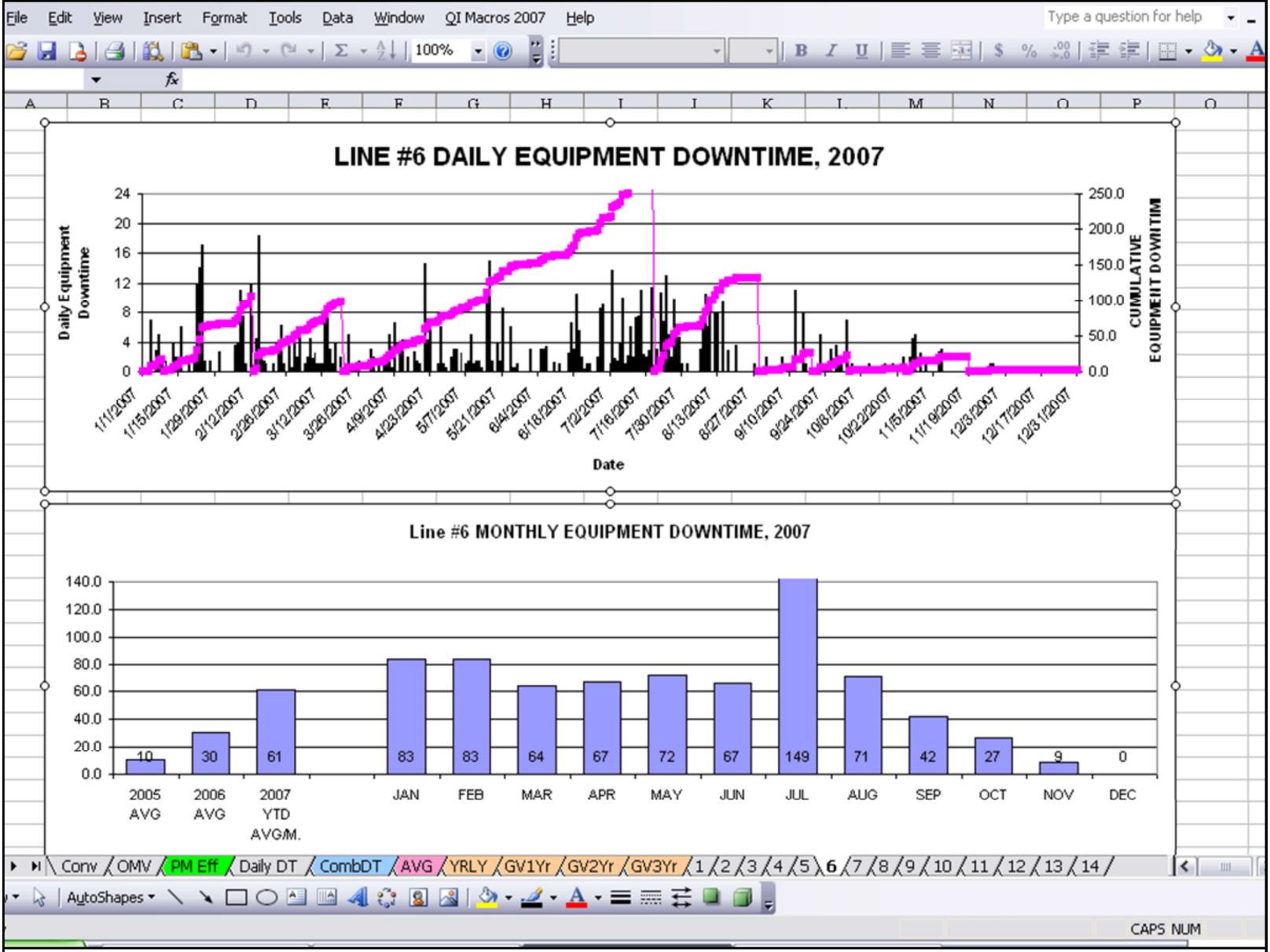
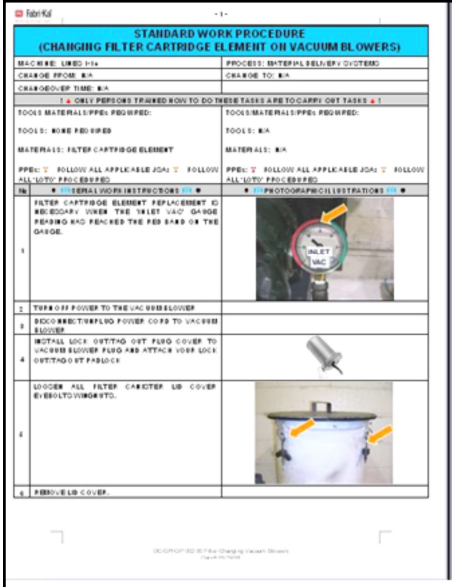
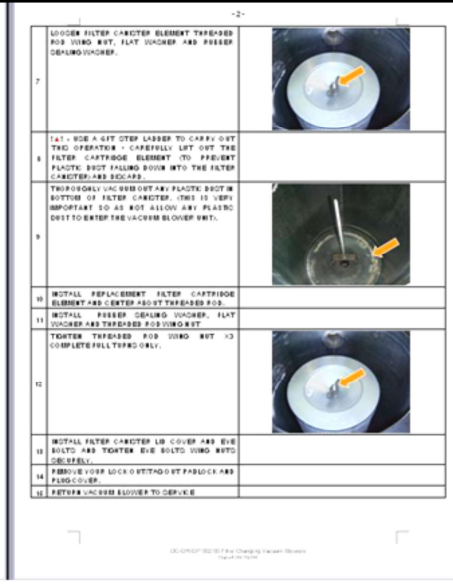
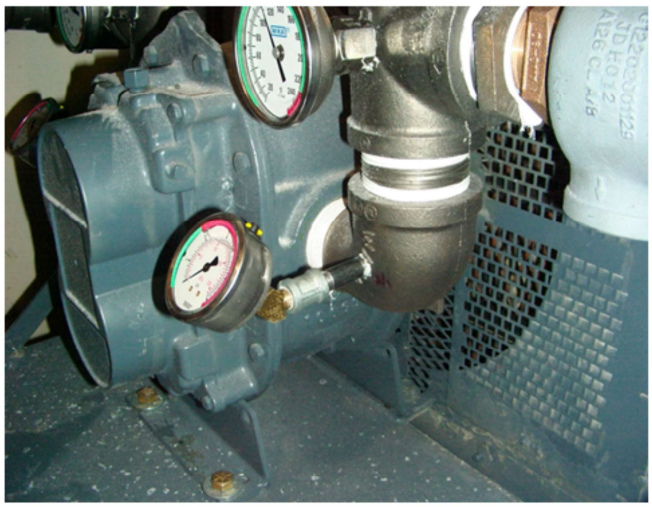


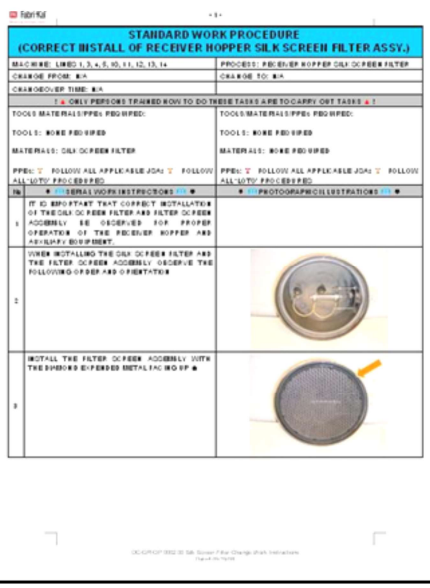
As I mentioned in previous presentations, a remarkable thing happening when you jump start your TPM initialize by beginning at Step 7 Sub-Step 1 'Initial Clean'. During the deep cleaning event you are finding all manner of potential hidden failures, just waiting to happen. When you correct, repair or replace all those potential failure that are already on the PF Curve your breakdowns on that piece of equipment or machine go way down. This is my selling pitch for TPM.

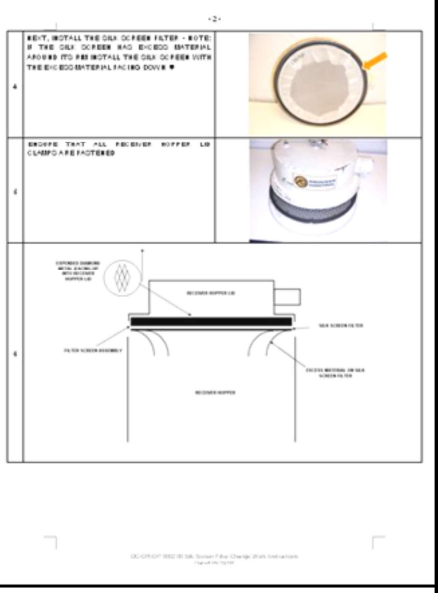
Data collection and analysis showing a 40% percent reduction in equipment related downtime following implementation of 2007 TPM August 2007.


STANDARD WORK PROCEDURE
(CHANGING FILTER CARTRIDGE ELEMENT ON VACUUM BLOWERS)






STANDARD WORK PROCEDURE
(CORRECT INSTALL OF RECEIVER HOPPER SILK SCREEN FILTER ASSY.)



This picture is of a standard work procedure I developed on when and how to change and clean screen and cartridge filters on the receiver hoppers to a plastics thermo former extruder blend system.

The need for this standard came about as part of a recurrence prevention action item following my root cause analysis investigating the short service life - which was only about 1000 thousand hours - of the vacuum blowers used to deliver the plastic pellets to the receiver hoppers.

I used again the P-M Analysis approach in which part of that process is having an understanding of the system under investigation in Step 2 ‘Conduct a Physical Analysis’. I needed to understand these vacuum blowers inside and out, their principles of operation, standards, interacting elements and then quantify the changes. During my survey of the system I discovered all manner of problems with the way in which we were using these vacuum blowers: Running too fast to OEM specifications, no relief valves installed on both inlet and outlet ports, running too deep a vacuum to OEM specifications running too hot to OEM specifications etc.…

When these vacuum blowers failed they were changed out and the failed unit was sent out to a authorized rebuilder. I called and asked the company to tell me ‘how’ it failed, not ‘Why’. I had to explain to them what I meant by that exactly. Their report was ‘Insufficient clearance between interacting lobes and case walls’. Continued on next page.

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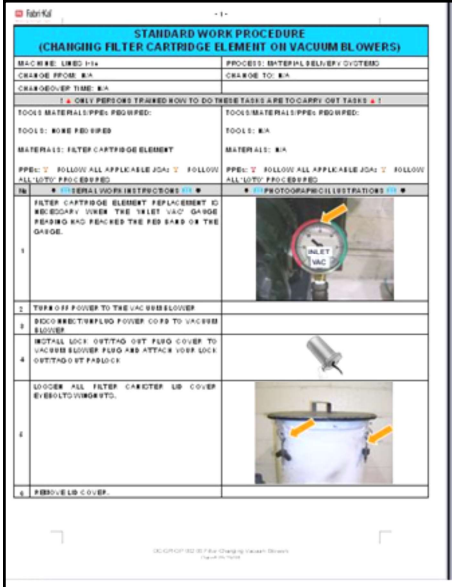
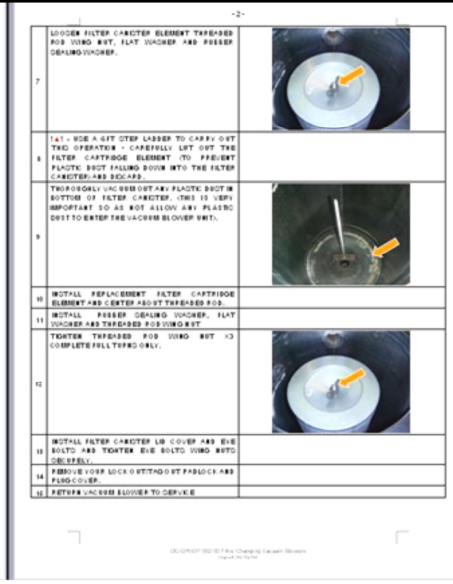
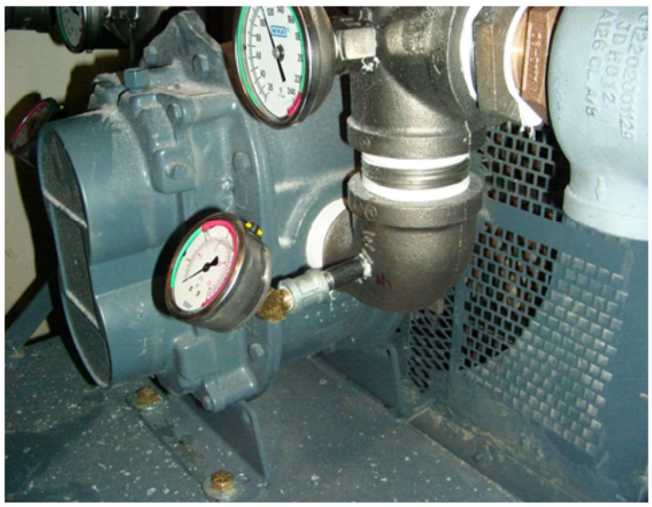
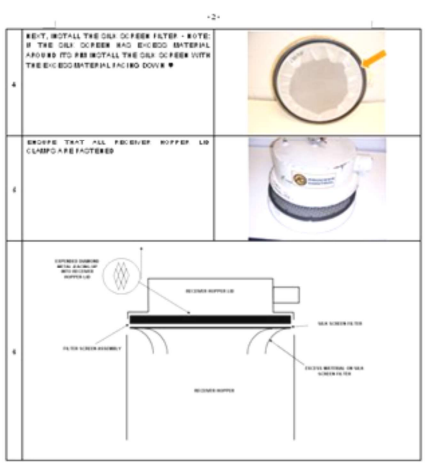

STANDARD WORK PROCEDURE
(CHANGING FILTER CARTRIDGE ELEMENT ON VACUUM BLOWERS)





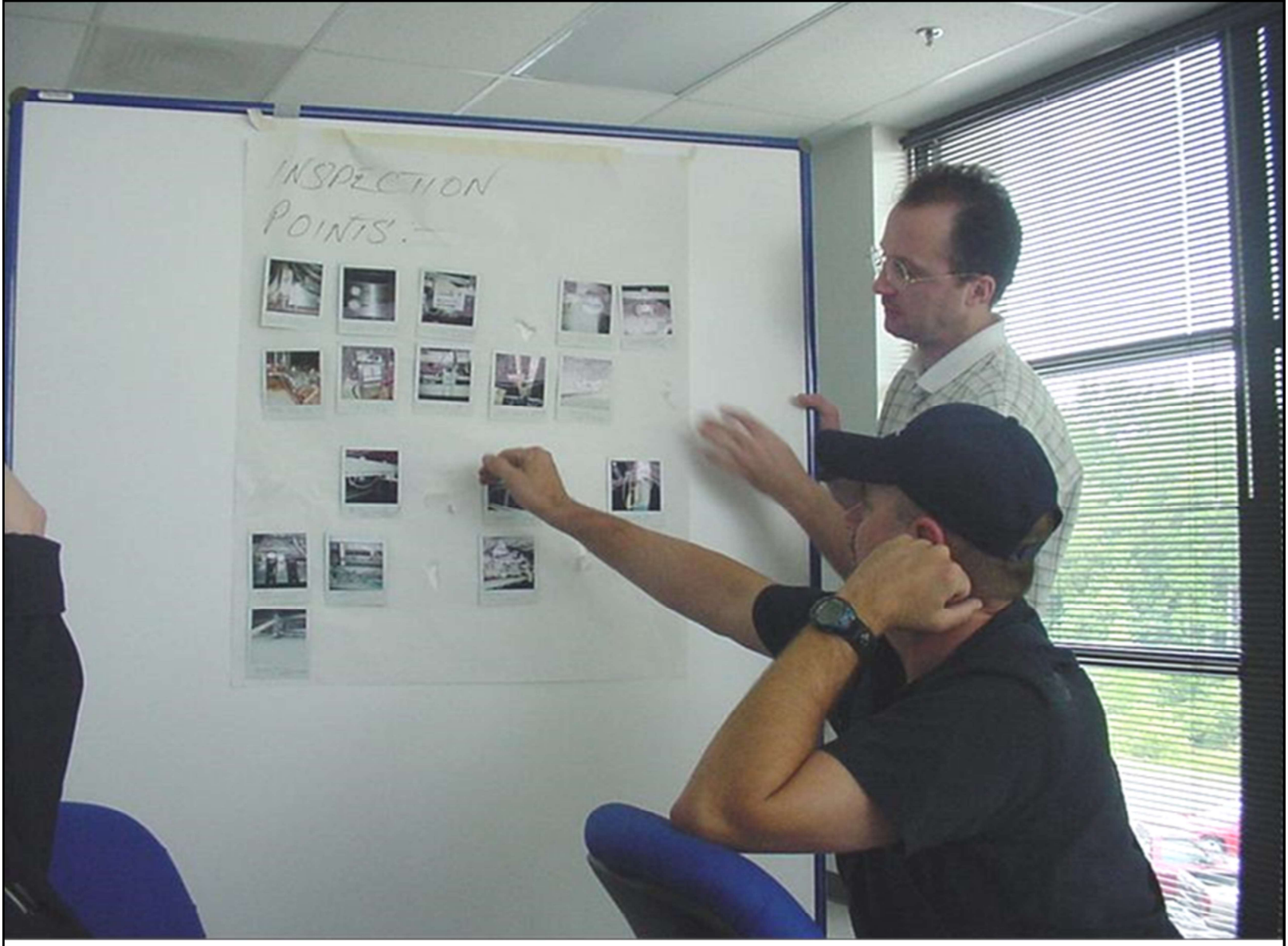

STANDARD WORK PROCEDURE
(CORRECT INSTALL OF RECEIVER HOPPER SILK SCREEN FILTER ASSY.)



This allow me to better investigate the ‘whys’. In a nutshell it was plastic dust entering the units and seizing up the rotors. The dust was getting in the blowers because upstream filters were not being cleaned, so I created the standards of cleaning both cartridge and screen filters you see above. I trained the line operators to that standard and set the tasks to a kanban cards to have the filters cleaned once each shift.

I also had the authorized rebuilder install inlet and outlet port temperature, pressure and vacuum gauges - using a paint pen I draw in the red and green bands on the gauge bezels - so the line operators could condition monitor the blowers operating state. Installed vacuum and exhaust relief valves - vacuum side with filter cartridges to prevent contamination from being sucked in if it should open to relief - and set to OEM specifications.

This resolved the problem…



After all the cleaning and fixing TPM Step 8 Sub-Step 3 ‘Develop Cleaning, Lubricating, Bolting and Inspection Standards’ with former co-workers.

ACME Manufacturing Inc.

TOTAL PRODUCTIVE MAINTENANCE

CLEANING CHECKLIST

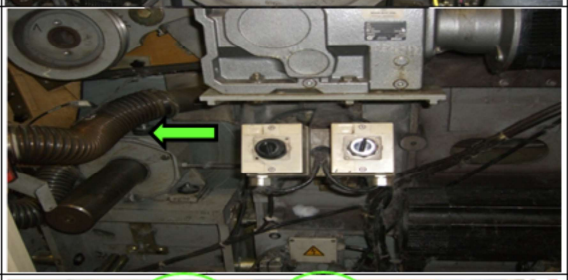
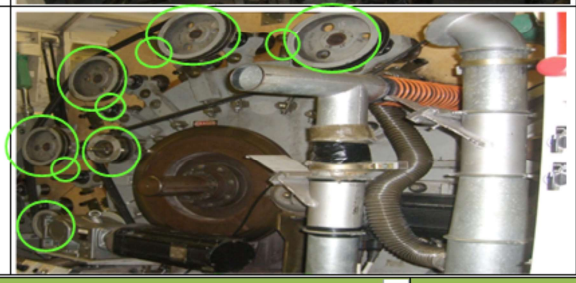
DEPT: OMV LINE 10 **PROCESS:** OVEN/FORM STAION **DATE:** 04:10:07

BOX	WHAT TO CLEAN	TOOLS/MATERIALS NEEDED	FREQUENCY	BASIC WORK INSTRUCTIONS
!▲ ONLY PERSONS TRAINED HOW TO DO THESE TASKS ARE TO CARRY OUT THESE TASKS ▲!				
1.	Heating table Thermo imaging camera lens	Glass cleaner Paper towels Can air	Every 1st start of work cycle	First, blow off from lens dirt/dust/debris using can air Then use glass cleaner and paper towels to clean lens
2.				
3.				
4.				
5.				

CHECKLIST 1

TPM cleaning standard template that I created in PowerPoint with a word document embedded for the rich text.

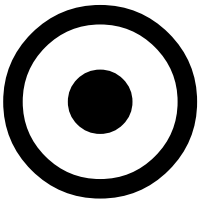
Picture showing TPM pegboards that I installed for each production line where individualized components such as grease guns, hand tools, high frequency use and expendable parts were stored.

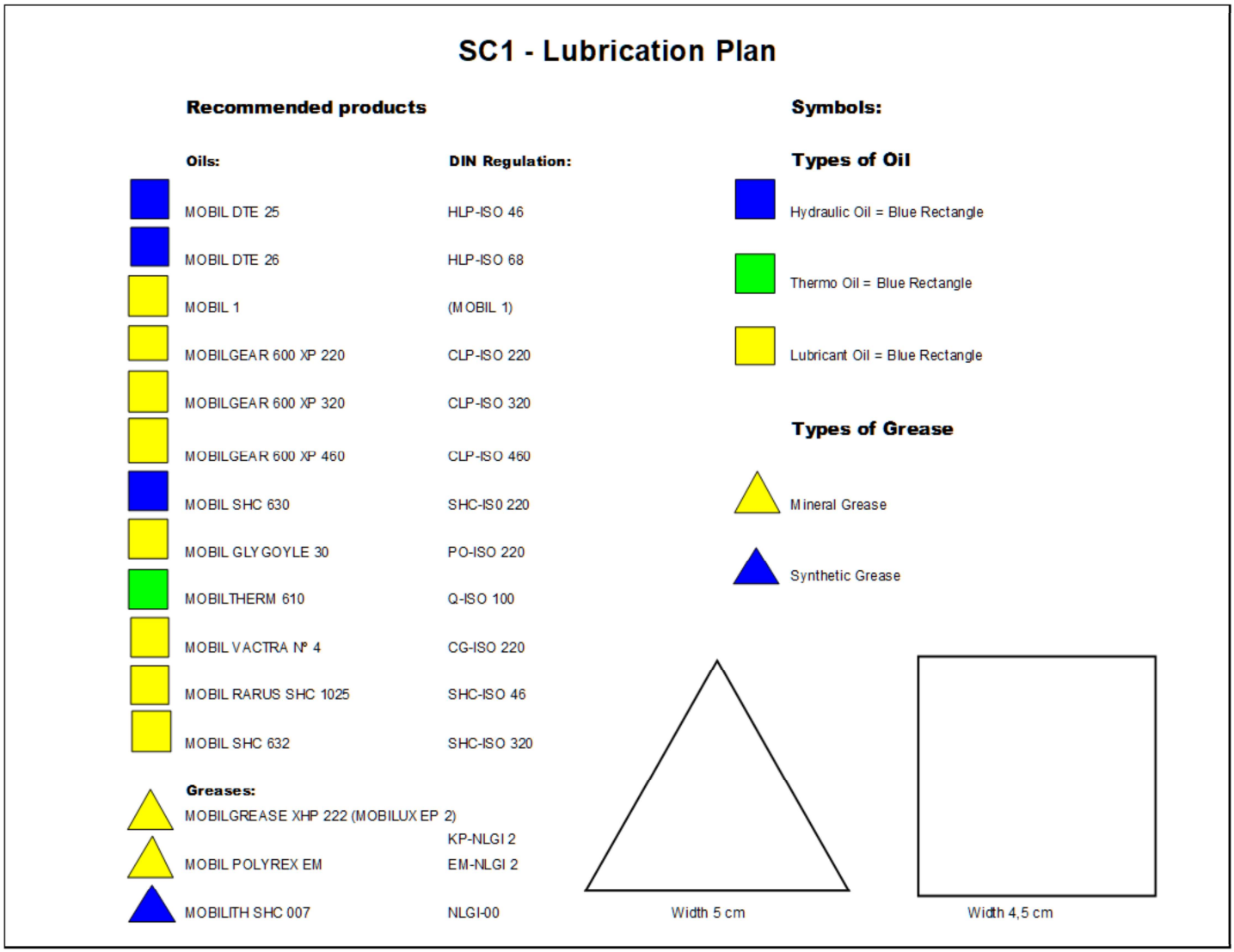
CARD - Drive side								
ID	Lubrication Point	Image	Application	N° L.P.	Lubricant	Quantity	Time	Ref. Folder
1	Strippers & Workers Rolls Bearings #1		Grease	7*	PARA-SYN 70	2 Grips	3000 hours	CARD1
2	Transfer Roll Bearing		Grease	1	PARA-SYN 70	6 Grips	3000 hours	CARD4
3	Strippers & Workers Rolls Bearings #2		Grease	10**	PARA-SYN 70	2 Grips	3000 hours	CARD6

ID	N° of L.P.	Lubrication Points	Lubricant Quantity	Lubrication Time	Lubricant	Grips
1	3	Feer Rolls Bearing #1	2 Grips	3000 hours	PARA-SYN 70	6
2	1	Chain #1	SPRAY	250 hours	Castrol Viscogen KL 23 Spray	
3	2	Gearboxes #1	Fill Up	10000 hours	ISO VG 150	
4	1	Lickerin Roll Bearing #1	4 Grips	3000 hours	PARA-SYN 70	4
5	7*	Strippers & Workers Rolls Bearings #1	2 Grips	3000 hours	PARA-SYN 70	14
6	2	Breast Cylinder Bearing #1	6 Grips	3000 hours	PARA-SYN 70	12
7	1	Transfer Roll Bearing	6 Grips	3000 hours	PARA-SYN 70	6
8	10**	Strippers & Workers Rolls Bearings #2	2 Grips	3000 hours	PARA-SYN 70	20

During the stint at one of my former employers I developed a lubrication plan. Tribology if you want to be technical is the science of friction, lubrication and wear. A quick memorization reference for a lubrication plan is ♦ the right lubricant ♦ by the right amount ♦ at the right place ♦ at the right time ♦ by the right method…

Seems like an over simplified bullet line plan, but there are details behind each of those lines to a good lubrication plan that need to be adhered to. It's well known that fully 50% of bearings fail before the end of life cycle and 90% of those failures are for non-fatigue causes.

It all begins with a survey of your entire plant – meaning your entire plant – to access your assets lubrication needs by determining their criticality. If it failed, could it 1. Can it shut down the plant? 2. Cause and interruption to production and the balance of plant… The asset you forgot is our undoing…A bearing this big  or this big ⊙ can shut entire process down…! Having lubrication plan is vital!



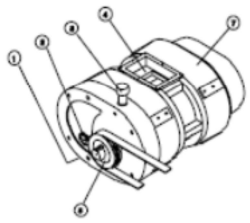
Lubrication legends of the types of lubricants Oils - Greases and Dry albeit Synthetic – Vegetable and Mineral…

REICOFIL

MACHINES / EQUIPMENTS	ITEM	PARTS TO LUBRICATE	APLICATION METHOD	PRODUCT (DIN REGULATION)	SERVICES / PERIOD
Sector: 1) Dosing Unit					
Vacuum Pump A1 AND A2 (Baratti)	1	BEARING	Oil Bath	MOBIL RARUS 429 (ISO-150)	Verify Oil Level WEEKLY Sample every 6 months (4.000 H)
Vacuum Pump B1 (Baratti)	2	BEARING	Oil Bath	MOBIL RARUS 429 (ISO-150)	Verify Oil Level WEEKLY Sample every 6 months (4.000 H)
Vacuum Pump C1 (Baratti)	3	BEARING	Oil Bath	MOBIL RARUS 429 (ISO-150)	Verify Oil Level WEEKLY Sample every 6 months (4.000 H)
Vacuum Pump D1 (Baratti)	4	BEARING	Oil Bath	MOBIL RARUS 429 (ISO-150)	Verify Oil Level WEEKLY Sample every 6 months (4.000 H)
Vacuum Pump E1 and E2 (Baratti)	5	BEARING	Oil Bath	MOBIL RARUS 429 (ISO-150)	Verify Oil Level WEEKLY Sample every 6 months (4.000 H)

PG. 01

BARATTI



3 – Oil filler porter
2 – Oil sightglass
1 – Oil drainage

Fill up oil

- Oil drainage (1) must be closed/ ensure tight fit
- Open oil filling(3)
- Fill up oil/ at first until center of sight glass/ oil can run down the inside walls
- Correct oil level to the lower part under the middle of oil sight glass (2)
- Close oil filling(3)

In operating warm condition the oil level has to be in the lower part under the middle of oil sight glass (2)

Drain oil

- Unscrew the cap of the oil filling (3)
- Put under a collect vessel
- Open oil drainage-nut (1)
- Effect proper disposal of used oil
- Oil drainage-nut (1) has to be closed tighten
- If the complete oil drainage-nut is released in the fixing thread, it has to be exchanged against a new drainage-nut with a new seal
- Close oil filling (3)

As with this and other lubrications plans that I have developed you have a master list of assets with ever decreasing levels of details about their lubrication needs with cross-references to highlight specific details to include pictures, diagrams and lubricating work instructions.

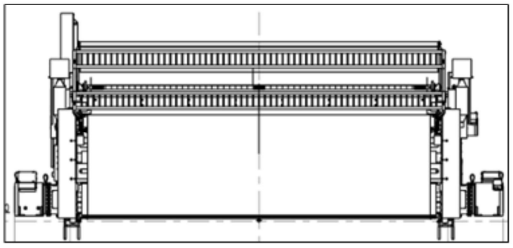
If you are greasing a 500 horsepower (373 kW) bearings the method is going to be quite precise – a little bit is enough, but more is better attitude is not going to cut it…

REICOFIL

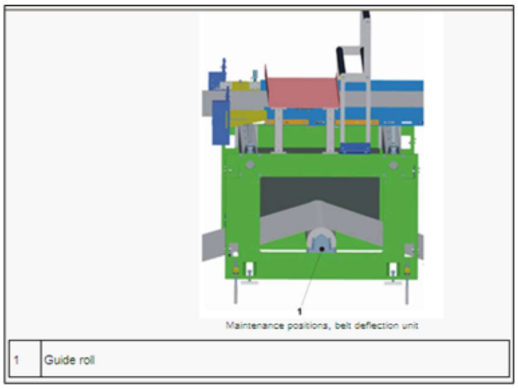
MACHINES/ EQUIPMENTS	ITEM	PARTS TO LUBRICATE	APLICATION METHOD	PRODUCT (DIN REGULATION)	SERVICES/ PERIOD
Sector: 10) Webformer					
Transfer/Nose Rolls (2 Units)	1	Roll Bearings	Central Lubrication	Max. 800 g BECHEM Berutox FH 28 KN (Item no.: 581193)	Fill the lubrication tank of the lubrication system.
Press Roll Torque Motors A - B - E (3 Units)	2	Electric motor bearing (2 points) (Siemens)	Grease Pump	Mobil Polyrex EM (EM-NLGI 2) (40 G)	Lubricate Every 6 months (4000 h)
Spinbelt Torque Motors Operator Side And Non Operator Side (2 Units)	3	Electric motor bearing (2 points) (Siemens)	Grease Pump	Mobil Polyrex EM (EM-NLGI 2) (40 G)	Lubricate Every 6 months (4000 h)
SPINBELT BEARINGS OPERATOR SIDE (24 Bearing Housings)	4	Rolls Bearing Housing	Grease Pump	Mobilgrease XHP 222	Lubricate Every 3 months Change Every Year
SPINBELT NON OPERATOR SIDE (24 Bearing Housings)	5	Rolls Bearing Housing	Grease Pump	Mobilgrease XHP 222	Lubricate Every 3 months Change Every Year
PRESS ROLLS OPERATOR AND NON OPERATOR SIDE (3 UNITS)	6	Press Roll Bearings (2 points)	Central Lubrication	Klubertemp HM 83-402 DIN 51502-K FK 2 U-40	Fill the lubrication tank of the lubrication system.
ROTARY JOINTS OPERATOR AND NON OPERATOR SIDE (3 UNITS)	7	Rotary Joint	Central Lubrication	Klubertemp HM 83-402 DIN 51502-K FK 2 U-40	Fill the lubrication tank of the lubrication system.

PG.08

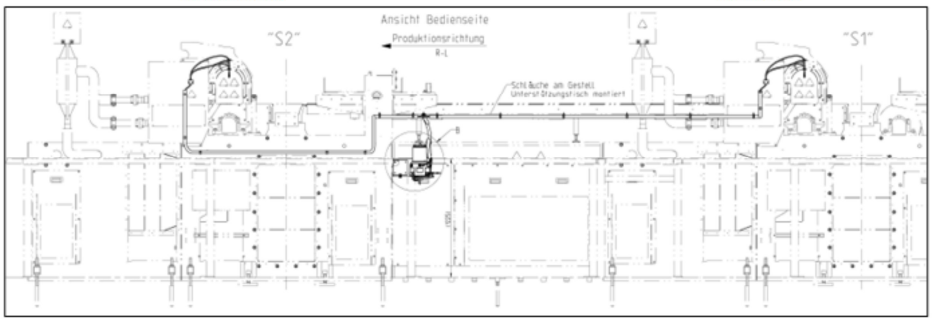
Spinbelt Torque Motors Operator Side And Non Operator Side



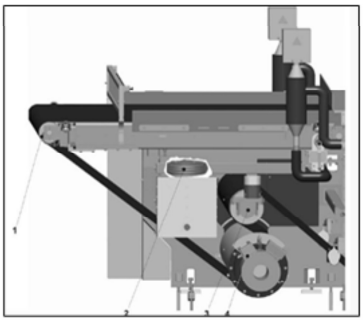
SPINBELT BEARINGS OPERATOR AND NON OPERATOR SIDE



ROTARY JOINTS **PRESS ROLLS**



Transfer/Nose Rolls



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If you are greasing a 500 horsepower (373 kW) motor bearings the method is going to be quite precise – a little bit is enough, but more is better attitude is not going to cut it…

A lubrication plan has many sides to it, one of which is Autonomous Maintenance for Operators in which simple lubrication tasks can be assigned to the operations that do no require specialized skills, technical training or formal qualifications to perform. Below is a TPM lubrication standard form that I have devised in many lubrication plans.


STANKIEWICZ Total Productive Maintenance
LUBRICATION CHECKLIST
DAILY SCHEDULE

Number Box	What To Lubricate	Lubricant and or Tools Needed	Frequency	Work Instructions
1.	Nolek seals retaining caps	No tools necessary hand tight only	Friday	Check nolek seals retaining caps are tight
2.	Date stamps guide rods	Red oil can on TPM board	Friday	Apply a small amount of oil on guide rods
3.	Test head guide rods	Red oil can on TPM board	Friday	Apply a small amount of oil on guide rods