

LEVEL 4 ASSESSMENT SPECIFICATION

Student name:		Student ID number:	
Programme:	HNC Process Operations Engineering		
Module:	Plant Maintenance and Asset Care		
Module code:	PCPO4005	Contribution to Overall Module Assessment (%):	100%
Lecturer:	P R Taylor	Internal Verifier:	Lance Rutherford
Assignment Title:	Asset Management	Word count (or equivalent):	2000
Submission deadline:	10 April 2019	Return date of provisional marks & written feedback:	15 May 2019
Submission method:	All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.) Alternative submission method (if applicable): Late submission of the assessment will result in a late penalty mark. Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.		
Academic honesty / referencing:	Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.		

Module Learning Outcomes (from module syllabus)

- Explain maintenance strategies and asset care methodologies.
- Select an appropriate maintenance strategy based on an assessment of the operational, business and legal requirements for the asset.
- Develop and implement asset care improvement techniques

STUDENT FEEDBACK FORM

This section details the *extent* to which the assessment criteria are demonstrated by you, which in turn determines your mark. The marks available for each category of skill are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.

Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills		
Research undertaken with limited but relevant sources. Reference conventions basic but evident.	10	4½
2. Knowledge and Understanding Skills		
Very good examples of very good levels of understanding and application of theory to practical scenarios.	40	30½
3. Cognitive and Intellectual Skills		
Excellent evaluation of the underlying concepts and principles. Good use of examples and context. Good justification for choice of strategy.	20	14½
4. Practical Application Skills		
Very good consideration of the context of the application. Good evidence of different approaches and selection of appropriate solutions	20	13½
5. Transferable Skills for Life and Professional Practice		
A professionally presented submission. Clearly articulated.	10	8

Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)

Late Submission Penalties (tick if appropriate)

Up to 1 week late (40% Max)

Over 1 week late (0%)

%

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Learner Name : Matthew Thomas.

Course : HNC Process Operations Engineering, Year 1.

Module Code : PCPO4005.

Module Name : Plant Maintenance and Asset Care.

Assignment : Maintenance Strategies.

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Introduction.

In this assignment, five pieces of work shall be completed.

The first is a brief explanation of a System Life Cycle and how it applies to different situations within a plant's life.

The second is an overview of Kaizen and how improvement techniques can be applied to workplaces.

The third is a brief summary of a Total Productive Maintenance plan and its key principles.

The fourth will cover a simple Maintenance Strategy for a water supply system.

And finally the fifth will encompass an Asset Care Assessment for an item of plant within The First Milk Cheese Company Ltd.

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Task 1 : System Life Cycle

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Introduction.

The purpose of this section of the Assignment is to briefly explain what the System Life Cycle of a piece of plant or equipment is and how this Asset Management Strategy works at the different stages of a plant's life.

Task 1 : System Life Cycle

A System Life Cycle is the term used to describe the “being” of a piece of plant or equipment. This being starts from the first concept and design and only ends with the removal and disposal of said equipment. ✓

Upon the decision that a new piece of equipment is required, the basics of a System Life Cycle begins. The requirements of what the equipment must do and the conditions within which it must work are known ✓ and the equipment is designed so as to complete these requirements and withstand these conditions. Good

This piece of plant may be an off the shelf item and typical of the industry standard, but it may also be rather different in nature. So knowing the basic needs of the plant will help determine which item of plant would be suitable to purchase. ✓ This will help to develop further Maintenance Strategies and indicate which would be the most effective for this plant.

Once the plant has been purchased and installed, it will require commissioning. During this phase of the plant's life, it will be checked to ensure that it performs as per the customer requirements. Whilst this might not give a 100% guarantee of longevity, it will give some reassurance that the plant is fit for purpose. ✓

The Operation and Maintenance of the plant goes hand in hand through the main part of its life span. A reliable and efficient plant operation cannot be achievable without a successful maintenance strategy for the plant. ✓ Having an effective maintenance strategy on the plant will allow for better and longer running hours and in turn a better output from the plant. This section of the System Life Cycle will have the most focus and use of the plant. ✓

Finally, once the plant gets to a point where it's operation and / or maintenance becomes ineffective or most costly than replacement, the plant will be decommissioned and removed. This doesn't end the System Life Cycle as the plant must be properly disposed of as well. ✓ Disposing of the equipment will possibly return funds to the company so is an important step to not miss.

Good reference
to plant.

Clear, articulate
and concise

References

Science Direct Website : <https://www.sciencedirect.com/topics/computer-science/system-life-cycle>
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Task 2 : Improvement Techniques – Kaizen

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Introduction.

In this part of the Assignment, a report on the methods of Kaizen will be written and how this can be used within Industrial Factories.

Task 2 : Improvement Techniques – Kaizen

Kaizen is a Japanese continuous improvement strategy used in many manufacturing businesses. The term itself means “Change for the Better” and can be broken down into 4 steps. Plan-Do-Check-Act.

Step	Meaning
Plan	This step usually begins with completing the 5S. The 5S is an organising technique so known after the five Japanese words Seiri (to sort), Seiton (to organise), Seiso (to clean), ~~Seiketsu~~ (to standardise) and Shitsuke (to sustain) that make up its methodology. Performing this start allows the plant to be reset to a clean starting point and ensure that it's operated to a standardised procedure. It also allows for the identification of opportunities to improve the process and plan how to implement them.
Do	For this second step, the plans discussed and agreed in the Plan stage are implemented and begun
Check	Next is the Check step. Here the process is checked again with the new procedures in place and an results are compared to previous to see if it has been a success or not
Act	Finally is the Act step. Here the results of the Check step are analysed and ~~adjustments~~ made to further enhance the results.

Table : Kaizen's 4 Steps and their Meanings

This strategy can be rolled out to any industry setting, whether it be a whole plant or just a single piece of plant. The plant would need to undergo a cleaning window where the 5S methodology can begin and also standard operating procedures put into place and ~~trained~~ out. Whilst being done, any opportunities should be identified and an action plan put into place to benefit from them. Once this has been done and the plant is running again, the new plan needs to be implemented and regularly checked and results tracked.

Finally after a set period of time, ~~the~~ results would need to be analysed and a decision made on how to improve on them again.

This technique can be completed over and over again across individual pieces of equipment or plan or even across whole production lines or factories. Each time improving the procedures with the ultimate aim of achieving 100% efficiency from the plant.

*Clearly understood.
Industrial setting
lightly applied.*

References

What is Kaizen Website : <https://www.kaizen.com/what-is-kaizen.html> : Visited March 2020

What is Kaizen YouTube : <https://www.youtube.com/watch?v=xpELPDY82ds> : Visited March 2020



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Task 3 : Total Productive Maintenance

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Introduction.

For this part of the Assignment, a summary of Total Productive Maintenance and how this method of maintenance can be used based on its key principles.

Task 3 : Total Productive Maintenance

Total Productive Maintenance is Maintenance Strategy that aims to increase operational effectiveness whilst also achieving zero defects, accidents or breakdowns through a system of maintaining and improving the whole plant or process through developing and enhancing all aspects of the plant or process, its operators, its method of operation and also the method and quality of the maintenance performed on it. *good*

Total Productive Maintenance uses a number of key principles to ensure that the Plant works to its full effectiveness whilst also minimising maintenance and operations costs and increasing plant reliability. There are eight key principles of Total Productive Maintenance which are set out in the Table below.

Principle	Meaning
Autonomous Maintenance	The main focus of this principle is to get the plant Operators to begin to take ownership of the plant. This is done by getting the Operators to understand their plant by thoroughly observing it and carrying out routine checks and simple maintenance tasks and repairs. By doing this, any abnormalities in the operation of the plant should be noticed quickly and put right before any defect to the product occurs.
Planned Maintenance	The Planned Maintenance principle focuses itself on ensure that necessary maintenance is carried out within set time frequencies, i.e. a monthly task being carried out. These Planned Maintenance tasks can be of any frequency (hourly, daily, weekly, annual) and can vary in skillset. Some tasks can be carried out by the Operation whilst others might need Site Engineers or even dedicated Contract Engineers to complete. By doing this the rate of plant failures will be reduced to the point of predicting a failure before it occurs and performing an action (such as replacing the item) before said failure.
Focused Improvement	This principle aims to give individual plant operators the understanding for why maintenance is being performed. This could be a simple "Benefits v Losses" explanation, or could even include a group discussion of Operators, Maintenance Staff and Management. Included in this would be a decision on whether the item is worth repairing, or should there be a need to replace.
Early Equipment Management	This main focus of this principle is to ensure that the plant is suitable for the task that it's required to do. This needs to be performed prior to purchasing the equipment and needs to also cover Maintenance requirements as well. Not performing this action could result in a plant unsuitable for use in the process or one that is difficult to maintain.
Quality Maintenance	Quality Maintenance is about ensuring that the Process runs at maximum effectiveness all the time without a defects or downgrade. The System may still produce, but if it's not producing at nominal speed or quality, then additional maintenance or operational checks need to be carried out.
Education and Training	The Education and Training principle focuses on ensure all persons operating and maintaining the plant are suitable trained to carry out their tasks. It also ensures that a standard procedure is followed for all operational and maintenance requirements.
Safety, Health and Environment	A key focus for all industry is not just the successful and efficient running of the plant, but also for the plant to be run safely. This principle focuses on that side of the Total Productive Maintenance strategy and ensures that all tasks are run safely for those running the plant and those working on it and also the environment around the plant isn't damaged by the processes.
Office / Admin TPM	The aim of this principle is to ensure that the results of the other key principles are logged and used to help continuing improving the process. Without documenting the details of what works and what doesn't within the process, it will over time become blurred and it would be easier to miss important information.

Table : Total Productive Maintenance's 8 Principles and their Meanings

Good overview of key principles

References

Plant Maintenance Website : http://www.plant-maintenance.com/articles/tpm_intro.shtml : Visited March 2020

“Beginning Engineers Total Productive Maintenance” YouTube :
<https://www.youtube.com/watch?v=wnjVQhB56cl> : Visited March 2020

“Learn What Total Productive Maintenance is” YouTube :
<https://www.youtube.com/watch?v=vZY0ZL3izbE> : Visited March 2020

“Total Productive Maintenance” YouTube : <https://www.youtube.com/watch?v=FtK8RAjvOdq> :
Visited March 2020

*Evidence of basic,
but independent, research.*

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Task 4 : Maintenance Strategy

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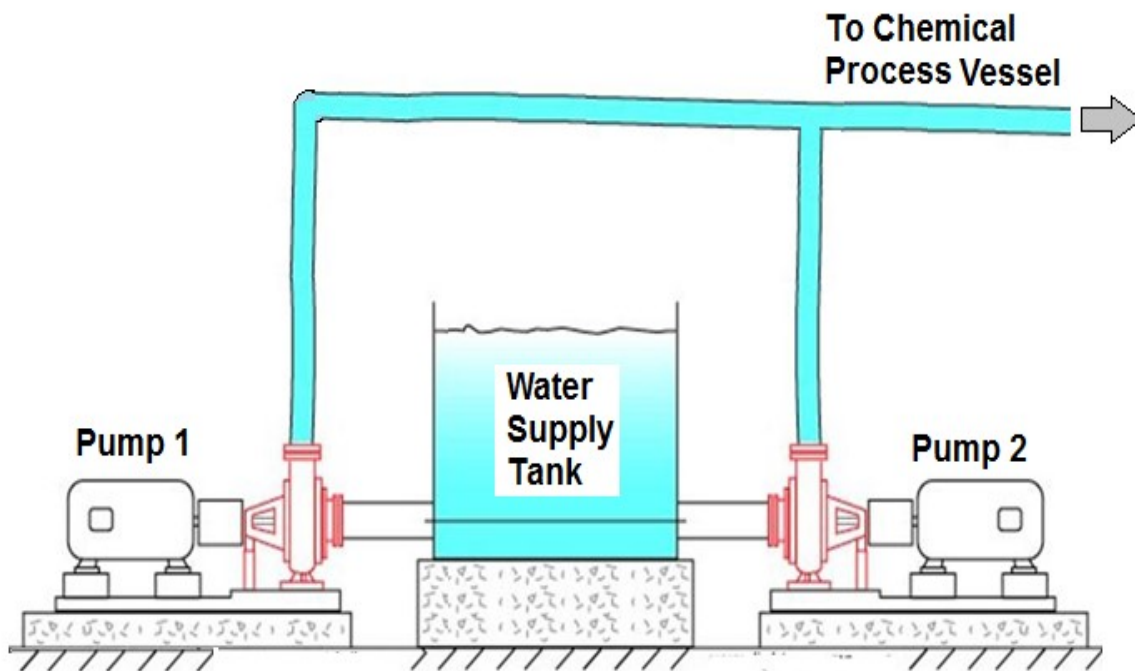
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Introduction.

Within this section of the Assignment, a detailed Maintenance Strategy will be discussed for a Water Supply System. This will cover two Maintenance Strategies and the pros and cons of each as well as what Monitoring Equipment that could be used to assist.

Task 4 : Maintenance Strategy

For the below installation, what Maintenance Strategy would be best, Run to Failure or Planned Maintenance?



Picture : Duty / Standby Pump Configuration to Supply Cooling Water to Chemical Process Vessel

For this installation, there are a number of different Maintenance Strategies that could work but this report will focus on whether a Run to Failure or Planned Maintenance Strategy would work best.

In order to gather baseline data for the new installation, a number of items must be checked and recorded. There are a number of different ways of collecting the required information and good points and bad for each. This information is shown below in a table.

Reading	Device	Reason
Vibration	Handheld Vibration Anyliser	Using a Handheld Vibration Anyliser will allow the Engineer / Operator to take Vibration readings at the pump. This is a quick, cheap way of collecting the data required. However, it requires training to use this equipment, and all future readings must be taken from the same spot to ensure accuracy.
	Permament Vibration Sensor	Installing a Perament Vibration Sensor on the Pump will mean that the vibration levels can be taken 24/7. This can in turn be connected to a site SCADA system and monitored and / or have automatic alarms set up. This is however costly to set up.
Running Temperature	Handheld Temperature Probe	Using a Handheld Temperature Probe is quick, cheap way of collecting the standard running temp of each pump. However, the probe could require training to use.
	Permament Temperature Sensor	Installing a Perament Temperature Sensor will mean that the temparture can be taken 24/7 for each pump. They could also be connected to a site SCADA system and monitored and / or have automatic alarms set up. This is of a high cost to set up.
Noise	Handheld Decibel Meter	Running up each pump in turn with a decibel meter next to it will show on the meter the standard noise levels when each pump is running. Any chances in the noise level can be seen if this test is repeated at later dates.
Flow Rate	Flowmeters installed on Lines	Installing Flowmeters after each pump will give the rate at which the water is flowing after them. This can be done with a local display, or connected to a site SCADA system and monitored from anywhere.
Pressure	Pressure Sensors	Installing a Pressure Sensor before and after each pump will show the Differential Pressure across the line. This can be useful in indicating any leaks on the pump.

Table : Pros and Cons for collecting Baseline Data for Duty / Standby Pump Configuration

Both the vibration levels and temperature can be collected using either a handheld or permemmently installed vibration anyliser. Depending on the importance of the installation, it might be decided to spend additional and install a permanent device that records this information can be set to alarm on a site SCADA system should it deviate from set parameters. However this extra expense might not be available so it might be nessacary to collect this information using a hand held device. ✓

As the installation has two pumps, it is entirely possible to run Pump 1 to failure before switching over to Pump 2. If there is little importance in keeping a steady flow to the Process Vessel, it would be OK to run the first pump until failure and then switch the backup pump on at this time. However if the flow is important, then this method begins to have flaws. Is it important in this context?

The main flaw to this plan would be that from the point of failure of Pump 1, if the area is unmanned or little monitored, the failure wouldn't be noticed until the Prcoess Vessel begins to lose water level. By this time, there could be catastrophic problems within the Process that could lead to Product being lost. Also leaving a standby pump idle for too long could cause it to seize, thus rendering it useless when it is required. ✓

Another option for this set up would be to use a Planned Maintenance strategy. Within this strategy, regular inspections and checks can be made to the set up and also complete routine switch overs between the pumps to ensure equal running and not allow one pump to idle for too long. ✓

An example of this would be weekly inspection of the running pump with some condition monitoring checks, with monthly switch over to the secondary pump and annual overhaul of both pumps (possibly offset by half its normal run length to the secondary pump).

A flaw with the Planned Maintenance Strategy could be that the Strategy is too large for the resource to manage. This will lead to some Tasks possibly being missed due to them being a lower priority or done in a rushed and poor standard. Ultimately this would run the risk of plant failures.

When comparing both Strategies, neither is perfect but both have an argument as being the right Strategy to undertake. The main justification for which Strategy is correct lies in the importance of the flow to the Process Vessel. The greater the importance that this flow remains steady and uninterrupted, the greater the lean towards a Planned Maintenance Strategy. Obviously, from this statement, the opposite must also be true, the less importance, the greater the lean towards a Run to Failure Strategy.

Any installation that comes with a Duty / Standby arrangement is likely to be of importance to the Process; as such the Planned Maintenance Strategy would be the better option.

Using a Planned Maintenance Strategy would be better for the operation of the plant as there would never be a period of no flow. Each Pump will be routinely inspected and serviced and ensured that at least one is always online and running. Any maintenance works would be able to be undertaken without the process being compromised.

To assist in making the operation of this plant a success, the Planned Maintenance for this installation must be fed into the Maintenance Plan for the entire process and the Plan put together so as to ensure focus is given to the whole plant. Running a Maintenance Team too hard could result in tasks being missed or rushed which could lead to unsafe practices and ultimately injuries. This from a business and Health and Safety viewpoint would mean that the Maintenance Team is running correctly and putting the focus onto the correct items. It also ensures that no unsafe practices can happen due to rushed jobs.

Using a set thought out Planned Maintenance Strategy would help give the business the best return on this install.

Good reasoning
& justification

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Task 5 : Asset Care Assessment

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Introduction.

For this last part of the Assignment, an Asset Care Assessment for a piece of plant within The First Milk Cheese Company Ltd will be completed. This will cover information from the Manufacturers and Historical Knowledge to allow for a Maintenance Strategy to be produced that will ensure the smooth and efficient running of the Plant. From this Assessment an Improvement Plan will be developed and a method of implementing it will also be discussed.

Task 5 : Asset Care Assessment

The Blockmaster is an aged piece of Equipment within The First Milk Cheese Company Ltd. Its role within the Production Line is to box up 20Kg blocks of Curd into Cardboard. This piece of Equipment is currently manned 24/7 by an Operator who loads the Cardboard into the Machine and ensures the Weighing and Labelling Process works correctly. Planned Maintenance is by standard completed by one of the four Engineering Teams on Site who work on a 4on 4off pattern. Any Priority tasks would however be picked up by the Team on Site at the time.

A failure on the Blockmaster Plant would very quickly cause ramifications further back up the Production Line so it is vital that the Plant has Zero Downtime. There are a number of Components on the Blockmaster that could fail and a table below shows their severity for the Business.

Good overview

Component	Factor 1	Factor 2	Factor 3	Factor 4	Total Score (1x2x3x4)
	Risk to Product Contamination	Risk to Product Loss	Risk to Operator Safety	Time to Repair	
Inlet Conveyor	1	1	1	2	2
Inlet Pusher Cylinder	1	1	1	3	3
Main Drive Chain	1	1	1	5	5
Station 1 Cardboard Dropper Cylinder	1	1	1	3	3
Station 1 Cardboard Pusher Cylinder	1	1	1	3	3
Station 1 Glue Gun	1	1	3	4	12
Station 1 Glue Hose	1	1	4	4	16
Station 2 Cardboard Dropper Cylinder	1	1	1	3	3
Station 2 Cardboard Pusher Cylinder	1	1	1	3	3
Station 2 Glue Gun	1	1	3	4	12
Station 2 Glue Hose	1	1	4	4	16
Outlet Pusher Cylinder	1	1	1	3	3
Outlet Conveyor	1	1	1	2	2
Glue Tank	1	1	4	4	16

Table : Plant Assessment for the Blockmaster Plant at The First Milk Cheese Company Ltd

Factor	Score				
	1	2	3	4	5
Risk to Product Contamination	Failure to Component will not cause a risk to Contamination of Product	Failure to Component will be unlikely cause a risk to Contamination of Product	Failure to Component will possibly cause a risk to Contamination of Product	Failure to Component will definitely cause a risk to Contamination of Product	Failure to Component will definitely cause a risk to Contamination of Product and be untraceable
Risk to Product Loss	Failure to Component will not cause a risk to Product Loss / Downgrade	Failure to Component will be unlikely cause a risk to Product Loss / Downgrade	Failure to Component will possibly cause a risk to Product Loss / Downgrade	Failure to Component will definitely cause a risk to Product Loss / Downgrade	Failure to Component will cause a loss of over a Day of Production
Risk to Operator Safety	Failure to Component will not cause Safety a risk to Operator	Failure to Component will be unlikely to cause Safety a risk to Operator	Failure to Component will possibly cause a Safety risk to Operator	Failure to Component will definitely cause a risk to the Safety of the Operator	Failure to Component will definitely cause harm to the Operator
Time to Repair	Time to Repair failed Component is minimal (less than 10mins) and will not disrupt Production	Time to Repair failed Component is minimal (less than 10mins) but will disrupt Production	Time to Repair failed Component is greater than 10mins but less than an hour. Production will be halted.	Time to Repair failed Component is greater than an hour but less than 2hours. Production will be halted.	Time to Repair failed Component is greater than 2hours. Production will be halted.

Table : Score Card for Plant Assessment

Understanding this data, it's easy to point out the higher risk items and this can be used to help develop the system of care given to the Asset.

Ensuring that this important piece of Plant is kept to Zero Downtime is a job of both Operators and Maintenance. Neither can complete this task alone. From an Operations point of view, a number of tasks can be done that can keep the Plant clean and prevent Breakdowns due to debris. Currently the Operators within this Area only clean the plant once a shift. This is leading to a build-up of Cardboard Dust which is drying out lubricated Cylinders and causing them to wear. Maintenance can also completed Planned Maintenance Tasks and Servicing to keep the Plant running. The Engineering Team responsible for the Planned Maintenance on the Blockmaster currently carries out a routine Inspection every 8 days, covering items as set out in the table below.

Make visual inspection of the machine for loose panels guards and oil leaks	Drain glue tank of glue and flush with solvent
Check all nuts and screws for tightness	Check temperature controllers on the glue unit
Clean faces of infra-red switches	Inspect all glue gun hoses and wiring for wear
Check motors are firmly secured	Change of glue filter if needed
Lubricate all transmission chains	Check drive chain tension
Check nylon rollers and apply light oil to the bearings	Check all holding down bolts
Check motor gear boxes for oil	Check all switches are working correctly
Remove vacuum pads and check for any debris and clean filters. Replace if necessary	Check oil levels
Drain water from pressure regulator	Spray grease all chains
Top up air lubricators used in conjunction with the air pressure regulators	Add grease to all grease points (grease nipples)
Drain and clean filter unit of air lubricator	Inspect all electrical wiring on the machine and ensure it is safe and well secured
Check all valve exhaust port muffles	Advise of any further work that can be completed during a shutdown period
Check pneumatic pipes	Advise any obsolete items that can be removed
Check operation of all cylinders	Advise any recommendations for plant

Table : Maintenance Checks for Engineering Team on Blockmaster Plant

In order to fully implement this Strategy, it would be vital to ensure that all Operators and Maintenance Staff are on board. Whilst the Operators may initially dislike the fact that “Maintenance” Checks are being passed over to them, the idea is that these checks will give them a better understanding of the mechanisms of the Plant whilst carrying out vital cleaning. It would also allow the Maintenance Team additional time to complete more in-depth checks and services on the Plant. Good

Through discussions with all members of the Operations and Maintenance Teams new Best Practice Standard Operating Procedures for this Plant can be created and documented for everyone to follow and understand.

Looking at the above Maintenance Tasks, a number of them could actually be completed by the Operator thus freeing up time for the Maintenance Team to perform other tasks.

Taking the tasks currently completed, these could be split so as to allow the Operator to have an increased Ownership over his Plant.

Operator	Maintenance
Cleaning of Plant	Check all nuts and screws for tightness
Make visual inspection of the machine for loose panels guards and oil leaks	Check motors are firmly secured
Clean faces of infra-red switches	Lubricate all transmission chains
Remove vacuum pads and check for any debris and clean filters. Replace if necessary	Check nylon rollers and apply light oil to the bearings
Drain water from pressure regulator	Check motor gear boxes for oil
Drain and clean filter unit of air lubricator	Top up air lubricators used in conjunction with the air pressure regulators
Check all valve exhaust port muffles	Check operation of all cylinders
Check pneumatic pipes	Check temperature controllers on the glue unit
Drain glue tank of glue and flush with solvent	Inspect all glue gun hoses and wiring for wear
Change of glue filter if needed	Check all switches are working correctly
Check drive chain tension	Check oil levels
Check all holding down bolts	Spray grease all chains
Advise of any further work that can be completed during a shutdown period	Add grease to all grease points (grease nipples)
Advise any obsolete items that can be removed	Inspect all electrical wiring on the machine and ensure it is safe and well secured
Advise any recommendations for plant	Advise of any further work that can be completed during a shutdown period
	Advise any obsolete items that can be removed
	Advise any recommendations for plant

Table : Proposed Operator and Maintenance Checks for Blockmaster Plant

By increasing the Operator's ownership of the Plant, it is hoped that they were take better care of it and allow time for the Maintenance Team to perform other tasks. *Well considered*

On this Plant, the highest number of Failures happen around the items with the greatest risk of causing Downtime, this being the Glue System. A failure to the Glue System can easily result in more than 2 hours being lost due to having to remove leaked glue from the damaged area and get the glue up to temp again when a repair or replacement is completed. It is important therefore to see if a suitable plan can be put into place to help reduce the risk of this fault occurring or assist to bring down the time to repair. The biggest failing of this plant is to the Glue Hoses. Due to the design of the Plant, the Glue Hoses must move in line with their Glue Guns as they supply Glue onto the Boxes to seal them. This movement generally leads to rubbing which will in turn lead to the Hose wearing and breaking.

However, redesigning the hose arrangement would allow for them to be placed into a position of less movement thus meaning less change of rubbing. It is also feasible to install a larger Glue Tank that would have multiple ports on it meaning that a second set of Glue Hoses could be in place ready for switching to on a failure. Both of these ideas would require a redesign and a cost against the Maintenance Budget, but both would allow for less Downtime. ✓

Once changes being to happen on the Plant it is important to keep track of them and set realistic targets for both the Operations and the Maintenance Staff. Doing so will keep them from drifting back to old habits and not allowing the Plant to reach its full effectiveness. ✓

Very insightful

Very good analysis

Word Count : 2,190.

Word Count does not include Introduction, References or Tables.