WS METAL

ERW/API PIPE MILL

WOOSUNG METAL CO., LTD

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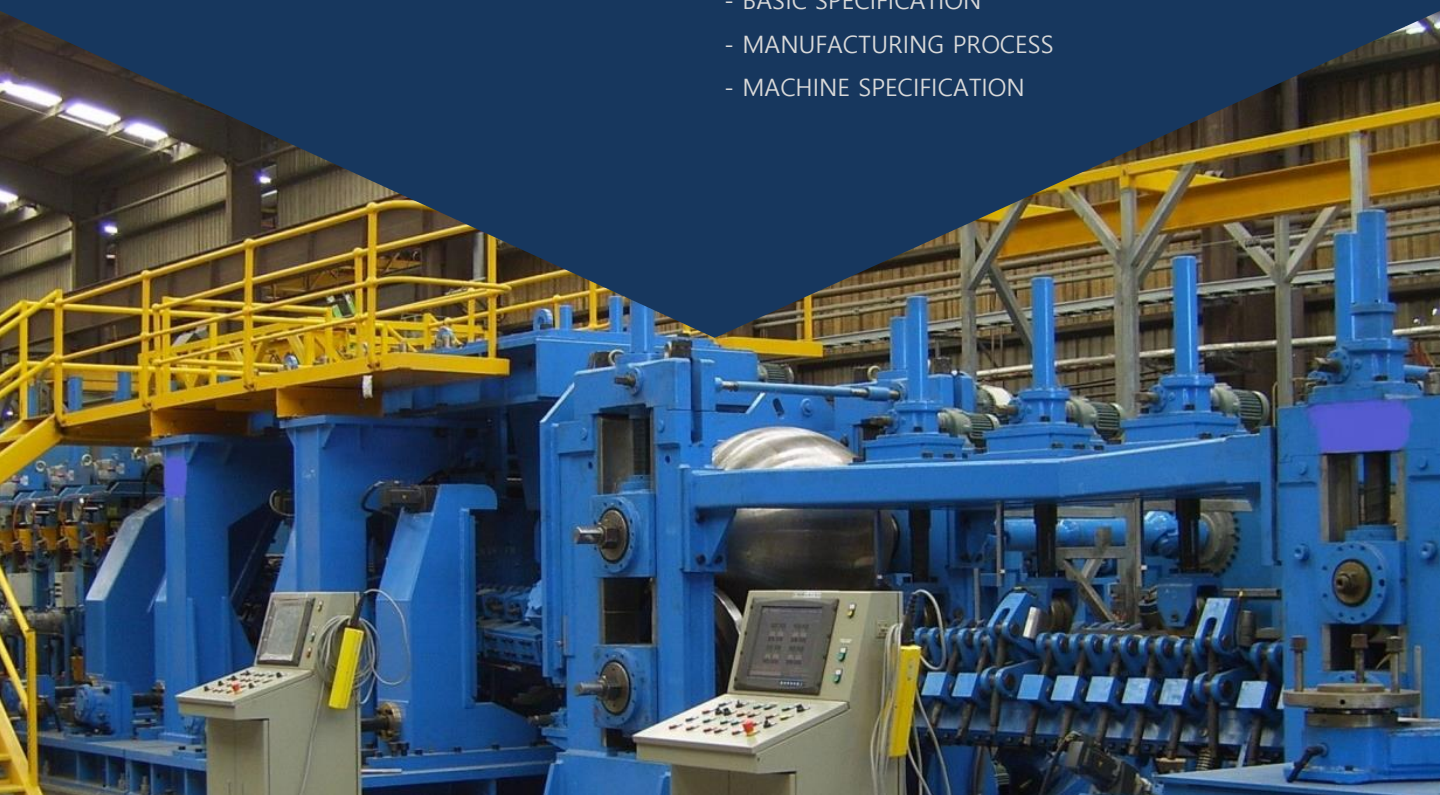


TUBE MILL OVERVIEW

This Tube Mill Line equipment by using high frequency induction heating apparatus continuously welded ERW for PIPE.

Automatic welding and cutting is that after forming a continuous longitudinal slitting the strip to the desired standard equipment.

Tube Mill Line basic component of the facility are entry section, forming section, welding section, seam heat treatment section and sizing & cut off section.

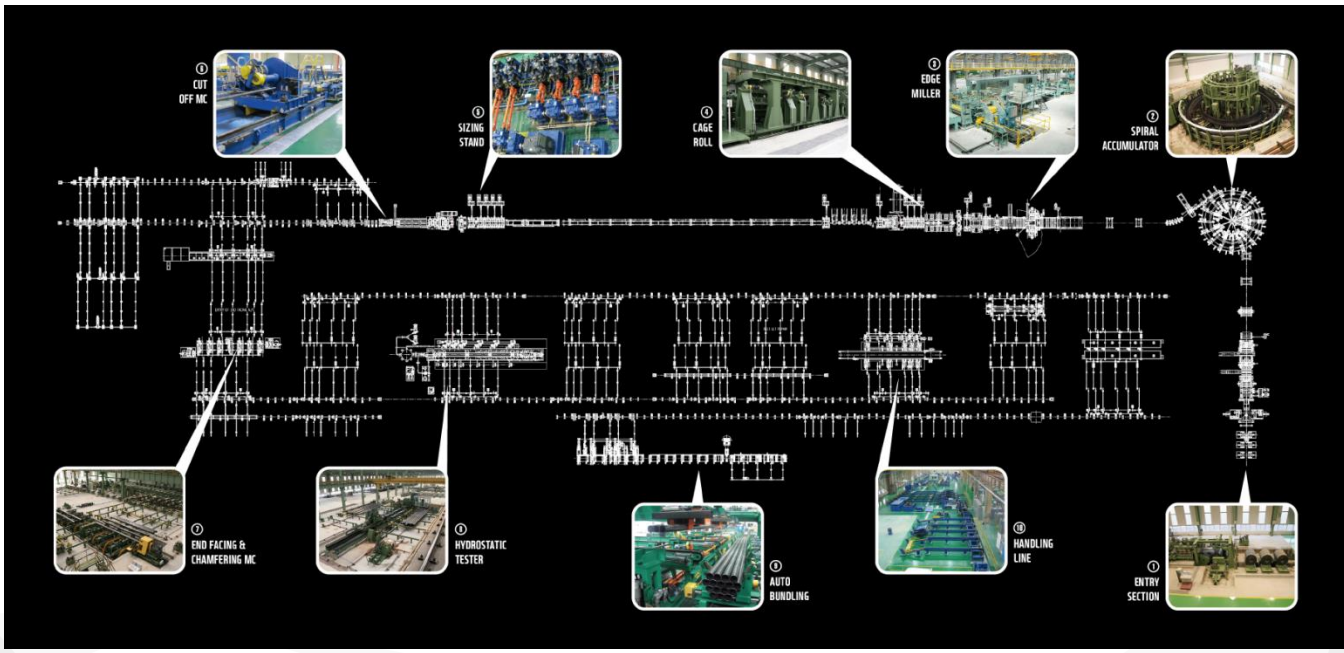
The machinery and manufacturing process described herein incorporates the latest technology to ensure the highest quality of pipe and productivity based on actual experience in pipe production as well as machine supply worldwide.

BASIC SPECIFICATION

Pipe standard : KS. BS. JIS. DIN. ASTM. API

Pipe size(inch)	Tubeout DIA (mm)	THICKNESS (mm)
2	Ø 17.3 - 50.8	0.8 - 3.2
2	Ø 21.7 - 60.5	0.8 - 3.6
2 1/2	Ø 25.4 - 76.3	1.0 - 4.5
3	Ø 34 - 89.1	1.0 - 4.5
4	Ø 34 - 114.3	1.6 - 6.5
6	Ø 60.5 - 168.3	2.0 - 11.0
8	Ø 89.1 - 219.1	3.2 - 12.7
12	Ø 114.3 - 323.9	4.8 - 12.7
16	Ø 168.3 - 406.4	4.8 - 16.0
20	Ø 168.3 - 508.0	5.6 - 16.0
24	Ø 219.1 - 610.0	6.0 - 19.0

MANUFACTURING PROCESS



Description of Manufacturing Process

Entry Section

Entry section starts from coil ramp to accumulator. Raw material, hot rolled coil, is delivered to Coil Ramp from coil storage area for loading preparation to Uncoiler.
This coil is delivered by overhead cranes one by one.

This coil is delivered to the center of Uncoiler on Coil Car which is operated by AC geared motor on the rail. The coil car has height centering system for adjustment of coil height center to load the coil onto Uncoiler easily. This height centering system shall be operated by PLC automatically.

Hold down roll operated by hydraulic cylinders holds and rotates the coil for cutting the strap band by peeler. The pressure roll press the leading end of strip to make it flatten to feed the strip into pinch roll easily. Before that, Coil Peeler cuts the strap band and guides the strip goes into the pinch rolls.

The strip passes the pinch roll, the top roll down and feed the strip into leveler.
When the strip passes the leveler rolls, the pinch roll shall be open by hydraulic cylinder automatically. The leading end of strip move to shear to cut the end.

The crop shear cuts the leading end of strip. The cut scrap fall down to scrap box.
The strip shall be guided by centering side guide rolls located in front of shear.

After cutting the strip leading end, the strip goes into shear & welder to join the leading and tail end. There is a single knife to cut the strip. The tail end of strip cuts by single knife. The leading of new strip goes into the position of cutting, then, the new leading end of strip is held by the pressure pad and cuts with the shear knife.
The shear weld flatten moves to the left positioning. And, the weld clamps close to hold the strip for welding. The weld torch welds the strip from front to rear. After completion of welding, the clamps open and the side guide open automatically.

After completion of welding, the paint is marked on the welding area by manually to provide the information for optimum cutting and automation system. After that, the coil fed into the spiral type accumulator to accumulate for next strip joining. During the joining of strip, mill runs continuously without any stopping. But if the coil length is not enough, the mill speed should be down.

The spiral type accumulator will be used to continuous operation of mill. It shows that the minimum coil OD shall be defined to have a continuous operation of pipe mill without any stopping.

The skelp coupling detecting system between the spiral accumulator and edge miller. This system detects the strip joining area by CCD camera and this detecting information is for the automatic operation for welding pipe line.

Forming Section

Forming and welding section starts from Edge Miller to Water cooling.

Edge Miller is used for edge milling. Both edges of coil strip will be milled by high power milling cutter, to obtain the best welding condition after forming. In this case, the high quality of coil is required, specially the camber, width tolerance and etc.

The strip Ultrasonic tester will be used to detect the lamination of both edge only. The minimum detecting area should be fulfilled by API requirement.

The pass line will be adjusted based on pipe size at Elevation Table before entering Sticker Stand which pulls the coil to feed into forming section.

At Transition Section to make the coil to slight “V” shape for easier entrance to break down roll which forms the coil into curved shape.

There are break down rolls to make a round shape. And, feed the strip into cage forming stand. break down rolls are forming the strip to get a more stable feeding of strip and good shape for edge bending.

There are edge bending rolls to bend both edges for easier and better welding. If this edge bending process is omitted, the fin pass stands will be highly stressed due to spring back force at strip edges before welding. Pipe may be formed in oval shape without edge bending. The each pipe size has it’s own edge bending rolls.

This Cage Rolls are tapered adjustment type which moves in tapered angle, not like other type's which moves x-y direction independently. Roll location can be slightly adjusted for precise location. Cage Rolls are preset to the forming locations by computer program, however fine adjustment should be done manually because exactly correct locations will be slightly different based on raw material, operators skill and power fluctuation etc. Fine adjustment movement will be displayed on digital indicator.

There are fin pass stand to make a proper shape and the round shape should be at last fin pass stand. At Fin Pass section, there are so called edge trainers (Fin type guide rolls) between stands which guide round-formed section from spring back for better welding. And the steering rolls are installed to guide the strip into welding stand.

Welding Section

At Seam Guide Roll Stand and Squeeze Roll Stand, round-formed section is tightly held its roundness and maintains proper welding gap. Squeeze Roll Stand is in box shape to maintain its rigidity.

High Frequency Solid State Welder provides good welding quality. This welding head moves to the best welding position. This is equipped with diagnostic system to control and show the all information of operating such as cooling water circulation, input & out put voltage, power consumption and etc.

Weld beads are removed at OD and ID. Inside bead cutter is supported by hydraulic cylinder with short length of cantilever beam for precise bead removal. ID bead is chopped in short length by hydraulic chopper. OD bead scraps are collected into a box after being wound by Scrap Winder. When the strip joining area comes into welding section, the contact tip, inside bead cutter shall be out due to the breaking of tools.

It pulls the welded pipe into Ultrasonic Tester for seam quality and inside bead quality check. To check the inside bead quality, there is pre -water cooling system to down the temperature of welded seam.

Seam Heat Treatment Section

There is a seam heat treatment process to get a proper quality of welded seam area.
Seam Normalizing calls “N” process.

There is Seam Annealer And, this equipment will be used to “N” process. After seam annealing, there is long air cooling for normalizing. After air cooling, the pipe goes to water cooling stand to reduce the temperature of welded seam.

Sizing & Cut off Section

The welded round pipe goes into Sizing Stands which size the welded pipe to perfect specification within tolerance.

One Turks Head will correct the pipe straightness and prevent from twisting of pipe.

The on line automatic marking machine installed in the turks head frame. The marking specification will be determined by operator. This machine marks the all required information by customer on the top surface of pipe.

Before cutting the pipe, exact pipe length is measured by Tacho Generator located at Measuring Roll Stand. Milling cut off equipped blades cutter for cutting the round and profile pipes. Each blade is rotating by AC servo motors and fed by AC servo control system.

To increase the material yield, the end of pipe length for each coil shall be monitored for optimized cutting monitoring system. This system can give the maximized cutting length of last pipe of coil to operator for cutting.

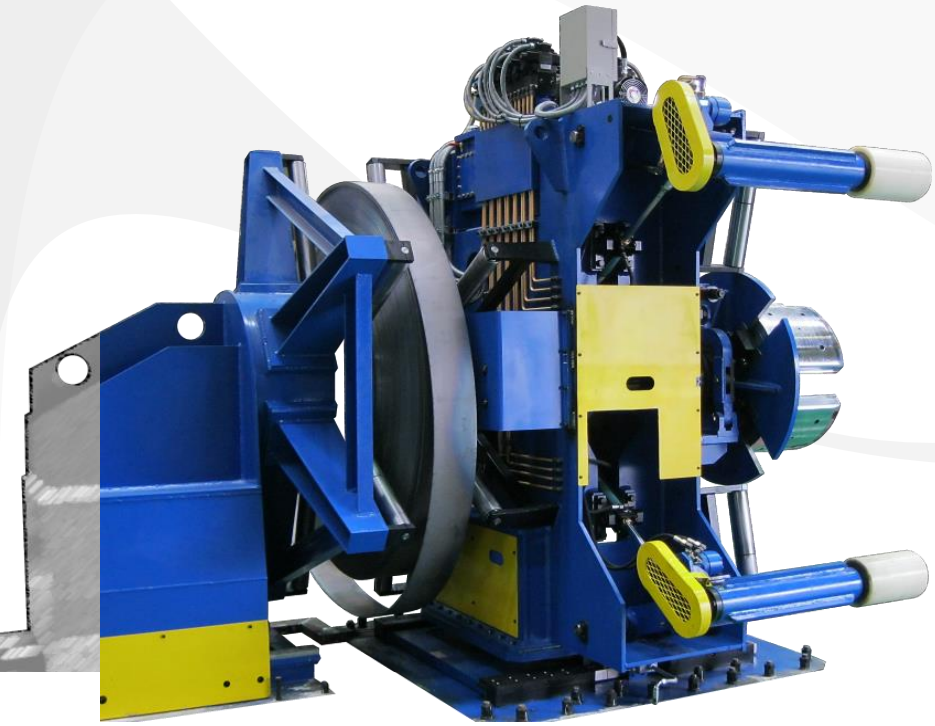
The cut pipe goes to finishing floor to machine the end and test the pressure and defects of weld seam and body.

MACHINE SPECIFICATION

A. PIPE MILL LINE MACHINE ARRANGEMENT

Entry Part

- Uncoiler
  - Single Drum / Double Drum
  - Double Cone Type
- Coil opener
  - With Coil Car
  - Telescope Type
- Pinch Roll & Leveler
- Shear & Welder
  - Strip Joiner
  - Semi-Auto Shear & Welder
  - Automatic Shear & Welder
- Accumulator
  - Vertical Type Rotary Looper
  - Horizontal Type

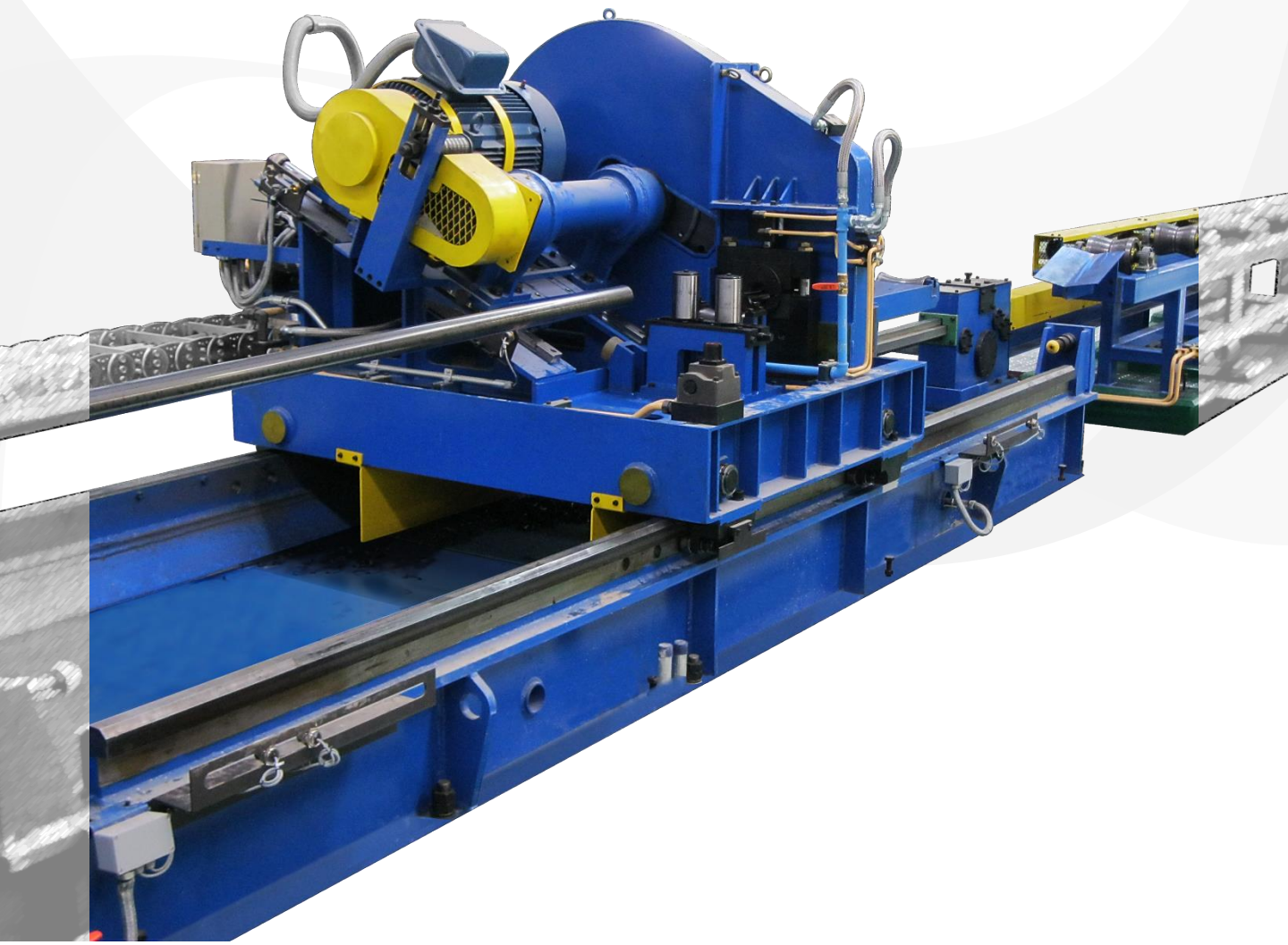


Forming & Sizing Part

- Forming Entry
  - Cage Forming Type
- Forming Sizing
  - Conventional Type
    - With Quick Joint system
    - With Quick Change Bed system
- Welding Section
  - ERW
    - For Mild Steel Pipe
    - For SUS Pipe
  - TIG Welding for SUS Pipe
- Pipe Cooling
  - Water Cooling
  - Air Cooling

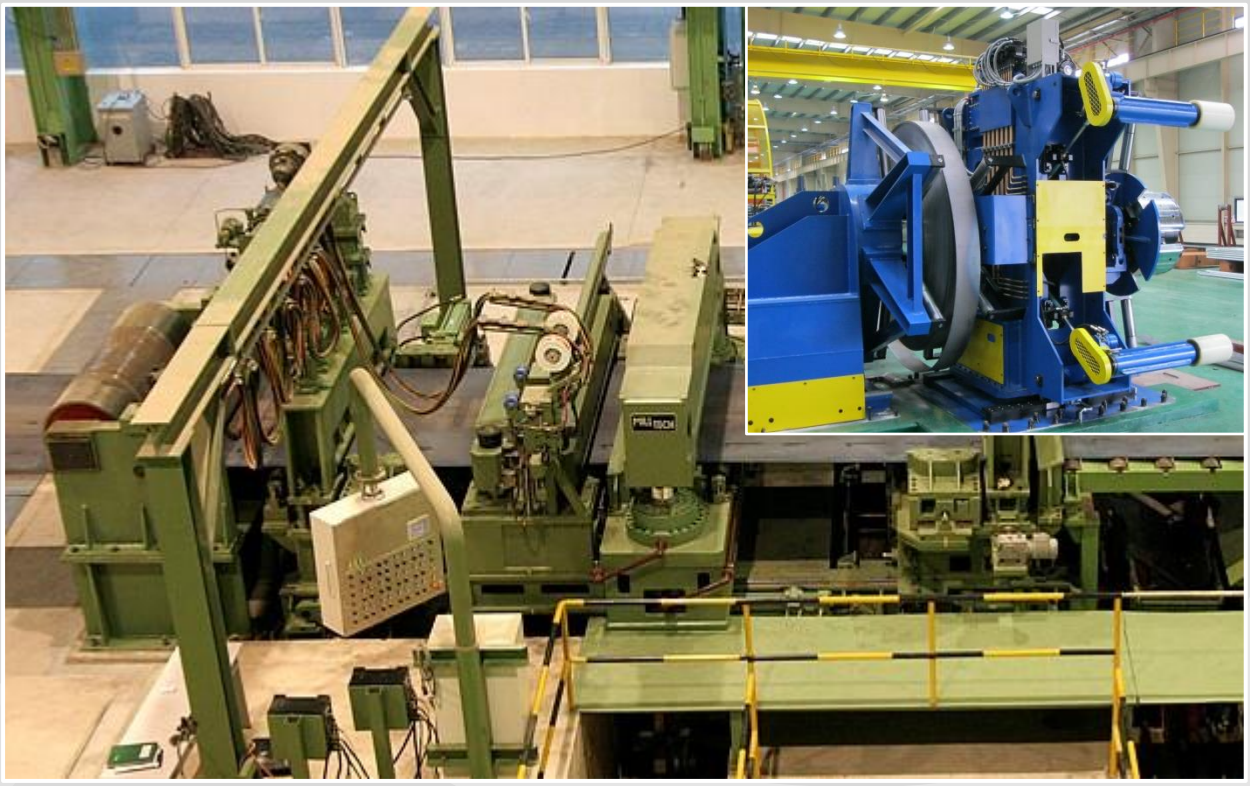
Cut Off M/C

- Circular Friction Saw Type
- Cold Saw Type
- Rotary Disc Cutter
- Milling Cutter



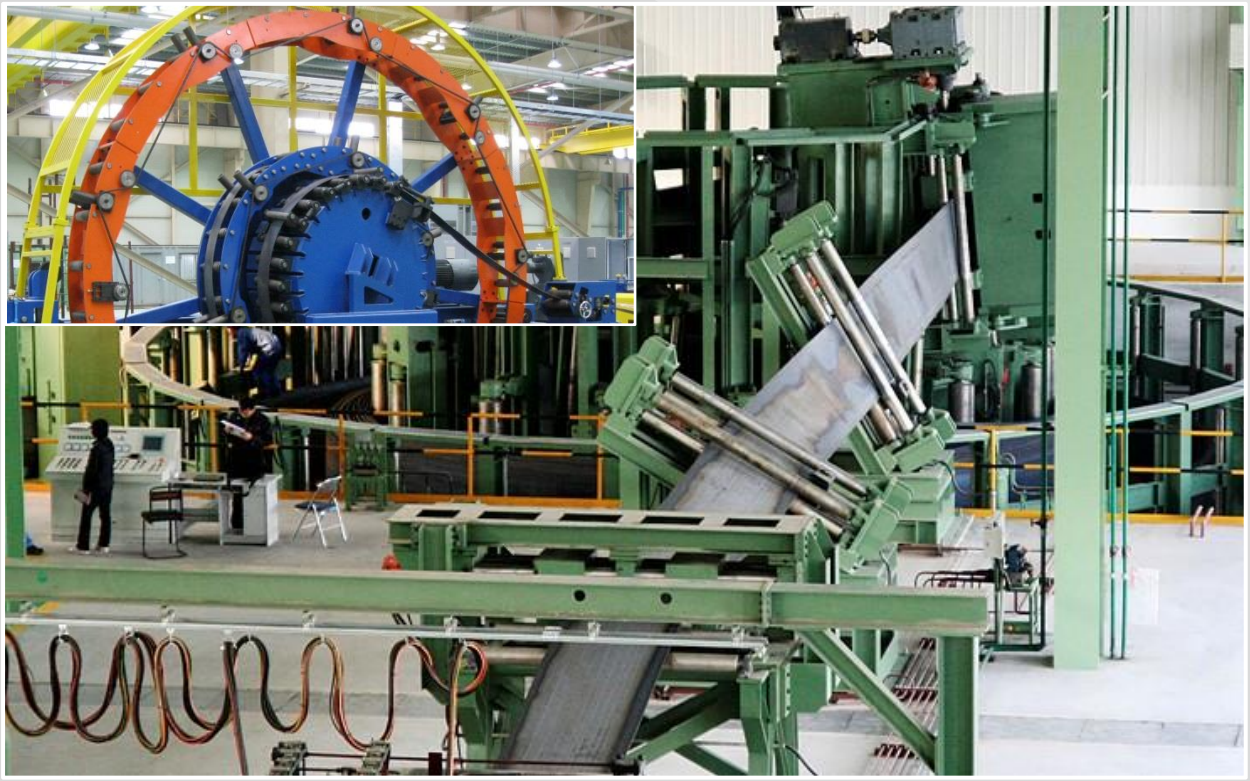
B. FINISHING LINE MACHINE ARRANGEMENT

- End Facing & Chamfering M/C
- Straightening M/C
- Hydrostatic Tester
- Automatic Packing M/C
- Tube Painting M/C
- Weight & Length Measuring M/C
- Off Line UST
- Off Line Marking M/C



Entry Part

Entry / Uncoiler



Accumulator

Accumulator

Edge Miller

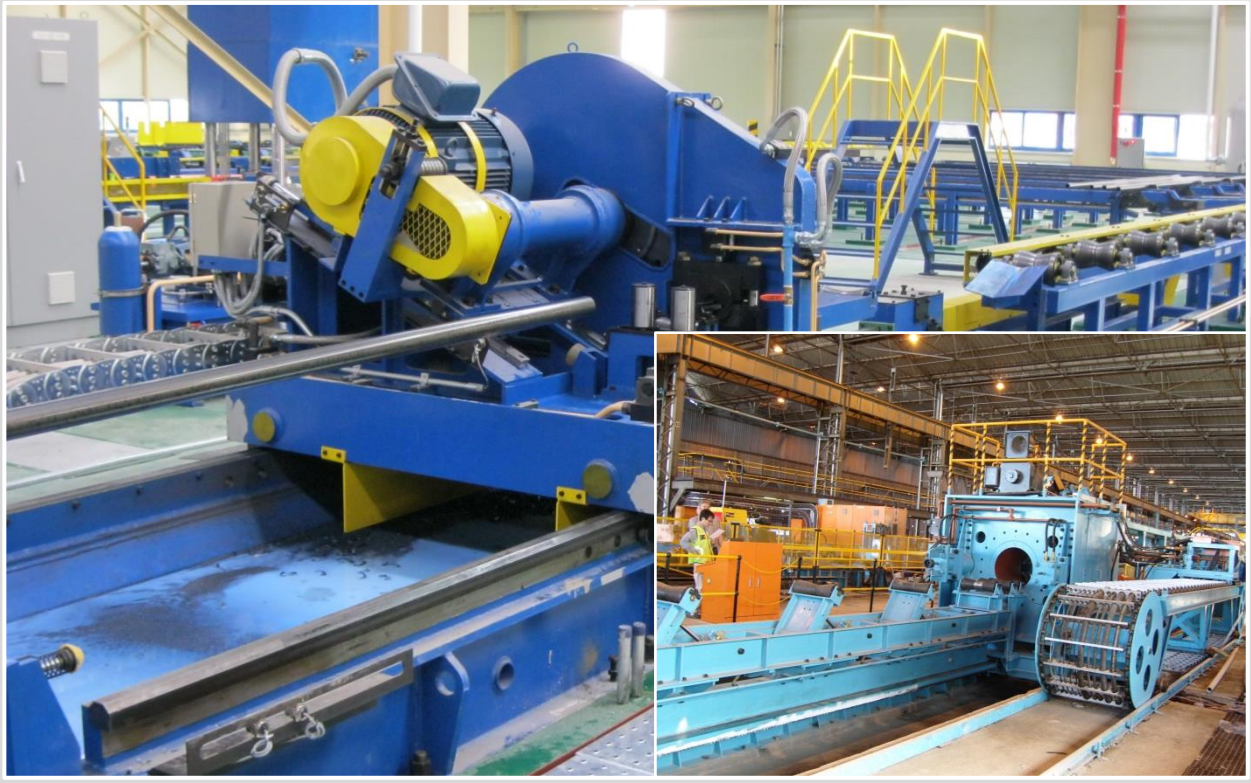
24 inch edge miller / 20 inch edge miller

Forming Part

Forming / Cooling and sizing

Welder Part

Welding



Cut off mc

Cut off mc

Roll Change part Roll Change

Straight mc straight mc

Finishing part 12 inch Inner Flushing / 5.5 inch handling conveyor

End Facing mc

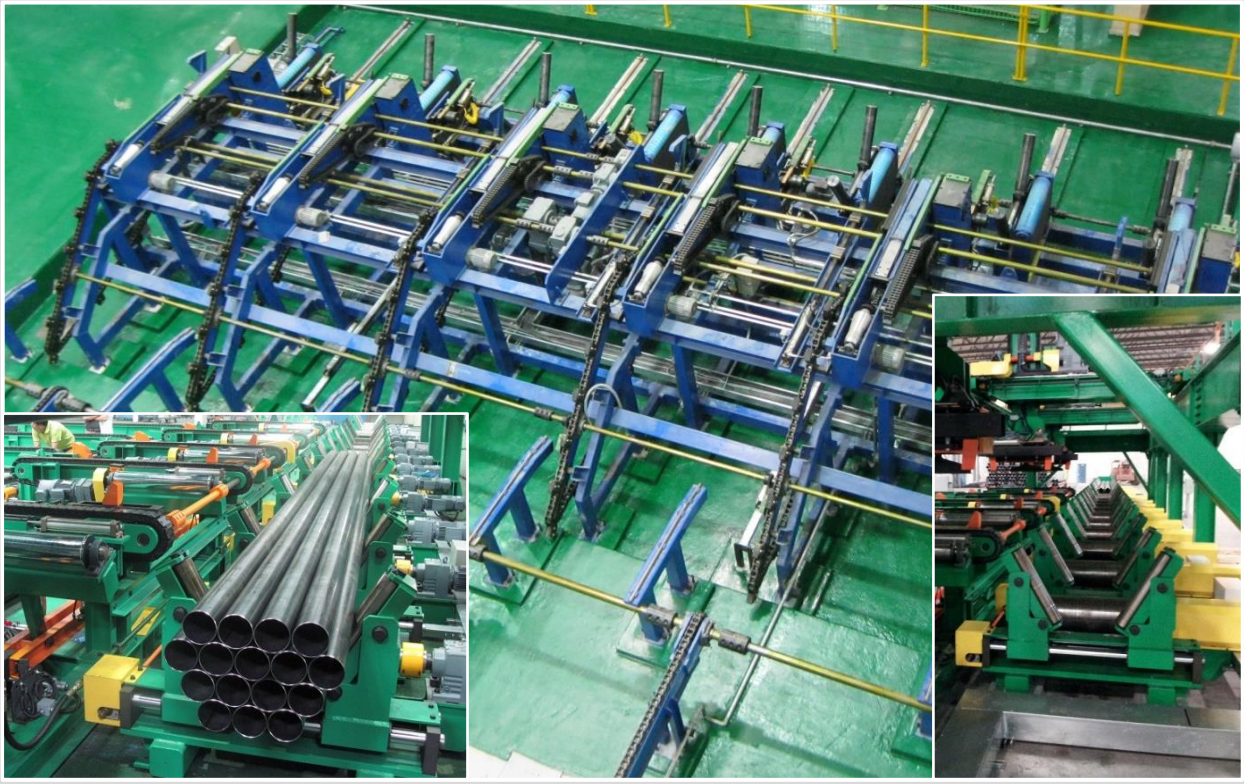
End Facing mc / 5.5 inch End Facing mc

Hyd Test

21 inch hyd test / 24 inch hyd test / Hyd Tester / 6inch hyd test

Draft Test

21inch draft test



bundling mc

12inch Bundling / Auto Bundling mc

STEP 1

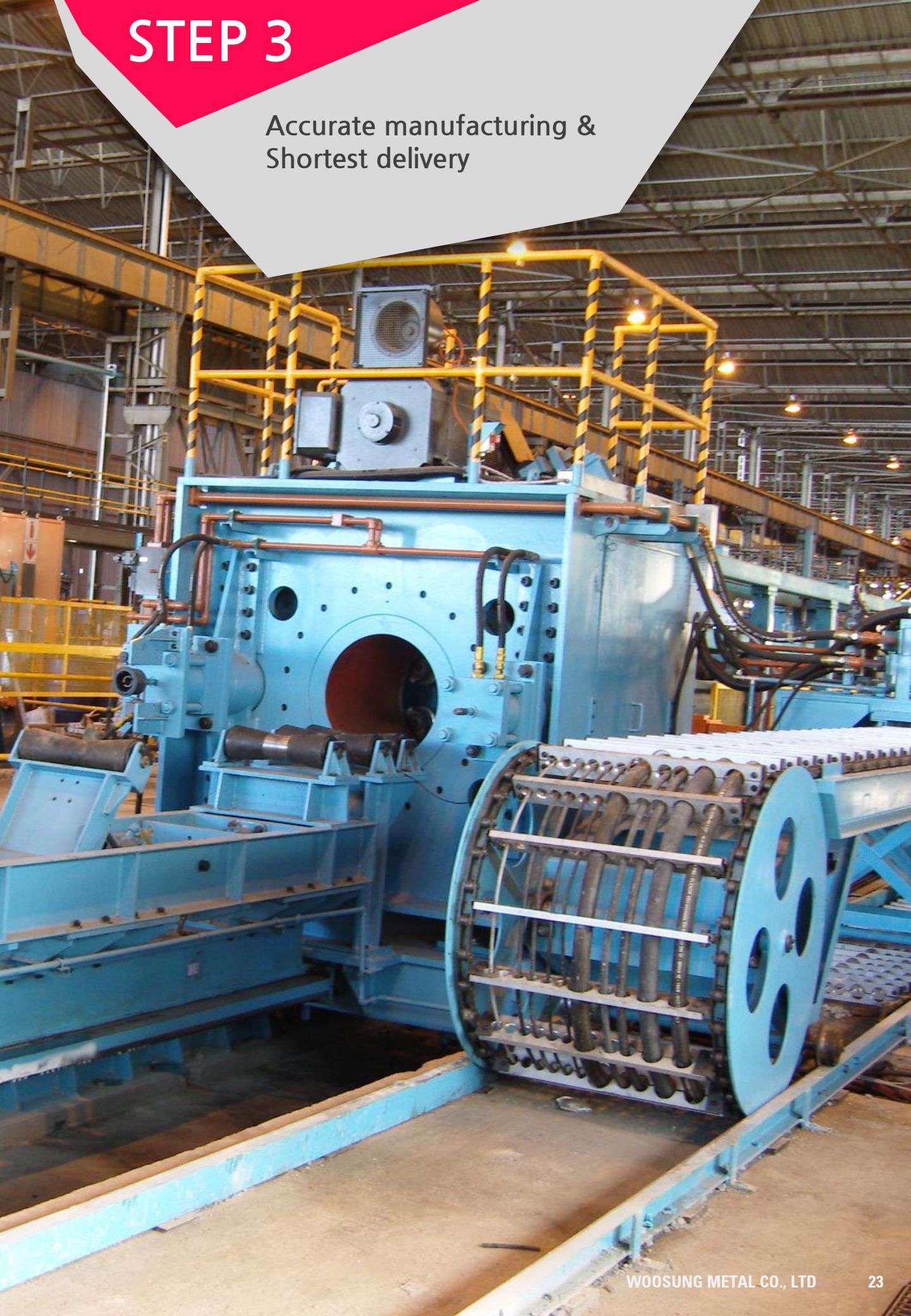
Constant innovation of technology & Skill

STEP 2

Top technology specialized
engineers & Technicians

STEP 3

Accurate manufacturing &
Shortest delivery

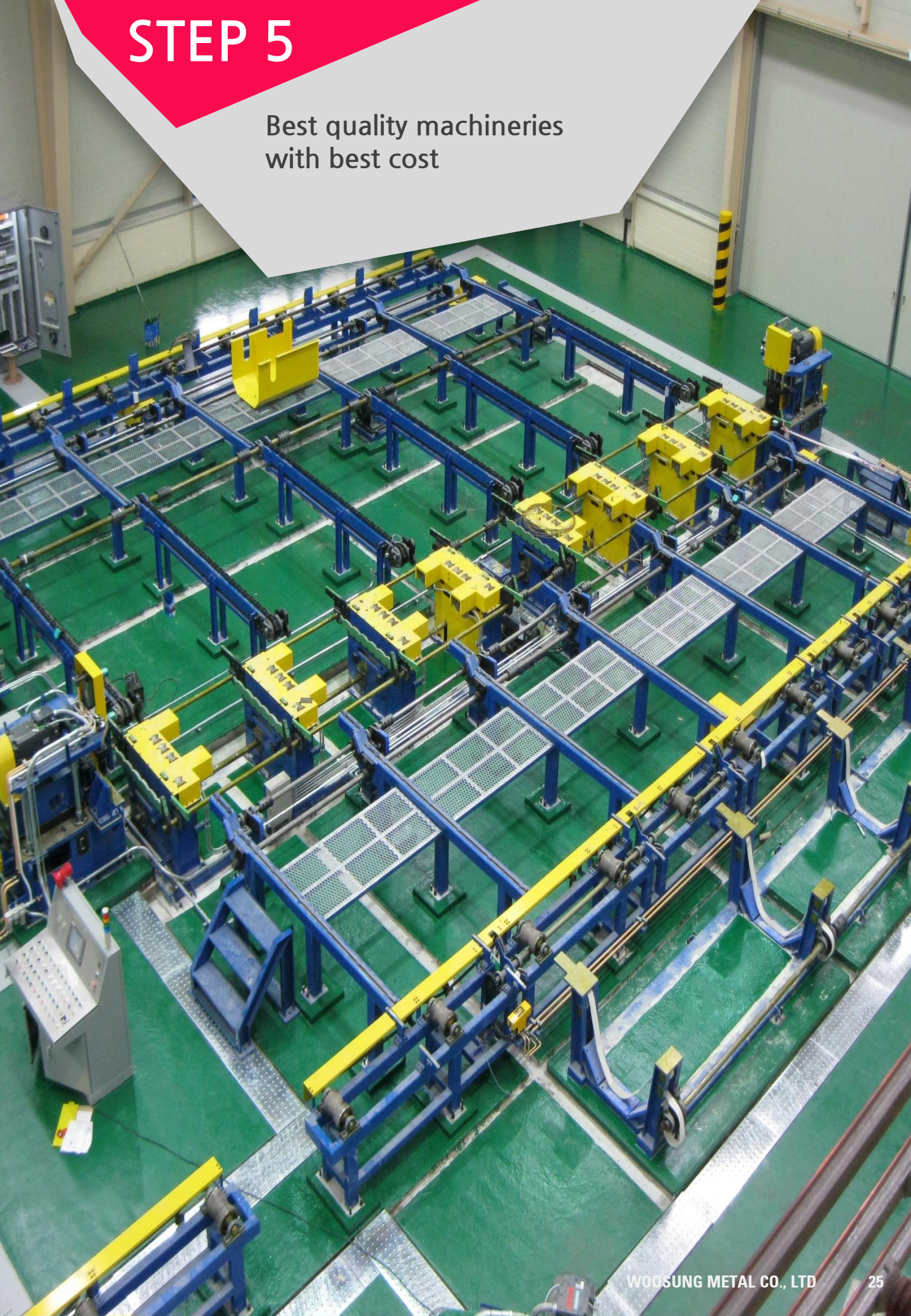


STEP 4

Global after-service system

STEP 5

Best quality machineries
with best cost



STEP 6

Customized manufacturing of individual machineries and line

STEP 7

Top leveled supplier of pipe manufacturing facilities, Individual machineries

www.woosungmill.kr

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