



The background features abstract, overlapping shapes in red, white, and blue, resembling a stylized gear or a flame.

Study of Critical Equipment
(Top Roll) Condition During
Summer and improving it's
reliability.

Prepared By:
Dhruv Saraswat

WCM PROJECT DESCRIPTION AREA LAYOUT



Batch Plant

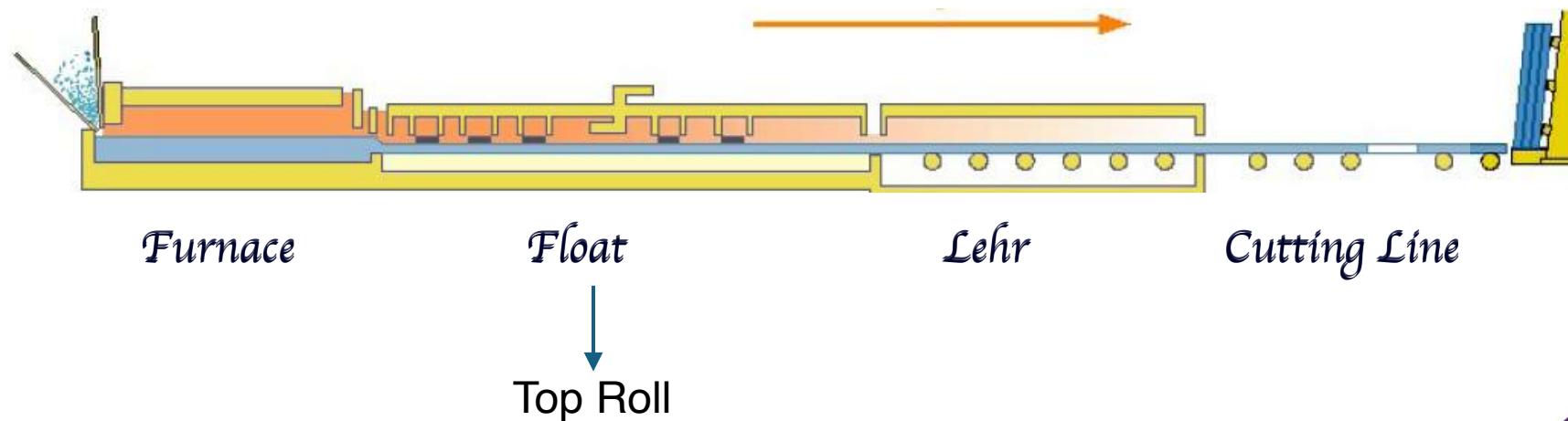
Furnace

Float

Annealing
Lehr

Cutting Line

Stacking



Furnace

Float

Lehr

Cutting Line

Top Roll

TOP ROLL



Penetration drive

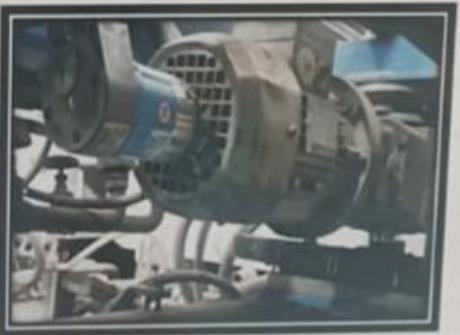
Purpose - Insert and remove of barrel to compensate for spread change during thickness and width changeover
Maximum limit : 0 to 2625 mm

Motor specification :
Rating - 0.55 Kw
Make - M/s Bonfiglioli



Depression drive

Purpose - Increase and decrease knurl nipping on glass ribbon
Maximum limit : ± 50 mm
Magnet brake: Torque - 15Nm
Motor specification :
Rating - 0.75 Kw
Make - M/s Bonfiglioli



Angulation drive

Purpose - Increase /decrease of angle during thickness and width changeover.
Maximum limit : ± 15 degree

Motor specification :
Rating - 0.12 Kw
Make - M/s Bonfiglioli

1.1. Project Title	1.2. Department & Machine involved	1.3. Problem description (What problem / Why is it a problem)	1.4. Weekly Meeting: (time)
Study on critical equipment condition (Top Roll) during summer and improving its reliability.	TS- Electrical - Top Roll	<p>What is the problem: Frequent Breakdown of critical equipments (top roll) especially in summers.</p> <p>Why is it a problem: Due to the failure/ breakdown of critical equipment (top roll) leads to downtime in glass making process.</p>	Every Friday 4-5pm
2.1. Team Involved: Leader name & Team members		2.2. Internal Customer (sponsor of the project)	
1.Dhruv Saraswat-Project Leader 2.Bhupathi Mohanti- Mentor 3.Sameer Gupta - Mentor 4.Sagar- TM Electrical 5.Mukesh- TM Electrical		Mr Bhupati Mohanty	
3. Project impact on Plant/Line KPI	4.1 Kaizen Type (MK/SK/AK)	4.2 Didactical/Learning Objectives (methods/tools to be used)	
Eliminate the number of breakdown of critical equipment(Top Roll) and their smooth functioning specially during summer.	SK	5-why cause analysis, Pareto Analysis, Deep study of VFD functioning and Analysation	
5. Objectives of the Project (to be achieved with the full implementation of all countermeasures)		6. Potential gains: Savings (INR FYI) / Risk or Gaps reduction	
Elimination in breakdown of critical equipment (Top Roll)		Elimination in breakdown will increase runtime and avoiding emergency situations. Loss of 118 tons to be saved and 5 orange risk reduced.	
Comments:			

SK CHART:

SGG STANDARD KAIZEN																																																																																															
Kaizen n° Start Date Leader																																																																																															
Title: Study of causal diagramming tool implementation during Kaizen & supporting its availability Area: Steel Mill - 14, 14																																																																																															
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own
THE FUTURE

1a: TEAM PICTURE

Nº	Name	Function	Role
1	Dhruv Saraswat	Intern	Project Leader
2	Bhupati Mohanty	Data Collection	Project Mentor
3	Sameer Gupta	Data Collection	Project Mentor
4	Mukesh Panchal	TM- ELECTRICAL	Project Member
5	Sagar	TM-ELECTRICAL	Project Member



Dhruv Saraswat



Bhupathi Mohanty



Sameer Gupta



Mukesh Panchal



Sagar

1.b: TEAMMEETING



Nº	Name	07-06	14-06	21-06	29-06	05 -07	11 -07
1	Dhruv Saraswat						
2	Bhupati Mohanti						
3	Sameer Gupta						
4	Mukesh						
5	Sagar						

1.c: RISK ASSESSMENT

- Number of Red Risk/Gaps : 0 Red , 34 orange risks.

Risk level	Score
Very critical	600≤Score≤1000
Critical	210≤Score<600
Medium	20≤Score<210
Low	<20

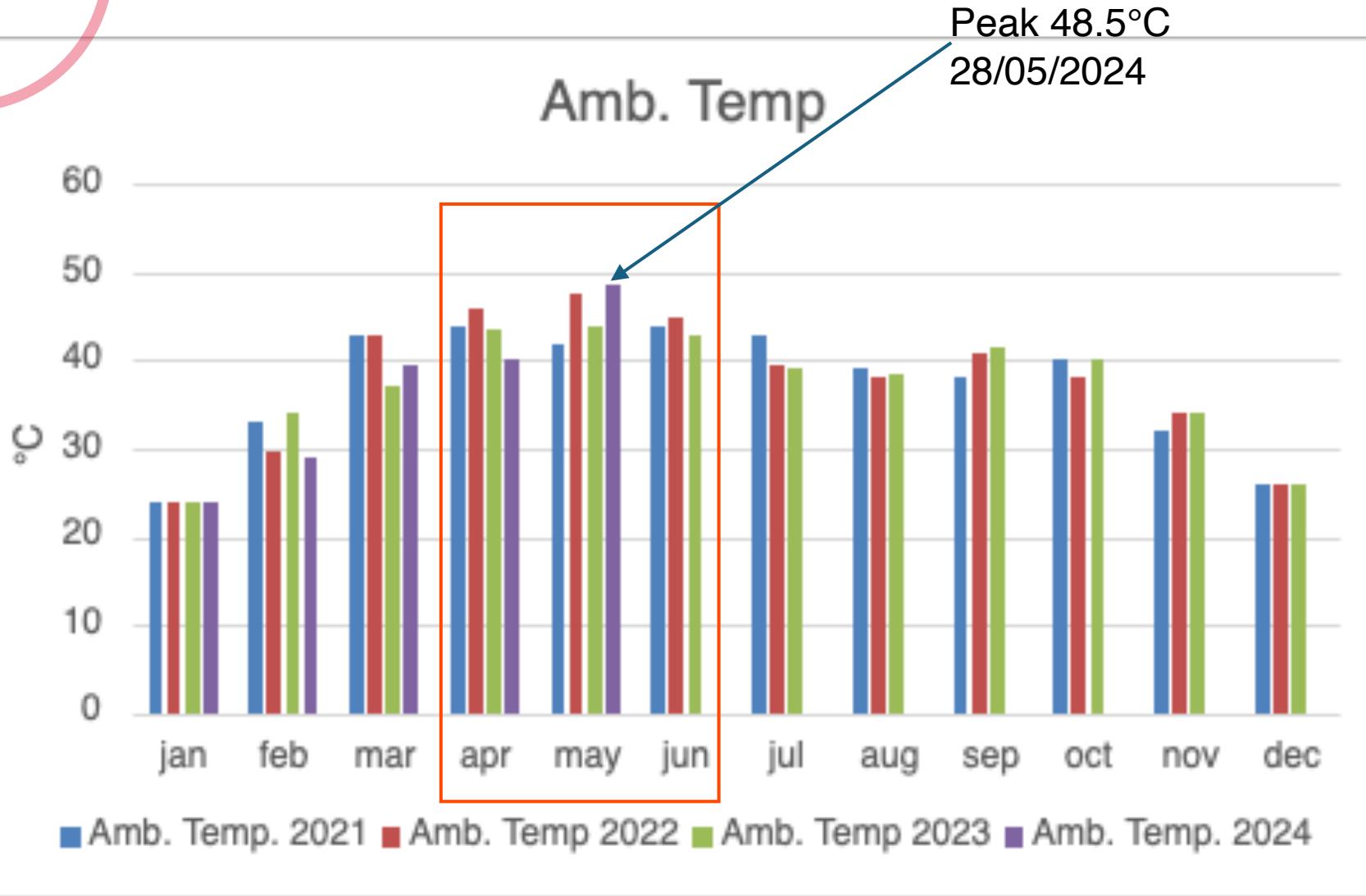
- Main Hazards : Electric shock, Heat, Sharp Object, Rotating Part, Dust, Gas, Fire Smoke Chemicals.
- Required PPEs: CRASH HELMET, GOGGLES, SAFETY SHOES, SAFETY GLOVES, REFLECTOR JACKET, REWORK PPE

Some of the orange risks:

- Screwing / unscrewing the bolts of top roll bellow
- Place the dummy plates to cover the Top roll side sealing opening
- Removal/insertion of top roll using LCS panel



1.d: DEPLOYMENT



LOSS DEPLOYMENT F4 2021-2023



3 Year trend

300.00

225.00

150.00

75.00

0.00

Max. Loss 117 tons
In Top Roll in 2023

Tons

Top Roll

Lehr

Robot 610

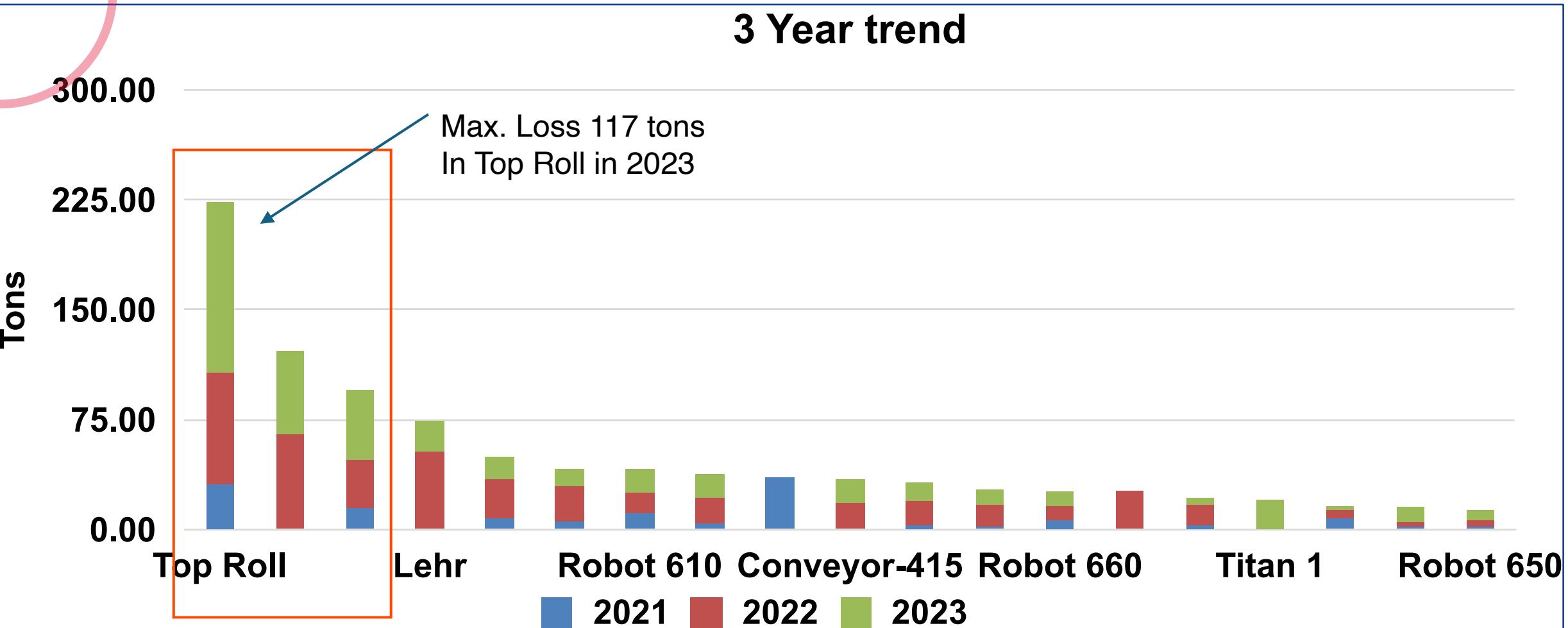
Conveyor-415

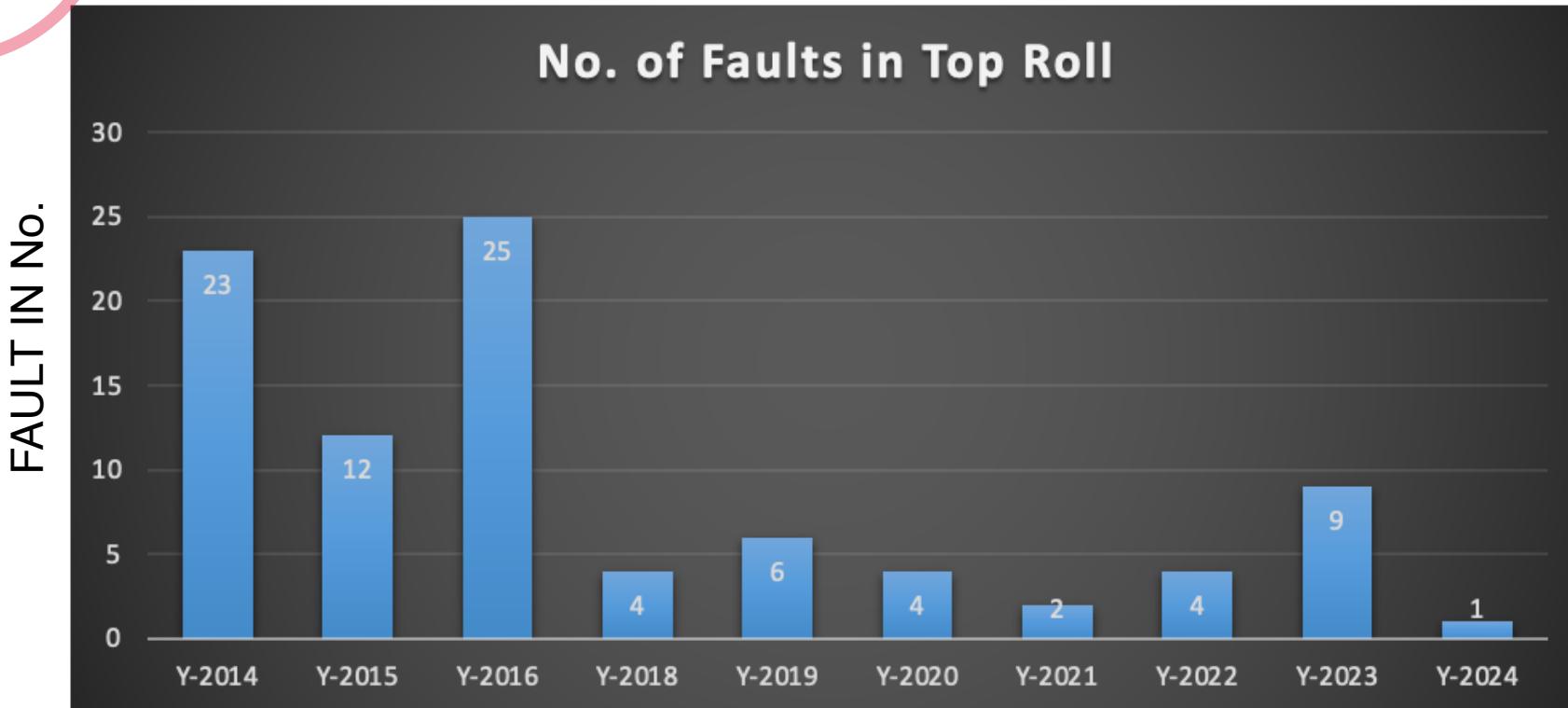
Robot 660

Titan 1

Robot 650

2021 2022 2023



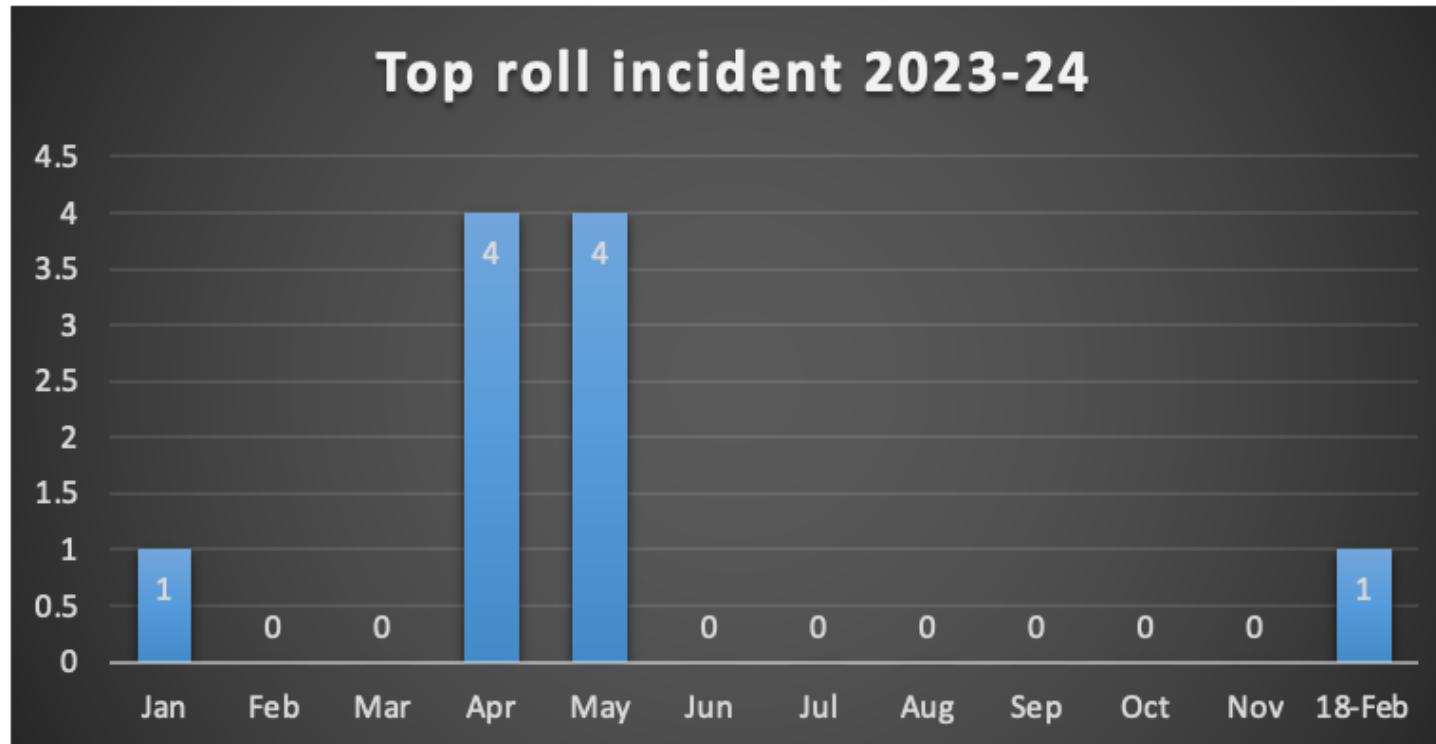


Year	No of faults in Top Roll
Y-2014	23
Y-2015	12
Y-2016	25
Y-2018	4
Y-2019	6
Y-2020	4
Y-2021	2
Y-2022	4
Y-2023	9
Y-2024	1

TR-7R
Knurl stop due to sensor



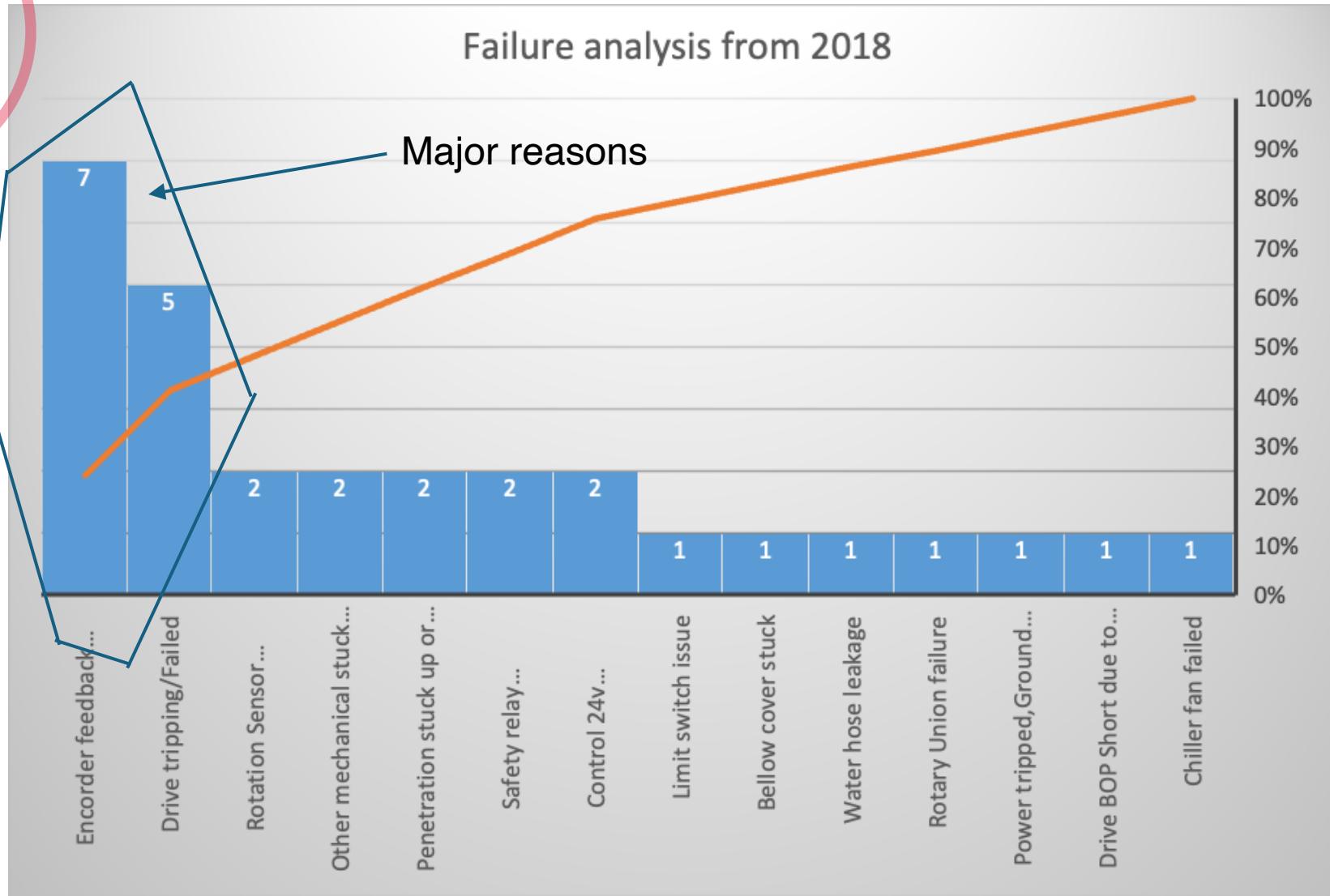
FAULT IN No.



2023	Incident No
Jan	1
Feb	0
Mar	0
Apr	4
May	4
Jun	0
Jul	0
Aug	0
Sep	0
Oct	0
Nov	0
18/02/2024	1

Mostly Encoder cable communication issue and Drive tripping/failure issue faced in 2023

Failure analysis since 2018 (Pareto Analysis) :



Out of the 29 failures since 2018, 12 are caused due to 2 major reasons which is encoder/Profile cable feedback problems and tripping/ failure of device. The encoder feedback is taken care by instruments team. Tripping of drive is looked by electrical department.

1.e: 5W&1H



- ❑ What : Heat exchangers and prolonged use of VFD of Top Roll lead to breakdown of machine.
- ❑ When: During general operation generally during summer.
- ❑ Where : Float area (Level 0).
- ❑ Who : TS-Electrical, Process.
- ❑ Which: VFD, Cooling Cabinet of Top Roll.
- ❑ How: It results in production halts, causing emergency situation, increased maintenance expenses, and reduced plant productivity.

1.f PROBLEM STATEMENT WITH PICTURE



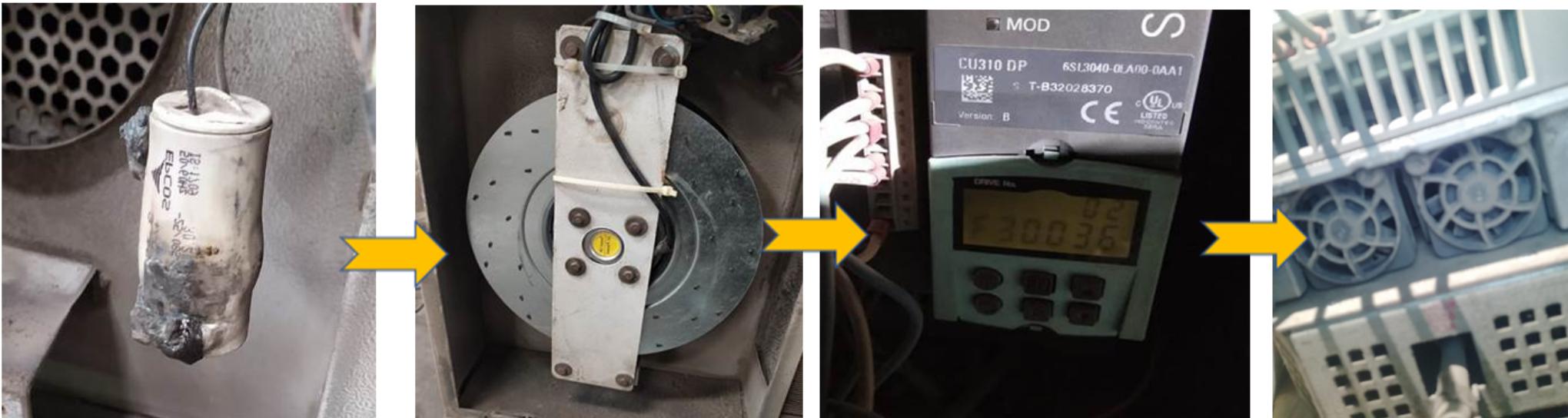
Top roll 5 R Drive tripped

13 May 2023

Drive Tripped in over temperature alarm due to chiller fan failed

Root Cause :

Chiller Unit Fan capacitor burnt in heat → Chiller fan stopped → Cabinet temperature Increased slowly → Drive tripped in over temperature → Top roll Unnipped

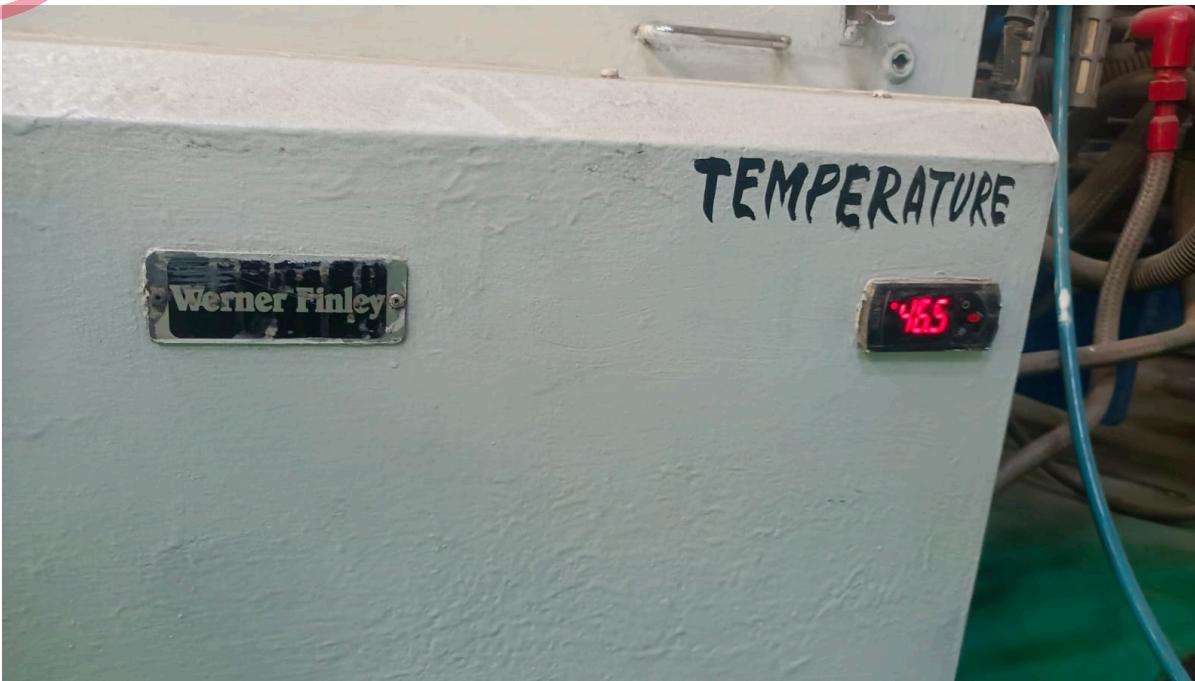


Chiller cooling fan replaced , also both side new knurl drive power module replaced as preventive

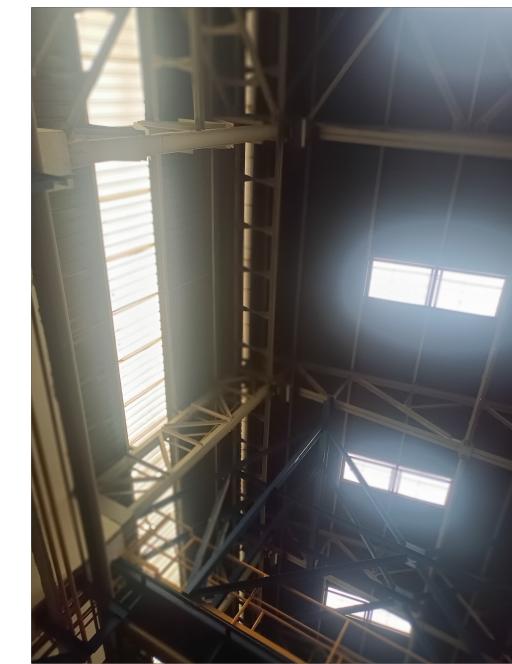
1.f PROBLEM STATEMENT WITH PICTURE



TOP Roll Panel



No Proper Ventilation



The temperature is more than the optimum Temp(0°C -40°C).

PROBLEM: The temperature of top roll panel is raised above optimum temperature (0°C -40°C) during hot summer due to high ambient temperature.

The failure of critical equipments can affect us in the following ways:

The failure of any VFD/ Drive has a direct impact on the running of motors and panels. Failure of those can leads to hinderance in the manufacturing process and will create emergency situation.

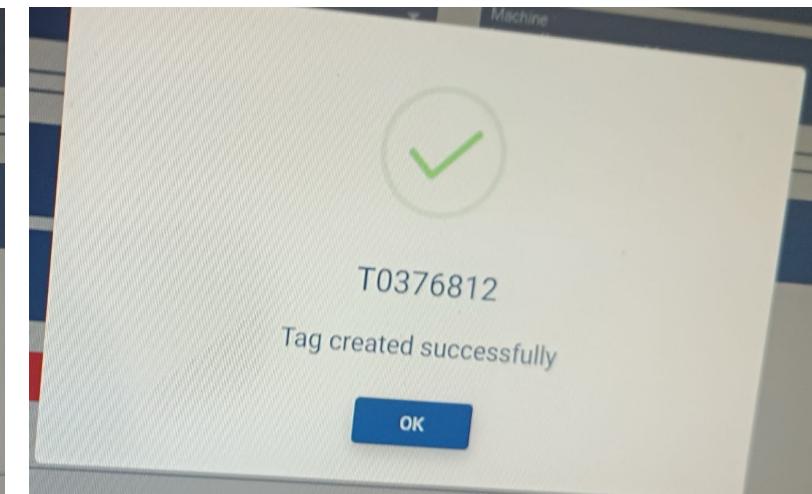
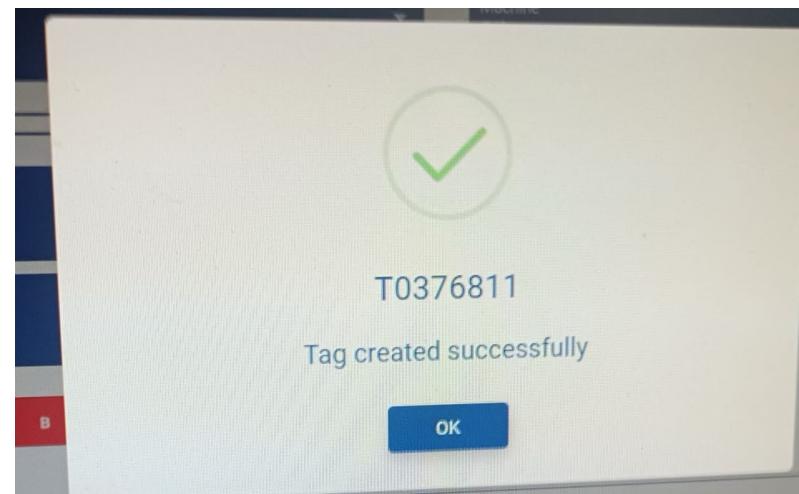
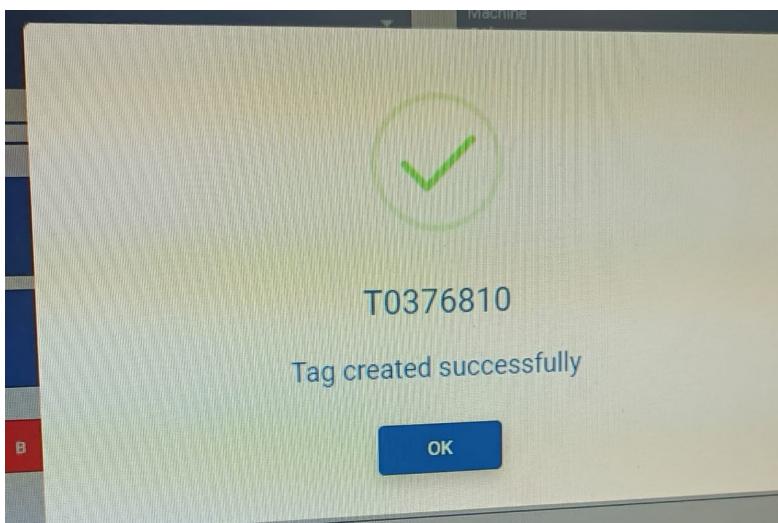
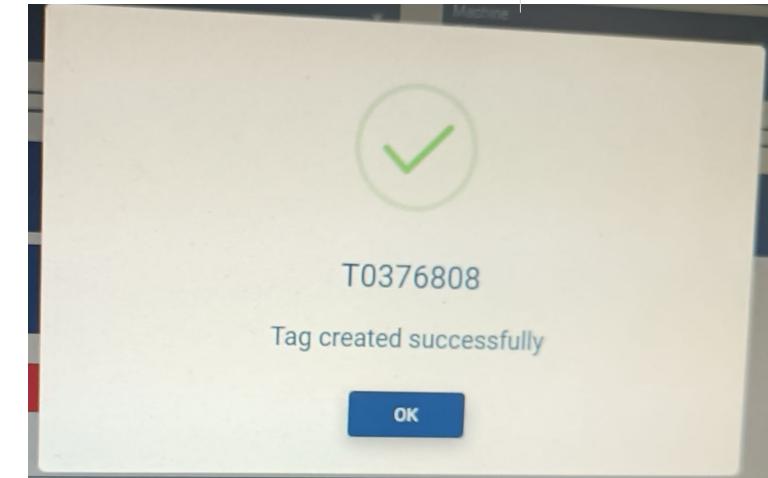
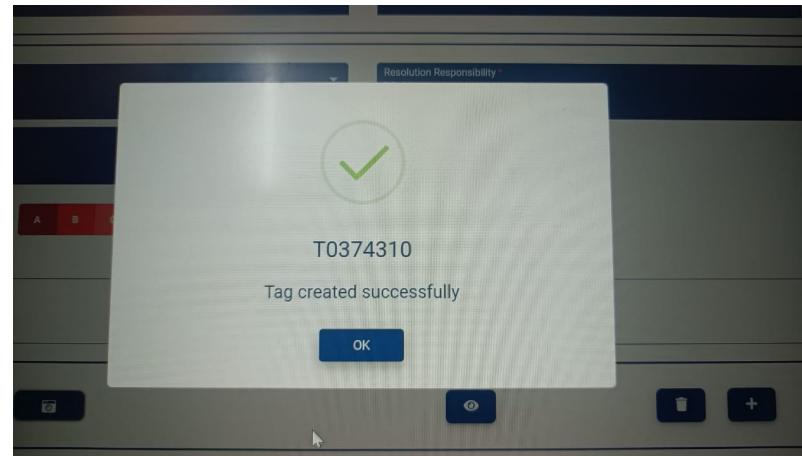
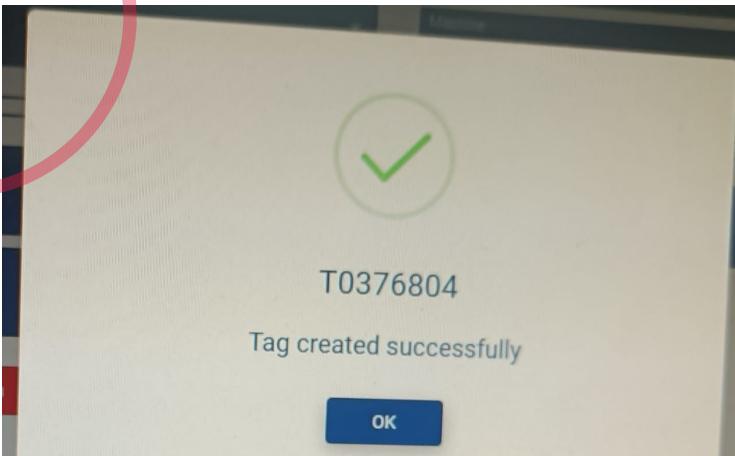
No direct loss quantifiable but estimated savings are:

- Reduction in defect probability
- Improvement of productivity
- Reduction in energy losses
- Avoiding further emergency situation
- Reduction in downtime

**The Highlighted loss in tons is targeted to be eliminated
Which which directly save around 118 tons.**

	Loss in Tons		
	2021	2022	2023
Top Roll	31.09	75.27	117.63
Trap-2	0.8	63.54	57.75
LCC Bridge	15.05	31.83	48.56
Lehr	0.62	52.12	21.71
Power Dip/Power black Out	7.54	27.29	14.49
Vision 2	5.06	24.8	12.07
Robot 610	11.17	13.79	16.94

E-TAGS:

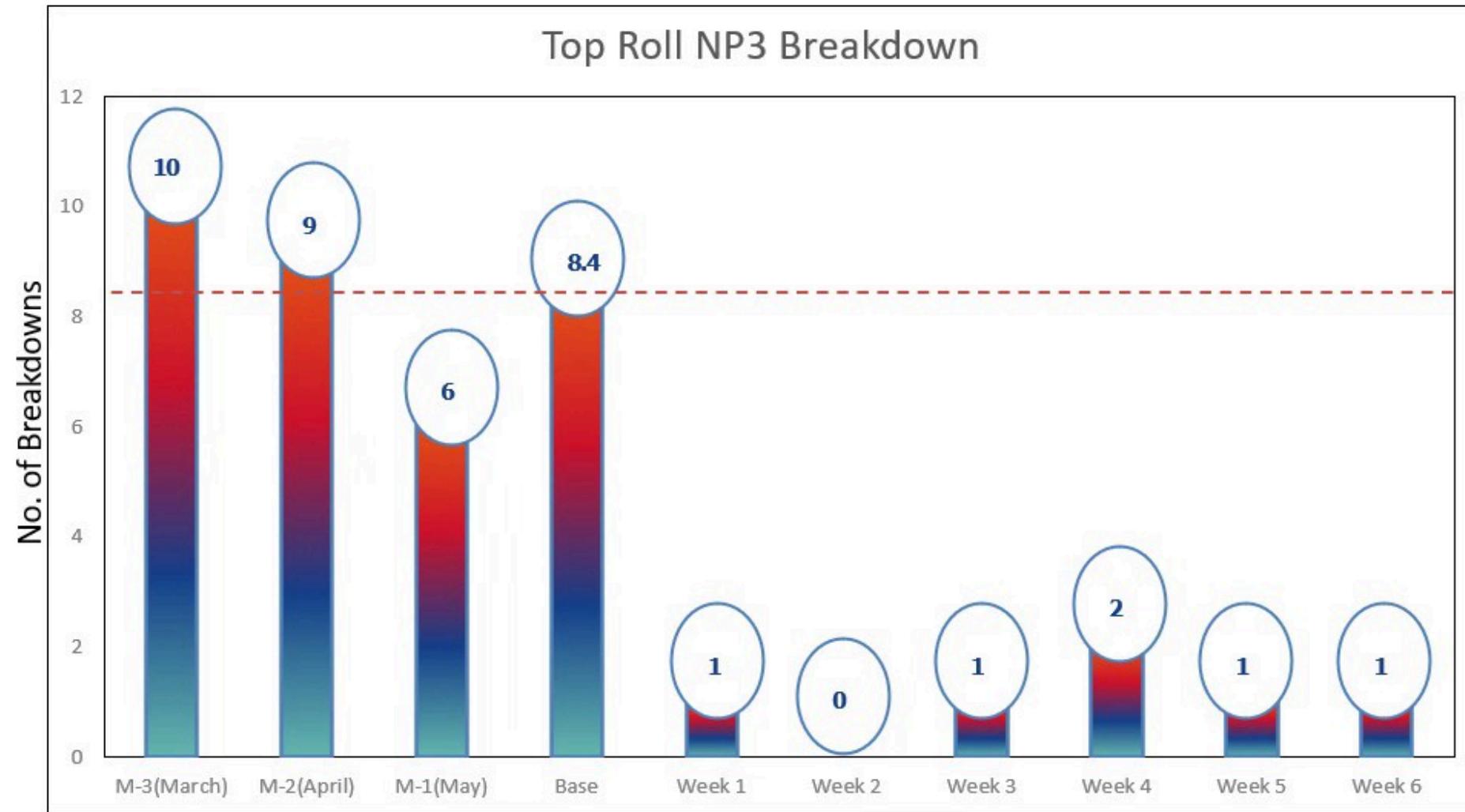


1h: CONTAINMENT ACTIONS



Description	Who	When	Done
Top Roll 5R, HMI Panel seal opening closed with silica sealant.	Bhoop Singh	08/07/2024	Yes
TR-7R and 7L PM done and chiller unit fan replaced.	Akash, Mukesh	06/06/2024	Yes
Top Roll 4L Camera water pipe cover closed at joint.	Dhruv	09/06/2024	Yes

1.i: OPERATIONAL PERFORMANCE INDICATOR



1.j: MASTERPLAN



Kaizen Steps		W1	W2	W3	W4	W5	W6	W7	W8	Audit Results			
										A1	A2	A3	
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
1	Problem Definition	<div style="width: 25%; background-color: green;"></div>								<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Basic Conditions Restoration		<div style="width: 25%; background-color: green;"></div>	<div style="width: 25%; background-color: green;"></div>						<input type="checkbox"/>	<input type="checkbox"/>		
3	5 Why Analysis			<div style="width: 25%; background-color: green;"></div>						<input type="checkbox"/>	<input type="checkbox"/>		
4	Countermeasures				<div style="width: 50%; background-color: green;"></div>	<div style="width: 50%; background-color: green;"></div>				<input type="checkbox"/>	<input type="checkbox"/>		
5	DCS & Standardization					<div style="width: 50%; background-color: green;"></div>				<input type="checkbox"/>	<input type="checkbox"/>		
6	Closure					<div style="width: 50%; background-color: green;"></div>				<div style="background-color: #cccccc; height: 20px; width: 100px;"></div>	<div style="background-color: #cccccc; height: 20px; width: 100px;"></div>	<div style="background-color: #cccccc; height: 20px; width: 100px;"></div>	
												Total Score	

2: BASIC CONDITIONS RESTORATION. (BEFORE)



2a: Conditions to check	Milieu	Safety guards & interlocks in place	OK / NOK
	Milieu	5S Machine / Area	OK / NOK
	Machine	Worn machine components	OK / NOK
	Method	Procedures available & up-to-date	OK / NOK
	Man	Procedures are followed (incl. safety)	OK / NOK
	Man	People are trained	OK / NOK
	Material	Materials used	OK / NOK
		Others :	OK / NOK

2b: Applied solutions	Tagging	Y / N / NA
	Preventive Maintenance Revision	Y / N / NA
	Update SOP	Y / N / NA
	Create OPL	Y / N / NA
	Calibration /R&R	Y / N / NA
	Training	Y / N / NA
	Mat. Spec. Revision	Y / N / NA
	Others :	Y / N / NA

TAGS RAISED AND SOLVED

E-Tagging

9

Raised

6

Raised

3

Raised

EVIDENCES (description/pictures)

BEFORE



TR-7L
Box Shield Broken



AFTER



EVIDENCES (description/pictures)



BEFORE

TR-7L
Dust resistant rubber detached

AFTER



EVIDENCES (description/pictures)



BEFORE



Those small opening to be closed with silicon sealant
TR-7R HMI Panel

AFTER



EVIDENCES (description/pictures)



BEFORE



Joint Open
TR-5L



AFTER



EVIDENCES (description/pictures)



TR-7L

Chiller fan abnormal sound, replaced with new one.



EVIDENCES (description/pictures)



BEFORE



Wires in TR-8L hanging

AFTER



EVIDENCES (description/pictures)



BEFORE



TR-2L Cabinet lock bolt missing

AFTER



2: BASIC CONDITIONS RESTORATION (LATER)



2a: Conditions to check	Milieu	Safety guards & interlocks in place	OK / NOK
	Milieu	5S Machine / Area	OK / NOK
	Machine	Worn machine components	OK / NOK
	Method	Procedures available & up-to-date	OK / NOK
	Man	Procedures are followed (incl. safety)	OK / NOK
	Man	People are trained	OK / NOK
	Material	Materials used	OK / NOK
		Others :	OK / NOK

One Point Lesson (OPL)-1



SAINT-GOBAIN		ONE POINT LESSON				WCM BY SAINT-GOBAIN					
Basic Knowledge		OPL Title :									
Problem Water stored under TR during PM		Improvement No water spillage in Float area during/after PM.		OPL No. 1							
Filled By : Dhruv Saraswat		Assessed By : Bhupati Mohanty									
BEFORE				AFTER							
											
Problem: During PM Cleaning of Chiller Unit lead to water all around below all top rolls and nearby area.				Improvement: A plastic tray must be placed before water jet cleaning to avoid filling of water on ground below top rolls.							
Results : No water spillage in Float area during/after PM											
Training Date:	11/07/2024										
Trainer:	Dhruv Saraswat										
Trainee:	Shift Team										



TRAINING:

SAINT-GOBAIN

Training Attendance Sheet
Employee wise

Doc. Ref. No.:
Rev. No.: 01
Date: 11/7/24
Time Period: 11/7/24 (PM)
Venue: Float bath, F4.

S. No.	E. No.	Name	Function	Period/Date	Signature
1	16517	Shivam	SUCS (PP)	11/7/24	Shivam
2	15911	Prashant Sonwane	TS Elec.	11/7/24	Prashant Sonwane
3	23002	Akash Yadev	TS Elec.	11/7/24	Akash Yadev
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

Name of the training program: - Water Stored under top roll during PM.

Name of Trainer: - Dhruv Saraswat

Signature of the Trainer -

3.a: 5-WHY ANALYSIS

Problem Description	Potential causes										Corrective actions	Preventive Actions	Done	5M
	Why (1)	Check	Why (2)	Check	Why (3)	Check	Why (4)	Check	Why (5)	Check				
Frequent breakdown of critical equipments(Top Roll) during summer.	Failure of Internal Parts	Y	Ageing	Y	Capacitor worn out.	Y	Running since long time	Y			Older obsolete Component replaced		Yes	Material
			Burning Out	Y	Hot Summer	Y	High Ambient Temp	Y	Improper Ventilation	Y	Windows and Chimneys to be installed	Dp Therm Cover Testing Going	Ongoing	Mother Nature
			Sudden FluctuationIn Voltage or Current	N										
	Device Tripping	Y	Overload on Equipment	N										
			Temperature beyond operating range of device	Y	Older Version Of Drive Used	Y	No Spares and service available	Y			Older Drive Replaced with new one		Ongoing	Material
					Chiller Unit Not working efficiently	Y	Unhealthy environment with dust.	Y	Missing of PM due to equipment in use	Y	PM Schedule Updated	Jet spray cleaning method adopted	Yes	Man
					Poor cooling system.	Y	Traditional method used since long time	Y	New N2 Cooling System is planning to be installed				No	Management

4.a: COUNTERMEASURES AND ACTION PLAN

Branch Number	Corrective and Preventive Actions				
	C / P	Action Description	Who	When	Done
1	Preventive	Existing Siemens 240 Ver: B01 replaced for TR-7R&L with new version drive, Both penetration and depression. Further action for other TR to be done in coming PM.	Aakash, Mukesh	06/07/2024	Yes
2	Corrective	Top Roll 7L chiller unit fan replaced.	Bhoop Singh, Mukesh	06/07/2024	Yes
3	Corrective	DP therm Panel Cover for TOP Roll in F6 to reflect heat from their body.	Sameer Gupta	Ongoing	Yes
4	Corrective	Panel seal replacement inside chiller unit panel door of TR 7L.	Mukesh	08/07/2023	Yes
5	Corrective	New N2 Cooling System is planning to be installed	TS Electrical	—	No

PROBLEM AND THEIR SOLUTIONS:



Top Roll - Knurl Servo drive upgradation

Existing
Siemens CU310 DP



New Siemens
CU310 -2DP



- Older version Obsolete and no spares available
- More DI /DO available in newer version so more reliable.
- Spare and service available for new version.
- Easy commissioning with Memory card in short time

Siemens CU310 DP

Climatic ambient conditions

- Long-term storage in the transport packaging
- Transport in the transport packaging
- Operation

Class 1K4 acc. to EN 60721-3-1

Temperature -25 °C to +55 °C

Class 2K4 acc. to EN 60721-3-2

Temperature -40 °C to +70 °C

Class 3K3 acc. to EN 60721-3-3

Temperature +0 °C to +40 °C

Relative / absolute air humidity 5% to 90 % / 25 g/m³
Oil mist, salt mist, formation of ice, moisture condensation, dripping, spraying, splashing water and water jets not permissible



Siemens CU310-2DP

Environmental conditions

Installation altitude

2,000 m (6,561.68 ft)

Ambient temperature during

Better operating Temp.

Operation

0 ... 55 °C (32 ... 131 °F)

Storage

-25 ... 55 °C (-13 ... 131 °F)

Transport

-40 ... 70 °C (-40 ... 158 °F)

Relative humidity during

Transport, max.

95 % at 40 °C (104 °F)

PROBLEM AND THEIR SOLUTIONS:



No Proper Ventilation



Proper Ventilation of Float in F4 through chimneys and Windows:



The ambient temperature of F4 in float area is generally around $>60^{\circ}\text{C}$ during summer which makes it unfavourable for the panels of Top Roll present there to operate efficiently.

To avoid this we can have proper ventilation through installing chimneys and windows at the ceiling and walls. This will reduce the temperature of Float area by a considerable amount and therefore will make it favourable for Drives and VFD to operate efficiently without breakdown.



PROBLEM AND THEIR SOLUTIONS:



Additional locking arrangement done so that there is no gap for dust entry and Panel seal replacement inside chiller unit panel door.

Advantage: Cooling effect of chiller, Dust entry prevention for equipment and drive electronic component reliability.



Improvement for cooling effectiveness and dust prevention in Top roll



Chiller Cleaning by water Jet Pump during PM of TR-7L on 06/07/2024

PROBLEM AND THEIR SOLUTIONS:



Ideas to improve reliability:

Further actions:

1. Other penetration and Depression drive upgradation in all top roll (R and L).
2. Encoder signal modification in logic & Drive.

PM and Daily Checklist

Actions to Sustain:

1. Preventive schedule modified from 3 month to 2 month.
2. Daily checklist in all shift

Penetration and depression drive replaced for Top Roll 7L:

6/7/2024



New
Siemens CU240 E-2



PROBLEM AND THEIR SOLUTIONS:



DP Therm Panel Cover:



This is a heat resistant panel cover which protect any drive or panel to become overheat and thus reducing the problem of breakdown during summer.

This acts as an insulation between the surrounding and the drive panel which does not allow the exchange of heat. The trial work is going in F6 under Sameer sir.

DAILY CHECKLIST



Top Roll Daily Check List

Date: 27/06/24

Sr.No	Equipment	Check Points										Remarks	
		HMI panel fan (Ok/Not OK)		Chiller Unit Fan (OK /Not OK)		Any Air leakage (Y/N)		Alarm in HMI (Y/N)		Any Water leakage or abnormal Sound (Y/N)			
		L	R	L	R	L	R	L	R	L	R		
1	Top roll-1	✓	✓	✓	✓	N	N	N	N	N	N	45 46	
2	Top roll-2	✓	✓	✓	✓	N	N	N	N	N	N	46 45	
3	Top roll-3	✓	✓	✓	✓	N	N	N	N	N	N	45 45	
4	Top roll-4	✓	✓	✓	✓	N	N	N	N	N	N	45 45	
5	Top roll-5	✓	✓	✓	✓	P	N	N	N	N	N	46 46	
6	Top roll-6	✓	✓	✓	✓	N	N	N	N	N	N	46 46	
7	Top roll-7	✓	✓	✓	✓	N	N	N	N	N	N	46 45	
8	Top roll-8	✓	✓	✓	✓	N	N	N	N	N	N	45 46	
9	Top roll-9	✓	✓	✓	✓	N	N	N	N	N	N	45 47	

Checked By:

Shukla

5.a: DAILY CONTROLSYSTEM



Loss Control Parameters	Values			
	Unit	Target	Trigger Up	Trigger Down
Breakdowns (Short Stop)	No.	4	1	-
NP1 Breakdown	No.	0	1	-
Top Roll Cabinet Temp.	°C	50	2	-

5.b: STANDARIZACION

Loss Prevention	Applied	In DCS
Sustainability Board implemented (DCS)	-	Yes
OPI + Loss Control + Deviation rules	Y /N/ NA	-
CILs + Checklist + Planning	Y /N/ NA	-
Preventive Maintenance updated in system	Y /N/ NA	-
Operating Procedures updated in IMS	Y /N/ NA	-
Quality Control Plan updated in IMS	Y /N/ NA	-
Area operators trained and skill matrix updated	Y /N/ NA	-
Others :	Y /N/ NA	-
MKT2 updated	Y /N/ NA	-
Team skill matrix updated	Y /N/ NA	-

TEAM ACTION PLAN



Sl. No.	Description	Who	When	Done
1	Proper Planning and sequence of action and team formation.	Dhruv, Bhupati Mohanty	Week 1	Yes
2	Data Collection and Data analysis	Dhruv	Week 2	Yes
3	Daily checking of Top Roll in every shift, maintain checklist.	TS Electrical	Every Shift	Yes
4	DP Therm Testing for Top Roll Panel in F6.	TS Electrical	Week 3	Yes
5	Daily Checklist Prepared	TS Electrical	Week 4	Yes
6	E-Tagging	TS Electrical	Week 5	Yes
7	Upgradation of VFD In TR 7L,R	TS Electrical	Week 5	Yes

6: CLOSURE



Kaizen Leader	Dhruv Saraswat
Dept. Manager	Mr. Mukesh Panchal
Sponsor / Coach	Mr. Bhupati Mohanti
Savings / Risk Reduction	Breakdown Elimination and avoiding emergency situations. Loss of 118 tons to be saved and 5 orange risk reduced.
Kaizen Completion Date	July 15th, 2024.



THANK YOU !