

A REPORT

ON

Study and Research Analysis on CRSS (Cold Rolled Steel Strips) production.

By

Name of the student

Enrolment/Registration No.

GUNDA VENKATA SAI JAI HARSHA

190169/190C2050003

Prepared in the partial fulfillment of the
Practice School II Course

AT

Pennar Industries Limited

opposite ICRISAT, Sreeram Nagar Colony, Patancheruvu, Telangana -502319

A Practice School II Station of



BML MUNJAL UNIVERSITY

(August 2021)

TITLE OF THE PROJECT

**Study and Research Analysis on CRSS
(Cold Rolled Steel Strips) production.**

TABLE OF CONTENTS

S.NO	CONTENTS	PAGE.NO:
1.	Certificate	4.
2.	Joining Report	5.
3.	Acknowledgment	6.
4.	Objective	6.
5.	A brief introduction of the organization's business sector.	7.
6.	Overview of the organization	8-9
7.	Plan of your internship program	9.
8.	<p style="text-align: center;">Methodology</p> <ul style="list-style-type: none"> ➤ CRSS (Cold Rolled Steel Strips). <ul style="list-style-type: none"> • Process Flow of CRSS. • Product Features. <ol style="list-style-type: none"> 1. Hard Rolling Slitter 2. Semi Continuous Pickling 3. Rolling Mill 4. Annealing 5. Skin Pass Mill 6. Cut to length 7. CR Slitting. 8. Packing 9. Dispatch. ➤ CRFS (C and Z purlin) <ul style="list-style-type: none"> • Process Flow of CRFS. • Product Features. ➤ Fabrication (Railway wagon) ➤ Engineering Components Division. ➤ Pipes (ERW, CDW, APH). <ul style="list-style-type: none"> • Process flow. ➤ PEBS (Pre-Engineering Building Systems). ➤ Solar panels. 	10-28
9.	Conclusion	29
10.	References	29

Certificate



PENNAR INDUSTRIES LIMITED



TO WHOMSOEVER IT MAY CONCERN

August 6, 2021

This is to certify that Mr.Venkata Sai Jai Harsha Gunda, pursuing B.Tech (Mechanical) from BML Munjal University, Gurgaon, Haryana has undergone Internship in Mechanical Maintenance Department from 15th June, 2021 to 24th July, 2021.

We wish him all the success in his future endeavours.

Yours faithfully,
for **PENNAR INDUSTRIES LIMITED**



M.Vijay Kumar
Senior Manager-Human Resources

Manufacture of Cold Rolled Steel Strips & Formed Sections, Sheet Metal Pressed, Fabricated & Machined Components, Precision Electric Resistance Welded Tubes, Cold Drawn electric resistance Welded Tubes, and Fabricated Components & Structures. Design, Development, Manufacture of Hydraulic cylinders

Corporate Office & Works : IDA, Patancheru-502 319, Sangareddy District, Telangana State, INDIA
Tel: +91 8455 242184 to 242193, **Fax:** +91 8455 242424 / 242161, **E-mail:** corporatecommunications@pennarindia.com, **Website:** www.pennarindia.com
Regd. Office: 9th Floor, DHFLVC Silicon Towers, Kondapur, Hyderabad - 500 084.
Tel: +91 40 4006 1621 to 24, **Fax:** +91 40 4006 1618
CIN No: L27109AP1975PLC001919

Joining Report



PENNAR INDUSTRIES LIMITED



May 24, 2021

To,

Mr. Venkata Sai Jai Harsha Gunda
Student pursuing B.Tech (Mechanical)
BML Munjal University,
Gurgaon
HARYANA.

Dear Mr.Venkata Sai Jai Harsha,

This has with reference to your email dated 21st May, 2021 for doing INTERNSHIP in Pennar Industries Limited in Mechanical Maintenance Department.

We are hereby granting permission to undergo the INTERSHIP at our Company's Plant, located at Isnapur, Sangareddy District, Telangana for a period of **6 (six) weeks**, commencing from 15th June, 2021 to 24th July, 2021.

Please acknowledge the copy of this letter as acceptance.

Thanking you,

Yours faithfully,
for **PENNAR INDUSTRIES LIMITED**



M.Vijay Kumar
Senior Manager-Human Resources

Manufacture of Cold Rolled Steel Strips & Formed Sections, Sheet Metal Pressed, Fabricated & Machined Components, Precision Electric Resistance Welded Tubes, Cold Drawn electric resistance Welded Tubes, and Fabricated Components & Structures. Design, Development, Manufacture of Hydraulic cylinders

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CIN No: L27109AP1975PLC001919

Acknowledgment.

There are many persons who may have helped a student during the work carried out by his project. It is one of our duty to acknowledge it and thank them for their help.

- I would like to thank Pennar Industries and Mr. **Nrupender Rao** founder and Chairman and Mr. **Aditya N Rao** Vice Chairman and Managing Director.
- I would like to thank the head of the organization Vice-chancellor and the Dean sir, SOET.
- I would like to thank my friend Dheeraj for providing an internship at Pennar Industries Limited.
- I would like to thank the supporting staff and special thanks to our mentor Dr. Ranbir sir for supporting me.
- I would like to thank HR Mr. Vijay Kumar and Mechanical Maintenance department team.
- I also thank all the other persons who helped me with my project.

Objective

The objective of our project is to study and research the analysis of CRSS Division production. The main thing is knowing about Cold-rolled Steel strips the process of manufacturing and the steps and machines which are used and the process flow of CRSS from raw material to the final dispatch stage. To observe and study each stage and note down about it and understand about it. We will write the process flow of manufacturing and all steps at each stage, and we will write about the capacity of each machine and product and grades are used in it. Through this project, we can gain knowledge of CRSS and the mechanical maintenance department of the company.

A brief introduction of the organization's business sector.

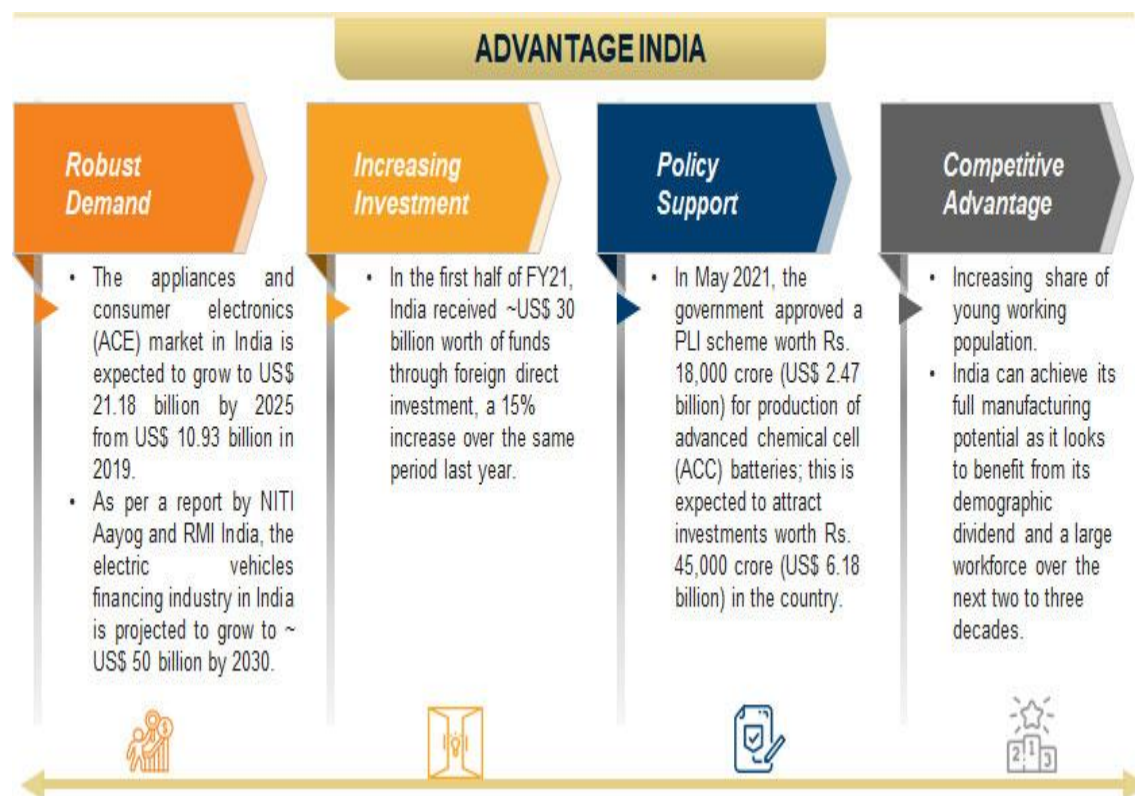
Manufacturing has emerged as one of India's fastest-growing industries. Mr. Narendra Modi, India's Prime Minister, initiated the "Make in India" programme to put India on the map as a manufacturing centre and to give the Indian economy international respect. By 2022, the government wants to create 100 million new employments in the sector.

Market Size

According to the second advanced estimates for FY21, the sector's gross value added (GVA) at current prices was anticipated to be US\$ 348.53 billion. In April 2021, the IHS Market India Manufacturing Purchasing Managers Index (PMI) increased to 55.5 from 55.4 in March. Manufacturing GVA accounts for 19% of real gross value added in the country.

Capacity utilisation in India's manufacturing sector was 66.6 percent in the third quarter of FY21, according to the latest study.

Between April 2020 and March 2021, the manufacturing component of the IIP was 116.9. India's industrial production, as measured by the Index of Industrial Production (IIP), was 143.4 in March 2021, according to the Ministry of Statistics and Programme Implementation.



Overview of the organization.

Pennar Industries Limited is one of the leading engineering organizations in India well known for its expertise in providing engineered products & services. An epitome of quality, precision, and perfection, Pennar is driven by an unrelenting desire to excel with experience spanning over three decades.

Quest for engineering excellence began in 1988, Pennar is headed by Mr. Nrupender Rao (Chairman), Mr. Aditya Rao (Vice Chairman and Managing Director) and is managed by experienced professionals. Being one of the leading engineering companies, our business philosophy strives on capital efficiency and accelerated growth. This serves as a key differentiator and consciously adds value to all our processes and stakeholders with a strategic decision to establish our first manufacturing plant at Isnapur, near Hyderabad with an installed capacity of 30,000 MTPA to manufacture Cold Rolled Steel Strips (CRSS). Our decision catapulted us from a start-up to a profitable organization in the very first year of our operations. The company was growing at a rapid pace and thus to incorporate its expansion and demand, Pennar increased its manufacturing capacity to 50,000 MTPA in the year 1997.

Today, with an annual production capacity of more than 350,000 MTPA, it is a multi-location, multi-product company manufacturing precision engineering products such as: Cold Rolled Steel Strips, Precision Tubes, Railway wagons / Coaches, Pre-Engineered Building Systems, Sheet Metal Components, Road Safety Systems, etc. Recently we have also added **Hydraulics** and **Warehousing** solutions as two new products in our portfolio. Our company's products have a significant presence in sectors like Infrastructure, Automobiles, Power, General Engineering, Building & Construction among others. Pennar is offering solutions for various types of Storage systems.

Pennar Industries has a pan-India presence with six manufacturing facilities situated across the country. These facilities include laser cutting, plasma cutting, transfer presses and CNC machines that enable it to make products of very high quality. All the plants are ISO certified. Pennar Industries endeavours to achieve 'total customer satisfaction through total quality management' and is committed to produce and provide steel-based products and associated services of the highest quality to customers all over the world.

Pennar has set up its two subsidiaries, Pennar Engineered Building Systems (PEBS) and Pennar Enviro Limited (PEL). In addition, it has established an engineering services and solutions business unit, Tech Pennar.

TOTAL NET INCOME: RS. 21,268 MILLION
PROFIT AFTER TAX: RS. 534 MILLION
CUSTOMERS: 500
EMPLOYEES: 2000

PRODUCTS MANUFACTURED/SERVICES

SYSTEMS AND PROJECTS

- Solar module mounting solutions
- Railways
- Storage solutions

INDUSTRIAL COMPONENTS

- Hydraulic cylinders
- Auto components
- White goods components

SHEET PRODUCTS AND PROFILES

- Cold rolled steel strips
- ESP electrodes
- Building components
- Metal crash barrier
- Sheet piles
- Automobile products

PRECISION TUBES

- ERW tubes
- CDW/DOM/CEW tubes
- APH & IBR

Plan of your internship program.

I have done my internship at Pennar Industries Limited in patanchervu branch. I have done in Mechanical maintenance department of CRSS Production and other products.

It is a 6weeks internship I have started my internship on 14 June 2021 and ended on 24 July 2021.

Timings: - 9:00AM – 4:00PM

- I have Visited 3weeks for CRSS and I have known about the process flow from raw materials till end dispatch studied CRSS production.
- 1 week for CRFS, Engineering Component Division, and Fabrication just we have seen Process Flow Manufacturing.
- 1 week for pipes (ERW, CDW, APH) just we have seen the Process Flow manufacturing.
- 1 week for Pre-Engineering Building systems (PEBS) and Solar panels just we have seen the process flow manufacturing.

I have done in Mechanical maintenance Department for all the different product to understand the process line of production and analysis on it. Knowing about different machines and their performance and the capacity of the machine how the production will happen observed and analyzed on the different products.

Methodology

We are going to explain the complete process involved in CRSS (Cold Rolled steel Slitter). Which includes the production and analysis CRSS of each stage. From raw material to end dispatch of CRSS.

And other CRFS, Engineering Component Division and Fabrication, pipes (ERW, CDW, APH), Pre-Engineering Building systems (PEBS), and Solar panels process flow.

Introduction of CRSS.

The Main process is like we get large hot rolled steel coils from the steel plant, and these steel coils are converted into cold-rolled steel strips by various stages, and it was done stepwise. The main raw material is cold-rolled steel.

The CRSS division at Patancheru & Isnapur combined annual production capacity of 120,000 MT.

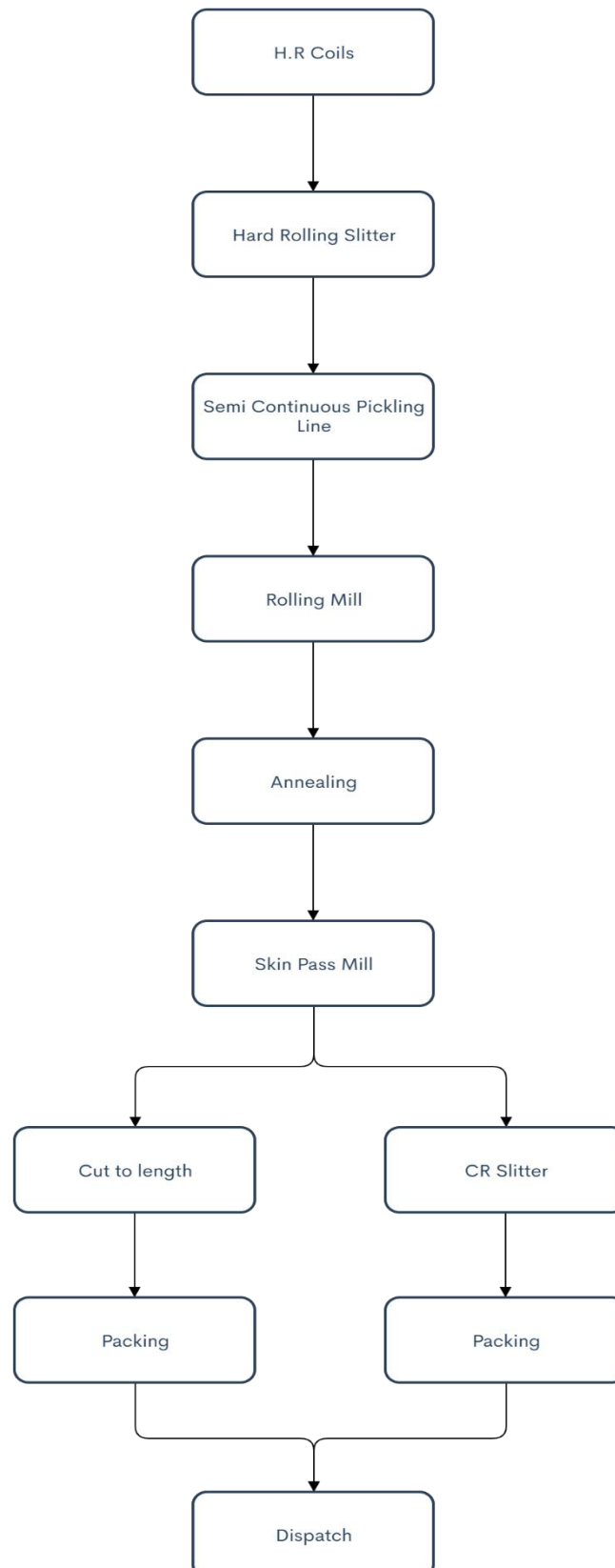
Process Flow of CRSS

- Select the component (Raw material).
- Collect the data such as specifications of the component, customer, number, customer requirement, which stages are required by the customer, List of operation performed.
- At each stage the quality will be checked and conduct test and then the process will continue with other machines according to customer requirement.
- This is the whole process of CRSS.

HR Rolls (Raw material).

1. HRS (Hard Rolling Slitter).
2. Semi Continuous Pickling.
3. Rolling Mill.
4. Annealing.
5. Skin pass Mill
6. Cut to length.
7. CR Slitter.
8. Packing.
9. Dispatch.

Process Flow



Product Features

Product range: Width :18 - 720 mm

Thickness : 0.25 -4.5 mm

Coil Weight Coil ID :3-7 kg per mm of strip width

Coil ID: 400/500 mm

Cut-to-length: 500 - 4000 mm

Grades : D/DD/EDD/S1-42/St-52/MC 11/MC 12/55C6/FH/HH/QH /C80/C30/HD/HREDD/FE330/FE410/SAPH440 etc., and semi-killed for laminations and enamelling quality grades conforming to domestic and international standards. : Two wheelers (Rear fender, Muffler body, Fuel tank, Mudguard, Front frame)

Applications

Four-wheelers (Assembly bumper, Cross member, Front panel, Support panel, Pail roof side)
Refrigerators/Air-conditioners (Door and Side panels, Compressor shells and other accessories)
Bearings (Cages, Bimetal used for Housings) General Engineering (Electrical Laminations, Oil filters, Containers, Gear cases, Cycle rims, Connectors)

HR Rolls

Hot rolled rolls are sent by steel plants example Vishakhapatnam Steel plant, Tata Steel, Jindal Steel plant, etc these rolls are converted into cold-rolled steel according to the customer requirement.

The hot-rolled rolls are tested by the quality department. They will check the dimensions of the coil, chemical properties by the tests, the microstructure of the small piece from the coil by using an industrial microscope, they will check the mechanical properties of the coil by some tests, edge conditions are checked in the coil, and they will gather the requirements of the customer according to the production planning will plan and sent to the next step and the quality is checked after each stage.



1. Hard Rolling Slitter

Hard rolling Slitting Machine is mainly used for slitting of Stainless-Steel Strips. The machine can handle up to 10mm of the sheet. The process is cutting of hot-rolled strip into small certain size according to the customer requirement. The slitter is adjusted according to the requirement of the size of the small rolls on the cutter stand.

The main equipment of hard rolling slitting machine is un-coiler, coil lifting trolley, Pinch roll unit, levelling unit, slitting stand, scrap winder units, tension roll unit, re-coiler, overarm separator, coil pusher, unloader, etc.

- The Big roll is fixed at one end with the adjustable jaws at the un-coiler after fixing the roll to the un-coiler the coil starts uncoiling the coil is lifted by the trolley slowly and sends through the pinch roll it makes the coil towards a forward direction.
- The next step is levelling the coil enters the leveller some pressure is applied so that the sheet will be straight without any bends now the sheet is levelled, the next step is guider we can check the thickness of the sheet by the measuring instrument called guider.
- Now the slitting stand the cutting tool is adjustable according to the customer measurements. The big coil is cut into the small coil sheet. The mechanism is like a scissors-type with two jaws on the upper side and one jaw on the lower side. The big coil is cut into 2,3,5 or many more according to the customer.
- The next step is Scrap winder unit where the sheet metal waste material is collected while cutting (It is like small strips) next is tension roll to maintain the sheet tension while moving and then final step it rolls to the Coiler at a certain speed the roll coils so that no gaps are formed and form into a proper roll. This is the entire process of HRS.

The quality department will check the process is done perfectly or not and check the final product at this stage.



2. Semi Continuous Pickling

The next process after HRS is semi-continuous pickling it is mainly to reduce the oxidation layer by layer to prevent rusting. The process is to make the sheet without any oxides layer rust layer on it.

The main equipment of the SCP are un-coiler, pinch roll unit, leveller unit, 3 acid tanks with different concentrations of acid, 3 water tanks with different PH value, hot air tanks, rubber plates, pinch roll then coiler, etc.

- The small roll is fixed at one end to the un-coiler, then the coil uncoils slowly at start moving into the pinch roll and makes the coil towards the forward direction.
- The next step is levelling the coil enters the leveller some pressure is applied so that the sheet will be straight without any bends now the sheet is levelled, the next step is sending the roll into the 3-acid tank one by one with different HCL concentrations

Tank-1: (4 % - 9 %)

Tank-2: (18 % - 19 %)

Tank-3: (25 % - 26 %)

The temperature is maintained at 65degrees- 75 degrees in all the tanks and the rubber plates are used to remove acid from the surface of the sheet rubber plates are arranged top and bottom of the sheet.

- After removing the acid, it is sent to the 3 RO water tanks with different Ph values so that the acidic nature of the sheet is slowly converted into normal.

Tank- 6.8 PH

Tank-2: 7 PH

Tank-3: 7.1 PH

The temperature is maintained at 65degrees- 75 degrees in all the tanks.

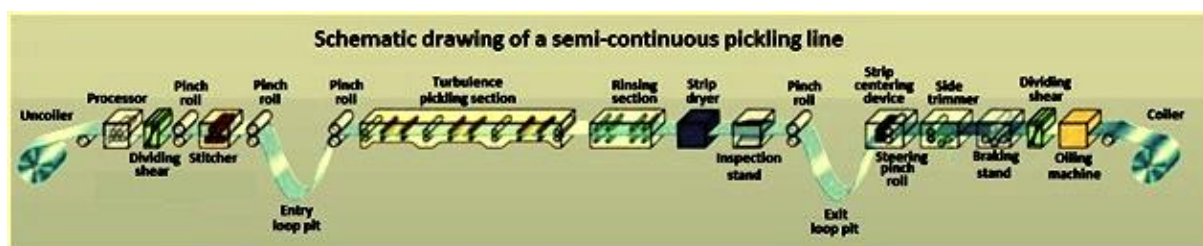
- Next, it sends to the hot air tanks which remove the moisture on the sheet and remove the liquid on the sheet.

The hot air comes from the boiler. A horizontal tube type vertical water type boiler is used, and the coal is used to produce heat in the boiler and to form steam without moisture.

Thermax company working pressure – 6.5kg/cm³ Capacity – 3T/hr

- Then again it passes through the leveller and then rolls to the coiler with a certain speed the roll coils so that no gaps are formed and form a proper roll and with a certain speed, all steps are done perfectly. This is the entire process of SCP.

The Quality department will check the process is done perfectly or not the check the coil whether the rust is removed, and oxides are removed.



3. Rolling Mill

The next process after semi-continuous pickling is the Rolling mill, it is a manual method. Mainly to reduce the thickness of the metal sheet, the rolling process is mainly to increase length and decrease thickness without change of the width of the sheet. This is about rolling mill.

The main equipment of the Rolling mill are un-coiler, leveller, rolling, pack of rolls, leveller, coiler, etc., the Four High Rolling Mill is used here.

- The small roll is fixed at one end to the un-coiler, then the coil uncoils slowly at start moving into the leveller, and then the process starts.
- The process in which metal coil is passed through the pack of rolls to reduce the thickness and coolant is used to decrease the temperature and make uniform thickness, Guide rolls are fixed at the corners according to the sheet not to increase the width the length of the roll increases by doing this.
- Coolant is a mixture of water and oil is used in the mill to decrease the temperature. Then the width is decreased we must decrease according to the customer requirement and the rolling is done 2,3 more times according to the customer measurements.
- Again, to the leveller and the coil rolls at the coiler. It is also a Reversible process.

There are 2 types of a pack of rolls

1) 0.06mm roll 2) 0.10mm roll these rolls are called work rolls. The rolls are changed according to the hardness of the metal the

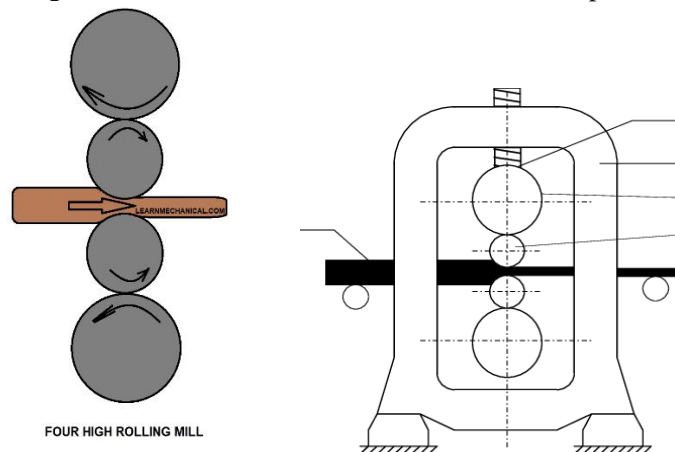
1) roll decreases up to 2mm-1.4mm

2) roll decreases up to 1.3mm-1.2mm.

E.g.:- The customer requirement is 4.8mm to 2.8mm we have to decrease the 2mm thickness so according to the hardness the roll is fixed, and the process is started, and it takes 3-4 passes to decrease the thickness. The work rolls are changed once a month and make the smooth surface with the help of a grinder and coolant is used in the grinder for smoothness.

In the rolling mill the radiator is used to find the thickness of the sheet it works like a radiator radiates the waves and a magnet is fixed at the bottom and by waves, the thickness is measured. This is about the Rolling Mill.

The Quality department will check the process is done perfectly or not the check the coil and measure the thickness and check the grain structures of the coil under the microscope.



4. Annealing.

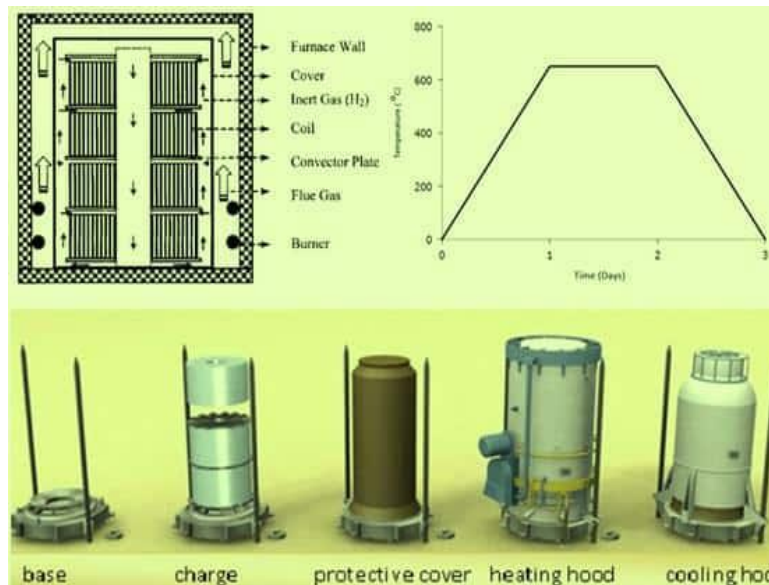
The next process after rolling mill is Annealing, it is mainly focused on changing the Physical properties and sometimes chemical properties changes, to increase ductility and decrease the hardness of the coil. This is done to prevent surface rusting resulting from oxidation. This is Annealing.

The main equipment of the Annealing base, charge, protective cover, heating bells, cooling hood, H₂, N₂ are used for heating diesel is used.

- The rolls are kept in the base of the bells, in a bell 4-5 coils are fitted according to the size of the rolls and the bell is arranged on it and the atmosphere consisting of N₂ & H₂ gas composition in the bell and the heating starts goes up to 660 degree C. It is a long process and heated slowly according to customer requirement it takes some hr of time to heat and the heat is produced by burning diesel.
- This is the record of the Annealing process at each 2hrs.
- After reaching 660 degrees they keep constant and start cooling slowly depend on customer requirement the cooling is done by cooling fan. The coils are removed.

The annealing is done under a protective to prevent surface oxidation to cold-rolled steel. The protective gas atmosphere consists of N₂ gas, H₂ gas, or a mixture of gases in various ratios. Annealing makes the Steel rolls more ductile and decreases the hardness to be more compatible and mechanical properties are changed, sometimes chemical properties are also changed. This is about Annealing Process.





The Quality department will check the process is done perfectly or not the check the coil and check the grain structures of the coil and check ductile and hardness of the coils.

5. Skin Pass Mill

The next process after Annealing is skin pass mill, Skin-pass rolling is the final step of the CRSS in the production of cold-rolled steel sheet. In this process the mechanical properties, the surface roughness, and other properties are according to customer requirements by rolling.

The main equipment of the Skin pass Mill is un-coiler, leveller, cutter, leveller, coiler, etc.

- The small roll is fixed at one end to the un-coiler, then the coil uncoils slowly at start moving into the leveller, and then the process starts.
- The coil passes through between 2 work rolls and an oil-type coolant is applied to the coil sheet to increase surface texture.
- The coil passes through the cutter it cuts the end of the coil to be a perfect end without any different shape.
- The coil again passes through the leveller and then coils at the coiler. This is about skin pass mill.

The main Benefits of the Skin pass Mill are

- ❖ It increases the strip elongation tolerance.
- ❖ Flatness
- ❖ High surface Quality
- ❖ Increase product yield strength.
- ❖ Smooth Finish, texture.



The Quality department will check the process is done perfectly or not the check the coil ductile and hardness, tolerance , yield strength of the coils.

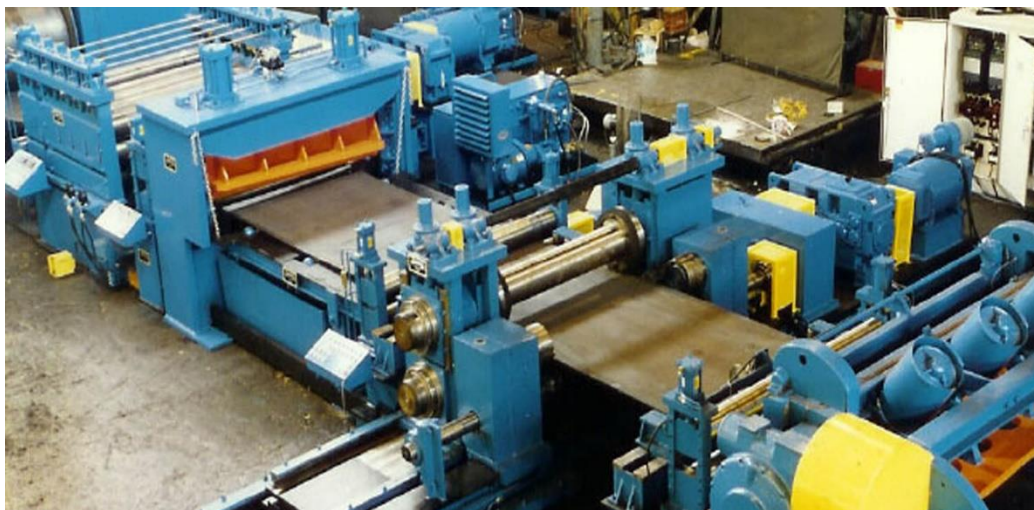
6. Cut to length

The next process after the skin pass mill is cut to length, is mainly focused on uncoiling sheet of flat-rolled metallic steel and cut into flat square blanks. The Cut to the length of the sheet depends on the customer requirement between the range of 400-500mm in the tolerance of $\pm 0.5\text{mm}$.

The main equipment of the Skin pass Mill is un-coiler, leveller, Cutter, final.

- The small roll is fixed at one end to the un-coiler, then the coil uncoils slowly at start moving into the leveller and then the sheet passes through the cutter and cut them into flat rectangular blanks of the desired length. The cut to length sheets is normally flat.

Cut to length is completed the rectangular sheet is sent to the packing.



7.CR Slitting.

The next process after the skin pass mill is Cold Rolled Slitting, it is mainly focused on the coil to get the perfect dimensions and cut the extra part and remove it, and again coiled.

The main equipment of cold rolling slitting machines is un-coiler, levelling unit, slitting stand, scrap winder units, leveler, re-coiler, overarm separator, coil pusher, unloader, etc.

- The small roll is fixed at one end to the un-coiler, then the coil uncoils slowly at start moving into the leveller.
- The roll is passing through the slitting stand it cuts the extra length at the corners and gets perfect dimensions of the coil and the extra part is wound at scrap winder unit.
- The coil passes through the leveller and again recoils at the coiler the product is finished and sent to the packing.

Quality will check all the requirements of the customer and check all the parameters of the coils and gives the final report of the product.

8) Packing

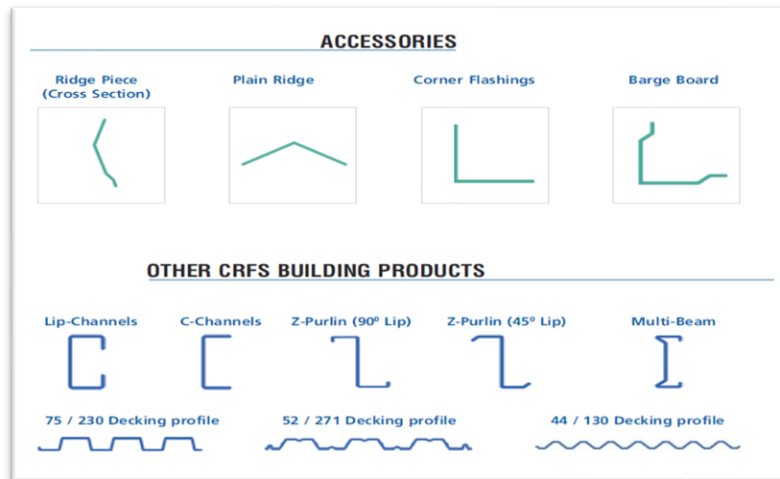
9) Dispatch

- The next process after Cold Rolled Slitting, cut to length is packing.
- The final product of cold-rolled is packed with cloth or sheet depends on the customer requirement and dispatch of material is after completion of packing.
- Polythene and gunny for coils.
- Poly craft and wooden/steel pallets for sheets.
- After packing the product will dispatch to the customer company.



CRFS (Cold Rolled Forming Sections).

Cold Roll Formed Sections (CRFS) Division produces Building Products (Purlins, roofing sheets, decking sheets), Special Sections & Panels for the Automobile Industry, long profiled steel sheets such as Collecting and Discharge Electrodes for ESPs, Stringer channels, deck sheets for the Material Handling Industry, Trough floor & other sections for Railway Wagons and Coaches.

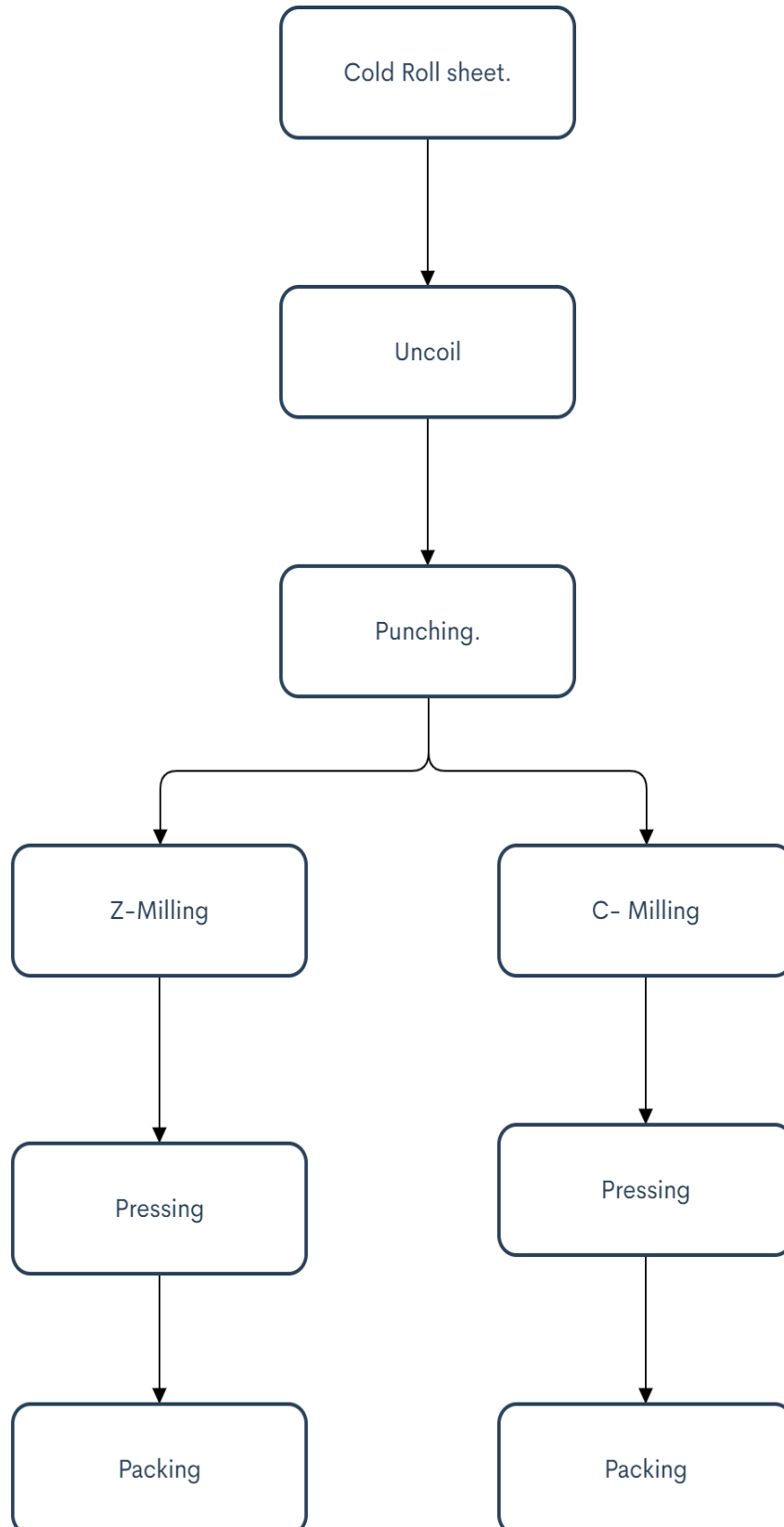


- The small roll is fixed at one end to the un-coiler, then the coil uncoils slowly at start moving into the leveller and then the process starts.
- The coil sheet enters in the punching machine make holes which are required according to the design and after this sent it to the Z or C milling according to the customer.
- Then the sheet is pressed in between the gates and form the shape. Then send to the packing and dispatch.

Product Features

Thickness	1.5 - 8.0 mm
Length	Up to 10,000 mm
Yield Strength	240 - 350 Mpa
Material	CR Steel/ HR Steel/ Galvanized Steel
Type	Bare/ RO primer Coated/ Pre-Galvanized/ Hot Dip Galvanized

Process Flow of CRFS



Fabrication

Pennar custom designed cold roll formed profiles find application in the production of railway carriages due to its higher strength to weight ratio, which are an alternative / substitute for non-uniform in thickness hot rolled sections.

- Pennar provides stainless steel Trough Floor and Sole Bar for Rail Coach under Frame, typically in larger lengths (9 metres and higher). Front Part, End Part, Bogie Bolster, Head Stock, Lower Spring Beam, and Trough Assemblies are just a few of the heavy manufactured products available.
- For typical coaches (Side / Roof Assemblies), Pennar also manufactures Cant Rail Assemblies, Side Wall Assemblies, and Stainless-Steel Body Pillar (in single piece construction). • Stainless Steel Fabrication of Side Walls, End Walls, and Roof Assemblies for LHB Coaches has also been created, with supplies fabricated to customer specifications.

Pennar manufactures the following products for all types of coaches i.e., conventional / EMU / MRVC / LHB and Metro coaches:

Under Frame assembly

- Longitudinal Beam
- Stainless Steel Trough Floor

Sheets

- Bogie Bolster Body Frame
- Head Stock
- Modular Frame
- Lower Spring Beam

Side Wall assembly

- Body Pillar
- Door Corner Sheet
- Light Rails / Waist Rails

Roof

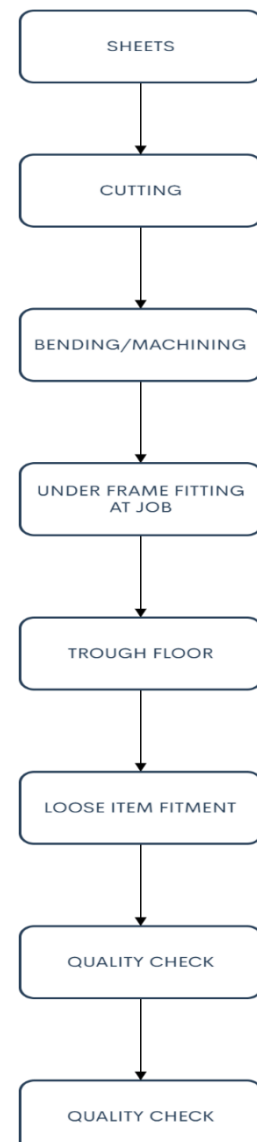
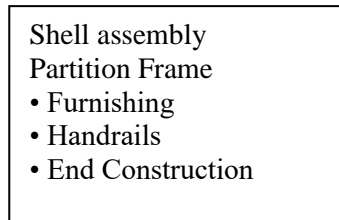
- Cant Rail Assembly
- U-Stiffener
- Trough for Roof-Mounted A/c

LHB COACHES (Stainless Steel)

- Side Wall Assembly
- Roof Assembly
- End Wall Construction
- Metro Coaches
- Cant Rail
- Sill Side
- Roof Panel
- Keystone

•

Process Flow



Engineering Components Division.

In patanchervu plant the disc brakes of the bikes and compressors are manufactured.

- The Cold rolled or other coil roll is fixed at un-coiler and coil goes into the exit poll pit to become free and the coil enters the machine(Servo Zig Zag Straightening feeder).
- The coil enters the pressing machine where the coils cuts in the round shape according to the customer requirement the disc brake plate and compressor plate made here.

Disc Brake

- The round plate is taken according to design and customer requirement the cuts are made with the hydraulic press.
- After cuts the plate is send to the punching hydraulic press to make the holes on it and then the part is completed and to the packing.

Compressor

- The round plate is taken according to design and customer requirement the plate is pressed in the hydraulic press to get the shape. And oil is used not to stick the plate in the machine.
- Then the compressor shape is sent to the cutter to cut the extra corner piece.
- After that it is sent to punching and make holes according to the requirement and then sent to the packing.

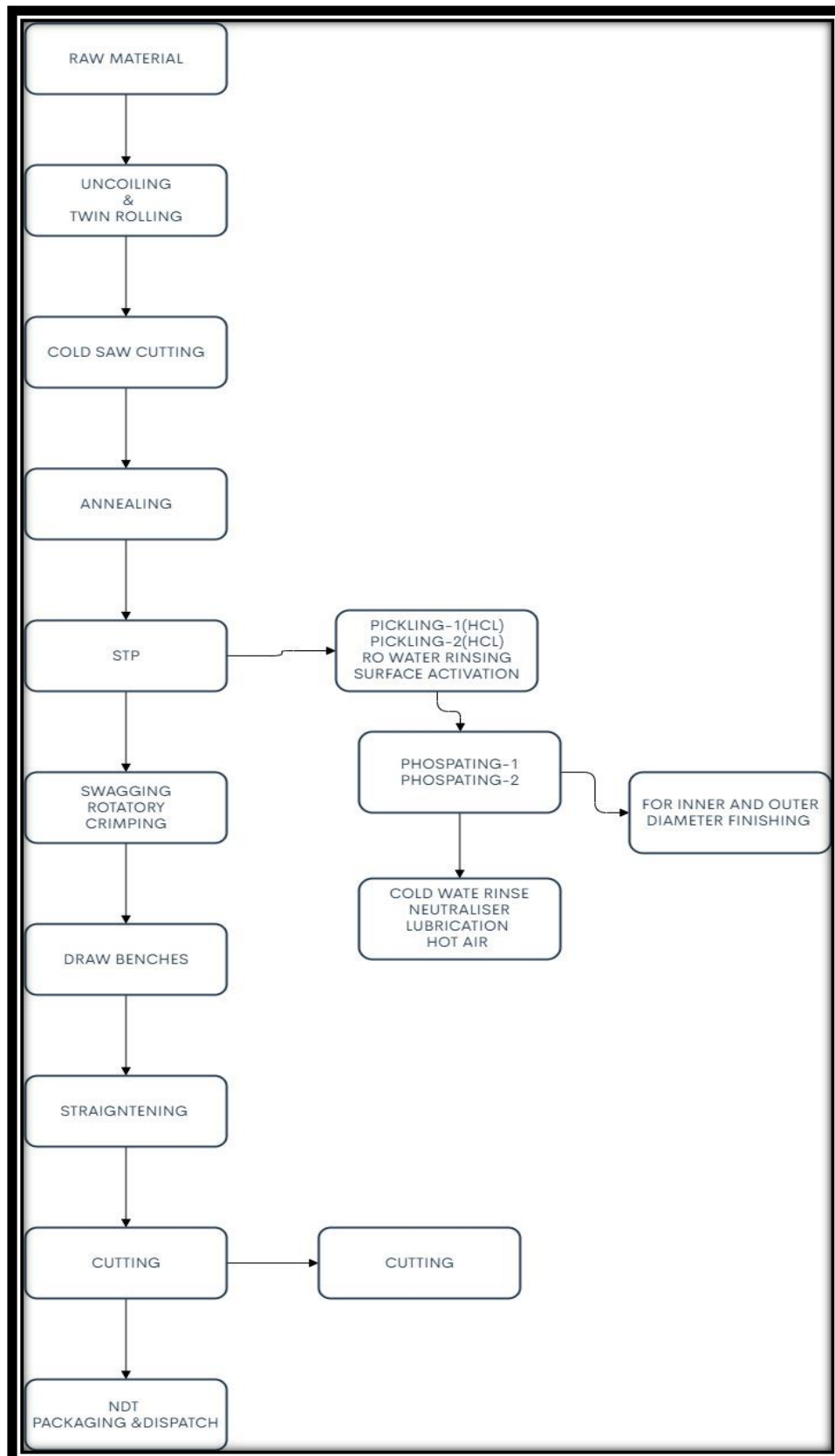


Pipes (ERW, CDW, APH).

The standard products include:

- Electric Resistance Welded tubes.
- Cold Drawn Welded tubes.
- Air Pre-heater tubes.

Process Flow



PROCESS LINE:

1. Raw material
2. Uncoiling & Coil Slitting
3. Twin Rolling
4. Cold Saw Cutting
5. Annealing
6. STP
7. Swagging, Rotatory & Crimping
8. Draw Benches
9. Straightening
10. Cutting
11. NDT & Dispatch.

1. RAW MATERIAL:

CRSS coils are the raw materials and the CRSS department has been made the coil according to customer requirement. Quality department will check the product done at each stage for a better final product.

2. UNCOLING & Coil Slitting

The coil roll is fixed at un-coiler, the un-coiler the coil starts uncoiling the coil and send through the pinch roll this makes the coil move in forward direction.

3. Twin Rolling

In this process the uncoiled sheet is passed through a set of rollers placed side by side with a continuous rotatory motion and pressure the sheet is rolled in the form of tubes.

- In this process the rolled tubes are sent through welding machine which makes a weld in the pipes from the inside not visible outside. To reduce the heat a coolant is applied to the pipes This weld is also known as ELECTRIC RESISTANCE WELDING.

4. Cold Saw Cutting

The welded tubes are sent through the cold saw which cuts the tubes according to the given lengths from the customer. It is automated system.

5. Annealing

Annealing is mainly to change the Physical properties and sometimes chemical properties changes, to increase ductility and decrease the hardness of the tubes. This is done to prevent surface rusting resulting from oxidation.

6. STP (SURFACE TREATMENT PROCESS):

A surface treatment is a process which applied to the surface of a material to be more resistant to corrosion.

1. In this treatment the tubes are dipped in different types of chemicals.

2. A huge crane mover dips the tubes according to batches. Each batch is dipped in the tank for 10 minutes minimum.
3. These are the chemical dipping's:
 - HCL -1,2
 - RO WATER RINSING
 - GALVANISATION
 - PHOSPHATING-1 , 2
 - COLD WATER RINSING
 - NEUTRALISER
 - LUBRICATION (IF NEEDED).
 - HOT AIR BLOWING.

6.SWAGGING, CRIMPING & PUSH POINTING:

SWAGGING: In this process tubes of less diameter are swagged and rotated in such a way to make a grip in the starting point of the tube.

CRIMPING: More diameter and medium thickness tubes are crimped in this process

PUSHPOINTING: More diameter and more thickness tubes are push pointed in this process.

7.DRAW BENCHES:

A draw bench is used to do cold work on a metal, to change the shape of the metal without any apply of heat and apply only pressure.

8.STRAIGHTENING

In this process the tubes are made straight using zigzag rollers which are placed adjacently in order.

9.CUT TO LENGTH

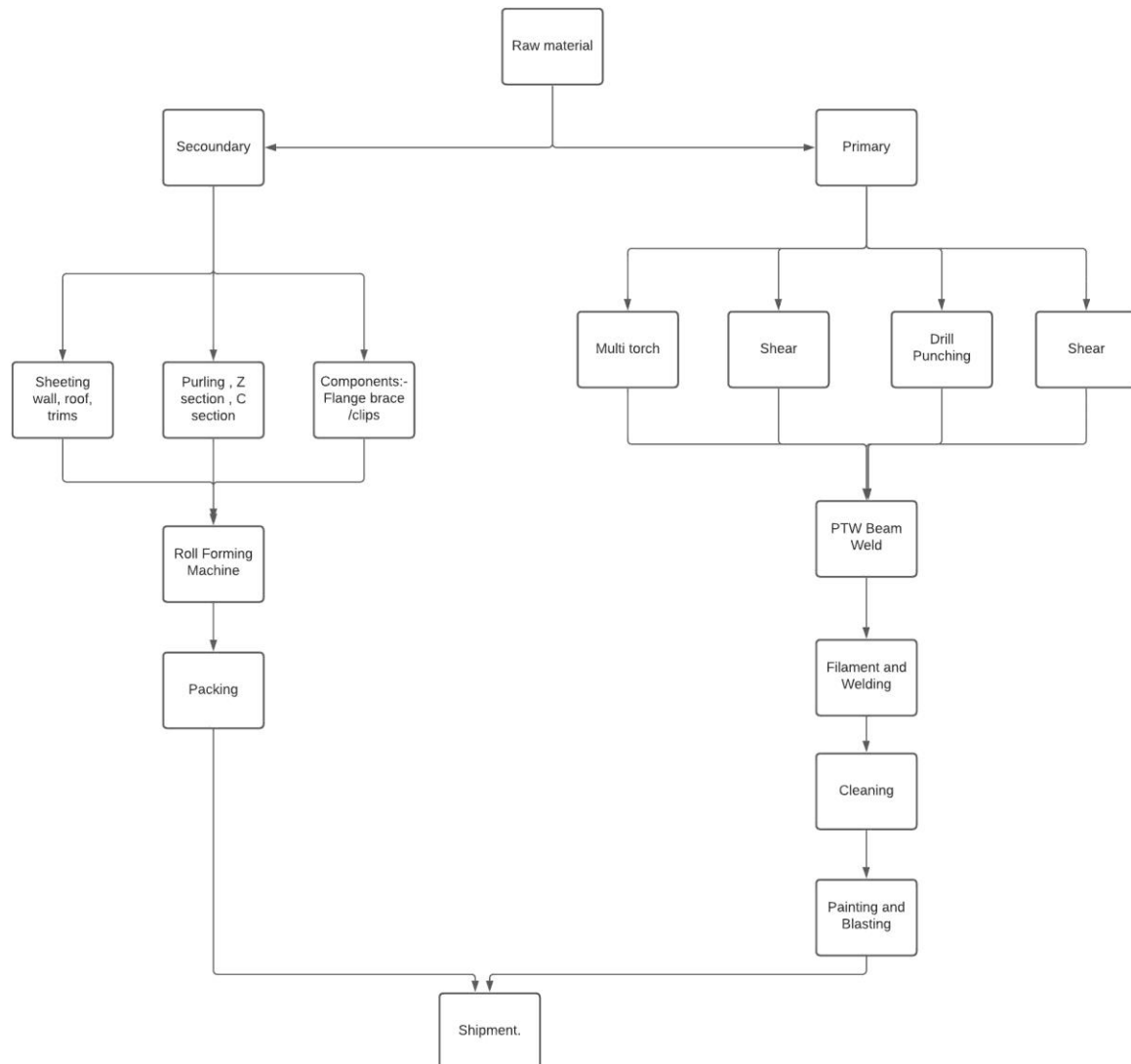
Tubes after straightening straightly goes onto cutting section where the pointed ends are removed and finished and send to next NDT test

10.NDT & PACKAGING

In this process the tubes are passed through set off rollers where the sensors detect minute holes, or any other deep scratches found it paints the affected area and send the tubes to re manufacturing. The selected tubes are sent to packaging department by marking the company logo and packed in boxes of wood and sent them directly to dispatch.

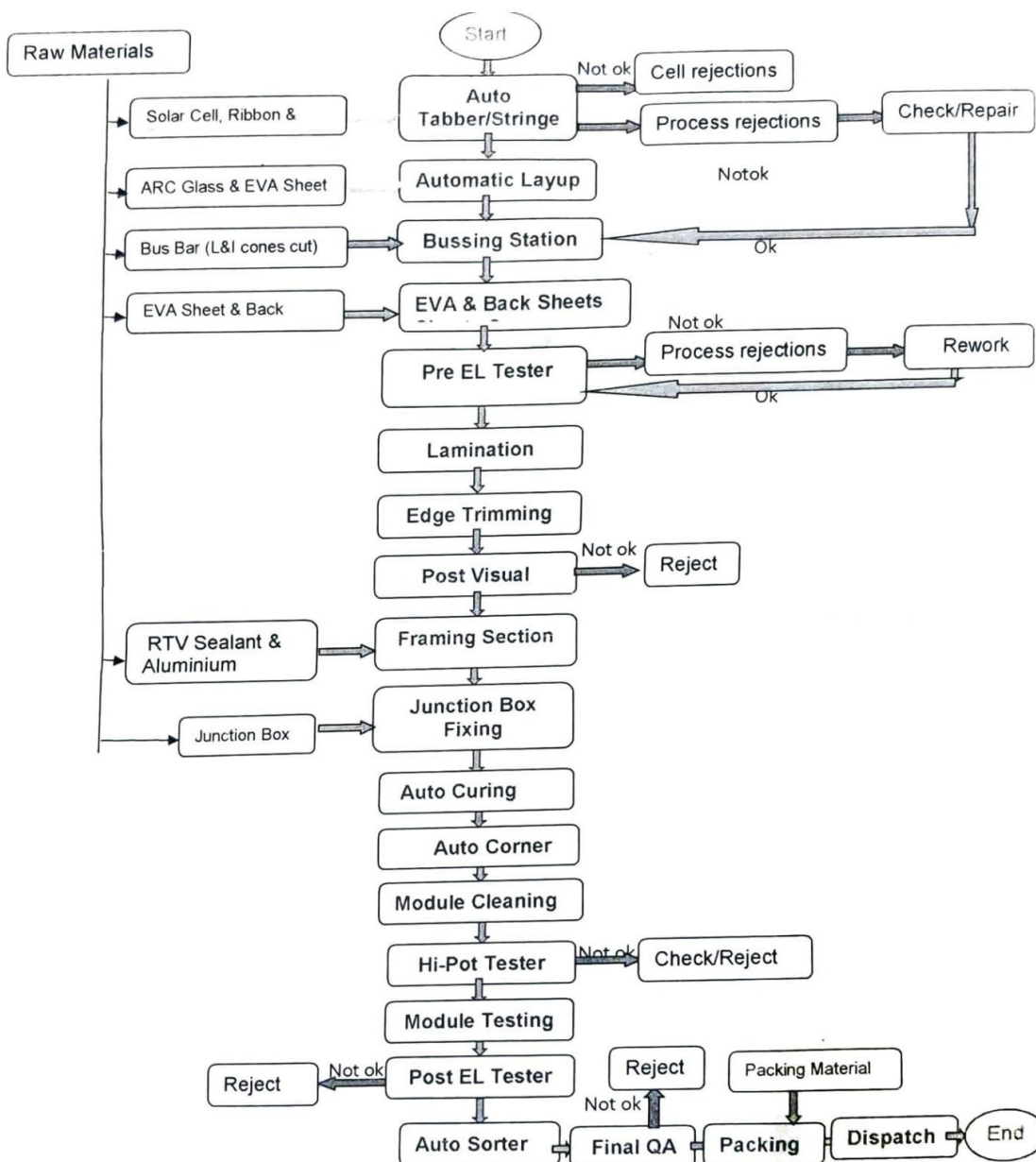
PEBS (Pre-Engineering Building Systems).

Process Flow



Solar panels.

Solar PV models assemble.



Conclusion

I conclude that I have seen and learned about different types of the products and my focus on the CRSS production, and the steps and the process involved in it and learned about it. Remaining I have seen the process and the different steps involved it. This all made me the practical industrial experience.

References

- 1) <https://www.pennarindia.com/>
- 2) Photos from Google.com