

Importance of Reduction Rolls Reconditioning for Mill Performance

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IAOM 2023, Vietnam



www.yenar.com.tr

1 of the Worlds Largest and Leading Flour Milling Rolls Manufacturer

Factory: Turkey
22,000 rolls /year



Rolls Reconditioning Machines:

- **CNC Fluting/Grinding**
- **Sandblasting**
- **Flute Profile Measurement**



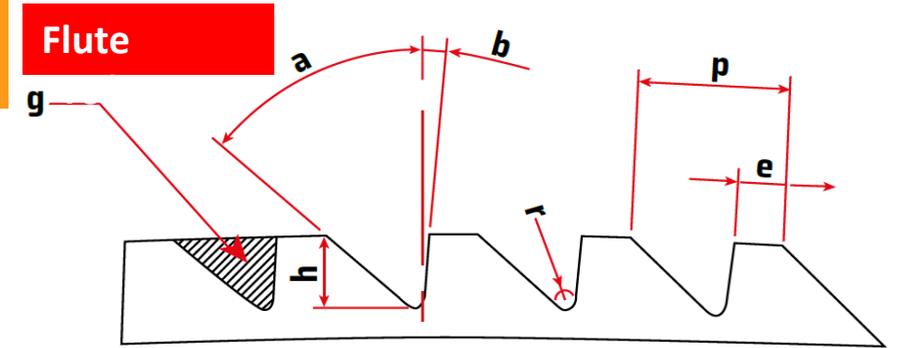
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Rolls Testing in Production



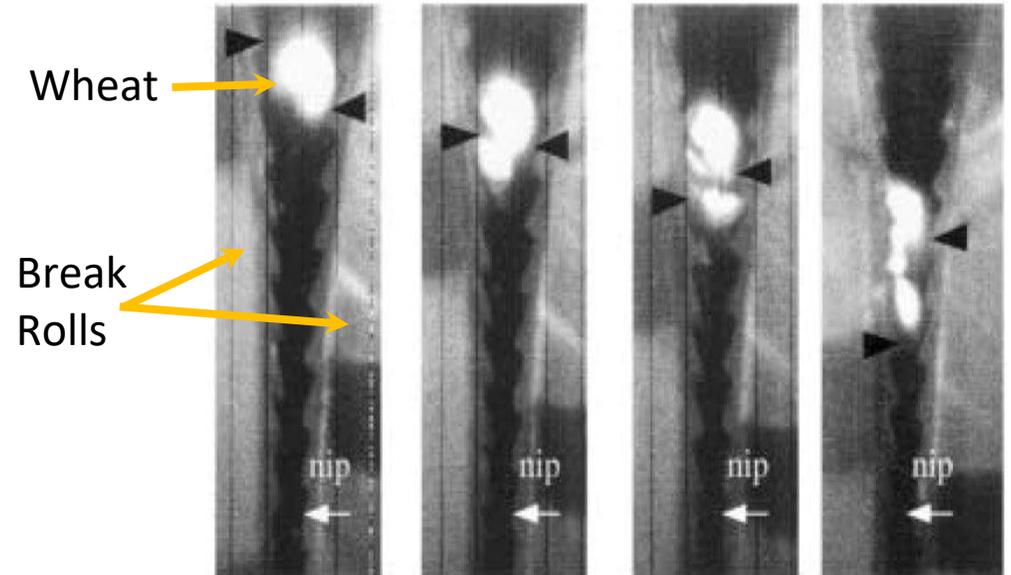
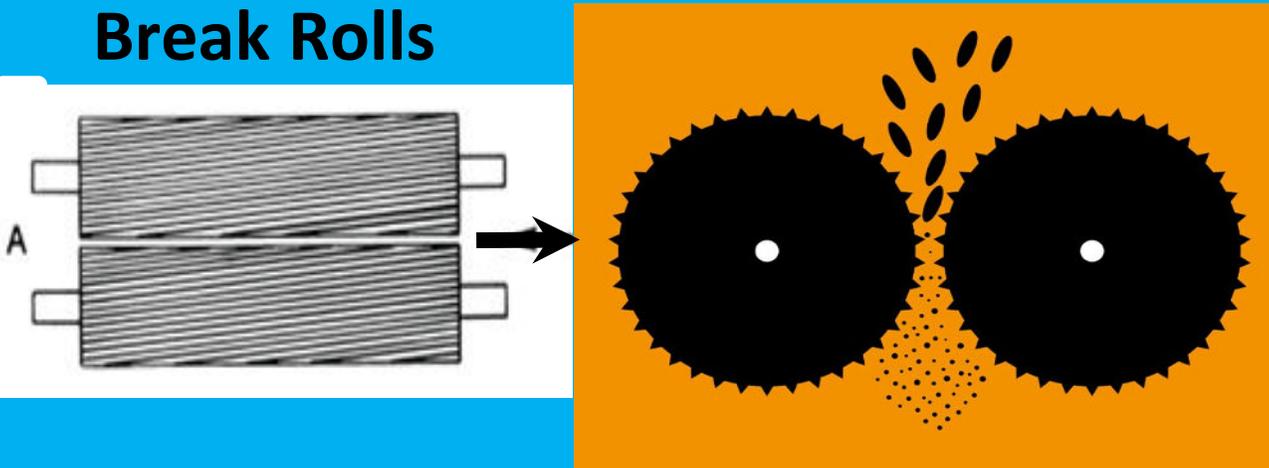
Importance of Accurate Flutes for Mill Performance

- Balanced mill
- Lower ash
- higher flour yield
- Lower electricity consumption



Important for flutes to be correct / good condition

Break Rolls



source: Effect of Roll Fluting Disposition and Roll Gap on Breakage of Wheat Kernels During First-Break Roller Milling, C. Fang, G. Campbell

What is the importance of Accurate Reduction Rolls??

- Capacity
- Flour yield
- Ash
- Moisture
- Electricity
- Starch damage
- Water adsorbtion
- Quality
- Ballanced mill

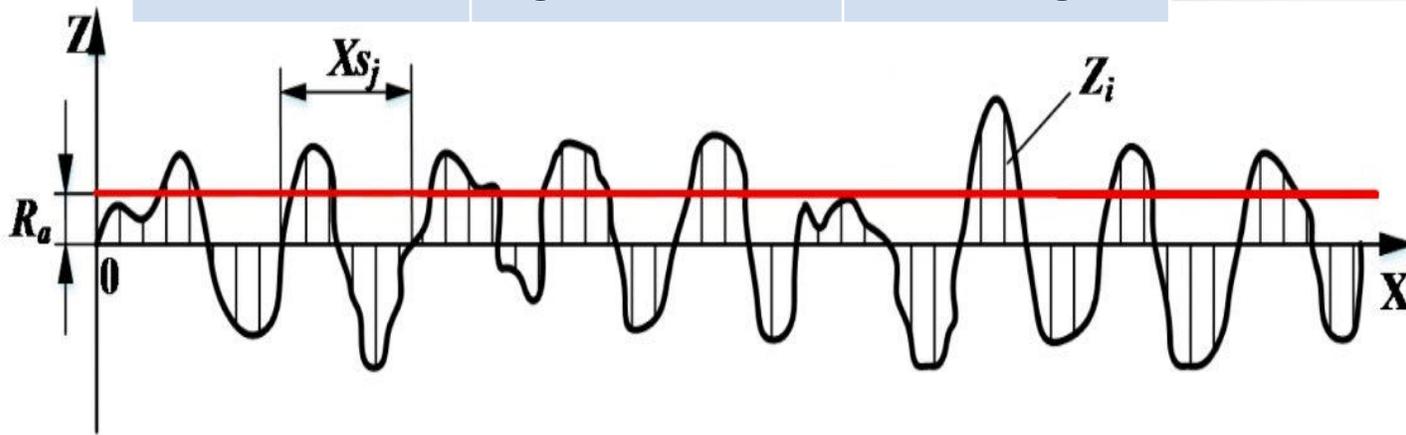
✓ Correct Surface Roughness

✓ Correct Taper/Crown



Surface Roughness of Reduction Rolls

Surface Roughness	Remarks	Shear Force
< 1.0 Ra	Shinning Rolls	Low
1.0 - 2.0 Ra	Very Low	
2.0 - 2.5 Ra	Low	
2.5 - 3.5 Ra	OK	
3.0 - 3.5 Ra	Good	
3.5 - 4.0 Ra	OK	
> 4.0 Ra	High	High



Ra
= Avg roughness of a surface
(Avg height of peaks & valleys)

YENAR YTK SAND BLASTING MACHINE FOR REDUCTION ROLLS



**Ergonomic
Compact**

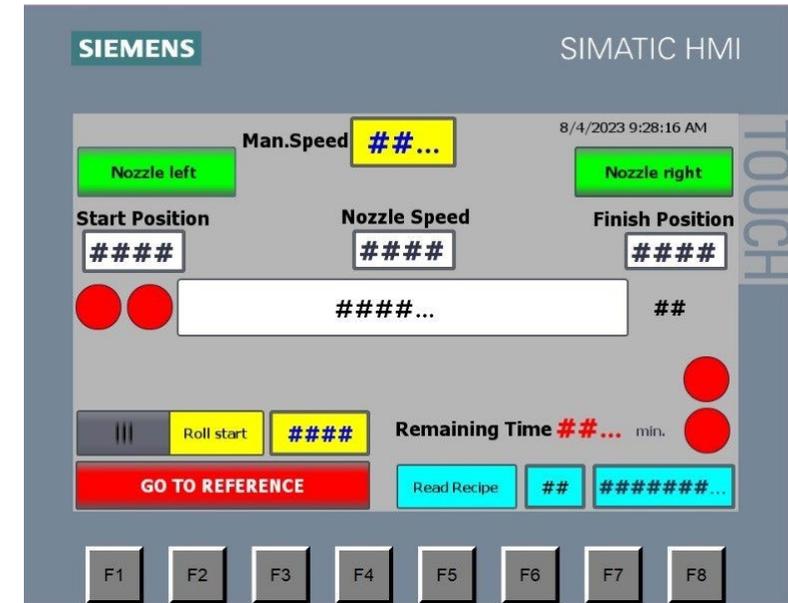
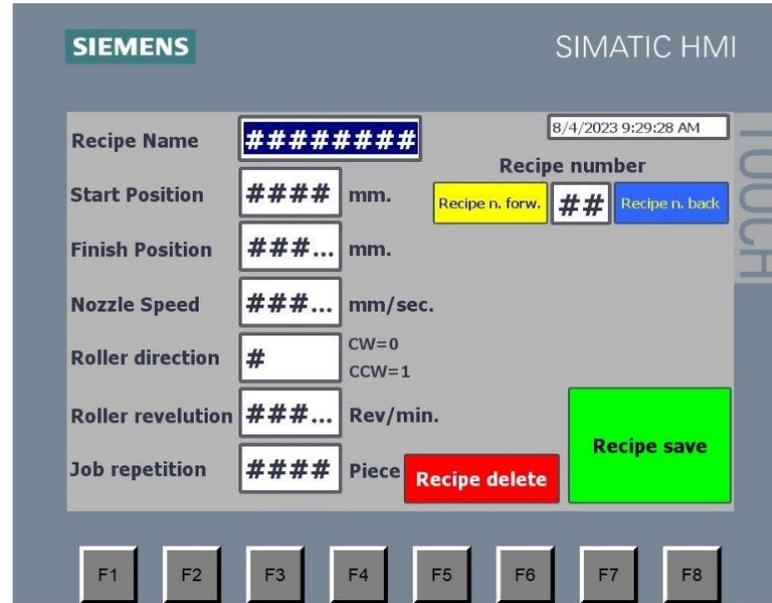
Not dusty

Safer



YTK

Sand Blasting Machine



Sand Blasting a 250 x 1000mm Roll

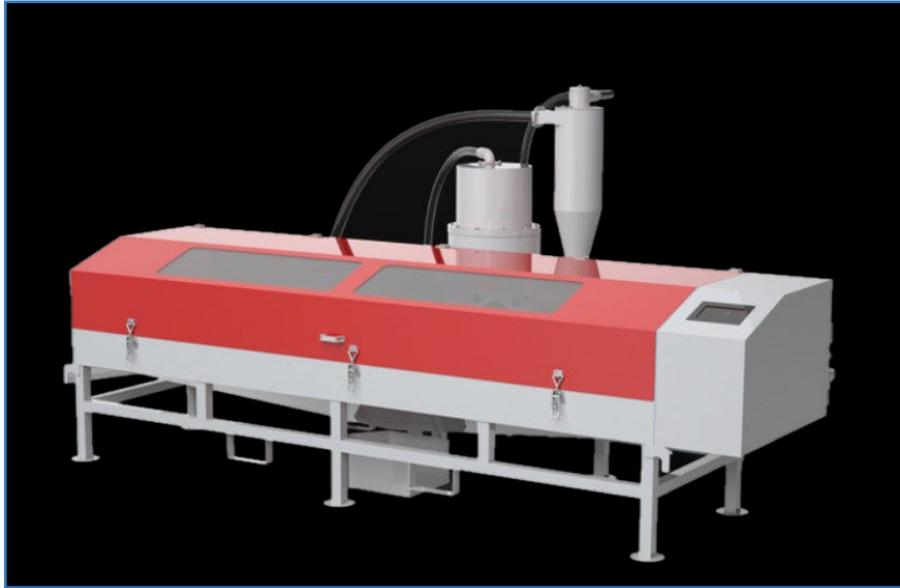
Nozzle Speed	Time/Roll	Point 1	Point 2	Point 3	Average Ra
0.7 mm/min	24 min	Ra 4.342	Ra 3.832	Ra 3.807	Ra 3.994
0.6 mm/min	28 min	Ra 4.186	Ra 4.400	Ra 4.153	Ra 4.246
0.5 mm/min	34 min	Ra 4.278	Ra. 4.238	Ra 4.815	Ra 4.444



YTK

VS

Traditional



Sand blasting Media



Abrasive	Common Uses	Mohs Hardness	Density	Shape	Mesh Sizes
Aluminum Oxide	Fast etching and profiling, anchor pattern	9	3.94 to 3.96	Angular / SubAngular	12 to 325
Corn Cob	Lowabrasion, minimal substrate removal for materials such as wood	4 to 4.5	1.2 to 1.4	SubAngular	8 to 40
Crushed Glass	Efficient and economical for stripping	5 to 6	2.5	Angular	30 to 325
Garnet	Cleaning of large structural aluminium and fibreglass structures	7.5 to 8.5	3.5 to 4.3	SubAngular / Sub Round	8 to 150
Glass Beads	Bright, satin finish ideal for stainless steel applications	5 to 6	2.5	Rounded	30 to 325
Plastic Abrasive	Cleaning and paint removal without damaging or marring delicate surfaces	3 to 4	1.5	SubAngular	12 to 80
Silicon Carbide	Fast cutting and deep etching for stone, glass and other hard materials	9 to 9.5	3.2 to 3.22	Angular	8 to 325
Staurolite	Removal of rust and coatings during bridge maintenance	7 to 7.5	3.6	SubRounded	20 to 120
Steel Grit	Fast stripping and aggressive cleaning for higher etch surface profiles	8	4.8 to 7.8	Angular / SubAngular	10 to 200
Steel Shot	Polishing and peening a variety of applications	8	4.8 to 7.8	Rounded	7 to 120
Walnut Shell	Aggressive stripping without damaging surface	4 to 5	1.2 to 1.35	SubRounded / Sub Angular	6 to 100

Brown Aluminium Oxide, 16 Mesh



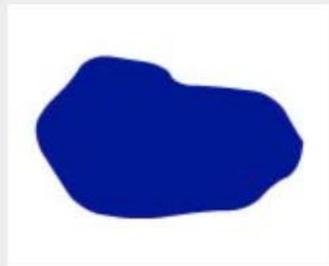
Angular



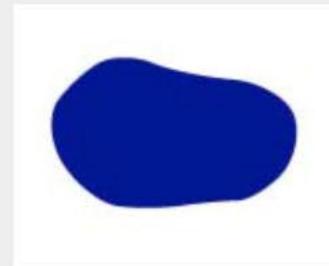
Sub-angular



Sub-rounded



Rounded



US Mesh	Micron
4	4,750 um
5	4,000 um
6	3,350 um
7	2,800 um
8	2,360 um
10	2,000 um
12	1,700 um
14	1,400 um
16	1,200 um
18	1,000 um
20	850 um
24	690 um
30	560 um
36	485 um
40	425 um
46	355 um

Hazardous Substance Fact Sheet

Common Name: **ALUMINUM OXIDE**

Synonyms: alpha-Alumina; Aluminum Trioxide

Chemical Name: Aluminum Oxide

CAS Number: 1344-28-1

RTK Substance Number: 2891

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Reasons for Citation

- ▶ **Aluminum Oxide** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, NIOSH, DEP and EPA.
- ▶ **Aluminum Oxide** can affect you when inhaled.
- ▶ Contact can irritate the skin and eyes.
- ▶ Inhaling **Aluminum Oxide** can irritate the nose, throat and lungs.
- ▶ Repeated exposure can lead to lung damage.

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	2	-
FLAMMABILITY	0	-
REACTIVITY	0	-
DOES NOT BURN		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

EXPOSURE LIMITS

OSHA: 5 mg/m³ (as *respirable dust*) and 15 mg/m³ (as *total dust*), 8-hr TWA

ACGIH: 1 mg/m³ (as the *respirable fraction*), 8-hr TWA **airborne exposure of 8 hours**

Firefighting

Extinguish fire using an agent suitable for type of surrounding fire. **Aluminum Oxide** itself does not burn.

Dusts may form explosive mixtures in air.



Dust Free Sand Blasting



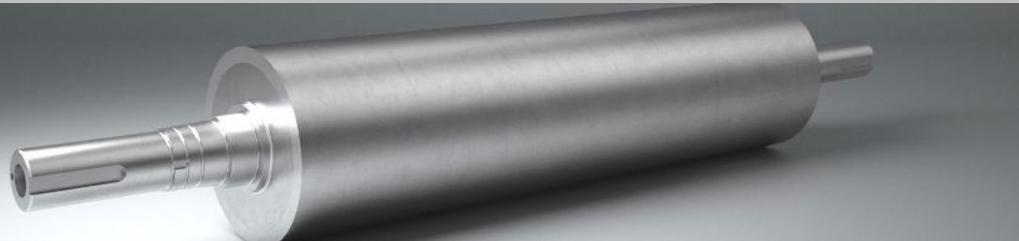
Yenar Sand Blasting Machine For Flour Milling



**What should we do if we are lazy
to sandblast rolls??**



Self Surfacing Rolls



- Maintains roll surface roughness
- Special alloy material
- Hardness 320-380HB
- Saves time and labour
- Saves sandblasting cost
- Saves grinding cost
- Maintains capacity, flour yield, ash, energy

So much work to remove rolls from roller mill. Worth it???



Remove small gear with puller



Removal of Transmission belt



Remove Main Bearing housing bolts



Remove Center Plates



Remove Bearing Housing both sides



Remove Main Belt Drive Pulley



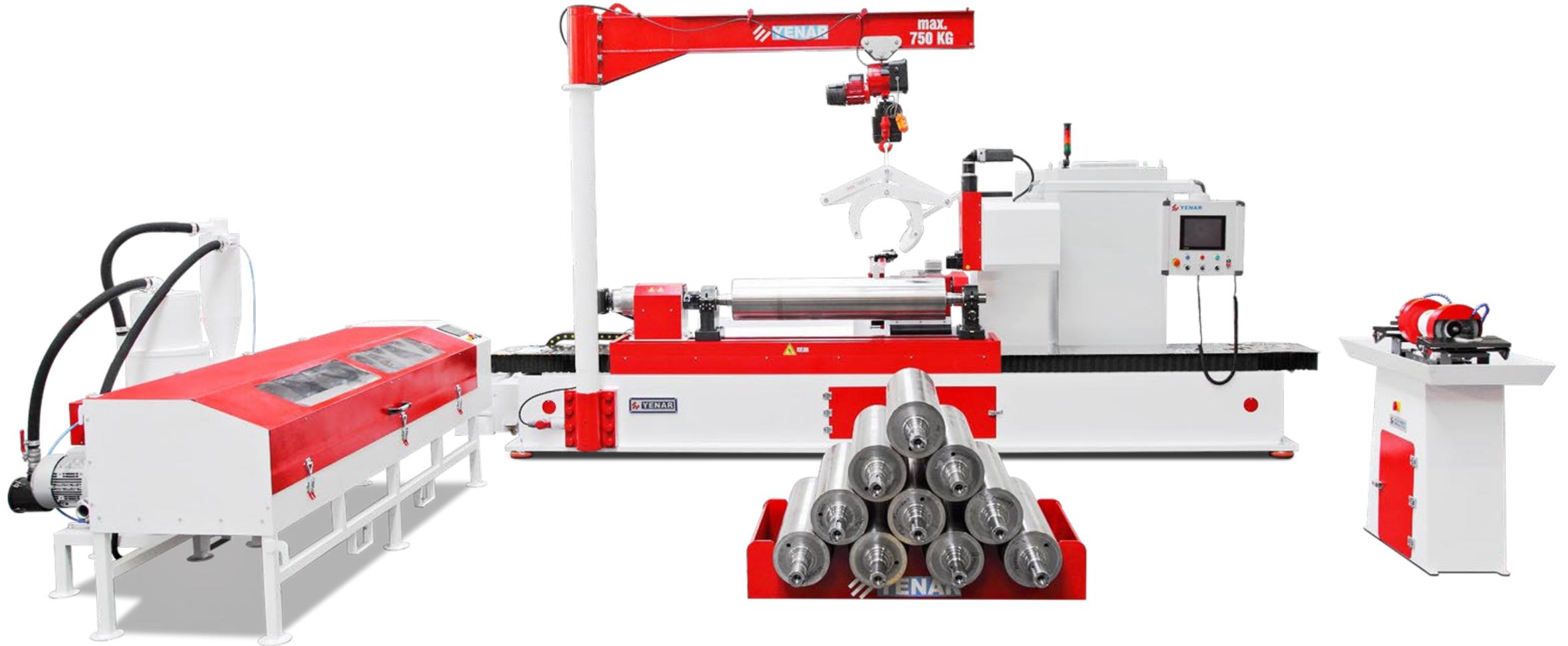
Remove Rear Roll

Source:

https://www.youtube.com/watch?app=desktop&v=6HQxM6xl_O8



PERFECT MACHINES FROM A ROLL EXPERT



Grinding of Reduction Rolls

- even diameter throughout rolls
- taper

Challenging to recondition rolls accurately every time



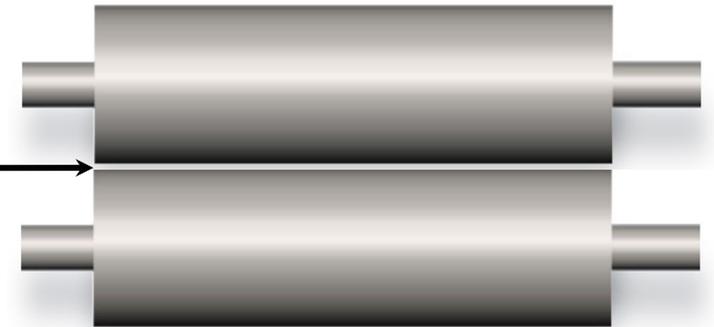
Reduction Rolls: Smooth Rolls, No Flutes



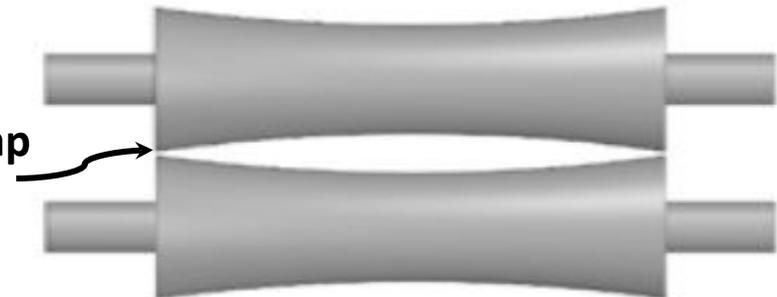
Taper

Important for Taper to be correct / good condition

Even Gap
= GOOD

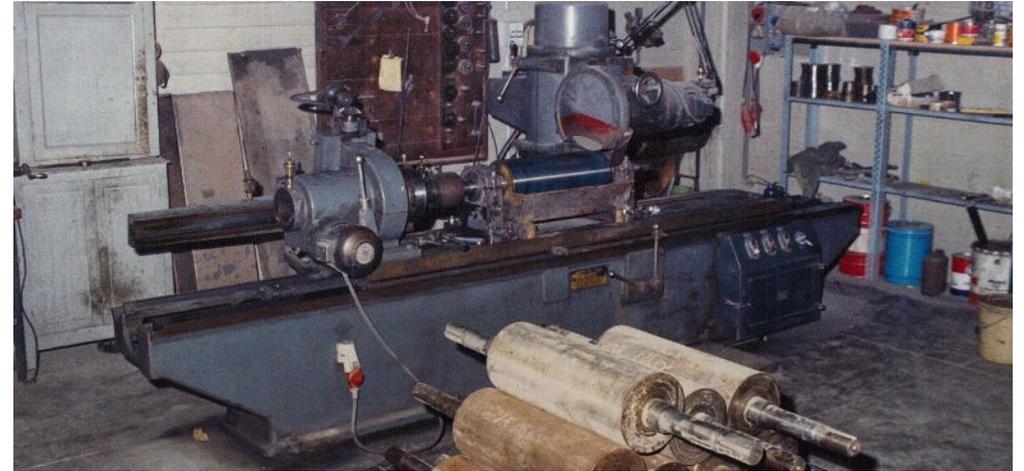


Un-Even Gap
= BAD





Fluting & Grinding Machine **CNC vs Traditional**



YENAR Sub 08 10:32:52 **MANUAL**

10 Y ZERO

18 0 / 0
Reset Cut Qty

Y
1 0.000

Z
2 0.000

Y Extra Cut (Micron) 11 0.000

Z Start Z Finish
12 13 0.000

Cut Qty (Micron) 3 0.005

Total Cut (Micron) 4 0.050

Y Inclination 0.001 14

Grinding Type
19 Cylindrical 20 Chamfer 21 Camber

5 @ Beginning 6 @ End 7 Both Sides

Water Pump ON/OFF 15 Stone Motor ON/OFF 16

Trips Without Cut 8 3

17 Roll Start Stop

9 100 % C SPEED

100 % Z SPEED 22

Home Parameters Reference Settings Grinding Home



Grinding

Grinding Type

Cylindrical Chamfer Camber

Grinding Type

Cylindrical Chamfer Camber

Cambering mm (D1-D2)
0.000

Grinding Type

Cylindrical Chamfer Camber

Chamfer Depth mm (D1-D2) 0.000

Chamfer Length mm(L) 0.000

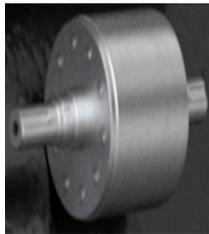
Fluting Table of Flour Mill

Passage	Grinding rolls						Flutes						Smooth	Feed rolls				Transmission		Scrapper type	Drive				
	Number	Length	Diameter	Thick walled	Watercooling	Aut. gap. adjustr	Flutes on circum.	Flutes per cm	Grinding action	Style of grooves	Spiral %	Land / mm	Tapering / μ (on diameter.)	Type front	Type rear	Distr. Bridge	Speed (slow)	Toothed belt ratio	1 / Min. roll		kW V-Belt	Motor / kW 50 Hz / 400 V	1 / Min. Motor 50 Hz / 400 V	min. Torque	
B1	8	1250	250	x			275	3.5	D	18	6	0.2		S2	-			1 : 2.5	-	560		30.0	1000	258	
B2T	8	1250	250	x			350	4.5	D	18	4	0.2		PT7	W			1 : 2.5	-	560		22.0	1000	189	
B2B	8	1250	250	x			375	4.8	D	18	6	0.2		-	-			1 : 2.5	-	560		22.0	1000	189	
B3	8	1250	250	x			500	6.4	D	18	8	0.1		PT7	W			1 : 2.5	B	560		18.5	1000	159	
B4c	4	1250	250	x			650	8.3	A	69	8	0.1		PT7	W			1 : 2.5	B	560		15.0	1000	129	
B4f	2	1250	250	x			800	10.2	A	69	10	0.1		PT5	W			1 : 2.5	B	560		15.0	1000	129	
B5c	4	1250	250	x			700	8.9	A	69	8	0.1		PT7	W			1 : 2.5	B	560		11.0	1000	95	
B5f	2	1250	250	x			850	10.8	A	69	10	0.1		PT5	W			1 : 2.5	B	560		15.0	1000	129	
C1AcT	8	1250	250	x			smooth						50 - 55	S7	S1	x		1 : 1.23	M	560		15.0	1000	129	
C1AcB	8	1250	250	x			smooth						60 - 65	-	-			1 : 1.23	M	560		18.5	1000	159	
C1Af	4	1250	250	x			smooth						50 - 55	S7	S1	x		1 : 1.23	M	560		18.5	1000	159	
C1B	4	1250	250	x			smooth						60 - 65	S7	S1	x		1 : 1.23	M	560		18.5	1000	159	
C2	8	1250	250	x			smooth						50 - 55	S7	S1	x		1 : 1.23	M	560		15.0	1000	129	
C3c	6	1250	250	x			smooth						50 - 55	S7	S1	x		1 : 1.23	M	500		15.0	1000	129	
C3f	2	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
C4	4	1250	250	x			smooth						50 - 55	S7	S1	x		1 : 1.23	M	500		15.0	1000	129	
C5	6	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
C6	4	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
C7	4	1250	250	x			smooth						50 - 55	S7	S1	x		1 : 1.23	M	500		15.0	1000	129	
C8	4	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
C9	2	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
C10	2	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
C11	2	1250	250	x			smooth						40 - 45	S7	S1	x		1 : 1.23	M	500		11.0	1000	95	
RED	4	1250	250	x			950	12.1	A	69	14	0.1		PT7	W			1 : 2.0	M	620		22.0	1000	189	

Effect of Smooth Roll on the Mill

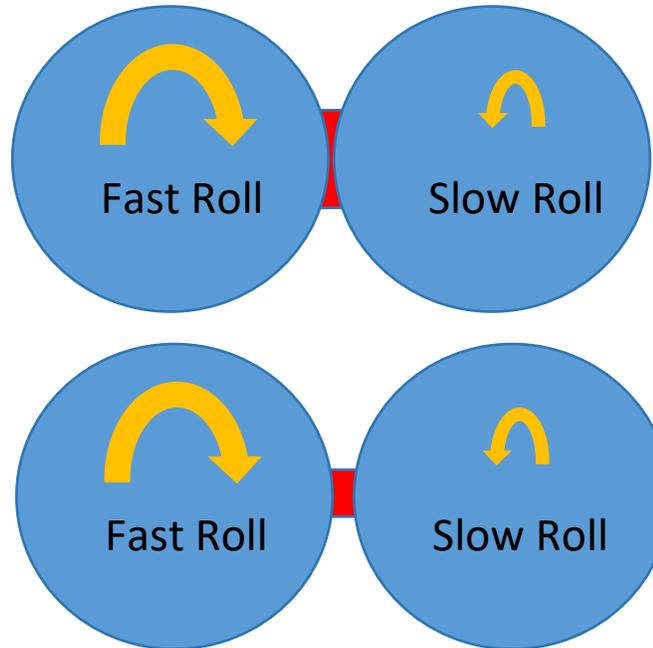
Experimental Runs

- wheat middlings / Semolina
- laboratory roll stand Variostuhl, model C Ex 2
 - reduction rolls
 - 250mm x 100mm
 - various different conditions



Small Roll Gap

- More compression
- Higher shear force
- Bigger grinding area
- Higher energy needed



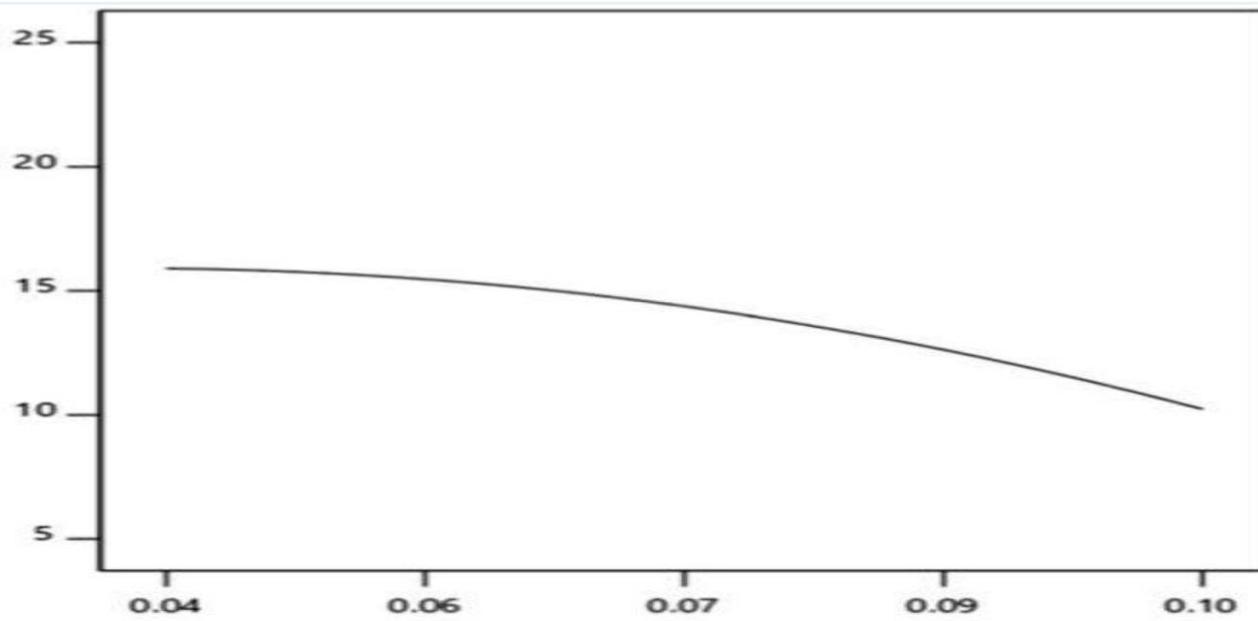
Big Roll Gap

- Less compression
- Lower shear force
- Smaller grinding area
- Lower energy needed

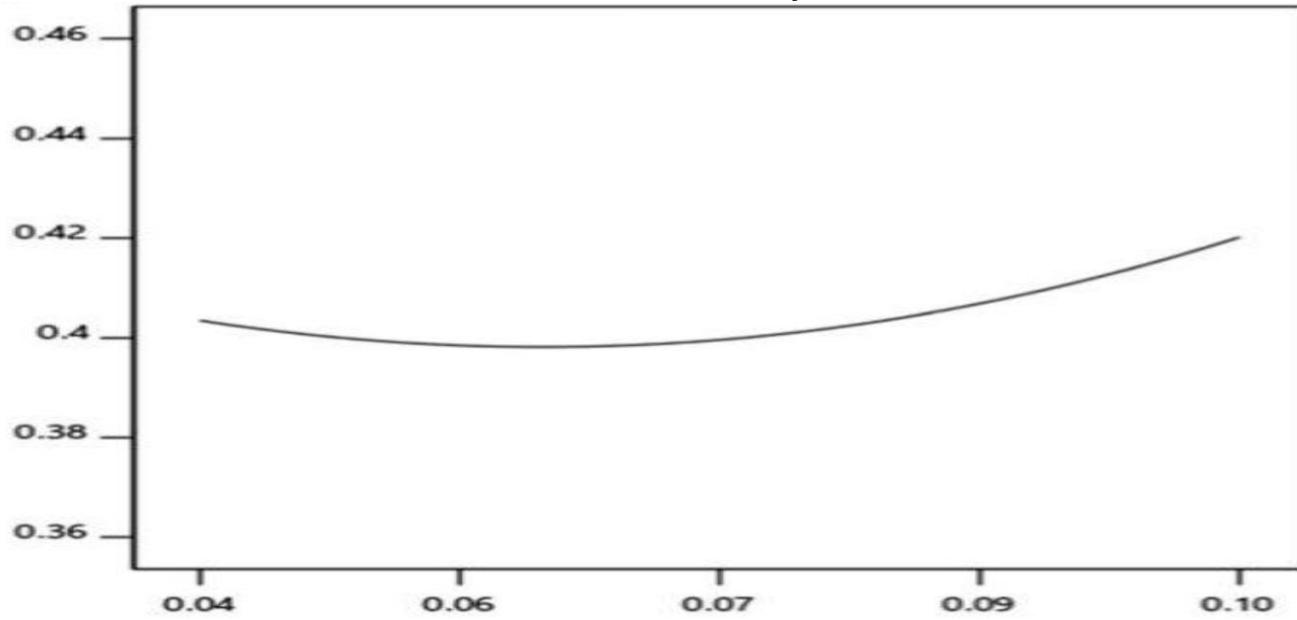
Grinding Run	A	B	C	D	R1	R2	R3	R4
1	0.1	500	1.5	0.3	10.26	0.43	35.87	349.74
2	0.07	400	1.5	0.3	14.49	0.41	33.64	232.21
3	0.07	500	1.5	0.2	21.33	0.39	55.6	260.65
4	0.07	400	1.1	0.2	10.48	0.36	36.85	351.62
5	0.07	500	1.5	0.4	13.66	0.37	34.74	254.32
6	0.04	500	1.5	0.3	17.85	0.39	42.98	240.81
7	0.07	400	1.9	0.4	11.8	0.42	37.77	320.21
8	0.07	400	1.5	0.3	14.19	0.39	34.44	242.73
9	0.04	400	1.5	0.4	12.05	0.41	33.45	277.73
10	0.07	300	1.9	0.3	11.01	0.42	36.84	334.78
11	0.07	400	1.9	0.2	16.83	0.42	53.07	315.21
12	0.04	400	1.5	0.2	21.76	0.39	53.63	246.46
13	0.07	500	1.1	0.3	10.52	0.38	31.75	301.77
14	0.1	400	1.9	0.3	9.3	0.43	36.02	387.34
15	0.1	400	1.1	0.3	6.23	0.42	22.85	367.04
16	0.07	400	1.5	0.3	12.94	0.41	33.76	260.86
17	0.04	400	1.1	0.3	10.19	0.41	26.26	257.67
18	0.07	300	1.5	0.4	10.06	0.37	24.96	248.2
19	0.07	400	1.1	0.4	6.45	0.4	19.69	305.51
20	0.04	400	1.9	0.3	14.07	0.42	45.15	320.9
21	0.1	400	1.5	0.4	9.61	0.39	26.35	274.36
22	0.1	400	1.5	0.2	10.26	0.43	40.6	395.9
23	0.04	300	1.5	0.3	12.91	0.4	31.38	243.08
24	0.07	300	1.5	0.2	14.63	0.39	38.31	261.93
25	0.07	300	1.1	0.3	5.56	0.45	22.08	397.43
26	0.07	500	1.9	0.3	15.38	0.41	49.28	320.38
27	0.1	300	1.5	0.3	9.17	0.42	25.09	273.72

Source: Study on the effects of smooth roll grinding conditions on reduction of wheat middlings using response surface methodology. N.Bojanic, A.Fistes, D. Rakic, S.Kolar, B.Curic, J.Petrovic

FLOUR YIELD (%)

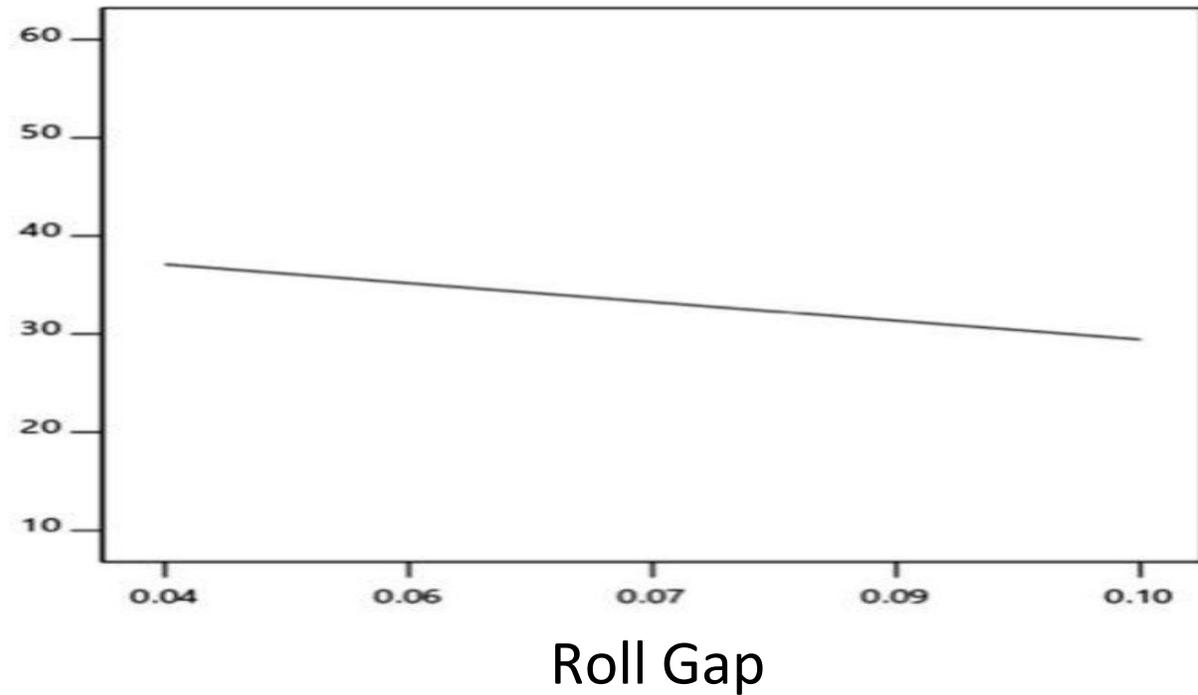


Ash (%)

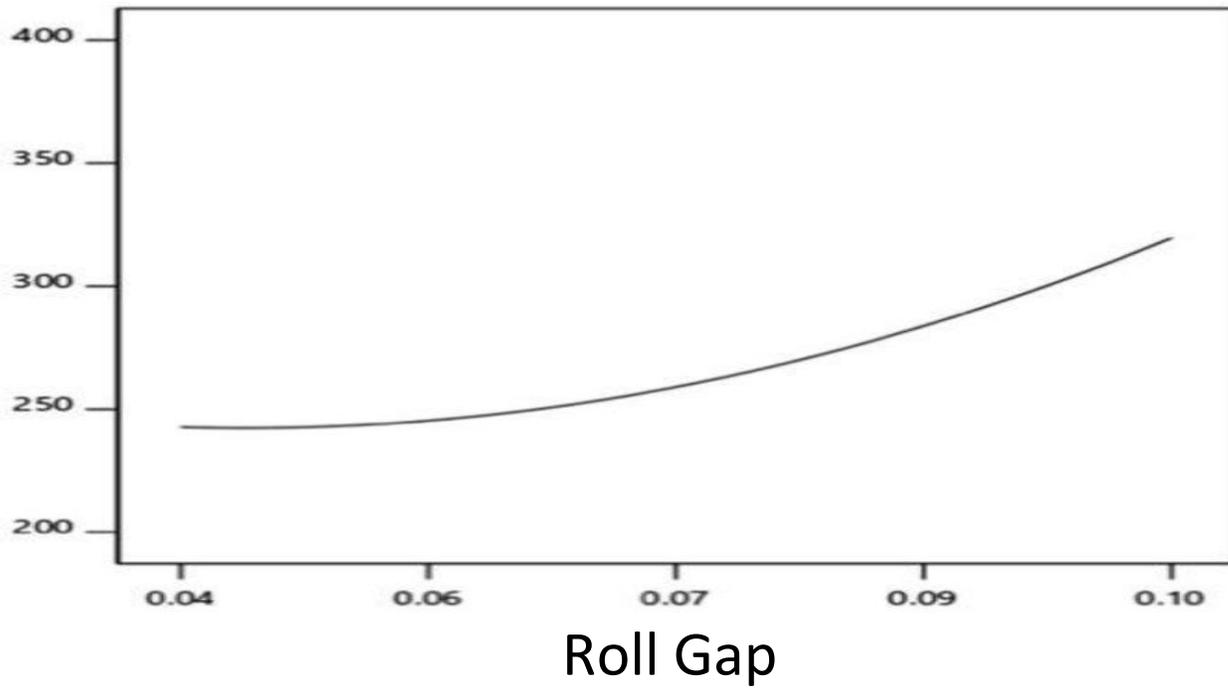


**Try to find
any tiny
way to
increase
flour yield
and lower
ash**

Milled Material
Energy
Consumption
(kJ/kg)



Flour Yield
Energy
Consumption
(kJ/kg)



Small roll gap brings many benefits

So make sure your rolls have correct taper



Cảm ơn bạn nhiều
Çok teşekkür ederim

**For more info, please visit
our Yenar booth in IAOM**

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**Only 1 factory in the world
specializing in producing
Roll Conditioning Machines**



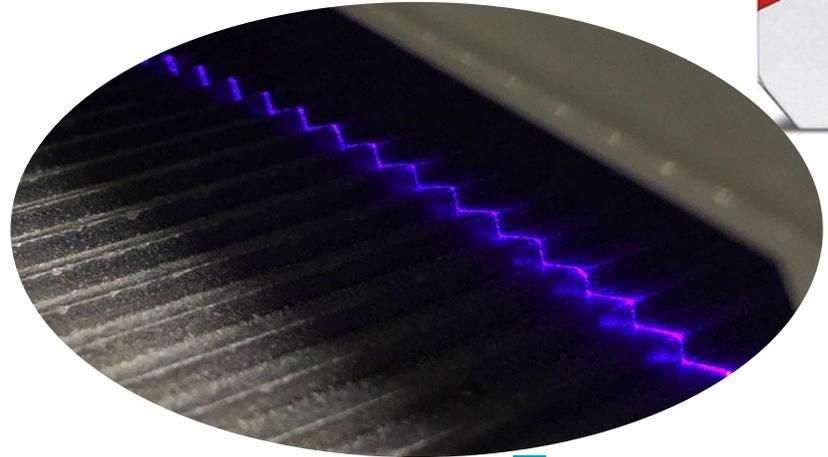
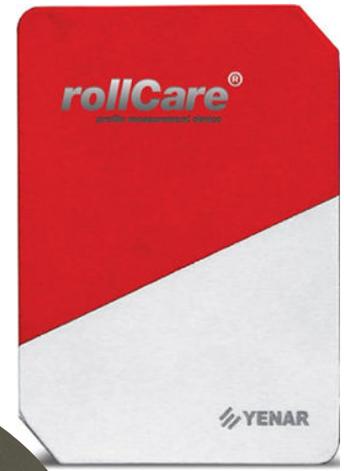


Assembly & Production in Action



rollCare[®] Flute Profile Measurement Device

profile measurement device



ROLLCARE

Large Spare Parts Warehouse for FAST Service of your Machines



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