WIZ-PARTS

# STEEL TUBE FABRICATION DESIGN GUIDE

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# What Is
# Steel Tube Fabrication?

Steel tube fabrication is the process of converting tubular structures into assemblies and is used across various industries, including construction, automotive, aerospace, and manufacturing. This process encompasses cutting, bending, welding, and assembling steel tubes to create components and frameworks tailored to specific design and functional needs. The inherent strength and versatility of steel make it an excellent choice for multiple applications.

## Contents

# Laser Cutting & Profiling

Both cutting and profiling are crucial for ensuring that steel tubes meet the exact specifications needed for their intended application. Precision in these processes enhances the fit, functionality, and aesthetic quality of the final product, making them essential steps in the steel tube fabrication process.

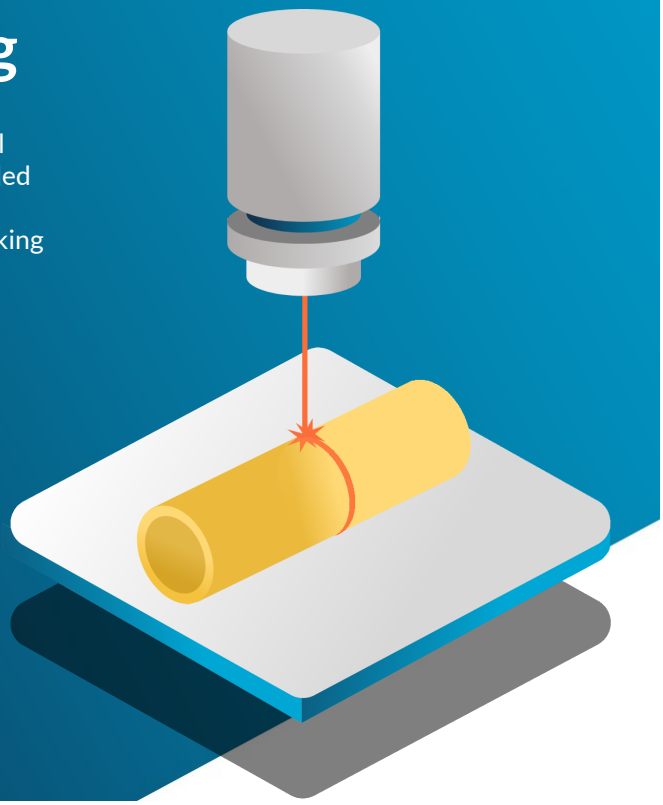
**Benefits of Laser Cutting & Profiling**

**Precision:** Offers high accuracy finish ensuring perfect fit joining multiple tubes.

**Efficiency:** Fast cutting speeds and reduced setup times increase productivity.

**Versatility:** Suitable for a variety of sections and wall thicknesses.

**Quality:** Provides smooth edges and minimal distortion, reducing the need for additional finishing processes.



# CNC Mandrel Bending

CNC tube bending offers unparalleled precision, repeatability, and efficiency in fabricating bent tubes. its ability to produce complex shapes with high accuracy makes it an essential process in modern manufacturing, ensuring high-quality and consistent results for various applications.

**Benefits of CNC Mandrel Bending**

**Repeatability:** Once the bending parameters are programmed into the machine, it can reproduce the same bend multiple times, ensuring uniformity across batches.

**Efficiency:** Automated process reduces manual labor and increases production speed.

**Reduced Waste:** The precision and control of CNC bending minimize material waste, as accurate bends reduce the likelihood of errors and the need for rework.

# Selecting The Right Material

Selecting the correct material grade for steel tube fabrications is crucial for ensuring the optimal performance and longevity and production cost of the final product. Different material grades offer varying levels of strength, ductility, and toughness, which are essential for the steel tubes to withstand the specific loads and stresses of their intended application.

## Comparison of Common Mild Steel Tube Grades

| | ERW1 | S235 | S355 |
|---|---|---|---|
| Yield Strength | Low | High | Very High |
| Tensile Strength | Low | High | Very High |
| Corrosion Resistance | Poor | Poor | Poor |
| Weldability | Very Good | Very Good | Good |
| Cost | £ | ££ | £££ |

### ERW1

Seam Welded
(BS EN 10305-3)


Benefits of ERW1 v

**Consistent Wall Thickness:** ERW tubes offer more uniform wall thickness and diameter, resulting in better consistency and reliability for various applications.

**Availability:** ERW tubes are widely available in various sizes and specifications, ensuring easier sourcing and reduced lead times.

**Cost-Effective:** ERW tubes are generally less expensive to produce than seamless tubes.

### S235

Seamless Cold Formed
(BS EN 10219-1)


Benefits of S235 v

**Cost vs Performance:** S235 steel is relatively inexpensive, making it a cost-effective choice for various construction and structural applications

**Versatility:** S235 steel is highly versatile, suitable for a wide range of applications such as structural frameworks, machinery parts, and building components.

**Good Weldability:** It has excellent weldability, facilitating easy joining and fabrication without requiring special techniques or treatments.

### S355

Seamless Cold Formed
(BS EN 10219-1)

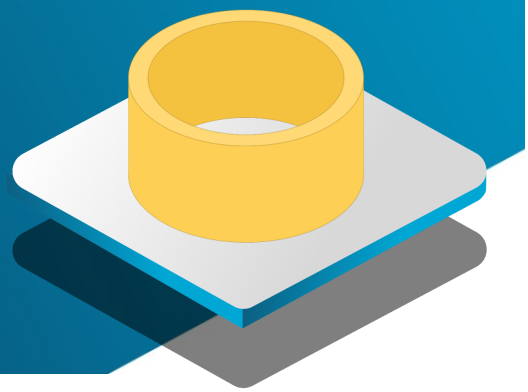

Benefits of S355 v

**High Strength:** S355 steel offers higher tensile and yield strength compared to S235, making it ideal for more demanding structural applications that require greater load-bearing capacity.

**Enhanced Durability:** The increased strength of S355 steel enhances the durability and lifespan of structures, reducing the need for frequent repairs or replacements.

# Circular Hollow Sections (CHS)

Circular Hollow Section (CHS) tube, more commonly known as round tube, are cylindrical steel tubes with a hollow center, widely used in construction and engineering applications. These tubes are characterized by their round cross-section and are known for their structural integrity and versatility.

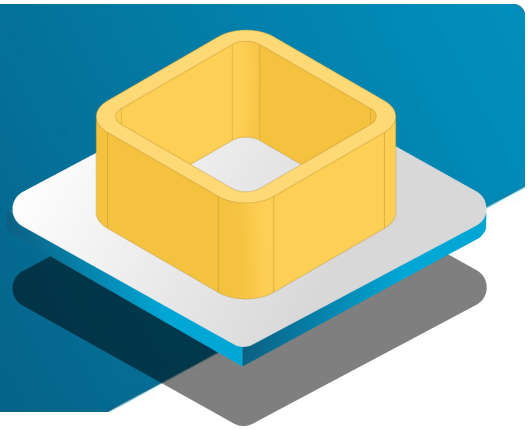


## Available Round Tube Profiles

| Tube Size (mm) | Wall Thickness (mm) | | | | | |
|---|---|---|---|---|---|---|
| | 1.0 | 1.2 | 1.5 | 2.0 | 2.5 | 3.0 |
| 12.70 | ✓ | ✓ | ✓ | ✓ | x | x |
| 15.80 | ✓ | ✓ | ✓ | ✓ | x | x |
| 19.05 | ✓ | ✓ | ✓ | ✓ | x | x |
| 20.00 | ✓ | ✓ | ✓ | ✓ | x | x |
| 22.20 | ✓ | ✓ | ✓ | ✓ | x | x |
| 25.00 | ✓ | ✓ | ✓ | ✓ | x | x |
| 25.40 | ✓ | ✓ | ✓ | ✓ | x | x |
| 28.60 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 30.00 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 31.75 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 38.10 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 40.00 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 44.45 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 50.00 | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| 50.80 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 63.50 | x | x | ✓ | ✓ | ✓ | ✓ |

# Square Hollow Sections (SHS)

Square Hollow Section (SHS) tubes, more commonly known as equal box section, are steel tubes with a square cross-section and a hollow center, extensively used in construction, engineering, and manufacturing. These tubes are characterized by their uniform strength and versatile flat surfaces.

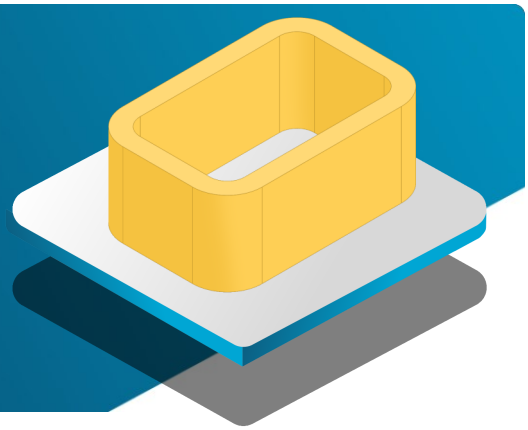


## Available Box Section Profiles

| Section Size (mm) | Wall Thickness (mm) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1.0 | 1.2 | 1.5 | 2.0 | 2.5 | 3.0 | 4.0 | 5.0 |
| 12.7 x 12.7 | ✓ | ✓ | ✓ | x | x | x | x | x |
| 15.8 x 15.8 | ✓ | ✓ | ✓ | ✓ | x | x | x | x |
| 19.05 x 19.05 | ✓ | ✓ | ✓ | ✓ | x | x | x | x |
| 20 x 20 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | x |
| 22.2 x 22.2 | ✓ | ✓ | ✓ | ✓ | x | x | x | x |
| 25 x 25 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | x |
| 25.4 x 25.4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | x |
| 28.6 x 28.6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | x |
| 30 x 30 | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | x |
| 31.75 x 31.75 | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | x |
| 38.1 x 38.1 | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | x |
| 40 x 40 | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | x |
| 50 x 50 | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 50.8 x 50.8 | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 60 x 60 | x | x | x | x | x | ✓ | ✓ | ✓ |

# Rectangular Hollow Sections

Rectangular Hollow Section (RHS) tubes, more commonly know as unequal box section, are steel tubes with a hollow interior and a rectangular cross-section, extensively employed in construction, engineering, and manufacturing industries. Renowned for their structural efficiency and versatility.

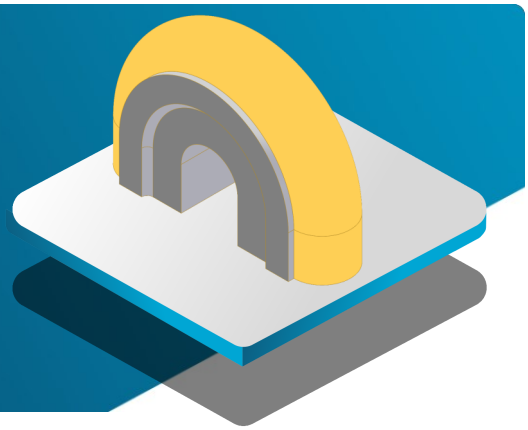


## Available Box Section Profiles

| Tube Size (mm) | Wall Thickness (mm) | | | | | |
|---|---|---|---|---|---|---|
| | 1.0 | 1.2 | 1.5 | 2.0 | 2.5 | 3.0 |
| 20 x 10 | ✓ | ✓ | ✓ | ✓ | x | x |
| 20 x 15 | ✓ | ✓ | ✓ | ✓ | x | x |
| 25 x 10 | ✓ | ✓ | ✓ | ✓ | x | x |
| 25 x 15 | ✓ | ✓ | ✓ | ✓ | x | x |
| 25.4 x 12.7 | ✓ | ✓ | ✓ | ✓ | x | x |
| 30 x 15 | ✓ | ✓ | ✓ | ✓ | x | x |
| 30 x 20 | ✓ | ✓ | ✓ | ✓ | x | x |
| 31.75 x 15.8 | ✓ | ✓ | ✓ | ✓ | x | x |
| 38.1 x 19.05 | ✓ | ✓ | ✓ | ✓ | x | x |
| 40 x 20 | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| 50 x 25 | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| 50.8 x 25.4 | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| 60 x 40 | x | x | ✓ | ✓ | ✓ | ✓ |
| 63.5 x 25.4 | x | x | ✓ | ✓ | ✓ | ✓ |
| 63.5 x 38.1 | x | x | x | x | x | ✓ |

## Standard Bend Tooling

We offer a comprehensive range of standard bend tooling designed specifically for bending round tube. Our tooling selection ensures precise, consistent bends to meet diverse project requirements. Whether you need to create simple curves or complex shapes, our high-quality bend tooling can handle various diameters and wall thicknesses.



### Available Bend Tooling

| Tube Diameter (mm) | Centre Line Radius (CLR) | Grip Length (mm) | Max Bend Angle (Degrees) |
|---|---|---|---|
| 19.05 | 38, 51, 64, 76 & 102 | 50 | 180 |
| 22.20 | 51, 64 & 102 | 55 | 180 |
| 25.00 | 50 | 60 | 180 |
| 25.40 | 51, 64, 76, 102, 127 & 152 | 60 | 180 |
| 28.60 | 45 & 102 | 80 | 180 |
| 30.00 | 75 & 165 | 90 | 180 / 120 |
| 31.80 | 64, 76, 102, 127 & 152 | 80 | 180 |
| 38.10 | 76, 102, 127 & 152 | 100 | 180 |
| 40.00 | 152 | 152 | 180 |
| 44.45 | 102, 127 & 152 | 152 | 180 |
| 50.80 | 102, 127, 152 & 203 | 152 | 180 |
| 63.50 | 152 & 190 | 152 | 180 |

### Centre Line Radius (CLR)

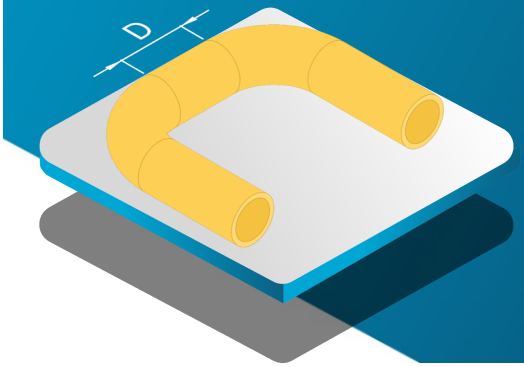
Tube CLR refers to the radius measured from the centerline of a bent tube to the center of the curvature.

### Grip Length

Tube grip length refers to the portion of the tube that is held securely by the bending machine's tooling during the bending process.

## Use Standard Bend Tooling

It is recommended to use our standard bend tooling wherever possible. If you are unable to use one of our standard bend CLRs, we can provide a quote for bespoke tooling which will greatly increase production costs.




## Consider Tool Grip Length

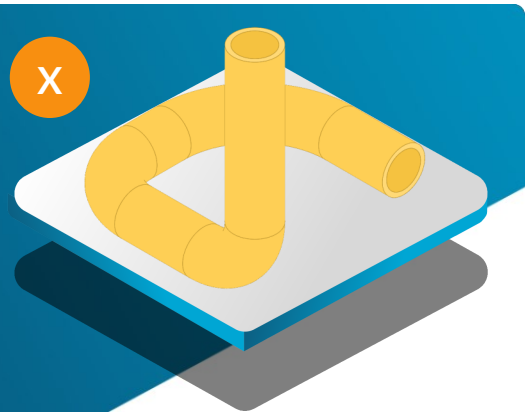
When bending steel tube it is important that the distance between two bends (D) is greater than the grip length of the intended bend tool.

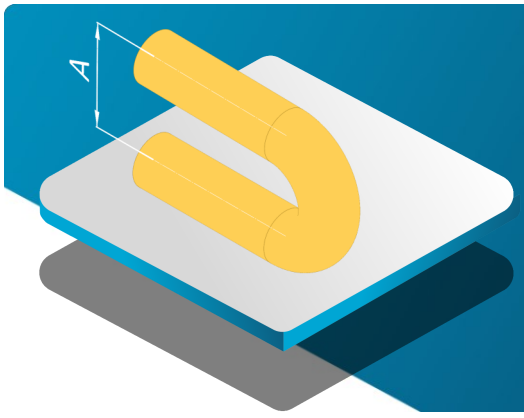
**D ≥ Grip Length**

## Keep Bends Simple

Only two bending tools can be fitted to our tube bending machines and so bent steel tubes must have a maximum of two different bend radii in a single part.

To reduce cost and improve part accuracy, it is recommended to keep all bends on a single plane where possible.




## Limit Bend Angle

It is important to make sure that all bends have a bend angle (A) less than or equal to 180 degrees to ensure the tube can be removed from the bend tooling and reduce the risk of compromising the structural integrity of the material.

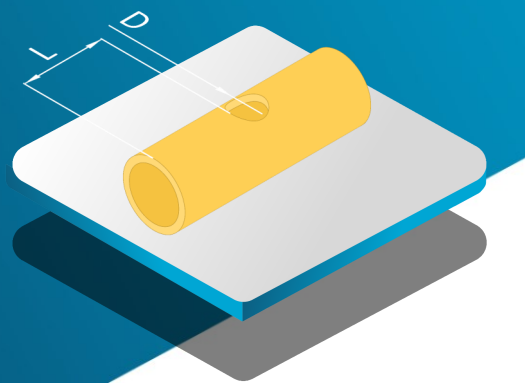
**A ≤ 180 Degrees**

## Adding Radial Holes

If you wish to add radial holes to a steel tube part, it is recommended to keep the hole diameter (D) less than or equal to half of the tube diameter and a distance (L) greater than or equal to two times the hole diameter (D) from the tube end.

$D \leq 0.5 \times T$

$L \geq 2 \times D$




## Consider Welding Heat

Where multiple tubes meet to a single nodal point, it is important to consider the heat build up during the welding process.

It is recommended to limit the number of tubes joining at a single point to no more than four.

## Be Careful Of Open Ends

When creating a tubular assembly it is important to consider potential water ingress through the open ends of the assembly.

It is recommended to eliminate open ends wherever possible or use end caps to reduce the risk of water ingress.

### And Remember to Make Sure Your Files Are in the Correct Format!

**2D CAD Files**

.DXF

.DWG

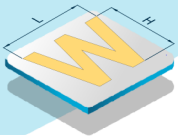
**3D CAD Files**

.STEP .IGES

.X_T .SLDPRT

**2D Drawings**

.PDF



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