



Published by

Association of Steel Tube and Pipe Manufacturers of South Africa

**Physical Address:
Spaces Building,210
Amarand Avenue
Menlyn Maine
Pretoria
South Africa**

Tel: +27 (0) 12 003 2878

**E-mail: astpm@astpm.com
Website: www.astpm.com**

Executive Director: Keitumetse Moumakoe

The background of the cover is a photograph of numerous stacks of steel tubes and pipes. The tubes are arranged in neat piles, with some showing the circular ends of the pipes. The lighting is bright, highlighting the metallic texture of the steel. The text is overlaid on this image in a bold, blue, sans-serif font.

**IDENTIFICATION MANUAL
FOR
STEEL TUBE
AND PIPE**

2020

**ASSOCIATION OF STEEL TUBE AND PIPE
MANUFACTURERS OF SOUTH AFRICA**

FOREWORD

The Association of Steel Tube and Pipe Manufacturers of South Africa proudly publishes this inaugural edition of the Identification Manual for Steel Tube and Pipe under the auspices of the South African Iron and Steel Institute. In doing so the Association and Institute demonstrate continued commitment to, and support of, the indispensable role of Government, through Customs and Excise, in providing an equitably regulated international trade interface with our trading partners.

Use of the manual will enhance the ability of officials of Customs and Excise to correctly identify internationally traded tubular steel products in the course of their duties.

Correct product identification is pivotal to the compilation of a reliable database on which international trade statistics are based. Accurate statistics, based on correct product classification, contribute to the image of South Africa as a fair and reliable trading partner contributing eventually to the well being of all South African citizens.

Keitumetse Moumakoe

Executive Director: Association of Steel Tube and Pipe Manufacturers of South Africa

September 2020

All rights reserved. This document or any part thereof must not be reproduced in any form without the written permission of the Association of Steel Tube and Pipe Manufacturers of South Africa.

© 2020 *Association of Steel Tube and Pipe Manufacturers of South Africa*

CONTENTS

1. **Introduction**

2. **Welded Tube and Pipe**

2.1 Electric Resistance Welded (ERW)

2.2 Longitudinal Submerged Arc-Welded (LSAW)

2.3 Spiral Submerged Arc-Welded (SSAW)

3. **Seamless Tube and Pipe (SMLS)**

4. **Cast Iron and Ductile Iron Pipe (CIP / DIP)**

5. **Ferrous Tube and Pipe Materials**

5.1 Carbon Steel

5.2 Stainless Steel

5.3 Ductile Iron

6. **Tube and Pipe Identification Aids**

6.1 Typical Characteristics of Ferrous Tube and Pipe

6.2 Identification of Material Types

6.3 Identification of Tube and Pipe Production Methods

7. **Typical Tariff codes used for Steel Tube and Pipe**

8. **Glossary**

9. **References**

Appendix A: Ductile Iron Pipe Production Process

Appendix B: Seamless Tube and Pipe Production Process

Appendix C: Electric Resistance Welded Tube and Pipe Production Process

Appendix D: LSAW Tube and Pipe Production Process

Appendix E: SSAW Tube and Pipe Production Process

Appendix F: South African Tariffs for Tubular Steel Products

10. **Tariff heading, description and examples**

1. INTRODUCTION

This document aims to introduce the reader to common production methods for tube and pipe made of carbon steel, stainless steel and cast iron. Knowledge of these processes should be invaluable for the proper identification and classification of tubular products.

Applied in a general sense, pipe is a term used to designate a hollow, tubular body used to transport any commodity possessing flow characteristics such as those found in liquids, gases, vapors, liquefied solids, and fine powders. By contrast, tube is similar in appearance, but is used to withstand mechanical loads. Thus tube is load bearing in application while pipe is pressure bearing. When used for construction purposes tube may be referred to as hollow sections or structural hollow sections.

Aside from copper and copper alloys, steel is the most popular tube and pipe metal used today. An alloy of iron and carbon, steel has excellent corrosion resistance, a high melting point and a malleability that is attractive to manufacturers. As a result, pipes made of steel serve as reliable conduits for contents under enormous amounts of pressure and steel tube can withstand large tensile, compressive, torsional and bending loads. Recognizing this broad utility, engineers have developed several techniques for making steel tube and pipe.

Modern carbon and stainless steel tube and pipe production methods are either welded or seamless. A third general category of ferrous pipes is made of cast iron. While technically not made of steel, it is easy to confuse this type with others and it is included for the sake of completeness. Each of these methods has its own characteristics, advantages, disadvantages and applications, which will be outlined in the paragraphs below. Table 1 contains a comparison of the key attributes of each type. Flowcharts 1 and 2 outline simple logic for determining the material and production method used to make a particular piece of tube or pipe.

Just as manufacturing methods differ, there are also different ways to categorize the size of a pipe. Pipe is identified by three different size categories: **nominal pipe size**, **outside diameter**, and **inside diameter** (see Figure 1.1 below). The figure also depicts wall thickness. It is customary for pipe to be referred to by its nominal inside diameter, while tube is generally specified by its outside dimensions and wall thickness.

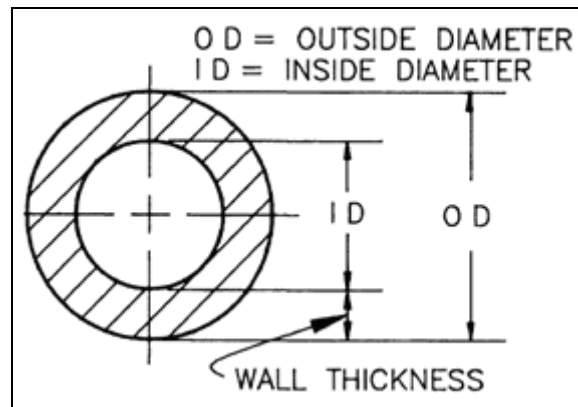


Figure 1.1 Tube and pipe sizing nomenclature

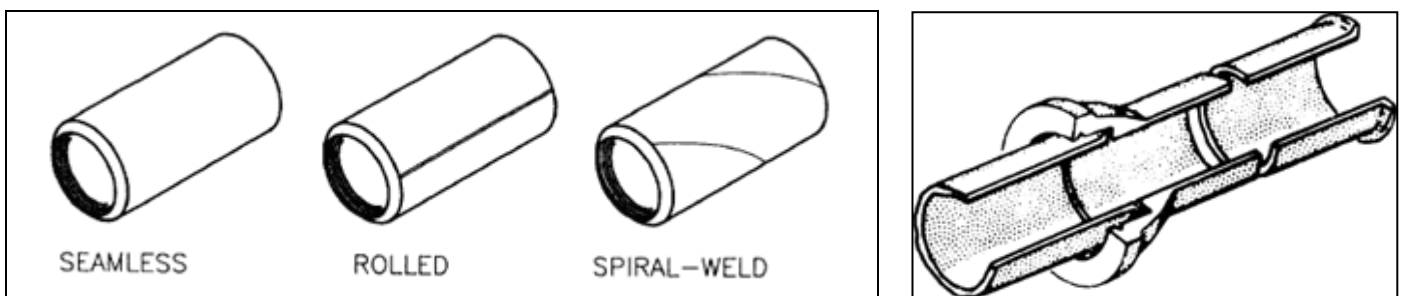
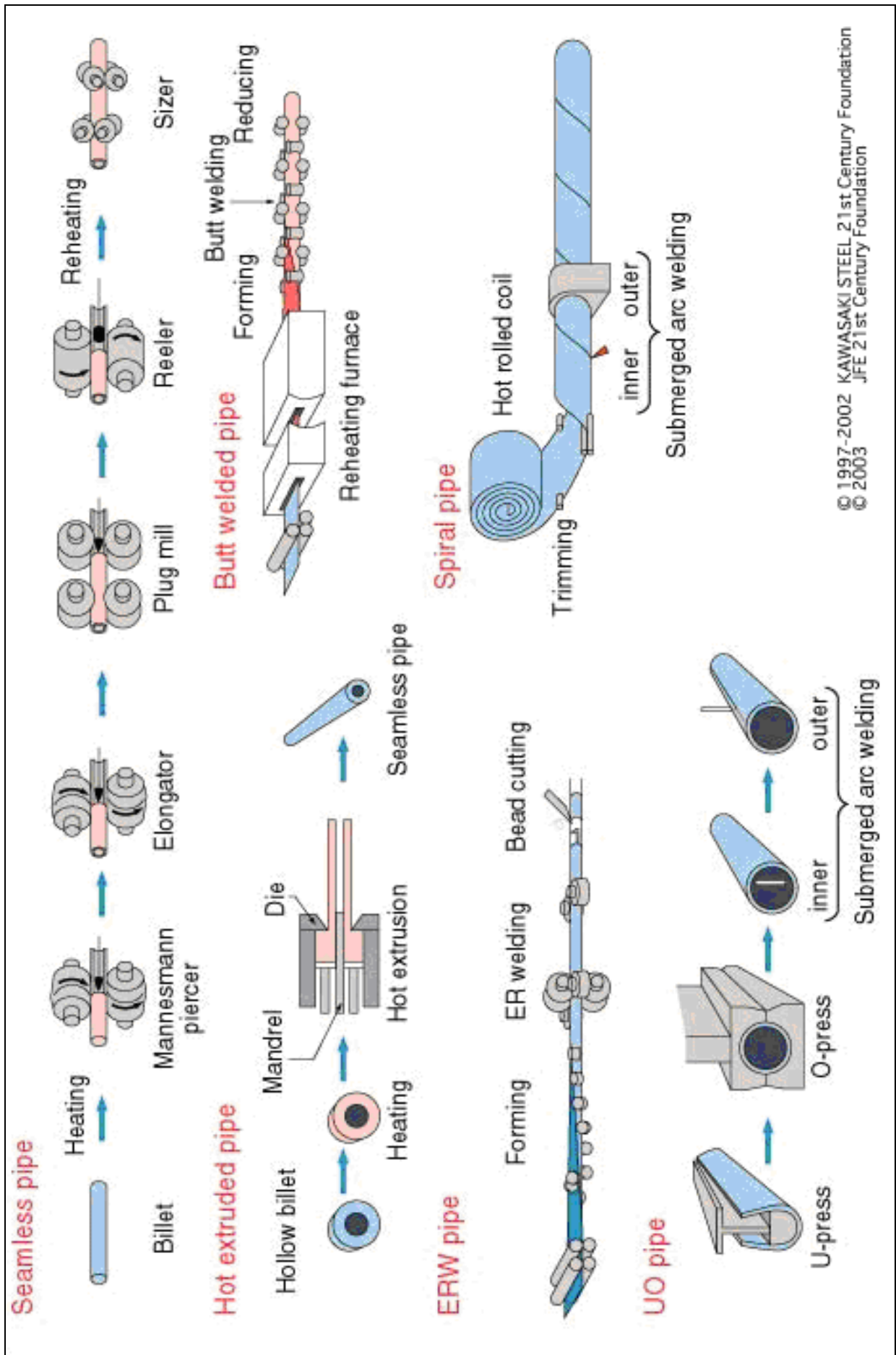


Figure 1.2 Three types of steel tube and pipe and cut-away view of a cast iron pipe (from Pipe Drafting & Design, Parishan & Rhea)



© 1997-2002 KAWASAKI STEEL 21st Century Foundation
 © 2003 JFE 21st Century Foundation

Figure 1.3 Schematic comparison of steel pipe making production methods (JFE 21st Century Foundation)

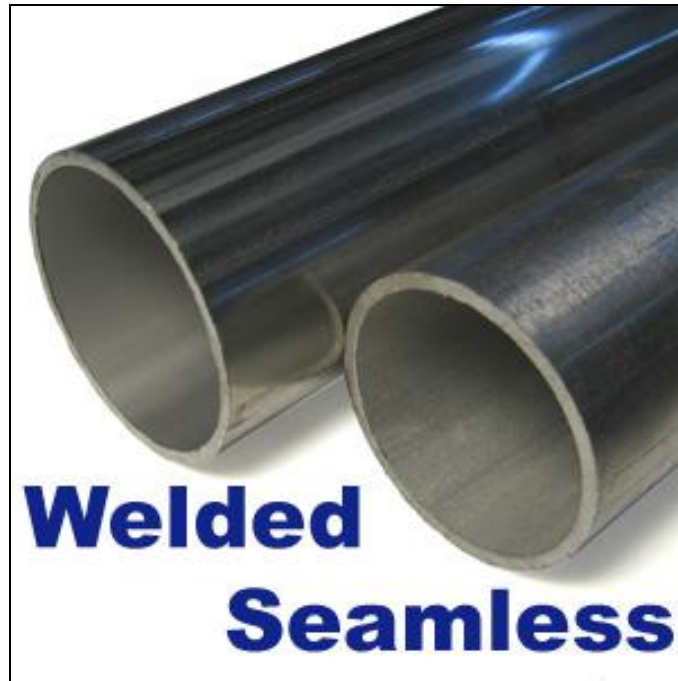


Figure 1.4 Classification of tube production methods can be tricky as show by this picture of welded and seamless stainless steel tubes. The welding heat affected zone (HAZ) is visible as a longitudinal discolouration at 12 o'clock on left hand side tube.

2. WELDED TUBE AND PIPE

The majority of carbon and stainless steel tube and pipe produced today is of the welded variety. These hollow sections are made in one of three ways:

- Continuously roll formed and welded longitudinally from steel coil (ERW)
- Discrete lengths formed from plate and then welded longitudinally (LSAW)
- Formed by twisting steel coil into a spiral shape, then welding the joining edges to form a weld seam (SSAW)

Paragraphs 2.1 through 2.3 explore these processes in greater detail.

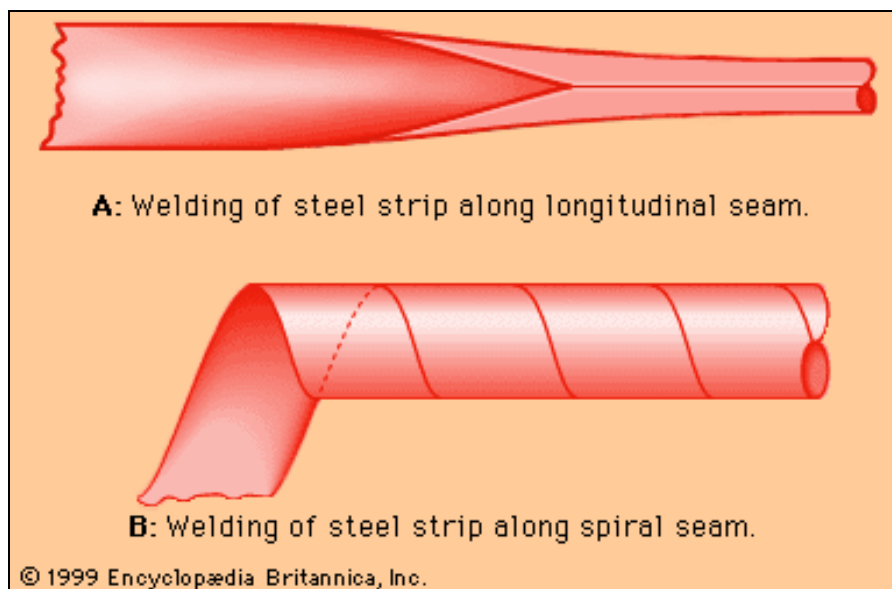


Figure 2.1 Longitudinal and spiral welded pipe compared (from Encyclopedia Britannica On-Line)

2.1 Electric Resistance Welded (ERW)

The ERW tube mill is a type of continuous roll forming line with integral welding station. Steel coil or strip is gradually shaped by forming rolls as it moves through the machine into a circular section. The edges of the strip are brought together as they exit the forming rolls and are continuously welded together.

Originally this type of tube or pipe was made using resistance heating to make the longitudinal weld. Most pipe mills now use high frequency induction heating (HFI) technology for better control and consistency. However, the product is still referred to as ERW even though the weld may have been produced by the HFI process. Squeeze rolls forge the molten strip edges together to form a fused joint or weld seam. The resultant external weld bead is generally removed, and the internal weld bead may be removed to specification or customer requirement. The heat affected zone (HAZ) remains visible on the ends of the section as an hourglass-shaped discolouration.

This continuous weld process is generally regarded as the most cost-effective means of producing tube and pipe. It was developed from the earlier Low Frequency Welding process which it has now replaced.

Square, rectangular and other closed profiles can be formed after welding by passing through turkshead shaping rolls. As an alternative process, tubes may be formed in a square or rectangular shape before welding.

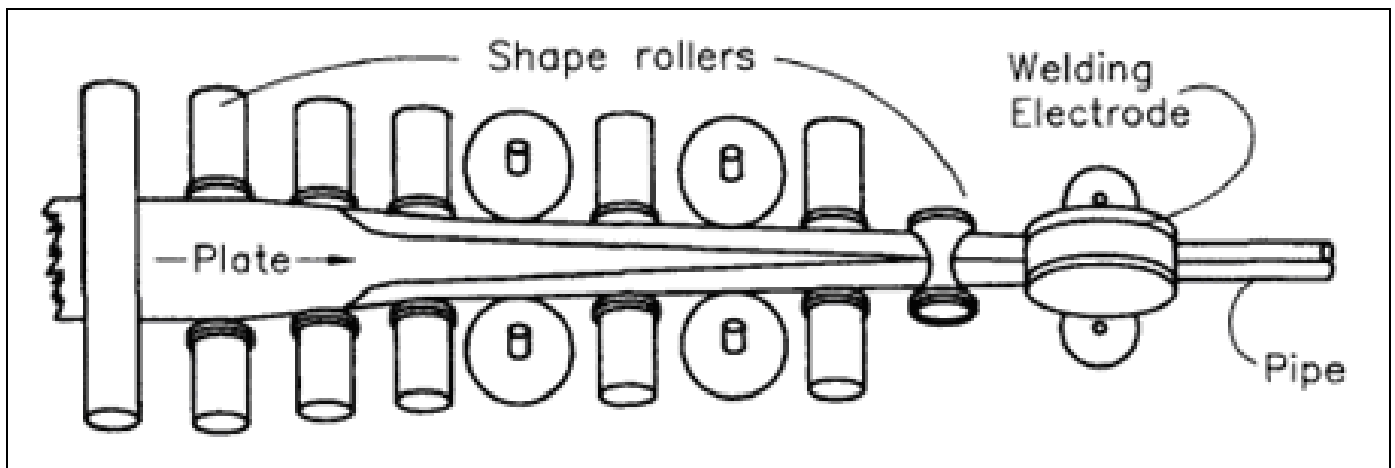


Figure 2.2 Schematic representation of the forming process on an ERW tubemill (from Pipe Drafting & Design, Parishan & Rhea)

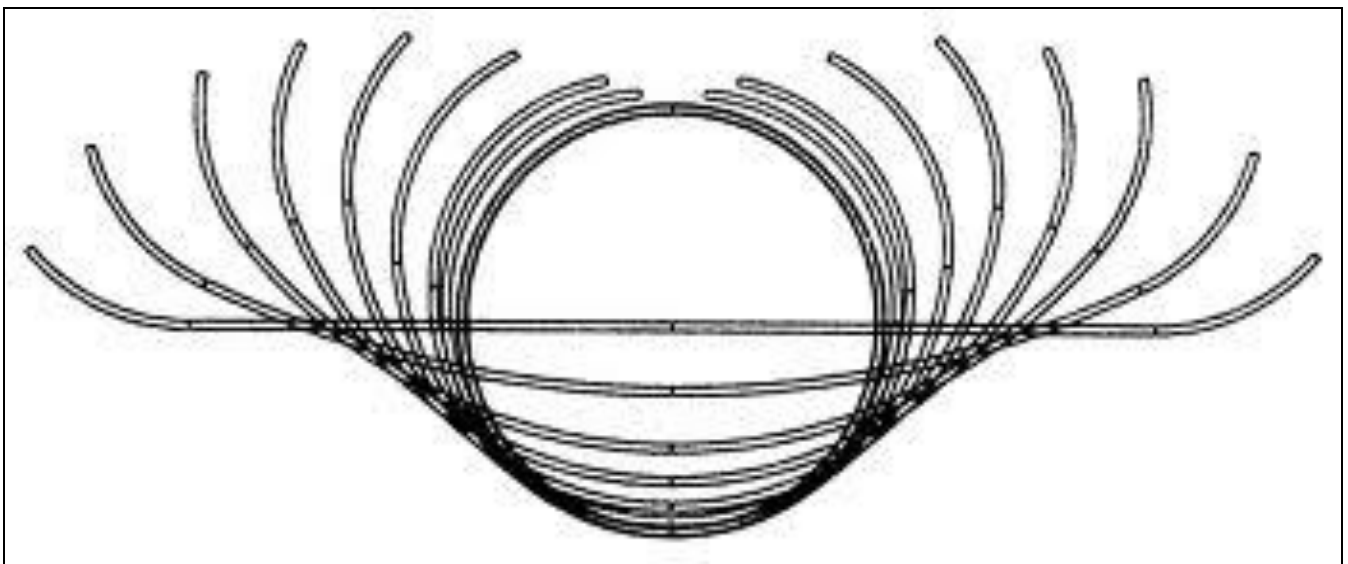


Figure 2.3 "Flower" diagram showing successive forming stages from flat strip to round profile on a tubemill (from Group)

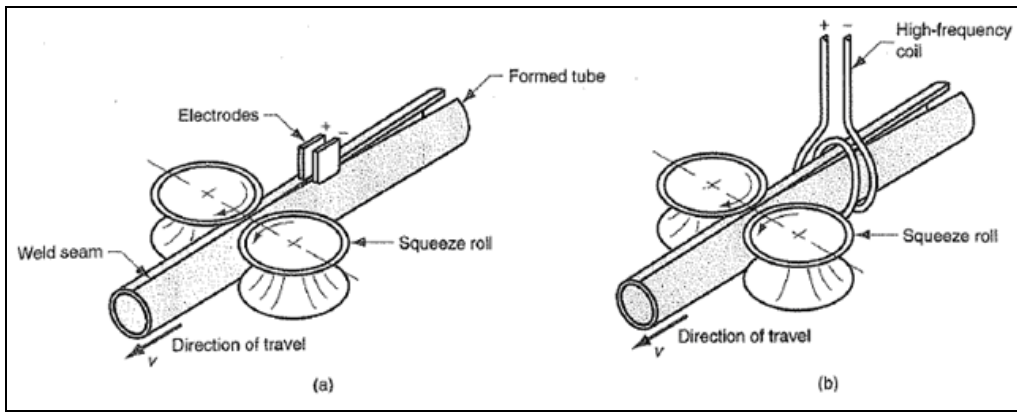


Figure 2.4 Welding of tube seams by (a) high frequency resistance welding and (b) high-frequency induction welding

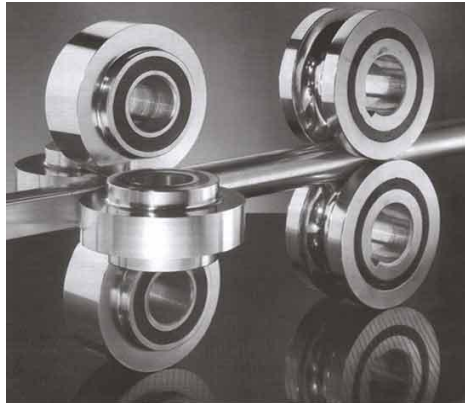


Figure 2.5 Turkshead squaring rolls as used for squaring tube on an ERW mill



Figure 2.6 Collection of different shapes in which longitudinally welded steel and stainless steel tube can be made



Figure 2.7 Tube produced by the HFI ERW method with the linear weld bead clearly visible on inside weld seam

2.2 Longitudinally Submerged Arc Welded (LSAW)

The LSAW process is typically used for large tubes where ERW is not practicable or cost-effective.

There are several different methods to make longitudinally submerged arc welded pipe. All the methods involve forming a piece of plate into a circular hollow shape before welding the seam by the submerged arc process. The seam is typically welded in at least two passes. The dominant methods of forming LSAW are UOE (U-press, O-press and Electric welding), three roll bending (RBW or 3RB) and JCOE (J-press, C-press, O-press and Electric welding) as illustrated below.

Used mainly on pipes with a larger diameter, the process starts with a long, rectangular sheet of steel whose thickness is the same as the final pipe. Most importantly, the width of the sheet must be the same as the circumference of the final pipe.

Through one of the processes mentioned earlier (UOE, 3RB or JCOE) The sheet is formed into a circular cross section with the edges pointing upward. The two edges are fused closed through a submerged arc welding (SAW) apparatus. In SAW, a powerful current passes from an electrode filled with a highly-conductive, anti-oxidant material called "flux" through the steel pipe and into a regulator and power source. The electrical resistance heats up the flux enough to melt, which in turn melts the electrode. Therefore, an endless length of new electrode is constantly fed into the fusing zone. Often the welding process is done in four steps:

- Tack welding to keep the circular shape
- Tab welding (tabs welded at both end of the pipe to ensure weld soundness at the pipe ends)
- Internal welding
- External welding
- Tab removal

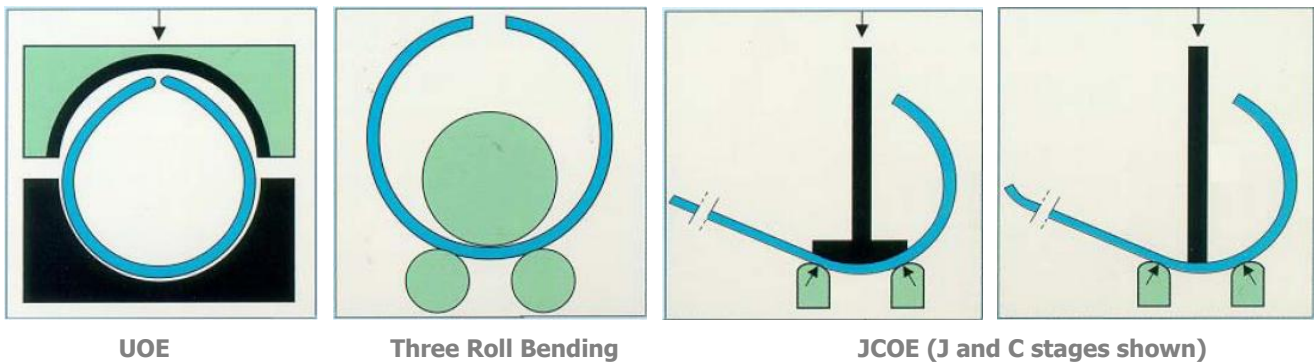


Figure 2.8 Three methods of forming large bore pipe for LSAW production

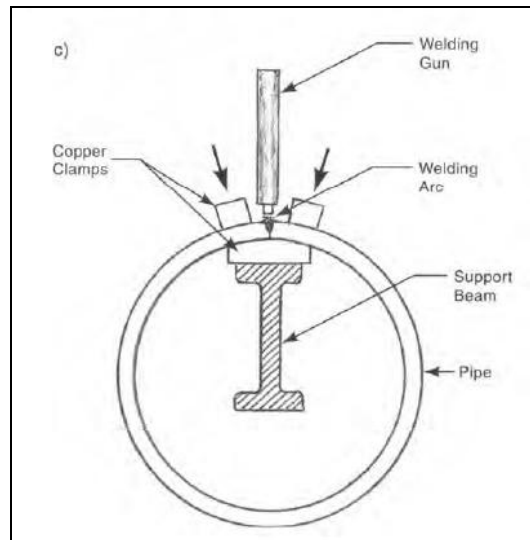


Figure 2.9 Typical arc welding arrangement for large diameter LSAW pipe



Figure 2.10 LSAW Pipe with weld seam visible at the bottom. Note welding tabs still attached to pipe end.

2.3 Spiral Submerged Arc Welded (SSAW)

A relatively uncommon production method is spiral-welded pipe, also known as helically welded pipe (HSAW). The process is designed for larger pipes typically of relatively thin thickness. Spiral-welded pipe is formed by twisting strips of metal into a spiral shape, similar to a barber's pole, by a series of rollers set along the edges. Where the edges join they are fused together using SAW apparatus to form a welded seam. An infinite range of diameters can be produced by varying the strip width and angle of approach. Wall thickness is typically much less than with any other production method.

This type of pipe is typically restricted to piping systems using low pressures due to its thin walls. Figure 2.14 shows spiralwelded pipe as it appears before welding.

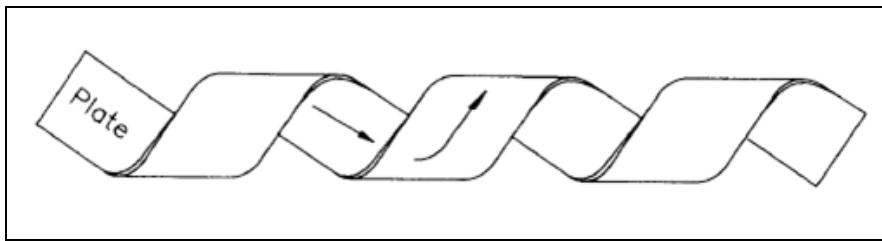


Figure 2.11 Principle of spiral welded pipe production



Figure 2.12 Spiral pipe mill (a) strip entry and (b) mill exit

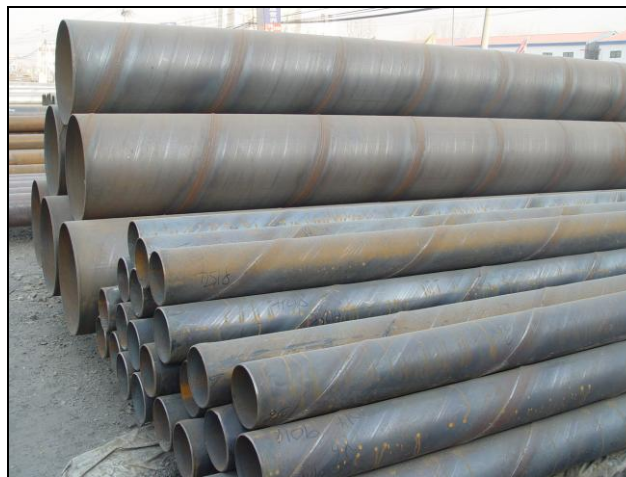


Figure 2.13 Spiral Submerged Arc Welded (SSAW) pipe displaying the Characteristic barber pole appearance

3. SEAMLESS TUBE AND PIPE (SMLS)

Seamless pipe is formed by piercing a long, solid, near-molten, steel rod, called a billet (or bloom for larger pipes), with a mandrel to produce a pipe that has no seams or joints. The process does not involve any welding.

There are many variations on the basic process but they all start with the billet being loaded into an induction heater or gas-fired furnace to heat the billet to a malleable temperature. A pair of rollers with perpendicular axes rotate the heated billet rapidly around its own axis while slowly drawing it into special instrument known as a "piercer." The piercer slowly enters the rotating billet as a near perfect tube forms around it.

Depending on the specific process a stretch reducing mill (SRM) may be used to reduce the pipe diameter and wall thickness. The pipe may also be cold drawn to its final dimensions.

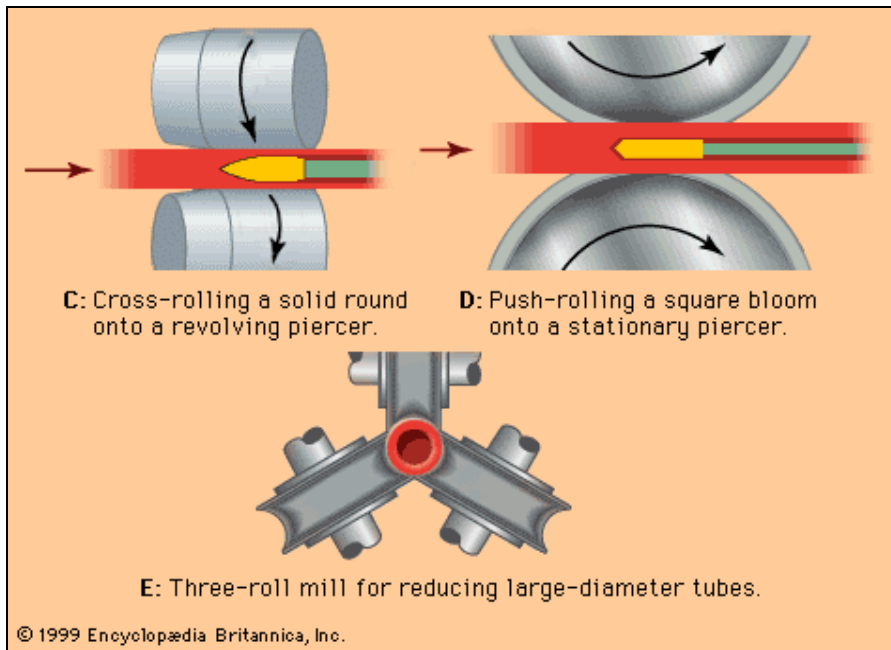


Figure 3.1 Schematic representation of two types of seamless mill with reduction rolling (from Encyclopedia Britannica Online)



Figure 3.2 Heavy-walled seamless pipe, representative of the type

Hot Extruded Pipe is made by a variation on the seamless process and is generally used for small diameter tubes only. Taking the first-stage hollowed billet, manufacturers load it into heating press known as an "extruder". A mandrel runs from the base of the press up through the middle of the billet. The other end of the press is covered with a patterned opening known as a "die," designed to set the outer diameter of the finished pipe. Electrical resistance heats the billet and the powerful hydraulic press pushes the malleable billet up through the die, resulting in a long stretch of steel pipe.

The extrusion process may also be used to produce profiles of many different cross-sectional or profile shapes, including many complex shapes.

All types of seamless tube may be cold drawn to reduce wall thickness while improving concentricity and surface finish. This type of tube is referred to as "cold drawn seamless" or CDS and is hard to tell apart from welded tube that was

drawn over a mandrel (i.e. DOM). The heat affected zone of the welded tube shows up on the tube end under ultraviolet light.

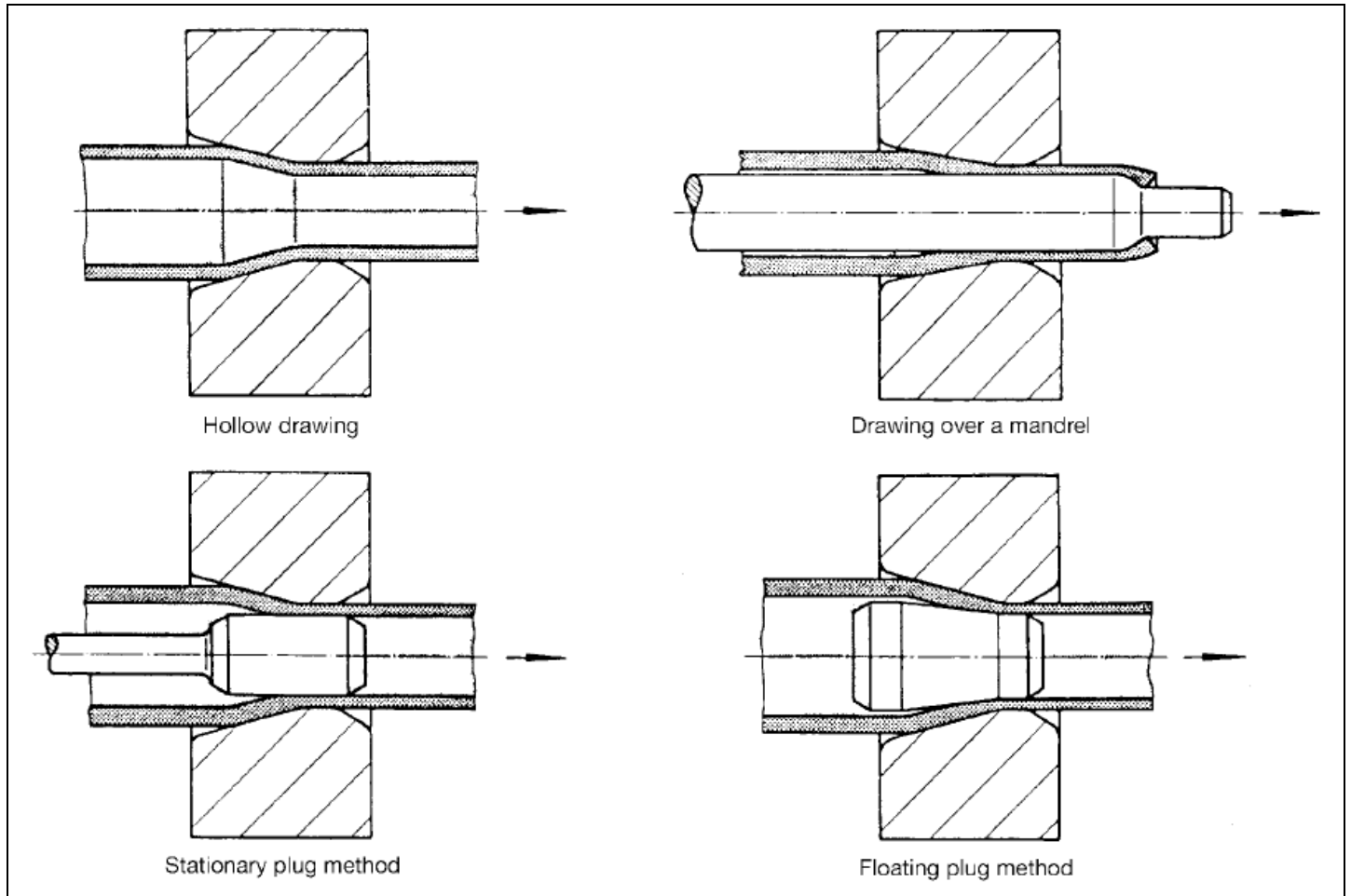


Figure 3.3 Diagrammatic illustration of the four main drawing processes for welded and seamless tube (from Brensig & Sommer, Steel Tube and Pipe Manufacturing Processes)

4. CAST IRON PIPE AND DUCTILE IRON PIPE

Cast iron pipe (CIP) is a historical pipe which found widespread use as a pressure pipe for transmission of water, gas and sewage, and as a water drainage pipe, during the 19th and 20th centuries. It comprises predominantly a gray cast iron tube and was frequently used uncoated, although later developments did result in various coatings and linings to reduce corrosion and improve hydraulics. Cast iron pipe was gradually superseded by ductile iron pipe (DIP), which is a direct development, with most existing manufacturing plants transitioning to the new material during the 1970's and 1980's. There is currently almost no new manufacture of cast iron pipe.

The process of making ductile iron pipe is that of centrifugal casting. Molten metal is poured into a spinning mould. Centrifugal force holds the molten metal against the outer walls of the mould. These forces also cause dross and other impurities to collect inner surface of the casting. No core is used except to form the bell ends of cast pipe. The mold is made of metal but may be sand-lined. The spinning mould gradually moves away from the machine to form the entire length of pipe, which is ejected on the return stroke.

Cast (ductile) iron pipe is grouped into two basic categories: hub and spigot and hubless. The hub, or bell, and spigot joint uses pipe with two different end types. The hub end of the pipe has an enlarged diameter thus representing a bell. Hubless types are either straight-ended or with integrally cast shoulders for clamp connections.

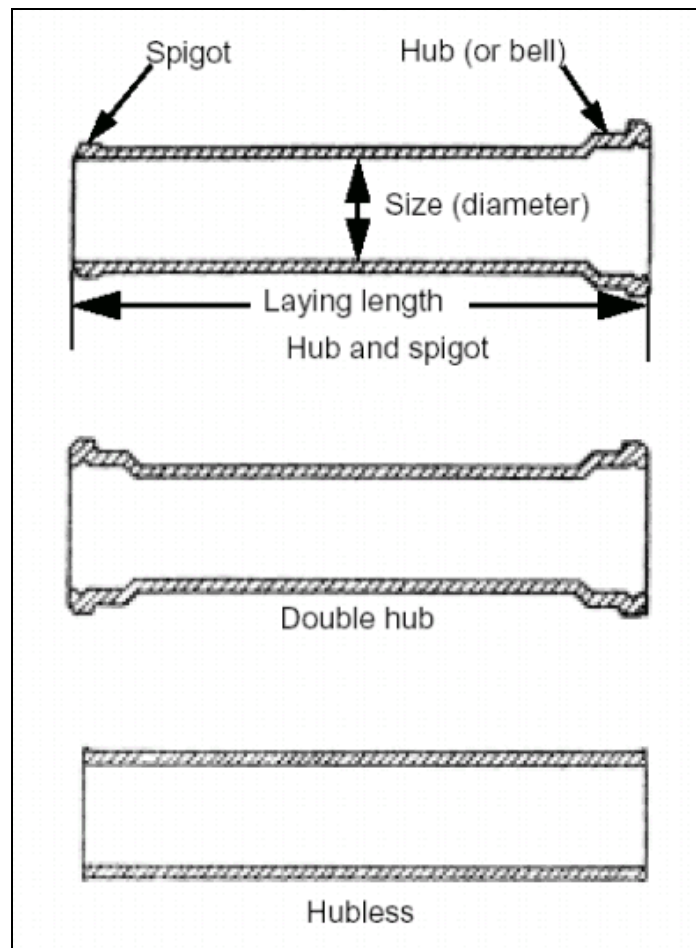


Figure 4.1 Three types of connecting systems for cast iron pipe

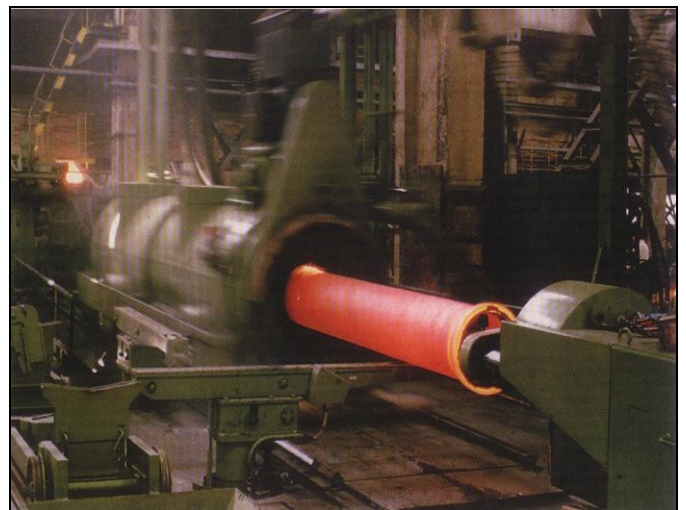


Figure 4.2 Cast (Ductile) Iron Pipe being (a) cast in a spinning mould and (b) withdrawn from the mould



Figure 4.3 Ductile Iron Pipe. Note "one end integral" cast coupling bell or hub.

5. FERROUS TUBE AND PIPE MATERIALS

5.1 Carbon Steel

Carbon steel, also called plain-carbon steel, is steel where the main alloying constituent is carbon. A more general use of the term "carbon steel" is in reference to steel which is not stainless steel. In this use carbon steel includes alloy steels and is the context in which it is typically used in the tube and pipe industry.

The vast majority of all steel produced worldwide is carbon steel.

Carbon steel is used to make all types of tube explained above. Cast carbon steel tube and pipe is extremely rare though.

Zinc coating, or galvanizing, is a common method to improve the corrosion resistance of carbon steel. Two types, namely pre-galvanized (PG) and hot dip galvanized (HDG) are common for tube and pipe. Both finishes give carbon steel a shiny to dull silvery appearance. PG has a smooth, spangled finish, while HDG tube and pipe typically have a slightly rougher and marbled appearance.

5.2 Stainless Steel

In metallurgy stainless steel, also known as inox steel or inox from French "inoxydable", is defined as a steel alloy with a minimum of 10.5% chromium content by mass. Stainless steel does not stain, corrode, or rust as easily as ordinary steel, but it is not stain-proof. There are different grades and surface finishes of stainless steel to suit the environment to which the material will be subjected in its lifetime.

Stainless steel is considered an exotic material which is reflected in its much higher price when compared to carbon steel. It is generally only used where both the properties of steel and resistance to corrosion are required.

As with carbon steel, stainless steel can be used for the production of all types. Also cast stainless tube or pipe is a rarity.

5.3 Ductile Iron

Apart from insignificant quantities of cast carbon steel and stainless steel tube and pipe, ductile iron accounts for all modern cast iron pipe.

Ductile iron, also known as ductile cast iron, nodular cast iron, spheroidal graphite iron, spherulitic graphite cast iron and SG iron, is a type of cast iron. While most varieties of cast iron are brittle, ductile iron is much more flexible and elastic, due to its nodular graphite inclusions.

Much of the annual production of ductile iron is in the form of ductile iron pipe, used for water and sewer lines. Ductile iron pipe is stronger and easier to tap, requires less support and provides greater flow area compared with normal cast iron pipe.

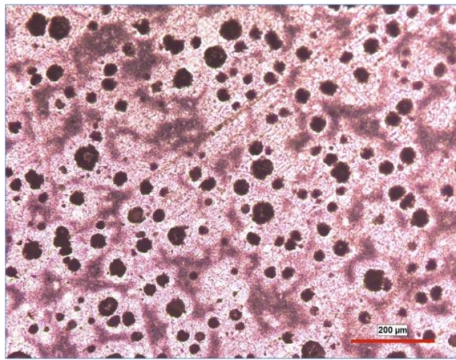
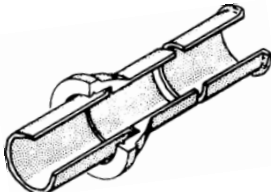
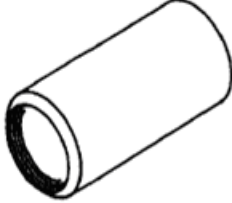
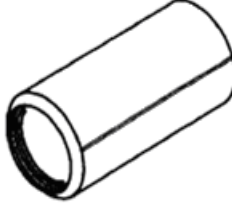
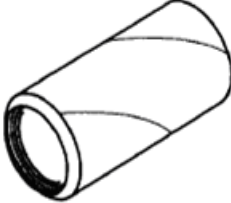


Figure 5.1 Light optical micrograph of polished and etched ductile iron displaying the typical spherical graphite nodules

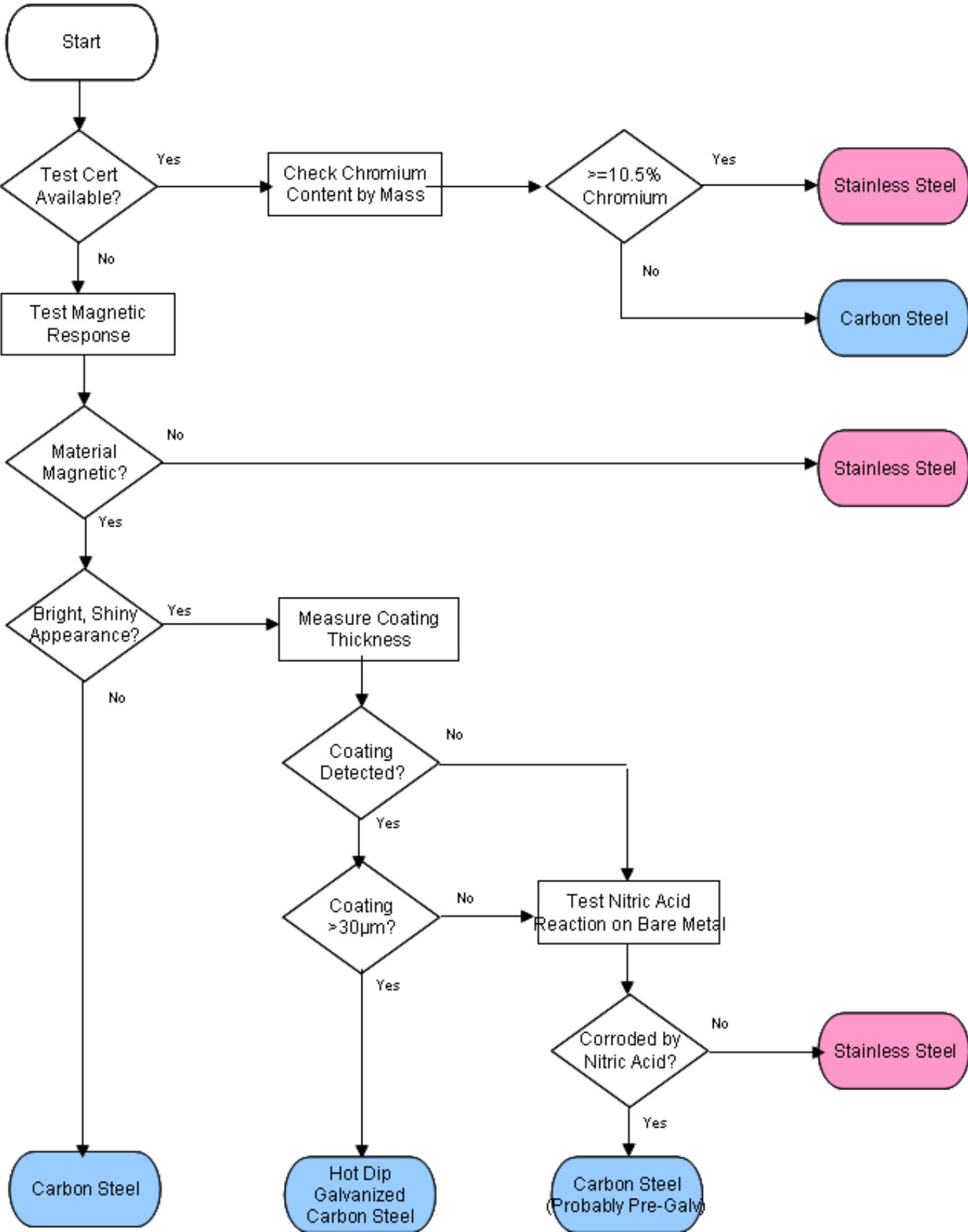
6. TUBE AND PIPE IDENTIFICATION AIDS

Table 1. Typical Characteristics of Ferrous Tube and Pipe

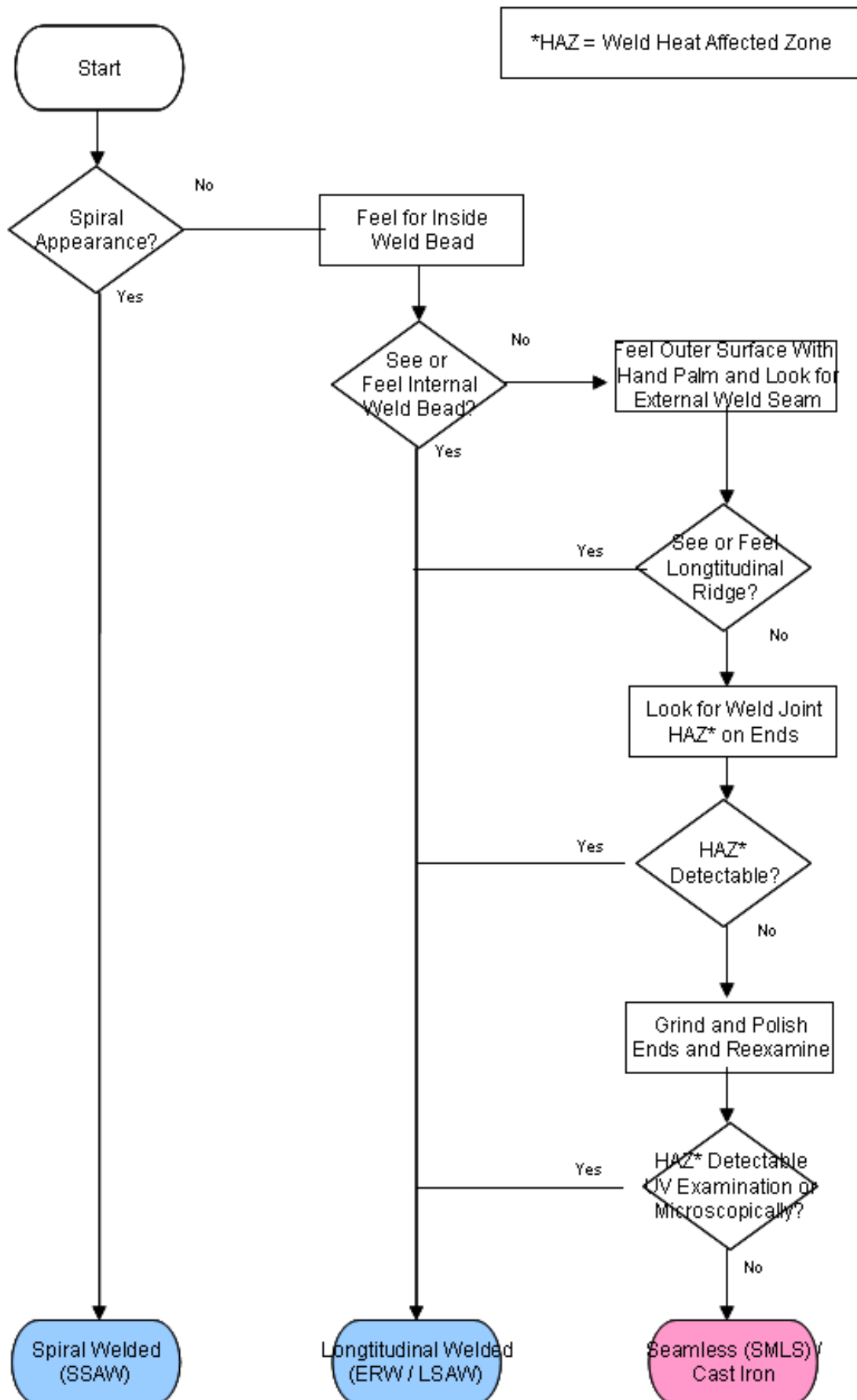
Characteristic	Cast Iron / Ductile Iron	Seamless	Welded	
			Longitudinal	Spiral
Market Description	Ductile Iron Pipe (DIP) Cast Iron Pipe (CIP) Ductile cast iron Nodular cast iron Spheroidal graphite iron (SG iron) Spherulitic graphite cast iron Cast Iron Soil Pipe (CISP) Ductile Iron Soil Pipe (DISP)	Seamless (SMLS) Hot Finished Seamless (HFS) Cold Drawn Seamless (CDS)	Electric Resistance Welded (ERW) High Frequency Induction ERW (HFI ERW) ERW also available as Drawn Over Mandrel (DOM) Electric Welded (EW) Electric Fusion Welded (EFW) Longitudinal Submerged Arc Welded (LSAW, incl. UOE, JCOE, 3RB / RSAW)	Spiral Submerged Arc Welded (SSAW) Helical Submerged Arc Welded (HSAW)
Outside Diameter Size Range	<u>Cast Iron:</u> $\varnothing 95 - \varnothing 1300$ mm <u>Ductile Iron:</u> $\varnothing 48 - \varnothing 2600$ mm	$\varnothing 17 - \varnothing 660$ mm <u>Continuous Mandrel / Push Bench:</u> $\varnothing 17 - \varnothing 178$ <u>Multistand Plug Mill (MPM)/ Stiefel:</u> $\varnothing 140 - \varnothing 406$ <u>Cross Roll Piercing / Pilger Rolling:</u> $\varnothing 250 - \varnothing 660$	$\varnothing 6 - \varnothing 660$ mm <u>ERW:</u> $\varnothing 6 - \varnothing 660$ <u>3RB:</u> $\varnothing 560 - \varnothing 1625$ <u>UOE:</u> $\varnothing 406 - \varnothing 1625$ <u>JCOE:</u> $\varnothing 305 - \varnothing 1625$	Typical: $\varnothing 219 - \varnothing 2500$ mm Extremes: $\varnothing 76 - \varnothing 4200$ mm
Wall Thickness Range	<u>Cast Iron:</u> 9.6 – 50mm <u>Ductile Iron:</u> 3.0 – 22.1mm	3 – 125 mm <u>Continuous Mandrel / Push Bench:</u> 3 – 25 <u>Multistand Plug Mill (MPM)/ Stiefel:</u> 3 – 40 <u>Cross Roll Piercing / Pilger Rolling:</u> 3 – 125	0.7 – 65 mm <u>ERW:</u> 0.7 – 22 <u>3RB:</u> 7 – 32 <u>UOE:</u> 6 – 40 <u>JCOE:</u> 5 – 65	Typical: 3.0 – 25.4 mm Extremes: 0.5 – 30 mm
Diameter to Thickness Range (D/t Ratio)	<u>Cast Iron:</u> 9 – 50 <u>Ductile Iron:</u> 19 – 117	Typical: 10 – 30 Extremes: 3 – 40	<u>ERW</u> Typical: 10 – 65 Extremes: 4 – 120 <u>LSAW</u> Typical: 12 – 17 Extremes: 9 – 160	Typical: 30 – 160 Extremes: up to 250?
Shapes / Profiles	Round only	Mainly round Other profiles very rare.	LSAW: Round only. ERW: Virtually any closed shape possible - Round, Square, Rectangle, Oval, Elliptical, D-Section, etc.	Round only
Markings	Cast markings or stenciling	Stenciling	No marking / hard stamp / stenciling	No marking / stenciling

Characteristic	Cast Iron / Ductile Iron	Seamless	Welded	
			Longitudinal	Spiral
Main Uses/ Applications	Unlined: Potable water supply Lined: Potable water supply, sewerage	Oil and gas drilling equipment, and pipelines High temperature and high pressure pipes Boiler assembly, automotive, mining equipment	<u>ERW</u> : Mechanical, structural, water pipe, other conveyance (air, steam), furniture, automotive, etc. <u>LSAW</u> : Large bore water, oil and gas pipelines. Large structural sections. Products for boiler construction.	low to high-pressure water and waste water pipelines, ducting, structural, piling Petrochemical line and process pipe
Dominant Specifications	ASTM A74, ASTM A888, BS437, BS2035, BS4772, EN545, EN598, EN877, ISO2531, ANSI/AWWA C151/A21.51	DIN2448, API 5L, ASTM A53, ASTM A500, ASTM A106, EN 10216, DIN 2391, ISO 2937, ISO 3304, ANSI B36.10	<u>Water Pipe</u> : ASTM A53, BS1387, DIN2440, EN10255 <u>Structural</u> : ASTM A500, EN10219, JIS G3466, EN10210, BS6263, EN39 <u>Large Bore</u> : API 5L, ISO 3183	API 5L, API 5CT, AWWA C200, ASTM A139, ASTM A252, ASTM A211, ISO 3183, EN10217/10219
South African Specifications	SABS SANS 746, SANS 1835, SANS 2531, SANS 6594	None	SANS SABS 62, 657, 719, 1182	SANS SABS 657-1, 719
General Appearance	No weld seam present Joining system usually integral (bell one end, shoulder both ends, flanges both ends, etc.) Surface finish much rougher than any other method of pipe production Typically internally lined (e.g. cement mortar)	No weld seam present Lengths single random (SRL 4880 – 6100mm), or double random (DRL 10675 – 12192mm) Noticeable aberrations in wall thickness and concentricity, especially for Hot Finished Seamless (HFS).	Longitudinal weld seam or weld Heat Affected Zone (HAZ) can be seen or felt Outside weld bead removed on ERW, may also be removed internally Wall thickness variation typically < 0.1mm Straightness typically better than 1: 1000	Spiraled “barber pole” welding effect clearly visible Vary light walls, large diameters Wall thickness variation typically < 0.1mm
Picture				

Flowchart 1. Identification of Steel Grades



Flowchart 2. Identification of Tube and Pipe Production Methods



7. Typical Tariff codes used for Steel Tube and Pipe

Material	Shape	Size	Welded		Seamless (SMLS)		Cast
			Longitudinal	Spiral	Hot Finished Seamless	Cold Drawn Seamless	
			ERW, LSAW	SSAW or PLASMA	HFS	CDS	CIP, DIP
Carbon Steel	Round	<406.4mm	7306.30 7306.50		7304.10 7304.19	7304.31 7304.41 7304.51	
		>406.4mm	7305.11 7305.12	7305.19			
	Square, Rectangular	All	7306.61				
	Other Closed Shapes	All	7306.69				
Stainless Steel	All	All	7306.11 7306.21 7306.40		Drill Pipe: 7304.22 7304.24	7304.11	
Cast / Ductile Iron	Round	All					7303.00

8. GLOSSARY

CDS	Cold Drawn Seamless
CDW	Cold Drawn Welded
CIP	Cast Iron Pipe
CREW	Cold Rolled Electric Welded
DIP	Ductile Iron Pipe
DOM	Drawn Over Mandrel
DSAW	Double Submerged Arc Welded
EFW	Electric Fusion Welded
ERW	Electric Resistance Welded
HREW	Hot Rolled Electric Welded
LSAW	Longitudinal Submerged Arc Welded
SMLS	Seamless
SSAW	Spiral Submerged Arc Welded

9. REFERENCES

1. Wikipedia, www.wikipedia.com
2. Encyclopedia Britannica On-line, www.britannica.com
3. GE Infrastructure - Pipe Manufacturing, www.gepower.com/prod_serv/serv/pipeline/en/about_pipelines/pipe_mfg.htm
4. Parisher, R.A., and Rhea, R.A., 2001, Pipe drafting and design 2nd ed.
5. Bralla, J.G. (Ed), 2006, Handbook of Manufacturing Processes
6. De Garmo, P.E. et al, DeGarmo's Materials and Processes in Manufacturing, Tenth Edition
7. Brensig, K.H., and Sommer, B., Steel Tube and Pipe Manufacturing Processes, Salzgitter Mannesmann Röhrenwerke
8. Pasquesi, A., How Is Steel Pipe Made?, www.ehow.com/how-does_5244425_steel-pipe-made_.html
9. The Ductile Iron Pipe Research Association (DIPRA), www.dipra.org
10. Steel Pipe Design Manual, Section One, American SpiralWeld Pipe, www.acipco.com/aswp/pdfs/ASWP1-Introduction.pdf
11. Methods of Manufacturing Steel Tubes and Pipe, www.jfe-21st-cf.or.jp/chapter_3/3e_1.html
12. The Simdex worldwide list of tube standards
13. Joshi, A.M., Centrifugal Casting
14. Steel Pipe: A Guide for Design and Installation, American Water Works Association, 1989
15. Schroers, D., New technologies for the Economical & Flexible Production of Large-Diameter Pipes, Iran PipeTech 2007, SMS Meer
16. Atlas Speciality Metals, 2008, Technical Handbook of Stainless Steels as quoted in Stainless Steel – Sorting and Identification Tests, www.azom.com
17. The difference between tube and pipe, <http://bbs.zuwharrie.com/content?topic=33982>

APPENDIX A: DUCTILE IRON PIPE PRODUCTION

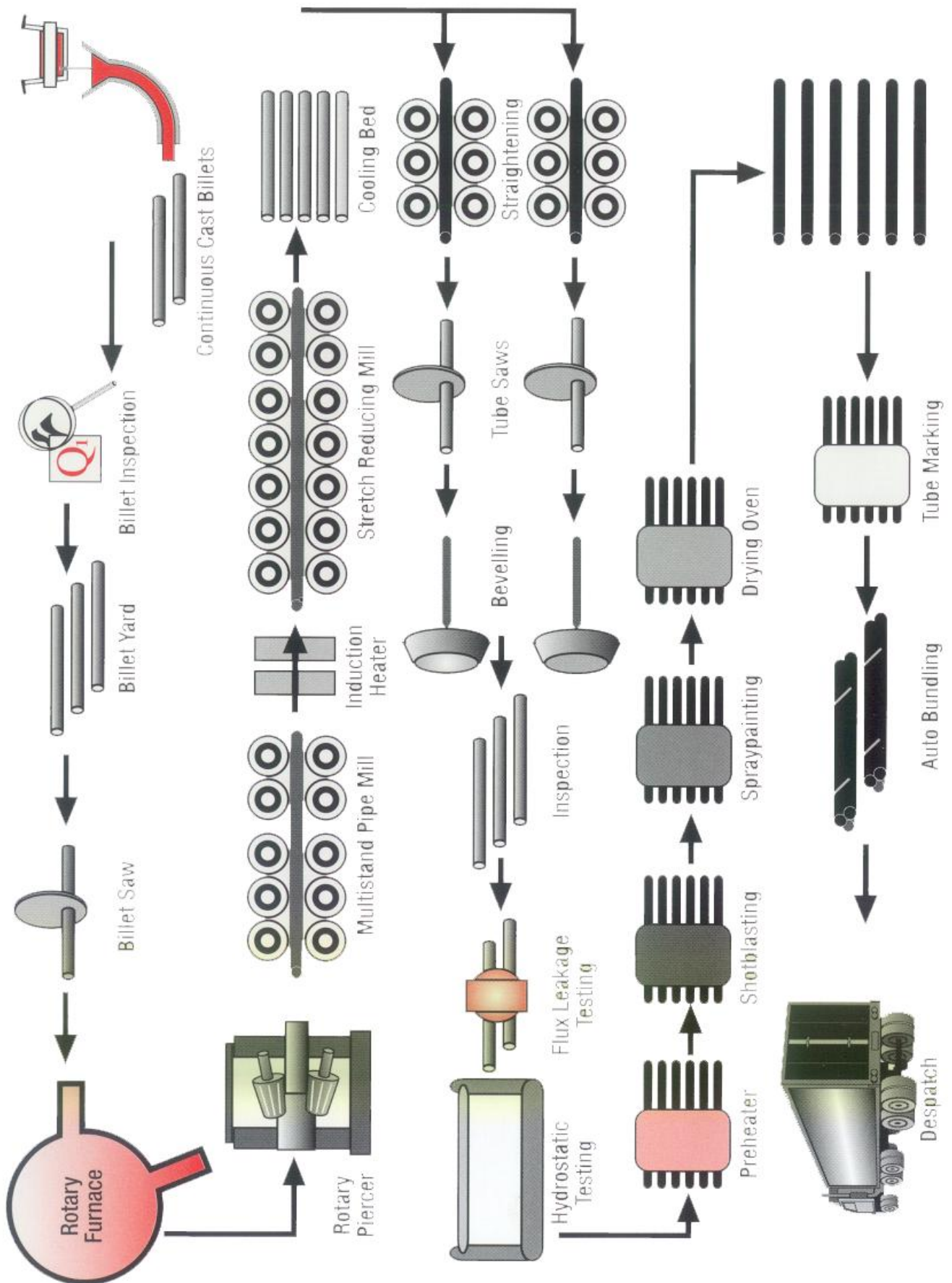


A.1 Handling the ductile cast iron pipes in the factory yard

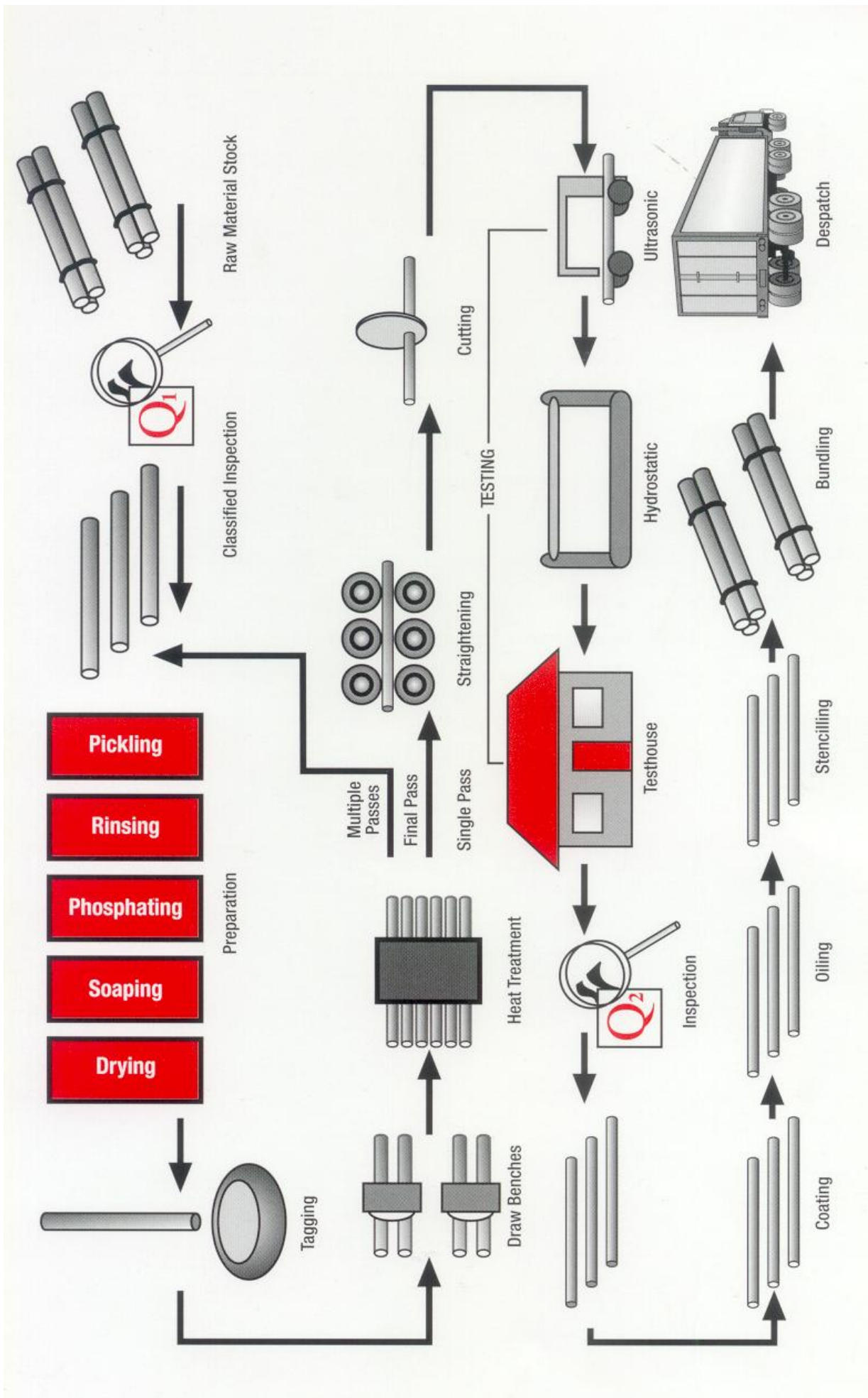


A2. Ductile cast iron pipe stock storage area

APPENDIX B: SEAMLESS TUBE AND PIPE PRODUCTION



B1. Hot Finished Seamless (HFS) process flow



B2. Cold Drawn Seamless (CDS) process flow



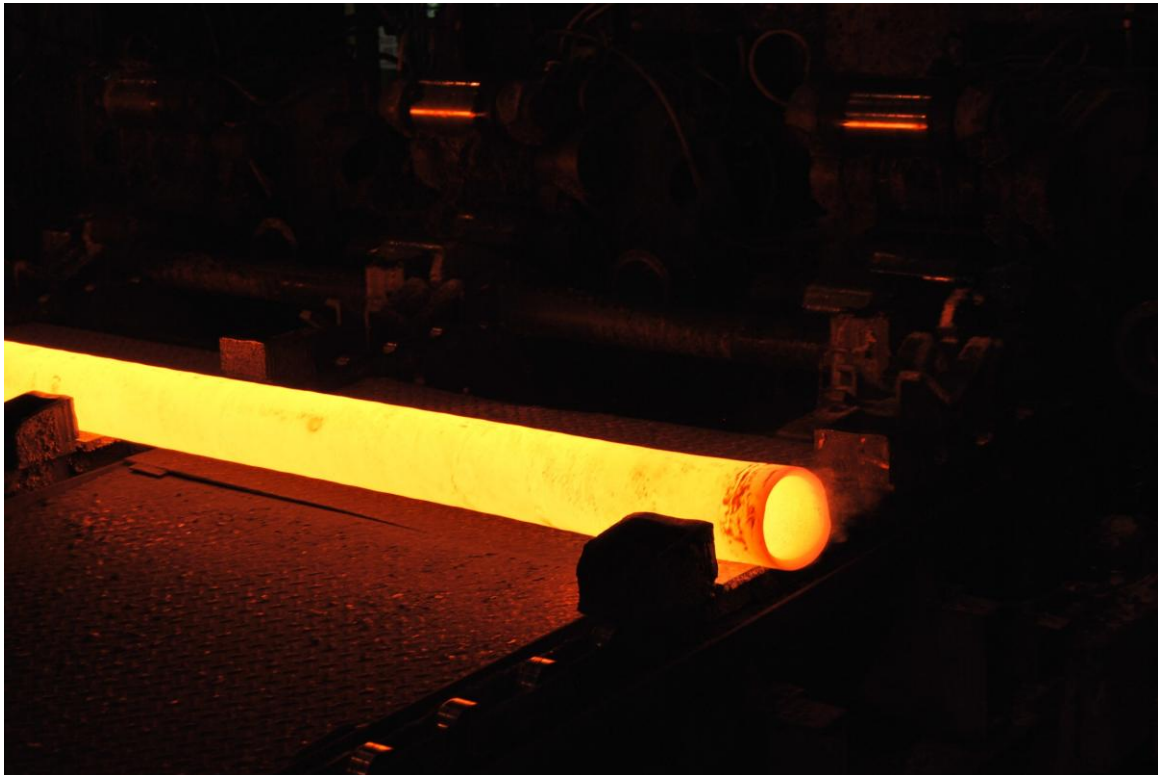
B3. Steel billets before seamless pipe mill



B4. Rotary furnace with billets inside



B5. Piercer heads



B6. Pierced tube still glowing hot

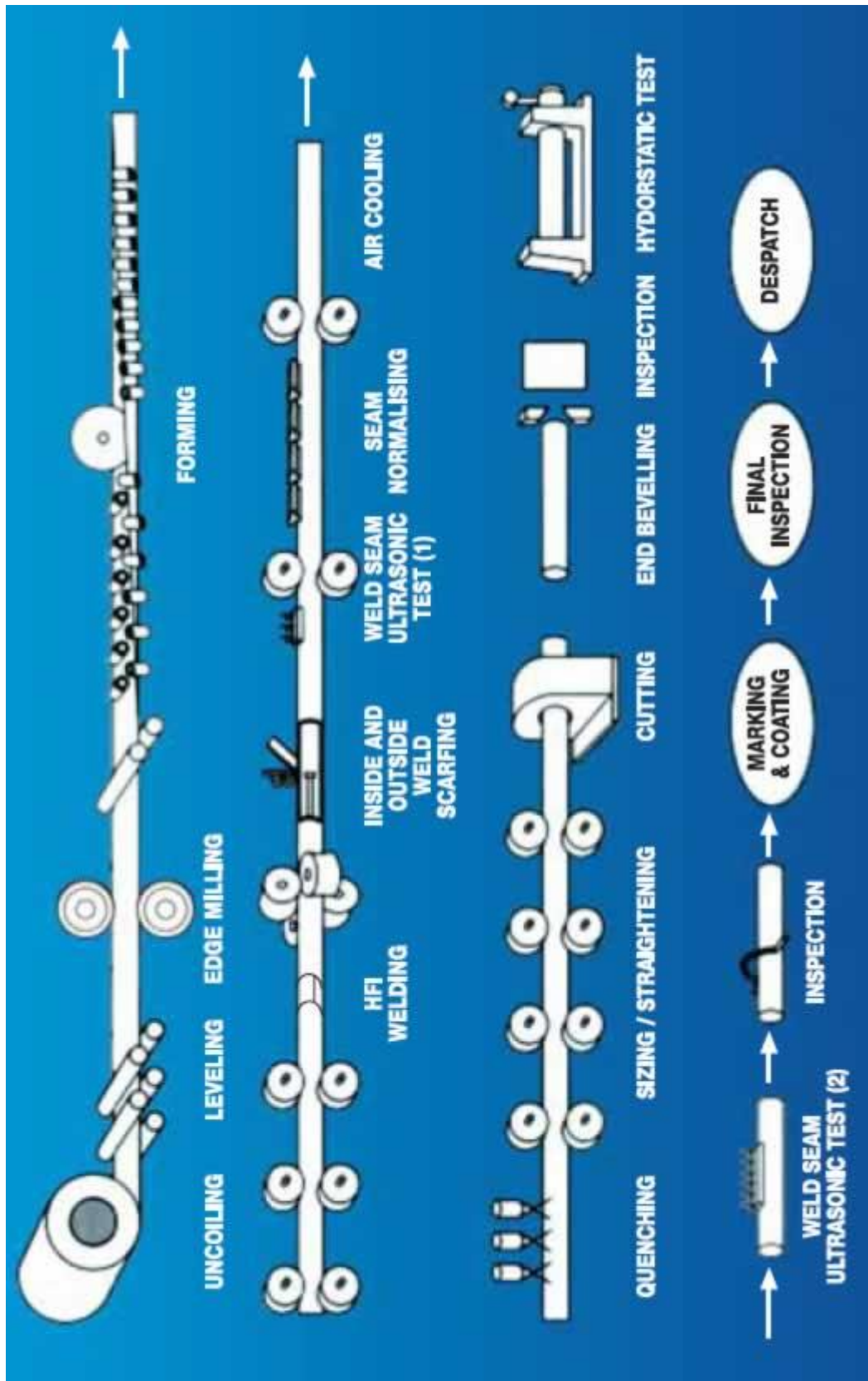


B7. Seamless pipe end before bevelling



B8. Bundles and stacked seamless tube

APPENDIX C: ELECTRIC RESISTANCE WELDED TUBE AND PIPE PRODUCTION



C1. Typical ERW process flow



C2. Slit mults ready before ERW tube mill



C3. Externally scarfed weld seam on round tube



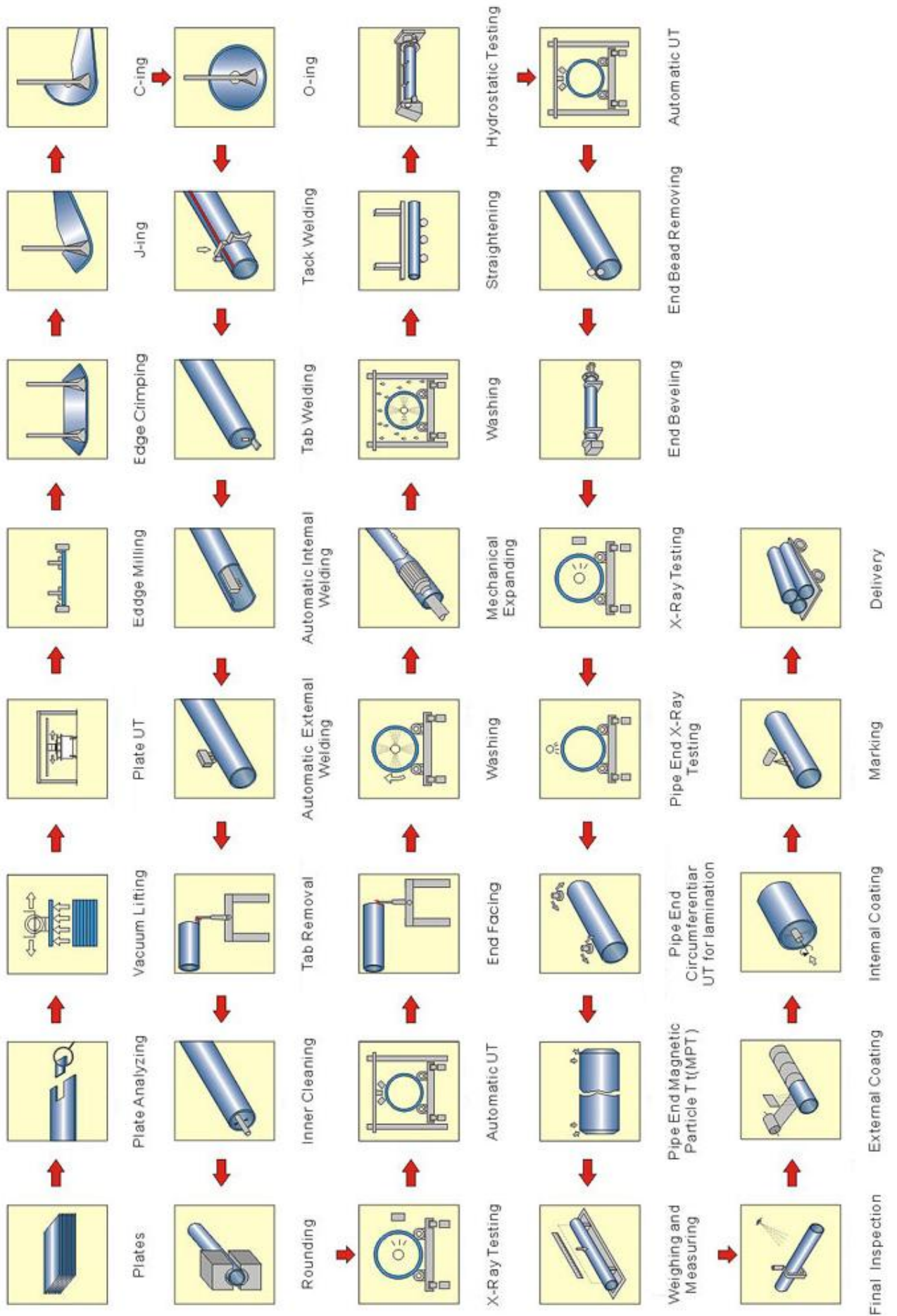
C4. Inside weld bead removed (internally scarfed)



C5. Inside weld bead not removed (unscarfed)

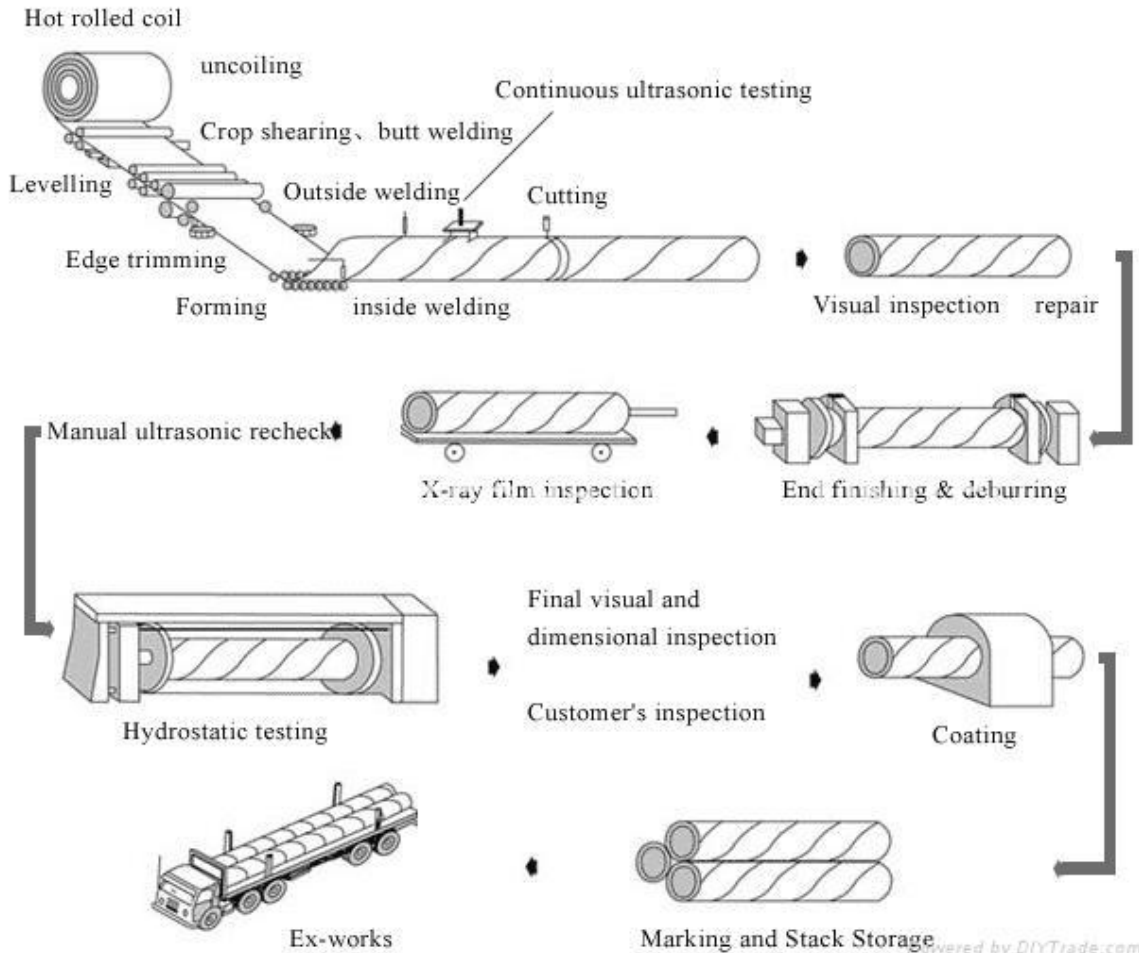
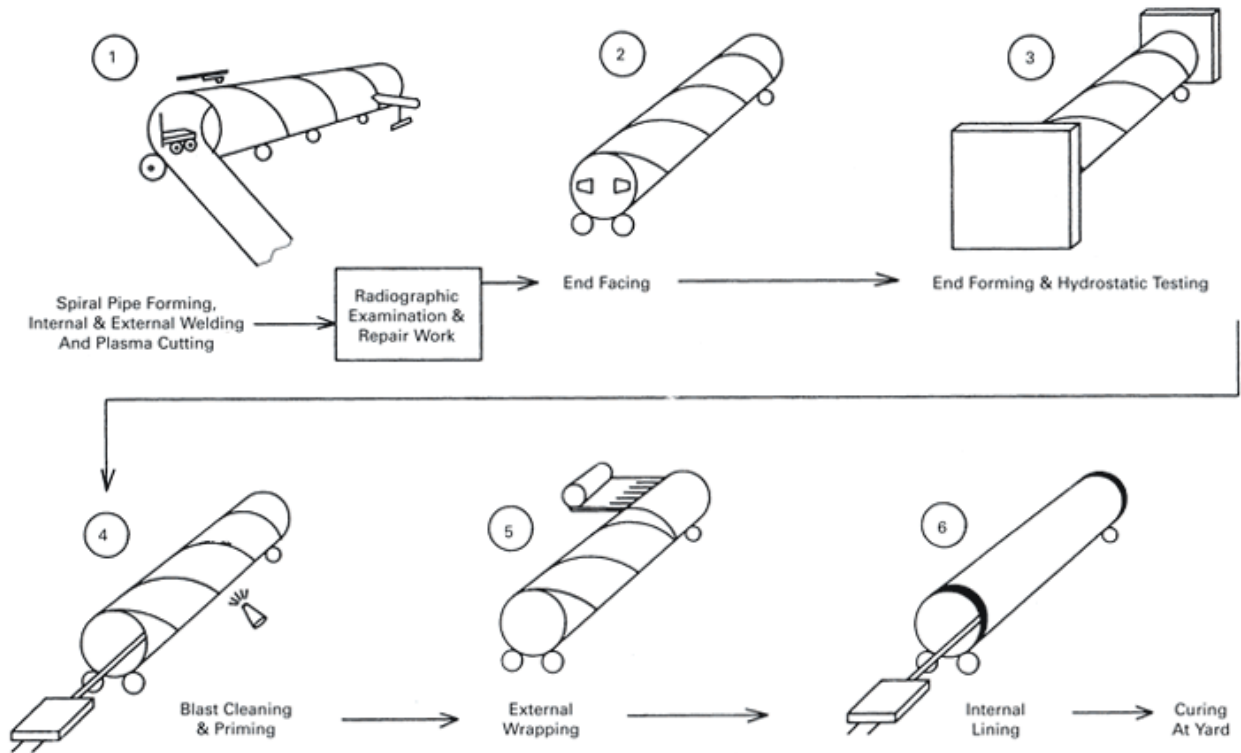
APPENDIX D: LSAW PIPE PRODUCTION PROCESS

LSAW Pipes Manufacturing Process



D1. Typical LSAW process flow

APPENDIX E: SSAW PIPE PRODUCTION



E1. Two typical spiral pipe production flows



E2. External welding



E3. Spiral pipe after welding

10. Tariff heading, description and examples

Tariff 73		Articles of Iron or Steel	
Tariff Code 73.03.00.00		Tubes, Pipes and hollow profiles, of Cast Iron (or ductile iron)	
Tariff Code 73.25.10.00		Other cast articles of iron or steel: Of non-malleable cast iron	
Tariff Code 73.25.99.00		Other cast articles of iron or steel: Other	
Rate of ordinary customs duty			
General	EU	EFTA	SADC
Free	Free	Free	Free

Features of Cast Iron and Ductile iron Tube and Pipe :

1. No weld therefore no seam will be visible
2. Rough surface finish
3. Joining System typically visible
4. May be internally vlined, coated or galvanized

Figure 1 :

Welded, internally unscarfed pipe – not a cast iron pipe



Figure 2:

Welded pipe externally scarfed – not a cast iron pipe

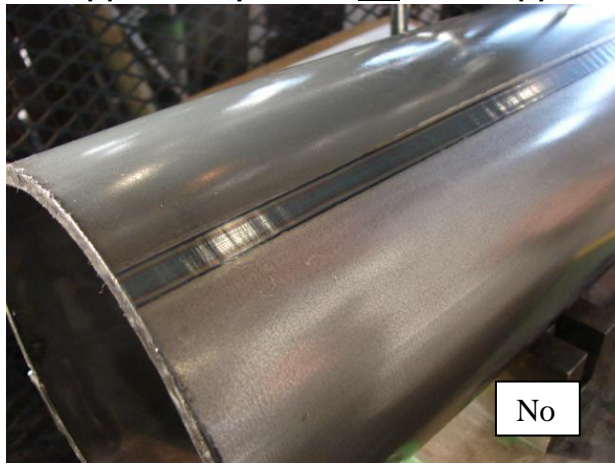


Figure 3:

Welded pipe that is internally scarfed, not a cast iron pipe

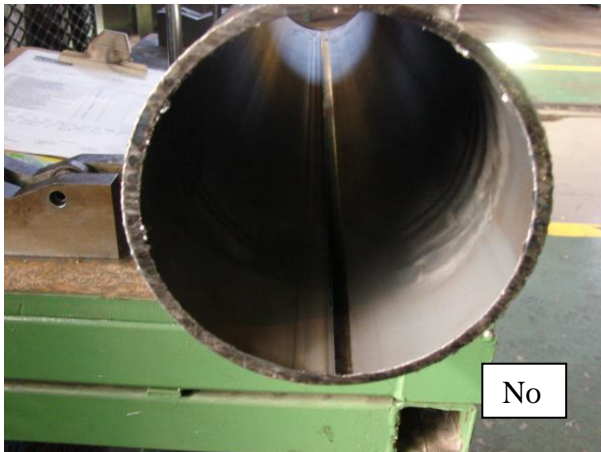


Figure 4:

Spirally welded pipe – not a cast iron pipe



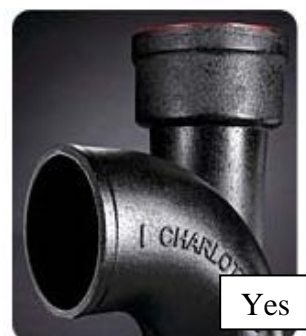
Figure 5:

Typical a Cast Iron Pipe with Hub end



Figure 6:

Hubless or no hub cast iron pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.04	Tubes, pipes and hollow profiles, seamless, of iron (excluding cast iron) or steel		
Tariff Code 73.04.11	Line pipe of a kind used for oil or gas pipelines: Of stainless steel		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
Free	Free	Free	Free

Features of seamless Stainless Steel Tube :

1. No weld therefore no seam will be visible
2. Rough surface finish due to seamless process, if smooth but with no seam should be booked in under 73.04.31
3. Resistance to Acid attack
4. Non magnetic
5. High Chrome content

Figure 1 :
Welded, internally unscarfed pipe – not a seamless pipe



Figure 2:
Welded pipe externally scarfed – not a seamless pipe

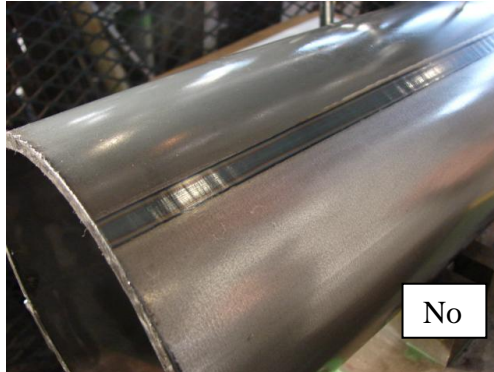


Figure 3:
Welded pipe that is internally scarfed, not a seamless pipe

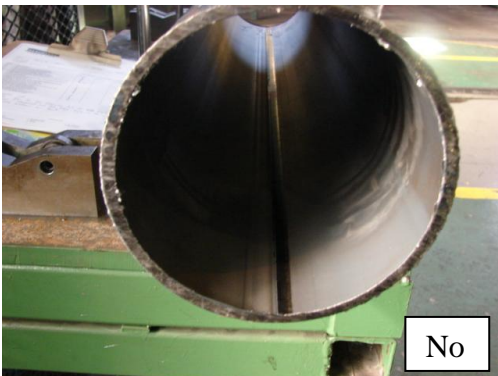
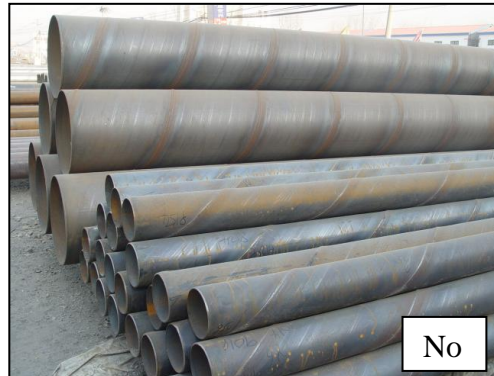
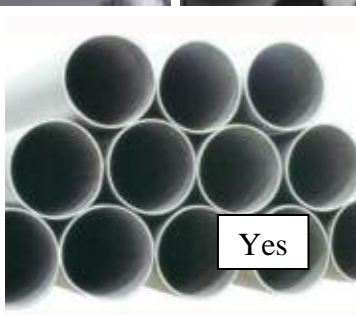


Figure 4:
Spirally welded pipe – not a seamless pipe



Figures 5
Seamless Stainless Steel tube



Tariff 73	Articles of Iron or Steel		
Tariff 73.04	Tubes, pipes and hollow profiles, seamless, of iron (excluding cast iron) or steel		
Tariff Code 73.04.39.35	Other, of circular cross-section, of iron or non alloy : Of wall thickness exceeding 25mm or an outside cross-sectional dimension exceeding 170mm		
Tariff Code 73.04.59.45	Other, of circular cross-section, of other alloy : Of wall thickness exceeding 25mm or an outside cross-sectional dimension exceeding 170mm		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
Free	Free	Free	Free

Features of seamless Tube :

1. No weld therefore no seam will be visible
2. Wall thickness exceeding 25mm or a diameter greater than 170mm.
3. Magnetic

Figure 1 :
Welded, internally unscarfed pipe – not a seamless pipe



Figure 2:
Welded pipe externally scarfed – not a seamless pipe



Figure 3:
Welded pipe that is internally scarfed, not a seamless pipe



Figure 4:
Spirally welded pipe – not a seamless pipe

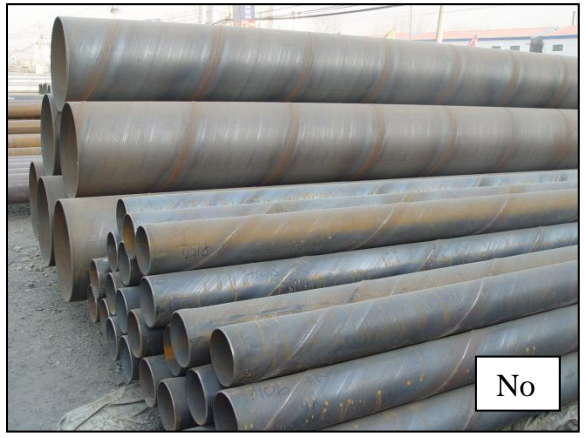


Figure 5: Seamless pipe



Figure 6: Seamless pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.04	Tubes, pipes and hollow profiles, seamless, of iron (excluding cast iron) or steel		
Tariff Code 73.04.41	Other, of circular cross section, of stainless steel : Cold-drawn or cold rolled (cold reduced)		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
Free	Free	Free	Free

Features of seamless Stainless Steel Tube :

1. No weld therefore no seam will be visible
2. Smooth surface finish
3. Resistance to Acid attack
4. Non magnetic
5. High Chrome content

Figure 1 :
Welded, internally unscarfed pipe – not a seamless pipe



Figure 2:
Welded pipe externally scarfed – not a seamless pipe

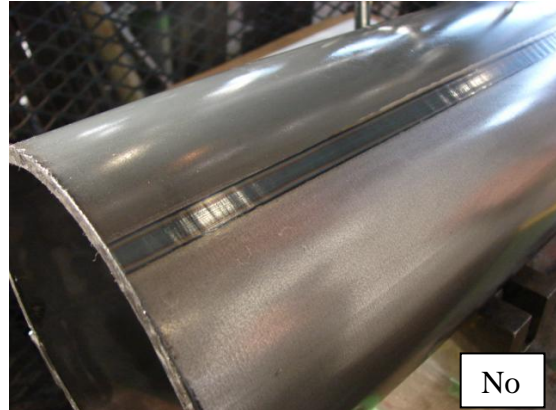


Figure 3:
Welded pipe that is internally scarfed, not a seamless pipe

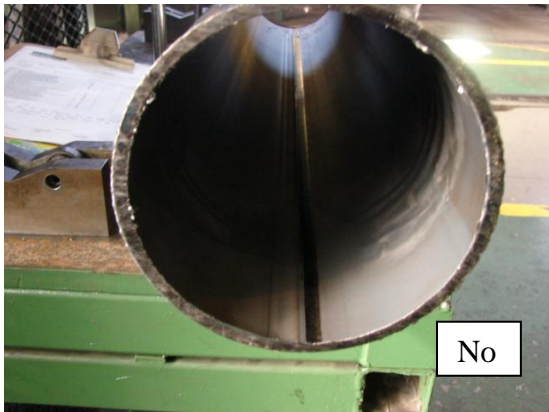


Figure 4:
Spirally welded pipe – not a seamless pipe

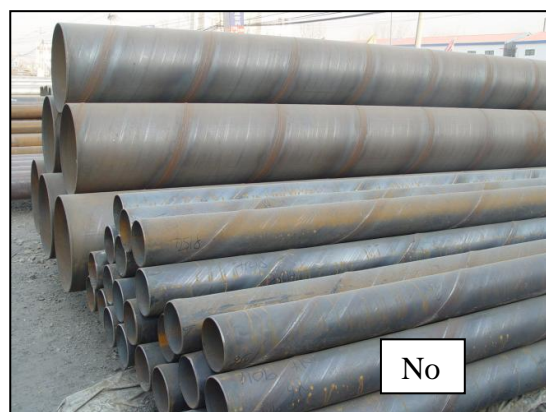
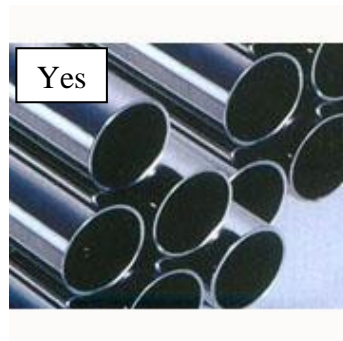


Figure 5. Stainless seamless



Figure 6. Stainless seamless



Tariff 73	Articles of Iron or Steel		
Tariff 73.04	Tubes, pipes and hollow profiles, seamless, of iron (excluding cast iron) or steel		
Tariff Code 73.04.49	Other, of circular cross section, of stainless steel , Other		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
Free	Free	Free	Free

Features of seamless Stainless Steel Tube :

1. No weld therefore no seam will be visible
2. Smooth or rough surface finish
3. Resistance to Acid attack
4. Non magnetic
5. High Chrome content

Figure 1 :
Welded, internally unscarfed pipe – not a cast iron pipe



Figure 2:
Welded pipe externally scarfed – not a cast iron pipe

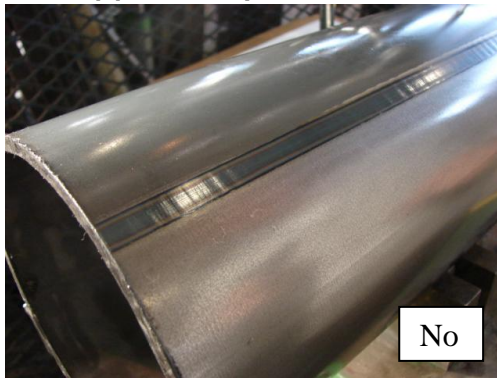


Figure 3:
Welded pipe that is internally scarfed, not a cast iron pipe

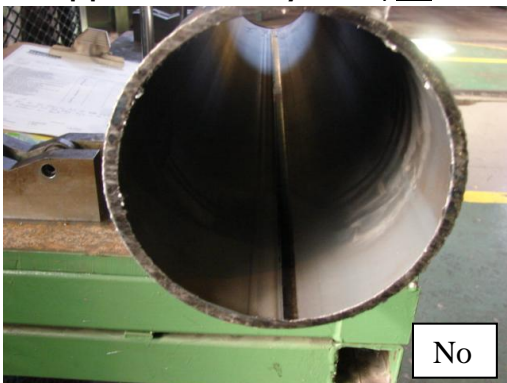


Figure 4:
Spirally welded pipe – not a cast iron pipe



Figure 5. Stainless seamless



Figure 6. Stainless seamless



Tariff 73	Articles of Iron or Steel		
Tariff 73.05	Other tubes and pipes (for example, welded, riveted or similarly closed), having circular cross-sections, the external diameter of which exceeds 406.4mm, of iron or steel		
Tariff Code 73.05.11	Line pipe of a kind used for oil or gas pipelines, Longitudinally submerged arc welded		
Tariff Code 73.05.12	Line pipe of a kind used for oil or gas pipelines, Other, longitudinally welded		
Tariff Code 73.05.19	Line pipe of a kind used for oil or gas pipelines, Other		
Tariff Code 73.05.20	Casing of a kind used in drilling for oil or gas		
Tariff Code 73.05.31.90	Other, welded, Other		
Tariff Code 73.05.39.90	Other, welded, Other, Other		
Tariff Code 73.05.90.90	Other, Other		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will not be visible as the excess weld bead will be removed however scarfing line should be visible but may be difficult to see.
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. If for oil and gas should be internally scarfed.
4. Typical hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
5. Will be magnetic

Figure 1 : Spirally Welded pipe internally coated



Figure 2: Welded pipe externally scarfed – not a cast iron pipe

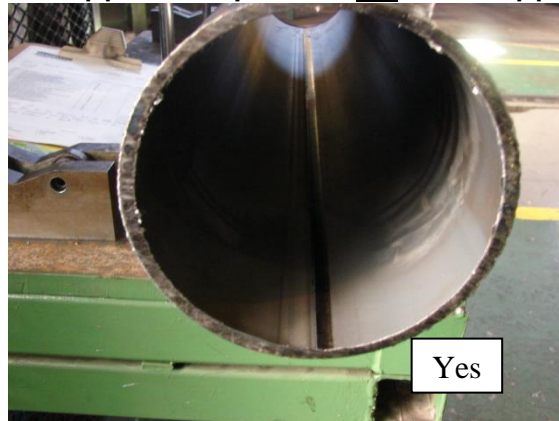


Figure 3: Longitudinally Welded pipe that is internally scarfed

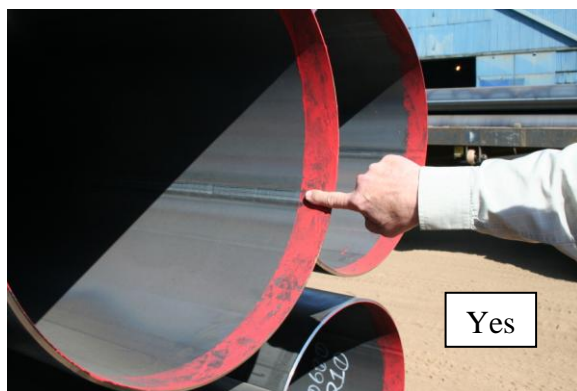
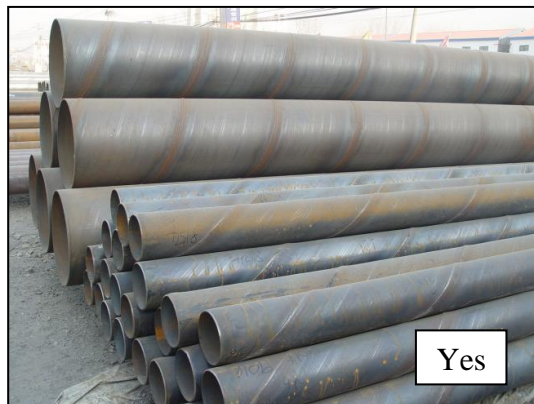


Figure 4: Spirally welded pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.19	Line pipe of a kind used for oil or gas pipelines, Other		
Tariff Code 73.06.29	Casing of a kind used in drilling for oil or gas		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. If for oil and gas should be internally scarfed.
4. Typical hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
5. Will be magnetic

Figure 1:
Welded pipe externally scarfed – not a cast iron pipe

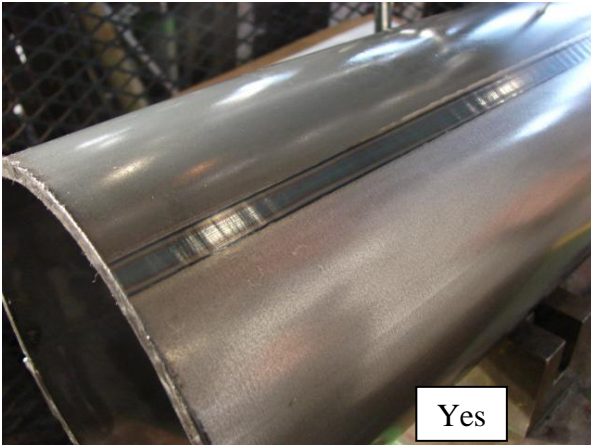


Figure 3:
Welded pipe that is internally scarfed, not a cast iron pipe



Figure 4:
Spirally welded pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.30.10	Other, welded, of circular cross-section, of iron or non-alloy steel, With wall thickness not exceeding 2mm, galvanized		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. Galvanized or Pregalvanized coating will be visible and may be shiny or dull grey. Often surface is rough due to impurities in the zinc coating.
4. Thickness of wall is 2mm or less
5. Will be magnetic

Figure 1 :
Welded galvanized ,internally galvanized pipe



Figure 2:
Welded Galvanized pipe externally scarfed



Figure 3:
Welded Galvanized Pipe

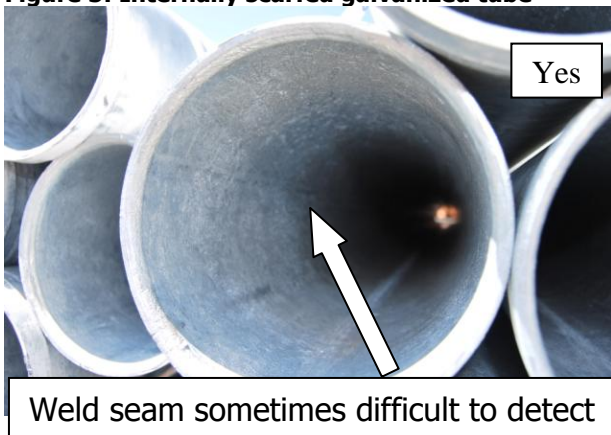


Figure 4:
Welded Galvanized

Pipe



Figure 5: Internally scarfed galvanized tube



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.30.20	Other, welded, of circular cross-section, of iron or non-alloy steel, With wall thickness not exceeding 2mm, not galvanized		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic
5. Thickness of wall is 2mm or less.

Figure 1 :
Welded, internally unscarfed pipe



Figure 2:
Welded pipe externally scarfed – not a cast iron pipe

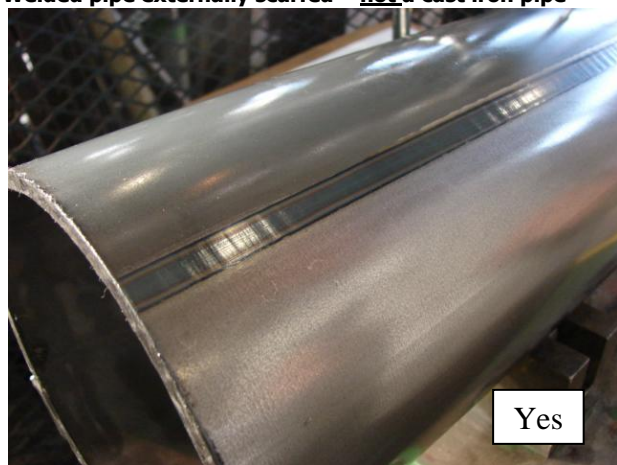
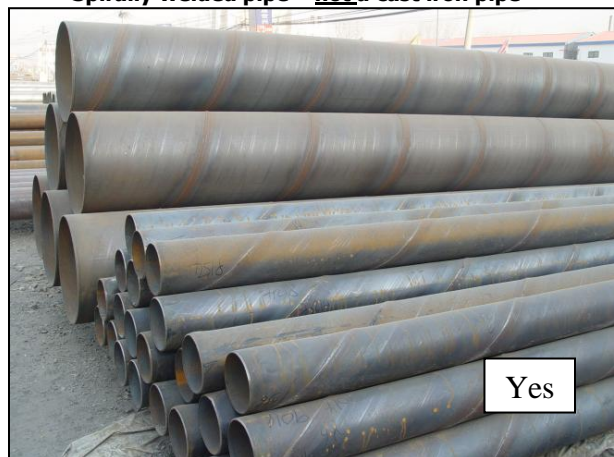


Figure 3:
Welded pipe that is internally scarfed, not a cast iron pipe



Figure 4:
Spirally welded pipe – not a cast iron pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.30.30	Other, welded, of circular cross-section, of iron or non-alloy steel, With wall thickness exceeding 2mm, galvanized		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic
5. Thickness of wall is more than 2mm.

Figure 1 :
Longitudinally welded, internally unscarfed pipe



Figure 2:
Welded pipe externally scarfed and internally scarfed



Figure 3:
Welded pipe that is internally scarfed

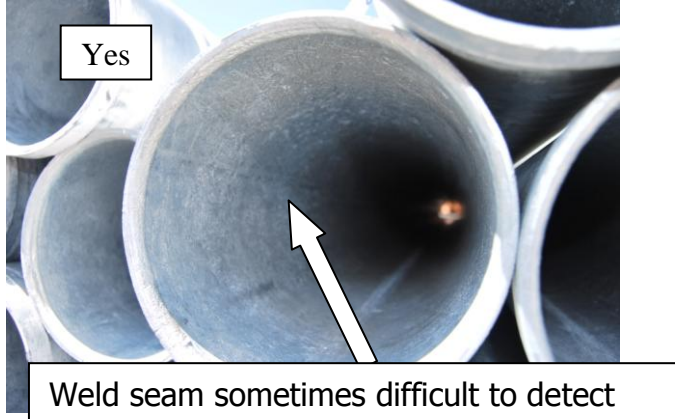


Figure 4:
Spirally welded pipe galvanized pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.30.40	Other, welded, of circular cross-section, of iron or non-alloy steel, With wall thickness exceeding 2mm, not galvanized		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic
5. Thickness of wall is more than 2mm.

Figure 1 :
Welded, internally unscarfed pipe

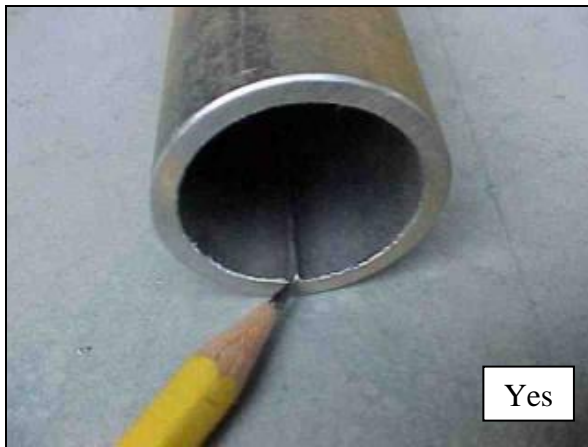


Figure 2:
Welded pipe externally scarfed – not a cast iron pipe



Figure 3:
Welded pipe that is internally scarfed, not a cast iron pipe



Figure 4:
Spirally welded pipe – not a cast iron pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.30.40	Other, welded, of circular cross-section, of iron or non-alloy steel, With wall thickness exceeding 2mm, not galvanized		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect. See pictures below.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic

Figure 1 :
Longitudinally Welded, internally scarfed pipe



Figure 2:
Welded pipe externally scarfed



Figure 3:
Longitudinally Welded pipe that is internally scarfed

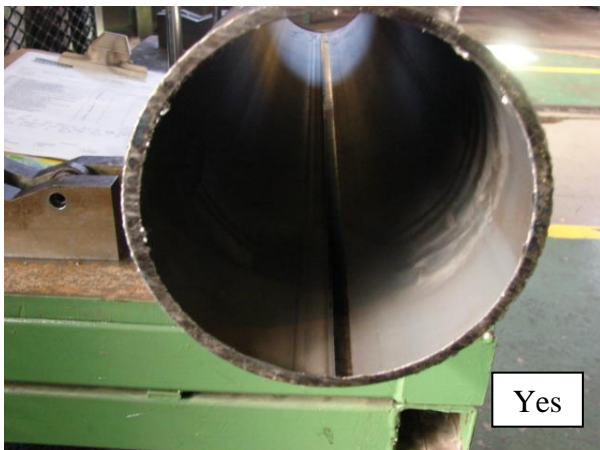


Figure 4:
Spirally welded pipe – not a cast iron pipe



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.61.10	Other, welded, of non-circular cross-section, Of square or rectangular cross-section, With a wall thickness not exceeding 2mm		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic
5. Profile will be either a square or rectangular
6. Thickness of wall is 2mm or less.

Figure 1 :
Welded, internally unscarfed pipe – not a cast iron pipe

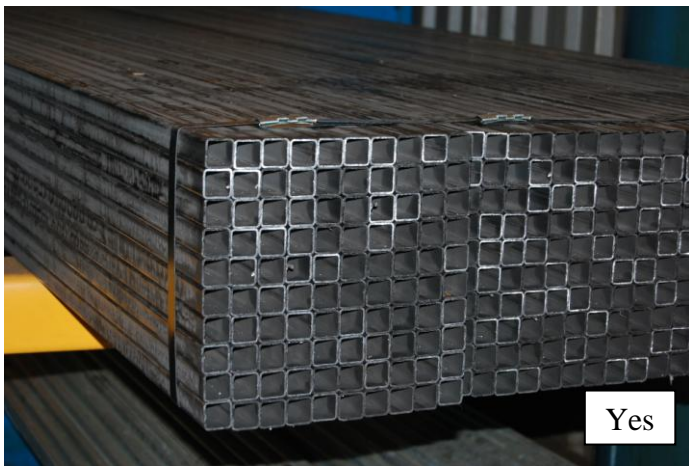


Figure 2:
Welded pipe externally scarfed – not a cast iron pipe

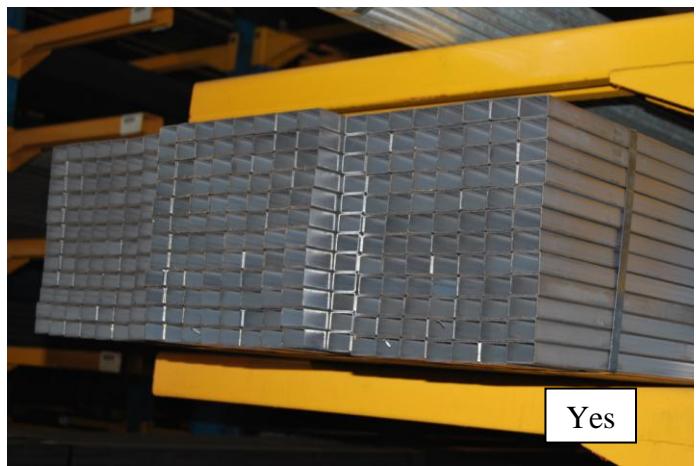


Figure 3:
Square hollow sections



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.61.20	Other, welded, of non-circular cross-section, Of square or rectangular cross-section, With a wall thickness exceeding 2mm		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, although excess weld bead will be removed
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic
5. Profile will be either a square or rectangular
6. Thickness of wall is more than 2mm.

Figure 1 : Square and rectanulr hollow sections



Figure 2: Rectangular Hollow Section



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.69.10	Other, welded, of non-circular cross-section, Of other non-circular cross-section, With a wall thickness not exceeding 2mm		
Tariff Code 73.06.69.20	Other, welded, of non-circular cross-section, Of other non-circular cross-section, With a wall thickness exceeding 2mm		
	Rate of ordinary customs duty		
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. External Weld seam/bead will be visible, but scarfing line may be visible
2. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect.
3. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
4. Will be magnetic
5. Profile not be circular, square or rectangle.

Figure 1 :
Oval Welded Tube less than 2mm thickness



Figure 2:
Oval welded tube more than 2mm wall thickness



Figure 3: Kidney shaped welded tube

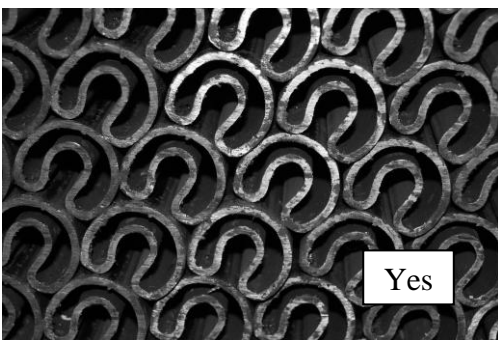
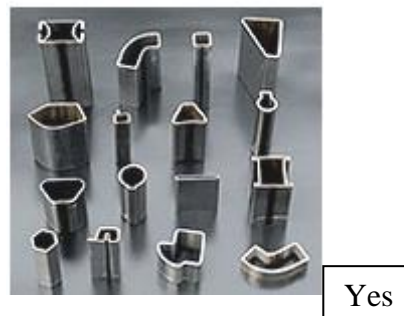


Figure 4: Other shapes



Tariff 73	Articles of Iron or Steel		
Tariff 73.06	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel		
Tariff Code 73.06.90	Other		
Rate of ordinary customs duty			
General	EU	EFTA	SADC
10%	Free	Free	Free

Features of welded Steel Tube :

1. Appropriate with tube and pipe not covered in previous tariff headings and includes amongst other non-circular profiles (squares, rectangles and other profiles) that are galvanized.
2. External Weld seam/bead will be visible, although excess weld bead will be removed
3. Internal weld seam/ bead will be visible in unscarfed tube while in internally scarfed tube scarfing line can be seen but may be difficult to detect.
4. Typical cold or hot rolled steel used to make tube and may be supplied in self color (Possible oiled) or Coated (painted or epoxy coated)
5. Will be magnetic

Figure 1: Welded Galvanized Square Hollow Section



Figure 2: Welded Galvanized Square Hollow Section

