

MEERDRIVE[®]PLUS WIRE ROD SIZING*

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Abstract

Conventional wire rod blocks have some limitations. They can only roll with fixed reduction ratios which always require the same rolling diameters within the block. With MEERdrive[®] SMS, as a pioneer, has introduced an innovative drive concept for wire rod blocks that can overcome the limitations of conventional solutions. The clue: the concept is based on individual drives for each stand position. The exigent wire rod market demand and the available technology melt in a new variant of MEERdrive[®], the MEERdrive[®]PLUS, which represents a sizing block solution for finished size rolling and allows conventional as well as thermomechanical rolling. Further “one family rolling” is also possible, since all roll / size changes will occur in this block.

Keywords: MEERdrive[®]PLUS; Wire rod sizing Block, ORRR (Oval Round Round Round); Single family pass design.

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1 INTRODUCTION

The wire rod has always been a 'noble rolled product' among all other products. Wire rod is used in the most demanding mechanical applications including a wide and rich class of steel grades.

Amidst all these applications let us remember tyre cord, welding, bearing, stainless, cold heading, spring, low alloy and alloyed steel, bolts, piano cord.

All the applications are high-quality demanding; furthermore, almost all those of a wire rod request the drawing of the material to the required finished diameter as downstream process.

The drawing plants are suffering low utilization time due to surface defects and poor dimensional tolerances produced by a conventional wire rod rolling block.

A better tolerance and intrinsically improved surface quality is a strong market request of downstream processors addressed to wire rod producers.

Drawing plants typically require 5.5mm wire rod, a dimensional tolerance better than 0.1mm and an ovality lower than 70-80%.

The only answer to the demands above is installing a Wire Rod Sizing Block or much better a MEERdrive^{®PLUS}.

A wire rod with a better finished tolerance will, most probably, not give our customers the opportunity to get a premium price, yet it will certainly make the difference in selling or not the final product on the market.

Wire Rod Sizing Block is becoming an obliged standard in the drawing downstream supply-oriented Wire Rod plants.

Wire rod plants usually suffer low utilization time also as a consequence of a great deal of changes in pass design because of the traditional single block technology.

The MEERdrive^{®PLUS} concept simplifies the roll ring management dramatically; it creates a great flexibility in pass design and minimizes maintenance efforts. The precise control of the rolling process enables the metallurgical properties of the end product. Roll ring utilization is considerably optimized, energy consumption falls remarkably as the individual motors can work much more efficiently compared to a group drive.

2 MATERIAL AND METHODS

The only way to get the required tight tolerances on wire rod mills is using a 4-stand Wire Rod Sizing block after the classic finishing block, with the essential precondition to adopt an ORRR (Oval Round Round Round) pass design with low reduction on the last two passes.

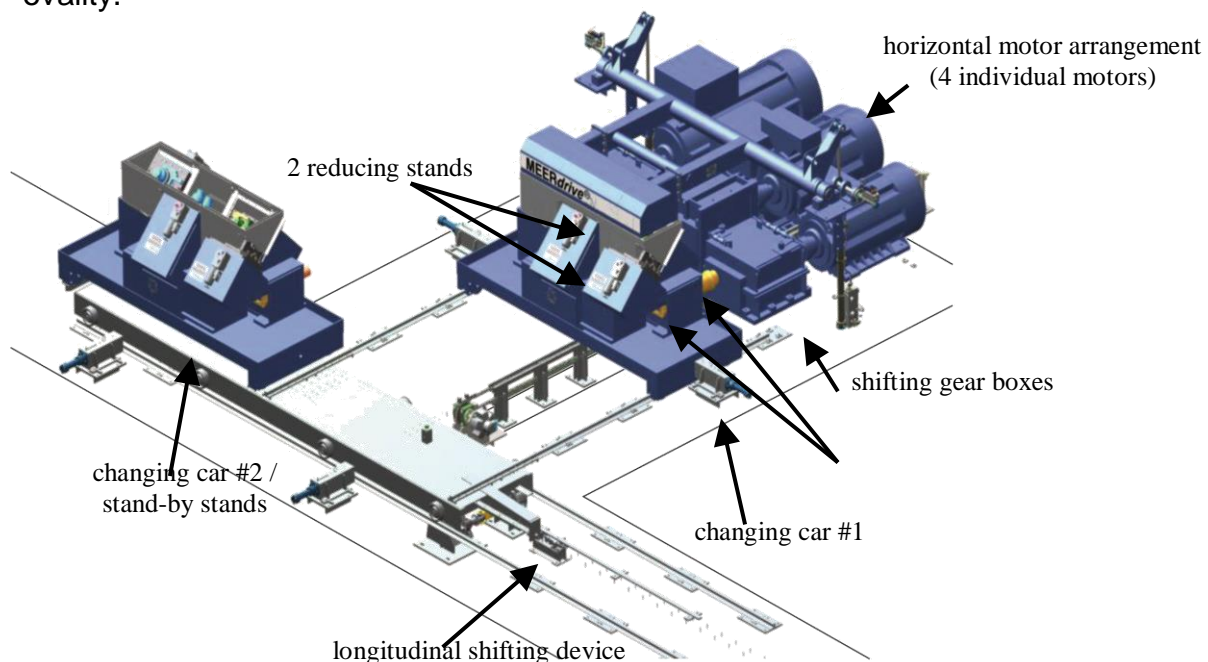
SMS group has been a pioneer in blocks with individually driven stands (2005 - 1st plant -). Blocks with new technology are named MEERdrive®.

The huge advantages of the innovative MEERdrive® solution with individual drives are obvious:

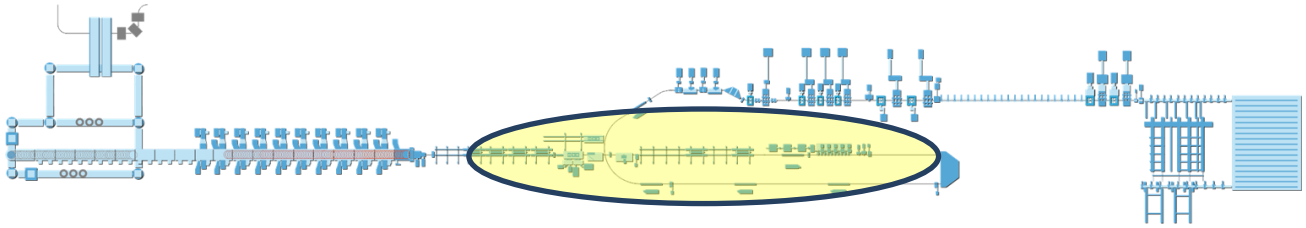
- Total flexibility in the roll pass design: no more fixed reduction ratio among the stands
- Minimized wear and maintenance of the block, much less gears
- Reduced roll inventory and simplified logistics
- Significant reduction of energy consumption
- Reduced operation costs because of Single Family Pass Design.

SMS group merged the market request of a 4-pass ORRR Wire Rod Sizing with our proven experience with individually driven-stand MEERdrive blocks.

The result was the MEERdrive®PLUS (Picture 1), a 4-pass OROR Sizing block capable to roll and to finish wire rod from 4.5mm to 27mm. With this Wire Rod Sizing, it will be possible to achieve tolerances close to 0.05mm on 5.5mm with an exceptional ovality.



Picture 1. MEERdrive®PLUS with quick changing



Picture 2. Typical layout for MEERdrive®PLUS after an 8-pass Block

A typical application of the MEERdrive®PLUS is to install it after an 8-pass finishing block as in Picture 2.

The technological distances and the necessary water boxes before and after the wire rod sizing block depend on steel grades and final utilizations.

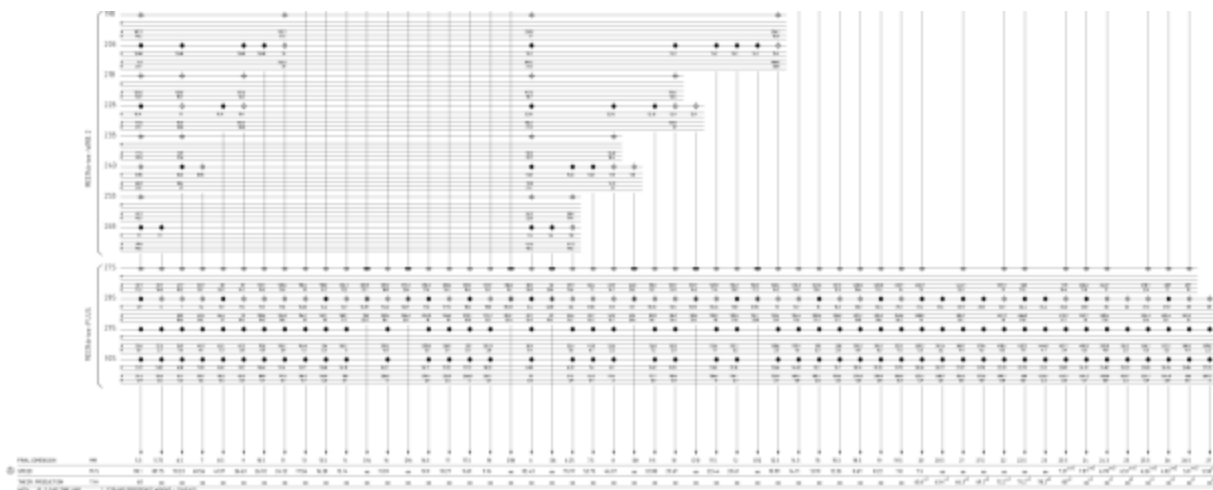
The MEERdrive®PLUS is already designed to perform TMR up to 780°/800°C (Thermal Mechanical Rolling), with all the related benefits in terms of refining of the final grain sizes and microstructure.

This configuration, in addition to better dimensional tolerances, offers also a great operative cost-reduction, allowing a simplified pass design as shown in Picture 3.

All sizes are finished on the MEERdrive®PLUS, using the 8-pass block as a feeder of small sizes: 4.5mm to 12.5mm, and the intermediate mill for the remaining sizes up to 27mm. **This is possible thanks to the presence of automatic speed changes on the gearboxes and adequate motor sizes.**

With this solution, changing times are drastically reduced and the mill utilization is improved significantly.

If the produced mix of sizes is particularly extended, a quick changing device (Picture 1) for changing all 4 stands simultaneously in less than 10', is also possible.



Picture 3. Typical pass design MEERdrive®plus after a 8-pass Block



Picture 4. MEERdrive^{@plus} with quick changing in a recent installation in Europe.

3 RESULTS AND DISCUSSIONS

The obtained results in terms of dimensional tolerances attest the process and equipment quality.

Since the very first billets rolled via the MEERdrive^{@PLUS}, in one of recent plants installed in Europe, very tight tolerances (also ovality) have been achieved and constantly repeated.

The in-line Dimensional Measuring Device (DMD) installed after the MEERdrive^{@PLUS} can measure up to 99% of bar surface (depending on speed), showing better outcomes than the design-related expectations.

The DMD, using a High Definition CMOS camera reading a laser beam shape on product surface, can perform up to 10,000 measurements/sec with a precision of up to 0.015mm. This is also a SMS group innovative product named MEERgauge[@].

The results reached on nominal 13mm (Picture 5) are:

-Min. dia. 12.95mm

-Max. dia. 13.03mm

The results reached on nominal 13mm (Picture 6) are:

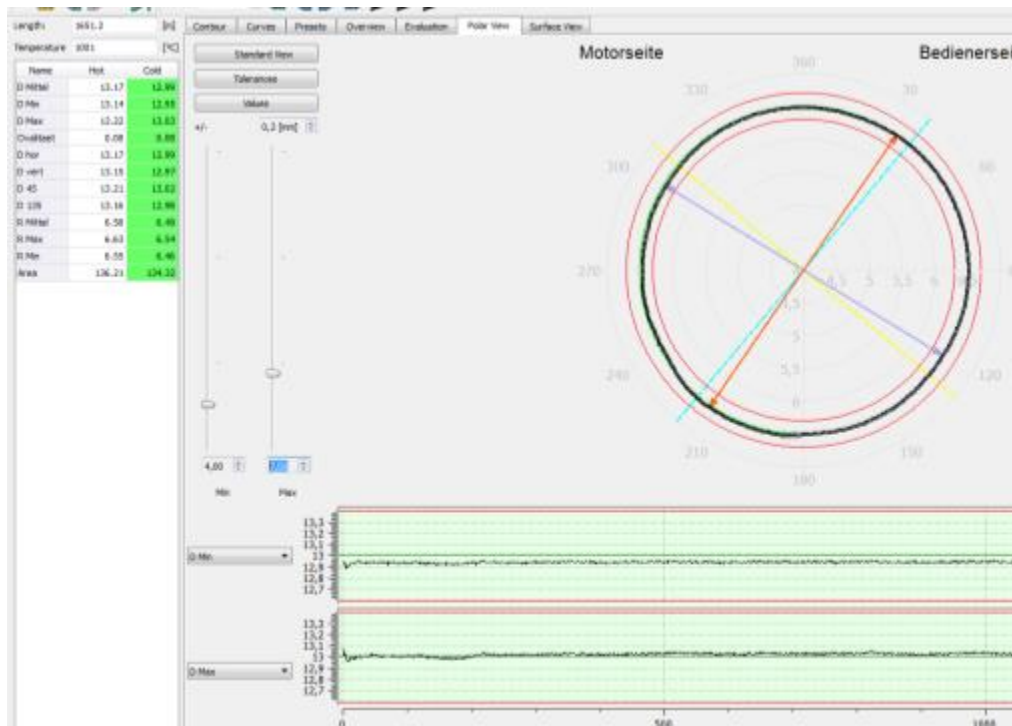
-Min. dia. 16.90mm

-Max. dia. 16.98mm

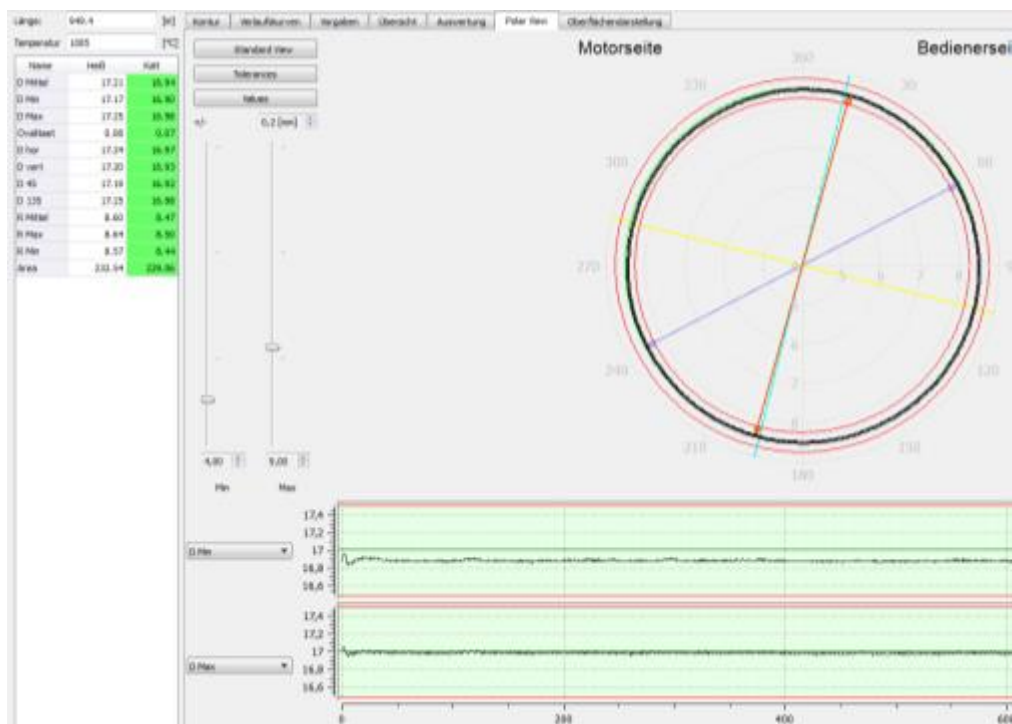
The outstanding figures above are better than the 1/8 DIN 59110 requirements.

The results are already transformed at room temperature by the DMD software.

The constancy of measurements are highlighted by the bar graphs at the bottom of the screen shots (Pictures 5 & 6), where red lines indicate the nominal tolerances required by the reference standard (e.g DIN 59110).



Picture 5. MDM measurement screen shot for 13mm rolled with MEERdrive®plus. Sizes measured are 12.95 to 13.03mm (cold).



Picture 6. MDM measurement screen shot for 17mm rolled with MEERdrive®plus. Sizes measured are from 16.90 to 16.98mm (cold).

4 CONCLUSIONS

The MEERdrive^{®plus} grants a solid opportunity to produce a supreme wire rod in terms of dimensional tolerances and surface quality.

The final product will become much more attractive for the drawing line operators, being these the biggest wire rod consumers. They prefer a product with better surface and dimensional tolerances, to avoid stoppages in the drawing lines because of starting material defects.

Soon, the quality wire-rod market trend will be to buy only these fine products.

The single-motor drive technology of this wire rod sizing shall reduce remarkably the operative costs as for rolling rings inventory, changing time and maintenance.