Good Shop Floor Practices for fabrication of stainless steel

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Differences between Carbon & Stainless Steels

Higher Capacity of press
Welding Parameters
Filler Metal
Cutting Speeds
The most Important Difference is the Surface

<table>
<thead>
<tr>
<th>Carbon Steel</th>
<th>Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive</td>
<td>Passive</td>
</tr>
<tr>
<td>Rust formation</td>
<td>No rusting</td>
</tr>
<tr>
<td>Needs Paint Protection</td>
<td>No need</td>
</tr>
</tbody>
</table>
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.
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
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

<table>
<thead>
<tr>
<th></th>
<th>Austenitic Stainless Steel</th>
<th>Carbon Steel</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tensile Strength</strong> (Mpa)</td>
<td>515</td>
<td>410</td>
<td>Higher tensile strength, lower yield strength with high ductility</td>
</tr>
<tr>
<td></td>
<td>205</td>
<td>250</td>
<td>characteristics of stainless steel enable forming of complex shapes.</td>
</tr>
<tr>
<td><strong>Yield Strength</strong> (Mpa)</td>
<td>40</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td><strong>%Elongation</strong></td>
<td>40</td>
<td>23</td>
<td></td>
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### Physical properties of SS and CS

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<td>Thermal Expansion over range indicated in./in./C x 10^{-6}</td>
<td>17.6 (20-500 °C)</td>
<td>11.7 (20-628 °C)</td>
<td>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.</td>
</tr>
</tbody>
</table>
### Physical properties of SS and CS

<table>
<thead>
<tr>
<th>Rate of heat conductivity</th>
<th>Austenitic Stainless Steel</th>
<th>Carbon Steel</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>% at 100 °C</td>
<td>(Type 304)</td>
<td>100 %</td>
<td>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.</td>
</tr>
<tr>
<td>% at 650 °C</td>
<td>28 %</td>
<td>100 %</td>
<td></td>
</tr>
<tr>
<td></td>
<td>66 %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Control distortion with fixtures and tacks
Note the close location of tacks
CORRECT TACK WELDING SEQUENCE
Unfinished TIG WELD (Showing tacking)
# TACK WELDING SPACING

<table>
<thead>
<tr>
<th>Sheet Thickness mm</th>
<th>1-1.5</th>
<th>2-3</th>
<th>4-6</th>
<th>&gt;6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet Spacing mm</td>
<td>30-60</td>
<td>70-120</td>
<td>120-160</td>
<td>150-200</td>
</tr>
</tbody>
</table>
Avoid Distortion

First welds
A good fit-up

- Reduces welding time
- Reduces dressing cost
- Improves the welded joint appearance
Bad Fit-up

Three common mistakes.

NIDI
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.
Site fabrication
Some Important Design Considerations

Design for Drainage
Maximize natural drainage.
Minimize cleaning costs.

Provide for Cleaning
150 East 42nd Street, New York City
Cleaned for the first time after 40 years of service
**Avoid crevices**

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<tr>
<th>Problem</th>
<th>Typical Solution</th>
</tr>
</thead>
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<tr>
<td>Backs of double angle create a crevice where dirt and moisture can accumulate</td>
<td>Design as single angle truss, or use T-section</td>
</tr>
<tr>
<td>Potential corrosion due to angles creating a crevice</td>
<td>Close crevice by sealing or welding</td>
</tr>
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Seal joints or make wide enough to drain freely and avoid crevice corrosion.
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<td>Dirt accumulates and moisture penetrates into crevices created by bolted joints</td>
<td>Consider using welded or butt-welded joints or sealing with mastic</td>
</tr>
<tr>
<td>Lapped joint creates ledge exposed to weather</td>
<td>Arrange joint so that ledge is not on the weather side</td>
</tr>
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</table>
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!