

BENEFITS ACHIEVED FROM THE INTEGRATION OF A SUPPLEMENTAL DIRECT APPLICATION OIL SYSTEM FOR COMBINATION SHEET & TIN TANDEM MILL DESIGNED WITH A RECIRCULATING SOLUTION SYSTEM

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Agenda

- Development of the Direct Application Oil System
- Procedure for System Integration
- Design of the Direct Application Lubricant Chemistry
- Optimization of the Application System and Lubricant
- Conclusion

➤ Development of the Direct Application Oil System

- Business Driver
 - Increase Mill Through-Put by Enhancing Speed Efficiency on Light Gauge Product Mix

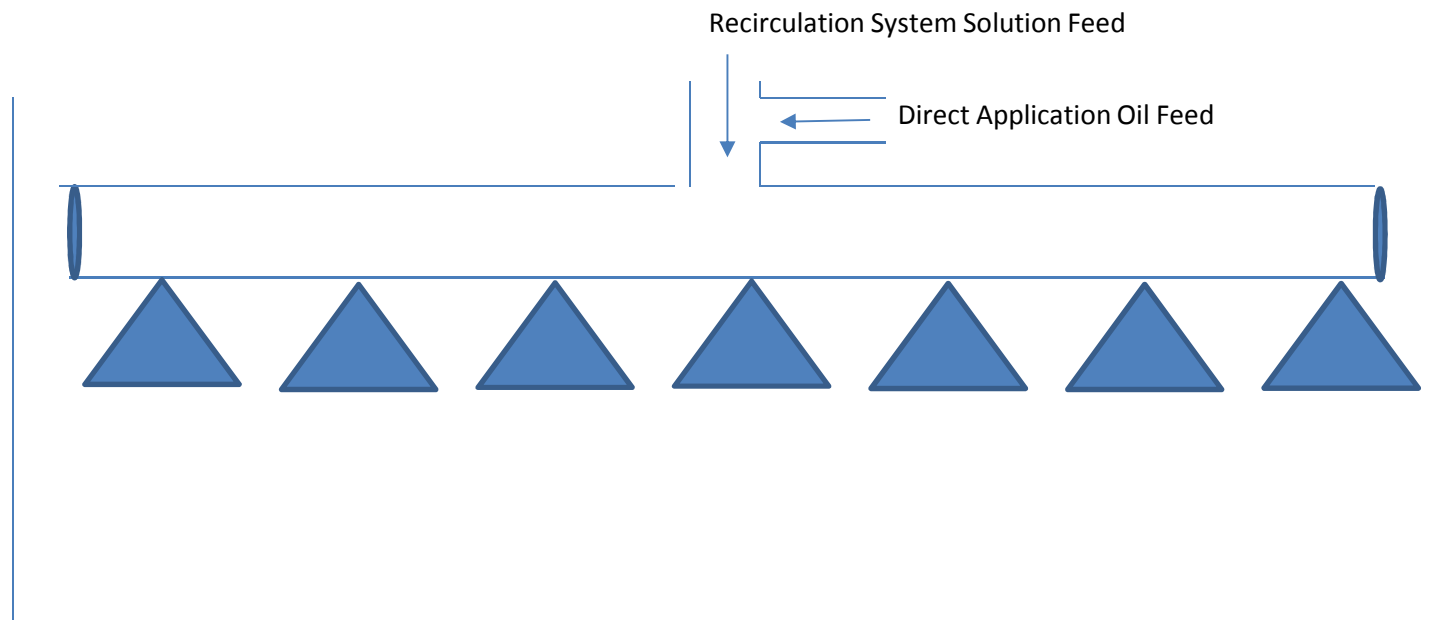
- Advantages of a Supplemental Direct Application Oil System
 - Direct Application of Rolling Oil was a Previously Proven Application for Tin Plate Mill – Low Risk
 - Minimal Investment for Proof of Concept – Low Investment for Application Equipment
 - Direct Application Oil Formula is Similar to Existing Recirculating Rolling Oil - Fresh oil make-up and no additional oil usage

- Advantages of Supplemental Direct Application Oil System (continued)
 - Direct Application can be Configured for 1 or Multiple Stands
 - % Oil Concentration Change Coil to Coil
 - Product Mix Specific Application

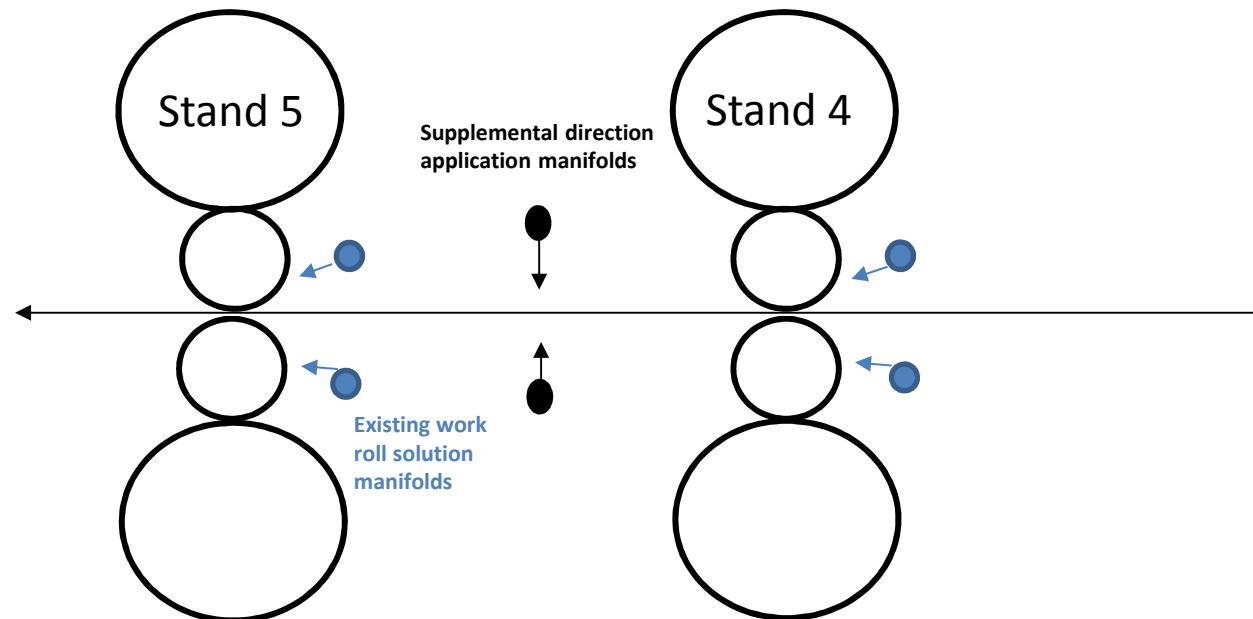


➤ Procedure for System Integration

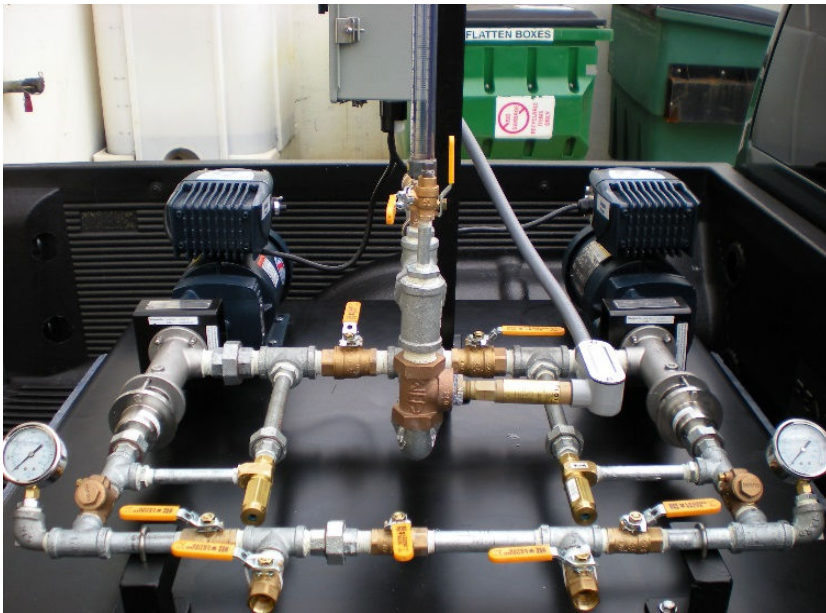
- Simplistic design
 - Objective to Provide Additional Oil on Strip Surface
 - Basic header design



- Impingement angle to strip surface 180 degrees



- Direct Application Oil Feed System



- Low Investment Cost
- Variable Speed Motors to control pump output
- Remote Control of Motors
- Calibration Column to Provide Validation of Pump Output

➤ Design of the Direct Application Lubricant Chemistry

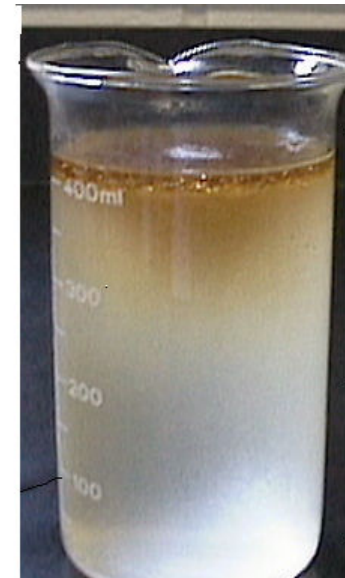
- Design Parameters
 - Fast oil water separation rate to provide additional lubricity
 - Direction Application Oil to have Maximum Compatibility with Recirculation Oil

Key Product Components
Saponification Value
Viscosity
Sulfur
Extreme Pressure
Anti-Wear
Anti-Oxidant
Emulsifier

- Design Parameters Continued
 - Emulsifier Content of Direct Application Oil Reduced to Allow Faster Oil Water Separation Rate



Moderate Recirculation Oil Breakout



Fast Breakout Direct Application Oil

- Performance Benefits of the Application & Lubricant
 - Trial data without and with use of Direct Application Oil with Typical Speeds

Trial	Total Coils	Coils Without Direction Application Oil	Coils With Direction Application Oil	Average Stand 5 Speed (mpm)	Average Stand 5 Roll Force (Tons) Without Direct Application Oil	Average Stand 5 Roll Force (Tons) With 15% Direct Application Oil	% Delta Roll Force (Tons)
1	24	12	12	1268	918	789	14.05%
2	21	10	11	1296	921	785	14.76%
3	28	14	14	1305	925	780	15.67%
4	32	16	16	1280	909	774	14.85%
5	20	10	10	1298	911	770	15.47%
Totals	125	62	63	1289(avg)	916	779	14.95%

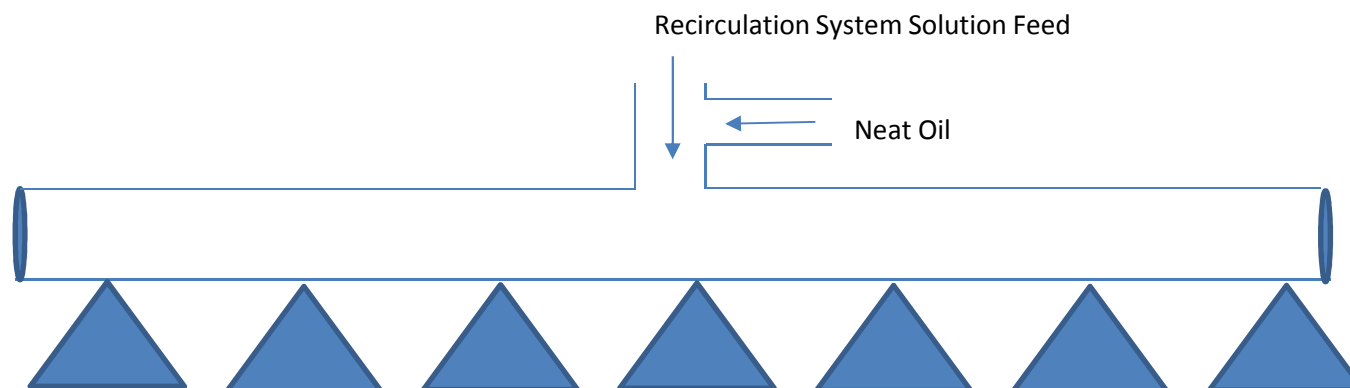
➤ Performance Benefits of the Application & Lubricant (continued)

- Trial data with use of Direct Application Oil with Speed Increase

Trial	Total Coils Using Direction Application	Direct Application Oil %	Average Stand 5 Speed (mpm)	Average Stand 5 Roll Force (Tons) With 15% Direct Application Oil
1	31	14.9	1425	898
2	28	15.5	1439	887
3	32	15.2	1460	890
Totals	91	~15	1441	892

➤ Optimization of Application System and Lubricant

- Installation of 1500 Liter Day Storage Day
 - Heater
 - Recirculation Pump
 - Fluid Level Control System
- Reduce Pour Point of Direct Application Rolling Oil
 - Neat Oil is Contained in the Feed Line from the Discharge of Pump to the Injection Point on the Manifold



Conclusion



- A Supplemental Direct Application Oil System can Enhance Mill Productivity
- Minimum Capital Investment is Required
- The Main Criteria for Consideration for Using the System is Dependent on the Desired Rolling Speeds and Productivity Goals