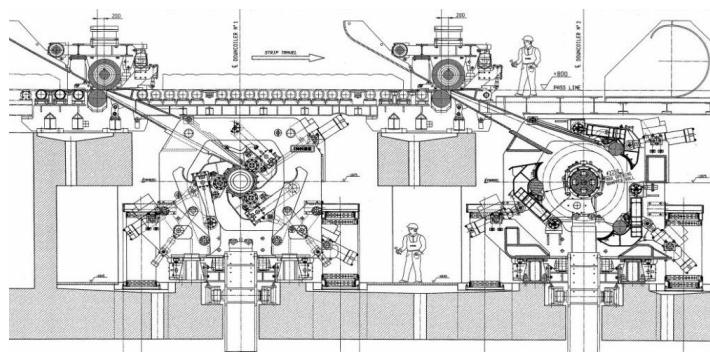


AIST Hot Sheet and Plate Rolling Fundamentals — A Practical Training Seminar

HOT STRIP MILL DOWNCOILERS

PRACTICAL CONSIDERATIONS FOR OPERATION AND MAINTENANCE



Xtek

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Xtek, Inc.
2022

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HOT STRIP MILL DOWNCOILERS

PRESENTATION:

THE DOWNCOILER - EQUIPMENT AND OPERATING SEQUENCE

AUXILIARY MATERIALS

- A. EQUIPMENT CONDITION PARAMETERS AFFECTING INITIAL CINCH
- B. EQUIPMENT CONDITION PARAMETERS AFFECTING IN-BAR COILING AND TAIL OUT

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HOT STRIP MILL DOWNCOILERS

THE GOALS:

RELIABLE COILING

Delay-free coiler operation
Controlled operating and maintenance costs

QUALITY COILING

Consistent and saleable coil quality –

- **Tight coils with straight sidewalls**
- This is necessary to limit handling damage and the need for downstream reprocessing



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HOT STRIP MILL DOWNCOILERS

THE DOWNCOILER consists of:

- Entry Guides
- Top and Bottom Pinch Rolls
- An Expanding, Rotating Mandrel
- A Series of Wrapper Rolls
- A Series of Guiding/Forming Aprons

Each component has a specific function and design parameters that must be maintained

All components work together as a system

WE WILL FOCUS ON THE THREE-ROLL COILER – MOST COMMON CONFIGURATION

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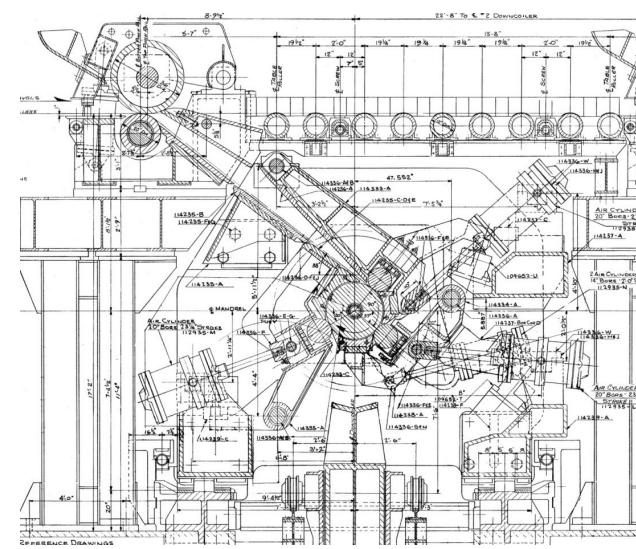
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TYPICAL EXAMPLE – Pneumatic Coilers 1960's vintage

- A fairly typical design
- **Pneumatic pinch rolls**
 - Top roll offset from bottom roll
- Three wrapper rolls w/ pneumatic cylinders
- Four-Segment Expanding Mandrel
 - “*Single Expand*”



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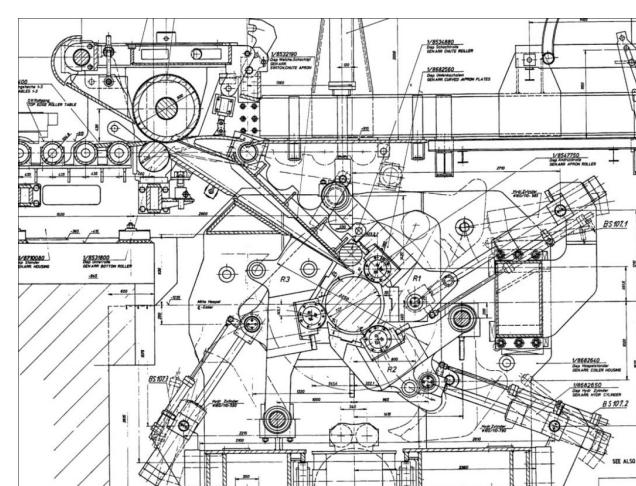
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TYPICAL EXAMPLE – Hydraulic Coilers, 1990's

- **Hydraulic Pinch Rolls**
- Three Hydraulic wrapper rolls with Jump, or Step, Control
- **Four-Segment Mandrel with “*Double Expand*” capability**

Looks the same but stiffer than pneumatic



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HOT STRIP MILL DOWCOILERS

COILER OPERATION

THE COILING SEQUENCE

Consists of 3 Main Phases:

- 1. Strip Entry and Threading up to “Cinch”**
- 2. In-bar Coiling**
- 3. Tail-out to Tail Spot**

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HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH:

“Cinch” – the initial grab and tightening to the mandrel

- ***Reliable coiling and coil quality are dependent on a good cinch***

GOAL – form the coil and cinch as early as possible

- ***Delayed cinch leads to looseness, telescoping of eyes, contributes to roll and mandrel wear***
- ***Good cinch and resulting tight eye are the foundation for the rest of the coil***

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH:

Initial Setups To Receive the Strip must be correct:

- Runout Table Speeds
- Sideguide opening (with short stroke)
- Pinch Roll gap and speeds
- Mandrel speed and power target
- Wrapper roll gaps and speeds

These setups are all functions of the incoming strip parameters:

- Width, Gauge, Finishing mill STRIP speed
- (*Strip speed is not simply the roll surface speed at the last stand – It's dependent on the reduction taken – forward slip*)

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH:

Initial Setups:

- **Runout Table Speed:**
 - *The traction on the table rolls is relatively minor – (strip weight per roll x coefficient of sliding friction) – the table rolls can't do much “work” to pull the strip flat*
 - *Match strip exit speed, or slight lead (only 1% or so)*
 - *Too much lead speed can reduce whatever traction is available, defeating the purpose*
 - *Slippage only wears the rolls and scratches the strip.*

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HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH

Initial Setups

- **Sideguide opening (with short stroke)**
 - The sideguide's job is to get the strip into the pinch rolls and down the chute on the mill centerline
 - Guide opening, with short stroke allowance, must be capable of accepting hooked head ends, and getting the head on center
 - Guide positioning must be accurate and repeatable, and must put the strip on center



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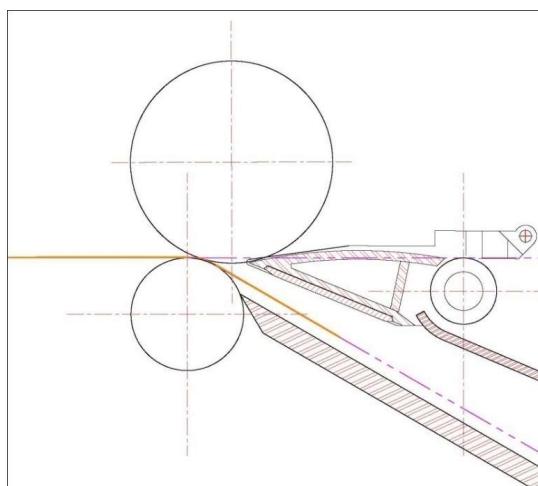
HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH

Initial Setups

Pinch Roll Gap and Speed:

- Gap is usually set slightly smaller than expected thickness (usually about 0.030", pneumatic) – to grip the sheet
- Slight lead speed compared to finishing mill exit speed (about 2 – 5%)
- Offset top roll provides some initial bend to the head end of the strip
- “Modern” Coilers use high force hydraulic cylinders and strong motors at the pinch rolls (mostly for TE control)



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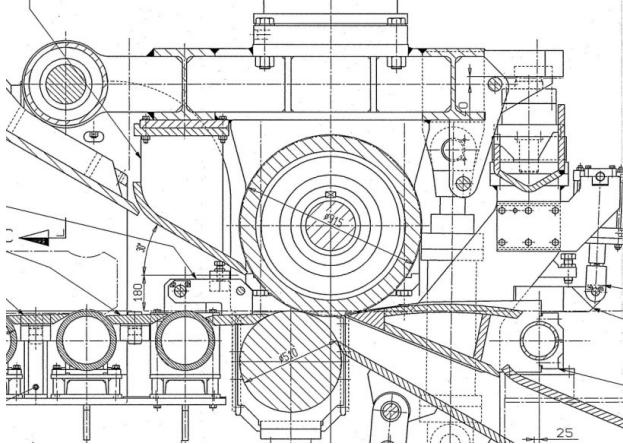
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HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH

Pinch Roll Gap Setting Mechanism:

- This can be a pair of screw jacks, with motor encoder
- This can be position sensors within a hydraulic cylinder, with cylinder position-control (and force-control) hydraulics
- *Must be accurately calibrated, and accurately maintained*



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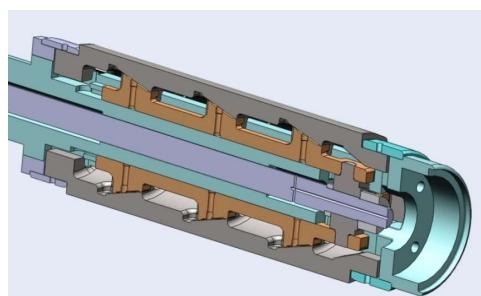
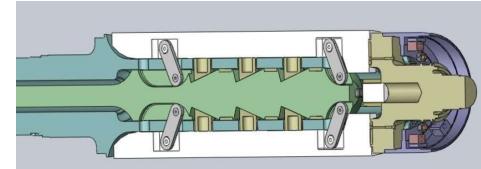
HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH

Initial Setups

Mandrel Diameter and Speed:

- The mandrel segments must be held solidly at the *initial coiling diameter* (for double expand units) or the fully expanded diameter for single expand units
- *This is the only time when the mandrel is truly round*
- *Segment positioning is critical for wrapper roll setup*
- Mandrel lead speed – generally around 10% to 15% above strip exit speed

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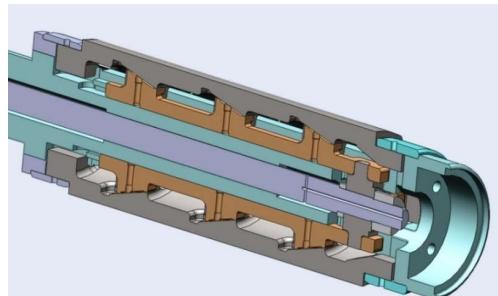
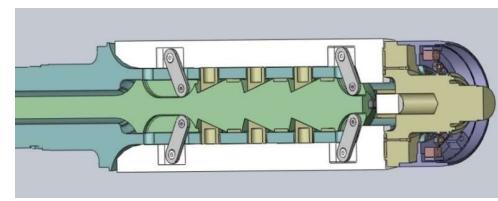
HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH

Initial Setups

Mandrel Speed and Torque:

- The mandrel is given a Speed Reference while awaiting the strip (includes lead)
- Also, there is generally a Tension (power, torque, amps) target in anticipation of cinch
 - This power (torque) reference includes power required to bend and yield the strip around the mandrel
 - Includes the tractive force (tension) required to pull the strip straight

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH

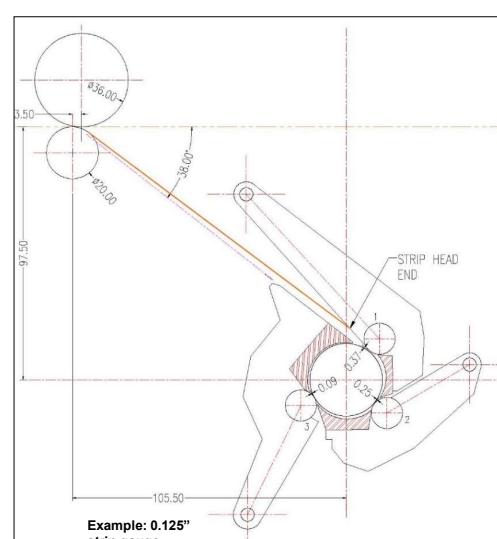
Initial Setups

Wrapper Roll Gaps and Speeds:

Nominal “generic” wrapper roll gap settings

- #1: 3 x strip gauge
- #2: 2 x strip gauge
- #3: strip gauge – (0.030”); pinch

- Wrapper Roll lead speed – only slightly above strip speed – *they only have limited power, limited traction*
 - *the best scenario is to minimize scratch potential on the strip and wear on the rolls*



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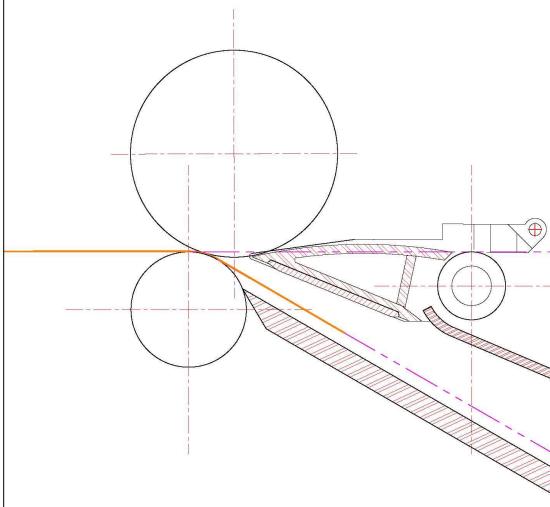
HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH

OPERATION - Strip Entry:

Strip Enters Pinch Roll bite

- HE directed down chute towards Wrapper Roll #1
- *The Top Pinch Roll offset can help impart a bend on HE*
- *PR grips the strip and the drive motors load up*
- *Impact force, speed drop, and current spike can be used to track HE*



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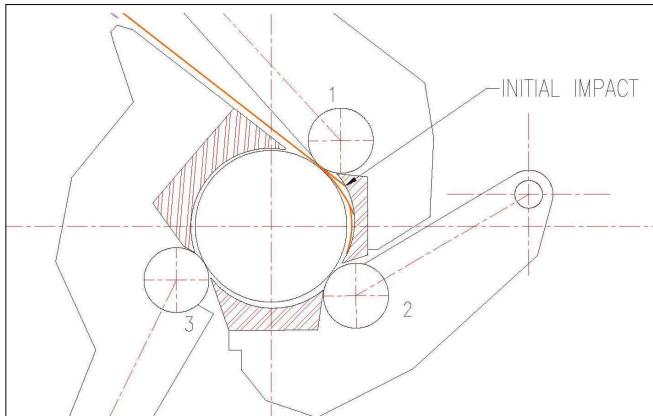
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HOT STRIP MILL DOWCOILERS

PHASE 1 - THREAD AND CINCH

OPERATION - Wrapper #1:

- Strip continues down chute to Wrapper Roll #1
- Impacts Curved Apron #1 and begins to bend
- *The Wrapper Roll itself provides no Bending*
- Continues to bend and slide towards Wrapper Roll #2
- *All driving force is essentially from the pinch rolls*



The Wrapper Roll Cylinder must have sufficient force to resist being pushed out by the strip

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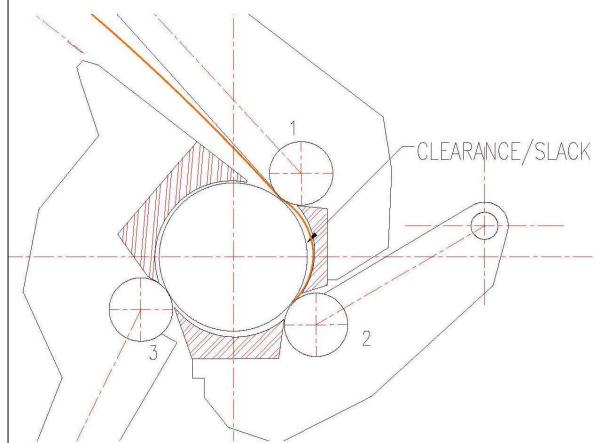
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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH

OPERATION - Wrapper #2:

- Strip enters gap at #2 Wrapper Roll
- Continues to #2 Curved Apron and begins to bend more
- Slack loop can now develop between rolls 1 and 2 due to the clearance between rolls/apron and the mandrel
- No grip at the mandrel yet; all drive is still from Pinch Rolls



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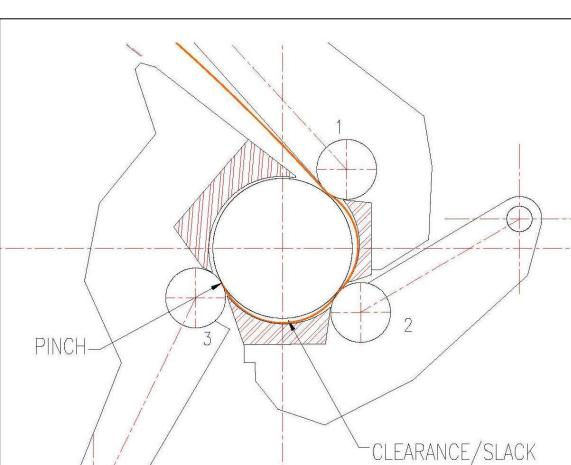
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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH

OPERATION – Wrapper Roll #3:

- Strip enters gap at #3 Wrapper Roll
- Slack loop again forms between Roll #2 and #3
- At bite of #3 roll, the first pinch to the mandrel occurs
- Lead speed on the mandrel can now help to pull out the slack
 - Friction force available is still relatively low
- If gripped, Strip can begin to tighten to the bottom of mandrel



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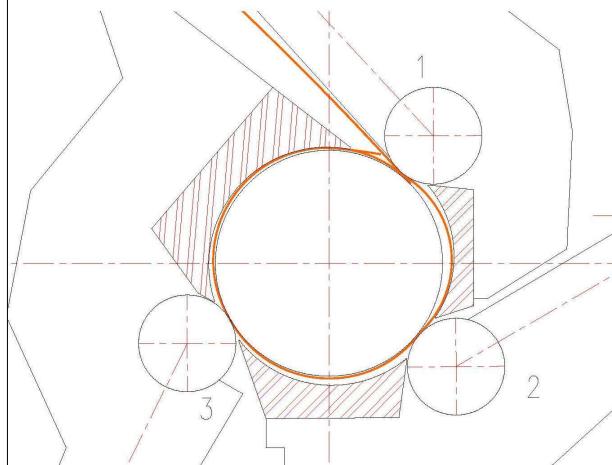
HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH

OPERATION - 1st Wrap

Head end exits Curved Plate #3

- Directed to the underside of incoming strip
- Enters the gap at #1 Wrapper Roll
- *First wrap completed*



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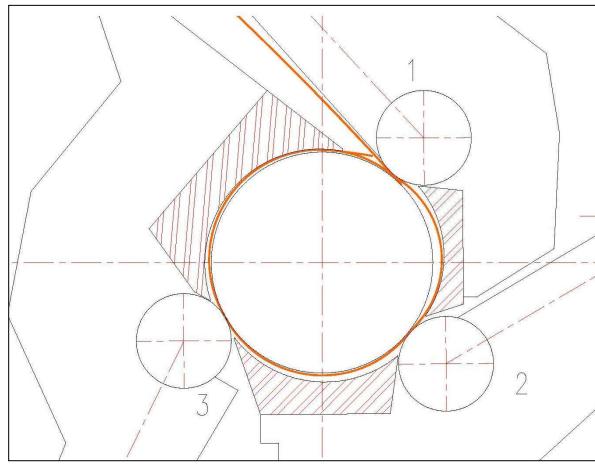
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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - THREAD AND CINCH:

Operation - 1st Wrap

- Even though we've completed a wrap, there is still slack in the loop.
- The mandrel cannot grab, or cinch, until all the slack is removed and the loop pulls tight to the mandrel
- Friction/traction is still light - Must pull out and fill up the gaps to force the issue



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HOT STRIP MILL DOWNCOILERS

PHASE 1 - THREAD AND CINCH:

Operation - Successive Head End Wraps

*Mandrel, with its **lead speed**, must pull the head end "forward" to pull out the slack – tighten from the inside.*

- *But - too much lead speed promotes loss of traction...it's a compromise.*
- *When slack is gone, friction builds and CINCH OCCURS*
- **THE MANDREL DRIVE LOADS UP AND CAN NOW ESTABLISH TENSION**

Goal is to attain cinch as early as possible

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HOT STRIP MILL DOWNCOILERS

PHASE 1 - CINCH

- You know you've cinched when you see the mandrel motor load up
- The mandrel speed drops to strip speed, and the mandrel motor current rises sharply
- Mandrel drive now enters the **tension control regime**, and Phase 2 begins.
- Once cinched, the wrapper roll job is essentially done until tail out

Mandrel Speed 2350 Ft/Min Prior to Cinch
Mandrel Current 30-82 Amps Prior to Cinch
Gauge - .080"
Width - 32.69"
Grade - Q,84XAA

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 - CINCH

- You know you've cinched when you see the mandrel load up

DOWNSCOILER A MANDREL

100%

0%

-100%

0 N SPEED REF 100% = 1000 2 N AV. CUR. FB. 100% = 5000
1 N RESOLVER SPD. FB 100% = 1000 3 N CONTROL OUTPUT 100% = 10000

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 – Completed

Again, the goal is to cinch as early as possible

- Nice tight eye, no looseness, minimal telescope
- Build a good foundation or the rest of the coil
- Minimize wear on segments, aprons, and rolls

So...what goes wrong?

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HOT STRIP MILL DOWNSCOILERS

PARAMETERS THAT DETRACT FROM A SUCCESSFUL CINCH:

- *Incorrect Speed/Tension Referencing to Mandrel and Rolls*
- *Improper gap setting of rolls and aprons – SLACK IN COIL EYE*
 - Position calibration inaccuracy, or equipment malfunctions
 - Incorrect info sent to coiler PLC
 - Offsets introduced by operator
 - The influence of roll and apron wear
- *Slack = Slippage = Increasing Wear*
- *Wear increases the Wear Rate – a vicious circle*

SEE AUXILIARY MATERIALS FOR DETAILED DISCUSSION OF THE ABOVE

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HOT STRIP MILL DOWNSCOILERS

PHASE 2 – In-Bar Coiling:
After cinch, building the coil...

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HOT STRIP MILL DOWNCOILERS

PHASE 2 – In-Bar Coiling

*Coil quality is dependent on good **tension control** and strip guidance*

GOAL: Consistent and sufficient tension to pull the strip straight between coil and mill

- POOR TENSION CONTROL
 - Loss of the tracking force in the strip
 - Allows the strip to weave and wander
 - This can happen on and off throughout the coil



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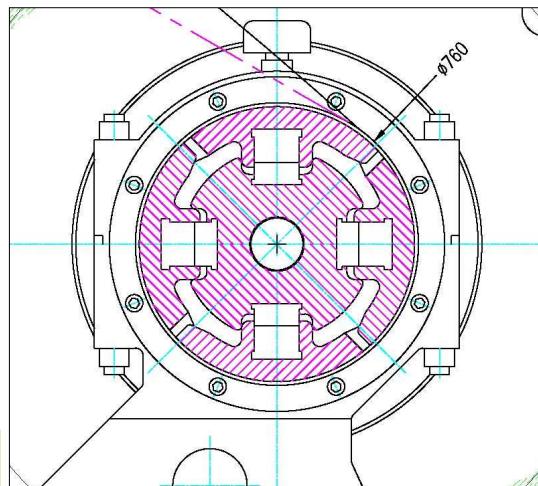
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HOT STRIP MILL DOWNCOILERS

PHASE 2 – In-Bar Coiling:

- **Tension control = Mandrel drive control**
- Once cinched, mandrel drive enters “tension control” regime
- This is control of mandrel **Power, or Torque**, required to:
 - Rotate the coil inertia at given speed
 - Bend and yield the strip around the coil
 - Provide the **tracking force (tension)** in the strip needed to pull straight

Tension is controlled in terms of mandrel motor current (amps)



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HOT STRIP MILL DOWCOILERS

PHASE 2 – In-Bar Coiling:

- **Tension control = mandrel drive control**
 - The mandrel drive must have sufficient power (torque) to coil the desired product
 - Strip gage and the mechanical properties of the steel grade enter into the desired current calculation
 - Thicker gage, stronger steels require more torque to bend
 - Coiling temp affects strength



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HOT STRIP MILL DOWCOILERS

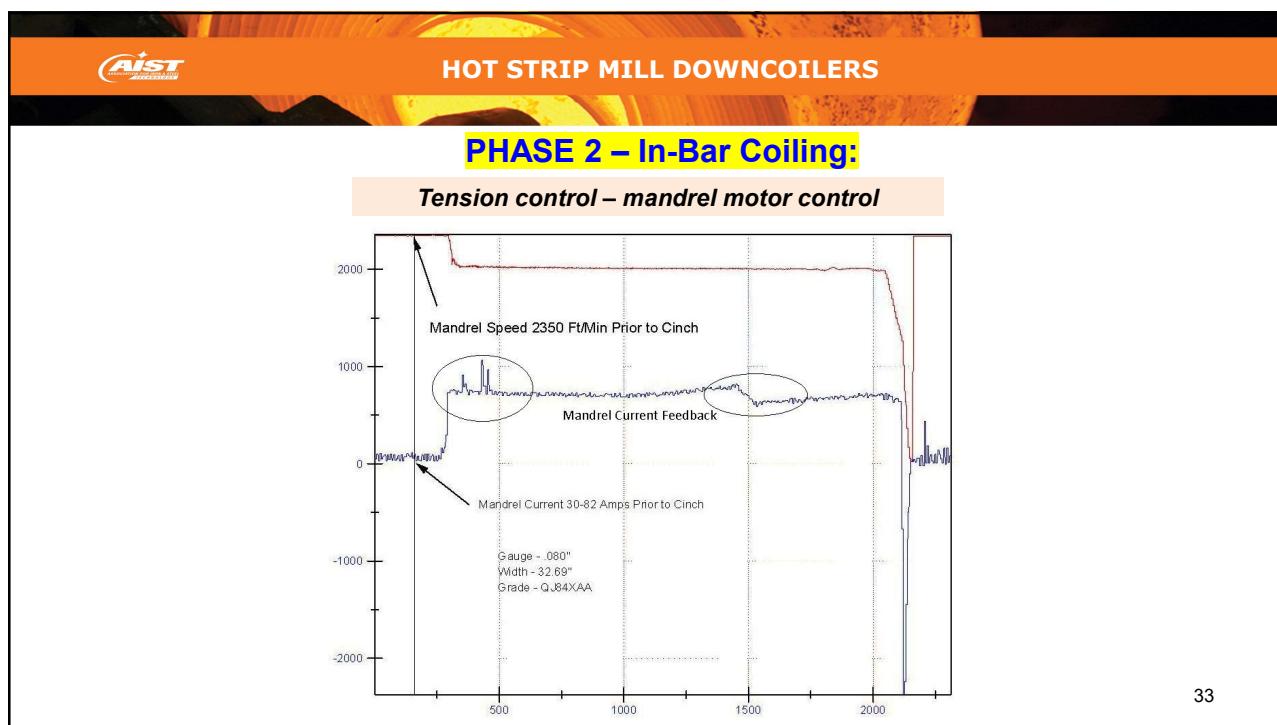
PHASE 2 – In-Bar Coiling:

- **Tension control = mandrel drive control**
 - **Mandrel Drive responsiveness is crucial**
 - The Mandrel Drive must be capable of reacting closely to the finishing mill drives
 - Mass flow out of the mill: AGC compensations, cold spots, etc.
 - Automated finishing temperature effects
 - All affect the strip delivery speed and thus the coiling tension continuously in-bar



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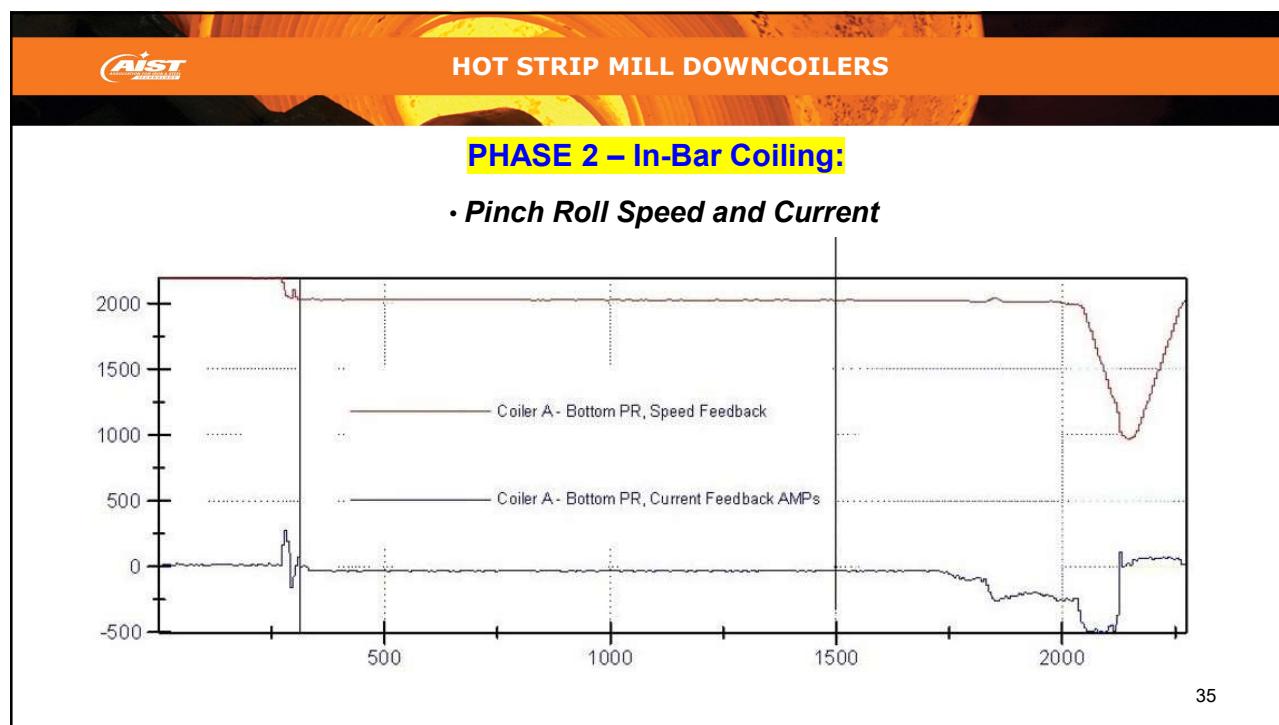
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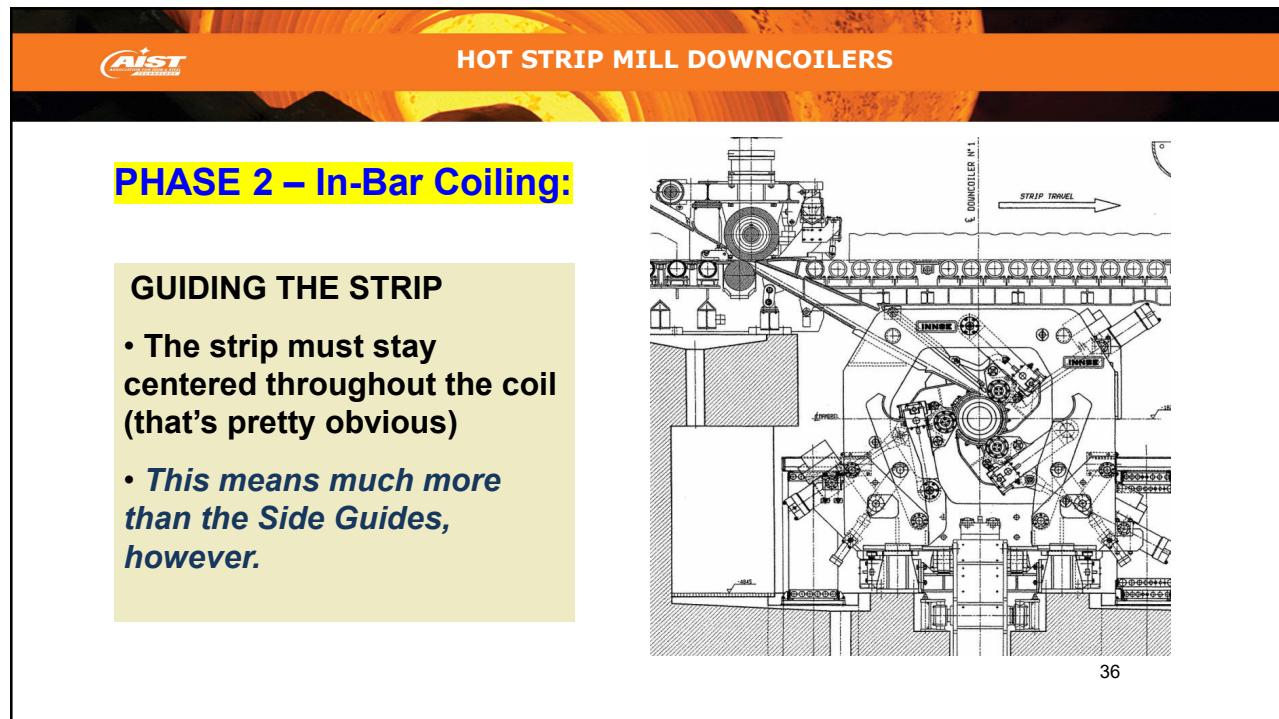
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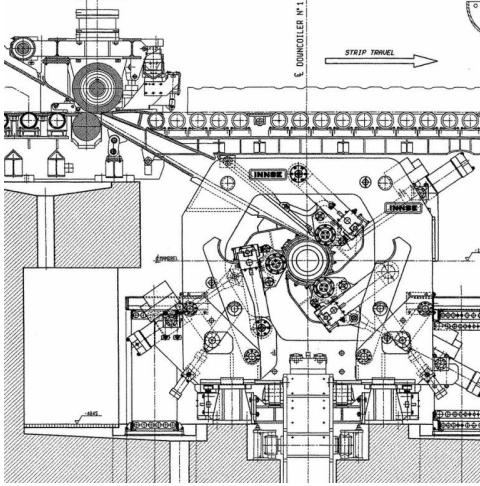
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PHASE 2 – In-Bar Coiling:

GUIDING THE STRIP

- Equipment alignment and condition is crucial to guidance
 - Especially with tension on the product
 - Under tension, if something is out of true, it will quickly and progressively run the strip off center
- **Mandrel and Bottom Pinch Roll alignment to the mill and to each other is critical**

SEE AUXILLIARY MATERIALS FOR DETAILED DISCUSSIONS ON THE ABOVE



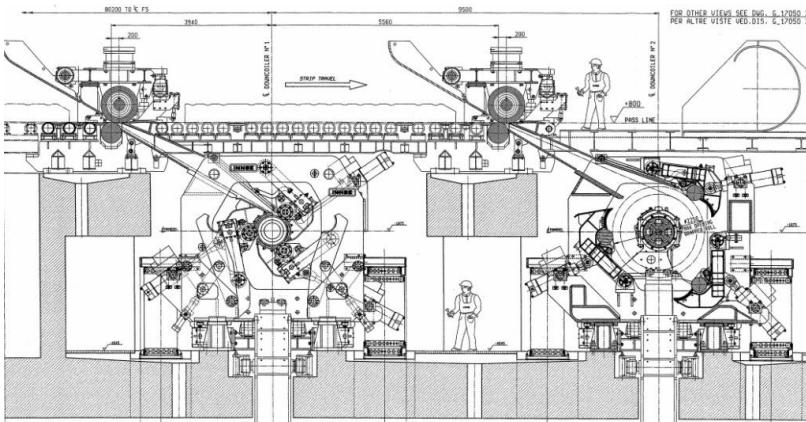
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HOT STRIP MILL DOWNCOILERS

PHASE 3 – Tail Out:

Tailing Out, Slowing Down, and Stopping the Coil



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HOT STRIP MILL DOWNSCOILERS

PHASE 3 – Tail Out:

Tail Out Tension is controlled between the Mandrel and the Pinch Rolls

The Mandrel drive must now **DECELERATE** the large coil inertia to slow the coil for tail spotting

The Mandrel Drive must also **MAINTAIN THE TENSION** required to hold the strip straight

- The mandrel needs something to pull against - The pinch rolls must provide sufficient hold-back force or braking to establish this tension
- This is accomplished with **REGENERATIVE BRAKING** at the pinch roll motors

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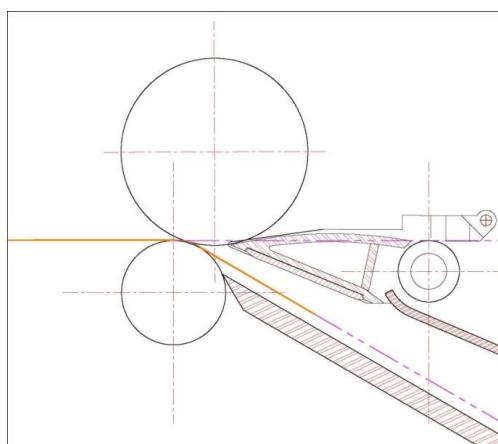
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HOT STRIP MILL DOWNSCOILERS

PHASE 3 – Tail Out:

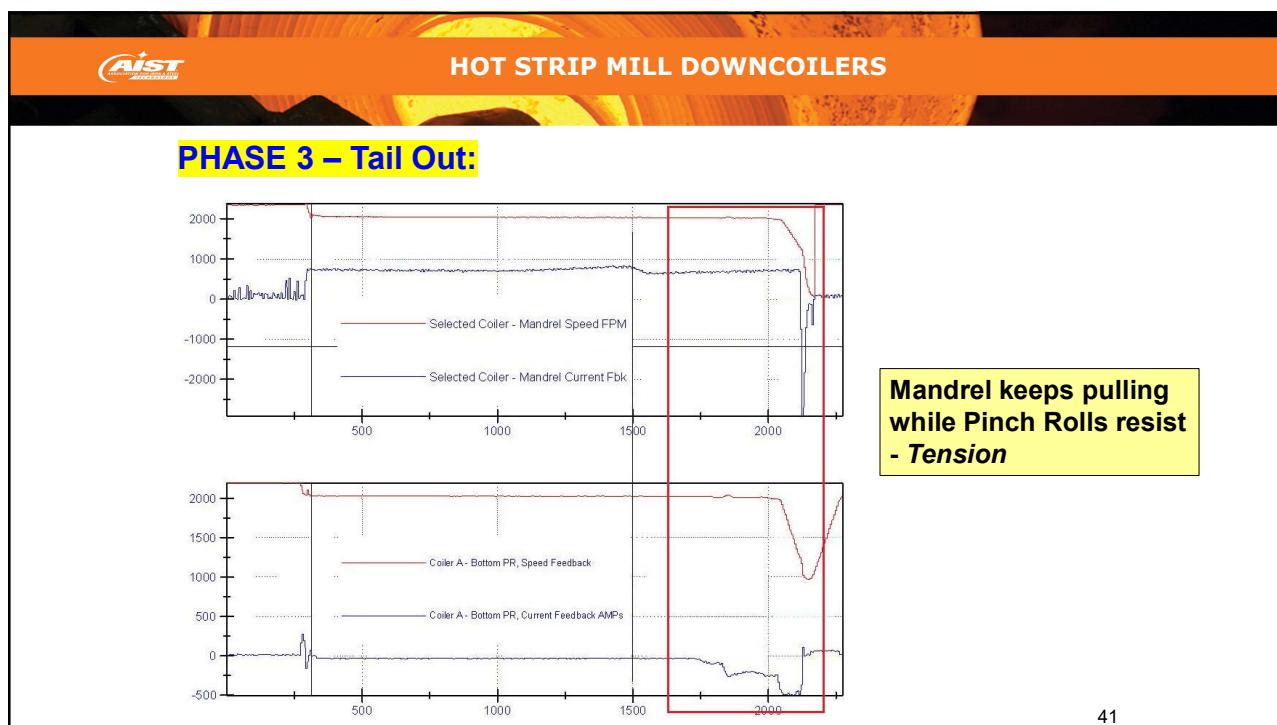
PINCH ROLLS: Regenerative Braking

- The drive motors will **regenerate** heavily (negative current) to provide the back tension – **drag brake**
- The top PR must have sufficient hold-down force to resist slipping
- Motors must have sufficient drive power to achieve and maintain tension
- Combined roll wear, top and bottom, can compromise grip

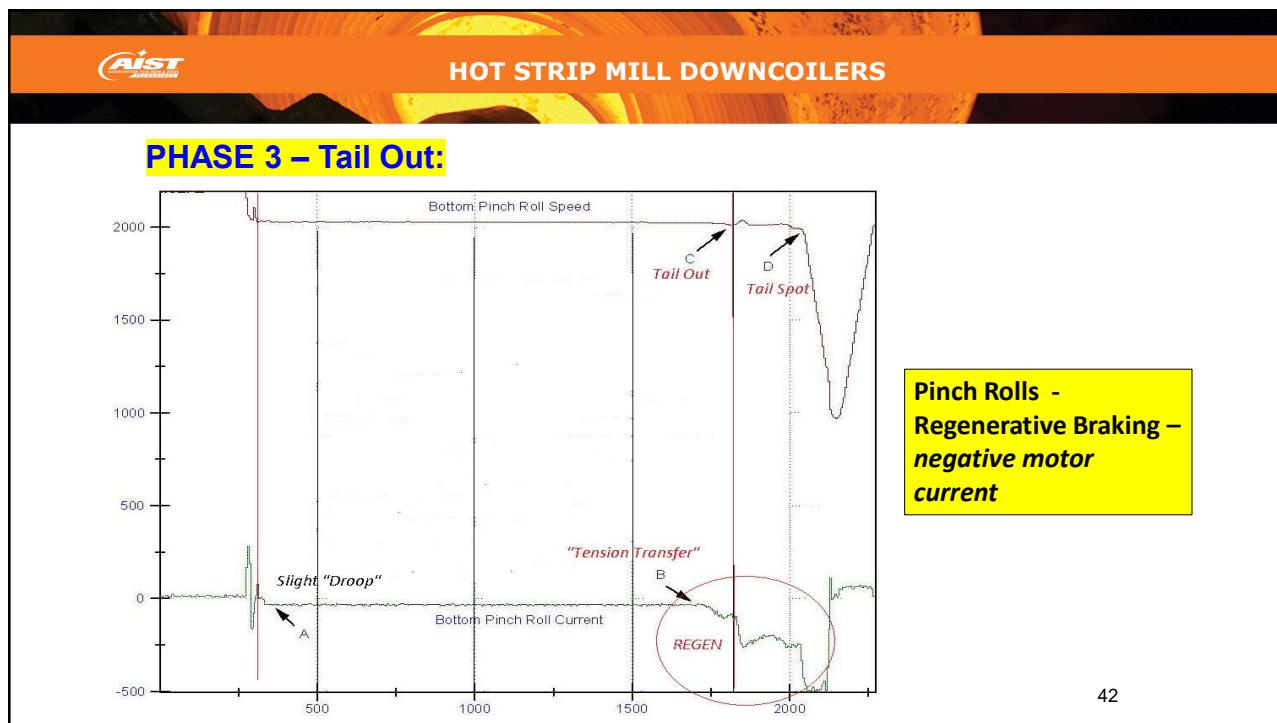


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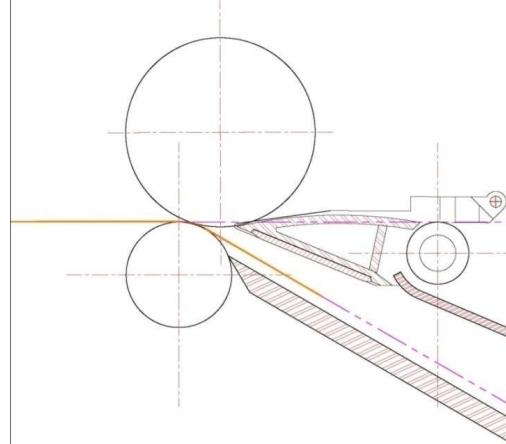
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HOT STRIP MILL DOWCOILERS

PHASE 3 – Tail Out:

Poor Tail End tension control -

- Loose wraps and Tail End run off
- TE runoff allows *pinchers* or edge lap in the Pinch Roll bite
 - Defect in strip; yield loss
 - Bruises on the PR's
- Uncontrolled tails will beat up the coiler equipment
- Makes the coil difficult to strip



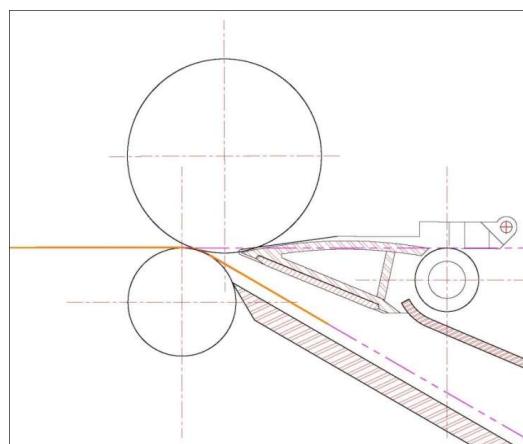
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HOT STRIP MILL DOWCOILERS

PHASE 3 – Tail Out:

- Poor tension control – *Uncontrolled Tail Speed*
- “Tail – End Whip” – strip tail pulling the PR's ahead of their assigned speed, or slipping thru the PR's, accelerated by the mandrel as it tries to maintain tension
- Can lead to tail end coiling temp defects
 - Strip is yanked from under the laminar sprays too fast to cool
 - Yield loss



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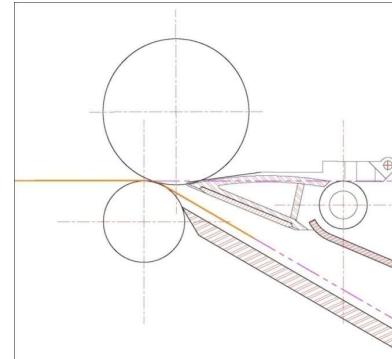
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HOT STRIP MILL DOWNCOILERS

PHASE 3 – Tail Out:

Transfer of Tension from the Mill to the Pinch Rolls begins with the tail well back in the finishers

- Must be complete *prior to* the tail leaving the last stand – “bumpless” transfer
 - If raised, the Top PR must be brought back down
 - Speed control on this roll is critical to avoid damage/mark strip
 - PR speed control shifted to a “Hard” control at this time (vs. droop response mode)



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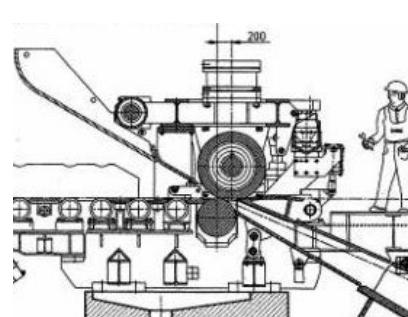
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HOT STRIP MILL DOWNCOILERS

PHASE 3 – Tail Out:

PINCH ROLLS - Alignment:

- Alignment of the *Top Pinch Roll* is now also critical to control the TE
 - Maintain condition of the ways and/or pivots
 - Contact force in the pinch roll bite must be uniform to avoid steering the strip, just like in the mill stands



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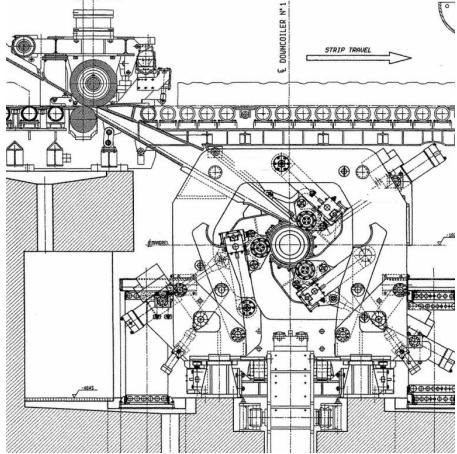
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HOT STRIP MILL DOWCOILERS

PHASE 3 – Tail Out:

TAIL SPOT:

- Tail is tracked down the table, mandrel and roll drive decelerate to position the tail
- One or more wrappers is usually brought in to the coil to help hold the free end
- On newer coilers, the wrappers are brought in near the coil OD with a combination of hydraulic *Position* and *Force Control*, and indexed outward as the coil finishes



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HOT STRIP MILL DOWCOILERS

PHASE 3 – Tail Out:

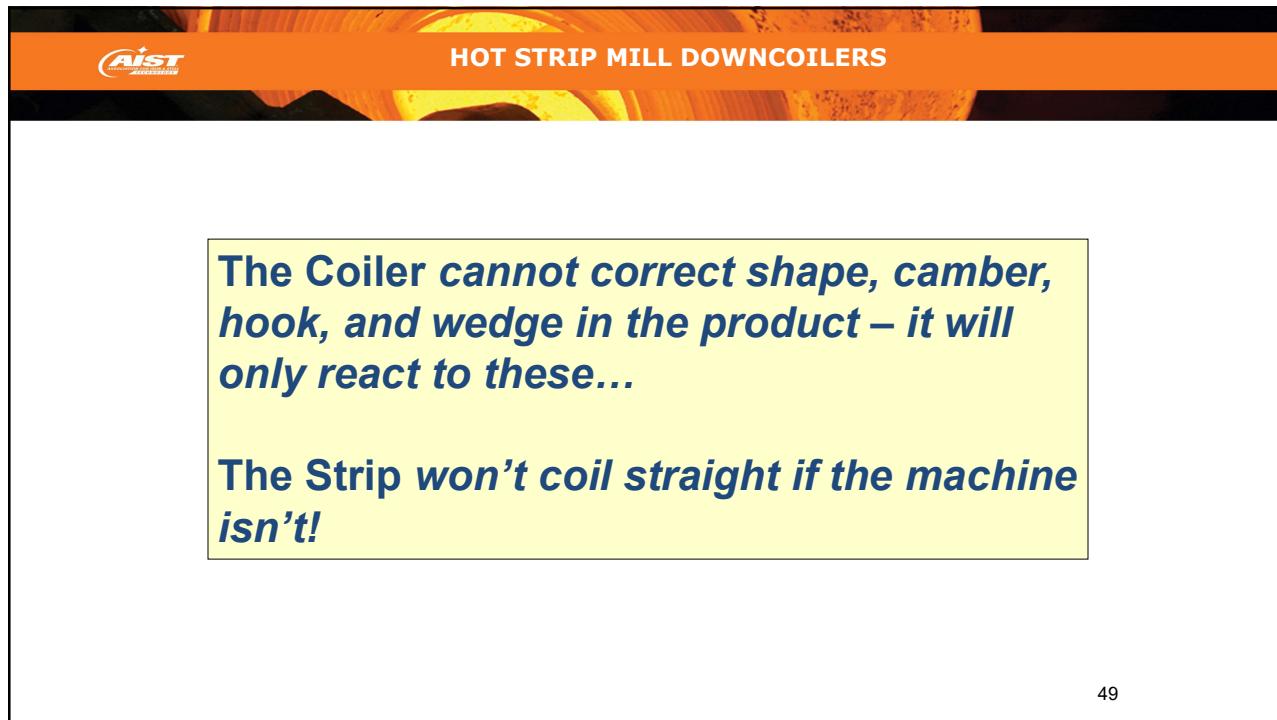
The TAIL OUT SEQUENCE can be one of the more challenging control scenarios in the hot mill

- Extremely sensitive to changing *machine* and *product* conditions
- It's easy to get drawn into chasing day-to-day tail end conditions existing *in the product*, such as camber or wedge

And that's it – we've completed a coil.

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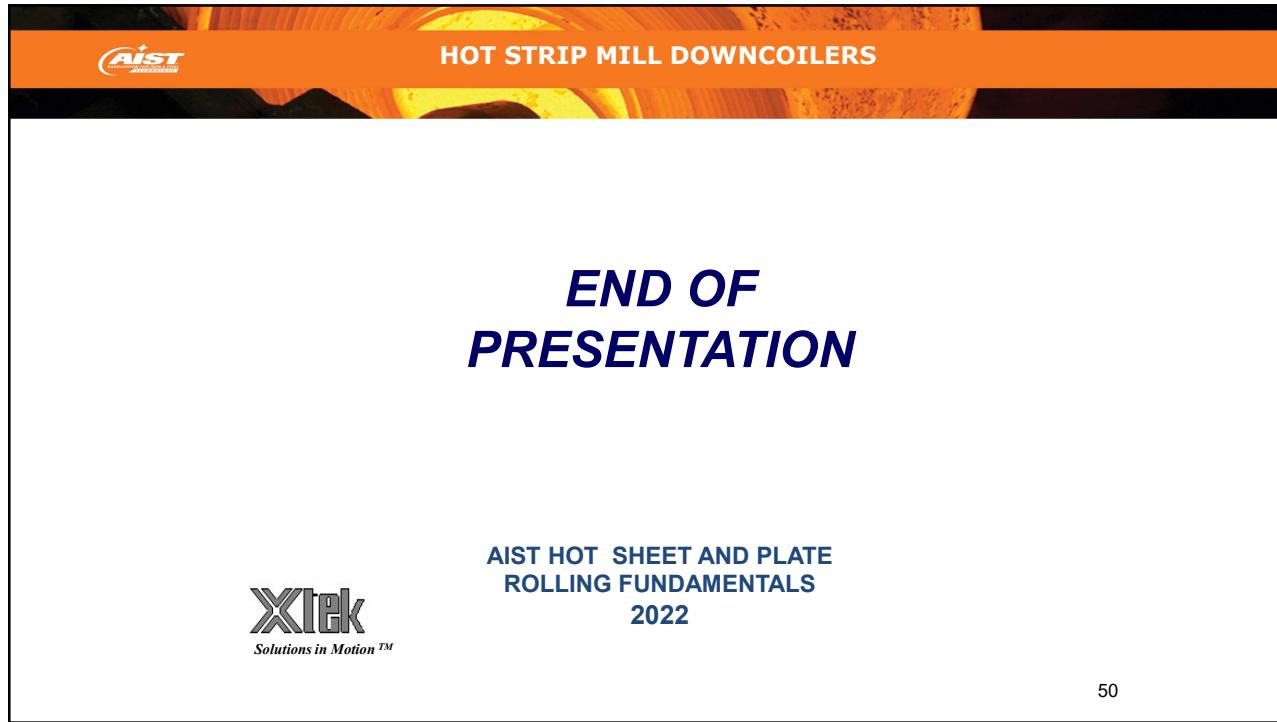
The banner at the top of the slide features the AIST logo on the left and the text "HOT STRIP MILL DOWCOILERS" in white capital letters on the right, set against a background of blurred industrial machinery.

The Coiler cannot correct shape, camber, hook, and wedge in the product – it will only react to these...

The Strip won't coil straight if the machine isn't!

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The banner at the top of the slide features the AIST logo on the left and the text "HOT STRIP MILL DOWCOILERS" in white capital letters on the right, set against a background of blurred industrial machinery.

***END OF
PRESENTATION***

AIST HOT SHEET AND PLATE
ROLLING FUNDAMENTALS
2022

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HOT STRIP MILL DOWNCOILERS

PRACTICAL CONSIDERATIONS FOR
OPERATION AND MAINTENANCE

AUXILIARY MATERIALS

EQUIPMENT CONDITION PARAMETERS AFFECTING COILING PERFORMANCE

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HOT STRIP MILL DOWNCOILERS

PHASE 1 – HEAD END ENTRY UP TO
CINCH

Equipment Condition as Affects the
Initial Wraps

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HOT STRIP MILL DOWNCOILERS

PHASE 1 – Equipment Condition

Wrapper Roll Gaps and Wear Issues:

- *Initial Setup – Roll and Apron Gaps are critical to coil cinching.*
- **Extra gap = Extra Clearance = Extra Slack**
 - Improper gap settings or gap holding
 - Position calibration inaccuracy, or equipment malfunctions
 - Offsets introduced by operator
- **Slack = Slippage = More Wear**
- *Wear increases the Wear Rate – a vicious circle*

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HOT STRIP MILL DOWNCOILERS

PHASE 1 Equipment Condition

Wrapper Roll Gaps and Wear Issues:

- *Roll gaps are affected by roll wear and segment wear*
 - Roll Body Wear increases the actual gap
 - Wear on roll combines with wear on Segments
 - Wear introduces extra slack to the first wrap and thus successive wraps, delaying cinch
 - Too much wear delays initial pinch at the wrapper rolls
 - More slippage between mandrel segments, rolls and strip

Wear increases the Wear Rate – a vicious circle

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HOT STRIP MILL DOWCOILERS

PHASE 1 – Equipment Condition

Wrapper Roll Gaps and Radial Wear:

“Strip’s-eye-view” of Wrapper Roll and Mandrel Segment wear

- Wear on these two items is additive, as far as the strip is concerned
- This wear cannot be “calibrated out” due to end contact. It fools the calibration

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HOT STRIP MILL DOWCOILERS

PHASE 1 – Equipment Condition

Wrapper Roll Gaps and Radial Wear:

How is the wrapper roll position calibrated?

- Each roll is creped in to touch the spinning mandrel
- When contact/speed is sensed, position sensor is “zeroed”.
 - A worn roll will contact at the unworn ends only, neglecting the wear
- So we can't fully account for the extra gap by recalibrating (or offsetting) the roll position without running into the mandrel

Too much inward offset will cause constant roll contact and damage to mandrel and roll units

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 – EQUIPMENT CONDITION

Wrapper Roll Gaps and Radial Wear:

- General Targets
 - Segment Wear : 0.100" Max per side
 - Wrapper Roll Wear <= 0.030" per side

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 – EQUIPMENT CONDITION

Wrapper Roll Gaps and Radial Wear: *LEAD SPEED*

- Poor cinching usually results in someone increasing the lead speed of the mandrel
- Proceed carefully – this can cause decreased traction
 - Like stepping on the gas while the tires are spinning.....
- Increased slippage = Increased wear
 - The wear cycle accelerates
 - Slip-Grab adds shock to the drive train components – increased damage

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HOT STRIP MILL DOWNCOILERS

PHASE 1 – Equipment Condition

PINCH ROLL and WRAPPER GAP SETTING EQUIPMENT:

- This equipment must be consistent and repeatable. We're controlling roll positions to thousandths of an inch.
- **Pneumatic coilers** will usually have some form of screw jack adjustment for the wrappers and pinch rolls.
 - These require mechanical linkages, couplings, etc. all prone to wear and backlash
 - The contact points where the equipment contacts the jack heads can also be subjected to uneven wear, and distort gap settings
 - The sensors have to be correct, and correctly calibrated

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HOT STRIP MILL DOWNCOILERS

PHASE 1 – EQUIPMENT CONDITION

PINCH ROLL AND WRAPPER GAP SETTING EQUIPMENT:

- **Hydraulic coilers** will usually use some form of linear sensor (Temposonics) within or tied to the cylinder
 - The hydraulic valve controls become critical and software intensive
 - Closed loop position feedback and correction can lead to “hunting” or “dithering” out at the roll – noise etc.
 - Wrapper roll “Jump” or “Step” control can beat up all the pivots, trunnion, pins over time
 - Fully dependent on position sensors - *sensor inaccuracy or failures can cause a lot of damage*

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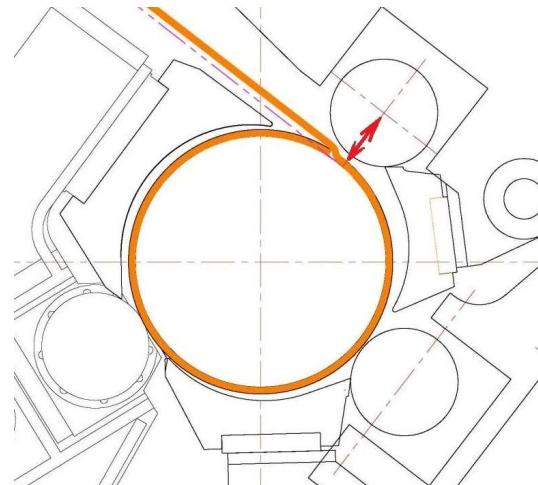
HOT STRIP MILL DOWNCOILERS

PHASE 1 – EQUIPMENT CONDITION

- **What is Wrapper Roll Step/Jump Control?**

Sharp, quick wrapper roll movements, out and back in

- **Timed to step over the head end lap**
- **Each roll moves out and back in as head passes**
- **HE Tracking is crucial**
- **Hydraulic responsiveness is crucial**



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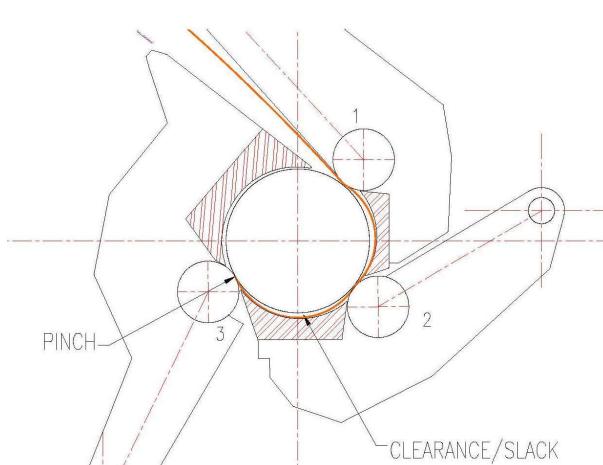
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HOT STRIP MILL DOWNCOILERS

PHASE 1 – EQUIPMENT CONDITION

WRAPPER CURVED APRON GEOMETRY:

- Good cinching is **VERY** dependent on the design shape and the condition of the CURVED APRONS
- Design geometry sets the available clearance and the slack in the initial wrap
- Subjected to heavy abrasion and impact from strip head ends
 - Wear increases clearance. Increases initial slack
 - Remember – the aprons do the actual bending of the strip head **and** hold the strip close to the mandrel surface on first wrap



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HOT STRIP MILL DOWNSCOILERS

PHASE 1 – EQUIPMENT CONDITION

CURVED APRON GEOMETRY:

- #1 Apron can be gouged from the head end (heavy gage, hard product) at first point of impact
- It sees a high wear rate from primary head end bending
- Deep gouges can cause stumbles, cobbles

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HOT STRIP MILL DOWNSCOILERS

PHASE 1 – EQUIPMENT CONDITION

THE MANDREL AND COIL CINCH:

- The Mandrel Condition is of course critical
- We've discussed segment wear a bit – it's additive to roll wear at coil thread
 - Uneven segment wear can skew the head end and contribute to coil quality problems
- *Mandrel Alignment to rolling stands is critical*
- *Uneven internal wear can make the mandrel appear off-level or skewed*

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HOT STRIP MILL DOWNCOILERS

PHASE 1 – EQUIPMENT CONDITION

THE MANDREL AND COIL CINCH:

"DOUBLE EXPAND" – a means to take up the clearance after initial coil eye is wrapped, and to increase driving friction force between mandrel and strip

- Mandrel is held at a predetermined initial (Pre-Expand) diameter at setup
- Energized to expand even further after a certain number of wraps are counted
- Trying to fill the gaps, grab the eye, and help force the cinch

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HOT STRIP MILL DOWNCOILERS

PHASE 1 – EQUIPMENT CONDITION

THE MANDREL AND COIL CINCH:

- A **DOUBLE EXPAND** mandrel is only round at one particular segment diameter
 - Mandrel is set up or turned to be ROUND at the Pre-Expand cylinder position
 - This is Important for Wrapper Roll calibration/setting
 - Cylinder must hold this position firmly at strip thread
 - This can be a problem with sensor-dependent position-controlled expand cylinders
 - Mechanical cylinder stop at the initial setup position can be more reliable

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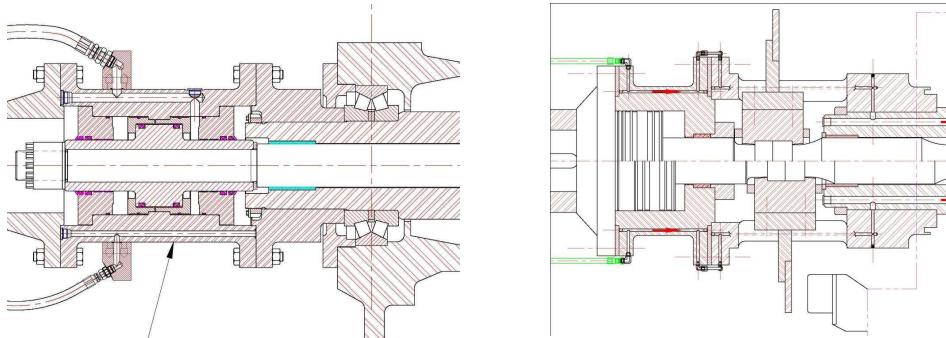
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HOT STRIP MILL DOWCOILERS

PHASE 1 – EQUIPMENT CONDITION

THE MANDREL AND COIL CINCH:

“DOUBLE EXPAND” – Cylinder positioning designs



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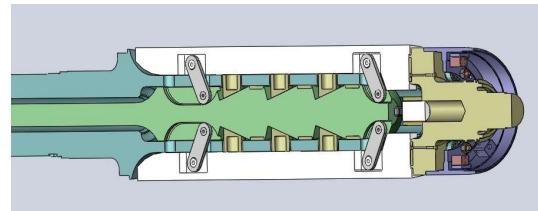
HOT STRIP MILL DOWCOILERS

PHASE 1 – EQUIPMENT CONDITION

THE MANDREL AND COIL CINCH:

“DOUBLE EXPAND” – Ideally, if cinch is quick, mandrel over-expand will be minimal (or none). No room to move.

- Mandrel will only over-expand to what the strip loop allows
- Less is better - You've already cinched.
 - Don't get hung up on the number shown on the screen
 - The Cylinder must hold this second position firmly throughout coil



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AIST

HOT STRIP MILL DOWNCOILERS

PHASES 2 and 3

IN-BAR COILING AND TAIL OUT

Equipment Condition as Affects Strip Guidance

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AIST

HOT STRIP MILL DOWNCOILERS

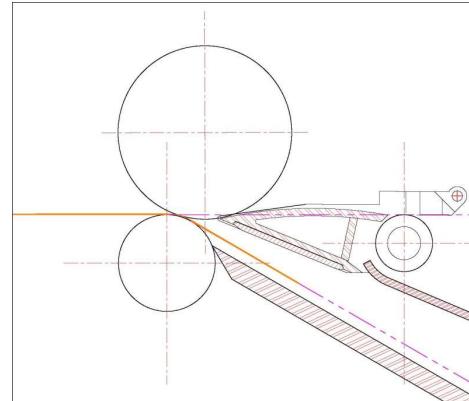
PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

• PINCH ROLL

- *Because you're wrapped under tension, Bottom Pinch Roll alignment has a great affect on guidance*
- *Must be Aligned to the mandrel and the mill in both planes*
- *Must not be worn unevenly or excessively*
- *Must be shimmed or set to the proper height after regrinds*

YOU MUST HAVE A RELIABLE, PERMANENT CENTERLINE BENCHMARK FOR THE ROLLING LINE TO BE ABLE TO VERIFY ALIGNMENTS



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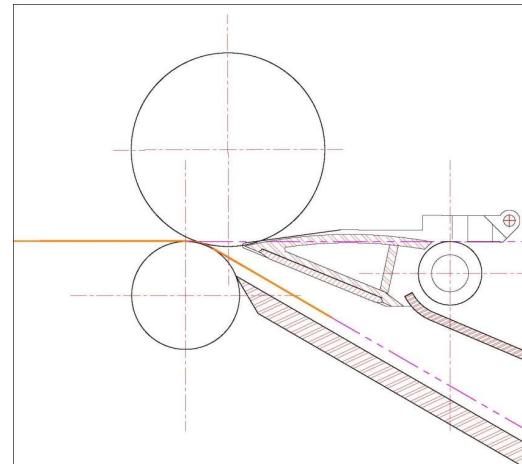
HOT STRIP MILL DOWCOILERS

PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

• PINCH ROLL

- *Bottom PR pocket must be maintained in good condition*
- *Any Liners on roll chocks or in the pocket must be properly set and even side-to-side*
- *If taper-ground (or crowned), the roll must be properly centered on the line*



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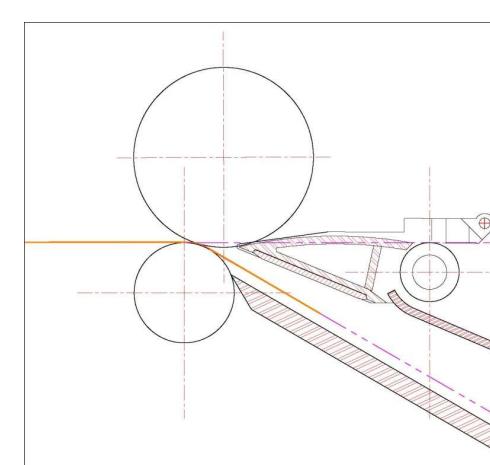
HOT STRIP MILL DOWCOILERS

PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

• MANDREL

- *As stated before, the mandrel alignment to the mill centerline is critical, in both planes*
- *Must be checked with OB Bearing supports engaged, if applicable*
- *This means coiler frame ways/gibs are in good condition on retractable coilers*



YOU MUST HAVE A RELIABLE, PERMANENT CENTERLINE BENCHMARK FOR THE ROLLING LINE TO VERIFY ALIGNMENTS

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HOT STRIP MILL DOWNCOILERS

PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

- **MANDREL**
 - *Mandrel main bearing bore condition is critical to alignment (and bearing life, of course)*
 - *Outboard Support alignment is critical to the function*
 - *Misaligned OB supports can cause damage to the main bearings and mandrel shaft*
 - *Be careful with that stripper car!*



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HOT STRIP MILL DOWNCOILERS

PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

- **MANDREL**
 - *Mandrel internal condition must be “tight”*
 - *Segment OD surfaces must be parallel to each other and to the bottom PR, and perpendicular to the line*
 - *Segments can’t be loose and shift in-bar*



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HOT STRIP MILL DOWCOILERS

PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

- **SIDEGUIDES**
 - *Must be centered on the line*
 - *Drive racks or screws must be tight with minimal slop*
 - *The short stroke cylinders must be powerful enough to avoid being pushed out by the sheet*



YOU MUST HAVE A RELIABLE, PERMANENT CENTERLINE BENCHMARK FOR THE ROLLING LINE TO VERIFY ALIGNMENTS

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HOT STRIP MILL DOWCOILERS

PHASE 2 – 3: EQUIPMENT CONDITION

GUIDING THE STRIP

- **SIDEGUIDES**
 - *Wear Liners: a critical consumable item*
 - *Cannot let the wear groove get so deep that it can gag and stop HE's*
 - *Can also cause edge tears in-bar*
 - *Operators like to see the sparks*
 - *Trying to machine the coil straight? Hmm...*
 - *Sparks mean particles riding the top side of the strip – good cross flush sprays are required to avoid rolling these into the strip.*
 - *Too tight, and strip can gag*

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HOT STRIP MILL DOWNCOILERS

REMEMBER:

- Understanding the 3 phases of the coiling sequence and the role of the coiler components in each of these phases helps drive your maintenance decisions.
- Understand what matters most for each component
- Understand how the components work together to make the coil
- Knowing the usage, ensure the equipment condition remains adequate for the task
- Don't let the machine condition get away from you – it's tougher to catch up.

IF YOU WANNA KILL A DINOSAUR, STEP ON THE EGG

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