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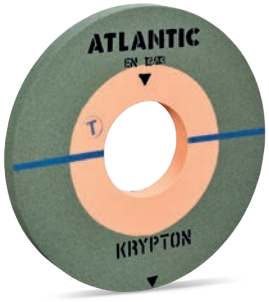
SCHLEIFSCHEIBEN + HONSTEINE

Process reliability from heavy plate to aluminium foil

Roll grinding wheels for high removal rates up to 500 kg per hour and finest surface structures up to 0.03 µm Ra



SHORT INFORMATION

ROLL GRINDING WHEELS FOR HOT & COLD MILLS

GET YOUR PERFORMANCE ADVANTAGES ROLLING
WITH OUR ROLL GRINDING WHEELS FOR HOT & COLD MILLS

These days, mainly two kinds of rolling mills are used in hot & cold rolling. On the one hand, a rolling mill with one rolling stand is used with back and forth running rolling material (reverse stand) or on the other hand a rolling mill with several stands, where the material is rolled in one process from a raw to a final dimension. Through these rolling processes the rolls are wearing whereby problems with the profile and surface occur. If the wear level exceeds the permissible tolerance, it is required to restore the geometry and surface texture. Therefore, grinding is an essential machining method for finishing operations as well as for intermediate processing before the final surface treatment such as super finishing, texturing, chrome-plating or other operations.

Rolls for hot & cold rolling mills
General remarks

Rolls normally consist of bales and journals, wherein the journals of composite casting rolls are made from the same material as the core and the bale and manufactured in a material that is substantially harder / more wear-resistant. The bale of forged rolls and rolls which are not composite casted are hardened on the periphery. Basically, a distinction is made between work, intermediate and back-up rolls.

Work rolls for hot mills are mostly manufactured of composite cast by means of centrifugal casting processes. Most common materials for roll bales in hot mills are indefinite, high-chrome and HSS with hardnesses of 70 to 90 ShC. In cold rolling mills mostly forged steel rolls are used with hardnesses of 70 to 80 ShC.

The offset to be machined relative to the diameter is about 0.2 to 0.5 mm, the required surface finish is approx. 0.3 to 2 µm Ra.

Back-Up rolls and **intermediate rolls** normally consist of casted or forged steel with hardnesses under 70 ShC. The required surface finish is usually 0.6 to 1.2 µm Ra with 1 to 4 mm material removal of the outer diameter of the bale.

Roll grinding

Roll grinding is an external cylindrical grinding process and the process parameters are in many areas comparable with those of normal external cylindrical grinding between centers.

The main differences are the dimension and the weight of the work pieces which resulted in the need for special roll grinding machines. These must have a high level of machine stiffness and are supplied with power ratings of up to 500 kW.

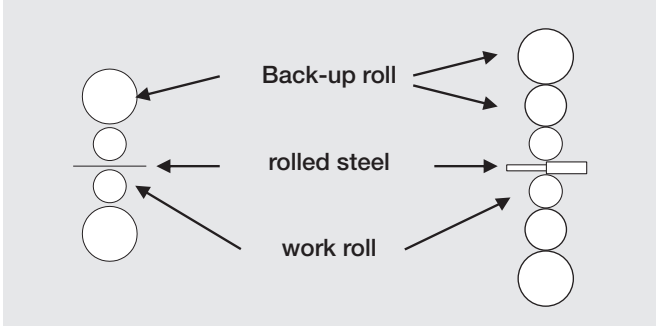
Modern machines are also equipped with fully automatic CNC systems and measuring controls.

Roll repair grinding

The roll user naturally machines smaller volumes as a roll producer, since only wear-related errors on the roll must be resolved. For roll repair grinding in hot & cold rolling mills the machine power of the machines used therefore is also lower than the rough grinding machines of the roll producers used, but still have up to 130 kW.

For repair or reconditioning grinding, a good compromise between the extreme high removal volume, high removal quotient and good surface finish (metrological and visually) has to be found.

Another special exception is the fact that the roll bale often has to be ground crowned (convex), in a concave form or in another special form (as CVC). Even more than with rough roll grinding, the total costs of the grinding process during repair grinding are influenced by the machine hourly rate, so that an optimum grinding program must be found between preliminary and final grinding.



In addition to the mechanical equipment, the selection of the process parameters adapted to the grinding wheel specification is an essential step to meet the required dimensional needs, create the surface finish of the rolls and to achieve a cost-effective process management.

It not only depends on a good under load cutting grinding wheel but also on good behaviour during finishing (fine grinding the surface at lower amperage).

ATLANTIC roll grinding wheels makes it possible to provide optimal solutions due to their universal applicability, their high technical standards, and their wide range of recipes. The performance of the grinding wheels is still predominantly based on the grinding wheel – which means the number of ground rolls – assessed.

A concrete number of ground rolls with **ATLANTIC** roll grinding wheels cannot be given because it depends on the dimensions of the rolls and the usable grinding wheel, as well as the coolant, roll material, stock removal, grain size used, the feed rate and the infeed of the machine etc.

As a result of this dependency, we have values from 30 to over 500 ground work rolls per grinding wheel. A certain proportion of these influences can be eliminated through a concrete experimental evaluation in which independent variables, such as the G-ratio (cut material volume per unit volume of grinding wheel used, e.g. cm^3/cm^3) are determined.

Even though there is still a wide range here, the following estimates can be given (may vary depending on machine and selected parameters):

Roll	Roll material	G-ratio
Work roll	Forged steel	4–9
	HSS	1–3
	High chrome	3–6
	Indefinite	3–6
Back-Up roll	Casted steel	2–5

Another criterion for the evaluation of grinding wheels is the processing time per roll. For work rolls, a floor to floor time of 1 hour, on back-up rolls 3-5 hours, is still very common.

As a result of increasing cost pressure, the demands for shortened grinding times rise due to increasing automation. Grinding times of 25 to 35 minutes for work rolls and 90 to 120 minutes for back-up rolls can be realized with modern machinery and **ATLANTIC** grinding tools which are adapted to that.

Through the development of new bonds, which have been specially adapted to the use of microcrystalline sol gel as an abrasive, **ATLANTIC** has succeeded in offering grinding wheels, which allow on the one hand removal rates of more than 2 $cm^3/min/kW$ or more than 1 kg/h/kW and on the other hand, easily reach the necessary requirements for hot & cold strip mills like metrological, geometry and surface finishes.

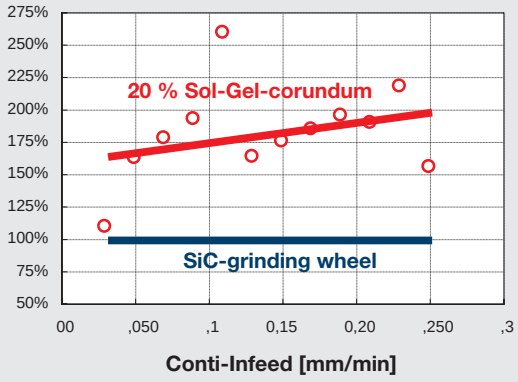


Diagram 1: Comparison of the specific machining performance [$cm^3/min/kW$]

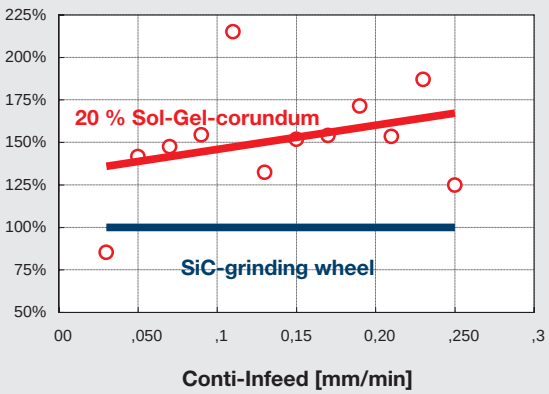


Diagram 2: Comparison of the G-ratio [cm^3/cm^3]

From the illustrations in the graphs 1 and 2, it is easy to see that **ATLANTIC** grinding wheels with sol gel, in contrast to grinding wheels without sol gel, have a clear benefit when it comes to effectiveness and when there is a higher infeed which can be realized due to shorter grinding times.

It not only increases the potential removal in a shorter time but also the life time of the wheels compared to grinding wheels without sol gel is increased significantly.

Specification recommendation

In table 1 you can find general suggestions for repair grinding in hot- & cold rolling mills with **ATLANTIC** grinding wheels. These recommendations are based on long-term experience in both areas of the rolling industry, like all other given specifications and information in this brochure. They represent a compromise and require adjustment to the circumstances on the customer's side to optimize the grinding operation. To determine an **ATLANTIC** grinding wheel according to your needs, certain information is of highest importance: Such as power of the spindle drive; grinding wheel dimensions, form and scrap diameter; Material, dimensions and hardness of the roll and surface values required.

We would be pleased to optimize your grinding application with all our experience in regards to quality and productivity.

Roll type	Roll material	Roughness Ra [µm]	Standard	High Performance
Work rolls	High chrome & HSS	0,4–1,2	Corundum #36–#46	Corundum & Sol Gel #46
		> 1,6	Corundum #24–#30	Corundum & Sol Gel #30
	Indefinite & Casted Steel	0,4–1,2	Silicon carbide #36–#46	Silicon carbide & Sol Gel #46
		> 1,6	Silicon carbide #24–#30	Silicon carbide & Sol Gel #30
	Forged Steel	0,2–0,6	Corundum #60–#100	Corundum & Sol Gel #60–#100
Back-Up rolls	All materials	--	Corundum #30	Corundum & Sol Gel#30

Case examples:

	Example 1	Example 2	Example 3
	Work roll	Work roll	Back-Up roll
Machine:	Waldrich	Herkules	Waldrich
Power:	100 kW	100 kW	100 kW
Coolant:	Emulsion, 2 %	Emulsion, 2 %	Emulsion, 2,5 %
Roll dimensions:	Ø650 x 1900 mm	Ø750 x 2200 mm	Ø1430 x 2030 mm
Roll material:	Casted high chrome Indefinite	Casted high chrome	Cast steel
Roll hardness:	75 – 85 ° ShC	80° ShC	65° ShC
Off-set:	0,3 – 0,5 mm	0,5 mm	2 mm
Grinding wheel dimensions:	915 x 125 x 304,8 mm	915 x 102 x 304,8 mm	915 x 100 x 304,8 mm
Grinding wheel speed:	45 m/s	50 m/s	45 m/s
Max. current consumption:	130 A	130 A	175 A
Grinding time per roll:	45 min.	40 min.	120 min.
Amount ground rolls per wheel:	300 pcs.	150 pcs.	40 pcs.

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