# NUCOR STEEL BERKELEY OVERVIEW

5/26/2022

# NUCOR STEEL BERKELEY

8,000 acre plant site including 6,000 acre conservation easement

975 teammates

Over 3.5 million tons of steel produced annually

# NUCOR STEEL BERKELEY PRODUCTS

Flat Rolled Sheet and Structural Beam Steel

2,800,000 tons of Sheet Steel

670,000 tons of Structural Beam Steel

# RAW MATERIALS

Heavy Melt Scrap

Shredded Scrap

Scrap Bundles

Direct Reduced Iron

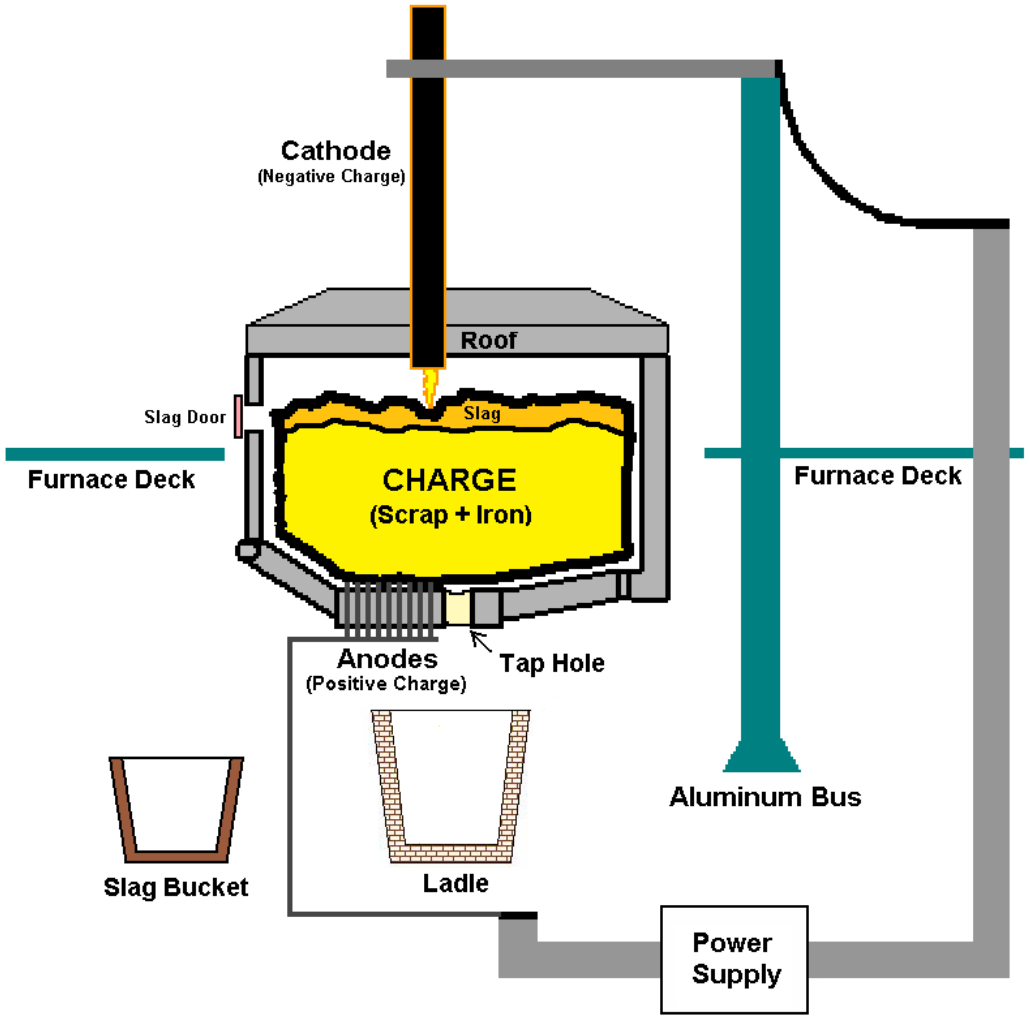
Hot Briquetted Iron

Pig Iron

- Scrap accounts for 60-90% of each furnace charge
- Scrap is screened for radiation twice before entering the plant

- “Virgin” iron is required to manage residuals form scrap through dilution
- Pig iron is high C iron reduced from iron ore in a blast furnace, has low residuals and good density
- DRI and HBI are pig iron substitutes but have slightly worse quality

# ELECTRIC ARC FURNACE (EAF)




- 2 EAF's
- DC Furnaces
- Charge Scrap, Iron and Flux
- Typical Charge = 165-190 tons
- Typical Tap = 155-170 tons (rest is kept as a heel)
- Typical Tap Time = 30-40min
- Energy Efficiency:
  - Electrical Energy (approx. 67%)
    - Electrical energy required to melt 1 heat would power a residential home for 6 years
  - Chemical Energy (approx. 33%)
- Typical Temp of finished heat = 3000 deg F



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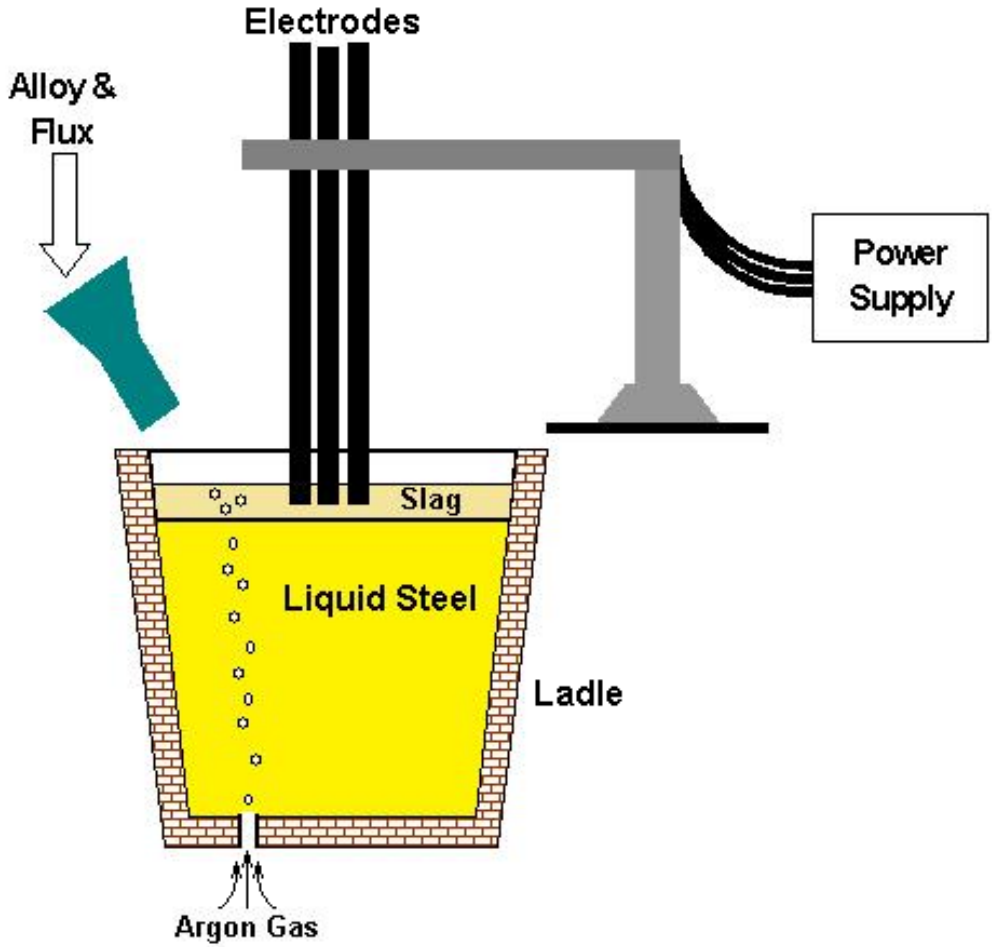
# LADLE METALLURGY FURNACE (LMF)

- Purpose is to clean steel and modify chemistry to make a specific steel grade
- AC electrodes
- 4 stations, 2 sets of sticks
- Argon Stirring
- Process
  - Monitor Temp (electrodes to maintain)
  - Deoxidization: “kill the heat” (Al – CSP, Si – beam)
  - Adjust chemistry
  - Final Verification
  - Calcium Treatment: ensures cleanliness of steel, modifies inclusions, improves castability and final product formability



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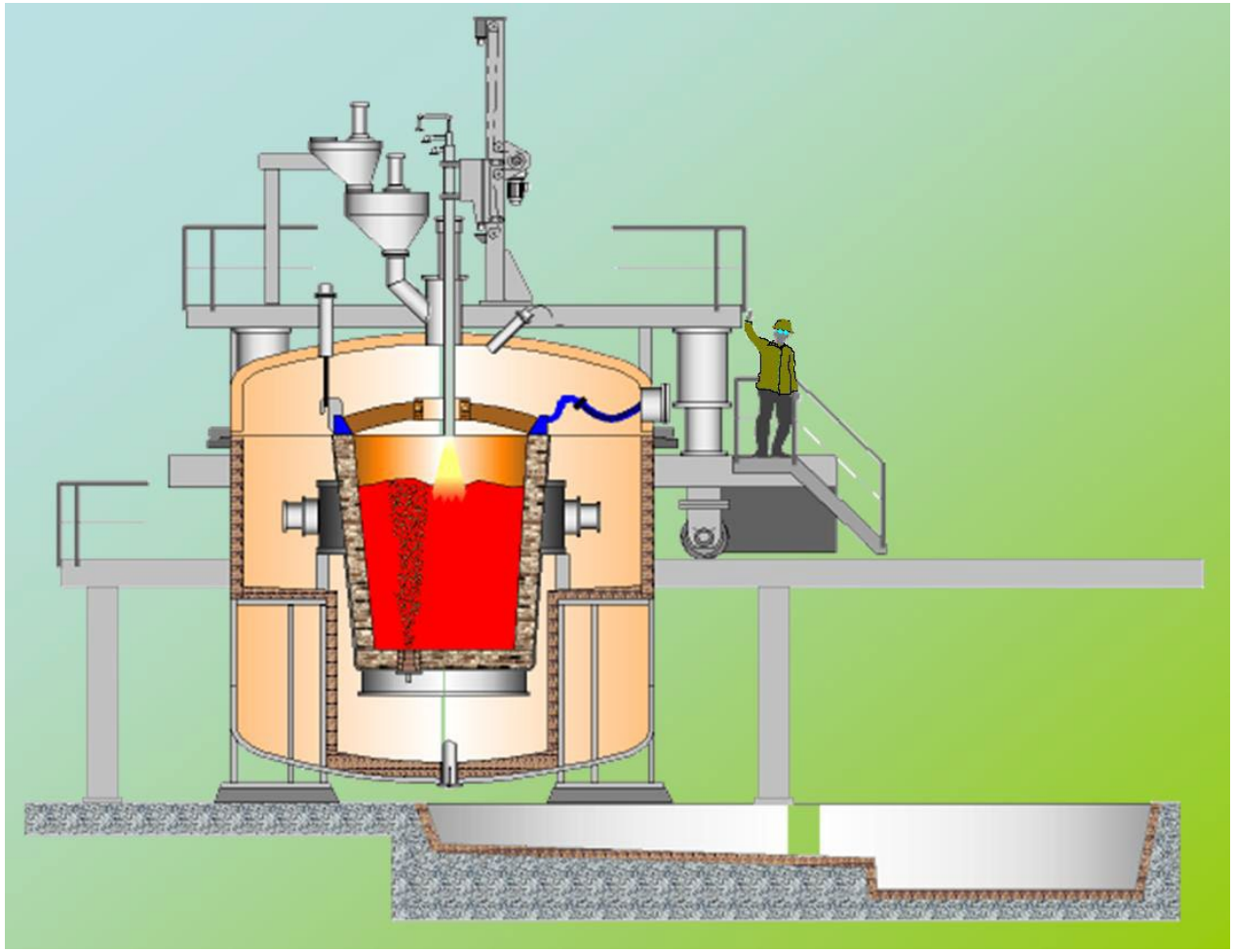
# VACUUM TANK DEGASSER



- Process is required for additional chemistry refinement
- Removes gasses to further clean steel
- Vacuum reduces pressure from 1034 millibars 1.0 millibars
- Argon stirring
- Reduces hydrogen to less than 1 ppm (.0001%)
- Reduces nitrogen to about 40 ppm (.0040%)
- Reduces carbon to about 30 ppm (.0030%)

# CONTINUOUS CASTING

-Purpose is to convert liquid steel to solid steel slab

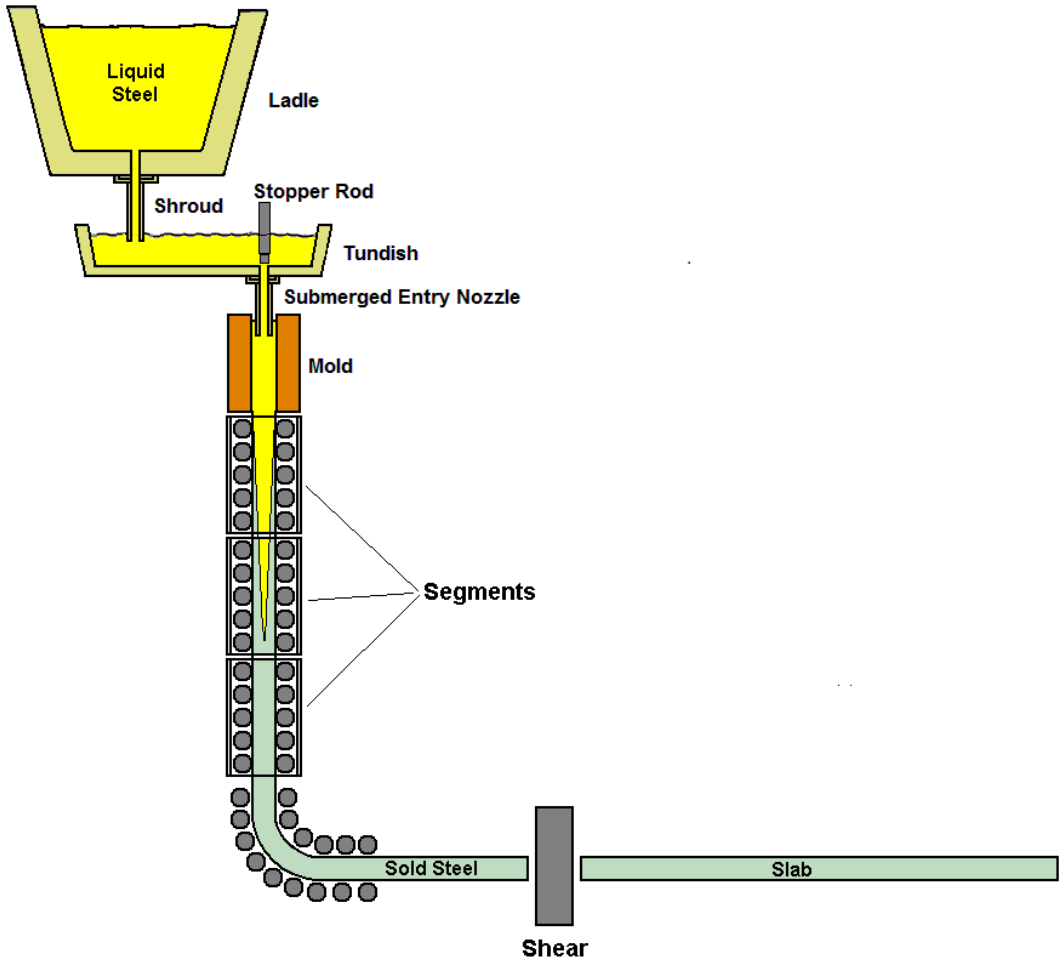
-Process:

- -Liquid steel in ladle pours through shroud into tundish
- -Stopper rod controls flow into mold
- -Flows into mold through SEN
- -Steel moves through water-cooled copper mold, solidifies from the outside inward

Each CSP caster can cast about 200 tons per hour

Typical slab exit temperature is 1800-1900 deg F

In-line shear cuts slab to length and sends slab to tunnel furnaces then hot mill



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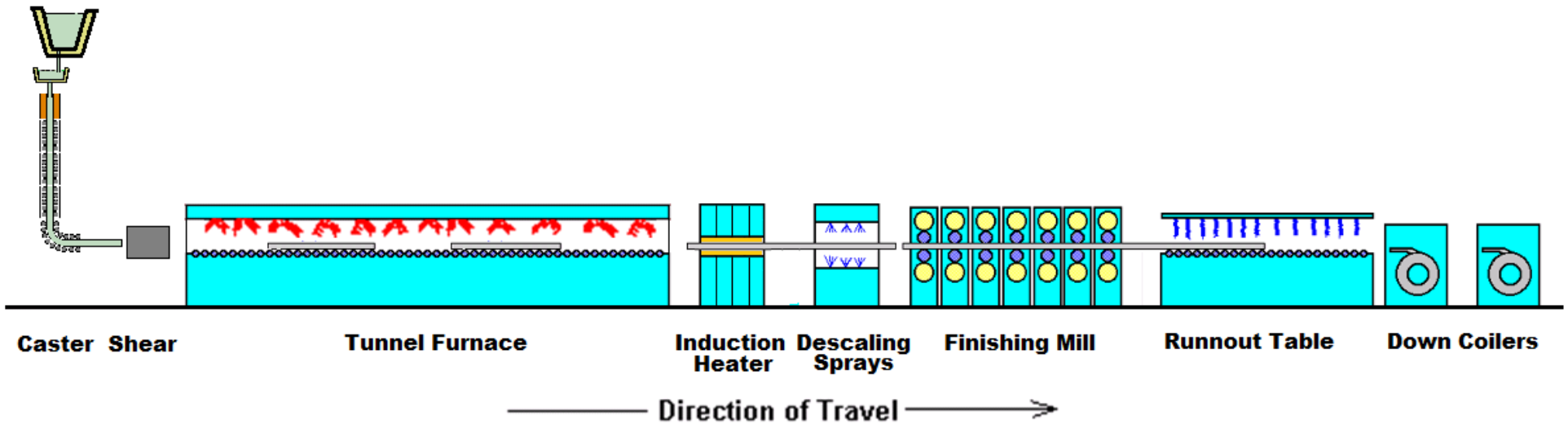
# HOT MILL




- Purpose is to reduce thickness (enters mill at about 2inches) and roll slab into a hot roll coil
- Tunnel furnace brings temp back up to about 1850degF
- Slab then enters descaler that washed off oxide layer
- Slab enters rolling mill
  - 4-high, 7-stand mill
- Steel then goes through Cognex inspection system, laminar cooling bed, then gets coiled up
- Takes 2-3 days to cool



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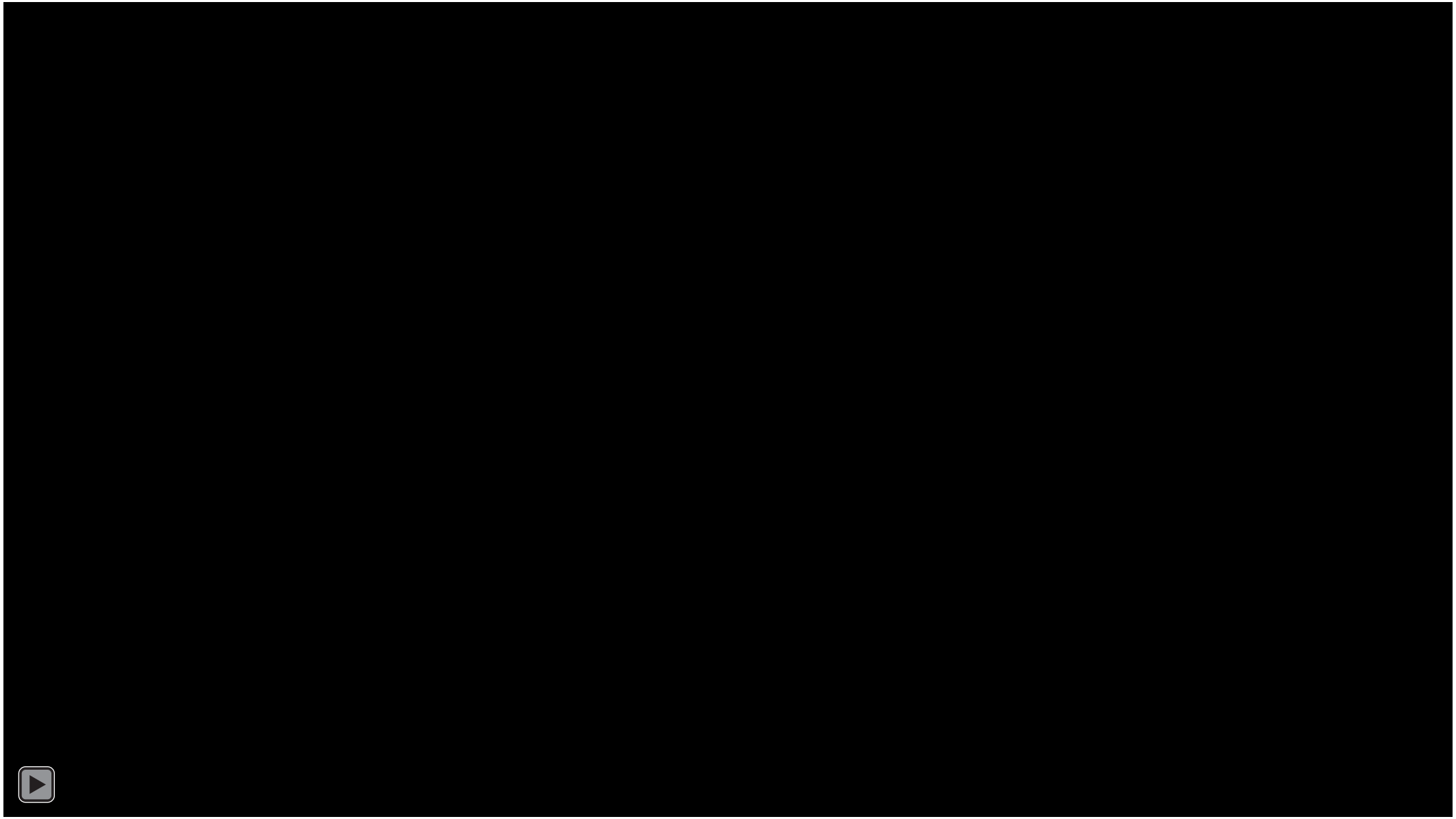
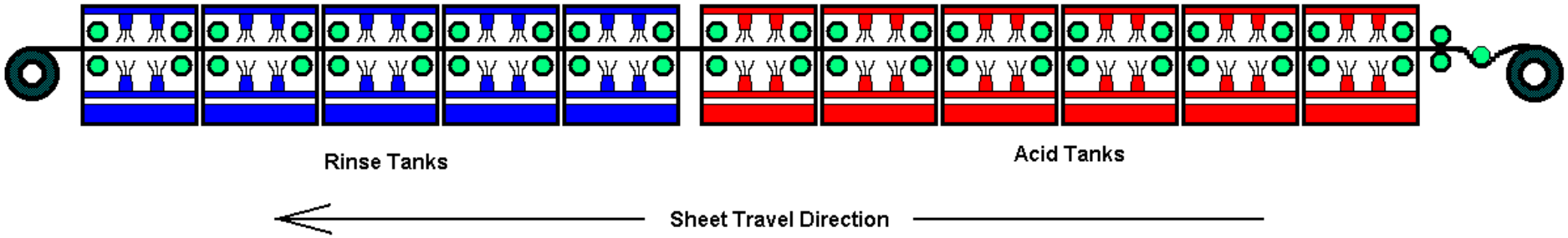
# HOT MILL



# PICKLING




- Purpose: chemically remove iron oxide/scale and trim width as necessary
- Scale removed with hydrochloric acid (HCl)
- Acid removed with water
- Water removed with squeegee rolls and air blow offs
- Electrostatic oiler
- Results in a scale-free steel surface



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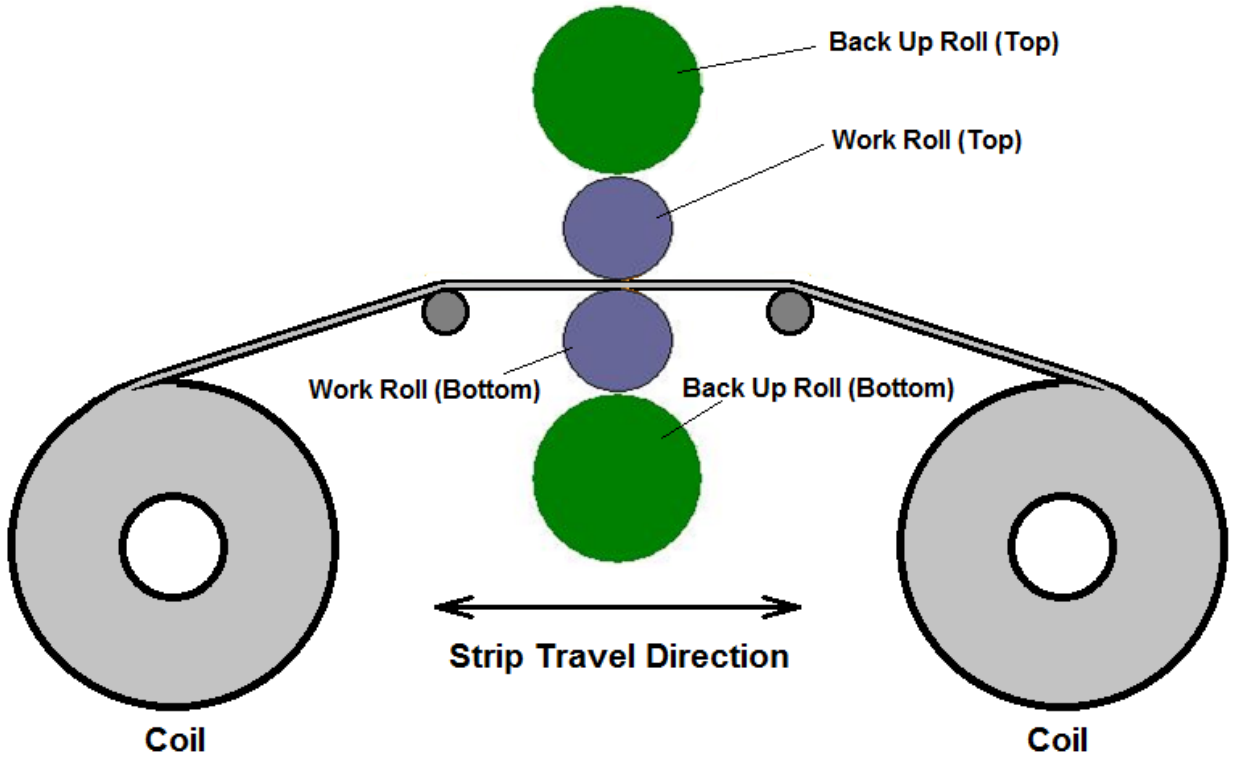
# COLD ROLLING (REVERSING MILL)




- Purpose is to roll a HRPO coil to create a CR (Full Hard) coil (CRFH)
- 4-high, single-stand, reversing mill
- Typically 3 to 5 passes through mill
- Reduce thickness by up to 85% and down to 0.012” if needed
- Achieve reduction through roll force and tension
- Roll force up to 1,630 MT
- Uniform thickness throughout coil
- Steel is extremely strong after cold-rolling but has very little ductility



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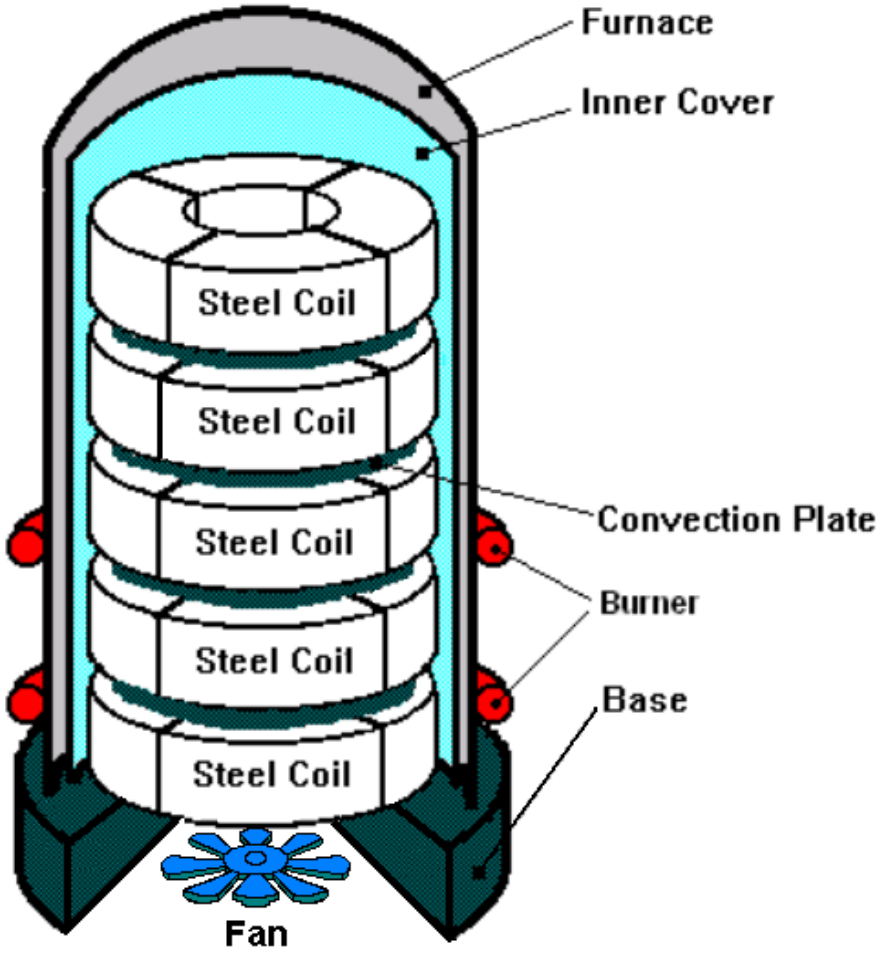
# BATCH ANNEALING

- Purpose is to soften a CRFH coil
- Primary heat transfer is by convection using a hydrogen atmosphere
- Natural gas combustion outside of inner cover
- Typical gas temp.: 1400degF
- Typical process time:  1 week
- Steel is very soft after annealing
- Microstructure undergoes recovery, recrystallization and grain growth to achieve desired mechanical properties.



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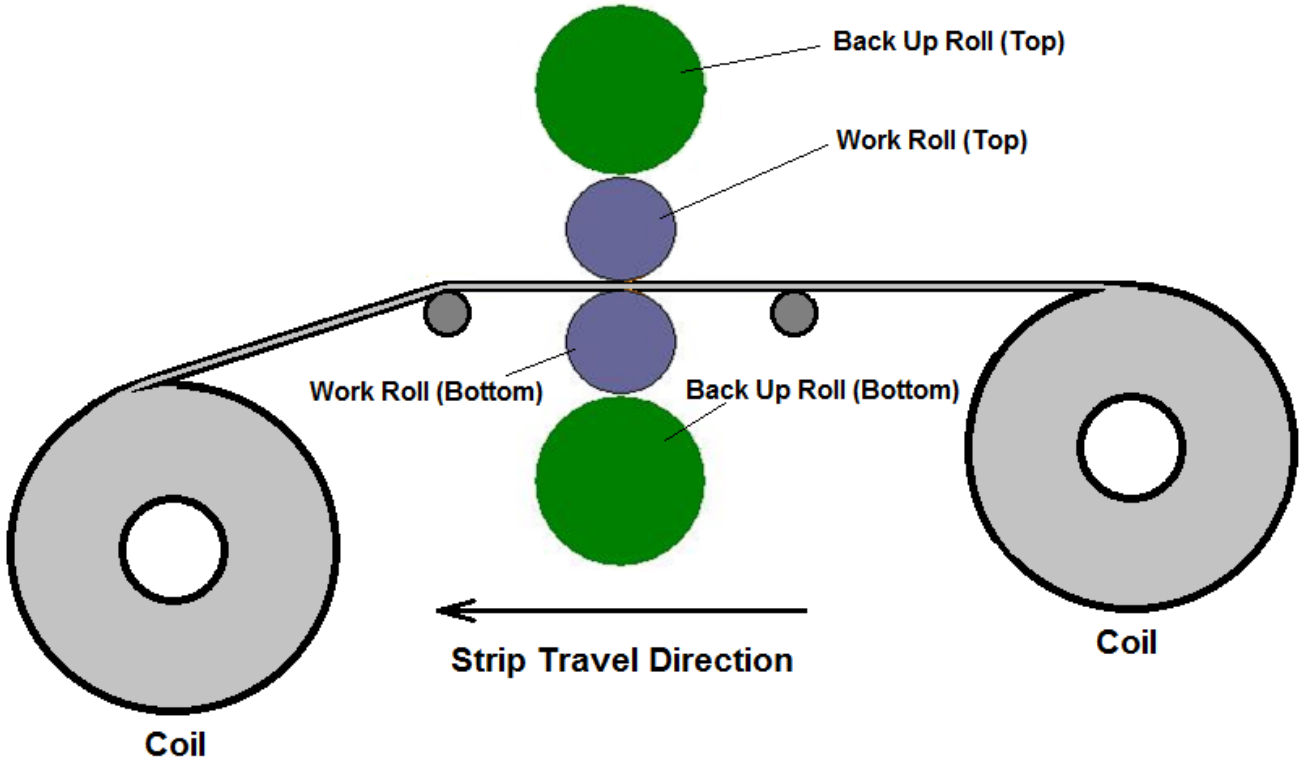
# TEMPER PASSING




- Increases mechanical properties, improves flatness, surface quality
- 4-high, single-stand mill
- Single pass through mill under extension makes steel stronger and harder
- Done after annealing to improve properties
- Electrostatic oiler



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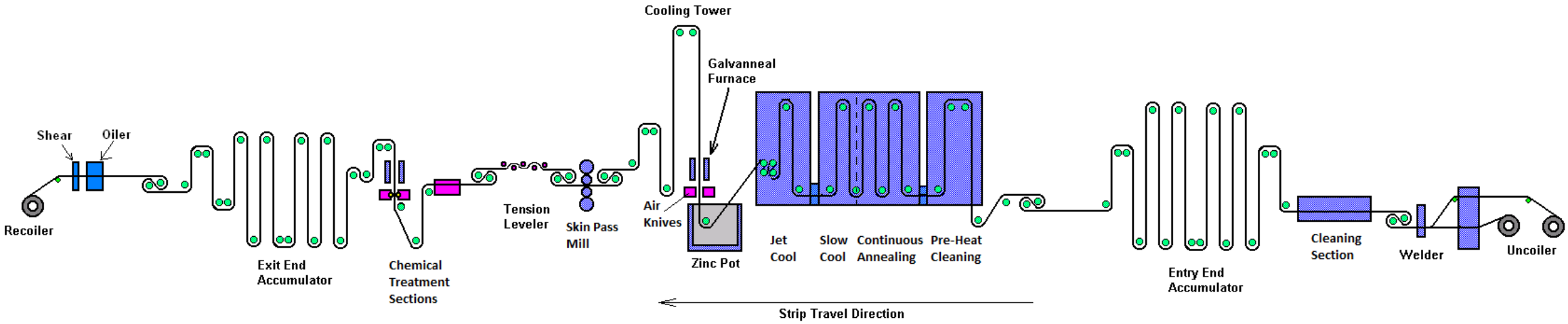
# HOT DIP GALVANIZING




- Purpose is to apply a zinc coating to a steel coil
- Zinc coating inhibits atmospheric corrosion
- Continuous operation - coils welded tail-to-tail
- Cleaning sections
- Preheat furnace for fast heating and cleaning

- Continuous annealing furnace
- Zinc pot
- Galvanneal furnace
- In-line temper mill and tension leveler
- Accumulators maintain process speed
- Post treatments



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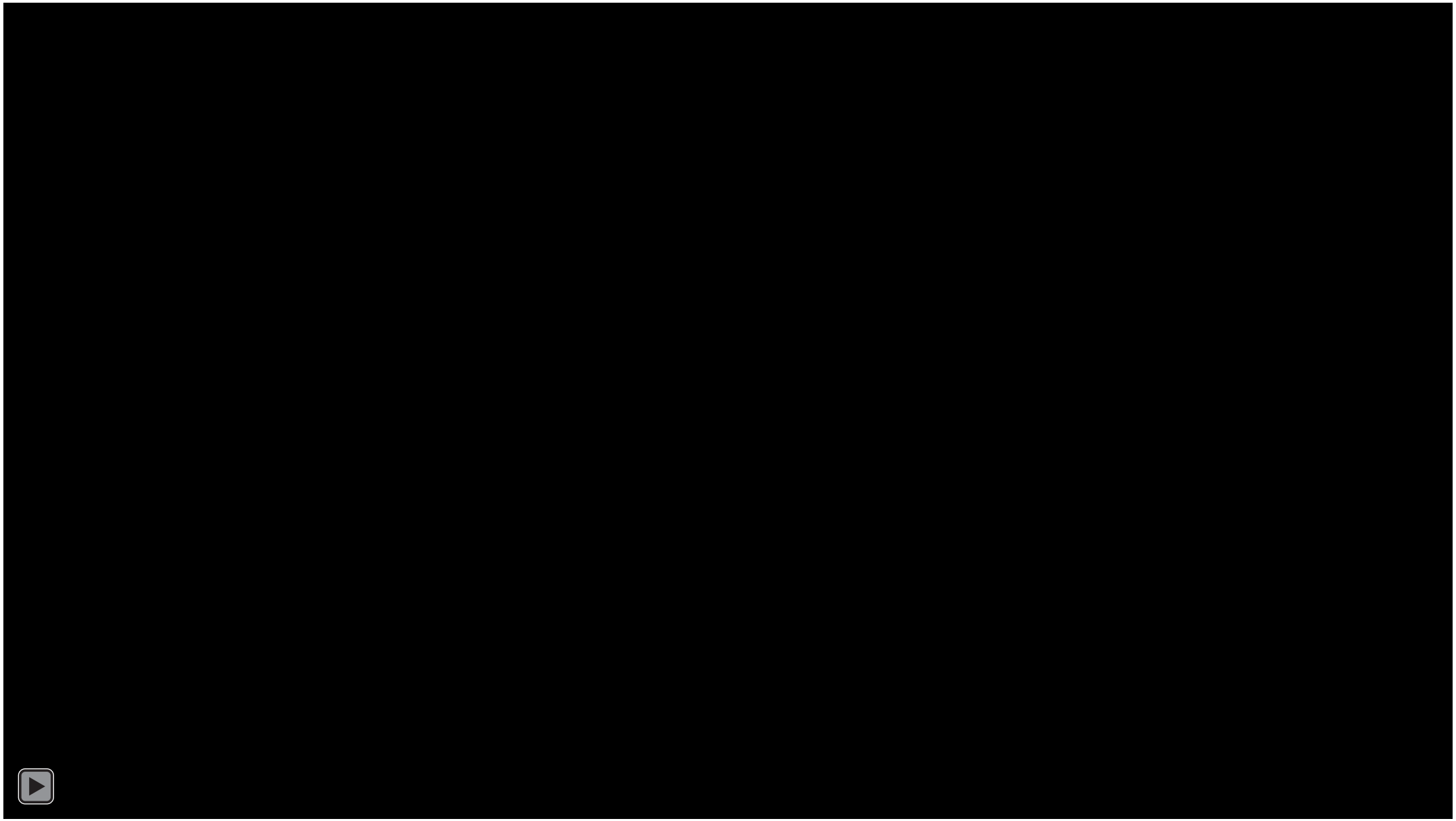
# HOT DIP GALVANIZING





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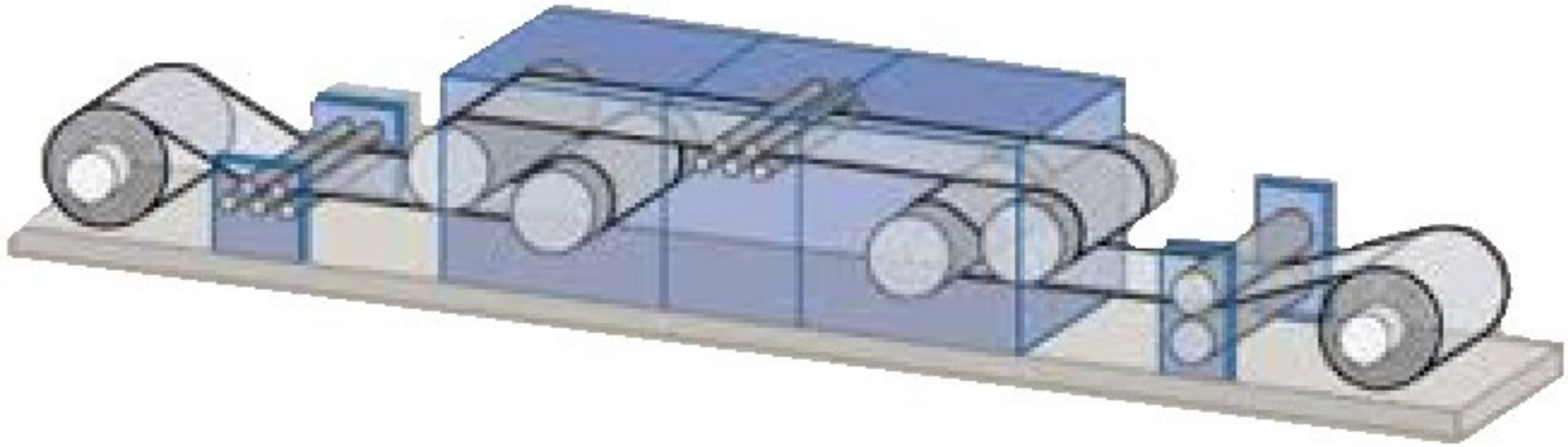
# TENSION LEVELING

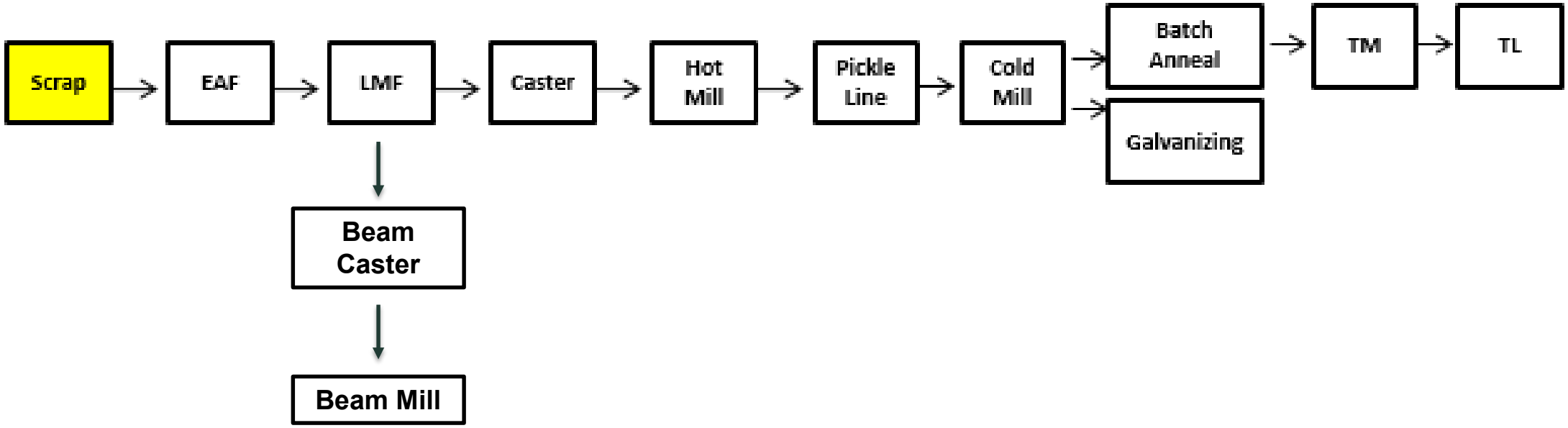


Purpose: Uses small amount of elongation to improve flatness by alleviating residual stresses

-Extensions typically 1% to 2%

-Head of coil is stitched into tail of last coil, travels through cleaning section, four bridal rolls, a leveling section, four more bridal rolls, an inspection table, oiler then out to shipping

# SUMMARY



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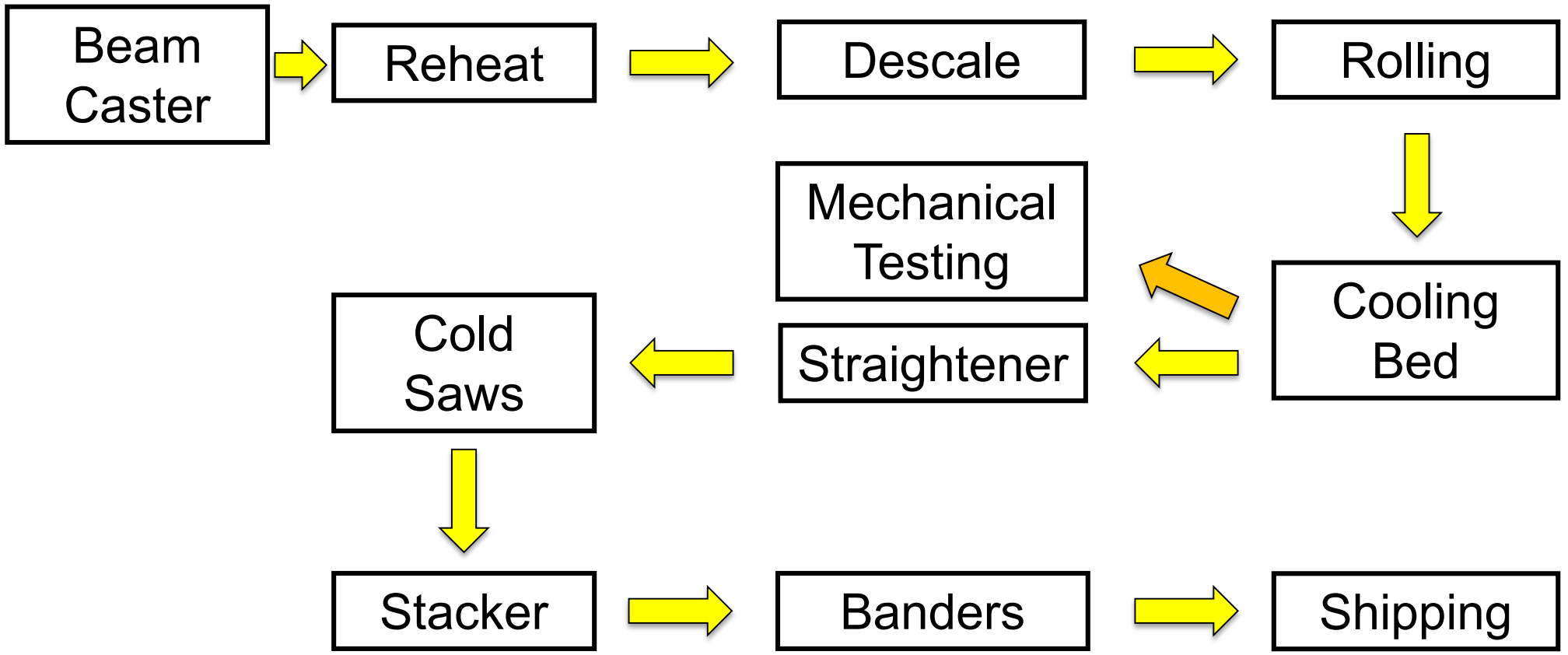
# NUCOR STEEL – BERKELEY

# BEAM MILL

# BASIC PROCESS FLOW SHEET



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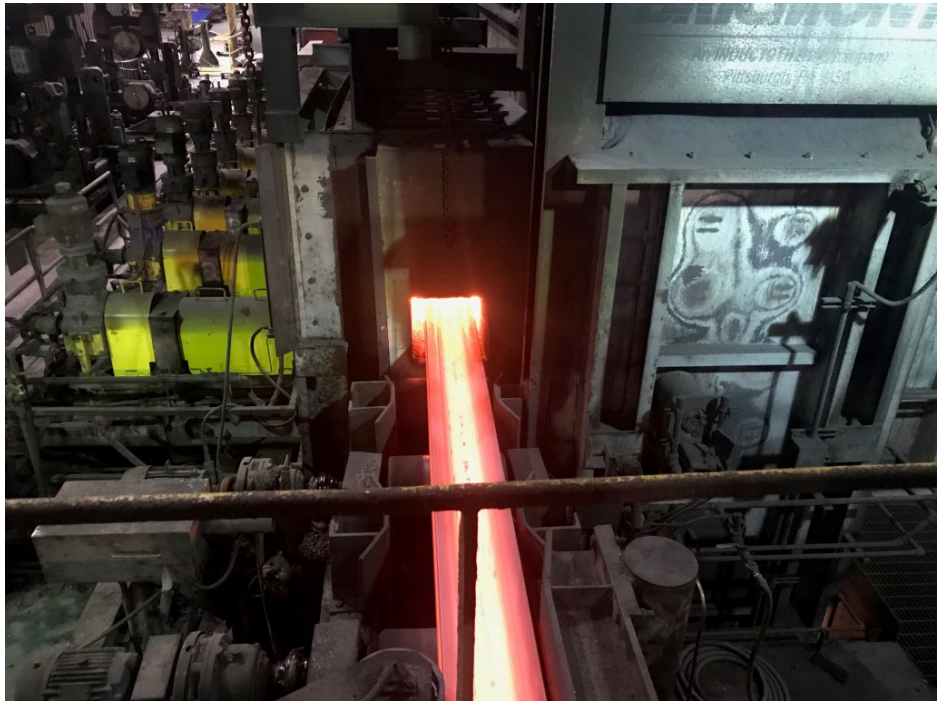
# REHEAT FURNACE



- Beam Caster casts 4 strands of billets (6x6”), blooms (6x9”), or beam blanks (8.5x13”)
  - Beam caster runs between 80-220 tons per hour depending on semi-finished product

- Can hot, warm, or cold charge into reheat furnace

# BARCODE TAG USED FOR TRACKING WHEN COLD CHARGING

When we push cast material to the bloom yard for cold charging later, a barcoded tag is attached to the end of the semi finish material. This allows tracking information to be scanned into the reheat charge system before the material enters the reheat furnace.

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# REHEAT FURNACE DISCHARGE AND DESCALER


- Material goes through a descaler which consist of high pressure water sprayed onto the bar to remove the scale produced from the reheat furnace.
- The descaling process helps us to achieve a better surface quality on the finished bar.



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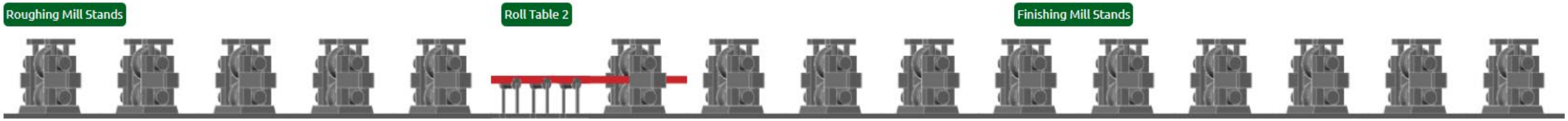
# ROLLING MILL OVERVIEW




- 15 total stands
  - 5 in the roughing mill
  - 10 in the finishing mill



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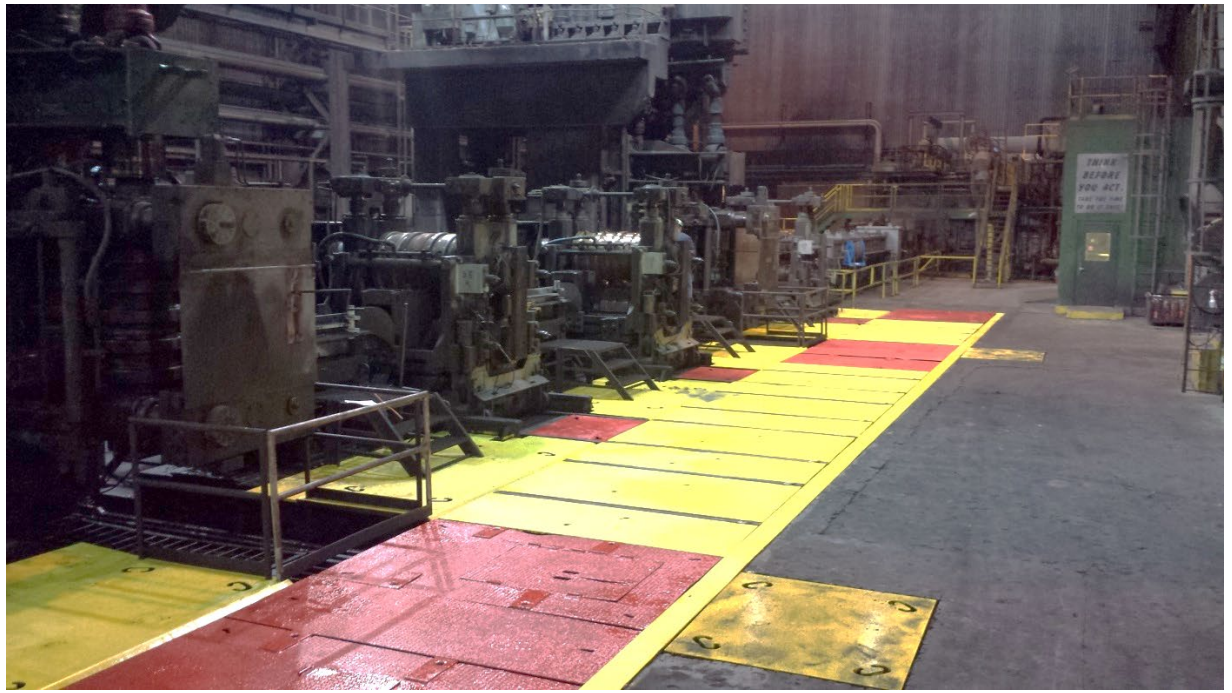
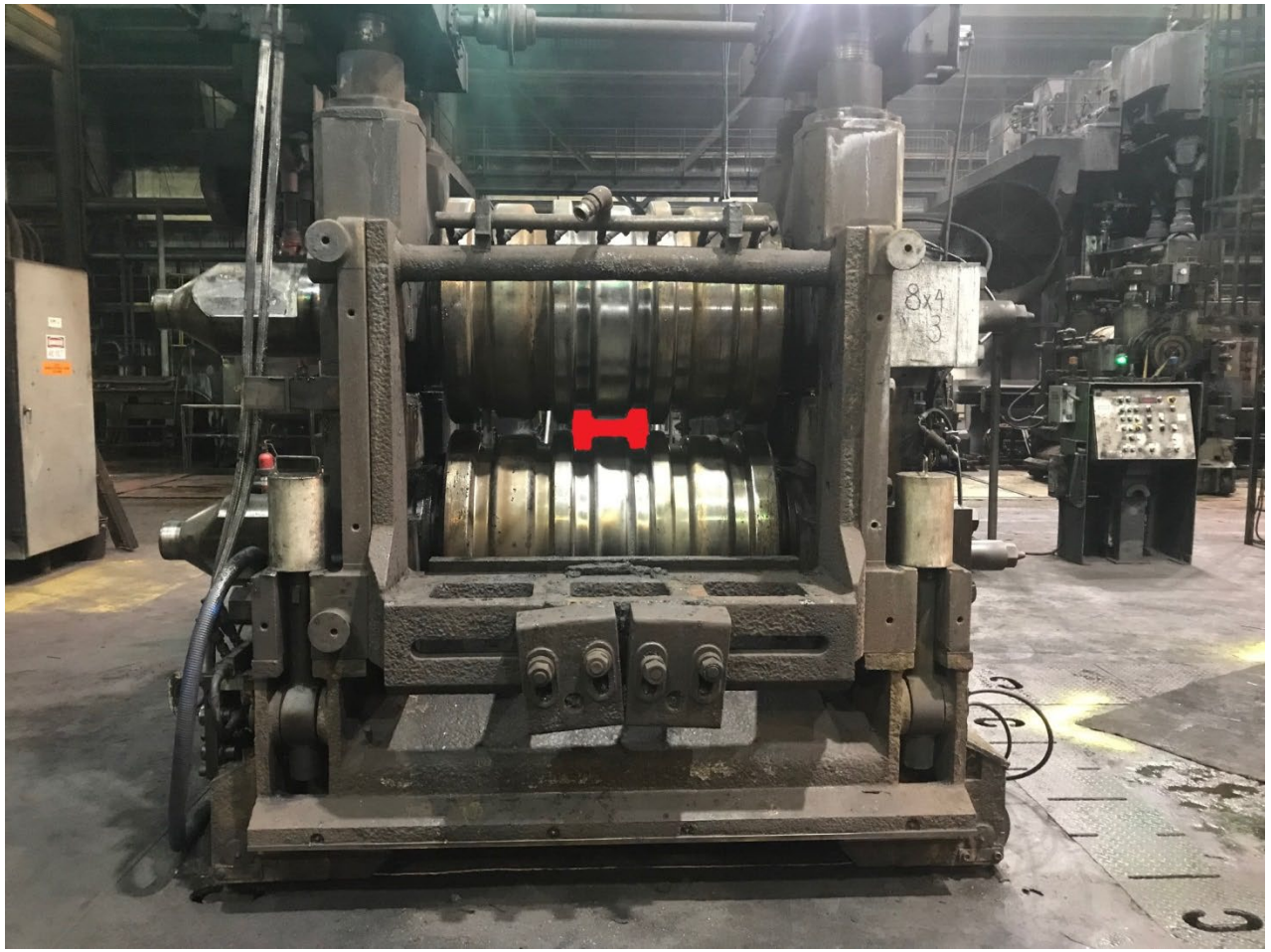
# ROUGHING MILL



- First 5 stands in our rolling mill are referred to as our roughing mill
- Two-high roll configuration where the gap cut into two rolls forms the pass that shapes the bar
- Stands 2 and 5 are our only vertical stands

# TYPICAL ROUGHING STAND



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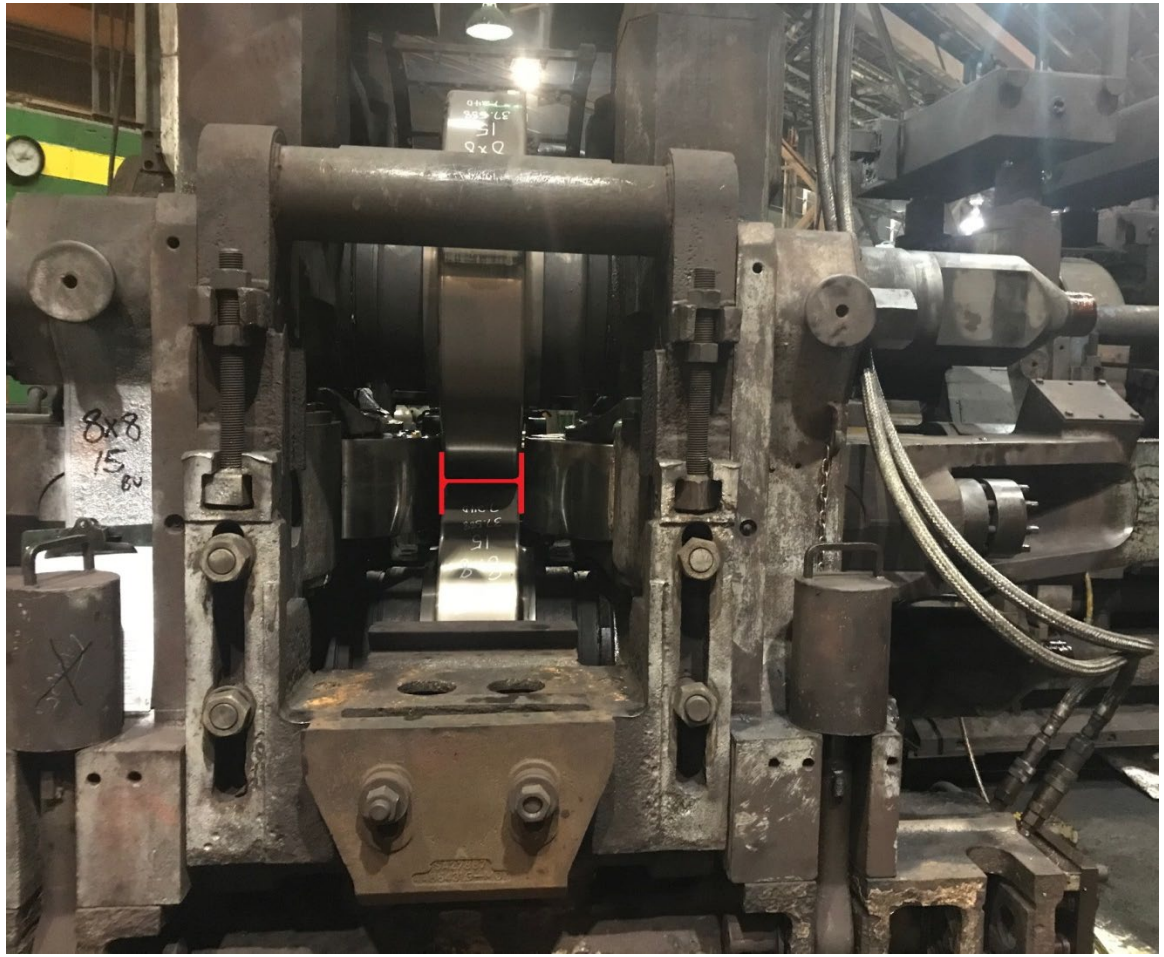
# FINISHING MILL

- After bar exits the roughing mill it travels down a roll table
- Gives an opportunity to hold a bar for a short period of time if a situation develops downstream, or trim the head off if needed.
- The bar then enters our finishing mill where it is worked in stand 6 through 15 to its final shape.
- Stands 7-15 utilize a universal roll setup where the gaps between four rolls create the pass to shape the bar

# TYPICAL FINISHING STAND



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# LASER GAUGE AND SHEAR

- After stand 15 bar passes through a laser gauge which measures and displays the dimensions of the bar passing through.

- We also have a flying shear to split bars into pieces that fit on our cooling bed if need be

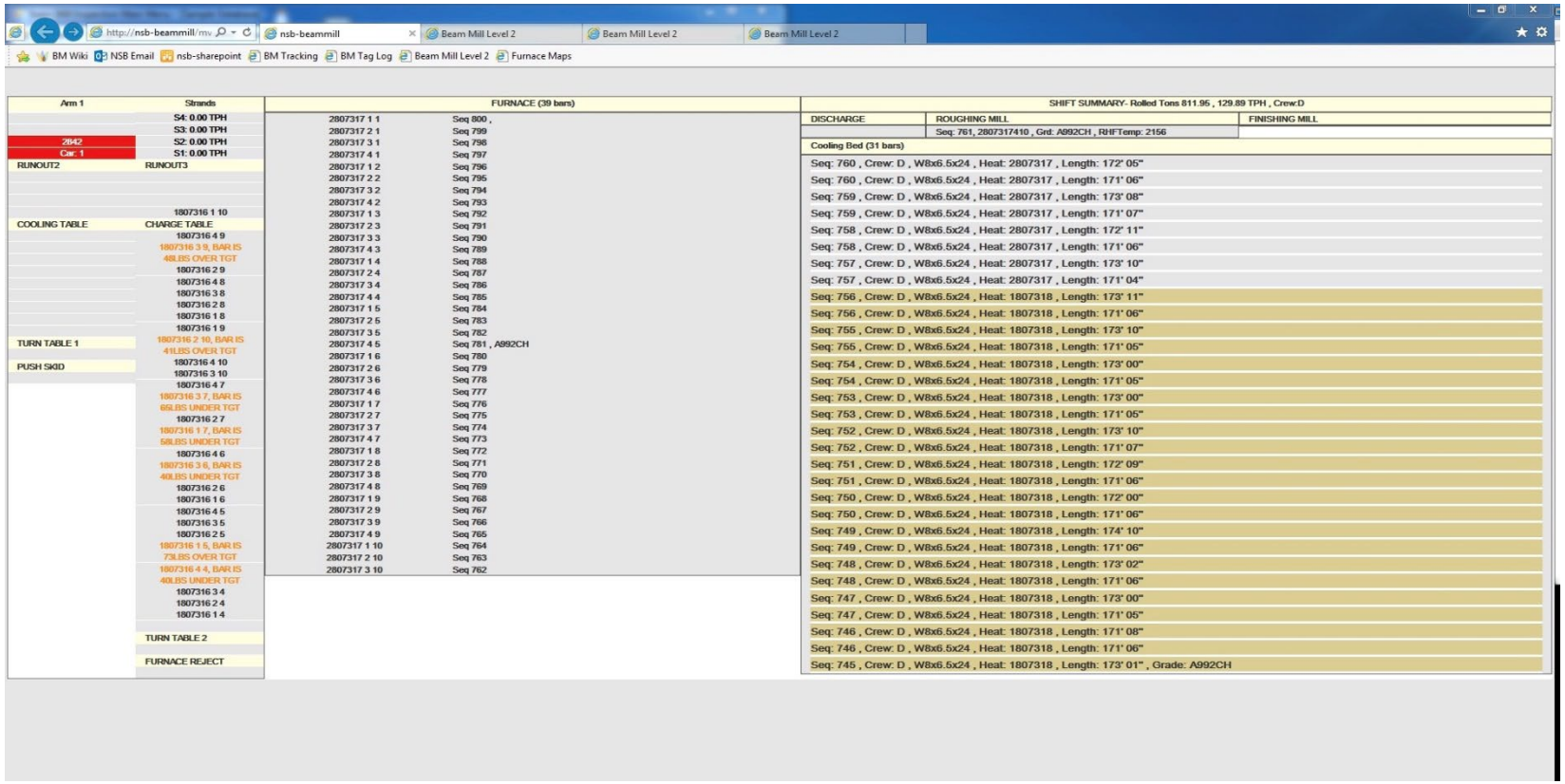
# COOLING BED

- Here samples are taken from each heat for mechanical testing to include tensile testing and charpy testing (upon request)
- Sampling is also done here to check dimensions and weight are within tolerances

# LEVEL 2 TRACKING

Each bar is tracked through the process with our Level 2 tracking. The screenshot below shows the sequence number of bars on the cooling bed as well as the sequence numbers of bars waiting to be discharged from the furnace.

Tracking allows us to easily identify bars downstream in our process.



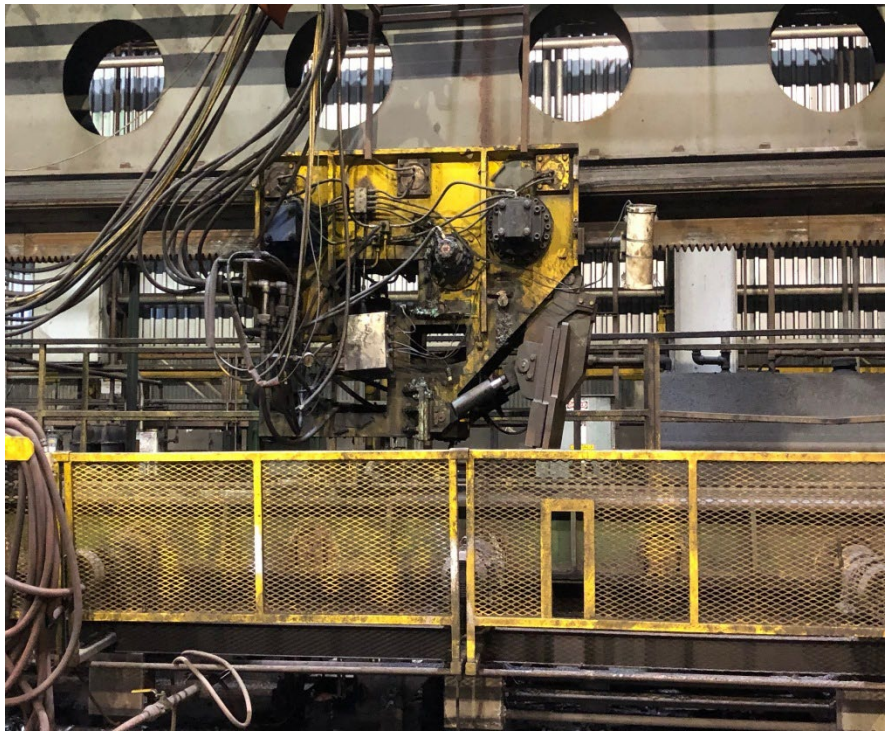
# ROTARY STRAIGHTENER

- Once the bar exits the cooling bed it goes through the straightener
- 10 roll cantilever design which can be adjusted axially or vertically to straighten bars
- As the bar exits the straightening process an ink jet stencils the heat number, section and grade approximately every 8’ on the bar.

# SURGE BED

The straightener operator utilizes the surge bed as a collection area after the bars have been through the straightener. The operator groups the bars into a “drag” (which is a group of bars) that are placed on the saw roll line. The drags then proceed to our cold saws.

# COLD SAWS

- Two stationary cold saws with moveable gage heads to ensure accurate lengths on cut material
- Also cuts off heads and tails that are tapered
  - This excess scrap gets re-melted at EAF



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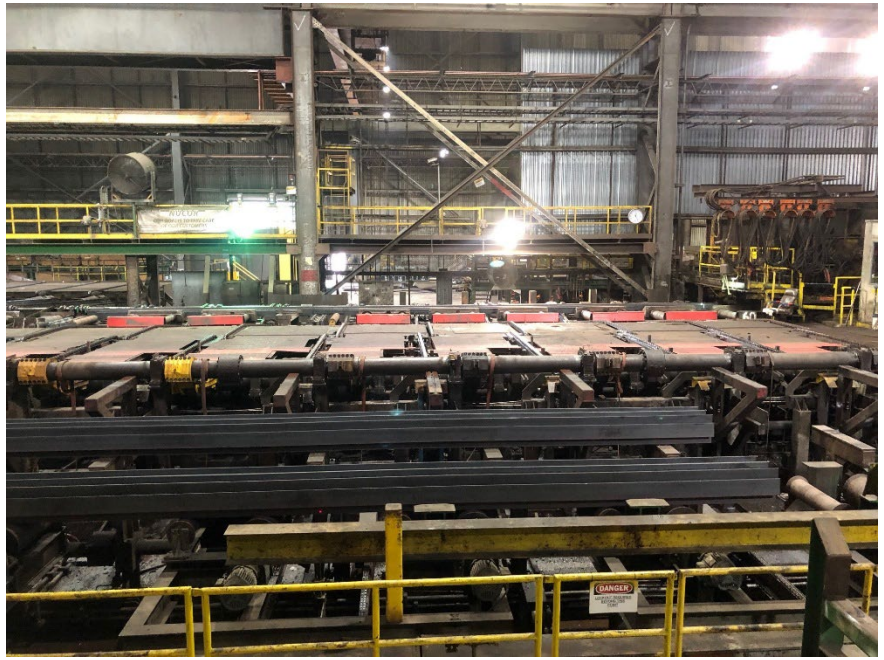
# STACKER



- The bars proceed to the stacker area after the cold saws. Material can be sent to either stacker A or B where it is inspected and the length is verified.
  - For material in excess of 65’ the stacker can be operated as a single stacker

- Material is stacked into the correct bundle configuration and sent to the tagging area where it is banded and tagged, then sent to shipping

# SHIPPING



We can ship via:

-Truck

-Rail

-Barge



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# THANK YOU FOR YOUR TIME!

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