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ABM

MODERN PQF® SEAMLESS TUBE ROLLING TECHNOLOGY[1]

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Abstract
Over the past 10 years, SMS Meer has developed and successfully established new and proven engineering solutions for the seamless tube and pipe industry in order to meet the rising demands of tube manufacturers worldwide for product volume, quality and profitability. Milestones were the successful commissioning of twelve (12) PQF® rolling lines with the 3-roll mandrel mill as main elongator in the tube size range from ½" up to 20". To date SMS Meer has received 19 confirmed orders for mills based on the new PQF® technology that are setting quality benchmarks in the seamless tube industry. Furthermore, modern design solutions and technologies for rotary hearth furnaces, cross-roll piercers, reheating furnaces (gas-fired and induction type), sizing and stretch-reducing mills with adjustable roll stands as well as the CARTA® Technology System and LASUS® (laser-ultrasonic) wall thickness measuring unit for temperatures up to 1200° C are keys to success for tube producers. All these applied technologies from the single-source supplier SMS Meer set the standards for seamless tube production and make our customers fit to face the future competition
Key words: Seamless tube and pipe mill; Long product mills; PQF technology; Seamless tube and pipe production.

TECNOLOGIA PQF® DE LAMINAÇÃO TUBOS SEM COSTURA

Resumo
Ao longo de 10 anos SMS Meer vem desenvolvendo e estabelecendo uma nova, provada e bem sucedida solução de engenharia para indústria de tubos sem costura para atender a demanda crescente dos produtores de tubos mundiais levando em consideração volume, qualidade e rentabilidade. Como marco podemos citar o comissionamento bem sucedido de 12 linhas de laminação PQF® usando a tecnologia de mandril de 3 rolos como principal alongador nos tamanhos de tubo de ½" a 20". Atualmente SMS Meer já consta com 19 pedidos confirmados usando a tecnologia PQF® que está trazendo novos conceitos de benchmarks para indústria de tubos sem costura. Além disso, projetos modernos e tecnologias atrelados aos fornos rotativos, fornos de reaquecimento a gas e indutivos, gaiolas calibradoras com ajuste automático assim como sistemas CARTA® e LASUS® são fatores críticos de sucesso para os produtores de tubos. Todas estas tecnologias podem ser disponibilizadas por apenas um fornecedor colocando a SMS Meer como um divisor de águas na produção de tubos sem costura e faz nossos clientes confortáveis para enfrentar as competições futuras.
Palavras-chave: Laminador de tubos sem costura; Laminação de aços longos; Tecnologia PQF®; Produção de tubos sem costura.

[1] *Technical contribution to the 48th Rolling Seminar – Processes, Rolled and Coated Products, October, 24th-27th, 2011, Santos, SP, Brazil.*
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1 INTRODUCTION

Considering the actual scenario of seamless pipe market below we have the main requirements seamless tubes makers are facing and what the market is demanding from the equipments manufacturers as SMS Meer:

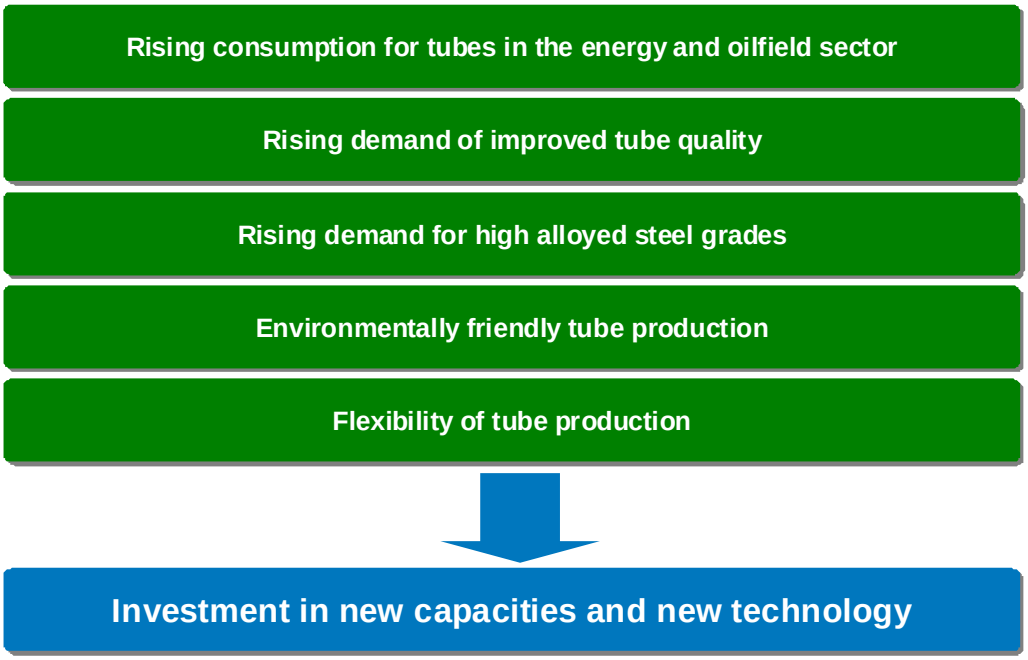

Figure 1: Market requirements for the seamless tubes producers.

2 METHODS AND MATERIALS

2.1 Modern PQF® Seamless Tube Mill Plant

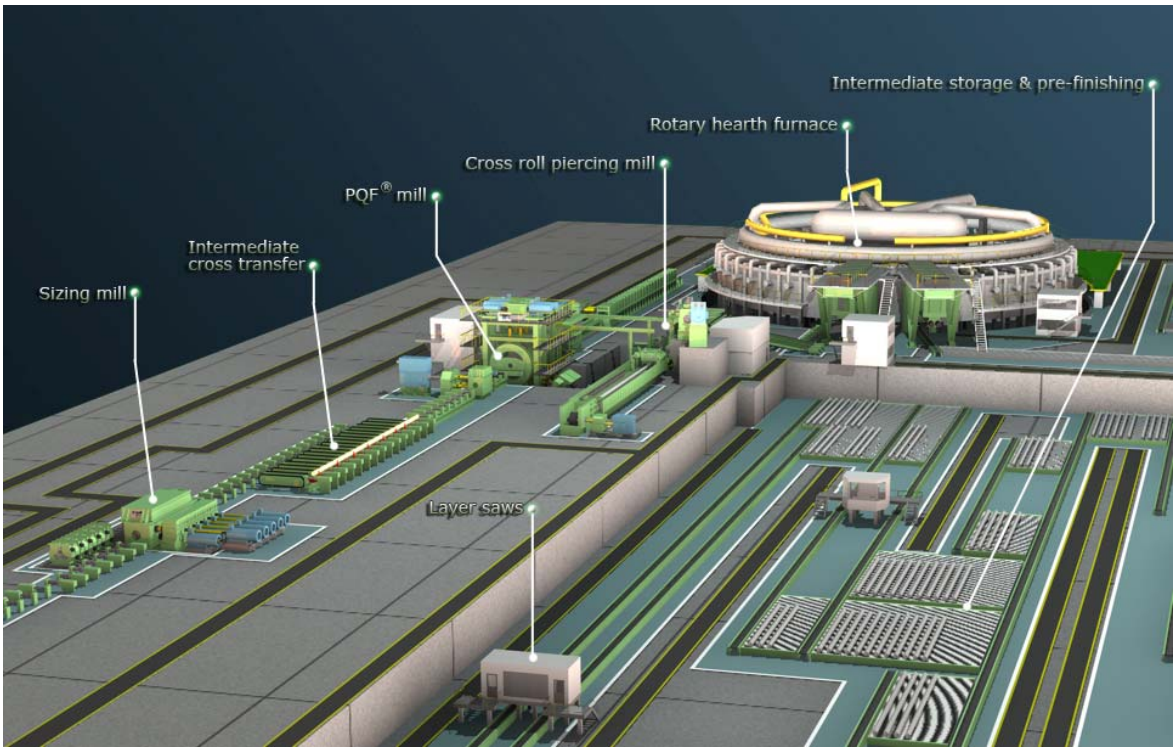

Figure 2*:* Overview of 18” PQF mill.

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A modern Seamless Tube Mill consists of the following main rolling mills and machines:

- Billet preparation area
- Rotary hearth furnace
- Cross roll piercing mill
- PQF mill
- Extracting mill
- Reheating furnace
- Sizing / Stretch reducing mill
- Cooling bed / Batch layer saws
- Finishing center with heat treatment facilities.

All these equipment will be described within this paper.

2.2 PQF Process Sequence

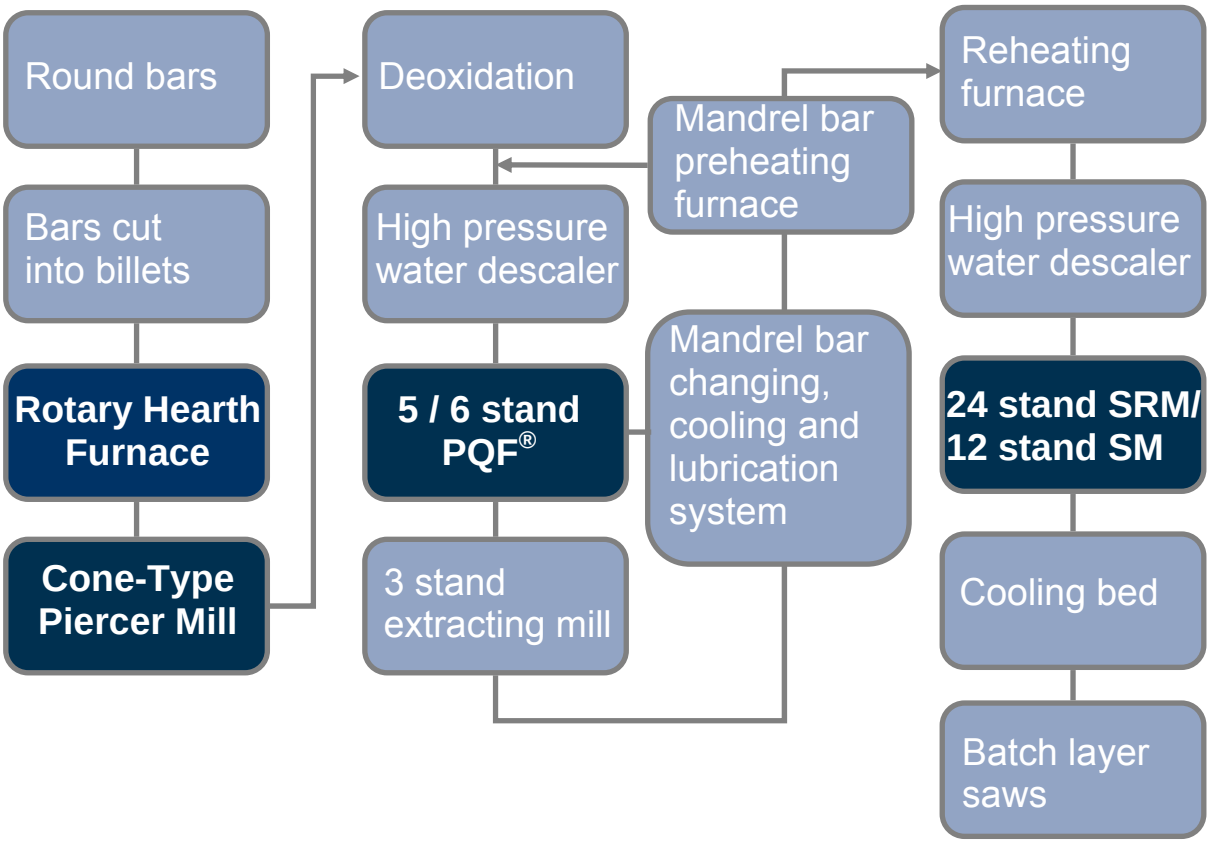

Figure 3: Process sequence in a modern seamless tube mill.

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2.3 Shell & Rotary Hearth Reheating Furnaces

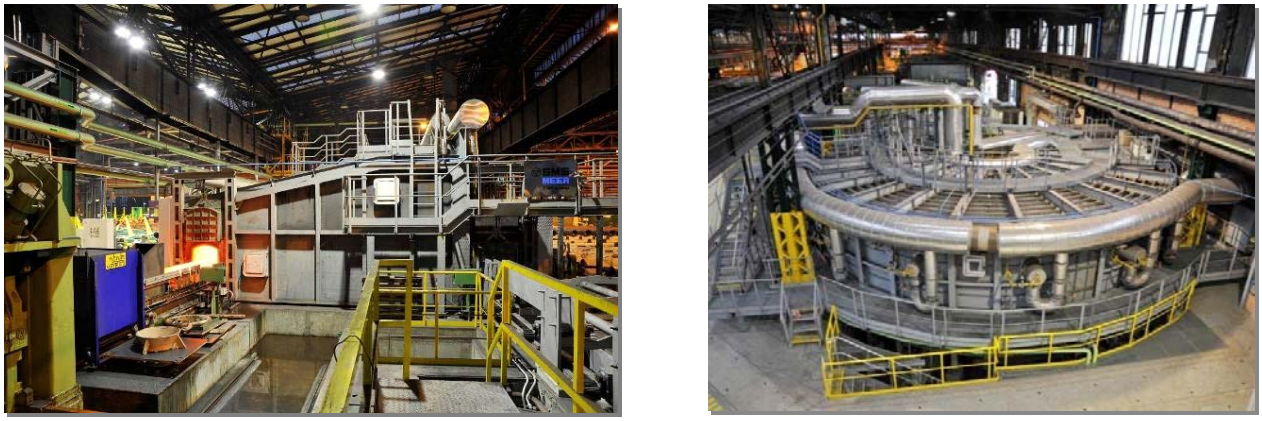

Figure 4: Rotary hearth and shell reheating furnaces of SMS Meer.

2.4 Technology Highlights – SMS Meer Cross-Roll Piercing Mills

Figure 5: Largest piercing mill in operation in a 18" PQF mill at TPCO / China.

- Working roll diameter 1,500 mm
- Piercing of billets with 500 mm diameter and max. weight of 5 tons
- Rolling of hollow blooms with max. 512 mm diameter and 11 m length
- Drive power 2 x 6,000 kW.

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2.5 Technology Highlights – SMS Meer PQF® mills

Figure 6: First 6 5/8" PQF® mill in operation at TPCO / China.

- Max. shell size: 185 mm diameter with 28 m length
- Optimum tube quality due to retained mandrel.

Figure 7: Largest PQF® mill in operation at TPCO / China.

- Max. shell size: 485 mm diameter with 28 m length
- Optimum tube quality due to retained mandrel process.

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2.5.1 PQF® - 1st generation "Axial Change Over type - ACO"

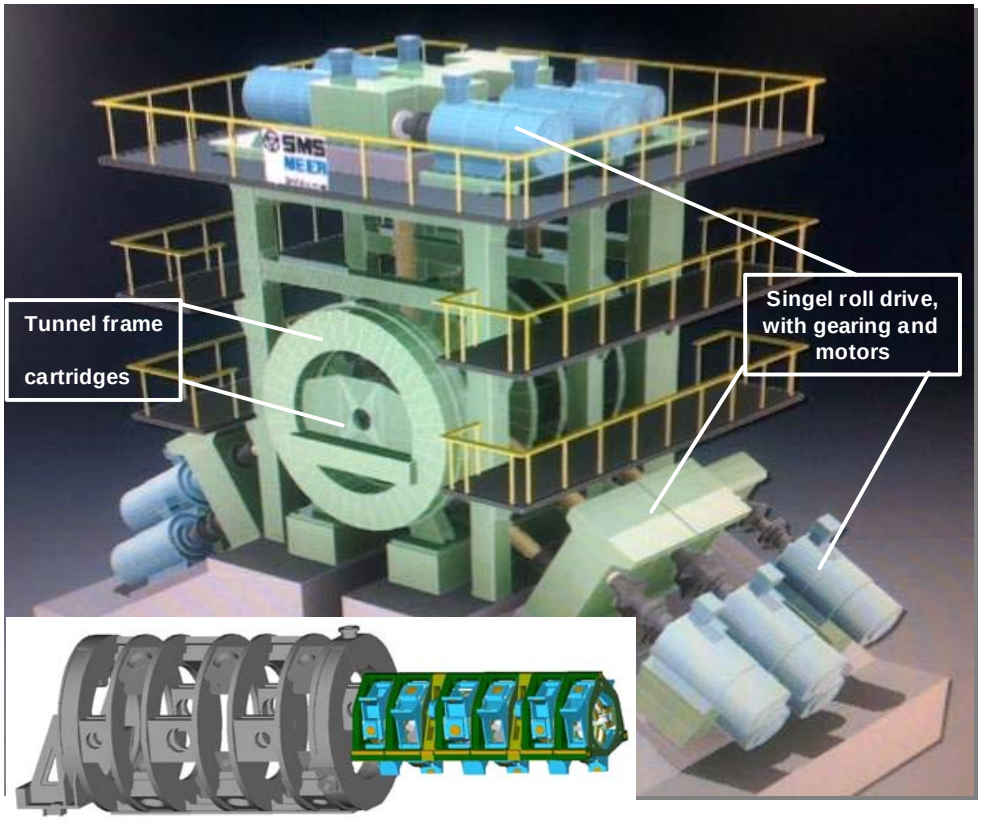

Figure 8: Design concept of a PQF frame – 1.

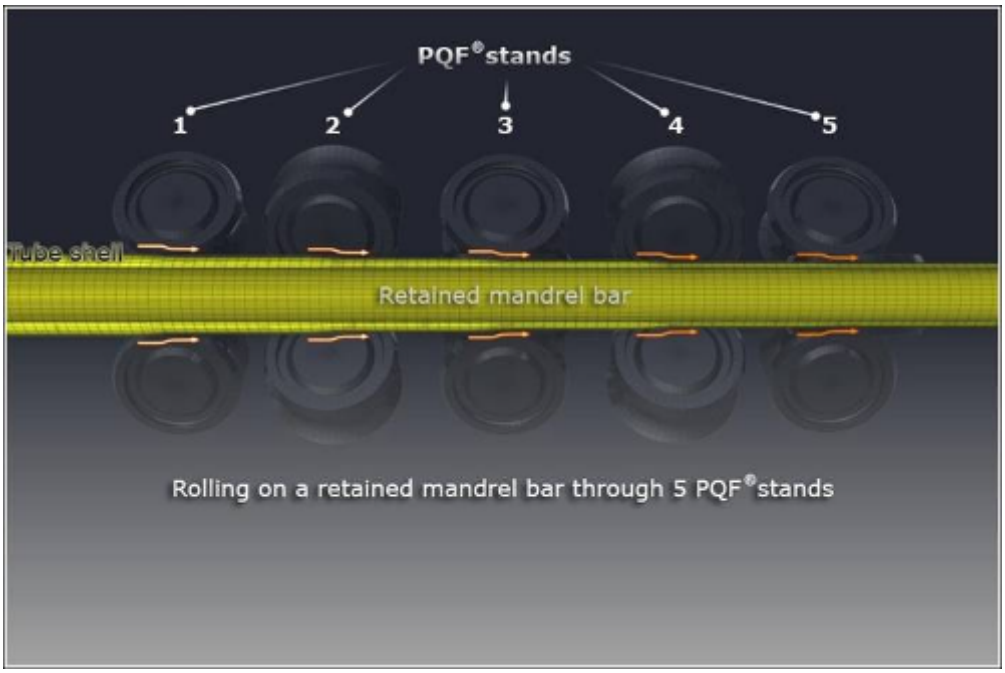

Figure 9. Design concept of a PQF frame – 2.

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2.5.2 PQF® - 2nd generation "Lateral Change Over type - LCO"

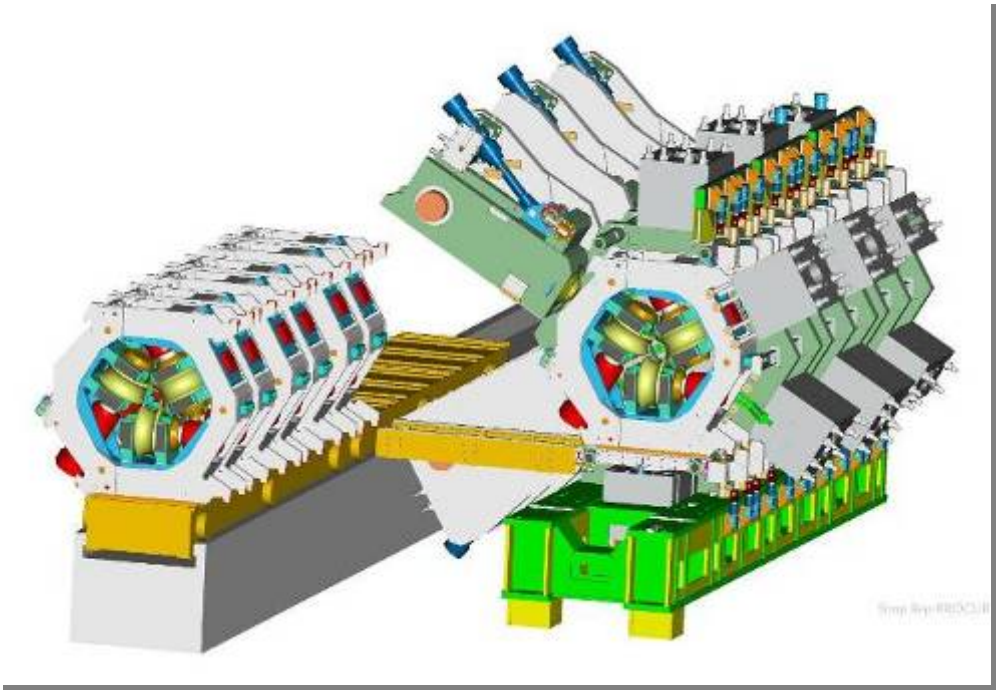

Figure 10: PQF mill design in "LCO" design.

Figure 11: 6 5/8″ PQF® (LCO) mill at ISMT / India.

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2.6 SRM and Sizing Mill – the Last Deformation Step

Figure 12: SRM - Stretch Reducing Mill type 310 A with 24 stand positions.

Figure 13: Sizing Mill type 670 A with 12 stand positions, single roll drive system – one motor per roll.

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2.7 New Technologies Applied on Seamless Production

2.7.1 CARTA® Computer Aided Rolling Technolgy Application

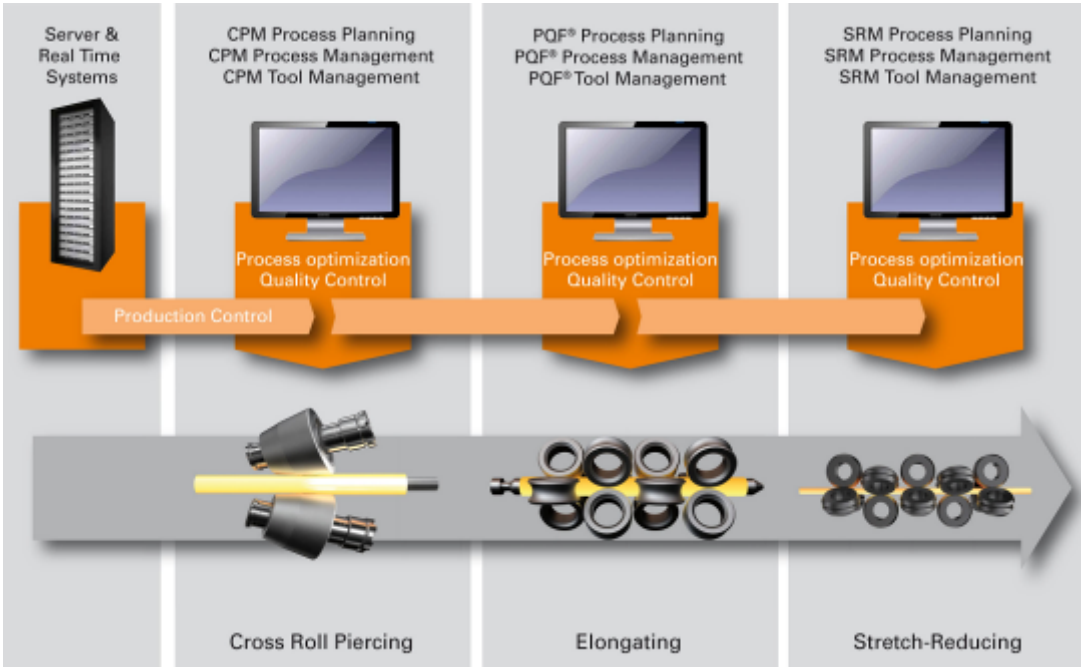
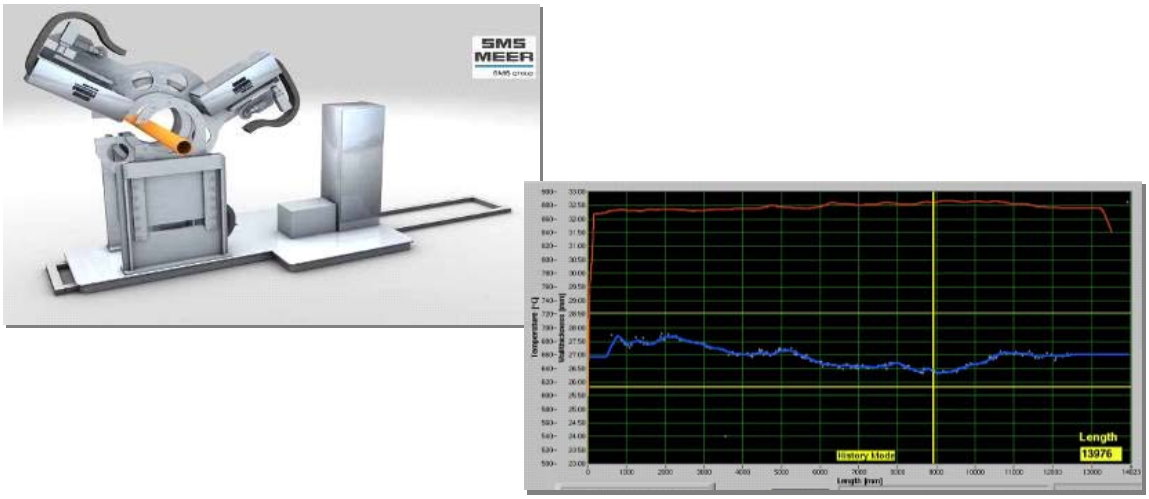


Figure 14: CARTA® process concept.

2.7.2 LASUS® Laser Ultrasonic wall thickness measurement



LASUS® wall thickness measurement for temperatures up to 1200°C!

Figure 15: LASUS® process concept.

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3 RESULTS

3.1 PQF® Technology: Advantages of PQF® mills compared to MPM mills

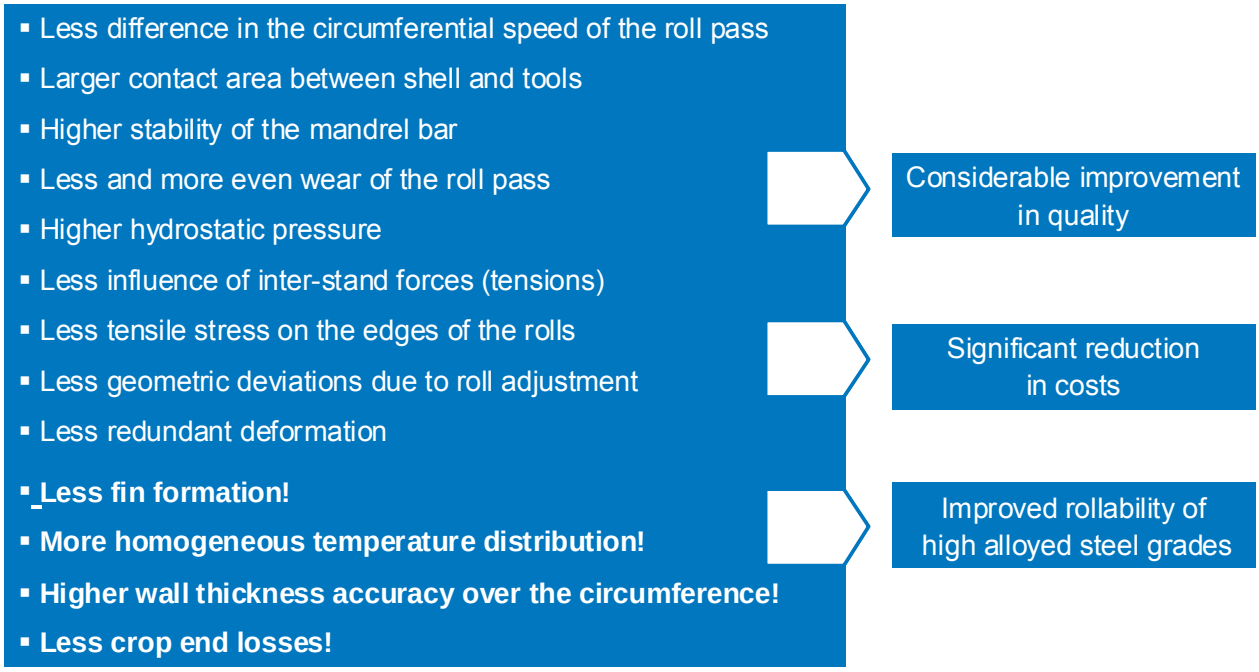

Figure 16: Advantages of PQF® mills compared to MPM mills.

3.2 Major Benefits of PQF® LCO with Respect to PQF® ACO Type Design

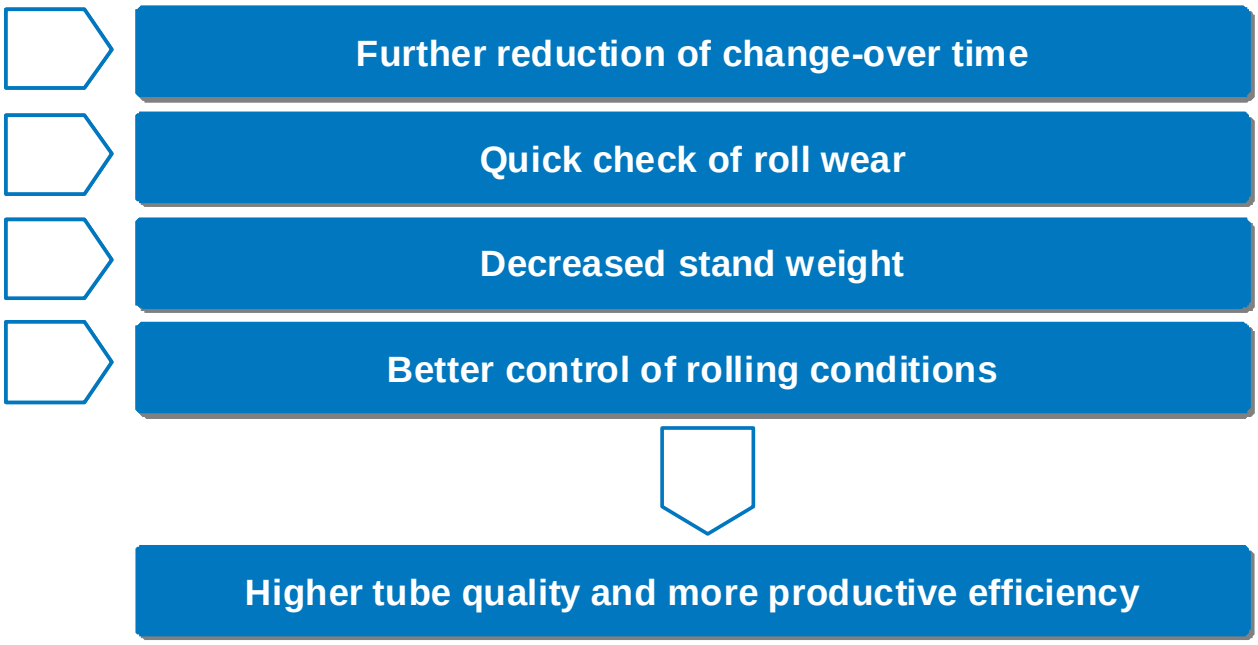

Figure 17: PQF® LCO compared to PQF® ACO.

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4 REFERENCES OF SMS MEER PQF® PLANTS

Below some worldwide reference of SMS Meer PQF® Plants

Figure 18: Tenaris Tamsa Veracruz Mexico 7” PQF® Plant.

Figure 19: Vallourec&Sumitomo Brasil 16” PQF® Plant.

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Figure 20: Baosteel Yantai Lubao 18" PQF® Plant.

5 CONCLUSION

As a conclusion the new technology called PQF could offer to the seamless pipe market a couple of beneficial features as:

- Wider size and steel grade range
- Reduced production costs
- Higher profitability
- Improved wall variation
- Energy consumption
- Green production
- Stable process capability
- Higher product quality.

Those proved features in various PQF plants installed worldwide gives a perfect combination and are keeping the customers in the way of good productivity, quality, environment and production costs.

Those for sure are helping all of them in keep their market share, their profitability, their competitivenes and their sustainability in a market.