COST EFFECTIVE AUTOMATION SOLUTIONS FOR LONG ROLLING PRODUCTS / REBAR & WIRE ROD MILLS

Presented by:
Mahesh Sachdeva
FUJI GEMCO PVT. LTD., INDIA
AGENDA

- Current Scenario Of Bar/Wire Rod Rolling Mills
- Major Factors Leading To Cost Optimization
- Cost Optimization In Automation
- Cost Optimization In Drive Systems
- Cost Optimization In Realizing Automation Functions
- Cost Reduction By Optimizing Layout
Current Scenario of Bar Rolling Mills

- The Steel Industry is going through challenging times with pressures on value addition and managing bottom lines.

- To sustain existence Steel plants and Mills have to ensure high capacities with controls on their Capital Costs to keep their production cost per ton low.

- Primary steel producers try to manage the production cost by producing high volumes.

- Secondary steel producers face the competition on Price as well as Quality.

- In developing markets like South Asia, Africa, South America and Middle East, Number of small and medium capacity bar and wire rod rolling mills are coming up. They have an advantage of proximity to the market and customer.
Major Factors Leading To Cost Optimization

- Reduction in capital cost
- Maximizing yield
- Reducing down time
- Reduction in manpower
- Shorter product change over time
- Controlling maintenance and inventory cost
Role of Automation in Cost Optimization

• Automation has proved to be the solution for most of these prerequisites for Cost optimisation necessary for the success of Small and Medium Capacity Rolling Mills.

• The Mills being designed and installed today are generally Straight Line Mills employing a number of continuous stands depending on finish size and the input billet size.
Role of Automation in Cost Optimization

The Automation functions employed to increase productivity, reduce wastage and faster start-ups:

- Automatic calculation and determination of motor speeds as per the gear box ratios, reduction ratios and linear speeds required.
- Memorising and retrieving the required speed of each stand for different bar sizes
- Cascading and synchronisation of continuous stands
- Ensuring quality by maintaining inter-stand tension to obtain good profile of finish bar
- Alarm annunciation and fault diagnostics
- Safety and protection interlocks
Cost Optimization by Mill Electric and Power Electronics

- The Mill speed and dynamics depends on the rotating machine which is the Drive motor

- The Mill stands need to be operated with variable linear speeds depending on the reduction ratio between each stand and varies with the bar size to be rolled.

- There are two options for the variable speeds:
  - AC Motors and AC Drives
  - DC Motors and DC Drives
AC vs DC Drive

- Performance of both AC and DC Drives is almost same
- Price wise today DC Motors and Inverter Duty AC Motors are almost same
- However, Mill Duty AC Inverter Drives are more expensive than DC Thyristor Drives
- Thyristor Controlled DC Drives are easy to maintain
- Possibility of in-house fault finding and repairs in case of DC Drives
- Low cost replacement power devices and control cards.
- In case of Faults in AC Drives, change of expensive complete unit is essential

There are few disadvantages of use of DC Drives namely it leads to low Power factor which require compensation on LV or MV side.
Cost Optimization In Drive Systems for Rolling Mills

Optimizing the cost by standardizing the controller for all ranges of DC Drives from 5 KW to 2000 KW.

Advantages:
- Common controls for all drives like Stand, Pinch Rolls, Shears, Tail breakers, Cooling Bed etc.
- Reduction in inventory cost as just one controller required as spare for complete mill.
- Easy accessibility to power devices for trouble shooting and replacement if required.
- No need of changing complete drive.
- With open stack system – No requirement of high level technical Skill for trouble shooting or repairs.
Cost Optimization In Realising Automation Functions

- Use of PLCs and Scada HMI to achieve the desired process automation

- Use OF Standard Hardware Modules & CPUs over High Cost Special Controllers

- The major cost content in Mill Automation: Software Program development and implementation.

- Deploy highly skilled local Engineers and standardisation of Software programme modules for various important functions
Cost Optimization by PLC Automation System

AUTOMATION FUNCTIONS FOR ROLLING AREA

- Mill Sequencing and Safety Interlocks
- Speed Reference Generation
- Impact Speed Drop Compensation
- Crop and Cobble Shears controls
- Pinch Roll Speed Setup
- Upstream Cascade Control
- Controls for Roller Table
- Controls of Auxillary Drives
- Media System Control
- Section Start / Stop
- Pinch Rolls UP/Down
- R-Factor Setting
- Pass Schedule Handlings
- User Interface for Data entry.

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Complete Solution for Long Rolling Mills

MILL CNTRL
CPU

MILL AREA CONTROL

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Functions of Shear Area PLC

- Controls for High Speed Divide Shear
- Controls for Slow Speed Divide Shear
- Controls for Shifter
- Servo Control for Shifter
- Pneumatic Control for Shifter
- Controls for Braking Pinch Roll
- Control of Twin Channel
- Cooling Bed Control
- Controls for Roller Table.
- Controls for Finishing Area Lubrication System
Complete Solution for Long Rolling Mills

1. **Settling time for the initial-pass impact**
   - Measure $M_1(t_1)$
   - Store $M_1(t_1)$
   - Settling time for the initial-pass impact
   - Measure $M_1(t_2)$
   - Store $M_1(t_2)$ and adjust
   - Settling time for the initial-pass impact
   - Measure $M_2(t_1)$
   - Store $M_2(t_1)$
   - Setpoint adjustment

2. **MTC_1**
   - $\Delta rpm$

3. **MTC_2**
   - $\Delta rpm$

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HMI FUNCTIONS

- Mill start / stop control
- Roughing mill control
- Cascade speed control (Individual / group)
- Min. tension control
- Loop control
- Shear Controls
- Mill drive presets operation.
- Actual value display.
- Input / output tracking
- Alarm display
- Event display
- Rolling Mill over view
- Real time / Historical process trends
- Interlock over view
- Pass schedule storage (max. 100 pass schedules)
- Production report generation
Combination Mill
Automation Network for Bar Mill
AUTOMATION CONFIGURATION FOR 5,00,00 TPA BAR MILL
| S.No. | ALARMS           | CCS1 | CCS2 | C1 | C2 | C3 | C4 | C5 | C6 | CCS1 | CCS2 | C7 | C8 | C9 | C10 | C11 | C12 | PR1 | PR2 | TB1 | TB2 |
|-------|------------------|------|------|----|----|----|----|----|----|------|------|----|----|----|----|----|----|----|----|----|----|----|
| 1     | MOTOR THERMISTOR |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 2     | HEAT SINK OVER TEMP |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 3     | SHORTED D-O      |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 4     | BAD REF EXCHANGE |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 5     | CONTACTOR LOCK OUT |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 6     | USER OR DRIVE WEB |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 7     | SYNC LOSS        |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 8     | E L1/2/3 LOSS    |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 9     | ARM CURRENT      |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 10    | SPD FB MISMATCH  |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 11    | OVER SPEED       |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 12    | ARM OVER VOLT    |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 13    | FIELD OVER VOLT  |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 14    | FIELD LOSS       |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 15    | MISSING PULSE    |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
| 16    | STALL            |      |      |    |    |    |    |    |    |      |      |    |    |    |    |    |    |    |    |    |    |    |
MULTI DRIVE PANELS
Cost Reduction By Optimizing Layouts

Planned layouts of electrical and automation equipments in the plant and control rooms can reduce:

- Interconnecting cable costs,
- Cable laying costs and time,
- Recurring power losses

convenience in maintenance

Important Considerations:
- Placement of Convertor Transformer closer to Drive Panels.
- Bus Bar connecting from Transformer to Drive Line Ups.
- Internal Distribution of Power through Bus Bars from Main incomer feeder to all Drives.
- Use of Communication bus and Cable to reduce control cabling cost e.g. Profibus and Ethernet.
- Use of Remote I/O stations to eliminate the need of interconnecting wiring for commands and feedback signals.

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While Automation is imperative and necessary for reliable and successful performance of Rebar / wire Rod Rolling Mills, it is possible to introduce world class latest Automation System in the mills at affordable and reasonable cost, without compromising on technology, performance or results.

It just requires identifying the right source with good experience and engineering skills.
Over 1000 Successful Systems Operating in over 25 countries

1. NIGERIA
2. MALAYSIA
3. NEPAL
4. JORDAN
5. SYRIA
6. DUBAI
7. BAHRAIN
8. SAUDI ARABIA
9. USBEKISTAN
10. INDONESIA
11. GREECE
12. KUWAIT
13. CHINA
14. KENYA
15. RUSSIA
16. IRAN
17. BANGLADESH
18. ITALY
19. VIETNAM
20. KOREA
21. CAMEROON
22. IVORY COAST
23. ZAMBIA
24. SRILANKA
25. ANGOLA
26. ARGENTINA
27. PAKISTAN
Thank you

Presenter:
MAHESH SACHDEVA
CEO, +91-9810150350
FUJI GEMCO PVT. LTD. , FARIDABAD, INDIA
www.gemcocontrols.com
mahesh-sachdeva@fujigemco.com