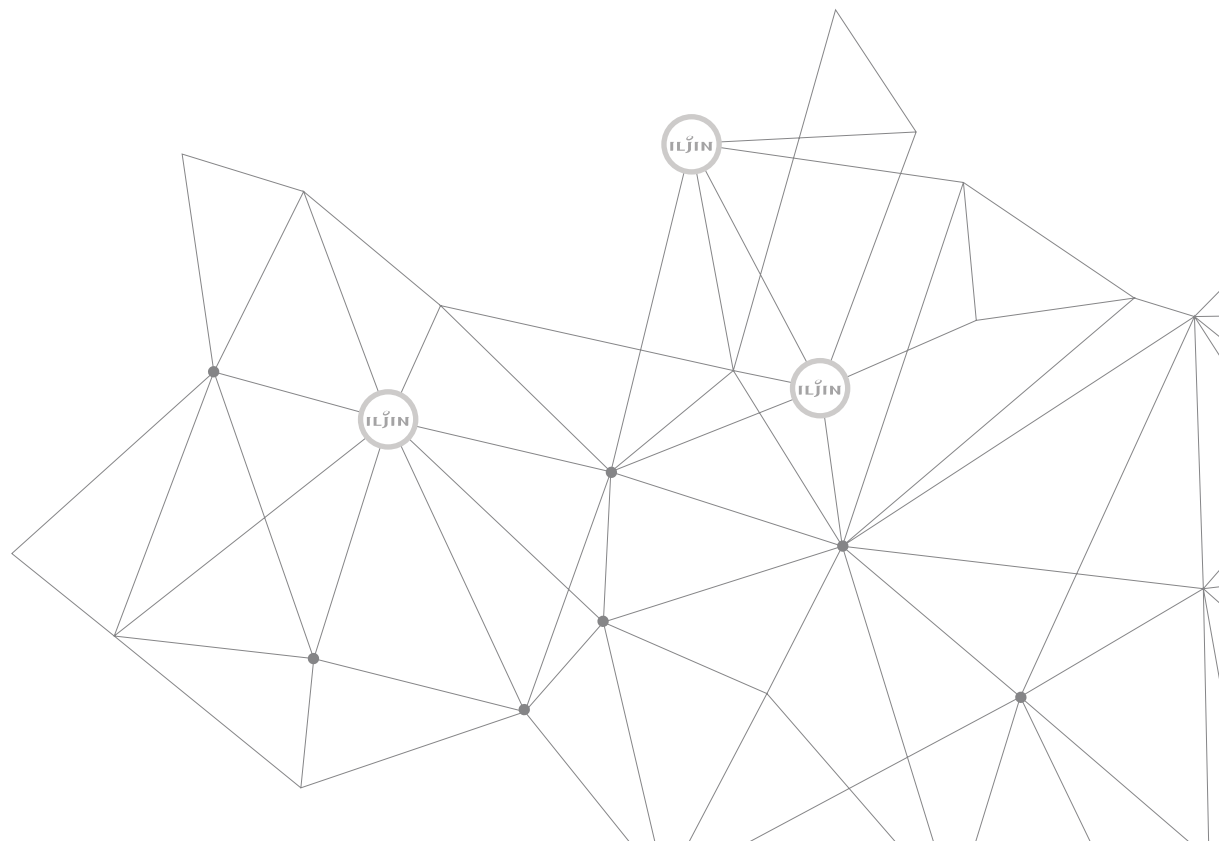


Version No. : IJS-19-0321



The First Partner **ILJIN STEEL Corporation**





ILJIN Steel Corporation Company Overview 04 Site Introduction 06	
Quality Assurance Quality Assurance System 41 Equipments for Quality Assurance 42 Certificate 44	
Products OCTG 08 Power Generation 12 Line Pipe 16 Mechanical Tube 20 Automotive 26 Stainless Steel Tube 30 Precision Cold Drawn Shapes 36 Aluminium Clad Steel Wire 38	

Company Overview

The Company Overview In Brief

Founded in 1982 as a Steel and aluminum bobbin supplier for synthetic fiber winding, ILJIN has been leading the market as a unique supplier for high strength and precision bobbins. In the early of 1990's on the basis of precision tube technology, ILJIN launched new businesses in cold drawn tube, aluminium clad steel wire and cold drawn shaped bar drawing industries.

ILJIN's creative philosophy has led the ILJIN Steel to become one of technological leaders of manufacturing raw material to innovative products. By establishing core competencies in cold drawing and metal forming technologies, ILJIN Steel maintains its edge through accelerated expansion in diversified products and persistent quality improvement.

ILJIN Steel established Seamless Pipe facility in 2012 upon the strong foundations of top-notch manufacturing and market experiences. ILJIN's Steel is proud of excellent product quality and reliable delivery.

ILJIN's one of priorities is to build a long term relationship with customers along with on-time delivery and highest quality in products and services. In order to reach the goal of total customer satisfaction, ILJIN has built a worldwide service network channel to provide customers real time services.

Professional R&D Capability

- ⊗ Number of Researchers/Engineers : 150
- ⊗ Material development, product design, production, inspection and quality assurance for customers

2 Manufacturing facilities, R&D Center, Sales office(ILJIN Steel America) in USA

Production Capacity

- ⊗ Cold drawn Tube & Pipe : 100,000 ton/year
- ⊗ Hot finished SMLS Tube & Pipe : 300,000 ton/year
- ⊗ Aluminium clad steel wire : 10,000 ton/year

1982. 05.
Established ILJIN Steel Corporation
Development & Production of Al/Steel Bobbin

1984. 04.
Expansion Anyang Factory

1991. 03.
Established R&D Center

1992. 05.
Established Suwon Plant

1992. 06.
Development of Precision Cold Drawn Steel Tubes

1998. 06.
Development of Cold Drawn Shaped Bars

2005. 03.
Development of Cold Drawn Stainless Steel tubes

2007. 12.
Development of Heat Exchanger Tube

2008. 09.
Approved as "Advanced Technology Center" by Korean Government

2008. 12.
Received "Parts and Materials Technology Award" by Korean Government

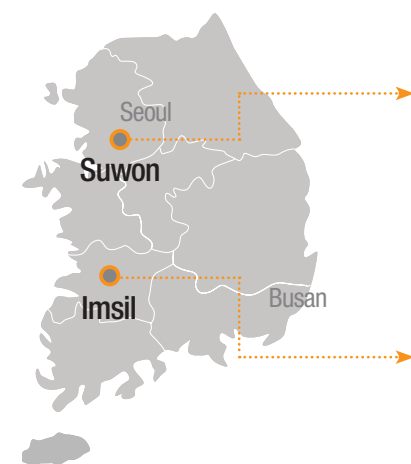
2011. 02.
Groundbreaking for Hot Finished Seamless Tube Plant

2011. 08.
Imsil Cold Drawn Tube Plant Completed

2012. 07.
Imsil Hot Finished Seamless Tube Plant Completed

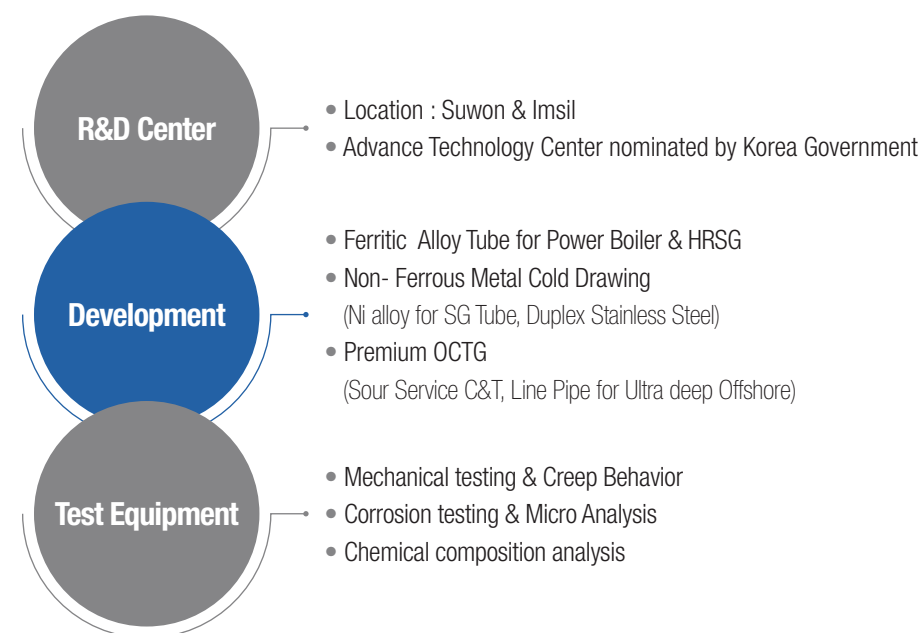
Site Introduction

Manufacturing Facilities



Plant	Manufacturing Facility
	Cold Drawing Facility - Carbon Steel Tube - Stainless Steel Tube - Precision Cold Drawn Shapes
	Seamless Steel Tube Facility - Complete Hot Rolling Line - Finishing Line - Quenching & Tempering
	Cold Drawing Facility

Research & Development Center



ILJIN Steel America INC.

- Location : Houston, USA
- Sales & customer services for ILJIN Steel Products

Products

08	OCTG Casing & Tubing Drill Pipe
12	Power Generation HRSG Boiler
16	Line Pipe Onshore Offshore
20	Mechanical Tube Hydraulic Cylinder Mechanical Tubing Drill Rod
26	Automotive
30	Stainless Steel Tube Mechanical tube Gas Spring Heat Exchanger Tube Clean tube
36	Precision Cold Drawn Shapes LM guide Block Miniature
38	Aluminium Clad Steel Wire

OCTG – Casing & Tubing

The first partner “ILJIN STEEL Coporation”

Product Introduction



OCTG is steel pipes which are used for oil and natural gas extraction and drilling. Casing is usually installed in rigs to prevent the breakdown of the oil well and the wall. It can also prevent foreign matters from entering to extraction process e.g., water or soil. Tubing transports the oil and gas from well to the on ground floor. Since ILJIN Steel has produced and supplied high value products for industry sectors in extreme temperatures and pressures, we are building our reputations as a seamless pipe manufacturer in the industry.

Performances

Strength & Ductility
(Heat treatment, Chemistry)

High Collapse
(Dimensive control)

Corrosion Resistant
(Sour Service)

Low Temperature
(Arctic Service)

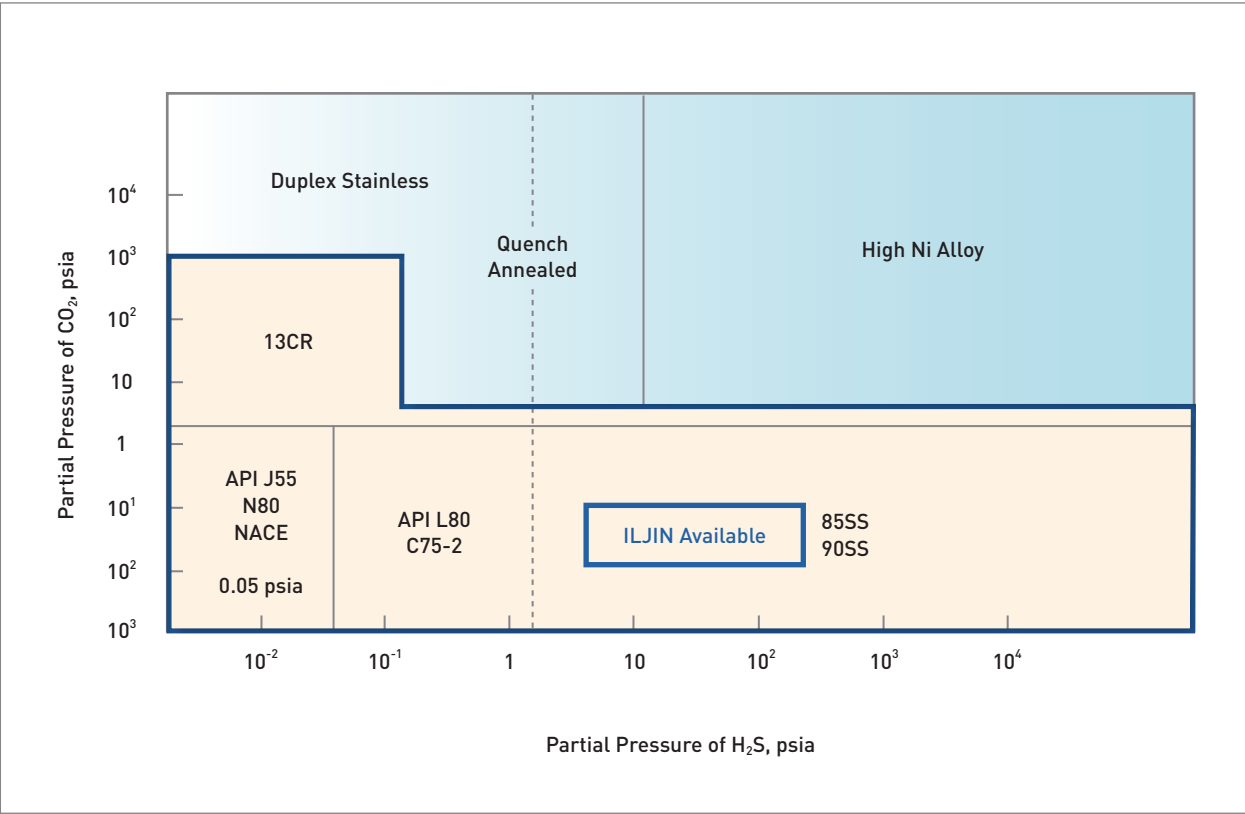
Product

Product	Method	Unit	O.D	W.T	Standards/Grades
Tubing	Seamless	inch(mm)	2 3/8 ~ 4 1/2 (60.33 ~ 114.3)	0.167 ~ 0.630 (4.24 ~ 16.00)	J55, K55, N80 Type 1/Q, L80 Type 1/9Cr/13Cr, C90, T95, C110, P110, Q125
Casing		inch(mm)	4 1/2 ~ 7 (114.3 ~ 177.8)	0.205 ~ 0.875 (5.21 ~ 22.23)	

Material Selection

Min. Y.S (ksi)	Group				High Collapse	Sour Service	Arctic Service
	1	2	3	4			
40	H40						
55	J55 K55						
65	M65						
80	N80-1 N80-Q	L80-1 L80-9Cr L80-13Cr			HC L80		L80L
90		C90-1				C90	
95	R95	T95-1			HC T95	T95	
110			P110		HC P110	C110	P110L
125				Q125-1			

Available Materials for Sour and Sweet Service



OCTG – Drill Pipe

The first partner “ILJIN STEEL Coporation”

Product Introduction



OCTG refers to steel Pipes used in extraction of natural gas & oil and Rig drilling. The Drill Pipe delivers a rotational movement of the ground drills attached to the bottom end of the excavation equipment and injects water for cooling. Since ILJIN Steel has supplied high quality Drill Pipes of a wide range of specifications to meet customer's requirements including API, we are recognized for high reliability and quality in the Oil & Gas drilling sites over the world.

Performances



Product

Product	Method	Unit	O.D	W.T	Grades
Drill Pipe	Seamless	inch(mm)	2 3/8 ~ 4 1/2 (60.33 ~ 114.3)	0.254 ~ 0.500 (6.45 ~ 12.7)	E75, X95, G105, S135

Dimensions and Tolerances

Item		Tolerances	
Outer Diameter	Pipe Body	D ≤ 101.60mm	±0.79mm
		D ≥ 101.60mm	+1.0%D -0.5%D
Wall Thickness	API Standard	-12.5% min.	
	Special Requirement	RBW 95% min.	
Weight (Single Length)	API Standard	-3.5 / +6.5%	
	Special Requirement	-3.5 / +14%	

Length Range

(Unit : m)

Product	Range 1	Range 2	Range 3
Drill Pipe	6.10 ~ 7.01	8.84 ~ 9.75	12.19 ~ 13.72

Standard Drift Size

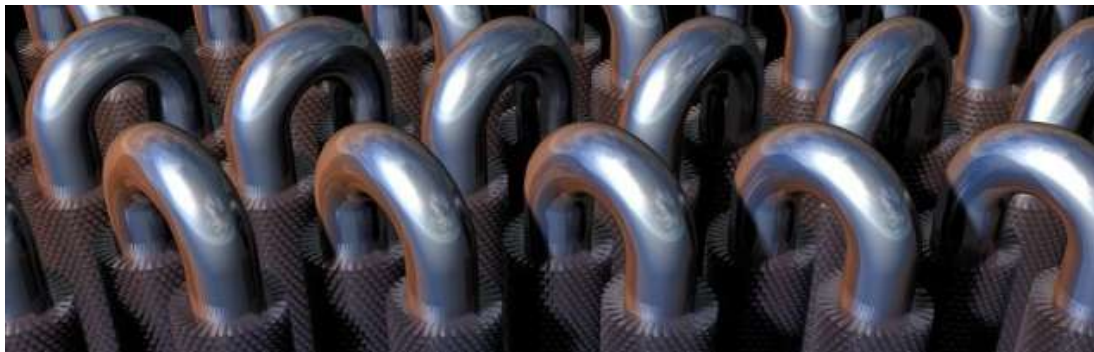
Grade	Mechanical Properties			
	Yield Strength		Tensile Strength	Elongation [%]
	min. ksi (MPa)	min. ksi (MPa)	min. ksi (MPa)	
E	75 (517)	105 (724)	≥ 100 (689)	e
X	95 (655)	125 (862)	≥ 105 (724)	
G	105 (724)	135 (931)	≥ 115 (793)	
S	135 (931)	165 (1,138)	≥ 145 (1,000)	

* Minimum pipe-body elongation in a 50.8mm gauge length, $e = k \times A^{0.2} / U^{0.9}$ where k is a constant.

Chemical Composition

Grade	C		Mn		Mo		Cr		Ni	Cu	P	S	Si
	min.	max.	min.	max.	min.	max.	min.	max.	max.	max.	max.	max.	max.
E											0.030	0.020	
X, G, S											0.020	0.015	

Product Introduction



ILJIN Steel provides tubes and pipes serving the power generation industry where critically high temperatures and pressures necessitate rigorous quality standards.

ILJIN Steel manufactures various carbon and alloy steel tubes and pipes in accordance with EN and ASTM standards.
ILJIN Steel offers a broad range of high quality hot-finished and cold-finished tubes and pipes for power generation applications.

Tubes and pipes are made in random lengths from 3 to 28m and fixed lengths upon customer request.

Performances

High Temperature Strength

Creep Properties

Steam Oxidation Resistance

Fire Side Corrosion Resistance
(High Alloy Steel)

Product

Method	O.D(mm)	W.T(mm)	Standards
Seamless	21.3~177.8	2~25	ASTM/ASME A/SA106, A/SA179, A/SA192, A/SA 209, A/SA210, A/SA213, A/SA335, EN 10216-2, JIS G3461, G3462

Tube and Pipe Products for HRSG & Boilers

	United States						Europe	Japan
	ASTM/ASME						EN	JIS
	A/SA 106	A/SA 179	A/SA 192	A/SA 209	A/SA 210	A/SA 213 A/SA 335	10216-2	G3461 G3462
Carbon Steel	Gr. A	Low Carbon	Low Carbon				P235GH	STB340
	Gr. B				Gr. A1		P265GH	STB410
	Gr. C				Gr. C			STB510
Low Alloy Steel				T1/T1a		P1	8MoB5-4	STBA12 STBA13
						T11/P11	10CrMo5-5	STBA23
						T12/P12	13CrMo4-5	STBA22
						T22/P22	10CrMo9-10	STBA24
High Alloy Steel						T91/P91	X10CrMoVNB9-1	STBA28
						T92/P92	X10CrWMoVNB9-2	STBA29

* Other Grades are available on request

Tolerances on outside diameter

	mm	Standard requirements	ILJIN Steel
H/F	OD ≤ 76.2	-0.8 / +0.4	-0.4 / +0.4
	OD > 76.2	According to ASTM standards	
C/F	All OD	According to ASTM standards	

Tolerances on minimum wall thickness (up to 76.2 mm OD)

	ASTM requirements		ILJIN Steel
MWT	Hot-finished	Cold-finished	Hot-finished
≤ 2.4	-0 / +40%	OD ≤ 38.1 : -0 / +20%	-0 / +35%
> 2.4 ~ ≤ 3.8	-0 / +35%		-0 / +35%
> 3.8 ~ ≤ 4.6	-0 / +33%	OD > 38.1 : -0 / +22%	-0 / +24%
> 4.6	-0 / +28%		-0 / +22%

* For OD > 76.2 mm, wall thickness tolerances according to ASTM standards

[illegible][illegible]Company Profile **15**

Line Pipe – Onshore / Offshore

The first partner “ILJIN STEEL Coporation”

Product Introduction



ILJIN Steel manufactures a wide range of line pipes for onshore and offshore applications. Line pipe is available in sizes ranging from 1 to 7 inches and can be produced by seamless manufacturing method following API 5L, EN and DNV standards. Pipes are inspected for internal and external defects using ultrasonic and electromagnetic inspection equipment. Pipes are automatically packed in bundles and tied with steel banding or wires in compliance with API loading and transportation standards.

Performances

Line Pipes require high yield strength, corrosion resistance and low temperature strength. ILJIN Steel offers X70 and X80 and their corrosion resistance is ensured by conducting Hydrogen Induced Cracking (HIC) test and Sulfide Stress Corrosion Cracking (SSCC) test. Additionally, ILJIN's line pipes possess excellent low temperature strength which is proven by Crack Tip Opening Displacement (CTOD) test.

Product

Standard / Grade		API 5L Grade B / X42 / X46 / X52 / X60 / X65 / X70 / X80 ASTM A106G B&C, A53 GB, A333 G6
Main Size	OD	21.3mm ~ 168.3mm (NPS ½" ~ 6")
	Length	6,401mm ~ 18,288mm (SRL / DRL / TRL)
Manufacturing Method		Hot Finished : NPS 2" and above Cold Finished : Less than NPS 2
Delivery Option	End Finish	Plain-End Beveled, Plain-End Square Cut, Threaded
	Coating	Outside Surface : Varnish Coated or 3-LPE (FBE+Adhesive+PE) Inside Surface : PE

Chemical Composition for PSL2, API Spec 5L / ISO 3183

Steel Grade (Steel Name)	Mass fraction, based upon heat & product analysis %, max									Carbon equivalent
	C	Si	Mn	P	S	V	Nb	Ti	other	CE _{IIW}
L245N or BN	0.24	0.4	1.2	0.025	0.015			0.04	•	≤0.43
L290N or X42N	0.24	0.4	1.2	0.025	0.015	0.06	0.05	0.04	•	≤0.43
L320N or X46N	0.24	0.4	1.4	0.025	0.015	0.04	0.05	0.04	•	≤0.43
L360N or X52N	0.24	0.45	1.4	0.025	0.015	0.1	0.05	0.04	•	≤0.43
L390N or X56N	0.24	0.45	1.4	0.025	0.015	0.1	0.05	0.04	•	≤0.43
L415N or X60N	0.24	0.45	1.4	0.025	0.015	0.1	0.05	0.04	•	≤0.43
L290Q or X42Q	0.18	0.45	1.4	0.025	0.015	0.05	0.05	0.04	•	≤0.43
L320Q or X46Q	0.18	0.45	1.4	0.025	0.015	0.05	0.05	0.04	•	≤0.43
L360Q or X52Q	0.18	0.45	1.5	0.025	0.015	0.05	0.05	0.04	•	≤0.43
L390Q or X56Q	0.18	0.45	1.5	0.025	0.015	0.07	0.05	0.04	•	≤0.43
L415Q or X60Q	0.18	0.45	1.07	0.025	0.015	•	•	•	•	≤0.43
L450Q or X65Q	0.18	0.45	1.07	0.025	0.015	•	•	•	•	≤0.43
L485Q or X70Q	0.18	0.45	1.80	0.025	0.015	•	•	•	•	≤0.43
L555Q or X80Q	0.18	0.45	1.90	0.025	0.015	•	•	•	•	as agreed

* Calculated according to API Spec 5L / ISO 3183

Chemical Composition for Sour & Offshore, API Products Spec 5L / ISO 3183

Steel Grade (Steel Name)	Mass fraction, based upon heat & product analysis %, max																Carbon equivalent
	C	Si	Mn	P	S	V	Nb	Ti	Al	Cu	Ni	Cr	Mo	B	N	other	CE _{IIW}
L360Q(S) or X52Q(S)	0.16	0.45	1.65	0.020	0.080	0.07	0.05	0.04	0.06	0.35	0.015	0.3	0.3	0.15	0.0005	•	≤0.20 + 0.03
L390Q(S) or X52Q(S)	0.16	0.45	1.65	0.020	0.080	0.07	0.05	0.04	0.06	0.35	0.015	0.3	0.3	0.15	0.0005	•	≤0.21 + 0.03
L415Q(S) or X60Q(S)	0.16	0.45	1.65	0.020	0.080	0.08	0.05	0.04	0.06	0.35	0.015	0.3	0.3	0.15	0.0005	•	≤0.22 + 0.03
L450Q(S) or X65Q(S)	0.16	0.45	1.65	0.020	0.080	0.09	0.05	0.06	0.06	0.35	0.015	0.3	0.3	0.15	0.0005	•	≤0.22 + 0.03
L485Q(S) or X70Q(S)	0.16	0.45	1.65	0.020	0.080	0.09	0.05	0.06	0.06	0.35	0.015	0.3	0.3	0.15	0.0005	•	≤0.22 + 0.03

* Other
(1) Ca ≤ 0.006%
(2) Al/N ≥ 2:1 (Not application to Ti killed or Ti treated steel)

Coatings	O.D	W.T	Length	Coatings
External	60.33~168.28	3.9~25	12,800 max.	3LPE
Internal	114.3~168.28	6.0~25	6,400 max.	PE

Parameter	Specification
Application Standard	API, DIN
Coating Thickness	1'st Layer : 100~175 μ m 2'nd Layer : 150~400 μ m 3'rd Layer : 3000 μ m
Pipe end space	130~150mm
Adhesion Strength	Under Room Temp. : 150N/cm length
Pressure Resistance	Under Room Temp. : 0.2mm
Elongation[%]	Under-40℃ : 100

O.D	Wall Thickness									
	inch	0.079	0.118	0.157	0.196	0.236	0.275	0.314	0.354	0.393
inch	mm	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
0.840	21.34									
1.050	26.67									
1.315	33.40									
1.660	42.16									
1.900	48.26									
2.375	60.33									
2.875	73.03									
3.500	88.90									
4.000	101.60									
4.500	114.30									
5.000	127.00									
5.563	141.30									
6.625	168.28									

[illegible]

Mechanical tube – Hydraulic Cylinder

The first partner “ILJIN STEEL Coporation”

Product Introduction



ILJIN Steel produces hot-rolled and cold-drawn mechanical tubes made of alloy steel that meet or exceed various international standards including ASTM A519, ASTM A513, EN 10297 and EN 10305.

ILJIN Steel has integrated process with Seamless tube and cold drawing. ILJIN endeavors to provide better services to customers, quick delivery, technical improvement, value engineering, prompt feed back for quality improvement.

List of Standards and Ranges for Mechanical Application

Specification	Steel Grade
ASTM A519/513 Seamless/ERW Carbon and Alloy Steel Mechanical Tubes	1008 - 1045, 52100, 1520, 1536, 1541, 4115, 4130
JIS 3441 Alloy Steel Tube for Machine Structural Purpose	STKM11 - 20 S10C - S58C SCM, SCR, SNCM, SUJ2
JIS 3445 Carbon Steel Tube for Machine Structural Purpose	
JIS 4051 Carbon Steel for Machine Structural use	
DIN EN 10297-1 Seamless circular steel tubes for mechanical and general engineering purpose; Non-alloy and alloy steel tubes	E235, E355, E470 and others according to standards
DIN EN 10305-1 Steel tubes for precision applications; Seamless cold drawn tubes	E235, E355

Tube For Hydraulic Cylinder

Ready to Honing

(Unit : mm)

Application	Supply Condition		Material Grade	Size Range
Double Acting Telescopic	ERW & Seamless (DOM, CDS)	Stress Relived (BKS)	SAE1020, 1026 EN10305(St52.3) STKM13C	O.D : 40 ~ 308 W.T : 4.0 ~ 25.0 L'th : 4~11.5m

Ready to Use

(Unit : mm)

Application	Supply Condition		Material Grade	Size Range
SSID Tube (No honing)	Tube Condition	ERW & DOM (BK)	SAE1020/1026 EN10305(St52.3) STKM13C	O.D : 15.0~140 W.T : 1.0~12.5 L'th : 4~11.5m
	Dimension Tolerance	ISO H9 Grade		
	Inside Roughness	Rmax 5µm Max.		

Tube For Telescopic Cylinder

Technical Characteristics		
OD	Tolerance	-0 / +0.5mm
	Roughness	Ra 6.3µm , Rt 63µm Max.
ID	Tolerance	+0.05 ~ +0.35 / according to Spec.
	Roughness	Ra 1.6µm , Rt 16µm Max.
WT	Tolerance	±5% of Wall Thickness
Straightness		0.5mm/m
Concentricity		< 2% of wall thickness
Steel Grade		DIN 2393 St52.3+SR

Chrome Plating ROD tube

Technical Characteristics		
OD	Tolerance	-0 / +0.5
ID	Roughness	according to EN10305-2
Surface defects		max. 0.20mm
Straightness		0.5mm/m
Eccentricity		max. 5% from the value of the WT
Steel Grade		EN10305-2 E355+SR

[illegible][illegible]

22 ILJIN Steel Corporation

Mechanical Tube – Drill Rod

The first partner “ILJIN STEEL Coporation”

Product Introduction



ILJIN Steel is fully capable of producing drilling rods in both cold-drawn seamless and cold-drawn welded. All raw materials used in producing drilling rods are sourced and made in Korea. The fact that ILJIN Steel is a seamless mill that uses its own hollows to cold-drawn is what distinguishes itself among the others. Our materials used in manufacturing drilling rods have life-expectancy above 5,000 meters deep and an outstanding performance out in the field.

Performances



Product

Product	Method	Size	Unit	O.D	I.D	W.T	Grade
Drill Rod	Seamless or ERW	B rod	inch (mm)	2.187 (55.55)	1.813 (46.05)	0.187 (4.75)	SAE4130, SAE1541
		N rod	inch (mm)	2.750 (69.85)	2.375 (60.33)	0.188 (4.76)	
		H rod	inch (mm)	3.500 (88.90)	3.063 (77.80)	0.219 (5.55)	
		HWT rod	inch (mm)	4.500 (114.30)	4.000 (101.60)	0.250 (6.35)	

Dimensions and Tolerances

(Unit : inch)

Size	Tolerance		
	OD	ID	Length
B rod	-0.000 / +0.010	-0.005 / +0.005	-0 ~ +3/16"
N rod	-0.000 / +0.010	-0.005 / +0.005	
H rod	-0.000 / +0.012	-0.005 / +0.005	
HWT rod	-0.000 / +0.015	-0.008 / +0.008	

Technical characteristics

Item.	Spec.
Eccentricity	max. 5%
Residual Stress	max. 80 MPa
Straightness	1.0mm/3,000mm (T.I.R)*
Grain Size	According to ASTM E112, Shall be 8 or finer
Decarburization	shall not exceed 0.005" (0.127mm)

*T.I.R : Total Indication Reading

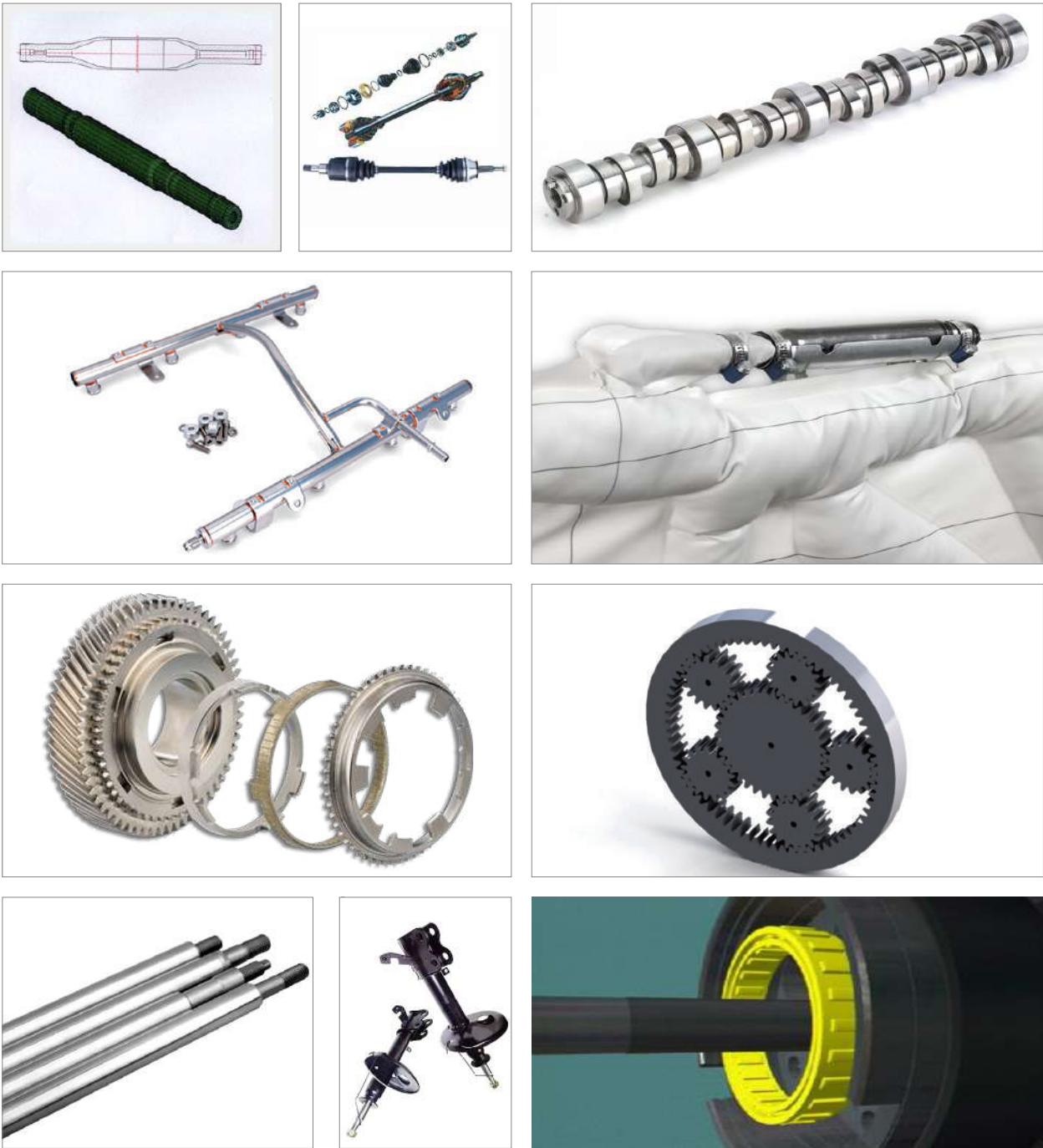
Mechanical Properties

Grade	Mechanical Properties		
	Yield Strength	Tensile Strength	Elongation 2"
	min. (MPa)	min. (MPa)	min. (%)
1541	690	813	15
4130	690	813	15

Chemical Composition

Grade	C		Mn		Mo		Cr		Si		P	S	Ni
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	max.	max.	max.
1541	0.36	0.44	1.35	1.65							0.040	0.050	
4130	0.28	0.33	0.40	0.60	0.15	0.25	0.80	1.10	0.15	0.35	0.040	0.040	

Product Introduction



ILJIN Steel manufactures a wide range of tubes for automotive applications. Pipes are available in sizes ranging from 0.5 to 7 inches and can be produced by seamless method according to ASTM, JIS, EN and SAE standards. The pipe is inspected for internal and external defects using ultrasonic inspection and ECT equipments. The pipe can be packed as customer's requests.

Performances

Automotive parts require high dimensional accuracy, and excellent internal and external surface condition. Also, its microstructure along with mechanical properties such as tensile, hardness, and impact properties should be strictly controlled.

Tube For Automotive Parts

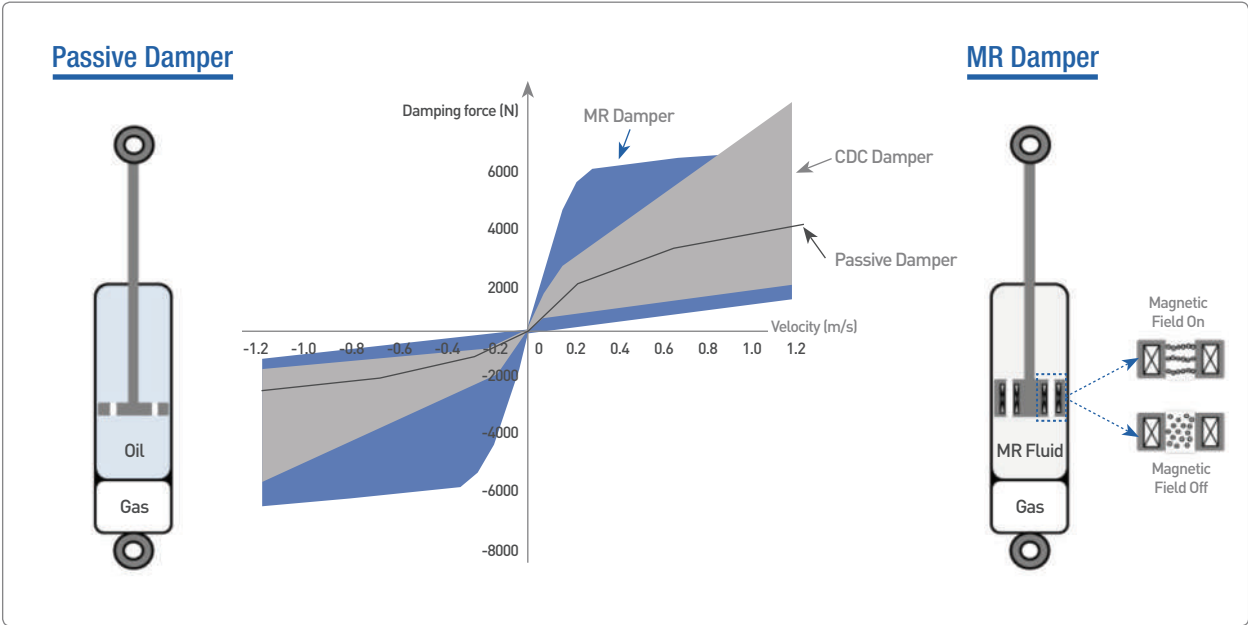
Items	Material	Size(mm)		Condition
		O.D	W.T	
Drive Shaft	ASTM 1026 ASTM 1035 EN 25CrMo4	20 - 60	2 - 6	Cold Drawn & Annealed Cold Drawn & Q/T
Cam Shaft	JIS S45C, SCM420 DIN 2391 ST52 ASTM A519 1527	25 - 45	4.5 - 6.5	Cold Drawn
Airbag Inflator	SAE 1510-M 10CrMnMo	20 - 70	1.5 - 4	Cold Drawn & Q/T
Axle	SAE 1030, SAE 1527 EN E355(ST52)	101.6 - 152.4	6.35 - 25.4	Hot Finished SMLS
CV Joint Cage	SAE 8617H EN 16MiCrMo2	40 - 90	4 - 14	As rolled or Normalized
Bearing	SAE52100 EN 100Cr6, SUJ2	20 - 170	1.5 -20	Spheroidizing Annealed
Synchronizer Cone	SUJ2 100CrMnSi6-4	59 - 103	4 - 8	Spheroidizing Annealed & Cold Drawn & Q/T
Annulus Gear	SCr420H	132 - 152	12 - 13	SMLS Tubing & Q/T
Shock Absorber Rod	JIS S45C SAE 1045, SAE 4130	22 - 25	3 - 4	Cold Drawn & Post-processed(Welding ~)
Inner Race	SCr420HB	149 - 169	9 - 12	SMLS Tubing & Q/T & Final Machining

Automotive-MR Damper

Product Overview



The MR damper is a computer-controlled suspension system that provides the best driving performance under any circumstances. MR dampers contain MR (Magneto Rheological) liquids, which vary in viscosity when exposed to magnetic fields, resulting in varying damping and magnitude of force. Height sensors detect bumps, potholes or obstacles and adjust magnetic energy within milliseconds to provide optimum damping for both comfort and control.



Automotive-Upset Drive Shaft

Product Overview



A drive shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them. As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, whilst avoiding too much additional weight as that would in turn increase their inertia. To allow for variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate one or more universal joints, jaw couplings, or rag joints, and sometimes a splined joint or prismatic joint.

Applied Items according to Upset Type

Item	Internal & External Upset (IEU)	Internal Upset (IUE)
Joint	• HCG (High-Efficiency Cross Groove)	• CG (Cross Groove), Rzeppa, etc.
Location	• Rear	• Front & Rear (Front is under development)
Product	• New development	• Replacing existing product (Swaged or welded D/Shaft)
Shape		
Characteristics	• Low working Angle • Weight reduction 10% ↑ • Manufactured with upset process only	• High working angle (for Front) • Cost reduction • High Productivity



Stainless Steel Tube

The first partner “ILJIN STEEL Coporation”

Applications



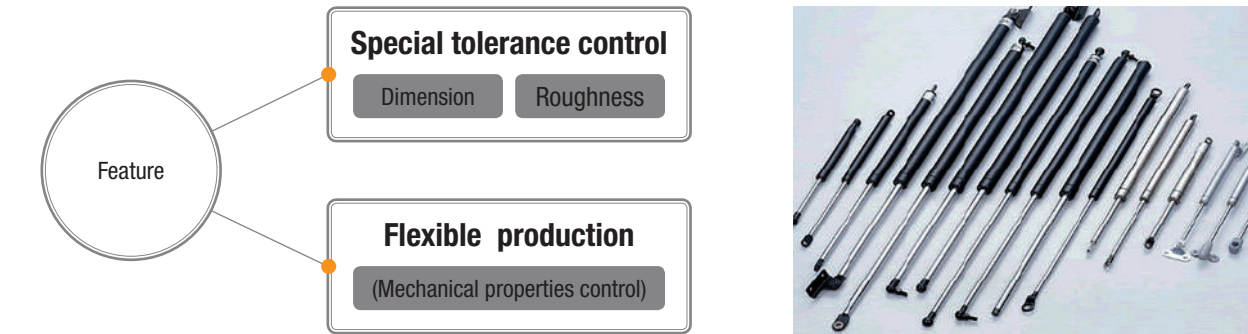
- Toxic and high purity gas supply line for semi-conductor and LCD manufacturing
- Instrument tube for oil & gas
- Painting & Sanitary use (beverage, drink, Medical)
- Damper & Gas spring
- Power plant Heat exchanger and Boiler
- Automobile parts (Engine fuel rail, Exhaustion system)
- Tube fitting & Elbow

Available Specification

Method	O.D(mm)	W.T(mm)	Standard
Cold finished	6.0~88.9	0.7~4.0	ASTM A213 ,269, 270, 632 ,789 ,B444 ASME SA213, SA789, JIS G3459 DIN 10216-5. DIN17458

Classification	Material	Application
Austenitic Stainless	TP304,304L,TP316,316L TP316Ti,TP321,TP317,TP310 TP347, 904L	Clean Tube, Heat exchanger tube, Mechanical tube, Automotive tube
Duplex	S31803, S32205, S32750, S32760	Heat exchanger tube, Petrochemical plant
Nickel Alloy	Alloy625, 690, 800, 825	Heat exchanger tube

Gas Spring



Mechanical Properties

Spec. (Actual)				
Grade	Y.S (MPa)	T.S (MPa)	E.L (%)	Remark
304/ 316	205min. (290)	515min. (605)	35min. (60)	
304L/316L	170min. (270)	485min. (585)	35min. (58)	

* It is possible to review when the required mechanical properties are out of above Spec.(Including Grade)

Dimension Tolerance

Contents	OD (mm)	ID (mm)	Remark
Commercial	±0.08 ¹⁾	0, +0.08 (or -0.08)	
Special	0 , +0.08 (or -0.08)	0, +0.05 (or -0.05)	

* ¹⁾ is Valid for less than O.D 28.0 mm (Please inquire if you need over size)

Roughness

Contents	Outer side	Inner side	Remark
Commercial	Ra 1.0 μm (40 μin) max.	Ra 0.8 μm (32 μin) max.	
Special	Ra 0.8 μm (32 μin) max.	Ra 0.5 μm (20 μin) max.	

* It is possible to review when the required roughness

Stainless Steel Tube

The first partner “ILJIN STEEL Coporation”

Heat Exchanger Tube



Spec.		OD (mm)	W.T (mm)	L (mm)	Steel Grade
Austenitic Stainless steels	ASTM A213 / ASME SA213	12.7~60.5	0.89 ~ 4.0	3~16	304(L), 316(L), 310S 316Ti, 321,347, 904L
	EN 10216-5	19.0~60.5	1.2 ~ 4.0		1.4301, 1.4306, 1.4401, 1.4404, 1.4509, 1.4541, 1.4550, 1.4845,
	DIN 17458				
Duplex Stainless Steels	ASTM A789/ ASME SA789	15.8~60.33	1.2~ 4.0	3~16	S31803, S32205, S32750, S32760
	EN 10216-5	19.0~60.33	1.65 ~ 4.0		1.4462, 1.4410, 14501
	DIN 17458				

- Produced order, minimum quantity 2 metric ton
- Length 4~18M (below out diameter 15.8 Maximum 10M)

Clean Tube

Spec.	Application
ASTM A632	Semiconductor Pipe Line, Fitting Using for Electro-polishing Tube
ASTM A269	
JIS G3459	
ASTM A270	Sanitary Line and Equipment



Item	Size (mm)			Outer side		Inner side	
	O.D		W.T	O.D	W.T(%)	Ry μ m	Ra (μ inch)
Tube	6.35	1/4"	0.89	-0, +0.05	± 10	3.0	15
			1.0		+10, -5		
	9.53	3/8"	0.89	-0, +0.05	± 10		
			1.0		+10, -5		
	12.7	1/2"	1.0	-0, +0.07	+10, -5		
			1.24		± 10		
			1.65				
	19.05	3/4"	1.65	-0, +0.10	± 10		
25.4	1"	1.65	± 0.10				
Pipe	21.7	15A	1.65	± 0.10	± 10	3.0	15
	27.2	20A					
	34.0	20A		± 0.15		3.5	15
	42.7	32A					
	48.6	40A		± 0.20		4.0	20
	60.5	50A				4.5	25

Chemical Composition (Special VOD¹⁾)

Grade			C	Si	Mn	P	P	Ni	Cr	Mo
VOD	316L-LS ²⁾	Min						12.00	16.00	2.00
		Max	0.025	0.60	0.80	0.040	0.005	15.00	18.00	3.00
	316L-HS ³⁾	Min					0.005	10.00	16.00	2.00
		Max	0.035	0.75	1.80	0.040	0.012	14.00	18.00	3.00
316L VIM ⁴⁾ /VAR ⁵⁾		Min						14.50	16.00	2.20
		Max	0.020	0.50	0.05	0.040	0.003	16.50	18.00	3.00

* ¹⁾ Vacuum Oxygen Decarburization ²⁾ Low Sulfur ³⁾ High Sulfur ⁴⁾ Vacuum Induction Melting ⁵⁾ Vacuum Arc Remelting

Stainless Steel Tube

The first partner “ILJIN STEEL Coporation”

Mechanical (Metric) Tube



Steel Grade

Contents	Steel Grade
ASTM/ ASME, JIS	304(L), 316(L), 316Ti, 317L, 321, 347, 904L
EN/ /DIN	1.4301, 1.4401, 1.4571, 1.4541, 1.4359

Dimension Tolerances

Spec.	OD (mm)	WT
ASTM A269 ¹⁾	Up to 38.1 excl. ±0.13 38.1 to 88.9 excl. ±0.25	Up to 12.7Ø (O.D) ±15% 12.7 to 88.9mm (O.D) ±10%
EN 10216-5	±0.5% or ±0.1 whichever is the greater [D4]	±0.10% or ±0.2mm whichever is the greater (T3) , T4 ²⁾
JIS G3459	Under 30 ± 0.3 30 or over ±1%	Under 2mm ± 0.2mm 2mm or over ±10%

- ¹⁾ is subject to change upon customer's request when required for min. wall, Nominal W.T. -0%, +20%
- ²⁾ ±7.5% or ±0.15 whichever is the greater (When required by purchaser)

* Contact the sales team for other Specification and further information and details.

Size Range

O.D	W.T														
mm	0.7	0.8	1.0	1.2	1.5	1.6	2.0	2.2	2.5	2.8	3.0	3.2	3.4	3.7	4.0
6.0															
8.0															
9.5															
10.0															
12.7															
15.8															
19.0															
25.4															
28.0															
31.8															
38.1															
43.0															
48.6															
50.8															
60.3															
63.5															
76.0															

* It is possible to review when the required size is out of above range

Precision Cold Drawn Shapes

Product Introduction

Applications

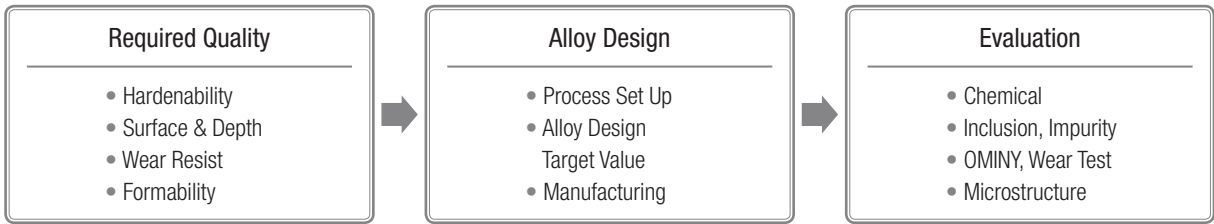


Performances

Advantages of Precision Cold Drawn Shapes

- Minimization of Material Scrap
- Homogeneous Microstructures
- Reducing of Processing time
- Precise dimensional tolerance
- Smooth and fine Surface
- High Strength
- Small quantity delivery

New Material Development



Full Line-Up of L / M Guide System

Item	Figure	Model No.	Size (W×H, mm)	Material Grade
L/M RAIL		No. 15 ~ 85	15×15 ~ 85×80	S55C ILM-1(S58CM) ILM-2(S55CM) ILM-3(S58CDV4) ILM-4(S55CR)
L/M BLOCK		FL Type No. 15 ~ 35	45×25 ~ 110×55	SCM415H SCM420H
		SL Type No. 15 ~ 45	30×20 ~ 100×60	
MINIATURE RAIL		Normal Type No. 9 ~ 15	9× 6~15×10	STS440A ILM-5(STS440A-M)
		Wide Type No. 9 ~ 15	20× 6~45×10	
SLIDER		No. 28 ~ 63	30×15~85×40	S55C ILM-1(S58CM) ILM-2(S55CM) ILM-3(S58CDV4) ILM-4(S55CR)

Available Specification

Spec.	Normal	Special
Dimension	± 0.1 mm	± 0.05 mm
Straightness	0.8 mm / m	0.3 mm / m
Twist	0.5 mm / m	0.1 mm / m
Decarburization	0.15 mm max.	0.05 mm max.
Surface Defect	0.15 mm max.	0.05 mm max.

Profile Size Range

Item	Normal
Width	6 - 180mm
Thickness	3 - 60mm
O.D (Tube)	10 ~ 250mm
Length (m)	2 - 11
C.S.A	25 - 8,000mm ²

CSA : Cross Section Area

Aluminium Clad Steel Wire

⚙️ **ASTM B416-98**

Size Nos/AWG	Nominal diameter of wire		Stranded diameter		Breaking strength		Weight		Resistance at 20℃		Nominal cross-section		
	in.	mm	in.	mm	lb	kN	lb/1,000ft	kg/km	Ω/1,000ft	Ω/km	cmils	in²	mm²
37/5	0.1819	4.620	1.27	32.34	142,800	636.2	2,802	4,168	0.04247	0.1395	1,225,000	0.9619	620.1
37/6	0.1620	4.115	1.13	28.80	120,200	535.9	2,222	3,308	0.05356	0.1758	971,300	0.7629	492.1
37/7	0.1443	3.665	1.01	25.66	100,700	449.7	1,762	2,624	0.06754	0.2216	770,300	0.6050	390.4
37/8	0.1285	3.264	0.899	22.85	84,200	373.4	1,398	2,081	0.08516	0.2794	610,900	0.4798	390.6
37/9	0.1144	2.906	0.801	20.34	66,770	296.0	1,108	1,650	0.1074	0.3525	484,400	0.3805	245.4
37/10	0.1019	2.588	0.713	18.12	52,950	234.7	879.0	1,308	0.1354	0.4445	384,200	0.3017	194.6
19/5	0.1819	4.620	0.910	23.10	73,350	326.7	1,430	2,128	0.08224	0.2701	628,900	0.4940	318.4
19/6	0.1620	4.115	0.810	20.57	61,700	275.2	1,134	1,689	0.1037	0.3403	498,800	0.3917	252.7
19/7	0.1443	3.665	0.721	18.33	51,730	230.9	899.5	1,339	0.1308	0.4289	395,500	0.3107	200.5
19/8	0.1285	3.264	0.642	16.32	43,240	191.7	713.5	1,062	0.1649	0.5408	313,700	0.2464	159.0
19/9	0.1144	2.906	0.572	14.53	34,290	152.0	565.8	842.1	0.2079	0.6824	248,800	0.1954	126.0
19/10	0.1019	2.588	0.509	12.94	27,190	120.5	448.7	667.8	0.2622	0.8604	197,300	0.1549	99.94
7/5	0.1819	4.620	0.546	13.86	27,030	120.4	524.9	780.9	0.2264	0.7302	231,700	0.1820	117.3
7/6	0.1620	4.115	0.486	12.34	22,730	101.4	416.3	619.7	0.2803	0.9200	183,800	0.1443	93.10
7/7	0.1443	3.665	0.433	11.00	19,060	85.1	330.0	491.5	0.3535	1.1598	145,700	0.1145	73.85
7/8	0.1285	3.264	0.385	9.792	15,930	70.6	261.8	389.8	0.4458	1.4623	115,600	0.09077	58.57
7/9	0.1144	2.906	0.343	8.717	12,630	56.0	207.6	309.0	0.5621	1.8447	91,650	0.07198	46.43
7/10	0.1019	2.588	0.306	7.765	10,020	44.4	164.7	245.1	0.7088	2.3261	72,680	0.05708	36.82
7/11	0.0907	2.304	0.272	6.911	7,945	35.2	130.6	194.2	0.8938	2.9352	57,590	0.04523	29.18
7/12	0.0808	2.052	0.242	6.156	6,301	27.9	103.6	154.1	1.127	3.6997	45,710	0.03590	23.15
3/5	0.1819	4.620	0.392	9.957	12,230	54.5	224.5	334.0	0.5177	1.7000	99,310	0.07800	50.28
3/6	0.1620	4.115	0.349	8.868	10,280	45.9	178.1	265.0	0.6528	2.1423	78,750	0.06185	39.90
3/7	0.1443	3.665	0.311	7.899	8,621	38.5	141.2	210.2	0.8232	2.7007	62,450	0.04905	31.65
3/8	0.1285	3.264	0.277	7.034	7,206	32.0	112.0	166.7	1.038	3.4055	49,530	0.03890	25.10
3/9	0.1144	2.906	0.247	6.263	5,715	25.3	88.81	132.2	1.309	4.2954	39,280	0.03085	19.90
3/10	0.1019	2.588	0.220	5.578	4,532	20.1	70.43	104.8	1.651	5.4169	31,150	0.02446	15.78

⚙️ **Aluminium Clad Mild Steel Wire(STALUME) KS D 7037-00**

Nominal Diameter	Diameter Tolerance	Ultimate tensile strength	Torsion	Conductivity	Aluminium Thickness Min	Calculated weight	Nominal Cross-section
(mm)	(mm)	(Kgf/mm²)	(times)	(%)	(mm)	(kg/km)	(mm²)
1.60	±0.05	60-90	55	20.3	0.06	13.3	2.011
2.30	±0.07	60-90	38	20.3	0.12	27.4	4.155
3.20	±0.07	55-85	26	20.3	0.16	53.0	8.042
3.50	±0.08	50-80	24	20.3	0.18	63.5	9.621
4.00	±0.08	40-80	21	20.3	0.20	82.9	12.566
5.00	±0.10	40-80	17	20.3	0.25	130.0	19.635
6.00	±0.12	40-80	13	20.3	0.30	186.0	28.274

⚙️ **ACS Wire ASTM B502-98**

Nominal cross-section		Stress at 1.0% extension		Ultimate tensile strength		Elongation	Resistivity at 20℃
(mm)	(mm)	(Kgf/mm²)	(times)	(%)	(mm)	%	Ω•mm2/m
1.956-3.274	0.0770-0.1289	1,206	175,000	1,344	195,000	1.5	0.08480
3.275-3.477	0.1290-0.1369	1,172	170,000	1,310	190,000	1.5	
3.478-3.665	0.1370-0.1443	1,137	165,000	1,275	185,000	1.5	
3.666-3.934	0.1444-0.1549	1,103	160,000	1,241	180,000	1.5	
3.935-4.115	0.1550-0.1620	1,103	160,000	1,206	175,000	1.5	
4.116-4.392	0.1621-0.1729	1,068	155,000	1,172	170,000	1.5	
4.393-4.620	0.1730-0.1819	1,034	150,000	1,137	165,000	1.5	
4.621-4.775	0.1820-0.1880	1,000	145,000	1,103	160,000	1.5	

Quality Assurance

Quality Assurance System

ILJIN STEEL has renowned for its well-established quality system. It has acquired a number of quality assurance system certificates from leading official organizations in and outside the country.

⚙️ **Quality policy**

To ensure the effective implementation of required processes we hereby declare the quality policy as follows;

Establishment of quality process for “F-Cost Zero”

Continuous improvement through control of P cost & A cost

Guarantee of partner's safety and profits who is concerned ILJIN steel Corp.

Process establishment from design to shipment through safety and Profitability

Business growth through contribution to public welfare

Production of product which is satisfied by customer NEED, standard and Regulations

Equipments for Quality Assurance

ILJIN Steel maintains the highest quality by continuing various systematic activities for products improvement, development and quality assurance.

Equipment	SEM/EDS	Optical Microscope	O.E.S
Image			
Standard	ASTM E2142, ISO 16700	ASTM E45/E112	ASTM A751
Equipment	ONH Analyzer / Thermo Fisher	Dilatometer	Collapse tester
Image			
Standard	ASTM E1019, 1587, 1409	ASTM E228	API 5C3

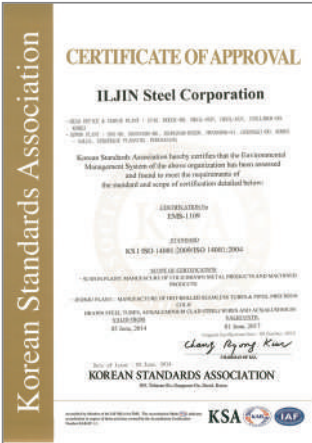
Equipment	U.T.M	Charpy Impact Tester	
Image			
Standard	ASTM E8/E83/A370	ASTM E23, ISO 148-01	
Equipment	Hardness Tester	Jominy Tester	Creep Tester
Image			
Standard	ASTM E384/E18/E10	ASTM A255, ISO 642	ASTM E139

The first partner “ILJIN STEEL Coporation”

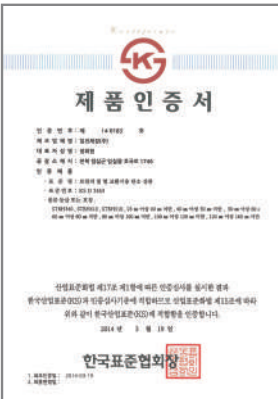
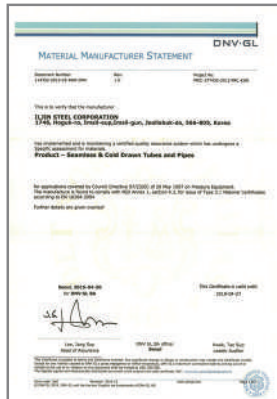
Equipment	SSCC/SCC Tester	HIC Tester
Image		
Standard	NACE TM 0177	NACE TM 0284
Equipment	Autoclave	Steam De-oxidation Tester
Image		
Standard	ASTM A1080	Boiler Tube Service

Equipment	Burst Tester	Drop Weight Tester
Image		
Standard	ASTM F1387	ASTM E208

Certificate – Quality System

ISO 9001	IATF16949
	
ISO 14001	OHSAS 18001
	

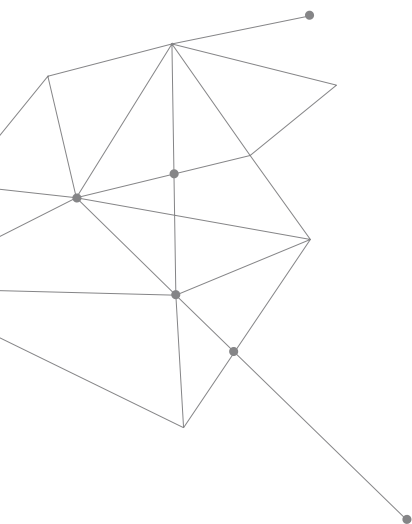
Certificate – Product

JIS G 3454 	JIS G 3461 	JIS G 3462 
KS D 3563 	PED&AD2000 W0 	PED(DNV) 
API 5L 	API 5CT 	

Certificate – CLASS

BV	DNV	LR
		

RINA	KR
	



ILJIN ILJIN Steel Corporation

Imsil Head Office / Plant

1746, Hoguk-ro, Imsil-gun, Jeollabuk-do, Korea

Suwon Office/Plant

905-80, Mannyeon-ro, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do, Korea

Seoul Office

04167 ILJIN B/D 3F. 45, Mapo-daero, Mapo-gu, Seoul, Korea

ILJIN Steel America

12012 Wickchester Lane, Suite670, Houston, TX 77079, USA

Busan Sales Office

A-409, 257, Hakgam-daero, Sasang-gu, Busan, Korea

Detroit Sales Office

850 stepenson Hwy, suite 400, Troy, MI, 48083, USA

Frankfurt Sales Office

Fridrich-Ebert-Anlage 49 (33.OG), 60308 Frankfurt am Main, Germany

E-Mail : iljinsteel@iljin.co.kr

Homepage : www.iljinsteel.com

