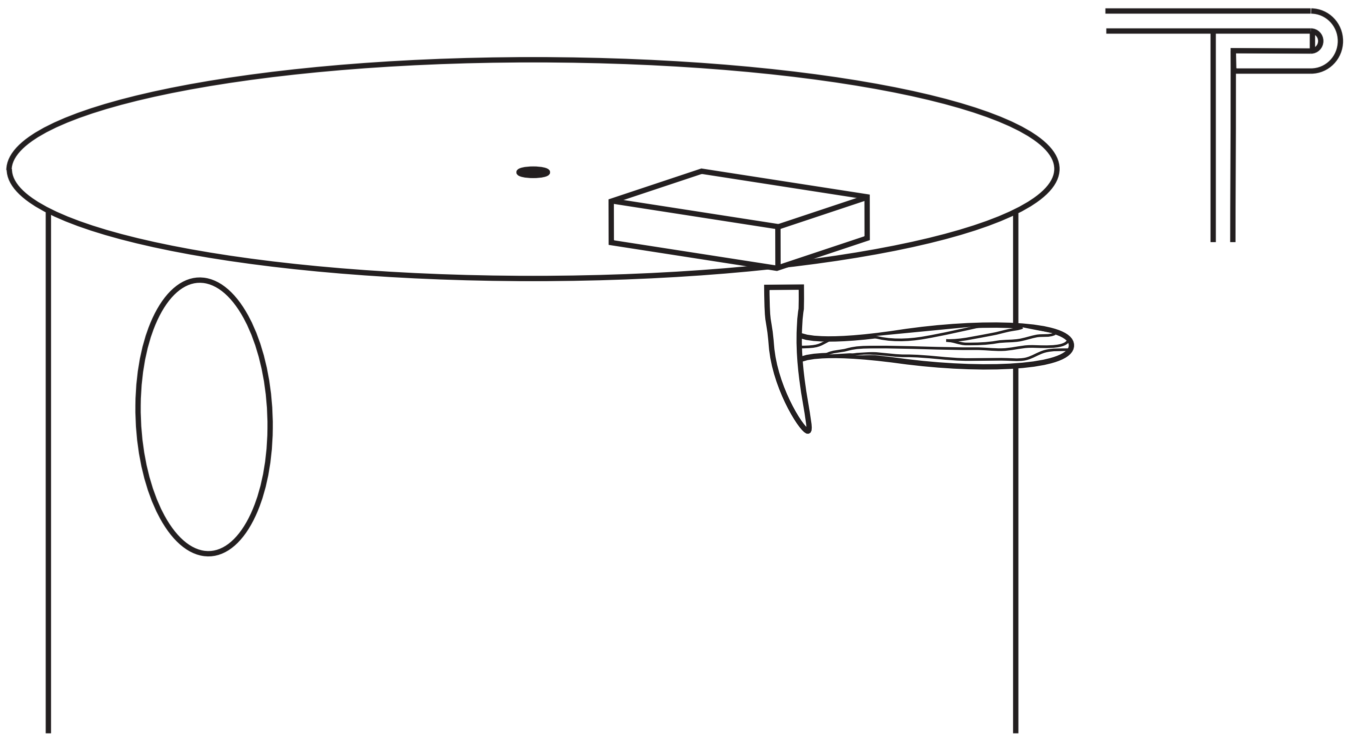
When you put them together they might not fit well at first. The body of the silo might not be a true circle. Mark with a pencil at the spots where it doesn't fit the bottom. Then gently tap it with the hammer from the inside. Only hit near the edge and be careful not to damage the soldered seams!



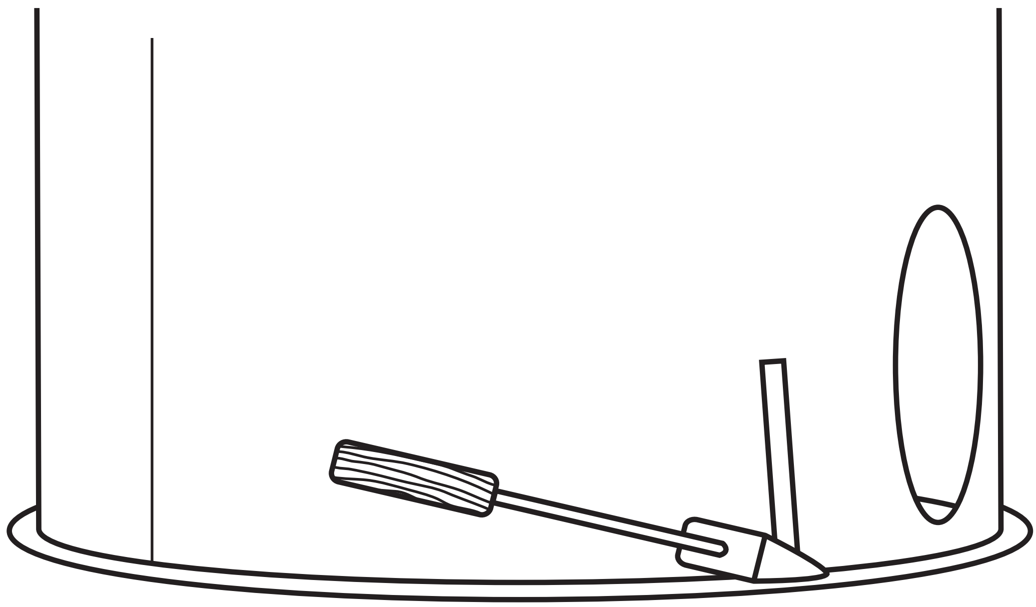
When the body of the silo fits the bottom you can start to join them together. Use the counterblow over the spot that you are hitting with the hammer as you work around the body of the silo. First, pound the flange to about 45 degrees.



Go around the circle again with the hammer and the counterblow. This time close the flange of the bottom piece completely over the flange of the body. Try to avoid wrinkles in the flange as you hammer it down. Be careful not to damage the body of the silo with the hammer.



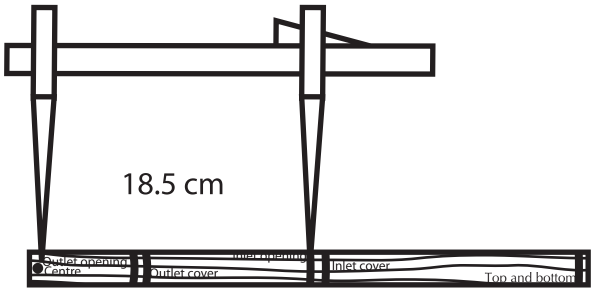
Turn the silo over. Solder around the flange. Be very careful not to leave any holes especially around the seams in the body.

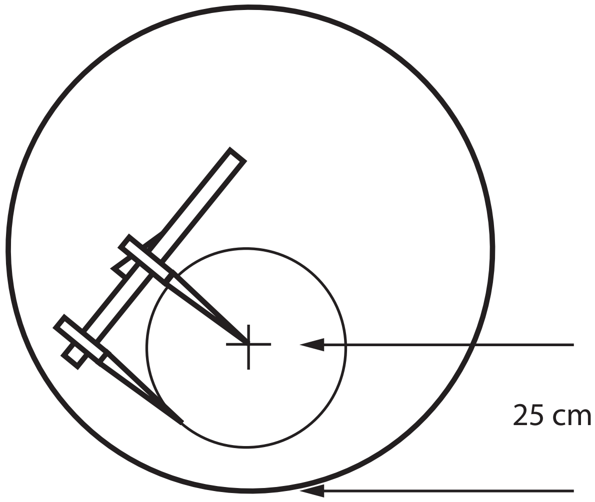


Making the Inlet and Outlet Openings

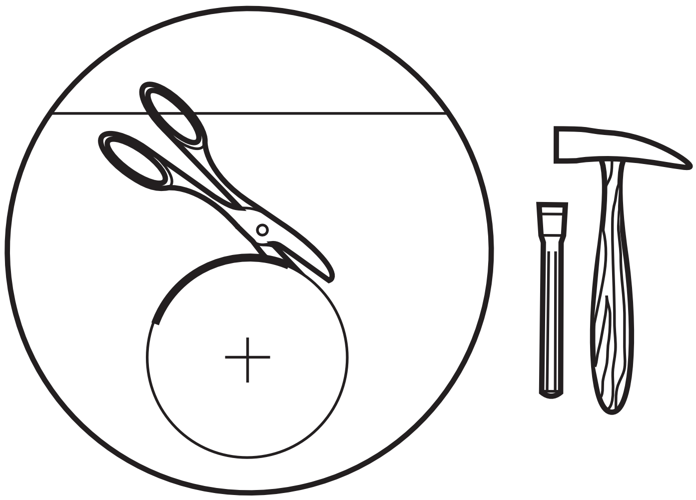
This section describes making the openings used for filling and emptying the silo. The inlet opening is the large hole in the top and the outlet opening is the small hole in the side of the silo.

Set the large compass to 18.5 cm and mark the hole for the inlet opening in the top piece. The center of the circle must be 25 cm from the edge of the top piece.

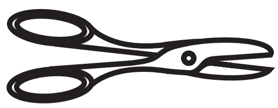




Use the chisel and the shears to cut the hole.



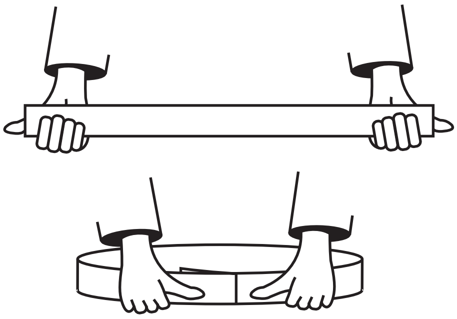
Cut pieces D and F.



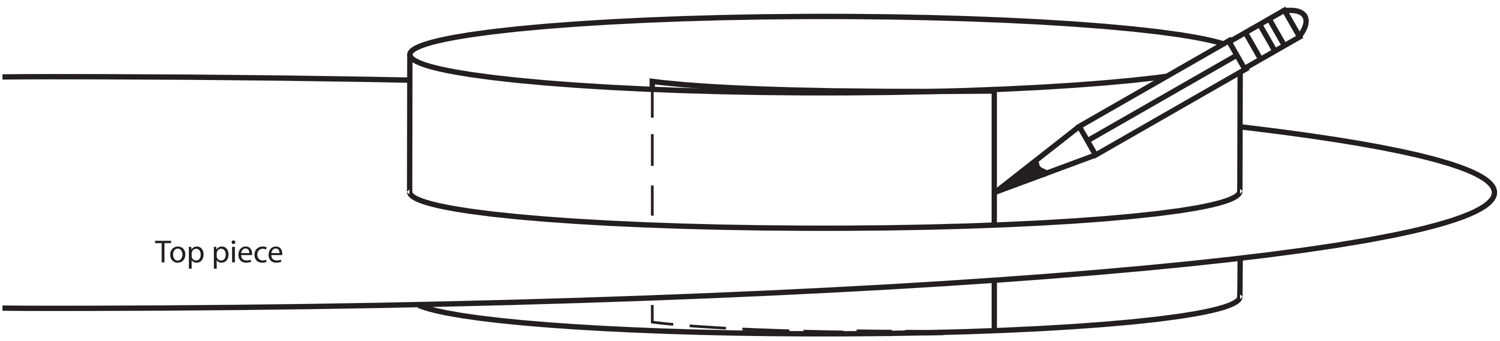
Inlet opening strip (11 x 118.2 cm)

Outlet opening strip (16 x 49 cm)

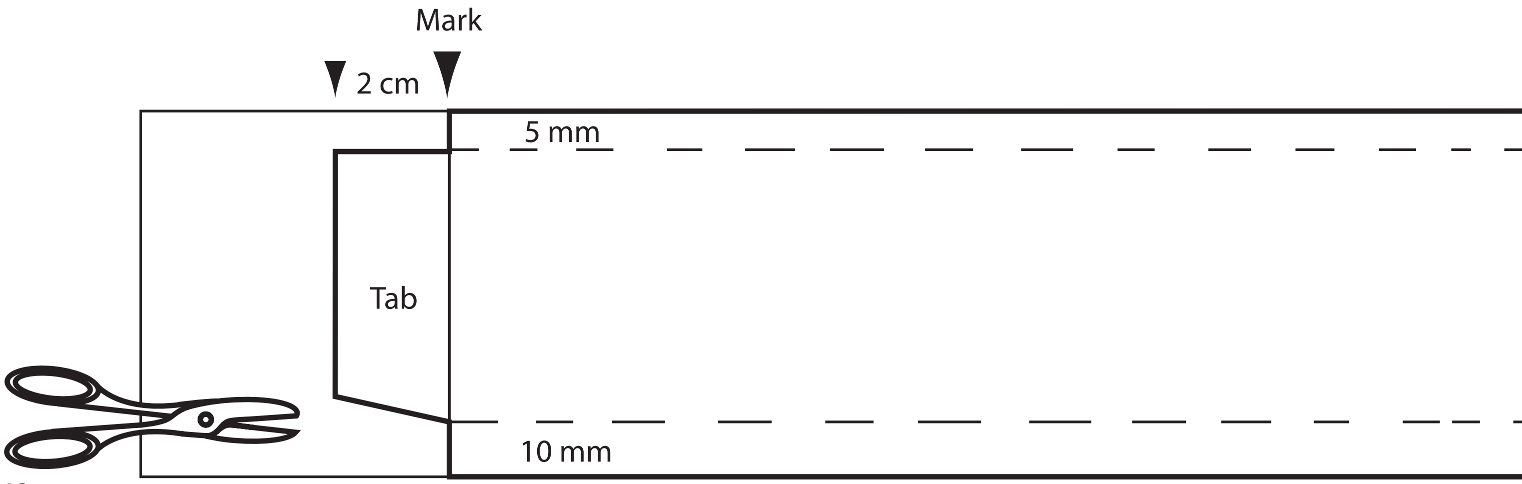
Take piece D and gently bend it into a circle.



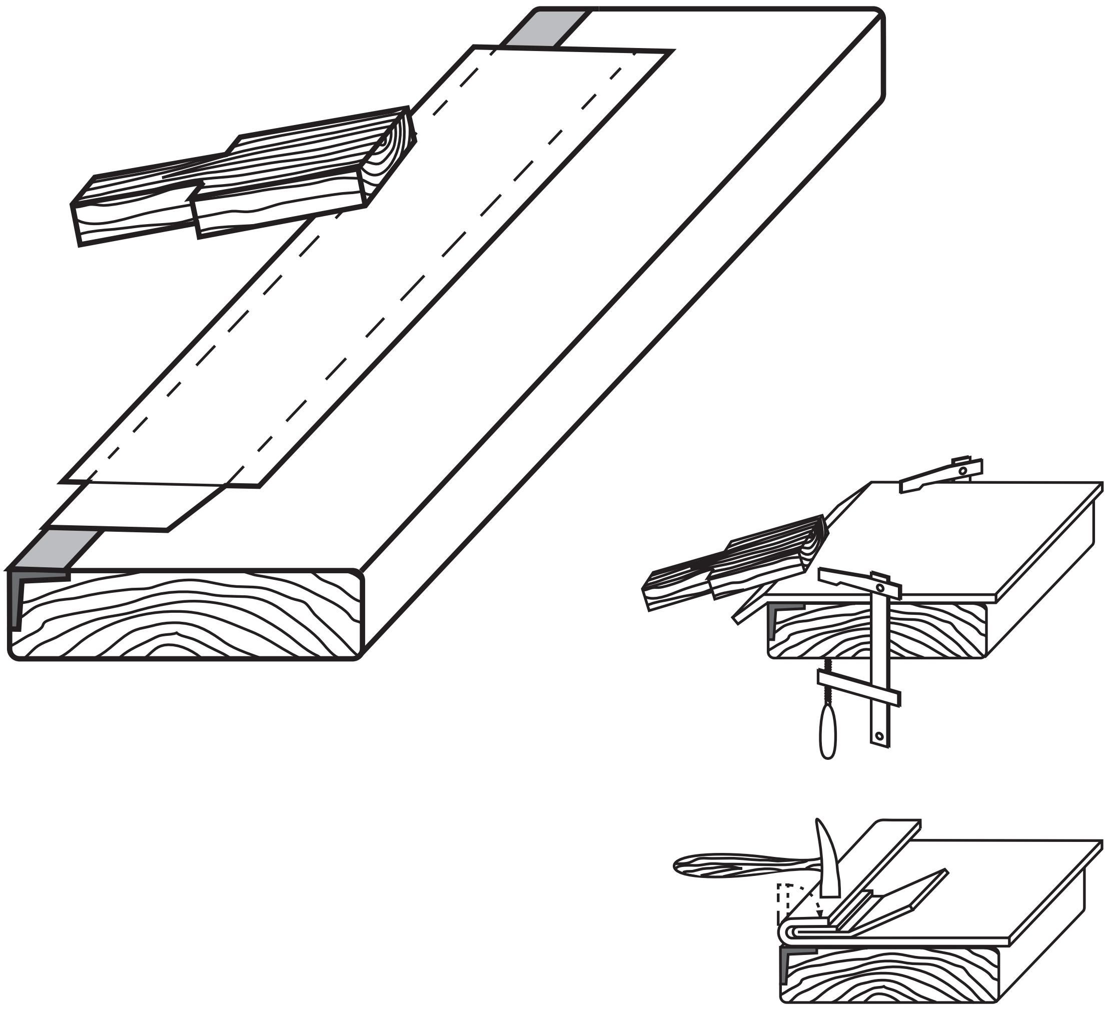
Place the strip in the hole in the top piece. Make sure that the long edges are lined up evenly. Make a mark where the end of the strip overlaps itself but don't cut it yet.



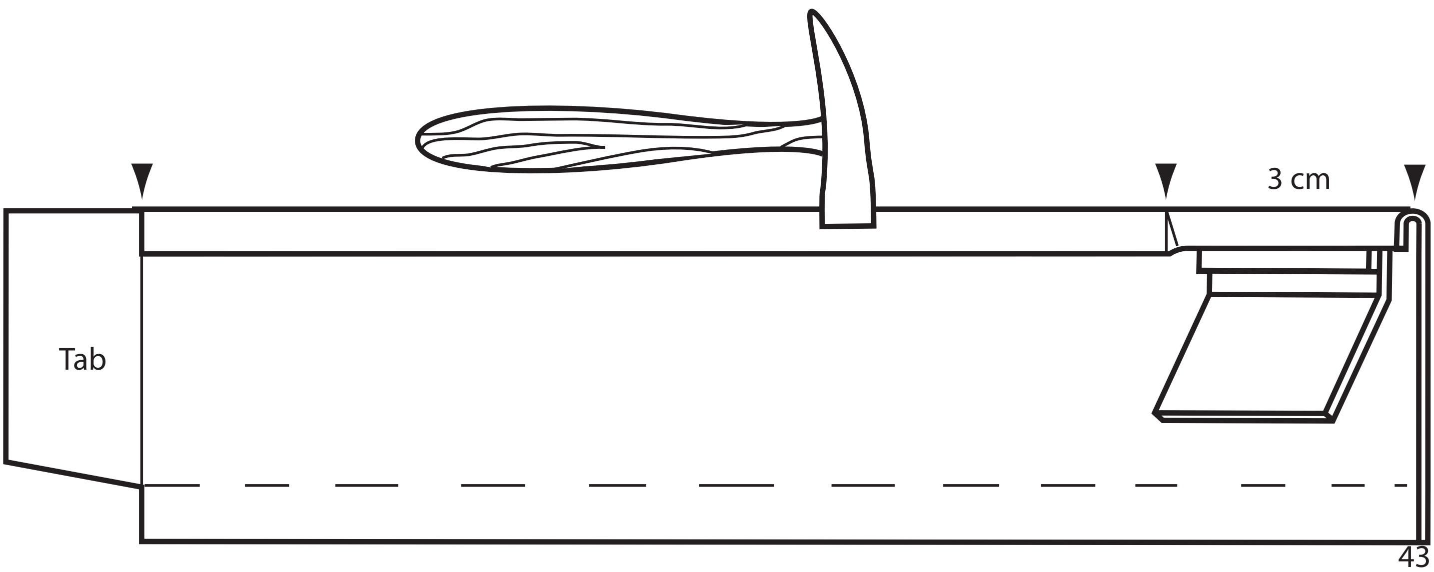
Make the strip flat again. From the mark you made, add 2 cm to make the piece longer. This 2 cm will be the tab. The tab needs relief cuts so that the edges of the strip can be folded.



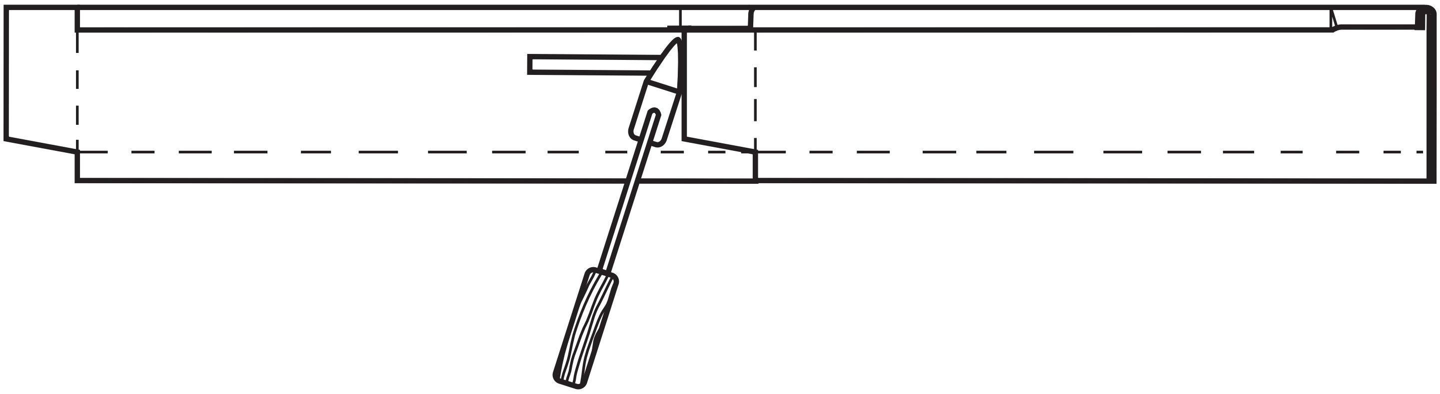
Fold the 5 mm edge of the strip.



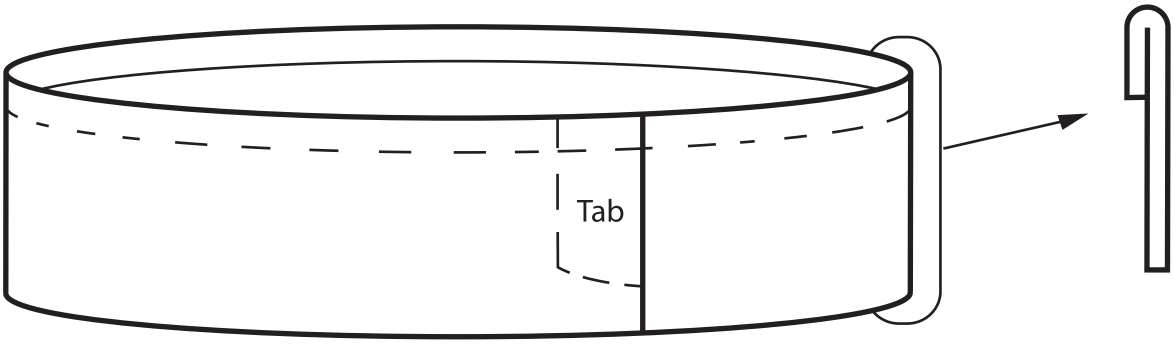
Use the hammer to completely close the fold but use the spacer for the last 3 cm on the end away from the tab.



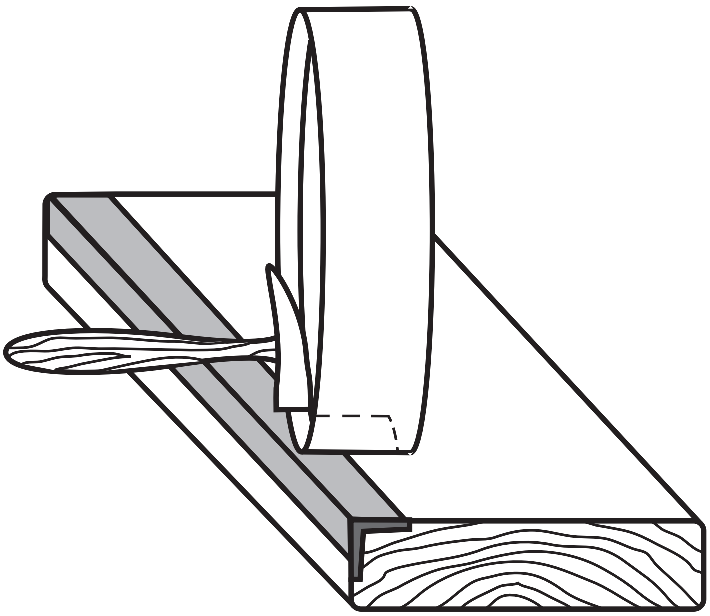
For some of the silos, the strips of metal used to make the openings are made from two pieces. This is so you can get all of your materials from the smallest number of sheets. Make a tab on each piece and solder them together.



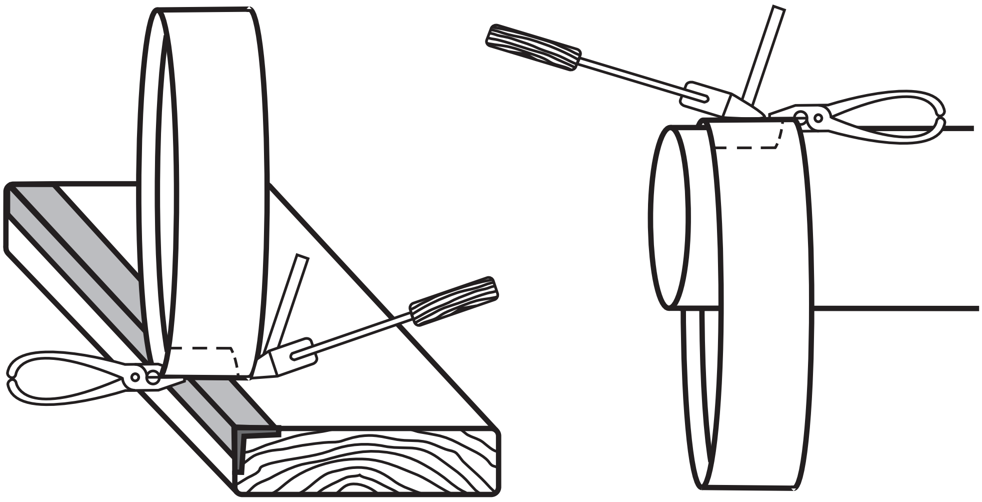
Bend the strip into a circle with the folded edge on the inside. Carefully align the measurement marks. The tab goes on the inside of the circle. The top edge of the tab fits under the folded edge of the strip.



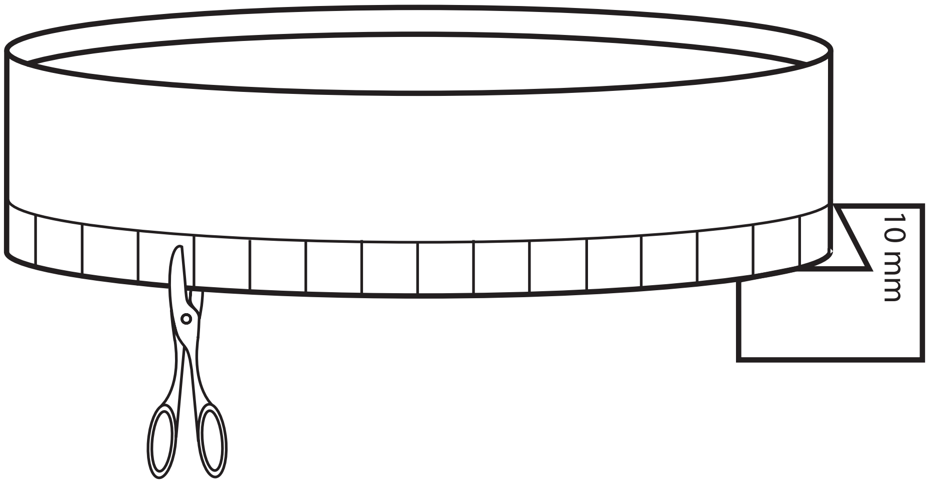
The folded edge must be pounded closed where it overlaps the tab.



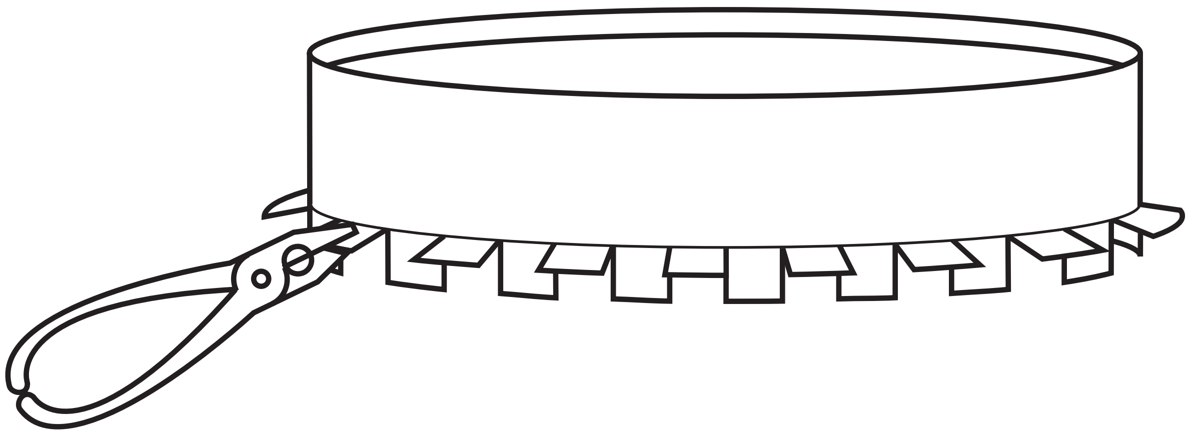
Use the acid to clean all the parts of the metal that will be touching. Hold the joint together with a clamp or the pliers. Solder the joint both inside and out especially under the tab.



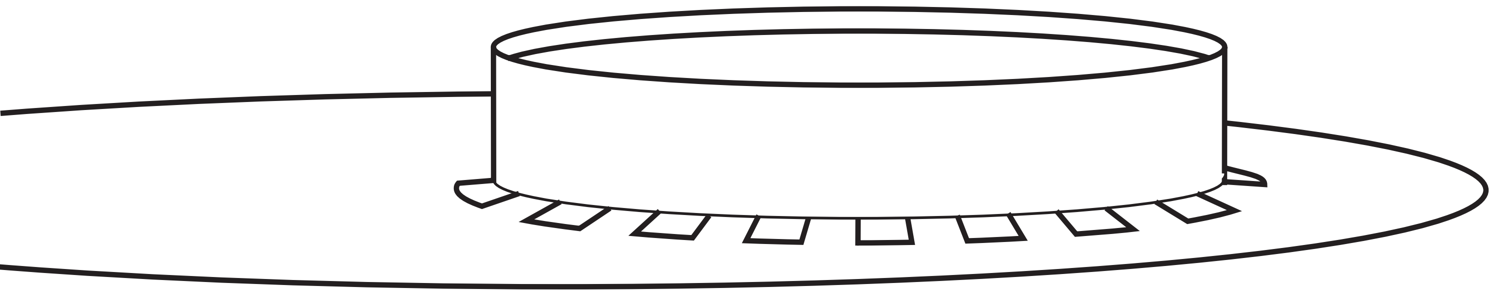
Use the marking gauge to mark 10 mm from the bottom edge. Make a small cut to the line about every 15 mm. Cut carefully to the line, not more, not less. This will help make a good joint.



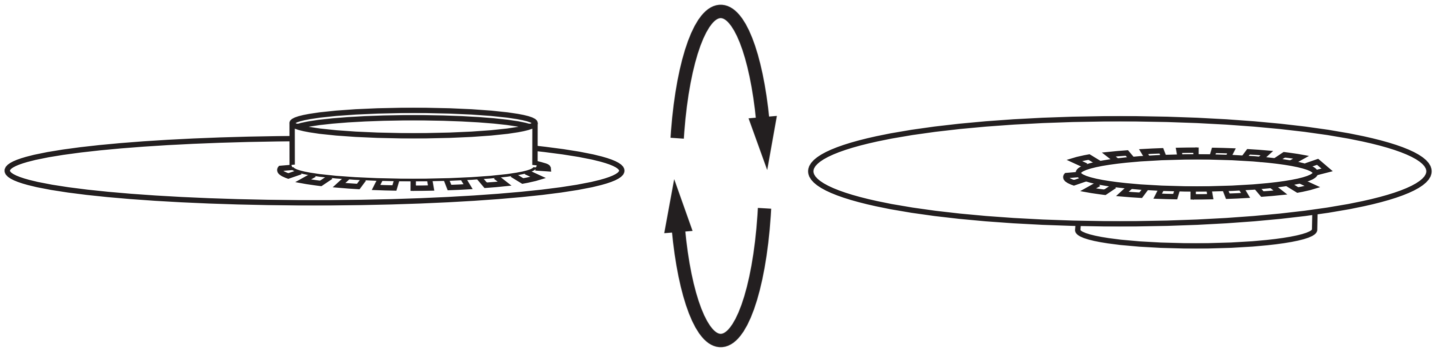
Bend every other "tooth" 90 degrees toward the outside. Be careful to bend exactly on the marked line.



Put the opening in place on the top of the silo. The teeth that are not bent go into the hole.

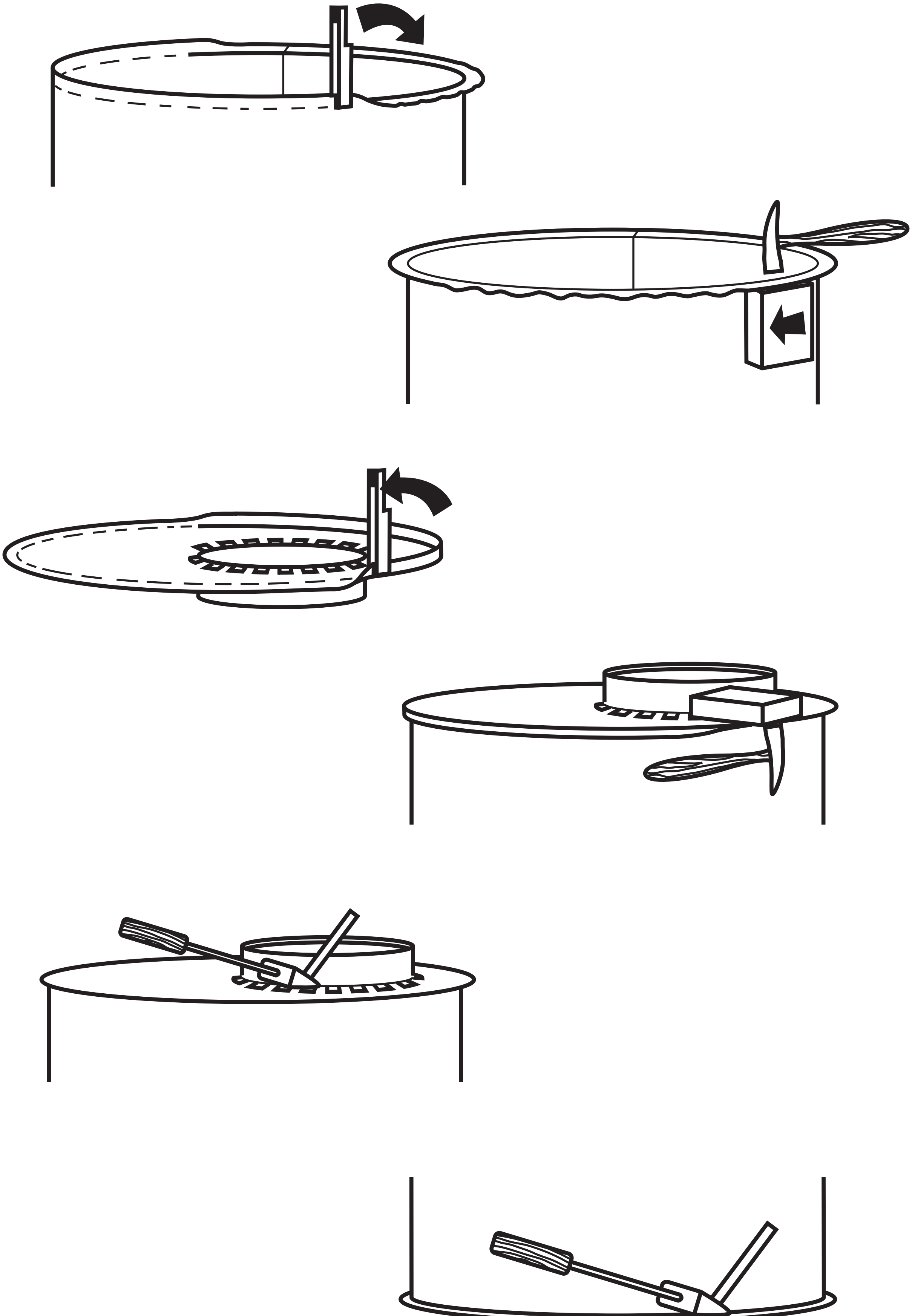


Turn the top piece over.



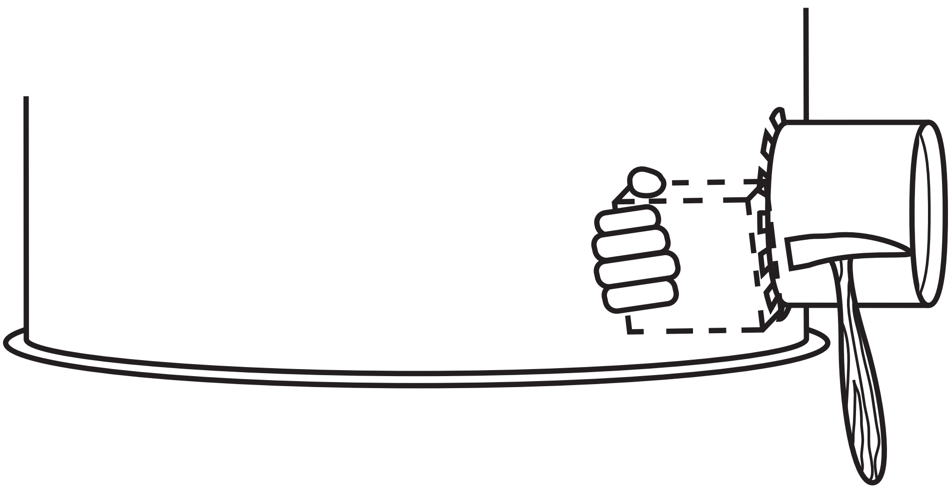
Bend some of the teeth to hold the opening in place. Go around the circle with the hammer and use the edge of the bench. Pound the teeth flat.

The top of the silo is now ready to be joined to the body. Use the flange method that you used to attach the bottom of the silo to the body.

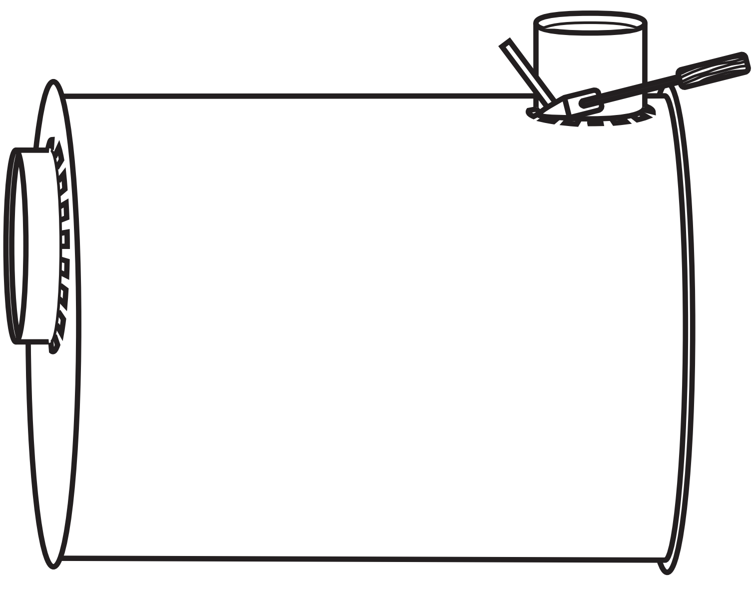


Use the same process to make the outlet opening.

Hold the edge of the counterblow tightly against the inside of the body of the silo. The hammer blows should make a solid sound as you pound the teeth against the body.



Solder well.



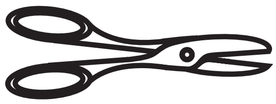
Making Covers for the Openings

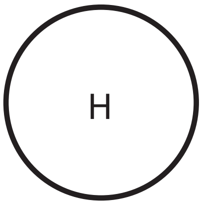
The covers have two pieces: the collar and the top. A tight cover holds the fumigation gases and prevents moisture, insects or fungus from entering the silo. This process is the same for both the inlet and outlet covers.

Cut pieces E, G, H and I.

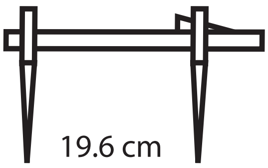
Inlet cover strip (7.5 x 119.2 cm)

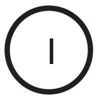
Outlet cover strip (11 x 50 cm)



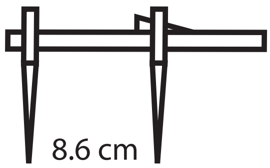


Top of inlet cover

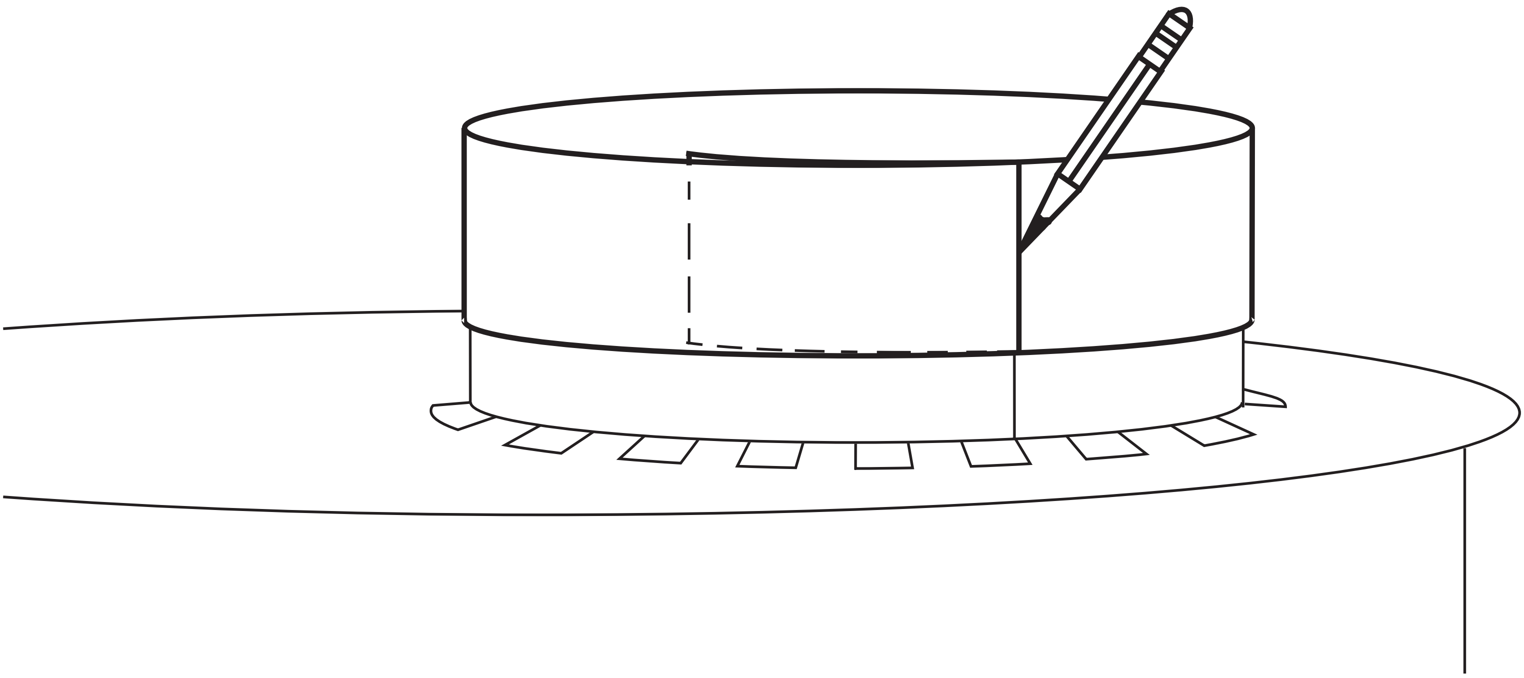




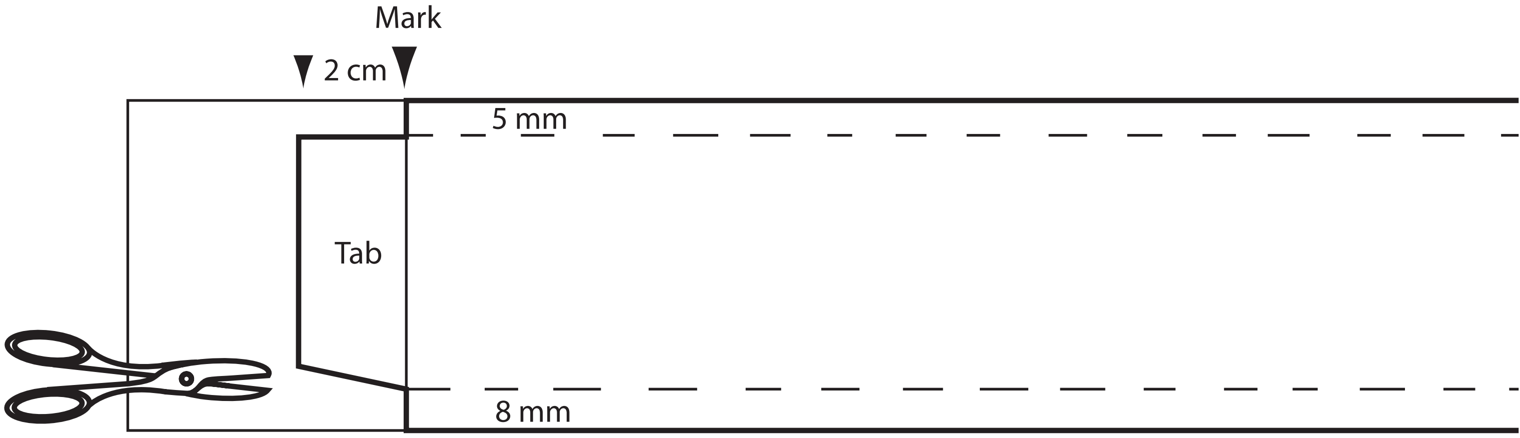
Top of outlet cover



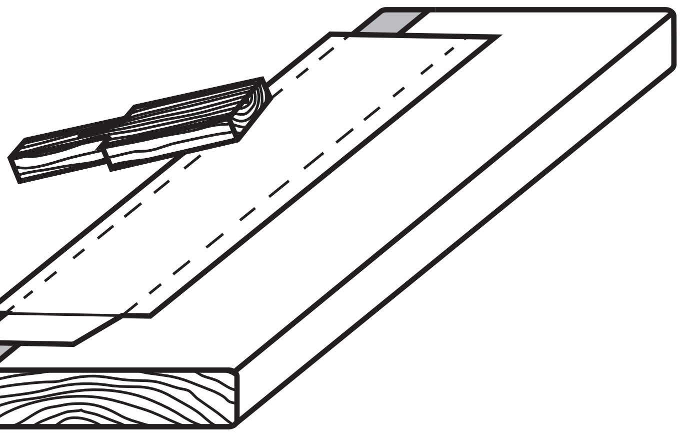
Wrap piece E around the inlet opening. Make a mark where it overlaps itself.



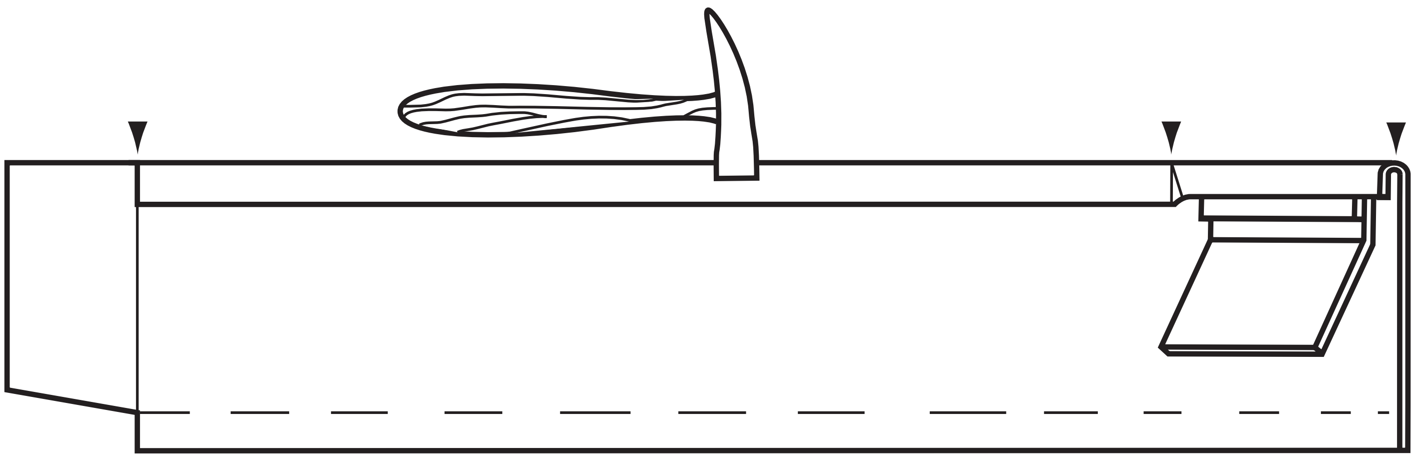
Lay the strip out flat and again add 2 cm to the length. This time the flange will be 8 mm. Use the tab method as you did before on the openings.



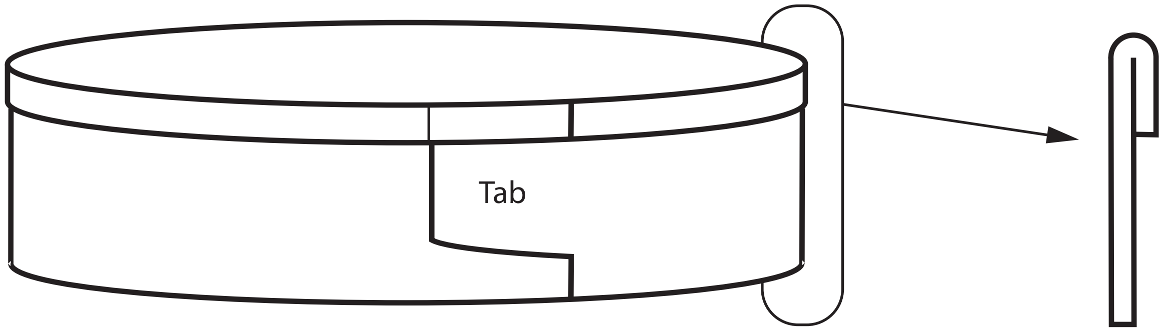
Fold the 5 mm edge of the strip.



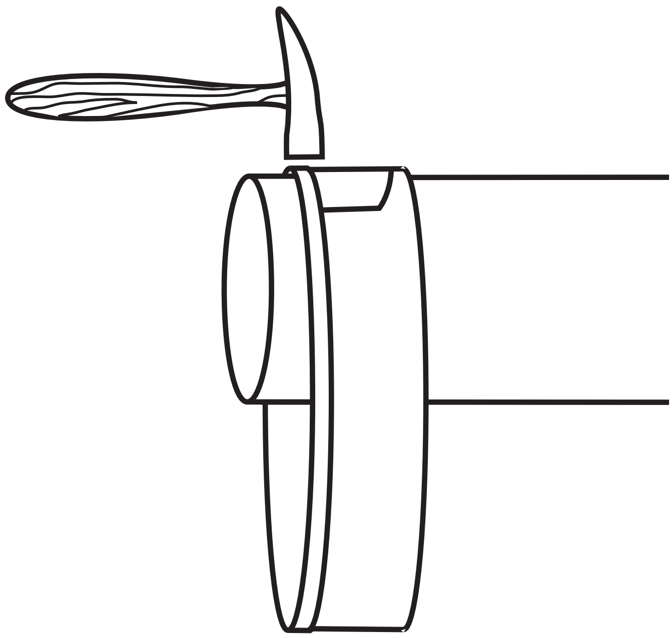
Use the hammer to close the fold but use the spacer for the last 3 cm on the end away from the tab.



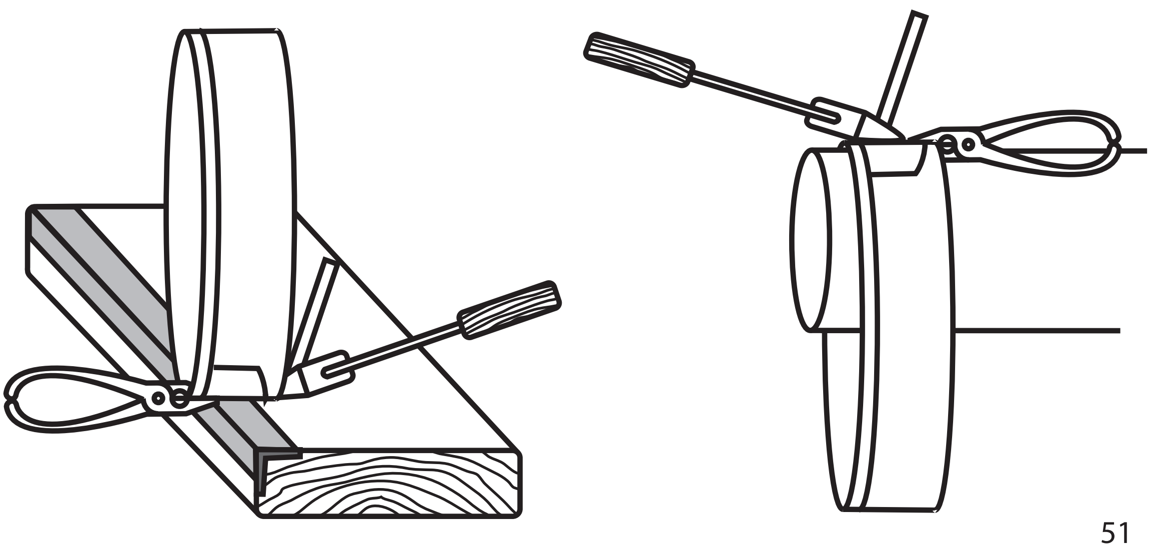
Bend the strip into a circle with the tab and the folded edge on the outside.



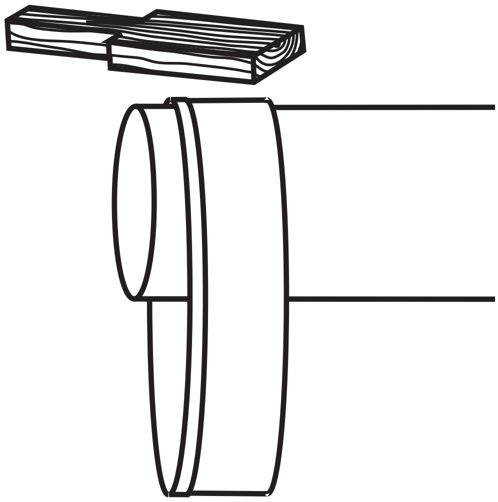
Pound the fold closed where it overlaps the tab.



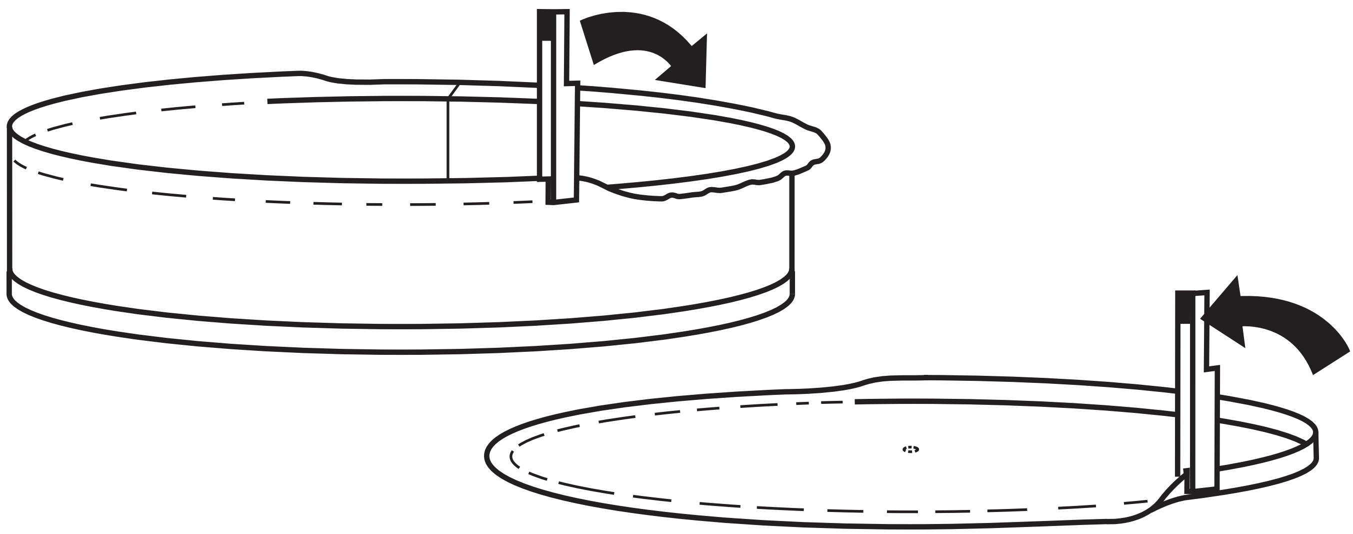
Solder well both inside and outside.



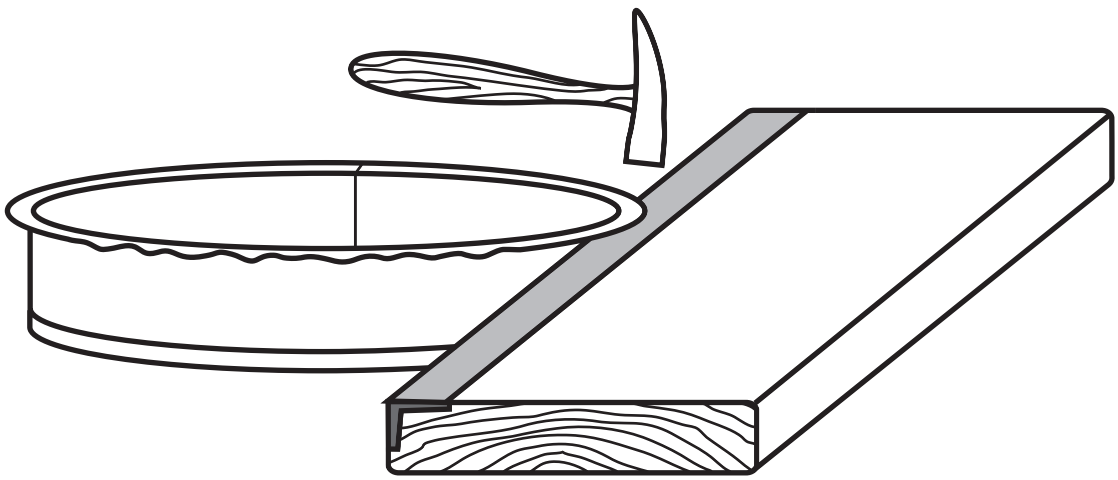
Use the mallet to smooth the circle.



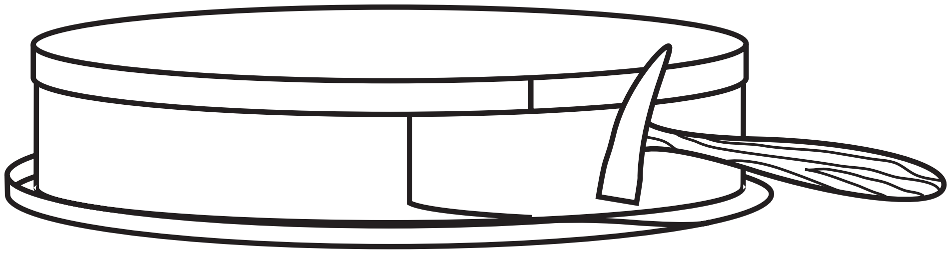
Use the flange method to join the top of the cover to the collar. Use the 8 mm bending tool.

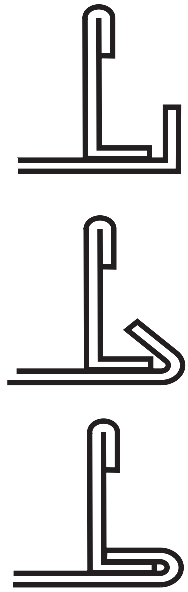


Smooth the flange of the collar on the bench.

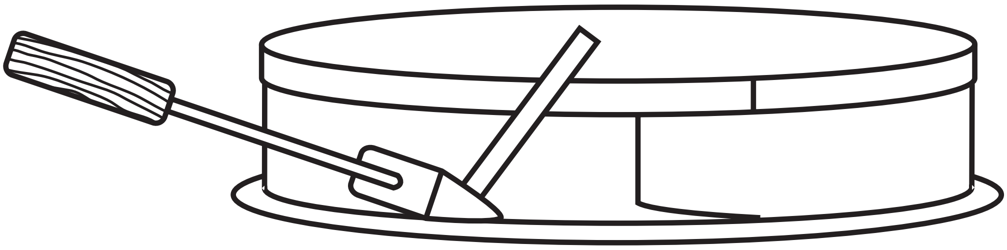


Close the flange of the top piece over the flange of the collar.

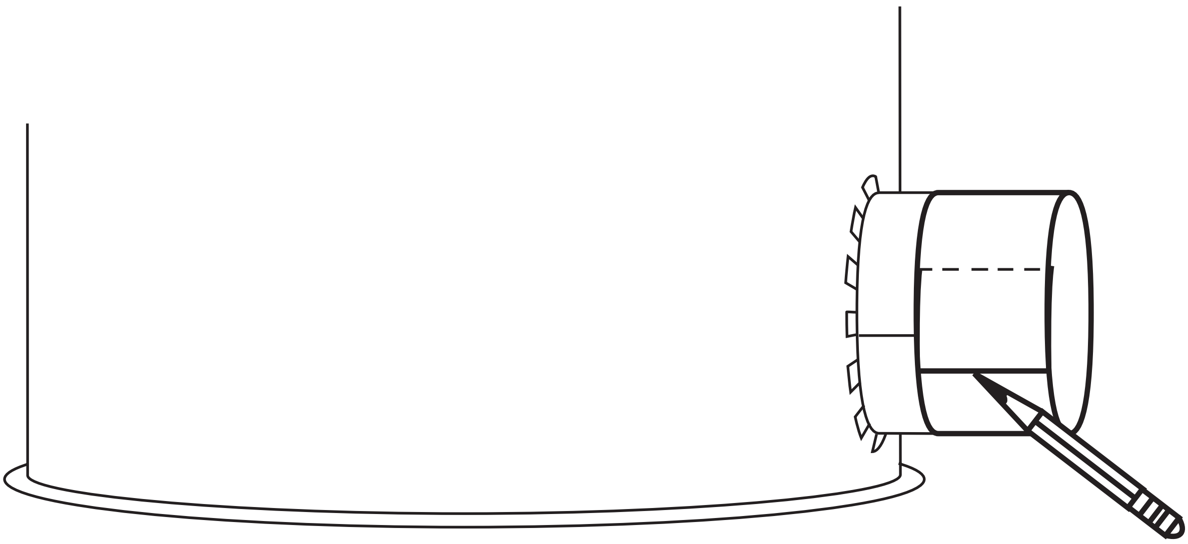




Solder well around the flange.



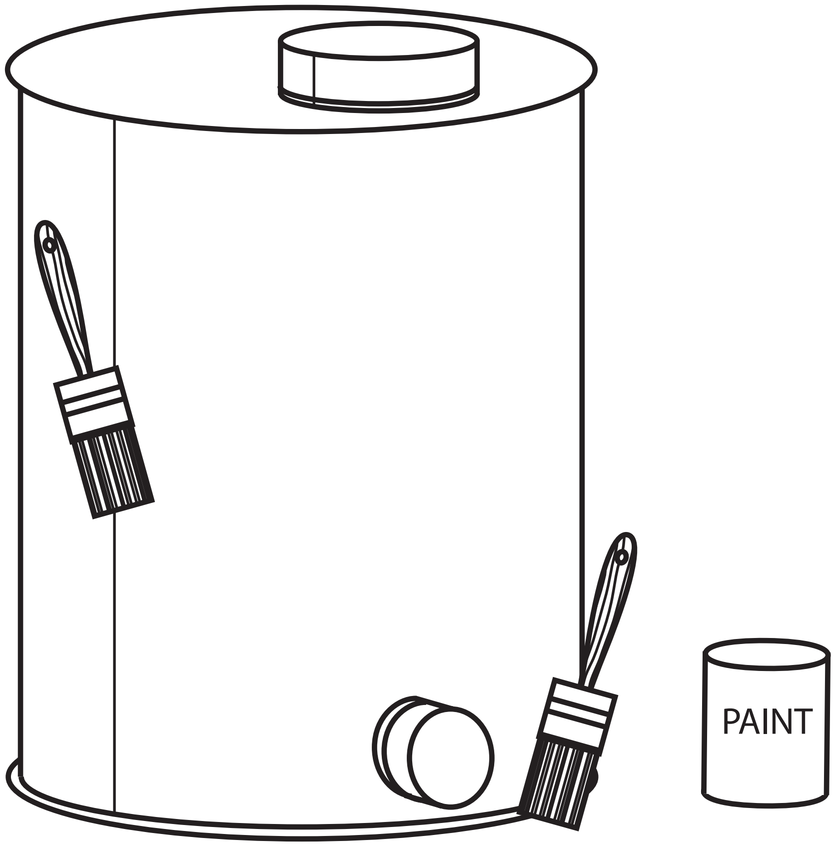
Repeat the process to make the cover for the outlet opening.



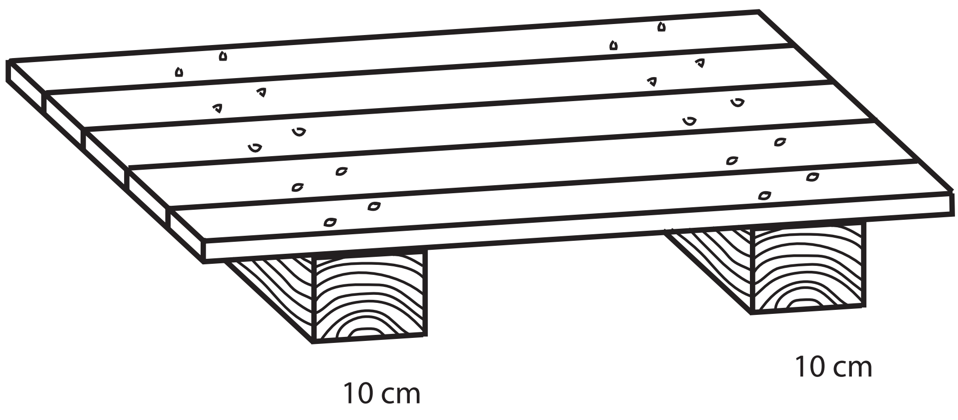
Final Steps

The silo is almost finished but there are a few more important things to do. Painting the joints will help to prevent the metal from rusting. The platform will also help prevent rust and it will make removing the stored grain easier. The information sheet is extremely important for showing how the silo is used.

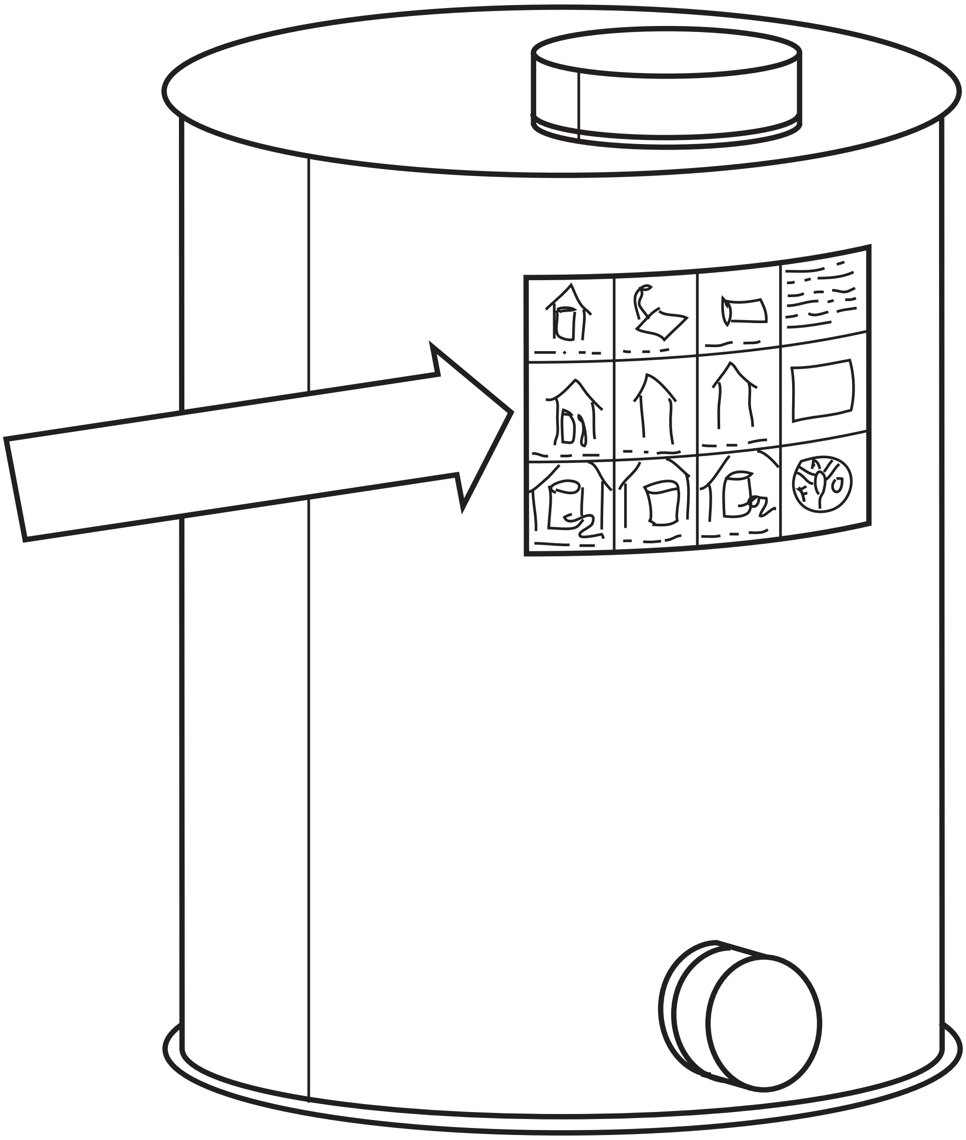
Paint all of the joints inside and outside with the anti-rust paint. Also paint any scratches or areas where the acid touched.



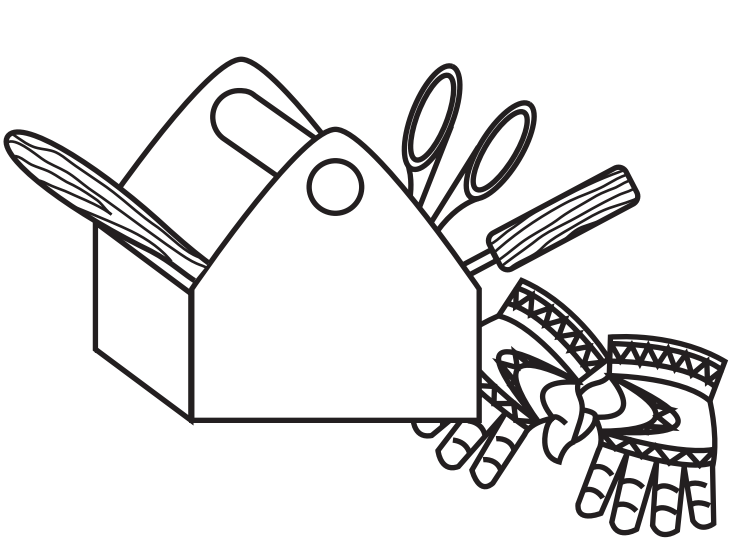
Make a wooden platform that is the same size as the bottom of the silo. It should be about 15 cm high. The large silos are heavy when they are full. They need a strong platform.



Place the information sheet on the front of the silo where it is easy to see.

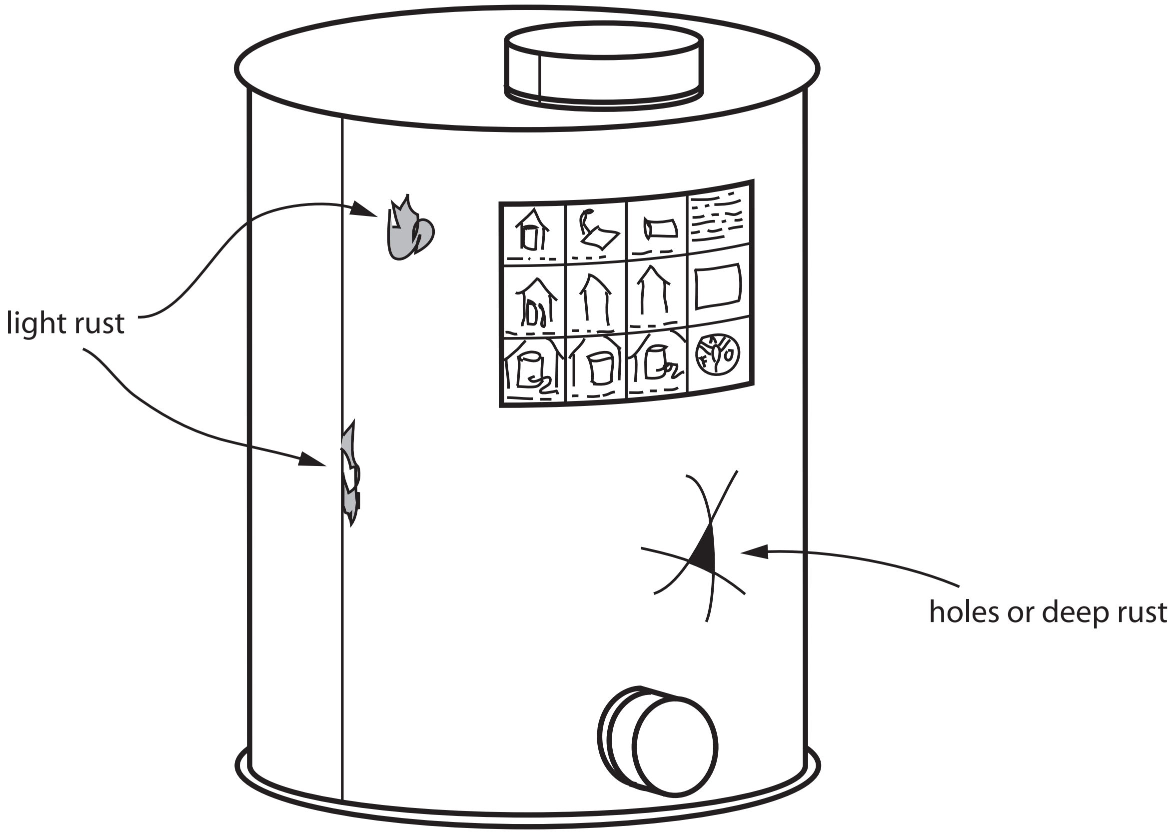


Good job. The silo is finished!



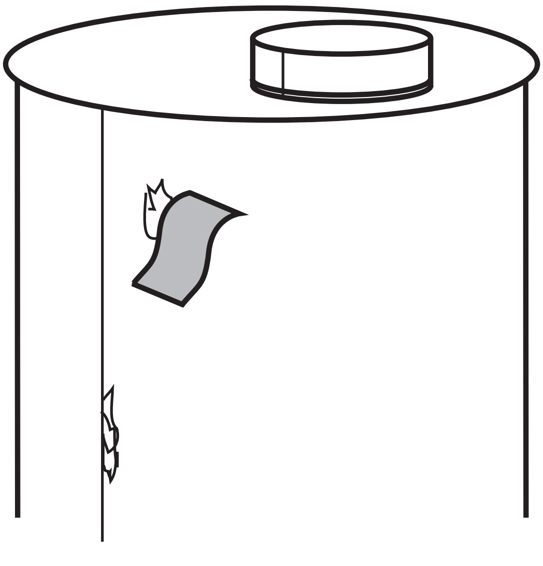
Repairs

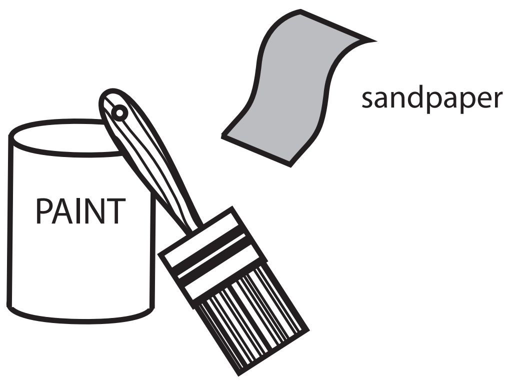
There are different ways that a silo may become damaged. After many years, even a well made and well cared-for silo may begin to rust. Holes are also possible.



Light Rust

Rust is common in older silos but a little maintenance may help them last several more years. If the rust is just on the surface of the silo then use sand paper to remove it. Paint the entire area. After you make any repairs to the joints check to see that there are no new small holes in the solder.

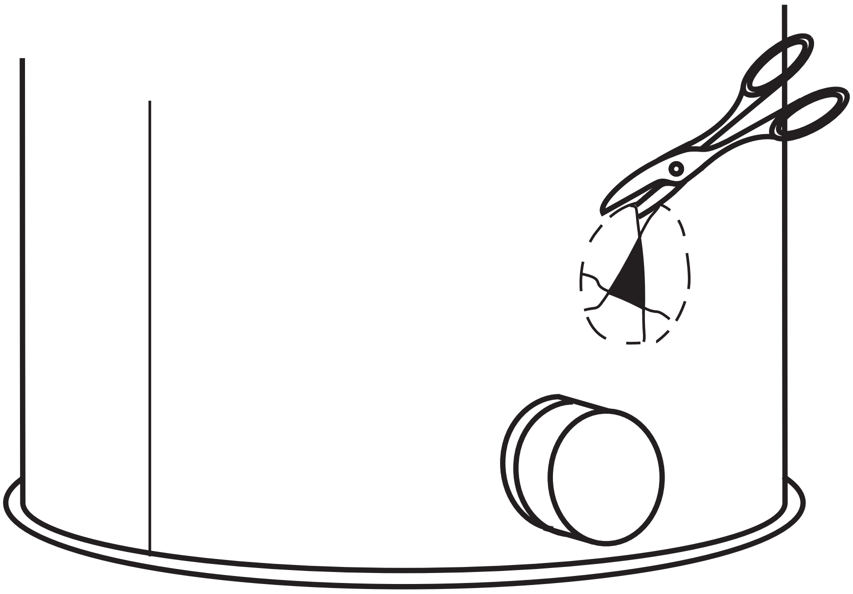




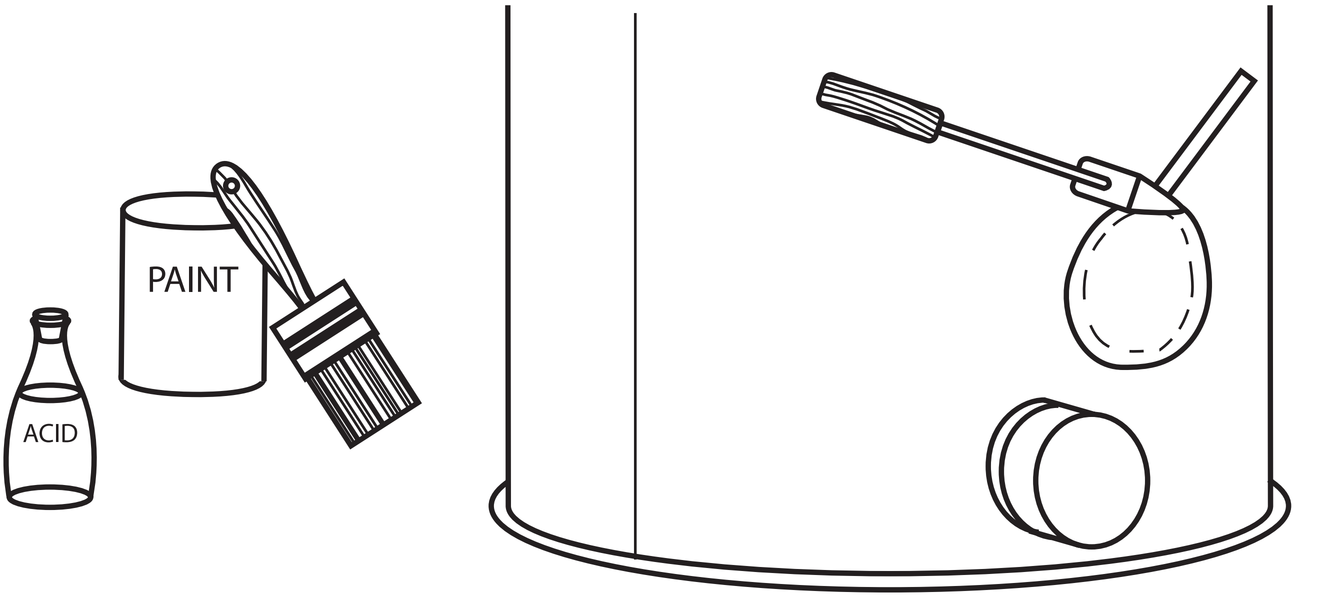
Holes or Deep Rust

Even if a large hole is punched in the silo, it can probably be fixed with a patch. A patch can also be used to fix an area of rust where the metal has become too thin to sand and paint. The silo must be empty before you start to fix the damaged area.

Use the shears to cut away any ragged metal and to even out the margins of the hole.

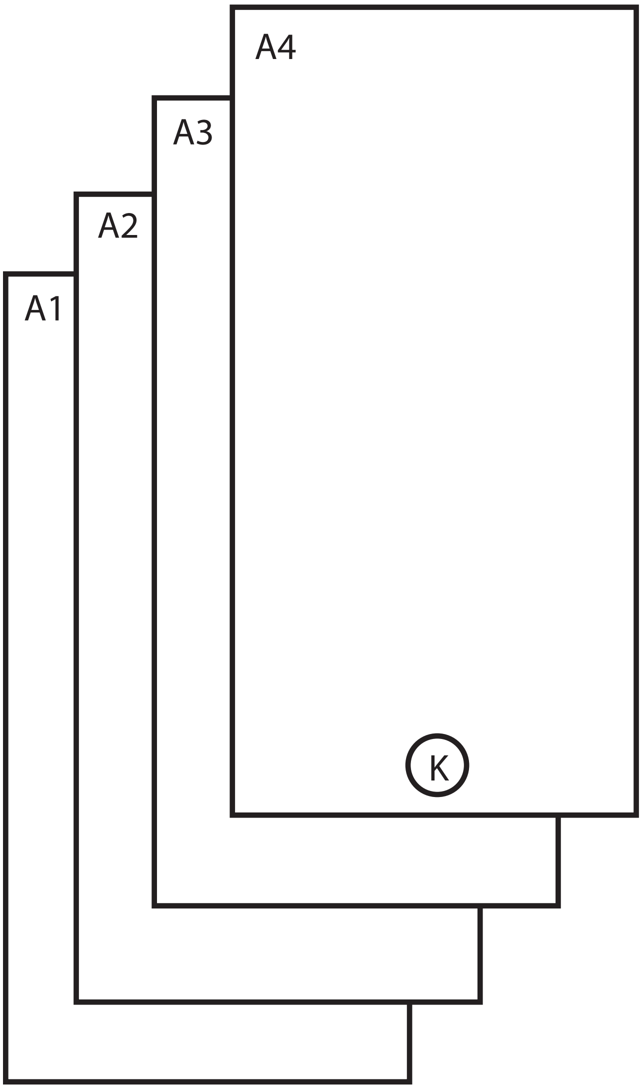


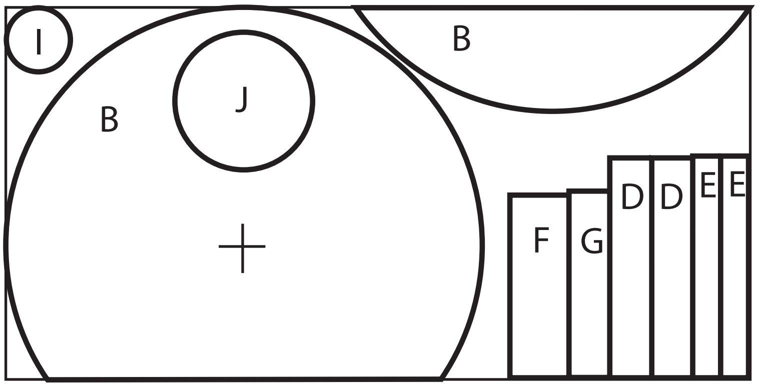
Cut a patch from scrap metal large enough to cover the hole plus about 2 cm extra all around. Use the acid to clean the metal. Solder the patch in place. Paint the solder joint inside and out as usual.

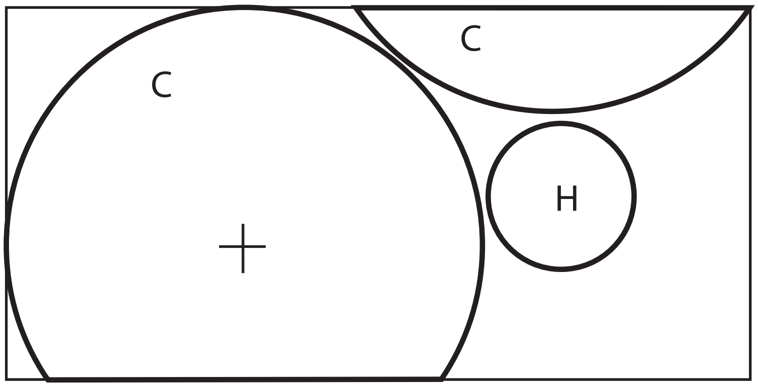


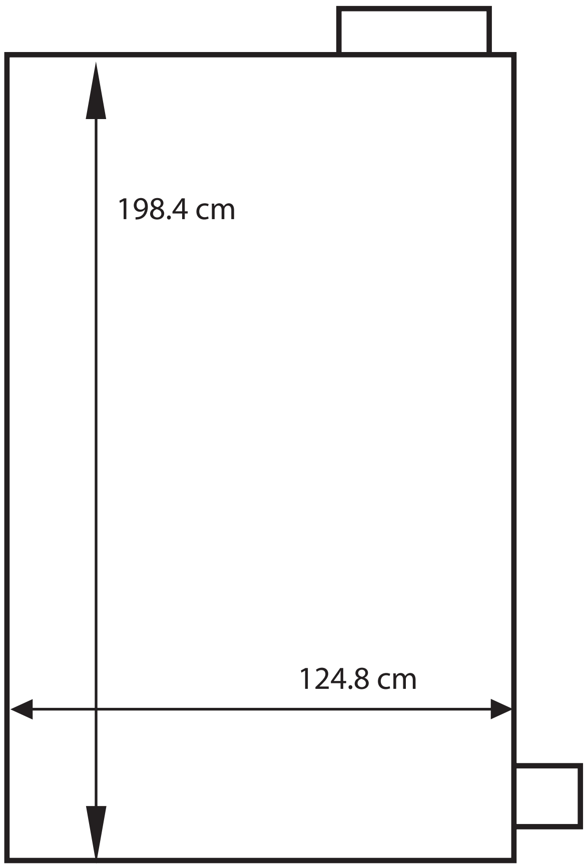
Plans

Plan for an 1800 Kg Silo made from 6 sheets (**100 x 200cm**)



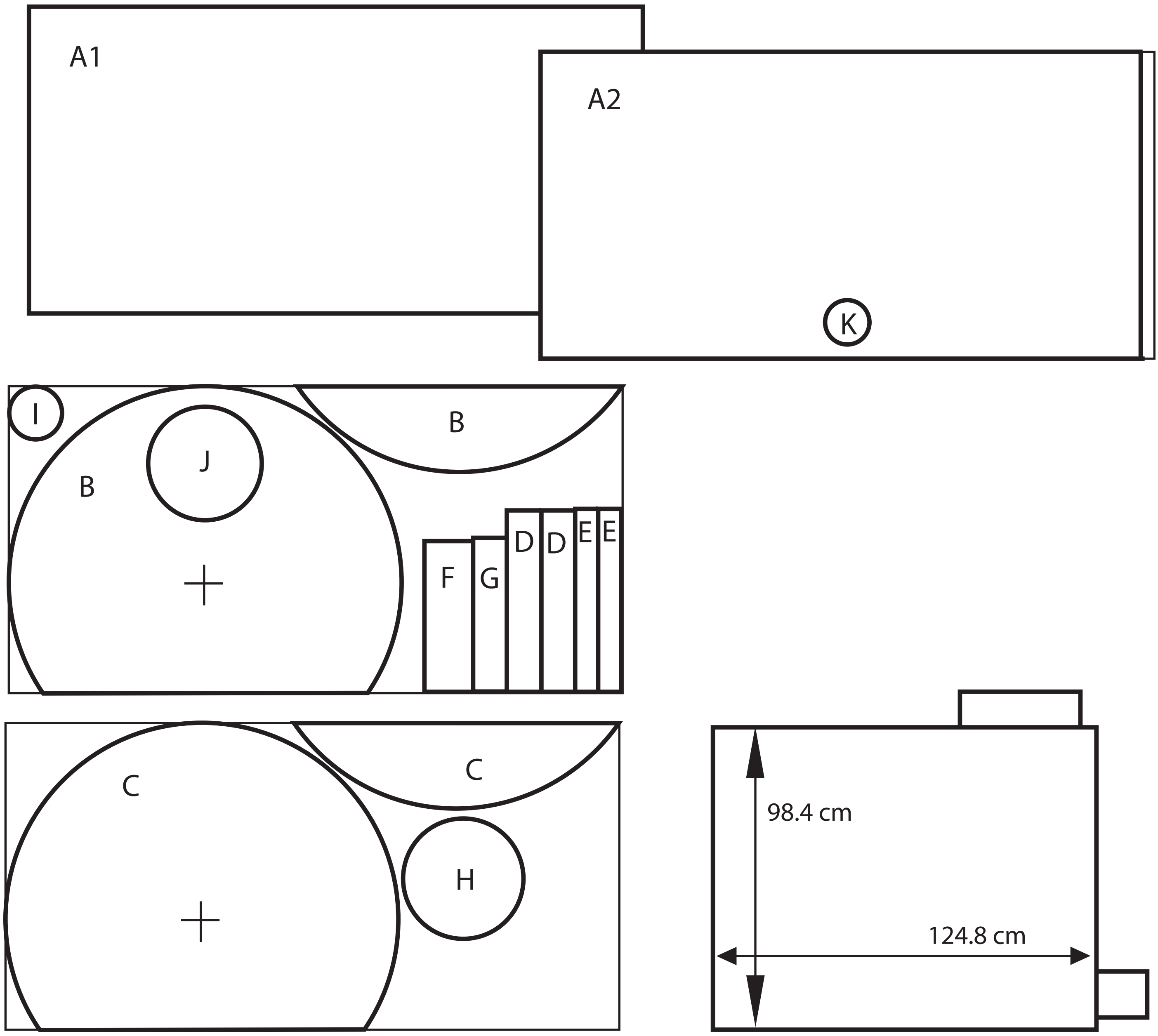






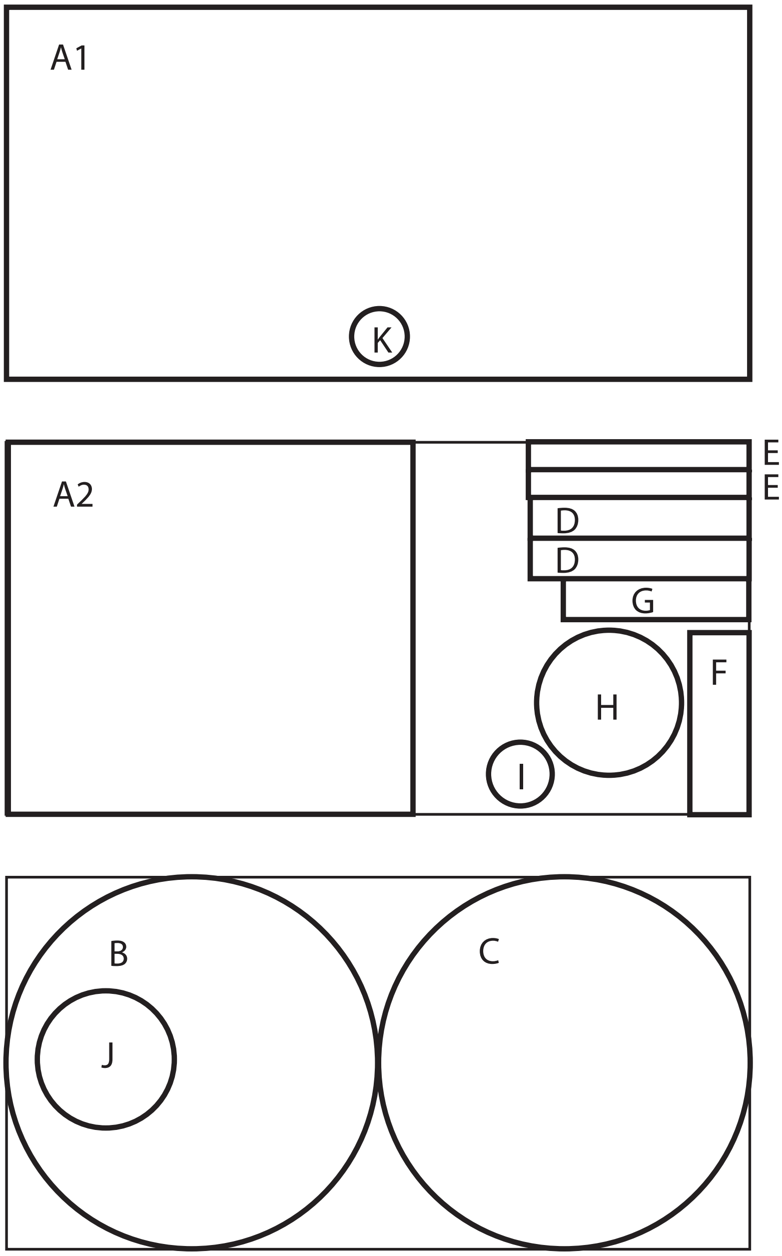
A1, A2, A3, A4: Body sheets (100 x 200 cm)
B: Top of silo (r = 64 cm)
C: Bottom of silo (r = 64 cm)
D: Inlet opening strip (11 x 118.2 cm)
E: Inlet cover strip (7.5 x 119.2 cm)
F: Outlet opening strip (16 x 49 cm)
G: Outlet cover strip (11 x 50 cm)
H: Top of inlet cover (r = 19.6 cm)
I: Top of outlet cover (r = 8.6 cm)
J: Inlet opening (r = 18.5 cm, with center 25 cm from the edge)
K: Outlet opening (r = 7.5 cm, with center 10.5 cm from the edge)

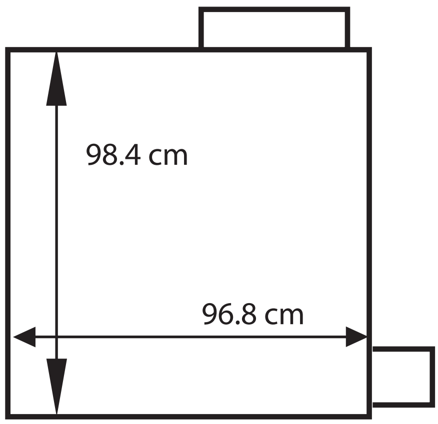
Plan for a 900 Kg Silo made from 4 sheets (**100 x 200cm**)



A1: Body sheet (100 x 200 cm)
A2: Body sheet (100 x 195.2 cm)
B: Top of silo (r = 64 cm)
C: Bottom of silo (r = 64 cm)
D: Inlet opening strip (11 x 118.2 cm)
E: Inlet cover strip (7.5 x 119.2 cm)
F: Outlet opening strip (16 x 49 cm)
G: Outlet cover strip (11 x 50 cm)
H: Top of inlet cover (r = 19.6 cm)
I: Top of outlet cover (r = 8.6 cm)
J: Inlet opening (r = 18.5 cm, with center 25 cm from the edge)
K: Outlet opening (r = 7.5 cm, with center 10.5 cm from the edge)

Plan for a 500 Kg Silo made from 3 sheets (**100 x 200cm**)

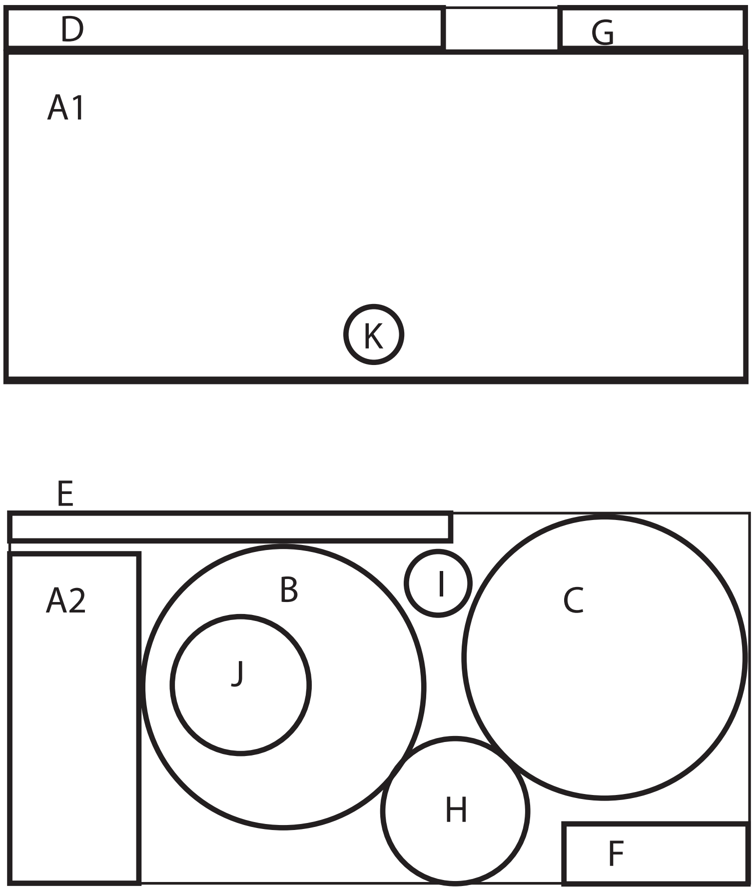


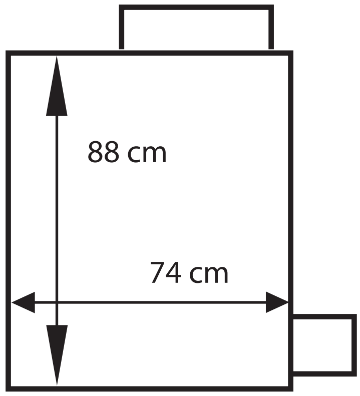


A1: Body sheet (100 x 200 cm)
A2: Body sheet (100 x 108.9 cm)
B: Top of silo (r = 50 cm)
C: Bottom of silo (r = 50 cm)
D: Inlet opening strip (11 x 118.2 cm)
E: Inlet cover strip (7.5 x 119.2 cm)
F: Outlet opening strip (16 x 49 cm)
G: Outlet cover strip (11 x 50 cm)
H: Top of inlet cover (r = 19.6 cm)
I: Top of outlet cover (r = 8.6 cm)
J: Inlet opening (r = 18.5 cm, with center 25 cm from the edge)
K: Outlet opening (r = 7.5 cm, with center 10.5 cm from the edge)

Plan for a 250 Kg Silo made from 2 sheets (**100 x 200cm**)

This silo can fit through openings less than 75 cm.

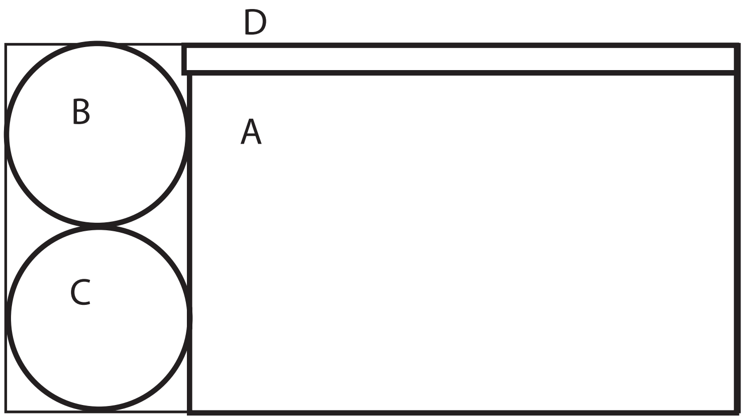


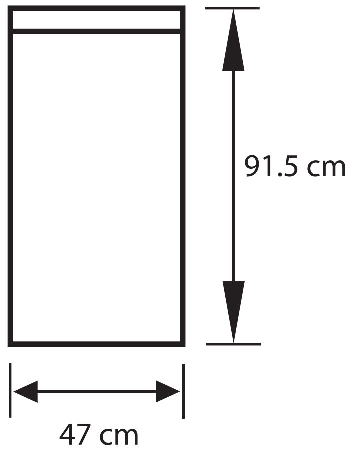


A1: Body sheet (89 x 200 cm)
A2: Body sheet (89 x 34.9 cm)
B: Top of silo (r = 38 cm)
C: Bottom of silo (r = 38 cm)
D: Inlet opening strip (11 x 118.2 cm)
E: Inlet cover strip (7.5 x 119.2 cm)
F: Outlet opening strip (16 x 49 cm)
G: Outlet cover strip (11 x 50 cm)
H: Top of inlet cover (r = 19.6 cm)
I: Top of outlet cover (r = 8.6 cm)
J: Inlet opening (r = 18.5 cm, with center 25 cm from the edge)
K: Outlet opening (r = 7.5 cm, with center 10.5 cm from the edge)

Plan for a 120 Kg Silo made from 1 sheet (**100 x 200cm**)

This silo can fit through openings less than 75 cm.



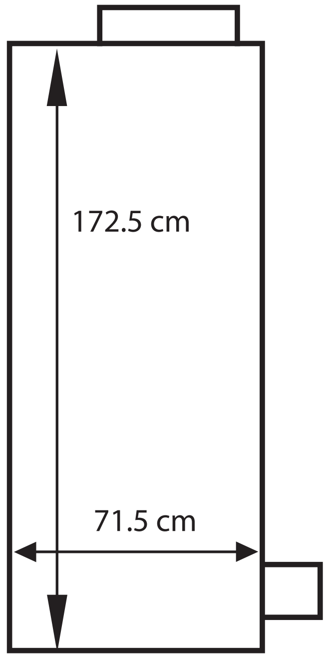


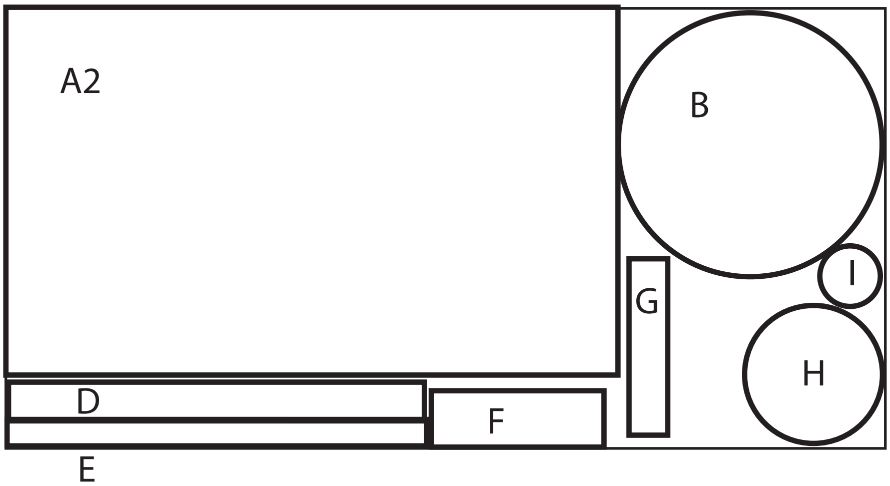
A: Body sheet (92.5 x 149 cm)
B: Top of silo (r = 24.7 cm)
C: Bottom of silo (r = 24.7 cm)
D: Inlet opening strip (7.5 x 1505 cm)

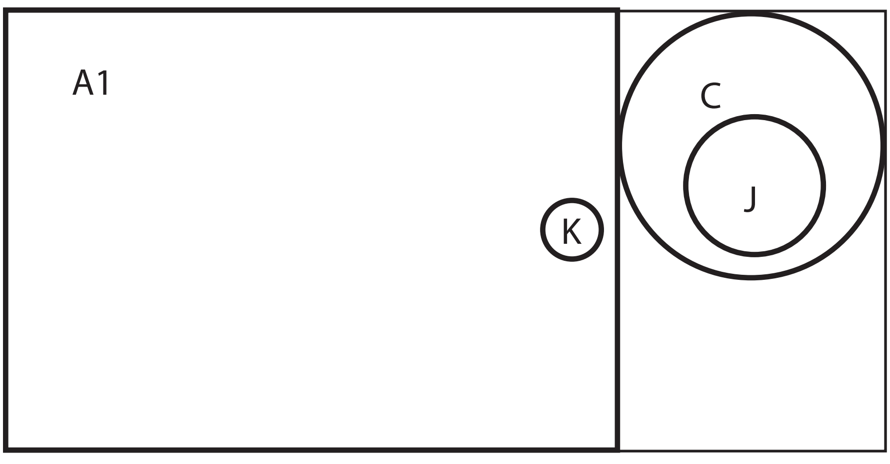
Special plan for a high 525 Kg Silo made from 2 sheets (**125 x 250cm**)

This silo can fit through openings less than 75 cm.

A1: First body sheet (125 x 174 cm)
A2: Second body sheet (104.5 x 174 cm)
B: Top of silo (r = 37.5 cm)
C: Bottom of silo (r = 37.5 cm)
D: Inlet opening strip (11 x 118.2 cm)
E: Inlet cover strip (7.5 x 119.2 cm)
F: Outlet opening strip (16 x 49 cm)
G: Outlet cover strip (11 x 50 cm)
H: Top of inlet cover (r = 19.6 cm)
I: Top of outlet cover (r = 8.6 cm)
J: Inlet opening (r = 18.5 cm, with center 25 cm from the edge)
K: Outlet opening (r = 7.5 cm, with center 10.5 cm from the edge)







Special plan for a low 530 Kg Silo made from 2 sheets (**125 x 250cm**)

This silo can fit through openings less than 75 cm.

A1: First body sheet (62.5 x 193.2 cm)
A2: Second body sheet (62.5 x 193.2 cm)
B: Top of silo (r = 62.5 cm)
C: Bottom of silo (r = 62.5 cm)
D: Inlet opening strip (11 x 118 cm)
E: Inlet cover strip (7.5 x 119 cm)
F: Outlet opening strip (16 x 49 cm)
G: Outlet cover strip (11 x 50 cm)
H: Top of inlet cover (r = 19.6 cm)
I: Top of outlet cover (r = 8.6 cm)
J: Inlet opening (r = 18.5 cm, with center 25 cm from the edge)
K: Outlet opening (r = 7.5 cm, with center 10.5 cm from the edge)