Sound of arc when welding under proper conditions:

- With aluminum alloy MIG welding, there is a quiet and continuous humming sound similar to that heard during carbon dioxide gas arc welding.
- A small amount of soot is formed along the bead during MIG welding. This is caused by magnesium contained in the electrode wires.

1. Differences in welding conditions

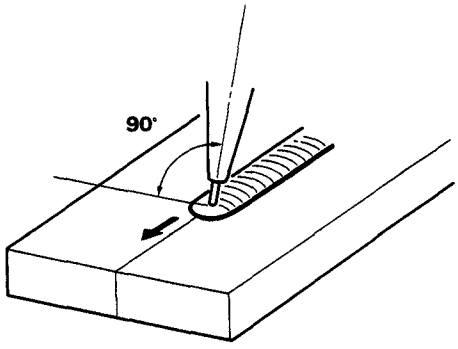
When comparing the welding of aluminum alloys and steel plate using the same welder, the thickness range of plates which can be welded is less for aluminum alloys. In other words, the welder setting conditions must be adjusted more finely for welding aluminum alloys.

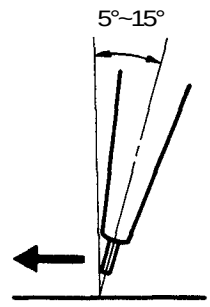
-1. Welding current, electrode wire speed
Under the same welding current conditions, the electrode wire for aluminum alloys needs to be fed faster than that for steel plates.

-2. Distance between contact tip and base metal
As for steel plate welding, the distance ranges from 8~15 mm (0.3~0.6 in). The gas shielding effect is enhanced by positioning the gun closer to the surface.

-3. Gun angle
The gun is held perpendicular to the welding surface. It is tilted at a 5~15° angle in the direction of the welding advance. Compared with steel plate welding, the gun angle is slightly more vertical.

-4. Direction of gun advance
Either a straight sequence or back-step can be used when for welding steel sheets. With aluminum alloys, however, only the forehand welding method is used.





-5. Gun travel speed
Welding of aluminum alloys progresses at a much faster rate than for steel plate. The speed increases as the welding progresses.

-6. Volume of shielding gas
About 50% more gas is required than for steel sheet welding.

(cont'd)

Aluminum Alloy Repair

MIG Welding Conditions (cont'd)

2. Nozzle and contact tip

Compared with the carbon dioxide arc welding of steel plates, spattering adheres more readily at the end of the nozzle and the contact tip.

- Adhesion of spattering can be reduced by using an anti-spatter compound. This makes it easier to remove spatter as well.
- The nozzle and contact tip are subjected to greater wear than with steel plate welding.

3. Electrode wire setting

Since the cable inner liner is made of teflon, be sure not to mark or scratch it.

- Use sandpaper to smooth the edge of the end of the electrode wire before feeding it through by hand.

4. Adjustment of electrode wire drive roller tension

Tension is adjusted to a setting less than that for steel plate welding. When the electrode wire is held lightly at the contact tip area and the torch switch is on, the wire is set so that it will slip in the drive roller area. If the tension is set too high, the aluminum alloy electrode wire will be twisted. If it is set too low, the wire speed will not be constant.

NOTE:

- The tools used for aluminum alloy welding should be kept completely separate from those used for steel plate.
- Use a stainless steel wire brush.
- Use sanding tools which have been reserved especially for use with aluminum alloys, (If the same tools are used for steel plate as well, iron deposits will remain on the surface of the aluminum alloy contaminating the welding locations.)
- Proper storage of electrode wire is important for best welding results.
- Store electrode wires where they will not become dirty or scratched and where they will be free from contact with oils and greases.
- When electrode wire is being used, ensure that it is wound properly on its spool. Use clean gloves to seal wire in airtight vinyl bags and store at a constant temperature in a location where it will be dry at all times.
- Take steps to ensure that the covers sealing electrode wire containers are not opened until actual use.

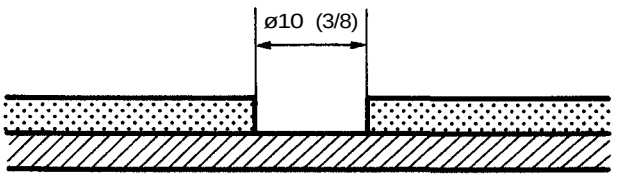
Plug Welding Procedures

When removing or replacing plates bonded by spot welding, drill through the spot weld nugget and remove. The combinations shown in the figures below apply when plates are to be welded together. Drill the hole when the plates have been removed or drill the prepared hole, and proceed with plug welding.

1. Plate combinations and prepared holes
   Diameter of drill (spot cutter) when removing plates: 10 mm (3/8")
   Drill the hole in the new part. Drill diameter: 8~10 mm (5/16~3/8")

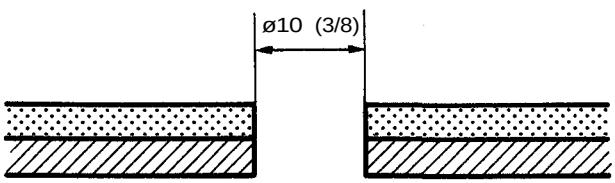
Unit: mm (in)

Two stacked plates:



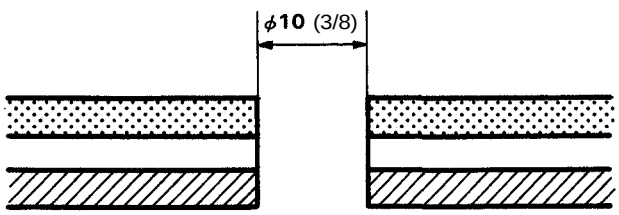
Hole drilled in one plate only.

Two stacked plates:



Hole drilled through both plates.

Three stacked plates:



Hole drilled through all three plates.

2. Adherence
   Where the plug welding is to be performed, the aluminum alloy plates must adhere together firmly, otherwise the welding will be defective.

(cont'd)

Aluminum Alloy Repair

Plug Welding Procedures (cont'd)

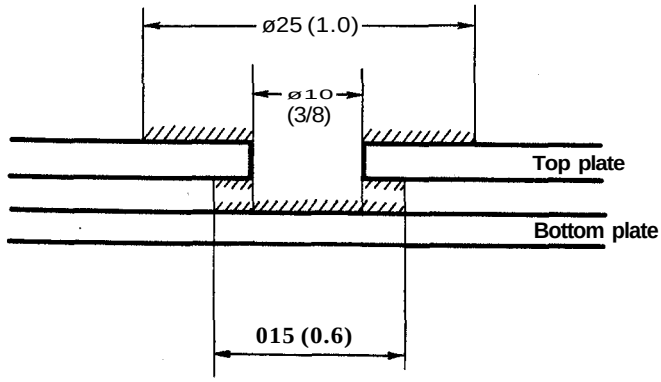
3. Cleaning and sanding
   - Use a wax and grease remover to clean off any dirt, oil or grease prior to welding.
   - If the aluminum alloy surface is coated with a paint film, use a disc sander and #80 sanding disc to remove the paint.
   - Use a stainless steel wire brush to burnish the bare surface of the aluminum alloy immediately before the welding.

   NOTE: Use a stainless steel wire brush to burnish the bare surface of the aluminum alloy immediately before welding.

Cleaning range

Unit: mm (in)

When drilling a single-layer hole in two stacked plates:

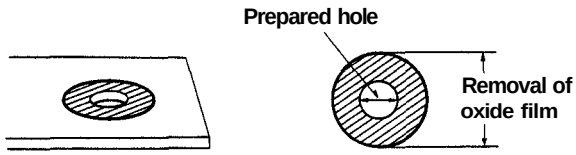
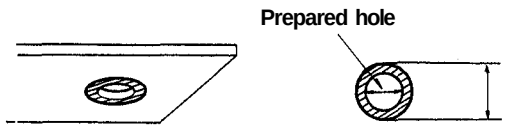


Sand the top and bottom surfaces of the top plate and the welding surface of the bottom plate.

Remove oxide film by sanding.

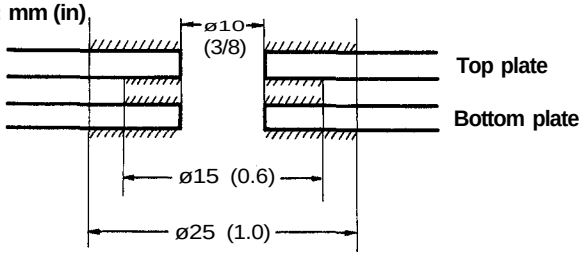
Prepared hole.

Oxide film removal by sanding

1. Top surface of top plate. 	25 mm (1.0 in) diameter area on top surface of top plate centering on plug hole.
2. Bottom surface of top plate.  3. Welding surface of bottom plate. 	15 mm (0.6 in) diameter area on bottom surface of top plate and welding surface of bottom plate centering on plug hole.

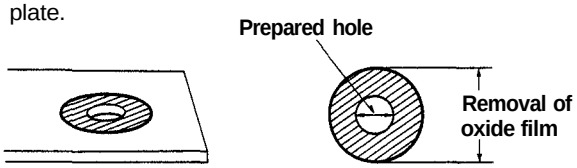
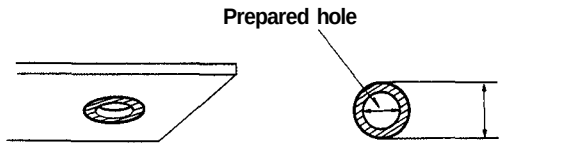
When a hole is to be made through two stacked plates:

Unit: mm (in)



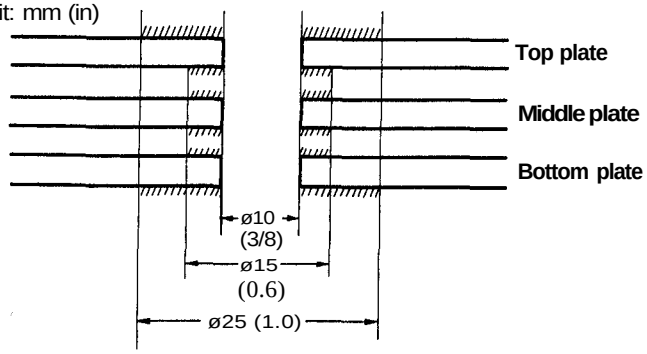
Sand the top and bottom surfaces of both the top and bottom plates.

Range of oxide film removal by sanding.

1. Top surface of top plate/bottom surface of bottom plate. 	25 mm (1.0 in) diameter area on top surface of top plate and bottom surface of bottom plate centering on plug hole.
2. Bottom surface of top plate/top surface of bottom plate. 	15 mm (0.6 in) diameter area on bottom surface of top plate and top surface of bottom plate centering on plug hole.

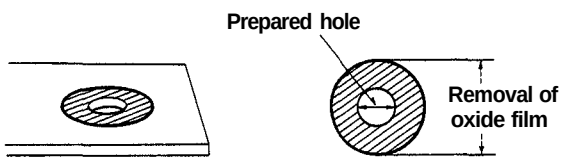
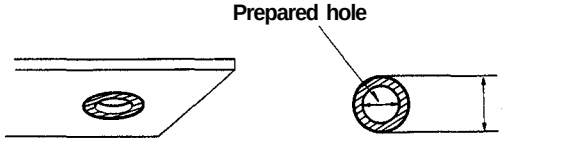
When a hole is to be made through three stacked plates:

Unit: mm (in)



Sand both surfaces of the top, middle and bottom plates as shown (/////) to remove oxide film.

Range of oxide film removal by sanding.

1. Outer surfaces of top and bottom plates. 	25 mm (1.0 in) diameter area on outer surfaces of top and bottom plates centering on plug hole.
2. Inner surfaces of top and bottom plates, both surface of middle plate. 	15 mm (0.6 in) diameter area on inner surfaces of top and bottom plates and on both surfaces of middle plate centering on plug hole.

(cont'd)

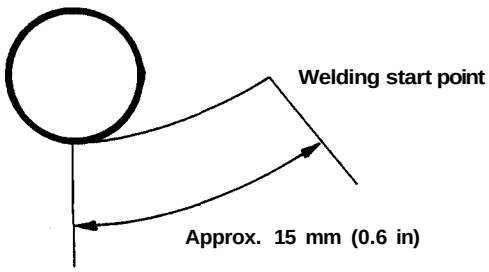
Aluminum Alloy Repair

Plug Welding Procedures (cont'd)

4. Welding
   Prepared hole diameter: 10 mm (0.4 in)

Plug welding starts from the outside of all weld zones (outside start).

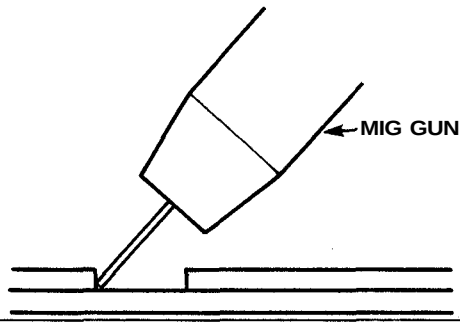
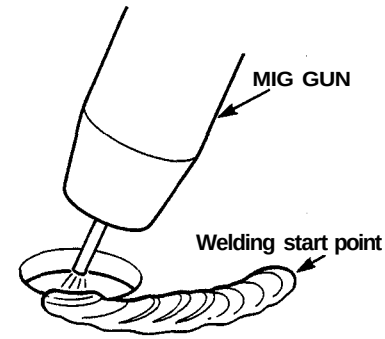
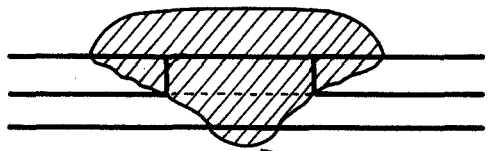
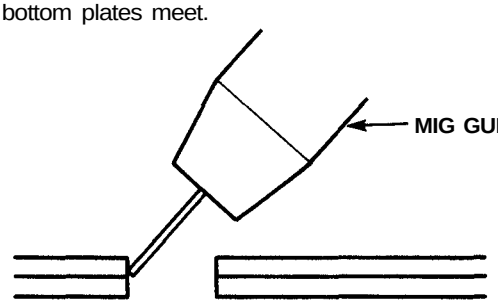
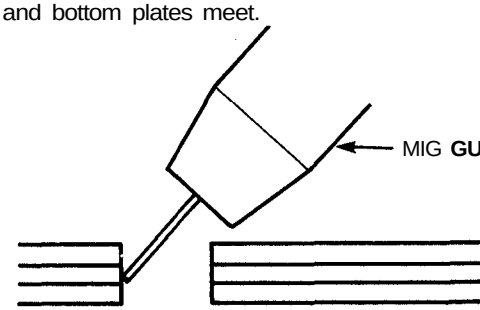
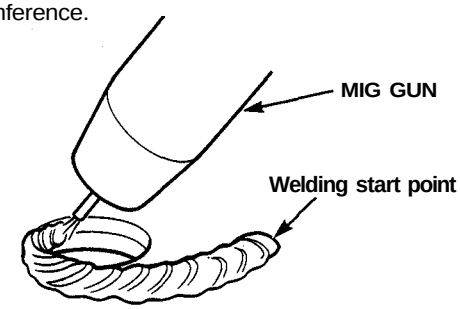
As shown in the figure, outside start welding commences at a position approximately 15 mm (0.6 in) from the weld zone.



Advantages of outside start

- Penetration is enhanced by the preheating effect accompanying the outside start.
- The initial penetration area is clearly visible is the light given off by the arc and working efficiency is improved.
- Outside start provides preheating to safeguard the aluminum alloy from inadequate initial penetration.

NOTE: Maintain a stable posture so that the torch does not move around but is held firmly and so that the weld zone is clearly visible.

Welding	Procedure
When drilling a single-layer hole in two stacked plates: Proceed with welding while aiming at the edge of the hole where the top and bottom plates meet.  	• Proceed with welding while closely observing the melting condition of the weld zone. • Until the operator is experienced in welding, take care not to increase the distance between the torch contact tip and base metal. 
 **Protrusion of reverse side bead.** NOTE: Melting of 1/3 to 2/3 of the bottom plate is the adequate for the weld.	• Ensure adequate penetration as far as the bottom plate. The reverse side bead on the bottom plate may protrude in the process. Keep the protrusion to a minimum.
With a hole through two stacked plates: Proceed with welding while aiming at the joint where the top and bottom plates meet.  With a hole through three stacked plates: Proceed with welding while aiming at the joint where the middle and bottom plates meet.  	(1) First, proceed from the top. • The plug hole is filled after welding to a distance equivalent to about one and half times the entire circumference.  • The plug hole is filled after welding to a distance equivalent to about twice the entire circumference.

(cont'd)