

SCHEMATIC FLOW DIAGRAM OF RICE HULLING ROLLER

MANUFACTURE FIGURE 6

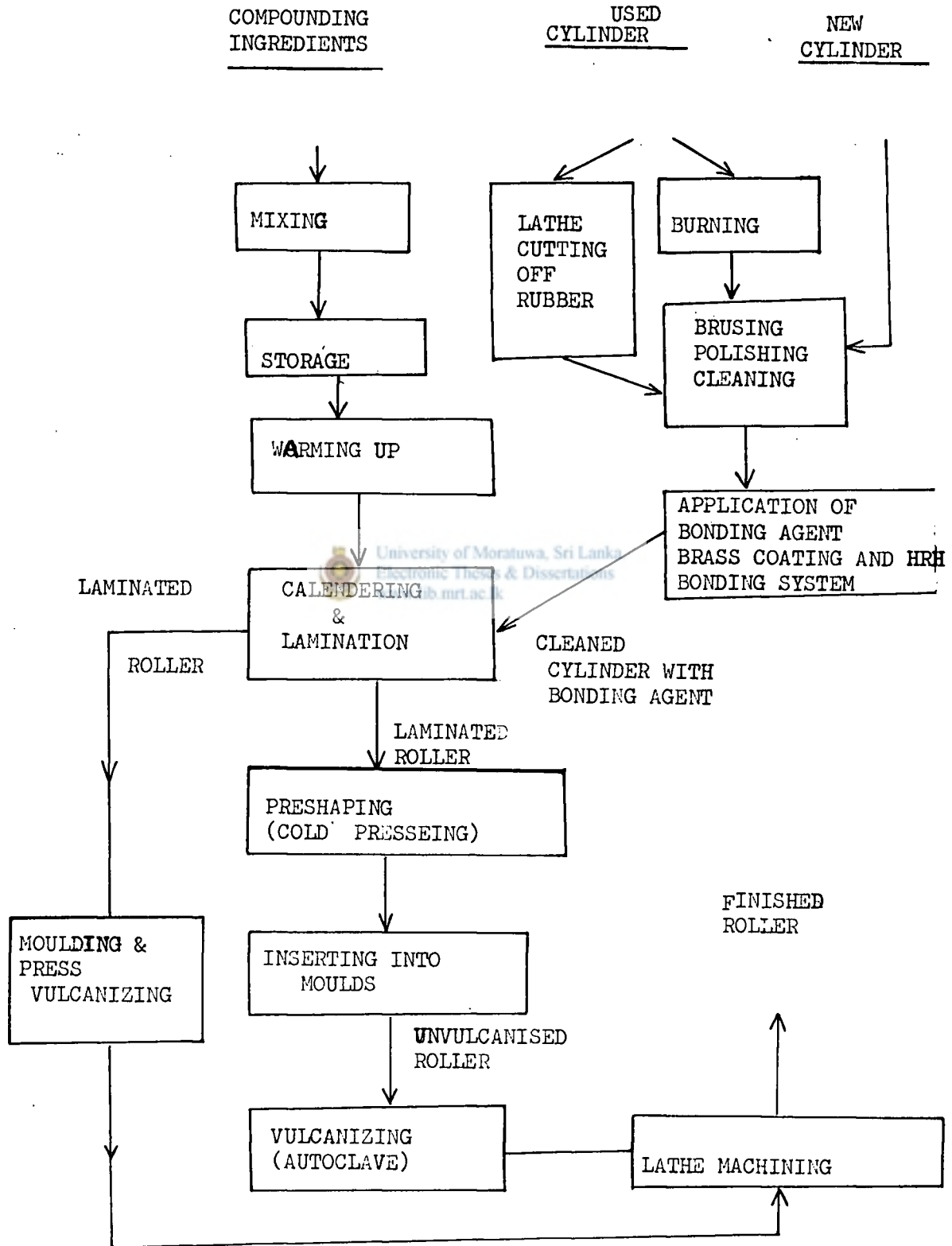


TABLE 2. TECHNOLOGICAL PROPERTIES OF
LABORATORY MIXES

	Control	A	B	C	D	E	F
Monsanto TM100 (140°C)							
Tmin (in.lb)	80.0	38.7	39.0	45.2	53.9	53.9	71.5
t2(min)	15.2	10.7	5.7	8.6	6.0	6.3	12.5
Tmax(in.lb)	110.0	85.0	90.0	83.0	88.9	101.0	100.3
t90(min)	35.5	21.4	10.7	15.0	9.5	12.9	25.0
T(in.lb)	30.0	46.3	51.0	37.8	35.0	47.1	28.8
T.S. (MN m ⁻²)	14.3	12.6	8.5	15.6	14.7	7.7	14.2
E _B	260	380	230	460	470	330	360
Dunlop Regilience							
@ 20°C	29.5	29.5	34.4	30.0	32.4	31.4	29.5
Shore A							
20°C	94.0	87.5	95.0	87.5	93.0	95.7	85.0
60°C	95.0	85.5	95.0	85.0	90.0	95.0	87.0
100°C	93.5	85.0	92.0	85.0	89.8	95.0	90.0
Tear strength							
(N per std test pc)	194	130	125	189	201	121	187

Note:

1. $\frac{\text{Wear of sample}}{\text{Wear of control}} = \text{Rel Du pont wear}$

TABLE 3. HARDNESS OF FACTORY TRIAL ROLLERS

	Shore A
Control	93
A	90
B	93
C	92
D	90
E	95
F	90



TABLE 4. SERVICE TEST RESULTS OF RICE HULLING ROLLERS

Sample	Time of run (in hours)	Hardness (at end of day run)	Temperature roller surface oC	Output No. of bag at end of day
Control				
Day 1	9	80	57	118
Day 2	14.5	80	63	186
Day 3	14.5	80	60	173
Day 4	5	-	-	58
Total	43	-	-	507
<u>A</u>				
Day 1	3	70	57	50
Day 2	14.5	70	57	104
Day 3	14.5	70	63	132
Day 4	11.5	-	-	102
Total	45	-	-	379
<u>B</u>				
Day 1	3	80	52	24
Day 2	14.5	80	54	153
Day 3	14.5	80	54	175
Day 4	14.5	80	63	155
Day 5	5.5	-	-	50
Total	52	-	-	-
<u>C</u>				
Day 1	7.5	70	57	90
Day 2	14	70	52	158
Day 3	14.5	70	57	175
Day 4	14.5	70	57	159
Day 5	6.5	-	-	-
Total	57	-	-	609



TABLE 4 (CONTD.) SERVICE TEST RESULTS OF RICE HULLING ROLLERS

sample	Time of run (in hours)	Hardness (at end of day run)	Temperature of roller surface °C	output (no of bag at end of day)
<u>D</u>				
Day 1	8	70	60	91
Day 2	14.5	70	60	170
Day 3	14.5	70	66	186
Day 4	10.5	-	-	116
Total	47.5	-	-	523
<u>E</u>				
Day 1	4	80	52	56
Day 2	14.5	80	57	176
Day 3	14.5	80	57	183
Day 4	14	80	57	177
Total	47	-	-	592
<u>F</u>				
Day 1	14.5	70	57	190
Day 2	14.5	70	57	159
Day 3	14.5	70	57	124
Day 4	10.5	-	-	122
Total	54	-	-	



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TABLE 5. COMPARATIVE PERFORMANCE OF SERVICE TRIAL
OF RICE HULLING ROLLERS

sample	Output No of bags per roller	Throughput (No. of bag per hour)
Control	169.0	11.8
A	126.5	8.4
B	135.5	10.7
C	201.0	20.6
D	174.0	11.0
E	198.0	12.6
F	192.0	10.7



Table 2 Silane 189 RICE HULLING ROLLER COMPOUNDS

	1	2	3
Skim blanket	50	50	50
RSS1	50	50	50
Silica	75	75	75
Zno	5	5	5
Stearic acid	2	2	2
Phenolic resin	5	5	5
S	2.5	2.5	2.5
Silane 189	-	2	4
TBBS	0.8	0.8	0.8
TMTM	0.2	0.2	0.2
PVI	0.1	0.1	0.1
Fleetol H	1.0	1.0	1.0
Diethylene glycol	5	5	5



TABLE 8. TECHNOLOGICAL PROPERTIES OF SILANE 189
RICE HULLING ROLLER COMPOUNDS

	Mix 1	2	3
Tensile Strength(MN m ⁻²)			
unaged	16.1	15.8	14.4
Aged 3d/100°C	8.2	8.5	7.7
% Retention	51	54	53
Elongation @ Break(MNM ⁻²)			
unaged	560	240	420
Aged 3d/100°C	140	70	80
% Retention	25	29	19
Modulus @(MN ⁻²)			
unaged	3.1	7.7	5.5
Aged	6.8	-	-
% Retention	219	-	-
Modulus @ 300%(MN m ⁻²)			
unaged	7.0	-	11.2
Aged 3d/100°C	-	-	-
Relaxed modulus MR 100(MN m ⁻²)	2.17	5	4.03
Dunlop Resilience @ 20°C(%)	36.7	35.5	36.8
Hardness			
Shore 'A' 23°C	90.0	95.0	97.0
30°C	85.0	92.0	95.0
Tear strength(N per mm test pc)			
Crescent	199.2	149.7	208.3
Akron abrasion(ml loss/1000 rev)			
Dusted	0.236	0.192	0.261
Specific gravity	1.243	1.251	1.255
Compression set(%)			
(24 hr @ 70 + 1 C)	85.1	44.9	68.2
calculated S.G	1.213	1.284	1.226
Mill mixing time(min)	45	30	30

RUBBER TO METAL BONDING COMPOUND

Ingredients	1	2	3	6	5	4
1. RSSI	100	100	100	100	100	100
2. Silica	50	50	50	50	50	50
3. WSP	1	1	1	4	-	-
4. IDDP	-	-	-	1	1	1
5. Zno	5	5	5	5	5	5
6. Zinc Stearate	2.5	2.5	2.5	2.5	2.5	2.5
7. TBBS	1.5	1.5	1.5	1.5	1.5	1.5
8. DPG	0.3	0.3	0.3	0.3	0.3	0.3
9. Sulphur	3.5	3.5	3.5	3.5	3.5	3.5
10. PVI	0.1	0.1	0.1	0.1	0.1	0.1
11. Aromatic oil	5	5	5	5	5	5
12. Hexamethyle tetraamine	1.5	1.5	1.5	1.5	1.5	1.5
13. Resorcinol	2.4	-	-	2.4	-	-
14. Cardanol	-	6.5	-	-	6.5	-
15. Tetrahydro cardanol	-	-	6.5	-	-	6.5



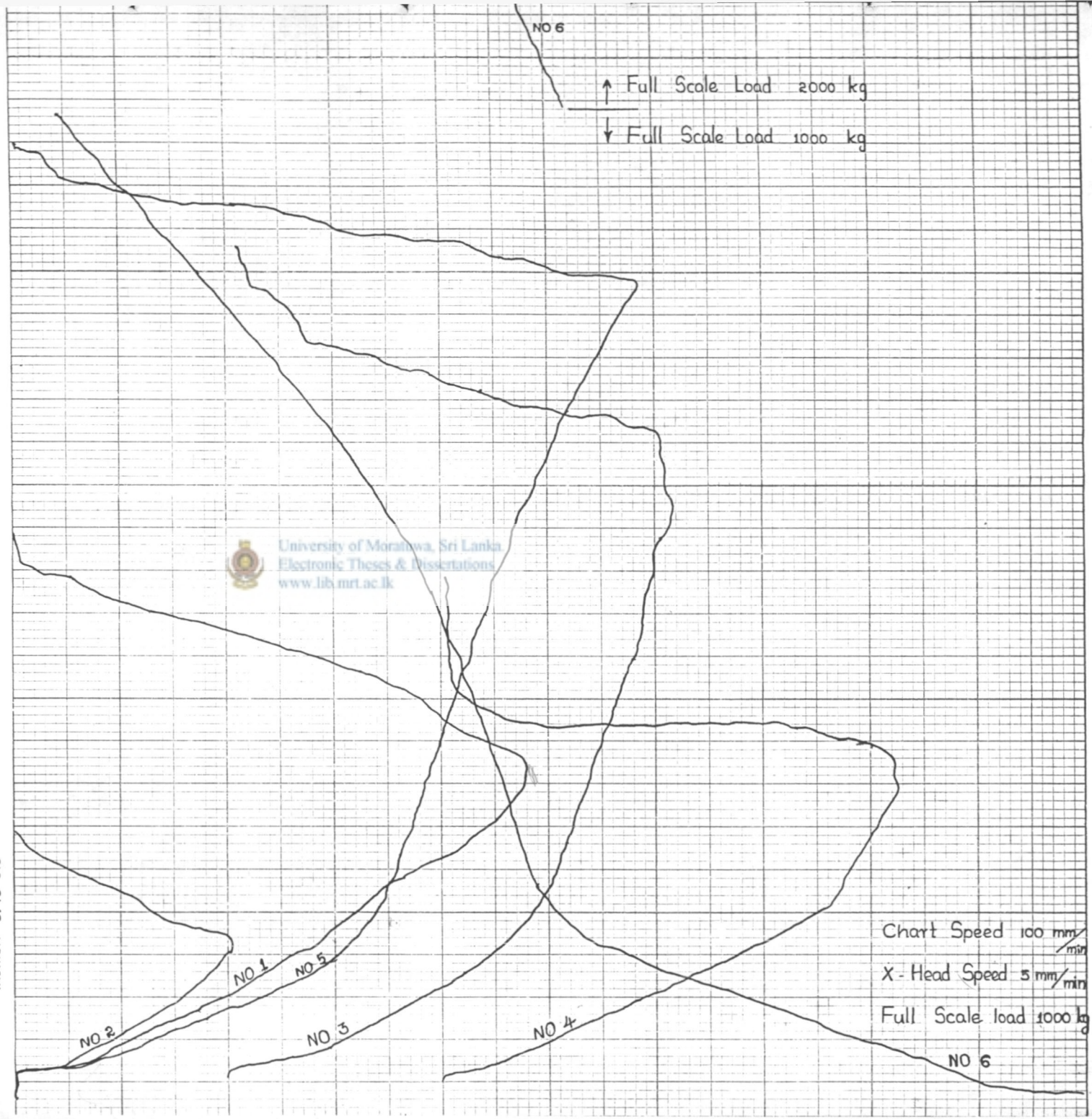
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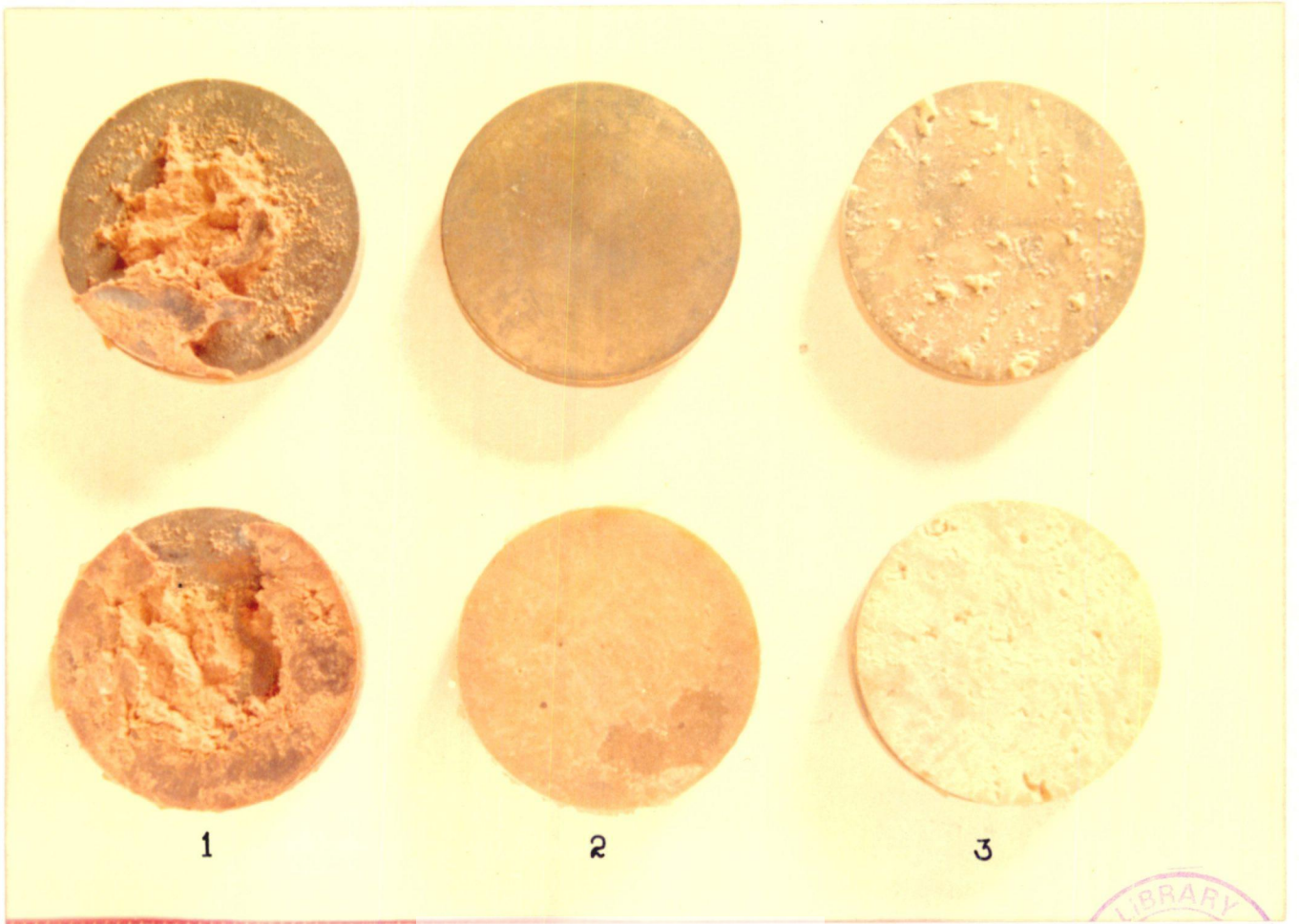


LOAD VS TIME CHART FOR RUBBER TO METAL BOND STRENGTH TEST

FACTORY LTD. HIGH VINCORBE BUCKS

INSTRON 3710-016





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4



VIEWS OF TEST SPECIMEN OF RUBBER TO METAL BOND

ADHESION TEST RESULTS

Stock	Cure	300% Modulus	Metal	Pull KGS/cm ²	Type of Break, percent			
					R	RC	CP	M
1	140	48.08	Brass	37.14	R			
2	140	77.12	Brass	15.48				M
3	140	49.09	Brass	32.50		RC		
4	140	50.13	Brass	33.27				M
5	140	43.18	Brass	45.65		RC		
6	140	87.45	Brass	82.80	R			

Adhesion Failure Terminology

- * R indicates the failure is in the rubber.
- * RC indicates the failure is at the rubber-cover cement interface.
- * CP indicates the failure is at the cover-cement prime cement interface.
- * M indicates the failure is at the metal prime-cement interface.

DISCUSSION

From laboratory and factory service test results obtained some remarks may be drawn

Natural rubber including skim rubber can be used in rice hulling rollers. Service performance of these rollers have been shown to be comparable to SBR 1500 rollers.

No significant processing problems are encountered in using natural rubber with the exception of the need for more stringent control of compound viscosity which tends to be more variable than SBR mixes. Early addition of antidegradant, strict adherence to mixing schedule and conditions and on line quality control check is recommended.

Laboratory test parameters do not give reliable indications of service performance.

The incorporation of skim rubber can lead to reduction of both filler loading and curative dosage.

Silane 189 mixed sulphur curative systems are beneficial in reducing mixing time by over 30% and improving set properties.

The CNSL based HRH adhesive system gives adequate bond between, the rubber and metal for the Rice huller roller.




Conclusion:-

The laboratory and service test data indicate that natural rubber, particularly skim rubber can be used to advantage in this application. The timely development of Silane 189 offers prospects for further improvement in rice hulling roller manufacturing as demonstrated by Laboratory evaluation data. However as laboratory test results do not seem to correlate well with service performance actual factory trials need to be carried out to substantiate the possible advantage of Silane 189 rice hulling roller compounding.



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APPENDIX 1

SPECIFICATION FOR RUBBER ROLLERS FOR
RICE HULLING MACHINES

1. Material

1.1. The rubber part of the roller shall be made from natural or synthetic rubber or a blend of both. It shall not contain any scrap or reclaimed rubber. The rubber shall be compounded with non toxic materials.

1.2 The metal part of the roller shall be of annular cross selection of a suitable metal which may be plain or perforated.

2 DIMENSIONS

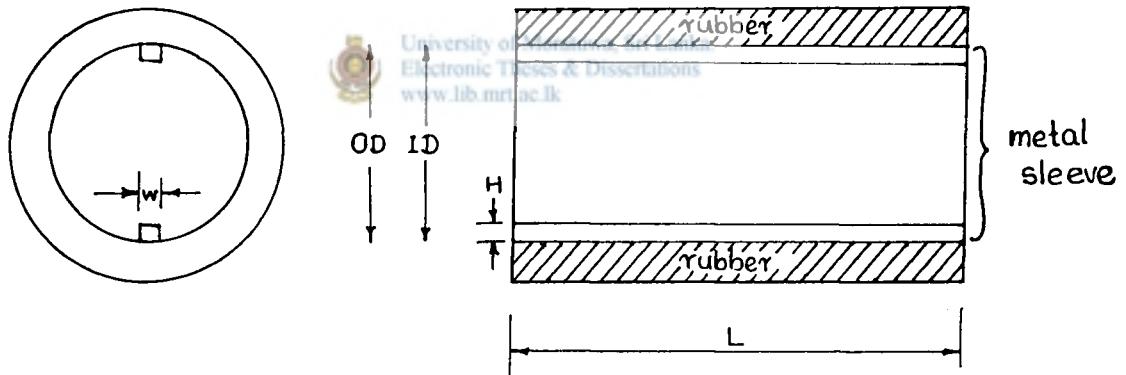
Table 1 Dimensions of the key type rubber roller

SI NO	Size Code	Outer Diameter (OD) mm	Length (L) mm	Inner Diameter (ID) mm	No of keys	Key Dimensions		
						W mm	H mm	M mm
1	2	3	4	5	6	7	8	9
i	AK	256	254	202	2	21	9.5	50
ii	BK	223	203	184	1	9.5	6.5	50
iii	CK	223	152	184	1	14.5	5.5	32
Tolerance		+2		+0	-	±0.5	±0.5	±0.5
		-1		-1				

3 Surface Finish

The rubber roller shall be free from blisters, pin holes, cracks, embedded foreign matter, air bubbles and defects which may impair their serviceability and shall have a smooth or grooved finish.

The maximum depth of groove shall be 1mm.



PHYSICAL PROPERTIES OF RUBBER

4.1 Hardness for both types of rollers, hardness of all five measurements in accordance with 4.1.1 shall be between 85 IRHD and 95 I R H D.

4.1.1 The hardness shall be measured at $27 \pm 2^{\circ}$ c in accordance with the method specified in S.L.S. 297 part 4.

The hardness meter shall be equipped with a suitable base plate for use with curved surfaces.

The measurements shall be taken at five points three points approximately 120° apart around the circumference in the middle of the roller and two points at a distance 10 percent of the cover face length, from each other.

If the roller is grooved it shall be made smooth by buffing the surface before hardness measurements are taken.



4.2. TENSILE STRENGTH AND ELONGATION AT BREAK

- 4.2.1 Tensile strength shall be minimum of 9.8 Mpa
- 4.2.2. Elongation at break shall be minimum of 200%
- 4.2.3 The test for tensile strength and elongation at break shall be carried out in accordance with the method. Stipulated in SLS 297 part 2 by using dumb-bell test pieces. Three pieces shall be taken preferably from different layers of rubber in length wise direction of the rubber roller (ie parallel to the axis of the roller).
The test result shall be the mean **but** all three values shall be reported.



5. Other requirements

5.1 The rubber roller shall be uniform and homogeneous in construction.

5.2. The thickness of the rubber shall be uniform and not less than 18 mm.

The difference in thickness measured at random at four points in a rubber roller shall not be more than 0.5 mm.

5.3 The rubber rollers shall be adhere firmly to the metal.

5.4. The rubber surface shall be free from sulphur blooms.



APPENDIX II

Paddy/Rice Conversions

1 bushel of paddy 46 (lbs)	=	20.87 kgs
1 metric tonne paddy	=	47.92 bushels paddy
	=	0.7 metric tonne rice
1 Metric tonne rice	=	68.46 bushels paddy
	=	1.43 metric tonne paddy
1 bushel paddy/acre	=	51.55 kgs paddy/hectare
5 bushels paddy	=	1 bag of rice



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