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MASTER'S THESIS

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Abstract

There were two main goals of this thesis. The first was to conduct a Root Cause Analysis of a unit called A275 in the facilities of Kverneland Group Klepp. This unit had problems with excessive downtime. Based on that analysis, the second goal was to use the insights gained by in the process of analyzing A275 to develop a new, modified Root Cause Analysis framework that was specifically suited to be used by the Kverneland Group at their facilities. This was important for Kverneland Group as the framework they used previously was too time consuming to be properly used.

The approach was to first conduct a Root Cause Analysis of A275. This process was completed with a combination of conversation with key-personnel at Kverneland Group and examination and analysis of their maintenance database. By applying Root Cause Analysis methods, the root causes were discovered to be the absence of a feedback system between two systems inside one of a sub-unit of A275. A theoretical solution was presented at the end of the analysis.

Based on the information and methods applied to analyze unit A275, as well as the general structure and processes of the units at Kverneland Group Klepp a new Root Cause Analysis framework was developed.

The Root Cause Analysis framework was developed based on requirements from Kverneland Group, background theory and modifications which made the framework more suited to be used at their facilities. Based on an example Root Cause Analysis conducted over A275 using the developed framework, it was found that the process was quicker and more intuitive to use even for people with limited experience with Root Cause Analysis.

Acknowledgements

First I would like to thank my thesis advisor and mentor Idriss El-Thalji of the Offshore Technology – Industrial Asset Management department at the University of Stavanger. Professor El-Thalji was always there to assist whenever I had problems during the process of writing the thesis. His insight of the process of developing the framework, and competence when it comes to thesis work was immensely helpful. Without his participation, the quality of the thesis would be of a lower degree.

I would also thank my mentor from Kverneland Group, Technical Director Egil Brastad Hansen. With his guidance and enthusiasm for my work, Egil kept my motivation up during these months. Whenever I encountered parts of my thesis which required the involvement of Kverneland Group, Egil was quick to offer his assistance either personally, or by directing me to key personnel which could help me with my task. For this I am very grateful.

Also I would also like to thank maintenance analyst Karina Djuve Aanderaa from Kverneland Group. She explained various process units at the Kverneland Groups facilities and showed me around in the Kverneland Groups facilities Klepp. Her assistance and input regarding the development of the Root Cause Analysis (RCA) framework was very helpful, and allowed me to create a framework which suited their facilities.

I would also like to express my thanks to maintenance planner Ingrid Glette-Iversen from Kverneland Group. She assisted by teaching me how to utilize the database at Kverneland and was always there to give answers to my questions about Kverneland Group.

I would like to thank everyone at Kverneland Group. Their genuine interest and enthusiasm about my work was very motivating and lead me to enjoy my time working with Kverneland Group.

Lastly, I would also like to thank my family and friends. Their support during my years at the University of Stavanger is much appreciated. With their inputs and encouraging words I kept my motivation up so that I would be able to present a developed Root Cause Analysis framework which I am proud of.

Author

Vegard Goa

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List of Abbreviations

RCA	Root Cause Analysis
FMEA	Failure Mode Effects Analysis
FMECA	Failure mode, effects, and Criticality analysis
PDCA	Plan-Do-Check-Act
PDSA	Plan-Do-Study-Act
FTA	Fault Tree Analysis
FTD	Fault Tree Diagram
Qty	Quantity
Est.	Estimate
C&E-diagram	"Cause and Effect"-diagram
Corr.	Corrective
KPI	Key Performance indicator

1. Introduction

1.1. Background

RCAs are usually generalized solutions which can be applied with various effectiveness on different systems. However there should be a more specialized solution for facilities which operates with many of the same processes, arranged in a more heterogeneous manner.

1.2. Presentation of problem

Kverneland Group is experiencing trouble with their production unit *A275*, and need to fix the underlying causes in order to make systematic changes which should make this unit operating at expected levels. This unit consists of different sub-units, which increases the complexity of the analysis. In order to efficiently handle system trouble, Kverneland Group would like a new Root Cause Analysis framework that is better suited for their own workers and systems. Currently Root Cause Analysis is not much used at the Kverneland Group facilities at Klepp, and they wish to have a framework which makes the process less time consuming and relatively simple to conduct with limited experience.

1.3. Relevance

The problem is reasonable and a good solution could be very useful to Kverneland Group. There are theoretical and practical relevancies that could motivate this work. This could be to find a solution for Kverneland could be increased machine availability, reduced cost and reduce diagnostic time for relevant units. The theoretical and practical relevancies as a master thesis is that the task ties together different ideas and frameworks that have been explored in various courses within the Bachelor- and Master degree study.

1.4. Problem Formulation

Kverneland Group requests a new model/framework for the conduction of a RCA that can be used in their facilities. Currently Kverneland Group does not utilize RCA much, and often FMEA is used instead. Kverneland Group wishes to incorporate RCA in their troubleshooting to reduce reoccurrence of problems. Ideally the process of RCA should not take weeks to complete.

There are also problems with a unit labeled A275 in their facilities. This unit will be examined, however the main focus is on the framework.

1.5. Objective

The purpose of this study/thesis is:

- To make a systematic plan over unit A275
- To analyze the sub units in A275, and derive the most critical sub-unit.
- To analyze the most critical sub-unit for the root cause of problems.
- To present a proposal for a solution to the root cause of the problems.
- To develop a framework which can be used to conduct root cause analysis in Kverneland Groups facilities.
- The developed framework should be generalized enough to be applicable to other units AXXX, either during the task, or in near future.

1.6. Scope of the work: Limitations/delimitations

- The Kverneland facilities are very large, thus this thesis has a main focus on unit A275.

- There are limitations in regards to how deep and how thorough the analysis for each sub units can be, as there can be extreme amounts of root causes.
  Thus this thesis would be limited to the ones that are considered to the most critical and likely to occur as they are the most relevant ones.

- The scale of collected data and information:
  Based on the previous point, the scale of the collection of data and information on A275 would be purposely aimed at the most critical sub-unit of A275 and the most relevant root cause.

- The scale of collected solution: The goal of the thesis is to provide a general model or framework for solving the described problem, without going into a deep analysis of the system.

- Validation of the solutions might have to be ignored, due to the limited time presented in the task. Thus the verification and demonstration in order to demonstrate how the solution/framework works will be more reasonable. This is because the overall results of the applied Root Cause Analysis will not become apparent until the end of a given test period.

1.7. Timeframe

Table 1: Timeframe for tracking thesis progression

	JAN		FEB				MAR					APR				May					June		
TASK	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	
Problem understanding and description																							
Literature review																							
Framework development																							
Data collection																							
Data analysis																							
Revise the framework and Case study description																							
Solutions generation																							
Data collection and analysis, Part 1																							
Data collection and analysis, Part 2																							
Data collection and analysis, Part 3																							
Verify the proposed solution																							
Writing the data and analysis chapter																							
Demonstrate the proposed solution																							
Discuss the proposed solution and the whole case study Draw up the conclusions and further work																							
Deadline for first submission																							
Thesis revision, Technical and academic checks																							
Final submission to university																							

2. Literature review and Theory

This chapter will consist of two main subjects; the literature review and the Theory. The literature review will be conducted with the utilization of UiS' Open Access thesis library, UiS Brage. The theory will first include a section which explains what Root Cause Analysis is. It will also include the general process of conducting a root cause analysis, as well as how to properly document the root cause analysis process. At the end of the chapter, different methods which can be used to support RCA will be examined.

2.1 Literature review

In order to determine the originality of the works completed in this one would have to conduct a literature review. This is done to get an overview over what past works have been done which are related to the subject touched in this thesis. The approach for conducting a literature review in regards to previous thesis submitted to the University of Stavanger is based the utilization of the Open Access thesis library at UiS; UiS Brage.

UiS Brage is a database where previous submitted theses are available to students to view. This system is equipped with a search function, which when loaded with different keywords can assist in determine the subject of the different theses. The keywords that would describe this thesis are all related to Root Cause Analysis.

<u>The keywords searched for are:</u>

- Root Cause Analysis Manufacturing
- Root Cause Analysis Template
- Root Cause Analysis Framework
- Root Cause Analysis
- RCA

The sorting used for the search function is "By relevance" as default. This means that the most relevant theses should appear on the pages in the beginning, and the less relevant ones should appear further back. Since a large number of the theses include the words "Analysis" and "Cause", a search for the keywords above yielded over 900 theses. This number is so large that it is not realistic to go through them all. Therefore, one assumption made is that if there are previous theses that relates to this thesis, the "By relevance" option of the search should list these in the first pages.

Since many of the keywords are the same, there is to be expected some overlapping between the resulting theses. An example of this is that searching for "Root Cause Analysis". These keywords appear in the keywords "Root Cause Analysis Framework", which means that there is to be expected that many theses related to the search for "Root Cause Analysis Framework" would also be included on the search for "Root Cause Analysis".

The results of the search was that while many the theses included sections about Root Cause Analysis, none seem to have the main subject of the thesis about the development of RCA framework to be used in manufacturing. This would mean that the entirety of the work in this thesis is not covered by previous theses submitted to the UiS Brage database.

2.2 What is Root Cause Analysis (RCA)

Root Cause Analysis (RCA) is a term that describes a method to solve problems by correcting the underlying root cause. By utilizing RCA, investigators examines and analyzes causal factors of the problem in order to identify what actually occurred in the beginning which lead to the manifestation of the problem. This process is particularly useful as the aim is to go deeper into the issue and determine the cause and effect leading up to the starting factor which created the issue, rather than to just implement the most apparent solution to a problem. Figure 1 describes the relationship between a visible problem and a root cause.

The process can be described as a corrective action to a problem, in that sense that RCA is mostly utilized in as a reaction a problem which has already occurred. However if the analysis and implementation of the solution is done in an effective way, it can be considered a mitigating or proactive action as well. This is because by removing the root cause of a problem effectively decreases the chances for it to occur again.

Since the basic idea of root cause analysis is simplistic, it can be difficult to determine who the "inventor" of RCA is. However, one of the common methods utilized in RCA, "The 5 Whys Method", was developed by Sakichi Toyoda which was the founder of Toyota Industries. The method will be explained in detail further in thesis.

As for users, many different industries and sectors have seen the advantages of utilizing this type of analysis. This includes aviation, manufacturing, and healthcare.

In order to understand what a Root Cause Analysis it is important to understand the process of conducting this type of analysis.

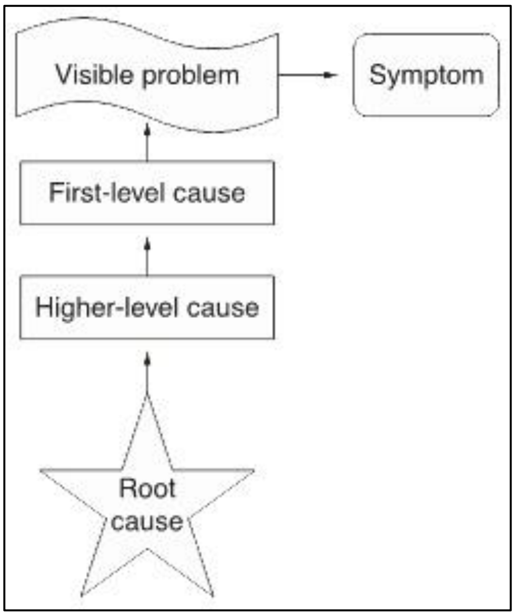


Figure 1: Root cause analysis diagram (ASQ, n.d)

(Mind-Tools-Editorial-Team, n.d-e)
(A, 2015a)
(A, 2015b)
(Ohno, 2016)

2.3 Root Cause Analysis process

The general process of conducting a Root cause analysis can be explained by five main steps. These steps can be supported by different frameworks, which will be explained later in this thesis. After conducting the five main steps of the RCA process, it is important to document the process. The documentation is valuable in the sense that people are able to review the report and gain understanding about the problem and which solutions were implemented to fix the problem. The five main steps are briefly presented below.

1. Define the problem:
- What is happening?
- What are specific symptoms?

The first step is to identify what is happening. It is important to give a clear picture of what is actually occurring, because this creates basis which the analysis is conducted on. With a clear notion of what has occurred, one can list the symptoms of the incident.

2. Collect Data:
- How long has the problem existed?
- How does the impact of the problem?
- What can you learn about it?

In order to press further and look to factors that lead to the problem, the problem has to be fully analyzed and defined. In order to ensure the effectiveness of the Root Cause Analysis it is important to get together people who understands the situation. By bringing the people who are the most familiar with the process or problem together, it will be easier to get a good understanding of the problem. This can include, but is not limited to experts and workers. It should be considered especially important to value the information of the people that work with the process in which the problem occurred. Often they are the most experienced with the situation, and therefore have some insights into what has occurred. They could also already attempted "quick-fixes" to treat the symptoms of the problem.

3. **Identify Possible Causes:**
   - What sequence of events lead to the problem?
   - What conditions allowed this problem to occur?

   In step three it is considered very important to identify as many possible causes as practically possible. Often only a few possible causal factors are identified. This is because while there are certain causes that may seem overwhelmingly likely compared to other, there is usually no absolute certainty. Because of this it is important to make note of that while certain possible causes may seem unlikely, by excluding them the real root cause may be excluded as well. This leaves the analysis fundamentally flawed. Because of the importance of being able to identify numerous possibly causes, many tools have been developed to ensure the integrity of this step. Some of them will be explained further down.

4. **Identify Root Cause**
   - What is responsible for the problems identified in the previous step?

   Once a list of possible causes have been generated, it is time to go deeper into each of the possible causes to identify the root causes. By utilizing methods applied in the previous step, the listed possible causes will be explored in deeper detail. The focus should be on cause and effect, with the mindset that each level of the possible causes is an effect from a previous cause. When a level have been reached where there is no reasonable precursor which can be identified it can be considered a root cause. Since RCAs are much more effective if there is room for teamwork, it can be very valuable to have discussions during this step to allow for multiple inputs. As a concluding remark to this step there should be a summary of the identified root causes, where it is encouraged to discuss as a group if people agree with the proposed root causes.

5. **Fix the problem**
   - Implement a solution
   - Documentation of process

   With all the data collected in the previous steps, a process of generating solutions can commence. This can be done by examining how each level of the causes and effects interact. From this one can get an understanding of how the root cause leads up to becoming an apparent problem, and what changes needs to be implemented to ensure the prevention of the root cause. There should also be a plan as to what may happen in the future as a result of the implemented solution. By doing this, should a problem occur later there could already be proposed solutions available for them. This can potentially decrease the downtime considerably.

(Mind-Tools-Editorial-Team, n.d-e)
(MindToolsVideos, 2014b)

2.4 Documentation of the Root Cause Analysis process

It is important to document the RCA process. To illustrate this, a sample report from ARMS Reliability's Apollo Root Cause methodology will be used for example. Each step of the documentation will include an explanation of the step as well as small examples cut from ARMS Reliability's example RCA called Lost Production. For a better overview, the two relevant pages which has been used in this thesis will be included in APPENDIX A. Only page one and page two will be considered for examples, as these cover the documentation process to a satisfying degree.

1. <u>Problem definition</u>
   Informative documentation should include a problem definition. This describes what kind of problem has occurred, when it occurred as well as the duration of the problem. It should also include where the problem occurred and how critical the problem is. The criticality can be assessed with respect to how the problem impacts factors such as the environment or business. For instance could there be loss of revenue, cost of fixing the problem, and how the problem affects the integrity of security in the facilities. As for an example, ARMS' Reliability proposes this method of defining the problem:

I. Problem Definition

What:	Lost Production
When:	December 18, 2013
Where:	USA
Facility:	Central 3
System:	Processor
Significance:	High
Safety:	Minimal impact – increased exposure to lifted loads and slippery conditions
Environment:	No Impact
Revenue:	Downtime 44 Hours
Cost:	$2.4M
Frequency:	First 1

Figure 2: Problem definition ARMS RELIABILITY (ARMS-Relibability, n.d-a)

2. <u>Report Summary</u>
   There should also be a summary of the incident. This has to be precise and documented in a manner which makes the events understandable, so that people that reviews the report later can get an adequate insight into what happened. The report summary explains the incident and the causal events that lead to the incident up to the root cause. The length of such reports can differ, however between half a page and a page is usually sufficient to give a clear overview into what occurred. This is a part of the summary used in the example from ARMS Reliability's example RCA report:

II. Report Summary

Lost production was caused by the CHP having to be shut down when the wet end bearing failed. This bearing failed because of metal-to-metal contact due to the bearing lubrication becoming ineffective because the grease was washed and contamination was present.

The grease was washed out because the wet end labyrinth seal failed and allowed the entry of gland water. Excessive wear occurred in the end cover and the labyrinth seal because the lubricant supply ran out.

Figure 3: Report Summary ARMS RELIABILITY (ARMS-Relibability, n.d-a)

3. <u>Solutions</u>
The summary should be followed by specific solutions, mainly targeted towards the root cause. However, it can also be useful to generate some solutions that acts as contingencies should the proposed solution to the root cause prove to be insufficient. An example of this could be to increase the frequency of inspections of elements that were a part of the chain of events for the problem. These solutions are generated for a specific cause previously identified, therefore the solutions should reflect which specific cause they are meant to fix. They should also include the person who came up with the solution, and is responsible for its implementation. That way people can later inquire about the specific about the solution, or be more inclined to include the person in another RCA process. The figure show two examples of solutions generated through the ARMS Reliability method in the "Lost Production" example.

III. Solutions

Causes	Solutions	Solution Owner	Due Date
Water pressure fell below 25 psi	Install uprated pump to ensure supply	Phil Sager	03-02-2014
Blockage not identified	Increase inspections of screens to weekly	Stirling Maus	25-12-2013

Figure 4: Solutions ARMS RELIABILITY (ARMS-Relibability, n.d-a)

4. <u>Team Members</u>
The next step in the documentation process is to include the names of the people involved in the RCA. This is not only limited to the people that have come up with specific solutions to causes, but should include everyone on the team. With the inclusion of names of the people involved, it is easier for people in the future to get answers to potential questions they may have about the event. To that end one should include information about the position of each member as well as a means of contact. This is an example of this by ARMS Reliability:

IV. Team Members

Name	Email	Member Info
Phil Sager	psage@somewhere.com	Reliability Superintendent
Roy Davies	rdavies@somewhere.com	Defect Elimination Officer
Nando Alonso	nalonso@somewhere.com	Plant Mechanical Engineer
Stirling Maus	smaus@somewhere.com	Plant Maintenance Supervisor

Figure 5: Team members ARMS RELIABILITY (ARMS-Relibability, n.d-a)

5. Notes
The four previous steps can be considered the main steps in the documentation framework. However if there is anything the team would like to convey in the report that does not fit elsewhere this can be done in the notes section. These notes can include assumptions made in the report, things to consider, or "milestones" met in the report.

V. Notes

1. Realitychart Status: The Realitychart and Incident Report have been finalized.
2. Rules Check Status: Missing Causes Resolved.
3. Rules Check Status: Conjunctions Resolved.

Figure 6: Notes ARMS RELIABILITY (ARMS-Relibability, n.d-a)

6. References
In the references step for the report, relevant references are included. This could include photos, plans, excel sheets, graphs, or interviews.

ARMS Reliability adds these notes and references to their example:

VI. References

1. Photo # 17
2. mining development plan at 23.01.2014
3. photo # 13

Figure 7: References ARMS RELIABILITY (ARMS-Relibability, n.d-a)

(ARMS-Relibability, n.d-b)

2.5 Different methods to support RCA

There are many different methods that compliments the RCA process. These six methods will be explored in this section: “Five Why”, “Cause and Effect”-diagram, “PDCA-cycle”, “Fault Tree Analysis”, “FMECA”, and “Appreciation”. The theory behind these methods will be explained as well as an example for each of them to provide a better understanding. Some of the methods are considered to be more basic than others. These methods can be suitable for people with limited experience with the RCA process.

2.5.1 Five Whys

The method of 5 Whys is a technique that is very often used to support a RCA. It is used in the process of identifying root causes, and is applied in the third step of the RCA process. The method at its core is to first define a problem, and then repeatedly question “why” to the answers given to the problem. For each “why” asked, different causal factors are determined. This continues until the problem is explored deep enough for a root cause to become apparent. Figure 8 represents the structure of the “5 Whys” approach.

For example: there might be a problem with a slippery floor in a plant. There are different approaches to fixing this issue, this is how it can be approached with the “5 Whys” as a problem solving tool. First the problem has to be clearly defined. If the problem is not defined properly, the “5 Whys” approach can be flawed by asking “why” to the wrong problem. In this example the problem can be defined as “The floor is slippery”. Then the process begins.

1. By asking “Why (is the floor slippery)?” the answer might be that coolant fluid is leaking from a machine.
2. Asking “Why (is the coolant fluid leaking form the machine)?” the reply could be that there is a worn-out pipe in the unit.
3. By asking “Why (is there a worn-out pipe in the unit)?” the answer might be that there has not been maintenance conducted on the unit.
4. By again asking “Why (has there not been enough preventive maintenance)?” the reply might be that management thought it not necessary.

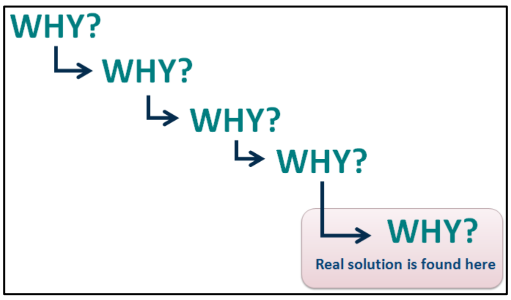


Figure 8: 5 Whys (Six-Sigma-Free-Training-Site, n.d)

Thus the root cause is for a seemingly technical problem has roots in human factors, which is very often the case. The problem can now be resolved by the managers by updating the preventive maintenance routines for the unit. If workers were to apply only the quick-fix, which could be to just clean up the floor, it would be realistic to assume that the problem would occur again as the pipe would not be fixed.

In this sense the workers would only treat the symptom and not the underlying cause. This in turn could eventually become a bigger issue, with for instance overheating of machinery.

There are many strengths with the utilization of this method. It is considered easy to use, and it does not require potentially tedious statistical analyses to be applied. “The 5 Whys” is a simple method, yet it can be very effective. It can be applied to many different situations, as the method itself is not limited to purely technical issues in machines. The basic idea can be applied to search for root causes in daily life as well. Figure 9 visualizes how a “5 Whys” analysis can be used to determine why a car will not start.

It is not always limited to ask “Why?” five times, sometimes more or less is required, but as a rule of thumb five is usually enough to get to a root cause. In the example on the previous page four “Whys” seemed to be efficient enough to get to the root cause.

Some of the challenges with this method is that it is based on personal opinions, which means it is biased. This means that the repeatability can be limited, in the sense that different people might have other viewpoints as to what could be causal factors.
This could heavily influence the method as varying causal factors can be discovered based on the responders knowledge or motivation about the situation.

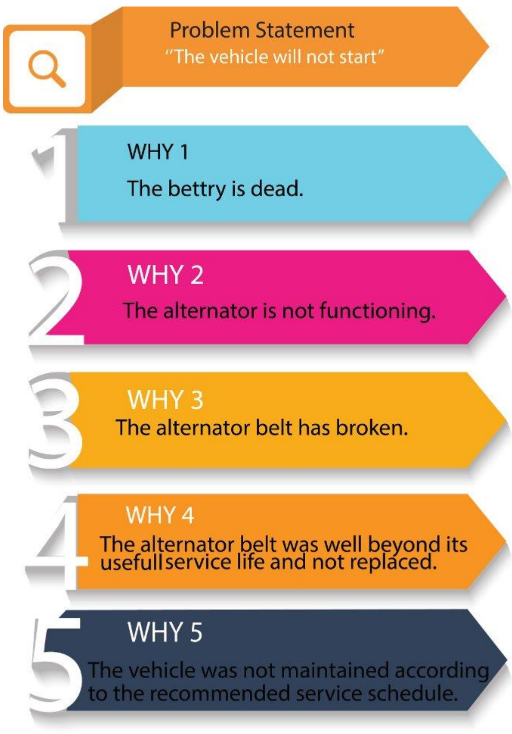


Figure 9: 5 Whys applied to “The Vehicle will not start” (Kaizen-Rocks, n.d)

(A, 2015a)
(Mind-Tools-Editorial-Team, n.d-a)
(Six-Sigma, n.d-a)
(MindToolsVideos, 2015)

2.5.2 Appreciation

Appreciation was originally developed by the military as a method for the commanders to get as much information about a single fact, problem or situation that they were faced with in battle. The method was designed to extract maximum amount of information from a fact or statement.

The process starts with first making a statement. After that, “So what?” is asked. An answer could be related to what would be the consequence of this statement? What are the positive- or negative outcomes of this statement? When an answer is given to the first “So what?”, the answer is subjected to another “So what?”. This process is repeated until the possible conclusions are drawn.

When using Appreciation it can be useful to go over several rounds of the process again. This is because this framework can be restricting in the sense that only one line of consequences may be explored, while there might be other lines of consequences if a different answer was given to the first “So What?”.

Appreciation can seem similar to the method of “5 Whys”, with the technique of asking a question over and over to statements. There are however some distinctive features which are different. The most apparent difference is that while method of “5 Whys” are designed to drill to the root of the problem, the purpose of “Appreciation” is to generate as much information as possible out of a simple statement or fact.

In this sense “5 Why” starts with a problem or statement and work backwards to reach the origin of why a problem occurred, while “Appreciation” looks forward into the implications that a fact or statement might have.

The table below can be used as an example of the “Appreciation” method.
In this example the implications of the public transportation being on strike is explored. From the statement about the strike, one can reach a conclusion that the consequences might be that students have to leave earlier in the morning to be in time for lectures.

Table 2: Appreciation example - Public transportation strike

Statement	The bus-driver union for public transportation is on strike
So what?	Public transportation might not be available tomorrow.
So what?	People might have to cycle or walk to reach the university.
So what?	Travelling between the home and the university will take more time.
So what?	People will have to leave earlier than usual to catch their lectures.

(Mind-Tools-Editorial-Team, n.d-b)

2.5.3 “Cause and Effect”-Diagram

“Cause and Effect”-diagram, also known as fishbone diagram or Ishikawa diagram is a technique which can be utilized to support a RCA. It was developed by the Japanese professor Kaoru Ishikawa in the 1960s. The technique can be described as a diagram-based approach for examining all possible causes of a problem within different categories. It is important that the problem which is to be examined is clearly defined, to ensure that the process is as effective as possible.

The process of creating a fishbone diagram starts with writing down the problem in a box on a sheet of paper. The box with the defined problem is usually placed to the right side on the sheet. The location of the box with the problem is irrelevant, as it does not affect the method. Some prefer to place it on the left side. From the box a horizontal life is drawn. This is the “backbone” of the fishbone-diagram.

From the backbone, diagonal lines are drawn which represent different factors that can influence the problem. These factors can vary depending on the defined problem. The factors are further are brainstormed for causes which can relate to the problem.

These potential causes are added to the diagonal lines under their respective factor. It is considered important to get many potential causes, as the causes that prove to be the “correct” ones are not necessarily the most apparent causes. Therefore it is important to add as many potential causes as can be identified.

When all possible causes are added, one can start investigating the causes that are considered to be the most likely. There are different methods that can be utilized for this investigation, for instance can the “5 Whys” method be applied to find the root causes. Figure 10 is an example of a fishbone diagram.

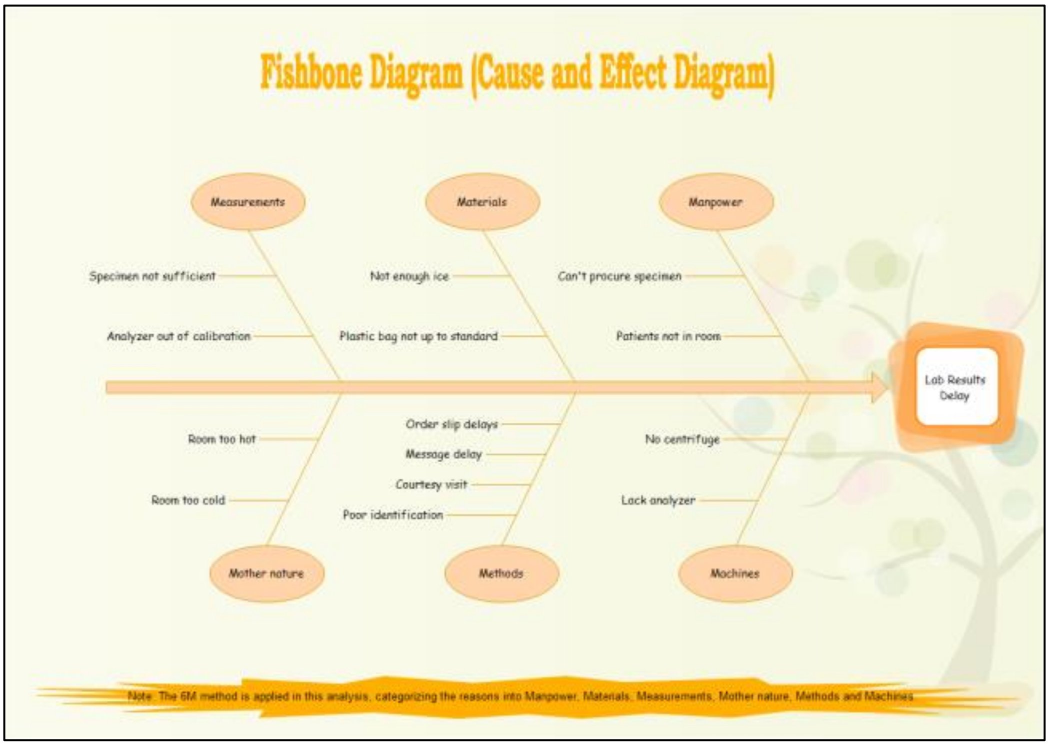


Figure 10: Fishbone Diagram applied to the problem “Lab Result Delay” (Edraw, n.d)

When deciding on which factors that can influence the problem, one common approach in manufacturing is the framework developed by Six Sigma, “6Ms”. Figure 11 is a graphical representation of Six Sigmas 6Ms. The “Ms” that often influence the manufacturing process are:

1. Man
   There are many different problems that relate to human factors. Often technical problems will have their root in human error, thus this factor is important to examine. Potential causes can include lack of training, miscommunications, and the general state of the personnel.
2. Machinery
   Potential causes for a problem that relates to machinery can be many. For example could excessive wear on machines be a cause of the problem. It could also be lack of lubrication or faulty components in the machines involved in the process.
3. Materials
   Maybe the materials that are used are not suitable for the process. This could relate the basic physical- or chemical properties of the materials used. It is also possible that the materials are well suited in theory, but the batch of raw materials currently in use are faulty.
4. Method
   The methodology or techniques applied in the process could affect the result. For instance could the execution or lack of precision cause problems.
5. Mother-nature
   Mother-nature in this sense relates to the environment in which the process takes place. The environment will influence the process in different ways, for instance could temperature or vibration cause issues with the end-result.
6. Measurement
   There are different factors relating to measurements that have to be examined. This can related to the way the method the measurements are collected or displayed. It can also relate to problems with calibration of measurement tools, or problems when converting between different units.

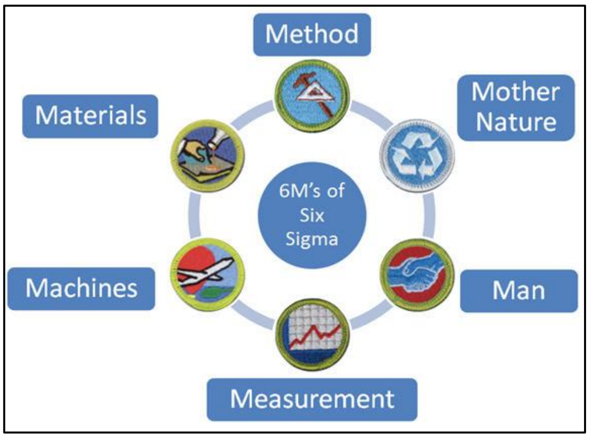


Figure 11: Six Sigmas 6Ms (Six-Sigma-Study-Guide, 2013b)

(Mind-Tools-Editorial-Team, n.d-c)
(MindToolsVideos, 2014a)
(Six-Sigma-Study-Guide, 2013a)

2.5.4 PDCA Cycle

The PDCA, also known as a Deming cycle is a model which uses four steps to support the implementation of a change. It is designed to be a framework for a continuous improvement process.

The way model relates to RCA is during the third step, “Check”. different tools are used to check and examine factors, and often RCA is one of the methods which is applied. The main reason for including the PDCA is that Kverneland Group utilizes it for their framework.

- The cycles begins with the “**Plan**” step. This step starts with formulating a plan for an action, defining what would be indicators of success and how the plan would be carried out. A goal needs to be formulated in order to have a standard to measure against.

- The next step is the “**Do**” step, where the plan is implemented.

- The next step is “**Check**” (or study) step.
  In this step the implementation done in the previous step will be examined.
  The outcome is checked with respect to degree of success, and can be useful in determining if there are areas that needs to be improved or if there are other flaws.

- The next step is “**Act**”. In this step all the insight gained from the previous steps are integrated to make room for potential changes that are needed in the process. This can include adjusting the goal, approaching the problem from other angles, or possibly reformulate the plan entirely.

Once the last step is completed, the cycle starts over again. This makes it an effective tool for creating a cycle of continuous improvement.
Figure 12 is a representation of the structure of a PDCA cycle.

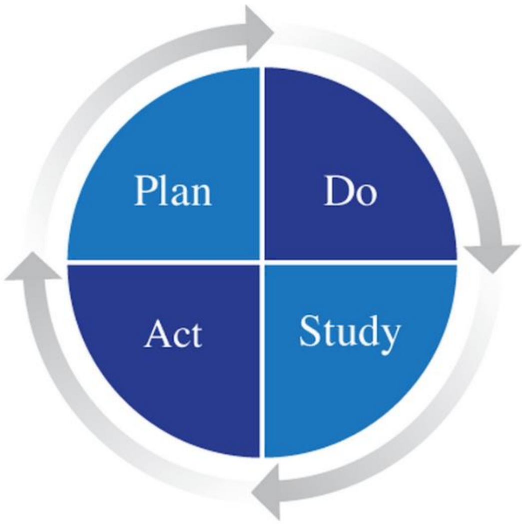


Figure 12: PDSA (PDCA)-cycle (The-W.Edwards-Deming-Institute, n.d-a)

(Mind-Tools-Editorial-Team, n.d-d)
(The-W.Edwards-Deming-Institute, n.d-b)
(DemingInstitute, 2012)

2.4.5 Fault Tree Analysis

Fault Tree Analysis or FTA is an analytical method that can be utilized to examine the causal factors leading to an undesired event. It is frequently used to determine system reliability, by using logic block diagrams top down with descriptions of basic events leading up to the top event.

The FTA is based on the construction of a Fault Tree Diagram (FTD). This diagram is constructed top-down with causal events which lead to the top-event downwards. The basic figures in the Fault Tree Diagram are events and gates. Events are considered a reached state, based on the conditions set by a gate. The method was developed by the Bell Telephone Laboratories in the 1960s to be used by the US Air Force with the Minuteman systems. Later these methods was adopted by other companies, including Boeing Company.

The example Fault Tree diagram below will be used to provide examples of events and gates. Events are square boxes, and in this example colored blue. This diagram does not contain other logic gates than the most common ones, which are "AND" and "OR".

- "AND" can be described as the event above the gate will only occur if all the events which are linked to the "AND"-gate occurs. For instance in the example will only "Car hits object" occur if both "Driver does not see object" and "Car fails to brake" occur.
- "OR" can be described as the event above the gate will occur if one- or all of the events which are linked to the "OR"-gate occurs. For instance "Car fails to brake" will occur if either or both of statements "Car going too fast" and "Brakes weak" are true.

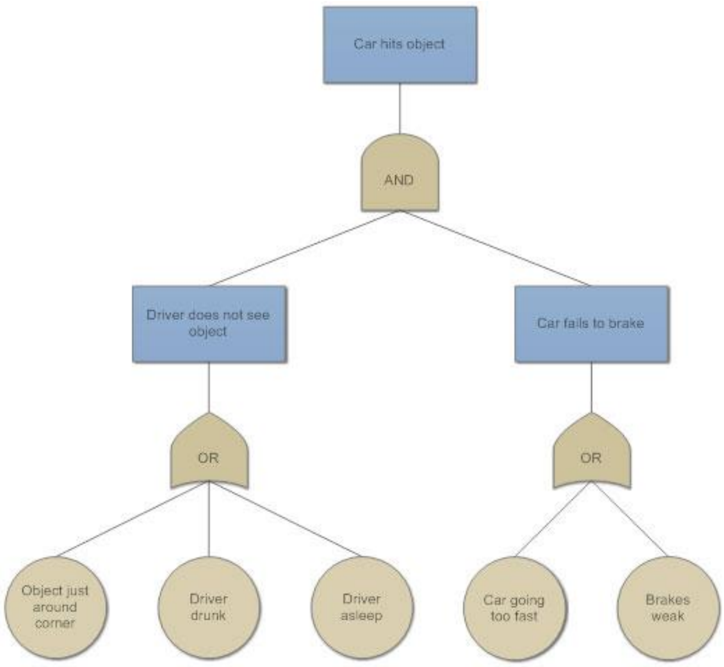


Figure 13: Fault Tree Diagram, "Car Hits Object" (Smartdraw, n.d-b)

The process of conducting a Fault Tree Analysis can be summarized in five steps:

1. Define what will be the undesired event. This will be considered the main fault, which is to be analyzed.
2. Determine what could instigate this fault. There could be a single reason, however often it is a combination of events which leads to a major fault. The relationship between the causal events can usually be described by simple logic gates like “OR” and “AND”.
3. Continue tracing back through the causal events until the basic causes are identified. It is not uncommon for technical issues to be rooted in human errors.
4. Based on the information gathered, construct a fault tree diagram. This diagram will make it easier to understand and examine the relationship between the different interactions.
5. Do an evaluation of the generated fault tree analysis.

There are many different components which can be used in a Fault Tree Diagram. The most basic and common ones are events with “OR”-gates and “AND”-gates. Below is a figure with description of the standard elements which are used in Fault Tree Analysis.

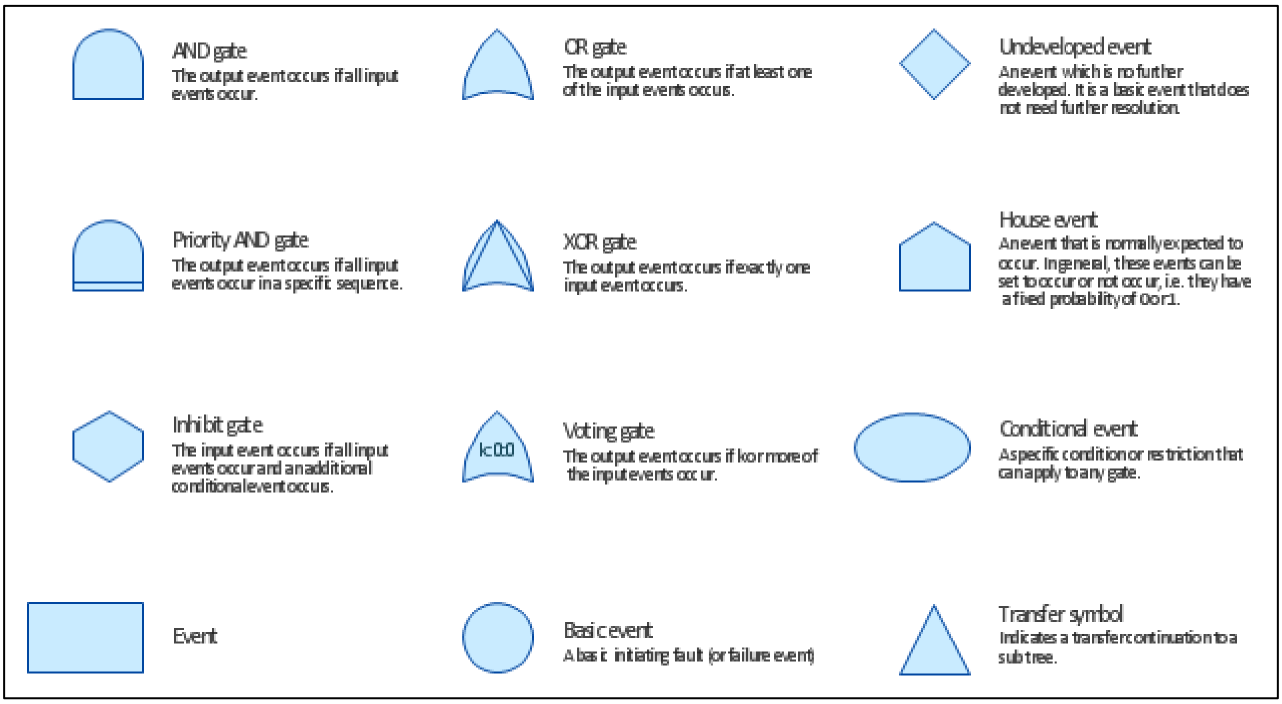


Figure 14: Elements in Fault Tree Diagrams (ConceptDraw, n.d)

(Pilot, 2002)
(Smartdraw, n.d-a)

2.5.5 FMECA

FMECA, or Failure Mode, Effects, and Critically Analysis is a method utilized in system design and reliability. The purpose of FMECA is to determine potential failure modes for a system, process, or product, do a risk assessment and rank the failure modes in terms of criticality. The failure modes which are deemed to bemost critical can then be discovered and corrective actions for the failure modes may be implemented.

FMECA was developed by the United States Military in 1949 under the title "Procedures for Performing a Failure Mode, Effects, and Criticality Analysis. It was formally further developed by NASA in the 1960s to improve and document reliability of hardware used in the space program.

The difference between FMEA and FMECA is that the latter include a Criticality Analysis. . The criticality is assessed based on the failure modes' likelihood of occurring, the severity of effect of failure, and the likelihood of being able to detect a failure before it becomes critical. A low score on Severity indicates that the failure it is not very severe. Low score on Occurrence would indicate that the event is not likely to occur. A low score on Detection would indicate that if the event occurs, it is very likely to be detected. Based on the values of severity, occurrence and detection, a Risk Priority Number (RPN) can be calculated. RPN is calculated this way: Occurrence x Severity x Detection = RPN.

Table 3 visualizes FMECA for a hypothetical event "Flat tire". The horizontal row of the table contains different steps of the FMECA sheet, as well as explanation for each step directly below. Before the solution is implemented the RPN is calculated to be 60. (Sev 10 x OCC 2 x Det 3= RPN 60).
After implementation of the solution to carry spare tire and tools for changing the tire, the RPN is updated to be 24. By implementing the solution the severity of the issue was reduced.

Table 3: FMECA example Flat Tire (Six-Sigma, n.d-b)

Function or Process Step	**Failure Type**	**Potential Impact**	**SEV**	**Potential Causes**	**OCC**	**Detection Mode**	**DET**	**RPN**
Briefly outline function, step or item being analyzed	Describe what has gone wrong	What is the impact on the key output variables or internal requirements?	How severe is the effect to the customer?	What causes the key input to go wrong?	How frequently is this likely to occur?	What are the existing controls that either prevent the failure from occurring or detect it should it occur?	How easy is it to detect?	Risk priority number
Tire function: support weight of car, traction, comfort	Flat tire	Stops car journey, driver and passengers stranded	10	Puncture	2	Tire checks before journey. While driving, steering pulls to one side, excess noise	3	60

Recommended Actions	**Responsibility**	**Target Date**	**Action Taken**	**SEV**	**OCC**	**DET**	**RPN**
What are the actions for reducing the occurrence of the cause or improving the detection?	Who is responsible for the recommended action?	What is the target date for the recommended action?	What were the actions implemented? Now recalculate the RPN to see if the action has reduced the risk.				
Carry spare tire and appropriate tools to change tire	Car owner	From immediate effect	Spare tire and appropriate tools permanently carried in trunk	4	2	3	24

(Weibull, 2004)
(ITEM-Software, n.d)
(Forrest, n.d)

3. Data Collection

This chapter will consist of the collection of information and data related to the Kverneland Group and their facilities. The first section will include the history of the Kverneland Group, about their products, and their mission and vision. Following that is a section will include an overview of their facilities and process flow at Klepp. The third section will consist of information about unit A275. This relates to what is produced, the sub-units of A275, and the processes that takes place. Lastly the current framework Kverneland Group utilizes when conducting Root Cause Analysis will be examined.

3.1. About Kverneland Group

Figure 15: Picture of Kverneland Group Klepp, internal Kverneland Group photo

Kverneland Group is a global supplier of agricultural machinery and services. The history of Kverneland AS stretches back to 1879 when the founder Ole Gabriel Kverneland constructed a forge to produce agricultural scythes. This forge was located in the village of Kvernaland in the proximity of Stavanger in Norway. Later the production expanded with the addition of small plows. Kverneland continued to be owned and managed for over a hundred years as a family business, until 1983 when the company was listed on the stock exchange.

Since the 90s, Kverneland Group has expanded significantly, acquiring many renowned producers of agricultural implementations. In May 2012 the Group hit a major milestone when the Japanese company Kubota Corporation acquired Kverneland Group and took full ownership.

The Group is developing, producing and distributing the machinery and services, and a constant emphasis on innovation and quality has allowed them to deliver a broad spectrum of high quality products. They are considered a reliable supplier, and their product consists of various products targeted towards the professional farming community. They are well-known for products within soil and seeding, foraging and bale equipment, spreading and spraying and technical solutions for tractors and other agricultural machinery.

On the Kverneland Groups webpage, they state that the Groups vision is
"Being a leading provider of intelligent and efficient farming systems contributing to sustainable agriculture, serving the world's growing population." (Kverneland-Group, n.d-e)

As for the mission, the Group states this on their website:
"Our Mission is to develop, market and support products, systems and services that are given superior value to customers throughout the whole value chain. Our products & innovations shall contribute positively to the contractors and farmers' development & long term success."
(Kverneland-Group, n.d-e)

Figure 16: Kverneland Group Logo (Kverneland-Group, n.d-d)

(Kverneland-Group, n.d-a)
(Kverneland-Group, n.d-e)
(Kverneland-Group, n.d-c)
(Kverneland-Group, n.d-b)

3.2. Production Process at Kverneland Group

Through conversations and tours of their facilities, Egil Brastad Hansen from Kverneland Group has explains the general processes and the flow in the facilities.

The production facilities at Kverneland Group Klepp are considered large facilities. Today the main facility consists of six connected production halls, and a separate building main assembly, painting and lacquering of the parts made in the six halls. The production halls are labeled A0 to A5 and the halls have been added and connected over the years to accommodate and make space for the processes and productions Kverneland wanted to include to their assortments. The general production processes in the facilities are to support the production of different agricultural equipment as well as spare parts for the products. This includes for instance conventionally-mounted and semi-mounted ploughs, spare topple trenchers, different minor attachments.

The layout of the halls is sorted by the general flow of the processes that take place:

- The first hall, A5 is the hall in which raw materials are received in the form of metal rolls, which are rolled out to sheet metal and cut to be used in the other facilities. This facility also serves as material stock.
- The second hall, A4 is the hall where forging and more cutting takes place. The materials are also hardened.
- The third hall, A3 is the hall where the materials are further forged, subjected to machining and also serves to stock material.
- The forth hall, A2 is the hall in which welding takes place.
- The fifth hall, A1 is where parts are painted. In this hall there is also sub-assembly of the minor parts as well as some machining.
- The sixth hall serves as stock for parts and semi-assembled parts
- In addition to hall A1-A5, a sixth hall serves as stock for stand-alone parts and parts which have been semi-assembled. An external hall serves as the main assembly. Here plows, and other complete products are assembled and prepared for shipping.

The finished products are placed on a lot before being loaded onto trailers and transported. Since the products are finished when reaching that lot, customers are also able to pick up the products themselves. For instance: farmers drive out in tractors themselves and pick up and attach the plow they purchase and drive back to their farm.

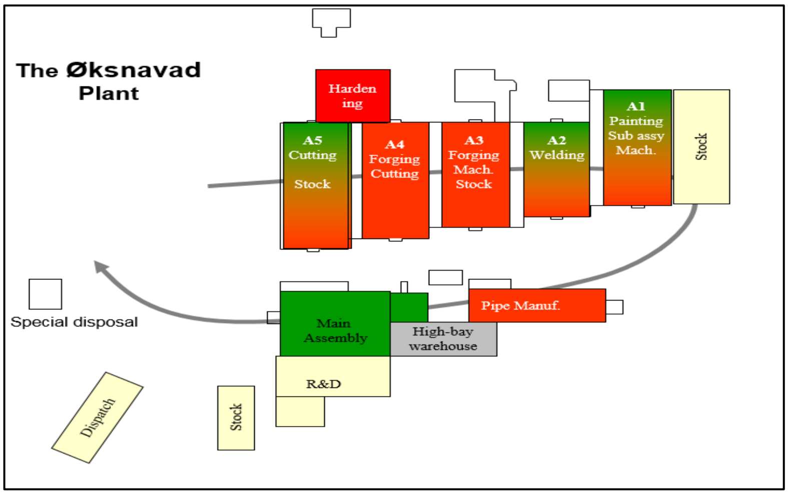


Figure 15: The Kverneland Group Klepp facilities' workflow, internal Kverneland Group figure

The figure of the workflow was provided by Kverneland Group from internal documents. Kverneland also provided a map with most prioritized units in their facilities.

Based on the information on the map, A4 is regarded as the hall containing the most prioritized units. The list provided by Kverneland has ranked the different units in the facilities based on value created and A4 contains seven out of the top ten.

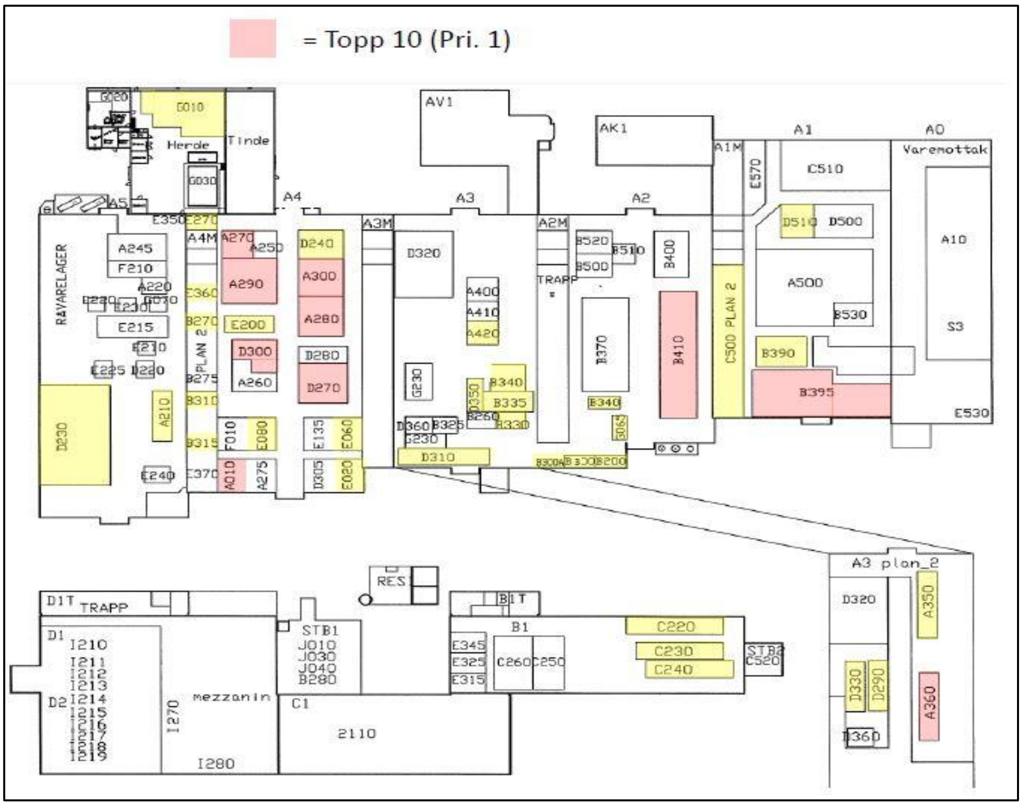


Figure 16: Top 10 processes at Kverneland Group Klepp, internal Kverneland Group figure

The general process which transforms the delivered raw materials to the finished products can be described by the figure below, starting with cutting and ending at main assembly. This is not to say that every piece of metal will be subjected to all of the different processes, as Kverneland Group manufactures many different products as well as spare parts. For instance could some parts not require paintings, and some parts may not require sub-assembly.

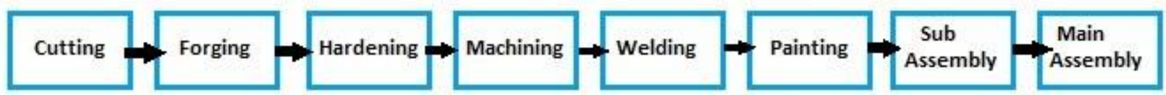


Figure 17: General process from raw material to product at Kverneland Group

A275, which is the unit that will be analyzed concerns the «Forging» part of the process described above. This unit will be covered on the next page.

3.3 About process unit A275

Unit A275 is located in hall A4. This unit was designed to produce a part known as a “knock-on holder”. Over time other similar parts are planned to be produced in this unit as well.

In Norway is it common for a holder to be worn-out within 1-2 years. However, in England these parts are often worn out within a few weeks due to the composition of the earth with its hard flint stones. The older version of this holder required farmers to remove 10-20 screws, take out the holder, apply a new holder, and then screw back the 10-20 screws. When this process as to be done almost weekly it amounts to much time just to replace the holder.

Figure 20: Photograph of unit A275

Instead of using a screw-based design, the new design involves the holder being wedged in place. Plows are only used when driving forward, thus the wedged holder is placed so that when the plows are used, the earth presses the wedged holder back so that it cannot wiggle free. To remove the holder, a force as to be applied the opposite direction. The new design allows farmers to save a lot of time during the switching-phase.

The following process takes place in A275 to produce the Knock-on-holder:

1. A275 receives parts of cut metal from A5, which is placed in a stock magazine.
2. A robot lifts and moves the part into the oven where it is heated.
3. In the oven the part is placed on a tray which rotates to make the part evenly heated.
4. Another robot then moves the part to a re-gripping station. This is done because the first grip the robot has is not compatible to the placement required from the next station.
5. The part is then moved by a robot to an arbor press, and placed in the first socket for pressing. The large arbor press is then applied.
6. A robot then moves the part from the first socket, and into the second socket of the arbor press. The large arbor press is applied again.
7. From there a robot moves and places the part in the Valdarno press. In this press the top of the part is shaped and holes are made. Indents are also added to the side of the part.
8. From the Valdarno press a robot moves the part to the hardening bath.
9. From the hardening bath the part is moved by a conveyor belt to be collected.

This unit will be analyzed in terms of problems and downtime further in the thesis, in chapter 4.1.

3.4 Current RCA framework at Kverneland

The current framework for conducting an improvement project in Kverneland Group consists of four pages. This is the basis in which the modified framework will be developed from. The front page serves as an overview and the place to put the data collected on the next pages. The second page is a template for a "Fishbone/Ishikawa"-diagram. The third page is a template for a grid with "5 Whys" diagram, and the forth page is a "Priority Matrix".

The current process of conducting an improvement project by using Root Cause Analysis will be explained on the next pages. The explanation for each page will not strictly follow page from page, but instead be explained by the order it takes in the process. The four-page document is also available in Appendix B.

3.4.1 Kverneland RCA Framework – Fishbone

This is in a sense the first part of the process in the framework used by Kverneland Group today. This page contains a fishbone/Ishikawa-diagram which will be used to find causes for a problem. The method of conducting this analysis is previously explained in the thesis under “Different methods to support RCA”. There are some slight variations from the more standard framework utilized in the “6Ms in Manufacturing”; Kverneland Group uses five of the six proposed “6Ms in Manufacturing”.

In this modified version the different bones stretching from the middle bone are “menneske” (man), “maskin” (machine), “miljø” (Mother Nature/Environmental), “materiale” (material), and “metode” (method). This modified Ishikawa diagram does not include the last proposed M which is “Measurement”.

The problem is inserted into the blue box, and different proposed causes of the problems are added to the fishbone in the different categories. Once there are sufficient causes are added to the fishbone, each cause is examined deeper in the “5Whys” framework on the next page.

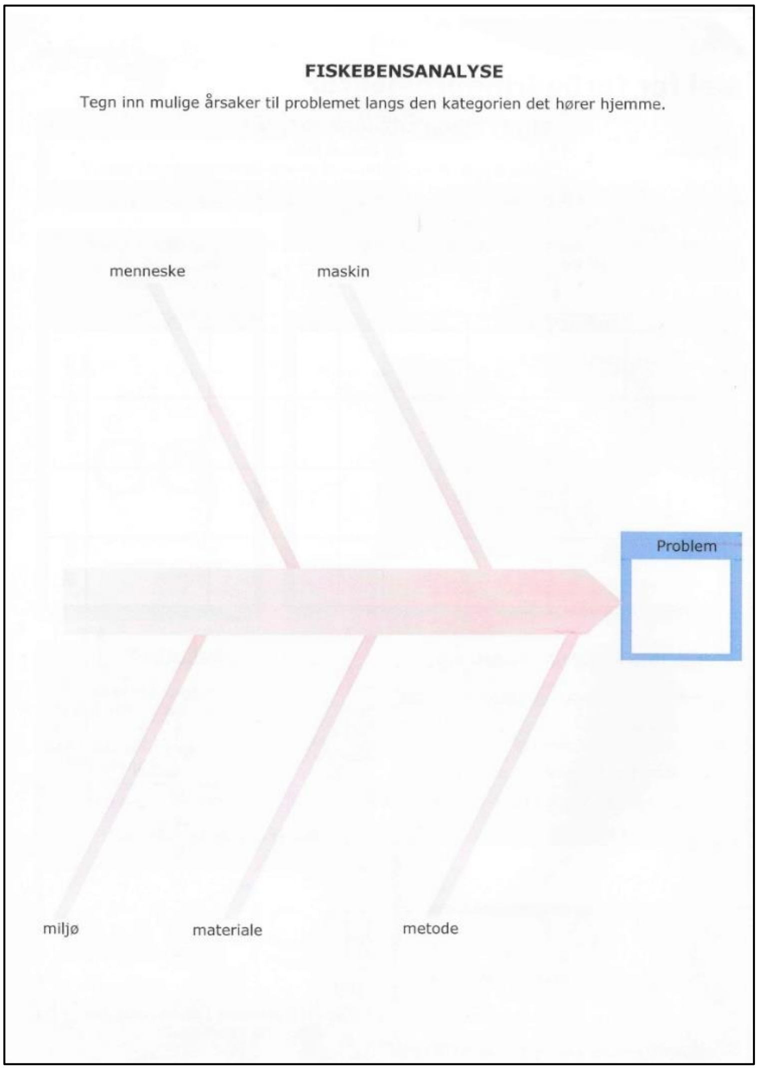


Figure 18: Fishbone analysis, from Kverneland framework page 2

3.4.2 Kverneland RCA Framework – 5 Whys

This page contains a template for conducting the “5 Whys” previously explained under “Different methods to support RCA”.

As a result from the utilization of the fishbone diagram, there should be some potential causes which will be deeper examined with the “5 Whys” method. Each cause is numerated under the label “**Nr**” and explained in the blank space under the label “**Årsak**”. From there each specific cause goes through the “5 Why” process horizontally under the label “**Hvorfor**” until a root cause can be determined.

Once a cause is explored deeply enough to be considered a root cause, a proposed specific solution to that root cause is added under the title “**Utbedringsforslag**”.

When root causes and a proposed solutions are generated, these will be subjected to the priority matrix on the next page.

5xHVORFOR

Metode for å gå dypere inn i årsakene til problemet å finne grunnårsaken.
Legg inn årsaker til problemet funnet fra fiskebensanalysen. Finn utbedringsforslag.

Nr	Årsak	Hvorfor	Hvorfor	Hvorfor	Hvorfor	Hvorfor	Utbedringsforslag

Fortsett tabellen på eget ark om nødvendig

Figure 19: 5 Whys analysis, from Kverneland framework page 3

3.4.3 Kverneland RCA Framework – Priority Matrix

In this page the proposed solutions generated from the "5Whys" are weighed based on expected effect and expected complexity. Solutions that are associated with high cost are assumed to have high complexity in this framework.

The vertical line represents the expected degree of the effectiveness of a proposed solution. The emphasis is on assumed degree of effectiveness since it inherits the potential bias that are associated with "5 Whys". The horizontal line represent the expected degree of complexity for a proposed solution. Solutions that are associated with high cost are assumed to have high complexity in this framework.

- A solution which is expected to have a high degree of effectiveness, but is complicated to implement would fall into the top left corner in the yellow area. A solution which ends there would have a medium degree of priority.
- A solution which is expected to have a low degree of effectiveness, but is easy to implement would fall into the bottom right corner in the yellow area. A solution which falls into this area would have a medium degree of priority.
- A solution which is expected to have a low degree of effectiveness, and is complicated to implement would fall into the bottom left corner in the red area. A solution which falls into this area would have a low priority.
- A solution which is expected to have high degree of effectiveness, and is easy to implement would fall into the top right corner in the green area. These are the kind of solutions which would be considered the most ideal and with a high degree of priority.

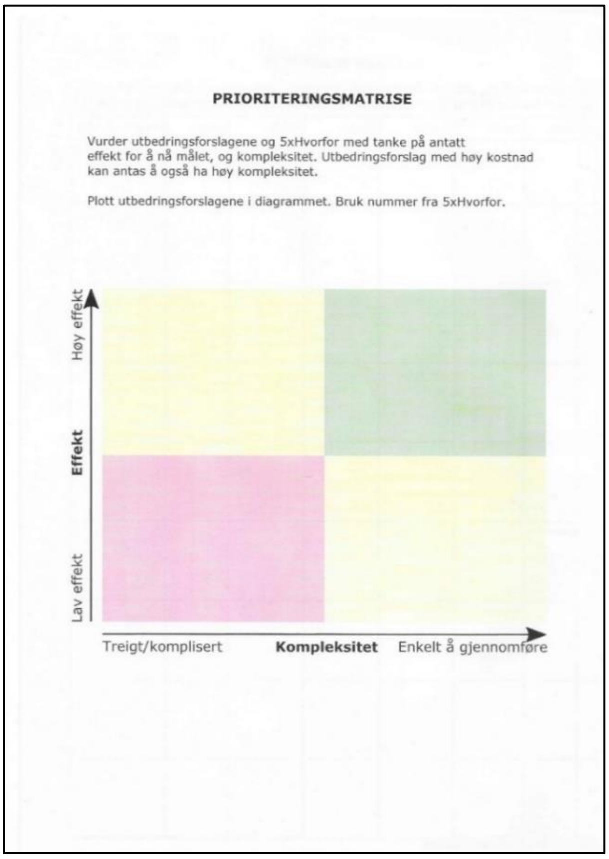


Figure 203: Priority Matrix, from Kverneland framework page 4

3.4.4 Kverneland RCA Framework – Plan – Do – Check - Act (PDCA)

This is the last part of the RCA framework. It is a modified version of Plan-Do-Check-Act cycle. On this page the Kverneland Group's modified version of this PDCA framework will be examined. This modified framework is designed to support the implementation of a solution based on information collected and analyzed on the previous pages.
Figure 22: Starting at the top of page, the problem is defined. A desired goal is added to the blank spaces labeled "Problem" and "Ønsket Mål", respectively. Further:

- <u>Plan</u>
  Root causes that are deemed to be of highest priority in relation to the priority matrix are added to the blue area "Plan". These were based on high effectiveness and low complexity. First the root cause is listed, with the next column proposal for improvement for each specific root cause is listed. The next column states who were responsible for this improvement process, with the two next columns stating the start date of this process and the deadline.

- <u>Do</u>
  Next is the green area labeled "Utføre Plan". Once there are data from the completion of the improvement, whether implementation is done is listed as well as the results of this.

- <u>Check</u>
  Next is the purple area labeled "Studere Resultat". Once the results are in, the framework inquires if the completion of the improvements were done completely to the plan. If the answer is no, the process and data collection restarts. If the answer is yes, the framework inquires what are the deviations from the expected goals are. These deviations are listed in the "CHECK" area. Further the framework questions if the measures have had the expected results. If no, the entire process starts again with the identification of root causes. If yes, the framework moves to the next part.

- <u>Act</u>
  The last part the yellow area labeled “Sikre Løsningen”. In this part the solution should be communicated to deter potential relapses. The checklist under “Act” is used to update the procedures for the unit based on the improvement process. The next is to create and hang up an “Ett punkts leksjon”. This is a simple description often accompanied with a picture and arrows explaining the basic procedures that take place in the unit. The “Ett Punks leksjon” is made in such a way that it is very easy to understand, even with limited language proficiency.

  The final pre-set of the check list is to make sure that the personnel is brought up-to-date with the solution. There is also three blank spaces in the checklist which can have customized statements which could be relevant for different units.

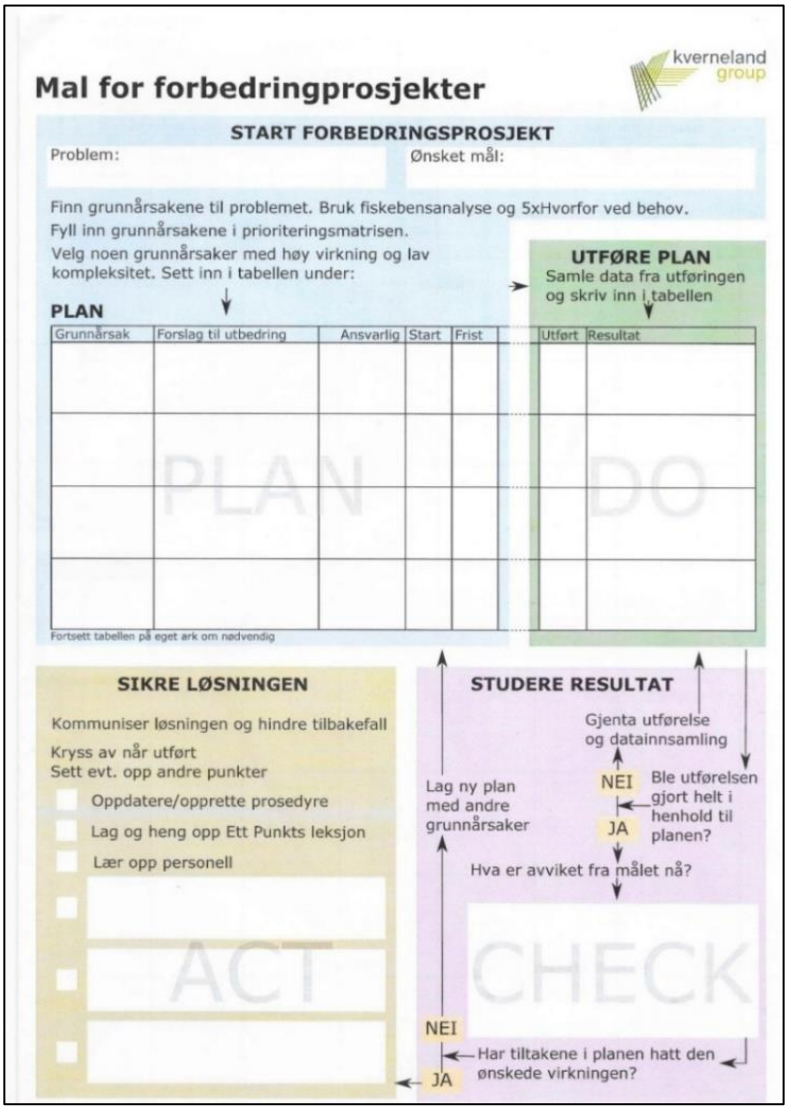


Figure 21: Modified PDCA Cycle, from Kverneland framework page 1

4. Analysis and Results

This chapter will consist of the analysis of unit A275 and the development of the new RCA framework to be used at Kverneland Groups facilities. The analysis of A275 is conducted through conversations with key-personnel at Kverneland Group, and data analysis from their databases. A solution to the Root Causes discovered in the analysis will be presented.

The RCA framework development will consist of five steps which will be presented in the section about the process of developing new RCA Framework. Further each briefly described step is completed. In the solution description, the developed framework will be presented. Lastly, under the section about the evaluation of the solution, an example RCA will be done with the developed framework.

4.1 Analysis of A275

An initial meeting with Egil Brastad Hansen at Kverneland Group revealed that there were many problems with processing unit A275. One of the prominent problems was that the design of the tool used in the arbor presses is too precise. This made slight variations of the size of the material cause trouble. Variations of only a few millimeters will result in faulty parts. In addition to problems with size variation, A275 also had problems related to its oven sub-unit. It was suggested that the database could be accessed for data related to corrective maintenance on A275.

<u>Database work</u>

The entries which were tagged as corrective maintenance was the entries of interest. This was because these entries related to problems that were not scheduled to be fixed or were a part of a plan. This is in contrast to the problems tagged with preventive maintenance.

All entries on corrective maintenance between January 2015 and April 2017 were accessed and exported to an Excel document. These raw data were then sorted by which sub-unit of A275 they related to. Once sorted by unit, the total estimated- and actual time spent on corrective maintenance was summarized. The summarized data was sorted by most-to-least hours spent on corrective maintenance in the relevant period.

The number of entries on each sub-unit was also noted. These entries can be considered a bit unreliable as some of the entries are not properly listed. They can however be used to notice trends. Based on the summarized data for each sub-unit of A275, the table on the next page was generated.

Table 4: Summarized data from database. Actual-, and Estimated hours + number of entries

	Actual Qty hours	Est. Qty hours	# entries
GASSOVN TYPE 4/2031 KYL.	577	637	85
SPINDELPRESSE HASENCLEVER FPR N 280 800t	218,50	216,00	51
EKSENTERPRESSE VALDARNO VPS 2P 30	209,00	207,00	51
ROBOT MOTOMAN DX100	80,45	80,5	28
ROBOT MOTOMAN ES165D	79	79	29
Smi Knock-on holder	64	64	11
MAGASIN SKALA	46,5	46,5	16
ROBOT MOTOMAN YASKAWA MH5	21,5	21,5	6
HYDR.AGGREGAT REXROTH	8,00	8,00	5
ROBOT MOTOMAN YR-SIA020D-A01	2,50	2,50	2

Three graphs were generated based on the data in the table, one for estimated hours spent on corrective maintenance, one for actual time spent on corrective maintenance, and one for the frequency of entries.

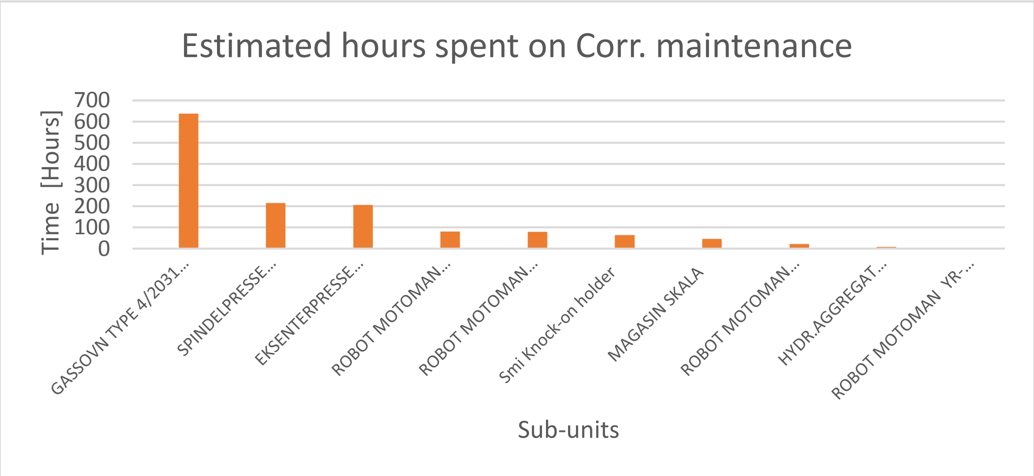


Figure 225: Estimated hours spent on Corrective Maintenance on sub-units, generated from Table 4

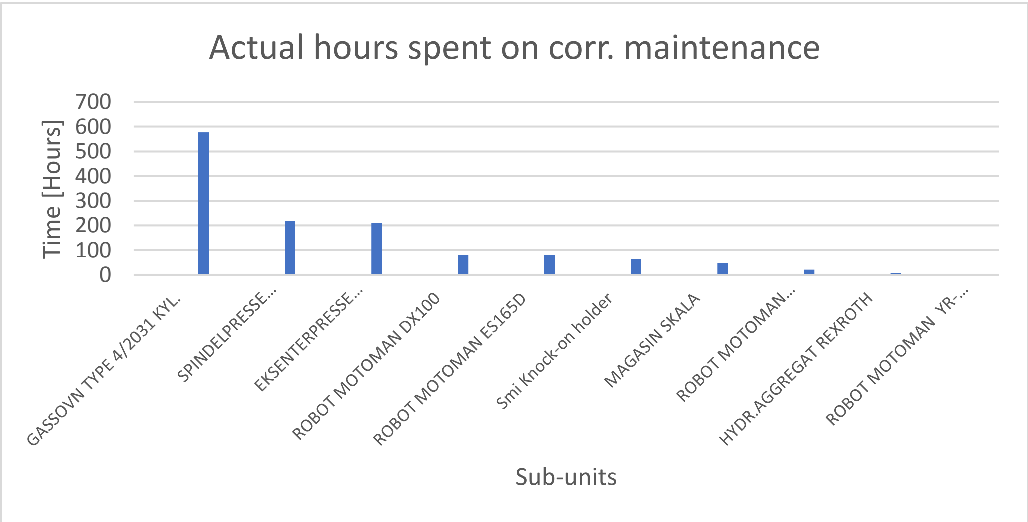


Figure 236: Actual hours spent on Corrective Maintenance on sub-units, generated from Table 4

When comparing the graphs in figure 25 and figure 26 a trend becomes apparent. Based on the data from the database, the oven is the sub-unit which causes the most downtime of A275. There is also a general consistency between the estimated- and actual time spend on corrective maintenance.

The largest variations in terms of hours can be observed on the oven. For the oven, estimated hours were 637, while the actual hours were 577. By dividing 577 by 637, the consistency between estimated- and actual hours can be discovered to be roughly 90%. It is wort noting that the actual time is lower than the estimated time. This means that the corrective maintenance on the oven is generally completed quicker than how long it initially was estimated to take.

The number of entries on each sub-unit was also noted. These entries can be considered a bit unreliable as some of the entries are not properly listed. This relates extra work orders being added to the database instead of expanding the previous one. The frequency can still be used to notice trends and supports the graphs on hours spent on corrective maintenance.

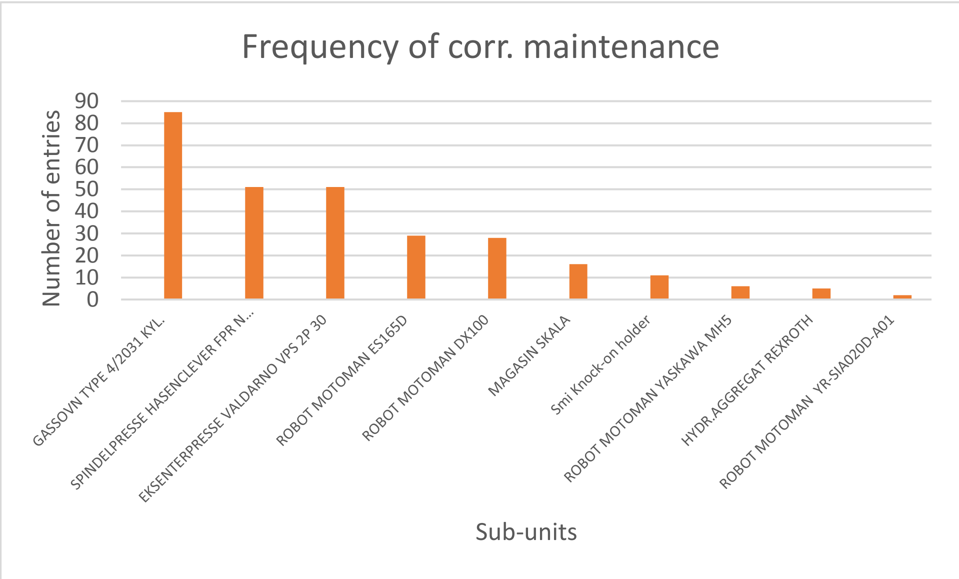


Figure 7: Frequency of Corrective Maintenance entries on sub-units, generated from Table 4

The most entries on A275 were regarding the oven. This was expected as it follows the pattern which is observable on the two other graphs relating to the time spent on corrective maintenance.

<u>Post-database work</u>

From conversations with Egil at Kverneland Group it was revealed that the oven is modified from an oil-based to a gas based design, which has its challenges. This related to the problems listed in the database. The rotation is currently based on pneumatics, over time Kverneland wishes to change the rotation to be a servo drive. A270 is a process unit which the servo drive is utilized. And Kverneland Group wishes over time for A275 to include many of the functions found in A270.

The main issues with the oven are related to the rotation of the plate and the heating. During operation the heating in the oven is applied on one side. The rotation of the plate makes the plate (and part) evenly heated. The problem occurs when the rotation stops and the heating is kept on. When the rotation stops, the plate is subjected to excessive heat only at one location. This causes deformation of the plate, making the circular shape warped to oval shape. The warped plate can then cause damages on the inside walls of the oven, as the plate is no longer shaped evenly.

This can be examined with the utilization of the 5 Whys:

Table 5: Simple 5 Whys diagram on A275

What is the problem	Unit A275 is experiencing a lot of downtime
Why is unit A275 experiencing a lot of downtime?	When sub-units of A275 is experiencing issues, A275 has to be brought down and will experience downtime. The sub-unit which causes the most downtime is the Oven
Why is the oven the cause of the most downtime?	The oven is experiencing downtime because the plate inside it which rotates the parts is often damaged.
Why is the plate inside the oven often damaged?	When the plate is rotating and the oven is on it functions as intended. However, if the rotation is stopped while the heating is on the plate it will be damaged.
Why is the heating on while the rotation is off?	There is no feedback/function between the rotation and the heating which checks if the rotation is on or not when the heating is on.

If personnel forgets to turn on, or check if the plate rotation is functioning before turning on the heat, the plate will be subjected to concentrated heat on one side.

If personnel forgets to turn off the heat when the machine is supposed to be stopped, the plate will also be subjected to concentrated heat on one side.

Either of these scenarios will cause the plate to be damaged. Thus a feedback system which checks the relationship between the status of rotation and the status of heating could be considered to be implemented.

The system could be designed with a detector that checks if the rotation stops while the heating is on. The detector would then shut down the oven if this were to occur. The shutdown of the oven should also trigger certain other events:

1. The sub-units before A275 should also be shut down the same time as the oven is shut down. This to avoid potential issues related to overflow from parts that become accumulated in the productions steps prior to heating.
2. The time for a part to move from the oven and until it is off the conveyor belt at the end of the process should be timed. If this time is known, a timer function could be connected between the sub-units after the oven. Parts that have completed this step of the process would then be finished, regardless of oven being brought offline.

These two points will be explained on the figure on the next page.

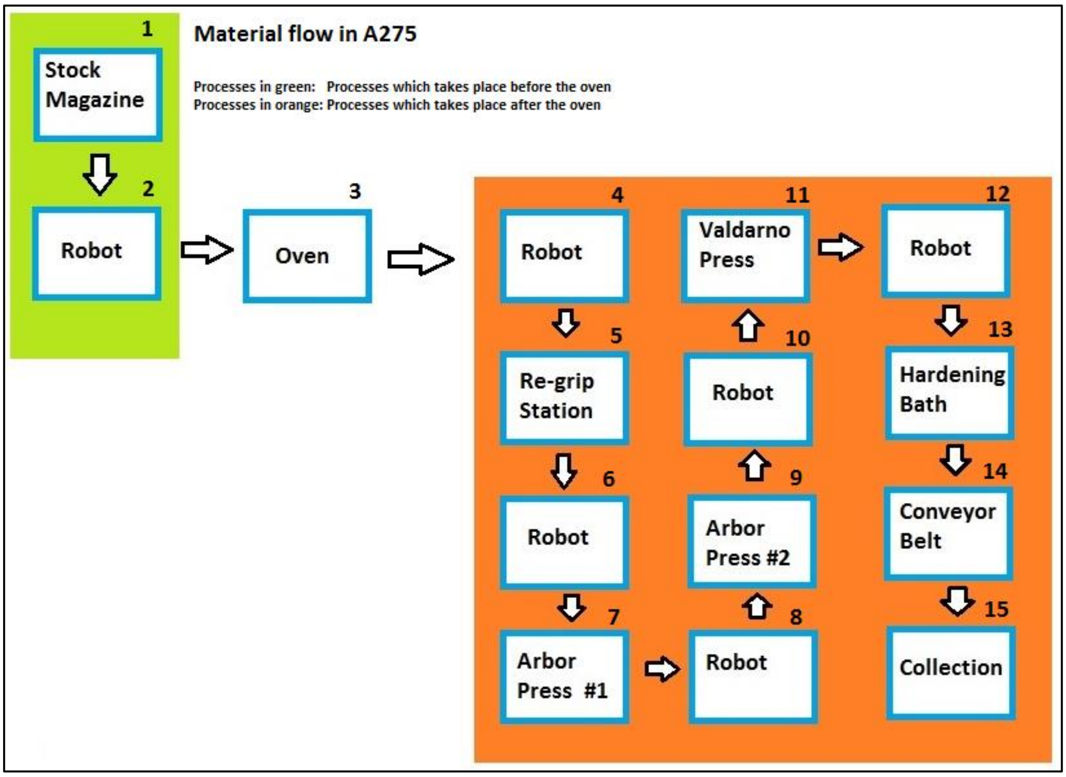


Figure 24: Flow of material in A275

The flow of the parts in A275 follows the arrows on the figure. If a problem is detected in the oven, the parts of the flow which are incased in green should be shut down at the same as the oven is. This will reduce problems related to the buildup of parts. For simplicity, this is the parts of the process labeled 1 and 2.

The part of the flow that is incased in orange needs to be timed. These are the processes label 4 to 15. This is the time it takes for a part to leave the oven before it reaches the collection stage. A safety buffer should also be determined. The timer which shuts down process 4 to 15 should be equal to the time it takes for part to move through that process + the safety buffer.

For instance if it takes 2 minutes to go through the process and a buffer of 1 min is chosen, this could be a scenario:

1. A problem is detected with the rotation/heating in the oven
2. The processes in the green box are immediately shut down.
3. The processes in the orange box are shut down after a timer of 3 minutes (2 min + 1 min).

This approach ensures that there will be minimal buildup of parts before the oven. The approach also ensures that the parts which are done with the oven will still be completed.

4 Additionally this solution could be reinforced by making guidelines which involve manually checking the status of the rotation of the plate when turning on the heat. These guidelines could also include an operation periodically checking the status of the rotation to ensure that there are no problems.

4.2 The process of developing new RCA framework

The approach to developing the new RCA framework will be based on experiences gained when conducting the analysis of A275, the theory reviewed, as well as inputs from the mentor from UiS and the mentor from Kverneland Group.

There will be 5 distinctive stages for the development process:

Stage 1: Problem definition

The first stage relates to the problem definition. This step includes what will be made, who it will be made for, and why it is made.

Stage 2: Determine requirements

The second stage relates to determining the requirements for the framework. These are in a sense what set of requirements should act as a frame and goal for the development process. The requirements are based on three points:

1. Inputs from Kverneland Group
2. Theory from other RCA practices
3. Personal opinions and ideas

Stage 3: Generate solutions

The third stage relates to generating solutions which will be used in the framework. The solutions has to fit the requirements set in the previous step. It includes reasoning for the methods chosen, the general frame, and what should be prioritized and included in the framework.

Stage 4: Solution description

The fourth stage relates to a description of the solution as well as the solution itself. In this stage, the ideas and methods used to generate solutions in stage 3 will be refined and formulated to create the actual developed RCA framework.

Stage 5: Evaluate solution

The fifth and last stage relates to the evaluation of the solution. This will be done by utilizing the developed RCA framework to conduct a brief RCA on unit A275. Personnel from Kverneland Group will be included in the process to ensure that the example will be precise and relatable to an actual event at their facilities.

4.3 Problem Definition

The problem can be defined as follows;

To develop a new Root Cause Analysis Framework to be used in the Kverneland Groups facilities.

To elaborate;

Kverneland Group is in need of a new Root Cause Analysis framework. It needs to be developed specifically with their facilities in focus. RCA is not a tool which is used often at Kverneland Group at the moment. It is more usual for Kverneland Group to use FMEA, however this is alone is not a very effective tool for fixing underlying root causes. The previous RCAs which Kverneland Group has conducted often takes more than 2 weeks to complete. This is considered by them to be too time consuming. Thus they would like a Root Cause Analysis framework which is quicker to use and has a more focus on user simplicity.

This framework should consist of different methods. These methods needs to be streamlined, in the sense that they follow a logical and structured process. The developed RCA framework should be complete enough to be used to conduct RCAs on different units in the Kverneland Group facilities. It should also be designed in such a way that it is possible to build further on it, if it is necessary to do this at a later time.

4.4 Determine Requirements

4.4.1 Kverneland Groups requirements

When designing a Root Cause Analysis framework, there are different aspects to consider. Since the framework is to be designed for usage by the Kverneland Group, it is important that their ideas and requirements are heard and respected.

The requirements from Kverneland Group / Egil Brastad Hansen:

1. Save time
   It is important for Kverneland that the Root Cause Analysis framework should be designed so that the processes of conducting an analysis is quicker relative to the current time Kverneland Group spends to conduct a RCA. The expected time to do a RCA in Kverneland currently is about 2 weeks. It is preferable that new framework will enable the process to take less than a week to be completed.

2. Interface
   Kverneland Group also wishes that the framework is a consistent, fixed setup. It should be designed systematically so that the structure of the framework has a flow to it.

3. User simplicity
   Kverneland Group wants the process to be simple and user friendly. This is important for them as it could allow personnel with limited experience with RCA to be able to use the framework. As stated by Egil Brastad Hansen during a meeting, they wish to be able to utilize RCA more than they currently do. By having a strong focus on user simplicity when designing the framework, ideally it would be more attractive for personnel with limited experience to use the framework.

4. Repeatability
   In addition to having a fixed setup, Kverneland wishes that there is a strong emphasis on repeatability in the framework. The framework should be designed in such a way that the similar results are obtained when the analysis is carried out by different personnel. It also relates to how the framework is suited to be used on different units.

5. Visual tools
   Kverneland Group also wishes for the framework to have a form for visual representation. This was important as it would allow for a structured way to gain insight in the process behind the problem from another angle. It was also important for the Group that the framework can be used as in presentations. This is important as data should be presented in order to justify systematic changes and solution implementations in the facilities.

4.4.2 Information to include in the framework

In order to determine what information would be relevant to include in the RCA template, reviews of the general RCA concepts has to be conducted. On the Smartsheet website, which includes a collection of different Root Cause Analysis Templates, it is stated that RCA templates typically includes the following information:

1. Event description
   This section includes a detailed description of the problem that will be examined.

2. Timeline
   This section includes descriptions of when different events occurred.

3. Investigative team
   This section includes the names of the participants in the team which conducted the RCA.

4. Root Causes
   This section includes what the team has discovered in terms of causes and root causes.

5. Corrective Actions
   This section includes the specific corrective actions that will act as solutions to the different root causes.

This statement seems to be backed up by the background theory reviewed earlier, as well as the specific example from ARMS Reliability's "Lost Production" example. The collection of RCA templates used by different organizations also includes the information in various forms.

Based on this, one can conclude that the RCA framework which is to be developed should include these practices as well.

(Smartsheet, n.d)

4.5 Generate solutions

In the RCA framework, there should be a simple problem definition. This should be located on the first page as it defined the problem which will be analyzed in the framework. Thus the problem definition should include at the top in a brief «What is the problem» box.
There should also be information on when the start of the RCA process begun, and when the process was done. This can be included on the front page, as it is a general part of documenting the RCA process. A box each for start- and end date should be sufficient.

In order to customize this problem definition, the facilities at Kverneland Group has to be in focus. Relevant information for defining the problem will relate to «Which hall» does the problem present itself in. This should also be specified «In which unit» the problem present itself.

The criticality of the problem should also addressed. This should be done by determining how critical the problem is to safety, to costs, and to the environment around and in the unit. The scoring will be that it either has a low or high impact. The lack of a "medium" option was a conscious choice; Kverneland Group said that if medium was included, personnel would almost always select that option. This way the personnel will have to make a brief assessment on the criticality.

As stated earlier, often «quick-fixes» are applied to the problem instead of doing RCA at Kverneland Group. By keeping this in mind, a box which describes temporary «quick-fix»-solutions should be present in the problem definition. The problem definition should also include when the problem last happened. There should also be a box to add the collective downtime registered in the unit. This can be acquired easily from an interface at Kverneland. It is important to add as it is this downtime registered that could warrant the need for conducting a RCA on the unit.

As presented in the section about information to include, the framework should include an Event Description. For the RCA framework this can be addressed by including a box with enough space to describe the event in detail.

In order to determine which methods should be included in the framework, a table will be used to compare how the different methods score in terms of the requirements set. The requirements to be used in this table are the ones that Kverneland Group requested in addition to their relevance to the RCA framework in terms of suitability. The score given to each method will have some degree on bias as it is based on the opinion of this thesis' author.

Table 6: Ranking different methods against requirements

Req\Method	5 Whys	Appreciation	C&E diagram	PDCA-cycle	FTA	FMECA
Save time	xx	xx	x			x
Interface	x		xx	x	xx	
User simplicity	xx	xx	xx		x	
Repeatability	x		xx		xx	xx
Visual Tools	x	x	xx	x		x
Relevance	xx		xx		xx	x
Sum	9	5	11	2	7	5

Based on the table, the three methods which scored the highest are «Cause and Effect»-diagram, «5 Whys» and «Fault Tree Analysis».

However, as one of the most important aspects about the framework from Kverneland Groups' view is to save time when using the framework, FTA may not prove suitable. This is because relative to the other high-scoring methods, FTA takes much time to complete.

Based on this, some of the specific methods to include in the framework will be «5 Whys» and «Cause and Effect»-diagram. These methods can prove particularly relevant due to them appearing in other frameworks at Kverneland Group, thus they are familiar with the methodology behind the techniques. Both of the methods appear specifically in the framework used for improvement projects.

In order to customize the methods to be more useful for an analysis at Kverneland Group, some modifications of the «Cause and Effect»-diagram should be done.

Below is an example of a common «Cause and Effect»-diagram.

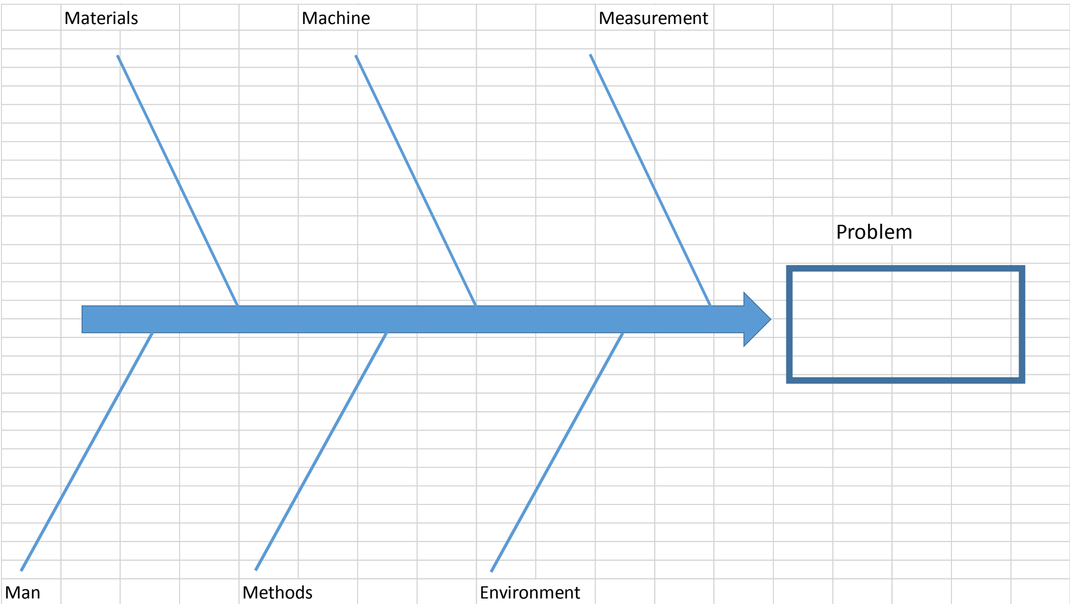


Figure 29: Common «Cause and Effect»-diagram with 6Ms

Kverneland Group needed methods which were more streamlined with units, sub-units and systems. A distinction between these three terms needs to be made:

- Unit: A system where a part undergoes different processes. An example would be A275.
- Sub-unit: A unit which is part of the processes done in a unit. An example could be an oven
- System: An important function within a sub-unit. An example could be a burner.

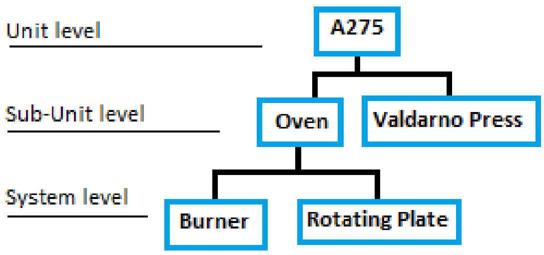


Figure 30: Relationship between "Unit", "Sub-unit", and "System"

To better suit the facilities at Kverneland Group, different modifications will be made. Since the purpose of the RCA framework is to be effectively utilized in the facilities, the diagram should reflect this.

Thus the diagrams «Problem» box will be modified to be «Sub-unit». Another modification will be to change the category of the branches on the fishbone. While the 6Ms can be useful, there is a better solution which suits the requirements from Kverneland Group when it comes to the framework. To reflect the nature of the unit composition, the categories on the branches in the figure above will be replaced with relevant «systems» for the sub-unit. The horizontal branches under each «system» will be causes related to the respective «system» that can influence the «Sub-unit».

These alterations makes the «Cause and Effect»-diagram more relatable to the real situations, and should give a structured overview over the causal factors between the systems and the sub-unit chosen.

This is the modified version of the «Cause and Effect»-diagram, which is more suited to be used at the Kverneland Facilities. It takes into account the setup with units, sub-units, and systems.

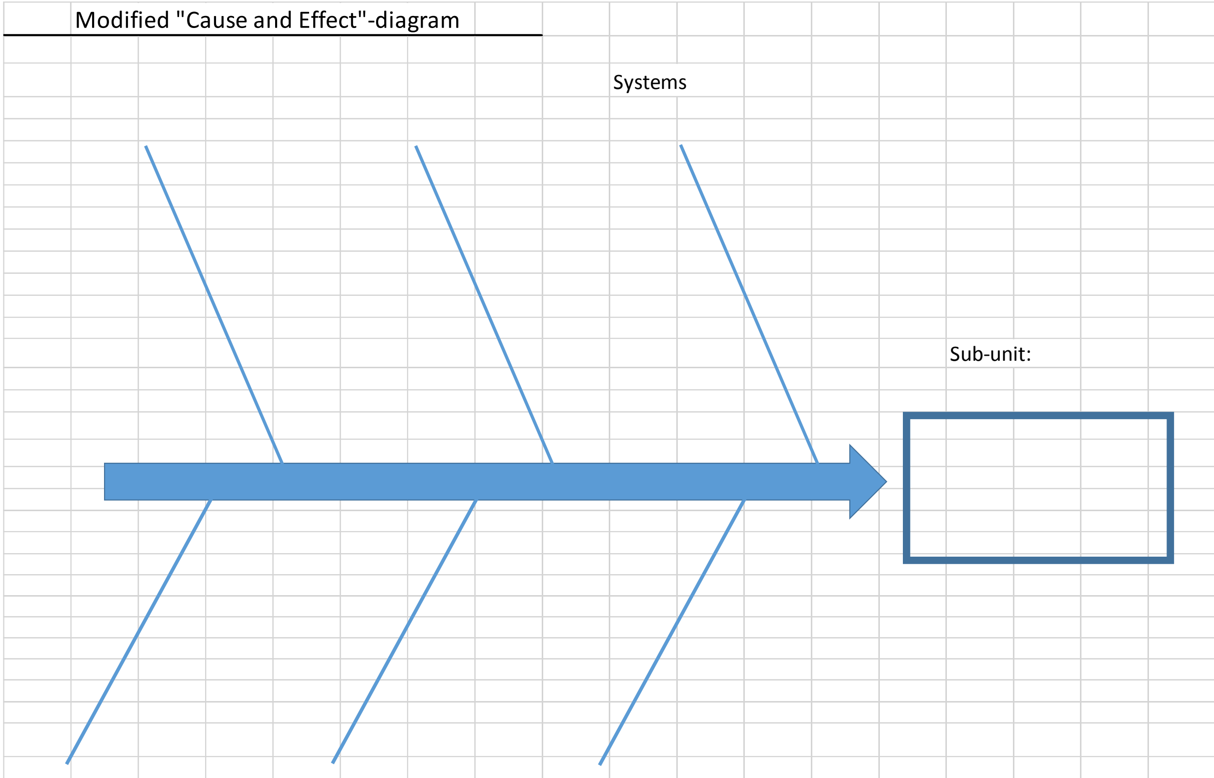


Figure 251: Modified version of «Cause and Effect»-diagram

The general framework of «5 Whys» is suitable to be included with minimal alterations. It should include a box for the problem at the top, a table which the «why»-process is done, checkboxes for whether the answers to the «Whys» are root causes, and a box for a brief elaboration on the root cause found.

Since numerous causes are ideally discovered with the «Cause and Effect»-diagram, multiple templates for conducting «5 Whys» should be included. Four templates can be the default, with two templates per page. More can be added easily by copying the page which only includes the template. Since multiple causes are likely analyzed, there should be a box which identifies the cause-number for each template.

A table for listing the members of the team which is conducting the analysis should also be included. Relevant information to include in this table should be the names of the team members, their position at Kverneland Group, and their work email. Their position is important to include not only for completion, but also because personnel review the RCA framework. By including team members' respective status, people for instance easily identify who the operator was. The work email is included as it can be useful to have a direct way of contacting members of the team if there are any questions related to the RCA conducted.

There should also be a table which presents the solutions to the root causes found with the utilization of the «5Whys». To compliment the «5Whys», the table should include the root cause as well as the identification number it is given. There should also be a specific solution related to each root cause. It is also important to document who is responsible for the implementation of specific solutions. If there are questions relating to a solution, or if there is confusion about who is doing what, this table can be used to point to the person of interest. There should also be a place to add when the solution implementation starts, and when the solutions is due, as well as a separate field to elaborate on the solutions.

The potential consequences of a solution should also be explored. This is because sub-units at Kverneland Group often have interactions among themselves which can potentially be affected by the solution. If for instance a robot is set to place a part in an oven at a specific height, a solution which impacts the height of the oven-entrance will cause troubles for the robot if not addressed. Thus it is important to determine how a solution changes interactions in the unit.

A report summary should also be included. This should address what has been done, how it was done, and potential difficulties. It also gives room to elaborate on root causes, solutions and the consequences of the solution implementation. In the summary it should also be included what has been learned during the root cause analysis process. A page can be enough for this. If there is need for more room to write on, copies of the report summary can be inserted.

References should also be included at the back of the report. This approach makes it more time efficient than having to find and access data which has been used after the RCA is concluded.

Instructions about how to conduct the RCA at the facilities of Kverneland Group should also be included. This will a list of precise instructions which covers the entire RCA process. These instructions will also address the specific way of gathering data using the database at Kverneland Group. The approach will be a more structured version of the approach used to gather the data on A275 in the 4.1 «Analysis of A275» chapter of this thesis.

4.6 Solution Description

A brief version of the instructions on how to conduct a Root Cause Analysis at Kverneland Group will be explained below. A more detailed instruction will be included at the end of the RCA framework.

1. Access the system, and find a unit which experiences excessive amounts of downtime. Select the most relevant unit, which will be subjected to the RCA.

2. Form a team. The team should be included in all following steps to make the analysis more effective.

3. Gather data on the unit with the utilization of the database at Kverneland. Using the data, create summarized data and graphs to determine which sub-unit in the unit causes the most downtime.

4. Fill in "Problem Definition and "Event Description" on the first page.
5. Add in sub-unit on the modified "Cause and Effect"-diagram in the RCA framework. Add the systems in sub-unit on the branches of the fishbone.

   Under the system branches, add in the different causes in the systems which can influence the sub-unit. Select causes from the system that the team decide is most likely ones.

6. Add the causes to the "5 Whys" template. Examine them using the framework, and decide which one can be considered Root Causes. Check that the Root Causes discovered makes sense with the data collected.
   - If they don't, consider going back to the "Cause and Effect"-diagram and select other causes. Repeat step 6 again.

7. Find solutions to the Root Cause discovered. Add these to the "Solution"-table as well as the respective Root Causes. Fill out the rest of the table.

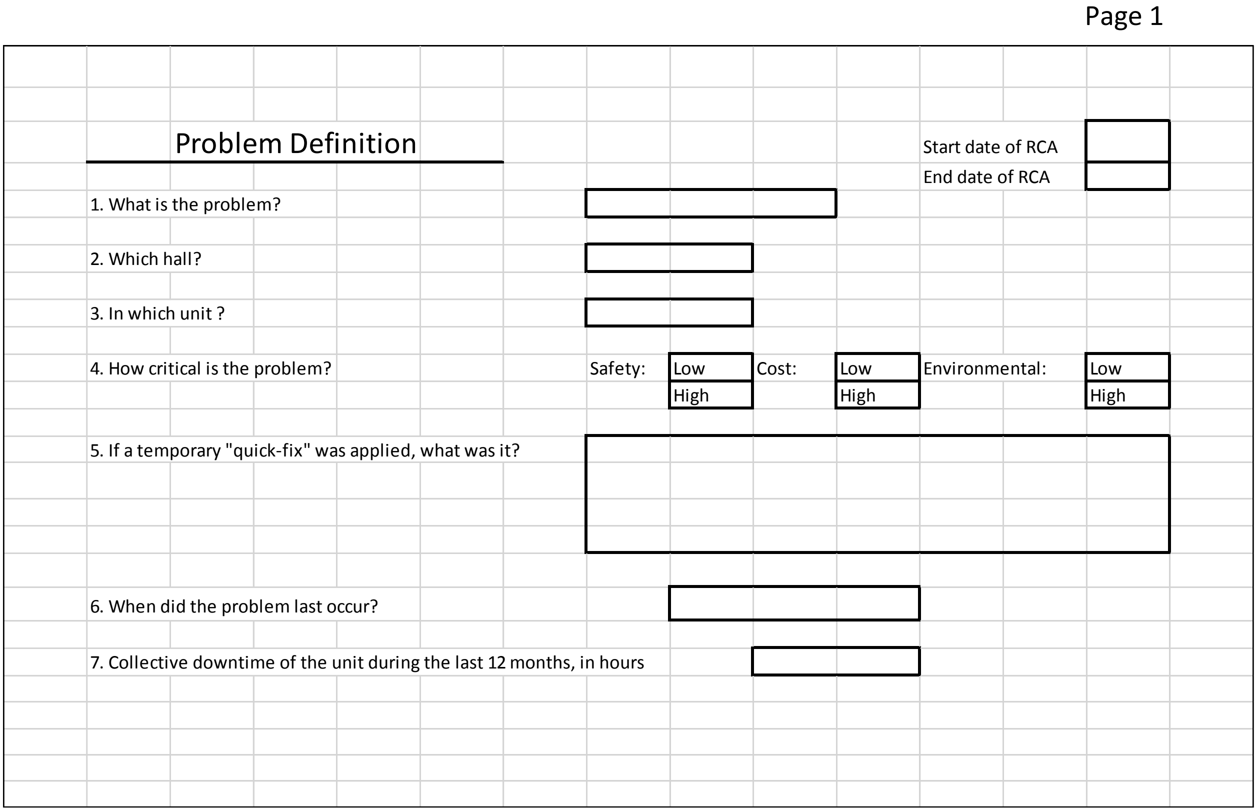
8. Fill out the "Elaboration of Solutions" by going more in detail about the proposed solution and their respective consequence of implementation.

9. Fill in a report summary of the process.

10. Add references that has been used during the process. Include the data collected in step 3. Include any other relevant references like machine drawings, etc.

What follows on the next pages is the developed Root Cause Analysis framework. Page numbers are included in the top right corner for clarity on the order they appear in RCA framework.
As previously stated, the last page will include detailed instructions on how to conduct the RCA.

RCA Framework Kverneland Group


Page 1

Problem Definition

Start date of RCA

End date of RCA

1. What is the problem?

2. Which hall?

3. In which unit ?

4. How critical is the problem? Safety: Low High Cost: Low High Environmental: Low High

5. If a temporary "quick-fix" was applied, what was it?

6. When did the problem last occur?

7. Collective downtime of the unit during the last 12 months, in hours

Figure 262: Problem definition - RCA Framework

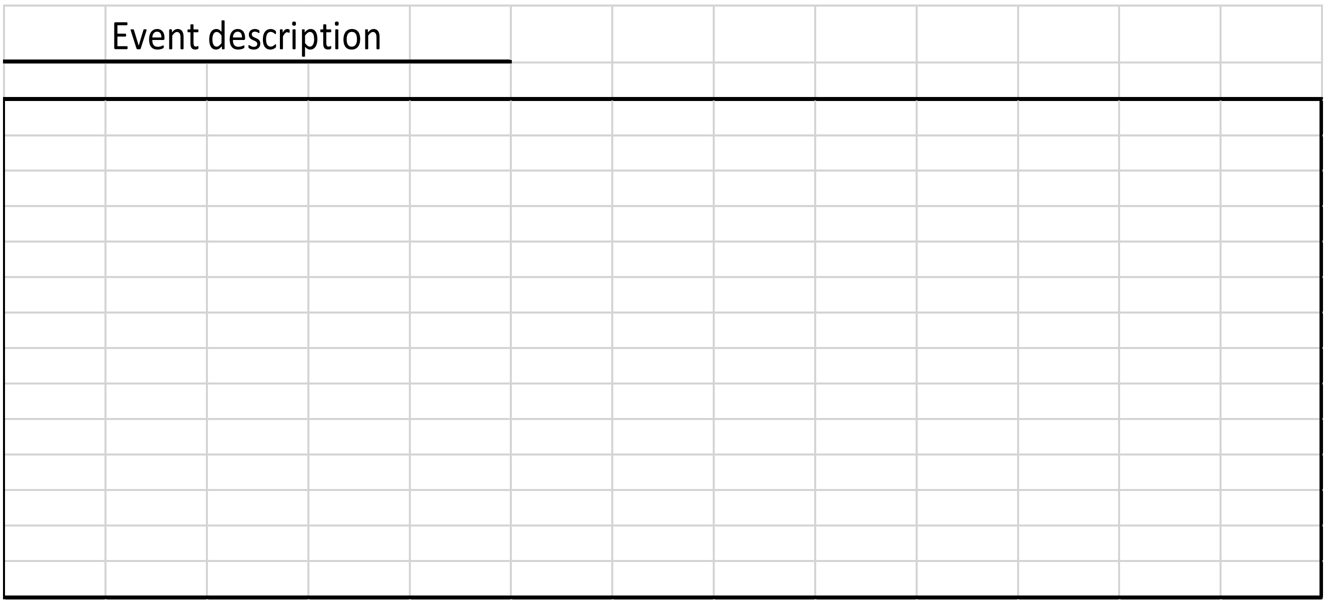

Event description

Figure 33: Event description - RCA Framework

Modified “Cause and Effect”-diagram

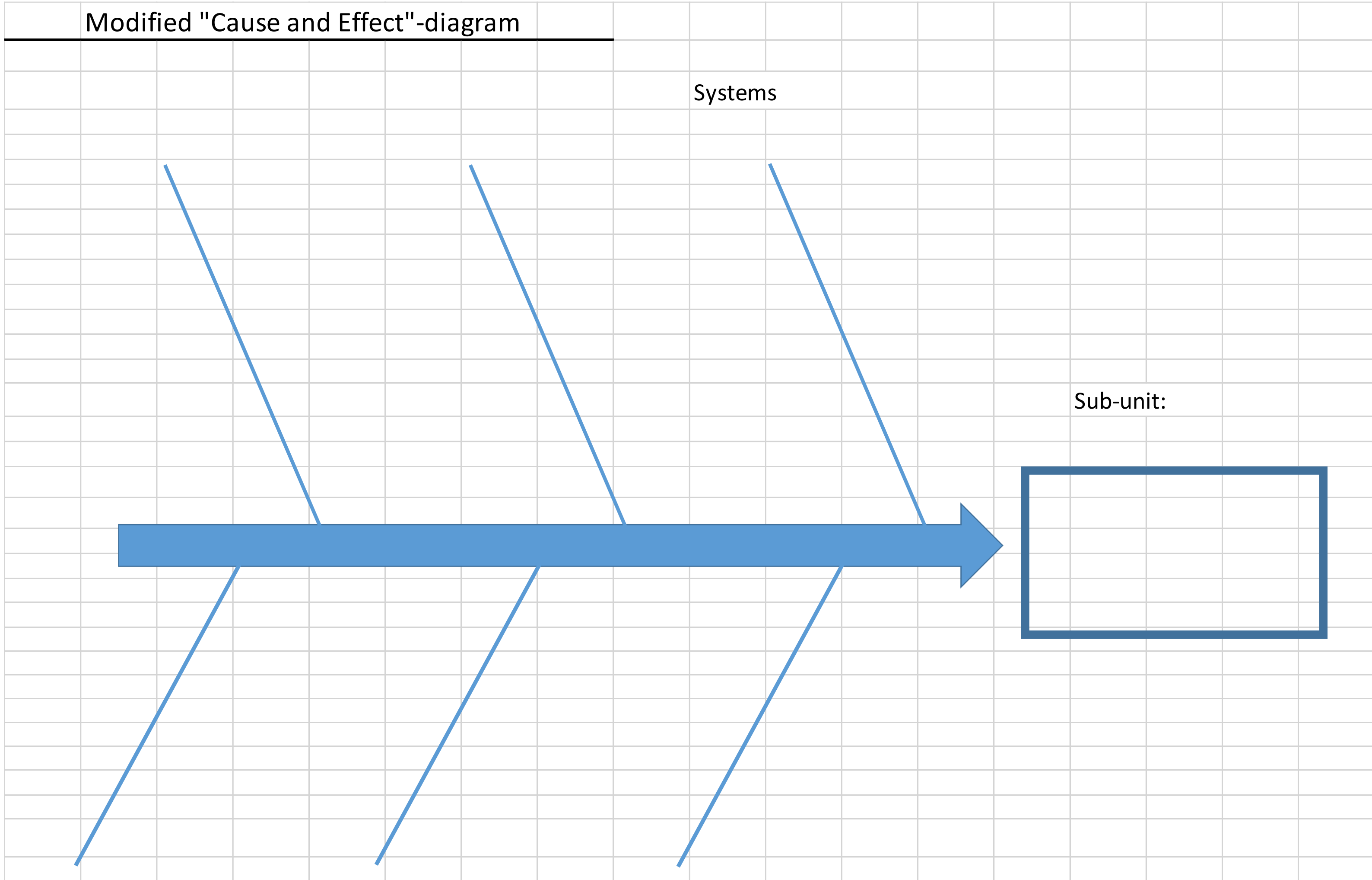


Figure 274: Modified “Cause and Effect”-diagram - RCA Framework

5 Whys template

Cause / Problem:			Cause number	
			Root Cause?	
1	Why?		No	Yes
2	Why?		No	Yes
3	Why?		No	Yes
4	Why?		No	Yes
5	Why?		No	Yes
Root Cause:				

Figure 28: 5 Whys template - RCA Framework

Cause / Problem:			Cause number	
			Root Cause?	
1	Why?		No	Yes
2	Why?		No	Yes
3	Why?		No	Yes
4	Why?		No	Yes
5	Why?		No	Yes
Root Cause:				

Cause / Problem:			Cause number	
			Root Cause?	
1	Why?		No	Yes
2	Why?		No	Yes
3	Why?		No	Yes
4	Why?		No	Yes
5	Why?		No	Yes
Root Cause:				

Cause / Problem:			Cause number	
			Root Cause?	
1	Why?		No	Yes
2	Why?		No	Yes
3	Why?		No	Yes
4	Why?		No	Yes
5	Why?		No	Yes
Root Cause:				

Team members

Page 4

Name	Position	Work Email

Figure 296: Team Members - RCA Framework

Solutions

Root Cause Number	Root Cause	Solution	Who is Responsible	Start Date	Due Date	Potential Consequences of Solution
1						
2						
3						
4						
5						
6						

Figure 30: Solutions - RCA Framework

Page 5

Elaboration of Solutions

Figure 31: Elaboration of Solutions - RCA Framework

Page 6

Report Summary

Figure 39: Report Summary - RCA Framework

Instructions to conduct Root Cause Analysis at Kverneland Group facilities

1. Access the system, and check the KPi measurements for units in the halls. Find a unit which is categorized as a unit which have been experiencing excessive amounts of downtime. Check the logged downtime for that unit over the last 12 months. Make a note of this number, as it will be added to the "Problem Definition".

2. Form a team.
   - RCA is more effective as a team effort. Explain to the team that the purpose of the analysis is to focus on the issue, and that everyone should contribute to the process.
   - Include people with different specializations to get different views.
   - Include operator of the unit, the operator is most familiar with the unit.
   - Add the info to the "Team Member"-section.

3. Gather Data
   - Check the database for corrective maintenance on the specified unit.
   - Export the raw data to Excel sheet.
   - Sort the raw data by the sub-units the data relates to.
   - Sum "Actual time spent on corr. maintenance" for each sub-unit to get the respective total downtime for each sub-unit. Put this in a second page in the Excel sheet.
   - Sort total "Actual time spent on corr. maintenance" so that the sub-unit which has the highest sum of time is on the top, descending downwards to sub-unit with the lowest sum.
   - Sum the number entries for each sub-unit to get the respective frequency of entries for each sub-unit. Put this in the second page of the Excel sheet.
   - Sort the frequency of entries, so that the sub-unit which has the highest sum is on the top, descending downwards to the sub-unit with the lowest sum.
   - Create graphs over the sums of "Actual time spent on corr. maintenance" and frequency on the second page of the Excel Sheet.
   - Usually select the sub-unit which causes the most downtime.
   - Examine the common issues related to the sub-unit, based descriptions in the database. Consult with the operator of the unit and the rest of the team.
   - Once the issues are verified, add the data collected as a reference to the RCA at the end. This includes the sorted raw data, the summed data, and the graphs created.

4. Fill in the "Problem Definition" and "Event Description" on the first page.

5. Fill in sub-unit on the modified “Cause and Effect”-diagram in the RCA framework.
    - Brainstorm with the team and find the systems on the branches that can influence the sub-unit in the box.
    - Discuss among the team what problems/causes in the systems can influence the sub-unit. Add these as vertical branches from system branches which they belong. There should be an emphasis on letting everyone voice their ideas and opinions.
    - Focus on generating many solutions, as many ideas are better than few.
    - Select the causes from the systems which the team has decided is the most likely ones.

6. Fill in most relevant causes in the “5 Whys” template.
    - Drill down these causes with the method of “5 whys” to determine what the actual root causes are.
    - Verify that the proposed root causes makes sense with the data collected.
    - If the root causes does not make sense with the data, consider going back to the “Cause and Effect”-diagram and select another cause. Repeat step 6 again.

7. Find solutions to the root causes discovered.
    - The solutions should be specific, and assign different team member who will be responsible for the implementation of the different solutions.
    - Discuss among the team what specific consequences could follow the implementation of the different solutions. This can relate to how different systems interact.
    - Set a start date to implement the solution, and a due data for expected completion.
    - Fill in a briefly in the “Solution”-table in the RCA framework.
    - Fill a more detailed description in the “Elaboration of Solutions”-table.

8. Fill in a report summary of the process
    - This should include a description of what has been done, elaborations on solutions, their consequences, what has been learned during the RCA, etc.

9. Add references that has been used during this process
    - Include the data from the data collection
    - If used, include manuals, machine drawings, etc.

Some definitions:

- Unit: A system where a part undergoes different processes. An example would be A275.
- Sub-unit: A unit which is part of the processes done in a unit. An example could be an oven.
- System: An important function within a sub-unit. An example could be a burner.

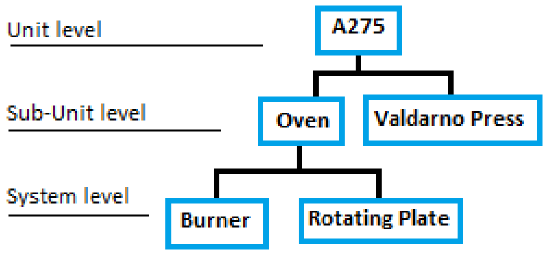


Figure 40: Relationship between "Unit", "Sub-unit", and "System"

4.7 Evaluate Solution

The solution evaluation will be an example of conducting a Root Cause Analysis using the developed framework on Kverneland Groups unit A275. The example RCA was conducted with direct inputs from Kverneland Group personnel to ensure the validity of the information added to the different steps of the framework as well as the proposed solutions.

Unit A275 is already analyzed in this thesis previously, therefore much of the data in the example will come from the analysis in chapter 4.1

This include:

- The «5 whys»-section will have the data from table 3 in chapter 4.1
- The solution-section will be based on information in chapter 4.1
- Data references will not be included, as they are already in chapter 4.1 and the raw data, formatted data and graphs are available in Appendix C and Appendix D.

Brief example of utilizing the RCA Framework on Unit A275

Problem Definition

		Start date of RCA	01.05.2017
		End date of RCA	09.05.2017
1. What is the problem?	Unit is experiencing downtime		
2. Which hall?	A4		
3. In which unit ?	A275		
4. How critical is the problem?	Safety: Low X / High	Cost: Low / High X	Environmental: Low X / High
5. If a temporary "quick-fix" was applied, what was it?	None. Unit was shutdown pending analysis and solution implementation.		
6. When did the problem last occur?	10.05.2017		
7. Collective downtime of the unit during the last 12 months, in hours	250		

Figure 32: ex. Problem Definition - RCA Framework

Event description

During the quality checking of the parts produced in the A275 units, the operator [name] discovered that many of the recently produced parts were deformed.

After a quick preliminary examination by the operator, the calibration of the presses seems to be alright and the presses seem to function as intended.

After a swift examination of the oven, the plate which rotates the parts during heating seem to be deformed, and the stones which coat the insidewalls of the oven is damaged.

The operator recognizes that this problem has occured before, and previously tried to remedy the situation by replacing the plate in the oven. The underlying cause needs to be adressed, to prevent further recurrence.

Figure 33: ex. Event Description - RCA Framework

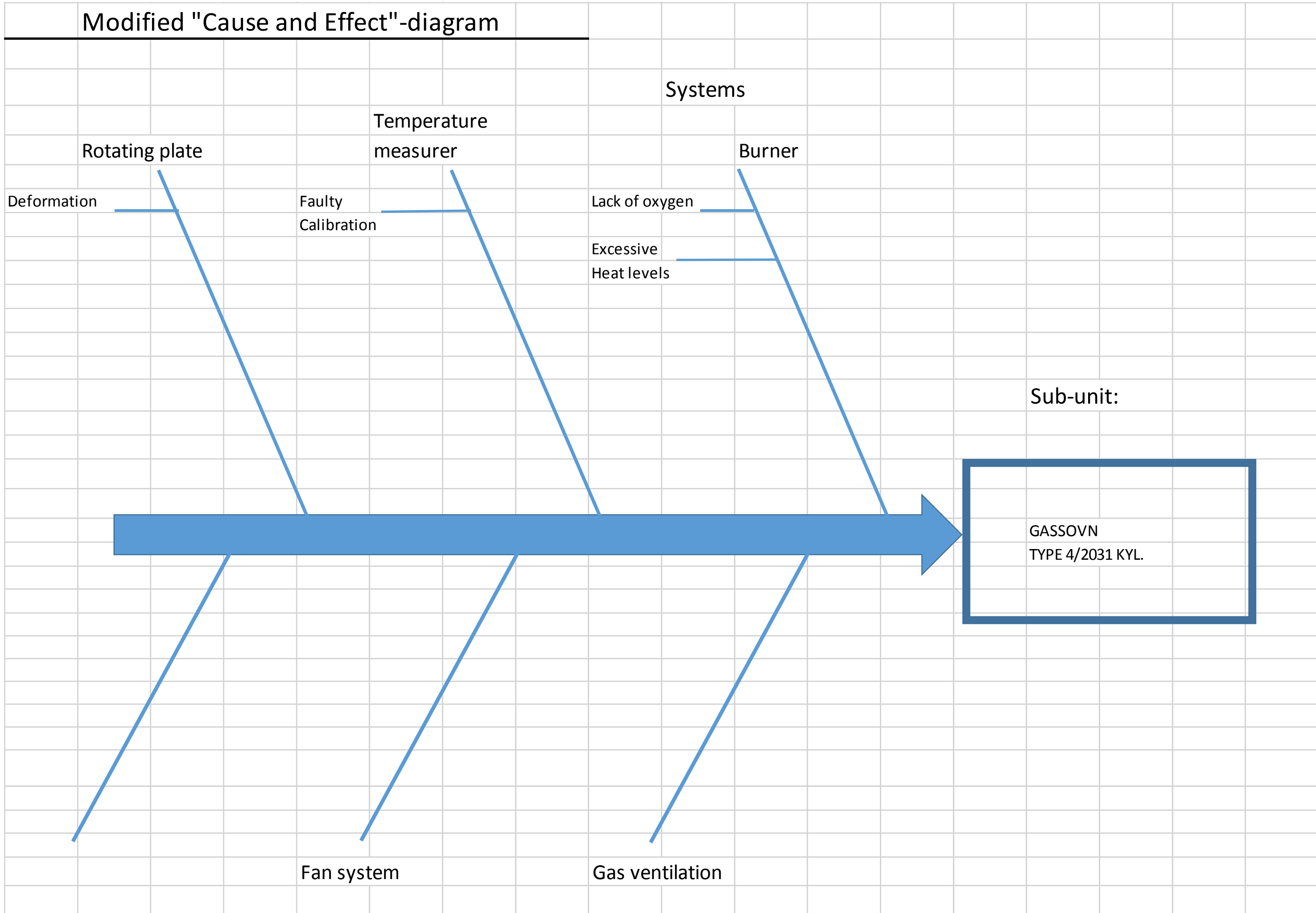


Figure 34: ex. Modified “Cause and Effect”-Diagram - RCA Framework

5 Whys template

Page 3

Cause / Problem:		Deformation on one side of the of the rotating plate in the oven	Cause number	1
			Root Cause?	
1	Why?	Excessive heat on one side of the plate	No X	Yes
2	Why?	Rotation stopped while heating was on	No X	Yes
3	Why?	The heating function does not check if the plate is rotating	No X	Yes
4	Why?	There is no feedback system between these systems.	No	Yes X
5	Why?		No	Yes
Root Cause:		There is no feedback system between the burner function and the drive which rotates the plate. The rotation can stop, and the heating will be kept high. This will result in one side of the plate being excessively heated and deformation of that side occur.		

Figure 35: ex. 5 Whys template - RCA Framework

Team members

Name	Position	Work Email
Vegard Goa	Student at University of Stavanger	Vgoa@sampleemail.com
John Doe	Electrical Engineer at Kverneland Group	Jdoe@sampleemail.com
Robert Smith	Operator of unit A275	RSmith@sampleemail.com
Ola Nordmann	Analyst at Kverneland Group	OlaN@sampleemail.com
Kari Olsen	Mechanical Engineer at Kverneland Group	KOlsen@sampleemail.com

Figure 36: ex. Team Members - RCA Framework

Solutions

Root Cause Number	Root Cause	Solution	Who is Responsible	Start Date	Due Date	Potential Consequences of Solution
1	No interaction between heat-function and the drive which causes the rotation of the plate.	Implement a feedback system between heating function and the drive which controls the rotation.	Vegard Goa	12.05 2017	19.06 2017	The function which turns of the sub-units in A275 can influence other functions.
2						
3						
4						
5						

Figure 37: ex. Solutions - RCA Framework

Elaboration of Solutions

Solution for Root Cause 1:

Implement a feedback system between heating function and the drive which controls the rotation. If rotation stop while the heating is on, a feedback function should turn off the burner.

The rest of the sub-units in A275 should then be turned off after a timer to ensure parts that are past in the oven is in the process is completed.

In general, two main functions should be added:

1. A function which turns off the sub-units before the oven immediately
   - No build-up of unfinished parts before the oven.
2. A function which turns off the sub-units after the oven based on a timer
   - Allows units which are done in the oven to be completed in the rest of the process, and when the last part is done all sub-units are turned off.

Consequences for Solution 1:

The function which turns of the sub-units in A275 can influence other functions. Potential programming on the robots might be in order as a shutdown function can affect the settings. Separate functions may need to be added for each sub-unit to ensure they are turned off while a desired state or position. For instance could turning the press off while the press is at the top position be considered not be ideal.

Figure 38: ex. Elaboration of Solutions - RCA Framework

Page 6

Report Summary

The team was formed and consisted of Vegard Goa, John Doe, Ola Nordmann, Kari Olsen, and Robert Smith.

The team examined A275 through the corrective maintenance done on the unit. After following the procedures explained in the introduction sheet in the RCA framework, the team discovered that the oven was the sub-unit which cause the most collective downtime on A275 from January 2012 to May 2017.

The oven was added as the sub-unit in the “Cause and Effect”-diagram. The team then explored the different systems. After an extensive brainstorming session, the causes in the systems which could cause issues for the sub-unit was then added to the branches of their respective systems.

After a thorough discussion in the team, it was concluded that the “deformation of the rotating plate” was the number one priority.
The team then followed the procedure of the framework and conducted a “5 Whys” analysis.
This root cause was found:

«There is no feedback system between the burner function and the drive which rotates the plate. The rotation can stop, and the heating will be kept high. This will result in one side of the plate being excessively heated and deformation of that side occur.»

The solution should be to implement a feedback function explained in “Elaboration of Solution”.

During this process the team have learned how to use Root Cause Analysis as a method to solve underlying problems in unit A275.
The first impression was that there was a problem with the oven, and potential quick-fix could be to simply replace the plate. However the problem had occurred so many times before, that the underlying cause had to be addressed to prevent recurrence of the same problem.
By creating a solution to the underlying root cause, the team is confident that there will be no recurrence of this particular cause.

Figure 398: ex. Report Summary - RCA Framework

5. Discussion

The main purpose of this thesis was to develop a better RCA framework for Kverneland Group to use at their facilities. For Kverneland Group to get a good understanding on the process of conducting a RCA, the framework example that was created for the evaluation of the solution was presented to Egil Brastad Hansen and Karina Djuve Aanderaa from Kverneland Group. After the presentation of the example they expressed a high degree of satisfaction when it came to the framework.

The new framework is designed with time efficiency as one of the main points. Several insights were gained after completing the RCA framework example. For one it has become apparent to both the author as well as Kverneland Group that the time it takes to conduct RCA at their facilities should be drastically reduced. Previously stated it could take up to two weeks, with the new framework it can be done in a matter of few days depending on the complexity of the system. As the complexity of the unit increases, it would be realistic to expect the time it takes to complete the RCA increases as well.

However, even in the more complex units, the developed RCA framework should still prove to be faster to use than the previous RCA methods used at Kverneland Group. This relates to the way the new framework is designed with the structure of the facilities and units at Kverneland Group as a key-input.

The interface of the framework meets the requirements set by Kverneland Group. It is structured, and follows a logical flow which compliments the general approach to Root Cause Analysis process explained in chapter 2.3. This is important as for RCA frameworks to be effective, they need to have a process which carries resemblance to the general ideas of the Root Cause Analysis process.

The developed RCA framework as it stands now will be an effective tool for Kverneland Group to utilize in their facilities. However there are some limitations when it comes to analyzing very big and complex systems. This is because the RCA framework at its current form is designed to be easy to use and to save time. Therefore it is likely that in the future, with issues relating large, and complex systems, different modifications may be applied to the developed RCA framework.

During the process of developing the RCA framework, certain lessons has been learned. When designing a specialized RCA framework, the structure of the systems it will be used on has be kept in focus during the entire process. This is because of the importance that the RCA framework is developed in a way which compliments the natural structure of the facilities. It should be created with an approach that relates the RCA process directly to the real situation. With this approach, time can be saved as it is time consuming to use general RCA models and having to convert and transform information between the system and the RCA model.

Another lesson learned is that it is almost impossible to not have some form for bias in a RCA process. This is due to RCA methods often relate to ideas and points of view of different people. People with different experience and degree of knowledge and certainty about events, can reach different conclusions about an event. It should therefore be considered of big importance to include the operator of the unit in the RCA. This is because this person more often than not the person who has the most experience and knowledge about the unit.

This is not to say that there is no repeatability in RCA; people can absolutely reach the same conclusion if the examination of the units and causes are done correctly. One should however know that there will be a degree of bias in a Root Cause Analysis.

6. Conclusion

The aim of the thesis was to analyze unit A275 and to use the results to develop a Root Cause Analysis framework. This approach proved to be a reasonable when it came to the quality of the analysis of A275 as well as the developed RCA framework. The main purpose of the thesis and Kverneland Group's main interest was the development of the RCA framework. The resulting Root Cause Analysis framework was one both the author and Kverneland Group were satisfied with.

The framework met Kverneland Groups expectations and requirements. The main requirement from Kverneland Group, to develop a framework which was superior over their previous framework in terms of time efficiency was clearly achieved. It was designed with user simplicity in mind, and the resulting RCA framework along with the instructions proved to be clear enough so that people that were unfamiliar with RCA could still use it.

The RCA framework utilizes methods that are easy to understand, and can be used in meetings as a tool to provide enough information to justify the cost of implementing various solutions. This information will in turn be backed up by a clear RCA documentation and Excel datasheets as references.

In the future the developed Root Cause Analysis framework can be used as a basis for further development. This will be necessary if the RCA framework will be used as a method to analyze very large, and more complex system. Another level can be introduced which can be defined as "sub-system" and will be a degree lower than the current level "system" is.

The developed Root Cause Analysis framework can also be digitalized. Since the RCA framework is designed to be straight forward and to avoid complexity, developing the framework to a Software can be a reasonable approach.

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Appendix A: ARMS RELIABILITY – Example documentation - Lost Production

This section includes the two relevant pages of the "Lost Production" example by ARMS Reliability. The full document can be accessed in the references.

ARMS
RELIABILITY

LOST PRODUCTION

Purpose: To prevent recurrence, not place blame.

Report Date: 12-12-2013
Start Date: 03-12-2013
Report Number: NC23-0351

I. Problem Definition

What:	Lost Production
When:	December 18, 2013
Where:	USA
Facility:	Central 3
System:	Processor
Significance:	High
Safety:	Minimal impact – increased exposure to lifted loads and slippery conditions
Environment:	No Impact
Revenue:	Downtime 44 Hours
Cost:	$2.4M
Frequency:	First 1

II. Report Summary

Lost production was caused by the CHP having to be shut down when the wet end bearing failed. This bearing failed because of metal-to-metal contact due to the bearing lubrication becoming ineffective because the grease was washed and contamination was present.

The grease was washed out because the wet end labyrinth seal failed and allowed the entry of gland water. Excessive wear occurred in the end cover and the labyrinth seal because the lubricant supply ran out.

The contamination was caused by the failure of the screen filtration system due to the self-cleaning system not operating and the subsequent blockage not being identified. The self-cleaning system failure was caused by the water pressure falling below the minimum because of demands on the water supply elsewhere on the site. This, in turn, was caused by new planned production arrangements and the limited capacity of the water storage.

III. Solutions

Causes	Solutions	Solution Owner	Due Date
Water pressure fell below 25 psi	Install uprated pump to ensure supply	Phil Sager	03-02-2014
Blockage not identified	Increase inspections of screens to weekly	Stirling Maus	25-12-2013
Lubricant supply exhausted	Double capacity of lube supply	Nando Alonso	14-02-2014
Lubricant supply exhausted	Schedule weekly inspections of supply	Stirling Mice	25-12-2013

IV. Team Members

Name	Email	Member Info
Phil Sager	psage@somewhere.com	Reliability Superintendent
Roy Davies	rdavies@somewhere.com	Defect Elimination Officer
Nando Alonso	nalonso@somewhere.com	Plant Mechanical Engineer
Stirling Maus	smaus@somewhere.com	Plant Maintenance Supervisor
Bryson Fittipaldi	bfittipaldi@somewhere.com	Condition Monitoring Co-ordinator
Merv Shews	mshews@somewhere.com	Condition Monitoring Technician
Les Gibston	lgibson@everywhere.com	Facilitator & Reliability Engineer

V. Notes

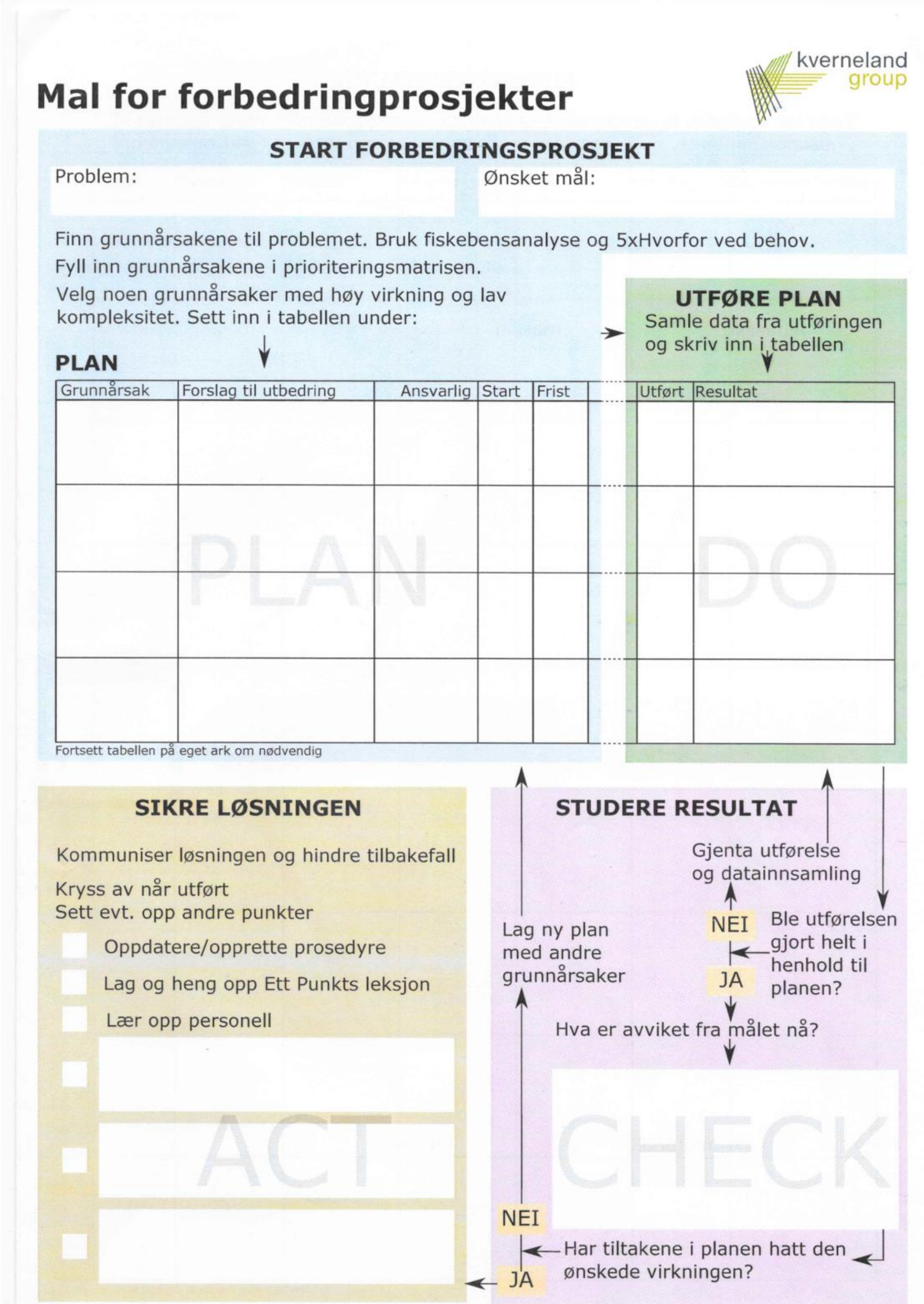
1. Realitychart Status: The Realitychart and Incident Report have been finalized.
2. Rules Check Status: Missing Causes Resolved.
3. Rules Check Status: Conjunctions Resolved.

VI. References

1. Photo # 17
2. mining development plan at 23.01.2014
3. photo # 13

Appendix B: Kverneland Group Improvement project framework

This section includes the framework for conducting an improvement project at Kverneland Group. They are scans of the document used by Kverneland Group. The four-page document include a PDCA-cycle, "Cause and Effect"-diagram, "5 Whys" and a Priority Matrix.



Mal for forbedringprosjekter

kverneland group

START FORBEDRINGSPROSJEKT

Problem:

Ønsket mål:

Finn grunnårsakene til problemet. Bruk fiskebensanalyse og 5xHvorfor ved behov.
Fyll inn grunnårsakene i prioriteringsmatrisen.
Velg noen grunnårsaker med høy virkning og lav kompleksitet. Sett inn i tabellen under:

UTFØRE PLAN
Samle data fra utføringen og skriv inn i tabellen

PLAN

Grunnårsak	Forslag til utbedring	Ansvarlig	Start	Frist	Utført	Resultat

Fortsett tabellen på eget ark om nødvendig

PLAN DO

SIKRE LØSNINGEN

Kommuniser løsningen og hindre tilbakefall

Kryss av når utført
Sett evt. opp andre punkter

- ☐ Oppdatere/opprette prosedyre
- ☐ Lag og heng opp Ett Punkts leksjon
- ☐ Lær opp personell
- ☐
- ☐
- ☐

ACT

STUDERE RESULTAT

Gjenta utførelse og datainnsamling

NEI

Ble utførelsen gjort helt i henhold til planen?

JA

Lag ny plan med andre grunnårsaker

Hva er avviket fra målet nå?

CHECK

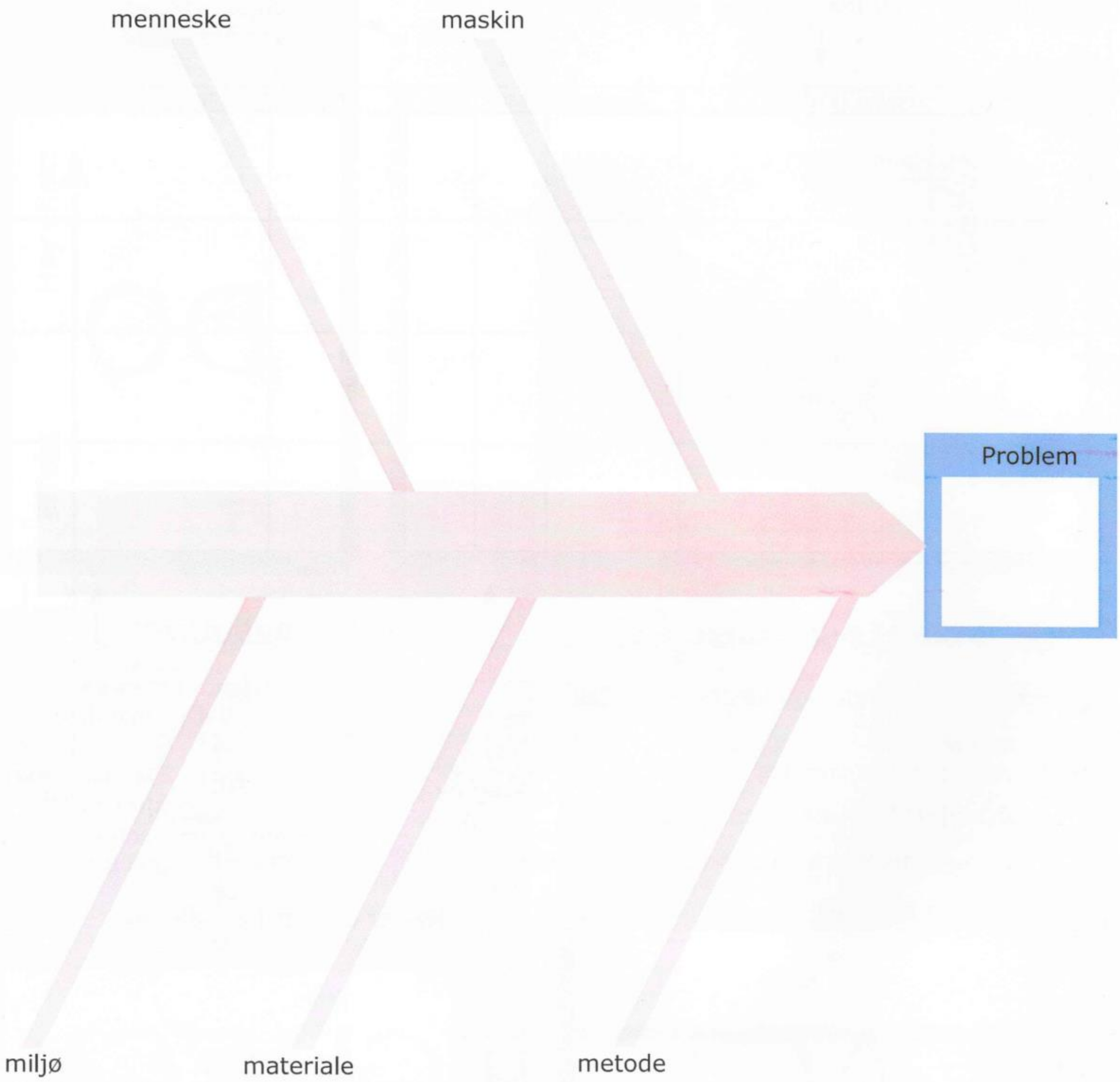
NEI

Har tiltakene i planen hatt den ønskede virkningen?

JA

FISKEBENSANALYSE

Tegn inn mulige årsaker til problemet langs den kategorien det hører hjemme.



5xHVORFOR

Metode for å gå dypere inn i årsakene til problemet å finne grunnårsaken.
Legg inn årsaker til problemet funnet fra fiskebensanalysen. Finn utbedringsforslag.

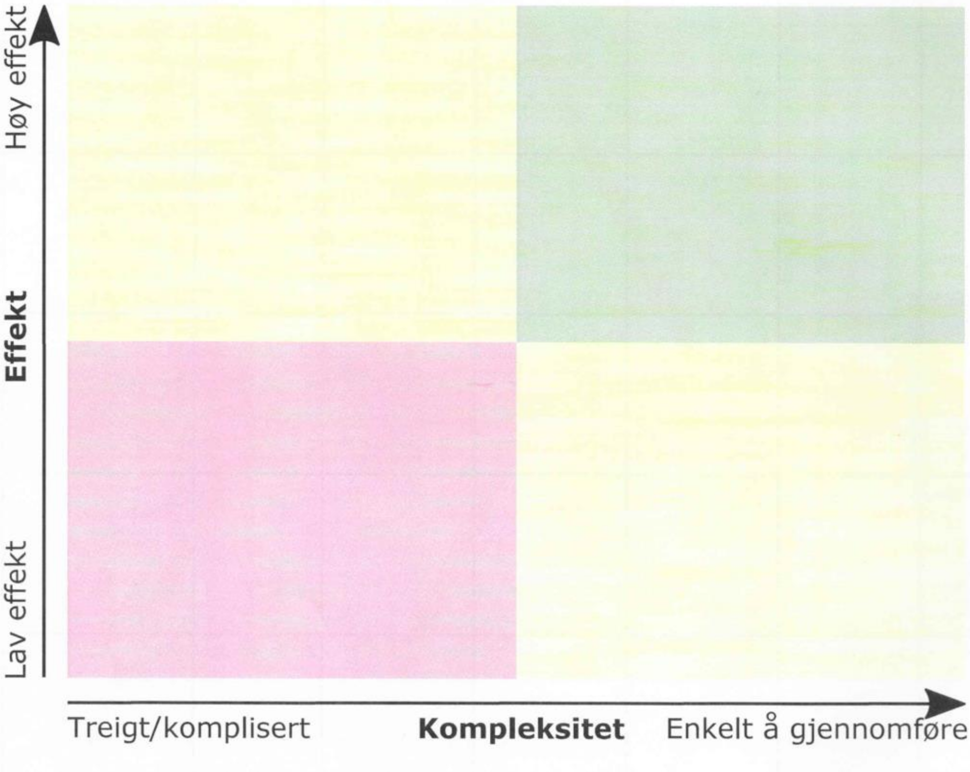
Nr	Årsak	Hvorfor	Hvorfor	Hvorfor	Hvorfor	Hvorfor	Utbedringsforslag

Fortsett tabellen på eget ark om nødvendig

PRIORITERINGSMATRISE

Vurder utbedringsforslagene og 5xHvorfor med tanke på antatt effekt for å nå målet, og kompleksitet. Utbedringsforslag med høy kostnad kan antas å også ha høy kompleksitet.

Plott utbedringsforslagene i diagrammet. Bruk nummer fra 5xHvorfor.



Appendix C

This section includes formatted Excel data from the database of Kverneland Group. Included in this section is also graphs generated from the formatted data. The summaries in C1 are based on the raw data in Appendix D.

C1: Excel data formatted from Kverneland Groups database

Data which has been formated and summarized from the raw data from the Onix database at Kverneland Group.
Entries collected in the span between the beginning of 2015 and the beginning of April 2017

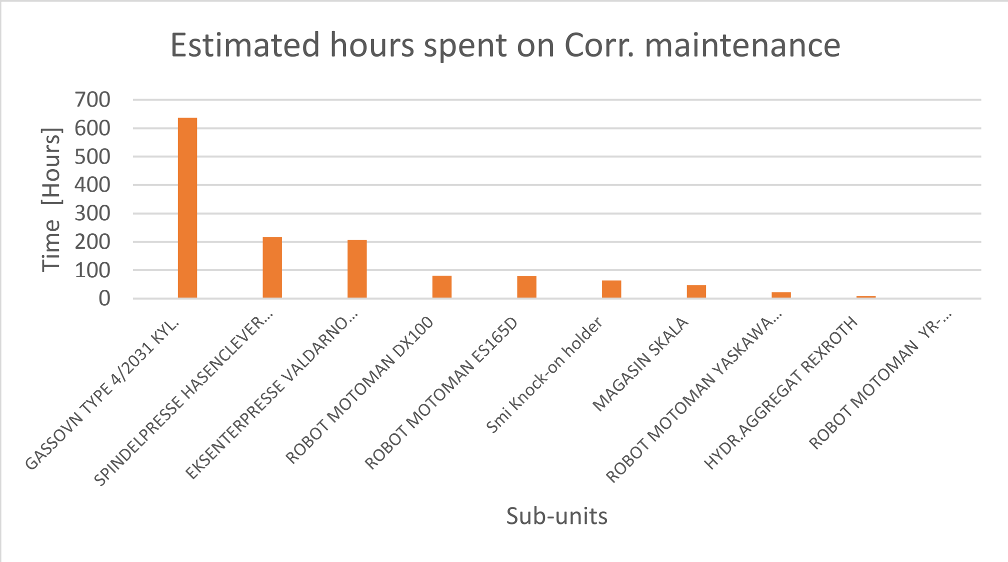
Sorted by time

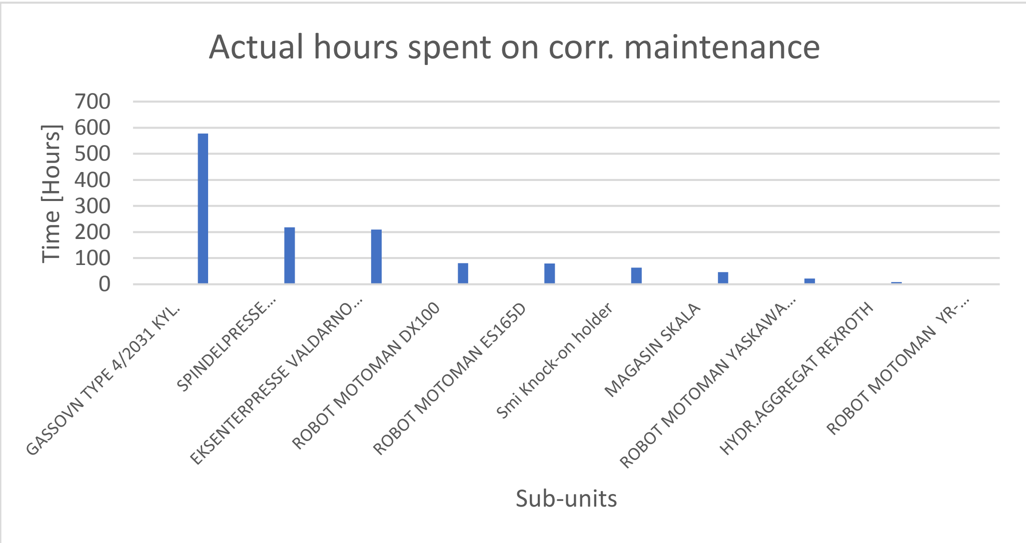
	Task Actual Qty	Task Est.Qty	# entries
GASSOVN TYPE 4/2031 KYL.	577	637	85
SPINDELPRESSE HASENCLEVER FPR N 280 800t	218,50	216,00	51
EKSENTERPRESSE VALDARNO VPS 2P 30	209,00	207,00	51
ROBOT MOTOMAN DX100	80,45	80,5	28
ROBOT MOTOMAN ES165D	79	79	29
Smi Knock-on holder	64	64	11
MAGASIN SKALA	46,5	46,5	16
ROBOT MOTOMAN YASKAWA MH5	21,5	21,5	6
HYDR.AGGREGAT REXROTH	8,00	8,00	5
ROBOT MOTOMAN YR-SIA020D-A01	2,50	2,50	2

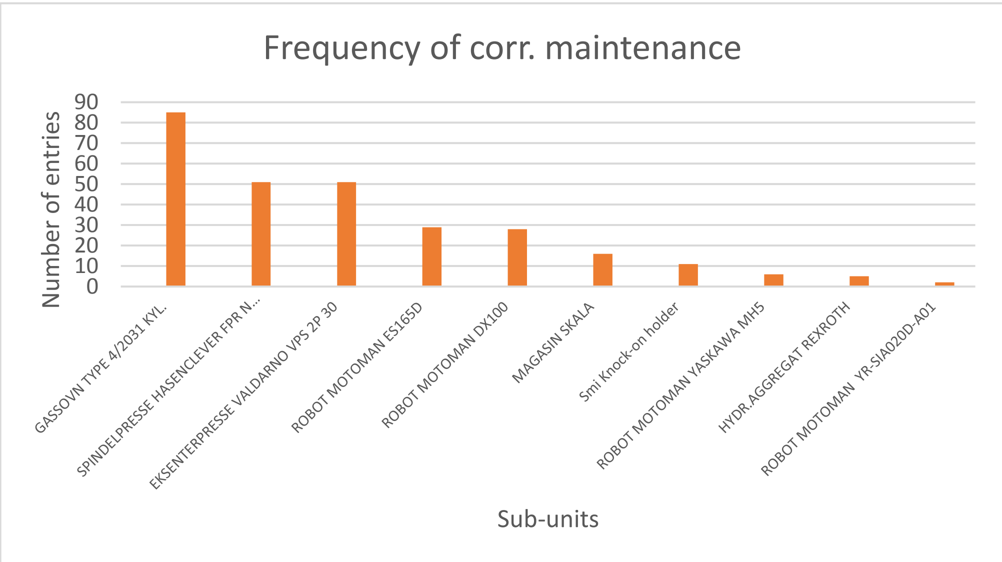
Sorted by frequency

	Task Actual Qty	Task Est.Qty	# entries
GASSOVN TYPE 4/2031 KYL.	577	637	85
SPINDELPRESSE HASENCLEVER FPR N 280 800t	218,50	216,00	51
EKSENTERPRESSE VALDARNO VPS 2P 30	209,00	207,00	51
ROBOT MOTOMAN ES165D	79	79	29
ROBOT MOTOMAN DX100	80,45	80,5	28
MAGASIN SKALA	46,5	46,5	16
Smi Knock-on holder	64	64	11
ROBOT MOTOMAN YASKAWA MH5	21,5	21,5	6
HYDR.AGGREGAT REXROTH	8,00	8,00	5
ROBOT MOTOMAN YR-SIA020D-A01	2,50	2,50	2

C2: Graphs based on formatted Excel data







Appendix D: Excel raw data from Kverneland Groups database

This section includes the raw rata on corrective maintenance conducted on unit A275 between January 2015 and April 2017. The data has been exported from Kverneland Groups database and is not available online. The reason for inclusion is that there are no other sources that can be used to verify the data used in the analysis of unit A275.

EKSENTERPRESSE VALDARNO VPS 2P 30																		
	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Elektriker	Sørensen	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Alarm for presse	155317	Utført og godkjent	17.08.2015	16.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	17.08.2015	
2	Elektriker	Sudmann	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	slår ut med alarm om for høyt oljetrykk	155415	Utført og godkjent	17.08.2015	17.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	18.08.2015	
3	Elektriker	Nordhus,	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	presse lavt trykk	155511	Utført og godkjent	17.08.2015	19.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	18.08.2015	
4	Mekaniker	Malmin, S	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Hjelpe italiener med reperasjon av høyt trykk på pressen.	155285	Utført og godkjent	14.08.2015	13.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	11,5	11,5	14.08.2015	
5	Mekaniker	Malmin, S	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	justere trykk på presse (hjelpe italiener.)	155286	Utført og godkjent	15.08.2015	14.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	9,5	9,5	15.08.2015	
6	Plateverksted	Kokes, S	3. Norma	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	transportbelte kar	171631	Utført og godkjent	22.09.2016	23.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	15	15	23.09.2016	
7	Elektriker	Bjerga, F	3. Norma	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	"Problem med å kjøre støssel	168586	Utført og godkjent	11.07.2016	17.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	2	11.07.2016	
8	Mekaniker	Nilssen, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Bytte manometer	156729	Utført og godkjent	21.09.2015	22.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	22.09.2015	
9	Elektriker	Pojar, La	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Problem med Adam-Eva sensor på dør	155579	Utført og godkjent	18.08.2015	20.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	19.08.2015	
10	Elektriker	Abeland,	3. Norma	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Får ikke resatt alarm på presse	172845	Utført og godkjent	25.10.2016	30.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	25.10.2016	
11	Mekaniker	Hoftun, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	rep ventilblokk	155280	Utført og godkjent	14.08.2015	13.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	14.08.2015	
12	Mekaniker	Malmin, S	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	alarm smøreolje.	152943	Utført og godkjent	12.06.2015	12.07.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	12.06.2015	
13	Mekaniker	Kurpios, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	problem med sikring mangler trykk	153005	Utført og godkjent	16.06.2015	16.07.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	16.06.2015	
14	Mekaniker	Hoftun, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	slår ut på smøring	152929	Utført og godkjent	12.06.2015	12.07.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	12.06.2015	
15	Mekaniker	Henriksen	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	felsøkning byte av oljefilter	148961	Utført og godkjent	16.03.2015	16.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	16.03.2015	
16	Plateverksted	Lunde, T	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	oppretting og sveising av konteiner	151205	Utført og godkjent	05.05.2015	05.06.2015	Korrektivt vedlikehold	Kan utføres under drift	4	4	05.05.2015	
17	Mekaniker	Kurpios, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	for høygt trykk/leter etter feil	154584	Utført og godkjent	06.08.2015	05.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	06.08.2015	
18	Elektriker	Faude, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	feilsøking,mottrykk	154789	Utført og godkjent	06.08.2015	09.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3,5	3,5	06.08.2015	
19	Mekaniker	Kurpios, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	problem med presse alarm viser for høygt trykk leter etter feil	154493	Utført og godkjent	04.08.2015	03.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	04.08.2015	
20	Teknisk kontor	Bjerga, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Problem med mottrykk	154353	Utført og godkjent	17.06.2015	13.08.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	12	12	10.07.2015	
21	Elektriker	Faude, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	mangler trykk	154780	Utført og godkjent	04.08.2015	09.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	04.08.2015	
22	Mekaniker	Haugstad	3. Norma	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	arb. smøring til verktøy	168442	Utført og godkjent	08.07.2016	07.08.2016	Korrektivt vedlikehold	Kan utføres under drift	7,5	7,5	08.07.2016	
23	Mekaniker	Haugvald	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	pumpe for grafitt var tett	167740	Utført og godkjent	17.06.2016	17.07.2016	Korrektivt vedlikehold	Kan utføres under drift	3	3	17.06.2016	
24	Mekaniker	Nilssen, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Rep lekkasje	172175	Utført og godkjent	03.10.2016	05.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	04.10.2016	
25	Elektriker	Abeland,	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Operatør kjørt fast verktøy	163521	Utført og godkjent	18.02.2016	21.02.2016	Korrektivt vedlikehold	Krever lang stopp > 1 uke	2	2	18.02.2016	
26	Mekaniker	Haugstad	3. Norma	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	rette opp robot	165369	Utført og godkjent	14.04.2016	15.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	14.04.2016	
27	Mekaniker	Nilssen, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Bytte oljefilter	162930	Utført og godkjent	01.02.2016	02.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	01.02.2016	
28	Elektriker	Sveinsvo	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Presse fusker	175459	Utført og godkjent	23.11.2016	24.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	10	10	25.11.2016	
29	Elektriker	Fosse, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Robot vil ikkje legge deler i presse	177147	Utført og godkjent	17.01.2017	16.02.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	20.01.2017	
30	Elektriker	Fosse, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Stopper av og til	175426	Utført og godkjent	23.11.2016	23.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	24.11.2016	
31	Elektriker	Fosse, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Alarm vil ikkje gå vekk	172840	Utført og godkjent	25.10.2016	24.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	27.10.2016	
32	Elektriker	Pojar, La	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Går ikke i auto	172999	Utført og godkjent	26.10.2016	29.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	26.10.2016	
33	Mekaniker	Haugstad	3. Norma	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	rette opp robot	165381	Utført og godkjent	15.04.2016	15.04.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	15.04.2016	
34	Elektriker	Faude, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	lavt trykk	159062	Utført og godkjent	28.10.2015	29.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	28.10.2015	
35	Elektriker	Orban, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Bandslipper snu på feil vei	159273	Utført og godkjent	02.11.2015	04.12.2015	Korrektivt vedlikehold	Kan utføres under drift	2	2	02.11.2015	
36	Elektriker	Faude, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Alarm ,-lavt mottrykk	158987	Utført og godkjent	27.10.2015	27.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3,5	3,5	27.10.2015	
37	Mekaniker	Kurpios, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	problem med presse alarm lav trykk	157975	Utført og godkjent	26.10.2015	26.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	26.10.2015	
38	Mekaniker	Kurpios, A	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	alarm lav kraft	157976	Utført og godkjent	27.10.2015	26.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	27.10.2015	
39	Elektriker	Pojar, La	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Problem med sensor	160871	Utført og godkjent	23.11.2015	24.12.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	23.11.2015	
40	Mekaniker	Hoftun, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	oljelekkasje	162290	Utført og godkjent	11.01.2016	14.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	11.01.2016	
41	Elektriker	Faude, J	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	har stopped	159331	Utført og godkjent	06.11.2015	06.12.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	06.11.2015	
42	Mekaniker	Hoftun, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	problem med hydraulikk	159386	Utført og godkjent	04.11.2015	06.12.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	04.11.2015	
43	Mekaniker	Hoftun, F	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	hydraulikkproblem	159388	Utført og godkjent	05.11.2015	06.12.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	05.11.2015	
44	Mekaniker	Haugvald	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	tett filter	149764	Utført og godkjent	19.02.2015	07.05.2015	Korrektivt vedlikehold	Krever kort stopp < 24t			19.02.2015	
45	Mekaniker	Hoftun, F	1. Kritisk	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	Mottrykk mangler	138614	Utført og godkjent	30.06.2015	07.09.2014	Korrektivt vedlikehold	Krever lang stopp > 1 uke	1	1	30.06.2015	
46	Mekaniker	Kurpios, Alexander		0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	problem med presse (viser alarm /lav kraft/leter etter feil)	159261	Utført og godkjent	28.10.2015	04.12.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	22,5	22,5	30.10.2015	
47	Mekaniker	Henriksen	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	byte av slangekobling	147545	Utført og godkjent	23.02.2015	25.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	23.02.2015	
48	Mekaniker	Grubert, I	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	støssel-instillinger	145961	Utført og godkjent	22.01.2015	22.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	22.01.2015	
49	Mekaniker	Henriksen	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	stramat slange	146415	Utført og godkjent	03.02.2015	05.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	03.02.2015	
50	Mekaniker	Haugvald	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	tett filter	149766	Utført og godkjent	19.02.2015	07.05.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	19.02.2015	
51	Mekaniker	Haugvald	2. Haster	0	M1174	A275	EKSENTERPRESSE VALDARNO VPS	tett filter	149765	Utført og godkjent	19.02.2015	07.05.2015	Korrektivt vedlikehold	Krever kort stopp < 24t			19.02.2015	
														Sum:	209,00	207,00		

GASSOVN TYPE 4/2031KYL.

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qty	End Date	Status Remark
1	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Reparere hjul på karusell.	171293	Utført og godkjent	12.09.2016	14.10.2016	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	25	25	20.09.2016	
2	Plateverksted	Sviland, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	rep karusell-ruller og bytte steiner i ovn	171453	Utført og godkjent	12.09.2016	17.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	13	7	16.09.2016	
3	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Reparere palearmen.	171526	Utført og godkjent	19.09.2016	20.10.2016	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	2,5	10	26.09.2016	
4	Plateverksted	Sviland, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	fikse problem med paling/robot bommer på deler	165236	Utført og godkjent	11.04.2016	12.04.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3,5	5	11.04.2016	
5	Elektriker	Sveinsvo	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Kommer ikke opp i temp	166328	Utført og godkjent	10.05.2016	09.06.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	10.05.2016	
6	Mekaniker	Haugsta	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	rep.bremse	160732	Utført og godkjent	18.11.2015	19.12.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	18.11.2015	
7	Mekaniker	Grubert, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	palling stoppte,kilte seg	172061	Utført og godkjent	01.10.2016	31.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	02.10.2016	
8	Mekaniker	Aasland,	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Prob med paling	148573	Utført og godkjent	10.03.2015	09.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	10.03.2015	
9	Mekaniker	Fosse, Ni	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Prob med paling	148572	Utført og godkjent	10.03.2015	09.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	10.03.2015	
10	Mekaniker	Haugvalc	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	laget foring og tapp for lager	171726	Utført og godkjent	22.09.2016	23.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	22.09.2016	
11	Elektriker	Pojar, La	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Problem med paling	171604	Utført og godkjent	22.09.2016	22.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	22.09.2016	
12	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Paling konti. drift har stopped	172067	Utført og godkjent	01.10.2016	31.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	01.10.2016	
13	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	mangler signal dør lukket	165017	Utført og godkjent	05.04.2016	04.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	05.04.2016	
14	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Lagt plate i ovnsdør for å hindre deler i å falle ned i karussell.	144805	Utført og godkjent	08.01.2015	07.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	5	4	12.01.2015	
15	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Fjerne del i karussell.	144804	Utført og godkjent	07.01.2015	07.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	5	5	08.01.2015	
16	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Fjerne del mellom karussell og vegg.	162500	Utført og godkjent	21.01.2016	21.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	22.01.2016	
17	Plateverksted	Kokes, S	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	transportbelte	171778	Utført og godkjent	26.09.2016	26.10.2016	Korrektivt vedlikehold	Kan utføres under drift	15	15	27.09.2016	
18	Mekaniker	Straalteo	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	stålemne kilt, ovn skrus av og platev. overtar.	146791	Utført og godkjent	11.02.2015	13.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	11.02.2015	
19	Eksternt firma	Lima Rør	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Rep. av gasslekkasje	144773	Utført og godkjent	08.01.2015	07.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	14.01.2016	
20	Plateverksted	Seland, I	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	rep. karusell	162396	Utført og godkjent	18.01.2016	17.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	15	20	18.01.2016	
21	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	vifte sviver ikke	145027	Utført og godkjent	03.01.2015	11.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	03.01.2015	
22	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	starter ikke	164367	Utført og godkjent	11.03.2016	10.04.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	11.03.2016	
23	Mekaniker	Grubert, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	problem med palling feilsøk,justering av sensorene	162966	Utført og godkjent	02.02.2016	03.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	02.02.2016	
24	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Alarm Brenner	162974	Utført og godkjent	02.02.2016	03.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	02.02.2016	
25	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	starter ikke, skiftet ventilblokk	163275	Utført og godkjent	11.02.2016	12.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	11.02.2016	
26	Plateverksted	Ueland, F	1. Kritisk	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Rep. ovn	155687	Utført og godkjent	25.08.2015	24.09.2015	Korrektivt vedlikehold		43	50	01.09.2015	
27	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	justert sensor etter sveising	175880	Utført og godkjent	06.12.2016	06.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	06.12.2016	
28	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Problem med paling /Plate må sveises del på plass	175917	Utført og godkjent	08.12.2016	07.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	08.12.2016	
29	Plateverksted	Sviland, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	rep. karusell	176522	Utført og godkjent	12.12.2016	15.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	8	3	15.12.2016	
30	Mekaniker	Hoftun, F	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	problem med karusell	175937	Utført og godkjent	05.12.2016	08.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	05.12.2016	
31	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Problem med paling	175789	Utført og godkjent	05.12.2016	04.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	05.12.2016	
32	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Reparere palinga(sette på endestopper) og rette på bremsa.	175794	Utført og godkjent	05.12.2016	04.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	12.12.2016	
33	Mekaniker	Grubert, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	sylinderfeste holder ikke mer	176606	Utført og godkjent	31.12.2016	01.02.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	31.12.2016	
34	Mekaniker	Straalteo	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	få gang på ovn. plate overtar	154339	Utført og godkjent	08.07.2015	13.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	08.07.2015	
35	Plateverksted	Undheim	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Rette opp karusell.	154229	Utført og godkjent	08.07.2015	08.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	17.07.2015	
36	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Reparere karusell.	176061	Utført og godkjent	12.12.2016	11.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	25	16.12.2016	
37	Plateverksted	Lunde, T	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	skjære vekk ødelagt stål i ovn	155204	Utført og godkjent	03.08.2015	13.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	03.08.2015	
38	Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	problem med paling	176620	Utført og godkjent	29.12.2016	01.02.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	30.12.2016	
39	Plateverksted	Undheim, Tom Arilc		0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Justere paling.	165422	Utført og godkjent	11.04.2016	18.05.2016	Korrektivt vedlikehold	Kan utføres under drift	3	3	18.04.2016	
40	Plateverksted	Lunde, T	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	a275. rette vegger/skal på ovn	148662	Droppet	11.03.2015	10.04.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	0	37	16.03.2015	feil. dobbelført
41	Plateverksted	Kokes, S	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	fikse stein	150157	Utført og godkjent	14.04.2015	14.05.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	14.04.2015	
42	Mekaniker	Straalteo	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	bytte pakninger i palesylinder.	154162	Utført og godkjent	07.07.2015	06.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	07.07.2015	
43	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Endre på fot til karussell	172129	Utført og godkjent	03.10.2016	03.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	25	15	17.10.2016	
44	Elektriker	Fosse, A	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Vil ikkje starte	172697	Utført og godkjent	21.10.2016	20.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	21.10.2016	
45	Elektriker	Sveinsvo	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Bistå RPT med bytte av gassregulator inn på ovn	172778	Utført og godkjent	24.10.2016	23.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	5	5	28.10.2016	
46	Plateverksted	Kokes, S	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	karusell rette steiner	156203	Utført og godkjent	08.09.2015	09.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	15	7,5	09.09.2015	
47	Plateverksted	Kokes, S	3. Norma	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	muring av ov	155936	Utført og godkjent	31.08.2015	01.10.2015	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	7,5	7,5	31.08.2015	
48	Plateverksted	Rydén, S	1. Kritisk	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	ovnen fungerar ej i palin. stop på rotering och vill inte svive	147817	Utført og godkjent	25.02.2015	28.03.2015	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	10	50	26.02.2015	
49	Plateverksted	Rydén, S	1. Kritisk	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	større reperation på ovn. ska rikta hela ovnen.	148732	Utført og godkjent	11.03.2015	11.04.2015	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	44	20	16.03.2015	
50	Mekaniker	Øye, Sve	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Stramme brems	173010	Utført og godkjent	27.10.2016	29.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	27.10.2016	
51	Elektriker	Pojar, La	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	problem med påling	173003	Utført og godkjent	27.10.2016	29.11.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	27.10.2016	
52	Mekaniker	Nilssen, .	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Bytte lager på støtterull	146823	Utført og godkjent	12.02.2015	14.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	12.02.2015	
53	Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031KYL.	Reparere karussell på ovn 3123.	147016	Utført og godkjent	13.02.2015	18.03.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	7,5	7,5	16.02.2015	

54		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Reparere karussellen på ovn 3123.	147017	Utført og godkjent	16.02.2015	18.03.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	7,5	7,5	17.02.2015
55		Plateverksted	Kokes, S	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	karusell	147819	Utført og godkjent	25.02.2015	28.03.2015	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	25	21	27.02.2015
56		Mekaniker	Kurpios,	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	problem med påling / sylinder til brems må skifte	148564	Utført og godkjent	09.03.2015	08.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	09.03.2015
57		Mekaniker	Grubert, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	tføringsrollene justering,platte overta	146834	Utført og godkjent	12.02.2015	14.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	12.02.2015
58		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	starter ikke ,skiftet tidsrele	151584	Utført og godkjent	18.05.2015	17.06.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	18.05.2015
59		Mekaniker	Henrikso	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	krångel med parling	155068	Utført og godkjent	12.08.2015	11.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7	7	12.08.2015
60		Mekaniker	Nilssen,	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Sveise brems på ovn	154883	Utført og godkjent	05.08.2015	10.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	05.08.2015
61		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	oppstart,rampet opp til 150grader i 6 timer etter muring	155922	Utført og godkjent	31.08.2015	30.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	31.08.2015
62		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rette opp karussell og mantel.	147946	Utført og godkjent	27.02.2015	29.03.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	10	10	27.02.2015
63		Elektriker	Fosse, A	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rampe opp temp i ovn.	155987	Utført og godkjent	01.09.2015	01.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	04.09.2015
64		Plateverksted	Rydén, S	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	lagt om isolation og sten i ovnen	150160	Utført og godkjent	14.04.2015	14.05.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	5	7	14.04.2015
65		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rette opp ogn (oval)	156062	Utført og godkjent	01.09.2015	03.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	03.09.2015
66		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Støpe i steiner i ovn.	150282	Utført og godkjent	16.04.2015	16.05.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	3,5	3,5	16.04.2015
67		Elektriker	Tolås, Ma	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rampe opp temp i ovn.	155991	Utført og godkjent	01.09.2015	01.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	04.09.2015
68		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Paling virker ikke	153967	Utført og godkjent	03.07.2015	02.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	03.07.2015
69		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Mating stopper av og til -,holder på med plate	154430	Utført og godkjent	30.07.2015	29.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4,5	4,5	31.07.2015
70		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rette opp ogn (oval)	156061	Utført og godkjent	31.08.2015	03.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	03.09.2015
71		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	stå i alarm	154396	Utført og godkjent	27.07.2015	26.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	27.07.2015
72		Elektriker	Fosse, A	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Vil ikkje starte	156421	Utført og godkjent	14.09.2015	14.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	18.09.2015
73		Elektriker	Fosse, A	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Sjekke om takting fungerer	154875	Utført og godkjent	11.08.2015	10.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	13.08.2015
74		Eksternt firma	RPT Gas	2. Haster	1	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Sette inn ny gassventil på ovn	148281	Problem	05.03.2015	04.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	0	0	05.03.2015
75		Plateverksted	Lunde, T	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	3123.rettet vegger i ovn	148873	Utført og godkjent	09.03.2015	15.04.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	37,5	37,5	13.03.2015
76		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Karussel stå	149251	Utført og godkjent	21.03.2015	20.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	21.03.2015
77		Elektriker	Munthe, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	oppstart etter ventil bytte	148393	Utført og godkjent	06.03.2015	05.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	06.03.2015
78		Mekaniker	Malmin, S	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	låse sylinder rep	148758	Utført og godkjent	09.03.2015	11.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	09.03.2015
79		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rette opp ogn (oval).	155693	Utført og godkjent	24.08.2015	25.09.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	37,5	37,5	03.09.2015
80		Elektriker	Tolås, Ma	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Vil ikke tenne	155138	Utført og godkjent	11.08.2015	12.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	13.08.2015
81		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	stå i alarm ,-Feilsøking	156424	Utført og godkjent	14.09.2015	14.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	14.09.2015
82		Elektriker	Sørenser	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Ovn står fast, paling virker ikke	154826	Utført og godkjent	11.08.2015	10.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	11.08.2015
83		Plateverksted	Undheim	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Rep skjeiv karussell	155157	Utført og godkjent	12.08.2015	13.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	14.08.2015
84		Elektriker	Faude, J	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Ombyggning stop mating/ned temp.	155861	Utført og godkjent	27.08.2015	27.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	11	11	28.08.2015
85		Elektriker	Munthe, I	2. Haster	0	M3123	A275	GASSOVN TYPE 4/2031 KYL.	Sjekke og bestille ny ventil	147968	Utført og godkjent	02.03.2015	01.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	06.03.2015
															Sum	577	637	

HYDR.AGGREGAT REXROTH

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Mekaniker	<Unknow	2. Haster	0	M8417	A275	HYDR.AGGREGAT REXROTH	Bytt filter	149289	Utført og godkjent	19.03.2015	22.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	19.03.2015	
2	Mekaniker	Eimstad,	2. Haster	0	M8417	A275	HYDR.AGGREGAT REXROTH	skifte filter , nesten sprengt	179642	Utført og godkjent	14.03.2017	13.04.2017	Korrektivt vedlikehold	Kan utføres under drift	0,5	0,5	14.03.2017	
3	Elektriker	Pojar, La	3. Norma	0	M8417	A275	HYDR.AGGREGAT REXROTH	Koble til motoren	161380	Utført og godkjent	11.12.2015	10.01.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4,5	4,5	11.12.2015	
4	Eksternt firma	Lima Rør	3. Norma	0	M8417	A275	HYDR.AGGREGAT REXROTH	anskaffa pakkning	167774	Utført og godkjent	20.06.2016	20.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	20.06.2016	
5	Eksternt firma	Lima Rør	4. Lav	0	M8417	A275	HYDR.AGGREGAT REXROTH	Bestilla pakkning	157858	Utført og godkjent	22.10.2015	21.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	0	0	30.03.201	va:43
														Sum:	8,00	8,00		

MAGASIN SKALA

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Elektriker	Orban, Fı	2. Haster	0	M2891	A275	MAGASIN SKALA	Magasin har problemer auto kjøring	165043	Utført og godkjent	05.04.2016	06.05.2016	Korrektivt vedlikehold	Kan utføres under drift	3	3	05.04.2016	
2	Mekaniker	Kurpios,	2. Haster	0	M2891	A275	MAGASIN SKALA	problem med paling (fixe luftslangene) og skifte ventil	164998	Utført og godkjent	04.04.2016	04.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4,5	4,5	04.04.2016	
3	Elektriker	Pojar, La	2. Haster	0	M2891	A275	MAGASIN SKALA	Skiftet sensor	167441	Utført og godkjent	07.06.2016	10.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	07.06.2016	
4	Elektriker	Abeland,	2. Haster	0	M2891	A275	MAGASIN SKALA	Beijer panel er helt dødt	157776	Utført og godkjent	19.10.2015	25.10.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	4	4	19.10.2015	Skiftet panel
5	Mekaniker	Henriksoı	2. Haster	0	M2891	A275	MAGASIN SKALA	byte av sylinder, rette lukka	149402	Utført og godkjent	26.03.2015	25.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	26.03.2015	
6	Mekaniker	Grubert, I	2. Haster	0	M2891	A275	MAGASIN SKALA	bytte sylinder	155301	Utført og godkjent	17.08.2015	17.08.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	17.08.2015	
7	Elektriker	Eriksen, H	2. Haster	0	M2891	A275	MAGASIN SKALA	Robot har gått når døra var åpen	179719	Utført og godkjent	16.03.2017	15.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	17.03.2017	
8	Mekaniker	Kurpios,	2. Haster	0	M2891	A275	MAGASIN SKALA	skrue på deksel og sensor feil	146155	Utført og godkjent	28.01.2015	27.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	0,5	0,5	28.01.2015	
9	Elektriker	Fosse, Aı	2. Haster	0	M2891	A275	MAGASIN SKALA	Feil med dør sikkerhet	179718	Utført og godkjent	16.03.2017	15.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	12	12	17.03.2017	
10	Elektriker	Fosse, Aı	2. Haster	0	M2891	A275	MAGASIN SKALA	Vil ikkje starte	155321	Utført og godkjent	18.08.2015	17.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	24.08.2015	
11	Elektriker	Faude, Jı	2. Haster	0	M2891	A275	MAGASIN SKALA	Magnet virker ikke(S1)	168795	Utført og godkjent	02.08.2016	02.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	03.08.2016	
12	Mekaniker	Henriksoı	2. Haster	0	M2891	A275	MAGASIN SKALA	bytte av sylinder .retta lukka	149416	Utført og godkjent	26.03.2015	25.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	26.03.2015	
13	Elektriker	Faude, Jı	2. Haster	0	M2891	A275	MAGASIN SKALA	sensorfeil	162975	Utført og godkjent	02.02.2016	03.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	02.02.2016	
14	Elektriker	Fosse, Aı	2. Haster	0	M2891	A275	MAGASIN SKALA	Def. Adam/Eva	155624	Utført og godkjent	24.08.2015	23.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	28.08.2015	
15	Elektriker	Pojar, La	2. Haster	0	M2891	A275	MAGASIN SKALA	Problem med sensor på verktoy	147820	Utført og godkjent	26.02.2015	28.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	26.02.2015	
16	Mekaniker	<Unknow	2. Haster	0	M2891	A275	MAGASIN SKALA	byte av sylinder	149419	Utført og godkjent	26.03.2015	25.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	26.03.2015	
														Sum:	46,5	46,5		

ROBOT MOTOMAN YR-SIA020D-A01

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Elektriker	Faude, Jı	2. Haster	0	M4085	A275	ROBOT MOTOMAN YR-SIA020D-AC	Feil med verktoy	175878	Utført og godkjent	07.12.2016	06.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	07.12.2016	
2	Mekaniker	Øye, Sve	2. Haster	0	M4085	A275	ROBOT MOTOMAN YR-SIA020D-AC	Rep motor til røre og lage til tåkesmøring	180064	Problem	22.03.2017	21.04.2017	Korrektivt vedlikehold	Kan utføres under drift	0	0	22.03.2017	
														Sum:	2,50	2,50		

ROBOT MOTOMAN DX100

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Elektriker	Nordhus,	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Problem med teachbox	147251	Utført og godkjent	17.02.2015	21.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	19.02.2015	
2	Elektriker	Sveinsvo	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Robot vil ikke starte	175468	Utført og godkjent	24.11.2016	24.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	5	5	25.11.2016	
3	Elektriker	Faude, Jı	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	mangler signal /verktoyveksle	175809	Utført og godkjent	05.12.2016	04.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	05.12.2016	
4	Elektriker	Orban, Fı	1. Kritisk	0	M4099	A275	ROBOT MOTOMAN DX100	Kalibrert roboten etter krsje	165302	Utført og godkjent	14.04.2016	14.05.2016	Korrektivt vedlikehold	Kan utføres under drift	4	4	14.04.2016	
5	Elektriker	Nordhus,	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Problem med robotprogram	147170	Utført og godkjent	18.02.2015	20.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	18.02.2015	
6	Mekaniker	Eimstad,	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	rep luftslange kobling til robotkjeft	161910	Utført og godkjent	07.01.2016	06.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t			07.01.2016	
7	Mekaniker	Eimstad,	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	rep luftslange kobling til robotkjeft	161911	Utført og godkjent	07.01.2016	06.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	0,45	0,5	07.01.2016	
8	Mekaniker	Grubert, I	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	girkassen lekasje	161805	Utført og godkjent	04.01.2016	03.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	04.01.2016	
9	Teknisk kontor	Bjerga, F	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Justere posisjoner ifm bytting av verktøy samt etter robotkrasj	156141	Utført og godkjent	03.09.2015	04.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	04.09.2015	
10	Elektriker	Faude, Jı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	stopper av og til	162797	Utført og godkjent	27.01.2016	27.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4,5	4,5	27.01.2016	
11	Elektriker	Sudmanı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	alarm nr 4381 og 4386	144614	Utført og godkjent	06.01.2015	05.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	06.01.2015	
12	Elektriker	Sudmanı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	Robot tror den har del hele tiden	145907	Utført og godkjent	22.01.2015	21.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	22.01.2015	
13	Elektriker	Fosse, Aı	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Fiske og bestile koblinger til verktøy	146343	Utført og godkjent	30.01.2015	01.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7	7	30.01.2015	
14	Elektriker	Fosse, Aı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	Bestille deler	146492	Utført og godkjent	05.02.2015	07.03.2015	Korrektivt vedlikehold	Kan utføres under drift	1	1	09.02.2015	
15	Elektriker	Orban, Fı	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Roboten vill ikke komme ut fra presse	161554	Utført og godkjent	17.12.2015	16.01.2016	Korrektivt vedlikehold	Kan utføres under drift	6	6	17.12.2015	
16	Elektriker	Orban, Fı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	Roboter vil ikke gå i presse	161508	Utført og godkjent	15.12.2015	14.01.2016	Korrektivt vedlikehold	Kan utføres under drift	4	4	15.12.2015	
17	Elektriker	Orban, Fı	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Roboten skal kalibreres	161309	Utført og godkjent	09.12.2015	08.01.2016	Korrektivt vedlikehold	Kan utføres under drift	5	5	09.12.2015	
18	Elektriker	Fosse, Aı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	Skifte kobling mellom robot og verktøy	151221	Utført og godkjent	06.05.2015	05.06.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	07.05.2015	
19	Elektriker	Orban, Fı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	Roboten har en lavt vanntryk feil	165044	Utført og godkjent	05.04.2016	06.05.2016	Korrektivt vedlikehold	Kan utføres under drift	3	3	05.04.2016	
20	Elektriker	Faude, Jı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	justert sensor fra griper,feilsøk.	150759	Utført og godkjent	24.04.2015	24.05.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	24.04.2015	
21	Elektriker	Faude, Jı	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	problem med verktoy robot 3	176022	Utført og godkjent	09.12.2016	08.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	09.12.2016	
22	Mekaniker	Haugvalc	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	laget foringer	166062	Utført og godkjent	25.04.2016	30.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	25.04.2016	
23	Mekaniker	Malmin, S	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	skifte hylse til griper/klype.	165605	Utført og godkjent	21.04.2016	22.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	22.04.2016	
24	Mekaniker	Kurpios,	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	problem med robotskjeft (crash)	165393	Utført og godkjent	15.04.2016	15.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	15.04.2016	
25	Elektriker	Fosse, Aı	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Feil på magnetavkjenner	176591	Utført og godkjent	02.01.2017	01.02.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	09.01.2017	
26	Elektriker	Pojar, La	2. Haster	0	M4091	A275	ROBOT MOTOMAN DX100	Problem med verktoy sensor	164469	Utført og godkjent	14.03.2016	16.04.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	14.03.2016	
27	Elektriker	Eriksen, H	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Skifte magnetavkjenner	176594	Utført og godkjent	02.01.2017	01.02.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	06.01.2017	
28	Elektriker	Faude, Jı	2. Haster	0	M4099	A275	ROBOT MOTOMAN DX100	Servofeil	162953	Utført og godkjent	02.02.2016	03.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	02.02.2016	
														Sum:	80,45	80,5		

ROBOT MOTOMAN ES165D

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Mekaniker	Kurpios,	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	sett op trykk til internt system (3bar)	176233	Utført og godkjent	16.12.2016	15.01.2017	Korrektivt vedlikehold	Kan utføres under drift	1	1	16.12.2016	
2	Elektriker	Eriksen, H	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Legge opp fast installasjon til kjølepumpe	179488	Utført og godkjent	10.03.2017	09.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	10.03.2017	
3	Elektriker	Fosse, A	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Koble til kjølepumpe	179553	Utført og godkjent	10.03.2017	09.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	13.03.2017	
4	Mekaniker	Kurpios,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	REP. VANNSLANGE TIL KJØLING AV rOBOTSKJEFT	178246	Utført og godkjent	10.02.2017	12.03.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	10.02.2017	
5	Mekaniker	Kurpios,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	fixe luftslange (kopling)	179301	Utført og godkjent	02.03.2017	06.04.2017	Korrektivt vedlikehold	Kan utføres under drift	2	2	02.03.2017	
6	Mekaniker	Eimstad,	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	skifte vannfilter (smadret filter, årsak: tett)	161708	Utført og godkjent	23.12.2015	22.01.2016	Korrektivt vedlikehold	Kan utføres under drift			23.12.2015	
7	Mekaniker	Kurpios,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	rep.vannslange og skifte sensor	164997	Utført og godkjent	04.04.2016	04.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	04.04.2016	
8	Mekaniker	Eimstad,	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	skifte vannfilter (smadret filter, årsak: tett)	161707	Utført og godkjent	23.12.2015	22.01.2016	Korrektivt vedlikehold	Kan utføres under drift			23.12.2015	
9	Mekaniker	Grubert,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	bytte kjølevannslange	164598	Utført og godkjent	17.03.2016	17.04.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	18.03.2016	
10	Mekaniker	Haugvalc	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	rep av slange	165167	Utført og godkjent	07.04.2016	08.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	07.04.2016	
11	Mekaniker	Eimstad,	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	skifte vannfilter (smadret filter, årsak: tett)	161709	Utført og godkjent	23.12.2015	22.01.2016	Korrektivt vedlikehold	Kan utføres under drift			23.12.2015	
12	Mekaniker	Haugvalc	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	rep av slange	165166	Utført og godkjent	06.04.2016	08.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	06.04.2016	
13	Mekaniker	Nilssen,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Feilsøke på kjøling til robot	165134	Utført og godkjent	07.04.2016	08.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	07.04.2016	
14	Mekaniker	Haugstac	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	rep. slanger	165111	Utført og godkjent	05.04.2016	08.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	05.04.2016	
15	Mekaniker	Kurpios,	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	fyllte på vann til interne kjøling	167716	Utført og godkjent	17.06.2016	17.07.2016	Korrektivt vedlikehold	Kan utføres under drift	1	1	17.06.2016	
16	Elektriker	Faude, J	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	slått ut med alarm(mangler kjøling)	167793	Utført og godkjent	16.06.2016	20.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	5,5	5,5	17.06.2016	
17	Elektriker	Fosse, A	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Rep etter kolisjon inne i ovn	156462	Utført og godkjent	15.09.2015	15.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	5	5	18.09.2015	
18	Mekaniker	Kurpios,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	rep skjeft av robot	146437	Utført og godkjent	03.02.2015	05.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	03.02.2015	
19	Mekaniker	Malmin, S	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Bore ut skruer i gripeverktøy.	156163	Utført og godkjent	07.09.2015	07.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	11.09.2015	
20	Teknisk kontor	Bjerga, F	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Etter overhaling av ovn stemmer ikke hente og leveringsposisjo	156139	Utført og godkjent	02.09.2015	04.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	04.09.2015	
21	Eksternt firma	Lima Rør	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	Sjekke vannsirkulasjon på roboter	165719	Utført og godkjent	26.04.2016	26.05.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	26.04.2016	
22	Mekaniker	Kurpios,	3. Norma	0	M4090	A275	ROBOT MOTOMAN ES165D	sette op vanntrykk(3bar) i kjølesystem til robot	176131	Utført og godkjent	14.12.2016	13.01.2017	Korrektivt vedlikehold	Kan utføres under drift	1	1	14.12.2016	
23	Mekaniker	Kurpios,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	skifte vannslange etter krasje av robot	167714	Utført og godkjent	17.06.2016	17.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	17.06.2016	
24	Elektriker	Fosse, A	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Krasjet inni i ovn	167704	Utført og godkjent	17.06.2016	17.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	17.06.2016	
25	Eksternt firma	Lima Rør	2. Haster	1	M4090	A275	ROBOT MOTOMAN ES165D	Skifte kjøleslanger på robot	167772	Problem	20.06.2016	20.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	0	0	20.06.2016	
26	Elektriker	Pojar, La	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Skiftet murr fordelingboks M12x4 veis	170989	Utført og godkjent	07.09.2016	07.10.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	07.09.2016	
27	Elektriker	Orban, F	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Lavy vanntryk alarm på roboten	167803	Utført og godkjent	21.06.2016	21.07.2016	Korrektivt vedlikehold	Kan utføres under drift	4	4	21.06.2016	
28	Elektriker	Faude, J	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	kopling,oppstart	167794	Utført og godkjent	15.06.2016	20.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	17.06.2016	
29	Mekaniker	Kurpios,	2. Haster	0	M4090	A275	ROBOT MOTOMAN ES165D	Problem med kjøling (fyllte på vann)	167554	Utført og godkjent	14.06.2016	14.07.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	14.06.2016	
														Sum:	79	79		

ROBOT MOTOMAN YASKAWA MH5

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est.Qt	End Date	Status Remark
1	Mekaniker	Grubert,	2. Haster	0	M4000	A275	ROBOT MOTOMAN YASKAWA MH5	ventil var tett	144607	Utført og godkjent	05.01.2015	04.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	05.01.2015	
2	Elektriker	Fjørtoft, V	2. Haster	0	M4000	A275	ROBOT MOTOMAN YASKAWA MH5	Strømbrudd, check home position	149294	Utført og godkjent	23.03.2015	22.04.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	26.03.2015	
3	Teknisk kontor	Bjerga, F	2. Haster	0	M4000	A275	ROBOT MOTOMAN YASKAWA MH5	Krasjer under syklus	146195	Utført og godkjent	28.01.2015	27.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	28.01.2015	
4	Mekaniker	Varhaug,	3. Norma	0	M4000	A275	ROBOT MOTOMAN YASKAWA MH5	montere ventil	176741	Utført og godkjent	02.01.2017	04.02.2017	Korrektivt vedlikehold	Kan utføres under drift	8	8	02.01.2017	
5	Mekaniker	Varhaug,	3. Norma	0	M4000	A275	ROBOT MOTOMAN YASKAWA MH5	Montera sleg ei kaviarstjerna	176656	Utført og godkjent	02.01.2017	02.02.2017	Korrektivt vedlikehold	Kan utføres under drift	7,5	7,5	02.01.2017	
6	Mekaniker	Nilssen,	3. Norma	0	M4000	A275	ROBOT MOTOMAN YASKAWA MH5	Montere ventil til smøring	176725	Utført og godkjent	02.01.2017	04.02.2017	Korrektivt vedlikehold	Kan utføres under drift	1	1	02.01.2017	
														Sum:	21,5	21,5		

Smi Knock-on holder

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est. Qt	End Date	Status Remark
1	Plateverksted	Kokes, S	3. Norma	0		471A275	Smi Knock-on holder	rep. ovn	147019	Utført og godkjent	13.02.2015	18.03.2015	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	7,5	7,5	13.02.2015	
2	Elektriker	Sudmanr	2. Haster	0		471A275	Smi Knock-on holder	Robot henter ikke deler riktig	161438	Utført og godkjent	11.12.2015	10.01.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	11.12.2015	
3	Elektriker	Munthe, I	2. Haster	0		471A275	Smi Knock-on holder	Problem	146667	Utført og godkjent	09.02.2015	11.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	09.02.2015	
4	Plateverksted	Kokes, S	2. Haster	0		471A275	Smi Knock-on holder	ovn, rep.	147020	Utført og godkjent	16.02.2015	18.03.2015	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	7,5	7,5	16.02.2015	
5	Elektriker	Sudmanr	2. Haster	0		471A275	Smi Knock-on holder	Lage referanseprogram til roboter	179846	Utført og godkjent	13.03.2017	16.04.2017	Korrektivt vedlikehold	Kan utføres under drift	2	2	13.03.2017	
6	Elektriker	Nordhus,	2. Haster	0		471A275	Smi Knock-on holder	Fikse verktøyvarmer og utslått sikring i kombiboks	175322	Utført og godkjent	15.11.2016	18.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	18.11.2016	
7	Operatør	Undheim	3. Norma	0		471A275	Smi Knock-on holder	Skjære vekk flattstål karusell.	154694	Utført og godkjent	03.08.2015	06.09.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	03.08.2015	
8	Elektriker	Sudmanr	2. Haster	0		471A275	Smi Knock-on holder	Robot legger deler feil?	168134	Utført og godkjent	29.06.2016	29.07.2016	Korrektivt vedlikehold	Krever lengre stopp 24t - 1	20	20	01.07.2016	
9	Elektriker	Grude, O	2. Haster	0		471A275	Smi Knock-on holder	Fikse verktøy varmer.	167260	Utført og godkjent	06.06.2016	06.07.2016	Korrektivt vedlikehold	Kan utføres under drift	1	1	06.06.2016	
10	Elektriker	Faude, J	2. Haster	0		471A275	Smi Knock-on holder	belte sviver ikke,motorskade pga. står ute ,byttet motor	168802	Utført og godkjent	03.08.2016	02.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	5	5	03.08.2016	
11	Plateverksted	Undheim	3. Norma	0		471A275	Smi Knock-on holder	Rep. Ovn.	161646	Utført og godkjent	14.12.2015	17.01.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	14.12.2015	
														Sum:	64	64		

SPINDELPRESSE HASENCLEVER FPR N 280 800t

	Discipline	Respons	Priority	Over Due	Serial Id	Tech Acc	Tech Acc Desc	WO Description	WO	Status	Start Date	Due Date	WO Type	Category	Task Act	Task Est. Qt	End Date	Status Remark
1	Mekaniker	Haugstad	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	arb.med oljelekkasje	169653	Utført og godkjent	26.08.2016	25.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	26.08.2016	
2	Elektriker	Eriksen, H	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Kortslutning i verktøyvarmer	168702	Utført og godkjent	01.08.2016	31.08.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	01.08.2016	
3	Mekaniker	Straalteo	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	lage bolter til pressebord.	151407	Utført og godkjent	06.05.2015	07.06.2015	Korrektivt vedlikehold	Kan utføres under drift	2	2	06.05.2015	
4	Elektriker	Pojar, La	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Problem med smøring på presse	157296	Utført og godkjent	29.09.2015	01.11.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	18	18	02.10.2015	
5	Mekaniker	Holtun, F	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	feste smøreblokk	157634	Utført og godkjent	12.10.2015	13.11.2015	Korrektivt vedlikehold	Kan utføres under drift	1	1	15.10.2015	
6	Mekaniker	Fosse, Ni	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Bygge om luft	179808	Utført og godkjent	16.03.2017	16.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	17.03.2017	
7	Mekaniker	Fosse, Ni	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Presse vil ike g`å	146911	Utført og godkjent	09.02.2015	15.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	09.02.2015	
8	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slår ut på smøring	157410	Utført og godkjent	07.10.2015	07.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	07.10.2015	
9	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	skifte bandasje + div feilsøking	162293	Utført og godkjent	13.01.2016	14.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	15	15	14.01.2016	
10	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slår ut på alarm	157402	Utført og godkjent	06.10.2015	06.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	06.10.2015	
11	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slår ut på smøring	157334	Utført og godkjent	02.10.2015	04.11.2015	Korrektivt vedlikehold	Krever lang stopp > 1 uke	7,5	7,5	02.10.2015	
12	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	problem med alarm på smøring	157399	Utført og godkjent	05.10.2015	06.11.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	7	7	05.10.2015	
13	Mekaniker	Malmin, S	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Skifte bandage på spindelpresse.	162273	Utført og godkjent	14.01.2016	14.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	7,5	7,5	20.01.2016	
14	Elektriker	Abeland,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Oppstøter virker ikke	163502	Utført og godkjent	15.02.2016	21.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	15.02.201	Ikke montert i verktøy
15	Elektriker	Faude, J	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Utstøtter virker ikke	163385	Utført og godkjent	15.02.2016	16.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	15.02.2016	
16	Mekaniker	Grubert, I	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slynghjul -bandagehjul innstillinger	162391	Utført og godkjent	18.01.2016	17.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3,5	3,5	18.01.2016	
17	Mekaniker	Kurpios,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	sjekk instilling til bandagehjul	162393	Utført og godkjent	18.01.2016	17.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	18.01.2016	
18	Mekaniker	Grubert, I	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	rep. ventil til bremsen	162400	Utført og godkjent	18.01.2016	17.02.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	18.01.2016	
19	Mekaniker	Haugvalc	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	rep av skjerm	152857	Utført og godkjent	08.06.2015	11.07.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	08.06.2015	
20	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slår ut på smøring	152928	Utført og godkjent	12.06.2015	12.07.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	12.06.2015	
21	Elektriker	Fjøtoft, V	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	presse står	146731	Utført og godkjent	10.02.2015	12.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	13.02.2015	
22	Mekaniker	Kurpios,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	problem med instillinger av presse robot crasher(Frode fixe)	146156	Utført og godkjent	27.01.2015	27.02.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1,5	1,5	27.01.2015	
23	Elektriker	Munthe, I	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Verktøy varmer	146686	Utført og godkjent	09.02.2015	11.03.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	09.02.2015	
24	Mekaniker	Malmin, S	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	alarm smøreolje.	152944	Utført og godkjent	12.06.2015	12.07.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	2,5	2,5	12.06.2015	
25	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slår ut på smøring	157020	Utført og godkjent	30.09.2015	31.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	30.09.2015	
26	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	problem med smøring	157023	Utført og godkjent	01.10.2015	31.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	6	6	01.10.2015	
27	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	slår ut på smøring	157018	Utført og godkjent	29.09.2015	31.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	29.09.2015	
28	Elektriker	Nordhus,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Sikring slått ut	156331	Utført og godkjent	09.09.2015	11.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	09.09.2015	
29	Elektriker	Sørenser	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Sikring slått ut	156321	Utført og godkjent	09.09.2015	11.10.2015	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	09.09.2015	
30	Mekaniker	Malmin, S	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Oppstøter vil ikkje gå opp etter omstilling (Feilmontert av verktør	163383	Utført og godkjent	15.02.2016	16.03.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	17.02.2016	
31	Mekaniker	Grubert, I	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	pressen kjøres ikke optimal,sentralsmøring	179768	Utført og godkjent	16.03.2017	15.04.2017	Korrektivt vedlikehold	Krever lang stopp > 1 uke	16	16	20.03.2017	
32	Elektriker	Eriksen, H	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Presse slår bare ut med problem med smøreoljetrykk	179824	Utført og godkjent	17.03.2017	16.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	17.03.2017	
33	Mekaniker	Kurpios,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	lage klosser(vordeler) og slanger til smøring av svinghjul og svei	177802	Utført og godkjent	02.02.2017	04.03.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	11,5	11,5	03.02.2017	
34	Elektriker	Fosse, A	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Stille inn presse	177219	Utført og godkjent	19.01.2017	18.02.2017	Korrektivt vedlikehold	Kan utføres under drift	10	10	20.01.201	Operatør feil: Hjelpe dei med å stille inn pressen
35	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	bygge om smøresystem	177876	Utført og godkjent	02.02.2017	05.03.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	5	5	02.02.2017	
36	Elektriker	Eriksen, H	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Feil på smøresystem	179997	Problem	20.03.2017	19.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	1	1	20.03.2017	
37	Mekaniker	Grubert, I	3. Norma	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	rep. -rensing graffitsprøte	145963	Utført og godkjent	23.01.2015	22.02.2015	Korrektivt vedlikehold	Kan utføres under drift	3	3	23.01.2015	
38	Elektriker	Sudmanr	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Hjelpe Frode med feilsøking på smøring	179904	Problem	20.03.2017	19.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	0	0	20.03.2017	
39	Elektriker	Fosse, A	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Feil på smøresystem	179990	Problem	20.03.2017	19.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	20.03.2017	
40	Mekaniker	Kurpios,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	rengjøre Hydr. tank til Sentralsmøring og skifte olje 2 ganger	179934	Utført og godkjent	20.03.2017	19.04.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	6,5	6,5	20.03.2017	
41	Elektriker	Faude, J	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Problem med oppløfter,mangler signal fra robot	176492	Utført og godkjent	22.12.2016	22.01.2017	Korrektivt vedlikehold	Krever kort stopp < 24t	4,5	4,5	23.12.2016	
42	Mekaniker	Eimstad,	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	aggregat til smøring kjørt tomt	168744	Utført og godkjent	02.08.2016	01.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	1,5	02.08.2016	
43	Mekaniker	Grubert, I	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	progressivfordeler pressen starter ikke opp	168755	Utført og godkjent	02.08.2016	01.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	02.08.2016	
44	Elektriker	Fosse, A	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Sikring gått.	167264	Utført og godkjent	07.06.2016	07.07.2016	Korrektivt vedlikehold	Kan utføres under drift	2	2	13.06.2016	
45	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	fikse retur fo olje	164682	Utført og godkjent	23.03.2016	22.04.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	3	3	23.03.2016	
46	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	bygge om sleidesmøring	167038	Utført og godkjent	27.05.2016	30.06.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	27.05.2016	
47	Elektriker	Faude, J	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	hovedmotor vil ikke starte	168819	Utført og godkjent	02.08.2016	03.09.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4,5	4,5	03.08.2016	
48	Elektriker	Fosse, A	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Feil med tilbakemelding bremse	175401	Utført og godkjent	22.11.2016	22.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	24.11.2016	
49	Elektriker	Sveinsvo	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	Stopper opp i syklusen	175400	Utført og godkjent	22.11.2016	22.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	2	2	25.11.2016	
50	Mekaniker	Grubert, I	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	sveising ny feste for en portsensor	175405	Utført og godkjent	22.11.2016	23.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	23.11.2016	
51	Mekaniker	Holtun, F	2. Haster	0	M1477	A275	SPINDELPRESSE HASENCLEVER FF	problem med smøring	173360	Utført og godkjent	08.11.2016	09.12.2016	Korrektivt vedlikehold	Krever kort stopp < 24t	4	4	08.11.2016	
														Sum:	218,50	216,00		