

## 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.

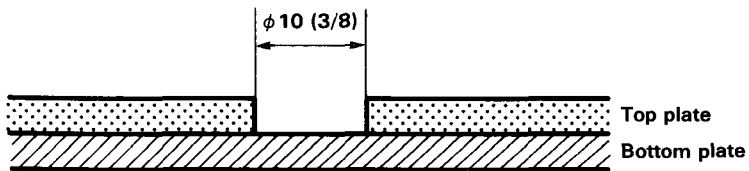
### 1. Plate combinations and prepared holes

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")

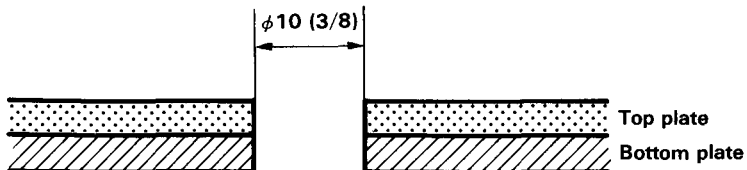
Unit: mm (in)

#### Two stacked plates:



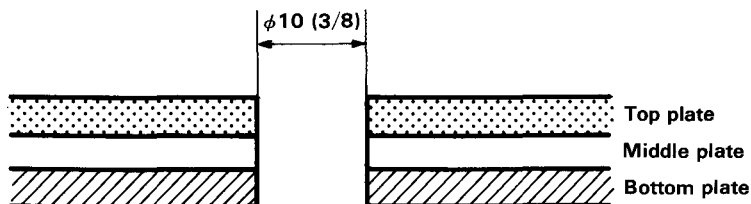
Hole drilled in one plate only.

#### 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.

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# Aluminum Alloy Repair

## Plug Welding Procedures (cont'd)

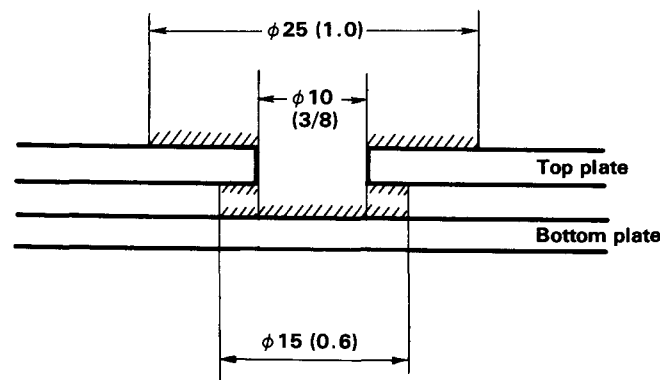
3. Cleaning and sanding
- Use a wax and grease remover to clean off any dirt, oil or grease prior to welding.
  - If the aluminum alloy surface is coated with a paint film, use a disc sander and #80 sanding disc to remove the paint.
  - Use a stainless steel wire brush to burnish the bare surface of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

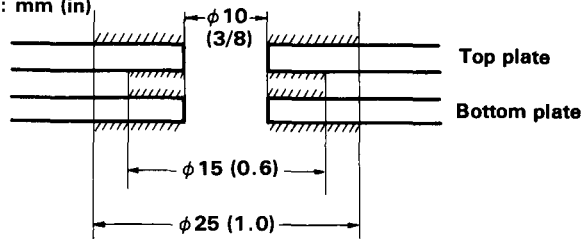
Prepared hole.

### Oxide film removal by sanding

<p>1. Top surface of top plate.</p> <p>Prepared hole</p> <p>Removal of oxide film</p>	<p>25 mm (1.0 in) diameter area on top surface of top plate centering on plug hole.</p>
<p>2. Bottom surface of top plate.</p> <p>Prepared hole</p>	<p>15 mm (0.6 in) diameter area on bottom surface of top plate and welding surface of bottom plate centering on plug hole.</p>
<p>3. Welding surface of bottom plate.</p> <p>Prepared hole</p>	

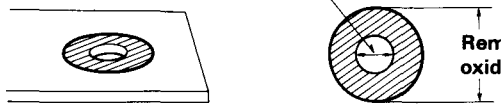

When a hole is to be made through two stacked plates:

Unit: mm (in)



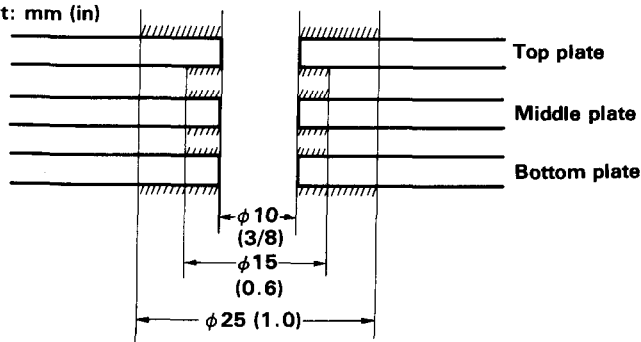
Sand the top and bottom surfaces of both the top and bottom plates.

Range of oxide film removal by sanding.

<p>1. Top surface of top plate/bottom surface of bottom plate.</p>  <p>Prepared hole</p> <p>Removal of oxide film</p>	<p>25 mm (1.0 in) diameter area on top surface of top plate and bottom surface of bottom plate centering on plug hole.</p>
<p>2. Bottom surface of top plate/top surface of bottom plate.</p>  <p>Prepared hole</p> <p>Removal of oxide film</p>	<p>15 mm (0.6 in) diameter area on bottom surface of top plate and top surface of bottom plate centering on plug hole.</p>


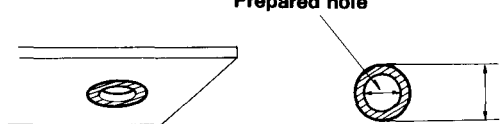
When a hole is to be made through three stacked plates:

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.

<p>1. Outer surfaces of top and bottom plates.</p>  <p>Prepared hole</p> <p>Removal of oxide film</p>	<p>25 mm (1.0 in) diameter area on outer surfaces of top and bottom plates centering on plug hole.</p>
<p>2. Inner surfaces of top and bottom plates, both surface of middle plate.</p>  <p>Prepared hole</p> <p>Removal of oxide film</p>	<p>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.</p>

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# Aluminum Alloy Repair

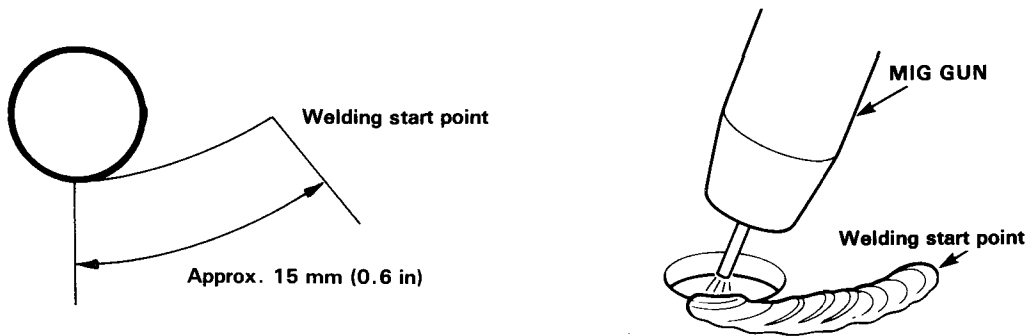
## Plug Welding Procedures (cont'd)

### 4. Welding

Prepared hole diameter: 10 mm (0.4 in)

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

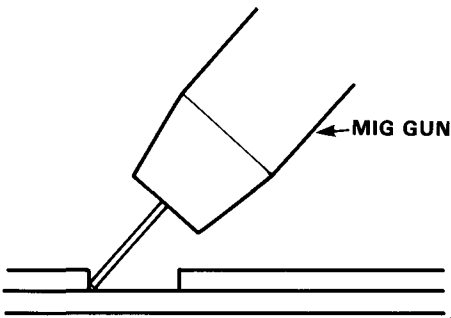
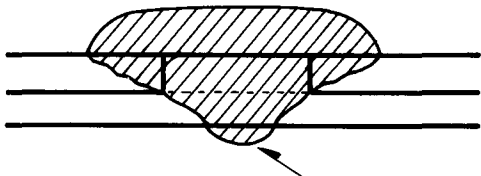
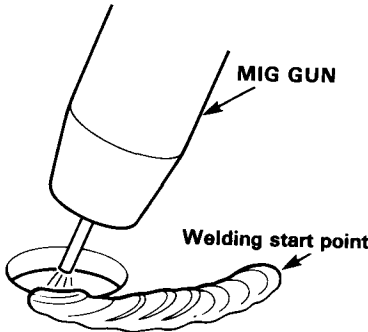
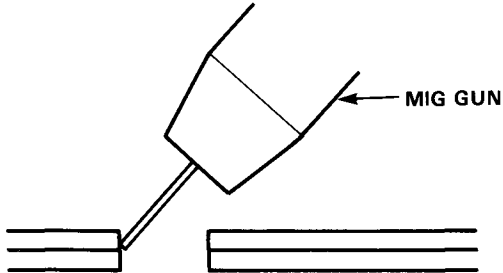
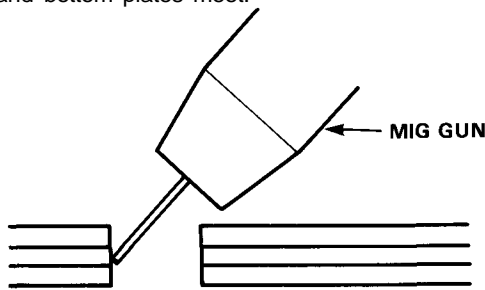
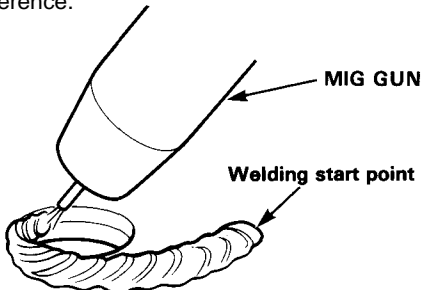
As shown in the figure, outside start welding commences at a position approximately 15 mm (0.6 in) from the weld zone.



### Advantages of outside start

- Penetration is enhanced by the preheating effect accompanying the outside start.
- The initial penetration area is clearly visible as 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.

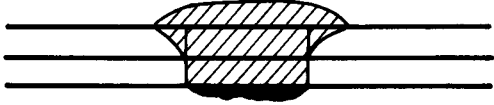
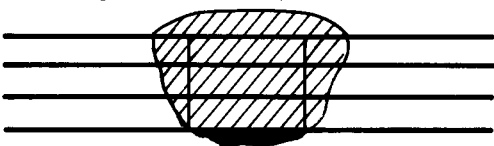
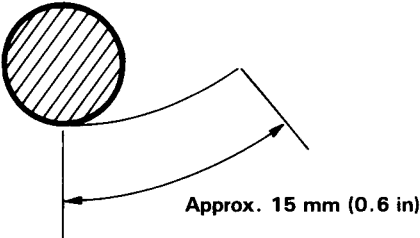
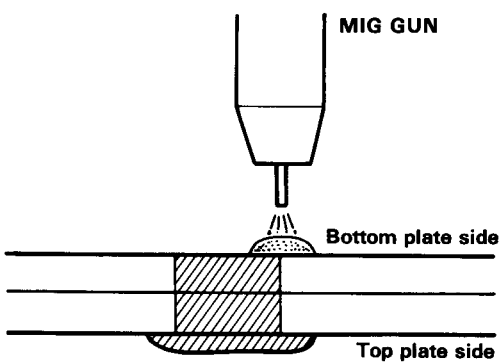
NOTE: Maintain a stable posture so that the torch does not move around but is held firmly and so that the weld zone is clearly visible.

Welding	Procedure
<p>When drilling a single-layer hole in two stacked plates:</p> <p>Proceed with welding while aiming at the edge of the hole where the top and bottom plates meet.</p>   <p><b>Protrusion of reverse side bead.</b></p> <p>NOTE: Melting of 1/3 to 2/3 of the bottom plate is the adequate for the weld.</p>	<ul style="list-style-type: none"> <li>• Proceed with welding while closely observing the melting condition of the weld zone.</li> <li>• Until the operator is experienced in welding, take care not to increase the distance between the torch contact tip and base metal.</li> </ul>  <ul style="list-style-type: none"> <li>• 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.</li> </ul>
<p>With a hole through two stacked plates:</p> <p>Proceed with welding while aiming at the joint where the top and bottom plates meet.</p>  <p>With a hole through three stacked plates:</p> <p>Proceed with welding while aiming at the joint where the middle and bottom plates meet.</p> 	<p>(1) First, proceed from the top.</p> <ul style="list-style-type: none"> <li>• The plug hole is filled after welding to a distance equivalent to about one and half times the entire circumference.</li> </ul>  <ul style="list-style-type: none"> <li>• The plug hole is filled after welding to a distance equivalent to about twice the entire circumference.</li> </ul>

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# Aluminum Alloy Repair

## Plug Welding Procedures (cont'd)

Grinding	Procedure
<p>Protrusion of reverse side bead. Hole through two stacked plates:</p> 	<p>(2) Use a disc grinder or disc sander to grind down the area where the bead on the reverse side protrudes until it is flush with the surface of the bottom plate.</p>
<p>Hole through three stacked plates:</p> 	<p>(3) Use a stainless steel wire brush to burnish the surface where the bead is ground down.</p>
Welding	
<p>View from bottom plate</p>   <p>MIG GUN</p> <p>Bottom plate side</p> <p>Top plate side</p>	<p>(4) Use an outside start to weld the bottom plate where the bead is ground down.</p> <p>(5) When welding the bottom surface, position the torch perpendicularly and weld around the edge of the plug hole.</p>