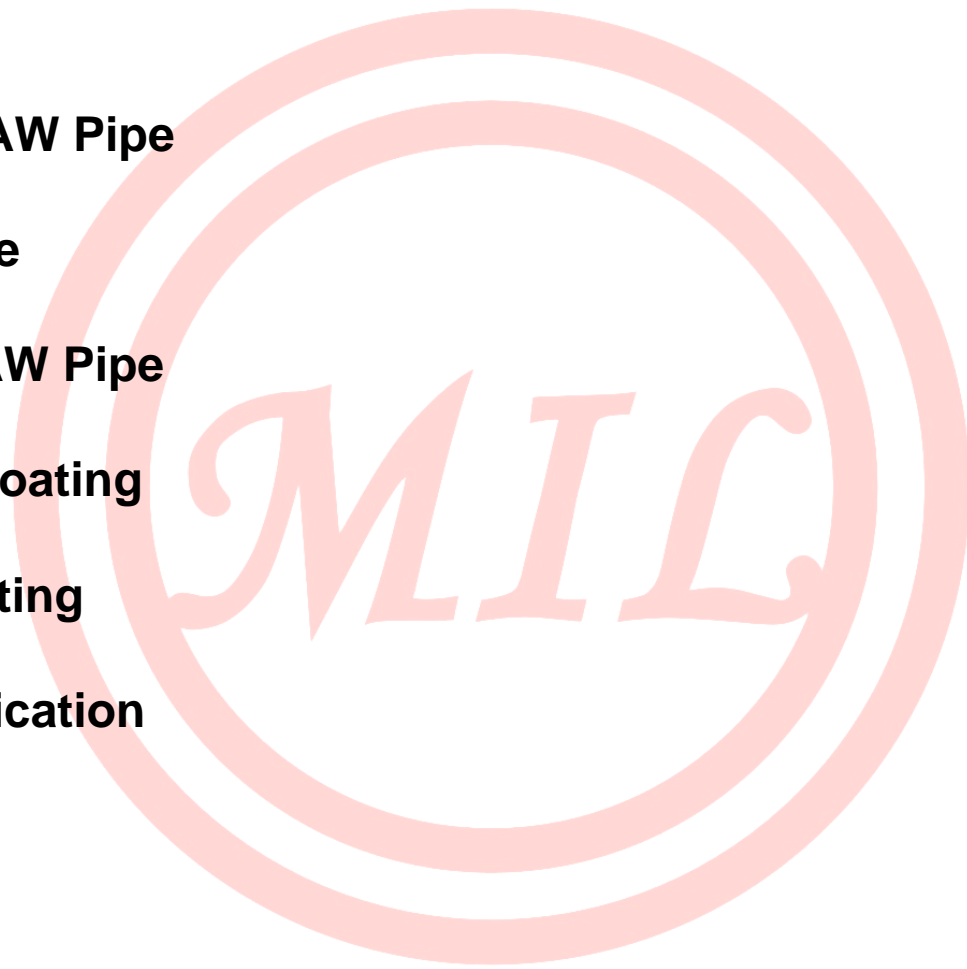




## Contents

1. **Company Profile**
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4. **3-Roller Bend SAW Pipe**
5. **Anti-Corrosion Coating**
6. **Inspection & Testing**
7. **Technical Specification**





## Company Profile

Metals International Limited offers a comprehensive portfolio of Longitudinal DSAW Pipe, Spiral DSAW Pipe, 3-Roller Bending SAW Pipe/Joint to customers on international basis. The steel pipes are widely used in crude oil pipelines, natural gas pipelines, water supply lines, distribution pipelines, foundation piles, offshore platforms, pipe pilings, steel structures for construction and other general purposes by means of their wide size range. Whether our customers are active in such fields, industries or projects, we endeavor to deliver the highest quality products and value-added services that improve our customers' business efficiency.

The pipes are manufactured by latest techniques with machines and equipments which fitted highest technology, in order to provide the manufacturing of products in full conformity with international standards with high quality materials in production in line with its carefully set policies for sustainable quality as possessing API-5L PSL1/PSL2, ISO 3183-1/2/3, DNV OS-F-101, API 2B, AS 2885, ASTM A139, ASTM A252, ASTM A500, ASTM A 671, ASTM A672, ASTM A691, EN10208, CSA Z245.1, GOST 20295, IPS-M-PI-190, KOC-MP-019, AWWA C200, NACE MR0175, NACE TM0177, NACE TM0284, CSA Z245.20/CSA Z245.21, DIN 30670, DIN 30678, API RP 5L2, AS 3862 and other international specifications. They are also approved by Third Party Inspection Agencies like DNV, BV, SGS, Moody, TUV, ABS, LR, GL, PED, RINA, KR, NKK, AIB-VINEOTTE, CEIL, VELOSI, CCSI, etc.

We are the approved Corporate Member of The Australian Pipeline Industry Association Ltd (APIA), Deep Foundation Institute (DFI), and Pile Driving Contractors Association (PDCA).

We have successfully completed the following projects:

**1. MOGE Project, Myanmar**

- (1) 9700 metric tons of 273.1x9.93mm API 5L X46 ERW Line Pipe as the first ERW Line Pipe exported to Myanmar (TPI: CCSI)
- (2) 25000 metric tons of 20" API 5L X52 ERW Steel Line Pipe 620,495.43 Ft (117.518 Miles) and with 3 Layer P.E Coating 10,560.00 Ft (2 Miles) as the largest line pipe order to Myanmar (TPI: CCSI)

**2. Ambatovy Slurry Pipeline Project, Madascar:**

- (1) 38000 metric tons (547,000 meters) of 609.6x7.92-17.48mm 3LPE coated API X70 PSL 2 ERW line pipe as the first and highest



# **METALS INTERNATIONAL LIMITED**

**ERW line pipe ex-China (TPI: SGS,);**

**(2) 20,000 metric tons of 1016/1219.2x22mm/762x9.53mm API 5L X52 & ASTM A672 Class 70 3LPE coated UOE DSAW line pipe(TPI: SGS);**

**(3) 305MT of 24" API 5L X70 PSL 2 Dual Fusion Bonded Epoxy Coated Induction Bends (TPI:SGS) ;**

**3. New Skikda LNG Piling Project, Algeria:**

**(1) 105,000 metric tons of 508x12.7mm/609.6x12.7mm API 5L B PSL1/ASTM A252-II ERW/Spiral Welded Pipe Piling as one of the biggest line pipe order ex-China (TPI: Moody International);**

**5. LNG Project, Papua New Guinea**

**(1) 1580.838 Metric Tons of 609.6x15.9mm & 229.514 Metric Tons of 406.4x9.5mm API 5L X52 PSL2 DSAW Pipe.**

**6. Water Pipeline Project, Egypt**

**(1) 784.521 metric tons of 457.2-1016x12.7mm API 5L B/ASTM A53 B Spiral Welded Pipe.**

**7. QCLNG Pipeline Project**

**(1) 207,000 metric tons of 42" API 5L X70 PSL 2/AS 2885-1+AS3862 UOE DSAW DFBE coated line pipe for QGC LNG Project in Australia as the first line pipe produced in line with Australian Standard AS2885-1 (TPI:ITI);**

**(2) 755MT of 1067mm API 5L X70 PSL 2 Induction Bends(TPI: TGRC);**

**8.Lilydale LNG Project,Austrilia**

**(1) 735 metric tons of 323.9x7/13.5mm API 5L X56, AS 2885-1,AS3862 HF-ERW Dual FBE coated line pipe(TPI: Moody International);**

**9. Highland Valley Copper Mill Optimization Project**

**1) Supply 4400 meters of 42"x0.375" API 5L B+CSA Z245.21-10 2LPE coated LSAW Line Pipe to Canada(TPI: BV).**

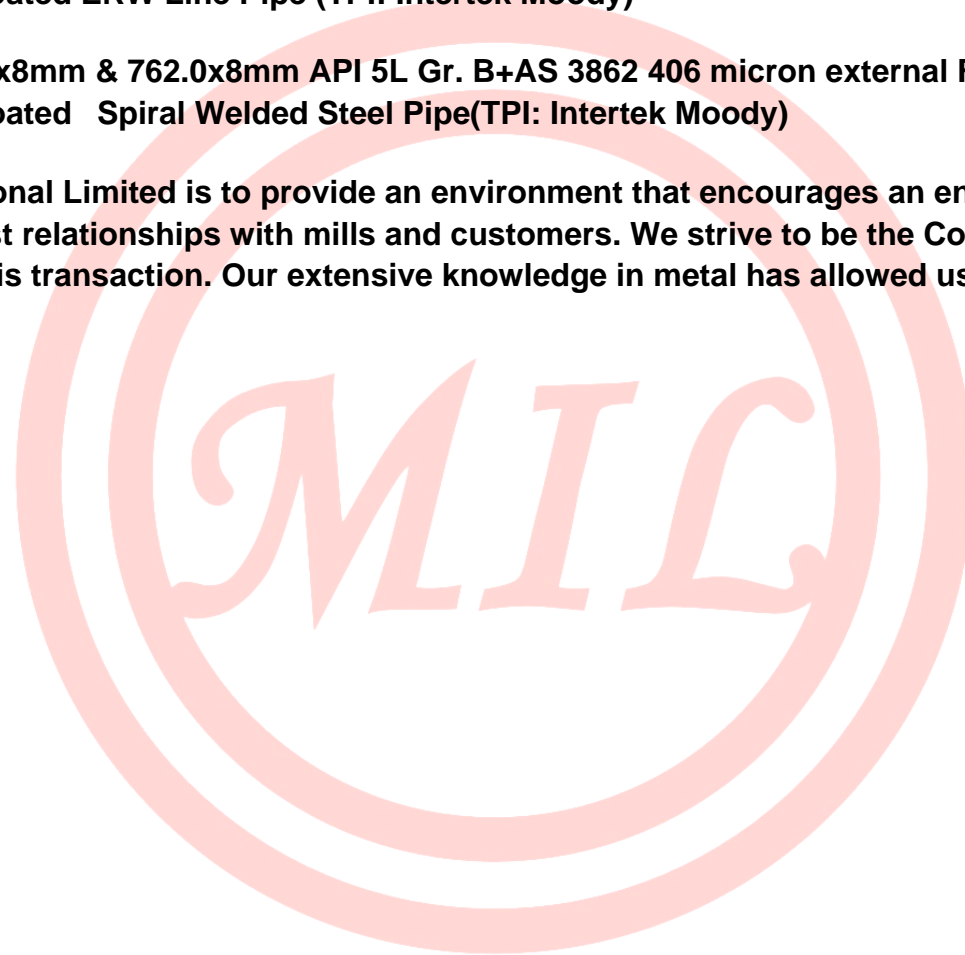


## 10.Yallourn Project,Australia

1) Supply 3155.36 meters of 323.9x6.4mm API 5L X52M+AS 3862 406 micron external FBE+AWWA C210 400 micron internal Liquid Epoxy coated ERW Line Pipe (TPI: Intertek Moody)

2) Supply 519.2 meters of 609.6x8mm & 762.0x8mm API 5L Gr. B+AS 3862 406 micron external FBE+AWWA C210 400 micron internal Liquid Epoxy coated Spiral Welded Steel Pipe(TPI: Intertek Moody)

The mission of Metals International Limited is to provide an environment that encourages an entrepreneurial spirit among its employees that leads to the best relationships with mills and customers. We strive to be the Company that others want to do business with – on win-win basis transaction. Our extensive knowledge in metal has allowed us to save our customers time and reduce their costs.





# METALS INTERNATIONAL LIMITED



This is to certify that

**Angbai Trading** A Subsidiary of Metals International Limited

is a Corporate Member of the

**Australian Pipeline Industry Association Ltd.**

and is entitled to the rights and privileges of membership  
subject to the Constitution of the Association

PRESIDENT

SECRETARY

Certificate Number  
Date of Admission

2143  
14 October 2012



# METALS INTERNATIONAL LIMITED







# METALS INTERNATIONAL LIMITED

## Longitudinal DSAW Pipe

The high-intensity, high-quality large diameter DSAW/LSAW pipes for oil and natural gas delivery and pipes for other purposes are produced in line with API5L, ISO3183, DNF OS-F101, AS 2885-1 standards and additional technical requirements and

材料等级: X90-X120 (Blue) ; X70、X80 (Yellow) X65 及以下 (Grey)

外径		壁 厚(mm)																													
Inch	mm	6.4	7.9	8.7	9.5	10.3	11.1	11.9	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8	25.4	27.0	28.6	30.2	31.8	33.3	34.9	38	40	42	44	46	48	50	60
16	406.4	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
18	457.2	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
20	508.0	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
22	558.8	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
24	609.6	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
26	660.4	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
28	711.2	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
30	762.0	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
32	812.8	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
34	863.6	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
36	914.4	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
38	965.2	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
40	1016.0	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
42	1066.8	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
44	1117.6	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
46	1168.4	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
48	1219.2	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
52	1320.8	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
56	1422.4	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue

Single Pipe Length can be 6-18m (20'-60')

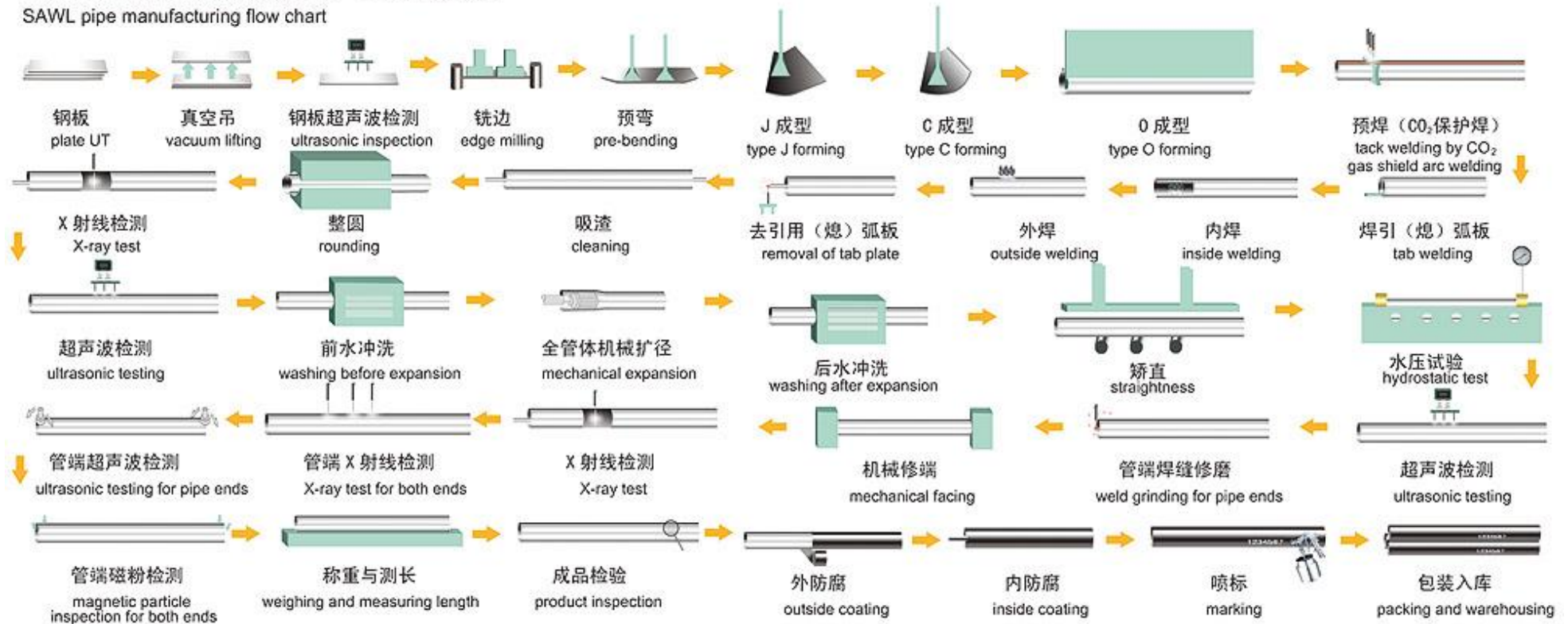




## Longitudinal DSAW Process Flowchart

### SAWL直缝埋弧焊钢管生产工艺流程图

SAWL pipe manufacturing flow chart





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## LSAW Mill Line





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## 3-Roller Bending SAW Pipe

For the formed short pipe section, tack welding is firstly carried out by CO<sub>2</sub> shielded arc welding, heating treatment before welding, and then internal straight welding, external straight welding, internal girth welding, and external girth welding are conducted with single wire, multi-layer and multi-pass welding. After completion of welding, the weld seam is heat preserved to reduce the weld residual stress and increase the property of stress corrosion resistance of metal. The characteristic of the production line is the wall thickness and diameter of product is large, which can be widely used for structural pipe, such as steel structural bridge, high-voltage transmission tower, sea and land wind tower, offshore platform equipment and super-long pipe piles etc.





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## Size Available

Diameter	Inch	16	18	20	22	24	26	28	30	32	34	36	38	40	44	48	50	54	60	64	68	72	80	88	96	104	112	120	140	160	180	200				
Wall Thickness (mm)	120																																			
	115																																			
	110																																			
	105																																			
	100																																			
	95																																			
	90																																			
	85																																			
	80																																			
	76																																			
	72																																			
	68																																			
	64																																			
	60																																			
	58																																			
	52																																			
	48																																			
	44																																			
	40																																			
	36																																			
32																																				
28																																				
22																																				

Based on nominal Yield Strength of 355Mpa



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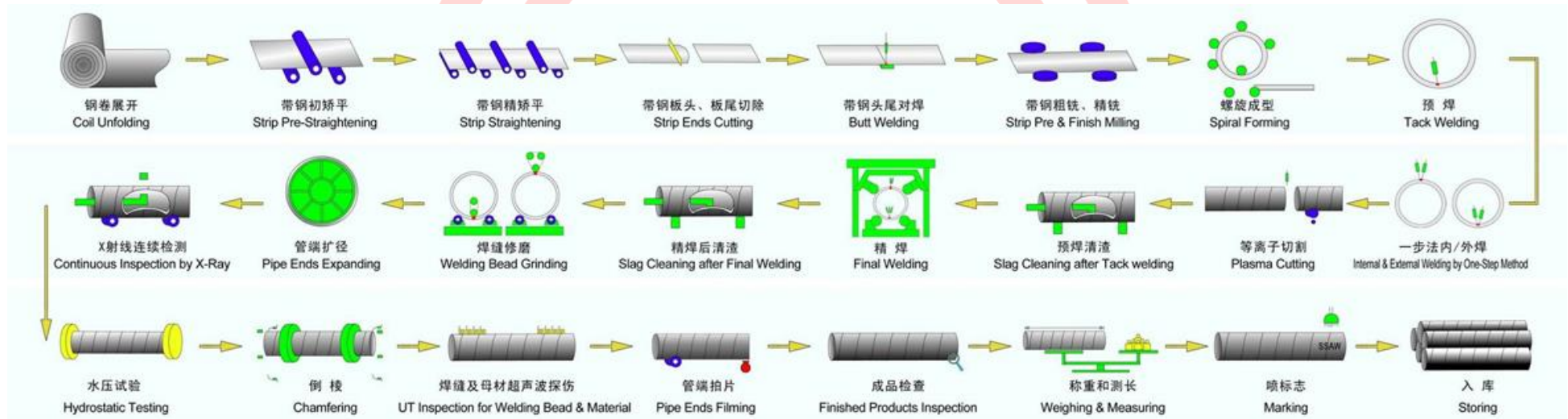




## Spiral Submerged Arc Welded Pipe

With first-class welding pipe production line and equipment, it provides the most competitive series of pipe products for international oil and gas markets and takes the lead in the industry. Products are primarily used in oil and natural gas delivery, tap water, sewerage, and heat supply network transformation, as well as in piling, bridge, and steel structure.

### Process Flowchart





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## SPIRAL WELDED PIPE MILL LINE





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Unfolding



Submerged Arc Welding



Pipe End X-Ray



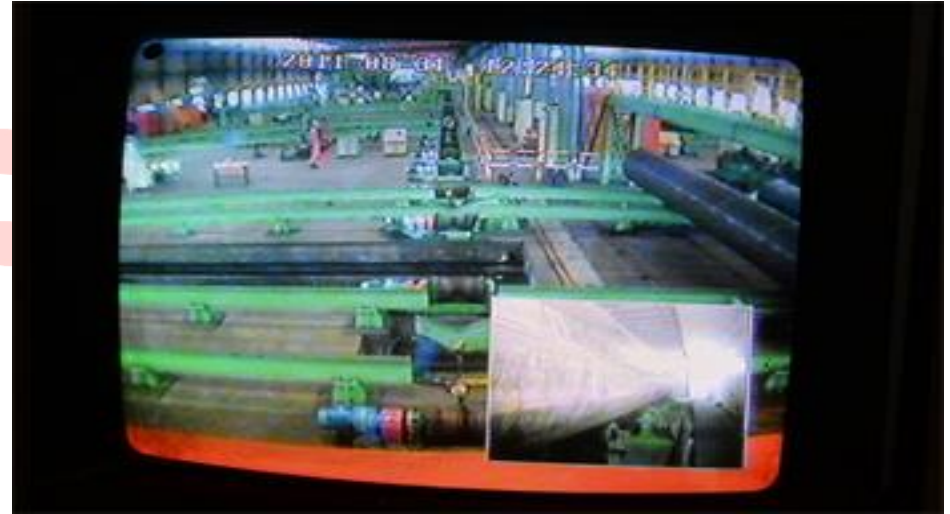
Pipe End X-Ray



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X-ray Inspection of Industrial Television



X-ray Inspection of Industrial Television



Hydrostatic Pressure Test



Hydrostatic Pressure Test



# METALS INTERNATIONAL LIMITED



Continuous Ultrasonic Flaw Detection



Continuous Ultrasonic Flaw Detection



Continuous Ultrasonic Flaw Detection



Continuous Monitoring Equipment of Ultrasonic Flaw Detection



# METALS INTERNATIONAL LIMITED



Continuous Monitoring Equipment of Ultrasonic Flaw Detection



Manual Ultrasonic Flaw Detection



Inspection of Pipe end Diameter



Cleavage Angle Inspection



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## Size Available

O.D.		Wall Thickness (mm)																	
(Inch)	(mm)	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	23.5	25
8"	219.1																		
10"	273.1																		
12"	323.9																		
14"	355.6																		
16"	406.4																		
18"	457.2																		
20"	508																		
22"	558.9																		
24"	610																		
26"	660.4																		
28"	711.2																		
30"	762																		
32"	812.8																		
34"	864																		
36"	914.4																		
40"	1,016																		
42"	1,067																		
48"	1,220																		
52"	1,320																		
56"	1,420																		
60"	1,520																		
64"	1,620																		
68"	1,720																		

Pipe size for grade up to X70  
 Pipe size for grade up to X80  
 Pipe Size for Water & Piling



# METALS INTERNATIONAL LIMITED

72"	1,820																		
76"	1,920																		
80"	2,032																		
84"	2,100																		
88"	2,200																		
92"	2,337																		
96"	2,438																		
100"	2,540																		
104"	2,642																		
108"	2,743																		
110"	2,794																		
112"	2,845																		
116"	2,946																		
120"	3,048																		

We can supply the length from 6 meters up to 80 meters





# METALS INTERNATIONAL LIMITED



**API 5L X65 PSL2 SPIRAL DSAW LINE PIPE**

<http://www.klsteel.com>

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Email: [metalsintl@klsteel.com](mailto:metalsintl@klsteel.com)



**FLANGED SPIRAL WELDED PIPE**



# METALS INTERNATIONAL LIMITED



**PIPE PILING WITH DRIVING SHOES**



# METALS INTERNATIONAL LIMITED



**AS1163 C350L0 STUBBED PIPE PILING**



# METALS INTERNATIONAL LIMITED



**TRUCK TRANSPORTED EXTRA LENGTH PIPE PILING**



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**3LPE COATED EXTRA LENGTH PIPE PILING**



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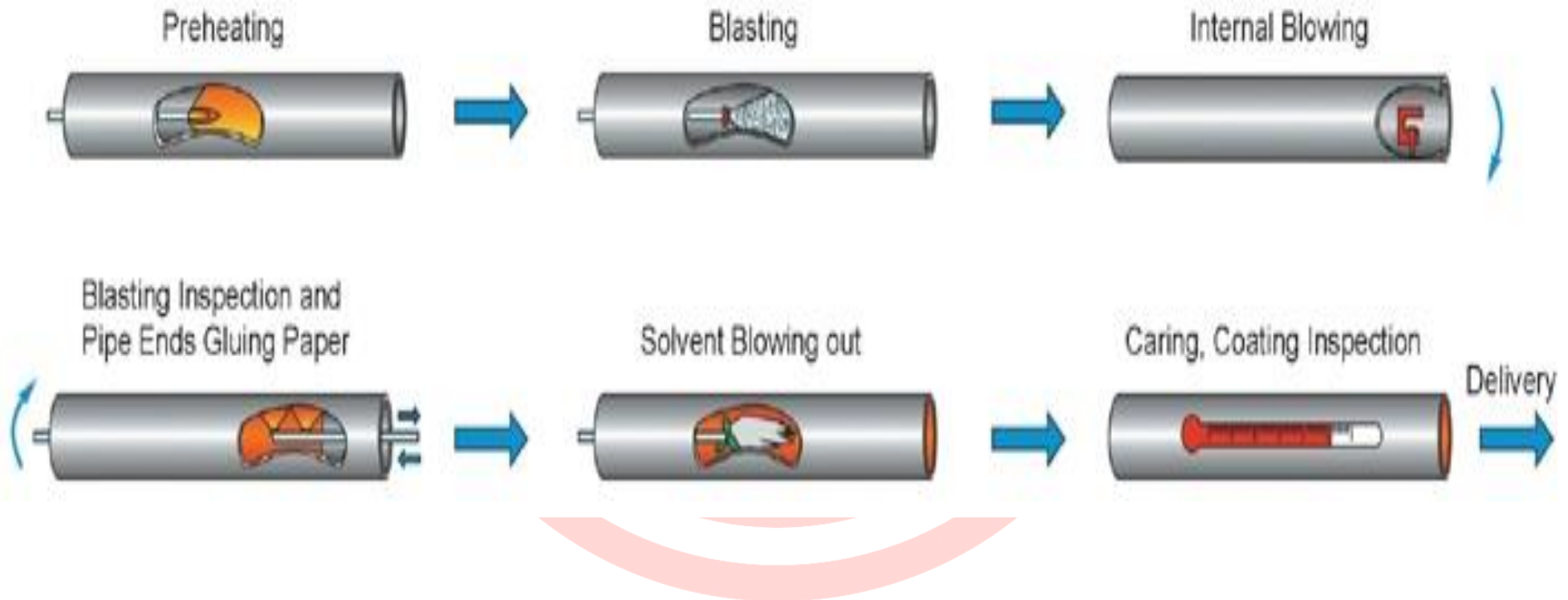
**SUPER LENGTH PIPE PILING LOADED INTO M.V.**



## Anti-Corrosion Coating

### Internal Liquid Epoxy Coating

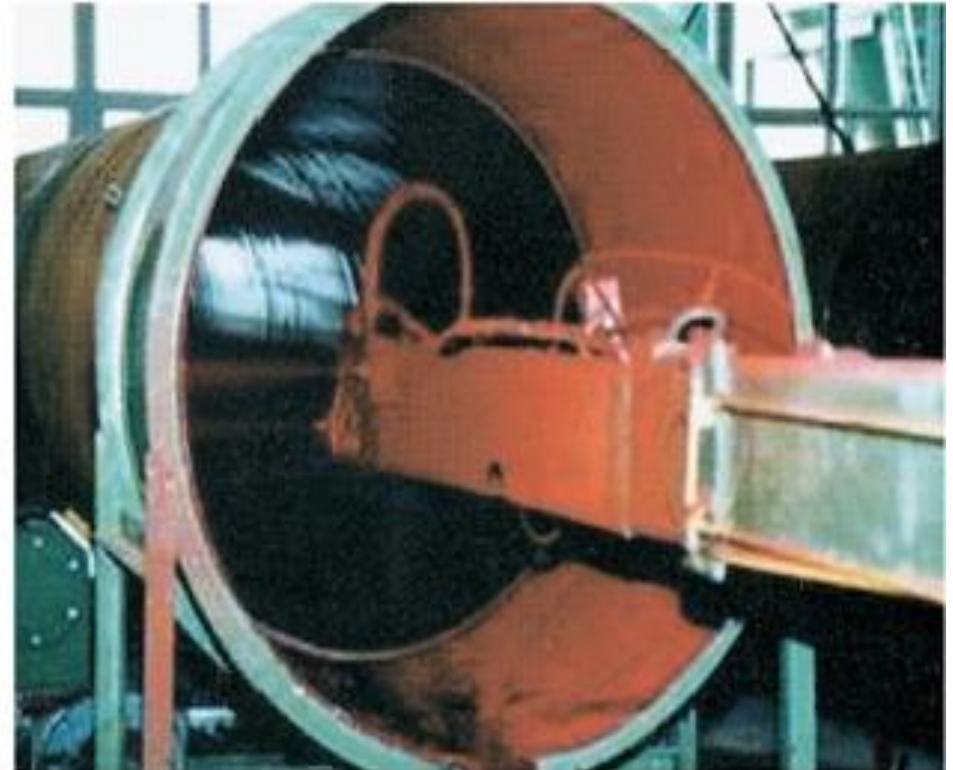
Epoxy coating system is preferred for lining pipe internal surfaces for potable water pipelines in order to protect steel surface from corrosion. This application uses a two-part liquid epoxy paint system which is applied in a single coat as anticorrosion protection for steel pipes. The first process the pipes go through are cleaning & blasting. Then liquid epoxy is applied to the pipes inner surface by spray guns in a bogey, forming a uniform single layer epoxy which cure after application. Special grade of liquid epoxy is also applied for gas pipes in order to reduce the back pressure created by roughness of the internal pipe surface.







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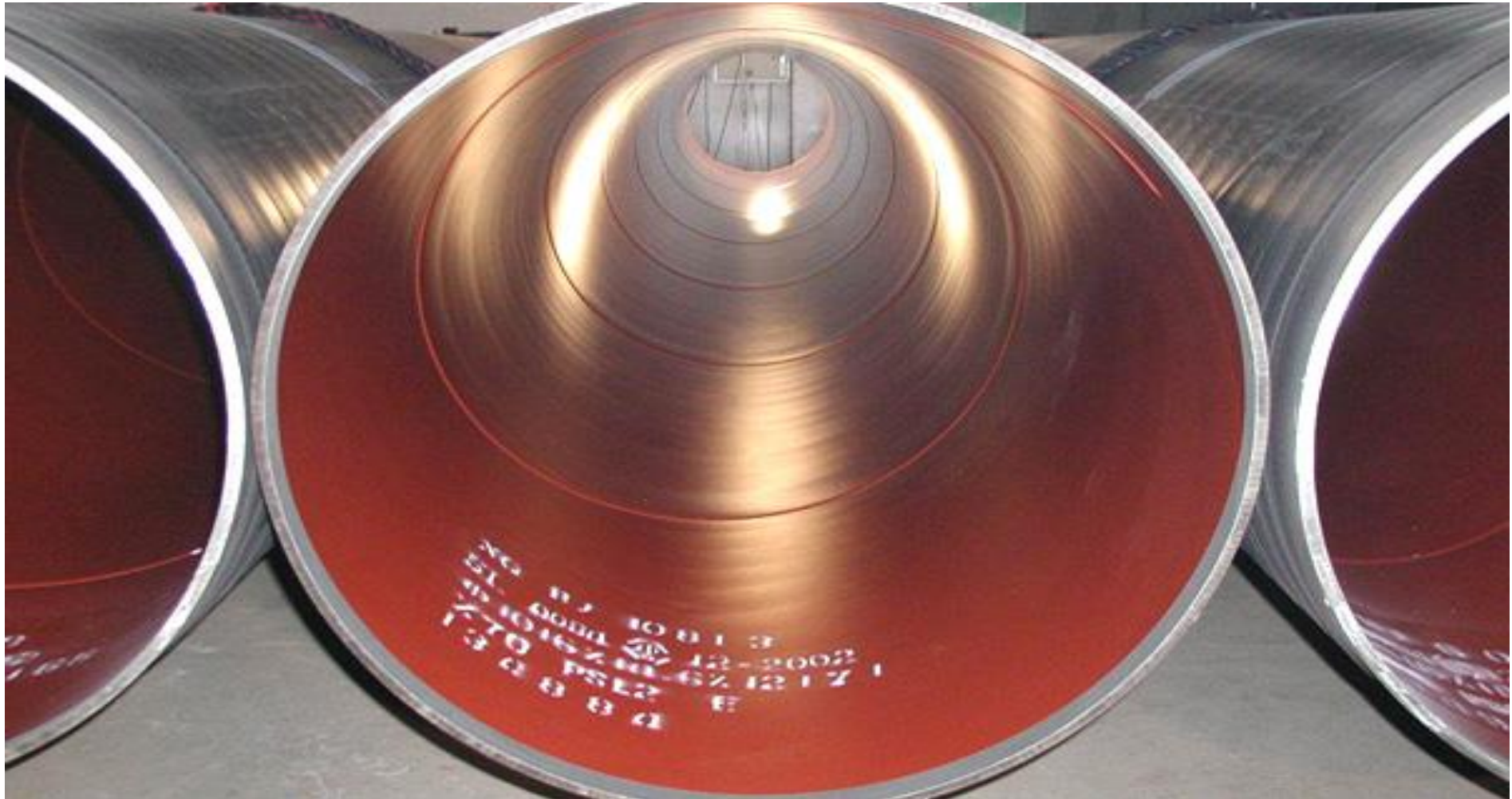


Internal Coating





# METALS INTERNATIONAL LIMITED



LIQUID EPOXY LINING+3LPE COATING



# METALS INTERNATIONAL LIMITED



F

**LIQUID EPOXY LINING+DOUBLE LAYER FBE COATING**

<http://www.klsteel.com>

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Email: [metalsintl@klsteel.com](mailto:metalsintl@klsteel.com)



## FBE/2FBE External/3LPE COATING

Fusion Bond Epoxy is a powder epoxy thermosetting coating applied for anticorrosion protection to steel pipelines. The pipe is first blast cleaned and heated. Then epoxy powder is spray applied by electrostatic guns to melt and form a uniform layer that hardens within a minute from application. Utilizing industry accepted materials supplied by manufacturers such as 3M, DuPont, and Valspar, the facility can apply FBE in a wide range of thickness to cost effectively meet any project specifications.

Fusion Bonded Epoxy with Abrasion Resistance Overcoating (FBE/ARO) – Utilizing two completely separate powder systems, the facility can produce FBE with an ARO at unprecedented processing speeds using industry accepted materials such as 3M 6352, DuPont 7-2610, and Lilly 2040.

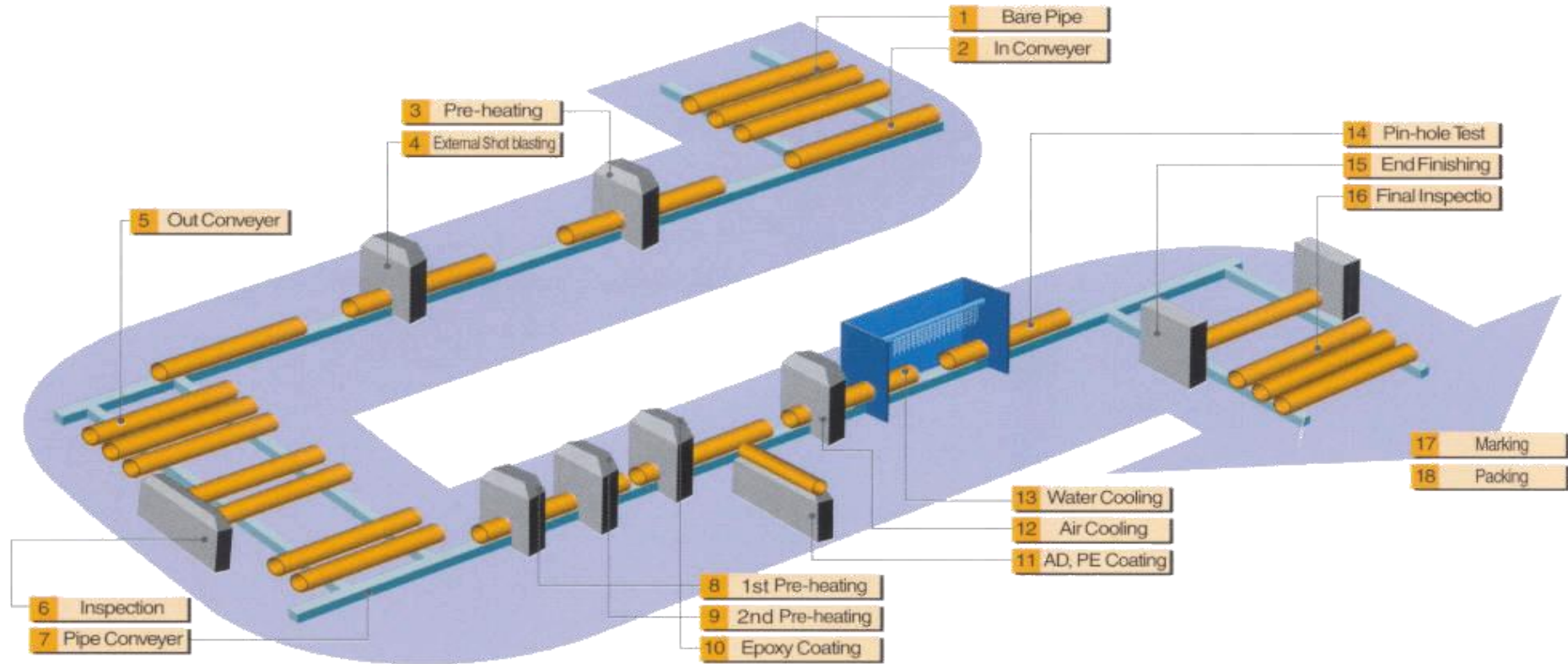
Fusion Bonded Epoxy with High Temperature Resistant Overcoating – Utilizing two completely separate powder systems, the facility can produce FBE with a high operating temperature resistant overcoating such as DuPont's Nap-Gard Gold and 3M's 6258.

For more severe abrasive & temperature conditions, Dual Layer FBE should be applied. Dual layer FBE is a dual powder abrasion resistant coating which is designed to provide excellent abrasion resistance to the pipes.

To improve anticorrosion performance and adhesion, an additional layer of epoxy primer is sprayed onto pipe surfaces prior to the adhesive layer and Polyethylene top layer application. Three Layer Polyethylene is suitable for service temperatures from 60°C to 80°C (85°C peaks). Typical coating thickness is from 1-2 mm to 3-5 mm.



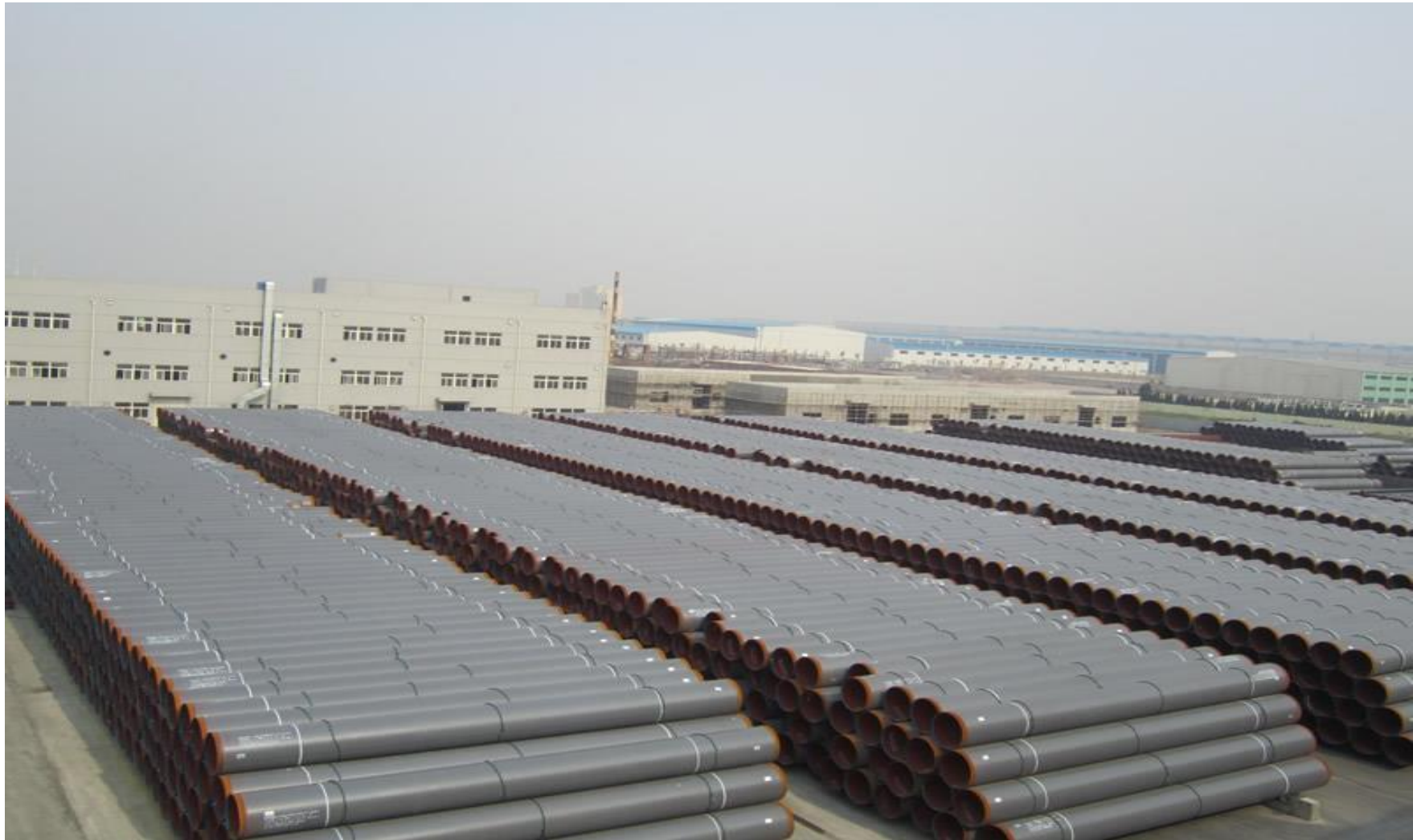
## FBE/3LPE Coating Process Flowchart



**Principle Structure of Typical Plant**



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**DOUBLE LAYER FBE COATING**



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**YELLOW JACKETED 3LPE COATING**



# METALS INTERNATIONAL LIMITED



**BLACK 3LPE COATING**



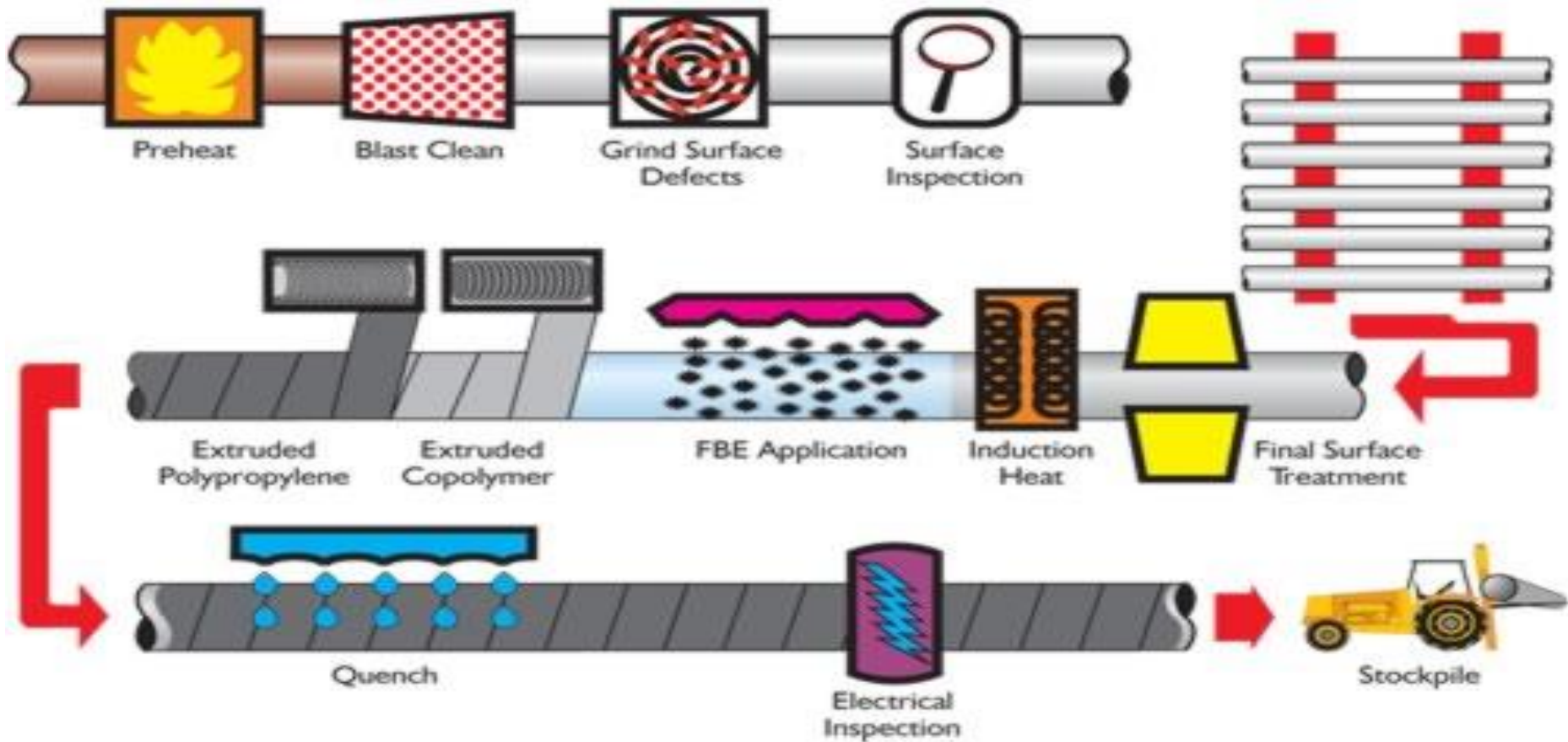


**3-LAYER POLETHYLENE COATING**



## 3 Layer Polypropylene Coating Process Flowchart

If a wider service temperature range and high stiffness is required, adhesive and top layers, applied over primer layer, are based on polypropylene instead of polyethylene. Three Layer Polypropylene is suitable for service temperatures up to 135 °C (140°C peaks). Typical coating thickness is from 1-2 mm to 3-5 mm.





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# METALS INTERNATIONAL LIMITED



Pipe Coating Line



# METALS INTERNATIONAL LIMITED

## Concrete Weighted Coating





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## Inspection & Testing



Tensile Test (Microcomputer-controlled Electro-hydraulic Servo Universal Testing Machine)



Tensile Test (30-ton Electronic Universal Testing Machine)





# METALS INTERNATIONAL LIMITED



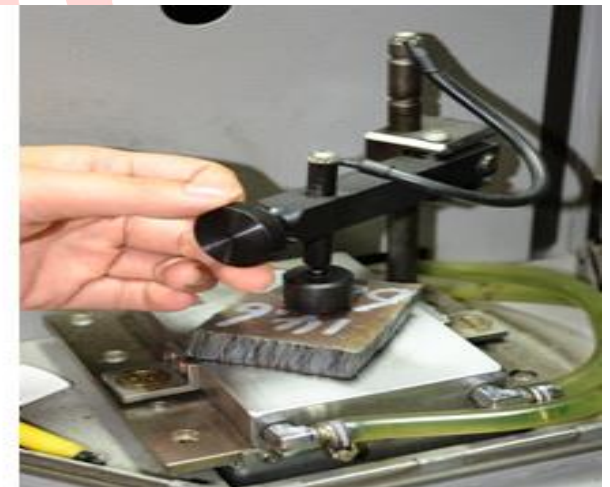
Impact Test (500J Impact Testing Machine)



Drop Weight Tear Test (Drop Weight Tear Testing Machine)



Spectrographic Analysis Test (Direct-reading Spectrometer)





# METALS INTERNATIONAL LIMITED



Hardness Test (Small-load Vicker Hardness Testing Machine)



Nitrogen Test (Oxygen/Nitrogen Determination)





# METALS INTERNATIONAL LIMITED





## Technical Specification

### 1. Steel Pipe

#### 1.1 Line Pipe

- API 5L PSL1/PSL 2 Line Pipe: Gr. B X42, X46, X52, X56, X60, X65, X70, X80/BM.X42M,X46M,X52M,X60M,X65M,X70,X80M
- ISO 3183-1/2 Petroleum and Natural Gas Industries-Steel Pipe for Pipelines-L240M,L290M,L320M,L360M,L390M,L415M,L450M,L485M,L555M,L690M
- ISO 3183-3 Petroleum and Natural Gas Industries Steel Pipe for Pipelines-L245NC / L245NCS,L290NC / L290NCS, L360NC / L360NCS, L290MC / L290MCS, L360MC / L360MCS, L415MC / L415MCS, L450MC / L450MCS, L485MC / L485MCS, L555MC
- AS 2885-1 Pipelines-Gas and liquid petroleum Part 1: Design and Construction
- CSA Z245.1 Steel Pipe-241,290,359,386,414,448,483,550,620,690,825
- DIN 2470-1 Steel gas pipelines for permissible service pressures up to 16 bar
- DIN 2470-2 Steel gas pipelines for permissible service pressures exceeding 16 bar
- DIN 17172 Steel pipes for pipelines for the transport of combustion fluids and gases--DIN 2470 Part II St. E210-7, E240-7,E290-7, St. E 320-7,St.E 360-7
- EN 10208-1:2009(TS 6047) Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 1: Pipes of requirement class A-L210GA,L235GA,L245GA,L290GA, L360GA
- EN 10208-2:2009, Steel pipes for pipelines for combustible fluids – Technical delivery conditions – Part 2: Pipes of requirement class B-L245MB,L290MB,L320MB,L360MB,L390MB,L415MB,L450MB, L485MB,L555MB
- EN 10208-3 Non alloy and alloy fine grain steel tubes
- EN 10217-1/3 Welded steel tubes for pressure purposes
- DEP 31.40.20.35-Gen Line pipe for non-critical service (amendments/supplements to ISO 3183-1)
- DEP 31.40.20.37-Gen Line pipe for critical service (amendments/supplements to ISO 3183-3)
- DEP 31.40.40.38-Gen Hydrostatic pressure testing of new pipelines
- DEP 31.40.20.35-Gen Line pipe for non-critical service (amendments/supplements to ISO 3183-1)
- DEP 31.40.60.11-Gen Pipeline leak detection
- DEP 31.40.60.12-Gen Pipeline Repairs (supplements to ANSI/ASME B31.4 and B31.8)
- DEP 61.40.20.30-Gen Welding of pipelines and related facilities (amendments/supplements to ANSI/API STD 1104)
- DEP 31.40.50.30-Gen Precommissioning of pipelines



GOST 10705-80	Electrically welded tube for the construction of trunk oil pipelines (426-1620mm)
GOST 20295	Welded Steel Pipes for Main Gas and Oil Pipelines--K34, K38, K42, K48, K50, K52, K54, K55, K56, K60,K65
GOST R 52079:2003	Specification for electric-welded steel pipe intended for conveying gas/oil and oil products
IPS-M-PI-190	Material And Equipment Standard for Line Pipe
KOC-MP-019	KOC Standard for Submerged-Arc Welded (SAW) Pipe to API 5L
KOC-MS-001 Part 1	Kuwait Material Specification Line Pipe for Sour Service
NACE MR 0175/ISO 15156-2	Petroleum and Natural Gas Industries – Materials for Use in H2S Containing Environments in Oil and Gas Production. Part 2. Cracking resistant Carbon and Low Alloy Steels, and the Use of Cast Irons.
NACE TM 0177	Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking in Hydrogen Sulfide (H2S) Environments
NACE TM 0284	Standard Test Method - Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking
NFA 49-211/NFA 49-411	TUE 220,TUE 250,TUE 275,TUE 290,TUE 320,TUE 360,TUE 415,TUE 450
NRF-001-Pemex-2007	Steel Piping for Hydrocarbon Collections and Transportation/TUBERÍA DE ACERO PARA RECOLECCIÓN Y TRANSPORTE DE HIDROCARBUROS
RP 43-1	Onshore Transmission Pipelines to BS 8010
01-SAMSS-332/01-SAMSS-333	High frequency welded line pipe
01-SAMSS-035/01-SAMSS-038	Submerged-arc welded line pipe per
TOTAL-GS-EP-PLR-202	Fabrication of longitudinally submerged arc welded pipes for pipelines (sweet service)
TOTAL-GS-PLR-212 REV.04	Fabrication of Longitudinally Submerged Arc Welded Pipes for Pipelines (Intermediate and Sever Sour Service)

## 1.2 Mechanical Pipe, Pressure Pipe, Structural Pipe & Pipe Piles, etc

API 2B	Specification for the Fabrication of Structural Steel Pipe
ASTM A155	Electric Fusion Welded Steel Pipe for High Temperature Service
ASTM A134	Standard Specification for electric-fusion (arc)-welded straight seam or spiral seam steel pipe NPS 16 and over in diameter
ASTM A139	Standard Specification for Electric-Fusion(Arc)-Welded Steel Pipe (NPS 4 and over) straight-seam or helical-seam steel pipe.-Grade A,B,C,D,E.
ASTM A155	Electric Fusion Welded Steel Pipe for High Temperature Service
ASTM A252	Standard Specification for Welded and Seamless Steel Pipe Piles-GR.1/2/3
ASTM A381-96	Standard Specification for Metal-Arc-Welded Steel Pipe for Use with High-Pressure Transmission Systems
ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes



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ASTM A671	Electric Fusion Welded Steel Pipe for Atmospheric and Lower Temperature
ASTM A672	Electric-fusion-welded steel pipe for high-pressure service at moderate temperatures
ASTM A691	Electric Fusion Welded Carbon and Alloy Steel Pipe for High Pressure Service at High Temperatures
AWWA C200-97	Steel Water Pipe-6 In. (150 mm) and Larger
AWWA C207-01	Steel Pipe Flanges for Waterworks Service- Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
AS 1579	Arc-Welded Steel Pipes and Fittings for Water and Wastewater
AS/NZS 1163	Cold Formed Structural Steel Hollow Sections- C250/L0, C350/L0,C450/L0
AS 2159	Piling Design and Installation
AS 812	Bored Piles
BS 534	Specification for steel pipes, joints and specials for water and sewage
BS 3601	Steel Pipe and Tubes for Pressure Proposes Carbon Steel: Ordinary Duties- Gr. 360,Gr. 430,
BS 3602-2	Specification for steel pipes and tubes for pressure purposes: carbon and carbon manganese steel with specified elevated temperature properties. Part 2: Submerged arc welded tubes
BS 6323	Seamless and welded steel tubes for automobile mechanical and general engineering purposes. Part 1: General requirements. Part 7: Specific requirements for submerged arc welded steel tube
BS 7191	All Specification for Weldable Structure Steels for Fixed Offshore Structures
DIN 1615	Welded circular tubes of non-alloy steel without special quality requirements.
DIN 1626	Welded circular tubes of non-alloy steel with special quality requirements-St. 37.0,St44.0, St.52.0
DIN 1628	Welded circular tubes of non-alloy steel with very high quality requirements- St. 37.4
DIN 2458	Plain end welded steel tubes, dimensions and conventional masses per unit length- DIN 2470 Part 1 St. 37.0,St44.0, St.52.0
DIN 2460	Steel tubes for waterworks services
DIN 17120	Welded structural steel circular tubes for structural engineering purposes
DIN 17172	Steel pipes for pipelines for the transport of combustion fluids and gases--DIN 2470 Part II St. E210-7, E240-7,E290-7, St. E 320-7,St.E 360-7
DIN 17174	Welded circular steel tubes for low temperatures
DIN 17177	Electric Pressure-welded Steel Tubes for Elevated Temperatures; Technical Conditions of Delivery-St. 37.8, St. 42.8
EN 10219-1/2	Cold formed welded structural hollow sections of non-alloy and fine grain steels. Part 1: Technical delivery requirements. Part 2: Dimensions
EN 10224	Steel pipes, joints and fittings for the conveyance of aqueous liquids including potable water
EN 10296-1	Welded steel tubes for mechanical and general engineering purposes – TDR. Part 1: Non alloy and alloy steel tubes



JIS A5525	Steel Pipe Pile
JIS G3444	Carbon Steel Tubes for General Structural Purpose- STK 90,400,490,500,540
JIS G3452	Carbon Steel Pipe for Ordinary Piping
JIS G 3457	Arc Welded Carbon Steel Pipe- STPY 400
KS D 3566	Carbon Steel Tubes for General Structural Purpose- STK 90,400,490,500,540
KS D 3583	Arc Welded Carbon Steel Pipe- SPW 400
KS F4602	Steel Pipes Piles
KS F4605	Steel Pipe Sheet Piles
NF A49-142-87	STEEL TUBES LONGITUDINALLY PRESSURE WELDED PLAIN ENDED AND HOT FINISHED TUBES
NF A49-150-85	STEEL TUBES WELDED TUBES INTENDED TO BE COATED OR PROTECTED FOR USE IN WATER PIPING SYSTEMS
NF A49-253-82	STEEL TUBES LONGITUDINALLY FUSION WELDED NON ALLOY AND FERRITIC ALLOY STEEL TUBES FOR USE AT ELEVATED TEMPERATURES
NF A49-402-88	STEEL TUBES SPIRAL FUSION WELDED NON ALLOY AND MICRO ALLOY STEEL TUBES FOR FLUID TRANSPORTING PIPES AND PRESSURE VESSELS
NF A49-401-88	STEEL TUBES LONGITUDINALLY FUSION WELDED NON ALLOY AND MICRO ALLOY STEEL TUBES FOR FLUID TRANSPORTING PIPES AND PRESSURE VESSELS

### 1.3 Offshore Pipeline System

API 5L PSL 2 Line Pipe BMS,X42MS,X46MS,X52MS,X60MS,X65MS,X70MS,X80MS

DNV OS-F101 Submarine Pipeline Systems-SAWL 245,SAWL290,SAWL 320,SAWL 360,SAWL 415,SAWL 450,SAWL 485,SAWL 555

### 1.4 Application

#### LINE PIPE AND PROCESS PIPES

Line pipe and process pipes range covers transmission lines, flow lines, jetty lines, steam lines, slug catchers, compressor stations and pump columns.

#### OFFSHORE PIPES

Offshore pipes include rolled and welded tubulars, cans, legs, piles, bracings, conductors, risers and tethers.



## CONSTRUCTION PIPES

Construction pipes cover a range of applications including bridges, stadiums and high-rise buildings.

## STEEL STRUCTURES UNDER WATER

Pipes for steel structures under water are for piles, dolphins and anchor piles.

## MECHANICAL PIPES

Mechanical pipes include felt rolls, wire rolls, press rolls, dryers, reel spools, winder drums, hydraulic cylinders, cable drums, yarn rollers, rolls for weaving machinery, cardan shafts, dryer rolls.

## 2. Coating Specifications

### 2.1 External Coating

#### 2.1.1 External Epoxy Coating

CAN/CSA-Z245.20 Standard for External Fusion Bond Epoxy Coating for Steel Pipe

AS3862 Standard Specification for External Fusion-Bonded Epoxy Coating for Steel Pipes

AWWA C210 Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

AWWA C213 Standard for Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

BP GIS 06-402 Guidance on Industry Standard for Fusion Bonded Epoxy Powder External Pipeline Coatings

DEP 31.40.30.32-Gen Technical Specification for External Fusion-Bonded Epoxy Powder coating for Line Pipe

EN 10289-2007 STEEL TUBES AND FITTINGS FOR ONSHORE AND OFFSHORE PIPELINES - EXTERNAL LIQUID APPLIED EPOXY AND EPOXY-MODIFIED COATINGS

NFA 49-709 Standard for External Fusion Bond Epoxy Coating for Steel Pipe

ISO 21809-2:2007 Petroleum and natural gas industries-External coatings for buried or submerged pipelines used in pipeline transportation systems-Part 2:

Fusion-bonded epoxy coatings

NACE RP 0394 National Association of Corrosion Engineers Standard Recommended Practice, Application, Performance, and Quality Control of Plant Applied,

Fusion Bonded Epoxy External Pipe Coating.

NACPA 12-78 National Association of Pipe Coating Applicators External Application Procedure for Plant Applied fusion Bonded Epoxy (FBE) to Steel Pipe.





SAES-H-002 Internal and External Coatings for Steel Pipelines and Piping

09-SAMSS-089 Shop-Applied External FBE Coating

09-SAMSS-091 Shop-Applied Internal FBE Coatings

## 2.1.2 Polyethylene Coating

CSA Z245.21 External Polyethylene Coating for Pipe

DIN 30670 Polyethylene Sheathing of Steel Tubes and of Steel Shaped Fittings

NFA 49-710 External Three-Layer Polyethylene Based Coating, Application by Extrusion

DNV-RP-F106 Factory Applied External Pipeline Coatings For Corrosion Control

ISO 21809-1 Petroleum and natural gas industries -- External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 1: Polyolefin coatings (3- layer PE and 3- layer PP)

ISO 21809-4 Petroleum and natural gas industries -External coatings for buried or submerged pipelines used in pipeline transportation systems-Part 4: Polyethylene Coatings (2-layer PE)

AS/NZS 1518 External Extruded High-Density Polyethylene Coating System for Pipes

AS4321 Fusion Bonded Medium-Density Polyethylene coating and lining for pipes and fittings

EN10288 Steel tubes and fittings for on and offshore pipelines - External two layer extruded polyethylene based coatings

DEP 31.40.30.31-Gen. Technical Specification for External Polyethylene and Polypropylene Coating for Line Pipe

IPS-G-TP-335 Material and Construction Standard for Three Layer Polyethylene Coating System

BP GIS 06-403 Guidance on Industry Standard for the Application of Three-Layer Fusion Bonded Epoxy-Polyethylene Coating and Three-Layer Polypropylene Coating System for Line Pipe

PETROBRAS ET-200.03 Engineering Specification ("Piping Materials for Production and Process Facilities") for using low density linear polyethylene in carbon steel piping, as to appendix 13 of such specification.

09-SAMSS-113 External Renovation Coating for Buried Pipelines and Piping (APCS-113)

TS 5139 External Three-Layer Polyethylene Based Coating, Application by Extrusion

UNI 9099 Polyethylene Coating Applied by Extrusion

## 2.1.3 Polypropylene Coating



- DIN30678 Polypropylene Sheathing of Steel Tubes and of Steel Shaped Fittings  
EN 10286 Steel tubes and fittings for onshore and offshore pipelines –External three layer extruded polypropylene based coatings.  
ISO 21809-1 Petroleum and natural gas industries -- External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 1: Polyolefin coatings (3- layer PE and 3- layer PP)  
NFA 49-711 External Three-Layer Polypropylene Based Coating, Application by Extrusion  
BP GIS 06-403 Guidance on Industry Standard for the Application of Three-Layer Fusion Bonded Epoxy-Polyethylene Coating and Three-Layer Polypropylene Coating System for Line Pipe  
09-SAMSS-114 Shop-Applied Extruded, Three-Layer Polypropylene External Coatings for Line Pipe

## 2.1.4 Polyurethane Coating

- AWWA C222-99: Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings  
BS 5493 Polyurethane Coating  
DIN 30677.2 polyurethane Insulation of the fittings  
EN 10290 External Liquid Applied Polyurethane Coatings

## 2.1.5 Polyolefin Coating

- AWWA C225-03 Fused Polyolefin Coating Systems for the Exterior of Steel Water Pipelines  
AWWA C215-99 Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines  
AWWA C216-00 Standard for Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fitting for the Steel Water Pipelines  
AWWA C224-01 Two-layer Nylon-11 Based Polyamide Coating System for Interior and Exterior of Steel Water Pipe and Fittings  
AWWA C225-03 Fused Polyolefin Coating Systems for the Exterior of Steel Water Pipelines

## 2.1.6 Tape Coating

- ISO 21809-3:2008 Petroleum and natural gas industries-External coatings for buried or submerged pipelines used in pipeline transportation systems-Part 3: Field joint coatings  
AWWA C209-00 Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines  
AWWA C214-00 Standard for Tape Coating Systems for the Exterior of the Steel Water Pipelines



AWWA C217-99 Standard for Cold-Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior for Special Sections, Connections, and Fittings for Buried/Submerged Steel Water Pipelines

AWWA C218-02 Standard for Coating the Exterior of Aboveground Steel Water Pipelines and Fittings

AWWA C224-01 Two-layer Nylon-11 Based Polyamide Coating System for Interior and Exterior of Steel Water Pipe and Fittings

EN 12068/DIN30672 STANDARD-POLYETHYLENE SELF ADHESIVE TAPES

## 2.1.7 Bitumen Coating

DIN 30673 Bitumen coatings and linings for steel pipes, fittings and vessels.

## 2.1.8 Concrete Weighted Coating

ISO 21809-5:2009, Petroleum and natural gas industries -External coatings for buried or submerged pipelines used in pipeline transportation systems - Part 5:External concrete coating.

DNV-OS-F101 Submarine Pipeline System

ASTM C171 Specification for Sheet Material for Coating Concrete

BS EN 12620 Aggregates for Concrete

ASTM C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C642 Standard Test Method for Specific Gravity, Absorption and Voids in Hardened Concrete

ASTM C87 Standard Test Method for Effect of Impurities in Fine Aggregate on Strength of Mortar BS 1881 Methods of Testing Concrete

BS 3148 Methods of Test for Water for Making Concrete

BS 4482 Hard Drawn Mild Steel Wire for the Reinforcement of Concrete

BS 4483 Specification for Steel Fabric for the Reinforcement of Concrete

BS 4449 Specification for Carbon Steel Bars for Reinforcement of Concrete

ISO 4012 Determination of Compressive Strength of Test Specimen

## 2.1.9 Marine Coating

EN ISO 12944:1998 Paints & Varnishes – Corrosion Protection of Steel Structures by protective paint system (parts 1 – 8)

ISO 20340:2009 Paints and varnishes – Performance requirements for protective paint systems for offshore and related structures

ISO 15741 Paints and varnishes-Friction-reduction coatings for the interior of on- and offshore pipelines for non-corrosive gases



## 2.2. Lining

### 2.2.1 Epoxy Lining

- API RP 5L2 Recommended Practice for Internal Coating of Line Pipe for Non-Corrosive Gas Transmission Service.  
API RP 5L7 (R2010) Recommended Practice for Unprimed Internal Fusion Bonded Epoxy Coating of Line Pipe  
AWWA C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines  
NFA 49-709 Internal can be epoxy 80 microns

### 2.2.2 Bitumen Lining

- DIN 30673 Bitumen coatings and linings for steel pipes, fittings and vessels  
UNI-ISO5256/87 STANDARD-BITUMEN COATING

### 2.1.3 Coal-Tar Enamel Coating

- AWWA C-203 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot-Applied  
NFA 49-708 Recommended Practice for Internal Coating of Line Pipe

### 2.2.3 Cement Mortar Lining

- AWWA C205-00 Cement-Mortar Protective Lining and Coating for Steel Water Pipe- 4 In. (100 mm) and Larger-Shop application  
AWWA C602 Standard for Cement-Mortar Lining of Water Pipelines - 4 inch (100 mm) and Larger - In Place  
AS 1281-2001 Cement mortar lining of steel pipes and fittings  
AS/NZS 1516 Cement Mortar Lining of Pipelines In Situ  
EN 10298 Steel tubes and fittings for onshore and offshore pipelines - Internal lining with cement mortar

### 2.2.5 Plastic Lined

- ASTM D4894 PTFE (Polytetrafluorethylene)  
ASTM D3307 PFA(Perfluoroalkory)



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ASTM D3222	PVDF(Polyvinylidene fluoride)
ASTM D4101	PP(Polypropylene)
BS 6374-2	Lining of equipment with polymeric materials for the process industries - Part 2: Specification for lining with non-sheet applied thermoplastics
BS 6374-3	Lining of equipment with polymeric materials for the process industries - Part 3: Specification for lining with stoved thermosetting resins
BS 6374-5	Lining of equipment with polymeric materials for the process industries - Part 5: Specification for lining with rubbers

## Brand and Material Applied:

3M: SK 134, SK6233, SK6352 Toughkote, SK 314, SK 323, SK 206N, SK 226N, SK 6251 DualKote SK-6171, SK 206P, SK226P,  
3M Internal Coatings: Coupon EP2306HP  
DuPont: 7-2500, 7-2501, 7-2502, 7-2508, 7-2514, 7-2803, 7-2504 Nap Gard Gold 7-2504, Nap Rock: 7-2610, 7-2617 FBE Powders  
DuPont: Repair Kits; 7-1631, 7-1677, 7-1862, 7-1851  
DuPont Internal Coatings: 7-0008, 7-0010, 7-0014, 7-0009SGR, 7-0009LGR, 7-2530, 7-2534, 7-2509  
Akzo Nobel: FBE - Fusion Bond Epoxy  
Internline 876 Seal Coat  
Hampel: 85448,97840  
Interzone 276,954  
Denso: 7200, 7900 High Service Temperature Coatings  
Internal Liquid Epoxy: Powercrete Superflow