

## Dream your future! Dongbu Steel will make it come true

It is a tin/ chrome coated steel sheets with an attractive metal gloss possessing excellent workability and rust resistance making it popular for the wide use of food and beverage cans.

Dongbu Steel is producing high value-added TP/TFS by reducing the weight of vessels.





ELECTROLYTIC TINPLATE/TIN FREE STEEL  
PRODUCT SPECIFICATION

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# Dream your future! Dongbu Steel will make it come true

Dongbu Steel is world class Tinplate company that leads the steel industry with continuous technical development and self-innovation

## History of Dongbu Steel's Tin Mill Products

- 1967 \_\_\_ Started cold rolled steel sheet manufacturing
- 1978 \_\_\_ Started NO.1 ETL at Incheon Works
- 1986 \_\_\_ Started TFS manufacturing
- 1999 \_\_\_ Started NO.2 ETL at Asan Bay Works

## Manufacturing Facilities

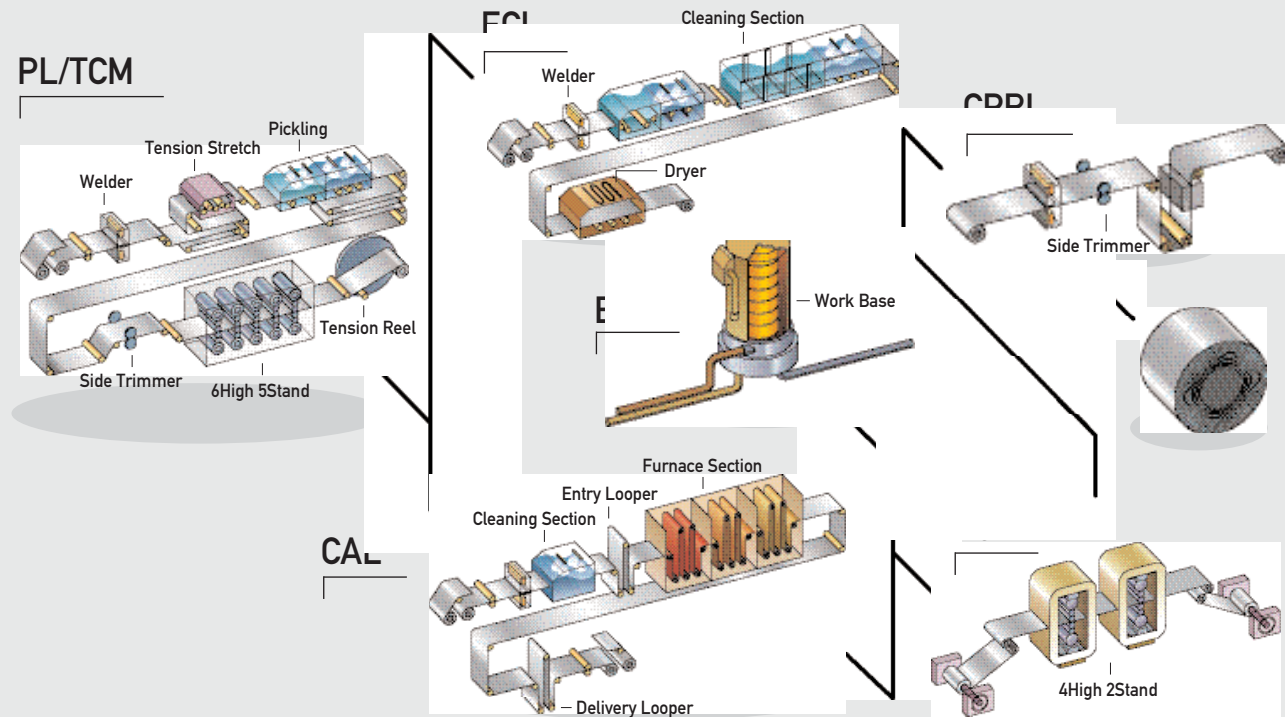
Dongbu Steel manufactures and supplies Tin mill products of outstanding quality complying with the demand of customers through two characteristic Electrolytic Tinning Lines.

- NO.1 ETL manufactures various products through the accumulated know-how since 1978. Materials for special use such as optical cable and electronic parts are under production in NO.1 ETL.
- NO.2 ETL adopted a-state-of-the-art technology reflecting customer's demands for thinner gauge, higher stiffness, higher quality.
  - insoluble anode tin plating technology
  - 2 steps chromium plating technology
  - combination reflow process with resistance heating and induction heating

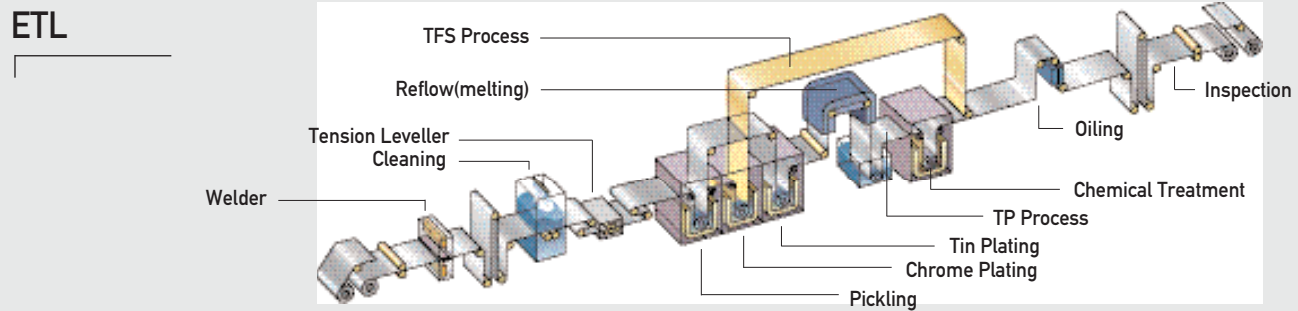


# 01 Manufacturing process

## TMBP manufacturing process



## TP/TFS manufacturing process



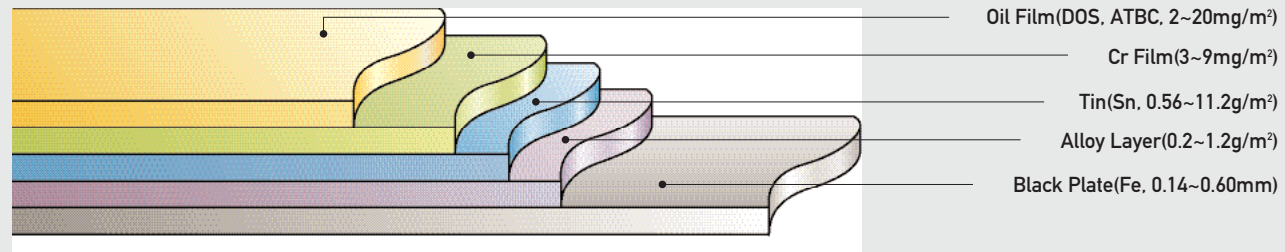
## TP/TFS manufacturing facility specs

ITEM		NO.1 ETL(Incheon Works)	NO.2 ETL(Asan Bay Works)
Location		Incheon Works	Asan Bay Works
Start		1978. 8.	1999. 5.
Line Speed		Max 300 m/min	Max 600 m/min
Capa.(year)		180,000 M/T	200,000 M/T
Process Type		Ferrositan Type	
Products		TP & ECCS(Dual Line)	
Strip Size	Thickness	0.15 ~ 0.60 mm	0.14 ~ 0.60 mm
	Width	600 ~ 980 mm	600 ~ 1220 mm
Coating Weight	TP	#10 ~ #100	#5 ~ #135
	ECCS	100 mg/m <sup>2</sup>	100 mg/m <sup>2</sup>
Shear Line	Straight	1 Line(HALLDEN)	1 Line(LITTELL)
	Scroll	2 Line(LITTELL)	1 Line(LITTELL)

## 02 Products

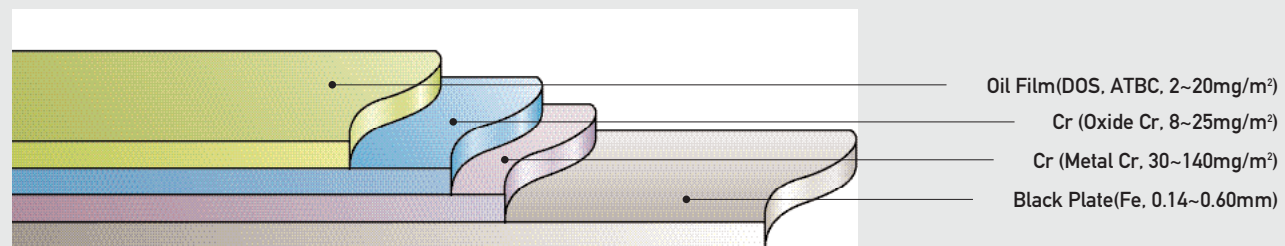
### Tinplate/ TP

In addition to its elegant shining surface, tinplate possess good corrosion resistance, formability, weldability, and printability. Such unique properties allow the tinplate to serve a broad range of applications including beverage can, food can, oil can, paint can, aerosol can, bottle cap, cable and electronic parts.



### Tin Free Steel/ ECCS

Tin Free Steel boasts superior lacquer and paint adhesion and strong resistance against corrosion. Tin Free Steel is used in the production of cans, containers, home applications and optical cables.



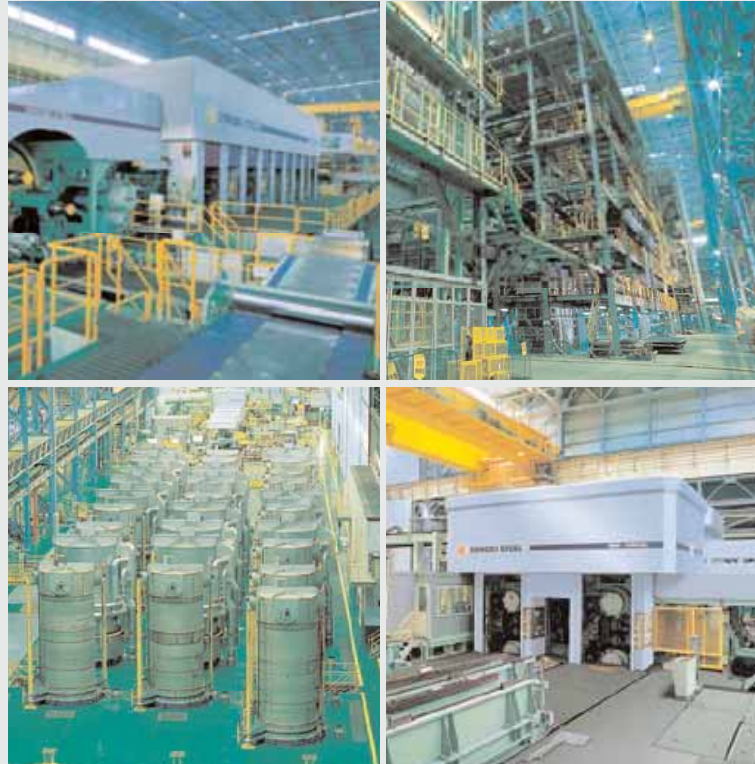
### Temper

Single Reduced Products				Double Reduced Products		
Temper Designation	Aim Hardness(HR30T)			Temper Designation	Aim Hardness (HR30T)	Tensile Yield Strength (N/mm <sup>2</sup> )
	t≤0.21mm	0.21< t≤0.28mm	t>0.28mm			
T-1(T50)	Below 53	Below 52	Below 51	DR-7.5 (DR520)	71±3	520±70
T-2(T52)	53±3	52±3	51±3	DR-8 (DR550)	73±3	550±70
T-2.5(T55)	56±3	55±3	54±3	DR-8.5 (DR580)	74±3	580±70
T-3(T57)	58±3	57±3	56±3	DR-9 (DR620)	76±3	620±70
T-4(T61)	62±3	61±3	60±3			
T-5(T65)	65±3	65±3	64±3			

## 03 Characteristics

### Diverse BP Manufacturing Capability

- BP with uniform thickness profile, wide range thickness(0.14mm~0.60mm), good shape due to modernized Tandem cold rolling mill
- Wide scope of selection for customers' applications and processing method, based on the heat treatment capability(CAL/ BAF)
- Double Cold Reduction(DCR)Mill, which produces ultra-thin gauge strip including Single Reduced(SR) and Double Reduced(DR) TP/ TFS



### Customer Satisfaction Centered TP/TFS

- 2 ETL Lines and 5 shear facilities, completely complying with customers' various demands
- Products with diverse surface roughness level-Bright, Stone(R1, R2), Silver(1~4)
- Fully computerized business management system(ERP) fulfilling customers' needs for e-business and IT trends
- Technical team and R&D Center staffed with experienced specialist in the field of BP/ TP and Laboratory with the most up-to-date facilities, offering "Customer Oriented Technical Service" and assisting "Customers' Technical Development"



# 04 Applications

## Food & beverages cans

01 | Welded cans



02 | D&I cans



03 | DRD cans



## Aerosol cans

01 | Body, Dome, Mounting Cup



## General cans

01 | 1~4l, 18l, Pail, Fancy etc



## For industrial use

01 | For cable



02 | For electronic parts



## Others

01 | Crown, Lug Cap, EOE



## 05 Type of Steel

- 1) Typical Steel Type for Tin Mill Products
- 2) Low Carbon and Al-Killed Steel

### 1) Typical Steel Type for Tin Mill Products

Type of Steel	Remark
MR	It contains few residual minor constituents and has a good corrosion resistance so that it is widely used for such applications as containers.
L	It contains particularly few residual minor constituents such as Cu, Ni, Cr, Mo, so that it is suitable for the materials of containers required improved corrosion resistance.
D	It is aluminum killed steel, so that it is suitable for the applications, which bear deep drawing, or other working that is liable to produce Luder's lines pattern.

### 2) Low Carbon and Al-Killed Steel

Units | Max. wt%

Item	C	Mn	P	S	Si	Cu	Ni	Cr	Mo
MR	0.13	0.60	0.020	0.05	0.020	0.20	0.15	0.10	0.05
L	0.13	0.60	0.015	0.05	0.020	0.06	0.04	0.06	0.05
D	0.12	0.60	0.020	0.05	0.020	0.20	0.15	0.10	0.05

#### Remarks

- When Al-killed steel is ordered or furnished, the total aluminum content is usually in excess of 0.020 %.

## 06 Surface Finish

Products	Classification	DBS	JIS	ASTM	Range ( $\mu\text{mRa}$ )
Single Reduced	Bright	MB	B	7B	- 0.15
		EB			- 0.20
		B			0.25 - 0.35
	Stone	R1	R	7C	0.35 - 0.50
		R2			0.45 - 0.70
	Silver	S1	S	5C	0.80 - 5.5
		S2			
		S3			
S4					
Double Reduced	Stone	R1C	R	7C	0.30 - 0.50

#### Remarks

- 1. Bright/ stone is grindstone finish pattern
- 2. Silver finish is provided by flow melted tin coating on dull finish pattern
- 3. Matte finish is provided by flow unmelted tin coating or ECCS on dull finish pattern base

# 07 Temper Designation

- 1) Single Reduced Products
- 2) Double Reduced Products

## 1) Single Reduced Products

Temper Designation	Aim Rockwell Hardness (HR30T)			Characteristics
	$t \leq 0.21\text{mm}$	$0.21 < t \leq 0.28\text{mm}$	$t > 0.28\text{mm}$	
T-1 ( T50 )	Below 53	Below 52	Below 51	Deep drawing, mounting cup, oil filter
T-2 ( T52 )	$53 \pm 3$	$52 \pm 3$	$51 \pm 3$	Moderate drawing, drawing can, body, end for large can
T-2.5 ( T55 )	$56 \pm 3$	$55 \pm 3$	$54 \pm 3$	
T-3 ( T57 )	$58 \pm 3$	$57 \pm 3$	$56 \pm 3$	General use, pail, 18l, 4l
T-4 ( T61 )	$62 \pm 3$	$61 \pm 3$	$60 \pm 3$	Moderate forming, body, end for small can
T-5 ( T65 )	$65 \pm 3$	$65 \pm 3$	$64 \pm 3$	High stiffness, body, end for small can

### Remarks

- 1. The hardness of less than 0.20mm in nominal thickness is normally tested using Rockwell 15T scale and results converted to Rockwell 30T scale
- 2. The annealing method involves the batch annealing(BA) and continuous annealing(CA), and even though the hardness values are equal, other mechanical characteristics than hardness are not always consistent. Therefore, the purchaser may specify either of them by agreement with manufacturer.

## 2) Double Reduced Products

Temper Designation	Aim Rockwell Hardness (HR30T)	Aim Tensile Yield Strength (N/mm <sup>2</sup> )	Characteristics
DR - 7.5 ( DR520 )	$71 \pm 3$	$520 \pm 70$	Moderate strength and stiffness with moderate forming, body, end, dome
DR - 8 ( DR550 )	$73 \pm 3$	$550 \pm 70$	High strength and stiffness, body, end, DRD can, caps
DR - 8.5 ( DR580 )	$74 \pm 3$	$580 \pm 70$	
DR - 9( DR620 )	$76 \pm 3$	$620 \pm 70$	Higher strength and stiffness for thinner gauge body, end, DRD can, caps

### Remarks

- 1. All factors which affect the work performance for double reduced products can not exactly be enumerated, however, Rockwell hardness or Tensile yield point shall be adopted, since this is useful indicator of the mechanical characteristics.
- 2. Tensile Yield Strength is average 0.2% Proof stress in parallel with rolling direction.

# 08 Tin-Coating Weight

1) Tin Plate  
2) Differential Marking\_3) ECCS

## 1) Tin Plate

Units | g/m<sup>2</sup>

Tin-Coating Weight(M)	Minimum Average Coating Weight
$1.0 \leq M < 1.5$	-0.25
$1.5 \leq M < 2.8$	-0.30
$2.8 \leq M < 4.1$	-0.35
$4.1 \leq M < 7.6$	-0.50
$7.6 \leq M < 10.1$	-0.65
$10.1 \leq M$	-0.90

## 2) Differential Marking

Letter Symbol	Marking Method
D	It shall be marked a continuous line about up to 5mm width on the designated coated surface near one of the trimmed side edges.
A	It shall be marked lines with specified interval or geometric pattern on the designated coated surface.

### Remarks

- The surface to be marked and marking method shall be subjected to the agreement between the parties and stated clearly in the contract of order.

## 3) ECCS

Item	Coating Weight (mg/m <sup>2</sup> )
Metal Cr	30 -140
Cr-oxide	8 - 25

### Remarks

- A sample of coating weight shall be taken from any point away from 10 mm from either edge of both sides.
- Average coating weight shall be calculated on the basis of measurement at 3 points (both edges and center).

# 09 Shape and Dimensions

1) Dimensions  
2) Flatness

## 1) Dimensions

Item	Tolerance	Remark
Thickness	Nominal $\pm 6\%$	at any point on the sheet not less than 6mm (1/4 in.) from either of both side edge
Width	Nominal -0, +2mm (-0, +0.08 in.)	Aim -0, +1.5mm (-0, +1/16 in.)
Length(Sheet)	Nominal -0, +1mm (-0, +0.04 in.)	Products of heavy coating (#50/75, #75/50) and width 900mm (35.4 in.) over:-0, +1.3mm (-0, +0.05 in.)
Out of Square	Max. 0.8mm(0.032 in.)	Max. 0.5mm (0.02 in.) for Crown Corks
Camber	Max. 6mm/6m(0.25 in./240 in.)	
Burr	Max. 0.05mm (0.002 in.)	Aim 0.03mm (0.0012 in.)
Inside Diameter for Coil	420mm (16 1/2 in.) 508mm ( 20 in. )	

## 2) Flatness

Item	Tolerance	Remark
Edge Wave	Pitch : Min. 150mm( 6 in.) Height : Max. 3mm( 1/8 in.)	Less than 6 waves are found on the 1m (40 in.) long sheet.
Bow	Height : Max. 3mm( 1/8 in.)	Aim 2.5mm ( 1/10 in.) on the flat plate
Buckle	Height : Max 1.5mm( 1/16 in.)	Cut the center part of buckle, lay it on a flat plate and measure its height.

# 10 Oiling

Item	Aim. Oil Weight (mg/m <sup>2</sup> ) - Each Side	Oil Weight	
		(mg/m <sup>2</sup> ) - Each Side	(g/bb) - Both Side
Slightly	2.5	1.0 - 3.5	0.05 - 0.14
Normal	4.5	3.0 - 6.0	0.12 - 0.24
Medium	7.5	6.0 - 9.0	0.24 - 0.35
Light Heavy	8.5	7.0 - 11.0	0.30 - 0.45
Heavy	9.5	10.0 -	0.40 -

### Remarks

- The most commonly used Oil films are DOS-A(Di-Octyl-Sebacate) and ATBC (Acetyl Tributyl Citrate)

## 11 Chemical Treatment (Passivation)

Item	Coating Weight (mg/m <sup>2</sup> )
SDCD (# 300)	Max. 2 mg/m <sup>2</sup> (Max. 200 µg/ft <sup>2</sup> )
CDC (# 311)	3 - 9 mg/m <sup>2</sup> ( 250 - 850 µg/ft <sup>2</sup> )

### Remarks

- This item is applicable to TP only.

## 12 Dealing with Weight

Item	Products Weight
Coil	5 - 15 Ton
Sheet	Min. 1 Ton, Max. 3 Ton

## 13 Appearance

The TP and TFS shall be uniform in thickness, uniformly and smoothly tin coating over whole surface, and free from flaws, dents, wrinkles, rusts, etc. that are detrimental to practical use. For the coils, however, welds and some irregular parts may be included in those coils, since generally the coils are afforded no opportunity to remove readily such defective portions

## 14 Yield (The ratio of successful application)

Item	Percent
The ratio of successful application with one lot.	97%
The ratio of successful application with any coil	95%

### Remarks

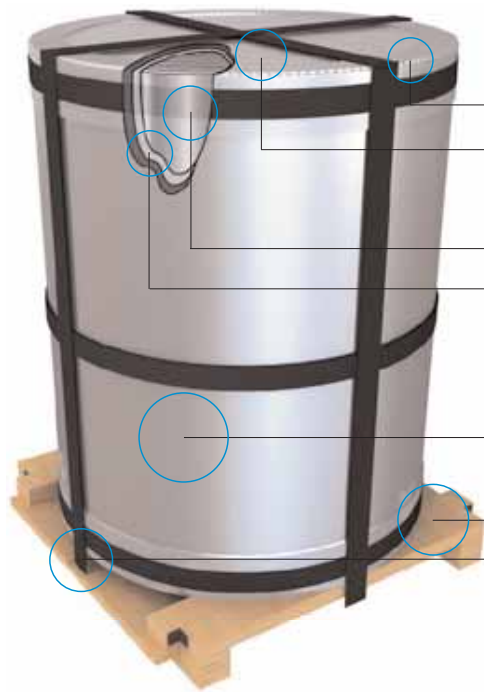
- If all the products of the same size weight over 50 tons, we will consider them as one lot.

# 15 Packaging and Marking

## Packaging

Dongbu Steel tinplate is packed with special care to withstand handing in long ocean shipping. Special care is given to prevent abrasion, rust and scratching.

## Coil Packaging



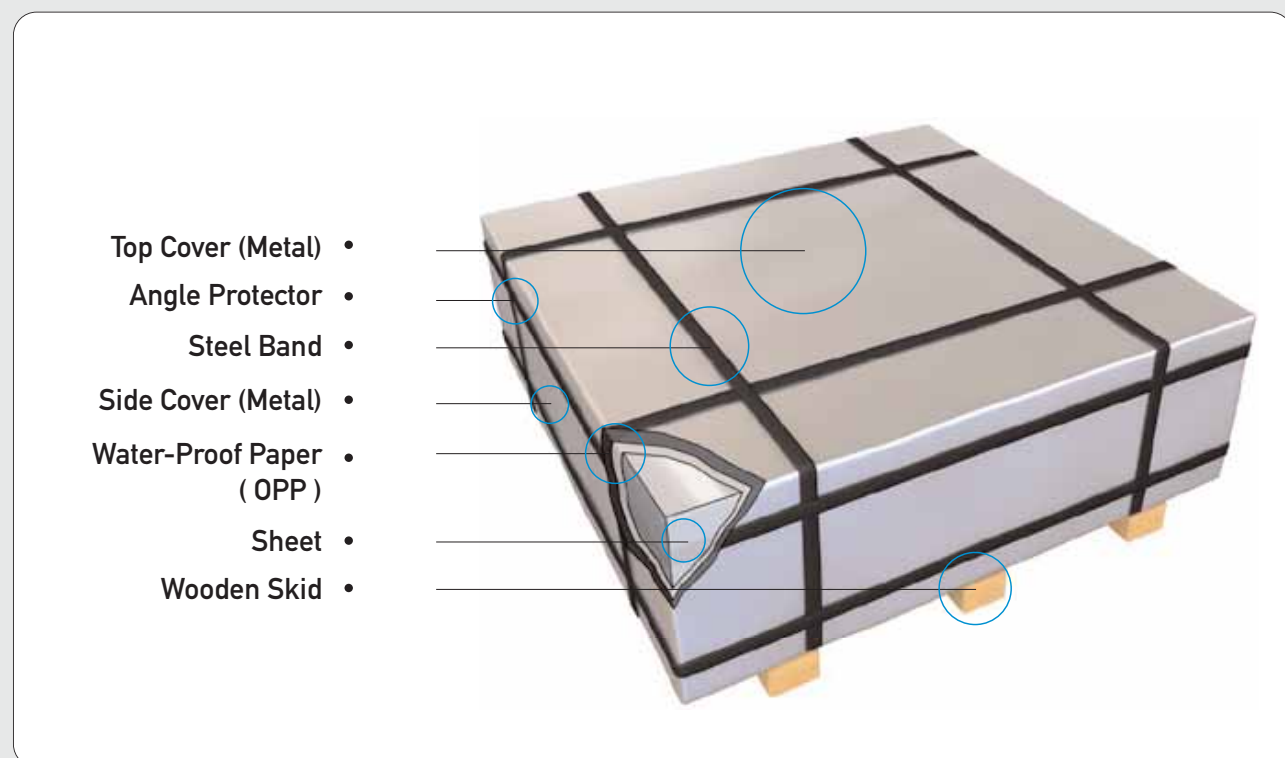
- Protector (Outside)
- Protector (Cap type)
- Coil
- Corrugated Hardboard
- Vinyl
- Water-Proof Paper (P.E)
- Metal Cover
- Wooden Skid
- Steel Band

No.	Parts	Material	Size
1	Water-Proof paper	-	-
2	Rust-Proof Paper	-	-
3	Vinyl	-	t : 0.08 mm
4	Corrugated Hardboard	-	-
5	Metal Cover	GI	t : 0.45 - 0.60 mm
6	Band	Steel	1.0t × 32w (mm)
7	Skid	Wood	-
8	Inside Protector	GI	1.0t
9	Outside Protector	GI	1.2t

## Marking

Each package is marked with product name, specifications, coating weight, thickness, dimensions, temper, number of sheets contained, net weight, gross weight, inspection no., package number, origin and "Dongbu Steel Co., Ltd" other marks can be added, if desired. An inspection card inside the package gives the same information.

## Sheet Packaging



No.	Parts	Material	Size
1	Water-Proof Paper	OPP	-
2	Top Cover	GI	t : 0.45 - 0.60mm
3	Side Cover	GI	t : 0.45 - 0.60mm
4	Band	Steel	0.7t × 19w(mm)
5	Angle Protector	GI	1.5t × 30 × 30mm
6	Corrugated Hardboard (Top Pad)	-	-
7	Skid	Wood	-
8	Corrugated Hardboard (Side Pad)	-	-

# 16 Application Code

1) A kind of can\_2) Application-1\_3) Applications-2  
4) Contents within can\_5) Top/End Treatment\_6) Example

## 1) A kind of Can

Code	Explanation
F	Food / Beverage
N	General Can( not for food )

## 2) Application-1

Code	Explanation
A	3 - Piece
B	D & I
C	E.O.E
D	DRD
E	DTR
H	General
L	Pail / Drum
M	Aerosol
N	Cap(crown, white, royal cap)
Z	The others

## 3) Application-2

Code	Explanation
A	Top / Bottom
B	Body
C	Drawing Quality for Top
D	Dome
Z	The Others

## 4) Contents within can

Code	Explanation
A	Juice
C	Carbonated / Sports Beverage
F	Fish / Meat
G	Fruit / Vegetable
H	Pet Food
J	Condensed Milk/ Powder
Z	The Others

## 5) Top/ End Treatment

Code	Explanation
A	Printing / Lacquer
1	Lacquer / Printing
B	Plain / Lacquer
2	Lacquer / Plain
C	Plain / Printing
3	Printing / Plain
4	Plain / Plain
5	Film attachment
Z	The others

If you use this application code when you order some products, Dongbu Steel will be able to produce them more precisely. Please refer the below example to see the method of using application code.

## 6) Example

Product	Application Code
TUNA CAN BODY-DRD-PRINTING/ LACQUERING	F D B F A
AEROSOL DOME PLAIN/ LACQUERING	N M D Z B

# 17 Special Specification

1) Food/Aerosol Can\_2) Crown Corks  
3) Scroll Sheet\_4) The Range of Product

This special specification is prior to general specification (No. 1 - No. 12)

## 1) Food/ Aerosol Can

- Thickness Tolerance  $\pm 4\%$  ( Aim 3% )

## 2) Crown Corks

- Out of Squareness Max. 0.5 mm
- Length Max. 0.8 mm  
(provided that tolerance limits must be permitted minus values)

## 3) Scroll Sheet

- Scroll sheet layout (Rescroll drawing) should be confirmed by Dongbu steel.
- It usually takes 6 months to make scroll knife.

## 4) The Range of Product

Unit | mm, g/m<sup>2</sup> ( plating )

Item	Incheon Works			Asan Bay Works		
	#1 ETL (Plating)	Shear		#2 ETL (Plating)	Shear	
		Drum	Scroll		Drum	Scroll
Thick.	0.15 - 0.60	0.16 - 0.60	0.15 - 0.60	0.14 - 0.60	0.12 - 0.60	0.12 - 0.51
Width	600 - 980	Max. 980	Max. 980	600 - 1,220	559 - 1,030	559 - 1,250
C/W	1.1 - 11.2	-	-	0.55 - 15.2	-	-
Length	-	450 - 1,005	450 - 1,115	-	450 - 1,200	550 - 1,206

# 18 DR Specification

1) Thickness\_2) Width\_3) Temper  
4) Mechanical Property (Reference)

## 1) Thickness

- 0.14 - 0.36 mm

## 2) Width

- 700 - 1,100 mm

## 3) Temper

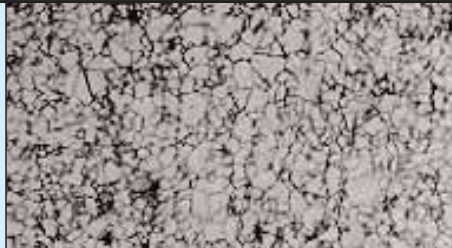
- DR-7, 7.5, 8, 8.5, 9,
- BA, CA available
- The double reduced tin mill products applied various application ,which demand different mechanical characteristics. Dongbu Steel can supply DR products specified for each application.

## 4) Mechanical Property (Reference)

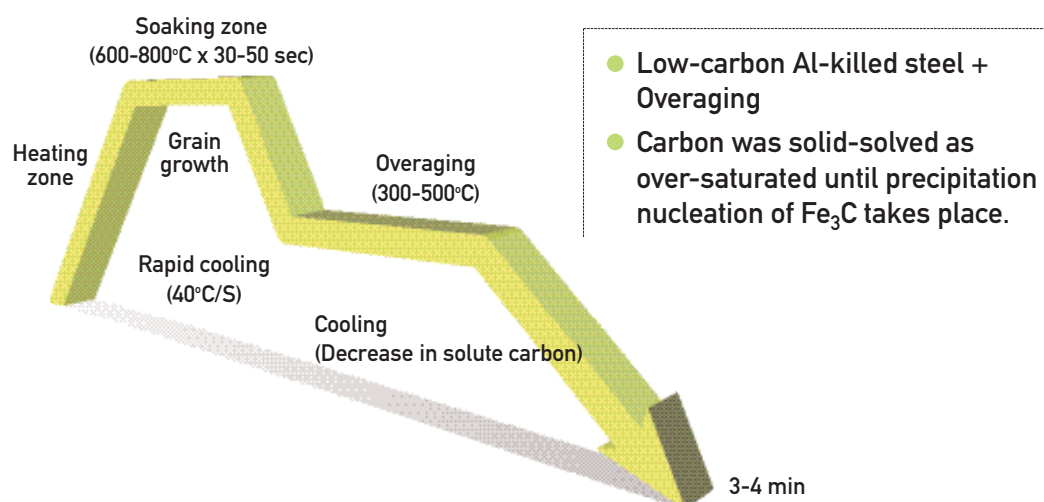
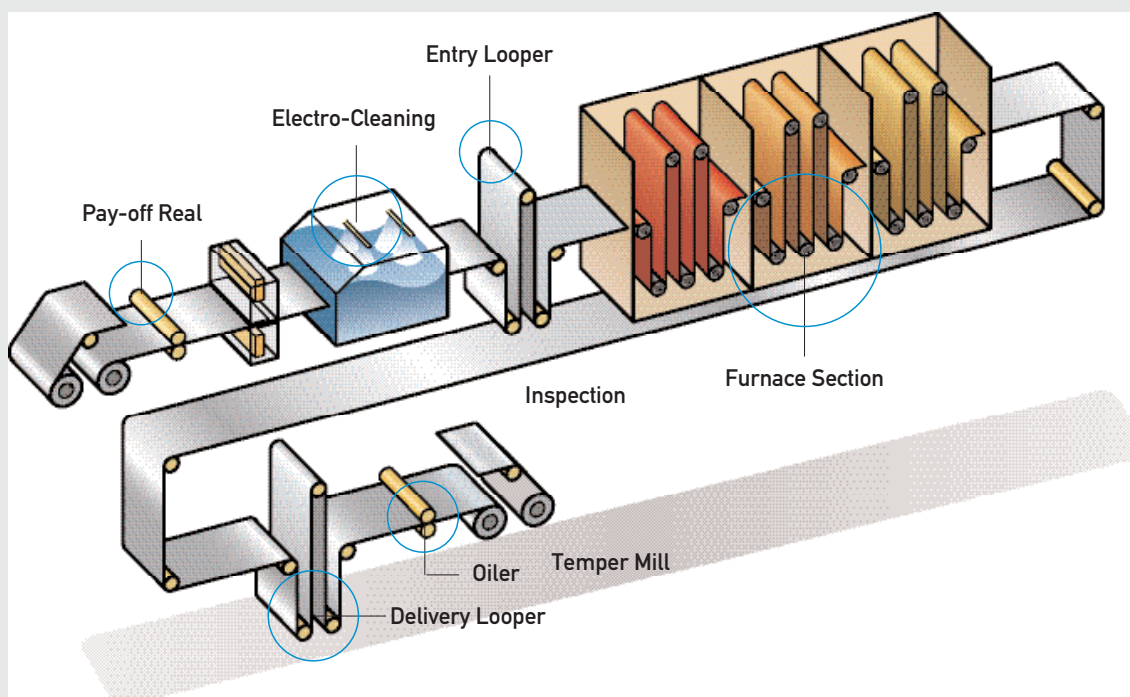
Temper Designation	DR - 8	DR - 9
Tensile Strength	56 kgf/mm <sup>2</sup>	63 kgf/mm <sup>2</sup>
Elongation	Max. 5%	Max. 3%
Spring - Back	100 - 115.	110 - 125.
Erichsen Value	Max. 5.0mm	Max. 4.0mm
HR 30T	73	76

# 19 Comparison of CAL

## 1) CAL

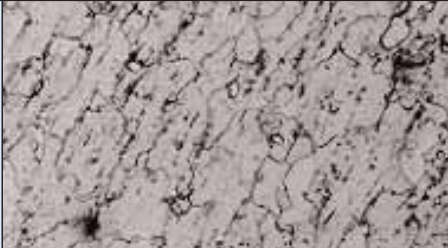
Characteristics	Microstructure
<p>It takes a few minute to anneal the coil in this process. (3 - 4 min.)</p> <p>This process have improved uniformity of properties from edge to edge and end to end of the coil.</p> <p>Since the annealing time is markedly shortened, surface defects caused by enrichment of carbon and manganese at the sheet surface during annealing can be prevented.</p>	

## Lay-Out of Line

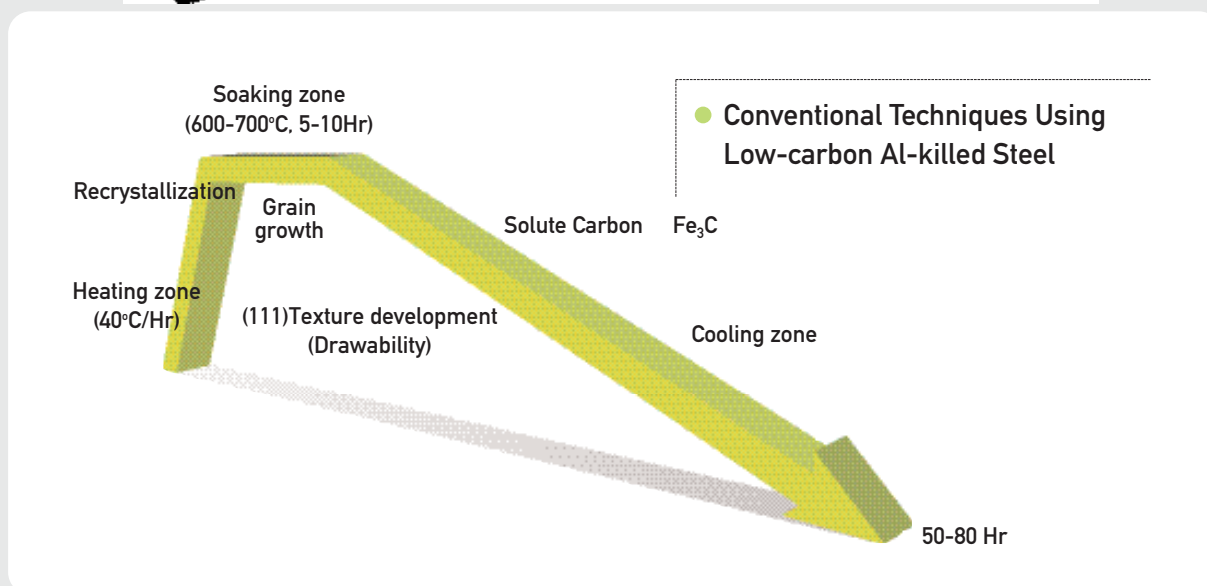
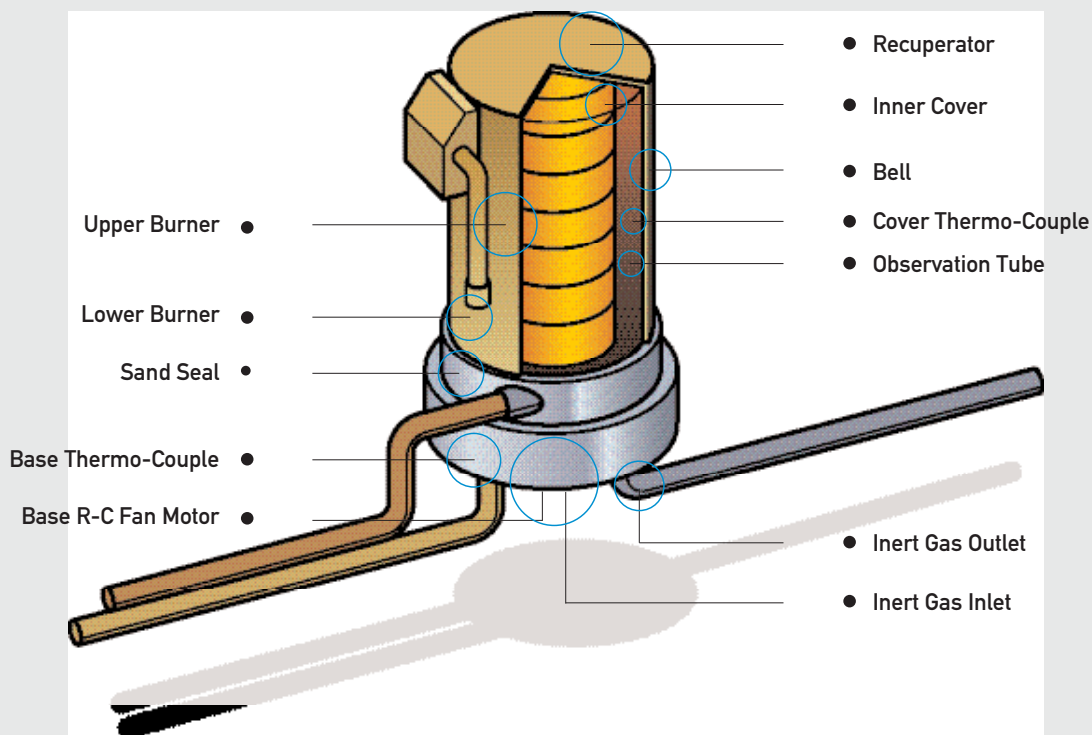


# 20 Comparison of BAF

## 2) BAF

Characteristics	Microstructure
<p>It takes much more time to anneal the coil in this process than CAL line. (50 - 80 hrs)</p> <p>Due to uneven heating, this Process can cause more ununiformity of properties than the CAL.</p> <p>Since the annealing time is long, more surface defect (stain, stacking) can be produced than the CAL. But due to large grain size, deep drawing is recommended.</p>	

### Lay-Out of Line



## Tin Mill Black Plate Manufacturing Facilities

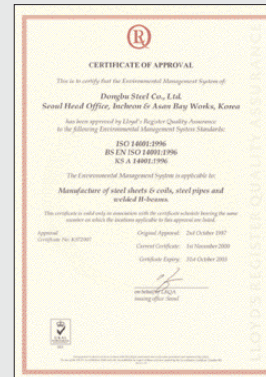
Dongbu Steel's Asan Bay Works is automated cold rolling mill that manufactures Black Plate of outstanding quality.

1. Pickling Line/Tandem Cold rolling Mill (PL-TCM)  
Cutting edge cold rolling machine enables precise thickness control by computerized system
2. Annealing Facilities  
Continuous Annealing Line (CAL)/Batch Annealing Facility (BAF)
3. Double Cold Reduction Mill (DCR)  
As the first established facility in Korea, DCR manufactures ultra-thin-gauge black plate with optimal quality.

## Quality & Environment Management System

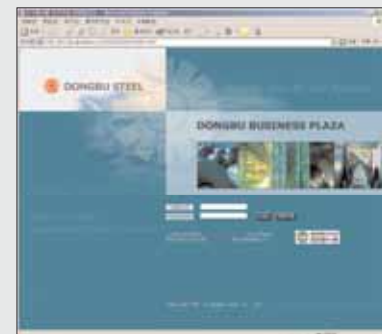
Dongbu Steel is always doing the best not only to supply the highest quality products to customer, but also to preserve clean environment for future.

- Certification for Quality Management System
  - ISO 9001:2000, KS A 9001:2001, QS 9000:1998, IS/TS 16949:1999
- Certification for Environment Management System
  - ISO 14001:1996, KS A 14001:1996, KOSHA2000 program certification,
  - Certification as environment-friendly company granted by the Ministry of Environment.
- Key Testing Facility
  - Mechanical analysis: Hardness Tester, Tensile Tester, Forming Tester
  - Chemical analysis: Coating weight gauge, AES, ICP, ATC, ISV
  - Surface analysis: Scanning Electron Microscopy, Optical Microscopy



## Service

- Dongbu Biz Plaza is a web-based system that connects customers with Dongbu Steel in order to supply faster and more accurate information. Through the web, customers can place order, check progress and make claim. Moreover, Mill sheet and other documents can be issued on the web.
- Dongbu Steel maintains global partnership with numerous companies in the world based on trusted products and services, and continues to make utmost effort to become a reliable partner in the steel industry.



e-Business : [biz.dongbusteel.co.kr](http://biz.dongbusteel.co.kr)





01



02



01 Asan Bay Works | 02 Incheon Works | 03 Pohang Works

## WORLD WIDE NETWORK

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