Good Shop Floor Practices for fabrication of stainless steel

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Differences between Carbon & Stainless Steels

Press Loading for forming

Welding Parameters

Filler Metal

Cutting Speeds

The most Important Difference is the Surface

Carbon Steel	Stainless Steel
Reactive	Passive
Rust formation	No rusting
Needs Paint Protection	No need

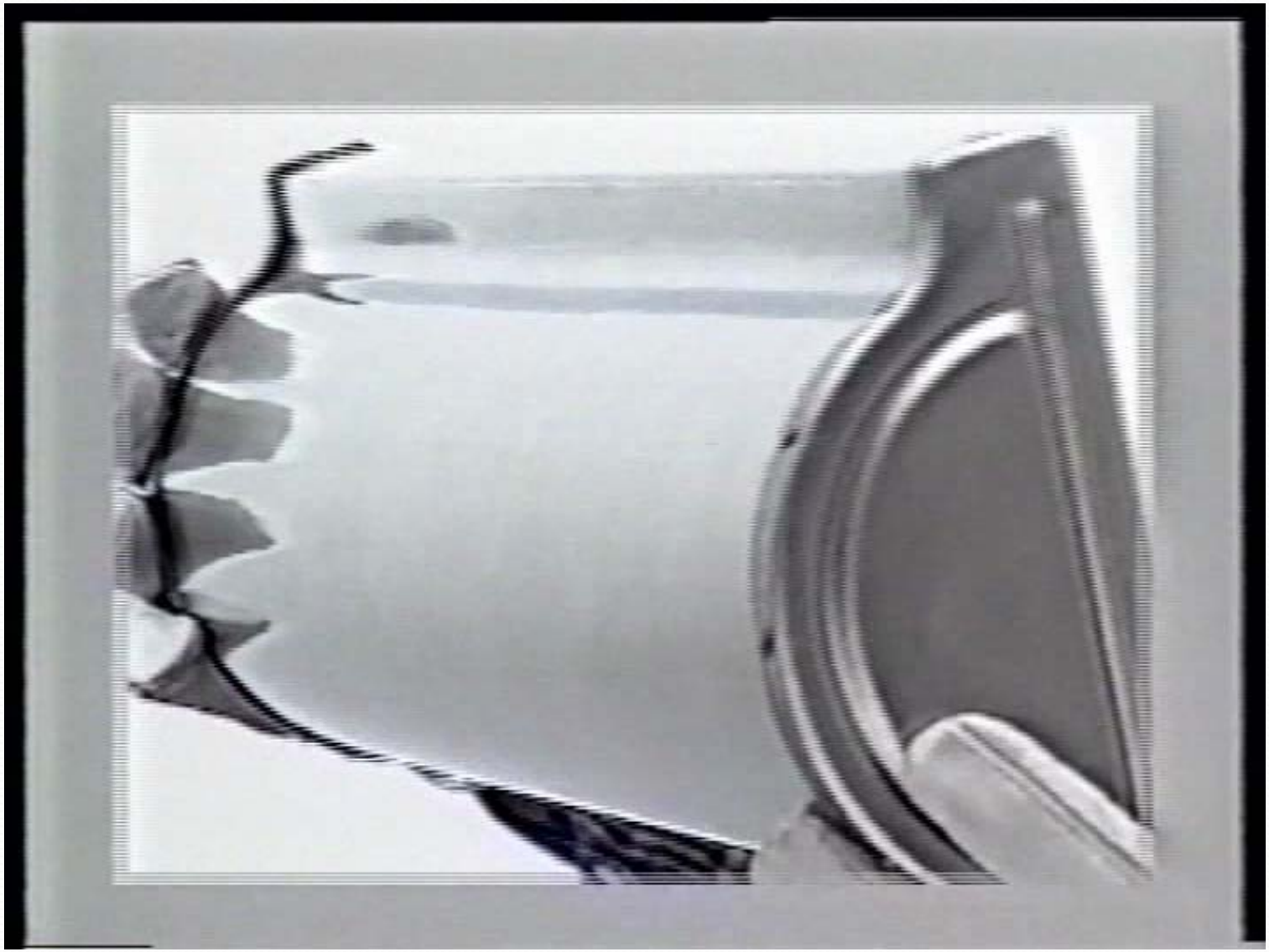
Sometimes you get complaints that stainless steel is rusting.

This is usually because tiny particles of iron are embedded on the surface of stainless steel during fabrication. This iron is what is rusting. Not the stainless steel itself. This is quite a common problem and can be easily avoided.

Avoiding Iron contamination is the Biggest Difference

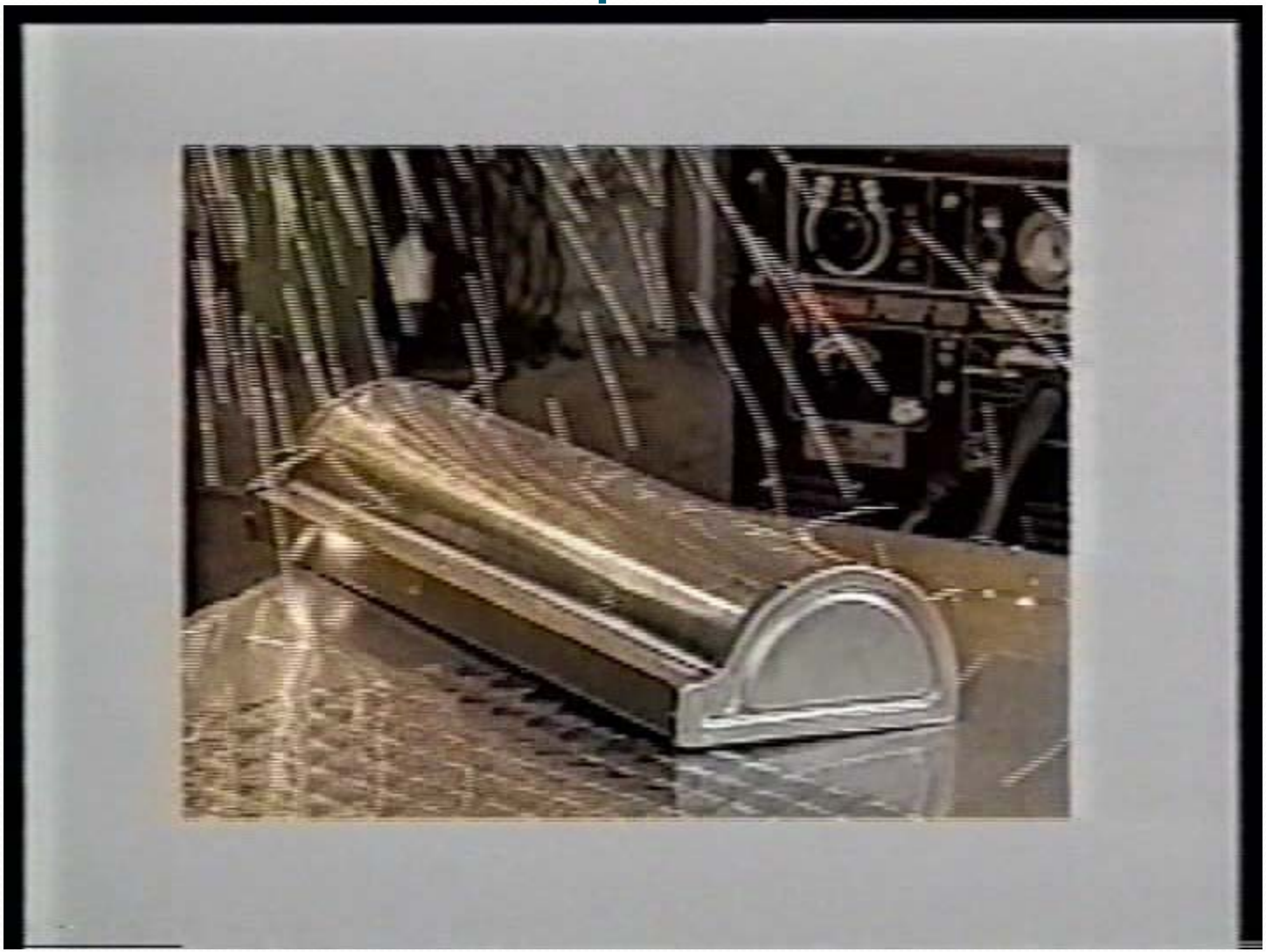
If you choose the right grade and fabricate it properly, you can do more with stainless steel than you can with carbon steel

Original Appearance



Carbon Steel being cut nearby

Sparks of carbon steel rain on stainless steel product

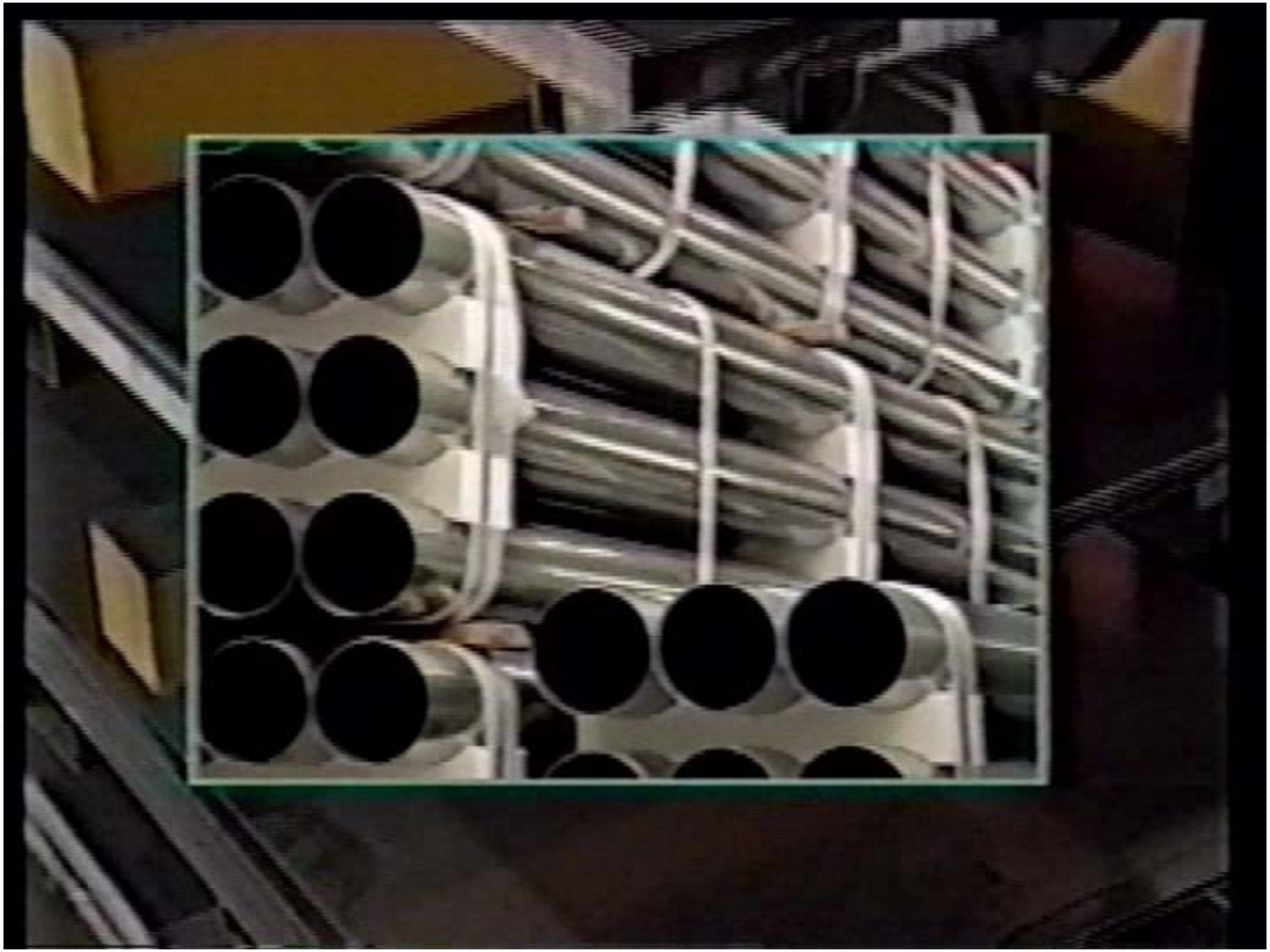


End Result

Do not store on the work floor or walk on them

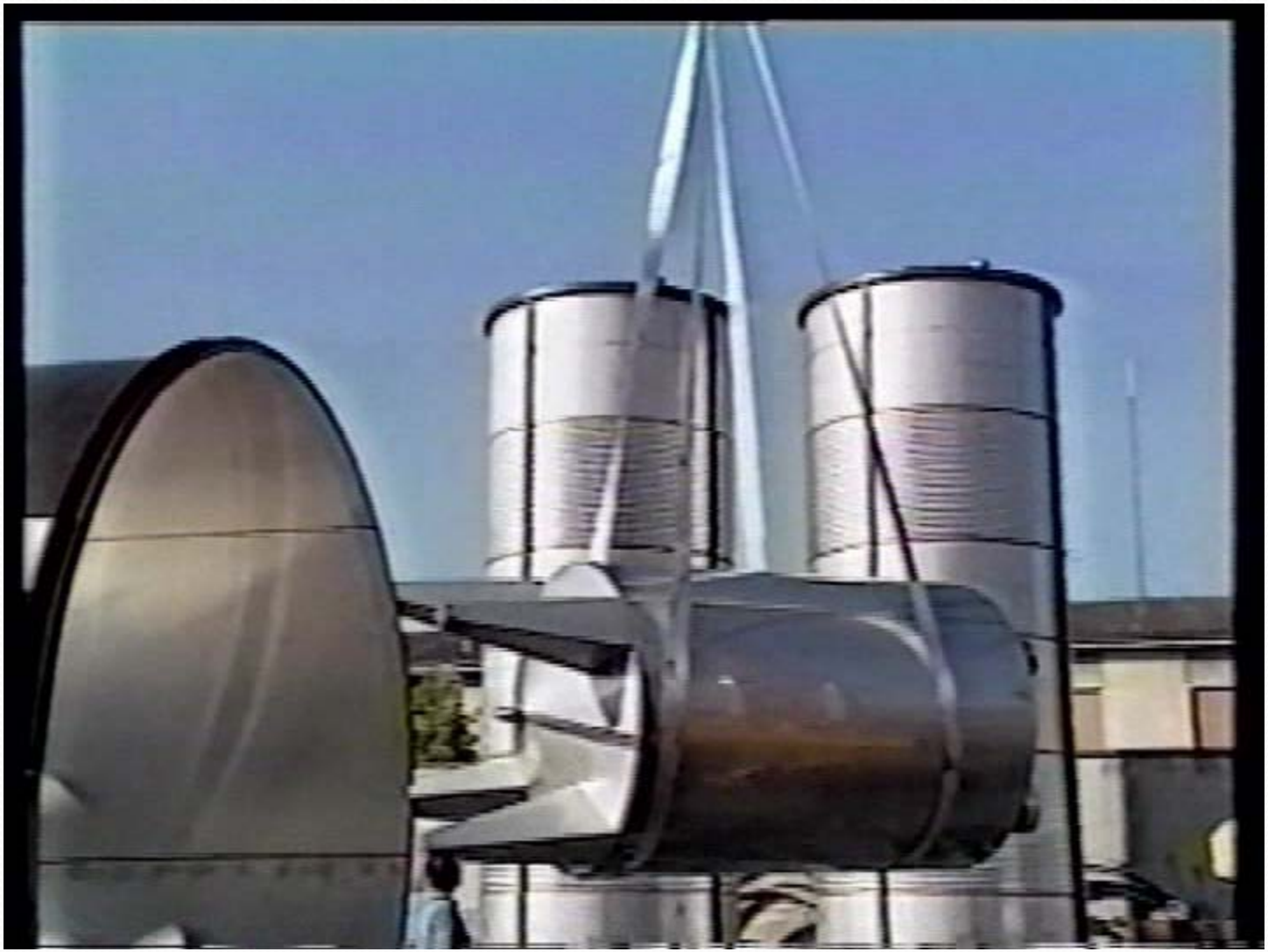
Shoe marks are full of contamination from shop floor

Use wood or plastic separators on shelves. Mild steel shelves should not be in direct contact with stainless steel

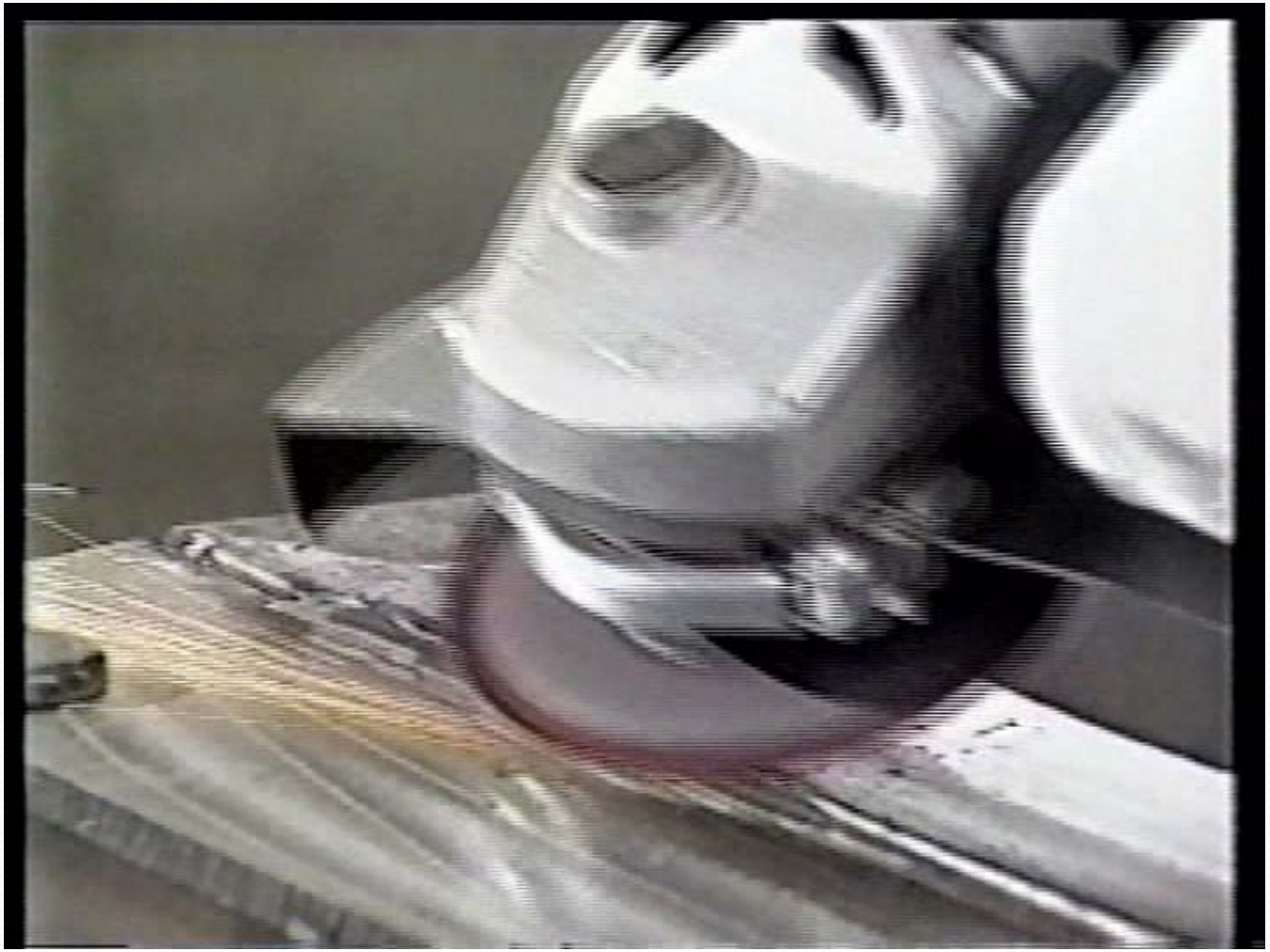


Do not use mild steel ropes for lifting

Use non-metallic straps

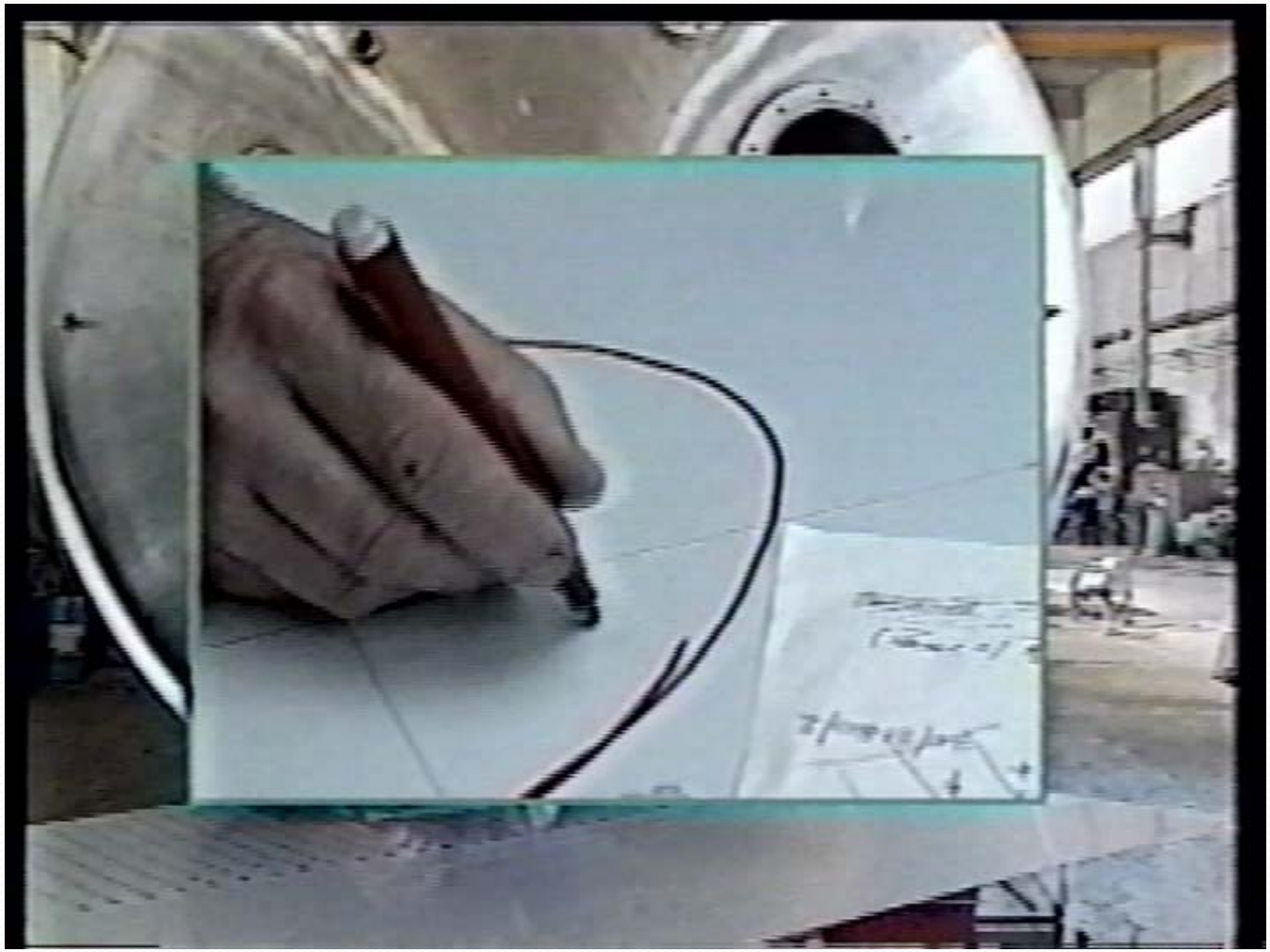


Grinding wheels should be dedicated for use only on stainless steel; Do not ever use them on carbon steel.



Use only stainless steel brushes

Do not mark with crayon on bare sheets. Mark on Polythene protective sheets



Good Practices

- Layer vice with thin sheets of tack-welded stainless steel at the jaws.
- Mild steel work tables should also be covered with either stainless steel or aluminium sheets to prevent direct rubbing or dragging over mild steel.
- Finally, a dedicated work space would be best because carbon steel welding fumes in the shed would condense overnight on the surfaces of stainless steel raw materials or products in process.

You need to clean heat tints. They reduce corrosion resistance.

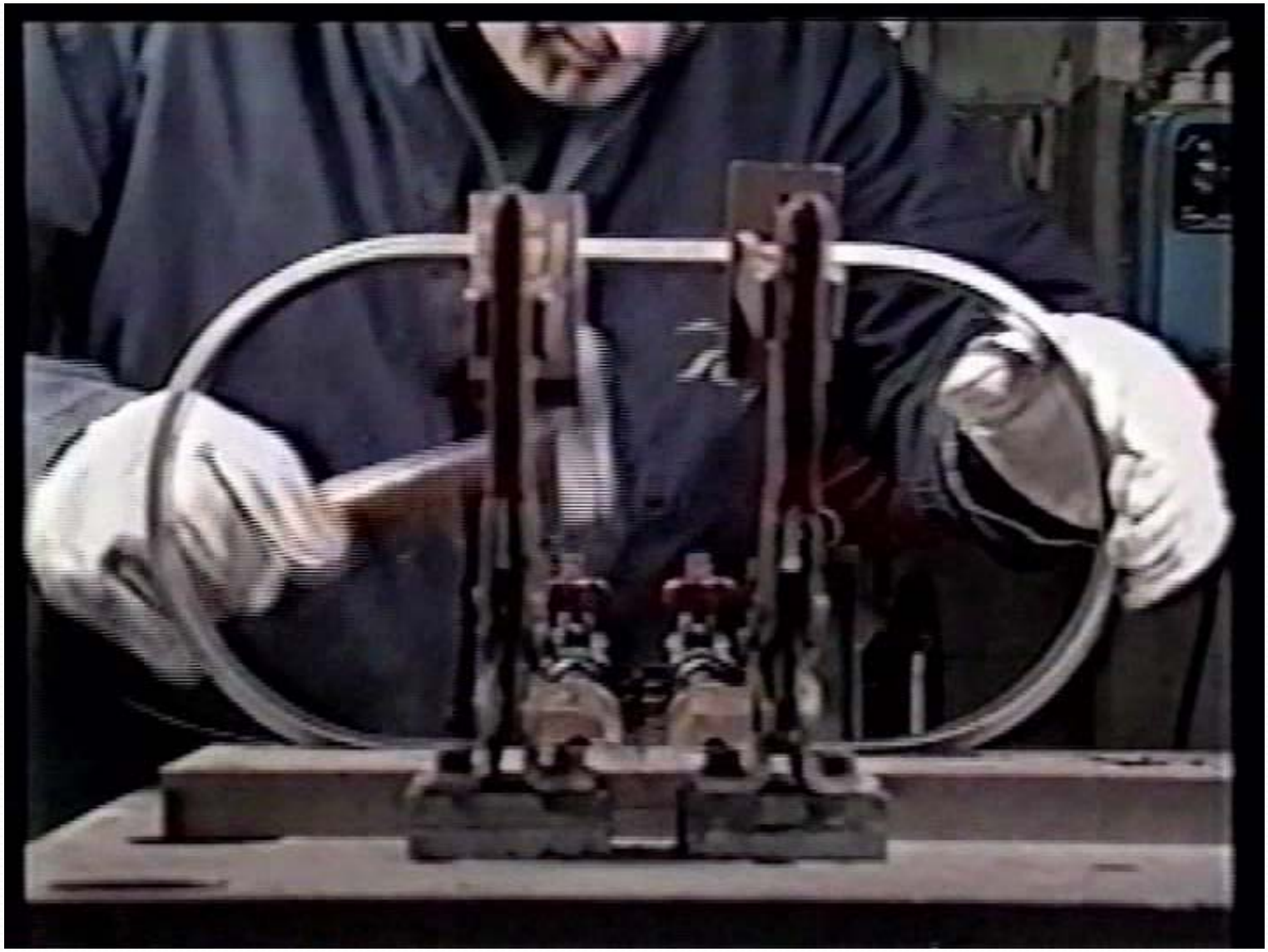
Physical properties of SS and CS contd.

	Austenitic Stainless Steel	Carbon Steel	Remarks
Thermal Expansion over range indicated in./in./C x 10^{-6}	17.6 (20-500 ^{o}C)	11.7 (20-628 ^{o}C)	Type 304 expands and contracts at a faster rate than CS, which means that increased expansion and contraction must be allowed for in order to control warping and the development of thermal stresses upon cooling. For example, more tack welds are used for SS than for CS.

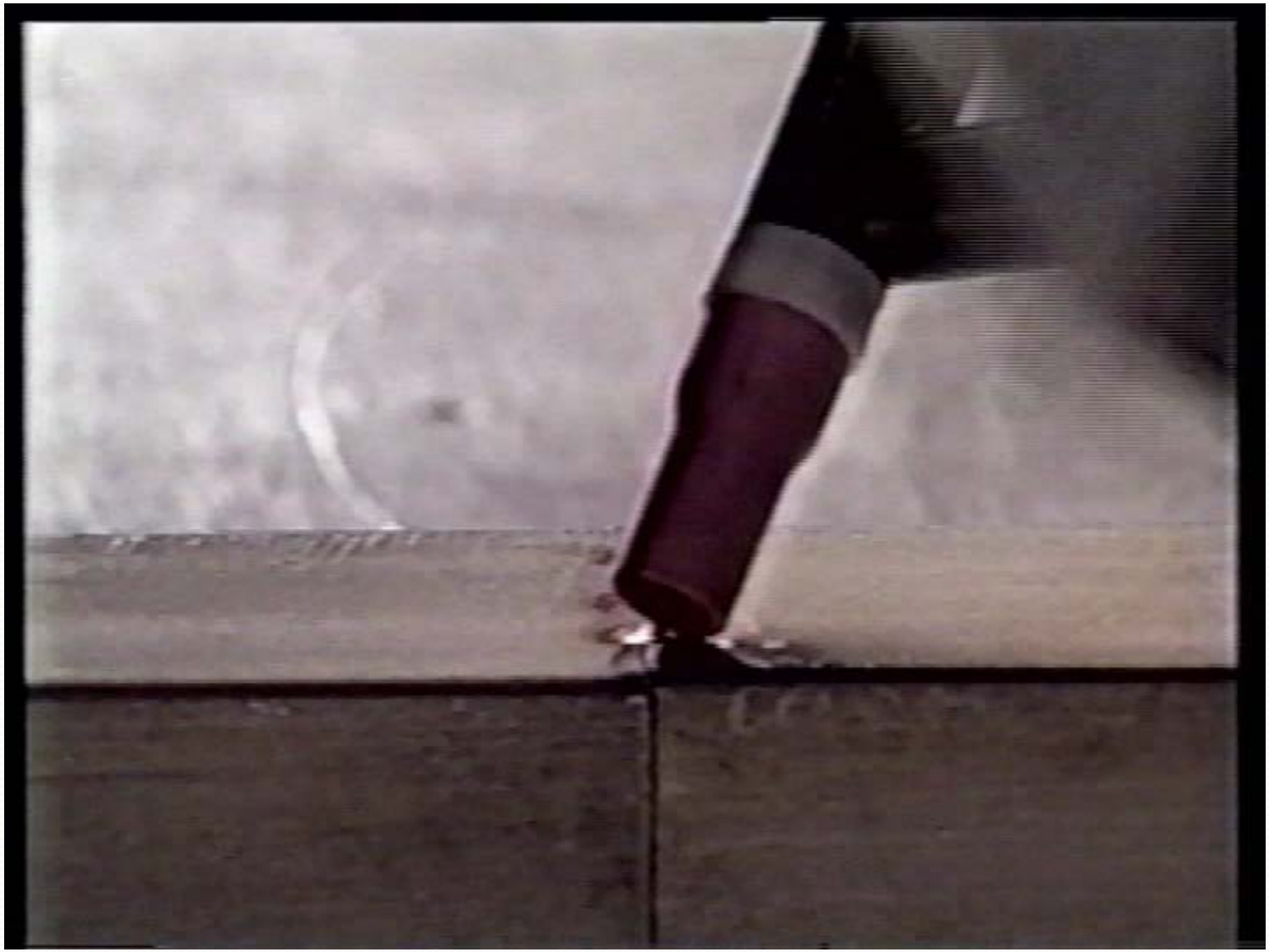
Physical properties of SS and CS contd.

	Austenitic Stainless Steel	Carbon Steel	Remarks
Rate of heat conductivity % at 100 ^{o}C % at 650 ^{o}C	(Type 304) 28 % 66 %	 100 % 100 %	Type 304 conducts heat much more slowly than CS thus promoting sharper heat gradients. This accelerates warping, especially in combination with higher expansion rates. Slower diffusion of heat expansion through base metal means that weld zones remain hot longer, one result of which may be longer dwell in the carbide precipitation range unless excess heat is artificially removed by chill bars, etc.

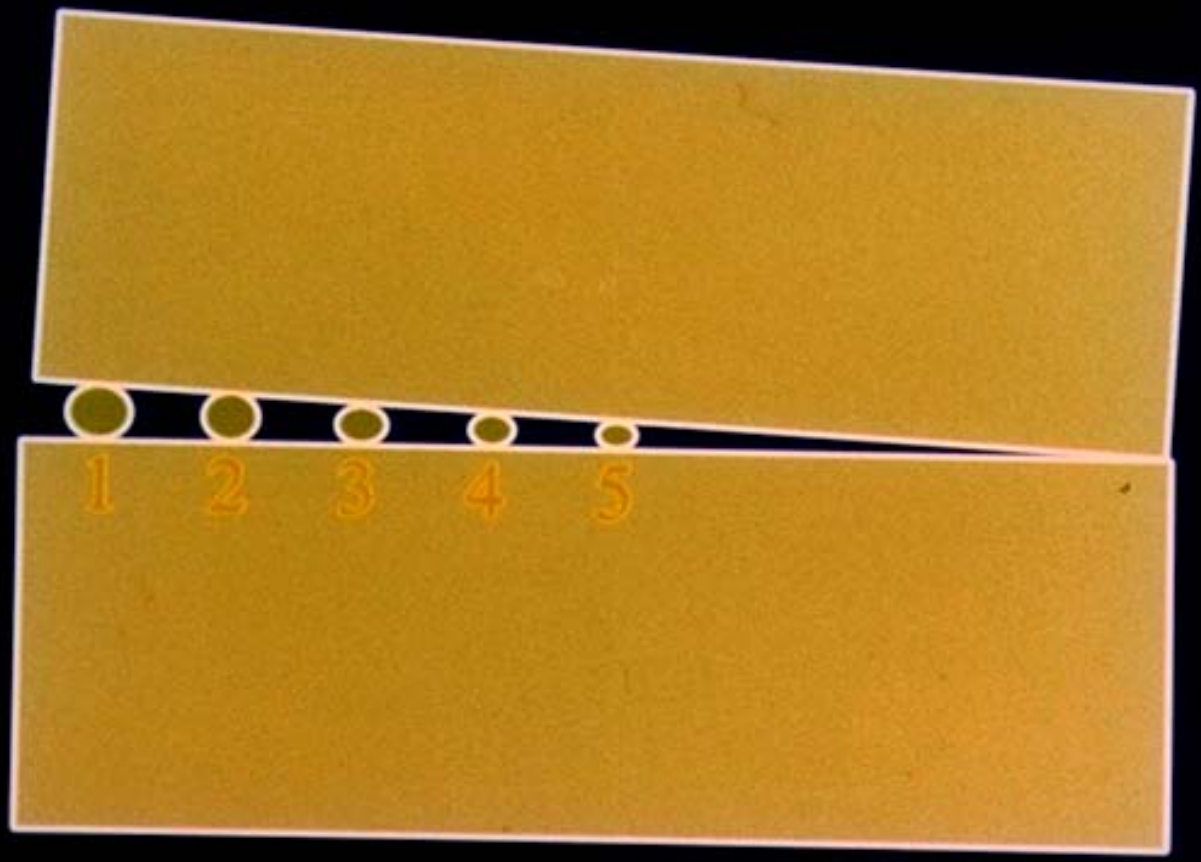
Control distortion with fixtures and tacks



Note the close location of tacks



WRONG TACK WELDING SEQUENCE



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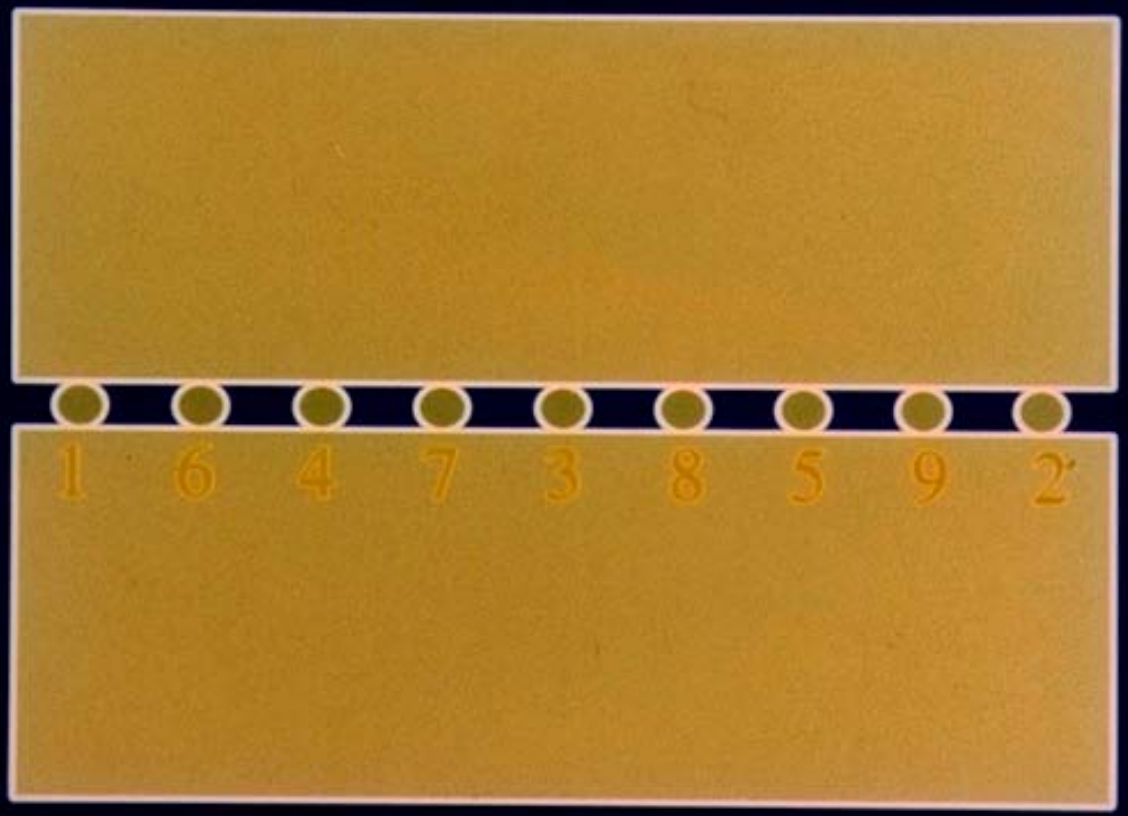
CORRECT TACK WELDING SEQUENCE




Unfinished TIG WELD
(Showing tacking)
NiDI

TACK WELDING SPACING

Sheet Thickness mm	1-1.5	2-3	4-6	>6
Sheet Spacing mm	30-60	70-120	120-160	150-200

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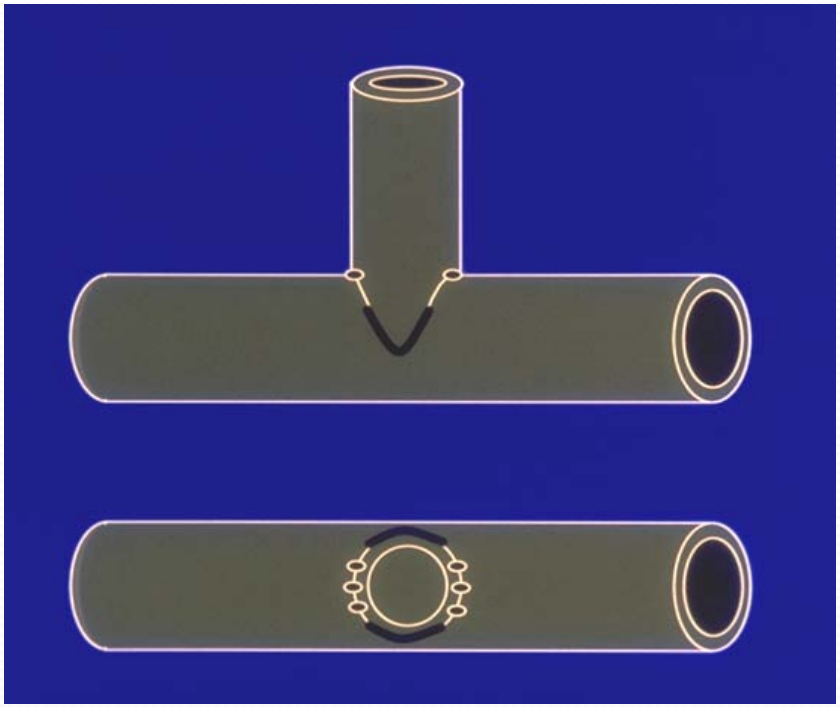
Avoid Distortion

First welds



A good fit-up

- Reduces welding time
- Reduces dressing cost
- Improves the welded joint appearance

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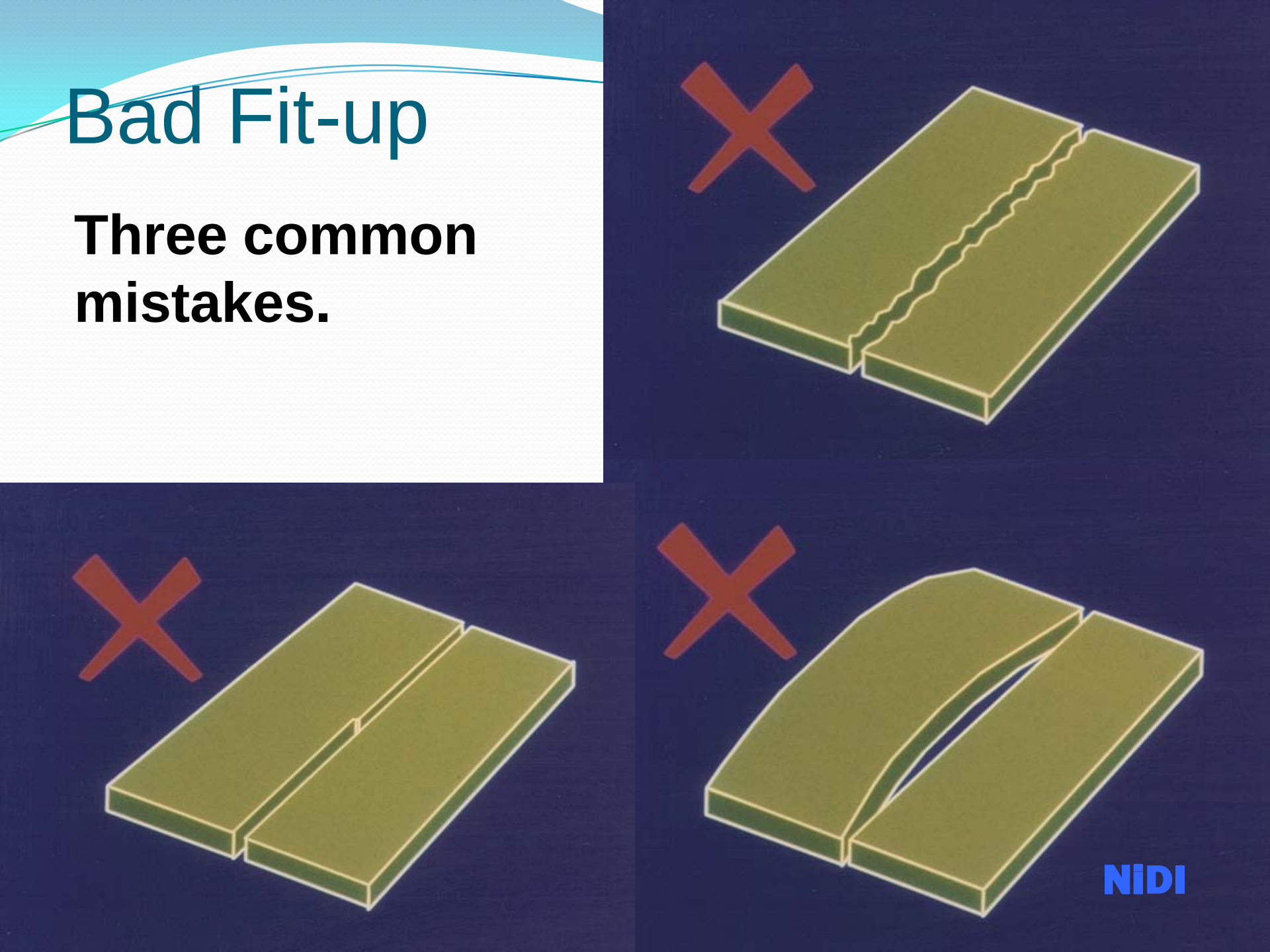
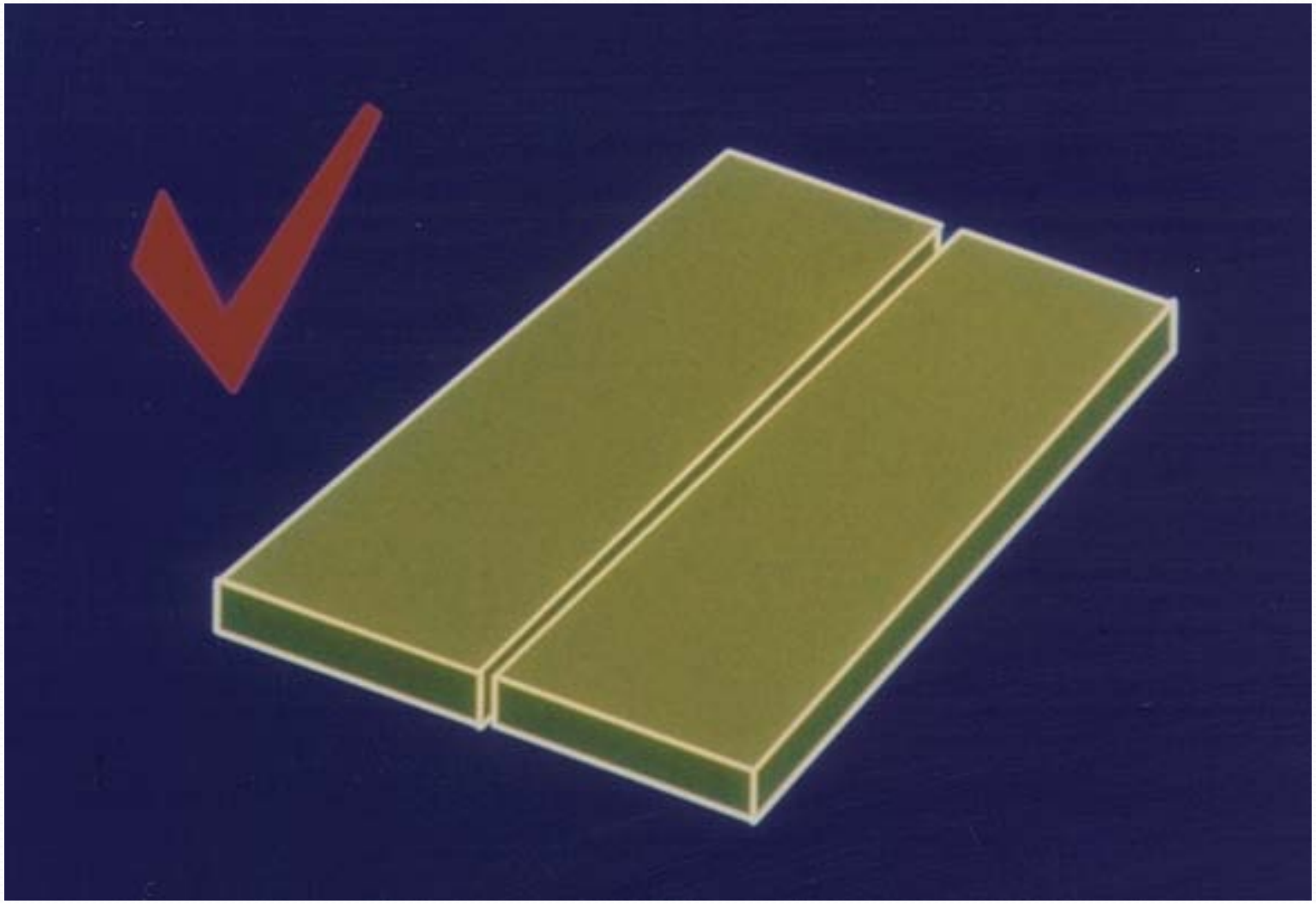
Bad Fit-up

Three common mistakes.



Good Fit-up



Minimize Site fabrication

- Site conditions are never ideal
- Difficult to obtain the same quality as in the workshop
- Design and plan to minimise site work.

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Site fabrication

NIDI

Some Important Design Considerations

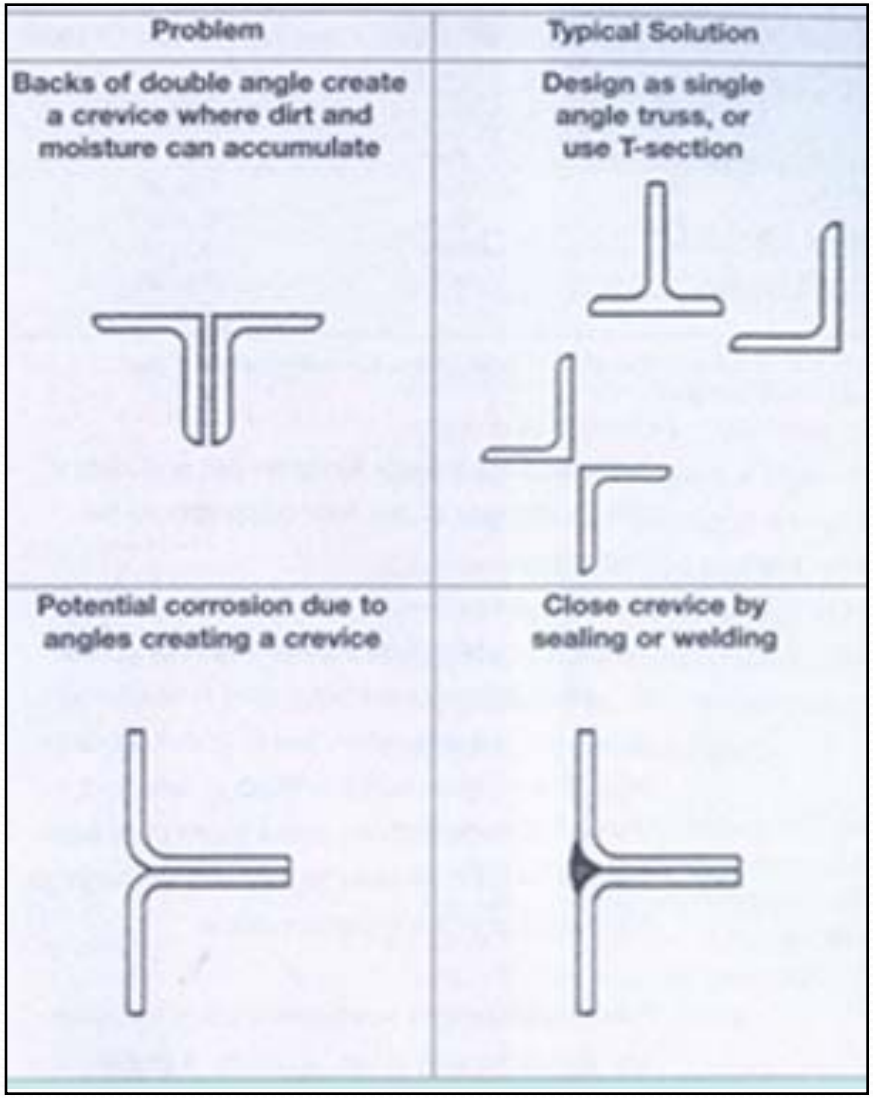
Design for Drainage

Maximize natural drainage.

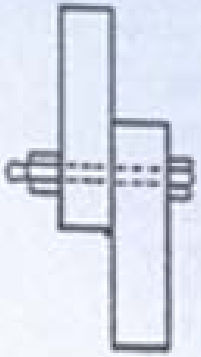
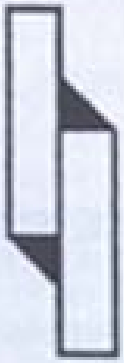
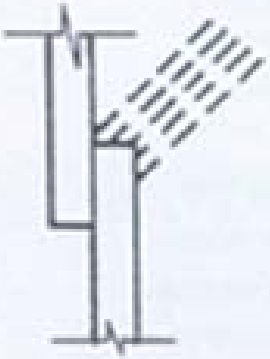
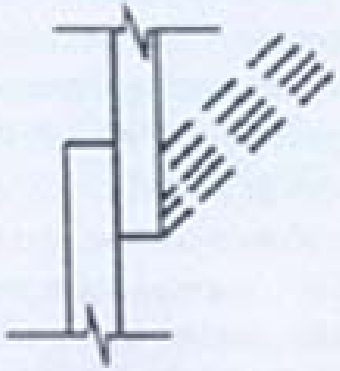
Minimize cleaning costs.

Provide for Cleaning

Avoid crevices



Seal joints or make wide enough to drain freely and avoid crevice corrosion.

Problem	Typical Solution
Dirt accumulates and moisture penetrates into crevices created by bolted joints 	Consider using welded or butt-welded joints or sealing with mastic 
Lapped joint creates ledge exposed to weather 	Arrange joint so that ledge is not on the weather side 

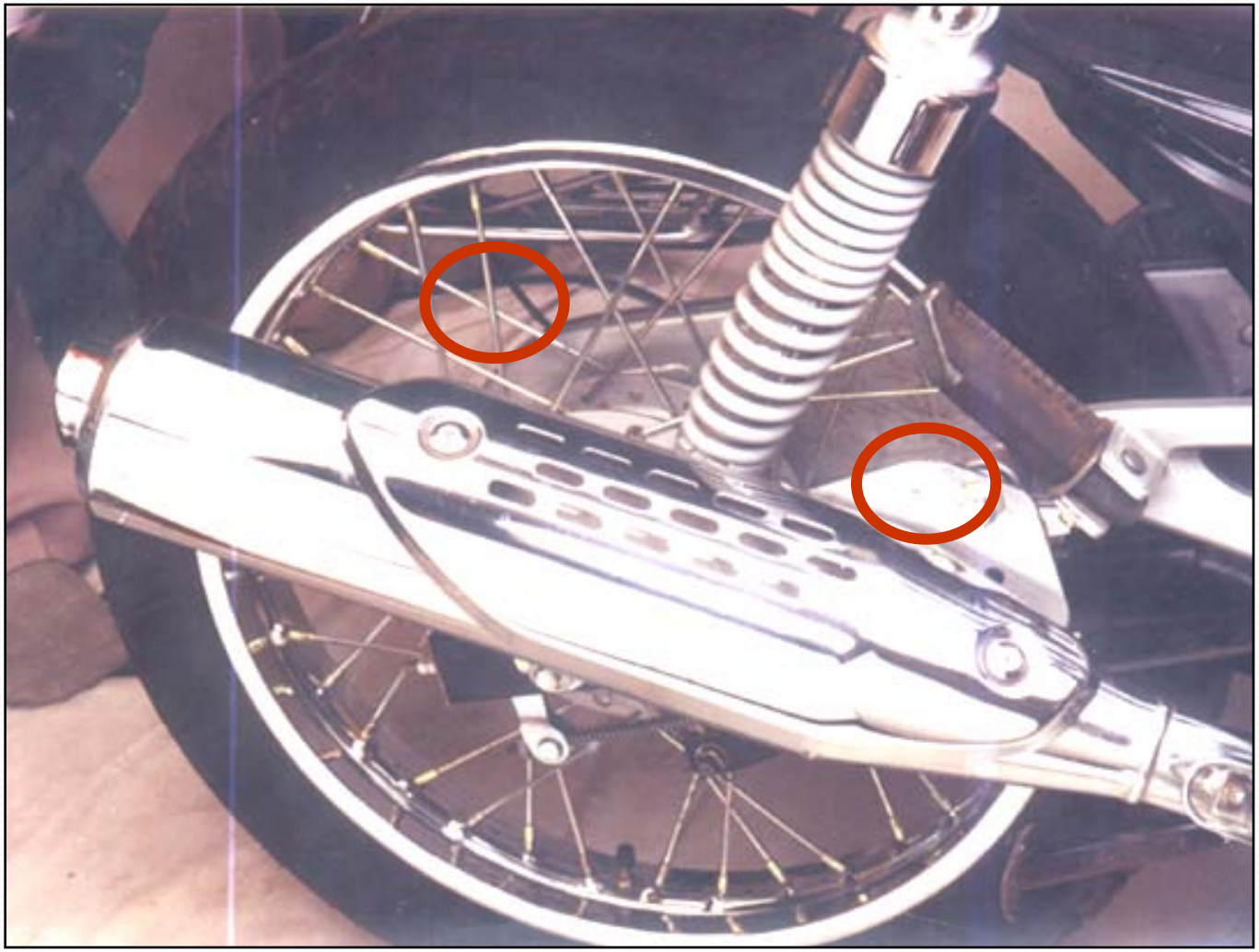
Fasteners & Galvanic Corrosion

DO NOT USE carbon steel (galvanized / plated) fasteners on SS products.

Brass fasteners can be considered.

SS fasteners of the same grade are ideal

SS fasteners on carbon steel components – negligible bimetallic corrosion.



Location

If stainless steel elements are located in sheltered and inaccessible areas such as under-the-eaves, they are denied the benefit of natural cleaning by rain, wind and sunshine.

In addition, such locations tend to have more humidity levels than exposed locations, thereby adding to the corrosiveness of the environment.

It is advisable not to locate stainless steel elements in such locations.

If you must use stainless steel, make sure a regular cleaning regimen is mandated.

Thank You!